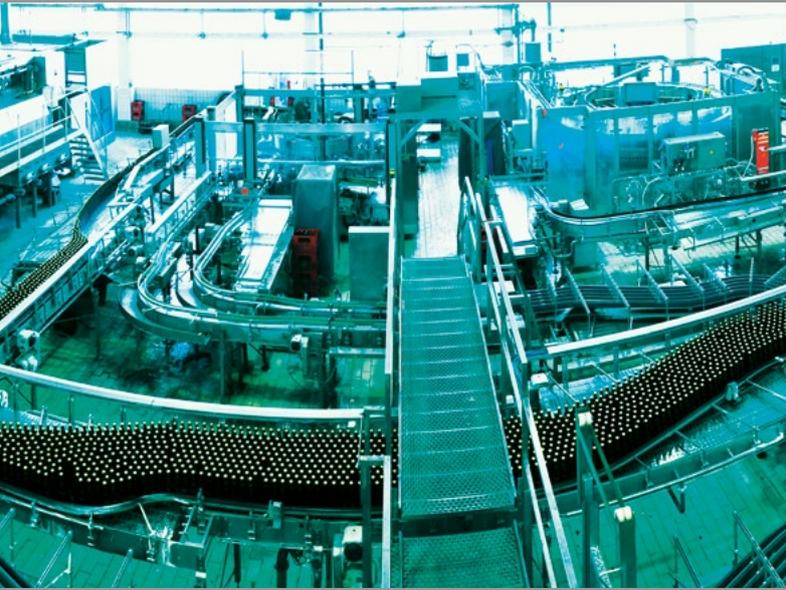




**HELUKABEL®**



 Edition 12

# DATA, NETWORK & BUS TECHNOLOGY

**HELUCOM®**

**HELUKAT®**

Data sheets are as of date of print.  
You can find the latest versions  
online according to this principle:  
[www.helukabel.com/10001en\\*](http://www.helukabel.com/10001en*)

\* Instead of 10001 please insert the wanted part number.



## ■ INTRODUCTION

The market for automation is growing, and with it the networking of production structures. In the future, communication will not only take place from desk to machine; the increasingly digital networking will make possible the automated exchange of information from machine to machine. Networking production via the internet makes it possible to globalise value-added chains, with production that independently responds to unplanned events.

The challenge to transmit ever higher quantities of data faster and faster is also present in other areas of life. Municipalities face the challenge of expanding their broadband infrastructure and providing a reliable supply, even in rural areas. High-performance broadband networks are a prerequisite for economic growth and have now become relevant for many applications and areas of day-to-day life.

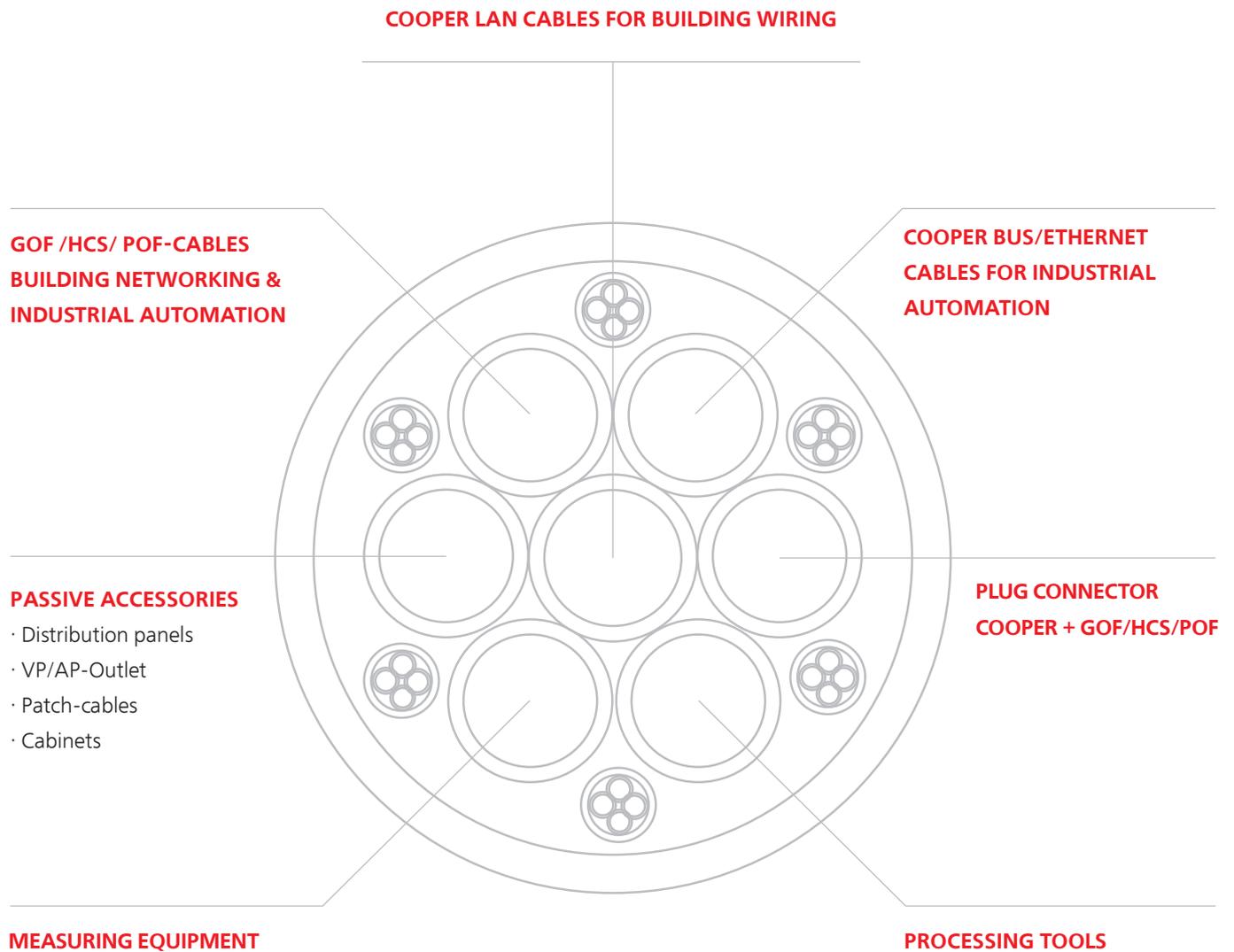
The challenges are quite diverse, but just as diverse are the solutions offered in the 12th edition of this catalogue. New additions to the product range include Ethernet cables with 600V or 1000V UL rating, Ethernet cables for torsional applications and use in robots, as well as an extensive portfolio of industrial Ethernet patch cables with RJ45 and M12 (D- and X-coded) moulded connectors in categories 5e and 6A. Discover our wide range of products. We welcome your questions and feedback.



Helmut Luksch,  
Chief Executive Officer, HELUKABEL® GmbH

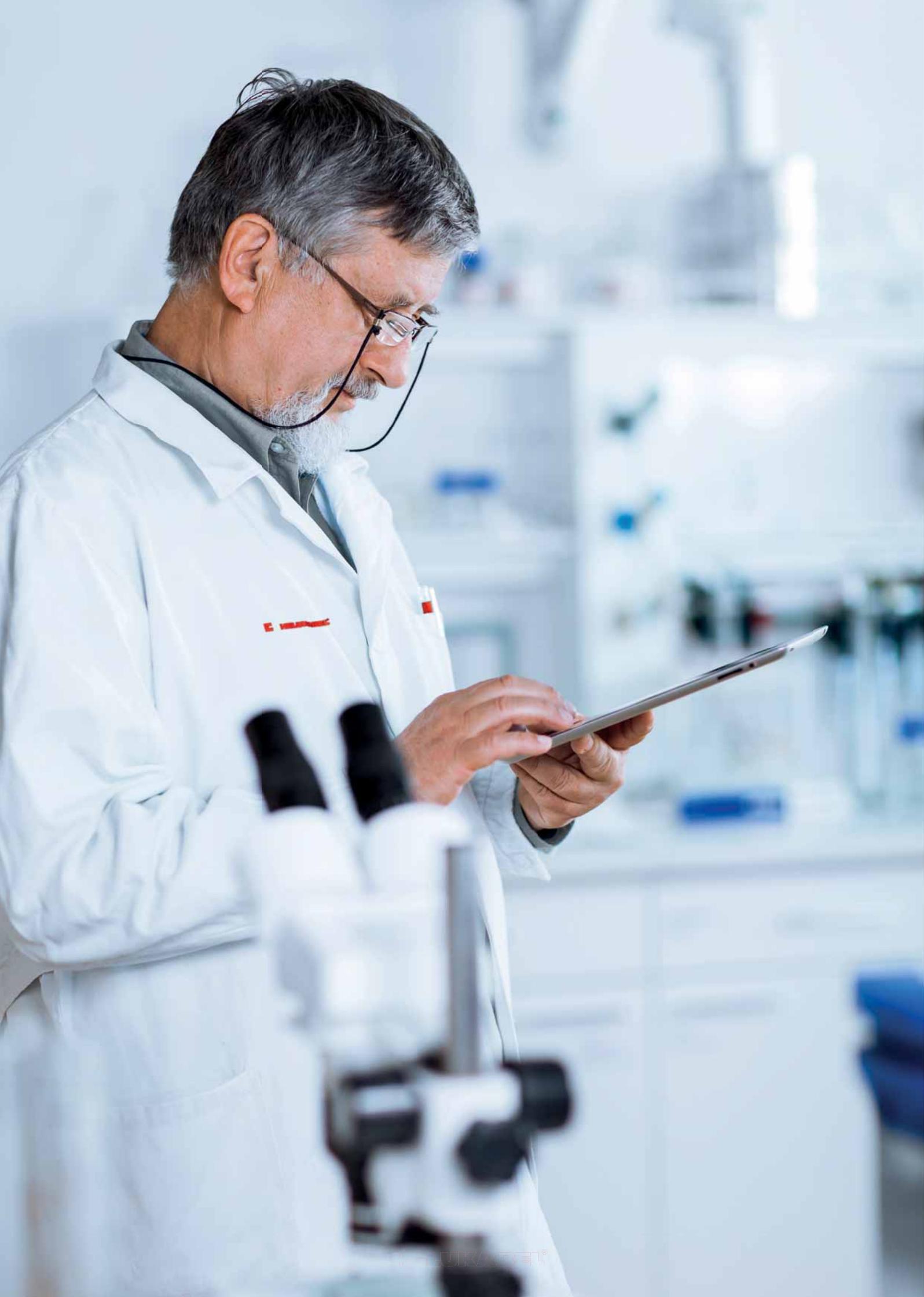


# ■ HELUKABEL® DATA-, NETWORK- & BUS TECHNOLOGY



# ■ TABLE OF CONTENTS

<b>INTRODUCTION</b> .....	<b>1</b>
Research & development.....	4
Production.....	6
Logistics.....	8
Our Branded Produkts .....	10
Certified products are products you can trust.....	12
Product finder HELUCOM® - Fibre Optic Systems.....	14
Plug matrix copper data systems .....	16
Product finder HELUKAT® - Cooper Data Systems.....	18
Plug matrix bus systems .....	20
Product finder HELUKABEL® - Bus Systems.....	22
Always close to you - 49 locations in 30 countries .....	24
Chapter overview.....	27
Chapter Description .....	28
<b>FIBRE OPTIC CABLES</b> .....	<b>32</b>
<b>COOPER DATA CABLES</b> .....	<b>82</b>
<b>BUS CABLES</b> .....	<b>118</b>
<b>COOPERCONNECTINGEQUIPMENT</b> .....	<b>222</b>
<b>FIBRE OPTIC CONNECTING EQUIPMENT</b> .....	<b>298</b>
<b>MEASUREMENT&amp;PROCESSINGTECHNICS</b> .....	<b>336</b>
<b>SERVICES</b> .....	<b>352</b>
<b>TECHNICAL INFORMATION</b> .....	<b>356</b>
Norm-Glossary.....	406
Glossary.....	409
Part Number Index .....	427
Notes .....	432



## ■ RESEARCH & DEVELOPMENT

We develop optimal, tailored cable solutions for our customers.



Torsion test apparatus

### Our test facilities:

- Test systems for bending and torsion requirements
- Drag chain test systems with movement distances of 1 m, 3 m, 5 m, 6 m, 18 m, and 40 m
- Fire testing systems
- Abrasion testing systems
- Torsion test tower for wind turbine cables
- Aging ovens in accordance with UL, VDE, CSA, HAR, TÜV & CCC

Research and development are the foundation of our work and are an important engine for growth. In interdisciplinary teams we continuously push the boundaries to enhance our products and develop solutions to meet the latest technological demands. Moreover, we value our customer interactions and partnerships with regional colleges and research institutes to stay on top of emerging technologies.

The materials that we use are an important starting point of our work. In this regard, we place as much emphasis on searching for and utilizing new materials, as we do on manufacturing our plastic mixtures (granulates) ourselves, and influencing the improvement of technical characteristics, such as oil-resistance, temperature range or chemical compatibility. Moreover, we are capable of pulling a majority of the copper ourselves, thus ensuring a uniform,

high-quality product relative to properties and workmanship.

With continuous optimization of our manufacturing processes and systems we take into consideration both efficient and economical production, and the complex requirements of various applications (such as cables for industrial robots or for applications under clean-room conditions) into account.

A crucial stage in the development process of our products is the work done at our Test Center. For example, cables suitable for drag chain implementation, can be tested using equipment that accelerates cables up to 10 g.

Temperature ranges from -50° to +250° are simulated in a special climate-controlled environment so that drag chain cables can be tested for series production readiness in applications such as refrigerated warehouses or steel mills.



Drag chain test system



## ■ PRODUCTION

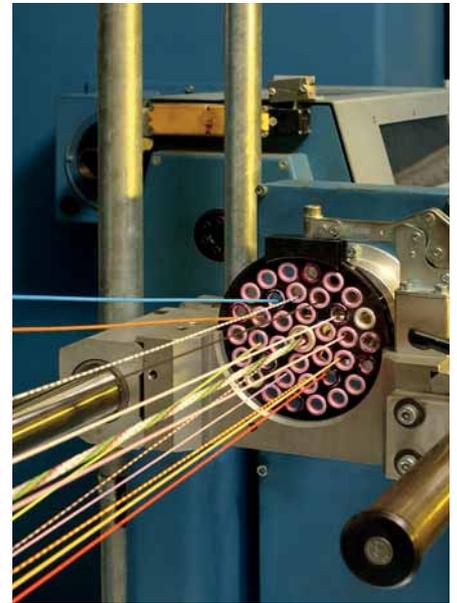
We specialize in the production of high-quality cables and wires.

Using the latest production methods, our two German plants manufacture approximately one million kilometers of conductors each year (= 25 times around the world). More than 300 qualified employees are specialized in the production of high-quality standard and custom cables. Through the use of the latest materials and collaboration with international test institutes, we drive innovation in the areas of automation, data technology, building system technology, and renewable energy.

Since 2014, in a 7,000 m<sup>2</sup> facility in the Chinese city of Taicang (approx. 50 km northwest of Shanghai) HELUKABEL® has been producing cable and wires, primarily for the Asian market. As is with our German plants, the focus is on high-quality, flexible and highly-flexible cables and wires that are manufactured in accordance with Chinese and international standards. The use of flexible manufacturing cells enable short delivery times.



Braiding machine



Stranding machine

### Our production in numbers:

- 40,000 m<sup>2</sup> production area
- 23 extruder systems
- 19 stranding machines
- 50 braiding machines
- Cables & wires from 0.05 to 1,000 mm<sup>2</sup> (30 AWG to 2,000 kcmil)
- Manufacturing in accordance with: VDE, EAC (GOST-R), UL, CSA, HAR, CCC, Germanischer Lloyd, TÜV or customer specification



## ■ LOGISTICS

Redefining logistics in the cable industry.

### INDUSTRIAL CABLE

#### Our logistics center - Hemmingen/Stuttgart

- 40,500 Euro-pallet racks
- 16 aisles with 16 storage and retrieval devices
- 35,900 bin locations in the automatic small parts warehouse with a capacity of 1,000 bins per hour
- 670 storage spaces in the heavy load warehouse with max. reels of 4,000 kg and 2.20 m diameter
- 2 km conveyor line for pallets
- Conveyor connects direct to the cable-cutting machines
- Manual processes reduced to merely packing

### INFRASTRUCTURE CABLES

#### Our logistics center - Neuenhagen/Berlin

- 11,000 cable reels in stock
- Automatic processing of reels up to 2.80 m Ø and 10 t
- 10 rewinding machines
- Cut to length with state-of-the-art 1,200 mm<sup>2</sup> cutting tools
- 24-hr delivery is possible

At its corporate headquarters in the Swabian town of Hemmingen/Stuttgart, HELUKABEL® operates Europe's largest distribution center for cables and wires. Here a majority of the more than 33,000 products are located in a storage area of 160,000 m<sup>2</sup>. Through the use of state-of-the-art conveyor and control technology, more than 1,000 orders can be picked and dispatched daily to destinations around the world.

Neuenhagen/Berlin is the central warehouse location for underground, medium-voltage, and other infrastructure cables. Storage capacities of more than 5,000 m<sup>2</sup> (indoor) and 50,000 m<sup>2</sup> (outdoor) enable fast delivery of cable, configured from 1 – 30 kV, to construction sites and major projects. The patented heavy-load cable-cutting machines with a load capacity of more than 10 tons are the largest of their kind in Germany.

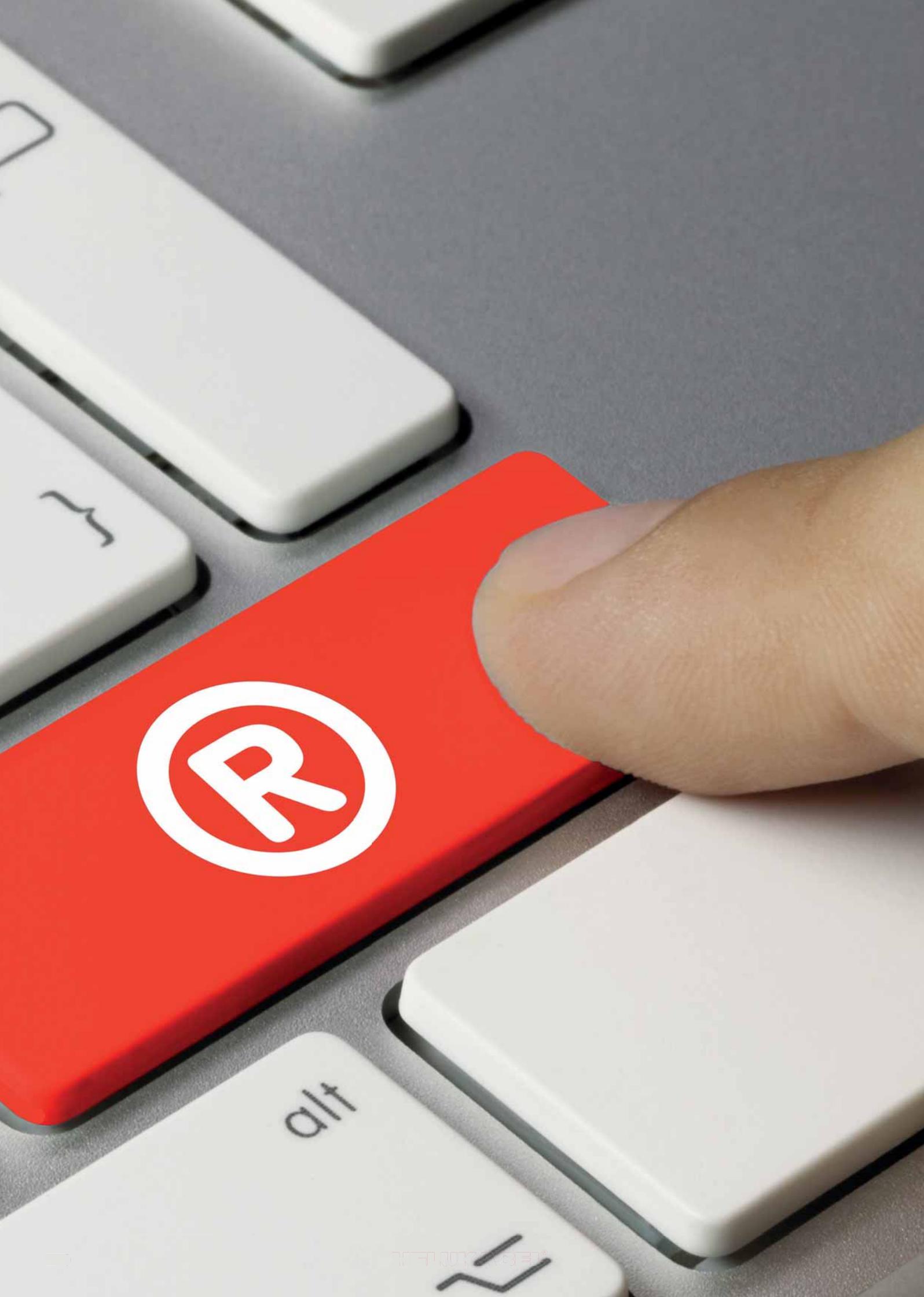
The new logistics center at the Taicang (Shanghai, China) production facility serves as a product distribution hub for the Asian market, and offers incredible advantages, particularly for servicing time- and volume-critical customer projects.



Heavy-load, cable-cutting facility



Small parts warehouse



## ■ OUR BRANDED PRODUCTS

### Cables & Wires

- BIOFLEX-500® bio-oil resistant cables
- CLEANFLEX® cleanroom data and control cables
- DATAFLAMM® data and computer cables, halogen-free
- DATAPUR-C® data and computer cables
- GALVANICABLE® high-voltage cathode cable
- HELUFLON® heat-resistant cables
- HELUTHERM® heat-resistant cables
- HELUTRAIN® train cables
- HELUTRUCK® vehicle cables / truck cables
- HELUWIND® wind power cables
- KOMPOFLEX® microbe-resistant cables
- KOMPOSPEED® bio-oil resistant drag chain cables
- LIFT-TRAGO® elevator control cables
- MEGAFLEX® flexible control cables, halogen-free (UL/CSA)
- MULTIFLEX 512® drag chain cables PUR
- MULTISPEED® drag chain cables
- NANOFLEX® PUR special control and data cables
- ROBOFLEX® robot cables
- SENSORFLEX® sensor cables
- SHIPFLEX® drag chain cables
- SOLARFLEX® photovoltaic cables
- SUPER-PAAR-TRONIC-C-PUR® drag chain cables, halogen-free
- SUPERTRONIC® drag chain cables
- THERMFLEX® heat-resistant cables
- TOPFLEX® servo, encoder, and motor cables
- TOPSERV® servo, encoder, and motor cables
- TRAYCONTROL® exposed run cable
- TROMMPUR® easy-to-wind cables
- UNIPUR® flexible control cables PUR

### Cable accessories

- HELUCHAIN® drag chain product line
- HELUTEK® industrial connector series
- HELUTOP® cable gland programme

### Data, network & bus technology

- HELUCOM® fiber optic cables
- HELUKAT® Fiber optic connection technology
- HELUKAT® copper data cable
- HELUKAT® Copper connection technology

### Media technology

- HELUEVENT® high-power cable for TV studios
- HELULIGHT® cables for lighting control systems
- HELUSOUND® audio cable



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CONNECTING SYSTEMS

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# ■ PRODUCT FINDER HELUCOM® Fibre Optic Systems

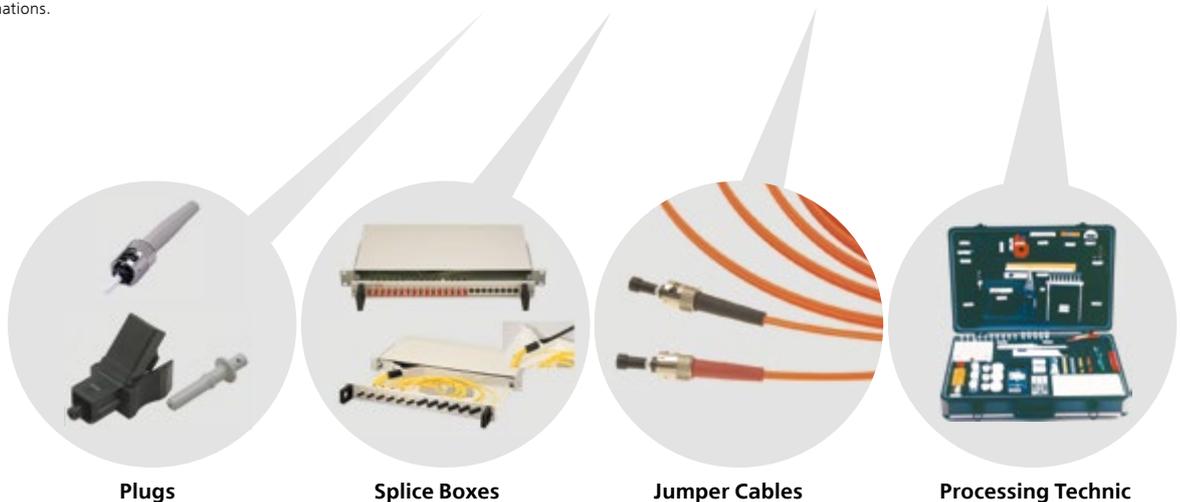
Installation area	Application	Kind of processing	Fibre Type	Pulling type*	Tensile strength up to N*	Number of fibres	Cable type			
Inside	fixed	Splicing	G50/ G62,5/ E9	Manual pulling	1200	4 - 12	I-D(ZN)H			
					3000	24 - 60	I-D(ZN)H			
	flexible	Direct pre-assembling	G50/ G62,5/ E9	Manual pulling	400	2	AT-VYY			
					400	1 - 2	I-VH			
					500	4 - 8	I-V(ZN)H			
					800	10 - 12	I-V(ZN)H			
					1200	4	AT-V(ZN)YY			
					1200	4	A-V(ZN)YY			
					1500	2 - 8	I-V(ZN)HH			
					2400	12 - 24	I-V(ZN)HH			
					600	2	I-VHH			
					800	4	AT-V(ZN)HH			
					800	2	I-V(ZN)Y11Y			
					800	2	I-V(ZN)YY			
					100	2	I-V4Y(ZN)11Y, red			
					100	2	I-V4Y(ZN)11Y, green			
	100	2	I-V4Y(ZN)11Y, purple							
	high flexible		G50/ G62,5/ E9	Manual pulling	140	1 - 2	I-V2Y			
650					2 - 8	A-V(ZN)11Y				
Inside/outside	fixed	Splicing	G50/ G62,5/ E9	Manual pulling	4800	4 - 12	AT-V(ZN)H(ZN)11Y			
					4800	4 - 12	AT-V(ZN)Y(ZN)Y			
					200	1 - 4	I-V2Y(ZN)11Y, green			
				flexible	Direct pre-assembling/ Splicing	G50/ G62,5/ E9	Blowing in*/ Manual pulling	700	4 - 12	A/I-D(ZN)BH(SR)H FS90
								1000	4 - 12	A-DQ(ZN)BH FS30
								1500	4 - 24	A/I-DQ(ZN)BH, central pact
	2500	4 - 24	A/I-DQ(ZN)BH, central							
	2700	24 - 72	A/I-DQ(ZN)BH, stranded							
	3000	84 - 96	A/I-DQ(ZN)BH, stranded							
	high flexible	Splicing	G50	Manual pulling	500	2	AT-W(ZN)H(ZN)H			
					500	2	AT-W(ZN)H(ZN)H			
					1000	4	AT-V(ZN)H(ZN)BH			
					3000	4 - 12	A/I-VQ(ZN)BH			
					800	2	AT-W(ZN)Y(ZN)11Y			
					800	2	AT-WQ(ZN)Y(ZN)B2Y			
						1200	4	AT-V(ZN)HH(BN)2Y		
						1500	2	AT-VQH(ZN)B2Y		
						E9 G652.D + G657.A1	Blowing in*/ Manual pulling	180	4 - 12	A-DQ2Y, Microduct central
700								4 - 72	A-DQ2Y, Microduct stranded	
1500								84 - 288	A-DQ2Y, Microduct stranded	
2500								12 - 72	A-DSF(L)(ZN)2Y	
2500								12 - 60	A-DF(ZN)2Y(SR)2Y	
2700								12 - 60	A-DF(ZN)2Y(SR)2Y	
E9						Manual pulling	3100	12 - 144	ADSS 6L	
							4100	12 - 144	ADSS 9L	
							9000	12 - 144	ADSS 9	
							11100	12 - 144	ADSS 16L	
							16000	12 - 144	ADSS 16	
							1500	4 - 24	A-DQ(ZN)(SR)2Y	
G50/ G62,5/ E9						Blowing in*/ Manual pulling	1500	2 - 24	A-DQ(ZN)B2Y, central pact	
							2700	2 - 24	A-DQ(ZN)B2Y, central	
							2600	2 - 4	A-DSQ(ZN)B2Y	
							2700	2 - 72	A-DF(ZN)2Y	
							2700	2 - 72	A-DF(ZN)2Y4Y	
							2700	2 - 72	A-DF(ZN)B2Y	
							2700	24 - 72	A-DQ(ZN)B2Y, stranded	
							3000	84 - 144	A-DF(ZN)2Y	
							3000	84 - 144	A-DF(ZN)2Y4Y	
							3000	84 - 144	A-DF(ZN)B2Y	
	3500	84 - 144	A-DSF(L)(ZN)2Y							

\* Note the information of the Blowing jet \* = Tensile strength up to N

If you have technical questions, please check the technical information at page 356 or contact our expert advisors from the Department data, network and bus technology.

			Accessories			
			Plug	Splice Boxes	Jumper Cables	Processing Technic
	Application	Page	Page	Page	Page	Page
	Floor- and Building wiring	37	312	308	315/316	from 342
	Floor- and Building wiring	37			315/316	
	Industry wiring (Patch Cables)	70			-	
	Device- and Floor wiring (Patch Cables)	34				
	Floor- and Building wiring	36	312	308	315/316	
	Floor- and Building wiring	36				
	Industry wiring (Control Level)	63				
	Industry wiring (Control Level, Monitoring)	61				
	Floor- and Building wiring	35				
	Floor- and Building wiring	35				
	Device- and Floor wiring (Patch Cables)	34	312/334	308/331	315/316/333	
	Industry wiring (Patch Cables)	73				
	Industry wiring (Control Level)	72			333	
	Industry wiring (Control Level)	71				
	Industry automation and cabinet wiring	78	334			
	PROFInet B Kommunikation	76			332	
	Profibus Communication	77				
	Industry automation and cabinet wiring	75				
	Industry wiring (Control Level, Monitoring)	60				
	Industry wiring (Control Level, Monitoring)	62	312	308	315/316	
	Industry wiring (Control Level, Monitoring)	62				
	PROFInet C Communication	75	334	-	332	
	Data Communication, Monitoring security relevant areas (Tunnels,...)	43				
	Data Communication, Monitoring security relevant areas (Tunnels,...)	42				
	Floor-, Building- and Campus wiring	39	312	308	315/316	
	Floor-, Building- and Campus wiring	40				
	Floor-, Building- and Campus wiring	41				
	Floor-, Building- and Campus wiring	41				
	PROFInet + Profibus wiring inside/outside	66				
	PROFInet + Profibus wiring inside/outside	66				
	PROFInet + Profibus wiring inside/outside	65				
	Floor-, Building- and Campus wiring	38				
	PROFInet + Profibus wiring inside/outside	67				
	PROFInet + Profibus wiring outside	69				
	Industry wiring, outside	64				
	Industry wiring, outside	74	334		333	
	Campus- and Roadway wiring (public communication,...)	51				
	Campus- and Roadway wiring (public communication,...)	52				
	Campus- and Roadway wiring (public communication,...)	52				
	Campus wiring (Signal wiring of roadways,...)	57				
	Campus wiring with extrem rodent attacks	54				
	Campus wiring with extrem rodent attacks (ARCOR Spezifikationen)	55				
	Areal wiring	58				
	Areal wiring	58				
	Areal wiring	59				
	Areal wiring	58				
	Areal wiring	59				
	Campus wiring with extrem rodent attacks	53	312	308	315/316	
	Campus wiring	44				
	Campus wiring	45				
	Campus wiring (coffer-dams,...)	56				
	Campus wiring	48				
	Campus wiring	50				
	Campus wiring	49				
	Campus wiring	44				
	Campus wiring	48				
	Campus wiring	50				
	Campus wiring	49				
	Campus wiring (Signal wiring of roadways,...)	57				

Subject to technical alternations.



Plugs

Splice Boxes

Jumper Cables

Processing Technic

## ■ PLUG MATRIX COPPER DATA SYSTEMS

		Part no. Page	Description
B1		801686 Page 245	RJ45 Plug TM11 Cat.5
B2		801772 Page 245	RJ45 Plug TM21 Cat.6
B3		802377 Page 226	RJ45 Jack Cat.6 <sub>A</sub>
B4		802916 Page 226	RJ45 Jack Cat.6/ Class E
B5		800986 Page 294	RJ45 Plug 4-pole/ IP 20, Cat.5
B6		802920 Page 294	RJ45 Plug 8-pole/ IP 20, Cat.5
B7		804234 Page 294	RJ45 Plug 90° 8-pole/ IP 20, Cat.5
B8		801318 Page 294	RJ45 Plug Snap-in 8-pole/ IP 67, Cat.5
B9		805401 Page 294	RJ45 Profinet Cat.5 tool free, 4-pole

		Part no. Page	Description
B10		805402 Page 294	RJ45 Profinet 90° Cat.5 tool free, 4-pole
B11		805781 Page 294	RJ45 Profinet IE Cat.5 tool free, 4-pole
B12		805782 Page 294	RJ45 Profinet IE Cat.5 45° tool free, 4-pole
B13		805783 Page 294	RJ45 IE Cat.6, tool free, 8-pole
B14		805784 Page 294	RJ45 IE 45° Cat.6, tool free, 8-pole
B16		804691 Page 226	RJ45 Jack Cat.6
B17		805044 Page 226	RJ45 Jack Cat.6
B18		804645 Page 226	RJ45 Jack Cat.5e
B19		804544 Page 294	RJ45 IE Kat6A, tool free, 8-pole

### Patch Cables



### Splice Box, DIN rail



### Splice Box



### Outlet





# PRODUCT FINDER HELUKAT® Copper Data Systems

Installation area	Areal	Application	Category	Frequency range MHz	Application area	UL	CSA	Flame retardance	halo- gen-free	resistance against		Con- struction	Core number			
										Oil	UV					
Inside	Office	fixed	5	100	Floor-/Building wiring of security areas	-	-	IEC 60332-3	x	-	-	F/UTP	4 x 2 x			
			5 <sub>e</sub>	155	Floor-/Building wiring	-	-	-	-	-	-	-	U/UTP	4 x 2 x		
			5 <sub>e</sub>	155		-	-	-	-	-	-	-	-	F/UTP	4 x 2 x	
			5 <sub>e</sub>	200		-	-	IEC 60332-3	x	-	-	-	-	SF/UTP	4 x 2 x	
			5 <sub>e</sub>	200		-	-	IEC 60332-3	x	-	-	-	-	SF/UTP	2 x 4 x 2 x	
			6	300		-	-	IEC 60332-1	x	-	-	-	-	U/UTP	4 x 2 x	
			6	450		-	-	IEC 60332-3	x	-	-	-	-	F/FTP	4 x 2 x	
			6	450		-	-	IEC 60332-3	x	-	-	-	-	F/FTP	2 x 4 x 2 x	
			6 <sub>A</sub>	500		-	-	IEC 60332-3	x	-	-	-	-	F/FTP	4 x 2 x	
			6 <sub>A</sub>	500		-	-	IEC 60332-3	x	-	-	-	-	F/FTP	2 x 4 x 2 x	
			6	600		x	-	IEC 60332-1	x	-	-	-	-	U/UTP	4 x 2 x	
			7 <sub>e</sub>	1000		-	-	IEC 60332-3	x	-	-	-	-	S/FTP	4 x 2 x	
			7 <sub>e</sub>	1000		-	-	IEC 60332-3	x	-	-	-	-	S/FTP	2 x 4 x 2 x	
			7 <sub>A</sub>	1200		-	-	IEC 60332-3	x	-	-	-	-	S/FTP	4 x 2 x	
			7 <sub>A</sub>	1200		-	-	IEC 60332-3	x	-	-	-	-	S/FTP	2 x 4 x 2 x	
			8(draft)	1200		-	-	IEC 60332-3	x	-	-	-	-	S/FTP	4 x 2 x	
		8(draft)	1200	-		-	IEC 60332-3	x	-	-	-	-	S/FTP	2 x 4 x 2 x		
		8(draft)	1500	-	-	IEC 60332-3	x	-	-	-	-	S/FTP	4 x 2 x			
		8(draft)	1500	-	-	IEC 60332-3	x	-	-	-	-	S/FTP	2 x 4 x 2 x			
		flexible	5	100	Workarea/Floor-wiring (Patchkabel)	5	100	-	-	-	-	-	-	U/UTP	4 x 2 x	
	5		100	-		-	IEC 60332-1	x	-	-	-	-	F/UTP	4 x 2 x		
	5 <sub>e</sub>		200	-		-	IEC 60332-1	x	-	-	-	-	SF/UTP	4 x 2 x		
	5 <sub>e</sub>		200	x		x	IEC 60332-1	-	-	-	-	-	F/UTP	4 x 2 x		
	6		300	-		-	IEC 60332-1	x	-	-	-	-	U/UTP	4 x 2 x		
	6		300	x		x	IEC 60332-1	-	-	-	-	-	U/FTP	4 x 2 x		
	6 <sub>A</sub>		500	-		-	IEC 60332-1	x	-	-	-	-	F/FTP	4 x 2 x		
	7		600	-		-	IEC 60332-1	x	-	-	-	-	S/FTP	4 x 2 x		
	Industry		fixed	5		100	Industry cabling Motion Controll	x	x	IEC 60332-1	-	x	-	-	S/FTP	2 x 2 x
				5 <sub>e</sub>		100	Industry cabling (Control- Automation- and Regulation Level)	-	-	IEC 60332-1	x	-	-	-	SF/UTP	2 x 2 x
				5 <sub>e</sub>		100		-	-	IEC 60332-1	x	x	-	-	SF/UTP	2 x 2 x
				5 <sub>e</sub>		100		x	x	IEC 60332-3	-	x	x	-	SF/UTP	2 x 2 x
				5 <sub>e</sub>		100		x	x	IEC 60332-3	x	-	-	-	SF/UTP	2 x 2 x
				5 <sub>e</sub>		100		-	-	IEC 60332-1	x	x	x	-	SF/UTP	2 x 2 x
				5 <sub>e</sub>		100		-	-	-	-	-	-	-	-	SF/UTP
				7 <sub>A</sub>		1200	-	-	IEC 60332-1	x	x	x	-	-	S/FTP	4 x 2 x
				6		250	x	x	IEC 60332-3	-	x	-	-	-	SF/UTP	4 x 2 x
				6		250	x	x	IEC 60332-1	-	x	-	-	-	SF/UTP	4 x 2 x
		6 <sub>A</sub>		500	x	x	IEC 60332-3	-	x	x	-	-	S/FTP	4 x 2 x		
		6 <sub>A</sub>		500	x	x	IEC 60332-3	-	x	-	-	-	S/FTP	4x2x		
		6 <sub>A</sub>		500	x	x	IEC 60332-1	x	x	x	-	-	S/FTP	4x2x		
		6 <sub>A</sub>		500	x	x	IEC 60332-3	x	-	-	-	-	S/FTP	4x2x		
		7 <sub>e</sub>		1200	-	-	IEC 60332-1	x	x	-	-	-	S/FTP	4 x 2 x		
		7 <sub>e</sub>		1200	x	x	IEC 60332-1	x	x	x	-	-	S/FTP	4x2x		
		7		600	-	-	IEC 60332-3	x	x	-	-	-	S/FTP	4 x 2 x		
		flexible		5	100	Industry cabling, flexible (C.- A.- a. R. L.)	x	x	IEC 60332-3	x	x	x	-	-	SF/UTP	2 x 2 x
			5 <sub>e</sub>	100	Industry cabling (Control- Automation- and Regulation Level)	-	-	IEC 60332-1	x	-	-	-	-	SF/UTP	2 x 2 x	
			5 <sub>e</sub>	100		-	-	IEC 60332-1	x	x	-	-	-	SF/UTP	2 x 2 x	
			5 <sub>e</sub>	100		x	x	IEC 60332-1	-	x	x	-	-	SF/UTP	2 x 2 x	
			5 <sub>e</sub>	100	Industry cabling, flexible (Control- Automation- and Regulation Level)	-	-	IEC 60332-3	x	-	-	-	-	SF/UTP	2 x 2 x	
			5 <sub>e</sub>	100		-	-	IEC 60332-1	x	-	-	-	-	SF/UTP	2 x 2 x	
			5 <sub>e</sub>	100		x	x	IEC 60332-3	x	-	-	-	-	SF/UTP	2 x 2 x	
			5 <sub>e</sub>	100	Schiffsverkabelung (C.- A.- a. R. L.)	x	x	IEC 60332-1	x	x	x	-	-	SF/UTP	2 x 2 x	
			5 <sub>e</sub>	100	Industry cabling, flexible (Control- Automation- and Regulation Level)	x	x	IEC 60332-1	-	x	x	-	-	SF/UTP	2 x 2 x + 4 x	
			5 <sub>e</sub>	100		-	-	IEC 60332-1	x	x	x	-	-	SF/UTP	2 x 2 x + 4 x	
			5 <sub>e</sub>	200		-	-	IEC 60332-1	x	x	-	-	-	SF/UTP	4 x 2 x	
			6	250		x	x	IEC 60332-3	-	x	-	-	-	S/FTP	4 x 2 x	
		7	600	x		x	IEC 60332-1	x	x	x	-	-	S/FTP	4 x 2 x		
	7 <sub>A</sub>	1000	-	-		IEC 60332-1	x	x	x	-	-	S/FTP	4 x 2 x			
	high flexible	5	100	Industry cabling, high flexible (Process- and Field Level)	-	-	IEC 60332-1	x	x	-	-	-	SF/UTP	4 x 1 x		
		5	100		-	-	IEC 60332-1	x	x	-	-	-	SF/UTP	4 x 2 x		
		5	100		x	x	IEC 60332-1	-	x	-	-	-	SF/UTP	2 x 2 x + 1 x 2 x		
		5	100	Industry cabling Motion Controll	x	x	IEC 60332-1	x	x	-	-	-	SF/UTP	2 x 2 x + 1 x 2 x		
		5 <sub>e</sub>	100		x	x	IEC 60332-1	x	x	x	-	-	SF/UTP	2 x 2 x		
		5 <sub>e</sub>	100		x	x	IEC 60332-3	-	x	x	-	-	SF/UTP	2 x 2 x		
		5 <sub>e</sub>	155	Industry cabling, high flexible (Process- and Field Level)	x	-	IEC 60332-1	x	x	x	-	-	SF/UTP	2 x 2		
		5 <sub>e</sub>	155		x	x	IEC 60332-1	x	x	x	-	-	SF/UTP	4 x 1 x		
		5 <sub>e</sub>	155		x	x	IEC 60332-1	x	x	x	-	-	SF/UTP	4 x 2 x		
		5 <sub>e</sub>	155		x	x	IEC 60332-1	x	x	x	-	-	SF/UTP	4x2x		
		6	250		x	x	IEC 60332-1	-	x	x	-	-	S/FTP	4 x 2 x		
		6 <sub>A</sub>	500		x	x	IEC 60332-3	-	x	-	-	-	F/FTP	4 x 2 x		
		6 <sub>A</sub>	500	x	x	IEC 60332-1	x	x	x	-	-	SF/FTP	4 x 2 x			
		6 <sub>A</sub>	500	Industry cabling, high flexible (C.- A.- a. R. L.)	x	x	IEC 60332-1	x	x	x	-	-	SF/FTP	4 x 2 x		
		7	600	Industry cabling, high flexible (Process- and Field Level)	x	x	IEC 60332-1	x	x	x	-	-	SF/FTP	4 x 2 x		
		Outside	Outdoor	fixed	5 <sub>e</sub>	100	Industry cabling, rodent attacked areas (Campus- and Building wiring)	-	-	-	-	x	x	SF/UTP armiert	2 x 2 x	
					5 <sub>e</sub>	200	Campus backbone	-	-	-	x	-	-	x	F/UTP	4 x 2 x
					6	300		-	-	-	x	-	-	x	U/UTP	4 x 2 x
	7 <sub>e</sub>				1000	-		-	IEC 60332-1	-	-	-	x	S/FTP PVC/PVC	4 x 2 x	
	7 <sub>e</sub>				1000	Campus backbone with rodent attacked	-	-	IEC 60332-1 (Inside cables)	x	-	-	x	S/FTP FRNC/PE armiert	4 x 2 x	
	7 <sub>e</sub>				1000	Campus backbone	x	x	IEC 60332-1	-	-	-	x	S/FTP PVC	4 x 2 x	

					Accessories			
					Plug	Patch panels	Jumper Cable	Processing Technic
Core dimension	Description*	Part no.	Page			Page	Page	Page
AWG23/1	HELUKAT 100 F/UTP FE60	804045	93	-	-	-	-	
AWG24/1	HELUKAT 155 U/UTP	80053	84	-	-	226, 230	244	
AWG24/1	HELUKAT 155 F/UTP	80043	91	-	-	226, 231	242, 243	
AWG24/1	HELUKAT 200 SF/UTP	81609, 81610	96	B6	-	226, 231	242, 243	
AWG24/1	HELUKAT 200 SF/UTP duplex	81123	97	B6	-	226, 231	242, 243	
AWG24/1	HELUKAT 300 U/UTP	804766	86	-	-	226, 230	237, 240, 241	
AWG24/1	HELUKAT 450 F/FTP	82501	100	B6*5, B7*5	-	226, 229	238, 239	
AWG24/1	HELUKAT 450 F/FTP duplex	82502	101	B6*5, B7*5	-	226, 229	238, 239	
AWG23/1	HELUKAT 500 F/FTP	803378	102	B3	-	226, 228	236	
AWG23/1	HELUKAT 500 F/FTP duplex	803379	103	B3	-	226, 228	236	
AWG23/1	HELUKAT 600 U/UTP	805179	87	-	-	226, 230	237, 240, 241	
AWG23/1	HELUKAT 600 S/FTP	80810	105	B3-B4	-		240	
AWG23/1	HELUKAT 600 S/FTP duplex	81446	106	B3-B4	-		236	
AWG23/1	HELUKAT 1200 S/FTP	803380	111	B3-B4*2	-		236	
AWG23/1	HELUKAT 1200 S/FTP duplex	803381	112	B3-B4*2	-	226, 228, 229	236	
AWG22/1	HELUKAT 1200 S/FTP	81699	113	B3-B4*2	-		236	
AWG22/1	HELUKAT 1200 S/FTP duplex	800647	114	B3-B4*2	-		236	
AWG22/1	HELUKAT 1500 S/FTP	802169	115	-	-		236	
AWG22/1	HELUKAT 1500 S/FTP duplex	802170	116	-	-		236	
AWG26/7	HELUKAT 100 U/UTP flex	80055	88	B1	-			
AWG26/7	HELUKAT 100 F/UTP flex	81278	92	B1, B6-B7	-			
AWG26/7	HELUKAT 200 SF/UTP flex	81254	98	B1-B2, B6-B7, B13-B14	-			
AWG26/7	HELUKAT 200 F/UTP flex UL	802173	94	B1	-			
AWG24/7	HELUKAT 300 U/UTP flex	804996	89	-	-			
AWG26/7	HELUKAT 300 U/FTP flex UL	802174	99	B1-B2, B6-B7, B13-B14	-			
AWG26/1	HELUKAT 500 F/FTP flex	804043	104	B2	-			
AWG26/7	HELUKAT 600 S/FTP flex	80294	107	B2*2	-			
AWG22/7	HELUKABEL HMCB 200, fixed	802471	178	-	-			
AWG24/1	HELUKABEL 100IND Industrial Ethernet FRNC	805699	138					
AWG24/1	HELUKABEL 100IND Industrial Ethernet PUR Robust	805700	138					
AWG22/1	HELUKAT 100IND PROFinet A, PVC fixed	800653	148	B5-B14, B19	-			
AWG22/1	HELUKAT 100IND PROFinet A, FRNC CMG	805653	149	B5-B14, B19	-			
AWG22/1	HELUKAT 100IND PROFinet A, robust	801194	148	B5-B14, B19	-			
AWG22/1	HELUKAT 100IND PROFinet A, radiation resistant	801195	150	B5-B14, B19	-			
AWG23/1	HELUKAT 1000IND S/FTP, Robust	805680	123	B13-B14, B19	-			
AWG24/1	HELUKAT 250IND SF/UTP, PVC CMG	805655	134	B13-B14, B19	-			
AWG24/1	HELUKAT 250IND SF/UTP, PVC AWM	805681	135	B13-B14, B19	-			
AWG22/1	HELUKAT 500IND S/FTP, 10GIG	803693	131	B13-B14, B19	-			
AWG22/1	PROFINET Typ A S/FTP Cat 6A PVC	11007776	130	B13-B14, B19	-			
AWG22/1	PROFINET Typ A S/FTP Cat 6A PUR U/CSA 600V	11007778	129	B13-B14, B19	-			
AWG22/1	PROFINET Typ A S/FTP Cat 6A FRNC	11007777	128	B13-B14, B19	-			
AWG23/1	HELUKAT 600IND S/FTP, Robust	801197	121	B6, B7	-			
AWG23/1	HELUKAT 600IND S/FTP UL/CSA 600V	11007775	122	B6-B7	-			
AWG24/7	HELUKAT 600IND S/FTP, Shipline	803382	126	a.A.	-			
AWG22/7	HELUKAT 100 SF/UTP, WK Industrial 105°C	802293	141	B5-B14, B19	-			
AWG26/7	HELUKABEL 100IND Industrial Ethernet FRNC flexible	805701	139					
AWG26/7	HELUKABEL 100IND Industrial Ethernet PUR Robustflex	805702	139					
AWG22/7	HELUKAT 100IND PROFinet B, PVC flexible	800654	151	B5-B14, B19	-			
AWG22/7	HELUKAT 100IND PROFinet B, FRNC CMG flexible	805654	149	B5-B14, B19	-			
AWG22/7	HELUKAT 100IND PROFinet B, FRNC flexible	805659	136	B5-B14, B19	-			
AWG22/7	HELUKAT 100IND PROFinet B, Shipline	802185	153	B5-B14, B19	-			
AWG22/7	HELUKAT 100IND PROFinet B, Festoon	803295	153	B5-B14, B19	-			
AWG22/7 + 1,5mm <sup>2</sup>	HELUKAT 100IND PROFinet B, hybrid	801651	152	-	-			
AWG26/7	HELUKAT 200IND SF/UTP, Robustflex	800068	140	B1-B2, B6-B7, B13-B14, B19	-			
AWG24/7	HELUKAT 250S SF/UTP, PVC CMG Drag chain	805658	136	B13-B14, B19	-			
AWG26/7	HELUKAT 600IND S/FTP, Robustflex	802184	127	B2, B6-B7, B13-B14, B19	-			
AWG26/7	HELUKAT 1200IND S/FTP, Robustflex	805684	124	B13-B14, B19	-			
AWG24/19	HELUKAT 200S SF/UTP, Drag chain	800088	145	B5-B8	-			
AWG24/19	HELUKAT 200S SF/UTP, Drag chain	81155	146	-	-			
AWG26/19	HELUKAT 100T SF/UTP, Tordierflex	800067	147	B6-B8	-			
AWG24/7 + AWG22/19	HELUKABEL HMCB 500S, Drag chain	803672	179	-	-			
2x2x0,20 + 1x2x0,38	HELUKABEL HMCB 800W, Drag chain	804767	180	-	-			
AWG22/7	HELUKAT 100IND PROFinet C, high flexible	800655	154	B5-B14, B19	-			
AWG22/7	HELUKAT 100IND PROFinet C, CMG high flexible	802914	154	B5-B14, B19	-			
AWG22/19	HELUKAT 100IND PROFinet C, Torsion	802186	155	B5-B14, B19	-			
AWG26/19	HELUKAT 100S SF/UTP, Drag chain ECO	82838	142	B1, B6-B7	-			
AWG26/19	HELUKAT 100S SF/UTP, Drag chain ECO	82839	144	B1-B2	-			
AWG 26/19	HELUKAT 100S SF/UTP UL/CSA 1kV, Drag chain ECO	11007779	143	B1-B2	-			
AWG26/19	HELUKAT 250S SF/UTP, Drag chain	803387	137	B6, B7*5	-			
AWG24/7	HELUKAT 500S SF/FTP, PVC CMG Drag chain	805704	132	B13-B14, B19	-			
AWG24/7	HELUKAT 500S SF/FTP, PUR Drag chain	805703	132	B13-B14, B19	-			
AWG26/7	HELUKAT 500S SF/FTP, Drag chain	805548	133	B13-B14, B19	-			
AWG24/7	HELUKAT 600S SF/FTP, Drag chain	805614	125	B13-B14, B19	-			
AWG22/1	HELUKAT 100IND PROFinet A, armoured	801650	150	B9-B12	-			
AWG24/1	HELUKAT 200A F/UTP PE	805572	95	B3-B4*	-			
AWG24/1	HELUKAT 300A U/UTP PE	805683	90	B3-B4*	-			
AWG23/1	HELUKAT 600A S/FTP PVC/PVC	801147	108	B3-B4*	-			
AWG23/1	HELUKAT 600AE S/FTP FRNC/PE	802168	110	B3-B4*	-			
AWG 23/1	HELUKAT 600E S/FTP PVC	802167	109	B3-B4*	-			

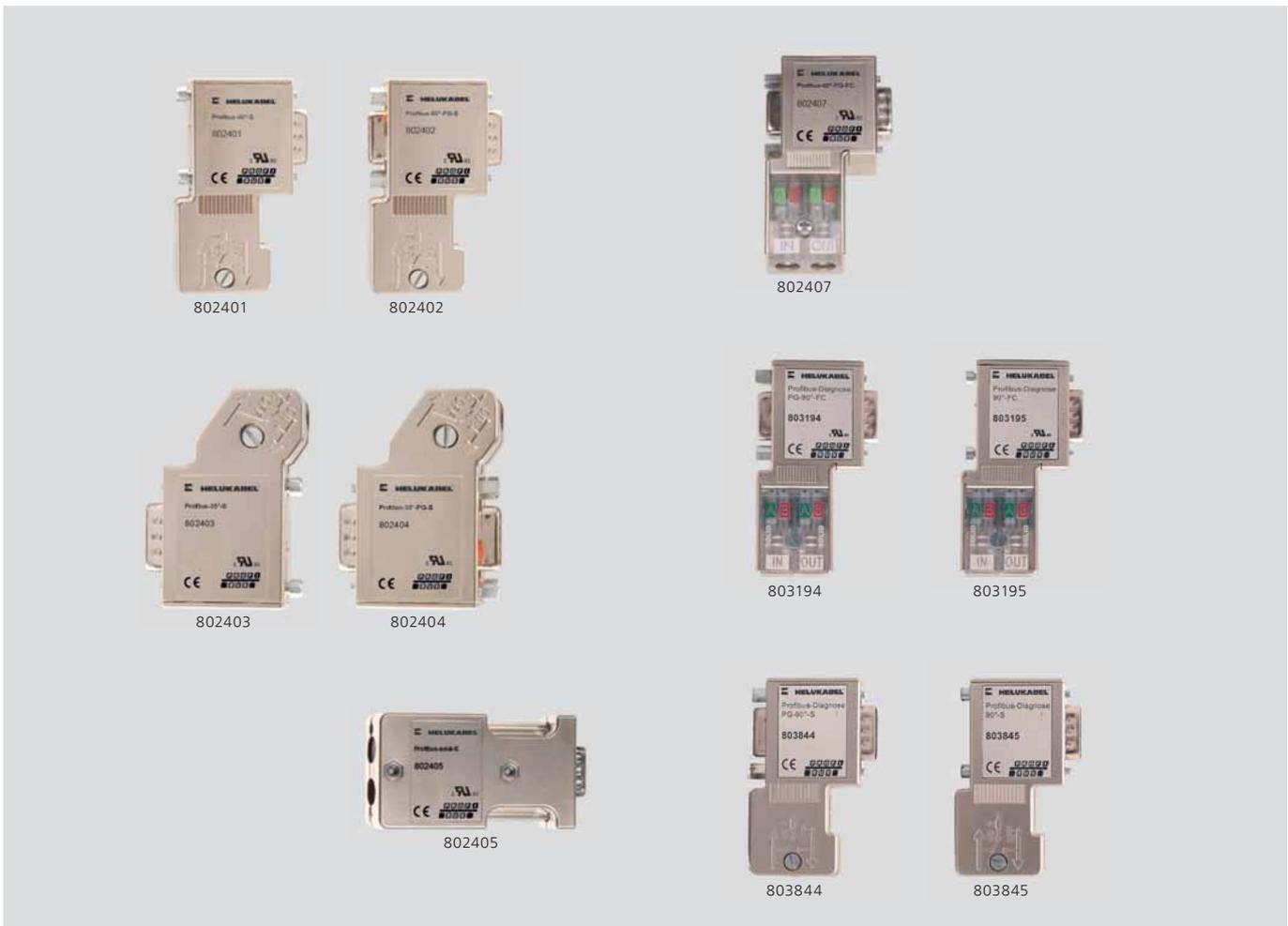
from 338

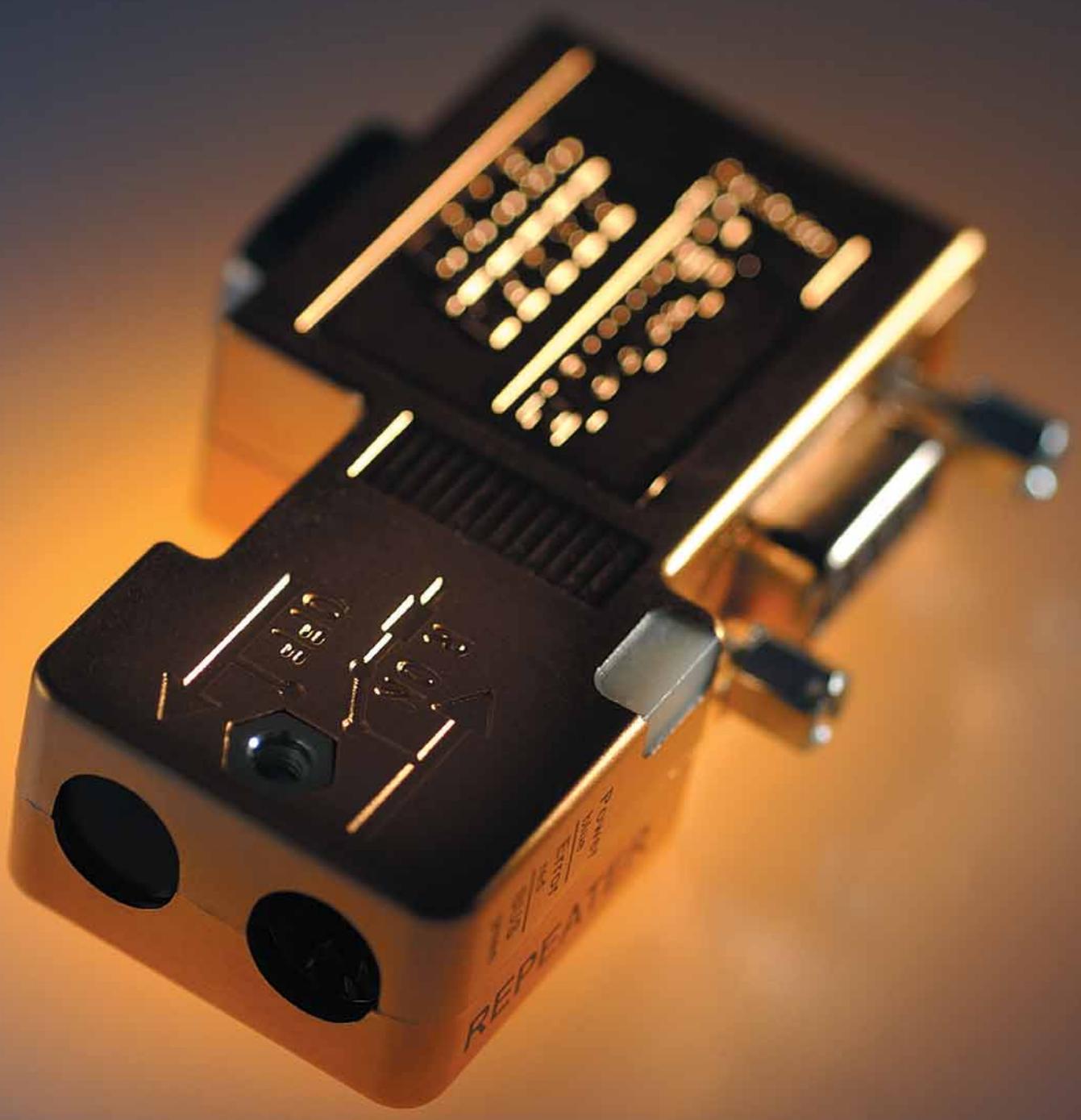
from 252

\* Preparation of the jacket before connection necessary, \*2 Reduced frequency to Cat. 6, \*3 Plugsystem- and ref. to the applications, \*4 Reduced frequency to Cat. 6 bzw. Cat. 5e, \*5 Reduced frequency to Cat. 5e

## ■ PLUG MATRIX BUS SYSTEMS

	Part no.	Description
C1	802401	Profibus-90°-S
C2	802402	Profibus-90°-PG-S
C3	802403	Profibus-35°-S
C4	802404	Profibus-35°-PG-S
C5	803356	Profibus-45°-SK, solid + flex
C6	803357	Profibus-45°-PG-SK, solid + flex
C7	803576	Profibus-45°-SK, flex
C8	803577	Profibus-45°-PG-SK, flex
C9	802405	Profibus-axial-S
C10	802406	Profibus-90°-SK, solid + flex
C11	802407	Profibus-90°-PG-SK, solid + flex
C14	803194	Profibus-90°-PG-SK Diagnose, solid + flex
C15	803195	Profibus-90°-SK Diagnose, solid + flex
C18	803844	Profibus-90°-PG-S Diagnose
C19	803845	Profibus-90°-S Diagnose
C20	803208	Profibus-axial-SK, solid + flex
C22	803511	Profibus-90°-PG-S Repeater
C23	803234	CAN-axial-S
C24	802967	CAN-90°-S
C25	803272	CAN-90°-GA-S





# PRODUCT FINDER HELUKABEL® Bus Systems

Bus Systems	Areal	Installation area	Application	UL	CSA	Flame retardance	halogen-free	resistance		Construction
								Oil	UV	
Profibus 150 Ohm	Industry	Inside	fixed	-	-	IEC 60332-1	x	x	-	konventionell
				-	-	-	-	x	x	konventionell
				-	-	IEC 60332-1	x	-	-	konventionell
				x	x	IEC 60332-1	-	-	-	konventionell
				-	-	IEC 60332-1	-	-	-	konventionell
				x	x	IEC 60332-3	-	-	x	Fast Connect (SK)
			x	x	EN 50265-2-1	x	-	x	Fast Connect (SK)	
			x	x	IEC 60332-1	x	x	x	Fast Connect (SK)	
			-	-	IEC 60332-1	x	-	-	Fast Connect (SK)	
			x	x	IEC 60332-3	-/x	-	-	Fast Connect (SK)	
			x	-	EN 50265-2-1	-	-	-	konventionell	
			-	-	IEC 60332-1	x	x	-	konventionell	
		x	-	-	x	x	x	konventionell		
		x	-	IEC 60332-1	x	x	-	konventionell		
		x	x	IEC 60332-1	x	x	-	konventionell		
		x	x	EN 50265-2-1	-	x	x	konventionell		
x	x	IEC 60332-1	x	x	x	Fast Connect (SK)				
-	-	-	-	-	-	x	konventionell			
-	-	-	-	-	-	x	konventionell			
-	-	-	-	-	-	x	konventionell			
-	-	-	-	-	-	x	Fast Connect (SK)			
Profibus PA 100 Ohm	Industry	Inside	fixed	x	-	EN 50265-2-1	-	-	-	konventionell
				x	-	IEC 60332-1	-	-	-	konventionell
				-	-	EN 50265-2-1	-	-	-	x
		x	-	EN 50265-2-1	-	-	-	x	konventionell	
		-	-	EN 50265-2-1	-	-	-	x	konventionell	
CAN Bus 120 Ohm	Industry	Inside	fixed	x	-	IEC 60332-1	-	-	-	1x2x0,22 / 4x1x0,22
				x	-	IEC 60332-1	-	-	-	2x2x0,22
				x	-	IEC 60332-1	-	-	-	1x2x0,34 / 4x1x0,34
				x	x	IEC 60332-1	-	-	-	2x2x0,34
				x	-	IEC 60332-1	-	-	-	1x2x0,5 / 4x1x0,5
				x	x	IEC 60332-1	-	-	-	2x2x0,5
			x	x	IEC 60332-1	-	-	-	1x2x0,75 / 4x1x0,75	
			x	x	IEC 60332-1	x	x	x	2x2xAWG24/19	
			-	-	-	x	x	-	1x2x0,25 / 4x1x0,25	
			x	-	IEC 60332-1	x	x	-	1x2x0,34 / 4x1x0,34	
		x	-	IEC 60332-1	x	x	-	1x2x0,5		
		x	-	IEC 60332-1	x	x	-	4x1x0,5		
		-	-	-	-	-	-	x	1x2x0,5, 4x1x0,5	
Foundation™ Fieldbus 100 Ohm	Industry	Inside/Outside	flexible	x	x	x	-	x	x	1x2x1,1/2,85-100 + 1x0,8 gnge
				x	x	x	-	x	x	1x2x1,1/2,55-100
				x	x	x	-	x	x	1x2x1,1/2,85-100 + 1x0,8 gnge
				x	x	x	-	x	x	1x2x1,1/2,85-10
DeviceNet™ 120 Ohm	Industry	Inside	fixed	x	x	IEC 60332-1	-	x	x	1x2xAWG18 + 1x2xAWG15/ 1x2xAWG24 + 1x2xAWG22
				x	x	IEC 60332-1	x	-	x	1x2xAWG18 + 1x2xAWG15/ 1x2xAWG24 + 1x2xAWG22
				x	x	VW 1	x	x	x	1x2xAWG18 + 1x2xAWG15/ 1x2xAWG24 + 1x2xAWG22
Interbus 100 Ohm	Industry	Inside	fixed	-	-	IEC 60332-1	-	-	-	3x2x0,22
				x	-	IEC 60332-1	-	-	-	3x2x0,22 + 3x1,0
			high flexible	-	-	IEC 60332-1	x	x	-	3x2x025
				-	-	IEC 60332-1	x	x	-	3x2x0,25 + 3x1,0
AS Interface	Industry	Inside	flexible	-	-	-	x	x	x	2x1,5
				-	-	-	x	x	-/x	2x2,5
				-	-	IEC 60332-1	-	x	-/x	2x1,5
			x	x	IEC 60332-1	-	x	-/x	2x1,5	
			x	x	IEC 60332-1	x	x	-/x	2x1,5	
			x	x	IEC 60332-1	x	x	-/x	2x2,5	
CC Link	Industry	Inside	fixed	x	x	IEC 60332-1	-	x	x	3x0,5
Safety BUS 110 Ohm	Industry	Inside	fixed	-	-	IEC 60332-1	-	x	-	3x0,75
				x	x	IEC 60332-1	x	x	-	3x0,75
Multibus	Industry	Inside	high flexible	x	x	VW 1/ FT1	x	x	-	1x2xAWG22+2x2xAWG22+2x2x0,25+4x1x1,0+1,0
				x	x	VW 1/ FT1	x	x	-	1x2x0,34+4x2x0,34+2x1+2x1,5+1,5
USB 2.0 90 Ohm	Industry	Inside	high flexible	x	x	IEC 60332-1	-	x	-	1x2xAWG28 + 1x2xAWG20
				x	x	IEC 60332-1	-	x	-	1x2xAWG24 + 1x2xAWG20
USB 3.0	Industry	Inside	high flexible	x	x	IEC 60332-1	x	x	-	1x2xAWG28+2x(1x2xAWG28)+1x2xAWG28
FireWire™ 800	Industry	Inside	high flexible	x	x	IEC 60332-1	x	x	-	2x2xAWG26/19 + 2xAWG22/19
Coax 50 Ohm	Industry	Inside	high flexible	-	-	IEC 60332-1	x	x	x	HF 50 0,9/2,95
EIB Bus 100 Ohm	Office	Inside	fixed	-	-	IEC 60332-1	-	-	-	2x2x0,8
				-	-	IEC 60332-1	x	-	-	2x2x0,8
				-	-	IEC 60332-1	x	-	-	2x2x0,8
		Outside	fixed	-	-	IEC 60332-1	-	-	-	4x2x0,8
-	-	-	-	-	-	x	-	x	2x2x0,8	
MOD-Bus	Office	Inside/Outside	fixed	-	-	IEC 60332-3	-	x	x	1x2x0,75
				-	-	IEC 60332-3	-	x	x	1x2x0,75 + SW
LON Bus 100/85 Ohm	Office	Inside	fixed	-	-	IEC 60332-1	x	-	-	1x2xAWG 22
			flexible	-	-	IEC 60332-1	-	-	-	1x2xAWG 16
			flexible	-	-	IEC 60332-1	x	-	-	1x2xAWG 16
Hospital-System-Bus	Office	Inside	fixed	-	-	IEC 60332-1	-/x	-	-	2x1,5+2x2x0,6

Description	Part no.	Page	Accessories		
			Plugs Number	Jumper cable Page	Processing Technic Page
Profibus L2 1x2x0,64mm PUR petrol	81186	159	C1-C4, C9, C18, C19, C22	292,293	348/350
Profibus High temperature FEP violett	802179	165	C1-C4, C9, C18, C19, C22		
Profibus L2 High temperature FRNC 200° FE120 black	805706	162	C1-C4, C9, C18, C19, C22		
Profibus L2 1x2x0,64mm PVC grey / violett	80384 / 81448	158	C1-C4, C9, C18, C19, C22		
Profibus L2 1x2x0,64mm PVC 105° violett	805705	162	C1-C4, C9, C18, C19, C22		
Profibus SK 1x2x0,64mm PVC violett	81903	170	C1-C6, C9-C11, C14, C15, C18-C20, C22		
Profibus SK 1x2x0,64mm FRNC violett	81501	171	C1-C6, C9-C11, C14, C15, C18-C20, C22		
Profibus SK 1x2x0,64mm PUR violett	81905	171	C1-C6, C9-C11, C14, C15, C18-C20, C22		
Profibus SHIPLINE FRNC violett	802178	165	C1-C4, C9, C18, C19, C22		
Profibus SK 7-wire 1x2xAWG23/7 PVC violett / 7FRNC violett	805656 / 805657	172	C1-C6, C9-C11, C14, C15, C18-C20, C22		
Profibus L2/FIP 7-wire PVC violett	800648	161	C1-C4, C9, C18, C19, C22		
Profibus L2 Drag chain 1x2x0,64mm (Litze) PUR petrol / violett	81003 / 80267	163	C1-C4, C9, C18, C19, C22		
Profibus ET200X PUR petrol	82913	164	-		
Profibus ECOFAST TPU petrol	800044	164	-		
Profibus L2 Torsion PUR violett	800109	166	C1-C4, C9, C18, C19, C22		
Profibus L2 FixedOON PVC petrol	800649	166	C1-C4, C9, C18, C19, C22		
Profibus SK Drag chain 1x2x0,64mm (Litze) PUR violett / petrol	801659 / 81906	173	C1-C4, C7-C11, C14, C15, C18-C20, C22		
Profibus L2 1x2x0,64mm PE black	80792	159	C1-C4, C9, C18, C19, C22		
Profibus L2 ERD 1x2x0,64mm PVC/PE black	82824	160	C1-C4, C9, C18, C19, C22*		
Profibus L2 ERD armoured 1x2x0,64mm PE/PE black	802177	160	C1-C4, C9, C18, C19, C22*		
Profibus SK 1x2x0,64mm PE black	81904	170	C1-C6, C9-C11, C14, C15, C18-C20, C22		
Profibus PA EX 1x2x1,0/ 2,55 PVC blue	82835	167	-		
Profibus PA Long Distance EX 1x2x1,6/ 3,2 PVC blue	800650	169	-		
Profibus PA EX armoured 1x2x1,0/ 2,55 PVC/PVC blau	802180	168	-		
Profibus PA not EX 1x2x1,0/ 2,55 PVC black	82836	167	-		
Profibus PA not EX armoured 1x2x1,0/ 2,55 PVC/PVC black	802181	168	-		
Profibus PA Long Distance not EX 1x2x1,6/ 3,2 PVC black	800715	169	-		
CAN Bus 2x0,22 PVC violett / CAN Bus 4x0,22 PVC violett	81286 / 81287	186	C23 up to C25		
CAN Bus 4x0,22 PVC violett	82509	187	C23 up to C25		
CAN Bus 2x0,34 PVC violett / CAN Bus 4x0,34 PVC violett	801572 / 801573	189	C23 up to C25		
CAN Bus 4x0,34 PVC violett	803344	190	C23 up to C25		
CAN Bus 2x0,5 PVC violett / CAN Bus 4x0,5 PVC violett	800571 / 800685	191	C23 up to C25		
CAN Bus 4x0,5 PVC violett	803722	192	C23 up to C25		
CAN Bus 2x0,75 PVC violett / CAN Bus 4x0,75 PVC violett	803383 / 803384	194	C23 up to C25		
CAN Bus 105°C 4xAWG24 PUR violett	801982	188	C23 up to C25		
CAN Bus Drag chain 2x0,25 PUR violett / 4x0,25 PUR violett	81911 / 81912	195	C23 up to C25		
CAN Bus Drag chain 2x0,34 PUR violett / 4x0,34 PUR violett	802182 / 802339	196	C23 up to C25		
CAN Bus Drag chain 2x0,5 PUR violett	805685	197	C23 up to C25		
CAN Bus Drag chain 4x0,5 PUR violett	805696	197	C23 up to C25		
CAN Bus ERD 2x0,5 PVC/PE black / CAN Bus ERD 4x0,5 PVC/PE black	804268 / 804269	193	C23 up to C25*		
Foundation™ Fieldbus Typ A armoured, PVC yellow	801192	176	-		
Foundation™ Fieldbus Basic PVC orange	803354	174	-		
Foundation™ Fieldbus Typ A + gnce, PVC yellow	801191	175	-		
Foundation™ Fieldbus Typ A, PVC yellow	801193	177	-		
DeviceNet™ Thick PVC grey/ Thin PVC grey	800683 / 800684	208	on request		
DeviceNet™ Thick FRNC violett/ Thin FRNC violett	800681 / 800682	209	on request		
DeviceNet™ Thick PUR violett/ Thin PUR violett	81909 / 81910	210	on request		
I-BUS Fernbus Fixed Inside PVC pastell-turquoise	80778	198	-		
I-BUS Insta-Fernbus Fixed Inside PVC pastell-turquoise	81202	198	-		
I-BUS Fernbus Drag chain PUR pastell-turquoise	81203	199	-		
I-BUS Insta-Fernbus Drag chain PUR pastell-turquoise	82696	199	-		
A-BUS EPDM yellow / black	80824 / 80825	202	-		
A-BUS EPDM Long Distance yellow / black	804408 / 804409	203	-		
A-BUS TPE yellow / black	801846 / 801847	207	-		
A-BUS TPE 105° yellow / black	805693 / 805694	206	-		
A-BUS PUR yellow / black	82434 / 82822	204	-		
A-BUS PUR Long Distance yellow / black	804410 / 804411	205	-		
CC-Link BUS PVC red	800497	211	-		
SafetyBUS FRNC yellow	800651	212	-		
SafetyBUS PUR yellow	800652	212	-		
Multibus I 15 core PUR violett	801652	200	on request		
Multibus II 15 core PUR violett	804115	201	on request		
USB Bus S	802469	181	on request		
USB Bus L	802470	182	on request		
USB Bus 3.0 PUR	805287	183	-		
FireWire™ 800 PUR	805057	184	-		
Coax 50 Ohm PUR	804299	185	-		
E-BUS 2-pair PVC violett / green	81081 / 81663	216/217	-		
E-BUS 2-pair FRNC violett	80826	216	-		
E-BUS 2-pair FRNC green	804042	217	-		
E-BUS 4-pair PVC violett	81077	218	-		
E-BUS ERD PE black	802800	219	-		
MOD-Bus PVC black	805698	215	-		
MOD-Bus PVC armoured black	805697	215	-		
LON BUS H122 FRNC	802187	213	-		
LON BUS Y116 PVC	802188	213	-		
LON BUS H116 FRNC	805661	214	-		
KH-BUS PVC / FRNC	81085 / 81447	220	-		

Subject to technical alternations. \* Preparation of the jacket before connection necessary.

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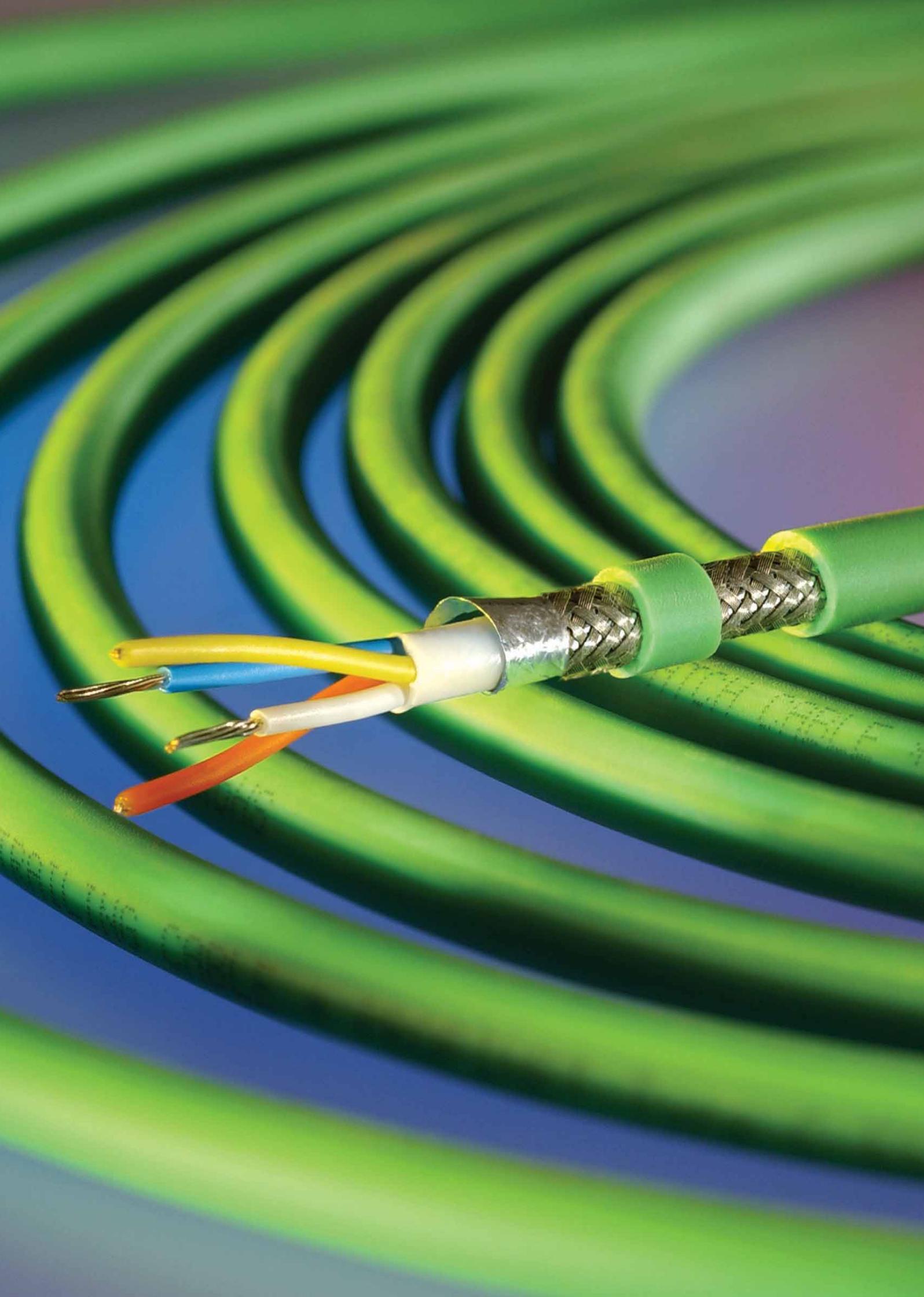
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# ■ CHAPTER OVERVIEW



## **Fibre optic cables**

S. 32 - 81

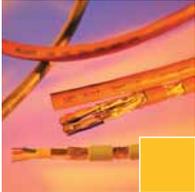
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## **Fibre optic connecting equipment - Office** S. 298 - 327

## **Fibre optic connecting equipment - Industry** S. 328 - 335

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## **Copper data cables**

S. 82 - 117

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## **Measurement & Processing Technics**

S. 336 - 351

---



## **Bus cables**

S. 118 - 221

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## **Services**

S. 352 - 355

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## **Copper connecting equipment - Office** S. 222 - 247

## **Copper connecting equipment - Industry** S. 248 - 297

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## **Technical Information**

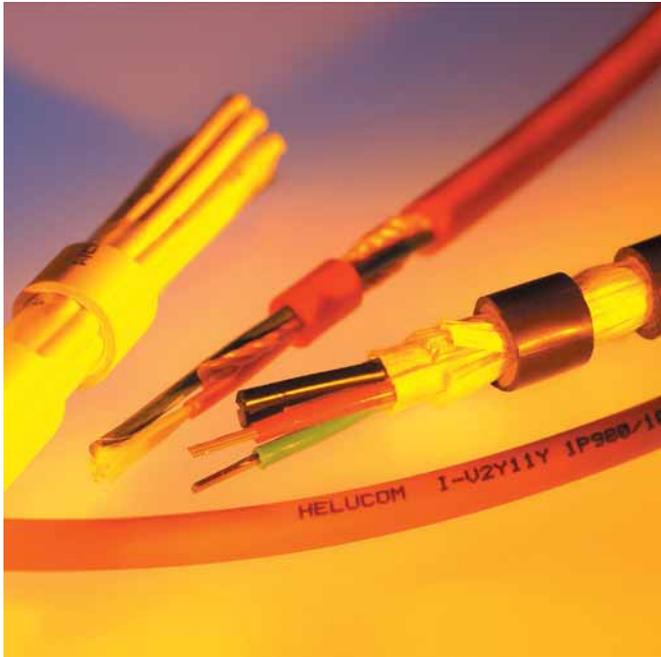
S. 356 - 432

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# OVERVIEW OF THE DATA-, NETWORK- & BUS TECHNOLOGY

## Fibre Optic Cables

HELUCOM®



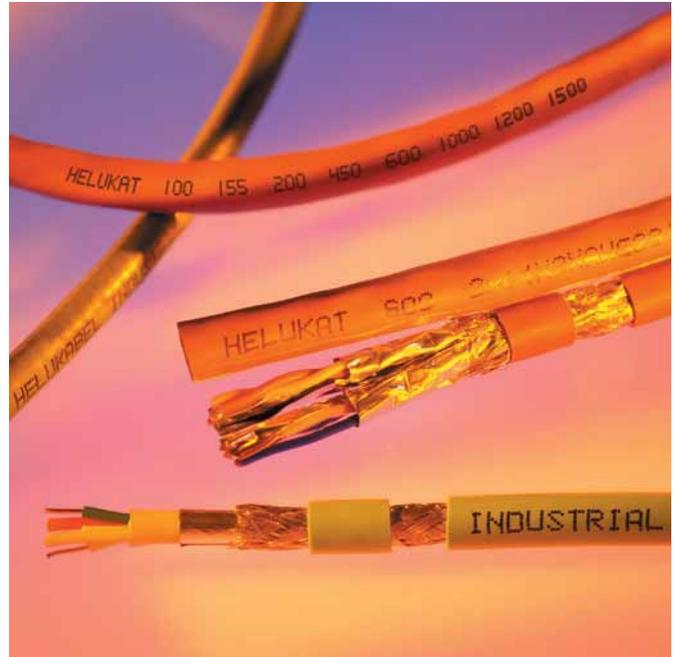
The future reliability of any installation depends on the correct choice of cable used in the network technique. It is only by careful selection of the components that compliance with the continually increasing requirements placed upon the quality of the network is possible. Infrastructures based on copper are continually nearing their physical limits because of the rapidly growing demands from multimedia developments, and hence an alternative to copper must be provided for installations in the future.

The benefits of optical fibre technology are obvious: High transmission rates, low attenuation, no electromagnetic problems, small dimensions and low weight. Modern designs for optical fibre cables of the HELUCOM® series exhibit the same robustness as a copper cable. The cable constructions are selected for optimum protection of the optical fibres in each application.

Within the HELUCOM® series, optical fibre cables are available with the common fibre types of 50/125 µm, (OM2, OM3, OM4), 62,5/125 µm (OM1), 9/125 µm (G652.D, G657.A), 200/230 µm und 980/1000 µm. The HELUCOM® optical fibre cables are manufactured in accordance with the standards and regulations of DIN VDE 0888.

## Cooper Data Cables

HELUKAT®



All HELUKAT® data cables and wires comply with the latest standardisation recommendations and are designed for use in high-speed networks with transmission rates of 100 Mbit/s and higher (e.g. CCDI, TPDDI, ATM, SDH/SONET). All HELUKAT® types of cables and wires meet the requirements of category 5 according to EIA/TIA TSB-36 ISO/IEC DIS 11801, CENELEC pr EN 50173, as well as category 6/7 according to DIN 44312-5/ EN 50288. Cables for Ethernet applications, as well as coax/twinned cables for IBM's IVS system complete the product range from HELUKABEL®.

The excellent transmission characteristics of HELUKAT® data cables and wires constitute enormous challenges for production equipment and the measurement laboratories. HELUKAT® data cables and wires are manufactured using the latest machinery technologies. These have been designed for producing cables and wires of the categories 5/6/7/8 in accordance with the latest standardisation recommendations. A special laboratory for high-frequency testing such high transmission rates has been installed complete with network analyser and computer-controlled equipment for HF cables.

## Bus-Cables



Bus technology is being used in an increasing number of industrial applications. This technology can be applied in every branch in industry where process-control techniques are used. The enormous pressures of competitiveness and costs in all areas of process control emphasise the need for even more rationalisation and greater efficiency. The traditional method of parallel wiring for the equipment and machines does not have the flexibility and thus constitutes a major factor in costs and time. The potential for saving costs from internetworking the machinery by bus systems is very high. So as to keep the amount of cabling low, the information from the master controller is sent over a bus network and is potentially available to all components in the system. Only those components specifically addressed by the information can respond and process these signals. All types of cables and wires used in all common bus systems are available from HELUKABEL®.

## Cooper connection equipment



In addition to active components and cables, passive components such as 19" patch panel, patch cable and wiring boxes are necessary for installation and start-up of a data network. The wiring boxes are an important part of both the tertiary wiring and the structured wiring as a whole. These systems, which are also referred to as „IT connection units“, can be installed in floors, walls or a channel system. No additional components are used in the wiring boxes. Also used in conjunction with the wiring boxes are sockets that fit the plug of the patch/connection cable. For operation of the data networks, HELUKABEL® provides complete CONNECTING SYSTEMS, which make it possible to ensure the full reliability and state-of-the-art functioning of the structured building wiring.

### Industrial cooper connection components

The Ethernet technology has established itself at the automation and production levels as so-called INDUSTRIAL ETHERNET because it makes continuous communication at all levels of a business network possible. By using standardised interfaces for all communication equipment, the complexity of processes is reduced and the productivity is increased. With new industry-compatible network components based on IP20, IP 65 or IP67, or suitable for DIN rail mounting and standards such as ISO/IEC 24702, the prerequisites for a completely networked future have been created.

The HELUKAT CONNECTING SYSTEMS INDUSTRY series from HELUKABEL® provides passive copper connection components such as patch panels, sockets and patch cables for harsh industrial environments.

# OVERVIEW OF THE DATA-, NETWORK- & BUS TECHNOLOGY

## Fibre optic connection



In addition to the fibre optic cable, the connection equipment plays an essential role in the construction of glass fibre networks. Optical transmission lines are only complete after installing pigtailed, jumper cables, plugs, couplings, splice boxes and wiring boxes. Regardless of the application, HELUKABEL® has the cable solution that's right for you. This also includes the use of pre-assembled fibre optic cables. In only a short time, we can supply you with pre-assembled kits containing all the most frequently used plugs and cable types. As a result, it is possible to eliminate the high costs involved in obtaining the required tools. In addition, this "plug-and-play" solution helps you to reduce the time necessary for installation. These features are what make HELUCOM CONNECTING SYSTEMS® the ideal choice when it comes to providing our customers economical, high-quality solutions.

### Industrial Fibre optics connection components

Ethernet was initially used exclusively in the office environment. The Ethernet technology has now also established itself at the automation and production levels as so-called INDUSTRIAL ETHERNET because it makes continuous communication at all levels of a business network possible.

By using standardised interfaces for all communication equipment, the complexity of processes is reduced and the productivity is increased. With new industry-compatible network components based on IP20, IP 65 or IP67, or suitable for DIN rail mounting and standards such as ISO/IEC 24702, the prerequisites for a completely networked future have been created.

## Measurement & Processing Technics



In addition to the attenuation coefficients of the fibre optic cable, the attenuation values of the connection points must be carefully observed when planning a fibre optic network. In view of the high demands posed by present-day transmission processes, it is particularly important to work toward optimising connection points with regard to their attenuation values. To achieve this goal, a thermal splice process has been used. In this process, direct splicing is carried out using an arc lamp, which creates an adhesive bond between the fibres without any air gaps or inclusion of other materials. Afterwards, functionality, reliability and performance are tested using fibre optic measuring devices. The test procedures document the quality of the system, while locating sources of errors. The test protocol provides proof as to whether the cable system has been installed correctly. OTDR and performance measuring devices are used for testing. Tool cases for fibre optic cable installation and service cases for adhesives complete the professional assortment of products. For high-speed copper networks, we offer cable analysers for certification and troubleshooting.





**HELUCOM pact fibre-optic universal cables AI-DQ(ZN)BH**

Plastic-fibre cables industry I-V4Y(ZN)11Y

Fibre-optic installation cables I-VH

Fibre-optic cables with functional integrity A-DQ(ZN)BH E30

**Fibre-optic breakout cables I-V(ZN)HH**

Fibre-optic universal mini breakout cables AI-VQ(ZN)BH

Fibre-optic aerial cables metal-free ADSS

**Fibre-optic outdoor cables A-DQ(ZN)2Y, stranded**

# FIBER OPTIC CABLES HELUCOM®

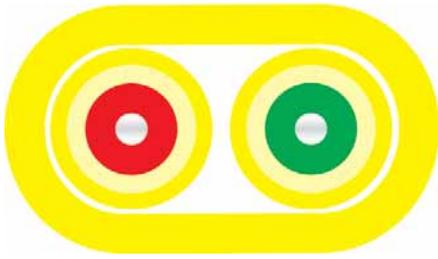
Designation			Page
<b>Indoor cables</b>			
Fibre-optic installation cables	HELUCOM®	I-VH, I-V1 1Y, I-VHH, I-V11Y1 1Y	34
Fibre-optic breakout cables	HELUCOM®	I-V(ZN)HH	35
Fibre-optic mini breakout cables	HELUCOM®	I-V(ZN)H	36
Fibre-optic bundle core cables indoor	HELUCOM®	I-D(ZN)H	37
<b>Universal cables</b>			
Fibre-optic universal mini breakout cables	HELUCOM®	A/I-VQ(ZN)BH	38
Fibre-optic universal bundle core cables	HELUCOM® pact	A/I-DQ(ZN)BH	Eca 39
Fibre-optic universal bundle core cables	HELUCOM®	A/I-DQ(ZN)BH, central	Eca 40
Fibre-optic universal bundle core cables	HELUCOM®	A/I-DQ(ZN)BH, stranded	Eca 41
Fibre-optic universal cables with functional integrity	HELUCOM® E30	A/I-DQ(ZN)BH	42
Fibre-optic universal cables with functional integrity	HELUCOM® FS90	A/I-D(ZN)BH(SR)H	43
<b>Outdoor cables</b>			
Fibre-optic outdoor cables	HELUCOM® pact	A-DQ(ZN)B2Y, central	44
Fibre-optic outdoor cables	HELUCOM®	A-DQ(ZN)B2Y, central	45
Fibre-optic outdoor cables	HELUCOM®	A-DQ(ZN)B2Y, stranded	46
Fibre-optic outdoor cables	HELUCOM®	A-DQ(ZN)B2Y fibre-combi MM+SM, stranded	47
Fibre-optic outdoor cables	HELUCOM®	A-DF(ZN)2Y	48
Fibre-optic outdoor cables	HELUCOM®	A-DF(ZN)B2Y	49
Fibre-optic outdoor cables	HELUCOM®	A-DF(ZN)2Y4Y	50
Fibre-optic outdoor cables, micro	HELUCOM®	A-DQ2Y, central	51
Fibre-optic outdoor cables, micro	HELUCOM®	A-DQ2Y, stranded	52
Fibre-optic outdoor cables, metal armouring	HELUCOM®	A-DQ(ZN)(SR)2Y	53
Fibre-optic outdoor cables, metal armouring	HELUCOM®	A-DF(ZN)2Y(SR)2Y	54
Fibre-optic outdoor cables, metal armouring	HELUCOM®	(ARCOR standard) A-DF(ZN)2Y(SR)2Y	55
Fibre-optic outdoor cables hybrid (DIN VDE 0888)	HELUCOM®	(fibre-optic temperature measurement), A-DSQ(ZN)B2Y	56
Fibre-optic outdoor cables hybrid (DIN VDE 0888)	HELUCOM®	A-DSF(L)(ZN)2Y	57
<b>Aerial cables</b>			
Fibre-optic aerial cables	HELUCOM®	ADSS L, metal-free	58
Fibre-optic aerial cables	HELUCOM®	ADSS, metal-free	59
<b>Mobile cables</b>			
Fibre Optic Cable flexible, WK - mobile	HELUCOM®	A-V(ZN)11Y	60
Fibre Optic Cable flexible, WK - UL/CSA	HELUCOM®	A-V(ZN)YY	61
<b>Industrial cables GOF</b>			
Fibre Optic Cable flexible, WK robust PUR + PVC (UL/CSA)	HELUCOM® WK	AT-V(ZN)H(ZN)11Y, AT-V(ZN)Y(ZN)Y	62
Fibre Optic Cable flexible robust	HELUCOM® WK	A-V(ZN)YY	63
Fibre Optic Breakout Cable outdoor	HELUCOM®	AT-V(ZN)HH(ZN)B2Y	64
<b>Breakout cables PROFIBUS + PROFinet</b>			
Fibre Optic Breakout Cable PROFIBUS + PROFinet, outdoor/ direct burial	HELUCOM®	AT-V(ZN)H(ZN)BH	65
Fibre Optic Breakout Cable PROFIBUS + PROFinet, fixed installation	HELUCOM®	AT-W(ZN)H(ZN)H	66
Fibre Optic Breakout Cable PROFIBUS + PROFinet, Drag Chain	HELUCOM®	AT-W(ZN)Y(ZN)11Y	67
Fibre Optic Breakout Cable PROFIBUS + PROFinet	HELUCOM®	AT-V(ZN)H(ZN)BH	68
Fibre Optic Breakout Cable PROFIBUS + PROFinet, direct burial	HELUCOM®	AT-WQ(ZN)H(ZN)B2Y	69
Fibre Optic Cable robust, multimode	HELUCOM®	AT-VYY	70
<b>Industrial cables HCS</b>			
Fibre Optic Breakout Cable robust, flexible, HCS UL/CSA	HELUCOM®	I-V(ZN)YY	71
Fibre Optic Breakout Cable robust, flexible, HCS	HELUCOM®	I-V(ZN)Y11Y	72
Fibre Optic Breakout Cable, flexible, HCS	HELUCOM®	AT-V(ZN)HH	73
Fibre Optic Breakout Cable robust, HCS	HELUCOM®	AT-VQH(ZN)B2Y	74
<b>Industrial cables POF</b>			
Plastic Fibre cable industry, POF/PE	HELUCOM®	I-V2Y, I-V2Y(ZN)11Y	75
Plastic Fibre Cable PROFinet, POF/PA	HELUCOM®	I-V4Y(ZN)Y (Typ B), I-V4Y(ZN)11Y (Typ C)	76
Plastic Fibre Cable PROFIBUS, POF/PA	HELUCOM®	I-V4Y(ZN)Y	77
Plastic Fibre Cable Automotive, POF/PA	HELUCOM®	I-V4Y(ZN)11Y	78

# Fibre Optic Indoor Cable

acc. DIN VDE 0888

**HELUCOM®**

I-VH, I-V11Y, I-VHH, I-V11Y11Y



## Cable structure

Core type: Composite buffered  
Strain relief elements: Aramide  
Outer sheath material: FRNC  
Outer sheath colour: Yellow

## Temperature range

Laying, min.: 0°C  
Laying, max.: +50°C  
Operating, min.: 0°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Flame-resistance acc. to IEC 60332-1-2  
Smoke density acc. to IEC 61034

Designation	No. of fibres	Fibre type	Fibre category	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
I-VH	1	Multimode G50/125	OM2	2,6	300	40	0,17	10	8,7	<b>80783</b>
I-VH	1	Multimode G62.5/125	OM1	2,6	300	40	0,17	10	8,7	<b>80782</b>
I-VH	1	Single-mode E9/125	ITU-T G.652	2,6	300	40	0,17	10	8,7	<b>80784</b>
I-VH	2	Multimode G50/125	OM2	2,6 x 5,6	400	40	0,24	10	17,5	<b>80316</b>
I-VH	2	Multimode G50/125	OM3	2,6 x 5,6	400	40	0,24	10	17,5	<b>804256</b>
I-VH	2	Multimode G62.5/125	OM1	2,6 x 5,6	400	40	0,24	10	17,5	<b>80699</b>
I-VH	2	Single-mode E9/125	ITU-T G.652	2,6 x 5,6	400	40	0,24	10	17,5	<b>80785</b>
I-V11Y	2	Multimode G50/125	OM2	2,6 x 5,6	400	40	2,80	20	14,0	<b>82408</b>
I-V11Y	2	Multimode G62.5/125	OM1	2,6 x 5,6	400	40	2,80	20	14,0	<b>82410</b>
I-V11Y	2	Single-mode E9/125	ITU-T G.652	2,6 x 5,6	400	40	2,80	20	14,0	<b>82411</b>
I-VHH	2	Multimode G50/125	OM2	3,6 x 6,2	600	50	0,57	20	20,0	<b>80789</b>
I-VHH	2	Multimode G50/125	OM3	3,6 x 6,2	600	50	0,57	20	20,0	<b>804254</b>
I-VHH	2	Multimode G62.5/125	OM1	3,6 x 6,2	600	50	0,57	20	20,0	<b>80790</b>
I-VHH	2	Single-mode E9/125	ITU-T G.652	3,6 x 6,2	600	50	0,57	20	20,0	<b>80791</b>
I-V11Y11Y	2	Multimode G50/125	OM2	3,6 x 6,2	600	60	4,20	20	16,0	<b>82409</b>
I-V11Y11Y	2	Multimode G62.5/125	OM1	3,6 x 6,2	600	60	4,20	20	16,0	<b>81900</b>
I-V11Y11Y	2	Single-mode E9/125	ITU-T G.652	3,6 x 6,2	600	60	4,20	20	16,0	<b>82412</b>

Dimensions and specifications may be changed without prior notice.

## Application

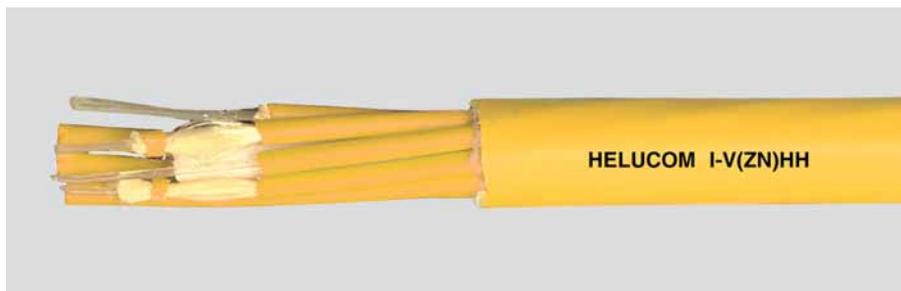
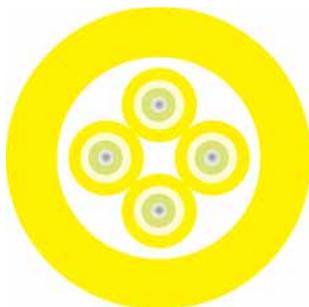
These HELUCOM® one-fibre and two-fibre (duplex) cables are used for fixed indoor installation, such as in cable ducts. These cables are also used as ready-made cables (pigtailed) that are spliced to fixed cables or as connection cables (jumper cable) as well as for switch frames. The small diameter and the high flexibility make these cables ideal for the application in switch frames as well as for the connection of terminals.

# Fibre Optic Breakout-Cable

acc. DIN VDE 0888

HELUCOM®

I-V(ZN)HH



## Cable structure

Core type: Composite buffered  
Strain relief elements: Aramide  
Outer sheath material: FRNC  
Outer sheath colour: Yellow

## Temperature range

Laying, min.: 0°C  
Laying, max.: +50°C  
Operating, min.: 0°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Flame-resistance acc. to IEC 60332-1 and IEC 60332-3  
Smoke density acc. to IEC 61034

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
I-V(ZN)HH	2	Multimode G50/125	OM2	1	7,4	500	120,0	1,00	150	50,0	<b>80743</b>
I-V(ZN)HH	2	Multimode G62.5/125	OM1	1	7,4	500	120,0	1,00	150	50,0	<b>80799</b>
I-V(ZN)HH	2	Single-mode E9/125	ITU-T G.652	1	7,4	800	120,0	1,00	150	54,0	<b>80813</b>
I-V(ZN)HH	4	Multimode G50/125	OM2	1	7,4	800	120,0	1,00	150	54,0	<b>80753</b>
I-V(ZN)HH	4	Multimode G62.5/125	OM1	1	7,4	800	120,0	1,00	150	54,0	<b>80800</b>
I-V(ZN)HH	4	Single-mode E9/125	ITU-T G.652	1	7,4	800	120,0	1,00	150	54,0	<b>80814</b>
I-V(ZN)HH	8	Multimode G50/125	OM2	1	9,7	2400	150,0	1,50	150	95,0	<b>80688</b>
I-V(ZN)HH	8	Multimode G62.5/125	OM1	1	9,7	2400	150,0	1,50	150	95,0	<b>80801</b>
I-V(ZN)HH	8	Single-mode E9/125	ITU-T G.652	1	9,7	2400	150,0	1,50	150	95,0	<b>80816</b>
I-V(ZN)HH	12	Multimode G50/125	OM2	1	12,2	3000	190,0	1,85	150	144,0	<b>80795</b>
I-V(ZN)HH	12	Multimode G62.5/125	OM1	1	12,2	3000	190,0	1,85	150	144,0	<b>80803</b>
I-V(ZN)HH	12	Single-mode E9/125	ITU-T G.652	1	12,2	3000	190,0	1,85	150	144,0	<b>80818</b>
I-V(ZN)HH	24	Multimode G50/125	OM2	1	14,3	4000	220,0	3,20	150	197,0	<b>80798</b>
I-V(ZN)HH	24	Multimode G62.5/125	OM1	1	14,3	4000	220,0	3,20	150	197,0	<b>80806</b>
I-V(ZN)HH	24	Single-mode E9/125	ITU-T G.652	1	14,3	4000	220,0	3,20	150	197,0	<b>80821</b>

Dimensions and specifications may be changed without prior notice.

## Application

HELUCOM® breakout cables are designed to replace splicing on-site. They are mainly used in indoor applications for small and medium transmission lines. The fibre-optic connectors are mounted directly to the individual cables. Therefore no splicing and no splice boxes are necessary. Pre-assembled cables only need to be laid on site and are immediately functional.

# Fibre Optic Minibreakout Cable

acc. DIN VDE 0888

HELUCOM®

I-V(ZN)H



## Cable structure

Core type: Tight buffer  
Strain relief elements: Aramide  
Outer sheath material: FRNC  
Outer sheath colour: Orange

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -10°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Flame-resistance acc. to IEC 60332-1-2  
Smoke density acc. to IEC 61034

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
I-V(ZN)H	2	Multimode G50/125	OM2	1	4,0	400	60,0	0,24	40	15,0	<b>80435</b>
I-V(ZN)H	2	Multimode G62.5/125	OM1	1	4,0	400	60,0	0,24	40	15,0	<b>80434</b>
I-V(ZN)H	2	Single-mode E9/125	ITU-T G.652	1	4,0	400	60,0	0,24	40	15,0	<b>80433</b>
I-V(ZN)H	4	Multimode G50/125	OM2	1	4,8	400	70,0	0,31	40	19,0	<b>80432</b>
I-V(ZN)H	4	Multimode G62.5/125	OM1	1	4,8	400	70,0	0,31	40	19,0	<b>80431</b>
I-V(ZN)H	4	Single-mode E9/125	ITU-T G.652	1	4,8	400	70,0	0,31	40	19,0	<b>80430</b>
I-V(ZN)H	6	Multimode G50/125	OM2	1	5,3	400	80,0	0,35	40	23,0	<b>80429</b>
I-V(ZN)H	6	Multimode G62.5/125	OM1	1	5,3	400	80,0	0,35	40	23,0	<b>80428</b>
I-V(ZN)H	6	Single-mode E9/125	ITU-T G.652	1	5,3	400	80,0	0,35	40	23,0	<b>80427</b>
I-V(ZN)H	8	Multimode G50/125	OM2	1	5,3	500	80,0	0,40	40	25,0	<b>80426</b>
I-V(ZN)H	8	Multimode G62.5/125	OM1	1	5,3	500	80,0	0,40	40	25,0	<b>80425</b>
I-V(ZN)H	8	Single-mode E9/125	ITU-T G.652	1	5,3	500	80,0	0,40	40	25,0	<b>80424</b>
I-V(ZN)H	12	Multimode G50/125	OM2	1	7,0	800	110,0	0,61	40	40,0	<b>80420</b>
I-V(ZN)H	12	Multimode G62.5/125	OM1	1	7,0	800	110,0	0,61	40	40,0	<b>80419</b>
I-V(ZN)H	12	Single-mode E9/125	ITU-T G.652	1	7,0	800	110,0	0,61	40	40,0	<b>80418</b>

Dimensions and specifications may be changed without prior notice.

## Application

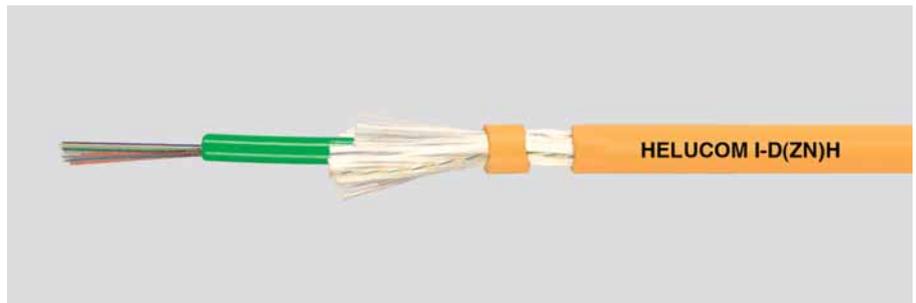
These HELUCOM® fibre-optic cables are used for the data network cabling in indoor applications. A big advantage of this cable type is its space-saving construction. Similar to the breakout cable, the connector is directly mounted at the tight buffer.

# Fibre Optic Indoor Cable

acc. DIN VDE 0888

**HELUCOM**<sup>®</sup>

I-D(ZN)H



## Cable structure

Core type: Loose tube  
Strain relief elements: Aramide  
Outer sheath material: FRNC  
Outer sheath colour: Yellow

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Flame-resistance acc. to IEC 60332-1-2  
Smoke density acc. to IEC 61034

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
I-D(ZN)H	4	Multimode G50/125	OM2	4	8,0	1200	120,0	1,50	150	65,0	<b>80631</b>
I-D(ZN)H	4	Multimode G62.5/125	OM1	4	8,0	1200	120,0	1,50	150	65,0	<b>80882</b>
I-D(ZN)H	4	Single-mode E9/125	ITU-T G.652	4	8,0	1200	120,0	1,50	150	65,0	<b>80896</b>
I-D(ZN)H	6	Multimode G50/125	OM2	6	8,0	1200	120,0	1,50	150	65,0	<b>80868</b>
I-D(ZN)H	6	Multimode G62.5/125	OM1	6	8,0	1200	120,0	1,50	150	65,0	<b>80883</b>
I-D(ZN)H	6	Single-mode E9/125	ITU-T G.652	6	8,0	1200	120,0	1,50	150	65,0	<b>80897</b>
I-D(ZN)H	8	Multimode G50/125	OM2	8	8,0	1200	120,0	1,50	150	65,0	<b>80869</b>
I-D(ZN)H	8	Multimode G62.5/125	OM1	8	8,0	1200	120,0	1,50	150	65,0	<b>80884</b>
I-D(ZN)H	8	Single-mode E9/125	ITU-T G.652	8	8,0	1200	120,0	1,50	150	65,0	<b>80898</b>
I-D(ZN)H	10	Multimode G50/125	OM2	10	8,0	1200	120,0	1,50	150	65,0	<b>80793</b>
I-D(ZN)H	10	Multimode G62.5/125	OM1	10	8,0	1200	120,0	1,50	150	65,0	<b>80885</b>
I-D(ZN)H	10	Single-mode E9/125	ITU-T G.652	10	8,0	1200	120,0	1,50	150	65,0	<b>80899</b>
I-D(ZN)H	12	Multimode G50/125	OM2	12	8,0	1200	120,0	1,50	150	65,0	<b>80045</b>
I-D(ZN)H	12	Multimode G62.5/125	OM1	12	8,0	1200	120,0	1,50	150	65,0	<b>80879</b>
I-D(ZN)H	12	Single-mode E9/125	ITU-T G.652	12	8,0	1200	120,0	1,50	150	65,0	<b>80880</b>
I-D(ZN)H	16	Multimode G50/125	OM2	16	8,0	1200	120,0	1,50	150	135,0	<b>80870</b>
I-D(ZN)H	16	Multimode G62.5/125	OM1	16	8,0	1200	120,0	1,50	150	135,0	<b>80886</b>
I-D(ZN)H	16	Single-mode E9/125	ITU-T G.652	16	8,0	1200	120,0	1,50	150	135,0	<b>80900</b>
I-D(ZN)H	24	Multimode G50/125	OM2	12	12,5	3000	190,0	2,20	200	150,0	<b>80872</b>
I-D(ZN)H	24	Multimode G50/125	OM2	24	9,0	1600	140,0	1,50	150	135,0	<b>80871</b>
I-D(ZN)H	24	Multimode G62.5/125	OM1	12	12,5	3000	190,0	2,20	200	150,0	<b>80888</b>
I-D(ZN)H	24	Multimode G62.5/125	OM1	24	9,0	1600	140,0	1,50	150	135,0	<b>81246</b>
I-D(ZN)H	24	Single-mode E9/125	ITU-T G.652	12	12,5	3000	190,0	2,20	200	150,0	<b>80902</b>
I-D(ZN)H	24	Single-mode E9/125	ITU-T G.652	24	9,0	1600	140,0	1,50	150	135,0	<b>80901</b>
I-D(ZN)H	36	Multimode G50/125	OM2	12	13,5	3000	200,0	2,20	200	160,0	<b>80875</b>
I-D(ZN)H	36	Multimode G62.5/125	OM1	12	13,5	3000	200,0	2,20	200	160,0	<b>80891</b>
I-D(ZN)H	36	Single-mode E9/125	ITU-T G.652	12	13,5	3000	200,0	2,20	200	160,0	<b>80905</b>
I-D(ZN)H	48	Multimode G50/125	OM2	12	13,5	3000	200,0	2,20	200	160,0	<b>80877</b>
I-D(ZN)H	48	Multimode G62.5/125	OM1	12	13,5	3000	200,0	2,20	200	160,0	<b>80893</b>
I-D(ZN)H	48	Single-mode E9/125	ITU-T G.652	12	13,5	3000	200,0	2,20	200	160,0	<b>80907</b>
I-D(ZN)H	60	Multimode G50/125	OM2	12	13,5	3000	200,0	2,20	200	170,0	<b>80878</b>
I-D(ZN)H	60	Multimode G62.5/125	OM1	12	13,5	3000	200,0	2,20	200	170,0	<b>80894</b>
I-D(ZN)H	60	Single-mode E9/125	ITU-T G.652	12	13,5	3000	200,0	2,20	200	170,0	<b>80908</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM<sup>®</sup> fibre-optic cables are available either as central bundle core cable or as stranded versions. They are suitable for indoor cabling of buildings and facilities. The halogen-free version is especially suitable for the application in skyscrapers, hospitals and stores as well as in facilities with high concentration of capital goods, such as power plants, computing centers, and at locations with high security requirements, such as underground and control stations.

# Fibre Optic Indoor/Outdoor Minibreakout Cable

acc. DIN VDE 0888

**HELUCOM**<sup>®</sup>  
A/I-VQ(ZN)BH



## Cable structure

Core type: Tight buffer  
Strain relief elements: Aramide  
Type of armouring: Glass yarns  
Outer sheath material: FRNC  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +55°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Flame-resistance acc. to IEC 60332-1-2  
Smoke density acc. to IEC 61034  
UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A/I-VQ(ZN)BH	4	Multimode G50/125	OM2	1	6,1	2000	90,0	0,35	40	40,0	<b>82804</b>
A/I-VQ(ZN)BH	4	Multimode G62.5/125	OM1	1	6,1	2000	90,0	0,35	40	40,0	<b>82809</b>
A/I-VQ(ZN)BH	4	Single-mode E9/125	ITU-T G.652	1	6,1	2000	90,0	0,35	40	40,0	<b>82814</b>
A/I-VQ(ZN)BH	6	Multimode G50/125	OM2	1	6,6	2000	100,0	0,41	40	47,0	<b>82805</b>
A/I-VQ(ZN)BH	6	Multimode G62.5/125	OM1	1	6,6	2000	100,0	0,41	40	47,0	<b>82810</b>
A/I-VQ(ZN)BH	6	Single-mode E9/125	ITU-T G.652	1	6,6	2000	100,0	0,41	40	47,0	<b>82815</b>
A/I-VQ(ZN)BH	8	Multimode G50/125	OM2	1	6,6	2000	100,0	0,43	40	51,0	<b>82806</b>
A/I-VQ(ZN)BH	8	Multimode G62.5/125	OM1	1	6,6	2000	100,0	0,43	40	51,0	<b>82811</b>
A/I-VQ(ZN)BH	8	Single-mode E9/125	ITU-T G.652	1	6,6	2000	100,0	0,43	40	51,0	<b>82816</b>
A/I-VQ(ZN)BH	12	Multimode G50/125	OM2	1	8,3	3000	125,0	0,71	40	70,0	<b>82808</b>
A/I-VQ(ZN)BH	12	Multimode G62.5/125	OM1	1	8,3	3000	125,0	0,71	40	70,0	<b>82813</b>
A/I-VQ(ZN)BH	12	Single-mode E9/125	ITU-T G.652	1	8,3	3000	125,0	0,71	40	70,0	<b>82818</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM<sup>®</sup> fibre-optic cables are used for the data network cabling in indoor and outdoor applications. With their black UV-resistant outer sheath and the non-metallic rodent protection, they are perfectly suited for outdoor use. A big advantage of this cable type is its space-saving construction. Similar to the breakout cable, the connector is directly mounted at the tight buffer.

# Fibre Optic Indoor/Outdoor Cable

acc. DIN VDE 0888

**HELUCOM<sup>®</sup> pact**   
A/I-DQ(ZN)BH



## Cable structure

Core type: Loose tube  
Strain relief elements: Glass yarns  
Type of armouring: Glass yarns  
Outer sheath material: FRNC  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Flame-resistance acc. to IEC 60332-1-2  
Smoke density acc. to IEC 61034  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A/I-DQ(ZN)BH	4	Multimode G50/125	OM2	4	7,5	1500	150,0	1,10	200	55,0	<b>82792</b>
A/I-DQ(ZN)BH	4	Multimode G62.5/125	OM1	4	7,5	1500	150,0	1,10	200	55,0	<b>82796</b>
A/I-DQ(ZN)BH	4	Single-mode E9/125	ITU-T G.652	4	7,5	1500	150,0	1,10	200	55,0	<b>82800</b>
A/I-DQ(ZN)BH	6	Multimode G50/125	OM2	6	7,5	1500	150,0	1,10	200	55,0	<b>82793</b>
A/I-DQ(ZN)BH	6	Multimode G50/125	OM3	6	7,5	1500	150,0	1,10	200	55,0	<b>802277</b>
A/I-DQ(ZN)BH	6	Multimode G62.5/125	OM1	6	7,5	1500	150,0	1,10	200	55,0	<b>82797</b>
A/I-DQ(ZN)BH	6	Single-mode E9/125	ITU-T G.652	6	7,5	1500	150,0	1,10	200	55,0	<b>82801</b>
A/I-DQ(ZN)BH	8	Multimode G50/125	OM2	8	7,5	1500	150,0	1,10	200	55,0	<b>82794</b>
A/I-DQ(ZN)BH	8	Multimode G50/125	OM3	8	7,5	1500	150,0	1,10	200	55,0	<b>802278</b>
A/I-DQ(ZN)BH	8	Multimode G62.5/125	OM1	8	7,5	1500	150,0	1,10	200	55,0	<b>82798</b>
A/I-DQ(ZN)BH	8	Single-mode E9/125	ITU-T G.652	8	7,5	1500	150,0	1,10	200	55,0	<b>82802</b>
A/I-DQ(ZN)BH	12	Multimode G50/125	OM2	12	7,5	1500	150,0	1,10	200	55,0	<b>82795</b>
A/I-DQ(ZN)BH	12	Multimode G50/125	OM3	12	7,5	1500	150,0	1,10	200	55,0	<b>802248</b>
A/I-DQ(ZN)BH	12	Multimode G50/125	OM4	12	7,5	1500	150,0	1,10	200	55,0	<b>804705</b>
A/I-DQ(ZN)BH	12	Multimode G62.5/125	OM1	12	7,5	1500	150,0	1,10	200	55,0	<b>82799</b>
A/I-DQ(ZN)BH	12	Single-mode E9/125	ITU-T G.652	12	7,5	1500	150,0	1,10	200	55,0	<b>82803</b>
A/I-DQ(ZN)BH	24	Multimode G50/125	OM2	24	8,5	1500	170,0	1,40	200	75,0	<b>802143</b>
A/I-DQ(ZN)BH	24	Multimode G50/125	OM3	24	8,5	1500	170,0	1,40	200	75,0	<b>802249</b>
A/I-DQ(ZN)BH	24	Multimode G50/125	OM4	24	8,5	1500	170,0	1,40	200	75,0	<b>804706</b>
A/I-DQ(ZN)BH	24	Multimode G62.5/125	OM1	24	8,5	1500	170,0	1,40	200	75,0	<b>802144</b>
A/I-DQ(ZN)BH	24	Single-mode E9/125	ITU-T G.652	24	8,5	1500	170,0	1,40	200	75,0	<b>802145</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM<sup>®</sup> pact fibre-optic cables have a small but robust construction. They are suitable for indoor and outdoor cabling of buildings and facilities when space is an important argument. They are used in particular if the installation is to be done in one piece from the inside to the outside without additional use of couplings. With their black UV-resistant outer sheath and the non-metallic rodent protection, they are perfectly suited for outdoor use. The halogen-free outer sheath makes installation inhouse possible without any problems.

# Fibre Optic Indoor/Outdoor Cable

acc. DIN VDE 0888

**HELUCOM**®   
A/I-DQ(ZN)BH, central



## Cable structure

Core type: Loose tube  
Strain relief elements: Glass yarns  
Type of armouring: Glass yarns  
Outer sheath material: FRNC  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Flame-resistance acc. to IEC 60332-1-2  
Smoke density acc. to IEC 61034  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A/I-DQ(ZN)BH	4	Multimode G50/125	OM2	4	10,0	2500	150,0	1,50	300	75,0	<b>80270</b>
A/I-DQ(ZN)BH	4	Multimode G62.5/125	OM1	4	10,0	2500	150,0	1,50	300	75,0	<b>80276</b>
A/I-DQ(ZN)BH	4	Single-mode E9/125	ITU-T G.652	4	10,0	2500	150,0	1,50	300	75,0	<b>80264</b>
A/I-DQ(ZN)BH	6	Multimode G50/125	OM2	6	10,0	2500	150,0	1,50	300	75,0	<b>80271</b>
A/I-DQ(ZN)BH	6	Multimode G62.5/125	OM1	6	10,0	2500	150,0	1,50	300	75,0	<b>80265</b>
A/I-DQ(ZN)BH	6	Single-mode E9/125	ITU-T G.652	6	10,0	2500	150,0	1,50	300	75,0	<b>80272</b>
A/I-DQ(ZN)BH	8	Multimode G50/125	OM2	8	10,0	2500	150,0	1,50	300	75,0	<b>80273</b>
A/I-DQ(ZN)BH	8	Multimode G62.5/125	OM1	8	10,0	2500	150,0	1,50	300	75,0	<b>80274</b>
A/I-DQ(ZN)BH	8	Single-mode E9/125	ITU-T G.652	8	10,0	2500	150,0	1,50	300	75,0	<b>80275</b>
A/I-DQ(ZN)BH	12	Multimode G50/125	OM2	12	10,0	2500	150,0	1,50	300	75,0	<b>80681</b>
A/I-DQ(ZN)BH	12	Multimode G62.5/125	OM1	12	10,0	2500	150,0	1,50	300	75,0	<b>80278</b>
A/I-DQ(ZN)BH	12	Single-mode E9/125	ITU-T G.652	12	10,0	2500	150,0	1,50	300	75,0	<b>80279</b>
A/I-DQ(ZN)BH	16	Multimode G50/125	OM2	16	10,0	2500	150,0	1,50	300	85,0	<b>80280</b>
A/I-DQ(ZN)BH	16	Multimode G62.5/125	OM1	16	10,0	2500	150,0	1,50	300	85,0	<b>80281</b>
A/I-DQ(ZN)BH	16	Single-mode E9/125	ITU-T G.652	16	10,0	2500	150,0	1,50	300	85,0	<b>80851</b>
A/I-DQ(ZN)BH	24	Multimode G50/125	OM2	24	10,0	2500	150,0	1,50	300	85,0	<b>80725</b>
A/I-DQ(ZN)BH	24	Multimode G62.5/125	OM1	24	10,0	2500	150,0	1,50	300	85,0	<b>82431</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are available either as central bundle core cable or as stranded versions. They are suitable for indoor and outdoor cabling of buildings and facilities. They are used in particular if the installation is to be done in one piece from the inside to the outside without additional use of couplings. With their black UV-resistant outer sheath and the non-metallic rodent protection, they are perfectly suited for outdoor use. The halogen-free outer sheath makes installation inhouse possible without any problems.

# Fibre Optic Indoor/Outdoor Cable

acc. DIN VDE 0888

**HELUCOM** <sup>CPR</sup>  
Eca

A/I-DQ(ZN)BH, stranded



## Cable structure

Core type: Loose tube  
GRP support element  
Strain relief elements: Glass yarns  
Type of armouring: Glass yarns  
Outer sheath material: FRNC  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Flame-resistance acc. to IEC 60332-1-2  
Smoke density acc. to IEC 61034  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A/I-DQ(ZN)BH	24	Multimode G50/125	OM2	12	11,0	2700	165,0	2,00	600	90,0	<b>81495</b>
A/I-DQ(ZN)BH	24	Multimode G62.5/125	OM1	12	11,0	2700	165,0	2,00	600	90,0	<b>802263</b>
A/I-DQ(ZN)BH	24	Single-mode E9/125	ITU-T G.652	12	11,0	2700	165,0	2,00	600	90,0	<b>80846</b>
A/I-DQ(ZN)BH	24	Multimode G50/125	OM3	12	11,0	2700	165,0	2,00	600	90,0	<b>801616</b>
A/I-DQ(ZN)BH	48	Multimode G50/125	OM2	12	11,0	2700	165,0	2,00	600	90,0	<b>802261</b>
A/I-DQ(ZN)BH	48	Multimode G50/125	OM3	12	11,0	2700	165,0	2,00	600	90,0	<b>802280</b>
A/I-DQ(ZN)BH	48	Multimode G62.5/125	OM1	12	11,0	2700	165,0	2,00	600	90,0	<b>802264</b>
A/I-DQ(ZN)BH	48	Single-mode E9/125	ITU-T G.652	12	11,0	2700	165,0	2,00	600	90,0	<b>802266</b>
A/I-DQ(ZN)BH	60	Multimode G50/125	OM2	12	11,0	2700	165,0	2,00	600	90,0	<b>802262</b>
A/I-DQ(ZN)BH	60	Multimode G62.5/125	OM1	12	11,0	2700	165,0	2,00	600	90,0	<b>802265</b>
A/I-DQ(ZN)BH	60	Single-mode E9/125	ITU-T G.652	12	11,0	2700	165,0	2,00	600	90,0	<b>802267</b>
A/I-DQ(ZN)BH	72	Multimode G50/125	OM2	12	11,5	2700	175,0	2,10	600	100,0	<b>802268</b>
A/I-DQ(ZN)BH	72	Multimode G62.5/125	OM1	12	11,5	2700	175,0	2,10	600	100,0	<b>802271</b>
A/I-DQ(ZN)BH	72	Single-mode E9/125	ITU-T G.652	12	11,5	2700	175,0	2,10	600	100,0	<b>802274</b>
A/I-DQ(ZN)BH	84	Multimode G50/125	OM2	12	12,5	3000	190,0	2,40	600	130,0	<b>802269</b>
A/I-DQ(ZN)BH	84	Multimode G62.5/125	OM1	12	12,5	3000	190,0	2,40	600	130,0	<b>802272</b>
A/I-DQ(ZN)BH	84	Single-mode E9/125	ITU-T G.652	12	12,5	3000	190,0	2,40	600	130,0	<b>802275</b>
A/I-DQ(ZN)BH	96	Multimode G50/125	OM2	12	12,5	3000	190,0	2,80	600	130,0	<b>802270</b>
A/I-DQ(ZN)BH	96	Multimode G62.5/125	OM1	12	12,5	3000	190,0	2,80	600	130,0	<b>802273</b>
A/I-DQ(ZN)BH	96	Single-mode E9/125	ITU-T G.652	12	12,5	3000	190,0	2,80	600	130,0	<b>802276</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are available either as central bundle core cable or as stranded versions. They are suitable for indoor and outdoor cabling of buildings and facilities. They are used in particular if the installation is to be done in one piece from the inside to the outside without additional use of couplings. With their black UV-resistant outer sheath and the non-metallic rodent protection, they are perfectly suited for outdoor use. The halogen-free outer sheath makes installation inhouse possible without any problems.

# Fibre Optic Cable with Functionality

with reference to DIN 4102-12

HELUCOM® FS30

A/I-DQ(ZN)BH



## Cable structure

Core type: Loose tube  
Strain relief elements: Aramide  
Type of armouring: Glass yarns  
Outer sheath material: FR/LSOH  
Outer sheath colour: Red

## Temperature range

Laying, min.: -10°C  
Laying, max.: +50°C  
Operating, min.: -25°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Flame-resistance acc. to IEC 60332-1-2  
Smoke density acc. to IEC 61034  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant  
Functional integrity: E30

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A/I-DQ(ZN)BH	4	Multimode G50/125	OM2	4	7,8	1000	80,0	1,08	200	102,0	<b>801217</b>
A/I-DQ(ZN)BH	4	Multimode G62.5/125	OM1	4	7,8	1000	80,0	1,08	200	102,0	<b>801218</b>
A/I-DQ(ZN)BH	4	Single-mode E9/125	ITU-T G.652	4	7,8	1000	80,0	1,08	200	102,0	<b>801219</b>
A/I-DQ(ZN)BH	12	Multimode G50/125	OM2	12	7,8	1000	80,0	1,08	200	102,0	<b>801220</b>
A/I-DQ(ZN)BH	12	Multimode G62.5/125	OM1	12	7,8	1000	80,0	1,08	200	102,0	<b>801221</b>
A/I-DQ(ZN)BH	12	Single-mode E9/125	ITU-T G.652	12	7,8	1000	80,0	1,08	200	102,0	<b>801190</b>

Dimensions and specifications may be changed without prior notice.

## Application

With the serie HELUCOM® E30 we have realized, based on a special construction and high quality raw materials, a functional integrity according to DIN 4102-12 E30 (30 minutes). Together with the planned accessories the cables realize the full function of the communication in areas like tunnels or buildings for the defined period of time. On request we also can deliver cables with more than 12 fibres as stranded construction.

# Fibre Optic Cable with Functionality

with reference to IEC 60331-25

HELUCOM® FS90

A/I-D(ZN)BH(SR)H



## Cable structure

Core type: Loose tube  
Strain relief elements: Glass yarns  
Inner sheath material: FRNC  
Type of armouring: steel tape  
Outer sheath material: FR/LSOH  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Flame-resistance acc. to IEC 60332-1 and -3  
Smoke density acc. to IEC 61034  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
Cable, laterally water-tight  
UV-resistant  
Functional integrity: IEC 60794/ IEC 60331-25

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A/I-D(ZN)BH(SR)H	4	Multimode G50/125	OM2	4	12,7	1500	180,0	6,20	300	216,0	<b>803917</b>
A/I-D(ZN)BH(SR)H	4	Single-mode E9/125	ITU-T G.652	4	12,7	1500	180,0	6,20	300	216,0	<b>803919</b>
A/I-D(ZN)BH(SR)H	12	Multimode G50/125	OM2	12	12,7	1500	180,0	6,20	300	216,0	<b>803918</b>
A/I-D(ZN)BH(SR)H	12	Single-mode E9/125	ITU-T G.652	12	12,7	1500	180,0	6,20	300	216,0	<b>803920</b>

Dimensions and specifications may be changed without prior notice.

## Application

With the serie HELUCOM® FS90 we have realized, based on a special construction and high quality raw materials, a functional integrity according to IEC 60331-25 within 90, minutes (up to 750°C). Together with the planned accessories the cables realize the full function of the communication in areas like tunnels or buildings for the defined period of time.

# Fibre Optic Outdoor Cable

acc. DIN VDE 0888

**HELUCOM<sup>®</sup> pact**

A-DQ(ZN)B2Y, central



## Cable structure

Core type: Loose tube  
Strain relief elements: Glass yarns  
Type of armouring: Glass yarns  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A-DQ(ZN)B2Y	2	Multimode G50/125	OM2	2	7,5	1500	150,0	1,60	300	40,0	<b>800754</b>
A-DQ(ZN)B2Y	2	Multimode G62.5/125	OM1	2	7,5	1500	150,0	1,60	300	40,0	<b>802131</b>
A-DQ(ZN)B2Y	2	Single-mode E9/125	ITU-T G.652	2	7,5	1500	150,0	1,60	300	40,0	<b>802137</b>
A-DQ(ZN)B2Y	4	Multimode G50/125	OM2	4	7,5	1500	150,0	1,60	300	40,0	<b>800755</b>
A-DQ(ZN)B2Y	4	Multimode G62.5/125	OM1	4	7,5	1500	150,0	1,60	300	40,0	<b>802132</b>
A-DQ(ZN)B2Y	4	Single-mode E9/125	ITU-T G.652	4	7,5	1500	150,0	1,60	300	40,0	<b>802138</b>
A-DQ(ZN)B2Y	6	Multimode G50/125	OM2	6	7,5	1500	150,0	1,60	300	40,0	<b>800756</b>
A-DQ(ZN)B2Y	6	Multimode G62.5/125	OM1	6	7,5	1500	150,0	1,60	300	40,0	<b>802133</b>
A-DQ(ZN)B2Y	6	Single-mode E9/125	ITU-T G.652	6	7,5	1500	150,0	1,60	300	40,0	<b>802139</b>
A-DQ(ZN)B2Y	8	Multimode G50/125	OM2	8	7,5	1500	150,0	1,60	300	40,0	<b>800757</b>
A-DQ(ZN)B2Y	8	Multimode G62.5/125	OM1	8	7,5	1500	150,0	1,60	300	40,0	<b>802134</b>
A-DQ(ZN)B2Y	8	Single-mode E9/125	ITU-T G.652	8	7,5	1500	150,0	1,60	300	40,0	<b>802140</b>
A-DQ(ZN)B2Y	12	Multimode G50/125	OM2	12	7,5	1500	150,0	1,60	300	40,0	<b>800759</b>
A-DQ(ZN)B2Y	12	Multimode G50/125	OM4	12	7,5	1500	150,0	1,60	300	40,0	<b>804682</b>
A-DQ(ZN)B2Y	12	Multimode G62.5/125	OM1	12	7,5	1500	150,0	1,60	300	40,0	<b>802135</b>
A-DQ(ZN)B2Y	12	Single-mode E9/125	ITU-T G.652	12	7,5	1500	150,0	1,60	300	40,0	<b>802141</b>
A-DQ(ZN)B2Y	24	Multimode G50/125	OM2	24	8,5	1500	170,0	1,90	300	60,0	<b>800762</b>
A-DQ(ZN)B2Y	24	Multimode G50/125	OM4	24	8,5	1500	170,0	1,90	300	60,0	<b>804683</b>
A-DQ(ZN)B2Y	24	Multimode G62.5/125	OM1	24	8,5	1500	170,0	1,90	300	60,0	<b>802136</b>
A-DQ(ZN)B2Y	24	Single-mode E9/125	ITU-T G.652	24	8,5	1500	170,0	1,90	300	60,0	<b>802142</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM<sup>®</sup> pact fibre-optic cables are characterized by a design that is particularly easy to mount and is rodent-protected. Around a central grooved cable, there is a composite of glass yarns and swelling fleece with characteristics that ensure rodent protection, strain relief, and waterproofing in longitudinal direction of the cable. In addition, these cables are designed grease-free. Wiping the jelly off is therefore unnecessary. This construction is particularly used in underground, tubes and channel areas, where normal tensile stresses and/or transverse compressions occur and rodent infestation is to be expected.

# Fibre Optic Outdoor Cable

acc. DIN VDE 0888

**HELUCOM®**

A-DQ(ZN)B2Y, central



## Cable structure

Core type: Loose tube  
Strain relief elements: Glass yarns  
Type of armouring: Glass yarns  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A-DQ(ZN)B2Y	2	Multimode G50/125	OM2	2	10,0	2700	160,0	1,60	300	85,0	<b>80196</b>
A-DQ(ZN)B2Y	2	Multimode G62.5/125	OM1	2	10,0	2700	160,0	1,60	300	85,0	<b>80212</b>
A-DQ(ZN)B2Y	2	Single-mode E9/125	ITU-T G.652	2	10,0	2700	160,0	1,60	300	85,0	<b>80180</b>
A-DQ(ZN)B2Y	4	Multimode G50/125	OM2	4	10,0	2700	160,0	1,60	300	85,0	<b>80197</b>
A-DQ(ZN)B2Y	4	Multimode G62.5/125	OM1	4	10,0	2700	160,0	1,60	300	85,0	<b>80213</b>
A-DQ(ZN)B2Y	4	Single-mode E9/125	ITU-T G.652	4	10,0	2700	160,0	1,60	300	85,0	<b>80181</b>
A-DQ(ZN)B2Y	6	Multimode G50/125	OM2	6	10,0	2700	160,0	1,60	300	85,0	<b>80198</b>
A-DQ(ZN)B2Y	6	Multimode G62.5/125	OM1	6	10,0	2700	160,0	1,60	300	85,0	<b>80214</b>
A-DQ(ZN)B2Y	6	Single-mode E9/125	ITU-T G.652	6	10,0	2700	160,0	1,60	300	85,0	<b>80182</b>
A-DQ(ZN)B2Y	8	Multimode G50/125	OM2	8	10,0	2700	160,0	1,60	300	85,0	<b>80199</b>
A-DQ(ZN)B2Y	8	Multimode G62.5/125	OM1	8	10,0	2700	160,0	1,60	300	85,0	<b>80215</b>
A-DQ(ZN)B2Y	8	Single-mode E9/125	ITU-T G.652	8	10,0	2700	160,0	1,60	300	85,0	<b>80183</b>
A-DQ(ZN)B2Y	12	Multimode G50/125	OM2	12	10,0	2700	160,0	1,60	300	85,0	<b>80201</b>
A-DQ(ZN)B2Y	12	Multimode G62.5/125	OM1	12	10,0	2700	160,0	1,60	300	85,0	<b>80217</b>
A-DQ(ZN)B2Y	12	Single-mode E9/125	ITU-T G.652	12	10,0	2700	160,0	1,60	300	85,0	<b>80185</b>
A-DQ(ZN)B2Y	16	Multimode G50/125	OM2	16	10,0	2700	180,0	1,80	300	95,0	<b>80202</b>
A-DQ(ZN)B2Y	16	Multimode G62.5/125	OM1	16	10,0	2700	180,0	1,80	300	95,0	<b>80218</b>
A-DQ(ZN)B2Y	16	Single-mode E9/125	ITU-T G.652	16	10,0	2700	180,0	1,80	300	95,0	<b>80186</b>
A-DQ(ZN)B2Y	24	Multimode G50/125	OM2	24	10,0	2700	180,0	1,80	300	95,0	<b>80204</b>
A-DQ(ZN)B2Y	24	Multimode G62.5/125	OM1	24	10,0	2700	180,0	1,80	300	95,0	<b>80220</b>
A-DQ(ZN)B2Y	24	Single-mode E9/125	ITU-T G.652	24	10,0	2700	180,0	1,80	300	95,0	<b>80187</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a design that is particularly easy to mount and is rodent-protected. Around a central grooved cable, there is a composite of glass yarns and swelling fleece with characteristics that ensure rodent protection, strain relief, and waterproofing in longitudinal direction of the cable. In addition, these cables are designed grease-free. Wiping the jelly off is therefore unnecessary. This construction is particularly used in underground, tubes and channel areas, where normal tensile stresses and/or transverse compressions occur and rodent infestation is to be expected.

# Fibre Optic Outdoor Cable

acc. DIN VDE 0888

**HELUCOM®**  
A-DQ(ZN)B2Y, stranded



## Cable structure

Core type: Loose tube  
GRP support element  
Strain relief elements: Glass yarns  
Type of armouring: Glass yarns  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A-DQ(ZN)B2Y	24	Multimode G50/125	OM2	12	10,5	2700	210,0	2,70	600	95,0	<b>81382</b>
A-DQ(ZN)B2Y	24	Multimode G62.5/125	OM1	12	10,5	2700	210,0	2,70	600	95,0	<b>80219</b>
A-DQ(ZN)B2Y	24	Single-mode E9/125	ITU-T G.652	12	10,5	2700	210,0	2,70	600	95,0	<b>80188</b>
A-DQ(ZN)B2Y	36	Multimode G50/125	OM2	12	10,5	2700	210,0	2,70	600	95,0	<b>81108</b>
A-DQ(ZN)B2Y	36	Multimode G62.5/125	OM1	12	10,5	2700	210,0	2,70	600	95,0	<b>81109</b>
A-DQ(ZN)B2Y	36	Single-mode E9/125	ITU-T G.652	12	10,5	2700	210,0	2,70	600	95,0	<b>81110</b>
A-DQ(ZN)B2Y	48	Multimode G50/125	OM2	12	10,5	2700	210,0	2,70	600	95,0	<b>82648</b>
A-DQ(ZN)B2Y	48	Multimode G62.5/125	OM1	12	10,5	2700	210,0	2,70	600	95,0	<b>81112</b>
A-DQ(ZN)B2Y	48	Single-mode E9/125	ITU-T G.652	12	10,5	2700	210,0	2,70	600	95,0	<b>81113</b>
A-DQ(ZN)B2Y	60	Multimode G50/125	OM2	12	10,5	2700	210,0	2,70	600	95,0	<b>80207</b>
A-DQ(ZN)B2Y	60	Multimode G62.5/125	OM1	12	10,5	2700	210,0	2,70	600	95,0	<b>80223</b>
A-DQ(ZN)B2Y	60	Single-mode E9/125	ITU-T G.652	12	10,5	2700	210,0	2,70	600	95,0	<b>80191</b>
A-DQ(ZN)B2Y	72	Multimode G50/125	OM2	12	11,0	2700	220,0	2,90	600	100,0	<b>81133</b>
A-DQ(ZN)B2Y	72	Multimode G62.5/125	OM1	12	11,0	2700	220,0	2,90	600	100,0	<b>81134</b>
A-DQ(ZN)B2Y	72	Single-mode E9/125	ITU-T G.652	12	11,0	2700	220,0	2,90	600	100,0	<b>81120</b>
A-DQ(ZN)B2Y	84	Multimode G50/125	OM2	12	12,0	3000	240,0	3,60	600	140,0	<b>80208</b>
A-DQ(ZN)B2Y	84	Multimode G62.5/125	OM1	12	12,0	3000	240,0	3,60	600	140,0	<b>80224</b>
A-DQ(ZN)B2Y	84	Single-mode E9/125	ITU-T G.652	12	12,0	3000	240,0	3,60	600	140,0	<b>80192</b>
A-DQ(ZN)B2Y	96	Multimode G50/125	OM2	12	12,0	3000	240,0	3,60	600	140,0	<b>81135</b>
A-DQ(ZN)B2Y	96	Multimode G62.5/125	OM1	12	12,0	3000	240,0	3,60	600	140,0	<b>81136</b>
A-DQ(ZN)B2Y	96	Single-mode E9/125	ITU-T G.652	12	12,0	3000	240,0	3,60	600	140,0	<b>81121</b>
A-DQ(ZN)B2Y	108	Multimode G50/125	OM2	12	13,5	3000	270,0	4,30	600	155,0	<b>80209</b>
A-DQ(ZN)B2Y	108	Multimode G62.5/125	OM1	12	13,5	3000	270,0	4,30	600	155,0	<b>80225</b>
A-DQ(ZN)B2Y	108	Single-mode E9/125	ITU-T G.652	12	13,5	3000	270,0	4,30	600	155,0	<b>80193</b>
A-DQ(ZN)B2Y	120	Multimode G50/125	OM2	12	13,5	3000	270,0	4,30	600	155,0	<b>80210</b>
A-DQ(ZN)B2Y	120	Multimode G62.5/125	OM1	12	13,5	3000	270,0	4,30	600	155,0	<b>80226</b>
A-DQ(ZN)B2Y	120	Single-mode E9/125	ITU-T G.652	12	13,5	3000	270,0	4,30	600	155,0	<b>80194</b>
A-DQ(ZN)B2Y	144	Multimode G50/125	OM2	12	14,5	3000	290,0	5,40	600	200,0	<b>80211</b>
A-DQ(ZN)B2Y	144	Multimode G62.5/125	OM1	12	14,5	3000	290,0	5,40	600	200,0	<b>80227</b>
A-DQ(ZN)B2Y	144	Single-mode E9/125	ITU-T G.652	12	14,5	3000	290,0	5,40	600	200,0	<b>80195</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a design that is particularly easy to mount, extremely tension-resistant and rodent-proof. Around a stranded grooved cable and filler elements, there is a composite of glass yarns and swelling fleece with characteristics that ensure rodent protection, strain relief, and waterproofing in longitudinal direction of the cable. In addition, these cables are designed grease-free. Wiping the jelly off is therefore unnecessary. This construction is particularly used in underground, tubes and channel areas, where above-average tensile stresses and/or transverse compressions occur and rodent infestation is to be expected.

# Fibre Optic Outdoor Cable

acc. DIN VDE 0888

**HELUCOM<sup>®</sup> pact**

A-DQ(ZN)B2Y fibre combi, stranded



## Cable structure

Core type: Loose tube  
GRP support element  
Strain relief elements: Glass yarns  
Type of armouring: Glass yarns  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A-DQ(ZN)B2Y	24	Single- and multimode G50/125	OM2 + ITU-T G.652	12	9,5	2500	200,0	2,50	400	90,0	<b>803037</b>
A-DQ(ZN)B2Y	24	Single- und Multimode G50/125 OM3	OM3 + ITU-T G.652	12	9,5	2500	200,0	2,50	400	90,0	<b>803923</b>
A-DQ(ZN)B2Y	48	Single- and multimode G50/125	OM2 + ITU-T G.652	12	9,5	2500	200,0	2,50	400	90,0	<b>803038</b>
A-DQ(ZN)B2Y	48	Single- und Multimode G50/125 OM3	OM3 + ITU-T G.652	12	9,5	2500	200,0	2,50	400	90,0	<b>803924</b>

Dimensions and specifications may be changed without prior notice.

## Application

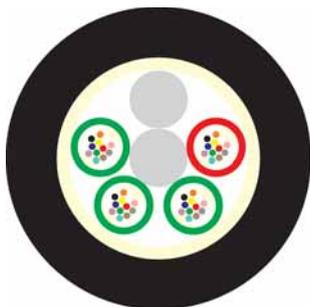
These HELUCOM<sup>®</sup> pact fibre-optic cables are characterized by a design that is particularly easy to mount, tension-resistant and rodent-proof. Around a stranded grooved cable and filler elements, there is a composite of glass yarns and swelling fleece with characteristics that ensure rodent protection, strain relief and waterproofing in longitudinal direction of the cable. In addition, these cables are designed grease-free. Wiping the jelly off is therefore unnecessary. This construction is particularly used in underground, tubes and channel areas, where packing density also plays a role.

# Fibre Optic Outdoor Cable

acc. DIN VDE 0888

HELUCOM®

A-DF(ZN)2Y



## Cable structure

Core type: Loose tube  
GRP support element  
Strain relief elements: Aramide  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A-DF(ZN)2Y	2	Multimode G50/125	OM2	2	9,5	2500	95,0	4,20	400	85,0	<b>80016</b>
A-DF(ZN)2Y	2	Multimode G62.5/125	OM1	2	9,5	2500	95,0	4,20	400	85,0	<b>80033</b>
A-DF(ZN)2Y	2	Single-mode E9/125	ITU-T G.652	2	9,5	2500	95,0	4,20	400	85,0	<b>80000</b>
A-DF(ZN)2Y	4	Multimode G50/125	OM2	4	9,5	2500	95,0	4,20	400	85,0	<b>80017</b>
A-DF(ZN)2Y	4	Multimode G62.5/125	OM1	4	9,5	2500	95,0	4,20	400	85,0	<b>80034</b>
A-DF(ZN)2Y	4	Single-mode E9/125	ITU-T G.652	4	9,5	2500	95,0	4,20	400	85,0	<b>80001</b>
A-DF(ZN)2Y	8	Multimode G50/125	OM2	8	9,5	2500	95,0	4,20	400	85,0	<b>80019</b>
A-DF(ZN)2Y	8	Multimode G62.5/125	OM1	8	9,5	2500	95,0	4,20	400	85,0	<b>80036</b>
A-DF(ZN)2Y	8	Single-mode E9/125	ITU-T G.652	8	9,5	2500	95,0	4,20	400	85,0	<b>80003</b>
A-DF(ZN)2Y	12	Multimode G50/125	OM2	12	9,5	2500	95,0	4,20	400	85,0	<b>80021</b>
A-DF(ZN)2Y	12	Multimode G62.5/125	OM1	12	9,5	2500	95,0	4,20	400	85,0	<b>80038</b>
A-DF(ZN)2Y	12	Single-mode E9/125	ITU-T G.652	12	9,5	2500	95,0	4,20	400	85,0	<b>80005</b>
A-DF(ZN)2Y	24	Multimode G50/125	OM2	12	9,5	2700	95,0	4,00	400	85,0	<b>80024</b>
A-DF(ZN)2Y	24	Multimode G62.5/125	OM1	12	9,5	2700	95,0	4,00	400	85,0	<b>80041</b>
A-DF(ZN)2Y	24	Single-mode E9/125	ITU-T G.652	12	9,5	2700	95,0	4,00	400	85,0	<b>80008</b>
A-DF(ZN)2Y	36	Multimode G50/125	OM2	12	9,5	2700	95,0	4,00	400	85,0	<b>80912</b>
A-DF(ZN)2Y	36	Multimode G62.5/125	OM1	12	9,5	2700	95,0	4,00	400	85,0	<b>80913</b>
A-DF(ZN)2Y	36	Single-mode E9/125	ITU-T G.652	12	9,5	2700	95,0	4,00	400	85,0	<b>80914</b>
A-DF(ZN)2Y	48	Multimode G50/125	OM2	12	9,5	2700	95,0	4,00	400	85,0	<b>80026</b>
A-DF(ZN)2Y	48	Multimode G62.5/125	OM1	12	9,5	2700	95,0	4,00	400	85,0	<b>80046</b>
A-DF(ZN)2Y	48	Single-mode E9/125	ITU-T G.652	12	9,5	2700	95,0	4,00	400	85,0	<b>80010</b>
A-DF(ZN)2Y	60	Multimode G50/125	OM2	12	9,5	2700	95,0	4,00	400	85,0	<b>80027</b>
A-DF(ZN)2Y	60	Multimode G62.5/125	OM1	12	9,5	2700	95,0	4,00	400	85,0	<b>80047</b>
A-DF(ZN)2Y	60	Single-mode E9/125	ITU-T G.652	12	9,5	2700	95,0	4,00	400	85,0	<b>80011</b>
A-DF(ZN)2Y	72	Multimode G50/125	OM2	12	10,0	2700	100,0	3,80	400	90,0	<b>80473</b>
A-DF(ZN)2Y	72	Multimode G62.5/125	OM1	12	10,0	2700	100,0	3,80	400	90,0	<b>80474</b>
A-DF(ZN)2Y	72	Single-mode E9/125	ITU-T G.652	12	10,0	2700	100,0	3,80	400	90,0	<b>80475</b>
A-DF(ZN)2Y	84	Multimode G50/125	OM2	12	10,7	3000	107,0	4,30	400	120,0	<b>80028</b>
A-DF(ZN)2Y	84	Multimode G62.5/125	OM1	12	10,7	3000	107,0	4,30	400	120,0	<b>80048</b>
A-DF(ZN)2Y	84	Single-mode E9/125	ITU-T G.652	12	10,7	3000	107,0	4,30	400	120,0	<b>80012</b>
A-DF(ZN)2Y	96	Multimode G50/125	OM2	12	11,5	3000	115,0	5,00	400	135,0	<b>80777</b>
A-DF(ZN)2Y	96	Multimode G62.5/125	OM1	12	11,5	3000	115,0	5,00	400	135,0	<b>80774</b>
A-DF(ZN)2Y	96	Single-mode E9/125	ITU-T G.652	12	11,5	3000	115,0	5,00	400	135,0	<b>80764</b>
A-DF(ZN)2Y	144	Multimode G50/125	OM2	12	14,5	3000	145,0	7,70	400	175,0	<b>80032</b>
A-DF(ZN)2Y	144	Multimode G62.5/125	OM1	12	14,5	3000	145,0	7,70	400	175,0	<b>80051</b>
A-DF(ZN)2Y	144	Single-mode E9/125	ITU-T G.652	12	14,5	3000	145,0	7,70	400	175,0	<b>80015</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a stranded construction with jelly filling. They are made waterproof in longitudinal direction by filling a jelly mass into the stranding cavities. Non-metallic tension elements ensure above average strain relief. This construction is particularly used in the area of telecommunication and long distance, but also in regular channels and tubes.

# Fibre Optic Outdoor Cable

acc. DIN VDE 0888

**HELUCOM**<sup>®</sup>

A-DF(ZN)B2Y



## Cable structure

Core type: Loose tube  
GRP support element  
Strain relief elements: Aramide  
Type of armouring: Glass yarns  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A-DF(ZN)B2Y	2	Multimode G50/125	OM2	2	10,5	2700	105,0	4,40	400	90,0	<b>80100</b>
A-DF(ZN)B2Y	2	Multimode G62.5/125	OM1	2	10,5	2700	105,0	4,40	400	90,0	<b>80115</b>
A-DF(ZN)B2Y	2	Single-mode E9/125	ITU-T G.652	2	10,5	2700	105,0	4,40	400	90,0	<b>80084</b>
A-DF(ZN)B2Y	4	Multimode G50/125	OM2	4	10,5	2700	105,0	4,40	400	90,0	<b>80101</b>
A-DF(ZN)B2Y	4	Multimode G62.5/125	OM1	4	10,5	2700	105,0	4,40	400	90,0	<b>80116</b>
A-DF(ZN)B2Y	4	Single-mode E9/125	ITU-T G.652	4	10,5	2700	105,0	4,40	400	90,0	<b>80085</b>
A-DF(ZN)B2Y	8	Multimode G50/125	OM2	8	10,5	2700	105,0	4,40	400	90,0	<b>80031</b>
A-DF(ZN)B2Y	8	Multimode G62.5/125	OM1	8	10,5	2700	105,0	4,40	400	90,0	<b>80771</b>
A-DF(ZN)B2Y	8	Single-mode E9/125	ITU-T G.652	8	10,5	2700	105,0	4,40	400	90,0	<b>80087</b>
A-DF(ZN)B2Y	12	Multimode G50/125	OM2	12	10,5	2700	105,0	4,40	400	90,0	<b>80104</b>
A-DF(ZN)B2Y	12	Multimode G62.5/125	OM1	12	10,5	2700	105,0	4,40	400	90,0	<b>80120</b>
A-DF(ZN)B2Y	12	Single-mode E9/125	ITU-T G.652	12	10,5	2700	105,0	4,40	400	90,0	<b>80089</b>
A-DF(ZN)B2Y	24	Multimode G50/125	OM2	12	10,5	2700	105,0	4,40	400	90,0	<b>80759</b>
A-DF(ZN)B2Y	24	Multimode G62.5/125	OM1	12	10,5	2700	105,0	4,40	400	90,0	<b>80123</b>
A-DF(ZN)B2Y	24	Single-mode E9/125	ITU-T G.652	12	10,5	2700	105,0	4,40	400	90,0	<b>80092</b>
A-DF(ZN)B2Y	36	Multimode G50/125	OM2	12	10,5	2700	105,0	4,30	400	90,0	<b>81137</b>
A-DF(ZN)B2Y	36	Multimode G62.5/125	OM1	12	10,5	2700	105,0	4,30	400	90,0	<b>81138</b>
A-DF(ZN)B2Y	36	Single-mode E9/125	ITU-T G.652	12	10,5	2700	105,0	4,30	400	90,0	<b>81139</b>
A-DF(ZN)B2Y	48	Multimode G50/125	OM2	12	10,5	2700	105,0	4,20	400	90,0	<b>80109</b>
A-DF(ZN)B2Y	48	Multimode G62.5/125	OM1	12	10,5	2700	105,0	4,20	400	90,0	<b>80125</b>
A-DF(ZN)B2Y	48	Single-mode E9/125	ITU-T G.652	12	10,5	2700	105,0	4,20	400	90,0	<b>80094</b>
A-DF(ZN)B2Y	60	Multimode G50/125	OM2	12	10,5	2700	105,0	4,20	400	90,0	<b>80110</b>
A-DF(ZN)B2Y	60	Multimode G62.5/125	OM1	12	10,5	2700	105,0	4,20	400	90,0	<b>80126</b>
A-DF(ZN)B2Y	60	Single-mode E9/125	ITU-T G.652	12	10,5	2700	105,0	4,20	400	90,0	<b>80095</b>
A-DF(ZN)B2Y	72	Multimode G50/125	OM2	12	11,0	2700	110,0	4,10	400	95,0	<b>81143</b>
A-DF(ZN)B2Y	72	Multimode G62.5/125	OM1	12	11,0	2700	110,0	4,10	400	95,0	<b>81144</b>
A-DF(ZN)B2Y	72	Single-mode E9/125	ITU-T G.652	12	11,0	2700	110,0	4,10	400	95,0	<b>81145</b>
A-DF(ZN)B2Y	84	Multimode G50/125	OM2	12	11,5	3000	115,0	4,60	400	136,0	<b>80111</b>
A-DF(ZN)B2Y	84	Multimode G62.5/125	OM1	12	11,5	3000	115,0	4,60	400	136,0	<b>80127</b>
A-DF(ZN)B2Y	84	Single-mode E9/125	ITU-T G.652	12	11,5	3000	115,0	4,60	400	136,0	<b>80096</b>
A-DF(ZN)B2Y	96	Multimode G50/125	OM2	12	12,0	3000	120,0	5,30	400	155,0	<b>81147</b>
A-DF(ZN)B2Y	96	Multimode G62.5/125	OM1	12	12,0	3000	120,0	5,30	400	155,0	<b>81148</b>
A-DF(ZN)B2Y	96	Single-mode E9/125	ITU-T G.652	12	12,0	3000	120,0	5,30	400	155,0	<b>81149</b>
A-DF(ZN)B2Y	144	Multimode G50/125	OM2	12	14,5	3000	145,0	8,00	400	228,0	<b>80114</b>
A-DF(ZN)B2Y	144	Multimode G62.5/125	OM1	12	14,5	3000	145,0	8,00	400	228,0	<b>80130</b>
A-DF(ZN)B2Y	144	Single-mode E9/125	ITU-T G.652	12	14,5	3000	145,0	8,00	400	228,0	<b>80099</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM<sup>®</sup> fibre-optic cables are characterized by a stranded construction with jelly filling. They are made waterproof in longitudinal direction by filling a jelly mass into the stranding cavities. Non-metallic tension elements and glass yarns ensure above average strain relief and rodent protection. This construction is particularly used in the area of telecommunication and long distance, but also in regular channels and tubes where rodent infestation is possible.

# Fibre Optic Outdoor Cable

acc. DIN VDE 0888

HELUCOM®

A-DF(ZN)2Y4Y



## Cable structure

Core type: Loose tube  
 GRP support element  
 Strain relief elements: Aramide  
 Inner sheath material: PE  
 Type of armouring: PA sheath  
 Outer sheath material: PA  
 Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
 Laying, max.: +50°C  
 Operating, min.: -20°C  
 Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
 Halogen-free acc. to 60754-2  
 Longitudinally water-tight acc. to IEC 60794-1-2-F5  
 Cable, laterally water-tight  
 UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A-DF(ZN)2Y4Y	2	Multimode G50/125	OM2	2	10,0	2700	100,0	6,10	400	90,0	<b>80915</b>
A-DF(ZN)2Y4Y	2	Multimode G62.5/125	OM1	2	10,0	2700	100,0	6,10	400	90,0	<b>80927</b>
A-DF(ZN)2Y4Y	2	Single-mode E9/125	ITU-T G.652	2	10,0	2700	100,0	6,10	400	90,0	<b>80945</b>
A-DF(ZN)2Y4Y	4	Multimode G50/125	OM2	4	10,0	2700	100,0	6,10	400	90,0	<b>80735</b>
A-DF(ZN)2Y4Y	4	Multimode G62.5/125	OM1	4	10,0	2700	100,0	6,10	400	90,0	<b>80928</b>
A-DF(ZN)2Y4Y	4	Single-mode E9/125	ITU-T G.652	4	10,0	2700	100,0	6,10	400	90,0	<b>80895</b>
A-DF(ZN)2Y4Y	8	Multimode G50/125	OM2	8	10,0	2700	100,0	6,10	400	90,0	<b>80691</b>
A-DF(ZN)2Y4Y	8	Multimode G62.5/125	OM1	8	10,0	2700	100,0	6,10	400	90,0	<b>80809</b>
A-DF(ZN)2Y4Y	8	Single-mode E9/125	ITU-T G.652	8	10,0	2700	100,0	6,10	400	90,0	<b>80118</b>
A-DF(ZN)2Y4Y	12	Multimode G50/125	OM2	12	10,0	2700	100,0	6,10	400	90,0	<b>80627</b>
A-DF(ZN)2Y4Y	12	Multimode G62.5/125	OM1	12	10,0	2700	100,0	6,10	400	90,0	<b>80931</b>
A-DF(ZN)2Y4Y	12	Single-mode E9/125	ITU-T G.652	12	10,0	2700	100,0	6,10	400	90,0	<b>80947</b>
A-DF(ZN)2Y4Y	24	Multimode G50/125	OM2	12	10,0	2700	100,0	6,10	400	90,0	<b>80578</b>
A-DF(ZN)2Y4Y	24	Multimode G62.5/125	OM1	12	10,0	2700	100,0	6,10	400	90,0	<b>80576</b>
A-DF(ZN)2Y4Y	24	Single-mode E9/125	ITU-T G.652	12	10,0	2700	100,0	6,10	400	90,0	<b>80577</b>
A-DF(ZN)2Y4Y	36	Multimode G50/125	OM2	12	10,0	2700	100,0	6,00	400	90,0	<b>80672</b>
A-DF(ZN)2Y4Y	36	Multimode G62.5/125	OM1	12	10,0	2700	100,0	6,00	400	90,0	<b>80935</b>
A-DF(ZN)2Y4Y	36	Single-mode E9/125	ITU-T G.652	12	10,0	2700	100,0	6,00	400	90,0	<b>80950</b>
A-DF(ZN)2Y4Y	48	Multimode G50/125	OM2	12	10,0	2700	100,0	6,00	400	90,0	<b>80732</b>
A-DF(ZN)2Y4Y	48	Multimode G62.5/125	OM1	12	10,0	2700	100,0	6,00	400	90,0	<b>80936</b>
A-DF(ZN)2Y4Y	48	Single-mode E9/125	ITU-T G.652	12	10,0	2700	100,0	6,00	400	90,0	<b>80951</b>
A-DF(ZN)2Y4Y	60	Multimode G50/125	OM2	12	10,0	2700	100,0	5,80	400	90,0	<b>80920</b>
A-DF(ZN)2Y4Y	60	Multimode G62.5/125	OM1	12	10,0	2700	100,0	5,80	400	90,0	<b>80938</b>
A-DF(ZN)2Y4Y	72	Multimode G50/125	OM2	12	10,5	2700	105,0	5,80	400	95,0	<b>80921</b>
A-DF(ZN)2Y4Y	72	Multimode G62.5/125	OM1	12	10,5	2700	105,0	5,80	400	95,0	<b>80939</b>
A-DF(ZN)2Y4Y	72	Single-mode E9/125	ITU-T G.652	12	10,5	2700	105,0	5,80	400	95,0	<b>80954</b>
A-DF(ZN)2Y4Y	84	Multimode G50/125	OM2	12	11,0	3000	110,0	8,40	400	110,0	<b>80922</b>
A-DF(ZN)2Y4Y	84	Multimode G62.5/125	OM1	12	11,0	3000	110,0	8,40	400	110,0	<b>80940</b>
A-DF(ZN)2Y4Y	84	Single-mode E9/125	ITU-T G.652	12	11,0	3000	110,0	8,40	400	110,0	<b>80955</b>
A-DF(ZN)2Y4Y	96	Multimode G50/125	OM2	12	11,5	3000	115,0	7,20	400	120,0	<b>80923</b>
A-DF(ZN)2Y4Y	96	Multimode G62.5/125	OM1	12	11,5	3000	115,0	7,20	400	120,0	<b>80941</b>
A-DF(ZN)2Y4Y	96	Single-mode E9/125	ITU-T G.652	12	11,5	3000	115,0	7,20	400	120,0	<b>80956</b>
A-DF(ZN)2Y4Y	144	Multimode G50/125	OM2	12	14,5	3000	145,0	10,40	400	180,0	<b>80926</b>
A-DF(ZN)2Y4Y	144	Multimode G62.5/125	OM1	12	14,5	3000	145,0	10,40	400	180,0	<b>80944</b>
A-DF(ZN)2Y4Y	144	Single-mode E9/125	ITU-T G.652	12	14,5	3000	145,0	10,40	400	180,0	<b>80959</b>

Dimensions and specifications may be changed without prior notice.

## Application

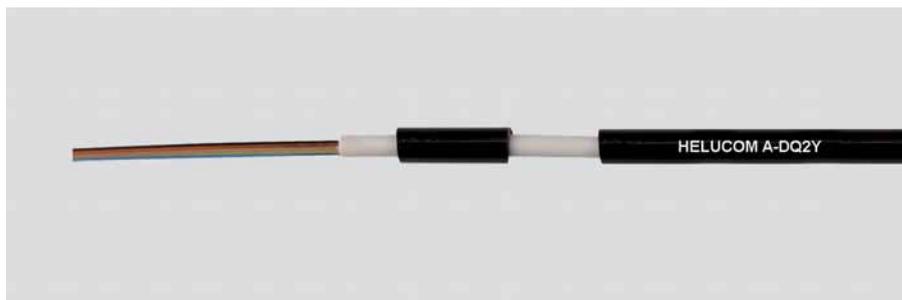
These HELUCOM® fibre-optic cables are characterized by a stranded construction with jelly filling. They are made waterproof in longitudinal direction by filling a jelly mass into the stranding cavities. Non-metallic tension elements and a second outer sheath made of polyamide (PA) ensure above average strain relief and rodent protection. This construction is particularly used in the area of telecommunication and long distance, but also in regular channels and tubes where rodent infestation is possible.

# Fibre Optic Outdoor Cable

Microduct

**HELUCOM**<sup>®</sup>

A-DQ2Y, central



## Cable structure

Core type: Loose tube  
Strain relief elements: Aramide  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -20°C  
Laying, max.: +60°C  
Operating, min.: -20°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A-DQ2Y central	4	Single-mode E9/125	ITU-T G.652	4	2,5	180	40,0	1,40	50	6,0	<b>803664</b>
A-DQ2Y central	4	Single-mode E9/125	ITU-T G.657	4	2,5	180	40,0	1,40	50	6,0	<b>805672</b>
A-DQ2Y central	12	Single-mode E9/125	ITU-T G.652	12	2,5	180	40,0	1,40	50	6,0	<b>803929</b>
A-DQ2Y central	12	Single-mode E9/125	ITU-T G.657	12	2,5	180	40,0	1,40	50	6,0	<b>805673</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM<sup>®</sup> micro fibre-optic cables are characterized by a design that is slim but robust. Around a central tube, there is a composite of swelling fleece with characteristics that ensure the strain relief, and waterproofing in longitudinal direction of the cable. Another feature is the low adhesion of the outer jacket. Therefore these cables can be blowing into microducts. A typical application is FTTH within communal building projects.

# Fibre Optic Outdoor Cable

Microduct

HELUCOM®

A-DQ2Y, stranded



## Cable structure

Core type: Loose tube  
Strain relief elements: Aramide  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -30°C  
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A-DQ2Y stranded	4	Single-mode E9/125	ITU-T G.652	4	5,8	850	90,0	0,87	150	27,0	<b>803931</b>
A-DQ2Y stranded	4	Single-mode E9/125	ITU-T G.657	4	5,8	850	90,0	0,87	150	27,0	<b>805664</b>
A-DQ2Y stranded	12	Single-mode E9/125	ITU-T G.652	12	5,8	850	90,0	0,87	150	27,0	<b>803932</b>
A-DQ2Y stranded	12	Single-mode E9/125	ITU-T G.657	12	5,8	850	90,0	0,87	150	27,0	<b>805665</b>
A-DQ2Y stranded	24	Single-mode E9/125	ITU-T G.652	12	5,8	850	90,0	0,87	150	27,0	<b>803930</b>
A-DQ2Y stranded	24	Single-mode E9/125	ITU-T G.657	12	5,8	850	90,0	0,87	150	27,0	<b>805666</b>
A-DQ2Y stranded	48	Single-mode E9/125	ITU-T G.652	12	5,8	850	90,0	0,87	150	27,0	<b>803658</b>
A-DQ2Y stranded	48	Single-mode E9/125	ITU-T G.657	12	5,8	850	90,0	0,87	150	27,0	<b>805667</b>
A-DQ2Y stranded	72	Single-mode E9/125	ITU-T G.652	12	5,8	850	90,0	0,87	150	27,0	<b>803659</b>
A-DQ2Y stranded	72	Single-mode E9/125	ITU-T G.657	12	5,8	850	90,0	0,87	150	27,0	<b>805668</b>
A-DQ2Y stranded	96	Single-mode E9/125	ITU-T G.652	12	6,8	1500	105,0	1,25	150	45,0	<b>803660</b>
A-DQ2Y stranded	96	Single-mode E9/125	ITU-T G.657	12	6,8	1500	105,0	1,25	150	45,0	<b>805669</b>
A-DQ2Y stranded	144	Single-mode E9/125	ITU-T G.652	12	9,4	1500	140,0	2,19	150	79,0	<b>803661</b>
A-DQ2Y stranded	144	Single-mode E9/125	ITU-T G.657	12	9,4	1500	140,0	2,19	150	79,0	<b>805670</b>
A-DQ2Y stranded	288	Single-mode E9/125	ITU-T G.652	12	10,2	3000	160,0	2,97	100	90,0	<b>803668</b>
A-DQ2Y stranded	288	Single-mode E9/125	ITU-T G.652	24	9,4	2500	150,0	2,97	150	77,0	<b>805674</b>
A-DQ2Y stranded	288	Single-mode E9/125	ITU-T G.657	12	10,2	3000	160,0	2,97	100	90,0	<b>805671</b>
A-DQ2Y stranded	288	Single-mode E9/125	ITU-T G.657	24	9,4	2500	150,0	2,97	150	77,0	<b>805675</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® micro fibre-optic cables are characterized by a design that is slim but robust. Around stranded tubes, there is a composite of swelling material with characteristics that ensure the strain relief, and waterproofing in longitudinal direction of the cable. Another feature of these cables is the low adhesion of the outer jacket. Therefore these cables can be blowing into microducts. A typical application is FTTx within communal infrastructure projects.

# Fibre Optic Outdoor Cable

steel armoured

**HELUCOM®**

A-DQ(ZN)(SR)2Y



## Cable structure

Core type: Loose tube  
Strain relief elements: Glass yarns  
Type of armouring: Steel rib  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
Cable, laterally water-tight  
UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A-DQ(ZN)(SR)2Y	4	Multimode G50/125	OM2	4	9,5	1500	95,0	2,00	500	115,0	<b>802917</b>
A-DQ(ZN)(SR)2Y	4	Multimode G62.5/125	OM1	4	9,5	1500	95,0	2,00	500	115,0	<b>803925</b>
A-DQ(ZN)(SR)2Y	4	Single-mode E9/125	ITU-T G.652	4	9,5	1500	95,0	2,00	500	105,0	<b>803927</b>
A-DQ(ZN)(SR)2Y	12	Multimode G50/125	OM2	12	9,5	1500	95,0	2,00	500	115,0	<b>802918</b>
A-DQ(ZN)(SR)2Y	12	Multimode G62.5/125	OM1	12	9,5	1500	95,0	2,00	500	115,0	<b>803926</b>
A-DQ(ZN)(SR)2Y	12	Single-mode E9/125	ITU-T G.652	12	9,5	1500	95,0	2,00	500	115,0	<b>803928</b>
A-DQ(ZN)(SR)2Y	24	Single-mode E9/125	ITU-T G.652	24	9,5	1500	95,0	2,00	500	115,0	<b>804797</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a compact construction with a swelling fleece. Above-average rodent protection is achieved with the metallic rodent protection (steel groove) and an outer sheath made of PE. This construction is particularly used in the area of telecommunication and long distance, but also in regular channels and tubes where rodent infestation is possible.

# Fibre Optic Outdoor Cable

steel armoured

**HELUCOM®**

A-DF(ZN)2Y(SR)2Y



## Cable structure

Core type: Loose tube  
 GRP support element  
 Strain relief elements: Aramide  
 Inner sheath material: PE  
 Type of armoring: Steel rib  
 Outer sheath material: PE  
 Outer sheath colour: Black

## Temperature range

Laying, min.: -20°C  
 Laying, max.: +50°C  
 Operating, min.: -30°C  
 Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3  
 Halogen-free acc. to 60754-2  
 Longitudinally water-tight acc. to IEC 60794-1-2-F5  
 Cable, laterally water-tight  
 UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A-DF(ZN)2Y(SR)2Y 12	12	Single-mode E9/125	ITU-T G.652	2	13,0	2500	200,0	4,30	400	160,0	<b>805244</b>
A-DF(ZN)2Y(SR)2Y 24	24	Single-mode E9/125	ITU-T G.652	4	13,0	2500	200,0	4,30	400	160,0	<b>805245</b>
A-DF(ZN)2Y(SR)2Y 48	48	Single-mode E9/125	ITU-T G.652	12	13,5	2500	210,0	4,50	400	170,0	<b>805246</b>
A-DF(ZN)2Y(SR)2Y 60	60	Single-mode E9/125	ITU-T G.652	12	13,5	2500	210,0	4,50	400	170,0	<b>805247</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a stranded construction with jelly filling. They are made waterproof in longitudinal direction by filling a jelly mass into the stranding cavities. Above-average rodent protection is achieved with the metallic rodent protection (corrugated steel) and the second outer sheath made of PE. This construction is particularly used in the area of telecommunication and long distance, but also in regular channels and tubes where rodent infestation is possible.

# Fibre Optic Outdoor Cable

acc. ARCOR Standard

**HELUCOM®**

A-DF(ZN)2Y(SR)2Y



## Cable structure

Core type: Loose tube  
GRP support element  
Strain relief elements: Aramide  
Inner sheath material: PE  
Type of armouring: Steel rib  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -20°C  
Laying, max.: +50°C  
Operating, min.: -30°C  
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
Cable, laterally water-tight  
UV-resistant

Designation	No. of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A-DF(ZN)2Y(SR)2Y 12	12	Single-mode E9/125	ITU-T G.652	2	15,0	2700	230,0	4,80	400	215,0	<b>82190</b>
A-DF(ZN)2Y(SR)2Y 24	24	Single-mode E9/125	ITU-T G.652	4	15,0	2700	230,0	4,80	400	215,0	<b>800708</b>
A-DF(ZN)2Y(SR)2Y 48	48	Single-mode E9/125	ITU-T G.652	12	17,0	2700	260,0	6,00	400	260,0	<b>800709</b>
A-DF(ZN)2Y(SR)2Y 60	60	Single-mode E9/125	ITU-T G.652	12	17,0	2700	260,0	6,00	400	260,0	<b>800710</b>
A-DF(ZN)2Y(SR)2Y 144	144	Single-mode E9/125	ITU-T G.652	12	23,0	3500	350,0	10,10	400	480,0	<b>803284</b>

Dimensions and specifications may be changed without prior notice.

## Application

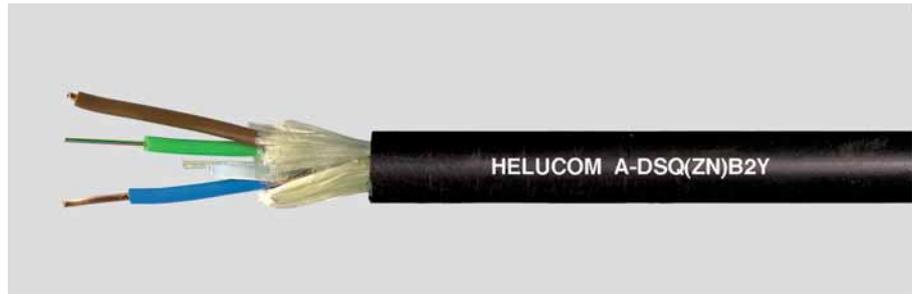
These HELUCOM® fibre-optic cables are characterized by a stranded construction with jelly filling. They are made waterproof in longitudinal direction by filling a jelly mass into the stranding cavities. Above-average rodent protection is achieved with the metallic rodent protection (steel groove) and the second outer sheath made of PE. This construction is particularly used in the area of telecommunication and long distance where ARCOR standards must be followed, but also in regular channels and tubes where rodent infestation is possible.

# Fibre Optic Outdoor Cable Hybrid

acc. DIN VDE 0888

HELUCOM®

A-DSQ(ZN)B2Y



## Cable structure

Core type: Loose tube  
 GRP support element  
 Number of fibres per core: 4  
 Strain relief elements: Glass yarns  
 Type of armouring: Glass yarns  
 Outer sheath material: PE  
 Outer sheath colour: Black

## Temperature range

Laying, min.: -10°C  
 Laying, max.: +60°C  
 Operating, min.: -25°C  
 Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
 Longitudinally water-tight acc. to IEC 60794-1-2-F5  
 UV-resistant

Designation	No. of fibres	Fibre type	No. of copper cores	Dimensions of copper cores mm	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A-DSQ(ZN)B2Y	4	Multimode G50/125	2	1,2	12,0	2100	300	4,80	200	140,0	<b>81209</b>
A-DSQ(ZN)B2Y	4	Multimode G62.5/125	2	1,2	12,0	2100	300	4,80	200	140,0	<b>81255</b>
A-DSQ(ZN)B2Y	4	Single-mode E9/125	2	1,2	12,0	2100	300	4,80	200	140,0	<b>81256</b>
A-DSQ(ZN)B2Y	4	Multimode G50/125	2	1,5	12,5	2300	320	4,80	200	160,0	<b>82561</b>
A-DSQ(ZN)B2Y	4	Multimode G62.5/125	2	1,5	12,5	2300	320	4,80	200	160,0	<b>81257</b>
A-DSQ(ZN)B2Y	4	Single-mode E9/125	2	1,5	12,5	2300	320	4,80	200	160,0	<b>81258</b>
A-DSQ(ZN)B2Y	4	Multimode G50/125	4	1,5	15,0	2600	430	5,80	200	250,0	<b>82786</b>
A-DSQ(ZN)B2Y	4	Multimode G62.5/125	4	1,5	15,0	2600	430	5,80	200	250,0	<b>81259</b>
A-DSQ(ZN)B2Y	4	Single-mode E9/125	4	1,5	15,0	2600	430	5,80	200	250,0	<b>81260</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are designed especially for use in fibre-optical temperature measurements, such as monitoring of dams. The extreme mechanical requirements in these areas are fulfilled by the specially designed cable construction. These lines are hybrid glass fibre lines with copper cores and a special PE outer sheath.

Typical application within a coffer-dam

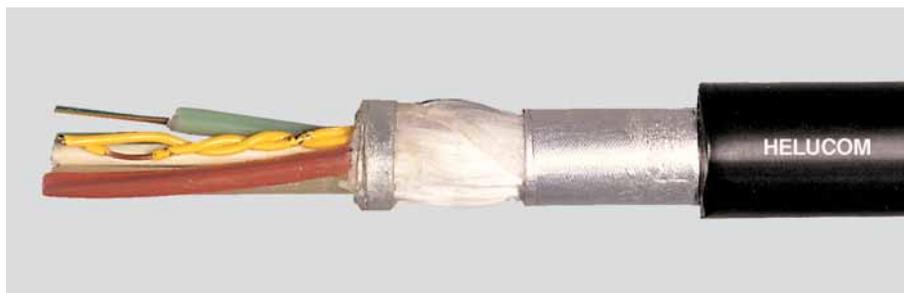


# Fibre Optic Outdoor Cable Hybrid

acc. DIN VDE 0888

**HELUCOM®**

A-DSF(L)(ZN)2Y



## Cable structure

Core type: Loose tube  
GRP support element  
Number of fibres per core: 12  
Strain relief elements: Aramide  
Aluminium laminated sheath  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -25°C  
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
Cable, laterally water-tight  
UV-resistant

Designation	No. of fibres	Fibre type	No. of copper cores	Dimensions of copper cores mm	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Caloric load app. MJ / m	Max. transverse pressure N / cm	Weight kg / km	Part no.
A-DSF(L)(ZN)2Y	12	Single-mode E9/125	2	0,6	12,0	2500	200	4,80	250	135,0	<b>80495</b>
A-DSF(L)(ZN)2Y	12	Single-mode E9/125	4	0,6	12,0	2500	200	4,80	250	140,0	<b>80497</b>
A-DSF(L)(ZN)2Y	24	Single-mode E9/125	2	0,6	13,1	2500	200	4,80	250	139,0	<b>800753</b>
A-DSF(L)(ZN)2Y	24	Single-mode E9/125	4	0,6	13,1	2500	200	4,80	250	144,0	<b>801182</b>
A-DSF(L)(ZN)2Y	48	Single-mode E9/125	2	0,6	13,1	2500	200	4,80	250	141,0	<b>80501</b>
A-DSF(L)(ZN)2Y	48	Single-mode E9/125	4	0,6	13,1	2500	200	4,80	250	146,0	<b>80503</b>
A-DSF(L)(ZN)2Y	60	Single-mode E9/125	2	0,6	14,1	2500	230	4,80	250	166,0	<b>80504</b>
A-DSF(L)(ZN)2Y	60	Single-mode E9/125	4	0,6	14,1	2500	230	4,80	250	171,0	<b>80506</b>
A-DSF(L)(ZN)2Y	72	Single-mode E9/125	2	0,6	14,8	2500	240	5,10	250	179,0	<b>80507</b>
A-DSF(L)(ZN)2Y	72	Single-mode E9/125	4	0,6	14,8	2500	240	5,10	250	184,0	<b>80509</b>
A-DSF(L)(ZN)2Y	96	Single-mode E9/125	2	0,6	16,6	3000	280	6,30	250	276,0	<b>80510</b>
A-DSF(L)(ZN)2Y	96	Single-mode E9/125	4	0,6	16,6	3000	280	6,30	250	281,0	<b>80512</b>
A-DSF(L)(ZN)2Y	120	Single-mode E9/125	2	0,6	18,4	3000	290	8,50	250	280,0	<b>80513</b>
A-DSF(L)(ZN)2Y	120	Single-mode E9/125	4	0,6	18,4	3000	290	8,50	250	285,0	<b>80515</b>
A-DSF(L)(ZN)2Y	144	Single-mode E9/125	2	0,6	20,3	3500	310	10,00	250	331,0	<b>80516</b>
A-DSF(L)(ZN)2Y	144	Single-mode E9/125	4	0,6	20,3	3500	310	10,00	250	336,0	<b>80518</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® outdoor cables are designed for use under extreme environmental conditions. With the double jelly filling and the Al/PE laminated sheath, they are waterproof in longitudinal and transverse direction. The welded Al tape acts as an additional vapour barrier. These cables can be laid directly in the ground, in tubes and in ducts. They are mainly used in local and long-distance networks.

# Aerial Fibre Optic Cable

metall free

HELUCOM®

ADSS L



## Cable structure

Core type: Loose tube  
GRP support element  
Strain relief elements: Aramide  
Inner sheath material: PE  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -10°C  
Laying, max.: +60°C  
Operating, min.: -40°C  
Operating, max.: +70°C

## Other data

Sag at 25°C ADSS 6L: 1,0m  
Sag at 25°C ADSS 9L: 1,6m  
Sag at 25°C ADSS 16L: 3,6m  
Halogen-free acc. to 60754-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
Cable, laterally water-tight  
UV-resistant

Designation	Number of fibres	Fibre type	Number of fibres per core	Span width m	Max. tensile force kN	Additional load daN / m	Min. stat. bending radius mm	Outer Ø app. mm	Weight kg / km	Part no.
ADSS 6L	12	Single-mode E9/125	6	80	3	0,073	230	11,5	100	<b>804733</b>
ADSS 6L	24	Single-mode E9/125	6	80	3	0,073	230	11,5	100	<b>805160</b>
ADSS 6L	48	Single-mode E9/125	12	80	3	0,073	252	12,6	120	<b>804735</b>
ADSS 6L	144	Single-mode E9/125	12	80	7	0,073	348	17,4	230	<b>804736</b>
ADSS 9L	12	Single-mode E9/125	6	150	4	0,073	230	11,5	100	<b>804737</b>
ADSS 9L	24	Single-mode E9/125	6	150	4	0,073	230	11,5	100	<b>805161</b>
ADSS 9L	48	Single-mode E9/125	12	150	4	0,073	252	12,6	120	<b>804739</b>
ADSS 9L	144	Single-mode E9/125	12	150	10	0,073	354	17,7	240	<b>804740</b>
ADSS 16L	12	Single-mode E9/125	6	350	11	0,073	250	12,5	120	<b>804741</b>
ADSS 16L	24	Single-mode E9/125	6	350	11	0,073	250	12,5	120	<b>804742</b>
ADSS 16L	48	Single-mode E9/125	12	350	9	0,073	264	13,2	135	<b>804743</b>
ADSS 16L	144	Single-mode E9/125	12	350	16	0,073	362	18,1	250	<b>804744</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® ADSS L cables designed as aerial cables for freely suspended installations on steel-bar-, wood-, concrete- or steel poles. The construction is waterproof in longitudinal direction thanks to the use of jelly-filled bundle cores and swelling tape. The outer jacket is UV-resistant and at the same time provides protection against light and normal environmental influences, such as sun insolation and wind. Installations on high voltage poles are possible up to a field-strength of 4 kV. There are constructions for span width of 80m, 150m or 350m under conditions according NESCC® Light available. Corresponding accessories like suspension and tension fittings are in chapter 5.

# Aerial Fibre Optic Cable

metall free

HELUCOM®

ADSS



## Cable structure

Core type: Loose tube  
GRP support element  
Strain relief elements: Aramide  
Inner sheath material: PE  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -10°C  
Laying, max.: +60°C  
Operating, min.: -25°C  
Operating, max.: +70°C

## Other data

Sag at 25°C ADSS 9: 2,0m  
Sag at 25°C ADSS 16: 4,5m  
Sag at 25°C : m  
Halogen-free acc. to 60754-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
Cable, laterally water-tight  
UV-resistant

Designation	Number of fibres	Fibre type	Number of fibres per core	Span width m	Max. tensile force kN	Additional load daN / m	Min. stat. bending radius mm	Outer Ø app. mm	Weight kg / km	Part no.
ADSS 9	12	Single-mode E9/125	12	150	9	0,5	410	13,6	135	<b>82390</b>
ADSS 9	24	Single-mode E9/125	12	150	9	0,5	410	13,6	137	<b>82391</b>
ADSS 9	36	Single-mode E9/125	12	150	9	0,5	470	15,6	177	<b>82392</b>
ADSS 9	48	Single-mode E9/125	12	150	9	0,5	470	15,6	178	<b>82393</b>
ADSS 9	60	Single-mode E9/125	12	150	9	0,5	450	15,0	161	<b>82394</b>
ADSS 9	96	Single-mode E9/125	12	150	9	0,5	450	15,5	180	<b>804275</b>
ADSS 9	144	Single-mode E9/125	12	150	9	0,5	630	20,8	316	<b>82395</b>
ADSS 16	12	Single-mode E9/125	12	350	16	0,3	430	14,4	162	<b>82396</b>
ADSS 16	24	Single-mode E9/125	12	350	16	0,3	430	14,4	165	<b>82397</b>
ADSS 16	36	Single-mode E9/125	12	350	16	0,3	500	16,4	200	<b>82398</b>
ADSS 16	48	Single-mode E9/125	12	350	16	0,3	500	16,4	201	<b>82399</b>
ADSS 16	60	Single-mode E9/125	12	350	16	0,3	480	15,8	184	<b>82400</b>
ADSS 16	96	Single-mode E9/125	12	350	16	0,3	480	16,0	200	<b>804276</b>
ADSS 16	144	Single-mode E9/125	12	350	16	0,3	650	21,6	333	<b>82401</b>

Dimensions and specifications may be changed without prior notice.

## Application

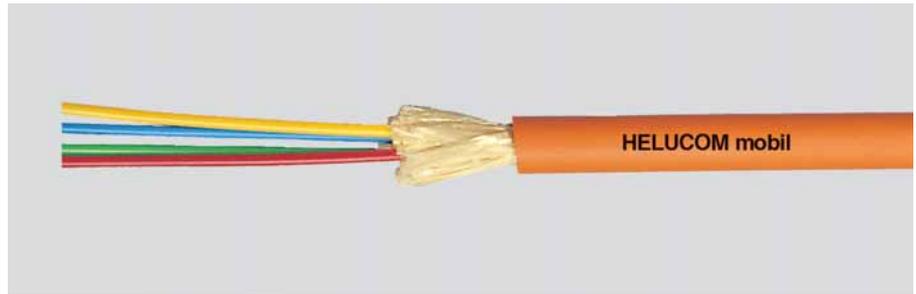
These HELUCOM® outdoor cables designed as aerial cables for freely suspended installations on posts and masts. The construction is waterproof in longitudinal direction thanks to the use of jelly-filled bundle cores and swelling tape. The outer jacket is UV-resistant and at the same time provides protection against environmental influences, such as snow, ice, sun insolation and wind. Corresponding accessories like suspension and tension fittings are in chapter 5.

# Fibre Optic Cable flexible

WK - mobile

HELUCOM®

A-V(ZN)11Y



## Cable structure

Core type: Tight buffer  
Strain relief elements: Aramide  
Outer sheath colour: Orange

## Temperature range

Laying, min.: +5°C  
Laying, max.: +50°C  
Operating, min.: -30°C  
Operating, max.: +70°C

## Other data

Max. tensile force: 650 N  
Max. transverse pressure: 40 N / cm  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant  
Resistant to hammer impact acc. to IEC 60794-1-2-E4  
Bending cycles acc. to IEC 60794-1-2-E6: 500.000  
Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Outer Ø app. mm	Outer sheath material	Min. stat. bending radius mm	Flame proof	halogen-free	UL	Weight kg / km	Part no.
Fibre-optic cable	2	Multimode G50/125	OM2	5,0	PUR	75	yes	yes	no	20	<b>80382</b>
Fibre-optic cable	2	Multimode G62.5/125	OM1	5,0	PUR	75	yes	yes	no	20	<b>80363</b>
Fibre-optic cable	4	Multimode G50/125	OM2	5,8	PUR	90	yes	yes	no	31	<b>80534</b>
Fibre-optic cable	4	Multimode G62.5/125	OM1	5,8	PUR	90	yes	yes	no	31	<b>81036</b>
Fibre-optic cable	4	Single-mode E9/125	ITU-T G.652	5,8	PUR	90	yes	yes	no	31	<b>801727</b>
Fibre-optic cable	8	Multimode G50/125	OM2	7,0	PUR	105	yes	yes	no	47	<b>81037</b>
Fibre-optic cable	8	Multimode G62.5/125	OM1	7,0	PUR	105	yes	yes	no	47	<b>81038</b>

Dimensions and specifications may be changed without prior notice.

## Application

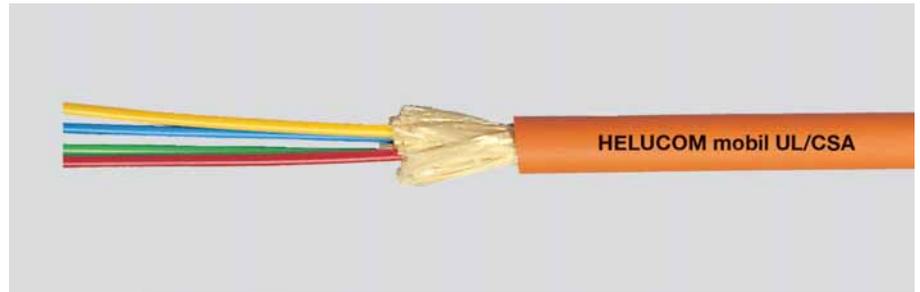
These HELUCOM® cables were designed as mobile field cables. They are easily wound up on a drum and are very tension-proof. As the outer sheath is tightly anchored on the aramid braiding, it is especially suitable for mobile use. The advantage of these cables is evident especially where mobile fibre-optic lines are to be installed, such as for drag chains, TV transmission, supervision of protected areas, etc.

# Fibre Optic Cable flexible

WK - UL/CSA

HELUCOM® WK

A-V(ZN)YY



## Cable structure

Core type: Tight buffer  
Strain relief elements: Aramide  
Outer sheath colour: Orange

## Temperature range

Laying, min.: 0°C  
Laying, max.: +50°C  
Operating, min.: -30°C  
Operating, max.: +80°C

## Other data

Max. tensile force: 1200 N  
Max. transverse pressure: 500 N / cm  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
Applicable UL standards: OFNG UL 1685  
Applicable CSA standards: FT4  
UV-resistant  
Bending cycles acc. to IEC 60794-1-2-E6: 9.000  
Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Outer Ø app. mm	Outer sheath material	Inner sheath material	Min. stat. bending radius mm	Flame proof	halogen-free	UL	Weight kg / km	Part no.
Fibre-optic cable	4	Multimode G50/125	OM2	7,0	PVC	PVC	75	yes	no	yes	50	<b>802792</b>
Fibre-optic cable	4	Multimode G62.5/125	OM1	7,0	PVC	PVC	75	yes	no	yes	50	<b>803934</b>
Fibre-optic cable	4	Single-mode E9/125	ITU-T G.652	7,0	PVC	PVC	75	yes	no	yes	50	<b>803935</b>

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® cables were designed as mobile field cables. They are easily wound up on a drum and are very tension-proof. As the outer sheath is tightly anchored on the aramid braiding, it is especially suitable for mobile use. The advantage of these cables is obvious especially where mobile fibre-optic lines have to be installed, such as windturbine projects, TV transmission, supervision of protected areas, etc. This series with PVC jacket is certified according to the **UL/CSA standard OFNG/ FT4**.

# Fibre Optic Cable flexible

WK robust PUR + PVC (UL/CSA)

HELUCOM® WK

AT-V(ZN)H(ZN)11Y, AT-V(ZN)Y(ZN)Y



## Cable structure

Core type: Composite buffered  
Strain relief elements: Aramide  
Outer sheath colour: Black

## Temperature range

Laying, min.: -10°C  
Laying, max.: +50°C  
Operating, min.: -40°C  
Operating, max.: +90°C

## Other data

Max. tensile force: 4800 N  
Max. transverse pressure: 200 N / cm  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant  
Resistant to hammer impact acc. to IEC 60794-1-2-E4  
Bending cycles acc. to IEC 60794-1-2-E6: 9.000  
Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Outer Ø app. mm	Outer sheath material	Inner sheath material	Min. stat. bending radius mm	Flame proof	halogen-free	UL	Weight kg / km	Part no.
AT-V(ZN)H(ZN)11Y	4	Multimode G50/125	OM2	8,5	PUR	ULSZH	100	yes	yes	no	125	<b>803346</b>
AT-V(ZN)Y(ZN)Y	4	Multimode G50/125	OM2	8,5	PVC	PVC	130	yes	no	yes	125	<b>803348</b>
AT-V(ZN)H(ZN)11Y	12	Multimode G50/125	OM2	12,4	PUR	ULSZH	190	yes	yes	no	320	<b>803347</b>
AT-V(ZN)H(ZN)11Y	12	Single-mode E9/125	ITU-T G.652	12,4	PUR	ULSZH	190	yes	yes	no	320	<b>804700</b>
AT-V(ZN)Y(ZN)Y	12	Multimode G50/125	OM2	12,4	PVC	PVC	190	yes	no	yes	320	<b>803349</b>

Dimensions and specifications may be changed without prior notice.

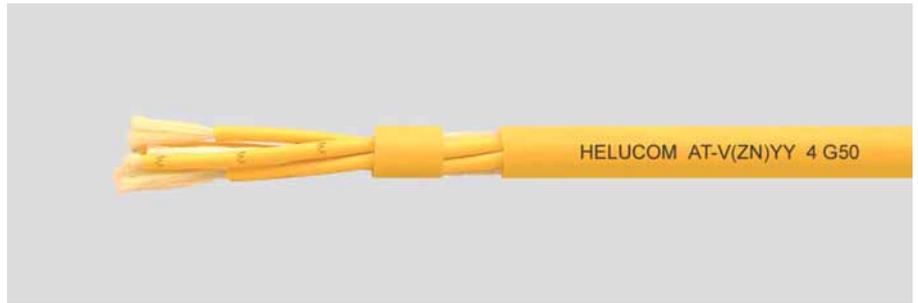
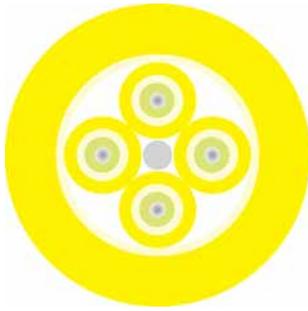
## Application

The HELUCOM® WK range is set apart by its extreme rugged yet highly-flexible design. It is used wherever demanding environmental conditions and extreme movements occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example Windturbines, TV transmissions, mobile field applications, etc.

# Fibre Optic Cable flexible

HELUCOM® WK

AT-V(ZN)YY



## Cable structure

Core type: Composite buffered  
Strain relief elements: Aramide  
Outer sheath colour: Yellow similar to RAL 1021

## Temperature range

Laying, min.: -10°C  
Laying, max.: +50°C  
Operating, min.: -40°C  
Operating, max.: +90°C

## Other data

Max. tensile force: 1200 N  
Max. transverse pressure: 100 N / cm  
UV-resistant  
Resistant to hammer impact acc. to IEC 60794-1-2-E4  
Bending cycles acc. to IEC 60794-1-2-E6: 15  
Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Outer Ø app. mm	Outer sheath material	Inner sheath material	Min. stat. bending radius mm	Flame proof	halogen-free	UL	Weight kg / km	Part no.
Fibre-optic cable	4	Multimode G50/125	OM2	7,4	PVC	PVC	90	yes	no	no	65	<b>803364</b>

Dimensions and specifications may be changed without prior notice.

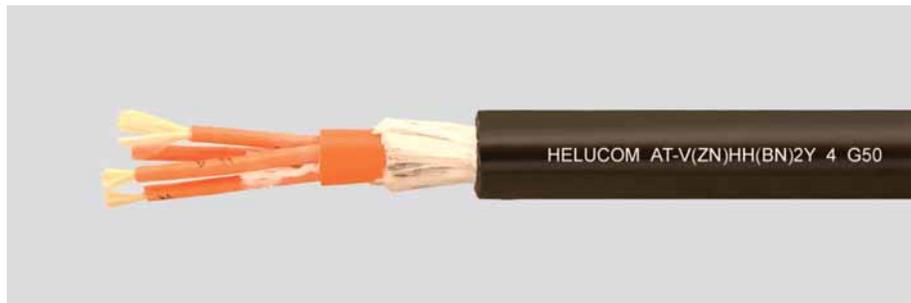
## Application

The HELUCOM® range is set apart by its extreme rugged yet flexible design. It is used wherever demanding environmental conditions and movements occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example industry applications, TV transmissions, etc.

# Fibre Optic Breakout Cable

outdoor

**HELUCOM®**  
AT-V(ZN)HH(ZN)B2Y



## Cable structure

Core type: Composite buffered  
GRP support element  
Strain relief elements: Aramide  
Inner sheath material: ULSZH  
Type of armouring: Glass yarns  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +60°C

## Other data

Longitudinally water-tight acc. to  
IEC 60794-1-2-F5  
UV-resistant  
Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Max. transverse pressure N / cm	Caloric load app. MJ / m	Weight kg / km	Part no.
AT-V(ZN)HH(ZN)B2Y	4	Multimode G50/125	OM2	13,5	1200	340	300	2,95	140	<b>801352</b>

Dimensions and specifications may be changed without prior notice.

## Application

The HELUCOM® range is set apart by its extreme rugged rodent protected design. It is used wherever demanding environmental conditions while fixed installations occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example industry applications, etc.

# Fibre Optic Breakout Cable PROFIBUS

## + PROFinet

outdoor/ direct burial

**HELUCOM®**

AT-V(ZN)H(ZN)BH



### Cable structure

Core type: Composite buffered  
GRP support element  
Strain relief elements: Aramide  
Inner sheath material: ULSZH  
Type of armouring: Glass yarns  
Outer sheath material: FRNC  
Outer sheath colour: Black

### Temperature range

Laying, min.: -20°C  
Laying, max.: +60°C  
Operating, min.: -40°C  
Operating, max.: +70°C

### Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Flame-resistance acc. to IEC 60332-1 and IEC 60332-3  
Smoke density acc. to IEC 61034  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant  
Resistant to hammer impact acc. to IEC 60794-1-2-E4  
Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Max. transverse pressure N / cm	Caloric load app. MJ / m	Weight kg / km	Part no.
AT-V(ZN)H(ZN)BH	4	Single-mode E9/125	ITU-T G.652	9,0	1000	90	600	1,50	85	<b>805687</b>

Dimensions and specifications may be changed without prior notice.

### Application

The HELUCOM® range is set apart by its rugged design. It is used wherever demanding environmental conditions while fixed installations occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example tray installation or building installation within industry areas. This series can be used within PROFIBUS and PROFinet communications.

# Fibre Optic Breakout Cable PROFIBUS

## + PROFINet

fixed installation

**HELUCOM**<sup>®</sup>

AT-W(ZN)H(ZN)H



### Cable structure

Core type: Buffered-fibre  
 GRP support element  
 Strain relief elements: Aramide  
 Outer sheath material: FRNC  
 Outer sheath colour: Green similar to RAL 6018

### Temperature range

Laying, min.: -5°C  
 Laying, max.: +50°C  
 Operating, min.: -40°C  
 Operating, max.: +85°C

### Other data

Corrosiveness acc. to EN50267-2-3  
 Halogen-free acc. to 60754-2  
 Flame-resistance acc. to IEC 60332-1 and IEC 60332-3  
 Smoke density acc. to IEC 61034  
 UV-resistant  
 Resistant to hammer impact acc. to IEC 60794-1-2-E4  
 Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Max. transverse pressure N / cm	Caloric load app. MJ / m	Weight kg / km	Part no.
AT-W(ZN)H(ZN)H	2	Multimode G50/125	OM2	9,2	1200	90	500	1,34	80	<b>805689</b>
AT-W(ZN)H(ZN)H	2	Multimode G50/125	OM4	9,2	1200	90	500	1,34	80	<b>805691</b>

Dimensions and specifications may be changed without prior notice.

### Application

The HELUCOM<sup>®</sup> range is set apart by its extreme rugged rodent protected design. It is used wherever demanding environmental conditions while fixed installations occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example Installation in backbones (805691) or in trays within industry areas (805689).

# Fibre Optic Breakout Cable PROFIBUS + PROFINet

Drag Chain

**HELUCOM**<sup>®</sup>  
AT-W(ZN)Y(ZN)11Y



## Cable structure

Core type: Composite buffered  
GRP support element  
Strain relief elements: Aramide  
Outer sheath material: PUR  
Outer sheath colour: Green similar to RAL 6018

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -40°C  
Operating, max.: +80°C

## Other data

UV-resistant  
Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Max. transverse pressure N / cm	Caloric load app. MJ / m	Weight kg / km	Part no.
AT-W(ZN)Y(ZN)11Y	2	Multimode G50/125	OM2	10,5	1000	150	700	2,50	100	<b>805690</b>

Dimensions and specifications may be changed without prior notice.

## Application

The HELUCOM<sup>®</sup> range is set apart by its rugged and high flexible design. It is used wherever demanding environmental conditions while moving applications occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example drag chains. This serie can be used within PROFIBUS and PROFINet communications.

# Fibre Optic Breakout Cable PROFIBUS + PROFinet

**HELUCOM®**  
AT-V(ZN)H(ZN)BH



## Cable structure

Core type: Composite buffered  
GRP support element  
Strain relief elements: Aramide  
Type of armouring: Glass yarns  
Outer sheath material: FRNC  
Outer sheath colour: Black

## Temperature range

Laying, min.: -10°C  
Laying, max.: +60°C  
Operating, min.: -30°C  
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Flame-resistance acc. to IEC 60332-1-2  
Smoke density acc. to IEC 61034  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant  
Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Max. transverse pressure N / cm	Weight kg / km	Part no.
AT-V(ZN)H(ZN)BH	2	Multimode G50/125	OM2	8,0	1000	140	300	70	<b>805445</b>

Dimensions and specifications may be changed without prior notice.

## Application

The HELUCOM® range is set apart by its extreme rugged rodent protected design. It is used wherever demanding environmental conditions while fixed installations occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example direct burial or tray installation within industry areas. This series can be used within PROFIBUS and PROFinet communications.

# Fibre Optic Breakout Cable PROFIBUS

## + PROFINet

direct burial

**HELUCOM**<sup>®</sup>

AT-WQ(ZN)H(ZN)B2Y



### Cable structure

Core type: Buffered-fibre  
GRP support element  
Strain relief elements: Aramide  
Type of armouring: Glass yarns  
Outer sheath material: PE  
Outer sheath colour: Black

### Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -40°C  
Operating, max.: +85°C

### Other data

Halogen-free acc. to 60754-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant  
Resistant to hammer impact acc. to IEC 60794-1-2-E4  
Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Max. transverse pressure N / cm	Caloric load app. MJ / m	Weight kg / km	Part no.
AT-WQ(ZN)H(ZN)B2Y	2	Multimode G50/125	OM2	10,5	1200	105	500	3,30	90	<b>805692</b>

Dimensions and specifications may be changed without prior notice.

### Application

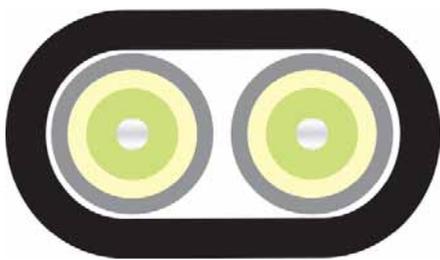
The HELUCOM<sup>®</sup> range is set apart by its extreme rugged rodent protected design. It is used wherever demanding environmental conditions while fixed installations occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example direct burial or tray installation out of industry areas. This series can be used for PROFIBUS and PROFINet communications.

# Fibre Optic Cable robust

multimode

HELUCOM®

AT-VYY



## Cable structure

Core type: Tight buffer  
Strain relief elements: Aramide  
Outer sheath material: PVC  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +60°C

## Other data

Flame-resistance acc. to IEC 60332-1-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant  
Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Max. transverse pressure N / cm	Caloric load app. MJ / m	Weight kg / km	Part no.
AT-VYY	2	Multimode G62.5/125 OM1		1	6,8 x 10,2	400	110,0	300	1,10	76,0	<b>800126</b>

Dimensions and specifications may be changed without prior notice.

## Application

This HELUCOM® fibre-optic cable is suited for fixed installations in pits and channels, but also for flexible applications as jumper cable. Because of the robust construction with Single- and Overall-jacket you also can use it in industrial areas. With the core-construction, direct plug manufacturing, even on site, poses no problems.

# Fibre Optic Breakout Cable robust, flexible

HCS UL/CSA

**HELUCOM®**  
I-V(ZN)YY



## Cable structure

Core type: Composite buffered  
Strain relief elements: Aramide  
Outer sheath material: PVC  
Outer sheath colour: Black

## Temperature range

Laying, min.: -20°C  
Laying, max.: +75°C  
Operating, min.: -30°C  
Operating, max.: +85°C

## Other data

Flame-resistance acc. to IEC 60332-1 and IEC 60332-3  
Applicable UL standards: OFNG UL 1685  
Applicable CSA standards: FT4  
UV-resistant  
Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Max. transverse pressure N / cm	Caloric load app. MJ / m	Weight kg / km	Part no.
I-V(ZN)YY	2	HCS 200/230	Other	1	7,5	800	100,0	300	1,40	68,0	<b>801733</b>

Dimensions and specifications may be changed without prior notice.

## Application

This HELUCOM® HCS fibre cable is suitable for fixed and normal flexible installations. Possible applications are normal and heavy-duty mechanical requirements for example in industrial environments. Because of a special PVC jacket this construction is certified by UL (FT1 and FT4). With the tight buffer construction, direct plug manufacturing, even on site, poses no problems. With a HCS fibre transmission lengths of up to 300m can be achieved.

# Fibre Optic Breakout Cable robust, flexible

HCS

**HELUCOM®**  
I-V(ZN)Y11Y



## Cable structure

Core type: Composite buffered  
Strain relief elements: Aramide  
Outer sheath material: PUR  
Outer sheath colour: Red

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +70°C

## Other data

Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Max. transverse pressure N / cm	Caloric load app. MJ / m	Weight kg / km	Part no.
I-V(ZN)Y11Y	2	HCS 200/230	Other	1	7,0	800	50,0	150	1,014	43,0	<b>800980</b>

Dimensions and specifications may be changed without prior notice.

## Application

This HELUCOM® HCS fibre cable is suitable for fixed installation. Possible applications are normal and heavy-duty mechanical requirements for example in industrial environments. With the tight buffer construction, direct plug manufacturing, even on site, poses no problems. With a HCS fibre transmission lengths of up to 300m can be achieved.

# Fibre Optic Breakout Cable flexible

HCS

HELUCOM®

AT-V(ZN)HH



## Cable structure

Core type: Composite buffered  
GRP support element  
Strain relief elements: Aramide  
Outer sheath material: FRNC  
Outer sheath colour: Black

## Temperature range

Laying, min.: -20°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Flame-resistance acc. to IEC 60332-1-2  
Smoke density acc. to IEC 61034  
UV-resistant  
Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Max. transverse pressure N / cm	Caloric load app. MJ / m kg / km	Weight	Part no.
AT-V(ZN)HH	4	HCS 200/230	Other	1	9,0	800	225,0	100	1,60	76,0	<b>802260</b>

Dimensions and specifications may be changed without prior notice.

## Application

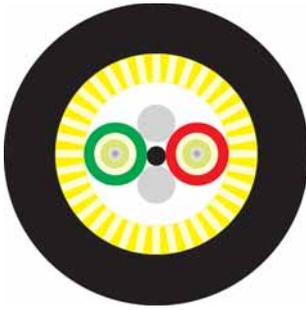
This HELUCOM® HCS fibre cable is suitable for fixed and normal flexible installation. Possible applications are normal requirements and also limited industrial environments. The tight buffer structure enables the cable to be pre-assembled on site with ease. With a HCS fibre transmission lengths of up to 300m can be achieved.

# Fibre Optic Breakout Cable robust

HCS

HELUCOM®

AT-VQH(ZN)B2Y



## Cable structure

Core type: Composite buffered  
GRP support element  
Strain relief elements: Aramide  
Type of armouring: Glass yarns  
Outer sheath material: PE  
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -25°C  
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3  
Halogen-free acc. to 60754-2  
Longitudinally water-tight acc. to IEC 60794-1-2-F5  
UV-resistant  
Oil-resistant

Designation	Number of fibres	Fibre type	Fibre category	Number of fibres per core	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Max. transverse pressure N / cm	Caloric load app. MJ / m	Weight kg / km	Part no.
AT-VQH(ZN)B2Y	2	HCS 200/230	Other	1	11,0	1500	200,0	500	2,10	90,0	<b>801196</b>

Dimensions and specifications may be changed without prior notice.

## Application

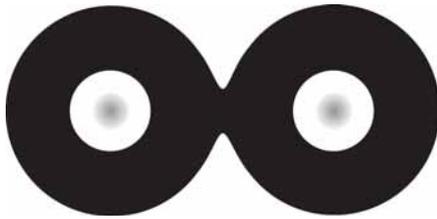
This HELUCOM® HCS fibre cable is suitable for fixed installation outdoors. Possible applications are normal and heavy-duty mechanical requirements for example in industrial environments. This is the reason we also equipped the cable with a non-metallic rodent-protection. With the tight buffer construction, direct plug manufacturing, even on site, poses no problems. With a HCS fibre transmission lengths of up to 300m can be achieved.

# Plastic Fibre cable industry

POF/PE

**HELUCOM®**

I-V2Y, I-V2Y(ZN)11Y



## Cable structure

Fibre type: POF 980/1000  
Fibre cladding: PE

## Optical characteristic

Refractive index core: 1,492  
Refractive index cladding: 1,419  
Numerical aperture: 0,5  
Attenuation see table

## Temperature range

Laying, min.: -20°C  
Laying, max.: +80°C  
Operating, min.: -20°C  
Operating, max.: +80°C

Designation	Outer sheath material	Sheath colour	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Fibre attenuation	Oil-resistant	Acc. to DESINA®	Weight kg / km	Part no.
I-V2Y 1P 980/1000	PE	Black	2,2	70	25,0	160A1	no	no	4,0	<b>80532</b>
I-V2Y 2P 980/1000	PE	Black	2,2 x 4,4	140	25,0	160A1	no	no	8,0	<b>80388</b>
I-V2Y(ZN)11Y 1P 980/1000, high flexible	PUR	Violet	5,8	400	30,0	230A1	yes	yes	30,0	<b>81611</b>
I-V2Y(ZN)11Y 2P 980/1000, high flexible	PUR	Violet	6,0	400	31,0	230A1	yes	yes	36,0	<b>80629</b>
I-V2Y(ZN)11Y 2P 980/1000, fixed installation	PUR	Violet	6,0	400	31,0	230A1	yes	yes	36,0	<b>81882</b>
I-V2Y(ZN)11Y 4P 980/1000, high flexible	PUR	Violet	7,1	400	45,0	230A1	yes	yes	65,0	<b>80630</b>

Dimensions and specifications may be changed without prior notice.

## Application

HELUCOM® plastic-fibre cables are used in mechanical engineering, both in mobile and fixed applications. With different constructions, such as PUR outer sheaths, special strain relief components, hybrid construction with copper cores for power supply or only raw fibre cables, any possible fields of application are covered. Due to their solidity and their simple adjustability on site, the plastic-fibres (PMMA) are particularly suitable for applications where trouble-free data transmission is necessary under heavy-duty conditions.

# Plastic Fibre Cable PROFInet

POF/PA

HELUCOM®

I-V4Y(ZN)Y (type B), I-V4Y(ZN)11Y (type C)



## Cable structure

Fibre type: POF 980/1000  
Fibre cladding: PA

## Optical characteristic

Refractive index core: 1,492  
Refractive index cladding: 1,419  
Numerical aperture: 0,5  
Attenuation see table

## Temperature range

Laying, min.: -10°C  
Laying, max.: +50°C  
Operating, min.: -30°C  
Operating, max.: +70°C

Designation	Outer sheath material	Sheath colour	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Fibre attenuation	Oil-resistant	Acc. to DESINA®	Weight kg / km	Part no.
I-V4Y(ZN)Y 2P980/1000µm, fixed installation	PVC	Green	7,8	100	100,0	160A1	yes	no	59,0	<b>805686</b>
I-V4Y(ZN)11Y 2P980/1000 green, drag chain	PUR	Green	8,0	200	120,0	230A1	yes	no	60,0	<b>805838</b>

Dimensions and specifications may be changed without prior notice.

## Application

Signal lines as plastic optical fibre. The use of these transmission systems significantly reduces the number of different cables in a planned bus installation in machine tools operations. Furthermore, possible EMC problems are prevented by the metal-free construction. The main fields of these cables are in machine construction and automobile industry. Installations for example in fixed installed rough areas (type B) or in drag chains (type C) are possible. The types on this page are especially constructed for communication within PROFInet systems.

# Plastic Fibre Cable PROFIBUS

POF/PA

**HELUCOM®**  
I-V4Y(ZN)Y



## Cable structure

Fibre type: POF 980/1000  
Fibre cladding: PA

## Optical characteristic

Refractive index core: 1,492  
Refractive index cladding: 1,419  
Numerical aperture: 0,5  
Attenuation see table

## Temperature range

Laying, min.: -10°C  
Laying, max.: +50°C  
Operating, min.: -30°C  
Operating, max.: +70°C

Designation	Outer sheath material	Sheath colour	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Fibre attenuation	Oil-resistant	Acc. to DESINA®	Weight kg / km	Part no.
I-V4Y(ZN)Y 2P980/1000µm, fixed installation	PVC	Violet	7,8	100	100,0	160A1	yes	yes	59,0	<b>801280</b>

Dimensions and specifications may be changed without prior notice.

## Application

Signal lines as plastic optical fibre. The use of these transmission systems significantly reduces the number of different cables in a planned bus installation in machine tools operations. Furthermore, possible EMC problems are prevented by the metal-free construction. The main application of these cables are in machine construction and automobile industry. The type on this page is especially constructed for communication within PROFIBUS systems.

# Plastic Fibre Cable Automotive

POF/PA

**HELUCOM**<sup>®</sup>

I-V4Y(ZN)11Y



## Cable structure

Fibre type: POF 980/1000  
Fibre cladding: PA

## Optical characteristic

Refractive index core: 1,492  
Refractive index cladding: 1,419  
Numerical aperture: 0,5  
Attenuation see table

## Temperature range

Laying, min.: -5°C  
Laying, max.: +50°C  
Operating, min.: -20°C  
Operating, max.: +70°C

Designation	Outer sheath material	Sheath colour	Outer Ø app. mm	Max. tensile force N	Min. stat. bending radius mm	Fibre attenuation	Oil-resistant	Acc. to DESINA <sup>®</sup>	Weight kg / km	Part no.
I-V4Y(ZN)11Y 2P980/1000 RUGGED	PUR	Red	8,0	100	50,0	160A1	yes	no	42,0	<b>801200</b>
I-V4Y(ZN)11Y 2P980/1000 FLEX RUGGED	PUR	Red	8,0	100	50,0	250A1	yes	no	51,0	<b>801201</b>
I-V4Y(ZN)11Y 2P980/1000 HEAVY	PUR	Red	6,0	100	30,0	160A1	yes	no	28,0	<b>801202</b>

Dimensions and specifications may be changed without prior notice.

## Application

Signal lines as plastic optical fibre. The use of these transmission systems significantly reduces the number of different cables in a planned bus installation in machine tools operations. Furthermore, possible EMC problems are prevented by the metal-free construction. The main application of these cables are in heavy and harsh industry application (801200, 801200) and in drag chains (801201).

# FIBRESPECIFICATIONS

<b>Graded index fibres</b>			
<b>Specification</b>		<b>Fibre type G 50/125</b>	<b>Fibre type G 62,5/125</b>
Fibre categorie		OM2 Standard fibre	OM1 Standard fibre
Core diameter		50 ± 3 µm	62,5 ± 3 µm
Numerical aperture		0,200 ± 0,015	0,275 ± 0,015
Typ. attenuation	850 nm	2,5 dB/km	3,0 dB/km
	1300 nm	0,7 dB/km	1,0 dB/km
Min. bandwidth	850 nm	500 MHz x km	200 MHz x km
	1300 nm	500 MHz x km	500 MHz x km
Cladding diameter		125 ± 1 µm	
Primary coating diameter		245 ± 10 µm	
Core noncircularity		< 5 %	
Cladding concentricity error		< 3,0 µm	
Cladding nonconcentricity		< 2,0 %	
<b>Specification</b>		<b>Fibre type G 50/125</b>	
Fibre categorie		OM3 Standard fibre	OM4 Standard fibre
Core diameter		50 ± 3 µm	50 ± 3 µm
Numerical aperture		0,200 ± 0,015	0,200 ± 0,015
Typ. attenuation	850 nm	2,5 dB/km	2,4 dB/km
	1300 nm	0,5 dB/km	0,7 dB/km
Min. bandwidth	850 nm	1500 MHz x km	3500 MHz x km
	1300 nm	500 MHz x km	500 MHz x km
Cladding diameter		125 ± 1 µm	125 ± 1 µm
Primary coating diameter		245 ± 10 µm	245 ± 10 µm
Core noncircularity		< 5 %	< 5 %
Cladding concentricity error		< 3,0 µm	< 6,0 µm
Cladding nonconcentricity		< 2,0 %	< 2,0 %

<b>Single-Mode-Fibre</b>			
<b>Specification</b>		<b>Fibre type E9...10/125 (single mode)</b>	
Fibre categorie		ITU-T G. 652.d	ITU-T G 657.A1
Attenuation	1310 nm	≤ 0,35 dB/km	≤ 0,34 dB/km
	1550 nm	≤ 0,24 dB/km	≤ 0,20 dB/km
Dispersion	1550 nm	≤ 22 ps/(nm x km)	
	1625 nm	≤ 18 ps/(nm x km)	≤ 17,5 ps/(nm x km)
Wave length		1304 - 1324 nm	1300 - 1322 nm
Mode field diameter at 1310 nm		9,2 ± 0,4 µm	9,0 ± 0,3 µm
Cladding diameter		125 ± 1 µm	125 ± 0,7 µm
Primary coating diameter		245 ± 10 µm	245 ± 5 µm
Cut-off wavelength		≤ 1260 nm	≤ 1260 nm
Cladding concentricity error		≤ 0,8 µm	≤ 0,5 µm
Cladding nonconcentricity		< 1,0 %	< 0,7 %

\*ITU-T G 657 A2, B3 on request

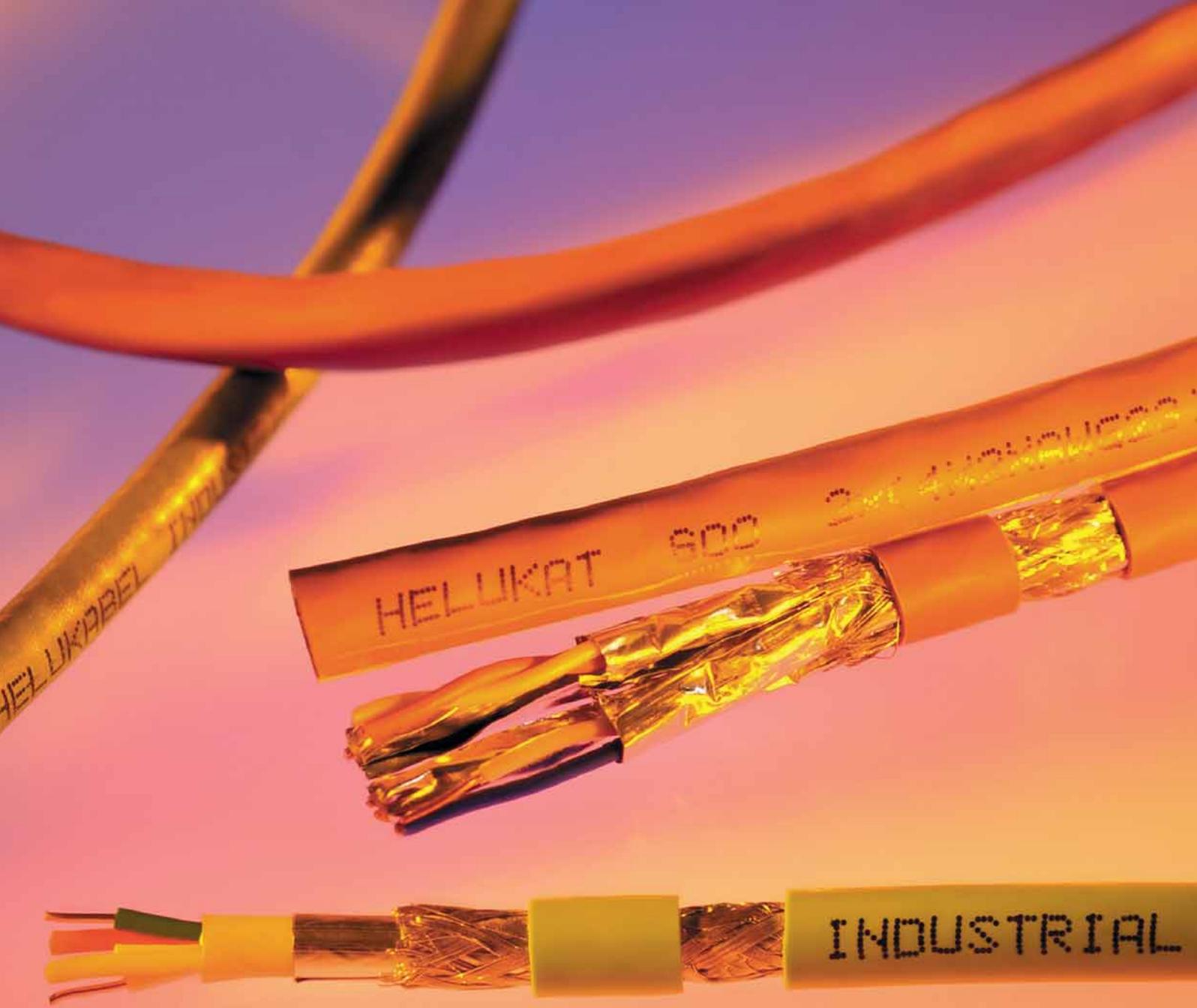
<b>POF and HCS-Fibre</b>			
<b>Specification</b>		<b>Fibre type POF P980/1000</b>	<b>Fibre type HCS K200/230</b>
Core diameter		980 µm	200 µm
Numerical aperture		0,5	0,37
Typ. attenuation	650nm	160 dB/km	10 db/km
	850nm	-	8 dB/km
Min. Bandwidth	650nm	10 MHz x 100m	17 MHz x km
	850nm	-	20 MHz x km
Wallthickness		1000 µm	230 µm

Fibres with other parameters on request

■ FIBRE-OPTIC CABLES-CODE ACC. TO DIN VDE 0888

1	—	2	3	4	5	6	7	8	9	10	11	12	13	14
														Lg layerstranding
														Bandwidth in MHz x km (GF) dispersion parameter in $\frac{\text{ps}}{\text{nm} \times \text{km}}$
														Wavelength B $\hat{=}$ 850 nm F $\hat{=}$ 1300 nm H $\hat{=}$ 1550 nm
														Attenuation coefficient in dB/km
														Cladding diameter in $\mu\text{m}$
														Core diameter in $\mu\text{m}$ of graded index fibre Field diameter in $\mu\text{m}$ of single mode fibre
														Design E Single mode fibre G Graded index fibre
														Number of fibres Number of fibres per buffer Number of multifibres per buffer
														Y PVC-sheath H Sheath with halogenfree material B Armouring BY Armouring with PVC-protective covering sheath B2Y Armouring mit PE-protective covering sheath
														Y PVC-sheath 2Y PE-sheath 4Y PA-sheath 11Y PUR-sheath (L)2Y PE-Laminated sheath (ZN)2Y PE-sheath with nonmetallic strength member (L)(ZN)2Y PE-Laminated sheath with nonmetallic strength member
														F Filling of the cable core with petroleum jelly Q Swellingmaterial
														S Metallic element in the cable core
														V Tight buffer K Composite buffer fibre H Loose buffer nonfilled W Loose buffer, filled B Multifibre buffer nonfilled D Multifibre buffer filles
														I Indoor cable AI Outdoor / Indoor cable (universal) A Outdoor cable AT Outdoor fan out cable





LAN Cable 300 U/UTP UL

**LAN Cable 155 U/UTP**

LAN Cable 100 U/UTP flex

LAN Cable 450 F/FTP

**LAN Cable 1000 S/FTP duplex**

LAN Cable 200 SF/UTP flex

Multimedia cable 1500 S/FTP

# COPPER DATA CABLES HELUKAT®

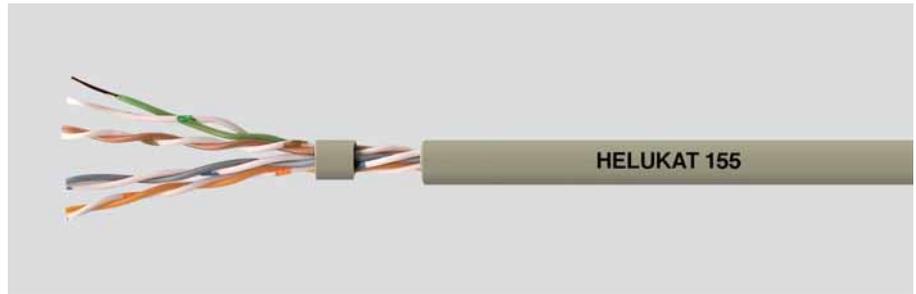
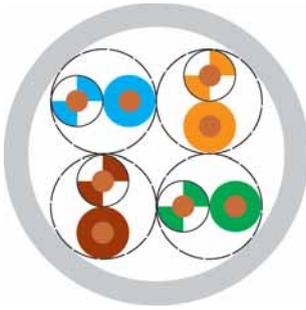
Designation				Page
<b>Data cable unshielded</b>				
LAN-Kabel, Kategorie 5e	HELUKAT® 155	U/UTP	Eca	84
LAN-Kabel, Kategorie 6	HELUKAT® 300	U/UTP UL	Eca	85
LAN-Kabel, Kategorie 6	HELUKAT® 300	U/UTP FRNC	Eca	86
LAN-Kabel, Kategorie 6	HELUKAT® 600	U/UTP FRNC	Eca	87
LAN-Kabel, Kategorie 5	HELUKAT® 100	U/UTP flex		88
LAN-Kabel, Kategorie 6	HELUKAT® 300	U/UTP flex		89
LAN-Kabel, Kategorie 6	HELUKAT® 300	U/UTP, outdoor		90
<b>Data cable shielded</b>				
LAN-Kabel, Kategorie 5e	HELUKAT® 155	F/UTP	Eca	91
LAN-Kabel, Kategorie 5	HELUKAT® 100	F/UTP flex		92
LAN-Kabel, Kategorie 5	HELUKAT® 100	F/UTP PH120		93
LAN-Kabel, Kategorie 5e	HELUKAT® 200	F/UTP Flex, UL		94
LAN-Kabel, Kategorie 5e	HELUKAT® 200A	F/UTP, outdoor		95
LAN-Kabel, Kategorie 5e	HELUKAT® 200	SF/UTP	Dca	CC-Link
LAN-Kabel, Kategorie 5e	HELUKAT® 200	SF/UTP duplex	Dca	97
LAN-Kabel, Kategorie 5e	HELUKAT® 200	SF/UTP flex		98
LAN-Kabel, Kategorie 6	HELUKAT® 300	U/FTP, UL		99
LAN-Kabel, Kategorie 6	HELUKAT® 450	F/FTP	Dca	100
LAN-Kabel, Kategorie 6	HELUKAT® 450	F/FTP duplex		101
LAN-Kabel, Kategorie 6 <sub>A</sub>	HELUKAT® 500	F/FTP	Dca	102
LAN-Kabel, Kategorie 6 <sub>A</sub>	HELUKAT® 500	F/FTP duplex	Dca	103
LAN-Kabel, Kategorie 6 <sub>A</sub>	HELUKAT® 500	U/FTP, flex		104
LAN-Kabel, Kategorie 7e	HELUKAT® 600	S/FTP	Dca	CC-Link
LAN-Kabel, Kategorie 7e	HELUKAT® 600	S/FTP duplex	Dca	CC-Link
LAN-Kabel, Kategorie 7	HELUKAT® 600	S/FTP flex		107
LAN-Kabel, Kategorie 7e	HELUKAT® 600A	S/FTP PVC/PVC, outdoor		108
LAN-Kabel, Kategorie 7e	HELUKAT® 600E	S/FTP PVC, direct burial		109
LAN-Kabel, Kategorie 7e	HELUKAT® 600AE	S/FTP FRNC/PE, direct burial, armoured		110
LAN-Kabel, Kategorie 7 <sub>A</sub>	HELUKAT® 1200	S/FTP	Dca	111
LAN-Kabel, Kategorie 7 <sub>A</sub>	HELUKAT® 1200	S/FTP duplex	Dca	112
LAN-Kabel, Kategorie 8	HELUKAT® 1200	S/FTP	Dca	113
LAN-Kabel, Kategorie 8	HELUKAT® 1200	S/FTP duplex	Dca	114
Multimedia cable, Kategorie 8	HELUKAT® 1500	S/FTP	Dca	115
Multimedia cable, Kategorie 8	HELUKAT® 1500	S/FTP duplex		116
<b>Data cable IBM</b>				
LAN cable	HELUKABEL® IVS	IBM P/N 33G2772		117

# LAN Cable

Category 5e

**HELUKAT® 155** 

U/UTP



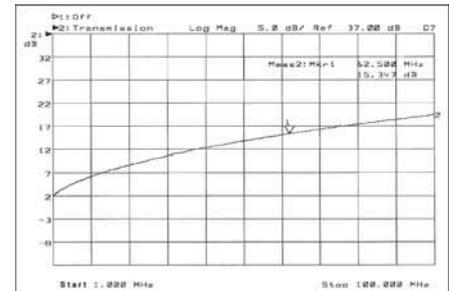
## Cable structure

Inner conductor Ø: 0,49 mm  
 Conductor material: Copper, bare  
 Core insulation: PE  
 Core colours: whbu/bu, whog/og, whgn/gn, whbn/bn  
 Separator: -  
 Screen over stranding element: -  
 Screen 1 over stranding: -  
 Screen 2 over stranding: -  
 Outer sheath material: PVC  
 Outer diameter: app. 4,9 mm  
 Outer sheath colour: Grey

## U/UTP 4x2xAWG 24/ 1 PVC

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
 100 Ohm ± 20 Ohm at 101 to 155 MHz  
 Loop resistance: 190 Ohm/km max.  
 Mutual capacitance: 50 nF/km nom.  
 Rel. propagation velocity: 66 %



## Typical values

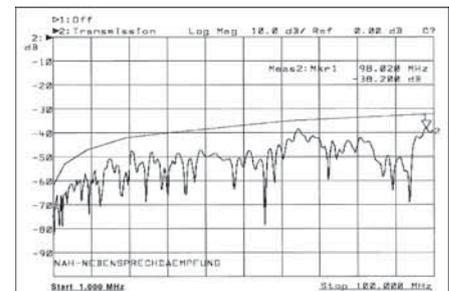
Frequency (MHz)	10	16	62,5	100	155
Attenuation (dB/100m)	6,3	8,0	16,5	21,3	26,8
Next (db)	50,3	47,3	38,4	35,3	33,0
ACR (db)	44,0	39,3	21,9	14,0	6,2

## Technical data

Weight: app. 26 kg/km  
 bending radius, repeated: 40 mm  
 Operating temperature range min.: -20°C  
 Operating temperature range max.: +60°C  
 Caloric load, approx. value: 0,40 MJ/m  
 Copper weight: 17,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e



## Application

HELUKAT® 155 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**80053**, U/UTP 4x2xAWG24/1 PVC (UTP)

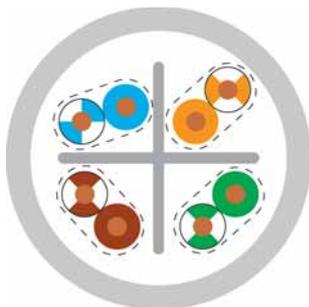
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 6

**HELUKAT®** 300 

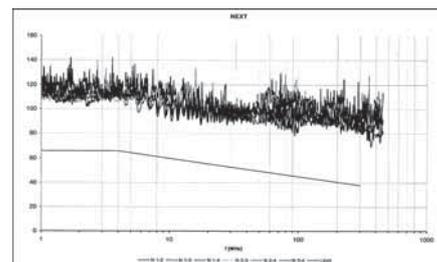
U/UTP UL



## Cable structure

Inner conductor Ø:	0,55 mm
Conductor material:	Copper, bare
Core insulation:	PE
Core colours:	whbu/bu, whog/og, whgn/gn, whbn/bn
Separator:	Polyester foil over stranded bundle
Screen over stranding element:	-
Screen 1 over stranding:	-
Screen 2 over stranding:	-
Outer sheath material:	PVC
Outer diameter:	app. 6,3 mm
Outer sheath colour:	Grey

## U/UTP 4x2xAWG 24/ 1 PVC, UL



## Electrical data

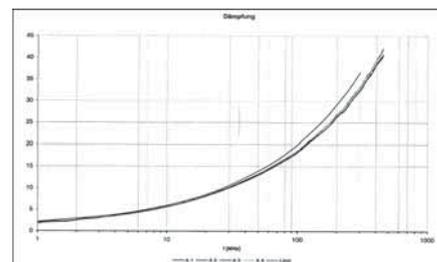
Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz 100 Ohm ± 20 Ohm at 101 to 300 MHz
Loop resistance:	190 Ohm/km max.
Mutual capacitance:	50 nF/km nom.
Rel. propagation velocity:	67 %

## Typical values

Frequency (MHz)	10	16	62,5	100	155	200	300
Attenuation (db/100m)	5,6	7,0	14,3	18,2	22,9	26,0	32,5
Next (db)	72,0	70,0	65,0	63,0	60,0	57,0	55,0
ACR (db)	66,4	63,0	50,7	44,8	37,1	31,0	22,5

## Technical data

Weight:	app. 46 kg/km
bending radius, repeated:	55 mm
Operating temperature range min.:	-20°C
Operating temperature range max.:	+60°C
Caloric load, approx. value:	0,68 MJ/m
Copper weight:	20,00 kg/km



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, CMX 444

## Application

HELUKAT®300 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction. This type is certified according UL because of the special PVC jacket

## Part no.

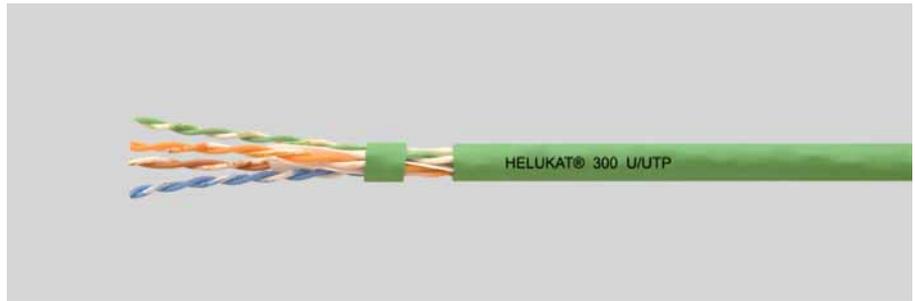
**802172**, U/UTP 4x2xAWG24/1 PVC UL (UTP)

Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 6

**HELUKAT®** 300   
U/UTP FRNC

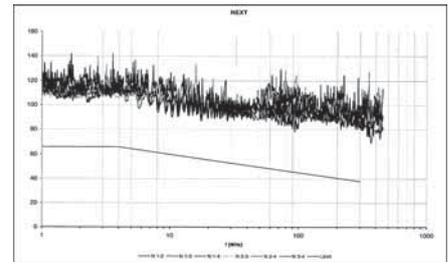


## Cable structure

Inner conductor Ø:  
Conductor material:  
Core insulation:  
Core colours:  
Separator:  
Screen over stranding element:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Outer diameter:  
Outer sheath colour:

## U/UTP 4x2xAWG 24/ 1 FRNC

0,55 mm  
Copper, bare  
PE  
whbu/bu, whog/og, whgn/gn, whbn/bn  
Polyester foil over stranded bundle  
-  
-  
FRNC  
app. 6,8 mm  
Green similar to RAL 6018



## Electrical data

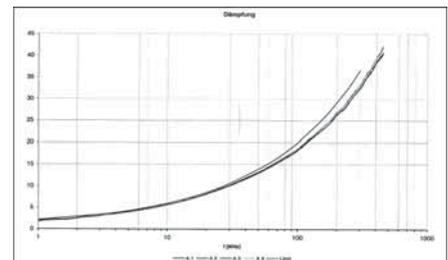
Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 300 MHz  
Loop resistance: 190 Ohm/km max.  
Mutual capacitance: 50 nF/km nom.  
Rel. propagation velocity: 67 %

## Typical values

Frequency (MHz)	10	16	62,5	100	155	200	300
Attenuation (db/100m)	5,6	7,0	14,3	18,2	22,9	26,0	32,5
Next (db)	72,0	70,0	65,0	63,0	60,0	57,0	55,0
ACR (db)	66,4	63,0	50,7	44,8	37,1	31,0	22,5

## Technical data

Weight: app. 46 kg/km  
bending radius, repeated: 55 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +60°C  
Caloric load, approx. value: 0,125 MJ/m  
Copper weight: 20,00 kg/km



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®300 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**804766**, U/UTP 4x2xAWG24/1 FRNC (UTP)

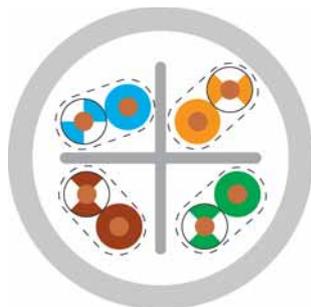
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 6

**HELUKAT**® 600 

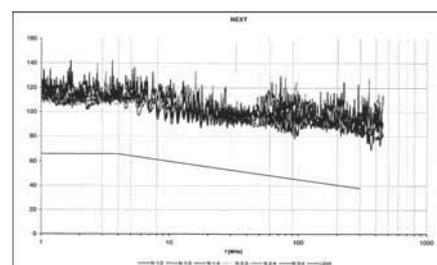
U/UTP FRNC



## Cable structure

Inner conductor Ø:	0,56 mm
Conductor material:	Copper, bare
Core insulation:	PE
Core colours:	whbu/bu, whog/og, whgn/gn, whbn/bn
Separator:	-
Screen over stranding element:	-
Screen 1 over stranding:	-
Screen 2 over stranding:	-
Outer sheath material:	FRNC
Outer diameter:	app. 6,5 mm
Outer sheath colour:	Grey similar to RAL 7035

## U/UTP 4x2xAWG 23/1 FRNC



## Electrical data

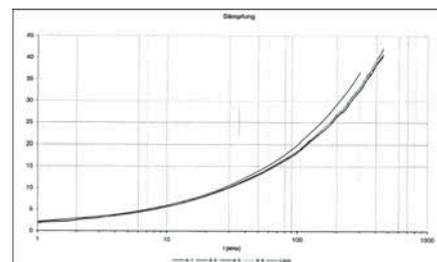
Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz 100 Ohm ± 20 Ohm at 101 to 600 MHz
Loop resistance:	150 Ohm/km max.
Mutual capacitance:	50 nF/km nom.
Rel. propagation velocity:	67 %

## Typical values

Frequency (MHz)	10	16	62,5	100	155	200	300	500	600
Attenuation (db/100m)	5,5	6,9	14,3	18,0	22,1	25,3	31,8	39,8	44,1
Next (db)	72,0	70,0	65,0	63,0	60,0	57,0	55,0	53,0	49,0
ACR (db)	66,5	63,1	50,7	45,0	37,9	31,7	23,2	13,2	4,9

## Technical data

Weight:	app. 52 kg/km
bending radius, repeated:	55 mm
Operating temperature range min.:	-20°C
Operating temperature range max.:	+60°C
Caloric load, approx. value:	0,135 MJ/m
Copper weight:	20,00 kg/km



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6<sub>A</sub>, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3, CMX 444

## Application

HELUKAT®600 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**805179**, U/UTP 4x2xAWG23/1 FRNC (UTP)

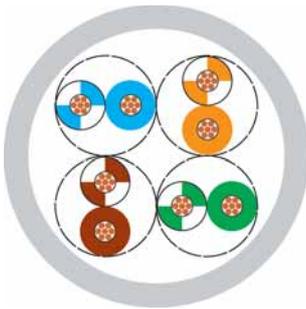
Dimensions and specifications may be changed without prior notice.

# LAN-Cable

Category 5

**HELUKAT® 100**

U/UTP flex



## Cable structure

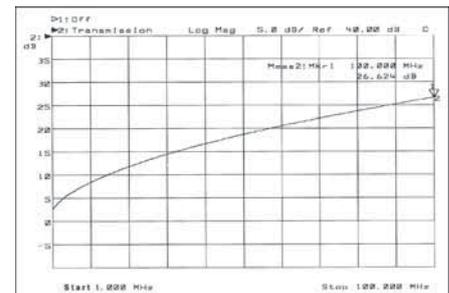
Inner conductor Ø:  
Conductor material:  
Core insulation:  
Core colours:  
Separator:  
Screen over stranding element:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Outer diameter:  
Outer sheath colour:

## U/UTP 4x2xAWG 26/7 PVC

0,48 mm  
Copper, bare  
PO  
whbu/bu, whog/og, whgn/gn, whbn/bn  
-  
-  
-  
PVC  
app. 4,5 mm  
Grey similar to RAL 7035

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
Loop resistance: 290 Ohm/km max.  
Mutual capacitance: 50 nF/km nom.  
Rel. propagation velocity: 74 %



## Typical values

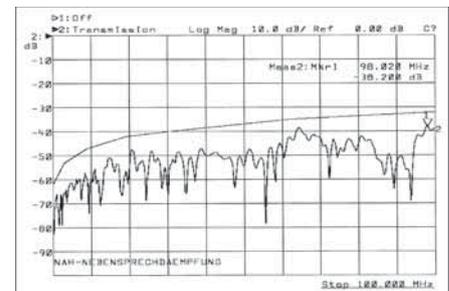
Frequency (MHz)	10	16	62,5	100
Attenuation (dB/10m)	0,9	1,2	2,4	3,1
Next (db)	53,0	50,0	41,0	38,0
ACR (db)	52,1	48,8	38,6	34,9

## Technical data

Weight: app. 17 kg/km  
bending radius, repeated: 35 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +60°C  
Caloric load, approx. value: 0,527 MJ/m  
Copper weight: 11,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5



## Application

HELUKAT®100 data cables are used in the tertiary level of a network as patch cables and connection cables. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®100 series can be manufactured quickly and easily with all common RJ45 plugs.

## Part no.

**80055**, U/UTP 4x2xAWG 26/7 PVC (UTP)

Dimensions and specifications may be changed without prior notice.

# LAN-Cable

Category 6

**HELUKAT® 300**

U/UTP flex



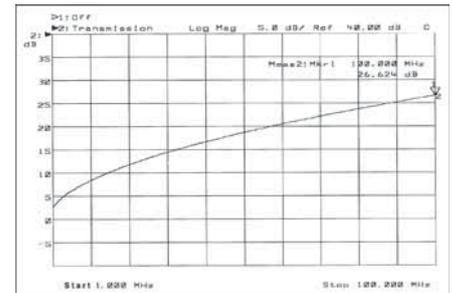
## Cable structure

Inner conductor Ø:	0,61 mm
Conductor material:	Copper, bare
Core insulation:	PE
Core colours:	whbu/bu, whog/og, whgn/gn, whbn/bn
Separator:	Polyester foil over stranded bundle
Screen over stranding element:	-
Screen 1 over stranding:	-
Screen 2 over stranding:	-
Outer sheath material:	FRNC
Outer diameter:	app. 6,0 mm
Outer sheath colour:	Grey similar to RAL 7035

## U/UTP 4x2xAWG 24/7 FRNC

## Electrical data

Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz 100 Ohm ± 20 Ohm at 101 to 300 MHz
Loop resistance:	180 Ohm/km max.
Mutual capacitance:	50 nF/km nom.
Rel. propagation velocity:	67 %



## Typical values

Frequency (MHz)	10	16	62,5	100	155	200	300
Attenuation (db/10m)	0,8	1,0	2,0	2,6	3,3	3,7	4,7
Next (db)	75,0	71,0	65,0	63,0	60,0	57,0	56,0
ACR (db)	74,2	70,0	63,0	60,4	56,7	53,2	51,3

## Technical data

Weight:	app. 38 kg/km
bending radius, repeated:	50 mm
Operating temperature range min.:	-20°C
Operating temperature range max.:	+60°C
Caloric load, approx. value:	0,11 MJ/m
Copper weight:	19,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

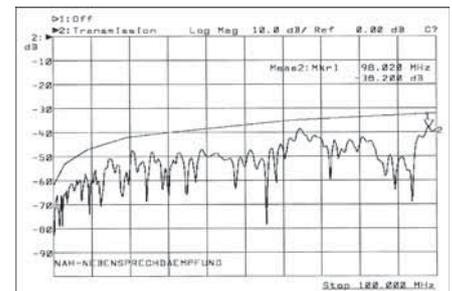
## Application

HELUKAT®300 unshielded data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®300 series can be manufactured quickly and easily with many common RJ45 plugs.

## Part no.

**804996**, U/UTP 4x2xAWG 24/7 FRNC (UTP)

Dimensions and specifications may be changed without prior notice.



# LAN-Cable, Outdoor

Category 6

**HELUKAT® 300A**

U/UTP, outdoor



## Cable structure

Inner conductor Ø:  
Conductor material:  
Core insulation:  
Core colours:  
Separator:  
Screen over stranding element:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Outer diameter:  
Outer sheath colour:

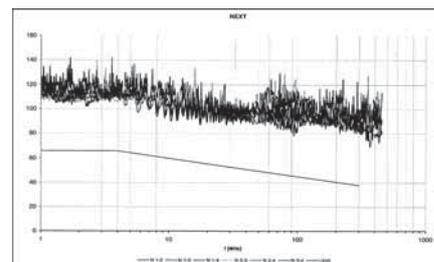
## U/UTP 4x2xAWG 24/ 1 PE

0,55 mm  
Copper, bare  
PE  
whbu/bu, whog/og, whgn/gn, whbn/bn  
Polyester foil over stranded bundle  
-  
-  
PE  
app. 6,4 mm  
Black similar to RAL 9005

## Electrical data

Characteristic impedance:  
Loop resistance:  
Mutual capacitance:  
Rel. propagation velocity:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 300 MHz  
190 Ohm/km max.  
50 nF/km nom.  
67 %

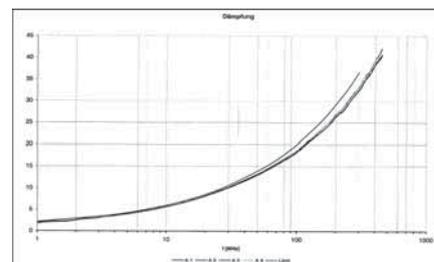


## Typical values

Frequency (MHz)	10	16	62,5	100	155	200	300
Attenuation (db/100m)	5,6	7,0	14,3	18,2	22,9	26,0	32,5
Next (db)	72,0	70,0	65,0	63,0	60,0	57,0	55,0
ACR (db)	66,4	63,0	50,7	44,8	37,1	31,0	22,5

## Technical data

Weight: app. 47 kg/km  
bending radius, repeated: 52 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +60°C  
Caloric load, approx. value: 0,30 MJ/m  
Copper weight: 19,00 kg/km



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Halogen-free acc. to 60754-2

## Application

HELUKAT® 300A outdoor data cables are used in the tertiary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in ducts or along buildings due to their optimized construction.

## Part no.

**805683**, U/UTP 4x2xAWG24/1 PE (UTP)

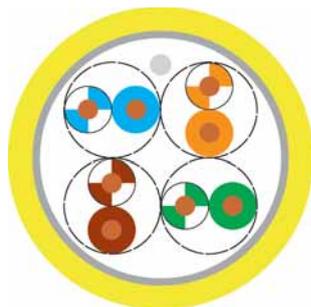
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 5e

**HELUKAT® 155** 

F/UTP



## Cable structure

Inner conductor Ø:  
Conductor material:  
Core insulation:  
Core colours:  
Separator:  
Screen over stranding element:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Drain wire:  
Outer sheath material:  
Outer diameter:  
Outer sheath colour:

## F/UTP 4x2xAWG 24/1 PVC

0,51 mm  
Copper, bare  
PE  
whbu/bu, whog/og, whgn/gn, whbn/bn  
Polyester foil over stranded bundle  
-  
Al-Foil  
-  
yes  
PVC  
app. 5,9 mm  
Yellow similar to RAL 1021

## Electrical data

Characteristic impedance:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 155 MHz

Loop resistance:

170 Ohm/km max.

Mutual capacitance:

50 nF/km nom.

Rel. propagation velocity:

69 %

## Typical values

Frequency (MHz)	10	16	62,5	100	155
Attenuation (dB/100m)	5,9	7,6	15,7	20,3	22,0
Next (db)	59,0	53,0	44,0	40,0	40,0
ACR (db)	53,1	45,4	28,3	19,7	18,0

## Technical data

Weight: app. 40 kg/km  
bending radius, repeated: 48 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +60°C  
Caloric load, approx. value: 0,40 MJ/m  
Copper weight: 18,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e

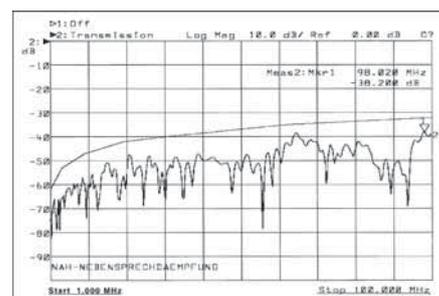
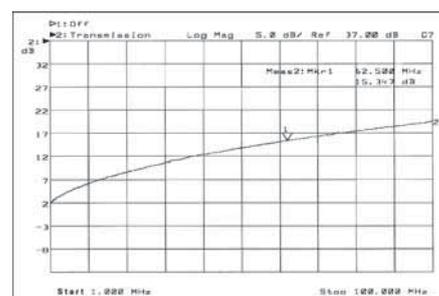
## Application

HELUKAT®155 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**80043**, F/UTP 4x2xAWG24/1 PVC (FTP)

Dimensions and specifications may be changed without prior notice.

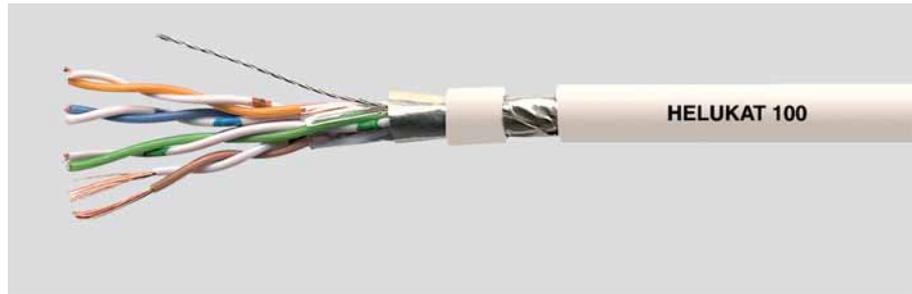
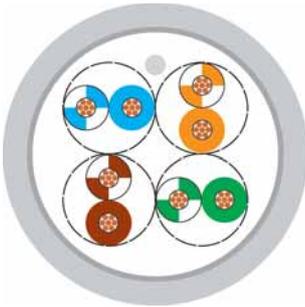


# LAN Cable

Category 5

**HELUKAT® 100**

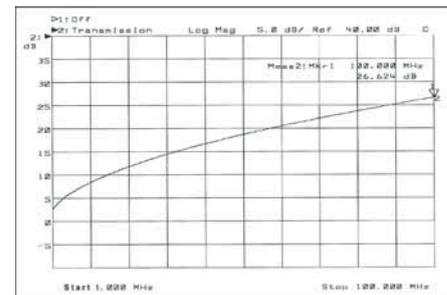
F/UTP flex



## Cable structure

Inner conductor Ø:	0,48 mm
Conductor material:	Copper, bare
Core insulation:	Foam-skin-PE
Core colours:	whbu/bu, whog/og, whgn/gn, whbn/bn
Separator:	-
Screen over stranding element:	-
Screen 1 over stranding:	Al-Foil
Screen 2 over stranding:	-
Drain wire:	yes
Outer sheath material:	FRNC
Outer diameter:	app. 5,3 mm
Outer sheath colour:	Grey similar to RAL 7035

## F/UTP 4x2xAWG 26/7 FRNC



## Electrical data

Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz
Loop resistance:	290 Ohm/km max.
Mutual capacitance:	50 nF/km nom.
Rel. propagation velocity:	74 %

## Typical values

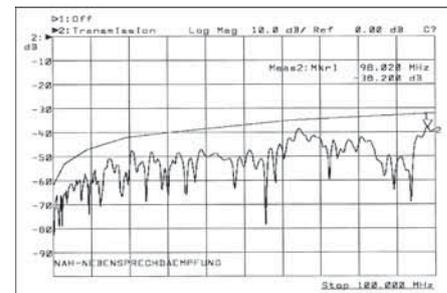
Frequency (MHz)	10	16	62,5	100
Attenuation (dB/10m)	0,9	1,2	2,4	2,9
Next (db)	58,0	56,0	45,0	43,0
ACR (db)	57,1	54,8	42,6	40,1

## Technical data

Weight:	app. 31 kg/km
bending radius, repeated:	40 mm
Operating temperature range min.:	-20°C
Operating temperature range max.:	+60°C
Caloric load, approx. value:	0,45 MJ/m
Copper weight:	14,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-1, Corrosiveness acc. to EN50267-2-3



## Application

HELUKAT®100 data cables are used in the tertiary level of a network as patch cables and connection cables. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®100 series can be manufactured quickly and easily with all common RJ45 plugs.

## Part no.

**81278**, F/UTP 4x2xAWG 26/7 FRNC (FTP)

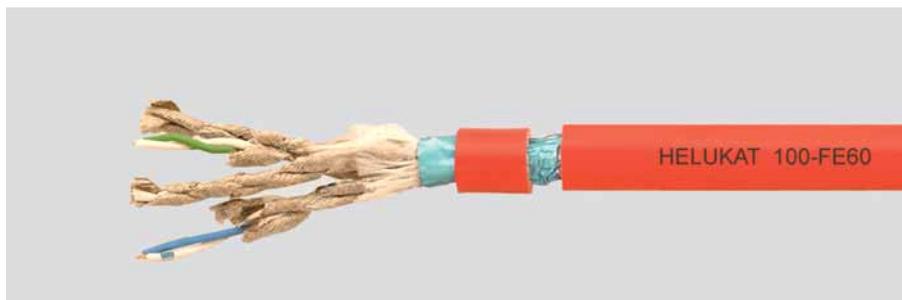
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 5

**HELUKAT® 100**

F/UTP PH120



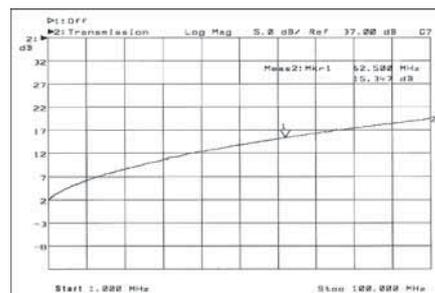
## Cable structure

Inner conductor Ø:	0,57 mm
Conductor material:	Copper, bare
Core insulation:	PO + flame resistant tape
Core colours:	whbu/bu, whog/og, whgn/gn, whbn/bn
Separator:	-
Screen over stranding element:	PO tape
Screen 1 over stranding:	Helical glasfibre tape
Screen 2 over stranding:	Al-Foil
Drain wire:	yes
Outer sheath material:	LSZH
Outer diameter:	app. 8,6 mm
Outer sheath colour:	Red

## F/UTP 4x2xAWG 23/1 FR-0H

## Electrical data

Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz
Loop resistance:	188 Ohm/km max.
Mutual capacitance:	65 nF/km nom.
Rel. propagation velocity:	67 %



## Typical values

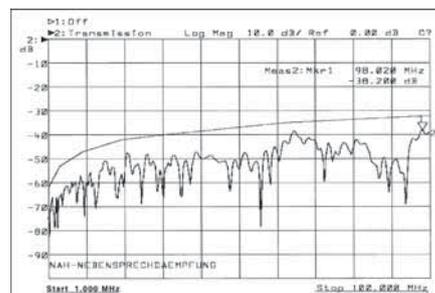
Frequency (MHz)	10	16	62,5	100
Attenuation (dB/100m)	5,9	7,9	16,3	21,1
Next (db)	58,0	51,0	41,0	38,0
ACR (db)	52,1	43,1	24,7	16,9

## Technical data

Weight:	app. 75 kg/km
bending radius, repeated:	130 mm
Operating temperature range min.:	-20°C
Operating temperature range max.:	+70°C
Caloric load, approx. value:	0,72 MJ/m
Copper weight:	24,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3



## Application

HELUKAT®100-PH120 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the thermal characteristics are perfectly suited to realize an isolation integrity according EN50289-14-16 due to their optimized construction.

## Part no.

**804045**, F/UTP 4x2xAWG23/1 FRNC

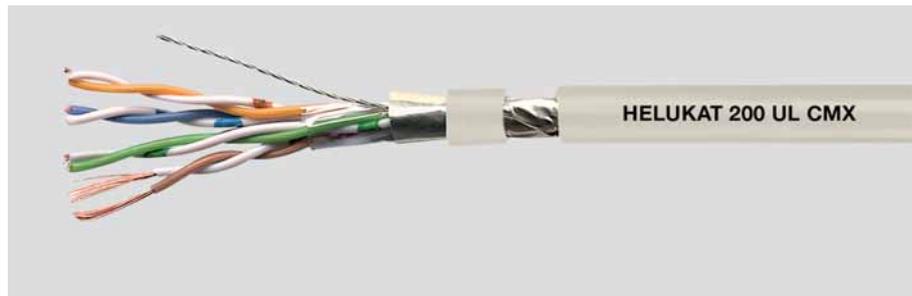
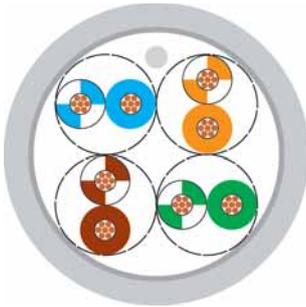
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 5e

**HELUKAT® 200**

F/UTP Flex, UL



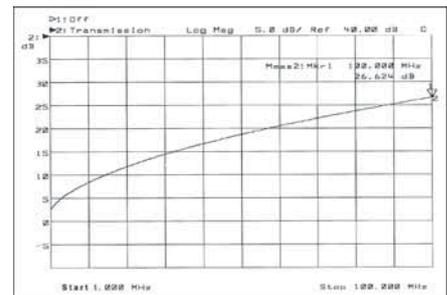
## Cable structure

Inner conductor Ø: 0,48 mm  
 Conductor material: Copper, bare  
 Core insulation: PE  
 Core colours: whbu/bu, whog/og, whgn/gn, whbn/bn  
 Separator: -  
 Screen over stranding element: -  
 Screen 1 over stranding: Al-Foil  
 Screen 2 over stranding: -  
 Drain wire: yes  
 Outer sheath material: PVC  
 Outer diameter: app. 5,4 mm  
 Outer sheath colour: Grey similar to RAL 7035

## F/UTP 4x2xAWG 26/7 PVC, UL

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
 100 Ohm ± 20 Ohm at 101 to 200 MHz  
 Loop resistance: 290 Ohm/km max.  
 Mutual capacitance: 50 nF/km nom.  
 Rel. propagation velocity: 67 %



## Typical values

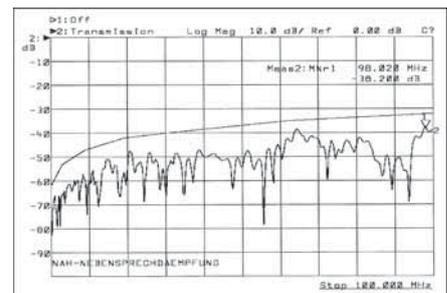
Frequency (MHz)	10	16	62,5	100	200
Attenuation (db/10m)	0,9	1,2	2,4	3,1	3,9
Next (db)	62,0	60,0	50,0	48,0	45,0
ACR (db)	61,1	58,8	47,6	44,9	41,1

## Technical data

Weight: app. 30 kg/km  
 bending radius, repeated: 44 mm  
 Operating temperature range min.: -20°C  
 Operating temperature range max.: +60°C  
 Caloric load, approx. value: 0,40 MJ/m  
 Copper weight: 15,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, CMX 444



## Application

HELUKAT®200 data cables are used in the tertiary level of a network as patch cables and connection cables. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®200 series can be manufactured quickly and easily with all common RJ45 plugs. This type is certified according to UL because of the special PVC jacket.

## Part no.

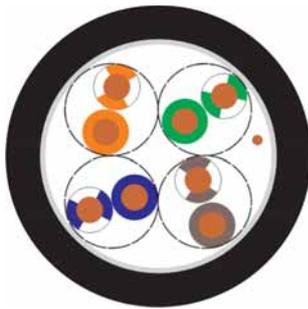
**802173**, F/UTP 4x2xAWG26/7 PVC UL (FTP)

Dimensions and specifications may be changed without prior notice.

# LAN-Cable, Outdoor

Category 5e

**HELUKAT®** 200A  
F/UTP



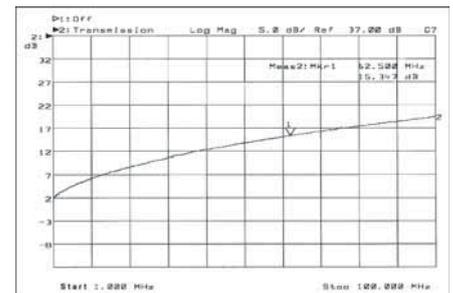
## Cable structure

Inner conductor Ø:	0,55 mm
Conductor material:	Copper, bare
Core insulation:	PE
Core colours:	whbu/bu, whog/og, whgn/gn, whbn/bn
Separator:	-
Screen over stranding element:	Al-Foil
Screen 1 over stranding:	-
Screen 2 over stranding:	-
Drain wire:	yes
Outer sheath material:	PE
Outer diameter:	app. 8,0 mm
Outer sheath colour:	Black similar to RAL 9005

## F/UTP 4x2xAWG 24/1 PE

## Electrical data

Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz 100 Ohm ± 20 Ohm at 101 to 200 MHz
Loop resistance:	190 Ohm/km max.
Mutual capacitance:	45 nF/km nom.
Rel. propagation velocity:	67 %



## Typical values

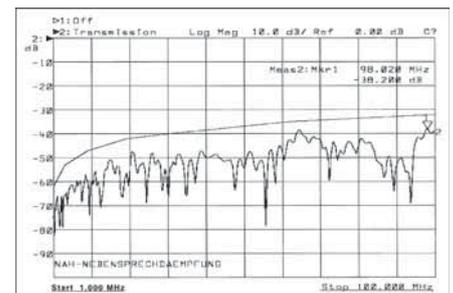
Frequency (MHz)	10	16	62,5	100	155	200
Attenuation (db/100m)	5,6	7,2	14,4	18,2	22,9	24,2
Next (db)	70,0	68,0	56,0	50,0	45,0	42,0
ACR (db)	64,4	60,8	41,6	31,8	22,1	17,8

## Technical data

Weight:	app. 100 kg/km
bending radius, repeated:	65 mm
Operating temperature range min.:	-30°C
Operating temperature range max.:	+70°C
Copper weight:	18,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Halogen-free acc. to 60754-2



## Application

HELUKAT® 200A outdoor data cables are used in the tertiary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in ducts or along buildings due to their optimized construction.

## Part no.

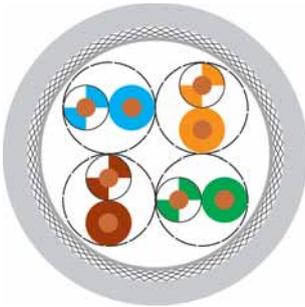
**805572**, F/UTP 4x2xAWG 24/1 PE (FTP)

Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 5e

**HELUKAT<sup>®</sup> 200**   
CC-Link IE  SF/UTP



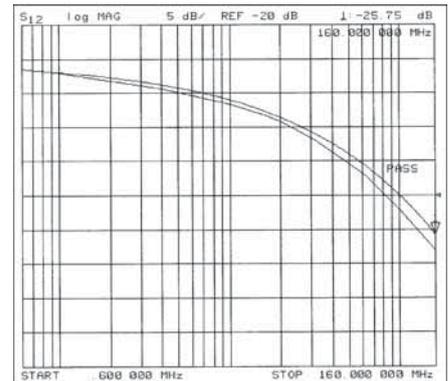
## Cable structure

Inner conductor Ø: 0,51 mm  
 Conductor material: Copper, bare  
 Core insulation: Foam-skin-PE  
 Core colours: whbu/bu, whog/og, whgn/gn, whbn/bn  
 Separator: -  
 Screen over stranding element: -  
 Screen 1 over stranding: Al-Foil  
 Screen 2 over stranding: Cu braid  
 Outer sheath material: PVC / FRNC  
 Outer diameter: app. 6,0 mm / app. 6,0 mm  
 Outer sheath colour: Grey similar to RAL 7035

## SF/UTP 4x2xAWG 24/ 1 PVC/ FRNC

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
 100 Ohm ± 20 Ohm at 101 to 200 MHz  
 Loop resistance: 185 Ohm/km max.  
 Mutual capacitance: 48 nF/km nom.  
 Rel. propagation velocity: 74 %



## Typical values

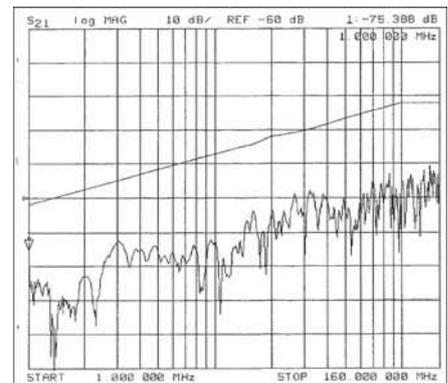
Frequency (MHz)	10	16	62,5	100	200
Attenuation (dB/100m)	5,6	7,2	14,4	18,2	25,9
Next (db)	62,0	59,0	50,0	46,0	40,0
ACR (db)	56,4	51,8	35,6	27,8	14,6

## Technical data

Weight: app. 50 kg/km  
 bending radius, repeated: 52 mm  
 Operating temperature range min.: -20°C  
 Operating temperature range max.: +60°C  
 Caloric load, approx. value: 0,60 MJ/m / 0,48 MJ/m  
 Copper weight: 28,00 kg/km

## Norms

81610:  
 Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e  
 81609:  
 Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant:  
 acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness  
 acc. to EN50267-2-3



## Application

HELUKAT<sup>®</sup>200 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**81610**, SF/UTP 4x2xAWG 24/1 PVC (S-FTP)      **81609**, SF/UTP 4x2xAWG 24/1 FRNC (S-FTP)

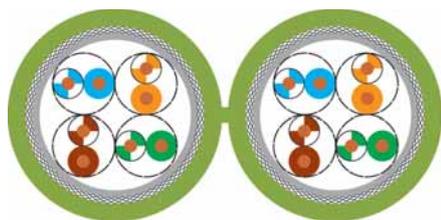
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 5e

**HELUKAT**® 200 

SF/UTP duplex



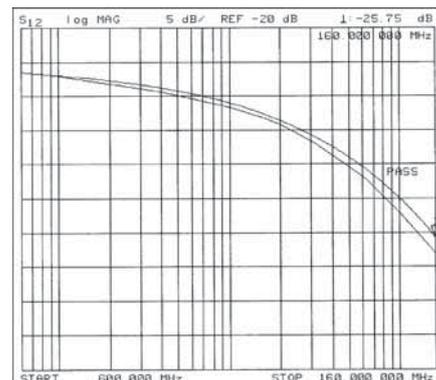
## Cable structure

Inner conductor Ø:	0,51 mm
Conductor material:	Copper, bare
Core insulation:	Foam-skin-PE
Core colours:	whbu/bu, whog/og, whgn/gn, whbn/bn
Separator:	-
Screen over stranding element:	-
Screen 1 over stranding:	Al-Foil
Screen 2 over stranding:	Cu braid
Outer sheath material:	FRNC
Cable dimensions:	app. 6,0 mm x 12,5 mm
Outer sheath colour:	Green similar to RAL 6018

## SF/UTP 2x(4x2xAWG 24/1) FRNC

## Electrical data

Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz 100 Ohm ± 20 Ohm at 101 to 200 MHz
Loop resistance:	185 Ohm/km max.
Mutual capacitance:	48 nF/km nom.
Rel. propagation velocity:	74 %



## Typical values

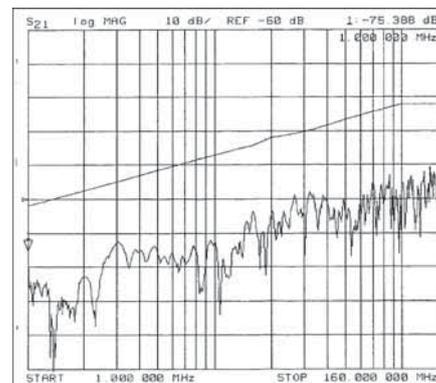
Frequency (MHz)	10	16	62,5	100	200
Attenuation (dB/100m)	5,6	7,2	14,4	18,2	25,9
Next (db)	62,0	59,0	50,0	46,0	40,0
ACR (db)	56,4	51,8	35,6	27,8	14,6

## Technical data

Weight:	app. 100 kg/km
bending radius, repeated:	52 mm
Operating temperature range min.:	-20°C
Operating temperature range max.:	+60°C
Caloric load, approx. value:	0,96 MJ/m
Copper weight:	56,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3



## Application

HELUKAT®200 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**81123**, SF/UTP 2x(4x2xAWG 24/1) FRNC (S-FTP)

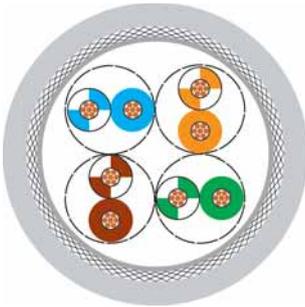
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 5e

**HELUKAT® 200**

SF/UTP flex



## Cable structure

Inner conductor Ø:  
Conductor material:  
Core insulation:  
Core colours:  
Separator:  
Screen over stranding element:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Outer diameter:  
Outer sheath colour:

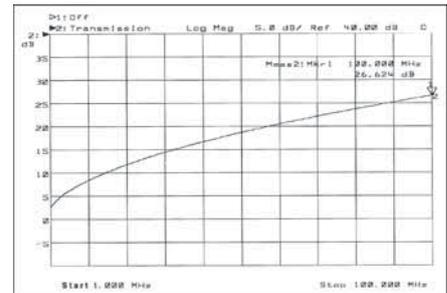
## SF/UTP 4x2xAWG 26/7 FRNC

0,48 mm  
Copper, bare  
Foam-skin-PE  
whbu/bu, whog/og, whgn/gn, whbn/bn  
-  
-  
Al-Foil  
Cu braid  
FRNC  
app. 5,4 mm  
Grey similar to RAL 7035

## Electrical data

Characteristic impedance:  
Loop resistance:  
Mutual capacitance:  
Rel. propagation velocity:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 200 MHz  
300 Ohm/km max.  
47 nF/km nom.  
69 %



## Typical values

Frequency (MHz)	10	16	62,5	100	200
Attenuation (dB/10m)	0,8	1,1	2,4	2,9	4,3
Next (db)	58,0	56,0	45,0	43,0	37,0
ACR (db)	57,2	54,9	42,6	40,1	32,7

## Technical data

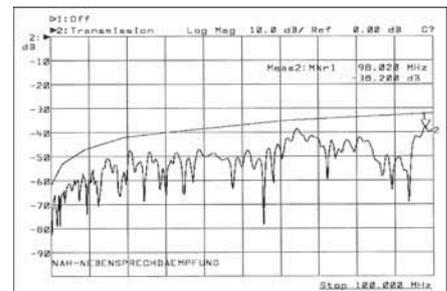
Weight: app. 40 kg/km  
bending radius, repeated: 46 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +60°C  
Caloric load, approx. value: 0,543 MJ/m  
Copper weight: 24,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-1, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®200 data cables are used in the tertiary level of a network as patch cables and connection cables. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®200 series can be manufactured quickly and easily with all common RJ45 plugs.



## Part no.

**81254**, SF/UTP 4x2xAWG 26/7 FRNC (S-FTP)

Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 6

**HELUKAT® 300**

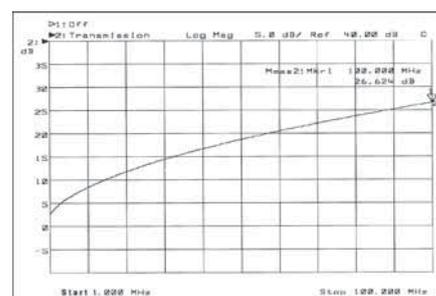
U/FTP, UL



## Cable structure

Inner conductor Ø:	0,48 mm
Conductor material:	Copper, bare
Core insulation:	Foam-skin-PE
Core colours:	whbu/bu, whog/og, whgn/gn, whbn/bn
Separator:	Polyester foil over stranded bundle
Screen over stranding element:	Al-Foil
Screen 1 over stranding:	-
Screen 2 over stranding:	-
Drain wire:	yes
Outer sheath material:	PVC
Outer diameter:	app. 5,9 mm
Outer sheath colour:	Grey similar to RAL 7035

## U/FTP 4x2xAWG 26/7 PVC, UL



## Electrical data

Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz 100 Ohm ± 20 Ohm at 101 to 300 MHz
Loop resistance:	290 Ohm/km max.
Mutual capacitance:	45 nF/km nom.
Rel. propagation velocity:	77 %

## Typical values

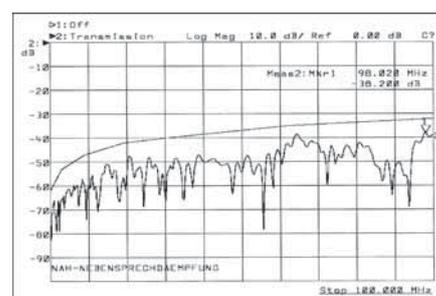
Frequency (MHz)	10	16	62,5	100	200	300
Attenuation (db/10m)	0,9	1,1	2,2	2,7	3,9	4,7
Next (db)	90,0	88,0	83,0	80,0	76,0	73,0
ACR (db)	89,1	86,9	80,8	77,3	72,1	68,3

## Technical data

Weight:	app. 37 kg/km
bending radius, repeated:	48 mm
Operating temperature range min.:	-20°C
Operating temperature range max.:	+60°C
Caloric load, approx. value:	0,41 MJ/m
Copper weight:	20,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-1-2, CMX 444



## Application

HELUKAT®300 data cables are used in the tertiary level of a network as patch cables and connection cables. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®300 series can be manufactured quickly and easily with all common RJ45 plugs. This type is certified according to UL because of the special PVC jacket.

## Part no.

**802174**, U/FTP 4x2xAWG 26/7 PVC

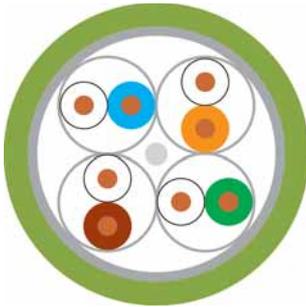
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 6

**HELUKAT**® 450 

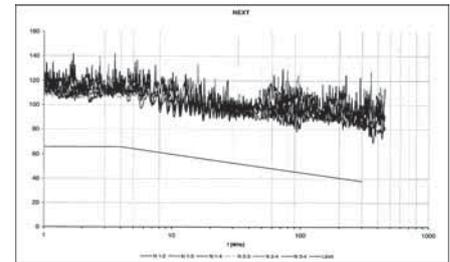
F/FTP



## Cable structure

Inner conductor Ø: 0,52 mm  
Conductor material: Copper, bare  
Core insulation: Foam-skin-PE  
Core colours: wh/bu, wh/og, wh/gn, wh/bn  
Separator: -  
Screen over stranding element: Al-Foil  
Screen 1 over stranding: Al-Foil  
Screen 2 over stranding: -  
Drain wire: yes  
Outer sheath material: FRNC  
Outer diameter: app. 7,4 mm  
Outer sheath colour: Green similar to RAL 6018

## F/FTP 4x2xAWG 24/1 FRNC



## Electrical data

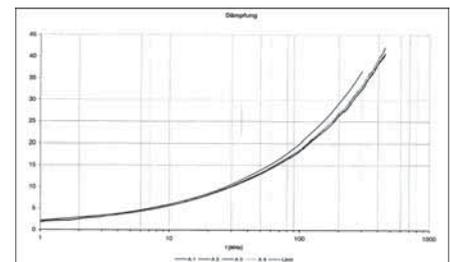
Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 450 MHz  
Loop resistance: 165 Ohm/km max.  
Mutual capacitance: 43 nF/km nom.  
Rel. propagation velocity: 79 %

## Typical values

Frequency (MHz)	10	16	62,5	100	200	300	450
Attenuation (dB/100m)	5,4	7,0	13,8	17,6	26,0	34,0	38,5
Next (db)	100,0	100,0	95,8	94,5	91,0	87,0	84,3
ACR (db)	94,6	93,0	82,0	76,9	65,0	53,0	45,8

## Technical data

Weight: app. 50 kg/km  
bending radius, repeated: 59 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +60°C  
Caloric load, approx. value: 0,57 MJ/m  
Copper weight: 24,00 kg/km



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®450 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**82501**, F/FTP 4x2xAWG 24/1 FRNC (S-STP)

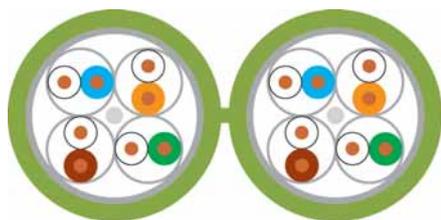
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 6

**HELUKAT® 450**

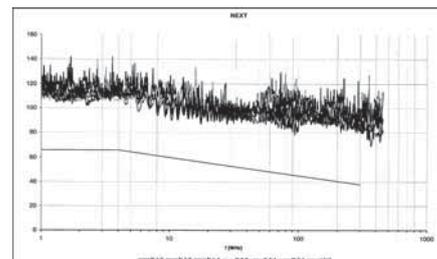
F/FTP duplex



## Cable structure

Inner conductor Ø:	0,52 mm
Conductor material:	Copper, bare
Core insulation:	Foam-skin-PE
Core colours:	wh/bu, wh/og, wh/gn, wh/bn
Separator:	-
Screen over stranding element:	Al-Foil
Screen 1 over stranding:	Al-Foil
Screen 2 over stranding:	-
Drain wire:	yes
Outer sheath material:	FRNC
Cable dimensions:	app. 7,4 mm x 15,0 mm
Outer sheath colour:	Green similar to RAL 6018

## F/FTP 2x(4x2xAWG 24/1) FRNC



## Electrical data

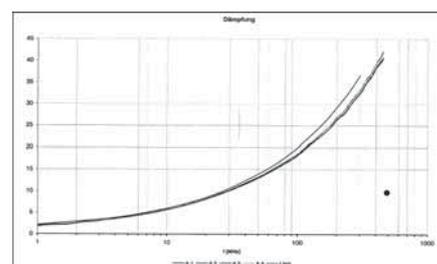
Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz 100 Ohm ± 20 Ohm at 101 to 450 MHz
Loop resistance:	165 Ohm/km max.
Mutual capacitance:	43 nF/km nom.
Rel. propagation velocity:	79 %

## Typical values

Frequency (MHz)	10	16	62,5	100	200	300	450
Attenuation (dB/100m)	5,4	7,0	13,8	17,6	26,0	34,0	38,5
Next (db)	100,0	100,0	95,8	94,5	91,0	87,0	84,3
ACR (db)	94,6	93,0	82,0	76,9	65,0	53,0	45,8

## Technical data

Weight:	app. 100 kg/km
bending radius, repeated:	59 mm
Operating temperature range min.:	-20°C
Operating temperature range max.:	+60°C
Caloric load, approx. value:	1,14 MJ/m
Copper weight:	48,00 kg/km



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®450 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**82502**, F/FTP 2x4x2xAWG 24/1 FRNC (S-STP)

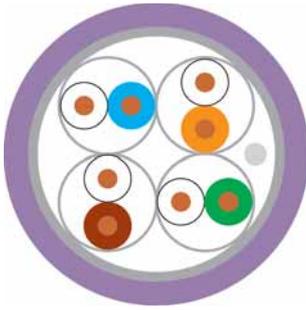
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 6A

**HELUKAT® 500** 

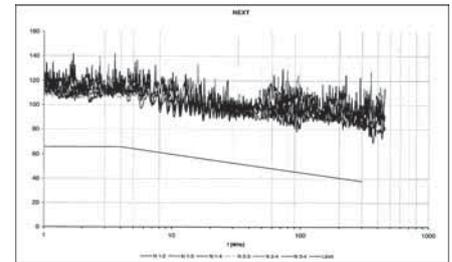
F/FTP



## Cable structure

Inner conductor Ø: 0,57 mm  
 Conductor material: Copper, bare  
 Core insulation: Foam-skin-PE  
 Core colours: wh/bu, wh/og, wh/gn, wh/bn  
 Separator: -  
 Screen over stranding element: Al-Foil  
 Screen 1 over stranding: Al-Foil  
 Screen 2 over stranding: -  
 Drain wire: yes  
 Outer sheath material: FRNC  
 Outer diameter: app. 7,5 mm  
 Outer sheath colour: Blue Lilac similar to RAL 4005

## F/FTP 4x2xAWG 23/1 FRNC



## Electrical data

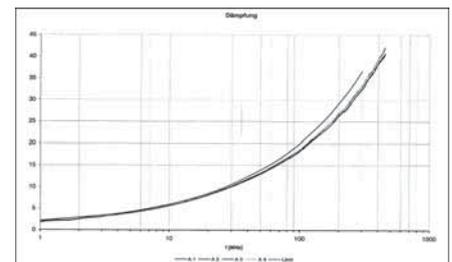
Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
 100 Ohm ± 20 Ohm at 101 to 500 MHz  
 Loop resistance: 160 Ohm/km max.  
 Mutual capacitance: 45 nF/km nom.  
 Rel. propagation velocity: 80 %

## Typical values

Frequency (MHz)	10	16	62,5	100	200	250	300	500
Attenuation (db/100m)	5,7	7,2	14,2	18,1	25,8	29,0	31,9	41,8
Next (db)	100,0	100,0	100,0	97,4	92,9	91,4	90,2	86,9
ACR (db)	94,3	92,8	85,8	79,3	67,1	62,4	58,3	45,1

## Technical data

Weight: app. 50 kg/km  
 bending radius, repeated: 100 mm  
 Operating temperature range min.: -20°C  
 Operating temperature range max.: +60°C  
 Caloric load, approx. value: 0,55 MJ/m  
 Copper weight: 26,00 kg/km



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6A, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT® 500 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as 10Gigabit Ethernet, Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**803378**, F/FTP 4x2xAWG 23/1 LSZH (S-STP)

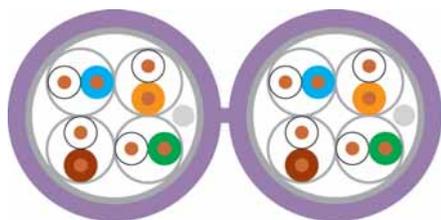
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 6A

**HELUKAT® 500** 

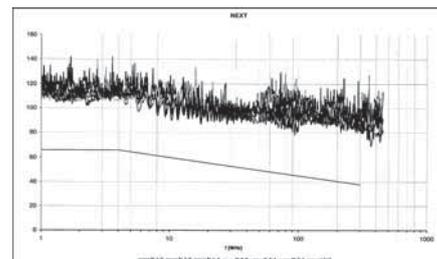
F/FTP duplex



## Cable structure

Inner conductor Ø: 0,57 mm  
 Conductor material: Copper, bare  
 Core insulation: Foam-skin-PE  
 Core colours: wh/bu, wh/og, wh/gn, wh/bn  
 Separator: -  
 Screen over stranding element: Al-Foil  
 Screen 1 over stranding: Al-Foil  
 Screen 2 over stranding: -  
 Drain wire: yes  
 Outer sheath material: FRNC  
 Cable dimensions: app. 7,8 mm x 15,9 mm  
 Outer sheath colour: Blue Lilac similar to RAL 4005

## F/FTP 2x(4x2xAWG 23/1) FRNC (S-STP)



## Electrical data

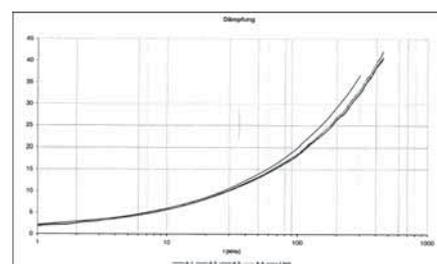
Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
 100 Ohm ± 20 Ohm at 101 to 500 MHz  
 Loop resistance: 160 Ohm/km max.  
 Mutual capacitance: 45 nF/km nom.  
 Rel. propagation velocity: 80 %

## Typical values

Frequency (MHz)	10	16	62,5	100	200	250	300	500
Attenuation (db/100m)	5,7	7,2	14,2	18,1	25,8	29,0	31,9	41,8
Next (db)	100,0	100,0	100,0	97,4	92,9	91,4	90,2	86,9
ACR (db)	94,3	92,8	85,8	79,3	67,1	62,4	58,3	45,1

## Technical data

Weight: app. 100 kg/km  
 bending radius, repeated: 100 mm  
 Operating temperature range min.: -20°C  
 Operating temperature range max.: +60°C  
 Caloric load, approx. value: 1,13 MJ/m  
 Copper weight: 52,00 kg/km



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6A, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT® 500 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as 10Gigabit Ethernet, Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**803379**, F/FTP 2x4x2xAWG 23/1 LSZH (S-STP)

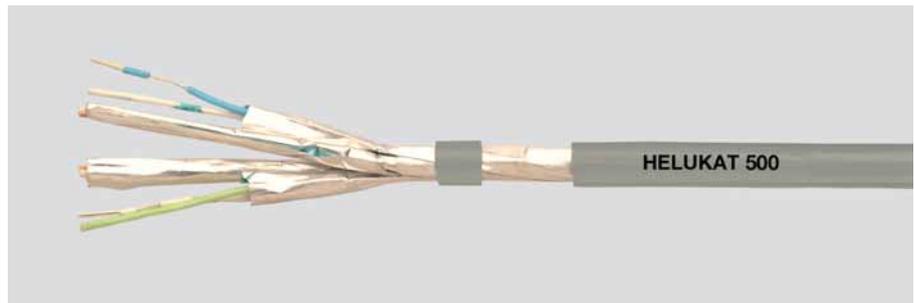
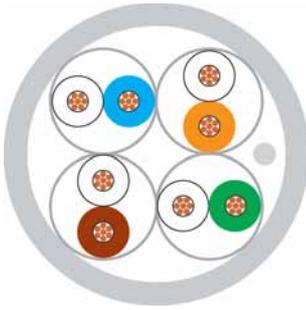
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 6A

**HELUKAT® 500**

U/FTP, flex



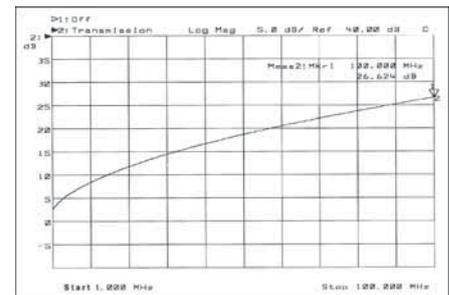
## Cable structure

Inner conductor Ø: 0,48 mm  
 Conductor material: Copper, bare  
 Core insulation: Foam-skin-PE  
 Core colours: wh/bu, wh/og, wh/gn, wh/bn  
 Separator: -  
 Screen over stranding element: Al-Foil  
 Screen 1 over stranding: -  
 Screen 2 over stranding: -  
 Drain wire: yes  
 Outer sheath material: LSZH  
 Outer diameter: app. 5,8 mm  
 Outer sheath colour: Grey similar to RAL 7035

## U/FTP 4x2xAWG 26/7 (stranded) LSZH

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
 100 Ohm ± 20 Ohm at 101 to 500 MHz  
 Loop resistance: 330 Ohm/km max.  
 Mutual capacitance: 54 nF/km nom.  
 Rel. propagation velocity: 78 %



## Typical values

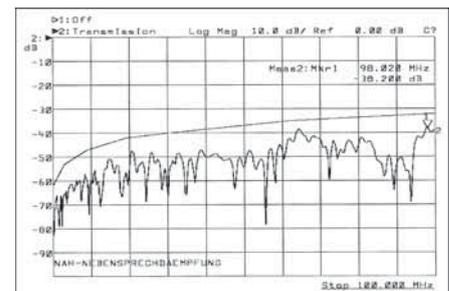
Frequency (MHz)	10	16	62,5	100	200	250	500
Attenuation (dB/10m)	0,8	1,1	2,1	2,7	3,9	4,4	6,3
Next (db)	100,0	100,0	100,0	97,0	92,0	91,0	86,0
ACR (db)	99,2	98,9	97,9	94,3	88,1	86,6	79,7

## Technical data

Weight: app. 35 kg/km  
 bending radius, repeated: 49 mm  
 Operating temperature range min.: -20°C  
 Operating temperature range max.: +60°C  
 Caloric load, approx. value: 0,39 MJ/m  
 Copper weight: 15,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6A, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-1, Corrosiveness acc. to EN50267-2-3



## Application

HELUKAT® 500 data cables are used in the tertiary level of a network as patch cables and connection cables. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as 10Gigabit Ethernet, Gigabit Ethernet, Fast Ethernet, Ethernet, ATM 155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT® 500 series can be manufactured quickly and easily with many common RJ45 plugs.

## Part no.

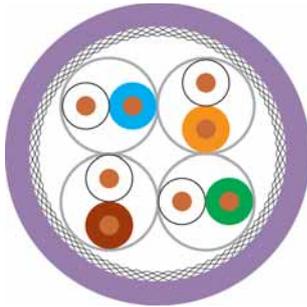
**804043**, U/FTP 4x2xAWG 26/7 LSZH

Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 7e

**HELUKAT® 600**   
 CC-Link IE  S/FTP



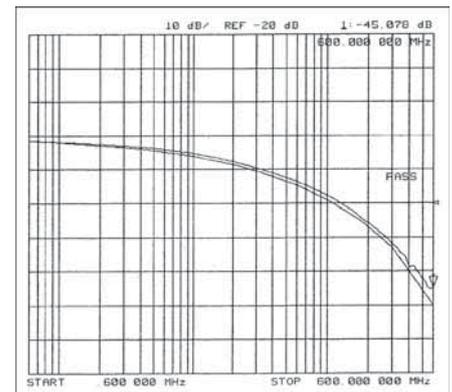
## Cable structure

Inner conductor Ø: 0,57 mm  
 Conductor material: Copper, bare  
 Core insulation: Foam-skin-PE  
 Core colours: wh/bu, wh/og, wh/gn, wh/bn  
 Separator: -  
 Screen over stranding element: Al-Foil  
 Screen 1 over stranding: Cu braid  
 Screen 2 over stranding: -  
 Outer sheath material: FRNC  
 Outer diameter: app. 7,5 mm  
 Outer sheath colour: Blue Lilac similar to RAL 4005

## S/FTP 4x2xAWG 23/1 FRNC

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
 100 Ohm ± 20 Ohm at 101 to 1000 MHz  
 Loop resistance: 169 Ohm/km max.  
 Mutual capacitance: 43 nF/km nom.  
 Rel. propagation velocity: 79 %

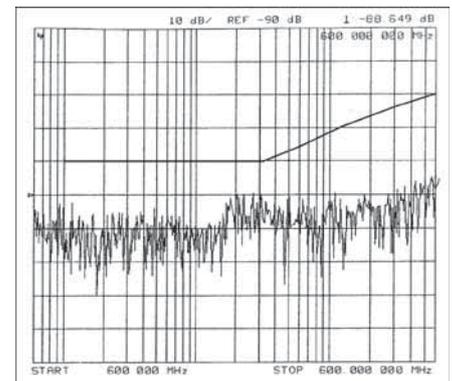


## Typical values

Frequency (MHz)	10	16	62,5	100	200	300	600	900	1000
Attenuation (dB/100m)	5,6	7,1	13,9	17,5	25,2	32,1	44,9	55,0	58,0
Next (db)	100,0	100,0	96,0	94,0	88,0	84,0	73,0	71,0	69,0
ACR (db)	94,4	92,9	82,1	76,5	62,8	51,9	28,1	16,0	9,0

## Technical data

Weight: app. 60 kg/km  
 bending radius, repeated: 60 mm  
 Operating temperature range min.: -20°C  
 Operating temperature range max.: +60°C  
 Caloric load, approx. value: 0,60 MJ/m  
 Copper weight: 28,00 kg/km



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®600 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

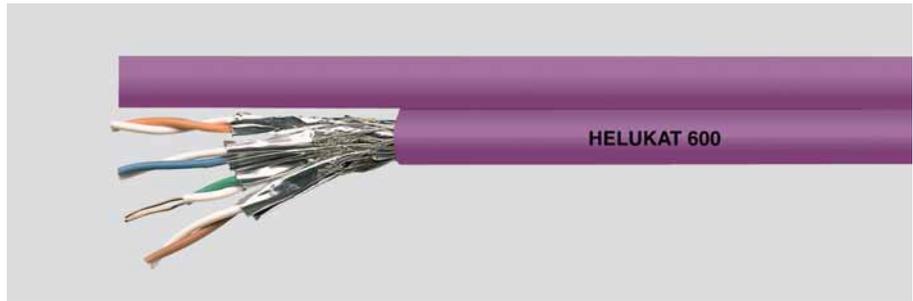
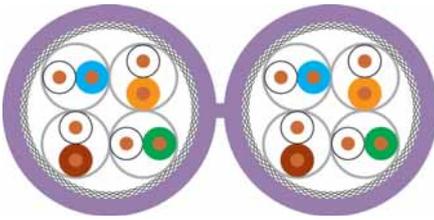
**80810**, S/FTP 4x2xAWG 23/1 FRNC (S-STP)

Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 7e

**HELUKAT**® 600   
CC-Link IE  S/FTP duplex



## Cable structure

Inner conductor Ø:  
Conductor material:  
Core insulation:  
Core colours:  
Separator:  
Screen over stranding element:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Cable dimensions:  
Outer sheath colour:

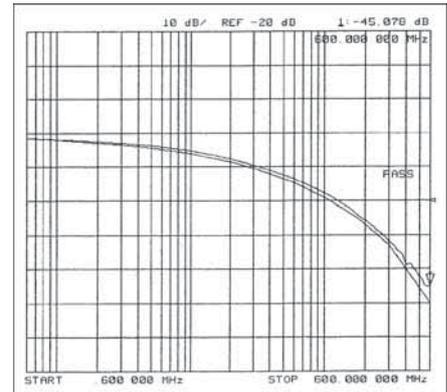
## S/FTP 2x(4x2xAWG 23/1) FRNC

0,57 mm  
Copper, bare  
Foam-skin-PE  
wh/bu, wh/og, wh/gn, wh/bn  
-  
Al-Foil  
Cu braid  
-  
FRNC  
app. 7,5 mm x 16,0 mm  
Blue Lilac similar to RAL 4005

## Electrical data

Characteristic impedance:  
Loop resistance:  
Mutual capacitance:  
Rel. propagation velocity:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 1000 MHz  
169 Ohm/km max.  
43 nF/km nom.  
79 %

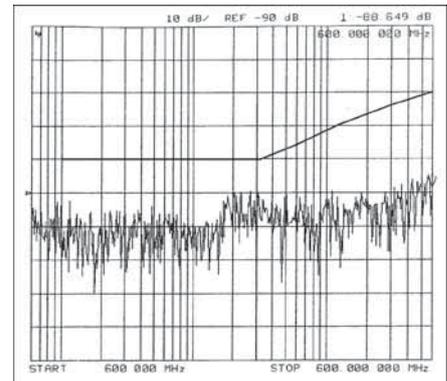


## Typical values

Frequency (MHz)	10	16	62,5	100	200	300	600	900	1000
Attenuation (dB/100m)	5,6	7,1	13,9	17,5	25,2	32,1	44,9	55,0	58,0
Next (db)	100,0	100,0	96,0	94,0	88,0	84,0	73,0	71,0	69,0
ACR (db)	94,4	92,9	82,1	76,5	62,8	51,9	28,1	16,0	9,0

## Technical data

Weight: app. 120 kg/km  
bending radius, repeated: 60 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +60°C  
Caloric load, approx. value: 1,20 MJ/m  
Copper weight: 56,00 kg/km



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®600 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**81446**, S/FTP 2x(4x2xAWG 23/1) FRNC (S-STP)

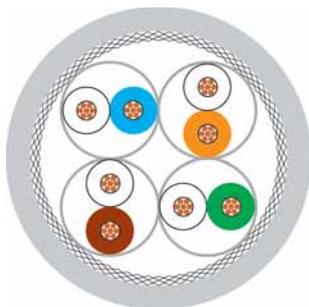
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 7

**HELUKAT® 600**

S/FTP flex



## Cable structure

Inner conductor Ø:  
Conductor material:  
Core insulation:  
Core colours:  
Separator:  
Screen over stranding element:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Outer diameter:  
Outer sheath colour:

## S/FTP 4x2xAWG 26/7 FRNC

0,48 mm  
Copper, bare  
Foam-skin-PE  
wh/bu, wh/og, wh/gn, wh/bn  
-  
Al-Foil  
Cu braid  
-  
FRNC  
app. 5,9 mm  
Grey similar to RAL 7035

## Electrical data

Characteristic impedance:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 600 MHz

Loop resistance:

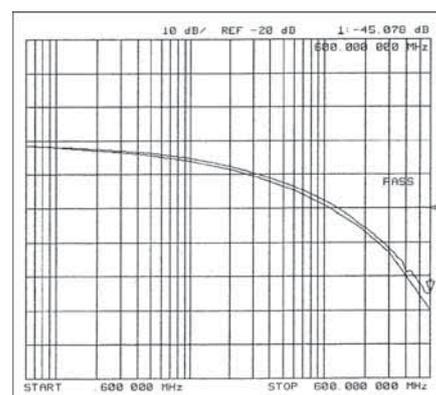
290 Ohm/km max.

Mutual capacitance:

45 nF/km nom.

Rel. propagation velocity:

77 %

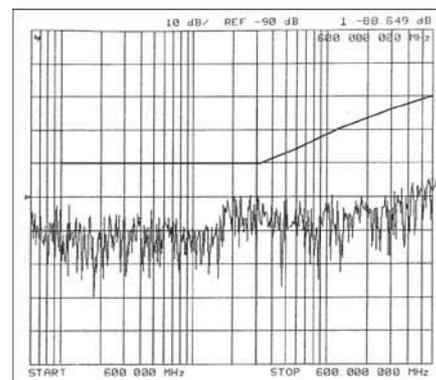


## Typical values

Frequency (MHz)	10	16	62,5	100	200	300	600
Attenuation (dB/10m)	0,8	1,0	2,0	2,6	4,0	4,9	6,3
Next (db)	96,0	96,0	95,0	94,0	88,0	86,0	80,0
ACR (db)	95,2	95,0	93,0	91,4	84,0	81,1	73,7

## Technical data

Weight: app. 42 kg/km  
bending radius, repeated: 55 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +60°C  
Caloric load, approx. value: 0,47 MJ/m  
Copper weight: 22,00 kg/km



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-1, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®600 data cables are used in the tertiary level of a network as patch cables and connection cables. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®600 series can be manufactured quickly and easily with all common RJ45 plugs.

## Part no.

**80294**, S/FTP 4x2xAWG 26/7 FRNC (S-STP)

Dimensions and specifications may be changed without prior notice.

# LAN Cable Outdoor

Category 7e

**HELUKAT® 600A**

S/FTP PVC/PVC



## Cable structure

Inner conductor Ø:  
Conductor material:  
Core insulation:  
Core colours:  
Separator:  
Inner sheath material:  
Screen over stranding element:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Outer diameter:  
Outer sheath colour:

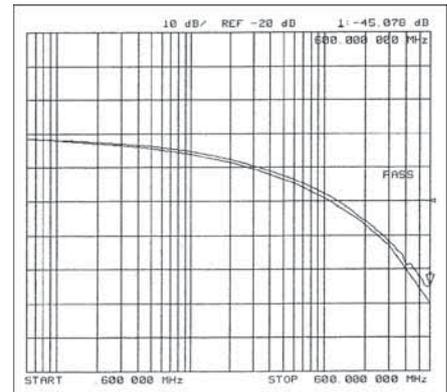
## S/FTP 4x2xAWG 23/1 PVC/PVC

0,58 mm  
Copper, bare  
Foam-skin-PE  
wh/bu, wh/og, wh/gn, wh/bn  
-  
PVC  
Al-Foil  
Cu braid  
-  
PVC  
app. 11,6 mm  
Black similar to RAL 9005

## Electrical data

Characteristic impedance:  
  
Loop resistance:  
Mutual capacitance:  
Rel. propagation velocity:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 1000 MHz  
160 Ohm/km max.  
43 nF/km nom.  
79 %



## Typical values

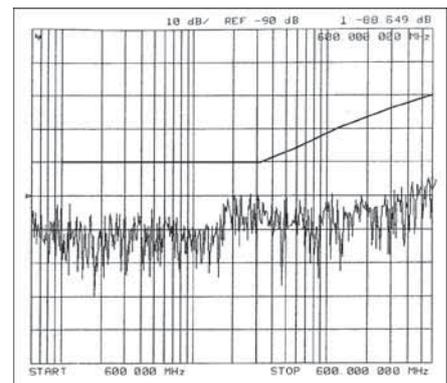
Frequency (MHz)	10	16	62,5	100	200	300	600	900	1000
Attenuation (dB/100m)	5,6	7,1	13,9	17,5	25,2	32,1	44,9	55,0	58,0
Next (db)	100,0	100,0	96,0	94,0	88,0	84,0	73,0	71,0	69,0
ACR (db)	94,4	92,9	82,1	76,5	62,8	51,9	28,1	16,0	9,0

## Technical data

Weight: app. 153 kg/km  
bending radius, repeated: 95 mm  
Operating temperature range min.: -30°C  
Operating temperature range max.: +70°C  
Caloric load, approx. value: 2,62 MJ/m  
Copper weight: 32,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e, Flame-retardant acc. to IEC 60332-1-2



## Application

HELUKAT® 600A data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. The series of HELUKAT® 600A with a double PVC jacket is constructed especially for outdoor applications like laying at house walls or in cable lines.

## Part no.

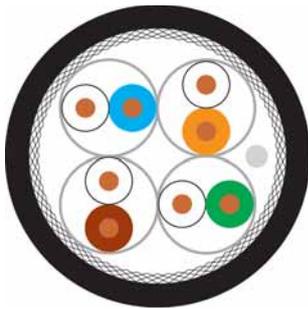
**801147**, S/FTP 4x2xAWG 23/1 PVC/PVC (S-STP)

Dimensions and specifications may be changed without prior notice.

# LAN Cable direct Burial

Category 7e

**HELUKAT® 600E**  
S/FTP PVC



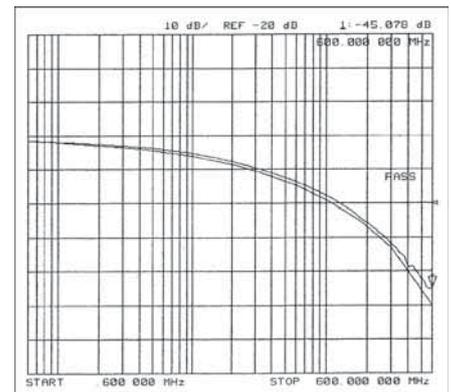
## Cable structure

Inner conductor Ø: 0,58 mm  
 Conductor material: Copper, bare  
 Core insulation: Foam-skin-PE  
 Core colours: wh/bu, wh/og, wh/gn, wh/bn  
 Separator: -  
 Screen over stranding element: Al-Foil  
 Screen 1 over stranding: Cu braid  
 Screen 2 over stranding: -  
 Outer sheath material: PVC  
 Outer diameter: app. 9,8 mm  
 Outer sheath colour: Black

## S/FTP 4x2xAWG 23/1 direct burial

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
 100 Ohm ± 20 Ohm at 101 to 1000 MHz  
 Loop resistance: 150 Ohm/km max.  
 Mutual capacitance: 42 nF/km nom.  
 Rel. propagation velocity: 79 %



## Typical values

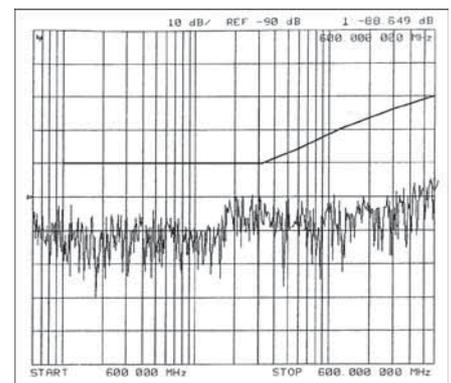
Frequency (MHz)	10	16	62,5	100	200	300	600	900	1000
Attenuation (dB/100m)	5,6	7,1	13,9	17,5	25,2	32,1	44,9	55,0	58,0
Next (db)	100,0	100,0	96,0	94,0	88,0	84,0	73,0	71,0	69,0
ACR (db)	94,4	92,9	82,1	76,5	62,8	51,9	28,1	16,0	9,0

## Technical data

Weight: app. 102 kg/km  
 bending radius, repeated: 100 mm  
 Operating temperature range min.: -45°C  
 Operating temperature range max.: +65°C  
 Caloric load, approx. value: 1,40 MJ/m  
 Copper weight: 32,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034



## Application

HELUKAT® 600E data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. The series of HELUKAT® 600E with a cold resistant PVC jacket is constructed especially for outdoor applications like laying at house walls or direct burial.

## Part no.

**802167**, S/FTP 4x2xAWG23/1 PVC (S-STP)

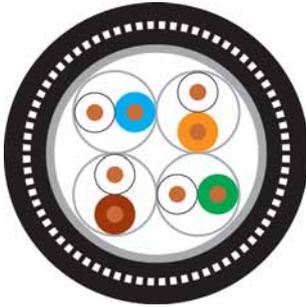
Dimensions and specifications may be changed without prior notice.

# LAN Cable direct Burial / armoured

Category 7e

**HELUKAT® 600AE**

S/FTP FRNC/PE



## Cable structure

Inner conductor Ø:  
Conductor material:  
Core insulation:  
Core colours:  
Separator:  
Inner sheath material:  
Screen over stranding element:  
Screen 1 over stranding:  
Screen 2 over stranding:  
:  
Outer sheath material:  
Outer diameter:  
Outer sheath colour:

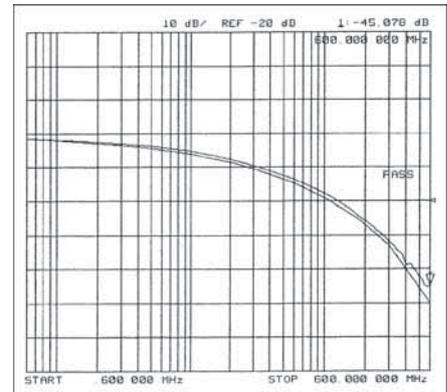
## S/FTP 4x2xAWG 23/1 FRNC/PE

0,58 mm  
Copper, bare  
Foam-skin-PE  
wh/bu, wh/og, wh/gn, wh/bn  
-  
FRNC  
Al-Foil  
Cu braid  
-  
Steel shaft  
PE  
app. 12,2 mm  
Black

## Electrical data

Characteristic impedance:  
  
Loop resistance:  
Mutual capacitance:  
Rel. propagation velocity:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 1000 MHz  
150 Ohm/km max.  
43 nF/km nom.  
79 %



## Typical values

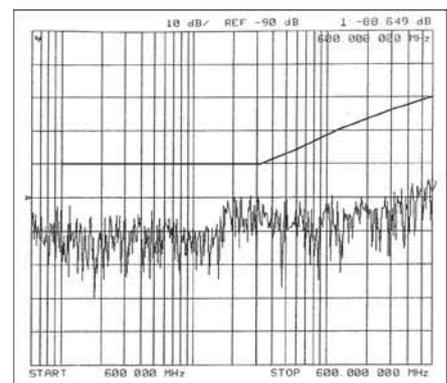
Frequency (MHz)	10	16	62,5	100	200	300	600	900	1000
Attenuation (dB/100m)	5,6	7,1	13,9	17,5	25,2	32,1	44,9	55,0	58,0
Next (db)	100,0	100,0	96,0	94,0	88,0	84,0	73,0	71,0	69,0
ACR (db)	94,4	92,9	82,1	76,5	62,8	51,9	28,1	16,0	9,0

## Technical data

Weight: app. 155 kg/km  
bending radius, repeated: 330 mm  
Operating temperature range min.: -45°C  
Operating temperature range max.: +70°C  
Caloric load, approx. value: 2,30 MJ/m  
Copper weight: 32,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e



## Application

HELUKAT® 600AE data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. The series of HELUKAT® 600AE with a FRNC/PE double jacket and the rodent protection is constructed especially for outdoor and direct burial applications.

## Part no.

**802168**, S/FTP 4x2xAWG 23/1 FRNC/PE (S-STP)

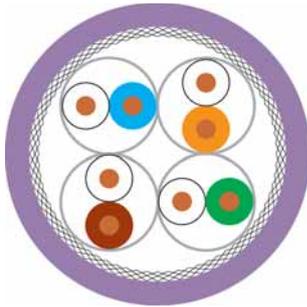
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 7<sub>A</sub>

**HELUKAT**® 1200 

S/FTP



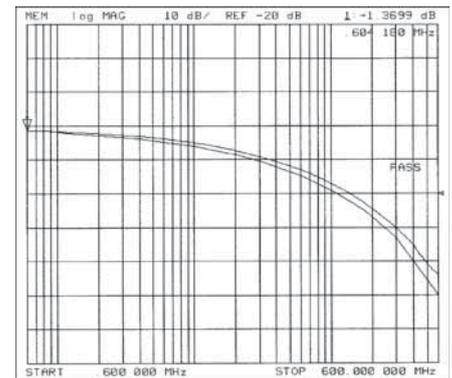
## Cable structure

Inner conductor Ø: 0,57 mm  
 Conductor material: Copper, bare  
 Core insulation: Foam-skin-PE  
 Core colours: wh/bu, wh/og, wh/gn, wh/bn  
 Separator: -  
 Screen over stranding element: Al-Foil  
 Screen 1 over stranding: Cu braid  
 Screen 2 over stranding: -  
 Outer sheath material: LSZH  
 Outer diameter: app. 7,5 mm  
 Outer sheath colour: Blue Lilac similar to RAL 4005

## S/FTP 4x2xAWG 23/1 LSZH

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
 100 Ohm ± 20 Ohm at 101 to 1200 MHz  
 Loop resistance: 160 Ohm/km max.  
 Mutual capacitance: 43 nF/km nom.  
 Rel. propagation velocity: 77 %



## Typical values

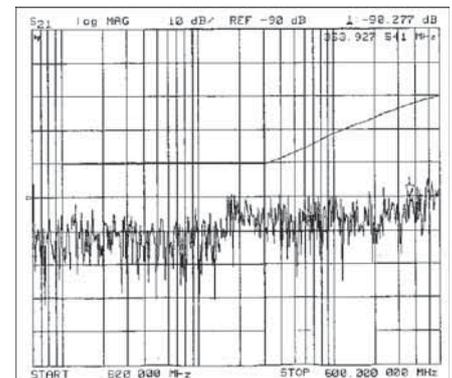
Frequency (MHz)	10	16	62,5	100	200	300	600	900	1000	1200
Attenuation (db/100m)	5,2	6,8	13,3	17,3	24,2	30,2	43,5	54,3	56,9	62,9
Next (db)	105,0	105,0	105,0	100,0	95,0	93,0	88,0	85,0	84,0	82,0
ACR (db)	99,8	98,2	91,7	82,7	70,8	62,8	44,5	30,7	27,1	19,1

## Technical data

Weight: app. 60 kg/km  
 bending radius, repeated: 65 mm  
 Operating temperature range min.: -20°C  
 Operating temperature range max.: +60°C  
 Caloric load, approx. value: 0,57 MJ/m  
 Copper weight: 30,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7<sub>A</sub>, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3



## Application

HELUKAT®1200-7A data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as 10Gigabit Ethernet, Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**803380**, S/FTP 4x2xAWG 23/1 FRNC (S-STP)

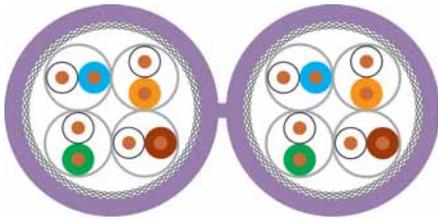
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 7<sub>A</sub>

**HELUKAT**® 1200 

S/FTP duplex



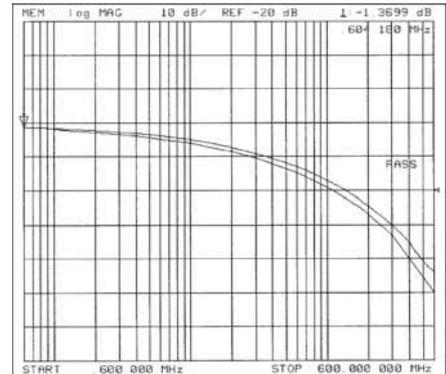
## Cable structure

Inner conductor Ø: 0,57 mm  
 Conductor material: Copper, bare  
 Core insulation: Foam-skin-PE  
 Core colours: wh/bu, wh/og, wh/gn, wh/bn  
 Separator: -  
 Screen over stranding element: Al-Foil  
 Screen 1 over stranding: Cu braid  
 Screen 2 over stranding: -  
 Outer sheath material: LSZH  
 Cable dimensions: app. 16,0 mm x 7,5 mm  
 Outer sheath colour: Blue Lilac similar to RAL 4005

## S/FTP 2x(4x2xAWG 23/1) LSZH

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
 100 Ohm ± 20 Ohm at 101 to 1200 MHz  
 Loop resistance: 160 Ohm/km max.  
 Mutual capacitance: 43 nF/km nom.  
 Rel. propagation velocity: 77 %



## Typical values

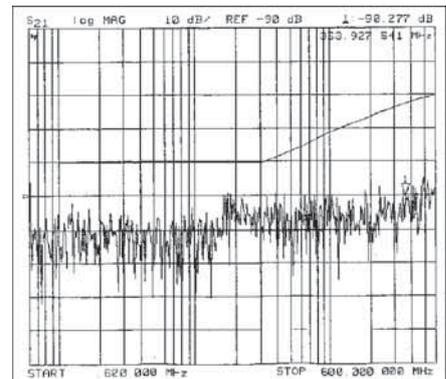
Frequency (MHz)	10	16	62,5	100	200	300	600	900	1000	1200
Attenuation (db/100m)	5,2	6,8	13,3	17,3	24,2	30,2	43,5	54,3	56,9	62,9
Next (db)	105,0	105,0	105,0	100,0	95,0	93,0	88,0	85,0	84,0	82,0
ACR (db)	99,8	98,2	91,7	82,7	70,8	62,8	44,5	30,7	27,1	19,1

## Technical data

Weight: app. 120 kg/km  
 bending radius, repeated: 65 mm  
 Operating temperature range min.: -20°C  
 Operating temperature range max.: +60°C  
 Caloric load, approx. value: 1,16 MJ/m  
 Copper weight: 60,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7<sub>A</sub>, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3



## Application

HELUKAT®1200-7A data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as 10Gigabit Ethernet, Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**803381**, S/FTP 2x(4x2xAWG 23/1) FRNC (S-STP)

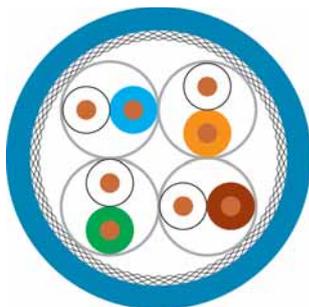
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 8

**HELUKAT**® 1200 

S/FTP



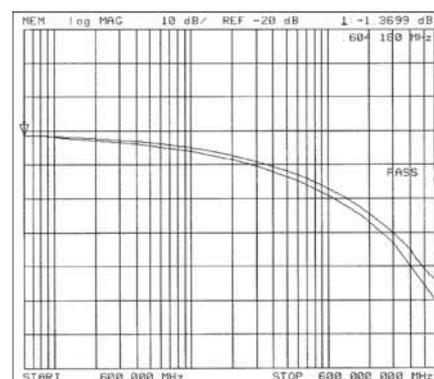
## Cable structure

Inner conductor Ø: 0,64 mm  
 Conductor material: Copper, bare  
 Core insulation: Foam-skin-PE  
 Core colours: wh/bu, wh/og, wh/gn, wh/bn  
 Separator: -  
 Screen over stranding element: Al-Foil  
 Screen 1 over stranding: Cu braid  
 Screen 2 over stranding: -  
 Outer sheath material: FRNC  
 Outer diameter: app. 7,7 mm  
 Outer sheath colour: Blue similar to RAL 5015

## S/FTP 4x2xAWG 22/1 FRNC

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
 100 Ohm ± 20 Ohm at 101 to 1200 MHz  
 Loop resistance: 120 Ohm/km max.  
 Mutual capacitance: 43 nF/km nom.  
 Rel. propagation velocity: 79 %



## Typical values

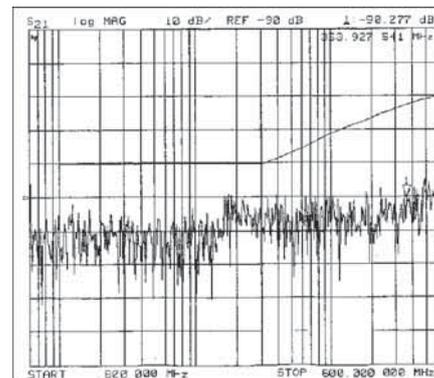
Frequency (MHz)	10	16	62,5	100	200	300	600	1000	1200
Attenuation (db/100m)	4,9	6,3	12,7	16,3	23,5	29,4	42,8	53,0	59,0
Next (db)	100,0	100,0	95,0	93,0	90,0	87,0	81,0	78,0	77,0
ACR (db)	95,1	93,7	82,3	76,7	66,5	57,6	38,2	25,0	18,0

## Technical data

Weight: app. 66 kg/km  
 bending radius, repeated: 72 mm  
 Operating temperature range min.: -20°C  
 Operating temperature range max.: +60°C  
 Caloric load, approx. value: 0,70 MJ/m  
 Copper weight: 40,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3



## Application

HELUKAT® 1200 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**81699**, S/FTP 4x2xAWG 22/1 FRNC (S-FTP)

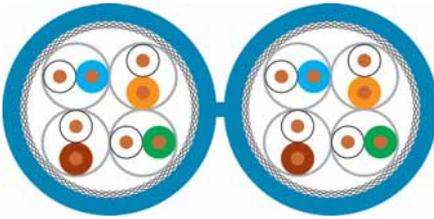
Dimensions and specifications may be changed without prior notice.

# LAN Cable

Category 8

**HELUKAT® 1200** 

S/FTP duplex



## Cable structure

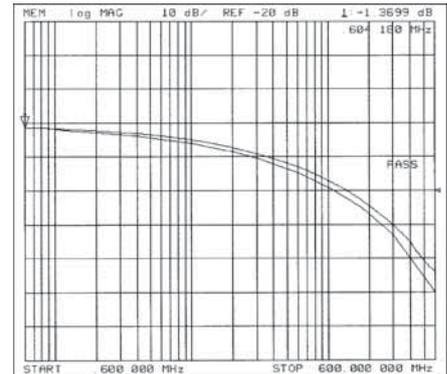
Inner conductor Ø:  
Conductor material:  
Core insulation:  
Core colours:  
Separator:  
Screen over stranding element:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Cable dimensions:  
Outer sheath colour:

## S/FTP 2x(4x2xAWG 22/1) FRNC

0,64 mm  
Copper, bare  
Foam-skin-PE  
wh/bu, wh/og, wh/gn, wh/bn  
-  
Al-Foil  
Cu braid  
-  
FRNC  
app. 7,7 mm x 16,5 mm  
Blue similar to RAL 5015

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 1200 MHz  
Loop resistance: 120 Ohm/km max.  
Mutual capacitance: 43 nF/km nom.  
Rel. propagation velocity: 79 %



## Typical values

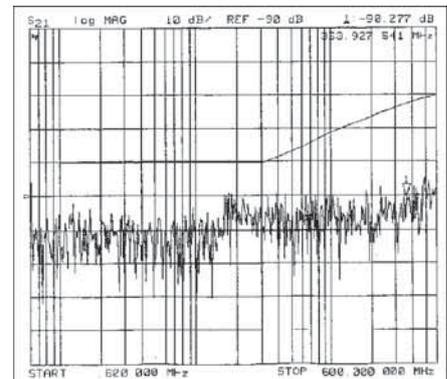
Frequency (MHz)	10	16	62,5	100	200	300	600	1000	1200
Attenuation (db/100m)	4,9	6,3	12,7	16,3	23,5	29,4	42,8	53,0	59,0
Next (db)	100,0	100,0	95,0	93,0	90,0	87,0	81,0	78,0	77,0
ACR (db)	95,1	93,7	82,3	76,7	66,5	57,6	38,2	25,0	18,0

## Technical data

Weight: app. 133 kg/km  
bending radius, repeated: 72 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +60°C  
Caloric load, approx. value: 1,50 MJ/m  
Copper weight: 80,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3



## Application

HELUKAT®1200 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**800647**, S/FTP 2x(4x2xAWG 22/1) FRNC (S-STP)

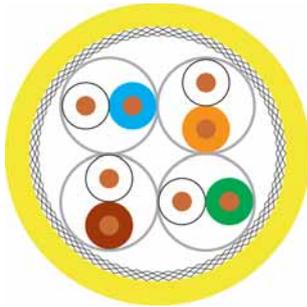
Dimensions and specifications may be changed without prior notice.

# Multimedia Cable

Category 8

**HELUKAT**® 1500 

S/FTP



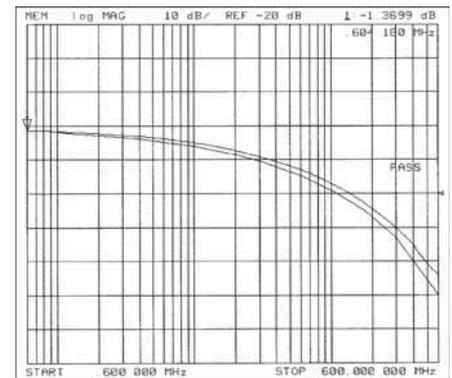
## Cable structure

Inner conductor Ø: 0,64 mm  
 Conductor material: Copper, bare  
 Core insulation: Foam-skin-PE  
 Core colours: wh/bu, wh/og, wh/gn, wh/bn  
 Separator: -  
 Screen over stranding element: Al-Foil  
 Screen 1 over stranding: Cu braid  
 Screen 2 over stranding: -  
 Outer sheath material: FRNC  
 Outer diameter: app. 7,7 mm  
 Outer sheath colour: Yellow similar to RAL 1021

## S/FTP 4x2xAWG 22/1 FRNC

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
 100 Ohm ± 20 Ohm at 101 to 1200 MHz  
 Loop resistance: 120 Ohm/km max.  
 Mutual capacitance: 42 nF/km nom.  
 Rel. propagation velocity: 77 %



## Typical values

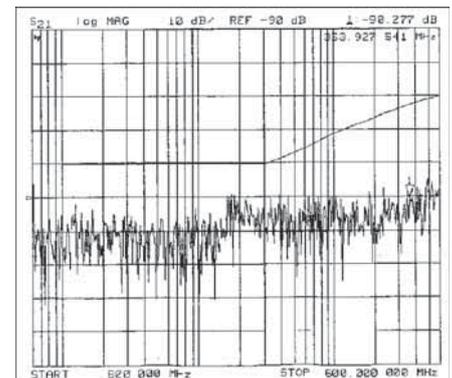
Frequency (MHz)	10	16	62,5	100	200	300	600	1000	1200	1500
Attenuation (db/100m)	4,2	6,3	12,7	16,5	21,5	27,5	41,7	54,4	59,8	66,2
Next (db)	110,0	110,0	110,0	110,0	110,0	105,0	95,0	85,0	80,0	74,0
ACR (db)	105,8	103,7	97,3	93,5	88,5	77,5	53,3	30,6	22,2	7,8

## Technical data

Weight: app. 66 kg/km  
 bending radius, repeated: 68 mm  
 Operating temperature range min.: -20°C  
 Operating temperature range max.: +60°C  
 Caloric load, approx. value: 0,74 MJ/m  
 Copper weight: 37,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 8 (draft),  
 Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3



## Application

HELUKAT® 1500 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as 10Gigabit Ethernet, Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. That means applications such as multimedia (TV, Video, Data, Speech) are no problem for this series. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**802169**, S/FTP 4x2xAWG 22/1 FRNC (S-STP)

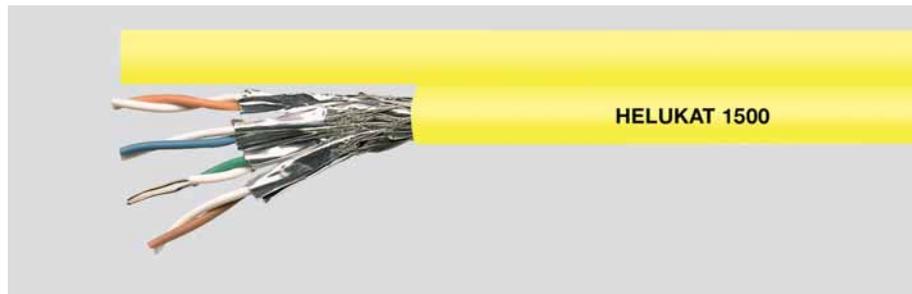
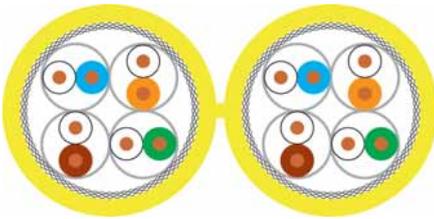
Dimensions and specifications may be changed without prior notice.

# Multimedia Cable

Category 8

**HELUKAT® 1500**

S/FTP duplex



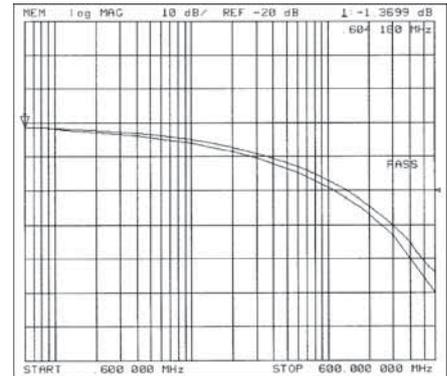
## Cable structure

Inner conductor Ø: 0,64 mm  
 Conductor material: Copper, bare  
 Core insulation: Foam-skin-PE  
 Core colours: wh/bu, wh/og, wh/gn, wh/bn  
 Separator: -  
 Screen over stranding element: Al-Foil  
 Screen 1 over stranding: Cu braid  
 Screen 2 over stranding: -  
 Outer sheath material: FRNC  
 Cable dimensions: app. 7,7 mm x 16,2 mm  
 Outer sheath colour: Yellow

## S/FTP 2x(4x2xAWG 22/1) FRNC

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
 100 Ohm ± 20 Ohm at 101 to 1200 MHz  
 Loop resistance: 120 Ohm/km max.  
 Mutual capacitance: 42 nF/km nom.  
 Rel. propagation velocity: 77 %



## Typical values

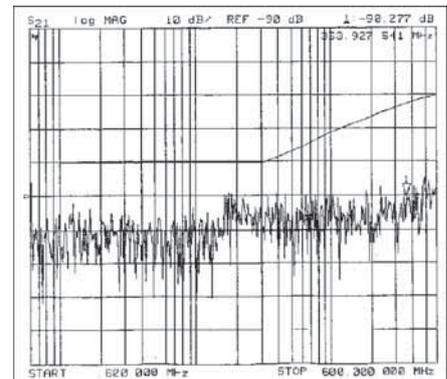
Frequency (MHz)	10	16	62,5	100	200	300	600	1000	1200	1500
Attenuation (db/100m)	4,2	6,3	12,7	16,5	21,5	27,5	41,7	54,4	59,8	66,2
Next (db)	110,0	110,0	110,0	110,0	110,0	105,0	95,0	85,0	80,0	74,0
ACR (db)	105,8	103,7	97,3	93,5	88,5	77,5	53,3	30,6	22,2	7,8

## Technical data

Weight: app. 135 kg/km  
 bending radius, repeated: 68 mm  
 Operating temperature range min.: -20°C  
 Operating temperature range max.: +60°C  
 Caloric load, approx. value: 1,50 MJ/m  
 Copper weight: 74,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 8 (draft),  
 Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3



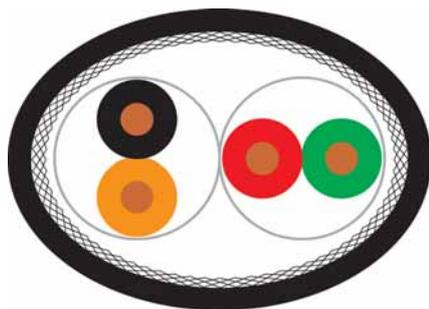
## Application

HELUKAT®1500 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as 10Gigabit Ethernet, Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. That means applications such as multimedia (TV, Video, Data, Speech) are no problem for this series. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**802170**, S/FTP 2x(4x2xAWG 22/1) FRNC (S-STP)

Dimensions and specifications may be changed without prior notice.



## Cable structure

Inner conductor Ø:  
 Conductor material:  
 Core insulation:  
 Number of cores:  
 Core colours:  
 Screen over stranding element:  
 Screen over stranding 1:  
 Screen over stranding 2:  
 Outer sheath material:  
 Cable dimensions:  
 Outer sheath colour:

## IBM P/N 33G2772 type 1A

0,64 mm  
 Copper, bare  
 Foam-skin-PE  
 4  
 bk/og, rd/gn  
 Al-Foil  
 Cu braid, tinned  
 -  
 PVC  
 app. 7,6 mm x 11,9 mm  
 Black

## Electrical data

Characteristic impedance:  
 Direct current resistance:  
 Rel. propagation velocity:

150 Ohm  
 ± 15 Ohm at 3 to 20 MHz  
 185 Ohm  
 ± 18.5 Ohm at 38.4 kHz  
 270 Ohm  
 ± 27 Ohm at 9.6 kHz  
 57,1 Ohm/km  
 78 %

## Typical values

Frequency (MHz)	20	100	20	100	20	100
Attenuation (dB/100m)	7,4	18,7	4,9	12,3	7,4	18,7
Next (db)	80,0	60,0	50,0	39,0	60,0	49,0

## Technical data

Weight: app. 85 kg/km  
 bending radius, repeated: 110 mm  
 Operating temperature range min.: -10°C  
 Operating temperature range max.: +70°C  
 Caloric load, approx. value: 1,70 MJ/m  
 Copper weight: 38,00 kg/km

## Application

HELUKABEL® IVS types are used in the area of the IVS system, developed by IBM. They correspond to the wiring guidelines set by IBM.

## Part no.

**80068**, IBM P/N 33G2772 type 1A

Dimensions and specifications may be changed without prior notice.

**BUS-Cables USB 3.0 Bus**

BUS-Cables E-Bus

BUS-Cables Profibus SHIPLINE

**BUS-Cables CAN Bus**

Industrial Ethernet PROFINet typee A

Industrial Ethernet 200IND SF/UTP ROBUSTFLEX

Industrial Ethernet PROFINet C Torsion



# BUS-CABLES

Designation				Page
<b>Industrial Ethernet</b>				
Industrial Ethernet, ROBUST, Cat.7e	HELUKAT® 600IND	S/FTP PUR	CC-Link	121
Industrial Ethernet, FRNC, Cat.7e	HELUKAT® 600IND	S/FTP FRNC		122
Industrial Ethernet, ROBUST, Cat.7 <sub>A</sub>	HELUKAT® 1200IND	S/FTP PUR		123
Industrial Ethernet, ROBUSTFLEX, Cat.7 <sub>A</sub>	HELUKAT® 1000IND	S/FTP PUR		124
Industrial Ethernet, PROFinet Drag chain + Torsion	HELUKAT® 600S	SF/FTP PUR	CC-Link	125
Industrial Ethernet, SHIPLINE Cat.7	HELUKAT® 600IND	S/FTP FRNC		126
Industrial Ethernet, ROBUSTFLEX, Cat.7	HELUKAT® 600IND	S/FTP PUR		127
Industrial Ethernet, Standard cable, Cat.6 <sub>A</sub>	HELUKAT® 500IND	S/FTP FRNC		128
Industrial Ethernet, Cat.6 <sub>A</sub> , 10GIG	HELUKAT® 500IND	S/FTP PUR		129
Industrial Ethernet, Cat.6 <sub>A</sub> , 10GIG	HELUKAT® 500IND	S/FTP PVC		130
Industrial Ethernet, Cat.6 <sub>A</sub> , 10GIG	HELUKAT® 500IND	S/FTP PVC-SK	CC-Link	131
Industrial Ethernet, Cat.6 <sub>A</sub> , PROFinet Drag chain PVC + PUR	HELUKAT® 500S	SF/FTP PVC + PUR		132
Industrial Ethernet, Cat.6 <sub>A</sub> , Drag chain	HELUKAT® 500S	SF/FTP PUR		133
Industrial Ethernet, Cat.6, Drag chain	HELUKAT® 250IND	SF/UTP PVC CMG		134
Industrial Ethernet, Cat.6	HELUKAT® 250IND	SF/UTP PVC AWM		135
Industrial Ethernet, Cat.6, Drag chain	HELUKAT® 250S	SF/UTP PVC		136
Industrial Ethernet, Cat.6, Drag chain	HELUKAT® 250S	SF/UTP PUR		137
Industrial Ethernet, Cat.5e	HELUKAT® 100IND	SF/UTP FRNC + PUR		138
Industrial Ethernet, Cat.5e, FLEX	HELUKAT® 100IND	SF/UTP FRNC + PUR		139
Industrial Ethernet, ROBUSTFLEX, Cat.5e	HELUKAT® 200IND	SF/UTP PUR		140
Industrial Ethernet, WK Industrial 105°, Cat.5e	HELUKAT® 100IND	SF/UTP X-FRNC		141
Industrial Ethernet, 4-Ader, Drag chain ECO, Cat.5	HELUKAT® 100S	SF/UTP PUR		142
Industrial Ethernet, 4-Paar, Drag chain ECO, Cat.5	HELUKAT® 100S	SF/UTP PUR		143
Industrial Ethernet, 4-Paar, Drag chain ECO, Cat.5	HELUKAT® 100S	SF/UTP PUR		144
Industrial Ethernet, 4-Ader, Drag chain, Cat.5	HELUKAT® 200S	SF/UTP PUR		145
Industrial Ethernet, 4-Paar, Drag chain, Cat.5	HELUKAT® 200S	SF/UTP PUR		146
Industrial Ethernet, TORDIERFLEX, Cat.5	HELUKAT® 100T	SF/UTP PUR		147
<b>PROFinet</b>				
Industrial Ethernet, PROFinet Type A fixed installation + robust, Cat. 5e	HELUKAT®	PVC + PUR	Eca	148
Industrial Ethernet, PROFinet Type A fixed installation FRNC, Cat. 5e	HELUKAT®	FRNC		149
Industrial Ethernet, PROFinet Type A radiation resistant, armoured, Cat. 5e	HELUKAT®	PUR + PE		150
Industrial Ethernet, PROFinet Type B flexible, Cat. 5e	HELUKAT®	PVC + FRNC	Eca, Dca	151
Industrial Ethernet, PROFinet Type B flexible hybrid, Cat. 5e	HELUKAT®	FRNC		152
Industrial Ethernet, PROFinet Type B SHIPLINE + FESTOON, Cat. 5e	HELUKAT®	FRNC + PVC		153
Industrial Ethernet, PROFinet Type C highflexible, Cat. 5e	HELUKAT®	PVC + PUR		154
Industrial Ethernet, TORSION, Cat. 5e	HELUKAT®	PUR		155
Industrial Ethernet, PROFinet Type R, TORSION, Cat. 5e	HELUKAT®	PUR		156
<b>Profibus DP</b>				
Profibus L2, fixed installation, indoor	HELUKABEL®	PVC		158
Profibus L2, fixed installation, outdoor + Robust	HELUKABEL®	PE + PUR		159
Profibus L2, direct burial PVC/PE and armoured	HELUKABEL®	PE		160
Profibus L2, 7-wire	HELUKABEL®	PVC		161
Profibus L2, fixed installation, high temp. +105°C bzw. +200°C/PH 120	HELUKABEL®	PVC + FRNC		162
Profibus L2, Drag chain	HELUKABEL®	PUR		163
Profibus, Drag chain ET200X + ECOFAST	HELUKABEL®	PUR		164
Profibus, fixed installation, SHIPLINE + high temperature 180°C	HELUKABEL®	X-FRNC + FEP		165
Profibus L2, highflexible TORSION + FESTOON	HELUKABEL®	PUR + PVC		166
<b>Profibus PA</b>				
Profibus PA, fixed installation	HELUKABEL®	PVC		167
Profibus PA, fixed installation, armoured	HELUKABEL®	PVC		168
Profibus PA, Long Distance, fixed installation	HELUKABEL®	PVC		169
<b>Profibus DP SK</b>				
Profibus SK, fixed installation, indoor and outdoor	HELUKABEL®	PVC + PE	Eca	170
Profibus SK, fixed installation, FRNC + Robust	HELUKABEL®	FRNC + PUR	Dca	171
Profibus SK, 7-wire	HELUKABEL®	PVC + FRNC		172
Profibus SK, Drag chain	HELUKABEL®	PUR		173
<b>FOUNDATION™ Fieldbus</b>				
FOUNDATION™ Fieldbus FF Type A, Basic	HELUKABEL®	PVC		174
FOUNDATION™ Fieldbus FF Type A, with device ground	HELUKABEL®	PVC		175
FOUNDATION™ Fieldbus FF Type A, with device ground and armouring	HELUKABEL®	PVC		176
FOUNDATION™ Fieldbus FF Type A, without device ground	HELUKABEL®	PVC		177

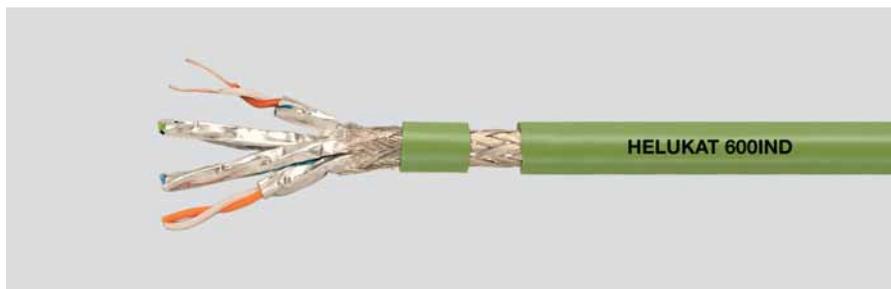
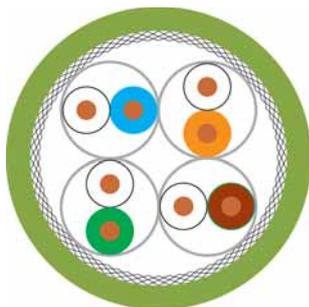
# BUS-CABLES

Designation			Page
<b>HMCB Bus cables for digital encoder cable</b>			
Bus Cable HMCB200, PVC	HELUKABEL®	PVC	178
Bus Cable HMCB500S, PVC, Drag chain	HELUKABEL®	PVC	179
Bus Cable HMCB800W, PUR, Drag chain	HELUKABEL®	PUR	180
<b>USB</b>			
Bus Cable USB S 2.0, PUR, highflexible	HELUKABEL®	PUR	181
Bus Cable USB L 2.0, PUR, highflexible	HELUKABEL®	PUR	182
Bus Cable USB 3.0, PUR, highflexible	HELUKABEL®	PUR	183
<b>FireWire™</b>			
FireWire™ PUR, Drag chain	HELUKABEL®	PUR	184
<b>Koax Drag chain</b>			
Bus Cable Koax PUR, Drag chain, 50 Ohm	HELUKABEL®	PUR	185
<b>CAN Bus</b>			
CAN-Bus 0,22 mm², flexible	HELUKABEL®	PVC	186
CAN Bus 0,22 mm², (pair stranded), flexible	HELUKABEL®	PVC	187
CAN-Bus 0,25 mm², flexible, 105°C	HELUKABEL®	PUR	188
CAN-Bus 0,34 mm², flexible	HELUKABEL®	PVC	189
CAN-Bus 0,34 mm², (pair stranded) flexible	HELUKABEL®	PVC	190
CAN-Bus 0,50 mm², flexible	HELUKABEL®	PVC	191
CAN-Bus 0,50 mm², (pair stranded), flexible	HELUKABEL®	PVC	192
CAN-Bus 0,50 mm², direct burial	HELUKABEL®	PE	193
CAN-Bus 0,75 mm², flexible	HELUKABEL®	PVC	194
CAN-Bus 0,25 mm², Drag chain	HELUKABEL®	PUR	195
CAN-Bus 0,34 mm², Drag chain	HELUKABEL®	PUR	196
CAN-Bus 0,5 mm², Drag chain	HELUKABEL®	PUR	197
<b>Interbus</b>			
Interbus fixed installation, remote bus and installation remote bus	HELUKABEL®	PVC	198
Interbus Drag chain, remote bus and installation remote bus	HELUKABEL®	PUR	199
<b>Multibus</b>			
Multibus I, highflexible	HELUKABEL®	PUR	200
Multibus II, highflexible	HELUKABEL®	PUR	201
<b>AS-Interface</b>			
ASI-Bus, EPDM	HELUKABEL®	EPDM	202
ASI-Bus, Long Distance, EPDM	HELUKABEL®	EPDM	203
ASI-Bus, PUR, highflexible, UL/CSA	HELUKABEL®	PUR	204
ASI-Bus, Long Distance, PUR, highflexible, UL/CSA	HELUKABEL®	PUR	205
ASI-Bus, TPE, 105°C, CMG	HELUKABEL®	TPE 105°C	206
ASI-Bus, TPE	HELUKABEL®	TPE	207
<b>DeviceNet™</b>			
DeviceNet™, PVC, fixed installation	HELUKABEL®	PVC	208
DeviceNet™, FRNC, fixed installation	HELUKABEL®	FRNC	209
DeviceNet™, CPE, fixed installation	HELUKABEL®	PUR	210
<b>CC-Link</b>			
CC-Link-Bus	HELUKABEL®	PVC	211
<b>SafetyBus</b>			
SafetyBus p, FRNC and PUR	HELUKABEL®	FRNC + PUR	212
<b>LON</b>			
LON BUS, H122 and Y116	HELUKABEL®	FRNC + PVC	213
LON BUS, H116	HELUKABEL®	FRNC	214
<b>MOD-Bus</b>			
MOD-Bus, PVC, armoured	HELUKABEL®	PVC + armoured	215
<b>EIB</b>			
KNX/EIB-Bus, 4-cores violet	HELUKABEL®	PVC + FRNC	Eca + Dca 216
KNX/EIB-Bus, 2-cores, green	HELUKABEL®	PVC + FRNC	Eca + Dca 217
E-BUS / KNX, fixed installation, 4 pairs	HELUKABEL®	PVC	Eca 218
E-BUS / KNX ERD, fixed installation	HELUKABEL®	PE	219
<b>Hospital-Bus</b>			
KH-Bus, PVC and FRNC	HELUKABEL®	PVC + FRNC	Eca 220

# Industrial Ethernet

ROBUST

**HELUKAT®** 600IND  
CC-Link IE **E**field S/FTP, Category 7e



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Industrial Area

### S/FTP 4x2xAWG 23/1 PUR

Copper, bare (AWG 23/1)  
Foam-skin-PE  
wh/bu, wh/og, wh/gn, wh/bn  
Double core  
-  
Al-Foil  
Cu braid  
-  
PUR  
app. 7,5 mm ± 0,3 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 1200 MHz  
Loop resistance: 149 Ohm/km max.  
Mutual capacitance: 43 nF/km nom.  
Relative propagation velocity: 77 %

## Typical values

frequency (MHz)	10	16	62,5	100	250	350	600	900	1000	1200
attenuation (db/100m)	5,6	7,0	13,8	17,6	28,3	34,0	45,2	57,1	60,8	66,0
next (db)	95,0	95,0	89,0	87,0	82,0	79,0	74,0	70,0	66,0	63,0
ACR (db)	89,4	88,0	75,2	69,4	53,7	43,0	27,8	13,9	5,2	-3,0

## Technical data

Weight: app. 68 kg/km  
bending radius, repeated: 78 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 0,74 MJ/m  
Copper weight: 34,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, Oil-resistant, AWM Style 21238 600V 80°C

## Application

HELUKAT® 600IND Category 7e Robust is used for harsh industrial environments. Mechanically, this product exhibits excellent resistance to mineral oils, greases and cooling lubricants and has good microbe and hydrolysis resistance. Electrically, this cable is characterized by high reserve capacity and outstanding performance. This allows you to create services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, Token Ring 4/16 Mbit/s or ISDN without difficulty. These cables considerably exceed the requirement for compliance with Class B interference emission to EN55022, as well as interference immunity to EN55024. This gives the series outstanding EMC characteristics. **Also in color blue under p/n 11008281 available.**

## Part no.

**801197**, S/FTP 4x2xAWG 23/1 PUR (S-STP)

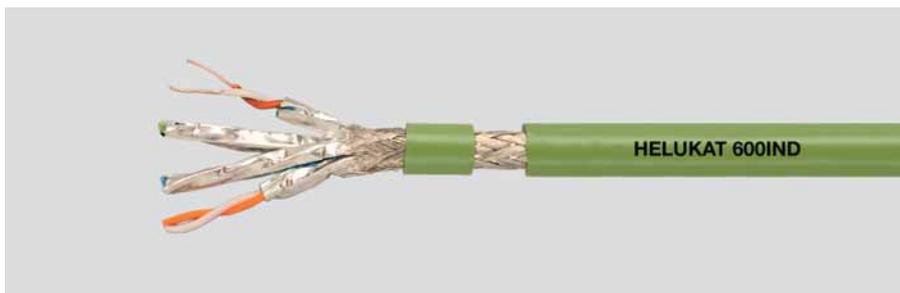
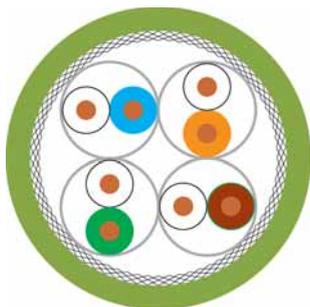
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

FRNC

**HELUKAT® 600IND**

S/FTP, Category 7e



## Cable structure

Inner conductor Ø:  
Conductor material:  
Core insulation:  
Core colours:  
Separator:  
Screen over stranding element:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Outer diameter:  
Outer sheath colour:

## S/FTP 4x2xAWG 23/1 FRNC

0,57 mm  
Copper, bare  
Foam-skin-PE  
wh/bu, wh/og, wh/gn, wh/bn  
-  
Al-Foil  
Cu braid  
-  
FRNC  
app. 7,8 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 1200 MHz

Loop resistance:

149 Ohm/km max.

Mutual capacitance:

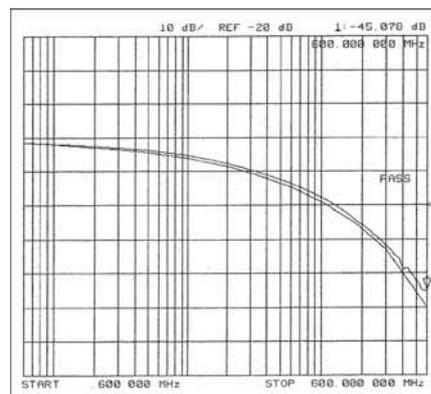
43 nF/km nom.

Rel. propagation velocity:

77 %

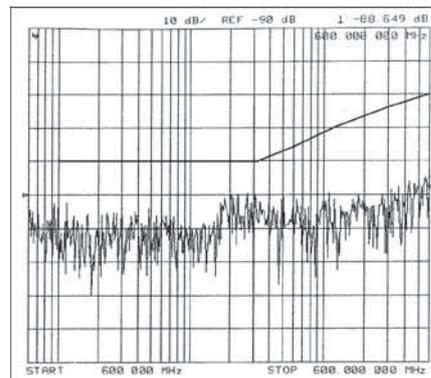
## Typical values

frequency (MHz)	10	16	62,5	100	250	350	600	900	1000	1200
attenuation (db/100m)	5,6	7,0	13,8	17,6	28,3	34,0	45,2	57,1	60,8	66,0
next (db)	95,0	95,0	89,0	87,0	82,0	79,0	74,0	70,0	66,0	63,0
ACR (db)	89,4	88,0	75,2	69,4	53,7	43,0	27,8	13,9	5,2	-3,0



## Technical data

Weight: app. 68 kg/km  
bending radius, repeated: 78 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 0,74 MJ/m  
Copper weight: 34,00 kg/km



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, Oil-resistant, UL AWM 21143 600V 80°C

## Application

HELUKAT® 600IND Category 7e FRNC is used for industrial environments with halogen free and low smoke characteristics. Electrically, this cable is characterized by high reserve capacity and outstanding performance. This allows you to create services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, Token Ring 4/16 Mbit/s or ISDN without difficulty. These cables considerably exceed the requirement for compliance with Class B interference emission to EN55022, as well as interference immunity to EN55024. This gives the series outstanding EMC characteristics.

## Part no.

**11007775**, S/FTP 4x2xAWG 23/1 FRNC (S-STP)

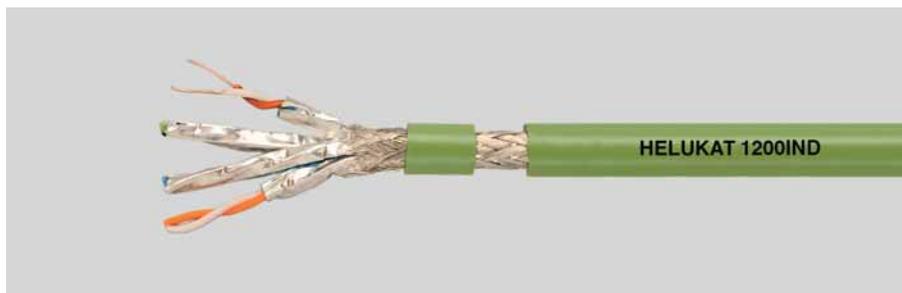
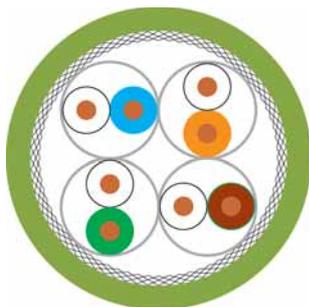
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

ROBUST

**HELUKAT®** 1200IND

S/FTP, Category 7<sub>A</sub>



## Cable structure

Inner conductor Ø:	0,57 mm
Conductor material:	Copper, bare
Core insulation:	Foam-skin-PE
Core colours:	wh/bu, wh/og, wh/gn, wh/bn
Separator:	-
Screen over stranding element:	Al-Foil
Screen 1 over stranding:	Cu braid
Screen 2 over stranding:	-
Outer sheath material:	PUR
Outer diameter:	app. 7,8 mm
Outer sheath colour:	Green similar to RAL 6018

## S/FTP 4x2xAWG 23/1 PUR

## Electrical data

Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz 100 Ohm ± 20 Ohm at 101 to 1200 MHz
Loop resistance:	149 Ohm/km max.
Mutual capacitance:	43 nF/km nom.

## Typical values

frequency (MHz)	10	16	62,5	100	250	350	600	900	1200
attenuation (db/100m)	5,6	7,0	13,8	17,6	28,3	34,0	45,2	57,1	66
Next (db)	95,0	95,0	89,0	87,0	82,0	89,0	74,0	70,0	63,0
PS-ACR (db)	89,4	86,0	73,2	67,4	51,7	43,0	27,8	13,9	1,0

## Technical data

Weight:	app. 68 kg/km
bending radius, repeated:	78 mm
Operating temperature range min.:	-40°C
Operating temperature range max.:	+80°C
Caloric load, approx. value:	0,76 MJ/m
Copper weight:	37,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7<sub>A</sub>, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, Oil-resistant, UL Style 20549

## Application

HELUKAT® 1200IND Category 7A Robust is used for harsh industrial environments. Mechanically, this product exhibits excellent resistance to mineral oils, greases and cooling lubricants and has good microbe and hydrolysis resistance. Electrically, this cable is characterized by high reserve capacity and outstanding performance.

## Part no.

**805680**, S/FTP 4x2xAWG 23/1 PUR (S-STP)

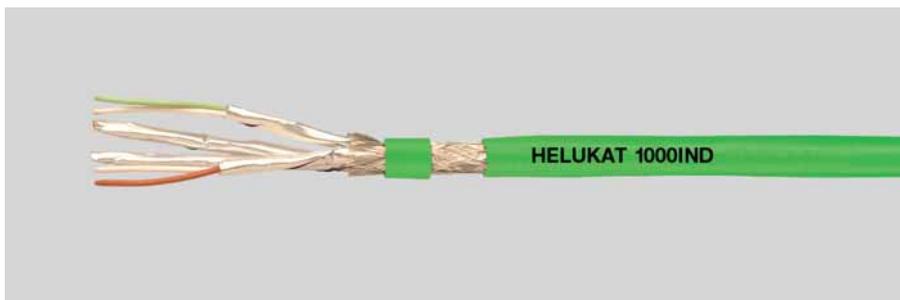
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

ROBUSTFLEX

**HELUKAT**® 1000IND

S/FTP, Category 7<sub>A</sub>



## Cable structure

Inner conductor Ø:	0,48 mm
Conductor material:	Copper, bare
Core insulation:	Foam-skin-PE
Core colours:	wh/bu, wh/og, wh/gn, wh/bn
Separator:	-
Screen over stranding element:	Al-Foil
Screen 1 over stranding:	Cu braid
Screen 2 over stranding:	-
Outer sheath material:	PUR
Outer diameter:	app. 6,2 mm
Outer sheath colour:	Green similar to RAL 6018

## S/FTP 4x2xAWG 26/7 PUR

## Electrical data

Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz 100 Ohm ± 20 Ohm at 101 to 1000 MHz
Loop resistance:	290 Ohm/km max.
Mutual capacitance:	44 nF/km nom.
Rel. propagation velocity:	64 %

## Typical values

Frequency (MHz)	10	100	250	800	900	1000
Attenuation (db/10m)	0,9	2,8	4,5	8,2	8,8	9,3
Next (db)	78,0	78,0	72,4	64,9	64,1	63,4
ACR (db)	77,1	75,2	67,9	56,7	55,3	54,1

## Technical data

Weight:	app. 40 kg/km
bending radius, repeated:	50 mm
Operating temperature range min.:	-25°C
Operating temperature range max.:	+80°C
Caloric load, approx. value:	0,45 MJ/m
Copper weight:	23,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7<sub>A</sub>, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-1, Oil-resistant, AWM Style 21238 (80°C/ 600V)

## Application

HELUKAT®1000IND Category 7<sub>A</sub> Robustflex is an Ethernet cable that, thanks to use of a halogen-free PU outer sheath, is ideal for harsh industrial surroundings. This cable is configurable with common RJ45 plugs (industrial and office version), as well as with some Sub-D and M12 plugs.

## Part no.

**805684**, S/FTP 4x2xAWG 26/7 PUR (S-STP)

Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

PROFINet Drag Chain + Torsion

**HELUKAT® 600S**  
CC-Link IE Field SF/FTP, Category 7



## Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Separator:  
Shielding 1:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Drag Chain

### SF/FTP 4x2xAWG 24/7 (stranded) PUR

Copper, tinned (AWG 24/7)  
Foam-skin-PE  
wh/bu, wh/og, wh/gn, wh/bn  
-  
Al-Foil  
Al-Foil  
Cu braid  
PUR  
app. 8,7 mm ± 0,3 mm  
Green similar to RAL 6018

## Torsion

### SF/FTP 4x2xAWG 24/7 (stranded) PUR

Copper, tinned (AWG 24/7)  
Foam-skin-PE  
wh/bu, wh/og, wh/gn, wh/bn  
-  
Al-Foil  
Al-Foil  
Cu braid  
PUR  
app. 8,7 mm ± 0,3 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 600 MHz  
175,2 Ohm/km max.

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 600 MHz  
175,2 Ohm/km max.

Loop resistance:

## Typical values

frequency	(MHz)	10	16	62,5	100	200	300	600
attenuation	(db/100m)	6,7	8,5	17,4	22,1	31,6	39,2	57,4
next	(db)	78	78	75,5	72,4	67,9	65,2	60,7
ACR	(db)	71,3	69,5	58,1	50,3	36,3	26	3,3

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Copper weight:

app. 95 kg/km  
131 mm  
-30°C  
+70°C  
46,00 kg/km

app. 95 kg/km  
131 mm  
-30°C  
+70°C  
46,00 kg/km

## Norms

Applicable standards:

Acc. to ISO/IEC 11801  
Acc. to EIA/TIA 568-A  
Category 7  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
CMX 75°C (shielded) or AWM 20940 600V

Acc. to ISO/IEC 11801  
Acc. to EIA/TIA 568-A  
Category 7  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
CMX 75°C (shielded) or AWM 20940 600V

UL Style:

## Application

HELUKAT® 600S Category 7 Trailing Cable is designed for use in cable carriers and the recurring loads caused by moving machine components. It provides excellent transmission characteristics under extremely difficult conditions. The Torsion edition has an optimized screen for torsion application which is typical in robotics.

## Part no.

**805614**, SF/FTP 4x2xAWG 24/7 PUR

**805828**, SF/FTP 4x2xAWG 24/7 PUR

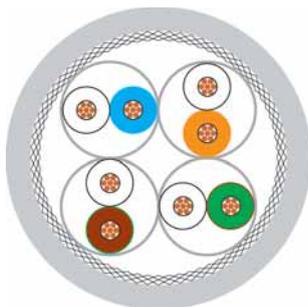
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

SHIPLINE

**HELUKAT®** 600IND

S/FTP, Category 7



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Marine and Offshore

### S/FTP 4x2xAWG 24/7 (stranded) FRNC

Copper, bare (AWG 24/7)  
Foam-skin-PE  
wh/bu, wh/og, wh/gn, wh/bn  
Double core  
-  
Al-Foil  
Cu braid  
-  
FRNC  
app. 9,1 mm ± 0,3 mm  
Grey similar to RAL 7035

## Electrical data

Characteristic impedance:  
  
Loop resistance:  
Mutual capacitance:  
Relative propagation velocity:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 600 MHz  
168 Ohm/km max.  
43 nF/km nom.  
72 %

## Typical values

Frequency (MHz)	10	16	62,5	100	200	600
Attenuation (dB/10m)	0,7	0,8	1,6	2,1	3,1	5,2
Next (db)	90,0	90,0	85,0	81,0	76,0	68,0
ACR (db)	89,3	89,2	83,4	78,9	72,9	62,8

## Technical data

Weight: app. 85 kg/km  
bending radius, repeated: 85 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +75°C  
Caloric load, approx. value: 0,80 MJ/m  
Copper weight: 36,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3, Oil-resistant

## Application

HELUKAT® 600IND Category 7 Shipline is designed specially for use in shipbuilding and exceptionally well-suited for Ethernet applications. It guarantees excellent transmission characteristics and may be used even under the harshest conditions. The cable listed here is certified by **German Lloyd**; this means it is designed for flexible marine and offshore applications.

## Part no.

**803382**, S/FTP 4x2xAWG 24/7 stranded FRNC (S-STP)

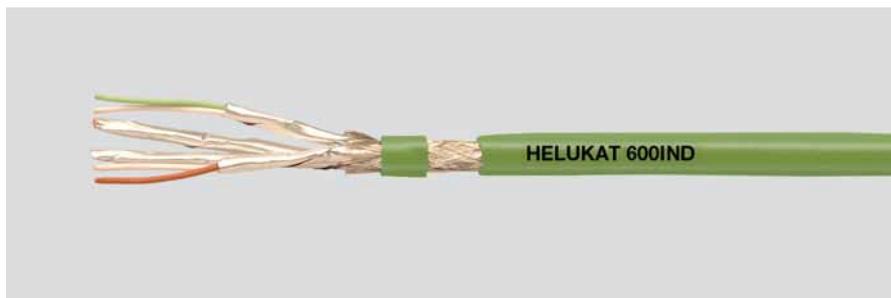
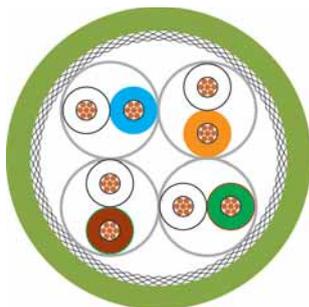
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

ROBUSTFLEX

**HELUKAT®** 600IND

S/FTP, Category 7



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Industrial Patch Cables

### S/FTP 4x2xAWG 26/7 PUR

Copper, bare (AWG 26/7)  
Foam-skin-PE  
wh/bu, wh/og, wh/gn, wh/bn  
Double core  
-  
Al-Foil  
Cu braid  
-  
PUR  
app. 6,4 mm ± 0,3 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 600 MHz

Loop resistance:

290 Ohm/km max.

Mutual capacitance:

42 nF/km nom.

Relative propagation velocity:

64 %

## Typical values

Frequency (MHz)	10	16	62,5	100	200	600
Attenuation (db/100m)	8,4	10,4	20,5	26,2	38	67,8
PS Next (db)	95	95	90	90	85	73
PS ACR (db)	86,6	84,6	69,5	63,8	47,0	5,2

## Technical data

Weight: app. 48 kg/km  
bending radius, repeated: 64 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 0,45 MJ/m  
Copper weight: 28,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-1, Oil-resistant, AWM 20963 (80°C/30V)

## Application

HELUKAT®600IND Category 7 Robustflex is an Ethernet cable that is ideal for harsh industrial surroundings thanks to use of a halogen-free PU outer sheath. This cable is configurable with common RJ45 plugs (industrial and office version), as well as with some Sub-D and M12 plugs.

## Part no.

**802184**, S/FTP 4x2xAWG 26/7 PUR (S-STP)

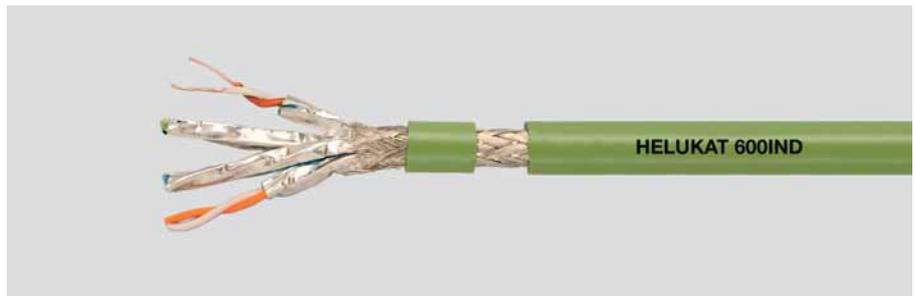
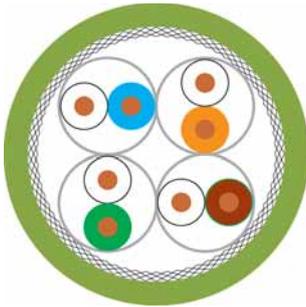
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

10GIG

**HELUKAT®** 500IND

S/FTP, Category 6A



## Cable structure

Inner conductor Ø:	0,64 mm
Conductor material:	Copper, bare
Core insulation:	Foam-skin-PE
Core colours:	whbu/bu, whog/og, whgn/gn, whbn/bn
Separator:	-
Inner sheath material:	-
Screen over stranding element:	Al-Foil
Total shielding:	Cu braid, tinned
Drain wire:	yes
Outer sheath material:	FRNC
Outer diameter:	app. 8,7 mm
Outer sheath colour:	Green similar to RAL 6018

## Electrical data

Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz 100 Ohm ± 20 Ohm at 101 to 500 MHz
Conductor resistance, max.:	59 Ohm/km
Insulation resistance, min.:	5 GOhm x km
Loop resistance:	118 Ohm/km max.
Mutual capacitance:	45 nF/km nom.
Test voltage:	2 kV

## Typical values

Frequency (MHz)	10	16	62,5	100	250	500
Attenuation (db/100m)	5,9	7,5	15,0	19,1	31,1	45,3
Next (dB)	60,3	57,2	48,4	45,3	39,3	34,8
PSNext (dB)	57,3	54,2	45,4	42,3	36,3	31,8

## Technical data

Weight:	app. 103 kg/km
bending radius, repeated:	70 mm
Operating temperature range min.:	-25°C
Operating temperature range max.:	+80°C
Caloric load, approx. value:	1,63 MJ/m
Copper weight:	53,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6A, Flame-retardant acc. to IEC 60332-3, Halogen-free acc. to 60754-1, Corrosiveness acc. to EN50267-2-3, CM 750C (shielded)

## Application

HELUKAT® 500IND was designed specially for extreme industrial applications for fixed installation. The copper data cable is especially well-suited for **Category 6A 10 Gigabit/500MHz (IEC 61156-5)** Ethernet applications. It guarantees excellent transmission characteristics and may be used even under the harshest conditions.

## Part no.

**11007777**, INDUSTRIAL ETHERNET CAT.6A 10GIG

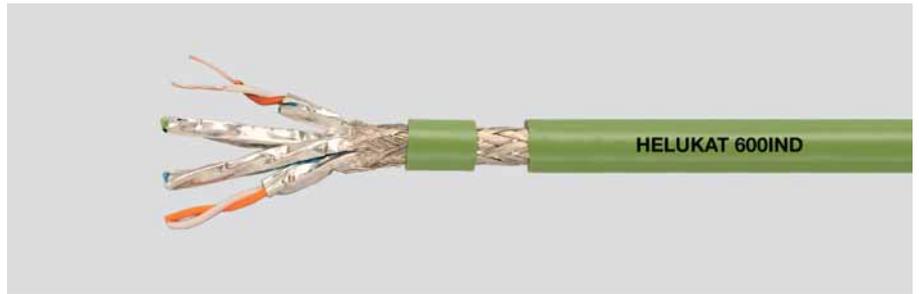
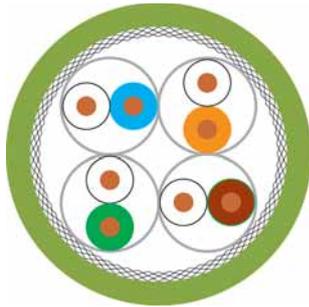
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

10GIG

**HELUKAT® 500IND**

S/FTP, Category 6A



## Cable structure

Inner conductor Ø:	0,64 mm
Conductor material:	Copper, bare
Core insulation:	Foam-skin-PE
Core colours:	whbu/bu, whog/og, whgn/gn, whbn/bn
Separator:	-
Inner sheath material:	-
Screen over stranding element:	Al-Foil
Total shielding:	Cu braid, tinned
Drain wire:	yes
Outer sheath material:	PUR
Outer diameter:	app. 8,7 mm
Outer sheath colour:	Green similar to RAL 6018

## Electrical data

Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz 100 Ohm ± 20 Ohm at 101 to 500 MHz
Conductor resistance, max.:	59 Ohm/km
Insulation resistance, min.:	5 GOhm x km
Loop resistance:	118 Ohm/km max.
Mutual capacitance:	45 nF/km nom.
Test voltage:	2 kV

## Typical values

Frequency (MHz)	10	16	62,5	100	250	500
Attenuation (db/100m)	5,9	7,5	15,0	19,1	31,1	45,3
Next (dB)	60,3	57,2	48,4	45,3	39,3	34,8
PSNext (dB)	57,3	54,2	45,4	42,3	36,3	31,8

## Technical data

Weight:	app. 103 kg/km
bending radius, repeated:	70 mm
Operating temperature range min.:	-40°C
Operating temperature range max.:	+80°C
Caloric load, approx. value:	1,63 MJ/m
Copper weight:	53,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6A, Flame-retardant acc. IEC 60332-2-1, Halogen-free acc. to 60754-1, Corrosiveness acc. to EN50267-2-3, CMX 444

## Application

HELUKAT® 500IND was designed specially for extreme industrial applications for fixed installation. The copper data cable is especially well-suited for **Category 6A 10 Gigabit/500MHz (IEC 61156-5)** Ethernet applications. It guarantees excellent transmission characteristics and may be used even under the harshest conditions.

## Part no.

**11007778**, INDUSTRIAL ETHERNET CAT.6A 10GIG

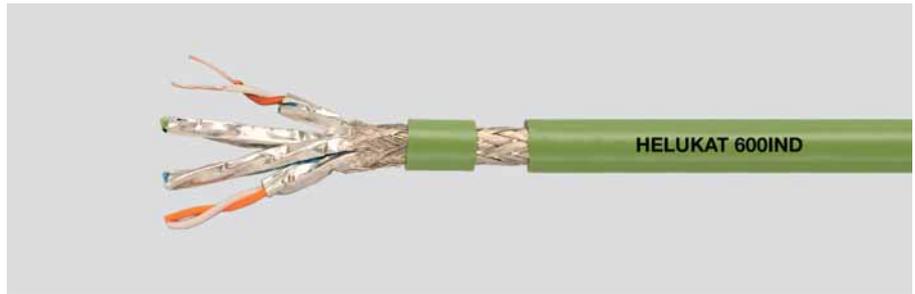
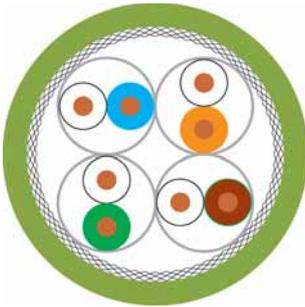
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

10GIG

**HELUKAT® 500IND**

S/FTP, Category 6A



## Cable structure

Inner conductor Ø:	0,64 mm
Conductor material:	Copper, bare
Core insulation:	Foam-skin-PE
Core colours:	whbu/bu, whog/og, whgn/gn, whbn/bn
Separator:	-
Inner sheath material:	-
Screen over stranding element:	Al-Foil
Total shielding:	Cu braid, tinned
Drain wire:	yes
Outer sheath material:	PVC
Outer diameter:	app. 8,7 mm
Outer sheath colour:	Green similar to RAL 6018

## S/FTP 4x2xAWG 22/1 PVC

## Electrical data

Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz 100 Ohm ± 20 Ohm at 101 to 500 MHz
Conductor resistance, max.:	59 Ohm/km
Insulation resistance, min.:	5 GOhm x km
Loop resistance:	118 Ohm/km max.
Mutual capacitance:	45 nF/km nom.
Test voltage:	2 kV

## Typical values

Frequency (MHz)	10	16	62,5	100	250	500
Attenuation (db/100m)	5,9	7,5	15,0	19,1	31,1	45,3
Next (dB)	60,3	57,2	48,4	45,3	39,3	34,8
PSNext (dB)	57,3	54,2	45,4	42,3	36,3	31,8

## Technical data

Weight:	app. 96 kg/km
bending radius, repeated:	70 mm
Operating temperature range min.:	-30°C
Operating temperature range max.:	+80°C
Caloric load, approx. value:	1,63 MJ/m
Copper weight:	53,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6A, Flame-retardant acc. to IEC 60332-3, CMG 75°C FT4 or CL2 or AWM 21694 600V SUN RES

## Application

HELUKAT® 500IND was designed specially for extreme industrial applications for fixed installation. The copper data cable is especially well-suited for **Category 6A 10 Gigabit/500MHz (IEC 61156-5)** Ethernet applications. It guarantees excellent transmission characteristics and may be used even under the harshest conditions.

## Part no.

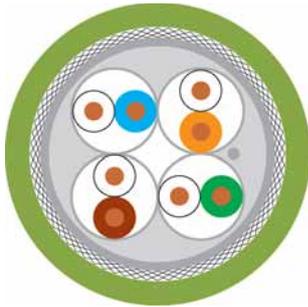
**11007776**, INDUSTRIAL ETHERNET KAT.6A 10GIG PVC

Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

10GIG

**HELUKAT®** 500IND  
CC-Link IE **E**field SF/FTP, Category 6A



## Type Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Drain wire:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Industrial Area S/FTP 4x2xAWG 22/1

Copper, bare (AWG 22/1)  
Foam-skin-PE  
wh/bu, wh/og, wh/gn, wh/bn  
Double core  
-  
FRNC  
Al-Foil  
AL-Foil + braid  
yes  
PVC  
app. 9,6 mm ± 0,3 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Relative propagation velocity:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 500 MHz  
59 Ohm/km  
0,5 GOhm x km  
118 Ohm/km max.  
72 nF/km nom.  
0,7 kV  
62 %

## Typical values

Frequency (MHz)	10	16	62,5	100	250	500
Attenuation (dB/100m)	5,9	7,5	15,0	19,1	31,1	45,3
Next (dB)	60,3	57,2	48,4	45,3	39,3	34,8
PSNext (dB)	57,3	54,2	45,4	42,3	36,3	31,8

## Technical data

Weight: app. 115 kg/km  
bending radius, repeated: 80 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +60°C  
Caloric load, approx. value: 1,63 MJ/m  
Copper weight: 44,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6A, Flame-retardant acc. to IEC 60332-3, CMG FT4

## Application

HELUKAT® 500IND was designed specially for extreme industrial applications for fixed installation. The copper data cable is especially well-suited for **Category 6A 10 Gigabit/500MHz (IEC 61156-5)** Ethernet applications. It guarantees excellent transmission characteristics and may be used even under the harshest conditions.

## Part no.

**803693**, INDUSTRIAL ETHERNET KAT.6A 10GIG PVC

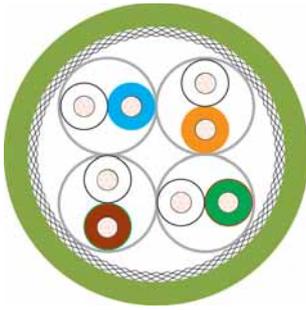
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

PROFInet Drag Chain PVC + PUR

**HELUKAT® 500S**

SF/FTP, Category 6<sub>A</sub>



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Screen over stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Drag chain applications SF/FTP 4x2xAWG 24/7

Copper, tinned (AWG 24/7)  
Foam-skin-PE  
wh/bu, wh/og, wh/gn, wh/bn  
Double core  
Al-Foil  
-  
Al-Foil  
AL-Foil + braid  
PVC  
app. 8,7 mm ± 0,3 mm  
Green similar to RAL 6018

### Drag chain applications SF/FTP 4x2xAWG 24/7

Copper, tinned (AWG 24/7)  
Foam-skin-PE  
wh/bu, wh/og, wh/gn, wh/bn  
Double core  
Al-Foil  
-  
Al-Foil  
AL-Foil + braid  
PUR  
app. 8,7 mm ± 0,3 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 500 MHz

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm at 101 to 500 MHz

Insulation resistance, min.:

Mutual capacitance:

Test voltage:

Relative propagation velocity:

5 GOhm x km  
50 nF/km nom.  
0,7 kV  
67 %

5 GOhm x km  
50 nF/km nom.  
0,7 kV  
67 %

## Typical values

frequency (MHz)	10	16	62,5	100	200	300	500
attenuation (db/100m)	6,8	8,6	17,7	22,1	31,7	39,2	51,5
next (dB)	>80	>80	>80	>80	>80	>80	>70

## Technical data

Weight:

bending radius, repeated:

Operating temperature range min.:

Operating temperature range max.:

Caloric load, approx. value:

Copper weight:

app. 88 kg/km  
135 mm  
-10°C  
+70°C  
1,69 MJ/m  
44,00 kg/km

app. 88 kg/km  
135 mm  
-10°C  
+70°C  
1,69 MJ/m  
44,00 kg/km

## Norms

Applicable standards:

Cat.6A norms acc. EN 50288 up to 500 MHz,  
IEC 61156-5  
Acc. to ISO/IEC 11801  
Acc. to EN 50173  
Acc. to EIA/TIA 568-A  
Category 6<sub>A</sub>  
Flame-retardant CSA FT4

Cat.6A norms acc. EN 50288 up to 500 MHz,  
IEC 61156-5  
Acc. to ISO/IEC 11801  
Acc. to EN 50173  
Acc. to EIA/TIA 568-A  
Category 6<sub>A</sub>  
Halogen-free acc. to 60754-1  
Flame-retardant CSA FT1  
CMX 75°C (shielded) or AWM 21576 1000V  
CSA FT1

UL Style:

CSA standard:

CM 750C (shielded)  
CSA FT 4

## Application

HELUKAT® 500S was designed specially for flexible applications in drag chains in extreme industrial environments. The copper data cable is especially well-suited for Category 6<sub>A</sub> Ethernet applications. It guarantees excellent transmission characteristics and may be used even under the harshest conditions.

The PVC version has UL CM listing; the PUR version UL CMX listing and is additional halogen free

## Part no.

**805704**, INDUSTRIAL ETHERNET KAT.6A  
10GIG PVC

**805703**, INDUSTRIAL ETHERNET KAT.6A  
10GIG PUR

Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

Drag Chain

**HELUKAT® 500S**

SF/FTP, Category 6A



## Cable structure

Inner conductor Ø:	0,55 mm
Conductor material:	Copper, tinned
Core insulation:	Foam-skin-PE
Core colours:	wh/bu, wh/og, wh/gn, wh/bn
Separator:	-
Screen over stranding element:	Al-Foil
Total shielding:	AL-Foil + braid
Outer sheath material:	PUR
Outer diameter:	app. 7,8 mm
Outer sheath colour:	Green similar to RAL 6018

## Electrical data

Characteristic impedance:	100 Ohm ± 15 Ohm at 1 to 100 MHz 100 Ohm ± 20 Ohm at 101 to 500 MHz
Conductor resistance, max.:	140 Ohm/km
Insulation resistance, min.:	5 GOhm x km
Loop resistance:	280 Ohm/km max.
Mutual capacitance:	50 nF/km nom.
Test voltage:	0,7 kV

## Typical values

Frequency (MHz)	10	16	62,5	100	300	500
Attenuation (db/10m)	0,9	1,1	2,3	2,9	5,1	6,8
Next (db)	60,3	57,2	48,4	45,3	38,1	34,8

## Technical data

Weight:	app. 64 kg/km
bending radius, repeated:	117 mm
Operating temperature range min.:	-10°C
Operating temperature range max.:	+70°C
Caloric load, approx. value:	1,35 MJ/m
Copper weight:	34,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6A, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-1, CMX 75°C (shielded) or AWM 21576 1000V

## Application

HELUKAT® 500S trailing cable Category 6A is designed for use in cable carriers and the recurring loads caused by moving machine components. It provides excellent transmission characteristics under extremely difficult conditions.

## Part no.

**805548**, INDUSTRIAL ETHERNET KAT.6A 10GIG PUR

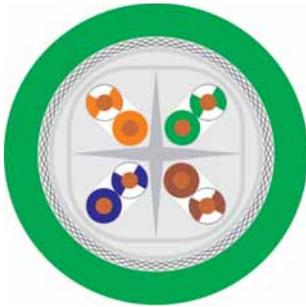
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

PVC CMG

**HELUKAT®** 250IND

SF / UTP, Category 6



## Cable structure

Inner conductor Ø:  
Conductor material:  
Core insulation:  
Core colours:  
Separator:  
Inner sheath material:  
Screen over stranding element:  
Total shielding:  
Outer sheath material:  
Outer diameter:  
Outer sheath colour:

## SF/UTP 4x2xAWG 24/ 1 PVC

0,51 mm  
Copper, bare  
PE  
wh/bu, wh/og, wh/gn, wh/bn  
Polyester foil over stranded bundle  
FRNC  
-  
AL-Foil + braid  
PVC  
app. 8,0 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm bei 101 bis 250 MHz  
Conductor resistance, max.: 95 Ohm/km  
Insulation resistance, min.: 0,5 GOhm x km  
Loop resistance: 190 Ohm/km max.  
Mutual capacitance: 72 nF/km nom.  
Test voltage: 0,7 kV  
Rel. propagation velocity: 62 %

## Typical values

Frequency	(MHz)	10	16	62,5	100	250
attenuation	(db/100m)	6,3	7,9	16,0	20,7	35,0
Next	(dB)	59,3	56,2	47,4	44,3	38,3
PSNext	(dB)	57,3	54,2	45,4	42,3	36,3

## Technical data

Weight: app. 76 kg/km  
bending radius, repeated: 40 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 1,69 MJ/m  
Copper weight: 37,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-3, CMG FT4

## Application

HELUKAT® 250IND was designed specially for extreme industrial applications. The copper data cable is especially well-suited for Ethernet applications Category 6. It guarantees excellent transmission characteristics and may be used even under the harshest conditions.

## Part no.

**805655**, INDUSTRIAL ETHERNET CAT.6

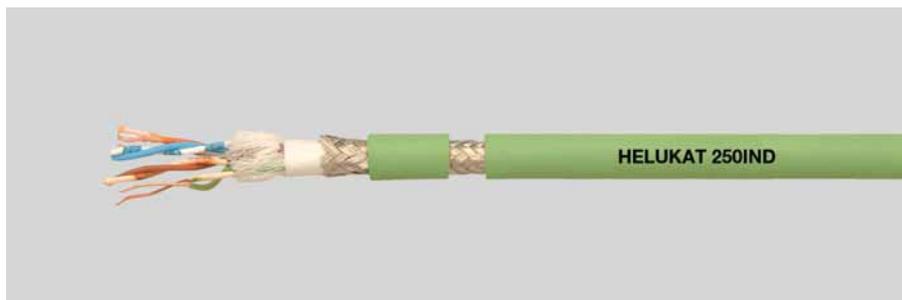
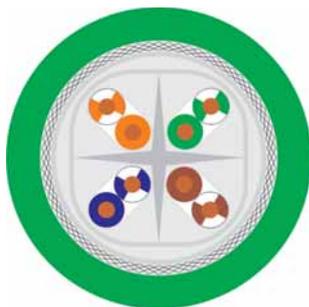
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

PVC AWM

**HELUKAT® 250IND**

SF / UTP, Category 6



## Cable structure

Inner conductor Ø:  
Conductor material:  
Core insulation:  
Core colours:  
Separator:  
Inner sheath material:  
Screen over stranding element:  
Total shielding:  
Outer sheath material:  
Outer diameter:  
Outer sheath colour:

## SF/UTP 4x2xAWG 24/1 PVC

0,52 mm  
Copper, bare  
PE  
wh/bu, wh/og, wh/gn, wh/bn  
-  
FRNC  
-  
AL-Foil + braid  
PVC  
app. 8,0 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm bei 101 bis 250 MHz

Insulation resistance, min.:

0,5 GOhm x km

Mutual capacitance:

72 nF/km nom.

Test voltage:

0,7 kV

Rel. propagation velocity:

62 %

## Typical values

Frequency (MHz)	10	16	62,5	100	250
Attenuation (db/100m)	5,9	7,5	15,0	19,1	31,1
Next (dB)	60,3	57,2	48,4	45,3	39,3
PSNext (dB)	57,3	54,2	45,4	42,3	36,3

## Technical data

Weight: app. 78 kg/km  
bending radius, repeated: 40 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 1,69 MJ/m  
Copper weight: 40,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-3, UL Style 2571

## Application

HELUKAT® 250IND was designed specially for extreme industrial applications. The copper data cable is especially well-suited for Category 6 Ethernet applications. It guarantees excellent transmission characteristics and may be used even under the harshest conditions. This version with PVC jacket is designed specifically for fixed installation under difficult industrial conditions.

## Part no.

**805681**, INDUSTRIAL ETHERNET CAT.6

Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

## Drag Chain PVC

**HELUKAT® 250S**

SF / UTP, Category 6



### Cable structure

Inner conductor Ø:  
Conductor material:  
Core insulation:  
Core colours:  
Separator:  
Inner sheath material:  
Screen over stranding element:  
Total shielding:  
Outer sheath material:  
Outer diameter:  
Outer sheath colour:

### SF/UTP 4x2xAWG 24/7 PVC

0,6 mm  
Copper, bare  
Foam-skin-PE  
whbu/bu, whog/og, whgn/gn, whbn/bn  
Polyester foil over stranded bundle  
FRNC  
-  
AL-Foil + braid  
PVC  
app. 8,0 mm  
Green similar to RAL 6018

### Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm bei 101 bis 250 MHz  
Conductor resistance, max.: 90 Ohm/km  
Insulation resistance, min.: 0,5 GOhm x km  
Loop resistance: 180 Ohm/km max.  
Mutual capacitance: 50 nF/km nom.  
Test voltage: 1,5 kV  
Rel. propagation velocity: 67 %

### Typical values

Frequency (MHz)	10	16	62,5	100	200	250
Attenuation (db/100m)	9,0	11,4	23,2	29,9	43,7	49,5
Next (dB)	59,3	56,2	47,4	44,3	39,8	38,3
PSNext (dB)	57,3	54,2	45,4	42,3	37,8	36,3

### Technical data

Weight: app. 72 kg/km  
bending radius, repeated: 160 mm  
Operating temperature range min.: -5°C  
Operating temperature range max.: +50°C  
Caloric load, approx. value: 1,69 MJ/m  
Copper weight: 39,00 kg/km

### Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-3, CMG FT4

### Application

HELUKAT® 250S was designed specially for extreme industrial applications. The copper data cable is especially well-suited for Category 6 Ethernet applications. It guarantees excellent transmission characteristics and may be used even under the harshest conditions. This version with PVC jacket and stranded conductor is designed specifically for trailing use under difficult industrial conditions.

### Part no.

**805658**, INDUSTRIAL ETHERNET CAT.6

Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

Drag Chain PUR

**HELUKAT® 250S**

SF/UTP, Category 6



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Drag chain applications

### SF/UTP 4x2x0.15 mm<sup>2</sup> (stranded) PUR

Copper, tinned (AWG 26/19)  
PP  
whbu/bu, whog/og, whgn/gn, whbn/bn  
Double core  
-  
FRNC  
-  
AL-Foil + braid  
PUR  
app. 7,8 mm ± 0,2 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
100 Ohm ± 20 Ohm bei 101 bis 250 MHz  
Conductor resistance, max.: 140 Ohm/km  
Insulation resistance, min.: 5 GOhm x km  
Loop resistance: 280 Ohm/km max.  
Mutual capacitance: 50 nF/km nom.  
Test voltage: 0,7 kV  
Relative propagation velocity: 67 %

## Typical values

Frequency (MHz)	10	16	62,5	100	250
Attenuation (db/10m)	0,9	1,2	2,4	2,9	4,9
Next (db)	60,3	57,2	48,4	45,3	39,3
ACR (db)	59,4	56,0	46,0	42,4	34,4

## Technical data

Weight: app. 63 kg/km  
bending radius, repeated: 60 mm  
Operating temperature range min.: -30°C  
Operating temperature range max.: +70°C  
Caloric load, approx. value: 1,35 MJ/m  
Copper weight: 34,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-1, CMX 75°C (shielded) or AWM 21576 1000V

## Application

HELUKAT® 250S trailing cable Category 6 is designed for use in cable carriers and the recurring loads caused by moving machine components. It provides excellent transmission characteristics under extremely difficult conditions.

## Part no.

**803387**, INDUSTRIAL ETHERNET CAT.6

Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

FRNC + PUR

**HELUKAT®** 100IND

SF/UTP, Category 5e



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Fixed installation, indoor SF/UTP 2x2xAWG24/ 1 FRNC

Copper, bare (AWG 24/1)  
Foam-skin-PE  
wsor/or, wsgn/gn  
Double core  
Polyester foil over stranded bundle  
-  
AL-Foil + braid  
FRNC  
app. 5,6 mm ± 0,2 mm  
blau similar to RAL 5021

### Fixed installation, indoor SF/UTP 2x2xAWG24/ 1 PUR

Copper, bare (AWG 24/1)  
Foam-skin-PE  
wsor/or, wsgn/gn  
Double core  
Polyester foil over stranded bundle  
-  
AL-Foil + braid  
PUR  
app. 5,6 mm ± 0,2 mm  
blau similar to RAL 5021

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Nominal voltage:  
Test voltage:  
Relative propagation velocity:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
96 Ohm/km  
5 GOhm x km  
192 Ohm/km max.  
48 nF/km nom.  
300 V  
1 kV  
70 %

100 Ohm ± 15 Ohm at 1 to 100 MHz  
96 Ohm/km  
5 GOhm x km  
192 Ohm/km max.  
48 nF/km nom.  
300 V  
1 kV  
-

## Typical values

frequency (MHz)	10	16	62,5	100
attenuation (dB/100m)	6,3	8,1	16,5	21,4
next (db)	50,3	47,4	38,4	35,3

## Technical data

Weight: app. 45 kg/km app. 53 kg/km  
bending radius, repeated: 84 mm 84 mm  
Operating temperature range min.: -25°C -30°C  
Operating temperature range max.: +80°C +80°C  
Caloric load, approx. value: 0,43 MJ/m -  
Copper weight: 22,00 kg/km 22,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Category 5, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-1

## Application

HELUKAT® 100IND Category 5e FRNC for fixed installation indoor in halogen free and flame retardant edition.  
The PUR version is excellent oil resistant, halogen free and abrasion resistant.

## Part no.

**805699**, INDUSTRIAL ETHERNET CAT.5e

**805700**, INDUSTRIAL ETHERNET CAT.5e

Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

FLEX FRNC + PUR

**HELUKAT®** 100IND

SF/UTP, Category 5e



## Type Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Mobile use SF/UTP 2x2xAWG26/7 (stranded) FRNC

Copper, bare (AWG 26/7)  
Foam-skin-PE  
wsor/or, wsgn/gn  
Double core  
-  
-  
AL-Foil + braid  
FRNC  
app. 5,6 mm ± 0,2 mm  
blau similar to RAL 5021

## Mobile use SF/UTP 2x2xAWG26/7 (stranded) PUR

Copper, bare (AWG 26/7)  
Foam-skin-PE  
wsor/or, wsgn/gn  
Double core  
-  
-  
AL-Foil + braid  
PUR  
app. 5,7 mm ± 0,2 mm  
blau similar to RAL 5021

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Nominal voltage:  
Test voltage:  
Relative propagation velocity:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
142 Ohm/km  
5 GOhm x km  
284 Ohm/km max.  
47 nF/km nom.  
125 V  
0,75 kV  
75 %

100 Ohm ± 15 Ohm at 1 to 100 MHz  
140 Ohm/km  
5 GOhm x km  
280 Ohm/km max.  
50 nF/km nom.  
300 V  
1 kV  
67 %

## Typical values

Frequency (MHz)	10	16	62,5	100
Attenuation (db/100m)	9,5	12,1	24,8	32,0
Next (db)	50,3	47,2	38,4	35,3

## Technical data

Weight: app. 44 kg/km  
bending radius, repeated: 87 mm  
Operating temperature range min.: -10°C  
Operating temperature range max.: +70°C  
Caloric load, approx. value: 0,44 MJ/m  
Copper weight: 19,00 kg/km

app. 45 kg/km  
89 mm  
-30°C  
+70°C  
0,64 MJ/m  
19,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-1

## Application

HELUKAT® 100IND Category 5e FRNC flex is designed for flexible use. Thanks to the FRNC sheath, it also offers halogen free and flame retardent parameters.

The PUR version is excellent oil resistant, halogen free and abrasion resistant and is UL recognized with AWM style 21576 for 1000V/80°C and can be used in drag chain with low performance.

## Part no.

**805701**, INDUSTRIAL ETHERNET CAT.5e

**805702**, INDUSTRIAL ETHERNET CAT.5e

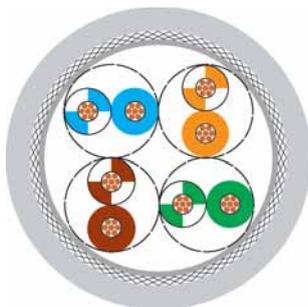
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

ROBUSTFLEX

**HELUKAT®** 200IND

SF/UTP, Category 5e



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Industrial Patch Cables

### SF/UTP 4x2xAWG 26/7 PUR

Copper, bare (AWG 26/7)  
PO  
whbu/bu, whog/og, whgn/gn, whbn/bn  
Double core  
Polyester foil over stranded bundle  
-  
Al-Foil  
Cu braid  
PUR  
app. 5,8 mm  
Grey similar to RAL 7035

## Electrical data

Characteristic impedance:  
  
Loop resistance:  
Mutual capacitance:  
Relative propagation velocity:

100 Ohm  $\pm$  15 Ohm at 1 to 100 MHz  
100 Ohm  $\pm$  20 Ohm at 101 to 200 MHz  
260 Ohm/km max.  
47 nF/km nom.  
74 %

## Typical values

Frequency (MHz)	10	16	62,5	100	200
Attenuation (dB/10m)	0,8	1,1	2,4	2,9	4,3
Next (db)	58,0	56,0	45,0	43,0	37,0
ACR (db)	57,2	54,9	42,6	40,1	32,7

## Technical data

Weight: app. 44 kg/km  
bending radius, repeated: 46 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 0,54 MJ/m  
Copper weight: 24,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-1, Oil-resistant, AWM Style 21576 1000V

## Application

HELUKAT® 200IND Category 5e Robustflex is used in harsh industrial surroundings and characterized by high reserve capacity and outstanding performance. Mechanically, the halogen-free PU outer sheath makes it ideal for harsh industrial surroundings. This cable is configurable with common RJ45 plugs (industrial and office version), as well as with various Sub-D and M12 plugs.

## Part no.

**800068**, SF/UTP 4x2xAWG 26/7 PUR (S-FTP)

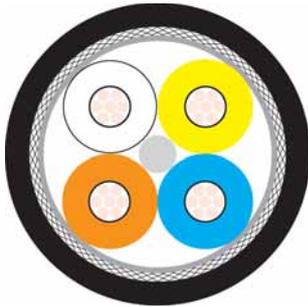
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

WK Industrial 105°C

**HELUKAT®** 100IND

SF/UTP, Category 5e



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Windenergy

### SF/UTP 2x2x0,75 mm (stranded)

Copper, tinned (AWG 22/7)  
XLPE ray cross-linking  
wh, ye, bu, og  
Star quad  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
X-FRNC  
app. 6,5 mm ± 0,2 mm  
Black similar to RAL 9005

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
Conductor resistance, max.: 60 Ohm/km  
Insulation resistance, min.: 0,5 GOhm x km  
Loop resistance: 120 Ohm/km max.  
Mutual capacitance: 57 nF/km nom.  
Test voltage: 2 kV  
Relative propagation velocity: 69 %

## Typical values

Frequency (MHz)	10	16	62,5	100
Attenuation (dB/100m)	6,3	8,0	16,5	21,3
Next (db)	70,0	65,0	55,0	50,0
ACR (db)	63,7	57,0	38,5	28,7

## Technical data

Weight: app. 64 kg/km  
bending radius, repeated: 52 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +105°C \*  
Caloric load, approx. value: 0,89 MJ/m  
Copper weight: 34,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Category 5, Flame-retardant acc. to IEC 60332-3, Halogen-free acc. to 60754-1, Corrosiveness acc. to EN50267-2-3, UL-Style 21281 80°C/300V

## Application

HELUKAT® 100IND Category 5e WK Industrial 105°C is designed specially for demanding temperature requirements such as those encountered in wind turbines. Radiation cross-linking provides improved thermal stability as well as good oil resistance.

## Part no.

**802293**, INDUSTRIAL ETHERNET CAT.5

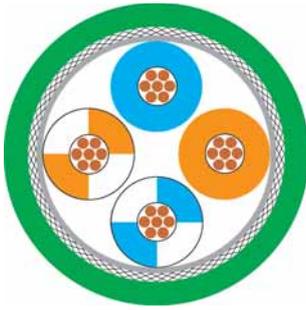
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

DRAG CHAIN ECO

**HELUKAT® 100S**

SF/UTP 4 core, Category 5e



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Drag chain applications

### SF/UTP 4x1x0.15 mm<sup>2</sup> (stranded)

Copper, bare (AWG 26/19)  
PO  
bl, or, whbl, whor  
Star quad  
-  
-  
AL-Foil + braid  
PUR  
app. 4,8 mm ± 0,2 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
Conductor resistance, max.: 125 Ohm/km  
Insulation resistance, min.: 5 GOhm x km  
Loop resistance: 250 Ohm/km max.  
Mutual capacitance: 50 nF/km nom.  
Test voltage: 0,5 kV  
Relative propagation velocity: 67 %

## Typical values

Frequency (MHz)	10	16	62,5	100	155
Attenuation (db/100m)	9,5	12,1	24,8	32,0	41,0
Next (db)	50,0	48,0	38,5	35,3	30,0

## Technical data

Weight: app. 30 kg/km  
bending radius, repeated: 70 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 0,37 MJ/m  
Copper weight: 17,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-1, AWM 20963 (80°C/30V)

## Application

HELUKAT® 100S Category 5e drag chain Eco is designed in use in cable carriers and the recurring loads cause by moving machine components. Thanks to the PU sheath, it also offers excellent resistance to common mineral oils, greases and cooling lubricants.

## Part no.

**82838**, INDUSTRIAL ETHERNET CAT.5e

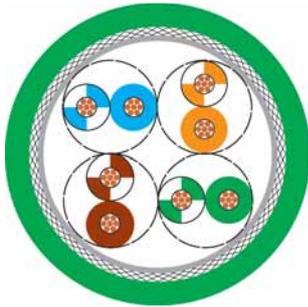
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

Drag Chain ECO 1000V rating

**HELUKAT® 100S**

SF/UTP 4-pair, Category 5e



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Drag chain applications

### SF/UTP 4x2x0.15 mm<sup>2</sup> (stranded)

Copper, bare (AWG 26/19)  
PO  
whbu/bu, whog/og, whgn/gn, whbn/bn  
Double core  
-  
PETP fleece  
AL-Foil + braid  
PUR  
app. 6,6 mm ± 0,2 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
Conductor resistance, max.: 125 Ohm/km  
Insulation resistance, min.: 5 GOhm x km  
Loop resistance: 250 Ohm/km max.  
Mutual capacitance: 50 nF/km nom.  
Test voltage: 0,5 kV  
Relative propagation velocity: 67 %

## Typical values

Frequency (MHz)	10	16	62,5	100	155
Attenuation (db/100m)	9,5	12,1	24,8	32,0	41,0
Next (db)	50,3	47,2	38,4	35,3	30,0

## Technical data

Weight: app. 56 kg/km  
bending radius, repeated: 102 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 0,64 MJ/m  
Copper weight: 31,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-1, AWM Style 21576 80°C 1000V

## Application

HELUKAT® 100S Category 5e drag chain Eco is designed for use in cable carriers and the recurring loads caused by moving machine components. Thanks to the PUR sheath, it also offers excellent resistance to common mineral oils, greases and cooling lubricants.

## Part no.

**11007779**, INDUSTRIAL ETHERNET CAT.5e

Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

Drag chain ECO

**HELUKAT® 100S**

SF/UTP 4-pair, Category 5e



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Drag chain applications

### SF/UTP 4x2x0.15 mm<sup>2</sup> (stranded)

Copper, bare (AWG 26/19)  
PO  
whbu/bu, whog/og, whgn/gn, whbn/bn  
Double core  
-  
PETP fleece  
AL-Foil + braid  
PUR  
app. 6,6 mm ± 0,2 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
Conductor resistance, max.: 125 Ohm/km  
Insulation resistance, min.: 5 GOhm x km  
Loop resistance: 250 Ohm/km max.  
Mutual capacitance: 50 nF/km nom.  
Test voltage: 0,5 kV  
Relative propagation velocity: 67 %

## Typical values

Frequency (MHz)	10	16	62,5	100	155
Attenuation (db/100m)	9,5	12,1	24,8	32,0	41,0
Next (db)	50,3	47,2	38,4	35,3	30,0

## Technical data

Weight: app. 56 kg/km  
bending radius, repeated: 102 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 0,64 MJ/m  
Copper weight: 31,00 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-1, AWM 20963 (80°C/30V)

## Application

HELUKAT® 100S Category 5e drag chain Eco is designed for use in cable carriers and the recurring loads caused by moving machine components. Thanks to the PUR sheath, it also offers excellent resistance to common mineral oils, greases and cooling lubricants.

## Part no.

**82839**, INDUSTRIAL ETHERNET CAT.5e

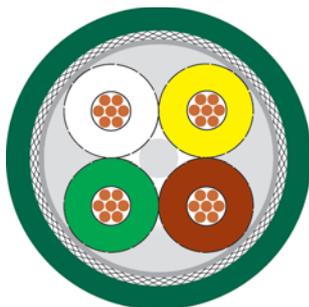
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

## DRAG CHAIN

**HELUKAT® 200S**

SF/UTP 4 core, Category 5



### Type

#### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Drag Chain Patch Cables

#### SF/UTP 4x1xAWG 24/19 (stranded) PUR

Copper, bare (AWG 24/19)  
PP  
wh, ye, br, gn  
Quad  
Polyester foil over stranded bundle  
-  
Al-Foil  
Cu braid  
PUR  
app. 6,2 mm ± 0,2 mm  
Green similar to RAL 6026

### Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
Loop resistance: 156 Ohm/km max.  
Mutual capacitance: 51 nF/km nom.  
Relative propagation velocity: 67 %

### Typical values

Frequency (MHz)	10	16	62,5	100
Attenuation (dB/10m)	0,6	0,8	1,6	2,2
Next (db)	59,0	55,0	43,0	38,0
ACR (db)	58,4	54,2	41,4	35,8

### Technical data

Weight: app. 54 kg/km  
bending radius, repeated: 75 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +70°C  
Caloric load, approx. value: 0,944 MJ/m  
Copper weight: 30,00 kg/km

### Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-1, Oil-resistant

### Application

HELUKAT® 200S Category 5e drag chain is designed for use in cable carriers and the extreme loads caused by moving machine components and provides excellent transmission characteristics under the most difficult and extreme conditions. Thanks to the clever structure, it is also suitable mechanically for use even in cable carriers with a high packing density.

### Part no.

**800088**, SF/UTP 4x1xAWG 24/19 PUR (S-FTP)

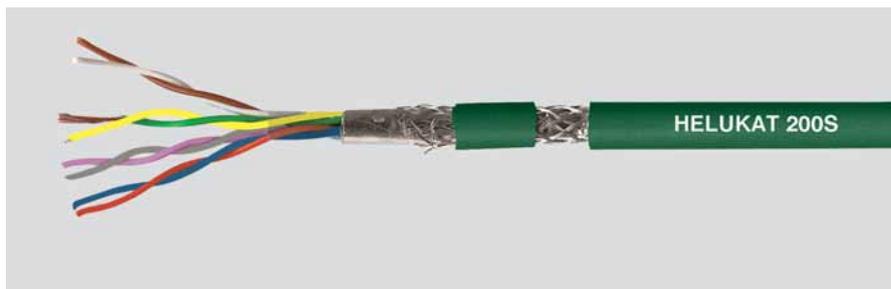
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

## DRAG CHAIN

**HELUKAT® 200S**

SF/UTP 4 pair, Category 5



### Type

#### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Drag Chain Patch Cables

#### SF/UTP 4x2xAWG 24/19 PUR (stranded)

Copper, bare (AWG 24/19)  
PE  
wh/bn, gn/ye, gy/pk, bu/rd  
Double core  
Polyester foil over stranded bundle  
-  
Al-Foil  
Cu braid  
PUR  
app. 9,5 mm ± 0,2 mm  
Green similar to RAL 6026

### Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
Loop resistance: 156 Ohm/km max.  
Mutual capacitance: 51 nF/km nom.  
Relative propagation velocity: 67 %

### Typical values

Frequency	(MHz)	10	16	62,5	100
Attenuation	(dB/10m)	0,7	0,9	1,9	2,5
Next	(db)	57,0	54,0	45,0	43,0
ACR	(db)	56,3	53,1	43,0	40,5

### Technical data

Weight: app. 110 kg/km  
bending radius, repeated: 115 mm  
Operating temperature range min.: -25°C  
Operating temperature range max.: +70°C  
Caloric load, approx. value: 2,08 MJ/m  
Copper weight: 54,30 kg/km

### Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-1, Oil-resistant

### Application

HELUKAT® 200S Category 5e drag chain is designed for use in cable carriers and the extreme loads caused by moving machine components and provides excellent transmission characteristics under the most difficult and extreme conditions. Thanks to the clever structure, it is also suitable mechanically for use even in cable carriers with a high packing density.

### Part no.

**81155**, SF/UTP 4x2xAWG 24/19 PUR (S-FTP)

Dimensions and specifications may be changed without prior notice.



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Torsion Patch Cables

### SF/UTP 4x2xAWG 26/19 (stranded) PUR

Copper, bare (AWG 26/19)  
PP  
wh/bu, wh/og, wh/gn, wh/bn  
Double core  
Polyester foil over stranded bundle  
-  
Polyester foil copper, bare  
Cu braid  
PUR  
app. 7,5 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
Loop resistance: 260 Ohm/km max.  
Mutual capacitance: 50 nF/km nom.  
Relative propagation velocity: 68 %

## Typical values

Frequency (MHz)	10	16	62,5	100
Attenuation (dB/10m)	0,9	1,2	2,4	3,1
Next (db)	56,0	53,0	43,0	40,0
ACR (db)	55,1	51,8	40,6	36,9

## Technical data

Weight: app. 74 kg/km  
bending radius, repeated: 56 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +60°C  
Caloric load, approx. value: 1,234 MJ/m  
Copper weight: 29,50 kg/km

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-1, Oil-resistant, AWM Style 20236 80°C/30V

## Application

HELUKAT® 100T Category 5 Torsionflex is designed for applications with torsion loads, e.g. in robots, and characterized by high reserve capacity and outstanding performance, even after exposure to extreme conditions. Thanks to the clever structure, it is also possible to achieve a long service life mechanically.

## Part no.

**800067**, SF/UTP 4x2xAWG 26/19 PUR (S-FTP)

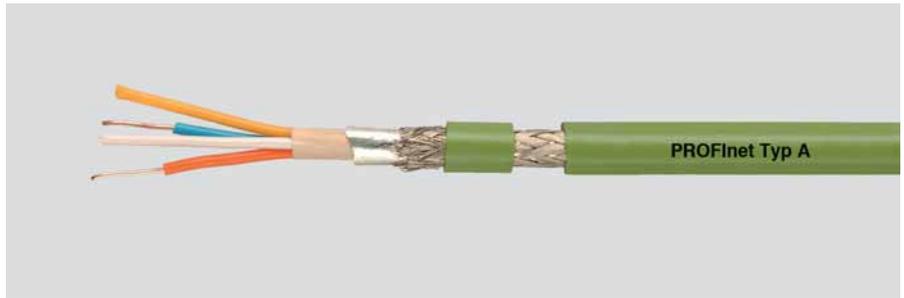
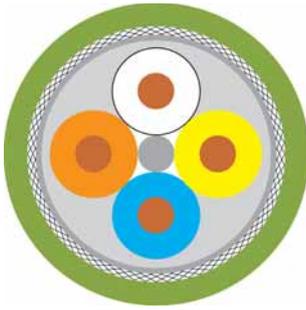
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

PROFINet Type A fixed installed + robust



PVC + PUR



## Type Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, indoor 2x2x0.64 mm

Copper, bare (AWG 22/1)  
PE  
wh, ye, bu, og  
Star quad  
Polyester foil over stranded bundle  
PVC  
Al-Foil  
Cu braid, tinned  
PVC  
app. 6,5 mm ± 0,2 mm  
Green similar to RAL 6018

## Industrial Area 2x2x0.64 mm

Copper, bare (AWG 22/1)  
PE  
wh, ye, bu, og  
Star quad  
Polyester foil over stranded bundle  
PVC  
Al-Foil  
Cu braid, tinned  
PUR  
app. 6,5 mm ± 0,2 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
57,5 Ohm/km  
5 GOhm x km  
115 Ohm/km max.  
48 nF/km nom.  
2 kV

100 Ohm ± 15 Ohm at 1 to 100 MHz  
62,5 Ohm/km  
0,5 GOhm x km  
115 Ohm/km max.  
50 nF/km nom.  
2 kV

## Typical values

		10	16	62,5	100
Frequency	(MHz)				
Attenuation	(dB/100m)	5,2	6,9	15,0	19,5
Next	(db)	70,0	65,0	55,0	50,0
ACR	(db)	64,8	58,1	40,0	30,5

## Technical data

Weight: app. 67 kg/km  
bending radius, repeated: 65 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 0,34 MJ/m  
Copper weight: 32,00 kg/km

app. 64 kg/km  
65 mm  
-40°C  
+70°C  
0,91 MJ/m  
32,00 kg/km

## Norms

Applicable standards:

PROFINet Guideline + IEC 61158-2  
Acc. to ISO/IEC 11801  
Acc. to EN 50173  
Category 5e  
Flame-retardant acc. to IEC 60332-3  
CMG 75°C or PLTC or AWM 21694 600V  
CSA FT 4

PROFINet Guideline + IEC 61158-2  
Acc. to ISO/IEC 11801  
Acc. to EN 50173

Category 5e  
Flame-retardant acc. to IEC 60332-1-2  
-  
-

UL Style:

CSA standard:

## Application

HELUKAT® PROFINet Type A Category 5e for fixed installation in industrial networks, rugged. It guarantees excellent transmission characteristics and may be used even under the harshest conditions. The cable listed here corresponds to PROFINet Type A; this means the version with PVC sheath is designed for normal fixed installations and the version with PUR sheath is for difficult fixed installations in harsh industrial environments.

## Part no.

**800653**, PROFINet type A (SK)

**801194**, PROFINet type A (SK)

Dimensions and specifications may be changed without prior notice.

### Ideal accessory:

RJ45 copper connector  
805401 + 805402  
chapter 4, page 294

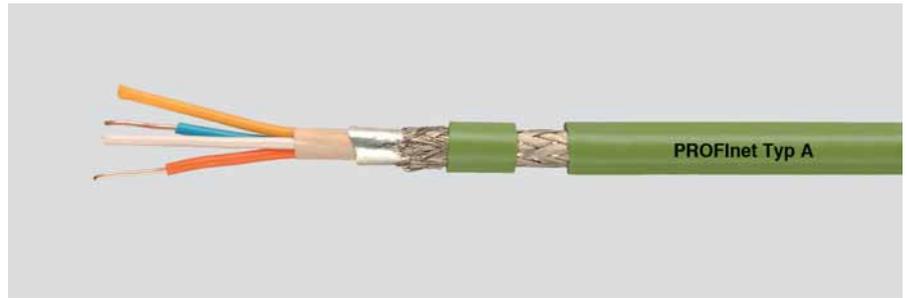


# Industrial Ethernet

PROFINet Type A fixed installed FRNC

**HELUKAT**<sup>®</sup>

FRNC



## Type Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, indoor 2x2x0.64 mm

Copper, bare (AWG 22/1)  
PE  
wh, ye, bu, og  
Star quad  
Polyester foil over stranded bundle  
FRNC  
Al-Foil  
Cu braid, tinned  
FRNC  
app. 6,5 mm ± 0,2 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
Conductor resistance, max.: 57,5 Ohm/km  
Insulation resistance, min.: 5 GOhm x km  
Loop resistance: 115 Ohm/km max.  
Mutual capacitance: 48 nF/km nom.  
Test voltage: 2 kV

## Typical values

Frequency (MHz)	10	16	62,5	100
Attenuation (dB/100m)	5,2	6,9	15,0	19,5
Next (db)	70,0	65,0	55,0	50,0
ACR (db)	64,8	58,1	40,0	30,5

## Technical data

Weight: app. 65 kg/km  
bending radius, repeated: 65 mm  
Operating temperature range min.: -25°C  
Operating temperature range max.: +75°C  
Caloric load, approx. value: 0,34 MJ/m  
Copper weight: 32,00 kg/km

## Norms

Applicable standards: PROFINet Guideline + IEC 61158-2  
Acc. to ISO/IEC 11801  
Acc. to EN 50173  
Category 5e  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-3  
Corrosiveness acc. to EN50267-2-3  
Low-smoke acc. to EN50268-2  
CMG 75°C or PLTC or AWM 21279 600V  
CSA FT 4

UL Style:  
CSA standard:

## Application

HELUKAT<sup>®</sup> PROFINet Type A FRNC Category 5e for fixed installation in industrial networks, rugged. It guarantees excellent transmission characteristics and may be used even under the harshest conditions. The cable listed here corresponds to PROFINet Type A in halogen free and flame retardent design.

## Part no.

**805653**, PROFINet type A (SK)

Dimensions and specifications may be changed without prior notice.

### Ideal accessory:

RJ45 copper connector  
805401 + 805402  
chapter 4, page 294

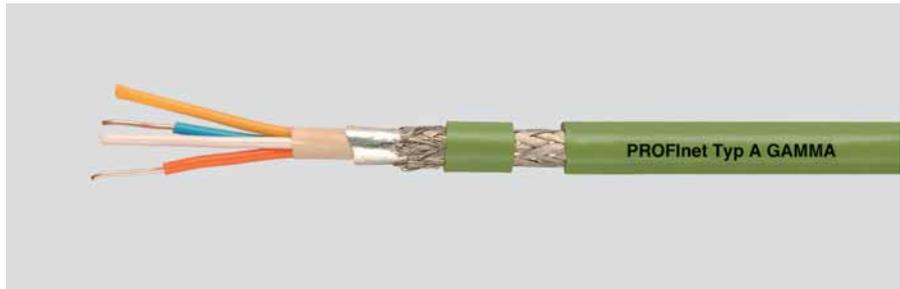
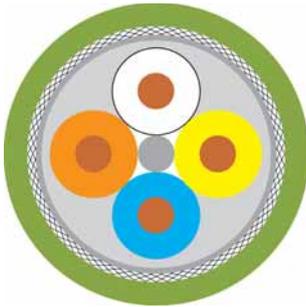


# Industrial Ethernet

PROFNet Type A radiation resistant + armoured

**HELUKAT**<sup>®</sup>

PUR + PE



## Type Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Armouring:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## ray loaded areas 2x2x0.64 mm

Copper, bare (AWG 22/1)  
XLPE ray cross-linking  
wh, ye, bu, og  
Star quad  
Polyester foil over stranded bundle  
TPR ray cross-linking  
Al-Foil  
Cu braid, tinned  
-  
PUR  
app. 6,5 mm ± 0,2 mm  
Green similar to RAL 6018

## Fixed installation, outdoor 2x2x0.64 mm

Copper, bare (AWG 22/1)  
PE  
wh, ye, bu, og  
Star quad  
Polyester foil over stranded bundle  
PVC  
Al-Foil  
Cu braid, tinned  
Steel band  
PE  
app. 9,3 mm ± 0,5 mm  
Black

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
62 Ohm/km  
0,5 GOhm x km  
124 Ohm/km max.  
50 nF/km nom.  
2 kV

100 Ohm ± 15 Ohm at 1 to 100 MHz  
57,5 Ohm/km  
0,5 GOhm x km  
115 Ohm/km max.  
50 nF/km nom.  
2 kV

## Typical values

Frequency (MHz)	10	16	62,5	100
Attenuation (dB/100m)	5,2	6,9	15,0	19,5
Next (db)	70,0	65,0	55,0	50,0
ACR (db)	64,8	58,1	40,0	30,5

## Technical data

Weight: app. 63 kg/km  
bending radius, repeated: 100 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 0,29 MJ/m  
Copper weight: 32,00 kg/km

app. 124 kg/km  
100 mm  
-40°C  
+70°C  
2,14 MJ/m  
31,00 kg/km

## Norms

Applicable standards: PROFNet Guideline + IEC 61158-2  
Acc. to ISO/IEC 11801  
Acc. to EN 50173  
Category 5e

PROFNet Guideline + IEC 61158-2  
Acc. to ISO/IEC 11801  
Acc. to EN 50173  
Category 5e

## Application

HELUKAT<sup>®</sup> PROFNet Type A Cat 5e is radiation-resistant + armoured for fixed installation in industrial networks. It guarantees excellent transmission characteristics and may be used even under the harshest conditions. The cables listed here correspond to PROFNet Type A and thanks to their special construction with cross-linked PVC-inner sheath/PUR outer sheath are well-suited for fixed applications inside irradiated areas, while the armoured type with PVC inner sheath/PE outer sheath is ideal for areas with rodent problems.

## Part no.

**801195**, PROFNet type A (SK)

**801650**, PROFNet type A (SK)

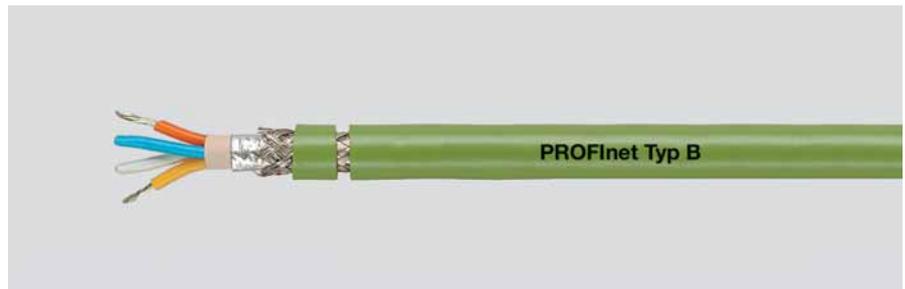
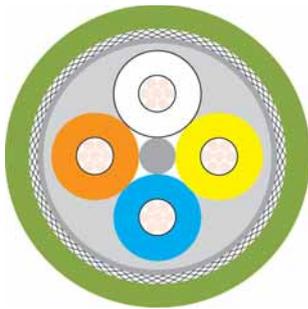
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

## PROFINet Type B flexible



PVC + FRNC



### Type Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Mobile use 2x2x0,75 mm (stranded)

Copper, tinned (AWG 22/7)  
PE  
wh, ye, bu, og  
Star quad  
Polyester foil over stranded bundle  
PVC  
Al-Foil  
Cu braid, tinned  
PVC  
app. 6,5 mm ± 0,2 mm  
Green similar to RAL 6018

### Mobile use 2x2x0,75 mm (stranded)

Copper, tinned (AWG 22/7)  
PE  
wh, ye, bu, og  
Star quad  
Polyester foil over stranded bundle  
FRNC  
Al-Foil  
Cu braid, tinned  
FRNC  
app. 6,5 mm ± 0,2 mm  
Green similar to RAL 6018

### Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
Conductor resistance, max.: 57,5 Ohm/km  
Insulation resistance, min.: 0,5 GOhm x km  
Loop resistance: 115 Ohm/km max.  
Mutual capacitance: 48 nF/km nom.  
Test voltage: 2 kV  
Relative propagation velocity: 65 %

100 Ohm ± 15 Ohm at 1 to 100 MHz  
60 Ohm/km  
0,5 GOhm x km  
120 Ohm/km max.  
52 nF/km nom.  
2 kV  
-

### Typical values

Frequency (MHz)	10	16	62,5	100
Attenuation (dB/100m)	6,3	8,0	16,5	21,3
Next (db)	70,0	65,0	55,0	50,0
ACR (db)	64,0	57,4	39,0	29,0

### Technical data

Weight: app. 67 kg/km  
bending radius, repeated: 100 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 0,32 MJ/m  
Copper weight: 32,00 kg/km

app. 65 kg/km  
100 mm  
-25°C  
+75°C  
0,32 MJ/m  
32,00 kg/km

### Norms

Applicable standards:  
PROFINet Guideline + IEC 61158-2  
Acc. to ISO/IEC 11801  
Acc. to EN 50173  
Category 5e  
Flame-retardant acc. to IEC 60332-3

PROFINet Guideline + IEC 61158-2  
Acc. to ISO/IEC 11801  
Acc. to EN 50173  
Category 5e  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-3  
Corrosiveness acc. to EN50267-2-3  
Low-smoke acc. to EN50268-2  
CMG 75°C or PLTC or AWM 21279 600V  
CSA FT 4

UL Style:

CSA standard:

CMG 75°C or PLTC or AWM 21694 600V  
CSA FT 4

### Application

HELUKAT® PROFInet Type B (flexible) Cat.5e for use on moving parts. The cables listed here correspond to the PROFInet classifications Type B for moving cables and are designed to withstand mechanical loads. The version PVC is the standard cable; the FRNC version is used for halogen free requirements.

### Part no.

**800654**, PROFInet type B (SK)

**805654**, PROFInet type B (SK)

Dimensions and specifications may be changed without prior notice.

#### Ideal accessory:

RJ45 copper connector  
805401 + 805402  
chapter 4, page 294

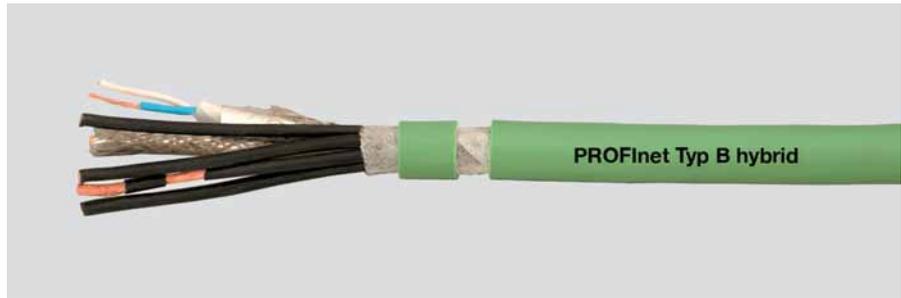


# Industrial Ethernet

## PROFINet Type B flexible hybrid

**HELUKAT**<sup>®</sup>

FRNC



### Type

#### Cable structure

Inner conductor diameter 1:  
Inner conductor diameter 2:  
Core insulation 1:  
Core insulation 2:  
Core colours 1:  
Core colours 2:  
Stranding element 1:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Mobile use

#### 2x2x0,75 mm (stranded)+ 4x1,5qmm

Copper, bare (AWG 22/7)  
Copper, bare (AWG 16/84)  
Foam-skin-PE  
PO  
wh, ye, bu, og  
Black  
Double core  
Polyester foil over stranded bundle  
AL-Foil + braid  
Polyester foil  
FRNC  
app. 10,3 mm ± 0,3 mm  
Green similar to RAL 6018

### Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
60 Ohm/km  
0,5 GOhm x km  
120 Ohm/km max.  
52 nF/km nom.  
2 kV

### Typical values

Frequency	(MHz)	10	16	62,5	100
Attenuation	(dB/100m)	6,3	8,0	16,5	21,3
Next	(db)	50,3	47,2	38,4	35,3
ACR	(db)	43,7	39,0	21,5	13,7

### Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 153 kg/km  
103 mm  
-40°C  
+70°C  
1,50 MJ/m  
94,00 kg/km

### Norms

Applicable standards:

PROFINet Guideline + IEC 61158-2  
Acc. to ISO/IEC 11801  
Acc. to EN 50173  
Category 5e  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
Corrosiveness acc. to EN50267-2-3  
Low-smoke acc. to EN50268-2  
UL Style:

### Application

HELUKAT<sup>®</sup> PROFINet Type B Category 5e hybrid for flexible applications. The cable listed here corresponds to PROFINet Type B with integrated power supply in a cable with halogen-free and flame-retardent construction.

### Part no.

**801651**, PROFINet type B (SK)

Dimensions and specifications may be changed without prior notice.

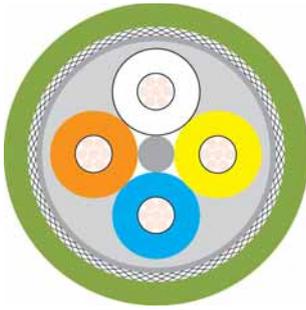


# Industrial Ethernet

PROFInet Type C high flexible

**HELUKAT**<sup>®</sup>

PVC + PUR



## Type Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Drag chain applications 2x2x0.75 mm (stranded)

Copper, tinned (AWG 22/7)  
PE  
wh, ye, bu, og  
Star quad  
Polyester foil over stranded bundle  
PVC  
Al-Foil  
Cu braid, tinned  
PVC  
app. 6,5 mm ± 0,2 mm  
Green similar to RAL 6018

## Drag chain applications 2x2x0.75 mm (stranded)

Copper, tinned (AWG 22/7)  
PE  
wh, ye, bu, og  
Star quad  
Polyester foil over stranded bundle  
FRNC  
Al-Foil  
Cu braid, tinned  
PUR  
app. 6,5 mm ± 0,2 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
60 Ohm/km  
0,5 GOhm x km  
120 Ohm/km max.  
52 nF/km nom.  
1,5 kV

100 Ohm ± 15 Ohm at 1 to 100 MHz  
60 Ohm/km  
0,5 GOhm x km  
120 Ohm/km max.  
52 nF/km nom.  
1,5 kV

## Typical values

		10	16	62,5	100
Frequency	(MHz)				
Attenuation	(dB/100m)	6,3	8,0	16,5	21,3
Next	(db)	70,0	65,0	55,0	50,0
ACR	(db)	64,0	57,4	39,0	29,0

## Technical data

Weight: app. 68 kg/km  
bending radius, repeated: 55 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +70°C  
Caloric load, approx. value: 0,85 MJ/m  
Copper weight: 32,00 kg/km

app. 61 kg/km  
55 mm  
-30°C  
+75°C  
0,85 MJ/m  
32,00 kg/km

## Norms

Applicable standards:

PROFInet Guideline + IEC 61158-2  
Acc. to ISO/IEC 11801  
Acc. to EN 50173  
Category 5e  
Flame-retardant acc. to IEC 60332-3

PROFInet Guideline + IEC 61158-2  
Acc. to ISO/IEC 11801  
Acc. to EN 50173  
Category 5e

UL Style:  
CSA standard:

CMG 75°C or PLTC or AWM 21694 600V  
CSA FT 4

Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
CMX 75°C (shielded)  
-

## Application

HELUKAT<sup>®</sup> PROFInet Type C PVC (highly flexible) Category 5e for use on moving parts and in cable carriers. The cable listed here correspond to the PROFInet classifications Type C for moving cables and are designed to withstand mechanical loads. Thanks to the flame retardant jacket the PVC cable has UL CMG PLTC FT4 AWM 600V approval. The PUR version has UL CMX listing and offers higher values in chain and chemical resistance.

## Part no.

**802914**, PROFInet type C (SK)

**800655**, PROFInet type C (SK)

Dimensions and specifications may be changed without prior notice.

### Ideal accessory:

RJ45 copper connector  
805401 + 805402  
chapter 4, page 294



# Industrial Ethernet

IE Torsion

**HELUKAT**<sup>®</sup>

PUR



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Torsional applications

### 2x2x0,75 mm (stranded)

Copper, tinned (AWG 22/19)  
Foam-skin-PE  
wh, ye, bu, og  
Star quad  
Polyester foil over stranded bundle  
Cu braid, tinned  
PUR  
app. 6,5 mm ± 0,2 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
Conductor resistance, max.: 60 Ohm/km  
Insulation resistance, min.: 0,5 GOhm x km  
Loop resistance: 120 Ohm/km max.  
Mutual capacitance: 52 nF/km nom.  
Test voltage: 0,7 kV

## Typical values

Frequency (MHz)	10	16	62,5	100
Attenuation (db/100m)	7,6	10,0	26,5	41,0
ELFEXT (db)	43,8	39,7	24,0	20,0

## Technical data

Weight: app. 54 kg/km  
bending radius, repeated: 70 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 0,45 MJ/m  
Copper weight: 32,00 kg/km

## Norms

Category 5e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-1, AWM Style 21161 80°C

## Application

HELUKAT<sup>®</sup> INDUSTRIAL ETHERNET Category 5e TORSION offers excellent transmission characteristics and is designed for applications with torsion loads, e.g. in robots. The cable listed here corresponds to the classification for continuous movement.

## Part no.

**802186**, INDUSTRIAL ETHERNET CAT.5e

Dimensions and specifications may be changed without prior notice.

### Ideal accessory:

RJ45 copper connector  
805401 + 805402  
chapter 4, page 294



# Industrial Ethernet

PROFINet Typ R Torsion

**HELUKAT**<sup>®</sup>

PUR



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Stranding element:  
Separator:  
Shielding 1:  
Screen 1 over stranding:  
Screen 2 over stranding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Industrial Patch Cables

### 2x2x0,74mm

Copper, tinned (AWG 22/19)  
PO  
Quad  
Polyester foil over stranded bundle  
-  
Al-Foil  
Cu braid  
PUR  
app. 6,5 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance:  
Loop resistance:  
Mutual capacitance:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
60 Ohm/km max.  
52 nF/km nom.

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Copper weight:

app. 60 kg/km  
75 mm  
-40°C  
+80°C  
32,00 kg/km

## Norms

Applicable standards:

Acc. to ISO/IEC 11801  
Acc. to EN 50173  
Acc. to EIA/TIA 568-A  
Category 5e  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
AWM Style 21576 1000V

UL Style:

## Application

HELUKAT<sup>®</sup> PROFInet Type R Category 5e TORSION offers excellent transmission characteristics with double shielding and is designed for applications with torsion loads, e.g. in robots. The cable listed here corresponds to the classification for continuous movement.

## Part no.

**806740**

Dimensions and specifications may be changed without prior notice.

### Ideal accessory:

RJ45 copper connector  
805401 + 805402  
chapter 4, page 294



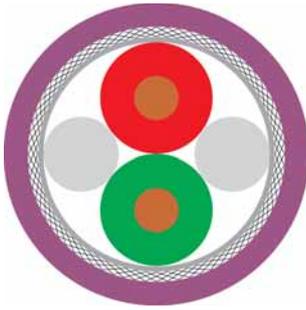


# BUS Cables

## Profibus L2 indoor



PVC



### Type

#### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

#### Fixed installation, indoor 1x2x0.64 mm

Copper, bare (AWG 22/1)  
Foam-skin-PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
PVC  
app. 7,8 mm ± 0,2 mm  
Grey similar to RAL 7001

#### Fixed installation, indoor 1x2x0.64 mm

Copper, bare (AWG 22/1)  
Foam-skin-PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
PVC  
app. 7,8 mm ± 0,2 mm  
Violet similar to RAL 4001

### Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Attenuation:

150 Ohm ± 10 %  
55 Ohm/km  
5 GOhm x km  
110 Ohm/km max.  
30 nF/km nom.  
1,5 kV  
9,6 kHz < 2,5 dB/km  
38,4 kHz < 4,0 dB/km  
4 MHz < 22,0 dB/km  
16 MHz < 42,0 dB/km

150 Ohm ± 10 %  
55 Ohm/km  
5 GOhm x km  
110 Ohm/km max.  
30 nF/km nom.  
1,5 kV  
9,6 kHz < 2,5 dB/km  
38,4 kHz < 4,0 dB/km  
4 MHz < 22,0 dB/km  
16 MHz < 42,0 dB/km

### Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 69 kg/km  
120 mm  
-40°C  
+70°C  
0,99 MJ/m  
24,00 kg/km

app. 69 kg/km  
120 mm  
-40°C  
+70°C  
0,99 MJ/m  
24,00 kg/km

### Norms

Applicable standards:

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. to IEC 60332-1-2  
CMX 75°C (shielded)  
CSA FT1

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. to IEC 60332-1-2  
CMX 75°C (shielded)  
CSA FT1

### Application

HELUKABEL® Profibus L2 Indoor is designed for fixed indoor installation in Profibus industrial networks. Depending on the application, the colour grey (special colour) or violet (standard colour) is available. Otherwise, the technical characteristics of the two products are identical.

### Part no.

**80384**, Profibus L2

**81448**, Profibus L2

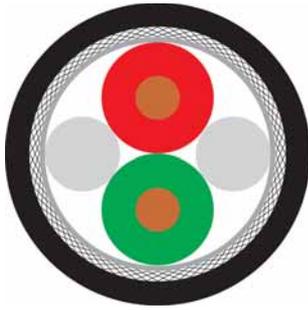
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# BUS Cables

PROFIBUS L2 Outdoor + Industry

**HELUKABEL®**

PE + PUR



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, outdoor

### 1x2x0.64 mm

Copper, bare (AWG 22/1)  
Foam-skin-PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
PE  
app. 8,0 mm ± 0,4 mm  
Black similar to RAL 9005

## Industrial Area

### 1x2x0.64 mm

Copper, bare (AWG 22/1)  
Foam-skin-PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
PUR  
app. 8,0 mm ± 0,4 mm  
Petrol similar to RAL 5018

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Attenuation:

150 Ohm ± 10 %  
55 Ohm/km  
1 GOhm x km  
110 Ohm/km max.  
30 nF/km nom.  
1,5 kV  
9,6 kHz < 2,5 dB/km  
38,4 kHz < 4,0 dB/km  
4 MHz < 22,0 dB/km  
16 MHz < 42,0 dB/km

150 Ohm ± 10 %  
55 Ohm/km  
1 GOhm x km  
110 Ohm/km max.  
30 nF/km nom.  
1,5 kV  
9,6 kHz < 2,5 dB/km  
38,4 kHz < 4,0 dB/km  
4 MHz < 22,0 dB/km  
16 MHz < 42,0 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 64 kg/km  
120 mm  
-40°C  
+70°C  
2,26 MJ/m  
24,00 kg/km

app. 67 kg/km  
120 mm  
-40°C  
+70°C  
1,52 MJ/m  
24,00 kg/km

## Norms

Applicable standards:

Profibus acc. to DIN 19245 T3 and EN50170  
Halogen-free acc. to 60754-1

Profibus acc. to DIN 19245 T3 and EN50170  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2

## Application

HELUKABEL® Profibus L2 Outdoor + Industry are special cables for use in Profibus industrial networks. The Outdoor version is designed for use in open-air environments, i.e. can withstand wind, weather and sun (not for burial directly in the ground). The Industry version is used in fixed installation applications in harsh industrial environment. Mechanically, this product exhibits excellent resistance to mineral oils, greases and cooling lubricants and has good microbe and hydrolysis resistance.

## Part no.

**80792**, Profibus L2

**81186**, Profibus L2

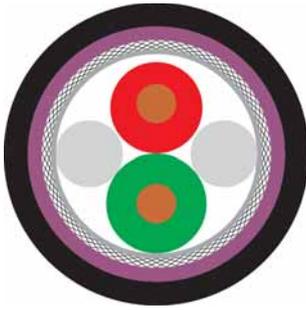
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# BUS Cables

## Profibus L2 direct Burial without + with Armouring



PE



### Type Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Armouring:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Direct burial 1x2x0.64 mm

Copper, bare (AWG 22/1)  
Foam-skin-PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
PVC  
Al-Foil  
Cu braid, tinned  
-  
PE  
app. 10,0 mm ± 0,2 mm  
Black similar to RAL 9005

### Direct burial 1x2x0.64 mm

Copper, bare (AWG 22/1)  
Cell PE  
rd, gn  
2 cores + 2 fillers stranded together  
-  
PVC  
Al-Foil  
Cu braid, tinned  
Steel band  
PE  
app. 10,6 mm ± 0,5 mm  
Black similar to RAL 9005

### Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Nominal voltage:  
Test voltage:  
Attenuation:

150 Ohm ± 10 %  
55 Ohm/km  
1 GOhm x km  
110 Ohm/km max.  
30 nF/km nom.  
-  
1,5 kV  
9,6 kHz < 2,5 dB/km  
38,4 kHz < 4,0 dB/km  
3 MHz < 22,0 dB/km  
20 MHz < 42,0 dB/km

150 Ohm ± 10 %  
55 Ohm/km  
5 GOhm x km  
110 Ohm/km max.  
30 nF/km nom.  
250 V  
1,5 kV  
9,6 kHz < 2,5 dB/km  
38,4 kHz < 4,0 dB/km  
4 MHz < 22,0 dB/km  
16 MHz < 42,0 dB/km

### Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 92 kg/km  
150 mm  
-40°C  
+80°C  
2,657 MJ/m  
24,00 kg/km

app. 132 kg/km  
165 mm  
-40°C  
+80°C  
2,40 MJ/m  
24,00 kg/km

### Norms

Applicable standards:

Profibus acc. to DIN 19245 T3 and EN50170

Profibus acc. to DIN 19245 T3 and EN50170

### Application

HELUKABEL® Profibus L2 Direct Burial cables without + with armouring are special cables in the Profibus industrial networks. The version without armouring is for normal and direct cable burial in the ground. The version with steel tape armouring offers additional protection against rodents and is the right choice for regions with such animals.

### Part no.

**82824**, Profibus ERD

**802177**, Profibus L2

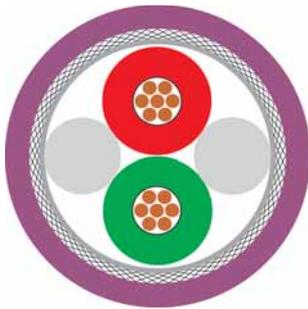
Dimensions and specifications may be changed without prior notice.

# BUS Cables

## Profibus L2 7-wire

**HELUKABEL®**

PVC



### Type

#### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Mobile use

#### 1x2x0.64 mm (stranded)

Copper, bare (AWG 24/7)  
Foam-skin-PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
PVC  
app. 7,8 mm ± 0,3 mm  
Violet similar to RAL 4001

### Electrical data

Characteristic impedance: 150 Ohm ± 10 %  
Conductor resistance, max.: 80 Ohm/km  
Insulation resistance, min.: 2 GOhm x km  
Loop resistance: 160 Ohm/km max.  
Mutual capacitance: 30 nF/km nom.  
Test voltage: 1,5 kV  
Attenuation: 9,6 kHz < 2,9 dB/km  
38,4 kHz < 4,6 dB/km  
4 MHz < 25,0 dB/km  
16 MHz < 49,0 dB/km

### Technical data

Weight: app. 70 kg/km  
bending radius, repeated: 94 mm  
Operating temperature range min.: -30°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 1,20 MJ/m  
Copper weight: 24,00 kg/km

### Norms

Applicable standards: Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. IEC 60332-2-1  
UL Style: UL Style 2571

### Application

HELUKABEL® Profibus L2 7-wire for mobile applications in Profibus industrial networks. With its core design and the special PVC sheath, the type described here is suitable for normal mobile applications.

### Part no.

**800648**, Profibus L2

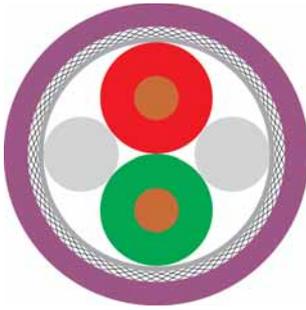
Dimensions and specifications may be changed without prior notice.

# BUS Cables

Profibus fixed installed High Temperature +105°C or +200°C

**HELUKABEL®**

PVC + FRNC PH120



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, indoor

### 1x2x0.64 mm

Copper, bare (AWG 22/1)  
Foam-skin-PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
PVC  
app. 7,8 mm ± 0,2 mm  
Violet similar to RAL 4001

## High temperature areas

### 1x2xAWG23/1

Copper, bare (AWG 23/1)  
Rubber compound  
rd, gn  
2 cores + 2 fillers stranded together  
-  
-  
AL-Foil + braid  
FRNC  
app. 8,3 mm ± 0,3 mm  
Black similar to RAL 9005

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Attenuation:

150 Ohm ± 10 %  
55 Ohm/km  
5 GOhm x km  
110 Ohm/km max.  
30 nF/km nom.  
1,5 kV  
Frequency at +20°C  
9,6 kHz < 3,0 dB/km  
38,4 kHz < 5,0 dB/km  
4 MHz < 22,0 dB/km  
16 MHz < 42,0 dB/km

150 Ohm ± 10 %  
74,5 Ohm/km  
2 GOhm x km  
149 Ohm/km max.  
36 nF/km nom.  
1,5 kV  
Frequency at +20°C at +200°C  
9,6 kHz < 3,0 dB/km < 8,0 dB/km  
38,4 kHz < 5,0 dB/km < 12,0 dB/km  
4 MHz < 22,0 dB/km < 41,0 dB/km  
16 MHz < 42,0 dB/km < 90,0 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 69 kg/km  
120 mm  
-40°C  
+105°C  
0,99 MJ/m  
24,00 kg/km

app. 88 kg/km  
130 mm  
-50°C  
+200°C  
1,46 MJ/m  
28,00 kg/km

## Norms

Applicable standards:

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. to IEC 60332-1-2

Profibus acc. to DIN 19245 T3 and EN50170  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2

## Application

HELUKABEL® Profibus L2 105°C is for fixed installation indoor and enhanced temperature resistance.

The version Profibus L2 SR 200°C Fire Resistant has additional circuit integrity for 120 minutes (EN50200 PH120) and the temperature range up to +200°C for fix indoor installation.

## Part no.

**805705**, Profibus high temperature

**805706**, Profibus high temperature with circuit integrity

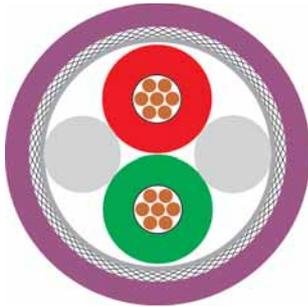
Dimensions and specifications may be changed without prior notice.

# BUS Cables

## Profibus L2 drag Chain



PUR



### Type

#### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

#### Drag chain applications 1x2x0.65 mm (stranded)

Copper, bare (AWG 24/19)  
Foam-skin-PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
PUR  
app. 8,0 mm ± 0,4 mm  
Violet similar to RAL 4001

#### Drag chain applications 1x2x0.65 mm (stranded)

Copper, bare (AWG 24/19)  
Foam-skin-PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
PUR  
app. 8,0 mm ± 0,4 mm  
Petrol similar to RAL 5018

### Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Attenuation:

150 Ohm ± 10 %  
80 Ohm/km  
5 GOhm x km  
160 Ohm/km max.  
30 nF/km nom.  
1,5 kV  
9,6 kHz < 3,0 dB/km  
38,4 kHz < 5,0 dB/km  
4 MHz < 25,0 dB/km  
16 MHz < 52,0 dB/km

150 Ohm ± 10 %  
80 Ohm/km  
5 GOhm x km  
160 Ohm/km max.  
30 nF/km nom.  
1,5 kV  
9,6 kHz < 3,0 dB/km  
38,4 kHz < 5,0 dB/km  
4 MHz < 25,0 dB/km  
16 MHz < 52,0 dB/km

### Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 70 kg/km  
80 mm  
-30°C  
+70°C  
1,24 MJ/m  
25,00 kg/km

app. 70 kg/km  
80 mm  
-30°C  
+70°C  
1,24 MJ/m  
25,00 kg/km

### Norms

Applicable standards:

Profibus acc. to DIN 19245 T3 and EN50170  
Halogen-free acc. to 60754-1

Profibus acc. to DIN 19245 T3 and EN50170  
Halogen-free acc. to 60754-1

### Application

HELUKABEL® Profibus L2 Trailing cable for permanent moving in drag chain. Two jacket colours available - petrol or violet. All other technical parameters are the same.

### Part no.

**80267**, Profibus L2

**81003**, Profibus L2

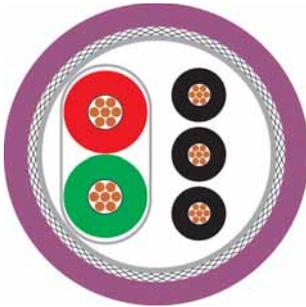
Dimensions and specifications may be changed without prior notice.

# BUS Cables

Profibus drag chain ET200X + ECOFAST

 **HELUKABEL®**

PUR



## Type Cable structure

Inner conductor diameter 1:  
Inner conductor diameter 2:  
Core insulation 1:  
Core insulation 2:  
Core colours 1:  
Core colours 2:  
Stranding element 1:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Drag chain applications 1x2x0.65 mm + 3x1x0.75 mm<sup>2</sup> (stranded)

Copper, bare (AWG 24/19)  
Copper, bare (AWG 18/42)  
Foam-skin-PE  
PE  
rd, gn  
bk, bu, gnye  
Double core  
Polyester foil over stranded bundle  
AL-Foil + braid  
Polyester foil  
PUR  
app. 9,7 mm ± 0,3 mm  
Petrol similar to RAL 5018

## Drag chain applications 1x2x0.65 mm + 4x1x1.5 mm<sup>2</sup> (stranded)

Copper, bare (AWG 24/19)  
Copper, bare (AWG 18/85)  
Foam-skin-PE  
PE  
rd, gn  
bk, bk, bk, bk  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
AL-Foil + braid  
-  
PUR  
app. 11,5 mm ± 0,3 mm  
Violet similar to RAL 4001

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Relative propagation velocity:  
Attenuation:

150 Ohm ± 10 %  
73 Ohm/km  
5 GOhm x km  
145 Ohm/km max.  
30 nF/km nom.  
1,5 kV  
-  
9,6 kHz < 3,0 dB/km  
38,4 kHz < 5,0 dB/km  
4 MHz < 25,0 dB/km  
16 MHz < 52,0 dB/km

150 Ohm ± 15 %  
73 Ohm/km  
1 GOhm x km  
145 Ohm/km max.  
30 nF/km nom.  
1,5 kV  
81 %  
9,6 kHz ≤ 3,0 dB/km  
38,4 kHz ≤ 5,0 dB/km  
4 MHz ≤ 25,0 dB/km  
16 MHz ≤ 52,0 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 106 kg/km  
145 mm  
-15°C  
+60°C  
1,953 MJ/m  
46,00 kg/km

app. 160 kg/km  
173 mm  
-15°C  
+60°C  
2,835 MJ/m  
90,00 kg/km

## Norms

Applicable standards:

Profibus acc. to DIN 19245 T3 and EN50170  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
AWM Style 20236 AWM I/II A/B 80°C 30V  
FT1

Profibus acc. to DIN 19245 T3 and EN50170  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
UL Style 20233

## Application

HELUKABEL® Profibus ET200X + Ecofast Hybrid cables are designed for continuous motion in cable carriers. The hybrid construction integrates the power supply next to the Profibus in one cable. The type ET200X offers three 0,75mm<sup>2</sup> power conductors, while the type Ecofast 4 has 1,5mm<sup>2</sup> power conductors and greater current-carrying capacity.

## Part no.

**82913**, Profibus L2

**800044**, Profibus L2

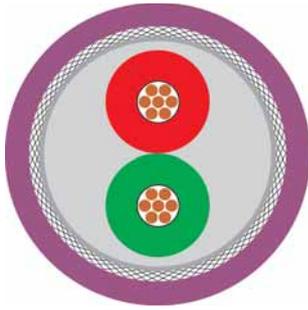
Dimensions and specifications may be changed without prior notice.

# BUS Cables

Profibus fixed installed SHIPLINE + High Temperature 180°C

**HELUKABEL®**

X-FRNC + FEP



## Type Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Marine and Offshore 1x2x0.75 mm (stranded)

Copper, bare (AWG 22/7)  
Foam-skin-PE  
rd, gn  
Double core  
Polyester foil over stranded bundle  
FRNC  
Al-Foil  
Cu braid, tinned  
X-FRNC  
app. 8,0 mm ± 0,4 mm  
Violet similar to RAL 4001

## High temperature areas 1x2x0.64 mm

Copper, bare (AWG 22/1)  
FEP  
rd, gn  
2 cores + 2 fillers stranded together  
-  
Al-Foil  
Cu braid, tinned  
FEP  
app. 7,2 mm ± 0,3 mm  
Violet similar to RAL 4001

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Nominal voltage:  
Test voltage:  
Attenuation:

150 Ohm ± 10 %  
55 Ohm/km  
1,6 GOhm x km  
110 Ohm/km max.  
29 nF/km nom.  
60 V  
1 kV  
9,6 kHz < 2,5 dB/km  
38,4 kHz < 4,0 dB/km  
4 MHz < 22,0 dB/km  
16 MHz < 42,0 dB/km

150 Ohm ± 10 %  
55 Ohm/km  
1,6 GOhm x km  
110 Ohm/km max.  
28 nF/km nom.  
250 V  
3,6 kV  
9,6 kHz < 2,5 dB/km  
38,4 kHz < 4,0 dB/km  
4 MHz < 22,0 dB/km  
16 MHz < 42,0 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 84 kg/km  
80 mm  
-25°C  
+80°C  
1,26 MJ/m  
35,00 kg/km

app. 64 kg/km  
52 mm  
-50°C  
+180°C  
0,30 MJ/m  
24,00 kg/km

## Norms

Applicable standards:

Profibus acc. to DIN 19245 T3 and EN50170  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. to IEC 60332-3

## Application

HELUKABEL® Profibus Shipline is designed for marine/offshore applications and **certified by German Lloyd**. Thanks to use of stranded conductors, this cable can be moved occasionally. The High-Temperature version is used in fixed installations with demanding temperature requirements, e.g. in the vicinity of a hot furnace or near welding activities.

## Part no.

**802178**, Profibus SHIPLINE

**802179**, Profibus high temperature

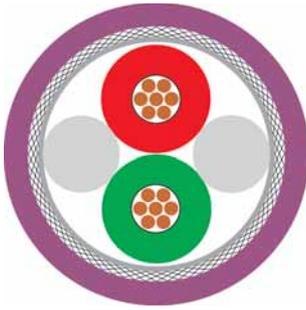
Dimensions and specifications may be changed without prior notice.

# BUS Cables

Profibus L2 high flexible TORSION + FESTOON

**HELUKABEL®**

PUR + PVC



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Torsional applications

### 1x2x0.80 mm (stranded)

Copper, bare (AWG 22/19)  
Foam-skin-PE  
rd, gn  
2 cores + filler  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
PUR  
app. 8,0 mm ± 0,4 mm  
Violet similar to RAL 4001

## Mobile use

### 1x2x0.65 mm (stranded)

Copper, bare (AWG 23/19)  
Cell PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
PVC  
app. 8,0 mm ± 0,3 mm  
Petrol similar to RAL 5018

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Relative propagation velocity:  
Attenuation:

150 Ohm ± 10 %  
49 Ohm/km  
1,6 GOhm x km  
98 Ohm/km max.  
29 nF/km nom.  
3,6 kV  
-  
9,6 kHz < 2,5 dB/km  
38,4 kHz < 3,0 dB/km  
4 MHz < 25,0 dB/km  
16 MHz < 49,0 dB/km

150 Ohm ± 10 %  
66,5 Ohm/km  
1,6 GOhm x km  
133 Ohm/km max.  
28 nF/km nom.  
2 kV  
81 %  
9,6 kHz ≤ 3,0 dB/km  
38,4 kHz ≤ 4,0 dB/km  
4 MHz ≤ 25,0 dB/km  
16 MHz ≤ 49,0 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 66 kg/km  
100 mm  
-25°C  
+75°C  
0,89 MJ/m  
32,00 kg/km

app. 64 kg/km  
70 mm  
-40°C  
+60°C  
1,09 MJ/m  
23,00 kg/km

## Norms

Applicable standards:

Profibus acc. to DIN 19245 T3 and EN50170  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
CMX 75°C (shielded)

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. IEC 60332-2-1

UL Style:

CMG 75°C FT4 or CL2 or AWM 21694 600V  
SUN RES  
CSA FT 4

CSA standard:

-

## Application

HELUKABEL® Profibus Torsion is used in mobile applications in robots. The special torsion construction allows this cable to be twisted (torsioned) and is halogen-free thanks to use PU sheath. The Festoon version is used for hanging/moving loads in garland applications.

## Part no.

**800109**, Profibus L2

**800649**, Profibus L2

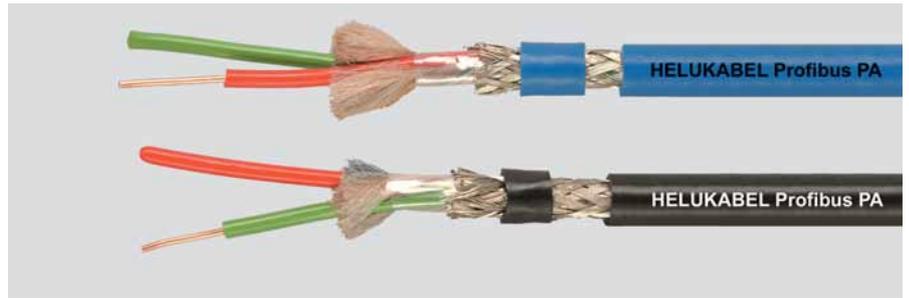
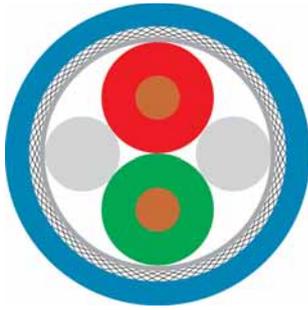
Dimensions and specifications may be changed without prior notice.

# BUS Cables

Profibus PA fixed installed

**HELUKABEL®**

PVC



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Hazardous areas 1x2x1.0/2.55 mm

Copper, bare (AWG 18/1)  
PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
PVC  
app. 7,6 mm ± 0,2 mm  
Blue similar to RAL 5015

## Non-hazardous areas 1x2x1.0/2.55 mm

Copper, bare (AWG 18/1)  
PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
PVC  
app. 7,6 mm ± 0,2 mm  
Black

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Nominal voltage:  
Test voltage:  
Attenuation:

100 Ohm ± 20 %  
22 Ohm/km  
1 GOhm x km  
44 Ohm/km max.  
60 nF/km nom.  
300 V  
2,5 kV  
39 kHz ≤ 3,0 dB/km

100 Ohm ± 20 %  
22 Ohm/km  
1 GOhm x km  
44 Ohm/km max.  
60 nF/km nom.  
300 V  
2,5 kV  
39 kHz ≤ 3,0 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 76 kg/km  
140 mm  
-30°C  
+80°C  
0,95 MJ/m  
44,00 kg/km

app. 76 kg/km  
140 mm  
-30°C  
+80°C  
0,95 MJ/m  
44,00 kg/km

## Norms

Applicable standards:  
UL Style:

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. IEC 60332-2-1  
UL Style 2571

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. IEC 60332-2-1  
UL Style 2571

## Application

HELUKABEL® Profibus PA is used for normal requirements in the process automation field (chemical industry). The colour blue identifies it as suitable for use in potentially explosive areas (and ATEX/ Class II, EX-i/ EN 60079-14). For other applications, the colour black is usually selected.

## Part no.

**82835**, Profibus PA

**82836**, Profibus PA

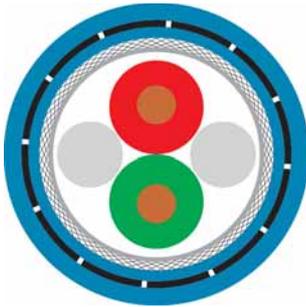
Dimensions and specifications may be changed without prior notice.

# BUS Cables

Profibus PA fixed installed armoured

 **HELUKABEL®**

PVC



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Armouring:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Hazardous areas 1x2x1.0/2.55 mm

Copper, bare (AWG 18/1)  
PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
PVC  
Al-Foil  
Cu braid, tinned  
Steel band  
PVC  
app. 10,2 mm ± 0,2 mm  
Blue similar to RAL 5015

### Non-hazardous areas 1x2x1.0/2.55 mm

Copper, bare (AWG 18/1)  
PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
PVC  
Al-Foil  
Cu braid, tinned  
Steel band  
PVC  
app. 10,2 mm ± 0,2 mm  
Black

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Nominal voltage:  
Test voltage:  
Attenuation:

100 Ohm ± 15 %  
22 Ohm/km  
1 GOhm x km  
44 Ohm/km max.  
55 nF/km nom.  
300 V  
2,5 kV  
39 kHz ≤ 3,0 dB/km

100 Ohm ± 15 %  
22 Ohm/km  
1 GOhm x km  
44 Ohm/km max.  
55 nF/km nom.  
300 V  
2,5 kV  
39 kHz ≤ 3,0 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 170 kg/km  
140 mm  
-20°C  
+70°C  
1,95 MJ/m  
45,00 kg/km

app. 170 kg/km  
200 mm  
-20°C  
+70°C  
1,95 MJ/m  
45,00 kg/km

## Norms

Applicable standards:

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. IEC 60332-2-1

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. IEC 60332-2-1

## Application

HELUKABEL® Profibus PA Armoured is used in areas with rodent such as rats, nutria etc. but also offers additional protection against all other outside mechanical influences thanks to its steel tape armouring. The colour blue identifies it as suitable for use in potentially explosive areas (and ATEX/ Class II, EX-i/EN 60079-14). For other applications, the colour black is usually used.

## Part no.

**802180**, Profibus PA

**802181**, Profibus PA

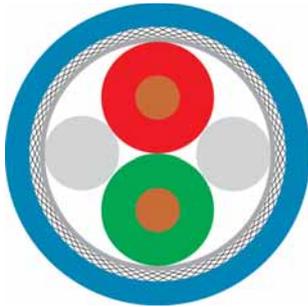
Dimensions and specifications may be changed without prior notice.

# BUS Cables

Profibus PA LD fixed installed

**HELUKABEL®**

PVC



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Hazardous areas

### 1x2x1.6/3.2 mm

Copper, bare (AWG 16/7)  
Foam-skin-PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
PVC  
app. 9,5 mm ± 0,3 mm  
Blue similar to RAL 5015

## Non-hazardous areas

### 1x2x1.6/3.2 mm

Copper, bare (AWG 16/7)  
Foam-skin-PE  
rd, gn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
PVC  
app. 9,5 mm ± 0,3 mm  
Black

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Nominal voltage:  
Test voltage:  
Attenuation:

100 Ohm ± 20 %  
24 Ohm/km  
1 GOhm x km  
48 Ohm/km max.  
60 nF/km nom.  
300 V  
1 kV  
39 kHz ≤ 2,7 dB/km

100 Ohm ± 20 %  
24 Ohm/km  
1 GOhm x km  
48 Ohm/km max.  
60 nF/km nom.  
300 V  
1 kV  
39 kHz ≤ 2,7 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 131 kg/km  
100 mm  
-40°C  
+70°C  
1,57 MJ/m  
62,00 kg/km

app. 131 kg/km  
100 mm  
-40°C  
+70°C  
1,57 MJ/m  
62,00 kg/km

## Norms

Applicable standards:

UL Style:

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. to IEC 60332-1-2  
UL Style 2571

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. to IEC 60332-1-2  
UL Style 2571

## Application

HELUKABEL® Profibus PA Long Distance is used for especially long transmission distances in process networks. It uses a larger conductor cross-section to satisfy the attenuation requirements. The colour blue identifies it as suitable for use in potentially explosive areas (and ATEX/Class II, EX-i/EN 60079-14). For other applications, the colour black is usually selected.

## Part no.

**800650**, Profibus PA

**800715**, Profibus PA

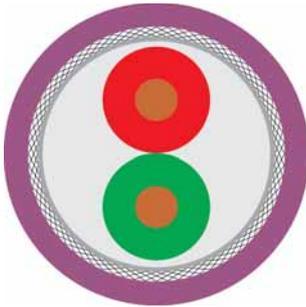
Dimensions and specifications may be changed without prior notice.

# BUS Cables

Profibus SK fixed installed Indoor + Outdoor



PVC + PE



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Fixed installation, indoor 1x2x0.64 mm

Copper, bare (AWG 22/1)  
Foam-skin-PE  
rd, gn  
Double core  
Polyester foil over stranded bundle  
PVC  
Al-Foil  
Cu braid, tinned  
PVC  
app. 8,0 mm ± 0,4 mm  
Violet similar to RAL 4001

### Fixed installation, outdoor 1x2x0.64 mm

Copper, bare (AWG 22/1)  
Foam-skin-PE  
rd, gn  
Double core  
Polyester foil over stranded bundle  
PVC  
Al-Foil  
Cu braid, tinned  
PE  
app. 8,0 mm ± 0,4 mm  
Black similar to RAL 9005

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Attenuation:

150 Ohm ± 10 %  
55 Ohm/km  
1 GOhm x km  
110 Ohm/km max.  
35 nF/km nom.  
1,5 kV  
9,6 kHz < 2,5 dB/km  
38,4 kHz < 4,0 dB/km  
4,0 MHz < 22,0 dB/km  
16,0 MHz < 42,0 dB/km

150 Ohm ± 10 %  
55 Ohm/km  
1 GOhm x km  
110 Ohm/km max.  
35 nF/km nom.  
1,5 kV  
9,6 kHz < 2,5 dB/km  
38,4 kHz < 4,0 dB/km  
4 MHz < 22,0 dB/km  
16 MHz < 42,0 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 79 kg/km  
120 mm  
-40°C  
+80°C  
1,068 MJ/m  
24,00 kg/km

app. 65 kg/km  
120 mm  
-20°C  
+70°C  
1,451 MJ/m  
24,00 kg/km

## Norms

Applicable standards:

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. to IEC 60332-3  
CMG 75°C or CL3 or AWM 21694 600V  
CSA FT 4

Profibus acc. to DIN 19245 T3 and EN50170

UL Style:

CSA standard:

-

-

## Application

HELUKABEL® Profibus SK Indoor + Outdoor have a special structure for processing with the Fast Connect Stripping Tool from Siemens. The indoor version is used for normal requirements in fixed installation applications in equipment; the Outdoor version is used in open-air applications, i.e. can withstand wind, weather and sun (not for burial directly in the ground).

## Part no.

**81903**, Profibus SK

**81904**, Profibus SK

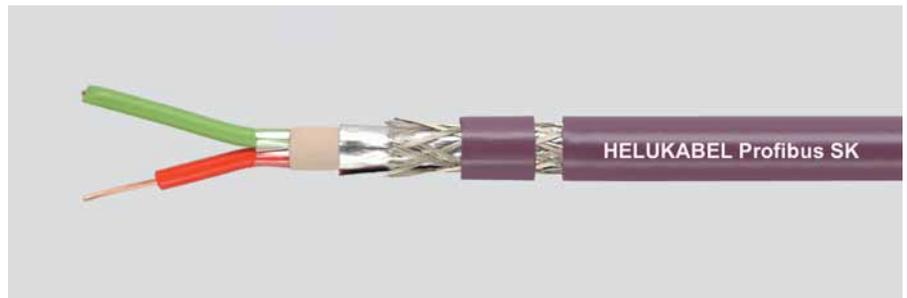
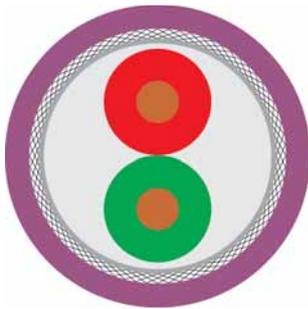
Dimensions and specifications may be changed without prior notice.

# BUS Cables

Profibus SK fixed installed FRNC + Robust



FRNC + PUR



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, indoor

### 1x2x0.64 mm

Copper, bare (AWG 22/1)  
Foam-skin-PE  
rd, gn  
Double core  
Polyester foil over stranded bundle  
FRNC  
Al-Foil  
Cu braid, tinned  
FRNC  
app. 8,0 mm ± 0,4 mm  
Violet similar to RAL 4001

## Industrial Area

### 1x2x0.64 mm

Copper, bare (AWG 22/1)  
Foam-skin-PE  
rd, gn  
Double core  
Polyester foil over stranded bundle  
FRNC  
Al-Foil  
Cu braid, tinned  
PUR  
app. 8,0 mm ± 0,4 mm  
Violet similar to RAL 4001

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Attenuation:

150 Ohm ± 10 %  
55 Ohm/km  
1 GOhm x km  
110 Ohm/km max.  
35 nF/km nom.  
1,5 kV  
9,6 kHz < 2,5 dB/km  
38,4 kHz < 4,0 dB/km  
4 MHz < 22,0 dB/km  
16 MHz < 42,0 dB/km

150 Ohm ± 10 %  
55 Ohm/km  
1 GOhm x km  
110 Ohm/km max.  
35 nF/km nom.  
1,5 kV  
9,6 kHz < 2,5 dB/km  
38,4 kHz < 4,0 dB/km  
4 MHz < 22,0 dB/km  
16 MHz < 42,0 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 73 kg/km  
160 mm  
-25°C  
+70°C  
1,203 MJ/m  
24,00 kg/km

app. 71 kg/km  
120 mm  
-40°C  
+70°C  
1,574 MJ/m  
24,00 kg/km

## Norms

Applicable standards:

Profibus acc. to DIN 19245 T3 and EN50170  
Halogen-free acc. to 60754-1  
Flame-retardant acc. IEC 60332-2-1  
CM 750C (shielded)

Profibus acc. to DIN 19245 T3 and EN50170  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
AWM Style 20236 AWM I/II A/B 80°C 30V  
FT1  
CSA FT1

UL Style:

CSA standard:

## Application

HELUKABEL® Profibus SK FRNC + Robust has a special structure for processing with the Fast Connect Stripping Tool from Siemens. The FRNC version is used to satisfy halogen-free and flame-retardant requirements in buildings. The Robust version is used in harsh industrial environments and offers excellent resistance to mineral oils, greases and cooling lubricants.

## Part no.

**81501**, Profibus SK

**81905**, Profibus SK

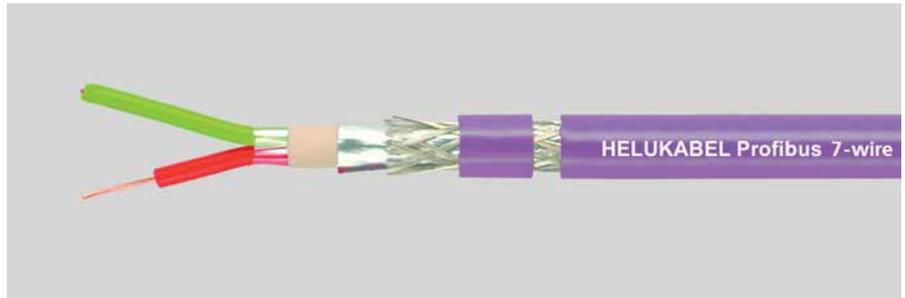
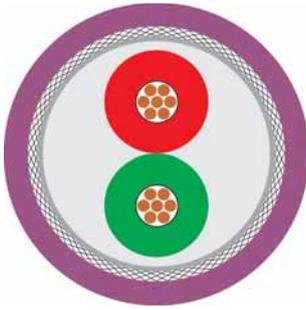
Dimensions and specifications may be changed without prior notice.

# BUS Cables

## Profibus SK 7-wire



PVC + FRNC



### Type

#### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Mobile use

#### 1x2x0.64 mm (stranded)

Copper, bare (AWG 24/7)  
Foam-skin-PE  
rd, gn  
Double core  
Polyester foil over stranded bundle  
PVC  
Al-Foil  
Cu braid, tinned  
PVC  
app. 8,0 mm ± 0,5 mm  
Violet similar to RAL 4001

### Mobile use

#### 1x2x0.64 mm (stranded)

Copper, bare (AWG 24/7)  
Foam-skin-PE  
rd, gn  
Double core  
Polyester foil over stranded bundle  
FRNC  
Al-Foil  
Cu braid, tinned  
FRNC  
app. 8,0 mm ± 0,5 mm  
Violet similar to RAL 4001

### Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Attenuation:

150 Ohm ± 10 %  
93 Ohm/km  
5 GOhm x km  
186 Ohm/km max.  
30 nF/km nom.  
1,5 kV  
9,6 kHz < 2,9 dB/km  
38,4 kHz < 4,6 dB/km  
4 MHz < 25,0 dB/km  
16 MHz < 49,0 dB/km

150 Ohm ± 10 %  
93 Ohm/km  
5 GOhm x km  
186 Ohm/km max.  
30 nF/km nom.  
1,5 kV  
9,6 kHz < 2,9 dB/km  
38,4 kHz < 4,6 dB/km  
4 MHz < 25,0 dB/km  
16 MHz < 49,0 dB/km

### Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 70 kg/km  
64 mm  
-40°C  
+80°C  
1,20 MJ/m  
26,00 kg/km

app. 70 kg/km  
64 mm  
-5°C  
+50°C  
1,47 MJ/m  
26,00 kg/km

### Norms

Applicable standards:

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant CSA FT4  
CMG FT4

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. to IEC 60332-1-2

UL Style:

### Application

HELUKABEL® Profibus SK 7-wire for mobile applications in Profibus industrial networks. With its core design and the special PVC sheath, the type described here is suitable for normal mobile applications. The cable is optimized for use of the fast contact stripping tool. The FRNC edition fulfills the parameter halogen free.

### Part no.

**805656**, Profibus SK 7-wire PVC

**805657**, Profibus SK 7-wire FRNC

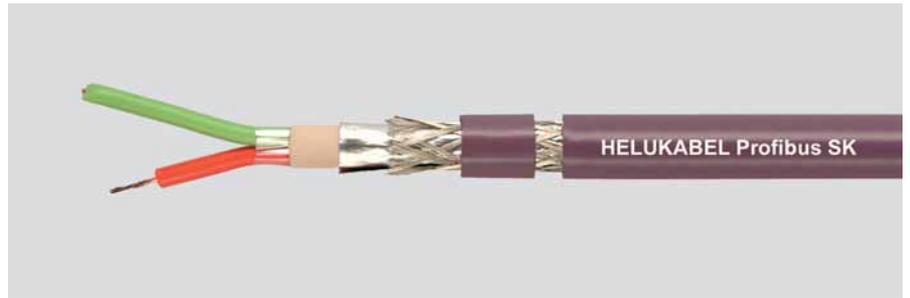
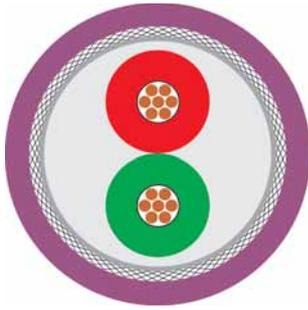
Dimensions and specifications may be changed without prior notice.

# BUS Cables

## Profibus SK drag chain



PUR



### Type

#### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

#### Drag chain applications 1x2x0.65 mm (stranded)

Copper, bare (AWG 24/19)  
Foam-skin-PE  
rd, gn  
Double core  
Polyester foil over stranded bundle  
PVC  
Al-Foil  
Cu braid, tinned  
PUR  
app. 8,0 mm ± 0,4 mm  
Violet similar to RAL 4001

#### Drag chain applications 1x2x0.65 mm (stranded)

Copper, bare (AWG 24/19)  
Foam-skin-PE  
rd, gn  
Double core  
Polyester foil over stranded bundle  
PVC  
Al-Foil  
Cu braid, tinned  
PUR  
app. 8,0 mm ± 0,4 mm  
Petrol similar to RAL 5018

### Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Attenuation:

150 Ohm ± 10 %  
67 Ohm/km  
1 GOhm x km  
134 Ohm/km max.  
35 nF/km nom.  
1,5 kV  
9,6 kHz < 3,0 dB/km  
38,4 kHz < 5,0 dB/km  
4 MHz < 25,0 dB/km  
16 MHz < 49,0 dB/km

150 Ohm ± 10 %  
67 Ohm/km  
1 GOhm x km  
134 Ohm/km max.  
35 nF/km nom.  
1,5 kV  
9,6 kHz < 3,0 dB/km  
38,4 kHz < 5,0 dB/km  
4 MHz < 25,0 dB/km  
16 MHz < 49,0 dB/km

### Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 70 kg/km  
100 mm  
-40°C  
+70°C  
1,53 MJ/m  
25,00 kg/km

app. 70 kg/km  
100 mm  
-40°C  
+70°C  
1,53 MJ/m  
25,00 kg/km

### Norms

Applicable standards:  
UL Style:  
CSA standard:

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. to IEC 60332-1-2  
CMX 75°C (shielded)  
CSA FT1

Profibus acc. to DIN 19245 T3 and EN50170  
Flame-retardant acc. to IEC 60332-1-2  
CMX 75°C (shielded)  
CSA FT1

### Application

HELUKABEL® Profibus SK drag chain is designed for continuous motion in cable carriers and has a special structure for processing with the Fast Connect Stripping Tool from Siemens. Thanks to the PU sheath, it also offers excellent resistance to common mineral oils, greases and cooling lubricants. Depending on the application, the colour petrol or violet is available.

### Part no.

**801659**, Profibus SK

**81906**, Profibus SK

Dimensions and specifications may be changed without prior notice.

# BUS Cables

FOUNDATION™ Fieldbus flexible Basic

 **HELUKABEL®**

PVC



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Drain wire:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## process automation

### 1x2x1.2/2,55-100 LI

Copper, bare (AWG 18/7)  
PO  
or, bl  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
yes  
PVC  
app. 8,0 mm ± 0,3 mm  
Orange similar to RAL 2003

## Electrical data

Characteristic impedance: 100 Ohm ± 20 Ohm  
Conductor resistance, max.: 22 Ohm/km  
Insulation resistance, min.: 5 GOhm x km  
Loop resistance: 44 Ohm/km max.  
Mutual capacitance: 60 nF/km nom.  
Nominal voltage: 300 V  
Test voltage: 1,5 kV  
Attenuation: 39 kHz ≤ 3,4 dB/km

## Technical data

Weight: app. 85 kg/km  
bending radius, repeated: 80 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 1,22 MJ/m  
Copper weight: 45,00 kg/km

## Norms

Applicable standards: Foundation Fieldbus Spec. FF-816-1.4  
Flame-retardant acc. to IEC 60332-3  
UL Style: CMG 75°C PLTC FT4  
CSA standard: CSA FT 4

## Application

HELUKABEL® FOUNDATION™ Fieldbus Basic for normal requirements in this industrial networks. Thanks to use of stranded conductors, this cable can be moved occasionally and satisfies the usual American requirements for such networks.

## Part no.

**803354**, Foundation™ Fieldbus Basic

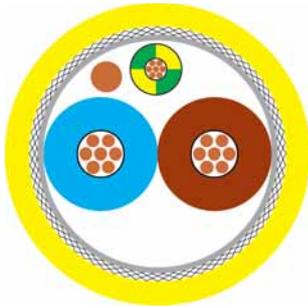
Dimensions and specifications may be changed without prior notice.

# BUS Cables

FOUNDATION™ Fieldbus flexible Type A + gnye

 **HELUKABEL®**

PVC



## Type

### Cable structure

Inner conductor diameter 1:  
Inner conductor diameter 2:  
Core insulation 1:  
Core insulation 2:  
Core colours 1:  
Core colours 2:  
Stranding element 1:  
Separator:  
Shielding 1:  
Total shielding:  
Drain wire:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## process automation

### 1x2x1.1/2, 85-100 LI + 1x0,8 gnye

Copper, bare (AWG 18/41)  
Copper, bare (AWG 18/41)  
XLPE ray cross-linking  
PVC  
bu, bn  
gn/ye  
Double core  
-  
Al-Foil  
Cu braid, tinned  
yes  
PVC  
app. 7,9 mm ± 0,3 mm  
Yellow

## Electrical data

Characteristic impedance: 100 Ohm ± 20 Ohm  
Conductor resistance, max.: 24 Ohm/km  
Insulation resistance, min.: 2 GOhm x km  
Loop resistance: 48 Ohm/km max.  
Mutual capacitance: 65 nF/km nom.  
Nominal voltage: 300 V  
Test voltage: 1,5 kV  
Attenuation: 39 kHz ≤ 3,4 dB/km

## Technical data

Weight: app. 84 kg/km  
bending radius, repeated: 80 mm  
Operating temperature range min.: -25°C  
Operating temperature range max.: +105°C  
Caloric load, approx. value: 1,00 MJ/m  
Copper weight: 49,00 kg/km

## Norms

Applicable standards: Foundation Fieldbus Spec. FF-816-1.4  
Flame-retardant acc. to IEC 60332-3  
UL Style: CMG 105° or CL3 FT4  
CSA standard: CSA FT 4

## Application

HELUKABEL® FOUNDATION™ Fieldbus Type A + gnye offers an additional conductor in the structure in compliance with the FF specification. Thanks to use of stranded conductors, this cable can be moved occasionally and satisfies the usual American requirements for such networks.

## Part no.

**801191**, Foundation Fieldbus FF A

Dimensions and specifications may be changed without prior notice.

# BUS Cables

FOUNDATION™ Fieldbus flexible Type A armoured

 **HELUKABEL®**

PVC



## Type

### Cable structure

Inner conductor diameter 1:  
Inner conductor diameter 2:  
Core insulation 1:  
Core insulation 2:  
Core colours 1:  
Core colours 2:  
Stranding element 1:  
Separator:  
Shielding 1:  
Total shielding:  
Drain wire:  
Armouring:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### process automation

#### 1x2x1.1/2, 85-100 LI + 1x0,8 gnye, armoured

Copper, bare (AWG 18/41)  
Copper, bare (AWG 18/37)  
XLPE ray cross-linking  
PVC  
bu, bn  
gn/ye  
Double core  
-  
Al-Foil  
Al-Foil  
yes  
Corrugated copper tube  
PVC  
app. 12,3 mm ± 0,3 mm  
Yellow

### Electrical data

Characteristic impedance: 100 Ohm ± 20 Ohm  
Conductor resistance, max.: 24 Ohm/km  
Insulation resistance, min.: 2 GOhm x km  
Loop resistance: 48 Ohm/km max.  
Mutual capacitance: 65 nF/km nom.  
Nominal voltage: 300 V  
Test voltage: 1,5 kV  
Attenuation: 39 kHz ≤ 3,4 dB/km

### Technical data

Weight: app. 187 kg/km  
bending radius, repeated: 130 mm  
Operating temperature range min.: -25°C  
Operating temperature range max.: +105°C  
Caloric load, approx. value: 1,65 MJ/m  
Copper weight: 125,00 kg/km

### Norms

Applicable standards: Foundation Fieldbus Spec. FF-816-1.4  
Flame-retardant acc. to IEC 60332-3  
CMG 105°C or PLTC FT4 Sun Res  
CSA FT 4  
UL Style:  
CSA standard:

### Application

HELUKABEL® FOUNDATION™ Type A Armoured finds use in areas with rodents such as rats, nutria etc. but also offers additional protection against all other outside mechanical influences thanks to its corrugated tape armouring. Thanks to use of stranded conductors, this cable can be moved occasionally and satisfies the usual American requirements for such networks.

### Part no.

**801192**, Foundation Fieldbus FF A

Dimensions and specifications may be changed without prior notice.

# BUS Cables

## FOUNDATION™ Fieldbus flexible Type A



PVC



### Type

#### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Drain wire:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### process automation

#### 1x2x1.1/2, 85-100 LI

Copper, bare (AWG 18/37)  
XLPE ray cross-linking  
bu, bn  
Double core  
-  
Al-Foil  
Cu braid, tinned  
yes  
PVC  
app. 7,9 mm ± 0,3 mm  
Yellow

### Electrical data

Characteristic impedance: 100 Ohm ± 20 Ohm  
Conductor resistance, max.: 24 Ohm/km  
Insulation resistance, min.: 2 GOhm x km  
Loop resistance: 48 Ohm/km max.  
Mutual capacitance: 65 nF/km nom.  
Nominal voltage: 300 V  
Test voltage: 1,5 kV  
Attenuation: 39 kHz ≤ 3,4 dB/km

### Technical data

Weight: app. 89 kg/km  
bending radius, repeated: 80 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +105°C  
Caloric load, approx. value: 1,05 MJ/m  
Copper weight: 42,00 kg/km

### Norms

Applicable standards: Foundation Fieldbus Spec. FF-816-1.4  
Flame-retardant acc. to IEC 60332-3  
UL Style: CMG 105° or CL3 FT4  
CSA standard: CSA FT 4

### Application

HELUKABEL® FOUNDATION™ Fieldbus Type A for normal requirements in this industrial network. Thanks to use of stranded conductors, this cable can be moved occasionally and satisfies the usual American requirements for such networks.

### Part no.

**801193**, Foundation Fieldbus FF A

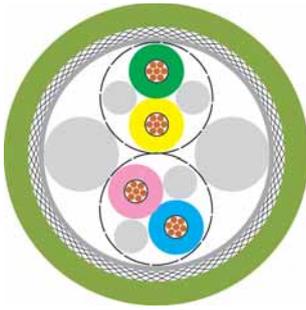
Dimensions and specifications may be changed without prior notice.

# BUS Cables

HMCB200 fixed installed

 **HELUKABEL®**

PVC



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, indoor

### 2x2x0,22qmm

Copper, bare (AWG 24/7)  
Foam-skin-PE  
gn, ye, pk, bu  
Double core  
Polyester foil over stranded bundle  
Al-Foil  
AL-Foil + braid  
PVC  
app. 6,85 mm ± 0,15 mm  
Green similar to RAL 6018

## Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
Conductor resistance, max.: 94,2 Ohm/km  
Insulation resistance, min.: 1 GOhm x km  
Loop resistance: 188,4 Ohm/km max.  
Mutual capacitance: 50 nF/km nom.  
Test voltage: 0,5 kV

## Typical values

Frequency (MHz)	10	16	62,5	100
Attenuation (db/100m)	8,0	10,0	20,0	27,0
Next (db)	56,0	53,0	43,0	40,0
ACR (db)	48,0	43,0	23,0	13,0

## Technical data

Weight: app. 63 kg/km  
bending radius, repeated: 70 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +80°C  
Caloric load, approx. value: 0,92 MJ/m  
Copper weight: 35,00 kg/km

## Norms

Applicable standards: Flame-retardant acc. to IEC 60332-1-2  
UL Style: AWM Style 2502 AWM I/II A/B 80°C 30V FT1

## Application

HELUKABEL® HMCB200 for fixed installation and slight occasional movement, range up to 100m. This cable is used in Siemens Systems. Typical plugs are RJ45 Industrial IP20 Siemens or Y-Con RJ45 Yamaichi or round M-Connectors from Molex.

## Part no.

**802471**, HMCB200

Dimensions and specifications may be changed without prior notice.

\* Drive Cliq is registered trademark from Siemens AG.

# BUS Cables

## HMCB500S Drag Chain



Drag Chain



### Type

#### Cable structure

Inner conductor diameter 1:  
Inner conductor diameter 2:  
Core insulation 1:  
Core insulation 2:  
Core colours 1:  
Core colours 2:  
Stranding element 1:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Drag chain applications

#### 2x2x0,22 + 1x2x0,38

Copper, bare (AWG 24/7)  
Copper, tinned (AWG 22/19)  
Foam-skin-PE  
PE  
gn, ye, pk, bu  
rd, bk  
Double core  
-  
-  
AL-Foil + braid  
PVC  
app. 6,95 mm ± 0,15 mm  
Green similar to RAL 6018

### Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:

100 Ohm ± 15 Ohm at 1 to 100 MHz  
90 Ohm/km  
1 GOhm x km  
180 Ohm/km max.  
50 nF/km nom.  
0,5 kV

### Typical values

Frequency	(MHz)	10	16	62,5	100
Attenuation	(db/100m)	10,0	12,0	23,0	30,0
Next	(db)	47,0	44,0	35,0	32,0
ACR	(db)	37,0	36,0	12,0	2,0

### Technical data

Weight: app. 66 kg/km  
bending radius, repeated: 125 mm  
Operating temperature range min.: 0°C  
Operating temperature range max.: +60°C  
Caloric load, approx. value: 0,00 MJ/m  
Copper weight: 38,00 kg/km

### Norms

Applicable standards: Flame-retardant acc. to IEC 60332-1-2  
UL Style: AWM Style 2502 AWM I/II A/B 80°C 30V FT1  
CSA standard: CSA FT1

### Application

HELUKABEL® HMCB500S is designed for occasional moving in cable carriers and ranges up to 100m without repeater. This cable is used in Siemens Systems.

Typical plugs are RJ45 Industrial IP20 Siemens or Y-Con RJ45 Yamaichi or round M-Connectors from Molex.

### Part no.

**803672**, HMCB500S

Dimensions and specifications may be changed without prior notice.

\* Drive Cliq is registered trademark from Siemens AG.

# BUS Cables

## HMCB800 drag chain



PUR



### Type

#### Cable structure

Inner conductor diameter 1:  
Inner conductor diameter 2:  
Core insulation 1:  
Core insulation 2:  
Core colours 1:  
Core colours 2:  
Stranding element 1:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Drag chain applications

#### 2x2x0,20qmm + 1x2x0,38qmm

Copper, bare (AWG 25/19)  
Copper, tinned (AWG 22/19)  
PE  
PE  
gn, ye, pk, bu  
rd, bk  
Double core  
-  
-  
AL-Foil + braid  
PUR  
app. 6,95 mm ± 0,15 mm  
Green similar to RAL 6018

### Electrical data

Characteristic impedance: 100 Ohm ± 15 Ohm at 1 to 100 MHz  
Conductor resistance, max.: 100 Ohm/km  
Insulation resistance, min.: 1 GOhm x km  
Loop resistance: 270 Ohm/km max.  
Mutual capacitance: 50 nF/km nom.  
Test voltage: 0,5 kV

### Typical values

Frequency (MHz)	10	16	62,5	100
Attenuation (db/100m)	8,0	10,0	20,0	27,0
Next (db)	47,0	44,0	35,0	32,0
ACR (db)	39,0	34,0	15,0	5,0

### Technical data

Weight: app. 61 kg/km  
bending radius, repeated: 75 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +60°C  
Caloric load, approx. value: 0,90 MJ/m  
Copper weight: 37,00 kg/km

### Norms

Applicable standards: Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
UL Style: AWM Style 20236 AWM I/II A/B 80°C 30V FT1  
CSA standard: CSA FT1

### Application

HELUKABEL® HMCB800W is designed for the most demanding continuous moving requirements in cable carriers and ranges up to 70 m without repeater. This cable is ideal solution in Siemens systems.  
Typical plugs are RJ45 Industrial IP20 Siemens or Y-Con RJ45 Yamaichi or round M-Connectors from Molex.

### Part no.

**804767**, HMCB800

Dimensions and specifications may be changed without prior notice.

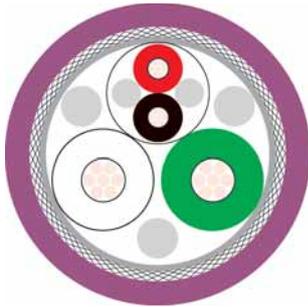
\* Drive Cliq is registered trademark from Siemens AG.

# BUS Cables

## USB Bus S 2.0 drag chain



PUR



### Type

#### Cable structure

Inner conductor diameter 1:  
Inner conductor diameter 2:  
Core insulation 1:  
Core insulation 2:  
Core colours 1:  
Core colours 2:  
Stranding element 1:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Drag chain applications

#### 1x2xAWG28 + 1x2xAWG20

Copper, tinned (AWG 28/19)  
Copper, tinned (AWG 20/64)  
PP  
PP  
wh, gn  
rd, bk  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
-  
AL-Foil + braid  
PUR  
app. 5,0 mm ± 0,2 mm  
Violet similar to RAL 4001

### Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:

90 Ohm ± 15 %  
230 Ohm/km  
0,1 GOhm x km  
460 Ohm/km max.  
60 nF/km nom.  
0,5 kV

### Typical values

Frequency (MHz)	1	10	16	62,5	100	200	300	400
Attenuation (db/100m)	4,5	12,0	15,4	31,0	39,0	60,0	76,2	99,0

### Technical data

Weight: app. 45 kg/km  
bending radius, repeated: 50 mm  
Operating temperature range min.: -30°C  
Operating temperature range max.: +70°C  
Caloric load, approx. value: 0,55 MJ/m  
Copper weight: 30,00 kg/km

### Norms

Applicable standards: USB-Standard 2.0  
Halogen-free acc. to 60754-1  
Flame-retardant CSA FT1  
UL Style: AWM 20963 (80°C/30V)  
CSA standard: CSA FT1

### Application

HELUKABEL® USB BUS S is designed for continuous moving in cable carriers and lengths up to max. 5m. Conventional USB cables fail within a short period of time, which is why HELUKABEL developed this special cable. Thanks to the PUR sheath, it also offers excellent resistance to common mineral oils, greases and cooling lubricants.

### Part no.

**802469**, USB S

Dimensions and specifications may be changed without prior notice.

# BUS Cables

## USB Bus L 2.0 drag chain



PUR



### Type

#### Cable structure

Inner conductor diameter 1:  
Inner conductor diameter 2:  
Core insulation 1:  
Core insulation 2:  
Core colours 1:  
Core colours 2:  
Stranding element 1:  
Separator:  
Shielding 1:  
Total shielding:  
Drain wire:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Drag chain applications

#### 1x2xAWG24 + 1x2xAWG20

Copper, tinned (AWG 24/19)  
Copper, tinned (AWG 20/19)  
PO  
PVC  
wh, gn  
rd, bk  
Double core  
-  
-  
AL-Foil + braid  
yes  
PUR  
app. 6,3 mm ± 0,2 mm  
Violet similar to RAL 4001

### Electrical data

Characteristic impedance: 90 Ohm ± 15 %  
Conductor resistance, max.: 36 Ohm/km  
Insulation resistance, min.: 0,2 GOhm x km  
Loop resistance: 71,6 Ohm/km max.  
Mutual capacitance: 50 nF/km nom.  
Nominal voltage: 300 V  
Test voltage: 2 kV

### Typical values

Frequency (MHz)	1	24	48	96	200	400
Attenuation (db/100m)	2,6	14,0	21,0	30,0	45,0	69,0

### Technical data

Weight: app. 56 kg/km  
bending radius, repeated: 95 mm  
Operating temperature range min.: -30°C  
Operating temperature range max.: +70°C  
Caloric load, approx. value: 0,57 MJ/m  
Copper weight: 40,00 kg/km

### Norms

Applicable standards: USB-Standard 2.0  
Flame-retardant acc. IEC 60332-2  
UL Style: AWM 21198 (80°C/ 300V)

### Application

HELUKABEL® USB BUS L is designed for continuous motion in cable carriers and lengths up to max. 10m without a repeater. Conventional USB cables fail within a short period of time and need a repeater after a cable length of 5m, which is why HELUKABEL developed this special cable with a larger cross-section. Thanks to the PUR sheath, it also offers excellent resistance to common mineral oils, greases and cooling lubricants.

### Part no.

**802470**, USB L

Dimensions and specifications may be changed without prior notice.

# BUS Cables

## USB Bus 3.0 drag chain



### Type

#### Cable structure

Inner conductor diameter 1:  
Inner conductor diameter 2:  
Core insulation 1:  
Core insulation 2:  
Core colours 1:  
Core colours 2:  
Stranding element 1:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Drag chain applications

#### 2x2xAWG28 + 2x(1x2xAWG28)

Copper, tinned (AWG 28/19)  
Copper, tinned (AWG 28/19)  
Foam-skin-PE  
PE  
bu/ye, or/vio  
rd/bk, gn/gnwh  
Double core  
Polyester foil over stranded bundle  
AL-Foil + braid  
Cu braid, tinned  
PUR  
app. 6,5 mm ± 0,3 mm  
Violet similar to RAL 4001

### Electrical data

Characteristic impedance: 90 Ohm ± 20 %  
105 Ohm ± 15% at 1 MHz  
Conductor resistance, max.: 205 Ohm/km  
Insulation resistance, min.: 2 GOhm x km  
Loop resistance: 410 Ohm/km max.  
Mutual capacitance: 60 nF/km nom.  
Test voltage: 0,7 kV  
Relative propagation velocity: 75 %

### Typical values

Frequency (MHz)	1	625	1200
Attenuation UTP pair (dB/100m)	4,0	-	-
Attenuation S/FTP pair (dB/100m)	4,0	115,0	180,0

### Technical data

Weight: app. 62 kg/km  
bending radius, repeated: 55 mm  
Operating temperature range min.: -30°C  
Operating temperature range max.: +70°C  
Caloric load, approx. value: 0,69 MJ/m  
Copper weight: 42,00 kg/km

### Norms

Applicable standards: USB-Standard 3.0  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
AWM Style 20236 AWM I/II A/B 80°C 30V FT1  
CSA FT1  
UL Style:  
CSA standard:

### Application

HELUKABEL® USB S 3.0, designed specifically for use in heavy-duty industries, are the ideal solution for highly-flexible applications such as drag chains and camera technology. They guarantee superior transmission properties. The transmission distance is connected with the transmission rate.

### Part no.

**805287**, USB S

Dimensions and specifications may be changed without prior notice.

# BUS Cables

FIREWIRE drag chain

 **HELUKABEL®**

PUR



## Type

### Cable structure

Inner conductor diameter 1:  
Inner conductor diameter 2:  
Core insulation 1:  
Core insulation 2:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Drag chain applications

### 2x2xAWG26/19 + 2xAWG22/19

Copper, tinned (AWG 22/19)  
Copper, tinned (AWG 26/19)  
PP  
Foam-skin-PE  
Cu braid, tinned  
PUR  
app. 8,2 mm  
Violet similar to RAL 4001

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Nominal voltage:  
Test voltage:

100 Ohm ± 15 %  
59,4 Ohm/km  
2 GOhm x km  
120 Ohm/km max.  
45 nF/km nom.  
30 V  
0,7 kV

## Typical values

Frequency (MHz)	250	400	500	800	1000
attenuation (db/5m)	2,5	3,0	3,6	4,7	5,6

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 88 kg/km  
98 mm  
-30°C  
+70°C  
0,986 MJ/m  
58,00 kg/km

## Norms

Applicable standards:  
UL Style:

Halogen-free acc. to 60754-1  
Flame-retardant CSA FT1  
AWM Style 20236 AWM I/II A/B 80°C 30V FT1

## Application

HELUKABEL® FireWire™ Trailing will be used for permanent moving processes.

## Part no.

**805057**, FireWire™

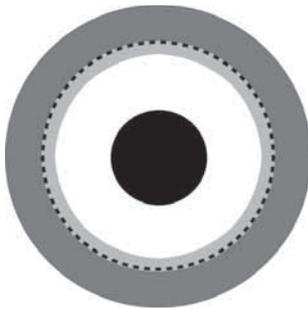
Dimensions and specifications may be changed without prior notice.

# BUS Cables

Coax 50 Ohm, drag chain

**HELUKABEL®**

PUR



## Cable structure

Inner conductor material: copper, bare  
Inner conductor diameter: 0,9 mm  
Outer conductor material: copper, tinned  
Outer conductor form: Braiding  
Dielectric: PP  
Total shielding: Cu braid, tinned  
Sheath material: PUR (Polyurethan)  
External diameter: app. 5,4 mm ± 0,2 mm  
Sheath colour: black

## 19x0,18/ 2,95mm 50 Ohm

## Electrical data

Characteristic impedance: 50 Ohm ± 2 Ohm  
Conductor resistance, max.: 38 Ohm/km  
Insulation resistance, min.: 1 GOhm x km  
Test voltage: 2 kV  
Relative propagation velocity: 67 %

## Typical values

Frequency (MHz)	50	100	200	300	500	800	900	1000	1800	2000
Attenuation (db/100m)	11,5	16,5	24,0	30,0	40,0	52,0	59,0	65,0	105,0	112,0

## Technical data

Weight: app. 45 kg/km  
bending radius, repeated: 54 mm  
Operating temperature range max.: +50°C  
Laying temperature range min.: -20°C  
Laying temperature range max.: +50°C  
Copper weight: 23,00 kg/km

## Norms

Applicable standards: Halogen-free acc. to 60754-2

## Application

This Coax cable, designed specifically for use in heavy-duty industries, is the ideal solution for highly-flexible applications such as drag chains.

## Part no.

**804299**, Coax Drag Chain

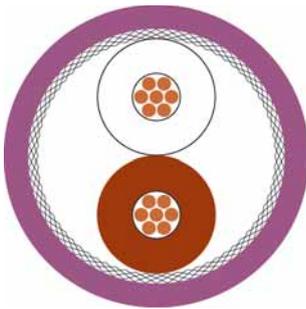
Dimensions and specifications may be changed without prior notice.

# BUS Cables

CAN Bus fixed installed

 **HELUKABEL®**

PVC



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Fixed installation, indoor 1x2x0.22 mm<sup>2</sup> (stranded)

Copper, bare (AWG 24/7)  
Cell PE  
wh/bn  
Double core  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PVC  
app. 5,4 mm ± 0,2 mm  
Violet similar to RAL 4001

### Fixed installation, indoor 4x1x0.22 mm<sup>2</sup> (stranded)

Copper, bare (AWG 24/7)  
Cell PE  
wh, bn, gn, ye  
Star quad  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PVC  
app. 6,9 mm ± 0,2 mm  
Violet similar to RAL 4001

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Nominal voltage:  
Test voltage:

120 Ohm ± 10 %  
88 Ohm/km  
1 GOhm x km  
175,2 Ohm/km max.  
58 nF/km nom.  
30 V  
1,5 kV

120 Ohm ± 10 %  
88 Ohm/km  
1 GOhm x km  
175,2 Ohm/km max.  
58 nF/km nom.  
30 V  
1,5 kV

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 41 kg/km  
81 mm  
-40°C  
+70°C  
0,574 MJ/m  
17,00 kg/km

app. 60 kg/km  
107 mm  
-40°C  
+70°C  
1,234 MJ/m  
21,00 kg/km

## Norms

Applicable standards:  
UL Style:

CAN Bus acc. to ISO 11898-2  
Flame-retardant acc. IEC 60332-2-1  
UL Style 2571

CAN Bus acc. to ISO 11898-2  
Flame-retardant acc. IEC 60332-2-1  
UL Style 2571

## Application

HELUKABEL® CAN Bus for fixed installation and occasional motion, for normal requirements. The 2-pair version is designed with star-quad twisting, i.e. diagonal conductors form an electrical pair and meets the requirements of the CAN Standard. For cable lengths up to max. 40m (observe CAN specifications).

## Part no.

**81286**, CAN BUS

**81287**, CAN BUS

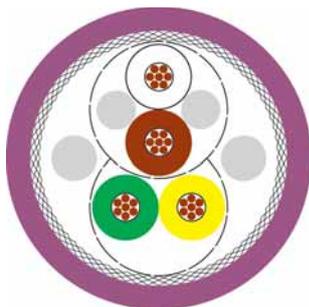
Dimensions and specifications may be changed without prior notice.

# BUS Cables

CAN Bus fixed installed

**HELUKABEL®**

PVC



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, indoor 2x2x0.22 mm<sup>2</sup> (stranded)

Copper, bare (AWG 24/7)  
Cell PE  
wh/bn, gn/ye  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PVC  
app. 7,5 mm ± 0,3 mm  
Violet similar to RAL 4001

## Electrical data

Characteristic impedance: 120 Ohm ± 10 %  
Conductor resistance, max.: 87,6 Ohm/km  
Insulation resistance, min.: 5 GOhm x km  
Loop resistance: 175,2 Ohm/km max.  
Mutual capacitance: 40 nF/km nom.  
Nominal voltage: 30 V  
Test voltage: 1,5 kV

## Technical data

Weight: app. 60 kg/km  
bending radius, repeated: 113 mm  
Operating temperature range min.: -25°C  
Operating temperature range max.: +70°C  
Caloric load, approx. value: 1,13 MJ/m  
Copper weight: 32,00 kg/km

## Norms

Applicable standards: CAN Bus acc. to ISO 11898-2  
Flame-retardant acc. to IEC 60332-1-2  
UL Style: UL Style 2571  
CSA standard: CSA FT1

## Application

HELUKABEL® CAN BUS for fixed installation and occasion motion, for normal requirements. The two signal pairs are provided in the form twisted pairs. As a result, the diameter is somewhat larger than that of 81287. In the event of diameter problems, please have a look at this type. For cable lengths up to max. 40m ( observe CAN specifications).

## Part no.

**82509**, CAN BUS

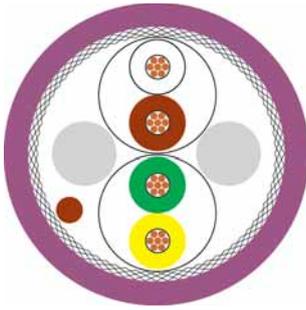
Dimensions and specifications may be changed without prior notice.

# BUS Cables

CAN Bus fixed installed 105°C

 **HELUKABEL®**

PUR



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Industrial Area

### 2x2x0,25 mm<sup>2</sup> (stranded)

Copper, bare (AWG 24/19)  
XLPE ray cross-linking  
wh/bn, gn/ye  
Double core  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PUR  
app. 8,4 mm ± 0,3 mm  
Violet similar to RAL 4001

## Electrical data

Characteristic impedance: 120 Ohm ± 10 %  
Conductor resistance, max.: 87,2 Ohm/km  
Insulation resistance, min.: 1 GOhm x km  
Loop resistance: 174,4 Ohm/km max.  
Mutual capacitance: 42 nF/km nom.  
Nominal voltage: 600 V  
Test voltage: 2,5 kV

## Technical data

Weight: app. 80 kg/km  
bending radius, repeated: 126 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +105°C \*  
Caloric load, approx. value: 1,31 MJ/m  
Copper weight: 40,00 kg/km

## Norms

Applicable standards: CAN Bus acc. to ISO 11898-2  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
UL/CSA 21223 80°C, 600V  
UL Style:

## Application

HELUKABEL® CAN Bus for fixed installation up to 105°C in difficult industrial environments with demanding temperature requirements thanks to cross-linking of the conductor insulation. Thanks to use a PUR sheath, this version is also halogen-free. For cable lengths up to max. 40m (observe CAN specifications).

## Part no.

**801982**, CAN BUS

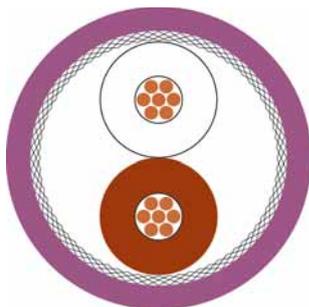
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# BUS Cables

CAN Bus fixed installed

**HELUKABEL®**

PVC



## Type Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, indoor 1x2x0.34 mm<sup>2</sup> (stranded)

Copper, bare (AWG 22/7)  
Cell PE  
wh/bn  
Double core  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PVC  
app. 6,5 mm ± 0,2 mm  
Violet similar to RAL 4001

## Fixed installation, indoor 4x1x0.34 mm<sup>2</sup> (stranded)

Copper, bare (AWG 22/7)  
Cell PE  
wh/bn, gn/ye  
Star quad  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PVC  
app. 8,0 mm ± 0,2 mm  
Violet similar to RAL 4001

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Nominal voltage:  
Test voltage:

120 Ohm ± 10 %  
57 Ohm/km  
5 GOhm x km  
114 Ohm/km max.  
58 nF/km nom.  
30 V  
2 kV

120 Ohm ± 10 %  
57 Ohm/km  
5 GOhm x km  
114 Ohm/km max.  
40 nF/km nom.  
30 V  
2 kV

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 65 kg/km  
98 mm  
-30°C  
+70°C  
1,109 MJ/m  
23,00 kg/km

app. 77 kg/km  
120 mm  
-30°C  
+70°C  
1,179 MJ/m  
30,00 kg/km

## Norms

Applicable standards:  
UL Style:

CAN Bus acc. to ISO 11898-2  
Flame-retardant acc. IEC 60332-2-1  
UL Style 2571

CAN Bus acc. to ISO 11898-2  
Flame-retardant acc. IEC 60332-2-1  
UL Style 2571

## Application

HELUKABEL® CAN Bus for fixed installation and occasional motion, for normal requirements. The 2-pair version is designed with a star-quad twisting, i.e. diagonal conductors form an electrical pair and meets the requirements of the CAN standard. For cable lengths up to max. 40m (observe CAN specifications).

## Part no.

**801572**, CAN BUS

**801573**, CAN BUS

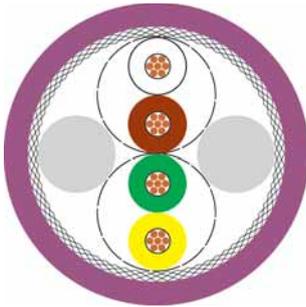
Dimensions and specifications may be changed without prior notice.

# BUS Cables

CAN Bus fixed installed

 **HELUKABEL®**

PVC



## Type

### Cable structure

Inner conductor Ø:	Copper, bare (AWG 22/7)
Core insulation:	Foam-skin-PE
Core colours:	wh/bn, gn/ye
Stranding element:	Double core
Separator:	Polyester foil over stranded bundle
Shielding 1:	-
Total shielding:	Cu braid, tinned
Outer sheath material:	PVC
Cable external diameter:	app. 8,5 mm ± 0,3 mm
Outer sheath colour:	Violet similar to RAL 4001

### Electrical data

Characteristic impedance:	120 Ohm ± 10 %
Conductor resistance, max.:	55,4 Ohm/km
Insulation resistance, min.:	5 GOhm x km
Loop resistance:	110,8 Ohm/km max.
Mutual capacitance:	40 nF/km nom.
Nominal voltage:	250 V
Test voltage:	1,5 kV

### Technical data

Weight:	app. 85 kg/km
bending radius, repeated:	130 mm
Operating temperature range min.:	-40°C
Operating temperature range max.:	+70°C
Caloric load, approx. value:	1,32 MJ/m
Copper weight:	46,00 kg/km

### Norms

Applicable standards:	CAN Bus acc. to ISO 11898-2 Flame-retardant acc. to IEC 60332-1-2
UL Style:	CMX 75°C (shielded)
CSA standard:	CSA FT1

### Application

HELUKABEL® CAN Bus fixed installations and occasionally motion, for normal requirements. The two signal pairs are provided in the form twisted pairs. As a result, the diameter is somewhat larger than that of 801573. In the event of diameter problems, please have a look at this type. For cable lengths up to max. 40m (observe CAN specifications).

### Part no.

**803344**, CAN BUS

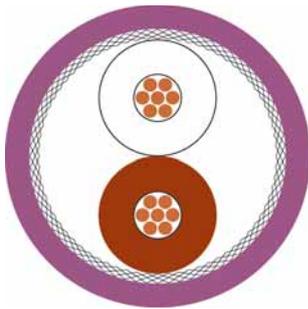
Dimensions and specifications may be changed without prior notice.

# BUS Cables

CAN Bus fixed installed

**HELUKABEL®**

PVC



## Type Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, indoor 1x2x0.50 mm<sup>2</sup> (stranded)

Copper, bare (AWG 20/7)  
Foam-skin-PE  
wh/bn  
Double core  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PVC  
app. 7,0 mm ± 0,2 mm  
Violet similar to RAL 4001

## Fixed installation, indoor 4x1x0.50 mm<sup>2</sup> (stranded)

Copper, bare (AWG 20/7)  
Foam-skin-PE  
wh, bn, gn, ye  
Star quad  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PVC  
app. 8,5 mm ± 0,2 mm  
Violet similar to RAL 4001

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:

120 Ohm ± 10 %  
36,4 Ohm/km  
1 GOhm x km  
72,8 Ohm/km max.  
40 nF/km nom.  
1,5 kV

120 Ohm ± 10 %  
37 Ohm/km  
1 GOhm x km  
74 Ohm/km max.  
44 nF/km nom.  
1,5 kV

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 69 kg/km  
100 mm  
-40°C  
+70°C  
1,09 MJ/m  
30,00 kg/km

app. 100 kg/km  
130 mm  
-40°C  
+70°C  
1,64 MJ/m  
45,00 kg/km

## Norms

Applicable standards:  
UL Style:

CAN Bus acc. to ISO 11898-2  
Flame-retardant acc. IEC 60332-2-1  
UL Style 2571

CAN Bus acc. to ISO 11898-2  
Flame-retardant acc. IEC 60332-2-1  
UL Style 2571

## Application

HELUKABEL® CAN Bus for fixed installation and occasion motion, for normal requirements. The 2-pair version is designed with star-quad twisting, i.e. diagonal conductors form an electrical pair and meets the requirements of the CAN standard. For cable lengths up to 600m (observe CAN specifications).

## Part no.

**800571**, CAN BUS

**800685**, CAN BUS

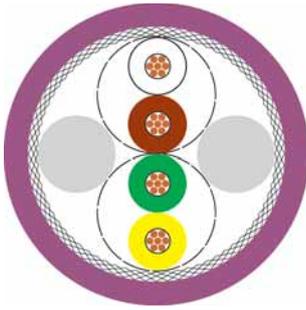
Dimensions and specifications may be changed without prior notice.

# BUS Cables

CAN Bus fixed installed

**HELUKABEL®**

PVC



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Fixed installation, indoor 2x2x0.50 mm<sup>2</sup> (stranded)

Copper, bare (AWG 20/7)  
Foam-skin-PE  
wh/bn, gn/ye  
Double core  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PVC  
app. 9,6 mm ± 0,3 mm  
Violet similar to RAL 4001

### Electrical data

Characteristic impedance: 120 Ohm ± 10 %  
Conductor resistance, max.: 34,4 Ohm/km  
Insulation resistance, min.: 5 GOhm x km  
Loop resistance: 68,8 Ohm/km max.  
Mutual capacitance: 40 nF/km nom.  
Nominal voltage: 250 V  
Test voltage: 1,5 kV

### Technical data

Weight: app. 116 kg/km  
bending radius, repeated: 150 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +70°C  
Caloric load, approx. value: 1,62 MJ/m  
Copper weight: 60,00 kg/km

### Norms

Applicable standards: CAN Bus acc. to ISO 11898-2  
Flame-retardant acc. to IEC 60332-1-2  
UL Style: CMX 75°C (shielded)  
CSA standard: CSA FT1

### Application

HELUKABEL® CAN Bus for fixed installation and occasion motion, for normal requirements. The two signal pairs are provided in the form twisted pairs. As a result, the diameter is somewhat larger than that of 800685. In the event of diameter problems, please have a look at this type. For cable lengths up to 600m (observe CAN specifications).

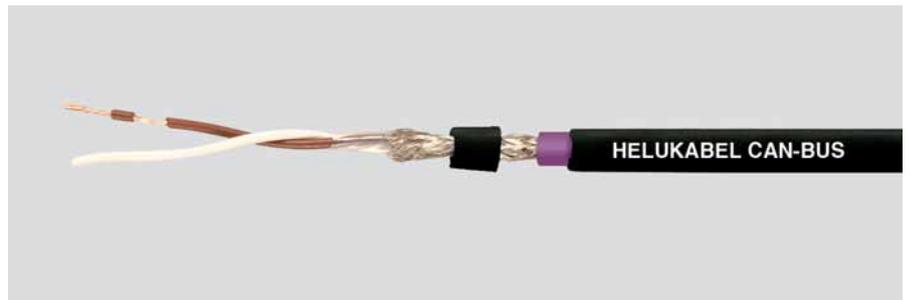
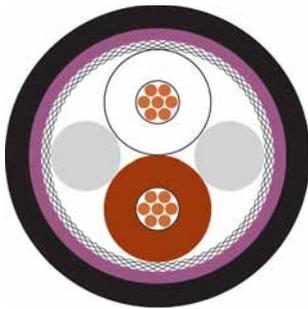
### Part no.

**803722**, CAN BUS

Dimensions and specifications may be changed without prior notice.

# BUS Cables

## CAN Bus direct Burial



### Type

#### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Armouring:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

#### Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:

#### Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

#### Norms

Applicable standards:

#### Application

HELUKABEL® CAN Bus Direct Burial is suitable for fixed outdoor installation or direct burial applications. The 2-pair version is designed with star-quad twisting, i.e. diagonal conductors form an electrical pair and meets the requirements of the CAN standard. For cable lengths up to 600m (observe CAN specifications).

#### Part no.

Dimensions and specifications may be changed without prior notice.

#### Direct burial

##### 1x2x0.50 mm<sup>2</sup> (stranded)

Copper, bare (AWG 20/7)  
Foam-skin-PE  
wh/bn  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
PVC  
-  
Cu braid, tinned  
PET/PA tape  
PE  
app. 9,2 mm ± 0,4 mm  
Black similar to RAL 9005

120 Ohm ± 10 %  
37 Ohm/km  
1 GOhm x km  
74 Ohm/km max.  
40 nF/km nom.  
1,5 kV

app. 105 kg/km  
150 mm  
-40°C  
+70°C  
2,05 MJ/m  
33,00 kg/km

CAN Bus acc. to ISO 11898-2

#### Direct burial

##### 4x1x0.50 mm<sup>2</sup> (stranded)

Copper, bare (AWG 20/7)  
Foam-skin-PE  
wh, bn, gn, ye  
Star quad  
Polyester foil over stranded bundle  
PVC  
-  
Cu braid, tinned  
PET/PA tape  
PE  
app. 9,7 mm ± 0,4 mm  
Black similar to RAL 9005

120 Ohm ± 10 %  
36,4 Ohm/km  
1 GOhm x km  
72,8 Ohm/km max.  
44 nF/km nom.  
1,5 kV

app. 115 kg/km  
160 mm  
-40°C  
+70°C  
2,18 MJ/m  
45,00 kg/km

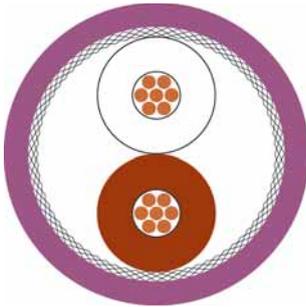
CAN Bus acc. to ISO 11898-2

# BUS Cables

CAN Bus fixed installed

**HELUKABEL®**

PVC



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Fixed installation, indoor 1x2x0.75 mm<sup>2</sup> (stranded)

Copper, bare (AWG 18/24)  
Foam-skin-PE  
wh/bn  
Double core  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PVC  
app. 8,3 mm ± 0,3 mm  
Violet similar to RAL 4001

### Fixed installation, indoor 4x1x0.75 mm<sup>2</sup> (stranded)

Copper, bare (AWG 18/24)  
Foam-skin-PE  
wh, bn, gn, ye  
Star quad  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PVC  
app. 8,8 mm ± 0,3 mm  
Violet similar to RAL 4001

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Nominal voltage:  
Test voltage:

120 Ohm ± 15 %  
27,5 Ohm/km  
1 GOhm x km  
55 Ohm/km max.  
42 nF/km nom.  
300 V  
1,5 kV

120 Ohm ± 15 %  
27,5 Ohm/km  
1 GOhm x km  
55 Ohm/km max.  
42 nF/km nom.  
300 V  
1,5 kV

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 101 kg/km  
110 mm  
-40°C  
+70°C  
1,67 MJ/m  
40,00 kg/km

app. 112 kg/km  
110 mm  
-40°C  
+70°C  
1,76 MJ/m  
58,00 kg/km

## Norms

Applicable standards:

UL Style:  
CSA standard:

CAN Bus acc. to ISO 11898-2  
Flame-retardant acc. to IEC 60332-1-2  
UL Style 2571  
CSA FT1

CAN Bus acc. to ISO 11898-2  
Flame-retardant acc. to IEC 60332-1-2  
UL Style 2571  
CSA FT1

## Application

HELUKABEL® CAN Bus for fixed installation and occasion motion, for normal requirements. The 2-pair version is designed with star-quad twisting, i.e. diagonal conductors form an electrical pair and satisfy the requirements of the CAN standard. For cable lengths over 600m (observe CAN specifications).

## Part no.

**803383**, CAN BUS

**803384**, CAN BUS

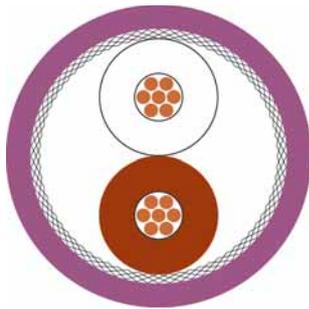
Dimensions and specifications may be changed without prior notice.

# BUS Cables

## CAN Bus drag Chain



PUR



### Type

#### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

#### Drag chain applications 1x2x0.25 mm<sup>2</sup> (stranded)

Copper, bare (AWG 24/19)  
PE  
wh/bn  
Double core  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PUR  
app. 6,1 mm ± 0,3 mm  
Violet similar to RAL 4001

#### Drag chain applications 4x1x0.25 mm<sup>2</sup> (stranded)

Copper, bare (AWG 24/19)  
PE  
wh, bn, gn, ye  
Star quad  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PUR  
app. 6,5 mm ± 0,3 mm  
Violet similar to RAL 4001

### Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:

120 Ohm ± 10 %  
87,6 Ohm/km  
1 GOhm x km  
175,2 Ohm/km max.  
50 nF/km nom.  
1,5 kV

120 Ohm ± 10 %  
85 Ohm/km  
1 GOhm x km  
170 Ohm/km max.  
50 nF/km nom.  
1,5 kV

### Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 40 kg/km  
90 mm  
-30°C  
+70°C  
0,798 MJ/m  
18,00 kg/km

app. 45 kg/km  
95 mm  
-30°C  
+70°C  
0,943 MJ/m  
25,00 kg/km

### Norms

Applicable standards:

CAN Bus acc. to ISO 11898-2  
Halogen-free acc. to 60754-1

CAN Bus acc. to ISO 11898-2  
Halogen-free acc. to 60754-1

### Application

HELUKABEL® CAN Bus is designed for guided continuous motion in cable carriers. The 2-pair version is designed with a star-quad twisting, i.e. diagonal conductors form an electrical pair and satisfy the requirements of the CAN standard. For cable lengths up to max. 40m (observe CAN specifications).

### Part no.

**81911**, CAN BUS, highly flexible

**81912**, CAN BUS, highly flexible

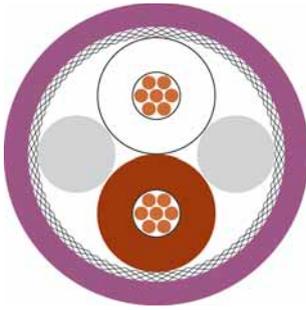
Dimensions and specifications may be changed without prior notice.

# BUS Cables

CAN Bus drag chain, UL

 **HELUKABEL®**

PUR



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Drag chain applications 1x2x0.34 mm<sup>2</sup> (stranded)

Copper, bare (AWG 22)  
Foam-skin-PE  
wh/bn  
2 cores + 2 fillers stranded together  
-  
-  
Cu braid, tinned  
PUR  
app. 6,9 mm ± 0,3 mm  
Violet similar to RAL 4001

### Drag chain applications 4x1x0.34 mm<sup>2</sup> (stranded)

Copper, bare (AWG 22/43)  
Foam-skin-PE  
wh/bn, gn/ye  
Star quad  
-  
-  
Cu braid, tinned  
PUR  
app. 7,5 mm ± 0,3 mm  
Violet similar to RAL 4001

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Nominal voltage:  
Test voltage:

120 Ohm ± 15 %  
56 Ohm/km  
5 GOhm x km  
170 Ohm/km max.  
40 nF/km nom.  
250 V  
1,5 kV

120 Ohm ± 15 %  
56 Ohm/km  
5 GOhm x km  
170 Ohm/km max.  
40 nF/km nom.  
250 V  
1,5 kV

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 54 kg/km  
105 mm  
-30°C  
+70°C  
1,20 MJ/m  
30,00 kg/km

app. 64 kg/km  
130 mm  
-30°C  
+70°C  
1,20 MJ/m  
42,00 kg/km

## Norms

Applicable standards:

CAN Bus acc. to ISO 11898-2  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
CMX 444

CAN Bus acc. to ISO 11898-2  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
CMX 444

## Application

HELUKABEL® CAN Bus is designed for guided continuous motion in cable carriers. The 2-pair version is designed with star-quad twisting, i.e. diagonal conductors form an electrical pair and meets the requirements of the CAN standard. For cable lengths up to max. 40m (observe CAN specifications).

## Part no.

**802182**, CAN BUS, highly flexible

**802339**, CAN BUS, highly flexible

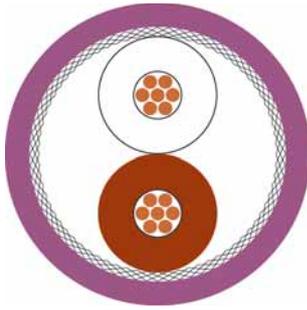
Dimensions and specifications may be changed without prior notice.

# BUS Cables

CAN Bus drag chain, UL

**HELUKABEL®**

PUR



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Drag chain applications 1x2x0.5 mm<sup>2</sup> (stranded)

Copper, bare (AWG 20/30)  
Foam-skin-PE  
wh/bn  
Double core  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PUR  
app. 7,9 mm ± 0,2 mm  
Violet similar to RAL 4001

### Drag chain applications 4x1x0.5 mm<sup>2</sup> (stranded)

Copper, bare (AWG 20/30)  
Foam-skin-PE  
wh, bn, gn, ye  
Star quad  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PUR  
app. 8,1 mm ± 0,2 mm  
Violet similar to RAL 4001

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:

120 Ohm ± 10 %  
39 Ohm/km  
5 GOhm x km  
78 Ohm/km max.  
40 nF/km nom.  
1,5 kV

120 Ohm ± 10 %  
39 Ohm/km  
5 GOhm x km  
78 Ohm/km max.  
40 nF/km nom.  
1,5 kV

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 76 kg/km  
120 mm  
-30°C  
+70°C  
1,41 MJ/m  
41,00 kg/km

app. 87 kg/km  
122 mm  
-30°C  
+70°C  
1,51 MJ/m  
55,00 kg/km

## Norms

Applicable standards:

CAN Bus acc. to ISO 11898-2  
Acc. to ISO/IEC 11801  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
CMX 75°C (shielded)  
CSA FT1

CAN Bus acc. to ISO 11898-2  
Acc. to ISO/IEC 11801  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
CMX 75°C (shielded)  
CSA FT1

## Application

HELUKABEL® CAN Bus is designed for guided continuous motion in cable carriers. For long cable lengths acc. ISO 11898 (observe CAN specifications). As 1- or 2-pair (starquad) version available

## Part no.

**805685**, CAN BUS, highly flexible

**805696**, CAN BUS, highly flexible

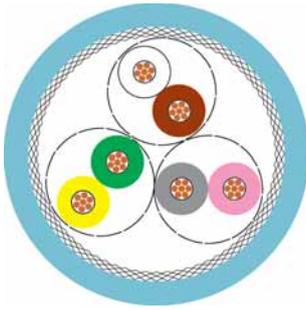
Dimensions and specifications may be changed without prior notice.

# BUS Cables

I-BUS fixed installed



PVC



## Type Cable structure

Inner conductor diameter:  
Inner conductor diameter 2:  
Core insulation:  
Core insulation 2:  
Core colours:  
Core colours 2:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, indoor 3x2x0.22 mm<sup>2</sup>

Copper, bare (AWG 24/7)  
-  
PE  
-  
wh/bn, gn/rd, ye/gn  
-  
Double core  
Polyester foil over stranded bundle  
-  
Cu braid, bare  
PVC  
app. 7,0 mm ± 0,3 mm  
Pastel turquoise similar to RAL 6034

## Fixed installation, indoor 3x2x0.22 mm<sup>2</sup> + 3x1.0 mm<sup>2</sup>

Copper, bare (AWG 24/7)  
Copper, bare (AWG 17/56)  
PE  
PE  
wh/bn, gn/rd, ye/gn  
bu, rd, gnye  
Double core  
Polyester foil over stranded bundle  
-  
Cu braid, bare  
PVC  
app. 8,0 mm ± 0,3 mm  
Pastel turquoise similar to RAL 6034

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Attenuation:

100 Ohm ± 15 Ohm  
96 Ohm/km  
1 GOhm x km  
192 Ohm/km max.  
60 nF/km nom.  
1 kV  
256 kHz < 15,0 dB/km  
772 kHz < 24,0 dB/km  
1 MHz < 27,0 dB/km  
4 MHz < 52,0 dB/km  
10 MHz < 84,0 dB/km  
16 MHz < 112,0 dB/km  
20 MHz < 119,0 dB/km

100 Ohm ± 15 Ohm  
96 Ohm/km  
1 GOhm x km  
192 Ohm/km max.  
60 nF/km nom.  
1 kV  
256 kHz < 15,0 dB/km  
772 kHz < 24,0 dB/km  
1 MHz < 27,0 dB/km  
4 MHz < 52,0 dB/km  
10 MHz < 84,0 dB/km  
16 MHz < 112,0 dB/km  
20 MHz < 119,0 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 70 kg/km  
110 mm  
-40°C  
+70°C  
1,20 MJ/m  
35,00 kg/km

app. 96 kg/km  
120 mm  
-40°C  
+70°C  
1,31 MJ/m  
68,00 kg/km

## Norms

Applicable standards:  
UL Style:

interbus specification 2.0, IEC61158  
Flame-retardant acc. IEC 60332-2-1  
UL Style 2571

interbus specification 2.0, IEC61158  
Flame-retardant acc. IEC 60332-2-1  
UL Style 2571

## Application

HELUKABEL® I-Bus is designed for fixed installation and occasional motion, for normal Interbus installation and as a hybrid cable with integrated power supply.

## Part no.

**80778**, I-BUS

**81202**, I-BUS

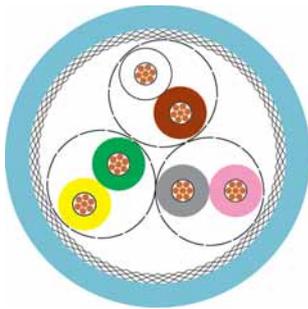
Dimensions and specifications may be changed without prior notice.

# BUS Cables

## I-BUS drag chain



PUR



### Type Cable structure

Inner conductor diameter:  
Inner conductor diameter 2:  
Core insulation:  
Core insulation 2:  
Core colours:  
Core colours 2:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Attenuation:

### Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

### Norms

Applicable standards:

### Application

HELUKABEL® I-Bus is designed for guided continuous motion in cable carriers and as strictly a bus cable or a hybrid version (with integrated power supply). Both versions feature a halogen-free PUR jacket.

### Part no.

Dimensions and specifications may be changed without prior notice.

### Drag chain applications 3x2x0.25 mm<sup>2</sup>

Copper, bare (AWG 24/19)  
-  
PE  
-  
wh/bn, gn/rd, ye/gn  
-  
Double core  
Polyester foil over stranded bundle  
-  
Cu braid, bare  
PUR  
app. 7,6 mm ± 0,3 mm  
Pastel turquoise similar to RAL 6034

100 Ohm ± 15 Ohm  
96 Ohm/km  
1 GOhm x km  
192 Ohm/km max.  
60 nF/km nom.  
1 kV  
256 kHz < 15,0 dB/km  
772 kHz < 24,0 dB/km  
1 MHz < 27,0 dB/km  
4 MHz < 52,0 dB/km  
10 MHz < 84,0 dB/km  
16 MHz < 112,0 dB/km  
20 MHz < 119,0 dB/km

app. 63 kg/km  
120 mm  
-20°C  
+70°C  
0,937 MJ/m  
36,00 kg/km

interbus specification 2.0, IEC61158  
Halogen-free acc. to 60754-1  
Flame-retardant acc. IEC 60332-2-1

### Drag chain applications 3x2x0.25 mm<sup>2</sup> + 3x1.0 mm<sup>2</sup>

Copper, bare (AWG 24/19)  
Copper, bare (AWG 17/56)  
PE  
PE  
wh/bn, gn/rd, ye/gn  
bu, rd, gnye  
Double core  
Polyester foil over stranded bundle  
-  
Cu braid, bare  
PUR  
app. 8,6 mm ± 0,3 mm  
Violet similar to RAL 4001

100 Ohm ± 15 Ohm  
96 Ohm/km  
1 GOhm x km  
192 Ohm/km max.  
60 nF/km nom.  
1 kV  
256 kHz < 15,0 dB/km  
772 kHz < 24,0 dB/km  
1 MHz < 27,0 dB/km  
4 MHz < 52,0 dB/km  
10 MHz < 84,0 dB/km  
16 MHz < 112,0 dB/km  
20 MHz < 119,0 dB/km

app. 92 kg/km  
130 mm  
-20°C  
+70°C  
1,227 MJ/m  
70,00 kg/km

interbus specification 2.0, IEC61158  
Halogen-free acc. to 60754-1

# BUS-Cables

Multibus I, high flexible

 **HELUKABEL®**

PUR



## Type Cable structure

Profibus:	1 x 2 x AWG 22 mm <sup>2</sup> (Foam-Skin PO/rd/gn)
DeviceNet™:	2 x 2 x AWG 22 mm <sup>2</sup> (Foam-Skin PO/wh/bn, ye/gn)
Interbus:	2 x 2 x 0,25 (Foam-Skin PO/ gn/pk, ye/gn)
Power cores:	4 x 1 x 1,0 mm <sup>2</sup> (PO/rd, bl, bu, bn)
Protective earth core:	1,0 mm <sup>2</sup> (PO/gnye)
Stranding:	Single cores totally stranded together and filled with plastic elements
Total shielding:	PP vlies
Outer sheath material:	PUR, halogenfree
Cable external diameter:	app. 14,7 mm
Outer sheath colour:	violet similar to RAL 4001

## Electrical data

Characteristic impedance:	150 + -15 Ohm (Profibus) 120 + -12 Ohm (DeviceNet™) 100 + -15 Ohm (Interbus)
Conductor resistance:	<= 20 Ohm/km (power cores + protection core) <= 70 Ohm/km (Profibus) <= 70 Ohm/km (DeviceNet™) <= 80 Ohm/km (Interbus)
Insulation resistance:	>= 500 Mohm x km (at 20° C)
Mutual capacitance:	30 pF/m nominal (Profibus) 40 pF/m nominal (DeviceNet™) 50 pF/m nominal (Interbus)
Testvoltage:	2500 V (core/ core) 1500 V (core/ screen)

## Mechanical data

Bending radius single:	<= 70 mm
Bending radius repeated:	<= 110 mm
Tensile strength static:	300 N
Tensile strength dynamic:	140 N
Oil resistance:	Diesel, IRM 902, Biohydran TM68, Ecocut HFN 10LE
Flame resistance:	IEC 60332-1, VW1/ FT1 acc. C-UL
FCKW free:	yes
Self extinguishable:	yes
Other attributes:	PVC free, free of lacquer wetting disturbing substances, siliconfree, resistant against PVC flexibiliser and cable fat RB1

## Thermal attributes

Operating temperature range:	- 40° C to + 80° C
Laying temperature range:	- 30° C to + 80° C

## Norms

Profibus standard, DeviceNet™ standard, Interbus standard

## UL-Style

VW1/ FT1 acc. C-UL, AWM style 20236

## Application

HELUKABEL® Multibus I is highly flexible with a special structure for use in cable carrier applications and robotics (use in acc. with HELU specification) in a PVC-free design. The Multibus I combines the Profibus / DeviceNet™ / Interbus bus systems as well as the power supply in a single hybrid cable.

## Part no.

**801652**, Multibus I, 15 cores

# BUS-Cables

Multibus II, high flexible

 **HELUKABEL®**

PUR



## Type Cable structure

Profibus:  
DeviceNet™:  
Power cores 1:  
Power cores 2:  
Protective earth core:  
Stranding:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Multibus II, 15 cores high flexible

1 x 2 x 0,34 mm<sup>2</sup> (Foam-Skin PO/rd/gn)  
4 x 2 x 0,34 mm<sup>2</sup> (Foam-Skin PE/ye, or, wh, bu-ye, or, wh, bu)  
2 x 1,0 mm<sup>2</sup> (PO/rd, bl)  
2 x 1,5 mm<sup>2</sup> (PO/bu, bn)  
1,5 mm<sup>2</sup> (PO/gnye)  
Single cores totally stranded together and filled with plastic elements  
PP vlies  
PUR, halogenfree  
app. 15,0 mm  
violet similar to RAL 4001

## Electrical data

Characteristic impedance:  
  
Conductor resistance:  
  
Insulation resistance:  
Mutual capacitance:  
  
Testvoltage:

150 + - 15 Ohm (Profibus)  
100 + - 15 Ohm (PROFINet)  
<= 20 Ohm/km (power cores + protection core)  
<= 70 Ohm/km (Profibus)  
<= 62 Ohm/km (PROFINet)  
>= 500 Mohm x km (at 20° C)  
30 pF/m nominal (Profibus)  
40 pF/m nominal (PROFINet)  
2500 V (core/ core)  
1500 V (core/ screen)

## Mechanical data

Bending radius single:  
Bending radius repeated:  
Tensile strength static:  
Tensile strength dynamic:  
Oil resistance:  
Flame resistance:  
FCKW free:  
Self extinguishable:  
Other attributes:

<= 70 mm  
<= 110 mm  
300 N  
140 N  
Diesel, IRM 902, Biohydran TM68, Ecocut HFN 10LE  
IEC 60332-1, VW1/ FT1 acc. C-UL  
yes  
yes  
PVC free, free of lacquer wetting disturbing substances, siliconfree,  
resistant against PVC flexibiliser and cable fat RB1

## Thermal attributes

Operating temperature range:  
Laying temperature range:

- 40° C to + 80° C  
- 20° C to + 80° C

## Norms

### UL-Style

### Application

Profibus standard, PROFINet standard  
VW1/ FT1 acc. C-UL, AWM style 20236

HELUKABEL® Multibus II is highly flexible with a special structure for use in cable carrier applications and robotics (use in acc. with HELU specification) in a PVC-free design. The Multibus II (further development of Multibus I) combines the Profibus /Profinet bus systems as well as the power supply in a single hybrid cable.

## Part no.

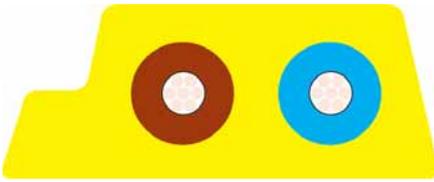
**804115**, Multibus II, 15 cores

# BUS Cables

A-BUS EPDM

 **HELUKABEL®**

EPDM



## Type Cable structure

Inner conductor:  
Core insulation:  
Core colours:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Outer sheath colour:

## Actuator Sensor Interface 2x1.5 mm<sup>2</sup>

Copper, tinned  
Rubber compound  
bu, bn  
-  
-  
-  
EPDM  
Yellow similar to RAL 1023

## Actuator Sensor Interface 2x1.5 mm<sup>2</sup>

Copper, tinned  
Rubber compound  
bu, bn  
-  
-  
-  
EPDM  
Black similar to RAL 9005

## Electrical data

Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Nominal voltage:  
Test voltage:

13,7 Ohm/km  
1 GOhm x km  
27,4 Ohm/km max.  
32 V  
1 kV at 15 min.

13,7 Ohm/km  
1 GOhm x km  
27,4 Ohm/km max.  
48 V  
1 kV at 15 min.

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 70 kg/km  
30 mm  
-40°C  
+85°C  
0,975 MJ/m  
31,00 kg/km

app. 70 kg/km  
30 mm  
-40°C  
+85°C  
0,975 MJ/m  
31,00 kg/km

## Norms

Applicable standards:

ASI standard  
Halogen-free acc. to 60754-1

ASI standard  
Halogen-free acc. to 60754-1

## Application

HELUKABEL® A-Bus EPDM Rubber for normal use in an AS-I system. Applications include wet/dry areas where the properties of a rubber jacket are desired. In addition, this material offers benefits such as low compression forces needed when contacting and the best sealing against the AS-I module.

## Part no.

**80824**, A-BUS EPDM

**80825**, A-BUS EPDM

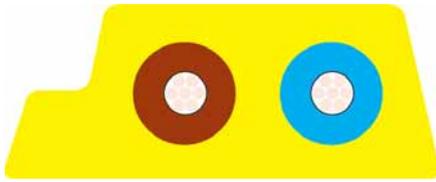
Dimensions and specifications may be changed without prior notice.

# BUS Cables

A-BUS EPDM, Long Distance



EPDM



## Type Cable structure

Inner conductor:  
Core insulation:  
Core colours:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Outer sheath colour:

## Industrial Area 2x2.5 mm<sup>2</sup>

Copper, tinned  
Rubber compound  
bu, bn  
-  
-  
EPDM  
Yellow similar to RAL 1023

## Industrial Area 2x2.5 mm<sup>2</sup>

Copper, tinned  
Rubber compound  
bu, bn  
-  
-  
EPDM  
Black similar to RAL 9005

## Electrical data

### Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 130 kg/km  
35 mm  
-40°C  
+85°C  
0,70 MJ/m  
49,00 kg/km

app. 130 kg/km  
30 mm  
-40°C  
+85°C  
0,70 MJ/m  
49,00 kg/km

## Norms

Applicable standards:

ASI standard  
Halogen-free acc. to 60754-1

ASI standard  
Halogen-free acc. to 60754-1

## Application

HELUKABEL® A-Bus Long Distance EPDM Rubber 2,5mm<sup>2</sup> for normal use in an AS-I system. The enlarged cross-section allows bigger transmission distances, higher ampacity and this results in savings of supplementary power packs. Applications include wet/dry areas where the properties of a rubber jacket are desired. In addition, this material offers benefits such as low compression forces needed when contacting and the best sealing against the AS-I module.

## Part no.

**804408**, A-BUS EPDM

**804409**, A-BUS EPDM

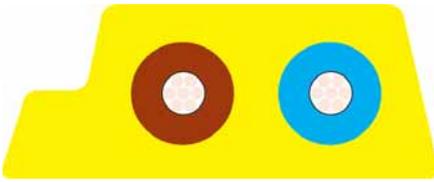
Dimensions and specifications may be changed without prior notice.

# BUS Cables

A-BUS PUR, UL/CSA

 **HELUKABEL®**

PUR



## Type Cable structure

Inner conductor:  
Core insulation:  
Core colours:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Outer sheath colour:

## Actuator Sensor Interface 2x1.5 mm<sup>2</sup>

Copper, tinned  
PO  
bu, bn  
-  
-  
-  
PUR  
Yellow similar to RAL 1023

## Actuator Sensor Interface 2x1.5 mm<sup>2</sup>

Copper, tinned  
PO  
bu, bn  
-  
-  
-  
PUR  
Black similar to RAL 9005

## Electrical data

Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Nominal voltage:  
Test voltage:

13,7 Ohm/km  
1 GOhm x km  
27,4 Ohm/km max.  
32 V  
1 kV at 15 min.

13,7 Ohm/km  
1 GOhm x km  
27,4 Ohm/km max.  
48 V  
1 kV at 15 min.

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 64 kg/km  
30 mm  
-40°C  
+80°C  
0,965 MJ/m  
31,00 kg/km

app. 64 kg/km  
30 mm  
-40°C  
+80°C  
0,965 MJ/m  
31,00 kg/km

## Norms

Applicable standards:

ASI standard  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
AWM Style 20549  
CSA FT2

ASI standard  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
AWM Style 20549  
CSA FT2

## Application

HELUKABEL® A-Bus PUR is ideal for use in wet/dry areas thanks to its outstanding characteristics when exposed to common coolants/lubricants. This version can also be used in cable carriers (special installation conditions must be observed: place wide cable side on inside radius, use partitions and install flat/round cables separately). These types are approved for use in the American market (UL 1581, FT2) thanks to use of special materials.

## Part no.

**82434**, A-BUS PUR

**82822**, A-BUS PUR

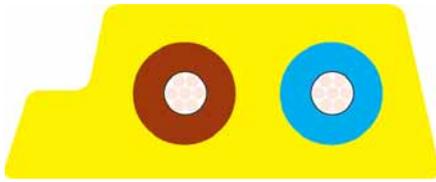
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# BUS Cables

A-BUS PUR 2X2.5 PUR, Long Distance, UL/CSA



PUR



## Type Cable structure

Inner conductor:  
Core insulation:  
Core colours:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Outer sheath colour:

## Drag chain applications 2x2.5 mm<sup>2</sup>

Copper, tinned  
PO  
bu, bn  
-  
-  
PUR  
Yellow similar to RAL 1023

## Drag chain applications 2x2.5 mm<sup>2</sup>

Copper, tinned  
PO  
bu, bn  
-  
-  
PUR  
Black similar to RAL 9005

## Electrical data

Conductor resistance, max.:  
Loop resistance:  
Nominal voltage:

8,21 Ohm/km  
16,42 Ohm/km max.  
32 V

8,21 Ohm/km  
16,42 Ohm/km max.  
48 V

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 140 kg/km  
30 mm  
-40°C  
+80°C  
0,90 MJ/m  
49,00 kg/km

app. 140 kg/km  
30 mm  
-40°C  
+80°C  
0,90 MJ/m  
49,00 kg/km

## Norms

Applicable standards:

ASI standard  
Halogen-free acc. to 60754-1  
Flame-retardant CSA FT2  
AWM Style 20549  
CSA FT2

ASI standard  
Halogen-free acc. to 60754-1  
Flame-retardant CSA FT2  
AWM Style 20549  
CSA FT2

## Application

AS components are interconnected with this special system cable. With the AS interface, the cable assembly from the control system to the sensor/actuator is not needed. The AS interface is the field bus system that transmits both data and power in one single cable. With fast contacting in penetration technique, the possibility of errors in cabling is largely reduced. The special outer jacket provides protection against oil, grease, and refrigerant lubricants, and the cable is therefore even suitable for applications in wet surroundings, in machinery and plant construction, as well as in the machine tool and automotive industry. The PUR variant is suitable for heavy-duty industrial environments.

Because of the cross section 2,5qmm it is possible to realize longer distances.

These types are certified for the American market (UL 1581, FT2) through the use of special materials.

## Part no.

**804410**, A-BUS PUR

**804411**, A-BUS PUR

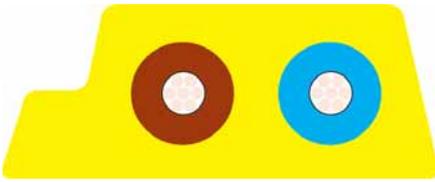
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# BUS Cables

A-BUS TPE, UL CMG

**HELUKABEL®**

TPE 105°



## Type Cable structure

Inner conductor:  
Core insulation:  
Core colours:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Outer sheath colour:

## Mobile use 2x1.5 mm<sup>2</sup>

Copper, tinned  
TPE  
bu, bn  
-  
-  
-  
TPE  
Yellow

## Mobile use 2x1.5 mm<sup>2</sup>

Copper, tinned  
TPE  
bu, bn  
-  
-  
-  
TPE  
Black

## Electrical data

Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Nominal voltage:  
Test voltage:

13,7 Ohm/km  
1 GOhm x km  
27,4 Ohm/km max.  
32 V  
1,5 kV at 15 min.

13,7 Ohm/km  
1 GOhm x km  
27,4 Ohm/km max.  
48 V  
1,5 kV at 15 min.

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 71 kg/km  
24 mm  
-40°C  
+105°C  
1,10 MJ/m  
31,00 kg/km

app. 70 kg/km  
24 mm  
-40°C  
+105°C  
1,10 MJ/m  
31,00 kg/km

## Norms

Applicable standards:

ASI standard  
Flame-retardant acc. to IEC 60332-1-2  
CL2 CMG  
CSA FT 4

ASI standard  
Flame-retardant acc. to IEC 60332-1-2  
CL2 CMG  
CSA FT 4

## Application

HELUKABEL® A-Bus TPE UL/CSA for demanding temperature requirements up to 105 °C and with improved flame retardance specifically for the American market. The special outer sheath makes the cable resistant to many oils, greases and cooling lubricants and thus suitable for applications in wet surroundings, in machinery and plant construction as well as in the machine tool and automotive industries.

## Part no.

**805693**, A-BUS UL

**805694**, A-BUS UL

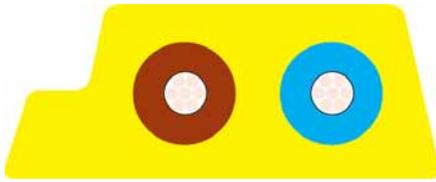
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# BUS Cables

A-BUS TPE

**HELUKABEL®**

TPE



## Type Cable structure

Inner conductor:  
Core insulation:  
Core colours:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Outer sheath colour:

## Actuator Sensor Interface 2x1.5 mm<sup>2</sup>

Copper, tinned  
TPE  
bu, bn  
-  
-  
TPE  
Yellow

## Actuator Sensor Interface 2x1.5 mm<sup>2</sup>

Copper, tinned  
TPE  
bu, bn  
-  
-  
TPE  
Black

## Electrical data

Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Nominal voltage:  
Test voltage:

13,7 Ohm/km  
1 GOhm x km  
27,4 Ohm/km max.  
32 V  
1,5 kV at 15 min.

13,7 Ohm/km  
1 GOhm x km  
27,4 Ohm/km max.  
48 V  
1,5 kV at 15 min.

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 70 kg/km  
24 mm  
-40°C  
+105°C  
1,10 MJ/m  
31,00 kg/km

app. 70 kg/km  
24 mm  
-40°C  
+105°C  
1,10 MJ/m  
31,00 kg/km

## Norms

Applicable standards:

ASI standard  
Flame-retardant acc. to IEC 60332-1-2

ASI standard  
Flame-retardant acc. to IEC 60332-1-2

## Application

HELUKABEL® A-Bus TPE for demanding temperature requirements up to 105 °C and flame retardance. The special outer sheath makes the cable resistant to many oils, greases and cooling lubricants and thus suitable for applications in wet surroundings, in machinery and plant construction as well as in the machine tool and automotive industries.

## Part no.

**801846**, A-BUS TPE

**801847**, A-BUS TPE

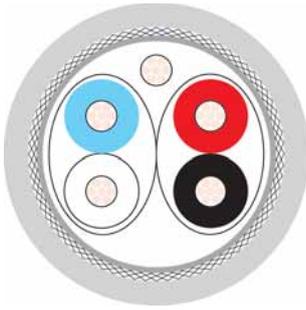
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# BUS Cables

DeviceNet™ fixed installed thick + thin

**HELUKABEL®**

PVC



## Type Cable structure

Inner conductor diameter 1:  
Inner conductor diameter 2:  
Core insulation 1:  
Core insulation 2:  
Core colours 1:  
Core colours 2:  
Stranding element 1:  
Separator:  
Shielding 1:  
Total shielding:  
Drain wire:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, indoor 1x2xAWG18 + 1x2xAWG15

Copper, tinned (AWG 18/19)  
Copper, tinned (AWG 15/19)  
Foam-skin-PE  
PVC  
light bu, wh  
rd, bk  
Double core  
-  
Al-Foil  
Cu braid, tinned  
yes  
PVC  
app. 12,2 mm ± 0,3 mm  
Grey similar to RAL 7001

## Fixed installation, indoor 1x2xAWG24 + 1x2xAWG22

Copper, tinned (AWG 24/19)  
Copper, tinned (AWG 22/19)  
Foam-skin-PE  
PVC  
light bu, wh  
rd, bk  
Double core  
-  
Al-Foil  
Copper shifting, tinned  
yes  
PVC  
app. 6,9 mm ± 0,3 mm  
Grey similar to RAL 7001

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Attenuation:

120 Ohm ± 10 %  
22,6 Ohm/km  
0,2 GOhm x km  
45,2 Ohm/km max.  
39,8 nF/km nom.  
2 kV  
125 kHz < 4,2 dB/km  
500 kHz < 8,1 dB/km

120 Ohm ± 10 %  
90 Ohm/km  
0,2 GOhm x km  
180 Ohm/km max.  
39,8 nF/km nom.  
2 kV  
125 kHz < 9.5 dB/km  
500 kHz < 16.4 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 192 kg/km  
190 mm  
-20°C  
+80°C  
2,92 MJ/m  
88,00 kg/km

app. 67 kg/km  
110 mm  
-20°C  
+80°C  
0,91 MJ/m  
35,00 kg/km

## Norms

Applicable standards:

UL Style:  
CSA standard:

ODVA DeviceNet  
Flame-retardant acc. to IEC 60332-3  
CMG 75°C PLTC FT4  
CEC: CMG FT4

ODVA DeviceNet  
Flame-retardant acc. to IEC 60332-3  
CMG 75°C PLTC FT4  
CSA FT 4

## Application

HELUKABEL® DeviceNet™ PVC for fixed installation. The special aspect of this bus system is that a data pair and a power supply pair are **always** integrated in one cable. The small cross-section is used for short distances or as a point-to-point connection; the large cross-section as main conductor for long distances and frequently in combination with the thin conductor as drain wire.

## Part no.

**800683**, DeviceNet PVC

**800684**, DeviceNet PVC

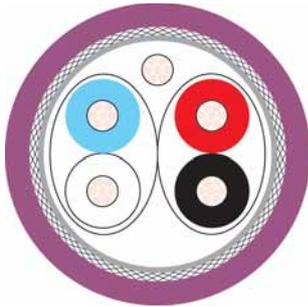
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# BUS Cables

DeviceNet™ fixed installed thick + thin



FRNC



## Type Cable structure

Inner conductor diameter 1:  
Inner conductor diameter 2:  
Core insulation 1:  
Core insulation 2:  
Core colours 1:  
Core colours 2:  
Stranding element 1:  
Separator:  
Shielding 1:  
Total shielding:  
Drain wire:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, indoor 1x2xAWG18 + 1x2xAWG15

Copper, tinned (AWG 18/19)  
Copper, tinned (AWG 15/19)  
Cell PE  
PE  
light bu, wh  
rd, bk  
Double core  
-  
Al-Foil  
Cu braid, tinned  
yes  
FRNC  
app. 12,2 mm ± 0,3 mm  
Violet similar to RAL 4001

## Fixed installation, indoor 1x2xAWG24 + 1x2xAWG22

Copper, tinned (AWG 24/19)  
Copper, tinned (AWG 22/19)  
Cell PE  
PE  
light bu, wh  
rd, bk  
Double core  
-  
Al-Foil  
Cu braid, tinned  
yes  
FRNC  
app. 6,9 mm ± 0,3 mm  
Violet similar to RAL 4001

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Attenuation:

120 Ohm ± 10 %  
22,6 Ohm/km  
0,2 GOhm x km  
45,2 Ohm/km max.  
39 nF/km nom.  
2 kV  
125 kHz < 4.2 dB/km  
500 kHz < 8.1 dB/km

120 Ohm ± 10 %  
90 Ohm/km  
0,2 GOhm x km  
180 Ohm/km max.  
39,8 nF/km nom.  
2 kV  
125 kHz < 9.5 dB/km  
500 kHz < 16.4 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 195 kg/km  
190 mm  
-25°C  
+80°C  
2,73 MJ/m  
88,00 kg/km

app. 70 kg/km  
110 mm  
-25°C  
+80°C  
0,82 MJ/m  
34,00 kg/km

## Norms

Applicable standards:

ODVA DeviceNet  
Halogen-free acc. to 60754-1  
Flame-retardant acc. IEC 60332-2-1  
CL2 CMG  
CEC: CMG FT4

ODVA DeviceNet  
Halogen-free acc. to 60754-1  
Flame-retardant acc. IEC 60332-2-1  
CL2 CMG  
CEC: CMG FT4

## Application

HELUKABEL® DeviceNet™ FRNC for fixed installation in areas where high flame retardance and a halogen-free design are needed. The special aspect of this bus system is that a data pair and a power supply pair are **always** integrated in one cable. The small cross-section is used for short distances or as a point-to-point connection; the large cross-section as main conductor for long distances and frequently in combination with the thin conductor as drain wire.

## Part no.

**800681**, DeviceNet FRNC

**800682**, DeviceNet FRNC

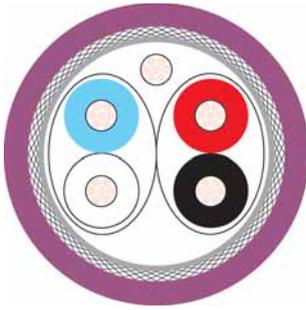
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# BUS Cables

DeviceNet™ high flexible thick + thin

**HELUKABEL®**

PUR, high flexible



## Type Cable structure

Inner conductor diameter 1:  
Inner conductor diameter 2:  
Core insulation 1:  
Core insulation 2:  
Core colours 1:  
Core colours 2:  
Stranding element 1:  
Separator:  
Shielding 1:  
Total shielding:  
Drain wire:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Drag chain applications 1x2xAWG18 + 1x2xAWG15

Copper, tinned (AWG 18/40)  
Copper, tinned (AWG 15/84)  
Cell PE  
PE  
light bu, wh  
rd, bk  
Double core  
-  
Al-Foil  
Cu braid, tinned  
yes  
PUR  
app. 12,2 mm ± 0,3 mm  
Violet similar to RAL 4001

## Drag chain applications 1x2xAWG24 + 1x2xAWG22

Copper, tinned (AWG 24/19)  
Copper, tinned (AWG 22/19)  
Cell PE  
PE  
light bu, wh  
rd, bk  
Double core  
-  
Al-Foil  
Cu braid, tinned  
yes  
PUR  
app. 6,9 mm ± 0,3 mm  
Violet similar to RAL 4001

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:  
Attenuation:

120 Ohm ± 10 %  
22,6 Ohm/km  
0,2 GOhm x km  
45,2 Ohm/km max.  
39,8 nF/km nom.  
2 kV  
125 kHz < 4.1 dB/km  
500 kHz < 8.2 dB/km

120 Ohm ± 10 %  
90 Ohm/km  
0,2 GOhm x km  
45,2 Ohm/km max.  
39,8 nF/km nom.  
2 kV  
125 kHz < 9.5 dB/km  
500 kHz < 16.4 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 185 kg/km  
200 mm  
-40°C  
+80°C  
2,54 MJ/m  
90,00 kg/km

app. 68 kg/km  
70 mm  
-40°C  
+80°C  
0,76 MJ/m  
35,00 kg/km

## Norms

Applicable standards:

ODVA DeviceNet  
Halogen-free acc. to 60754-1  
Flame-retardant acc. IEC 60332-2-1  
CMX 75°C CL2X

ODVA DeviceNet  
Halogen-free acc. to 60754-1  
Flame-retardant acc. IEC 60332-2-1  
CMX 75°C CL2X

## Application

HELUKABEL® DeviceNet™ PUR highly flexible for use in cable carriers with outstanding resistance to common coolants/lubricants. The special aspect of this bus system is that a data pair and a power supply pair are **always** integrated in one cable. The small cross-section is used for short distances or as a point-to-point connection; the large cross-section as main conductor for long distances and frequently in combination with the thin conductor as drain wire.

## Part no.

**81909**, DeviceNet PUR

**81910**, DeviceNet PUR

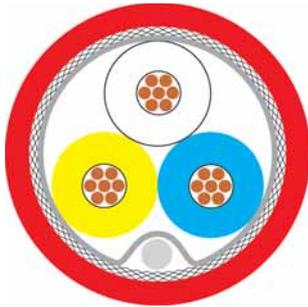
Dimensions and specifications may be changed without prior notice.

# BUS Cables

CC-Link BUS fixed installed

**HELUKABEL®**

PVC



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Drain wire:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, indoor

### 3x0.5 mm<sup>2</sup>

Copper, bare (AWG 20/7)  
Foam-skin-PE  
wh, bu, ye  
Triple core  
Polyester foil over stranded bundle  
Al-Foil  
Cu braid, tinned  
yes  
PVC  
app. 7,7 mm ± 0,3 mm  
Red

## Electrical data

Characteristic impedance: 110 Ohm ± 15 Ohm  
Conductor resistance, max.: 37,8 Ohm/km  
Insulation resistance, min.: 10 GOhm x km  
Loop resistance: 75,6 Ohm/km max.  
Mutual capacitance: 60 nF/km nom.  
Test voltage: 2 kV  
Attenuation:  
1 MHz < 16,0 dB/100m  
5 MHz < 35,0 dB/100m

## Technical data

Weight: app. 77 kg/km  
bending radius, repeated: 120 mm  
Operating temperature range min.: -40°C  
Operating temperature range max.: +75°C  
Caloric load, approx. value: 1,10 MJ/m  
Copper weight: 40,00 kg/km

## Norms

Applicable standards: CC-Link Specification 1.10  
Flame-retardant acc. IEC 60332-2-1  
UL Style: CM 75°C or PLTC  
CSA standard: CSA FT 4

## Application

HELUKABEL® CC-Link Bus PVC for fixed installation. The primary market is Asia, but the USA and the United Kingdom are using CC-Link increasingly. The cable has the appropriate approvals for these markets. A version with power supply conductors is optionally available. It is used particularly in channels.

## Part no.

**800497**, CC-Link communications cable

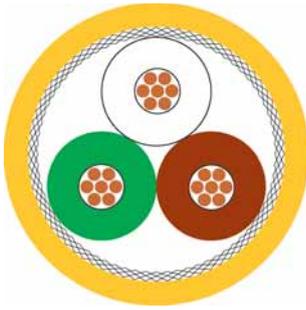
Dimensions and specifications may be changed without prior notice.

# BUS Cables

SafetyBUS fixed installed + high flexible

**HELUKABEL®**

FRNC + PUR



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Fixed installation, indoor 3x0,75 mm<sup>2</sup> (stranded)

Copper, bare (AWG 18/24)  
Foam-skin-PE  
wh, bn, gn  
Triple core  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
FRNC  
app. 7,5 mm ± 0,3 mm  
Yellow similar to RAL 1003

### Drag chain applications 3x0,75 mm<sup>2</sup> (stranded)

Copper, bare (AWG 18)  
Foam-skin-PE  
wh, bn, gn  
Triple core  
Polyester foil over stranded bundle  
-  
Cu braid, tinned  
PUR  
app. 7,8 mm ± 0,2 mm  
Yellow similar to RAL 1003

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Nominal voltage:  
Test voltage:  
Attenuation:

110 Ohm ± 10 Ohm  
27,7 Ohm/km  
5 GOhm x km  
52 Ohm/km max.  
45 nF/km nom.  
250 V  
3 kV  
1 MHz < 1,6 dB/km  
5 MHz < 3,4 dB/km  
10 MHz < 5,6 dB/km  
16 MHz < 7,5 dB/km

110 Ohm ± 10 Ohm  
26 Ohm/km  
5 GOhm x km  
52 Ohm/km max.  
45 nF/km nom.  
250 V  
3 kV  
1 MHz < 1,6 dB/km  
5 MHz < 3,4 dB/km  
10 MHz < 5,6 dB/km  
16 MHz < 7,5 dB/km

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 68 kg/km  
75 mm  
-25°C  
+80°C  
0,72 MJ/m  
50,00 kg/km

app. 65 kg/km  
80 mm  
-30°C  
+80°C  
0,76 MJ/m  
50,00 kg/km

## Norms

Applicable standards:

abuttet at SafetyBUS p technical guidelines  
copper wires 1.0  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-3  
-

abuttet at SafetyBUS p technical guidelines  
copper wires 1.0  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2  
CMX 75°C (shielded)

UL Style:

## Application

HELUKABEL® SafetyBUS FRNC for fixed installation; the PUR version is intended for use in cable carriers. Both versions are halogen-free.

## Part no.

**800651**, SafetyBus p

**800652**, SafetyBus p

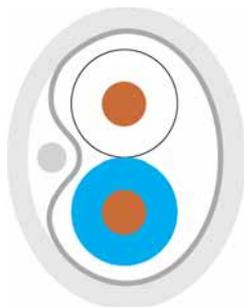
Dimensions and specifications may be changed without prior notice.

# BUS Cables

LON BUS H122 + Y116

**HELUKABEL®**

FRNC + PVC



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Drain wire:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

### Fixed installation, indoor 1x2xAWG 22/1

Copper, bare (AWG 22/1)  
Foam-skin-PE  
wh, bu  
Double core  
Polyester foil over stranded bundle  
-  
Al-Foil  
yes  
FRNC  
app. 4,4 mm ± 0,3 mm  
White

### Mobile use

### 1x2xAWG 16/19

Copper, tinned (AWG 16/19)  
PVC  
wh, bk  
Double core  
Polyester foil over stranded bundle  
-  
-  
-  
PVC  
app. 7,0 mm ± 0,4 mm  
Grey similar to RAL 7001

### Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Nominal voltage:  
Test voltage:

100 Ohm ± 10 %  
57 Ohm/km  
5 GOhm x km  
114 Ohm/km max.  
45 nF/km nom.  
125 V  
0,7 kV

85 Ohm ± 15 %  
14 Ohm/km  
0,02 GOhm x km  
28 Ohm/km max.  
100 nF/km nom.  
300 V  
2 kV

### Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:  
Applicable standards:

app. 25 kg/km  
70 mm  
-20°C  
+75°C  
0,337 MJ/m  
11,00 kg/km  
Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2

app. 65 kg/km  
85 mm  
-20°C  
+80°C  
1,25 MJ/m  
30,00 kg/km  
Flame-retardant acc. to IEC 60332-1-2

### Application

HELUKABEL® LON BUS H122 FRNC for fixed installation; version Y116 for mobile applications. For both versions: Use indoors is in fixed installations (H122) and as a patch cable (Y116) and must comply with DIN EN 50090-2-2 (VDE 0892 Part 2-2:1997-06).

### Part no.

**802187**, LON H122

**802188**, LON Y116

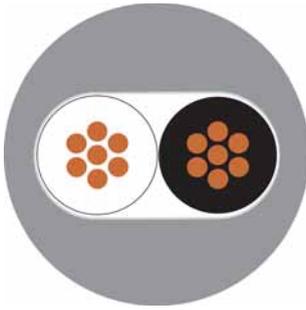
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# BUS Cables

LON BUS H116

 **HELUKABEL®**

FRNC



## Type

### Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, indoor

### 1x2xAWG 16/19

Copper, tinned (AWG 16/19)  
PE  
wh, bk  
Double core  
Polyester foil over stranded bundle  
-  
-  
FRNC  
app. 7,0 mm ± 0,4 mm  
Grey similar to RAL 7001

## Electrical data

Characteristic impedance: 85 Ohm ± 15 %  
Conductor resistance, max.: 15,8 Ohm/km  
Insulation resistance, min.: 0,02 GOhm x km  
Loop resistance: 31,6 Ohm/km max.  
Mutual capacitance: 82 nF/km nom.  
Nominal voltage: 300 V  
Test voltage: 2 kV

## Technical data

Weight: app. 65 kg/km  
bending radius, repeated: 85 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +70°C  
Caloric load, approx. value: 1,25 MJ/m  
Copper weight: 30,00 kg/km  
Applicable standards: Halogen-free acc. to 60754-1  
Flame-retardant acc. to IEC 60332-1-2

## Application

HELUKABEL® LON BUS H116 FRNC fixed installation indoor acc. DIN EN 50090-2-2 (VDE 0892 Teil 2-2:1997-06).

## Part no.

**805661**, LON H116

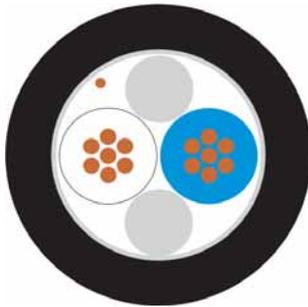
Dimensions and specifications may be changed without prior notice.

# BUS Cables

MOD-BUS fixed installed

**HELUKABEL®**

PVC + armoured



## Type Cable structure

Inner conductor diameter:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Inner sheath material:  
Shielding 1:  
Total shielding:  
Drain wire:  
Armouring:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Fixed installation, indoor 1x2x0,75-105 LI

Copper, bare (AWG 19)  
PE  
wh, bu  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
-  
Al-Foil  
-  
yes  
-  
PVC  
app. 7,5 mm ± 0,3 mm  
Black similar to RAL 9005

## Fixed installation, indoor 1x2x0,75-105 LI armoured

Copper, bare (AWG 19)  
PE  
wh, bu  
2 cores + 2 fillers stranded together  
Polyester foil over stranded bundle  
PVC  
Al-Foil  
-  
yes  
Steel band  
PVC  
app. 10,0 mm ± 0,5 mm  
Black similar to RAL 9005

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Nominal voltage:

105 Ohm ± 20 Ohm  
25 Ohm/km  
1 GOhm x km  
50 Ohm/km max.  
300 V

105 Ohm ± 20 Ohm  
25 Ohm/km  
1 GOhm x km  
50 Ohm/km max.  
300 V

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Copper weight:  
Applicable standards:

app. 70 kg/km  
80 mm  
-30°C  
+70°C  
28,00 kg/km  
Flame-retardant acc. to IEC 60332-3

app. 130 kg/km  
200 mm  
-30°C  
+70°C  
28,00 kg/km  
Flame-retardant acc. to IEC 60332-3

## Application

HELUKABEL® MOD-Bus PVC for standard application in this industry network.

## Part no.

**805698**, MOD-Bus Single Pair

**805697**, MOD-Bus Single Pair armoured

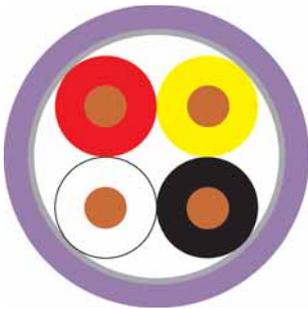
Dimensions and specifications may be changed without prior notice.

# BUS Cables

E-BUS / KNX fixed installed



PVC + FRNC



## Type Cable structure

Inner conductor:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Drain wire:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## 2-pairs 2x2x0.8 mm

Copper, bare  
PVC  
wh, ye, rd, bk  
Star quad  
Polyester foil over stranded bundle  
-  
Al-Foil  
yes  
PVC  
app. 6,2 mm ± 0,3 mm  
Blue Lilac similar to RAL 4005

## 2-pairs 2x2x0.8 mm

Copper, bare  
PE  
wh, ye, rd, bk  
Star quad  
Polyester foil over stranded bundle  
-  
Al-Foil  
yes  
FRNC  
app. 6,2 mm ± 0,3 mm  
Blue Lilac similar to RAL 4005

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:

100 Ohm  
36,6 Ohm/km  
0,1 GOhm x km  
73,2 Ohm/km max.  
120 nF/km nom.  
4 kV

100 Ohm  
36,6 Ohm/km  
0,1 GOhm x km  
73,2 Ohm/km max.  
120 nF/km nom.  
4 kV

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 64 kg/km  
95 mm  
-30°C  
+70°C  
0,90 MJ/m  
25,00 kg/km

app. 54 kg/km  
95 mm  
-30°C  
+70°C  
0,58 MJ/m  
25,00 kg/km

## Norms

Applicable standards:

EIB/KNX standard  
Flame-retardant acc. IEC 60332-2-1

EIB/KNX standard  
Halogen-free acc. to 60754-1  
Flame-retardant acc. IEC 60332-2-1

## Application

HELUKABEL® E-BUS EIB/KNX PVC for fixed installation. The E-Bus cable is intended for transmission of bus signals in intelligent building systems. The cables ensure perfect communication in compliance with EIB regulations. They can be installed over, in and under plaster, in conduits and cable channels, in dry, damp and wet rooms as well as outdoors - if protected from direct sunlight. Wiring together with high-power cables is possible without limitation. The EIB/KNX bus can be used to control lighting, blinds, heating, ventilation, indicator boards etc.

## Part no.

**81081**, E-BUS / KNX

**80826**, E-BUS / KNX

Dimensions and specifications may be changed without prior notice.

# BUS Cables

E-BUS / KNX fixed installed



PVC + FRNC



## Type Cable structure

Inner conductor:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Drain wire:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Electrical data

Characteristic impedance:  
Conductor resistance, max.:  
Insulation resistance, min.:  
Loop resistance:  
Mutual capacitance:  
Test voltage:

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

## Norms

Applicable standards:

## Application

### Part no.

Dimensions and specifications may be changed without prior notice.

## 2-pairs 2x2x0.8 mm

Copper, bare  
PVC  
wh, ye, rd, bk  
Star quad  
Polyester foil over stranded bundle  
-  
Al-Foil  
yes  
PVC  
app. 6,2 mm ± 0,3 mm  
Green similar to RAL 6010

100 Ohm  
36,6 Ohm/km  
0,1 GOhm x km  
73,2 Ohm/km max.  
120 nF/km nom.  
4 kV

app. 64 kg/km  
95 mm  
-30°C  
+70°C  
0,90 MJ/m  
25,00 kg/km

EIB/KNX standard  
Flame-retardant acc. IEC 60332-2-1

**81663**, E-BUS / KNX

## 2-pairs 2x2x0.8 mm

Copper, bare  
PE  
wh, ye, rd, bk  
Star quad  
Polyester foil over stranded bundle  
-  
Al-Foil  
yes  
FRNC  
app. 6,6 mm ± 0,3 mm  
Green

100 Ohm  
73,2 Ohm/km  
0,1 GOhm x km  
146,4 Ohm/km max.  
100 nF/km nom.  
4 kV

app. 54 kg/km  
95 mm  
-30°C  
+70°C  
0,58 MJ/m  
25,00 kg/km

EIB/KNX standard  
Halogen-free acc. to 60754-1  
Flame-retardant acc. IEC 60332-2-1

**804042**, E-BUS / KNX

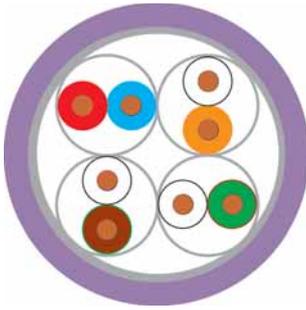
# BUS Cables

E-BUS / KNX fixed installed

 **HELUKABEL®**



PVC



## Type

### Cable structure

Inner conductor:	Copper, bare
Core insulation:	PVC
Core colours:	wh, ye, rd, gn, bu, bn, wh, wh
Stranding element:	Double core
Separator:	Polyester foil over stranded bundle
Shielding 1:	-
Total shielding:	Al-Foil
Drain wire:	yes
Outer sheath material:	PVC
Cable external diameter:	app. 8,6 mm ± 0,3 mm
Outer sheath colour:	Blue Lilac similar to RAL 4005

### Electrical data

Characteristic impedance:	100 Ohm
Conductor resistance, max.:	36,6 Ohm/km
Insulation resistance, min.:	0,1 GOhm x km
Loop resistance:	73,2 Ohm/km max.
Mutual capacitance:	120 nF/km nom.
Test voltage:	4 kV

### Technical data

Weight:	app. 92 kg/km
bending radius, repeated:	120 mm
Operating temperature range min.:	-30°C
Operating temperature range max.:	+70°C
Caloric load, approx. value:	1,37 MJ/m
Copper weight:	41,00 kg/km

### Norms

Applicable standards:	EIB/KNX standard Flame-retardant acc. IEC 60332-2-1
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### Application

#### Part no.

**81077**, E-BUS / KNX

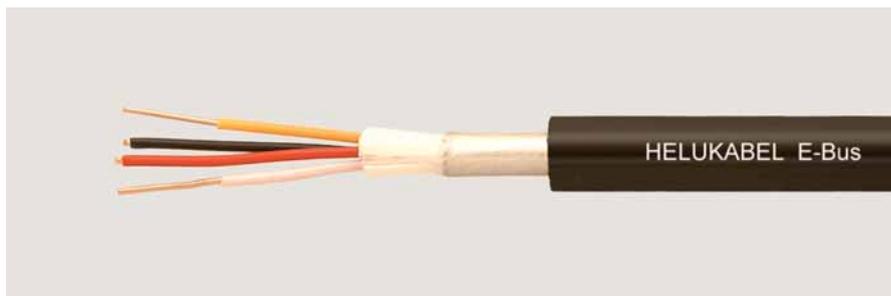
Dimensions and specifications may be changed without prior notice.

# BUS Cables

E-BUS / KNX BURIAL fixed installed

**HELUKABEL®**

PE, BURIAL



## Type Cable structure

Inner conductor:  
Core insulation:  
Core colours:  
Stranding element:  
Separator:  
Shielding 1:  
Total shielding:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Direct burial 2x2x0.8 mm

Copper, bare  
PE  
wh, ye, rd, bk  
Star quad  
Polyester foil over stranded bundle  
-  
Al-Foil  
PE  
app. 8,8 mm ± 0,3 mm  
Black similar to RAL 9005

## Electrical data

Characteristic impedance: 100 Ohm  
Conductor resistance, max.: 36,6 Ohm/km  
Insulation resistance, min.: 5 GOhm x km  
Loop resistance: 73,2 Ohm/km max.  
Mutual capacitance: 55 nF/km nom.  
Test voltage: 0,8 kV

## Technical data

Weight: app. 75 kg/km  
bending radius, repeated: 130 mm  
Operating temperature range min.: -20°C  
Operating temperature range max.: +70°C  
Caloric load, approx. value: 2,00 MJ/m  
Copper weight: 25,00 kg/km

## Norms

Applicable standards: EIB/KNX standard  
Halogen-free acc. to 60754-1

## Application

HELUKABEL® E-BUS / KNX ERD with PE jacket for fixed installation in the ground or outdoors and as a connection between buildings or to EIB/KNX components on the building. They can be installed over, in and under plaster, in conduits and cable channels, in dry, damp and wet rooms as well as outdoors - if protected from direct sunlight. Wiring together with high-power cables is possible without limitation. The EIB/KNX bus can be used to control lighting, blinds, heating, ventilation, indicator boards etc.

## Part no.

**802800**, E-BUS / KNX BURIAL

Dimensions and specifications may be changed without prior notice.

# BUS Cables

KH-BUS fixed installed



PVC + FRNC



## Type Cable structure

Inner conductor, power core:  
Inner conductor, data core:  
Core insulation, power core:  
Core insulation, data core:  
Core colours, power core:  
Core colours, data core:  
Stranding element, data core:  
Shielding, data pair:  
Drain wire:  
Outer sheath material:  
Cable external diameter:  
Outer sheath colour:

## Hospital-Bus 2x1.5mm<sup>2</sup> (stranded) + 2x2x0.60 mm (solid)

Copper, bare  
Copper, tinned  
PVC  
PE  
rd, bu  
gn/ye, gy/pk  
Double core  
PP foil + aluminium-lined foil + PP foil  
yes  
PVC  
app. 8,0 mm ± 0,3 mm  
Green similar to RAL 6001

## Hospital-Bus 2x1.5mm<sup>2</sup> (stranded) + 2x2x0.60 mm (solid)

Copper, bare  
Copper, tinned  
PE  
PE  
rd, bu  
gn/ye, gy/pk  
Double core  
PP foil + aluminium-lined foil + PP foil  
yes  
FRNC  
app. 8,0 mm ± 0,3 mm  
Green similar to RAL 6001

## Electrical data

Insulation resistance, min.:  
Mutual capacitance:  
Test voltage:

0,02 GOhm x km  
70 nF/km nom.  
2 kV

0,02 GOhm x km  
70 nF/km nom.  
2 kV

## Technical data

Weight:  
bending radius, repeated:  
Operating temperature range min.:  
Operating temperature range max.:  
Caloric load, approx. value:  
Copper weight:

app. 90 kg/km  
120 mm  
-40°C  
+80°C  
1,01 MJ/m  
53,00 kg/km

app. 93 kg/km  
120 mm  
-25°C  
+80°C  
0,86 MJ/m  
53,00 kg/km

## Application

HELUKABEL® KH-BUS PVC + FRNC for fixed installation of patient calling systems. Simple and fast installation is an important factor there. For this reason, a 6-conductor hybrid cable is used to connect the individual components of the calling system. This cable is used for the power supply, speech and data transmission. The FRNC version is the right choice when a halogen-free installation is required.

## Part no.

**81085**, KH-BUS

**81447**, KH-BUS

Dimensions and specifications may be changed without prior notice.





Wiring boxes

Industrial Ethernet RJ45 IP20

Patch cable SF/UTP PVC

PROFibus connectors

PROFINet RJ45 Plug IP20

Patch-Panel 24P

**HELUKAT**  
CONNECTING SYSTEMS

# ■ COPPER DATA CONNECTION TECHNICS – OFFICE

Designation	Page
<b>Connection Technic - Office</b>	
Complete system solutions	HELUKAT CONNECTION SYSTEMS® 224
Certificates	HELUKAT CONNECTION SYSTEMS® 225
Modular connector Systems RJ45	HELUKAT CONNECTION SYSTEMS® 226
Patch panel, screened, 24P Cat.6a, 500MHz (10 GBit)	HELUKAT CONNECTION SYSTEMS® 24P 228
Patch panel, screened, 24P Cat.6 /Class E	HELUKAT CONNECTION SYSTEMS® 24P 229
Patch panel, unscreened, 24P Cat.6 /Class E	HELUKAT CONNECTION SYSTEMS® 24P 230
Patch panel, screened, 24P Cat.5e/ Class D	HELUKAT CONNECTION SYSTEMS® 24P 231
Wiring boxes UP, screened, 2P Cat.6a, 500 MHz (10 GBit)	HELUKAT CONNECTION SYSTEMS® 2P UP 232
Wiring boxes UP, screened, 2P Cat.6/Class E	HELUKAT CONNECTION SYSTEMS® 2P UP 233
Wiring boxes UP, unscreened, Cat.5e/ Class D	HELUKAT CONNECTION SYSTEMS® 2P UP 234
Wiring boxes RJ45, screened, Kat.5e/ Class D	HELUKAT CONNECTION SYSTEMS® 2P UP 235
Patch cable RJ45, Cat.6a 500 MHz (10Gbit)	HELUKAT CONNECTION SYSTEMS® S/FTP LSZH 236
Patch cable RJ45, unscreened, Cat.6a 500 MHz (10Gbit)	HELUKAT CONNECTION SYSTEMS® U/UTP LSZH 237
Patch cable RJ45, Patch cabel, Kat.6	HELUKAT CONNECTION SYSTEMS® S/FTP LSZH 238
Patch cable RJ45, unscreened, Cat.6	HELUKAT CONNECTION SYSTEMS® U/UTP PVC 240
Patch cable RJ45, Cat.5e	HELUKAT CONNECTION SYSTEMS® SF/UTP PVC 242
Patch cable RJ45, unscreened, Cat.5e	HELUKAT CONNECTION SYSTEMS® U/UTP PVC 244
General accessories	HELUKAT CONNECTION SYSTEMS® 245
Rubber cable reel with HELUKAT® copper data cable	HELUKAT CONNECTION SYSTEMS® 246
<b>Connection Technic - Industry</b>	<b>248</b>

# ■ COMPLETE SYSTEM SOLUTIONS

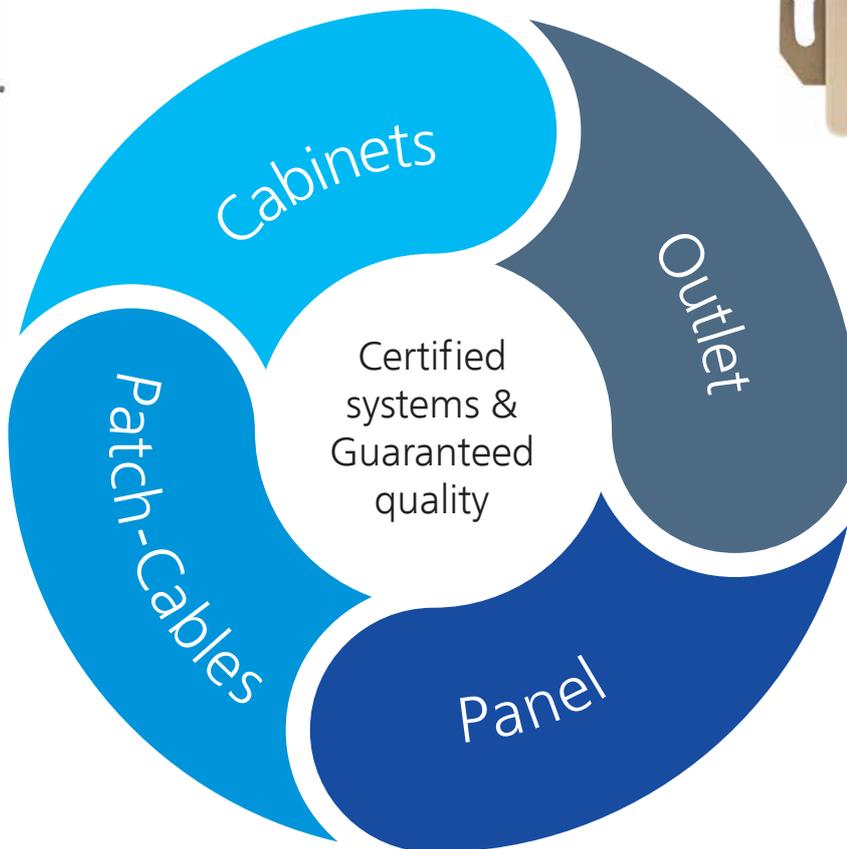


As a result of the drastic growth of the volume of data handled by data and network systems together with subsequently lower tolerance deviations allowed in relation to standard specifications, ensuring the optimum level of component integration and efficiency is sure to be a vital factor in the creation of successful systems in the future.

In recent years, **HELUKAT®** has earned an excellent reputation in the area of structured copper data wiring. Superior quality combined with expert technical assistance and prompt delivery to customers is what makes **HELUKABEL®** the brand of choice. With **HELUKAT CONNECTING SYSTEMS®**, we have come full

circle to provide you with a complete wiring system comprising everything from the installation cable, patch panels and RJ45 sockets all the way to patch cables and data cabinets. To provide customers and users with a sufficient level of transparency, components have been subjected to a non-biased examination carried out according to the channel link. The GHMT company has certified our products for category 6 and classes D, E and Ea.

Simply specify the network structures you need, and let the superior quality and reliability of **HELUKAT CONNECTING SYSTEMS®** do the rest.



## Certificate

No. z2912a-12-E

**Customer:** HELUKABEL GmbH  
Dieselstrasse 8-12  
D-71282 Hemmingen

**Test sample(s):**

- Connector: HELUKAT CONNECTING SYSTEMS® RJ Modular Jack Cat.6EA Part No.: 802377
- Data Cable: HELUKAT® 600 S-STP (4x2xAWG23/1) FRNC Part No.: 803898, 803897, 80810, 81446

**Applied standard(s):**

- ISO/IEC 11801 AMD 2 (2010-04)

**Results:**  
Up to a bandwidth of **500 MHz** the sample meets the **Class E<sub>A</sub>** limits of the specified standards and regulations.

**2-Connector Permanent Link, Class E<sub>A</sub>**

The test results which were determined in the course of the measurement refer to the submitted specimen. Any future technical modifications of the verified Products are subject to the responsibility of the manufacturer.  
This Certificate refers to the comprehensive test report, no. P2912a-12-E, dated April 10<sup>th</sup>, 2012 and shall only be applicable in conjunction with the test report.

Bexbach, April 10<sup>th</sup>, 2012

Dirk Wilhelm, engineer  
(Chairman of the Managing Board)

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In der Kolling 13  
D-66450 Bexbach  
Phone: +49 (0) 68 26 / 92 28 - 0  
Fax: +49 (0) 68 26 / 92 28 - 99  
Email: info@ghmt.de

## Certificate

**Customer:** HELUKABEL® GmbH  
Dieselstr. 8-12  
D-71282 Hemmingen

**Description:**

<b>Patchpanel:</b>	HELUKAT CONNECTING SYSTEMS® Patchpanel 24 Port Cat. 6EA 500 MHz Part No.: 802024
<b>Outlet:</b>	HELUKAT CONNECTING SYSTEMS® UTP-Down 2 Port Cat.6EA 500 MHz Part No.: 802025 (vertical), 802024 (horizontal)
<b>Connector:</b>	HELUKAT CONNECTING SYSTEMS® Connector Cat. 7 to connect Data Cables
<b>Data Cable:</b>	HELUKAT® 600MHz Data Cable S-STP 4x2xAWG23/1 FRNC 600MHz Part No.: 80810
<b>Patchcord:</b>	HELUKAT CONNECTING SYSTEMS® S-STP 4x2xAWG26/7 FRNC 600MHz RJ45 Category 6 (Stewart 39), Length 5,0m

**Applied standards:**

ISO/IEC 11801 Amendment 1 JTC 1/SC 21/25 Information technology – Generic cabling for customer premises  
ISO/IEC TR 24750 Assessment and mitigation of installed balanced cabling channels in order to support 10GBASE-T  
TIA/EIA-568-B-2-10 (shall also support)  
Transmission performance specifications for 4-pair 100 Ω category 6 cabling  
ANSI/TIA-TSB-155 Additional guidelines for 4-pair 100 Ω category 6 cabling for 10GBASE-T  
IEEE 802.3an TM-2006 Local and Metropolitan Area Networks (10 GBASE-T)

**Results:**  
Up to a bandwidth of **Augmented Class E (500MHz)** the sample, a 4-Connector-Channel, meet the limits of the specified standards and regulations.  
The test results which were determined in the course of the measurement refer to the submitted specimen. Any future technical modifications of the data cables or connectors are subject to the responsibility of the manufacturer.  
This Certificate refers to the comprehensive test report, no. P1768a-07-E, from August 31<sup>st</sup> 2007 and shall only be applicable in conjunction with the test report.  
Bexbach, August 31<sup>st</sup> 2007

Dirk Wilhelm, engineer  
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http://www.ghmt.de

GHMT Aktiengesellschaft

## Certificate

No. z2913a-12-E

**Customer:** HELUKABEL GmbH  
Dieselstrasse 8-12  
D-71282 Hemmingen

**Test sample(s):**

- Connector: HELUKAT CONNECTING SYSTEMS® RJ Modular Jack Kat.6 Part No.: 802916
- Data Cable: HELUKAT® 600 S-STP (4x2xAWG23/1) FRNC Part No.: 803898, 803897, 80810, 81446

**Applied standard(s):**

- ISO/IEC 11801 AMD 2 (2010-04)

**Results:**  
Up to a bandwidth of **250 MHz** the sample meets the **Class E** limits of the specified standards and regulations.

**2-Connector Permanent Link, Class E**

The test results which were determined in the course of the measurement refer to the submitted specimen. Any future technical modifications of the verified Products are subject to the responsibility of the manufacturer.  
This Certificate refers to the comprehensive test report, no. P2913a-12-E, dated April 10<sup>th</sup>, 2012 and shall only be applicable in conjunction with the test report.

Bexbach, April 10<sup>th</sup>, 2012

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## Certificate

**Customer:** HELUKABEL® GmbH  
Dieselstr. 8-12  
D-71282 Hemmingen

**Description:**

<b>Modul:</b>	HELUKAT CONNECTING SYSTEMS® Modulsystem Keystone Cat. 6EA 500 MHz Part No.: 802377
<b>Connector:</b>	HELUKAT CONNECTING SYSTEMS® Connector Cat. 7 to connect Data Cables
<b>Data Cable:</b>	HELUKAT® 600MHz Data Cable S-STP 4x2xAWG23/1 FRNC 600MHz Part No.: 80810
<b>Patchcord:</b>	HELUKAT CONNECTING SYSTEMS® S-STP 4x2xAWG26/7 FRNC 600MHz RJ45 Category 6 (Stewart 39), Length 5,0m

**Applied standards:**

ISO/IEC 11801 Amendment 1: 2008-04 Information technology – Generic cabling for customer premises  
ISO/IEC TR 24750 Assessment and mitigation of installed balanced cabling channels in order to support 10GBASE-T  
TIA/EIA-568-B-2-10 Transmission performance specifications for 4-pair 100 Ω augmented category 6 cabling  
ANSI/TIA-TSB-155 Additional guidelines for 4-pair 100 Ω category 6 cabling for 10GBASE-T  
IEEE 802.3an TM-2006 Local and Metropolitan Area Networks (10 GBASE-T)

**Results:**  
Up to a bandwidth of **Augmented Class E (500MHz)** the sample, a 4-Connector-Channel, meet the limits of the specified standards and regulations.  
The test results which were determined in the course of the measurement refer to the submitted specimen. Any future technical modifications of the data cables or connectors are subject to the responsibility of the manufacturer.  
This Certificate refers to the comprehensive test report, no. P1918b-08-E, from July 31<sup>st</sup> 2008 and shall only be applicable in conjunction with the test report.  
Bexbach, July 31<sup>st</sup> 2008

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GHMT Aktiengesellschaft

# MODULAR-SYSTEM RJ45



## Jack/Keystone

Category:  
Plug type:  
Screening:  
Colour:  
Part no:  
Packing unit:  
Dust Protection:

6 <sub>A</sub>	6	6	6	5e
RJ45 8(8)				
yes		no		
metallic		black	white	
<b>802377</b>	<b>802916</b>	<b>804691</b>	<b>805044</b>	<b>804645</b>
12				
yes	no	yes	yes	no



## Panel

Version:  
Module type:  
Colour:  
Max. number of modules:  
Part no:  
Packing unit:  
Dust Protection:

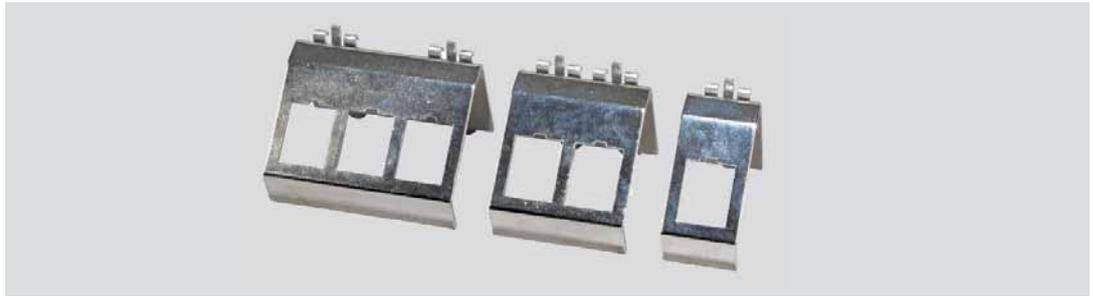
Modular Panel	
RJ45	
grey	black
<b>802376</b>	<b>805429</b>
optional see Accessories	



## Outlet

Version:  
Module type:  
Colour:  
Max. number of modules:  
Part no:  
Packing unit:  
Dust Protection:

Support for module			
RJ45			
white			Metall
3	2	1	2
<b>802986</b>	<b>802378</b>	<b>802985</b>	<b>804763</b>
4			1
optional see Accessories			no



## DIN rail module

Version:

DIN rail module for Jack/Keystone

Max. number of modules:

1	2	3
---	---	---

Colour:

metallic

Part no:

<b>805403</b>	<b>805404</b>	<b>805405</b>
---------------	---------------	---------------

Packing unit:

1



## Accessories

Part no:

<b>805381</b>	<b>802988</b>	<b>802987</b>	<b>802990</b>	<b>804286</b>
---------------	---------------	---------------	---------------	---------------

Description:

Tools for AMP-Twist Jack	Floor tank frame set 3x3 Port empty	Floor tank frame set 2x3 Port empty	Dust Protection forKeystone-system Outlet and Panels	
--------------------------	--	--	--	--

Colour:

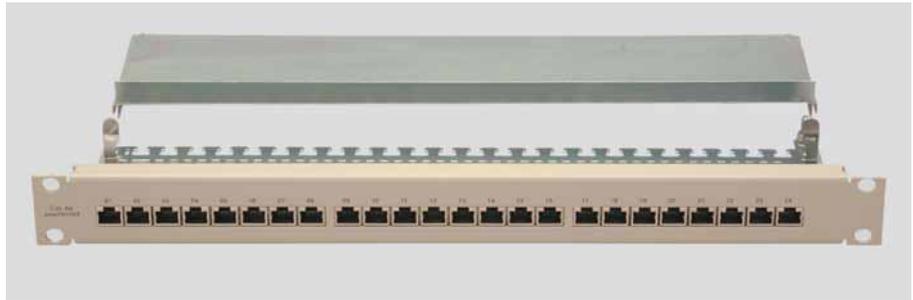
metallic	black		white	black
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### Norms and standards

Kat. 5, Kat. 5e, Kat. 6, Kat. 6<sub>A</sub>, Kat. 7<sub>A</sub> according to the specifications of each product. More informations can be found at our data sheets.

### Application

As floor distributor in applications of digital and analog image, data and voice transmission.



## Type

### Configuration

Housing material:	Steel plate, solid
Colour:	Grey similar to RAL 7035
Board:	3x8 mother board, number-coded
Push-on connector type:	RJ45(8/8)
Number of bushes:	24
Type of screen:	Overall screen
Screen removal:	metalized cable straps
Strain relief:	by means of cable straps
Cover lock:	Quick-action snap cover

### Patch panel category 24P 6EA 500MHz

### Connecting system

Connection type:	LSA plus - insulation piercing connections
Suitable for cable diameter:	0.4 - 0.64mm (AWG 26 - 22)
Insulation diameter, min.:	0,7 - 1,6 mm (PE)

### Assignment type

EIA/TIA 568 A + EIA/TIA 568 B

### Dimension

Width:	483 mm
Depth:	125 mm
Number of height modules (HM):	1
Fastening dimensions:	19"

### Norms and standards

HELUKAT® CONNECTING SYSTEMS® system component up to 500 MHz (10 GBit Ethernet) in accordance with category 6a EIA/TIA 568-B.2-10, IEEE 802.3an TM-2006, ISO/IEC 11801 (Amendment 1 JTC 1/SC N1255), ISO/IEC TR-24750 and EN 55022 (EMV).

### Application

As floor distributor in applications of digital and analog image, data and voice transmission.

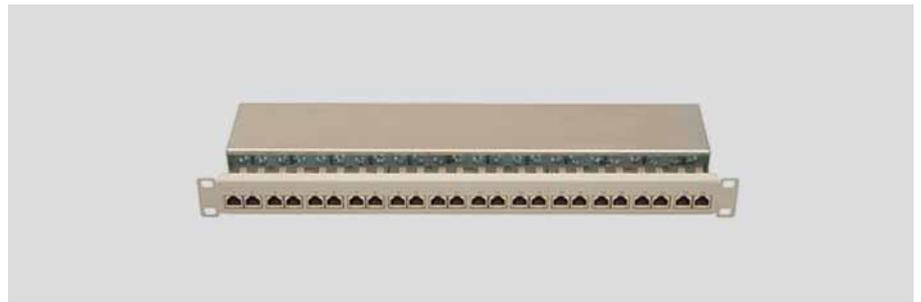
### Part no.

**802024**

Dimensions and specifications may be changed without prior notice.

### Packing unit

**1**



## Type

### Configuration

Housing material:	Steel plate, solid
Colour:	Grey similar to RAL 7035
Board:	3x8 mother board, colour and number-coded
Push-on connector type:	RJ45(8/8)
Number of bushes:	24
Type of screen:	Overall screen
Screen removal:	via continuous screening tape
Strain relief:	via pre-installed cable clips
Cover lock:	Quick-action snap cover

### Connecting system

Connection type:	LSA plus - insulation piercing connections
Suitable for cable diameter:	0.4 - 0.64mm (AWG 26 - 22)
Insulation diameter, min.:	0,7 - 1,7 mm (PE)

### Assignment type

EIA/TIA 568 A + EIA/TIA 568 B

### Dimension

Width:	483 mm
Depth:	148 mm
Number of height modules (HM):	1
Fastening dimensions:	19"

### Norms and standards

HELUKAT® CONNECTING SYSTEMS® system component up to 250 MHz in the permanent link of category 6 / Class E in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, EIA/TIA 568 B, and EN 55022 (EMC).

### Application

As floor distributor in applications of digital and analog image, data and voice transmission.

### Part no.

**82848**

Dimensions and specifications may be changed without prior notice.

### Packing unit

**1**

# Patch-Panels RJ45 unscreened



Category 6 / Class E



## Type

### Configuration

Housing material:	Steel plate, solid
Colour:	Black similar to RAL 9005
Board:	3x8 mother board, colour and number-coded
Push-on connector type:	RJ45(8/8)
Number of bushes:	24
Type of screen:	no
Strain relief:	by means of cable straps

### Connecting system

Connection type:	LSA plus - insulation piercing connections
Suitable for cable diameter:	0.4 - 0.64mm (AWG 26 - 22)
Insulation diameter, min.:	0,7 - 1,7 mm (PE)

### Assignment type

EIA/TIA 568 A + EIA/TIA 568 B

### Dimension

Width:	440 mm
Depth:	110 mm
Number of height modules (HM):	1
Fastening dimensions:	19"

### Norms and standards

HELUKAT® CONNECTING SYSTEMS® unscreened system component up to 250 MHz of category 6 / Class E in accordance with ISO 11801, EN 50173.

### Application

As floor distributor in applications of digital and analog image, data and voice transmission.

### Part no.

**802908**

Dimensions and specifications may be changed without prior notice.

### Packing unit

**1**



## Type

### Configuration

Housing material:

Colour:

Board:

Push-on connector type:

Number of bushes:

Type of screen:

Screen removal:

Strain relief:

Cover lock:

### Patch panel cat. 5e / class D 24P

Steel plate, solid

Grey similar to RAL 7035

3x8 mother board, colour and number-coded

RJ45(8/8)

24

Overall screen

via continuous screening tape

via pre-installed cable clips

Quick-action twist lock

### Connecting system

Connection type:

Suitable for cable diameter:

Insulation diameter, min.:

LSA plus - insulation piercing connections

0.4 - 0.64mm (AWG 26 - 22)

0,7 - 1,7 mm (PE)

### Assignment type

EIA/TIA 568 A + EIA/TIA 568 B

### Dimension

Width:

483 mm

Depth:

148 mm

Number of height modules (HM):

1

Fastening dimensions:

19"

### Norms and standards

HELUKAT® CONNECTING SYSTEMS® system component up to 100 MHz in category 5(e) / Class D in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, EIA/TIA 568 B, and EN 55022 (EMC)

### Application

As floor distributor in applications of digital and analog image, data and voice transmission.

### Part no.

**82010**

Dimensions and specifications may be changed without prior notice.

### Packing unit

**1**



## Type

**RJ-45 UP socket 2P cat. 6EA  
500MHz vertical**

**RJ-45 UP socket 2P cat. 6a  
500MHz horizontal**

## Configuration

Housing material:  
Colour:  
Board:  
Push-on connector type:  
Outlet direction:  
Number of bushes:  
Type of screen:  
Strain relief:  
Cable inlet:

Die-cast, shielded  
Pure White similar to RAL 9010  
1x2  
RJ45(8/8)  
45 degrees  
2  
Overall screen  
via pre-installed cable clips  
vertical

Die-cast, shielded  
Pure White similar to RAL 9010  
1x2  
RJ45(8/8)  
45 degrees  
2  
Overall screen  
via pre-installed cable clips  
horizontal

## Connecting system

Connection type:  
Suitable for cable diameter:  
Insulation diameter, min.:

LSA plus - insulation piercing connections  
0,4 - 0,64mm (AWG 26 - 22)  
0,7 - 1,6 mm (PE)

LSA plus - insulation piercing connections  
0,4 - 0,64mm (AWG 26 - 22)  
0,7 - 1,6 mm (PE)

## Assignment type

EIA/TIA 568 A + EIA/TIA 568 B

EIA/TIA 568 A + EIA/TIA 568 B

## Dimension

Dimensions of central plate:  
Installation dimensions:

50 x 50mm  
50 x 50 x 32mm

50 x 50mm  
50 x 50 x 32mm

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® system component up to 500 MHz (10 GBit Ethernet) in accordance with category 6a EIA/TIA 568-B.2-10, IEEE 802.3an TM-2006, ISO/IEC 11801 (Amendment 1 JTC 1/SC N1255), ISO/IEC TR-24750 and EN 55022 (EMV).

## Application

As workstation interface in applications of digital and analog image, data and voice transmission. Available as in-wall version (channel) and top-mount version (wall).

## Part no.

**802025**

**802034**

Dimensions and specifications may be changed without prior notice.

## Packing unit

**10**

**10**



## Type

### RJ-45 UP socket class E 2P horizontal

## Configuration

Housing material:	Die-cast, shielded
Colour:	Pure White similar to RAL 9010
Board:	1x2
Push-on connector type:	RJ45(8/8)
Outlet direction:	45 degrees
Number of bushes:	2
Type of screen:	Overall screen
Strain relief:	via pre-installed cable clips
Cable inlet:	horizontal

## Connecting system

Connection type:	LSA plus - insulation piercing connections
Suitable for cable diameter:	0,4 - 0,64mm (AWG 26 - 22)
Insulation diameter, min.:	0,7 - 1,6 mm (PE)

## Assignment type

EIA/TIA 568 A + EIA/TIA 568 B

## Dimension

Dimensions of central plate:	50 x 50mm
Installation dimensions:	51 x 51 x 29mm

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® system component up to 250 MHz in the permanent link of category 6 / Class E in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, EIA/TIA 568 B, and EN 55022 (EMC)

## Application

As workstation interface in applications of digital and analog image, data and voice transmission. Available as in-wall version (channel) and top-mount version (wall).

## Part no.

**82847**

Dimensions and specifications may be changed without prior notice.

## Packing unit

**10**

# Outlets RJ45 unscreened



Category 6/ Class E



## Type

**RJ-45 UP socket unscreened class E 2P vertical**

**RJ-45 UP socket unscreened class E 2P horizontal**

## Configuration

Housing material:  
Colour:  
Board:  
Push-on connector type:  
Outlet direction:  
Number of bushes:  
Type of screen:  
Strain relief:  
Cable inlet:

Plastic  
Pure White similar to RAL 9010  
1x2  
RJ45(8/8)  
45 degrees  
2  
no  
via pre-installed cable clips  
vertical

Plastic  
Pure White similar to RAL 9010  
1x2  
RJ45(8/8)  
45 degrees  
2  
no  
via pre-installed cable clips  
horizontal

## Connecting system

Connection type:  
Suitable for cable diameter:  
Insulation diameter, min.:

LSA plus - insulation piercing connections  
0,4 - 0,64mm (AWG 26 - 22)  
0,7 - 1,6 mm (PE)

LSA plus - insulation piercing connections  
0,4 - 0,64mm (AWG 26 - 22)  
0,7 - 1,6 mm (PE)

## Assignment type

EIA/TIA 568 A + EIA/TIA 568 B

EIA/TIA 568 A + EIA/TIA 568 B

## Dimension

## Norms and standards

HELUKAT® system component unscreened up to 250 MHz of category 6 or Class E in accordance with ISO 11801, EN 50173, ANSI/TIA/EIA 568 B2-1.

## Application

As workstation interface in applications of digital and analog image, data and voice transmission. Available as in-wall version (channel) and top-mount version (possible with an extra frame).

## Part no.

**802909**

**803033**

Dimensions and specifications may be changed without prior notice.

## Packing unit

**10**

**10**



## Type

### RJ-45 UP socket cat. 5e 2P horizontal

### RJ-45 UP socket cat. 5e 2P vertical

## Configuration

Housing material:  
Colour:  
Board:  
Push-on connector type:  
Outlet direction:  
Number of bushes:  
Type of screen:  
Strain relief:  
Cable inlet:

Die-cast, shielded  
Pure White similar to RAL 9010  
1x2  
RJ45(8/8)  
45 degrees  
2  
Overall screen  
via pre-installed cable clips  
horizontal

Die-cast, shielded  
Pure White similar to RAL 9010  
1x2  
RJ45(8/8)  
45 degrees  
2  
Overall screen  
via pre-installed cable clips  
vertical

## Connecting system

Connection type:  
Suitable for cable diameter:  
Insulation diameter, min.:

LSA plus - insulation piercing connections  
0,4 - 0,64mm (AWG 26 - 22)  
0,7 - 1,1 mm (PE)

LSA plus - insulation piercing connections  
0,4 - 0,64mm (AWG 26 - 22)  
0,7 - 1,1 mm (PE)

## Assignment type

EIA/TIA 568 A + EIA/TIA 568 B

EIA/TIA 568 A + EIA/TIA 568 B

## Dimension

Dimensions of central plate:  
Installation dimensions:

50 x 50mm  
51 x 51 x 29mm

50 x 50mm  
51 x 51 x 29mm

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® system component up to 100 MHz in category 5(e) / Class D in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, EIA/TIA 568 B, and EN 55022 (EMC)

## Application

As workstation interface in applications of digital and analog image, data and voice transmission. Available as in-wall version (channel) and top-mount version (wall).

## Part no.

**82008**

**82853**

Dimensions and specifications may be changed without prior notice.

## Packing unit

**10**

**10**



## Type

### Cable

Designation:  
Sheath material:  
Frequency:

## Patch cable S/FTP halogenfree, Cat.6a 500 MHz (10GBit)

S/FTP 4x2xAWG 26/7 LSZH  
LSZH  
up to 500 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
Pin assignment:

RJ45 8(8)  
RJ45 8(8)  
1:1 acc. to TIA/EIA 568 B

### Flame proof

acc. to IEC 60332-1-2

### Norms and standards

HELUKAT® CONNECTING SYSTEMS® system components up to 500 MHz (10GBit) of category 6a / Class E in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, and EIA/TIA 568 C-2.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>802380</b>	grey	1,0	10
<b>802381</b>	grey	2,0	10
<b>802382</b>	grey	3,0	10
<b>802383</b>	grey	5,0	10
<b>802384</b>	grey	7,5	10
<b>802385</b>	grey	10,0	10
<b>804287</b>	grey	15,0	10

Dimensions and specifications may be changed without prior notice.

### Options

Naturally, we also offer other lengths and colors on request.



## Type

### Cable

Designation:  
Sheath material:  
Frequency:

## Patch cable U/UTP halogenfree, Cat.6a 500 MHz (10GBit)

U/UTP 4x2xAWG 24/7 LSZH  
LSZH  
up to 500 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
Pin assignment:

RJ45 8(8)  
RJ45 8(8)  
1:1 acc. to TIA/EIA 568 B

### Flame proof

acc. to IEC 60332-1-2

### Norms and standards

HELUKAT® CONNECTING SYSTEMS® system components up to 500 MHz (10GBit) of category 6a / Class E in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, and EIA/TIA 568 C-2.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>804972</b>	grey	1,0	10
<b>804973</b>	grey	2,0	10
<b>804974</b>	grey	3,0	10
<b>804975</b>	grey	5,0	10
<b>804976</b>	grey	7,5	10
<b>804977</b>	grey	10,0	10
<b>805055</b>	grey	15,0	10

Dimensions and specifications may be changed without prior notice.

### Options

Naturally, we also offer other lengths and colors on request.



## Type

### Cable

Designation:  
Sheath material:  
Frequency:

## Patch cable S/FTP halogenfree, Cat.6

S/FTP 4x2xAWG 27/7 halogenfree  
LSZH  
up to 250 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
Pin assignment:

RJ45 8(8)  
RJ45 8(8)  
1:1 acc. to TIA/EIA 568 B

### Flame proof

acc. to IEC 60332-1-2

### Norms and standards

HELUKAT® CONNECTING SYSTEMS® system components up to 250 MHz of category 6 / Class E in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, and EIA/TIA 568 B.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806253</b>	grey	0,25	10
<b>82857</b>	grey	0,5	10
<b>82858</b>	grey	1,0	10
<b>806254</b>	grey	1,5	10
<b>82859</b>	grey	2,0	10
<b>82860</b>	grey	3,0	10
<b>82861</b>	grey	5,0	10
<b>82862</b>	grey	7,5	5
<b>82863</b>	grey	10,0	5
<b>82864</b>	grey	15,0	5

Part no.	Sheath colour	Length in metres	Unit
<b>802999</b>	blue	0,5	10
<b>803000</b>	blue	1,0	10
<b>803001</b>	blue	2,0	10
<b>803002</b>	blue	3,0	10
<b>803003</b>	blue	5,0	10
<b>803004</b>	blue	7,5	5
<b>803005</b>	blue	10,0	5
<b>803006</b>	blue	15,0	5

Part no.	Sheath colour	Length in metres	Unit
<b>806255</b>	green	0,25	10
<b>803007</b>	green	0,5	10
<b>803008</b>	green	1,0	10
<b>806256</b>	green	1,5	10
<b>803009</b>	green	2,0	10
<b>803010</b>	green	3,0	10
<b>803011</b>	green	5,0	10
<b>803012</b>	green	7,5	5
<b>803013</b>	green	10,0	5
<b>803014</b>	green	15,0	5

Continuation ►

# Patch Cables RJ45



Category 6 / Class E

Part no.	Sheath colour	Length in metres	Unit
802991	red	0,5	10
802992	red	1,0	10
802993	red	2,0	10
802994	red	3,0	10
802995	red	5,0	10
802996	red	7,5	5
802997	red	10,0	5
802998	red	15,0	5

Part no.	Sheath colour	Length in metres	Unit
803015	yellow	0,5	10
803016	yellow	1,0	10
803017	yellow	2,0	10
803018	yellow	3,0	10
803019	yellow	5,0	10
803020	yellow	7,5	5
803021	yellow	10,0	5
803022	yellow	15,0	5

Part no.	Sheath colour	Length in metres	Unit
803023	black	0,5	10
803024	black	1,0	10
803025	black	2,0	10
803026	black	3,0	10
803027	black	5,0	10
803028	black	7,5	5
803029	black	10,0	5
803030	black	15,0	5

Dimensions and specifications may be changed without prior notice.

## Options

Naturally, we also offer other lengths, colors and crossover cables on request.

# Patch Cables RJ45 unscreened



Category 6/ Class E



## Type

### Cable

Designation:  
Sheath material:  
Frequency:

## Patch cable unscreened U/UTP PVC, Cat.6

U/UTP 4x2xAWG 24/7 PVC  
PVC  
up to 250 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
Pin assignment:

RJ45 8(8)  
RJ45 8(8)  
1:1 acc. to TIA/EIA 568 B

### Flame proof

acc. to IEC 60332-1-2

### Norms and standards

HELUKAT® CONNECTING SYSTEMS® system components up to 250 MHz in the of category 6 or EIA/TIA 568 B.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>803097</b>	grey	0,5	10
<b>803098</b>	grey	1,0	10
<b>803099</b>	grey	2,0	10
<b>803100</b>	grey	3,0	10
<b>803101</b>	grey	5,0	10
<b>803102</b>	grey	7,5	10
<b>803103</b>	grey	10,0	10
<b>803104</b>	grey	15,0	10

Part no.	Sheath colour	Length in metres	Unit
<b>803113</b>	blue	0,5	10
<b>803114</b>	blue	1,0	10
<b>803115</b>	blue	2,0	10
<b>803116</b>	blue	3,0	10
<b>803117</b>	blue	5,0	10
<b>803118</b>	blue	7,5	10
<b>803119</b>	blue	10,0	10
<b>803120</b>	blue	15,0	10

Part no.	Sheath colour	Length in metres	Unit
<b>803121</b>	green	0,5	10
<b>803122</b>	green	1,0	10
<b>803123</b>	green	2,0	10
<b>803124</b>	green	3,0	10
<b>803125</b>	green	5,0	10
<b>803126</b>	green	7,5	10
<b>803127</b>	green	10,0	10
<b>803128</b>	green	15,0	10

Continuation ►

# Patch Cables RJ45 unshielded



Category 6/ Class E

Part no.	Sheath colour	Length in metres	Unit
803105	red	0,5	10
803106	red	1,0	10
803107	red	2,0	10
803108	red	3,0	10
803109	red	5,0	10
803110	red	7,5	10
803111	red	10,0	10
803112	red	15,0	10

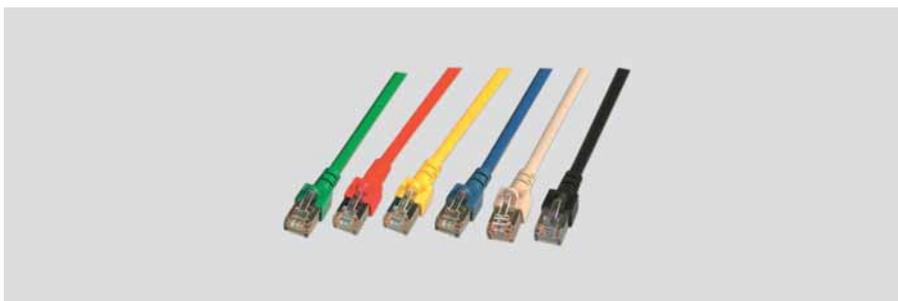
Part no.	Sheath colour	Length in metres	Unit
803129	yellow	0,5	10
803130	yellow	1,0	10
803131	yellow	2,0	10
803132	yellow	3,0	10
803133	yellow	5,0	10
803134	yellow	7,5	10
803135	yellow	10,0	10
803136	yellow	15,0	10

Part no.	Sheath colour	Length in metres	Unit
803137	black	0,5	10
803138	black	1,0	10
803139	black	2,0	10
803140	black	3,0	10
803141	black	5,0	10
803142	black	7,5	10
803143	black	10,0	10
803144	black	15,0	10

Dimensions and specifications may be changed without prior notice.

## Options

Naturally, we also offer other lengths, colors and crossover cables on request.



## Type

### Cable

Designation:  
Sheath material:  
Frequency:

## Patch cable SF/UTP PVC Cat.5e

SF/UTP 4x2xAWG 26/7 PVC  
PVC  
up to 100 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
Pin assignment:

RJ45 8(8)  
RJ45 8(8)  
1:1 acc. to TIA/EIA 568 B

### Flame proof

acc. to IEC 60332-1-2

### Norms and standards

HELUKAT® CONNECTING SYSTEMS® system components up to 100 MHz of category 5(e) / Class D in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, and EIA/TIA 568 B.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>803049</b>	grey	0,5	10
<b>803050</b>	grey	1,0	10
<b>803051</b>	grey	2,0	10
<b>803052</b>	grey	3,0	10
<b>803053</b>	grey	5,0	10
<b>803054</b>	grey	7,5	10
<b>803055</b>	grey	10,0	10
<b>803056</b>	grey	15,0	10

Part no.	Sheath colour	Length in metres	Unit
<b>803065</b>	blue	0,5	10
<b>803066</b>	blue	1,0	10
<b>803067</b>	blue	2,0	10
<b>803068</b>	blue	3,0	10
<b>803069</b>	blue	5,0	10
<b>803070</b>	blue	7,5	10
<b>803071</b>	blue	10,0	10
<b>803072</b>	blue	15,0	10

Part no.	Sheath colour	Length in metres	Unit
<b>803073</b>	green	0,5	10
<b>803074</b>	green	1,0	10
<b>803075</b>	green	2,0	10
<b>803076</b>	green	3,0	10
<b>803077</b>	green	5,0	10
<b>803078</b>	green	7,5	10
<b>803079</b>	green	10,0	10
<b>803080</b>	green	15,0	10

Continuation ►

# Patch Cables RJ45



Category 5e / Class D

Part no.	Sheath colour	Length in metres	Unit
803057	red	0,5	10
803058	red	1,0	10
803059	red	2,0	10
803060	red	3,0	10
803061	red	5,0	10
803062	red	7,5	10
803063	red	10,0	10
803064	red	15,0	10

Part no.	Sheath colour	Length in metres	Unit
803081	yellow	0,5	10
803082	yellow	1,0	10
803083	yellow	2,0	10
803084	yellow	3,0	10
803085	yellow	5,0	10
803086	yellow	7,5	10
803087	yellow	10,0	10
803088	yellow	15,0	10

Part no.	Sheath colour	Length in metres	Unit
803089	black	0,5	10
803090	black	1,0	10
803091	black	2,0	10
803092	black	3,0	10
803093	black	5,0	10
803094	black	7,5	10
803095	black	10,0	10
803096	black	15,0	10

Dimensions and specifications may be changed without prior notice.

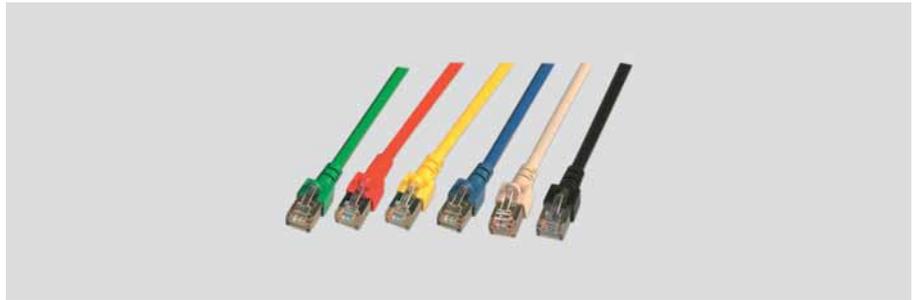
## Options

Naturally, we also offer other lengths, colors and crossover cables on request.

# Patch Cables RJ45



Category 5e / Class D



## Type

### Cable

Designation:  
Sheath material:  
Frequency:

## Patch cable U/UTP PVC Cat.5e

U/UTP 4x2xAWG 24/7 PVC  
PVC  
up to 155 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
Pin assignment:

RJ45 8(8)  
RJ45 8(8)  
1:1 acc. to TIA/EIA 568 B

### Flame proof

acc. to IEC 60332-1-2

### Norms and standards

HELUKAT® CONNECTING SYSTEMS® system components up to 155 MHz of category 5e in accordance with ISO 11801, EIA/TIA 568 B.

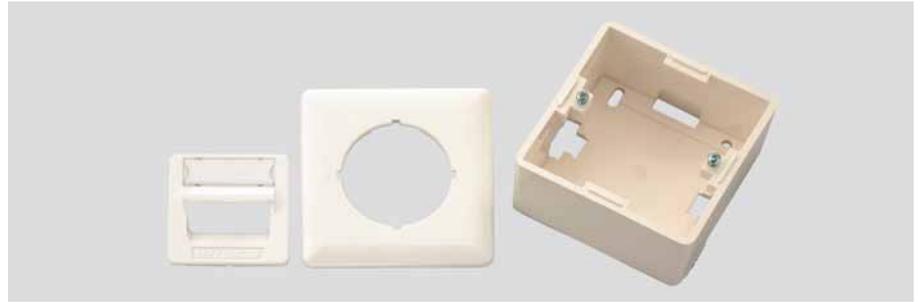
### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>804646</b>	grey	0,5	10
<b>804647</b>	grey	1,0	10
<b>804648</b>	grey	3,0	10
<b>805737</b>	grey	2,0	10
<b>805738</b>	grey	5,0	10
<b>805739</b>	grey	7,5	10
<b>805740</b>	grey	10,0	10
<b>805741</b>	grey	15,0	10

Dimensions and specifications may be changed without prior notice.

### Options

Naturally, we also offer other lengths, colors and crossover cables on request.



## Preferred types

Part no.	Description	Colour	Unit
<b>801686</b>	RJ45 plug 8 pole Category 5, TM11 grey	grey	10
<b>801772</b>	RJ45 plug 8 pole Category 6, TM21 black	black	10
<b>82852</b>	RJ-45 AP-frame	Pure White similar to RAL 9010	5
<b>82695</b>	RJ-45 AP-frame cat.5 socket	Pearl White similar to RAL 1013	5
<b>800260</b>	Central plate 80x80 UP-socket	Pure White similar to RAL 9010	10

Dimensions and specifications may be changed without prior notice.

# Rubber Cable Reels

HELUKAT® Datacables



## Type

### Drum

Equipment:

### Plug

Push-On connector type 1:

Push-On connector type 2:

System type:

Pin assignment:

## Norms and standards

## Preferred types

## Characteristics

## Options

## Rubber cable reel with HELUKAT® copper data cable

### Rubber

with supporting frame

RJ45 8/8 - jack

RJ45 8/8 - jack

office connector

1:1 acc. to TIA/EIA 568 B

Components of HELUKAT® CONNECTING SYSTEMS® to 155 MHz acc. Categorie 5E and to 600MHz acc. Categorie 6 (Link), ISO 11801 1st Edition, EN 50173-3 and EIA/TIA 568 B. Be in accordance with the Cat.5E respectively the Cat. 6 structured cabling.

Part no.	Designation	Sheath colour	Frequency MHz	Cable length m	Flame proof	Oil-resistant
802073	FTP 4x2xAWG24/1 PVC	Yellow similar to RAL 1021	155	50,0	-	-
802074	FTP 4x2xAWG24/1 PVC	Yellow similar to RAL 1021	155	90,0	-	-
802075	S-STP 4x2xAWG 23/1 FRNC	Blue Lilac similar to RAL 4005	600	50,0	acc. to IEC 60332-3	-
802076	S-STP 4x2xAWG 23/1 FRNC	Blue Lilac similar to RAL 4005	600	90,0	acc. to IEC 60332-3	-
802207	S-STP 4x2xAWG 23/1 PUR	Green similar to RAL 6018	600	50,0	acc. to IEC 60332-1-2	EN60811-2-1
802208	S-STP 4x2xAWG 23/1 PUR	Green similar to RAL 6018	600	90,0	acc. to IEC 60332-1-2	EN60811-2-1

Dimensions and specifications may be changed without prior notice.

Rubber cable reel with RJ45 jacks and dust protection. Suitable for mobile use on site, for example for meetings, TV-Transmissions, Fairs, etc.. Everywhere when there is a need for a removable cable connection. Usable for fixed installation cabling.

We also can deliver other cable length, cross-over cables or other types of plugs.





# COPPER CONNECTING EQUIPMENT – INDUSTRY

Designation				Page
<b>Connection Technics Industry</b>				
<b>Fixed installation, Cat. 5e</b>				
Fixed installation Patch Cables PROFinet A	RJ45-IP20 180°	Category 5e	806393	252
Fixed installation Patch Cables PROFinet A	RJ45-IP20 90°	Category 5e	806425	253
Fixed installation Patch Cables PROFinet A	RJ45-HAN® 3A-IP67 180°	Category 5e	801342	254
Fixed installation Patch Cables PROFinet A	RJ45-HAN® PP-IP65/67 180°	Category 5e	802423	255
Fixed installation Patch Cables PROFinet A	M12-D-IP67 180° (male)	Category 5e	806457	256
Fixed installation Patch Cables PROFinet A	M12-D-IP67 90° (male)	Category 5e	806489	257
<b>Flexible, Cat. 5e</b>				
Flexible application Patch Cables INDUSTRIAL ETHERNET	RJ45-IP20 180°	Category 5e	11007718	258
Flexible application Patch Cables PROFinet B	RJ45-IP20 180°	Category 5e	806401	259
Flexible application Patch Cables PROFinet B	RJ45-IP20 90°	Category 5e	806433	260
Flexible application Patch Cables INDUSTRIAL ETHERNET	RJ45-IP20 180°	Category 5e	806532	261
Flexible application Patch Cables PROFinet B	M12-D-IP67 180° (male)	Category 5e	806465	262
Flexible application Patch Cables PROFinet B	M12-D-IP67 90° (male)	Category 5e	806497	263
Flexible application Patch Cables INDUSTRIAL ETHERNET	M12-D-IP67 180° (male)	Category 5e	806539	264
<b>High flexible, Cat. 5e</b>				
High Flexible application Patch Cables PROFinet B	RJ45-IP20 180° to M12-D-IP67 180° (male)	Category 5e	806521	265
High Flexible application Patch Cables PROFinet C (PUR)	RJ45-IP20 180°	Category 5e	806409	266
High Flexible application Patch Cables PROFinet C (PUR)	RJ45-IP20 90°	Category 5e	806449	267
High Flexible application Patch Cables PROFinet C (PUR)	RJ45-HAN® 3A-IP67 180°	Category 5e	801332	268
High Flexible application Patch Cables PROFinet C (PUR)	RJ45-HAN® PP-IP65/67 180°	Category 5e	802395	269
High Flexible application Patch Cables PROFinet C (PUR)	M12-D-IP67 180° (male)	Category 5e	806481	270
High Flexible application Patch Cables PROFinet C (PUR)	M12-D-IP67 90° (male)	Category 5e	806505	271
High Flexible application Patch Cables PROFinet C (PUR)	RJ45-IP20 180° to M12-D-IP67 180° (male)	Category 5e	11008341	272
High Flexible application Patch Cables PROFinet C (PVC)	RJ45-IP20 180°	Category 5e	806417	273
High Flexible application Patch Cables PROFinet C (PVC)	RJ45-IP20 90°	Category 5e	806441	274
High Flexible application Patch Cables PROFinet C (PVC)	M12-D-IP67 180° (male)	Category 5e	806473	275
High Flexible application Patch Cables PROFinet C (PVC)	M12-D-IP67 90° (male)	Category 5e	806513	276
High Flexible application Patch Cables PROFinet C (PVC)	RJ45-IP20 180° to M12-D-IP67 180° (male)	Category 5e	11007406	277
High Flexible application Patch Cables INDUSTRIAL ETHERNET	RJ45-IP20 180°	Category 5e	806546	278
High Flexible application Patch Cables INDUSTRIAL ETHERNET	RJ45-IP20 90°	Category 5e	806555	279
High Flexible application Patch Cables INDUSTRIAL ETHERNET	M12-D-IP67 180° (male)	Category 5e	806564	280
High Flexible application Patch Cables INDUSTRIAL ETHERNET	M12-D-IP67 90° (male)	Category 5e	806573	281
<b>Flexible, Cat. 6A</b>				
Flexible application Patch Cables INDUSTRIAL ETHERNET	RJ45-IP20 180°	Category 6A	11007747	282
Flexible application Patch Cables INDUSTRIAL ETHERNET	RJ45-IP20 180°	Category 6A	806618	283
Flexible application Patch Cables INDUSTRIAL ETHERNET	RJ45-IP20 90°	Category 6A	806627	284
Flexible application Patch Cables INDUSTRIAL ETHERNET	M12-X-IP67 180° (male)	Category 6A	806636	285
Flexible application Patch Cables INDUSTRIAL ETHERNET	M12-X-IP67 90° (male)	Category 6A	806645	286
<b>High flexible, Cat. 6A</b>				
High Flexible application Patch Cables INDUSTRIAL ETHERNET	RJ45-IP20 180°	Category 6A	806582	287
High Flexible application Patch Cables INDUSTRIAL ETHERNET	RJ45-IP20 90°	Category 6A	806591	288
High Flexible application Patch Cables INDUSTRIAL ETHERNET	M12-X-IP67 180° (male)	Category 6A	806600	289
High Flexible application Patch Cables INDUSTRIAL ETHERNET	M12-X-IP67 90° (male)	Category 6A	806609	290
<b>Other systems</b>				
Patch Cables USB INDUSTRY	Plug type A	USB 2.0	802464	291
Patch Cables PROFIBUS high flexible	M12-B 180° (male)		800812	292
Patch Cables PROFIBUS high flexible	M12-B 90° (male)		800818	293
RJ45 Copper Connector	complete overview		800986	294
M12 Copper Connector	complete overview		805401	295
Copper Connecting Technics	PROFIBUS Plugs SUB-D		802401	296
Copper Connecting Technics	PROFIBUS Adapter M12/ SUB-D		805194	297

# ■ COPPER CONNECTORS OVERVIEW

## Plug RJ45 Industrial



- plastic housing
- IP20, light duty
- Category 5
- IEC 60603-7
- Field-processable

## Plug RJ45 Industrial



- plastic housing
- IP20, light duty
- Category 5
- IEC 60603-7
- Field-processable

## Plug RJ45 PROFINet IE



- Central construction
- plastic housing
- IP20, light duty
- Category 5e
- Field-processable

## Plug RJ45 Industrial



- plastic housing
- IP20
- Category 5
- IEC 60603-7
- Field-processable

## Plug RJ45 PROFINet IE



- Central construction
- metal housing
- IP20, light duty
- Category 5e
- Field-processable

## Plug RJ45 PROFINet IE



- Angled construction
- metal housing
- IP20, light duty
- Category 5e
- Field-processable

### Plug RJ45 PROFINet IE



- Angled construction
- plastic housing
- IP20, light duty
- Category 5e
- Field-processable

### Plug RJ45 Snap-In IE



- Central construction
- plastic housing
- IP67, heavy duty
- Category 5

### Plug RJ45 10GIG IE



- Central + Angled construction
- plastic housing
- IP20, light duty
- Category 6/ Classe EA
- Field-processable

### Plug RJ45 10GIG IE



- Central construction
- metal housing
- IP20, light duty
- Category 6A
- Field-processable

### Plug M12 D- /B-codet



- metal housing / plastic housing
- IP67, heavy duty
- Category 5 (IEC 61076-2-101)
- Profibus

### Plug SUB-D for PROFIBUS and CAN



- 180°, 90°, 45°, 35° execution
- metal housing
- IP20, light duty
- With and Without PG
- With and Without Diagnose function
- Field-processable

# Patch Cables PROFInet A

RJ45-IP20 180°



Category 5e



## Type

### Cable

Designation:  
Sheath material:  
Frequency:

PROFInet type A (SK)  
PVC  
up to 100 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP20  
RJ45-connector IP20  
HELUKAT® RJ45 Cat.5e  
1:1 acc. to TIA/EIA 568 B

### Flame proof

acc. to IEC 60332-3

### Oil-resistant

Acc. to EN60811-2-1

### Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-5, EIA/TIA 568 B and IEC 61918. Support the PROFInet guideline V4.0 (2017).

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806393</b>	green	0,5	50
<b>806394</b>	green	1,0	50
<b>806395</b>	green	2,0	50
<b>806396</b>	green	3,0	30
<b>806397</b>	green	5,0	30
<b>806398</b>	green	10,0	25
<b>806399</b>	green	15,0	10
<b>806400</b>	green	25,0	5

Dimensions and specifications may be changed without prior notice.

### Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for fixed installation cabling. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

### Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet A

RJ45-IP20 90°



Category 5e



## Patch Cable RJ45-IP20 90°, PROFinet A fixed installation

### Type

#### Cable

Designation:  
Sheath material:  
Frequency:

PROFinet type A (SK)  
PVC  
up to 100 MHz

#### Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP20  
RJ45-connector IP20  
HELUKAT® RJ45 Cat.5e  
1:1 acc. to TIA/EIA 568 B

#### Flame proof

acc. to IEC 60332-3

#### Oil-resistant

Acc. to EN60811-2-1

#### Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-5, EIA/TIA 568 B and IEC 61918. Support the PROFinet guideline V4.0 (2017).

#### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806425</b>	green	0,5	50
<b>806426</b>	green	1,0	50
<b>806427</b>	green	2,0	50
<b>806428</b>	green	3,0	30
<b>806429</b>	green	5,0	30
<b>806430</b>	green	10,0	25
<b>806431</b>	green	15,0	10
<b>806432</b>	green	25,0	5

Dimensions and specifications may be changed without prior notice.

#### Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for fixed installation cabling. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

#### Options

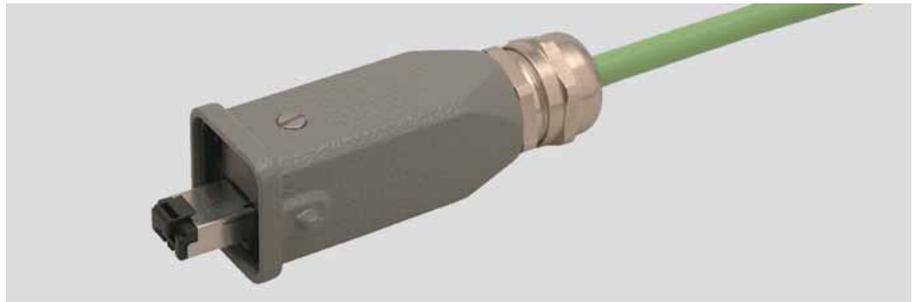
We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet A

RJ45-HAN® 3A-IP67 180°



Category 5e



## Type

**Patch Cable RJ45 HARTING HAN® 3A IP67, PROFinet A fixed installation**

## Cable

Designation: PROFinet type A (SK)  
Sheath material: PVC  
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45-connector IP67  
Push-on connector type 2: RJ45-connector IP67  
System type: Harting IP67 HAN® 3A metal  
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 (2002), EN 50173-3, IEC 61156-1, IEC 61156-5, EIA/TIA 568 B and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>801342</b>	green	0,5	10
<b>801343</b>	green	1,0	10
<b>801344</b>	green	2,0	10
<b>801345</b>	green	3,0	10
<b>801346</b>	green	5,0	10
<b>801347</b>	green	10,0	10
<b>801365</b>	green	15,0	10
<b>801366</b>	green	50,0	5
<b>801367</b>	green	100,0	1

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for fixed installation cabling.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFInet A

RJ45-HAN® PP-IP65/67 180°



Category 5e



## Type

**Patch Cable RJ45 HARTING Push-Pull plastic IP65/67, PROFInet A fixed installation**

## Cable

Designation:  
Sheath material:  
Frequency:

PROFInet type A (SK)  
PVC  
up to 100 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP67  
RJ45-connector IP67  
Harting IP65/67 HAN® PushPull 4P plastic  
1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-3

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 (2002), EN 50173-3, IEC 61156-1, IEC 61156-5, EIA/TIA 568 B and ISO/IEC 24702 variant 14 (AIDA conform). Support the PROFInet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>802423</b>	green	1,5	10
<b>802424</b>	green	3,0	10
<b>802425</b>	green	5,0	10
<b>802426</b>	green	10,0	10
<b>802427</b>	green	20,0	10
<b>802428</b>	green	50,0	5
<b>802429</b>	green	100,0	1

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP65/67 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for fixed installation cabling.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet A

M12-D-IP67 180° (male)



Category 5e



## Type

### Patch Cable M12D-IP67 180°, PROFinet A fixed installation

## Cable

Designation: PROFinet type A (SK)  
Sheath material: PVC  
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: M12-Connector bush shielded  
Push-on connector type 2: M12-Stecker bush shielded  
System type: HELUKAT® M12 D-coded  
Pin assignment: D-coded according to DKE/IEC 61076-2-101

## Flame proof

acc. to IEC 60332-3

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-5, DKE/IEC 61076-2-101 and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806457</b>	green similar RAL 6018	0,5	50
<b>806458</b>	green similar RAL 6018	1,0	50
<b>806459</b>	green similar RAL 6018	2,0	50
<b>806460</b>	green similar RAL 6018	3,0	30
<b>806461</b>	green similar RAL 6018	5,0	30
<b>806462</b>	green similar RAL 6018	10,0	25
<b>806463</b>	green similar RAL 6018	15,0	10
<b>806464</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12 plugs. Usable for fixed installation cabling. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFInet A

M12-D-IP67 90° (male)



Category 5e



## Type

## Patch Cable M12D-IP67 90°, PROFInet A fixed installation

### Cable

Designation:  
Sheath material:  
Frequency:

PROFInet type A (SK)  
PVC  
up to 100 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

M12-Connector bend shielded  
M12-Stecker bend shielded  
HELUKAT® M12 D-coded  
D-coded according to DKE/IEC 61076-2-101

### Flame proof

acc. to IEC 60332-3

### Oil-resistant

Acc. to EN60811-2-1

### Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-5, DKE/IEC 61076-2-101 and IEC 61918. Support the PROFInet guideline V4.0 (2017).

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806489</b>	green similar RAL 6018	0,5	50
<b>806490</b>	green similar RAL 6018	1,0	50
<b>806491</b>	green similar RAL 6018	2,0	50
<b>806492</b>	green similar RAL 6018	3,0	30
<b>806493</b>	green similar RAL 6018	5,0	30
<b>806494</b>	green similar RAL 6018	10,0	25
<b>806495</b>	green similar RAL 6018	15,0	10
<b>806496</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

### Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12 plugs. Usable for fixed installation cabling. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

### Options

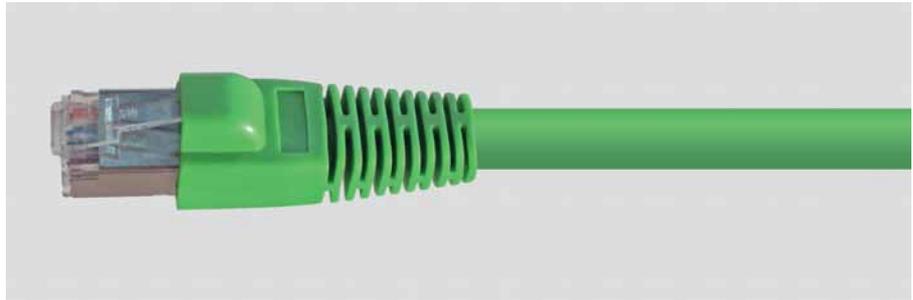
We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET flexible

RJ45-IP20 180°



Category 5e



## Type

### Patch Cable RJ45-IP20 180°, Industrial Ethernet Cat.5e flexible application

## Cable

Designation: SF/UTP 4x2xAWG 26/7 PUR  
Sheath material: PUR  
Frequency: up to 200 MHz

## Plug

Push-on connector type 1: RJ45 8(8)  
Push-on connector type 2: RJ45 8(8)  
System type: HELUKAT® RJ45 Cat.5e  
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 200 MHz acc. Category 5e, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, EIA/TIA 568 B and IEC 61918.

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>11007718</b>	green similar RAL 6018	0,15	100
<b>11007769</b>	green similar RAL 6018	0,25	100
<b>11007738</b>	green similar RAL 6018	0,5	50
<b>11007739</b>	green similar RAL 6018	1,0	50
<b>11007740</b>	green similar RAL 6018	1,5	50
<b>11007741</b>	green similar RAL 6018	2,0	50
<b>11007742</b>	green similar RAL 6018	3,0	30
<b>11007743</b>	green similar RAL 6018	5,0	30
<b>11007744</b>	green similar RAL 6018	7,5	25
<b>11007745</b>	green similar RAL 6018	10,0	25
<b>11007746</b>	green similar RAL 6018	15,0	10

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for normal flexible applications.

# Patch Cables PROFInet B

RJ45-IP20 180°



Category 5e



## Type

## Patch Cable RJ45-IP20 180°, PROFInet B flexible application

### Cable

Designation:  
Sheath material:  
Frequency:

PROFInet type B (SK)  
PVC  
up to 100 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP20  
RJ45-connector IP20  
HELUKAT® RJ45 Cat.5e  
1:1 acc. to TIA/EIA 568 B

### Flame proof

acc. to IEC 60332-3

### Oil-resistant

Acc. to EN60811-2-1

### Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-5, EIA/TIA 568 B and IEC 61918. Support the PROFInet guideline V4.0 (2017).

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806401</b>	green similar RAL 6018	0,5	50
<b>806402</b>	green similar RAL 6018	1,0	50
<b>806403</b>	green similar RAL 6018	2,0	50
<b>806404</b>	green similar RAL 6018	3,0	30
<b>806405</b>	green similar RAL 6018	5,0	30
<b>806406</b>	green similar RAL 6018	10,0	25
<b>806407</b>	green similar RAL 6018	15,0	10
<b>806408</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

### Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for normal flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

### Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet B

RJ45-IP20 90°



Category 5e



## Type

### Patch Cable RJ45-IP20 90°, PROFinet B flexible application

## Cable

Designation:  
Sheath material:  
Frequency:

PROFinet type B (SK)  
PVC  
up to 100 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP20  
RJ45-connector IP20  
HELUKAT® RJ45 Cat.5e  
1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-3

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-5, EIA/TIA 568 B and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806433</b>	green similar RAL 6018	0,5	50
<b>806434</b>	green similar RAL 6018	1,0	50
<b>806435</b>	green similar RAL 6018	2,0	50
<b>806436</b>	green similar RAL 6018	3,0	30
<b>806437</b>	green similar RAL 6018	5,0	30
<b>806438</b>	green similar RAL 6018	10,0	25
<b>806439</b>	green similar RAL 6018	15,0	10
<b>806440</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for normal flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

## Options

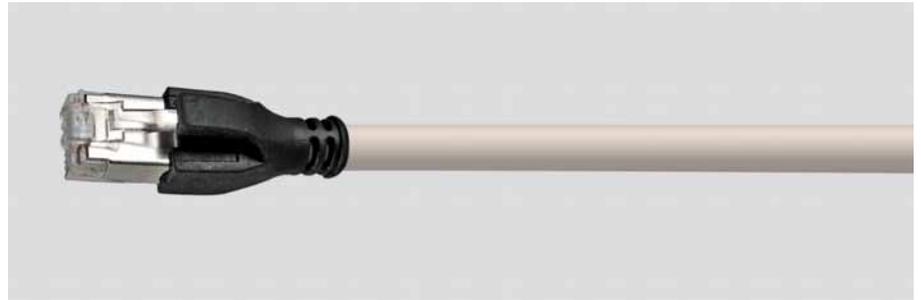
We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET flexible

RJ45-IP20 180°



Category 5e



## Type

### Patch Cable RJ45-IP20 180°, Industrial Ethernet Cat.5e flexible application

## Cable

Designation:  
Sheath material:  
Frequency:

SF/UTP 4x2xAWG 26/7 PUR  
PUR  
up to 200 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP20  
RJ45-connector IP20  
HELUKAT® RJ45 Cat.5e  
1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 200 MHz acc. Category 5e, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, EIA/TIA 568 B and IEC 61918.

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806532</b>	grey similar RAL 7035	0,5	50
<b>806533</b>	grey similar RAL 7035	1,0	50
<b>806534</b>	grey similar RAL 7035	2,0	50
<b>806535</b>	grey similar RAL 7035	3,0	30
<b>806536</b>	grey similar RAL 7035	5,0	30
<b>806537</b>	grey similar RAL 7035	10,0	25
<b>806538</b>	grey similar RAL 7035	15,0	10

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for normal flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done..

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet B

M12-D-IP67 180° (male)



Category 5e



## Type

**Patch Cable M12D-IP67 180°, PROFinet B flexible application**

## Cable

Designation: PROFinet type B (SK)  
Sheath material: PVC  
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: M12-Connector bush shielded  
Push-on connector type 2: M12-Stecker bush shielded  
System type: HELUKAT® M12 D-coded  
Pin assignment: D-coded according to DKE/IEC 61076-2-101

## Flame proof

acc. to IEC 60332-3

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-5, DKE/IEC 61076-2-101 and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806465</b>	green similar RAL 6018	0,5	50
<b>806466</b>	green similar RAL 6018	1,0	50
<b>806467</b>	green similar RAL 6018	2,0	50
<b>806468</b>	green similar RAL 6018	3,0	30
<b>806469</b>	green similar RAL 6018	5,0	30
<b>806470</b>	green similar RAL 6018	10,0	25
<b>806471</b>	green similar RAL 6018	15,0	10
<b>806472</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12 plugs. Usable for normal flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet B

M12-D-IP67 90° (male)



Category 5e



## Type

### Patch Cable M12D-IP67 90°, PROFinet B flexible application

## Cable

Designation:  
Sheath material:  
Frequency:

PROFinet type B (SK)  
PVC  
up to 100 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

M12-Connector bend shielded  
M12-Stecker bend shielded  
HELUKAT® M12 D-coded  
D-coded according to DKE/IEC 61076-2-101

## Flame proof

acc. to IEC 60332-3

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-5, DKE/IEC 61076-2-101 and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806497</b>	green similar RAL 6018	0,5	50
<b>806498</b>	green similar RAL 6018	1,0	50
<b>806499</b>	green similar RAL 6018	2,0	50
<b>806500</b>	green similar RAL 6018	3,0	30
<b>806501</b>	green similar RAL 6018	5,0	30
<b>806502</b>	green similar RAL 6018	10,0	25
<b>806503</b>	green similar RAL 6018	15,0	10
<b>806504</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12 plugs. Usable for normal flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET flexible

M12-D-IP67 180° (male)



Category 5e



## Type

**Patch Cable M12-D coded-IP67 180°, Industrial Ethernet flexible application**

## Cable

Designation:  
Sheath material:  
Frequency:

SF/UTP 4x2xAWG 26/7 PUR  
PUR  
up to 200 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

M12-Connector bush shielded  
M12-Stecker bush shielded  
HELUKAT® M12 D-coded  
D-coded according to DKE/IEC 61076-2-101

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT CONNECTING SYSTEMS® to 200 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, DKE/IEC 61076-2-101 and IEC 61918.

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806539</b>	grey similar RAL 7035	0,5	50
<b>806540</b>	grey similar RAL 7035	1,0	50
<b>806541</b>	grey similar RAL 7035	2,0	50
<b>806542</b>	grey similar RAL 7035	3,0	30
<b>806543</b>	grey similar RAL 7035	5,0	30
<b>806544</b>	grey similar RAL 7035	10,0	25
<b>806545</b>	grey similar RAL 7035	15,0	10

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12 plugs. Usable for normal flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet B

RJ45-IP20 180° to M12-D-IP67 180° (male)



Category 5e



## Type

**Patch Cable RJ45-IP20 180°/ M12-D-IP67 180°, PROFinet B flexible application**

## Cable

Designation:  
Sheath material:  
Frequency:

PROFinet type B (SK)  
PVC  
up to 100 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP20  
M12-Stecker bush shielded  
HELUKAT® RJ45/ M12 D-coded  
1:1 acc. TIA/EIA 568 B resp. D-coded acc. DKE/IEC 61076-2-101

## Flame proof

acc. to IEC 60332-3

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-5, EIA/TIA 568 B, DKE/IEC 61076-2-101 and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806521</b>	green similar RAL 6018	5,0	30
<b>806522</b>	green similar RAL 6018	10,0	25
<b>806523</b>	green similar RAL 6018	20,0	25
<b>806524</b>	green similar RAL 6018	25,0	5
<b>806525</b>	green similar RAL 6018	40,0	1
<b>806526</b>	green similar RAL 6018	50,0	1
<b>806527</b>	green similar RAL 6018	60,0	1
<b>806528</b>	green similar RAL 6018	70,0	1
<b>806529</b>	green similar RAL 6018	80,0	1
<b>806530</b>	green similar RAL 6018	90,0	1
<b>806531</b>	green similar RAL 6018	100,0	1

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 and IP67 protected ethernet applications according ISO/IEC 11801 with RJ45 and M12 plugs. Usable for normal flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

## Options

We also can deliver other cable length, cross-over cables other combinations or other types of plugs.

# Patch Cables PROFinet C (PUR)

RJ45-IP20 180°



Category 5e



## Type

**Patch Cable RJ45-IP20 180°, PROFinet C high flexible application**

## Cable

Designation:  
Sheath material:  
Frequency:

PROFinet type C (SK)  
PUR  
up to 100 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP20  
RJ45-connector IP20  
HELUKAT® RJ45 Cat.5e  
1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, EIA/TIA 568 B and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806409</b>	green similar RAL 6018	0,5	50
<b>806410</b>	green similar RAL 6018	1,0	50
<b>806411</b>	green similar RAL 6018	2,0	50
<b>806412</b>	green similar RAL 6018	3,0	30
<b>806413</b>	green similar RAL 6018	5,0	30
<b>806414</b>	green similar RAL 6018	10,0	25
<b>806415</b>	green similar RAL 6018	15,0	10
<b>806416</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for permanent flexible applications.

The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Acceleration 4 m/s<sup>2</sup> maximum
- Cycles maximum 5 Mio.
- Temperature range from -20°C to +75°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 85 m from the Hub to the receiver
- Suitable for the „Light-Duty“ range.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet C (PUR)

RJ45-IP20 90°



Category 5e



## Type

**Patch Cable RJ45-IP20 180°, PROFinet C high flexible application**

## Cable

Designation:  
Sheath material:  
Frequency:

PROFinet type C (SK)  
PUR  
up to 100 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP20  
RJ45-connector IP20  
HELUKAT® RJ45 Cat.5e  
1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-5, DKE/IEC 61076-2-101 and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806449</b>	green similar RAL 6018	0,5	50
<b>806450</b>	green similar RAL 6018	1,0	50
<b>806451</b>	green similar RAL 6018	2,0	50
<b>806452</b>	green similar RAL 6018	3,0	30
<b>806453</b>	green similar RAL 6018	5,0	30
<b>806454</b>	green similar RAL 6018	10,0	25
<b>806455</b>	green similar RAL 6018	15,0	10
<b>806456</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for permanent flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Acceleration 4 m/s<sup>2</sup> maximum
- Cycles maximum 5 Mio.
- Temperature range from -20°C to +75°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 85 m from the Hub to the receiver
- Suitable for the „Light-Duty“ range.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet C (PUR)

RJ45-HAN® 3A-IP67 180°



Category 5e



## Type

### Patch Cable RJ45 HARTING HAN® 3A IP67, PROFinet C drag chain

## Cable

Designation:  
Sheath material:  
Frequency:

PROFinet type C (SK)  
PUR  
up to 100 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP67  
RJ45-connector IP67  
Harting IP67 HAN® 3A metal  
1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 (2002), EN 50173-3, IEC 61156-1, IEC 61156-6, EIA/TIA 568 B and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>801332</b>	green	0,5	10
<b>801333</b>	green	1,0	10
<b>801334</b>	green	2,0	10
<b>801335</b>	green	3,0	10
<b>801336</b>	green	5,0	10
<b>801337</b>	green	10,0	10

Dimensions and specifications may be changed without prior notice.

## Characteristics

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Acceleration 4 m/s<sup>2</sup> maximum
- Cycles maximum 5 Mio.
- Temperature range from -20°C to +75°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 85 m from the Hub to the receiver
- Suitable for the „Heavy-Duty“ range.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet C (PUR)

RJ45-HAN® PP-IP65/67 180°



Category 5e



## Type

### Patch Cable RJ45 HARTING Push-Pull IP67, PROFinet C drag chain

#### Cable

Designation:  
Sheath material:  
Frequency:

PROFinet type C (SK)  
PUR  
up to 100 MHz

#### Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP67  
RJ45-connector IP67  
Harting IP65/67 HAN® PushPull 4P plastic  
1:1 acc. to TIA/EIA 568 B

#### Flame proof

acc. to IEC 60332-1-2

#### Oil-resistant

Acc. to EN60811-2-1

#### Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 (2002), EN 50173-1, IEC 61156-1, IEC 61156-6, EIA/TIA 568 B and ISO/IEC 24702 - variant 14 (AIDA konform). Support the PROFinet guideline V4.0 (2017).

#### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>802395</b>	green	0,5	10
<b>802396</b>	green	1,0	10
<b>802397</b>	green	2,0	10
<b>802398</b>	green	3,0	10
<b>802399</b>	green	5,0	10
<b>802400</b>	green	10,0	10

Dimensions and specifications may be changed without prior notice.

#### Characteristics

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Acceleration 4 m/s<sup>2</sup> maximum
- Cycles maximum 5 Mio.
- Temperature range from -20°C to +75°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 85 m from the Hub to the receiver
- Suitable for the „Heavy-Duty“ range.

#### Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet C (PUR)

M12-D-IP67 180° (male)



Category 5e



## Type

**Patch Cable M12-D coded-IP67 180°, PROFinet C high flexible application**

## Cable

Designation: PROFinet type C (SK)  
Sheath material: PUR  
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: M12-Connector bush shielded  
Push-on connector type 2: M12-Stecker bush shielded  
System type: HELUKAT® M12 D-coded  
Pin assignment: D-coded according to DKE/IEC 61076-2-101

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, DKE/IEC 61076-2-101 and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806481</b>	green similar RAL 6018	0,5	50
<b>806482</b>	green similar RAL 6018	1,0	50
<b>806483</b>	green similar RAL 6018	2,0	50
<b>806484</b>	green similar RAL 6018	3,0	30
<b>806485</b>	green similar RAL 6018	5,0	30
<b>806486</b>	green similar RAL 6018	10,0	25
<b>806487</b>	green similar RAL 6018	15,0	10
<b>806488</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12 plugs. Usable for permanent flexible applications.

The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Acceleration 4 m/s<sup>2</sup> maximum
- Cycles maximum 5 Mio.
- Temperature range from -20°C to +75°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 85 m from the Hub to the receiver
- Suitable for the „Heavy-Duty“ range.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet C (PUR)

M12-D-IP67 90° (male)



Category 5e



## Type

**Patch Cable M12-D coded-IP67 90°, PROFinet C high flexible application**

## Cable

Designation:  
Sheath material:  
Frequency:

PROFinet type C (SK)  
PUR  
up to 100 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

M12-Connector bend shielded  
M12-Stecker bend shielded  
HELUKAT® M12 D-coded  
D-coded according to DKE/IEC 61076-2-101

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, DKE/IEC 61076-2-101 and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806505</b>	green similar RAL 6018	0,5	50
<b>806506</b>	green similar RAL 6018	1,0	50
<b>806507</b>	green similar RAL 6018	2,0	50
<b>806508</b>	green similar RAL 6018	3,0	30
<b>806509</b>	green similar RAL 6018	5,0	30
<b>806510</b>	green similar RAL 6018	10,0	25
<b>806511</b>	green similar RAL 6018	15,0	10
<b>806512</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12 plugs. Usable for permanent flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Acceleration 4 m/s<sup>2</sup> maximum
- Cycles maximum 5 Mio.
- Temperature range from -20°C to +75°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 85 m from the Hub to the receiver
- Suitable for the „Heavy-Duty“ range.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet C (PUR)

RJ45-IP20 180° to M12-D-IP67 180° (male)



Category 5e



## Type

**Patch Cable RJ45-IP20 180°/ M12-D-IP67 180°, PROFinet C high flexible application**

## Cable

Designation: PROFinet type C (SK)  
Sheath material: PUR  
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45-connector IP20  
Push-on connector type 2: M12-Stecker bush shielded  
System type: HELUKAT® RJ45/ M12 D-coded  
Pin assignment: 1:1 acc. TIA/EIA 568 B resp. D-coded acc. DKE/IEC 61076-2-101

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, EIA/TIA 568 B, DKE/IEC 61076-2-101 and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>11008341</b>	green similar RAL 6018	0,5	50
<b>11008342</b>	green similar RAL 6018	1,0	50
<b>11008343</b>	green similar RAL 6018	2,0	50
<b>11008344</b>	green similar RAL 6018	3,0	30
<b>11008345</b>	green similar RAL 6018	5,0	30
<b>11008346</b>	green similar RAL 6018	10,0	25
<b>11008347</b>	green similar RAL 6018	15,0	10
<b>11008348</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 and IP67 protected ethernet applications according ISO/IEC 11801 with RJ45 and M12 kodierte plugs. Usable for permanent flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Acceleration 4 m/s<sup>2</sup> maximum
- Cycles maximum 5 Mio.
- Temperature range from -20°C to +75°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 85 m from the Hub to the receiver
- Suitable for the „Light-Duty“ to "Heavy-Duty" range.

## Options

We also can deliver other cable length, cross-over cables other combinations or other types of plugs.

# Patch Cables PROFinet C (PVC)

RJ45-IP20 180°



Category 5e



## Type

**Patch Cable RJ45-IP20 180°, PROFinet C high flexible application**

## Cable

Designation:  
Sheath material:  
Frequency:

PROFinet type C (SK)  
PVC  
up to 100 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP20  
RJ45-connector IP20  
HELUKAT® RJ45 Cat.5e  
1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-3

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, EIA/TIA 568 B and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806417</b>	green similar RAL 6018	0,5	50
<b>806418</b>	green similar RAL 6018	1,0	50
<b>806419</b>	green similar RAL 6018	2,0	50
<b>806420</b>	green similar RAL 6018	3,0	30
<b>806421</b>	green similar RAL 6018	5,0	30
<b>806422</b>	green similar RAL 6018	10,0	25
<b>806423</b>	green similar RAL 6018	15,0	10
<b>806424</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for permanent flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Acceleration 4 m/s<sup>2</sup> maximum
- Cycles maximum 1 Mio.
- Temperature range from -20°C to +75°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 85 m from the Hub to the receiver
- Suitable for the „Light-Duty“ range.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs

# Patch Cables PROFinet C (PVC)

RJ45-IP20 90°



Category 5e



## Type

**Patch Cable RJ45-IP20 90°, PROFinet C high flexible application**

## Cable

Designation: PROFinet type C (SK)  
Sheath material: PVC  
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45-connector IP20  
Push-on connector type 2: RJ45-connector IP20  
System type: HELUKAT® RJ45 Cat.5e  
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-3

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, EIA/TIA 568 B and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806441</b>	green similar RAL 6018	0,5	50
<b>806442</b>	green similar RAL 6018	1,0	50
<b>806443</b>	green similar RAL 6018	2,0	50
<b>806444</b>	green similar RAL 6018	3,0	30
<b>806445</b>	green similar RAL 6018	5,0	30
<b>806446</b>	green similar RAL 6018	10,0	25
<b>806447</b>	green similar RAL 6018	15,0	10
<b>806448</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for permanent flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Acceleration 4 m/s<sup>2</sup> maximum
- Cycles maximum 1 Mio.
- Temperature range from -20°C to +75°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 85 m from the Hub to the receiver
- Suitable for the „Light-Duty“ range.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs

# Patch Cables PROFinet C (PVC)

M12-D-IP67 180° (male)



Category 5e



## Type

### Patch Cable M12-D coded-IP67 180°, PROFinet C high flexible application

#### Cable

Designation:  
Sheath material:  
Frequency:

PROFinet type C (SK)  
PVC  
up to 100 MHz

#### Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

M12-Connector bush shielded  
M12-Stecker bush shielded  
HELUKAT® M12 D-coded  
D-coded according to DKE/IEC 61076-2-101

#### Flame proof

acc. to IEC 60332-3

#### Oil-resistant

Acc. to EN60811-2-1

#### Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, DKE/IEC 61076-2-101 and IEC 61918. Support the PROFinet guideline V4.0 (2017).

#### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806473</b>	green similar RAL 6018	0,5	50
<b>806474</b>	green similar RAL 6018	1,0	50
<b>806475</b>	green similar RAL 6018	2,0	50
<b>806476</b>	green similar RAL 6018	3,0	30
<b>806477</b>	green similar RAL 6018	5,0	30
<b>806478</b>	green similar RAL 6018	10,0	25
<b>806479</b>	green similar RAL 6018	15,0	10
<b>806480</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

#### Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12 plugs. Usable for permanent flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Acceleration 4 m/s<sup>2</sup> maximum
- Cycles maximum 1 Mio.
- Temperature range from -20°C to +75°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 85 m from the Hub to the receiver
- Suitable for the „Heavy-Duty“ range.

#### Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet C (PVC)

M12-D-IP67 90° (male)



Category 5e



## Type

**Patch Cable M12-D coded-IP67 90°, PROFinet C high flexible application**

## Cable

Designation:  
Sheath material:  
Frequency:

PROFinet type C (SK)  
PVC  
up to 100 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

M12-Connector bend shielded  
M12-Stecker bend shielded  
HELUKAT® M12 D-coded  
D-coded according to DKE/IEC 61076-2-101

## Flame proof

acc. to IEC 60332-3

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, DKE/IEC 61076-2-101 and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806513</b>	green similar RAL 6018	0,5	50
<b>806514</b>	green similar RAL 6018	1,0	50
<b>806515</b>	green similar RAL 6018	2,0	50
<b>806516</b>	green similar RAL 6018	3,0	30
<b>806517</b>	green similar RAL 6018	5,0	30
<b>806518</b>	green similar RAL 6018	10,0	25
<b>806519</b>	green similar RAL 6018	15,0	10
<b>806520</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12 plugs. Usable for permanent flexible applications.

The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Acceleration 4 m/s<sup>2</sup> maximum
- Cycles maximum 1 Mio.
- Temperature range from -20°C to +75°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 85 m from the Hub to the receiver
- Suitable for the „Heavy-Duty“ range.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFinet C (PVC)

RJ45-IP20 180° to M12-D-IP67 180° (male)



Category 5e



## Type

**Patch Cable RJ45-IP20 180°/ M12-D-IP67 180°, PROFinet C high flexible application**

## Cable

Designation:  
Sheath material:  
Frequency:

PROFinet type C (SK)  
PVC  
up to 100 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP20  
M12-Stecker bush shielded  
HELUKAT® RJ45/ M12 D-coded  
1:1 acc. TIA/EIA 568 B resp. D-coded acc. DKE/IEC 61076-2-101

## Flame proof

acc. to IEC 60332-3

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT CONNECTING SYSTEMS® to 100 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, EIA/TIA 568 B, DKE/IEC 61076-2-101 and IEC 61918. Support the PROFinet guideline V4.0 (2017).

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>11007406</b>	green similar RAL 6018	0,5	50
<b>11007407</b>	green similar RAL 6018	1,0	50
<b>11007408</b>	green similar RAL 6018	2,0	50
<b>11007409</b>	green similar RAL 6018	3,0	30
<b>11007410</b>	green similar RAL 6018	5,0	30
<b>11007411</b>	green similar RAL 6018	10,0	25
<b>11007412</b>	green similar RAL 6018	15,0	10
<b>11007413</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 and IP67 protected ethernet applications according ISO/IEC 11801 with RJ45 and M12 kodiert plugs. Usable for permanent flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Acceleration 4 m/s<sup>2</sup> maximum
- Cycles maximum 1 Mio.
- Temperature range from -20°C to +75°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 85 m from the Hub to the receiver
- Suitable for the „Light to Heavy-Duty“ range.

## Options

We also can deliver other cable length, cross-over cables other combinations or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET

## high flexible

RJ45-IP20 180°



Category 5e



### Type

### Patch Cable RJ45-IP20 180°, Industrial Ethernet high flexible application

### Cable

Designation: LAN Industry SF/UTP 4x2x0,15 PUR  
Sheath material: PUR  
Frequency: up to 155 MHz

### Plug

Push-on connector type 1: RJ45-connector IP20  
Push-on connector type 2: RJ45-connector IP20  
System type: HELUKAT® RJ45 Cat.5e  
Pin assignment: 1:1 acc. to TIA/EIA 568 B

### Flame proof

acc. to IEC 60332-1-2

### Oil-resistant

Acc. to EN60811-2-1

### Norms and standards

Components of HELUKAT CONNECTING SYSTEMS® to 155 MHz acc. Category 5e, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, EIA/TIA 568 B and IEC 61918.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806546</b>	green similar RAL 6018	0,5	50
<b>806547</b>	green similar RAL 6018	1,0	50
<b>806548</b>	green similar RAL 6018	2,0	50
<b>806549</b>	green similar RAL 6018	3,0	30
<b>806550</b>	green similar RAL 6018	5,0	30
<b>806551</b>	green similar RAL 6018	10,0	25
<b>806552</b>	green similar RAL 6018	15,0	10
<b>806553</b>	green similar RAL 6018	20,0	5
<b>806554</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

### Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for permanent moving applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 180 m/min maximum
- Movement distance 4,5 m maximum
- Acceleration 5 m/s<sup>2</sup> maximum
- Cycles maximum 5 Mio.
- Temperature range from -25°C to +80°C
- Transmission rate maximum 100 Mbit/s
- Suitable for the „Light-Duty“ range.

### Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET

## high flexible

RJ45-IP20 90°



Category 5e



### Type

### Patch Cable RJ45-IP20 90°, Industrial Ethernet high flexible application

### Cable

Designation:

LAN Industry SF/UTP 4x2x0, 15 PUR

Sheath material:

PUR

Frequency:

up to 155 MHz

### Plug

Push-on connector type 1:

RJ45-connector IP20

Push-on connector type 2:

RJ45-connector IP20

System type:

HELUKAT® RJ45 Cat.5e

Pin assignment:

1:1 acc. to TIA/EIA 568 B

### Flame proof

acc. to IEC 60332-1-2

### Oil-resistant

Acc. to EN60811-2-1

### Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 155 MHz acc. Category 5e, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, EIA/TIA 568 B and IEC 61918.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
806555	green similar RAL 6018	0,5	50
806556	green similar RAL 6018	1,0	50
806557	green similar RAL 6018	2,0	50
806558	green similar RAL 6018	3,0	30
806559	green similar RAL 6018	5,0	30
806560	green similar RAL 6018	10,0	25
806561	green similar RAL 6018	15,0	10
806562	green similar RAL 6018	20,0	5
806563	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

### Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for permanent moving applications.

The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 180 m/min maximum
- Movement distance 4,5 m maximum
- Acceleration 5 m/s<sup>2</sup> maximum
- Cycles maximum 5 Mio.
- Temperature range from -25°C to +80°C
- Transmission rate maximum 100 Mbit/s
- Suitable for the „Light-Duty“ range.

### Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET

## high flexible

M12-D-IP67 180° (male)



Category 5e



### Type

**Patch Cable M12-D coded-IP67 180°, Industrial Ethernet high flexible application**

### Cable

Designation:  
Sheath material:  
Frequency:

LAN Industry SF/UTP 4x2x0,15 PUR  
PUR  
up to 155 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

M12-Connector bush shielded  
M12-Stecker bush shielded  
HELUKAT® M12 D-coded  
D-coded according to DKE/IEC 61076-2-101

### Flame proof

acc. to IEC 60332-1-2

### Oil-resistant

Acc. to EN60811-2-1

### Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 155 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, DKE/IEC 61076-2-101 and IEC 61918.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806564</b>	green similar RAL 6018	0,5	50
<b>806565</b>	green similar RAL 6018	1,0	50
<b>806566</b>	green similar RAL 6018	2,0	50
<b>806567</b>	green similar RAL 6018	3,0	30
<b>806568</b>	green similar RAL 6018	5,0	30
<b>806569</b>	green similar RAL 6018	10,0	25
<b>806570</b>	green similar RAL 6018	15,0	10
<b>806571</b>	green similar RAL 6018	20,0	5
<b>806572</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

### Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12 plugs. Usable for permanent moving applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 180 m/min maximum
- Movement distance 4,5 m maximum
- Acceleration 5 m/s<sup>2</sup> maximum
- Cycles maximum 5 Mio.
- Temperature range from -25°C to +80°C
- Transmission rate maximum 100 Mbit/s
- Suitable for the „Heavy-Duty“ range.

### Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET

## high flexible

M12-D-IP67 90° (male)



Category 5e



### Type

**Patch Cable M12-D coded-IP67 90°, Industrial Ethernet high flexible application**

### Cable

Designation:  
Sheath material:  
Frequency:

LAN Industry SF/UTP 4x2x0,15 PUR  
PUR  
up to 155 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

M12-Connector bend shielded  
M12-Stecker bend shielded  
HELUKAT® M12 D-coded  
D-coded according to DKE/IEC 61076-2-101

### Flame proof

acc. to IEC 60332-1-2

### Oil-resistant

Acc. to EN60811-2-1

### Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 155 MHz acc. Category 5, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, DKE/IEC 61076-2-101 and IEC 61918.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806573</b>	green similar RAL 6018	0,5	50
<b>806574</b>	green similar RAL 6018	1,0	50
<b>806575</b>	green similar RAL 6018	2,0	50
<b>806576</b>	green similar RAL 6018	3,0	30
<b>806577</b>	green similar RAL 6018	5,0	30
<b>806578</b>	green similar RAL 6018	10,0	25
<b>806579</b>	green similar RAL 6018	15,0	10
<b>806580</b>	green similar RAL 6018	20,0	5
<b>806581</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

### Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12 plugs. Usable for permanent moving applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 180 m/min maximum
- Movement distance 4,50 m maximum
- Acceleration 5 m/s<sup>2</sup> maximum
- Cycles maximum 5 Mio.
- Temperature range from -25°C to +80°C
- Transmission rate maximum 100 Mbit/s
- Suitable for the „Heavy-Duty“ range.

### Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET extraflex

RJ45-IP20 180°



Category 6A



## Type

**Patch Cable RJ45-IP20 180°, Industrial Ethernet  
Cat.6<sub>A</sub> extra flexible applications**

## Cable

Designation: S/FTP 4x2xAWG 26/7 LSZH  
Sheath material: LSZH  
Frequency: up to 500 MHz

## Plug

Push-on connector type 1: RJ45 8(8)  
Push-on connector type 2: RJ45 8(8)  
System type: HELUKAT® RJ45 Cat 6A  
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 500 MHz acc. Category 6<sub>A</sub>, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, EIA/TIA 568 B and IEC 61918.

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>11007747</b>	green similar RAL 6018	0,15	100
<b>11007748</b>	green similar RAL 6018	0,25	100
<b>11007749</b>	green similar RAL 6018	0,5	50
<b>11007750</b>	green similar RAL 6018	1,0	50
<b>11007751</b>	green similar RAL 6018	1,5	50
<b>11007752</b>	green similar RAL 6018	2,0	50
<b>11007753</b>	green similar RAL 6018	3,0	30
<b>11007754</b>	green similar RAL 6018	5,0	30
<b>11007755</b>	green similar RAL 6018	7,5	25
<b>11007756</b>	green similar RAL 6018	10,0	25
<b>11007757</b>	green similar RAL 6018	15,0	10

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for normal extra flexible applications.

# Patch Cables INDUSTRIAL ETHERNET flexible

RJ45-IP20 180°



Category 6A



## Type

**Patch Cable RJ45-IP20 180°, Industrial Ethernet  
Cat.6A normal flexible application**

## Cable

Designation:  
Sheath material:  
Frequency:

S/FTP 4x2xAWG 26/7 PUR, UL  
PUR  
up to 600 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP20  
RJ45-connector IP20  
HELUKAT® RJ45 Cat 6A  
1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 500 MHz acc. Category 6A, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-5, EIA/TIA 568 B and IEC 61918.

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806618</b>	green similar RAL 6018	0,5	50
<b>806619</b>	green similar RAL 6018	1,0	50
<b>806620</b>	green similar RAL 6018	2,0	50
<b>806621</b>	green similar RAL 6018	3,0	30
<b>806622</b>	green similar RAL 6018	5,0	30
<b>806623</b>	green similar RAL 6018	10,0	25
<b>806624</b>	green similar RAL 6018	15,0	10
<b>806625</b>	green similar RAL 6018	20,0	5
<b>806626</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for normal flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET flexible

RJ45-IP20 90°



Category 6A



## Type

**Patch Cable RJ45-IP20 90°, Industrial Ethernet  
Cat.6A normal flexible application**

## Cable

Designation:  
Sheath material:  
Frequency:

S/FTP 4x2xAWG 26/7 PUR, UL  
PUR  
up to 600 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP20  
RJ45-connector IP20  
HELUKAT® RJ45 Cat 6A  
1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 500 MHz acc. Category 6A, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-5, EIA/TIA 568 B and IEC 61918.

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806627</b>	green similar RAL 6018	0,5	50
<b>806628</b>	green similar RAL 6018	1,0	50
<b>806629</b>	green similar RAL 6018	2,0	50
<b>806630</b>	green similar RAL 6018	3,0	30
<b>806631</b>	green similar RAL 6018	5,0	30
<b>806632</b>	green similar RAL 6018	10,0	25
<b>806633</b>	green similar RAL 6018	15,0	10
<b>806634</b>	green similar RAL 6018	20,0	5
<b>806635</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for normal flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET flexible

M12-X-IP67 180° (male)



Category 6A



## Type

**Patch Cable M12-X coded 180°, Industrial Ethernet  
Cat.6A normal flexible application**

## Cable

Designation:  
Sheath material:  
Frequency:

S/FTP 4x2xAWG 26/7 PUR, UL  
PUR  
up to 600 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

M12-Connector bush shielded  
M12-Stecker bush shielded  
HELUKAT® M12 X-coded  
X-coded acc. DKE/IEC 61076-2-109

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 500 MHz acc. Category 6A, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-5, DKE/IEC 61076-2-109 and IEC 61918.

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806636</b>	green similar RAL 6018	0,5	50
<b>806637</b>	green similar RAL 6018	1,0	50
<b>806638</b>	green similar RAL 6018	2,0	50
<b>806639</b>	green similar RAL 6018	3,0	30
<b>806640</b>	green similar RAL 6018	5,0	30
<b>806641</b>	green similar RAL 6018	10,0	25
<b>806642</b>	green similar RAL 6018	15,0	10
<b>806643</b>	green similar RAL 6018	20,0	5
<b>806644</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12-X coded plugs. Usable for normal flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET flexible

M12-X-IP67 90° (male)



Category 6A



## Type

**Patch Cable M12-X coded 90°, Industrial Ethernet  
Cat.6A normal flexible application**

## Cable

Designation:  
Sheath material:  
Frequency:

S/FTP 4x2xAWG 26/7 PUR, UL  
PUR  
up to 600 MHz

## Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

M12-Connector bend shielded  
M12-Stecker bend shielded  
HELUKAT® M12 X-coded  
X-coded acc. DKE/IEC 61076-2-109

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 500 MHz acc. Category 6A, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-5, DKE/IEC 61076-2-109 and IEC 61918.

## Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806645</b>	green similar RAL 6018	0,5	50
<b>806646</b>	green similar RAL 6018	1,0	50
<b>806647</b>	green similar RAL 6018	2,0	50
<b>806648</b>	green similar RAL 6018	3,0	30
<b>806649</b>	green similar RAL 6018	5,0	30
<b>806650</b>	green similar RAL 6018	10,0	25
<b>806651</b>	green similar RAL 6018	15,0	10
<b>806652</b>	green similar RAL 6018	20,0	5
<b>806653</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12-X coded plugs. Usable for normal flexible applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET

## high flexible

RJ45-IP20 180°



Category 6A



### Type

### Patch Cable RJ45-IP20 180°, Industrial Ethernet Cat.6A high flexible application

#### Cable

Designation:

SF/FTP 4x2xAWG 26/7 PUR

Sheath material:

PUR

Frequency:

up to 500 MHz

#### Plug

Push-on connector type 1:

RJ45-connector IP20

Push-on connector type 2:

RJ45-connector IP20

System type:

Harting IP20 RJ Industrial 8P

Pin assignment:

1:1 acc. to TIA/EIA 568 B

#### Flame proof

acc. to IEC 60332-1-2

#### Oil-resistant

Acc. to EN60811-2-1

#### Norms and standards

Components of HELUKAT CONNECTING SYSTEMS® to 500 MHz acc. Category 6A, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, EIA/TIA 568 B and IEC 61918.

#### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806582</b>	green similar RAL 6018	0,5	50
<b>806583</b>	green similar RAL 6018	1,0	50
<b>806584</b>	green similar RAL 6018	2,0	50
<b>806585</b>	green similar RAL 6018	3,0	30
<b>806586</b>	green similar RAL 6018	5,0	30
<b>806587</b>	green similar RAL 6018	10,0	25
<b>806588</b>	green similar RAL 6018	15,0	10
<b>806589</b>	green similar RAL 6018	20,0	5
<b>806590</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

#### Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for permanent moving applications.

- Drag chain suitable
- Bending radius 15 x cable outerdiameter maximum
- Moving speed 180 m/min maximum
- Movement distance 4,5 m maximum
- Acceleration 3 m/s<sup>2</sup> maximum
- Cycles maximum 2 Mio.
- Temperature range from -10°C to +70°C
- Transmission rate maximum 10 Gbit/s (length limited)
- Suitable for the „Light-Duty“ range.

#### Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET

## high flexible

RJ45-IP20 90°



Category 6A



### Type

**Patch Cable RJ45-IP20 90°, Industrial Ethernet Cat.6A high flexible application**

### Cable

Designation:  
Sheath material:  
Frequency:

SF/FTP 4x2xAWG 26/7 PUR  
PUR  
up to 500 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

RJ45-connector IP20  
RJ45-connector IP20  
Harting IP20 RJ Industrial 8P  
1:1 acc. to TIA/EIA 568 B

### Flame proof

acc. to IEC 60332-1-2

### Oil-resistant

Acc. to EN60811-2-1

### Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 500 MHz acc. Category 6A, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, EIA/TIA 568 B and IEC 61918.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806591</b>	green similar RAL 6018	0,5	50
<b>806592</b>	green similar RAL 6018	1,0	50
<b>806593</b>	green similar RAL 6018	2,0	50
<b>806594</b>	green similar RAL 6018	3,0	30
<b>806595</b>	green similar RAL 6018	5,0	30
<b>806596</b>	green similar RAL 6018	10,0	25
<b>806597</b>	green similar RAL 6018	15,0	10
<b>806598</b>	green similar RAL 6018	20,0	5
<b>806599</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

### Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for permanent moving applications.

- Drag chain suitable
- Bending radius 15 x cable outerdiameter maximum
- Moving speed 180 m/min maximum
- Movement distance 4,5 m maximum
- Acceleration 3 m/s<sup>2</sup> maximum
- Cycles maximum 2 Mio.
- Temperature range from -10°C to +70°C
- Transmission rate maximum 10 Gbit/s (length limited)
- Suitable for the „Light-Duty“ range

### Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET

## high flexible

M12-X-IP67 180° (male)



Category 6A



### Type

**Patch Cable M12-X coded-IP67 180°, Industrial Ethernet Cat.6A high flexible application**

### Cable

Designation:  
Sheath material:  
Frequency:

SF/FTP 4x2xAWG 26/7 PUR  
PUR  
up to 500 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

M12-Connector bush shielded  
M12-Stecker bush shielded  
HELUKAT® M12 X-coded  
X-coded acc. DKE/IEC 61076-2-109

### Flame proof

acc. to IEC 60332-1-2

### Oil-resistant

Acc. to EN60811-2-1

### Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 500 MHz acc. Category 6A, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, DKE/IEC 61076-2-109 and IEC 61918.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
806600	green similar RAL 6018	0,5	50
806601	green similar RAL 6018	1,0	50
806602	green similar RAL 6018	2,0	50
806603	green similar RAL 6018	3,0	30
806604	green similar RAL 6018	5,0	30
806605	green similar RAL 6018	10,0	25
806606	green similar RAL 6018	15,0	10
806607	green similar RAL 6018	20,0	5
806608	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

### Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12-X coded plugs. Usable for permanent moving applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 15 x cable outerdiameter maximum
- Moving speed 180 m/min maximum
- Movement distance 4,5 m maximum
- Acceleration 3 m/s<sup>2</sup> maximum
- Cycles maximum 2 Mio.
- Temperature range from -10°C to +70°C
- Transmission rate maximum 10 Gbit/s (length limited)
- Suitable for the „Heavy-Duty“ range.

### Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables INDUSTRIAL ETHERNET

## high flexible

M12-X-IP67 90° (male)



Category 6A



### Type

**Patch Cable M12-X coded-IP67 90°, Industrial Ethernet Cat.6A high flexible application**

### Cable

Designation:  
Sheath material:  
Frequency:

SF/FTP 4x2xAWG 26/7 PUR  
PUR  
up to 500 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
System type:  
Pin assignment:

M12-Connector bend shielded  
M12-Stecker bend shielded  
HELUKAT® M12 X-coded  
X-coded acc. DKE/IEC 61076-2-109

### Flame proof

acc. to IEC 60332-1-2

### Oil-resistant

Acc. to EN60811-2-1

### Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 500 MHz acc. Category 6A, ISO 11801 (2002), EN 50173-3, IEC61156-1, IEC61156-6, DKE/IEC 61076-2-109 and IEC 61918.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>806609</b>	green similar RAL 6018	0,5	50
<b>806610</b>	green similar RAL 6018	1,0	50
<b>806611</b>	green similar RAL 6018	2,0	50
<b>806612</b>	green similar RAL 6018	3,0	30
<b>806613</b>	green similar RAL 6018	5,0	30
<b>806614</b>	green similar RAL 6018	10,0	25
<b>806615</b>	green similar RAL 6018	15,0	10
<b>806616</b>	green similar RAL 6018	20,0	5
<b>806617</b>	green similar RAL 6018	25,0	5

Dimensions and specifications may be changed without prior notice.

### Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with M12-X coded plugs. Usable for permanent moving applications. The special plastic compound which is used for this plug series is good resistant against chemical and oil. Connected to special applications an individual evaluation from our consultants should be done.

- Drag chain suitable
- Bending radius 15 x cable outerdiameter maximum
- Moving speed 180 m/min maximum
- Movement distance 4,5 m maximum
- Acceleration 3 m/s<sup>2</sup> maximum
- Cycles maximum 2 Mio.
- Temperature range from -10°C to +70°C
- Transmission rate maximum 10 Gbit/s (length limited)
- Suitable for the „Heavy-Duty“ range.

### Options

We also can deliver other cable length, cross-over cables or other types of plugs.



### Type

**USB 2.0 A patch cable, industrial USB – drag chain application.**

### Cable

Designation:

USB 2.0 shielded cable PUR, up to 5,0m

Sheath material:

PUR

Frequency:

up to 400 MHz

### Plug

Push-on connection 1:

USB A

Push-on connection 2:

USB A

### Flame proof

Acc. to IEC 60332-1-2

### Norms and standards

HELUKABEL® CONNECTING SYSTEMS® system components to 400 MHz in compliance with USB 2.0 Standard. Suitable for applications such as image processing (e.g. surveillance cameras), metrology and control technology.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>802464</b>	violet	0,5	10
<b>802465</b>	violet	1,0	10
<b>802466</b>	violet	2,0	10
<b>802467</b>	violet	3,0	10
<b>802468</b>	violet	5,0	10

Dimensions and specifications may be changed without prior notice.

### Characteristics

- Suitable for use as a patch cable in harsh environments
- Suitable for drag chain and other constantly moving applications
- Application temperature from -20°C to +60°C
- High-speed data transmission rate to max. 480 Mbit/s
- 5.0m maximum transmission distance to terminal device.
- Suitable for light duty applications.

### Options

Naturally, we also offer other lengths and connector types for IP applications on request.

# Patch Cables PROFIBUS high flexible

M12-B 180° (male)



## Type

### Cable

Designation:  
Sheath material:  
Frequency:

## Patch Cable M12 for Profibus RS 485, drag chain

Profibus 1x2x0,64 (strand) drag chain  
PUR  
up to 16 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
Pin assignment:

M12-Connector bush shielded  
M12-Buchse bush shielded  
B-coded according to DKE/IEC 61076-2-101

### Oil-resistant

Acc. to EN60811-2-1

### Norms and standards

Components of HELUKABEL® CONNECTING SYSTEMS® for applications of Profibus RS 485. Plug according IEC 61076-2-101-A1. Support the EN50170.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>800812</b>	violet similar RAL 4001	0,3	10
<b>800813</b>	violet similar RAL 4001	1,0	10
<b>800814</b>	violet similar RAL 4001	2,0	10
<b>800815</b>	violet similar RAL 4001	3,0	10
<b>800816</b>	violet similar RAL 4001	5,0	10
<b>800817</b>	violet similar RAL 4001	10,0	10

Dimensions and specifications may be changed without prior notice.

### Characteristics

- Drag chain suitable
- Bending radius 10 x cable outerdiameter maximum
- Moving speed 200 m/min maximum
- Movement distance 5 m maximum
- Acceleration 5 m/s<sup>2</sup> maximum
- Cycles maximum 5 Mio.
- Temperature range from -25°C to +70°C
- Transmission rate maximum 3,6 re. 12 Mbit/s
- Segment distance maximum 100 m
- PIN 2 (A) = green, PIN 4 (B) = red, screen terminated on the nut and on PIN 5
- Suitable for the „Heavy-Duty“ range

### Options

We also can deliver other cable length, other pin codes or other types of plugs like SUB-D.

# Patch Cables PROFIBUS high flexible

M12-B 90° (male)



## Type

### Cable

Designation:  
Sheath material:  
Frequency:

## Patch Cable M12W for Profibus RS 485, drag chain

Profibus 1x2x0,64 (strand) drag chain  
PUR  
up to 16 MHz

### Plug

Push-on connector type 1:  
Push-on connector type 2:  
Pin assignment:

M12-Connector bend shielded  
M12-Buchse bend shielded  
B-coded according to DKE/IEC 61076-2-101

### Oil-resistant

Acc. to EN60811-2-1

### Norms and standards

Components of HELUKABEL® CONNECTING SYSTEMS® for applications of Profibus RS 485. Plug according IEC 61076-2-101-A1. Support the EN50170.

### Preferred types

Part no.	Sheath colour	Length in metres	Unit
<b>800818</b>	violet similar RAL 4001	0,3	10
<b>800819</b>	violet similar RAL 4001	1,0	10
<b>800820</b>	violet similar RAL 4001	2,0	10
<b>800821</b>	violet similar RAL 4001	3,0	10
<b>800822</b>	violet similar RAL 4001	5,0	10
<b>800823</b>	violet similar RAL 4001	10,0	10

Dimensions and specifications may be changed without prior notice.

### Characteristics

- Drag chain suitable
- Bending radius 10 x cable outerdiameter maximum
- Moving speed 200 m/min maximum
- Movement distance 5 m maximum
- Acceleration 5 m/s<sup>2</sup> maximum
- Cycles maximum 5 Mio.
- Temperature range from -25°C to +70°C
- Transmission rate maximum 3,6 re. 12 Mbit/s
- Segment distance maximum 100 m
- PIN 2 (A) = green, PIN 4 (B) = red, screen terminated on the nut and on PIN 5
- Suitable for the „Heavy-Duty“ range

### Options

We also can deliver other cable length, other pin codes or other types of plugs like SUB-D.

# RJ45 COPPER CONNECTOR



Category	Housing	Connector	Pin	Helukabel Part no.	Core Ø	Cable ø	AWG Sld.	AWG Strd.	UL	Class	Standard
Cat 5	Plastic	straight	4	800986	max. 1,6 mm	6,1-6,9 mm	22-23	22-24/7	N/A	IP20	Profinet
	Plastic	straight	4	803841		4,5-8,0 mm	22-26	22-26/7	N/A		Profinet
	Plastic	straight	8	802920		4,5-8,0 mm	22-26/7		yes		TIA-568A
	Plastic	90° angle	8	804234		4,5-8,0 mm	23-26	26-23/7	yes		TIA-568A
	Metal	straight - metal	4	805401		6,3-6,7 mm	22-24		N/A		Profinet
	Metal	90° angle - metal	4	805402		6,3-6,7 mm	22-24		N/A		Profinet
	Plastic	straight	4	805781		4,5-9,0 mm	22-24	22-27	N/A		Profinet
	Plastic	45° angle	4	805782		4,5-8,0 mm	22-24		22-27		N/A
Cat 6	Plastic	straight	8	801318	k. A.	5,0-8,5 mm	24	24-26	N/A	IP67	TIA-568A/B
Cat 6EA	Plastic	straight	8	805783	max. 1,6 mm	4,5-9,0 mm	22-24	22-27	N/A	IP20	Aufkleber
	Plastic	45° angle	8	805784		4,5-8,0 mm			N/A		Aufkleber
Cat 6A	Metal	straight - metal	8	804544		5,0-9,5 mm	22-26	22-27/7	N/A		TIA-568A

# M12 COPPER CONNECTOR



Category	Housing	Connector	Pin	Helukabel Part no.	Core Ø	Cable ø	AWG Sld.	AWG Strd.	UL	Class	Standard
Cat 5 D-coded	Metal	straight	4	803894	1,0-1,6mm	4,0-8,0mm	22-26		N/A	IP67	TIA-568B
	Metal	90° angle	4	805958					N/A		TIA-568B
	Metal	straight	4	805966		N/A	Profinet				
	Metal	straight	4	806205	0,75-2,0mm	5,0-9,7mm	20-24	N/A	Profinet		
	Metal	90° angle	4	805967	max. 1,6mm		22-26	N/A	Profinet		
Cat 6A D-coded	Metal	straight	8	805959	k. A.	4,0-8,0mm	26	yes		S.U.	
	Metal	straight	8	806206	0,75-2,0mm		5,0-9,7mm	22-26	N/A	S.U.	
	Metal	90° angle	8	805960			26	yes	S.U.		
Profibus B-coded	Metal	straight	2	801774	k. A.	4,0-8,0mm	20-26	yes		Profibus	
	Metal	90° angle	2	805964				yes	Profibus		

# Copper Connecting Technics

## PROFIBUS Plugs SUB-D



### Type

### Cage

Model:  
Number of poles:  
Contact design:  
Housing material:

Plug  
9  
male  
metalized plastic

### Technical details

Protection classification (IP): 20  
Suitable for core diameter: 0,64 mm  
max. transmission rate: 12  
max. current drain: 0,0125 A  
terminating impedance: yes  
Operating temperature range min.: 0°C  
Operating temperature range max.: +60°C

### PROFIBUS connectors

### Plug types

Part no.	Out-going cable	Pro-gramming inter-face	Dia-gnos-tics mode	Connection type	Suitable for cable structure	Suitable for core type	Dimensions in mm	Unit
<b>802401</b>	90°	-	-	Screwing terminal	-	solid/litz	64 x 40 x 17	10
<b>803845</b>	90°	-	yes	Screwing terminal	-	solid/litz	64 x 40 x 17	10
<b>802402</b>	90°	yes	-	Screwing terminal	-	solid/litz	64 x 40 x 17	10
<b>803844</b>	90°	yes	yes	Screwing terminal	-	solid/litz	64 x 40 x 17	10
<b>802406</b>	90°	-	-	Crimp	SK/FC	solid/litz	72 x 40 x 17	10
<b>803195</b>	90°	-	yes	Crimp	SK/FC	solid/litz	64 x 40 x 17	10
<b>802407</b>	90°	yes	-	Crimp	SK/FC	solid/litz	72 x 40 x 17	10
<b>803194</b>	90°	yes	yes	Crimp	SK/FC	solid/litz	64 x 40 x 17	10
<b>803356</b>	45°	-	-	Crimp	SK/FC	solid	95 x 70 x 17	10
<b>803576</b>	45°	-	-	Crimp	SK/FC	litz	72 x 40 x 17	10
<b>803357</b>	45°	yes	-	Crimp	SK/FC	solid	72 x 40 x 17	10
<b>803577</b>	45°	yes	-	Crimp	SK/FC	litz	72 x 40 x 17	10
<b>802403</b>	35°	-	-	Screwing terminal	-	solid/litz	54 x 40 x 17	10
<b>802404</b>	35°	yes	-	Screwing terminal	-	solid/litz	54 x 40 x 17	10
<b>802405</b>	axial	-	-	Screwing terminal	-	solid/litz	68 x 39,5 x 17	10
<b>803208</b>	axial	-	-	Crimp	SK/FC	solid/litz	70 x 35 x 17	10

Dimensions and specifications may be changed without prior notice.

### Application

The compact design of the bus connectors from the series HELUKABEL® CONNECTING SYSTEMS makes them suitable for use in nearly all Siemens CPU types. A slide switch sets whether the connector will be used as a node or end of segment. The switch can also be operated when the connector is plugged. The switch setting is clearly visible.

### Included in delivery

SUB-D plug 9 poles, housing and assembly instructions.

### Options

We also deliver connectors for other systems like CAN-Bus, DeviceNet or Interbus on request.

# Copper Connecting Technics

## PROFIBUS Adapter M12/ SUB-D



### Type

### Cage

Model:  
Contact design:  
Housing material:

Adaptor  
Sub-D / M12  
metalized plastic

### Technical details

Protection classification (IP): 20  
max. transmission rate: 12  
max. current drain: 0,0125 A  
terminating impedance: yes  
Operating temperature range min.: -25°C  
Operating temperature range max.: +85°C

### Plug types

Part no.	Out-going cable	PG-Connection Jack PG-Connection Jack	Diagnosis mode	Connection type	Dimensions in mm	Unit
805194	90°	-	-	M12	70 x 41 x 17	10
805195	90°	yes	-	M12 + Sub-D	70 x 41 x 17	10
805709	90°	yes	yes	M12 + Sub-D	70 x 41 x 17	10

Dimensions and specifications may be changed without prior notice.

### Application

PROFIBUS adaptor Sub-D / M12 will be used for interconnection with harnessed M12 cables. This will avoid interconnection failures and the time for installation is reduced to a minimum. This adaptor has two M12 interfaces and integrated termination resistors which can be selected under installed condition. The housing is metallized for an improved EMV resistance. Available with and without PG connector (Sub-D interface on the backside) and status LED's.  
orange = status of termination resistor  
green = activity of bus  
blue = participation on bus traffic  
The PROFIBUS adaptor has an enhanced temperature range of -25°C till +85°C (acc. UL test parameter +60°C)

### Included in delivery

Sub-D / M12 Adaptor

### Options

We also deliver connectors for other systems like CAN-Bus, DeviceNet or Interbus on request.

Fibre pigtails

Fibre optic wiring boxes

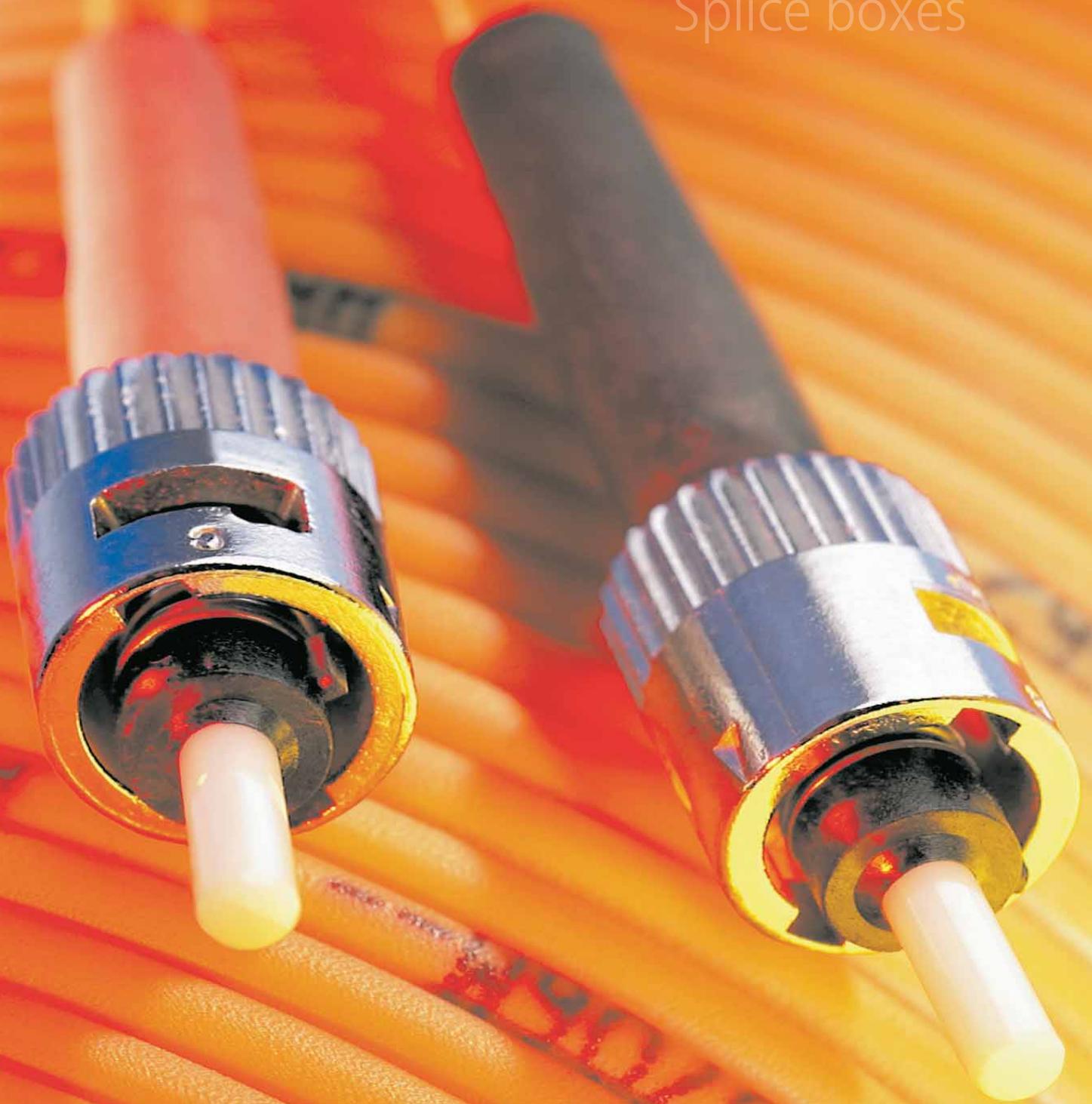
Multimode fibres

Industrial Ethernet SCdx-MM Outlets

DIN rail

HCS-fibre connection-cable

Splice boxes



# ■ FIBER OPTIC CONNECTION TECHNICS – OFFICE

Description			Page
<b>Fiber Optic Connection Technics - Office</b>			
Fibre Optic Connection Technics	HELUCOM®	19" splice boxes, telescope	308
Fibre Optic Connection Technics	HELUCOM®	19" splice boxes, telescope partially configured with couplings MM	309
Fibre Optic Connection Technics	HELUCOM®	Mini-Wallmount Cabinet	310
Fibre Optic Connection Technics	HELUCOM®	Fibre-optic wiring boxes, in-wall installation	311
Fibre Optic Connection Technics	HELUCOM®	Fibre-optic plug, fibre-optic couplings	312
Fibre Optic Connection Technics	HELUCOM®	Fibre pigtails	313
Fibre Optic Connection Technics	HELUCOM®	Fibre-optic connection-cable (jumper cable)	315
Fibre Optic Connection Technics	HELUCOM®	Consumption material	317
Rubber cable reel	HELUCOM®	with HELUCOM® fibre optic mobile cable	318
Fibre Optic enclosures			319
Fibre Optic enclosures			320
Fittings for metal-free optical fibre (ADSS) aerial cables	HELUCOM®	Span length < 80m	322
Fittings for metal-free optical fibre (ADSS) aerial cables	HELUCOM®	Span length 80 - 150m	323
Fittings for metal-free optical fibre (ADSS) aerial cables	HELUCOM®	Span length > 150m	325
<b>Fiber Optic Connection Technics - Industry</b>			329

# ■ FIBRE OPTIC PLUG & ADAPTER OVERVIEW

## ST plug



- Ceramic ferrule
- Available for single mode or multi-mode

## ST adapter



- Ceramic ferrule
- Available for single mode or multi-mode

## SC/SCdx plug



- Ceramic ferrule
- Normal cross section or 8° diagonal cross section (single mode only)
- Available for single mode or multi-mode

## SC/SCdx adapter



- Ceramic ferrule
- Normal cross section or 8° diagonal cross section (single mode only)
- Available for single mode or multi-mode

## LC plug



- Ceramic ferrule
- Available for single mode or multi-mode

## LC adapter



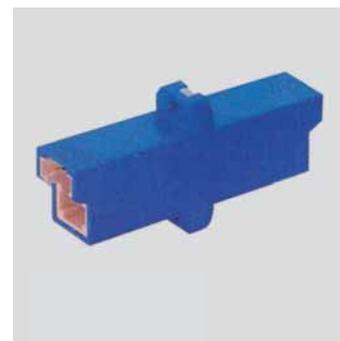
- Ceramic ferrule
- Available for single mode or multi-mode

## E-2000 plug



- Ceramic ferrule
- Normal cross section or 8° diagonal cross section (single mode only)
- Available for single mode or multi-mode

## E-2000 adapter



- Ceramic ferrule
- Normal cross section or 8° diagonal cross section (single mode only)
- Available for single mode or multi-mode

### DIN plug



- Ceramic ferrule
- Available for single mode or multi-mode

### DIN adapter



- Ceramic ferrule
- Available for single mode or multi-mode

### MTRJ Plug



- Ceramic ferrule
- Available for single mode or multi-mode

### MTRJ adapter



- Ceramic ferrule
- Available for single mode or multi-mode

### FC PC plug



- Ceramic ferrule
- Normal cross section or 8° diagonal cross section (single mode only)
- Available for single mode or multi-mode

### FC PC adapter



- Ceramic ferrule
- Normal cross section or 8° diagonal cross section (single mode only)
- Available for single mode or multi-mode

### F-SMA plug



- Ceramic ferrule
- Available for single mode or multi-mode

### F-SMA adapter



- Ceramic ferrule
- Available for single mode or multi-mode

# ■ PRE-ASSEMBLED FIBRE OPTIC CABLES

No special knowledge or tools are needed to install HELUCOM® pre-assembled fibre optic cables. The cable is pre-assembled and can be connected immediately after it has been laid. As a result, the installation process actually comprises nothing more than laying the cable itself. In the distributor bodies, the fibres from the loose-tube cable are conducted through the individual simplex cables without splicing. The simplex cables are terminated using pre-assembled plugs. Included in delivery is a plug shield

that protects the plugs, simplex cables and distributor body while the cable is being laid. The pulling aid is connected to the pull cable. As a result, it is possible to lay the cable together with the pre-assembled distributor just as you would lay a standard cable. The benefits of pre-assembled and pre-assembled cables are easy to see: The fibre optic cables are cut to the desired length, and the fibres are glued to different plug models in a clean and dust-free environment.

## Features:

### Applications:

1. Outdoor wiring
2. Indoor wiring

### Cable types:

- Zipcords with halogen-free outer jacket
- Breakout cables with halogen-free outer jacket
- Mini breakout cables with halogen-free outer jacket
- Fibre optic cables with central / stranded loose-tube cable
- Plastic fibre cables (POF)

### Fibre types:

- E9/125 µm
- G50/125 µm
- G62,5/125 µm
- 200/230 µm
- 980/1000 µm

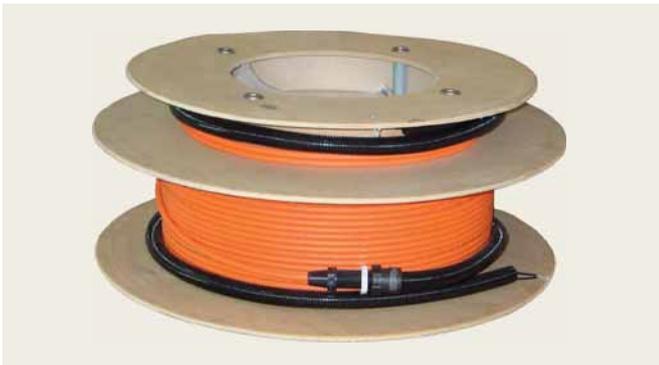
### Plug systems:

- ST, SC, SCdx, LC, MTRJ, E-2000, DIN, FDDI, FC-PC and F-SMA

### Additional pre-assembled kits:

- Pulling aid
- Pulling tube
- Core coding

## Pre-assembled fibre optic cables



**01** The pre-assembled loose-tube cable together with distributor body and pulling protection as it appears just before shipment. Depending on the length of the cable, the cable can be shipped as a ring or on a disposable shipping reel.



**02** Detailed view form the end of the cable with pulling aid.



**03** Detailed view of the robust cast distributor body. The distributor body is equipped with a compatible plastic gland for installation in splice boxes. In addition, the system can be reused in a new installation.



**04** Mini loose-tube cables designed to allow easy insertion into prepared splice boxes. In addition, the mini loose-tube cables are number-coded.



**05** Glass fibre splice box used as cable end enclosure for multi-core fibreoptic cables in 19" cabinets. The splice box is particularly suitable as a connecting unit for our pre-fabricated fibre-optic grooved cables.

# PRE-ASSEMBLED FIBRE OPTIC CABLES

Matrix Distributor bodies				
Designation	Figure	Top view		
		compact fibre	empty fibre	
<b>WKOM-01</b>				
<b>WKOM-02</b>				
<b>WKOM-03</b>				
<b>WKOM-04</b>				
<b>WKOM-05</b>				

Cable allocation				
Designation	Figure	Top view		
		compact fibre	empty fibre	
<b>WKOM-105</b>				
<b>WKOM-106</b>				
<b>WKOM-107</b>				

	Compact fibre	Empty fibre	Thread	Fibre optic cable	Allocation table			
	max. number	max. number	type	max $\varnothing$ [mm]	length [mm]	D [mm]	d <sub>A</sub> [mm]	d <sub>I</sub> [mm]
	24	24	M25	12	80	35	34	25
	12	12	M20	12	80	28	27	20
	4	12	PG11	10	66	29	26	18,5
	4	12	-	10	35	17	-	-
	4	4	-	5	29	12	-	-

	Thread	Cable A	Cable B	Cable B	Allocation table			
	type	max $\varnothing$ [mm]	number	$\varnothing$ [mm]	Length [mm]	D [mm]	d <sub>A</sub> [mm]	d <sub>I</sub> [mm]
	-	14	2	12	110	-	18	14
	-	10	2	8	100	-	14	10
	-	8	2	6	100	-	12	8

# ■ MTP®/ MPO – PLUG AND PLAY IN THE DATA PROCESSING CENTRE OF THE FUTURE

In data processing centres, height units in the rack as well as space along the cable routes are highly valuable. For fibre optic connections, the MTP® system (see IEC61754-7 and TIA/EIA 604-5) is an attractive option. With trunk cables, which bundle 12 to 24 fibres in a single connector, it is possible to implement a cabling structure that is flexible and future-proof.

(Refer to standard ISO11801 as well as EN50173-5). The trunk cable, which has a nominal diameter of 3.5 mm (4.5 mm in the case of 24 fibres), connects two modular inserts stowed in a 1 HE carrier frame. With push-pull technology, the plug of the

trunk cable is quickly and reliably connected with the module. The MTP® system from HELUKABEL® can be used to implement up to 96 fibres in a single height unit. In theory, this means that with 48 height units available, it is possible to manage up to 4608 fibres. With LC, SC, and ST connectivity, almost every connector preference can be met. MTP® products are factory pre-assembled and can be manufactured to order in any length. The fibre types OS1, OS2, and OM1 through 4 can be used for this system. Time-consuming, costly splicing work is a thing of the past with this plug and play system.



## MPO/MTP® module patch panel

- Carrier completely extractable
- 3 or 4 module slots
- up to 96 fibres per 1 HU possible
- 19" design, 1HU, 255 mm depth
- Colour RAL 9005



## MPO/MTP® cassette

- Available in 1HU or ½ HU.
- Lightweight aluminium housing
- with 12/24 LC, 12 SC, or 6 MTP® connections
- High packing density up to 12 LC duplex (24 fibres)
- Fibre types OS1(+APC), OM2, OM3, OM4



## Front panel 6x MPO/MTP®

- Lightweight aluminium front
- Painted in RAL 9005
- Push-Pull locking
- Fitted with 6 MTP® pass-thru connectors



## MPO/MTP® blanking plates

- for covering module slots not in use
- in 1 or ½ HU
- Fast push-pull locking

## ■ PRE-ASSEMBLED FIBRE OPTIC CABLES



### MPO/MTP®-trunk cables

- 12 or 24 fibres • Length to order
- Maximum performance due to factory quality assurance
- Diameter approx. 4.5mm (reinforced) or approx. 3.5mm
- Halogen-free
- Available as SM and OM3/4
- Fast, reliable push-pull locking
- MTP® male/female connectors possible



### MPO/MTP®-Fanout

- MTP® to LC/SC trunk cable
- 12 or 24 fibres • Pigtailed and total lengths to order
- Pigtail available as wire (0.9mm) or cable (2.0mm)
- Duplex clip possible
- Diameter 4.5 mm (reinforced) or 3.0 mm
- Halogen-free
- MTP® male/female connectors possible
- Fibre types OS1 (+APC), OM2, OM3, OM4

### MPO/MTP®-Fanout



### MPO/MTP® Cassette



### MPO/MTP®-Trunk cable



### MPO/MTP® module patch panel



This is only a small excerpt from our product range in order to serve as a basis for planning. We will be happy to work with you to put together an offer based on your requirements.



## Type

**19" splice boxes, telescope**

## Cage

Housing material:  
Cover lock:  
Colour:

Steel sheet  
Fastening by means of screws  
Grey similar to RAL 7035

## Equipment

Full  
Couplers  
Pigtails

## Dimensions

Number of height modules (HM):  
Fastening dimensions:  
Width:

1  
19"  
225 mm

## Preferred types

Part no.	Number of couplers	Type of coupler	Fibre type	Unit
<b>801164</b>	4	ST	Multimode G50/125	1
<b>802453</b>	4	ST	Multimode G50/125 OM3	1
<b>801165</b>	8	ST	Multimode G50/125	1
<b>802454</b>	8	ST	Multimode G50/125 OM3	1
<b>81354</b>	12	ST	Multimode G50/125	1
<b>802455</b>	12	ST	Multimode G50/125 OM3	1
<b>81355</b>	12	ST	Multimode G62.5/125	1
<b>82869</b>	12	ST	Single-mode E9/125	1
<b>81356</b>	24	ST	Multimode G50/125	1
<b>802456</b>	24	ST	Multimode G50/125 OM3	1
<b>81357</b>	24	ST	Multimode G62.5/125	1
<b>82870</b>	24	ST	Single-mode E9/125	1
<b>801166</b>	2	SC duplex	Multimode G50/125	1
<b>802457</b>	2	SC duplex	Multimode G50/125 OM3	1
<b>801167</b>	4	SC duplex	Multimode G50/125	1
<b>802458</b>	4	SC duplex	Multimode G50/125 OM3	1
<b>81358</b>	6	SC duplex	Multimode G50/125	1
<b>802459</b>	6	SC duplex	Multimode G50/125 OM3	1
<b>81359</b>	6	SC duplex	Multimode G62.5/125	1
<b>82871</b>	6	SC duplex	Single-mode E9/125	1
<b>81675</b>	12	SC duplex	Multimode G50/125	1
<b>802460</b>	12	SC duplex	Multimode G50/125 OM3	1
<b>81676</b>	12	SC duplex	Multimode G62.5/125	1
<b>82872</b>	12	SC duplex	Single-mode E9/125	1
<b>803145</b>	2	LCdx	Multimode G50/125	1
<b>803146</b>	2	LCdx	Multimode G50/125 OM3	1
<b>803147</b>	4	LCdx	Multimode G50/125	1
<b>803148</b>	4	LCdx	Multimode G50/125 OM3	1
<b>803149</b>	6	LCdx	Multimode G50/125	1
<b>803150</b>	6	LCdx	Multimode G50/125 OM3	1
<b>803151</b>	6	LCdx	Multimode G62.5/125	1
<b>803152</b>	6	LCdx	Single-mode E9/125	1
<b>803153</b>	12	LCdx	Multimode G50/125	1
<b>803154</b>	12	LCdx	Multimode G50/125 OM3	1
<b>803155</b>	12	LCdx	Multimode G62.5/125	1
<b>803156</b>	12	LCdx	Single-mode E9/125	1
<b>82875</b>	12	E2000	Single-mode E9/125	1

Dimensions and specifications may be changed without prior notice.

## Options

On request, different assembly variations, such as LC, F-SMA, FC/PC, and DIN and/or diagonal cross section designs, are also available. Naturally, we also offer empty boxes.

## Application

Glass fibre splice boxes are used as cable end enclosures for multi-core fibre-optic cables in 19" cabinets.

Splice-Boxes partly equipped, Telescope



## Type

**19" splice boxes, telescope partially configured with couplings MM**

## Cage

Housing material:  
Cover lock:  
Colour:

Steel sheet  
Fastening by means of screws  
Grey similar to RAL 7035

## Equipment

Partially-configured  
Couplers

## Dimensions

Number of height modules (HM):  
Fastening dimensions:  
Width:

1  
19"  
225 mm

## Preferred types

Part no.	Number of couplers	Type of coupler	Unit
<b>801171</b>	4	ST	1
<b>801172</b>	8	ST	1
<b>801173</b>	12	ST	1
<b>801174</b>	24	ST	1
<b>801168</b>	2	SC duplex	1
<b>801169</b>	4	SC duplex	1
<b>801170</b>	6	SC duplex	1
<b>80996</b>	12	SC duplex	1
<b>803157</b>	2	LCdx	1
<b>803158</b>	4	LCdx	1
<b>803159</b>	6	LCdx	1
<b>803160</b>	12	LCdx	1

Dimensions and specifications may be changed without prior notice.

## Options

On request, different assembly variations, such as F-SMA, FC/PC, and DIN and/or diagonal cross section designs, are also available.

## Application

Glass fibre splice boxes are used as cable end enclosures for multi-core fibreoptic cables in 19" cabinets. The splice boxes described here are particularly suitable as a connecting unit for our pre-fabricated fibre-optic grooved cables.



### Type

### Mini-Wallmount Cabinet

### Cage

Housing material:  
Colour:

Steel sheet  
Grey similar to RAL 7035

### Equipment

With front plate  
Maximum number of couplings/adapters: 8  
Number of couplings/adapters: 8  
With coupling/adapter:

8  
8  
Empty

### Dimensions

Width:

54 mm

### Included in delivery

Housing with cover, lockable, 2 keys, 2 plastic expanding rivets, 4 openings with sealing strips for incoming and outgoing cables.

### Application

A maximum of 8 splice boxes or 4 splice boxes and one distributor plate can be installed. The distributor plate can be fastened using 2 plastic expanding rivets. Dimensions: W=320xH=280xD=54mm.

### Part no.

**802461**

Dimensions and specifications may be changed without prior notice.



## Type

### Cage

Housing material:  
Colour:  
Outlet direction:  
Type of fastening:

## Fibre-optic wiring boxes, in-wall installation

Plastic  
Pure White similar to RAL 9010  
Angled  
Snap-in

## Equipment

Coupler  
Central plate  
Text box

## Dimension

50 x 50mm

## Preferred types

Part no.	Number of couplers	Type of coupler	Suitable for fibre type	Unit
<b>81072</b>	2	ST	Multi-mode	10
<b>81073</b>	4	ST	Multi-mode	10
<b>81074</b>	2	SC	Multi-mode	10
<b>81075</b>	4	SC	Multi-mode	10

Dimensions and specifications may be changed without prior notice.

## Options

On request, we also supply sockets in other configurations, such as three-way, to four-way, or six-way sockets. In addition, different codings can be supplied by means of colored identification buttons.

## Application

The fibre-optic wiring box forms the end element of the fibre-optic network at the workstation. From the wiring box, computers and peripheral devices are connected with cable connections (jumper cables). Depending on the version, the wiring box can be used in-wall mounting or top-mounting.



### Type

#### Preferred types

### Fibre Optic connector

Part no.	Type	Suitable for fibre type	Unit
<b>80396</b>	ST	Multi-mode	50
<b>81062</b>	SC	Multi-mode	50
<b>81063</b>	SC duplex	Multi-mode	50
<b>800728</b>	SC duplex	Single-mode	50
<b>800725</b>	F-SMA	Multi-mode	50
<b>800727</b>	F-SMA	Single-mode	50
<b>800723</b>	LC	Multi-mode	50
<b>800726</b>	LC	Single-mode	50
<b>82025</b>	MT-RJ	Multi-mode	50
<b>800724</b>	FC	Multi-mode	50
<b>800720</b>	E2000	Single-mode	50
<b>800721</b>	DIN	Multi-mode	50

Dimensions and specifications may be changed without prior notice.

### Included in delivery

#### Application

Fibre-optic plug

Fibre-optic plugs and couplings serve as links or removable connections for equipment outputs or distribution centers.

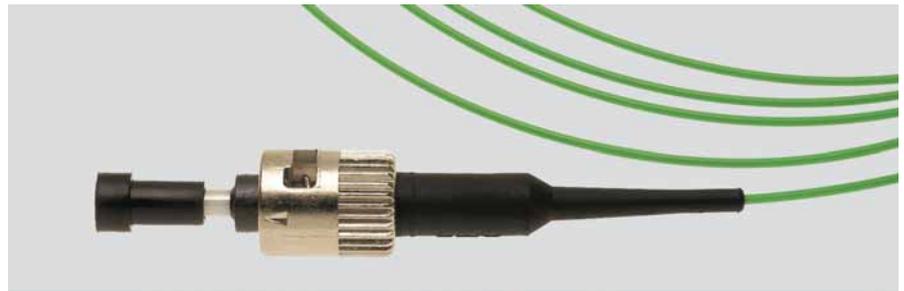
### Type

#### Preferred types

### LWL-coupler

Part no.	Type	Suitable for fibre type	Unit
<b>800729</b>	SC / ST	Single-mode	50
<b>802252</b>	ST / ST	Multi-mode	50
<b>80605</b>	ST / ST	Single-mode	50
<b>81069</b>	SC / ST	Multi-mode	50
<b>805112</b>	SC / SC	Multi-mode	50
<b>81065</b>	SC / SC	Multi-mode	50
<b>800731</b>	SC / SC	Single-mode	50
<b>805111</b>	SC / SC	Single-mode	50
<b>81070</b>	SC duplex / ST	Multi-mode	50
<b>800730</b>	SC duplex / ST	Single-mode	50
<b>81066</b>	SC duplex / SC duplex	Multi-mode	50
<b>800732</b>	SC duplex / SC duplex	Single-mode	50
<b>82026</b>	MT-RJ / MT-RJ	Multi-mode	50
<b>800735</b>	LC / LC	Multi-mode	50
<b>800736</b>	LC / LC	Single-mode	50
<b>800733</b>	E2000 / E2000	Single-mode	50
<b>800737</b>	FC/PC / FC/PC	Multi-mode	50
<b>800738</b>	F-SMA / F-SMA	Multi-mode	50
<b>800734</b>	DIN / DIN	Multi-mode	50

Dimensions and specifications may be changed without prior notice.

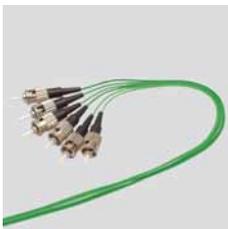


**Type**  
**Standard length**  
**Preferred types**

**Fibre pigtails**  
**2,0m**

Plug type:

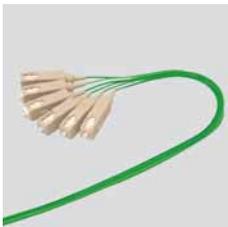
ST



Part no.	Fibre type	Sheath colour	Unit
<b>80457</b>	Multimode G50/125 OM2	Green	12
<b>80606</b>	Multimode G62.5/125	Blue	12
<b>81041</b>	Single-mode E9/125	Yellow	12

Plug type:

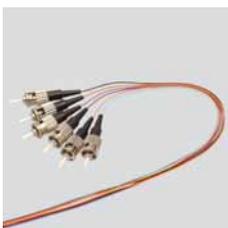
SC



Part no.	Fibre type	Sheath colour	Unit
<b>81044</b>	Multimode G50/125 OM2	Green	12
<b>81045</b>	Multimode G62.5/125	Blue	12
<b>81046</b>	Single-mode E9/125	Yellow	12

Plug type:

ST



Part no.	Fibre type	Sheath colour	Unit
<b>805718</b>	Multimode G50/125 OM2	color coded	12
<b>805719</b>	Multimode G50/125 OM3	color coded	12
<b>805720</b>	Multimode G50/125 OM4	color coded	12
<b>805722</b>	Multimode G62.5/125	color coded	12
<b>805721</b>	Single-mode E9/125	color coded	12

Plug type:

SC



Part no.	Fibre type	Sheath colour	Unit
<b>805723</b>	Multimode G50/125 OM2	color coded	12
<b>805080</b>	Multimode G50/125 OM3	color coded	12
<b>805724</b>	Multimode G50/125 OM4	color coded	12
<b>805725</b>	Multimode G62.5/125	color coded	12
<b>805110</b>	Single-mode E9/125	color coded	12

Continuation ►

Plug type:

LC



Part no.	Fibre type	Sheath colour	Unit
<b>805726</b>	Multimode G50/125 OM2	color coded	12
<b>805727</b>	Multimode G50/125 OM3	color coded	12
<b>805728</b>	Multimode G50/125 OM4	color coded	12
<b>805730</b>	Multimode G62.5/125	color coded	12
<b>805729</b>	Single-mode E9/125	color coded	12

Dimensions and specifications may be changed without prior notice.

## Application

Pigtails are used in glass fibre sets, such as splice boxes. 12 pigtails with fibrecoatings 900µ in a packing unit. Every packing unit contains an individual measurement protocol.

## Options

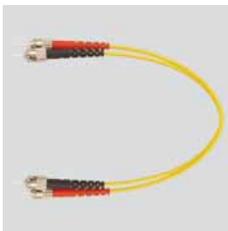
On request, different assembly variations, such as E2000, FC/PC, F-SMA or DIN, are also available. 8° or 9° diagonal cross sections are also manufactured with the corresponding plug types.



## Type Preferred types

Plug type:

ST / ST

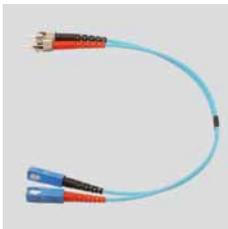


### Jumper cable I-VH 2x1 (glas fibre)

Part no.	Fibre type	Length in metres	Sheath colour	Unit
803161	Multimode G50/125 OM2	1	Orange	10
80983	Multimode G50/125 OM2	2	Orange	10
801175	Multimode G50/125 OM2	3	Orange	10
801176	Multimode G50/125 OM2	5	Orange	10
805796	Multimode G50/125 OM3	1	turquoise	10
802442	Multimode G50/125 OM3	2	turquoise	10
805797	Multimode G50/125 OM3	3	turquoise	10
805798	Multimode G50/125 OM3	5	turquoise	10
80636	Multimode G62.5/125	2	Orange	10
805799	Single-mode E9/125	1	Yellow	10
81043	Single-mode E9/125	2	Yellow	10
805800	Single-mode E9/125	3	Yellow	10
805801	Single-mode E9/125	5	Yellow	10

Plug type:

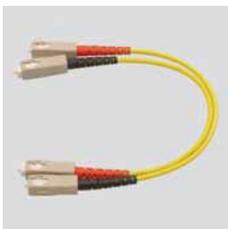
SC duplex / ST



Part no.	Fibre type	Length in metres	Sheath colour	Unit
803163	Multimode G50/125 OM2	1	Orange	10
81053	Multimode G50/125 OM2	2	Orange	10
803164	Multimode G50/125 OM2	3	Orange	10
803165	Multimode G50/125 OM2	5	Orange	10
805790	Multimode G50/125 OM3	1	turquoise	10
802444	Multimode G50/125 OM3	2	turquoise	10
81055	Single-mode E9/125	2	Yellow	10
805791	Multimode G50/125 OM3	3	turquoise	10
805792	Multimode G50/125 OM3	5	turquoise	10
81054	Multimode G62.5/125	2	Orange	10
805793	Single-mode E9/125	1	Yellow	10
805794	Single-mode E9/125	3	Yellow	10
805795	Single-mode E9/125	5	Yellow	10

Plug type:

SC duplex / SC duplex

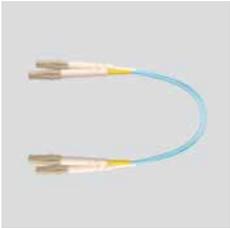


Part no.	Fibre type	Length in metres	Sheath colour	Unit
803162	Multimode G50/125 OM2	1	Orange	10
81050	Multimode G50/125 OM2	2	Orange	10
805078	Multimode G50/125 OM3	1	turquoise	10
802443	Multimode G50/125 OM3	2	turquoise	10
805079	Multimode G50/125 OM3	3	turquoise	10
805712	Multimode G50/125 OM3	5	turquoise	10
81051	Multimode G62.5/125	2	Orange	10
800423	Single-mode E9/125	1	Yellow	10
81052	Single-mode E9/125	2	Yellow	10
800424	Single-mode E9/125	3	Yellow	10
805715	Single-mode E9/125	5	Yellow	10

Continuation ►

Plug type:

LC duplex / LC duplex



Part no.	Fibre type	Length in metres	Sheath colour	Unit
803166	Multimode G50/125 OM2	1	Orange	10
802447	Multimode G50/125 OM2	2	Orange	10
803167	Multimode G50/125 OM2	3	Orange	10
803168	Multimode G50/125 OM2	5	Orange	10
805076	Multimode G50/125 OM3	1	turquoise	10
802445	Multimode G50/125 OM3	2	turquoise	10
805077	Multimode G50/125 OM3	3	turquoise	10
805714	Multimode G50/125 OM3	5	turquoise	10
802449	Multimode G62.5/125	2	Orange	10
805045	Single-mode E9/125	1	Yellow	10
802451	Single-mode E9/125	2	Yellow	10
805046	Single-mode E9/125	3	Yellow	10
805717	Single-mode E9/125	5	Yellow	10

Plug type:

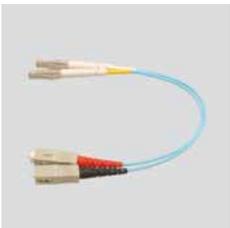
LC duplex / ST



Part no.	Fibre type	Length in metres	Sheath colour	Unit
803171	Multimode G50/125 OM2	1	Orange	10
803172	Multimode G50/125 OM2	3	Orange	10
803173	Multimode G50/125 OM2	5	Orange	10
805802	Multimode G50/125 OM3	1	turquoise	10
803174	Multimode G50/125 OM3	2	turquoise	10
805804	Multimode G50/125 OM3	3	turquoise	10
805803	Multimode G50/125 OM3	5	turquoise	10
803175	Multimode G62.5/125	2	Orange	10
805805	Single-mode E9/125	1	Yellow	10
803176	Single-mode E9/125	2	Yellow	10
805807	Single-mode E9/125	3	Yellow	10
805806	Single-mode E9/125	5	Yellow	10

Plug type:

LC duplex / SC duplex



Part no.	Fibre type	Length in metres	Sheath colour	Unit
803169	Multimode G50/125 OM2	1	Orange	10
802448	Multimode G50/125 OM2	2	Orange	10
803170	Multimode G50/125 OM2	5	Orange	10
805074	Multimode G50/125 OM3	1	turquoise	10
802446	Multimode G50/125 OM3	2	turquoise	10
805075	Multimode G50/125 OM3	3	turquoise	10
805713	Multimode G50/125 OM3	5	turquoise	10
802450	Multimode G62.5/125	2	Orange	10
802482	Single-mode E9/125	1	Yellow	10
802452	Single-mode E9/125	2	Yellow	10
801836	Single-mode E9/125	3	Yellow	10
805716	Single-mode E9/125	5	Yellow	10

Dimensions and specifications may be changed without prior notice.

## Application

### Options

Cable connections by HELUCOM® are used for wiring terminals.

On request, different assembly variations, such as E2000, FC/PC, F-SMA or DIN, are also available. 8° or 9° diagonal cross sections are also manufactured with the corresponding plug types.



## Preferred types

Part no.	Type	Unit
<b>80307</b>	SPLICING CASSETTE	10
<b>81365</b>	SPLICE HOLDER "SHRINK"	100
<b>81364</b>	SPLICE HOLDER "CRIMP"	100
<b>81363</b>	CASSETTE COVER	10
<b>81362</b>	SHRINK-ON SPLICE PROTECTOR	100
<b>80309</b>	CRIMP SPLICE PROTECTOR	100

Dimensions and specifications may be changed without prior notice.

## Options

On request, we also supply special consumables that are not covered by our high-quality types.



## Type

**Rubber cable reel with HELUCOM® fibre optic mobile cable**

## Drum

Equipment:

## Rubber

with supporting frame

## Cable

Description:  
sheath colour:

Fibre-optic cable, mobile, trailing  
Orange

Flame proof

acc. IEC 60332-2-1

## Plug

System type:  
Protective grommet:  
APC version:

office connector  
Plugged  
no

## Norms and standards

Components of HELUCOM CONNECTING SYSTEMS® according actual standards. Meet the standard IEC 60794-1-2 F5 and E6. Also they realize the optical data acc. OM1, OM2 and ITU-T G.652.

## Preferred types

Part no.	Fibre category	Fibre count	Plug 1	Plug 2	Cable length m
<b>802223</b>	Multimode G50/125	4	ST	ST	500,0
<b>802226</b>	Multimode G62,5/125	4	ST	ST	500,0
<b>802229</b>	Single-Mode E9/125	4	ST	ST	500,0
<b>802224</b>	Multimode G50/125	4	SC duplex	SC duplex	500,0
<b>802227</b>	Multimode G62,5/125	4	SC duplex	SC duplex	500,0
<b>802230</b>	Single-Mode E9/125	4	SC duplex	SC duplex	500,0
<b>802225</b>	Multimode G50/125	4	LC duplex	LC duplex	500,0
<b>802228</b>	Multimode G62,5/125	4	LC duplex	LC duplex	500,0
<b>802231</b>	Single-Mode E9/125	4	LC duplex	LC duplex	500,0

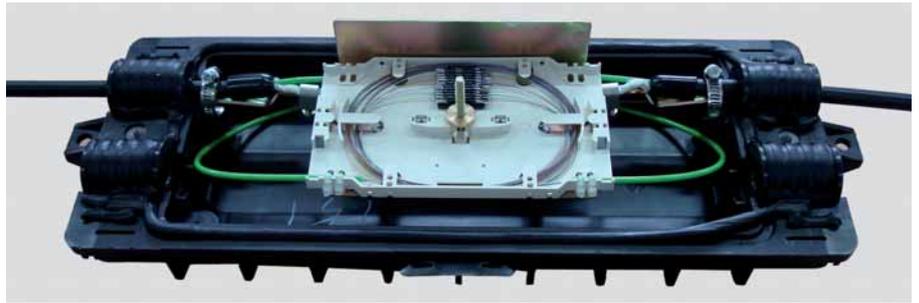
Dimensions and specifications may be changed without prior notice.

## Characteristics

Rubber cable reel with 4 fibre optic jacks and fibre optic plugs. Suitable for mobile use on site, for example for meetings, TV-Transmissions, Fairs, etc.. Everywhere when there is a need for a removable cable connection. Usable for flexible and fixed installation cabling.

## Options

We also can deliver other cable length, other fibre types or other types of plugs.



## Preferred types

Part no.	Type	Unit
<b>802936</b>	Fibre Optic Burial Sleeve 24 Fibre capacity	1
<b>804300</b>	Fibre Optic Burial Sleeve 48 Fibre capacity	1

Dimensions and specifications may be changed without prior notice.

## Application

This fiber optic sleeve is suitable for use with up to 48 fibers and is therefore suitable for most applications in optical distribution networks. The fiber optic sleeve is to chemical and mechanical influences in all fields of optical crosslinked, resistant. In the sleeve set are all included for the complete assembly of the sleeve parts required. The type and number of splice trays are selected according to the particular application. The joint consists of two plastic parts and mastic sealants. The wedge slide closure enables easy and fast closing the outdoor sleeve. Through the closure mechanism short installation times and simple open and closed again be made possible.



## Preferred types

Part no.	Type	Unit
<b>804301</b>	Mast- Hood-Sleeves 48 Fibre capacity	1
<b>804302</b>	Mast- Hood-Sleeves 144 Fibre capacity	1

Dimensions and specifications may be changed without prior notice.

## Application

Mast-, tower or hood sleeves are designed for underground laying and mounting in stacks and on masts. These types of sleeves are used in a vertical position – all ingoing and outgoing cables are feeded at the bottom. The special construction ensures a maximal protection against environmental conditions. The family of hood sleeves contains 24 to 144 shrinking splices in which max. 12 fiber optic splices lead to a hinged splice cassette. These sleeves are used in long distance data transmission and in the backbone-area of big companies. Access to single fibers is possible trough operation by the hinged splice cassettes, which ensures an undisturbed function of the cables.

## ■ FITTINGS FOR METAL-FREE AERIAL CABLE

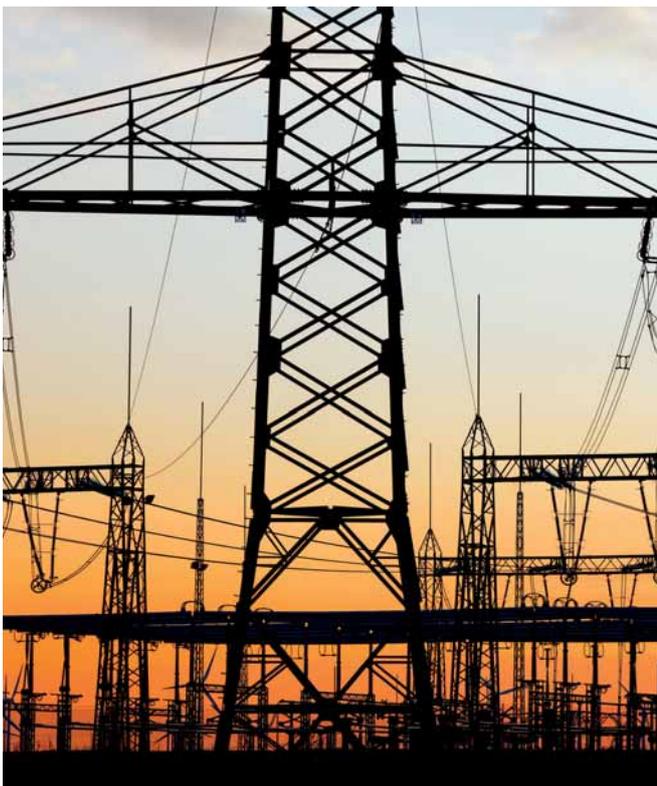
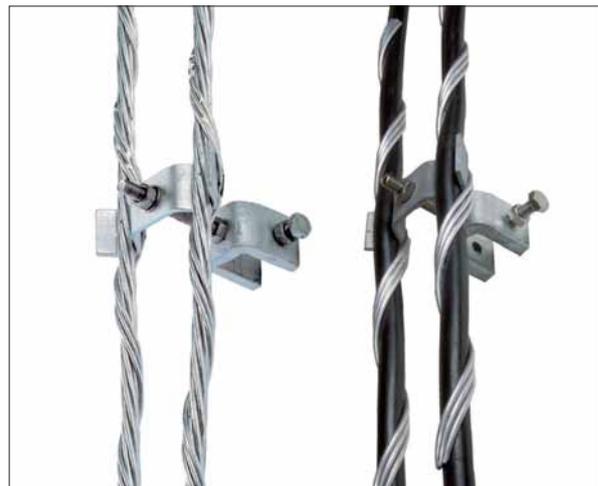
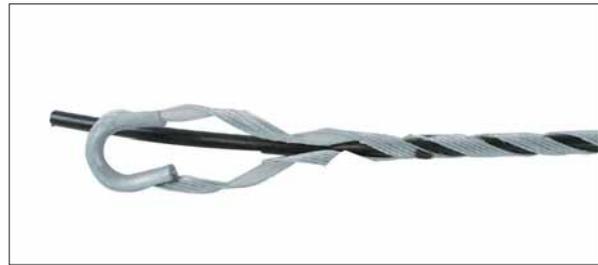
HELUCOM® ADSS fittings are designed to meet the special requirements of optical fibre aerial cable. Our customers, such as electricity supply companies, erection firms, railway and telecommunication companies, receive with the beginning of the planning technical solutions with optimized fittings and the best technical solutions from the planning stage through to optimized fittings and state-of-the-art damping concepts for durable and reliable operation of their transmission lines.

HELUCOM® ADSS fittings are designed to meet the increased demands on optical fibre aerial cables. Especially the helical fittings even exceed the necessary mechanical requirements. The range of HELUCOM® ADSS helical fittings includes a suitable solution for every application.

The method of operation of helical fittings has been adapted from nature and is based on the principle of a cable puller. The inside diameter of the unloaded helical rods is slightly smaller than the outside diameter of the optical fibre aerial cable.

Installing these preformed helical rods creates a spring tension and sets up the mechanical preloaded contact. A special feature of this design is that the helical fitting distributes the forces acting on the cable uniformly over a large area of the cable, which avoids mechanical loads on the optical fibres.

The advantages of HELUCOM® ADSS helical fittings include easy installation and low load on the cable. The helical rods can be installed without tools and installation faults are impossible. The installation can be inspected visually from the ground level.



# Fittings for metal-free optical fibre aerial cables (ADSS)

Span length < 80 m

HELUCOM®

## Suspension Fittings



### Suspension rods

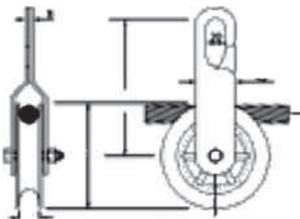
#### Application

HELUCOM® ADSS Suspension rods consisting of thimble, LG- and TG-helical rods are designed for vertical loads up to 1kN. They are used for span lengths up to 80 m approximately. The TG-suspension rods with the preformed loop is the supporting accessory. The shorter and straight LG-supporting rods are only used for stiffening the area round the suspension point. The loop of the fitting is stabilized and protected against abrasion with a ring type thimble.

#### Details

Designation	Material	Part no.	Unit
Suspension rod (TG) 80m/ ADSS 6L	Steel	<b>805731</b>	1
Supporting rod (LG) 80m/ ADSS 6L	Steel	<b>805732</b>	1
Thimble 80m/ ADSS 6L	Steel	<b>805733</b>	1

Dimensions and specifications may be changed without prior notice.



### Suspension pulleys with/ without protection rods

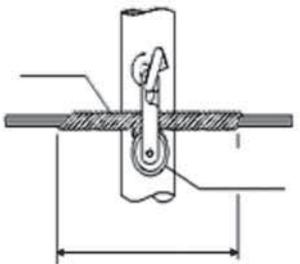
#### Application

HELUCOM® ADSS Suspension pulleys are used for suspension of ADSS cables. The suspension pulleys benefit from the fact that in case of a tree falling in the span length the ADSS cable is not destroyed. This has no influence on the communication line. To avoid high compression forces at the point of contact between cable and suspension pulleys the use of protection rods is recommended.

#### Details

Designation	Material	Part no.	Unit
Suspension pulley ADSS 6L/ 9L	Steel	<b>805747</b>	1
Protection rod ADSS 6L/ 9L	Steel	<b>805748</b>	1

Dimensions and specifications may be changed without prior notice.



### Suspension pulley with helical rod

#### Application

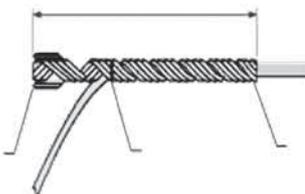
HELUCOM® ADSS Suspension pulleys with helical rods are used for suspension of ADSS cables. They are designed for span lengths up to 150 m approximately and tensile forces up to 2,5 kN.

#### Details

Designation	Material	Part no.	Unit
Suspension pulley with helical rod ADSS 6L/9L	Steel	<b>805749</b>	1

Dimensions and specifications may be changed without prior notice.

## Tension Fittings



### Helical Dead Ends

#### Application

HELUCOM® ADSS Helical dead ends are designed for the full tensioning of ADSS cables in short span lengths up to 80 m/ 150m. The loop of the dead end can be protected against abrasion by a thimble.

For short spans (up to approx. 80m) and small forces: The dead end is mounted on the cable starting at the black crossing mark. This leads to a long cable loop and a large bending radius of the cable. A thimble can be used in the loop of the dead end.

#### Details

Designation	Material	Part no.	Unit
Helical dead end (AG) ADSS 6L/9L	Steel	<b>805751</b>	1
Thimble ADSS 6L/9L	Steel	<b>805752</b>	1

Dimensions and specifications may be changed without prior notice.

# Fittings for metal-free optical fibre aerial cables (ADSS)

Span length 80 - 150 m

## Suspension Fittings

HELUCOM®



### Suspension rods

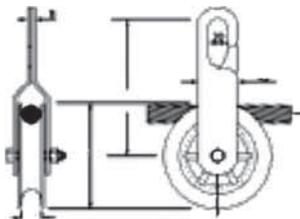
#### Application

HELUCOM® ADSS Suspension rods consisting of thimble, TG- and UTA-helical rods are designed for vertical loads up to 5kN. They are used for span lengths from 80m up to 150 m. The loop of the TG-suspension rods is stabilized and protected against abrasion by a ring type thimble. Protection rods are mounted under the suspension rods to protect the ADSS cable. They reduce radial forces in the cable and increase - due to the increased bending stiffness - the bending radius of the ADSS cable.

#### Details

Designation	Material	Part no.	Unit
Suspension rod (TG) 150m/ ADSS 9L	Steel	<b>805734</b>	1
Supporting rod (UTA) 150m/ ADSS 9L	Steel	<b>805735</b>	1
Thimble 150m/ ADSS 9L	Steel	<b>805736</b>	1

Dimensions and specifications may be changed without prior notice.



### Suspension pulleys with/ without protection rods

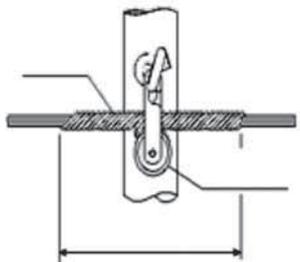
#### Application

HELUCOM® ADSS Suspension pulleys are used for suspension of ADSS cables. The suspension pulleys benefit from the fact that in case of a tree falling in the span length the ADSS cable is not destroyed. This has no influence on the communication line. To avoid high compression forces at the point of contact between cable and suspension pulleys the use of protection rods is recommended.

#### Details

Designation	Material	Part no.	Unit
Suspension pulley ADSS 6L/ 9L	Steel	<b>805747</b>	1
Protection rod ADSS 6L/ 9L	Steel	<b>805748</b>	1

Dimensions and specifications may be changed without prior notice.



### Suspension pulley with helical rod

#### Application

HELUCOM® ADSS Suspension pulleys with helical rods are used for suspension of ADSS cables. They are designed for span lengths up to 150 m approximately and tensile forces up to 2,5 kN.

#### Details

Designation	Material	Part no.	Unit
Suspension pulley with helical rod ADSS 6L/9L	Steel	<b>805749</b>	1

Dimensions and specifications may be changed without prior notice.



### Vibration damper (AVIBRA)

#### Application

The purpose of HELUCOM® ADSS Avibra vibration dampers is to dissipate partly the wind power input on the ADSS cable to prevent critical cable stresses. The Avibra vibration damper is composed of a helically formed plastic rod. About one fifth of the overall length of the helix is of smaller diameter. This section is used to attach the damper and provides a completely reliable grip on the ADSS cable so that the damper will not slip even on slopes. The remaining length of the helix has no close contact to the cable. Due to differential motions between ADSS cable and Avibra damper, the ADSS cable vibrations are eliminated.

#### Details

Designation	Material	Part no.	Unit
Vibration damper (AVIBRA) 150m/ ADSS 9L	Plastic	<b>805753</b>	1

Dimensions and specifications may be changed without prior notice.

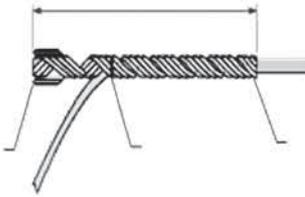
Continuation ►

# Fittings for metal-free optical fibre aerial cables (ADSS)

Span length 80 - 150 m

HELUCOM®

## Tension Fittings



### Helical Dead Ends

#### Application

HELUCOM® ADSS Helical dead ends are designed for the full tensioning of ADSS cables in short span lengths up to 80 m/ 150m. The loop of the dead end can be protected against abrasion by a thimble.

For short spans (up to approx. 80m) and small forces: The dead end is mounted on the cable starting at the black crossing mark. This leads to a long cable loop and a large bending radius of the cable. A thimble can be used in the loop of the dead end.

#### Details

Designation	Material	Part no.	Unit
Helical dead end (AG) ADSS 6L/9L	Steel	<b>805751</b>	1
Thimble ADSS 6L/9L	Steel	<b>805752</b>	1

Dimensions and specifications may be changed without prior notice.

# Fittings for metal-free optical fibre aerial cables (ADSS)

Span length > 150 m

HELUCOM®

## Suspension Fittings



### LTA - Armour grip suspensions

#### Application

HELUCOM® ADSS armour grip suspension is used for the movable suspension of conductors and optical fibre aerial cables on suspension towers. The armour grip suspension is composed of a certain number of helically formed rods, a concave Neoprene insert consisting of two halves and a clamp body. The helical rods are placed on the Neoprene insert at the suspension point. This centre assembly is fixed by the clamp body which due to positive locking prevents axial displacement of the conductor.

#### Details

Designation	Material	Part no.	Unit
Armour grip suspension (LTA) 350m/ ADSS 16L	Aluminum alloy	<b>805756</b>	1
Shakle (for LTA) 350m/ ADSS 16L	Steel	<b>805757</b>	1

Dimensions and specifications may be changed without prior notice.

#### Characteristics

Other Materials:  
Straps: Steel, h.d.g.  
Bolt: Steel, h.d.g.  
Insert: Neoprene



### Vibration damper (AVIBRA)

#### Application

The purpose of HELUCOM® ADSS Avibra vibration dampers is to dissipate partly the wind power input on the ADSS cable to prevent critical cable stresses. The Avibra vibration damper is composed of a helically formed plastic rod. About one fifth of the overall length of the helix is of smaller diameter. This section is used to attach the damper and provides a completely reliable grip on the ADSS cable so that the damper will not slip even on slopes. The remaining length of the helix has no close contact to the cable. Due to differential motions between ADSS cable and Avibra damper, the ADSS cable vibrations are eliminated.

#### Details

Designation	Material	Part no.	Unit
Vibration damper (AVIBRA) 350m/ ADSS 16L	Plastic	<b>805758</b>	1

Dimensions and specifications may be changed without prior notice.

## Tension Fittings



### Helical dead ends

#### Application

HELUCOM® ADSS helical dead ends are particularly designed for the full tensioning of metal-free optical fibre aerial cable in medium and long spans.

For long spans and high forces: The dead end is mounted on the cable starting at the red crossing mark. This leads to a short cable loop. Additional intermediate fittings for installation at the tower and a thimble are necessary. The use of protection rods is recommended. When selecting the helical dead ends the total diameter resulting out of the cable diameter plus two times the rod diameter of protection rods has to be taken into account.

#### Details

Designation	Material	Part no.	Unit
Helical dead end (AG) 350m/ ADSS 16L	Steel	<b>805775</b>	1
Thimble for helical dead end ADSS 16L	other	<b>805776</b>	1
Shakle (for AG) 350m/ ADSS 16L	Steel	<b>805777</b>	1

Dimensions and specifications may be changed without prior notice.

Continuation ►

# Fittings for metal-free optical fibre aerial cables (ADSS)

Span length > 150 m

HELUCOM®

## Protection rods

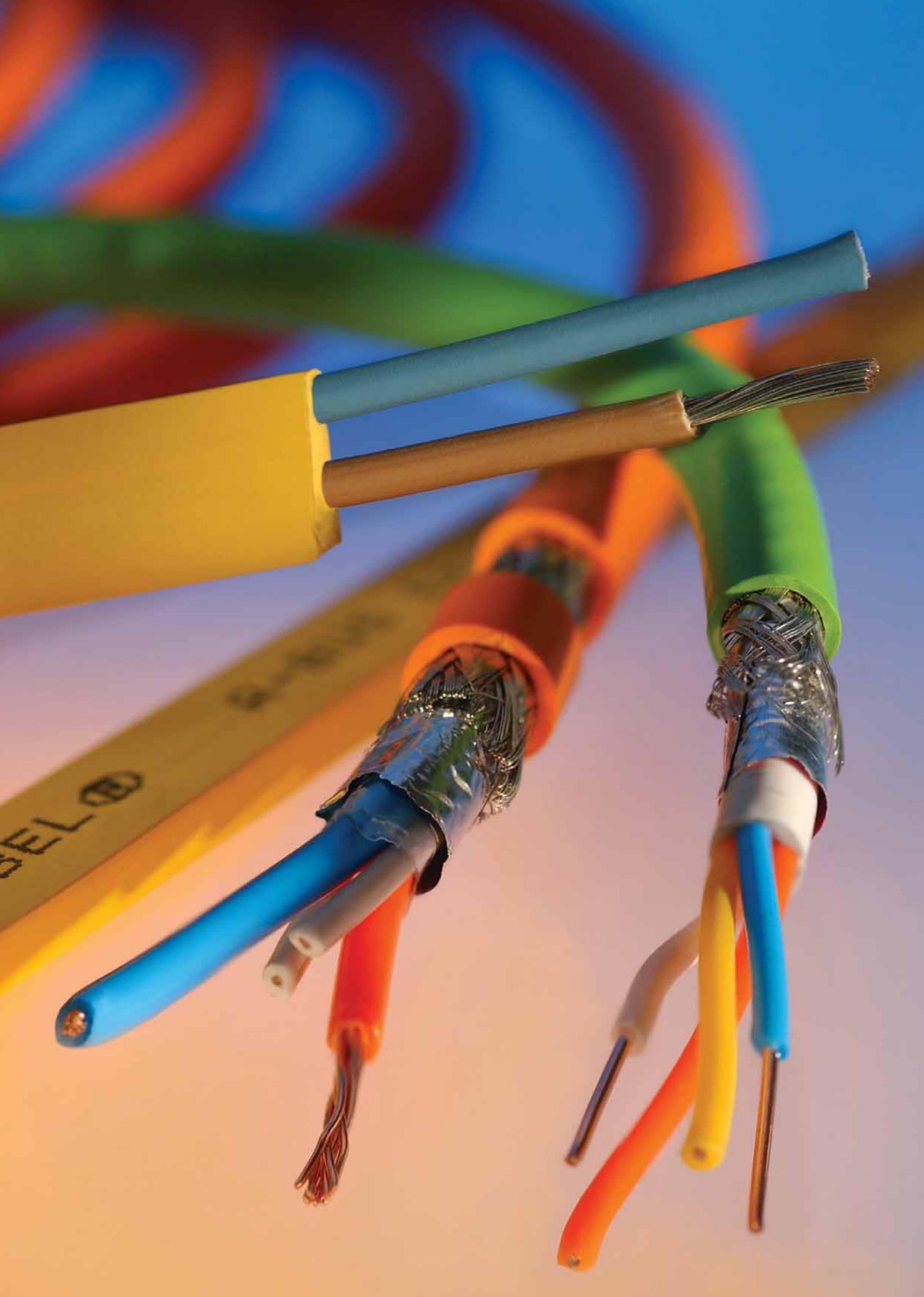
### Application

HELUCOM® ADSS URG-Protection rods are preferably made of steel, h.d.g. and shall protect the self supporting fibre optical aerial cables at tension sets. They are mounted beneath the helical dead end and spread the radial forces on the cable uniformly along the zone of contact. Especially on the cable at the loop-side of the helical dead end radial forces (depending on the tension force) can stress the optical part of the cable inadmissibly. This will cause high damping which results in a reduced data transmission or in the worst case an interruption.

### Details

Designation	Material	Part no.	Unit
Protection rod (URG) 350m/ ADSS 16L	Steel	<b>805778</b>	1

Dimensions and specifications may be changed without prior notice.



Industry Plugs POF / HCS / MM

Patch-Panels

POF/HCS F-SMA

HCS-fibre connection cable

Machine outlet IP65



# ■ FIBRE OPTIC CONNECTION TECHNICS - INDUSTRY

Description			Page
<b>Fibre Optic Connection Technics - Industry</b>			
INDUSTRIAL ETHERNET Patch-Panels	HELUCOM®	Fibre Optic DIN RAIL splicebox vertical, telescope partially configured with couplings MM	<b>331</b>
Fibre Optic Connection Technics	HELUCOM®	Jumper cable I-V2Y 1P 980/1000µm (POF)	<b>332</b>
Fibre Optic Connection Technics	HELUCOM®	Jumper cable I-V(ZN)HH 2K 200/230µm (HCS)	<b>333</b>
Fibre Optic Connection Technics	HELUCOM®	Fibre Optic connector	<b>334</b>

# POF/HCS CONNECTION TECHNOLOGY

## POF-HFBR 4501/4511 HCS-HFBR 4521



- Simplex connector
- Plastic enclosure
- For POF and HCS
- Processing: crimping, grinding, polishing

## POF-TOCP 155/F05 HCS-TOCP/F05



- Simplex connector
- Plastic enclosure
- For POF and HCS
- Processing: crimping, grinding, polishing or hotplate

## POF-HFBR 4503/4513



- Simplex connector
- Plastic enclosure
- For POF
- Processing: crimp /latch

## POF-TOCP 255/F07 HCS-TOCP 255/F07



- Duplex connector
- Plastic enclosure
- For POF and HCS
- Processing: crimping, grinding, polishing or hotplate

## POF-HFBR 4533/4531



- Simplex connector
- Plastic enclosure
- For POF
- Processing: crimping, grinding, polishing

## POF/HCS F-SMA



- Simplex connector
- Metal enclosure
- For POF and HCS (2.2/3.6/6.0 mm)
- Processing: crimping, grinding, polishing

## POF-HFBR 4506



- Duplex connector
- Plastic enclosure
- For POF
- Processing: crimping, grinding, polishing

## POF/HCS ST



- Simplex connector
- Metal / plastic enclosure
- For POF and HCS (2.2/3.6 mm)
- Processing: crimping, grinding, polishing



## Type

## Fibre Optic DIN RAIL splicebox vertical, telescope partially configured with couplings MM

## Cage

Housing material:  
Cover lock:  
Colour:

Steel sheet  
Fastening by means of screws  
Grey

## Equipment

Partially-configured  
Couplers

## Dimensions

Number of height modules (HM):  
Width:

3  
133 mm

## Preferred types

Part no.	Number of couplers	Type of coupler	Unit
<b>804303</b>	2	SC duplex	1
<b>804305</b>	4	ST	1
<b>804307</b>	2	LCdx	1

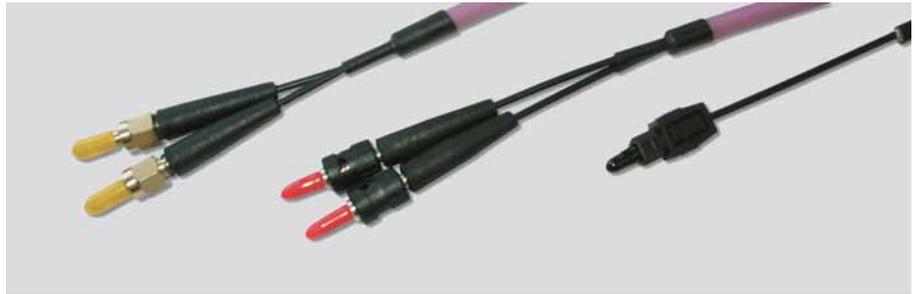
Dimensions and specifications may be changed without prior notice.

## Options

On request, different assembly variations, such as F-SMA, FC/PC, and DIN and/or diagonal cross section designs, are also available.

## Application

The Fibre Optic DIN rails are used for installing preassembled Breakout cables with cable splitter WKOM-03. The compact and robust construction and handsome design make them suitable for applications in the industry. The panels consist of a metal housing with integrated coupling heads are built in at the front. Breakout cables are inserted up and down. Modern components provide for excellent attenuation and low reflection losses.



## Type

## Version

## Preferred types

### Jumper cable I-V2Y 1P 980/ 1000µm (POF)

Simplex

Part no.	End 1	End 2	Fibre type	Length m	Unit
<b>801411</b>	ST	ST	POF 980/1000	2	10
<b>801413</b>	HFBR 4533 blau, simplex	HFBR 4533 blau, simplex	POF 980/1000	2	10
<b>801410</b>	F-SMA	F-SMA	POF 980/1000	2	10
<b>801472</b>	HFBR 4511 blue, simplex	HFBR 4511 blue, simplex	POF 980/1000	2	10
<b>801473</b>	HFBR 4503 grey, simplex	HFBR 4503 grey, simplex	POF 980/1000	2	10
<b>801474</b>	HFBR 4513 blue, simplex	HFBR 4513 blue, simplex	POF 980/1000	2	10
<b>801412</b>	HFBR 4531 black, simplex	HFBR 4531 black, simplex	POF 980/1000	2	10
<b>801471</b>	HFBR 4531 black, simplex	HFBR 4531 black, simplex	POF 980/1000	2	10
<b>801475</b>	F05 simplex	F05 simplex	POF 980/1000	2	10

Dimensions and specifications may be changed without prior notice.

## Options

These connecting cables are also available in other lengths and with other plug types, on request. We also supply jumper cable with PUR sheath reinforcement for implementation in extreme industrial environments.

## Application

POF (Polymer Optical Fibre) connection cable from HELUCOM® are particularly used in applications involving machine tools and industrial equipment, e.g. for connecting controller and drive. Systems such as SERCOS rely on POF fibre. POF jumper cables are characterized by a significantly more robust structure compared to traditional glass fibre lines. The version with PE coating is designed for normal implementation.



## Type

## Version

## Preferred types

### Jumper cable I-V(ZN)HH 2K 200/230µm (HCS)

Duplex

Part no.	End 1	End 2	Fibre type	Length m	Unit
<b>801415</b>	ST	ST	HCS 200/230	2	10
<b>801416</b>	HFBR 4521 simplex	HFBR 4521 simplex	HCS 200/230	2	10
<b>801414</b>	F-SMA	F-SMA	HCS 200/230	2	10
<b>801476</b>	F07 duplex	F07 duplex	HCS 200/230	2	10

Dimensions and specifications may be changed without prior notice.

## Options

These connecting cables are also available in other lengths and with other plug types, on request. We also supply jumper cable with PUR or PE sheath reinforcement for implementation in extreme industrial environments.

## Application

HCS (Hard Clad Silica) connection cables from HELUCOM® are particularly used in applications involving machine tools and industrial equipment, e.g. for connecting controller and drive. Systems such as LIGHTBUS rely on HCS fibre. HCS jumper cables are characterized by a significantly more robust structure compared to traditional glass fibre lines. The version with FRNC sheathing is designed for normal mobile implementation.



## Type

### Preferred types

## Fibre Optic connector

Part no.	Type	Suitable for fibre type	Unit
<b>801378</b>	HFBR 4501 grey, simplex	POF 980/1000	50
<b>801379</b>	HFBR 4511 blue, simplex	POF 980/1000	50
<b>801380</b>	HFBR 4503 grey, simplex	POF 980/1000	50
<b>801381</b>	HFBR 4513 blue, simplex	POF 980/1000	50
<b>801382</b>	HFBR 4516 latch, duplex	POF 980/1000	50
<b>800713</b>	HFBR 4533 blue, simplex	POF 980/1000	50
<b>800714</b>	HFBR 4531 black, simplex	POF 980/1000	50
<b>801387</b>	HFBR 4506 grey, duplex	POF 980/1000	50
<b>801388</b>	HFBR 4516 latch, duplex	POF 980/1000	50
<b>801383</b>	F05 simplex, grind and polish	POF 980/1000	50
<b>801384</b>	F05 simplex, hotplate	POF 980/1000	50
<b>801386</b>	TOCP 255 duplex	POF 980/1000	50
<b>801385</b>	F07 duplex, hotplate	POF 980/1000	50
<b>801390</b>	ST	POF 980/1000	50
<b>801420</b>	SC duplex	POF 980/1000	50
<b>82821</b>	F-SMA 2,2mm	POF 980/1000	50
<b>801389</b>	F-SMA 6,0mm	POF 980/1000	50
<b>801832</b>	HFBR 4521 blue simplex, for 2,2mm	HCS 200/230	50
<b>801394</b>	F07 duplex, für 2,2mm	HCS 200/230	50
<b>801419</b>	SC duplex	HCS 200/230	50
<b>801418</b>	SC duplex	Multi-mode	50

Dimensions and specifications may be changed without prior notice.

On request, we also supply other plug connector types.

Fibre-optic plug (partly with housing, crimping)

Fibre optic plugs and couplings serve as links or removable connections for equipment outputs or distribution centers. The types designed have been especially designed for industrial use (light-duty or heavy-duty). They can be assembled in the field and, depending on the type, they are available in a clamp, crimp, adhesive, or hot plate version. According to IAONA the ST or the F-SMA plug is specified as standard.

## Options

### Included in delivery

### Application



Measuring instrument toolbox

HELUCUT

ASSEMBLY CASE

Crimping tool



## ■ MEASUREMENT & PROCESSING TECHNICS

Designation			Page
Technic of Measurement	HELUCOM®	OTDR OV 1000 QUAD MDSD-SC	338
Technic of Measurement	HELUCOM®	DTX Compact-OTDR QUAD Kit	339
Technic of Measurement	HELUCOM®	Measuring instrument toolbox POF / TOCP 255/F07	340
Technic of Measurement	HELUCOM®	Measuring instrument toolbox HCS	341
Technic of Measurement	HELUCOM®	Fibre-optic toolbox	342
Processing Technic	HELUCOM®	Cut start tools fibre-optic, HELUCUT I 0,9-4,2	343
Processing Technic	HELUCOM®	Cut start tools fibre-optic, HELUCUT II 4,2-10,5	343
Processing Technic	HELUCOM®	POF plug manufacture toolbox ST	344
Processing Technic	HELUCOM®	POF plug manufacture toolbox F-SMA	344
Processing Technic	HELUCOM®	Tools for POF processing I HELUCUT'n STRIPP	345
Processing Technic	HELUCOM®	Tools for POF processing I HELUCUT'n STRIPP Multi	345
Processing Technic	HELUCOM®	Tools for POF processing II Multi Stripper Tool	346
Processing Technic	HELUCOM®	Tools for POF processing HELUcrimp	346
Processing Technic	HELUCOM®	HCS plug manufacture toolbox ST	347
Processing Technic	HELUCOM®	HCS plug manufacture toolbox F-SMA	347
Technic of Measurement	HELUKABEL®	Test device for PROFIBUS systems	348
Processing Technic	HELUKAT®	RJ45 crimping tool HELUCRIMP45	349
Processing Technic	HELUKAT®	Crimping tool for Harting Industrial RJ45 8 - poles	349
Processing Technic	HELUKABEL®	Stripper for Bus cables, SKABI I	350
Processing Technic	HELUKABEL®	Stripper for LAN cables HELU-LAN 12	350
Processing Technic	HELUKAT®	Stripper for PROFinet™ cables, SKABI II	351



## Characteristics

Roof fan, 1U, Weight 7 kg  
4 Fans, capacity 640 cbm/h  
For installation in all networking and server cab.  
Control via connected thermostat  
Thermostat and mounting material included  
Rear sided mains connection via non-heating appliance socket (connection cable not included)  
Rated voltage 230 V, 50 Hz  
Illuminated switch ON/OFF  
Material: steel sheet  
Finish: RAL7035, light grey  
Fan features:  
Rated voltage 230 V, Frequency 50 Hz, Rated power 22 W, Speed 2700 r/min, Noise level 44 dB(A), Air capacity 160 m<sup>3</sup>/h, Temperature range -10 to +70 °C, Dimensions 119 x 199 x 38 mm

## Application

- Test and collect data up to four wavelengths by pressing only one button
- Very fast acquisition time
- Fast ready-to-measure boot-up time of 4 seconds

## Details

- Simultaneous use of touch screen, short-cut keys and tracking knob for high user convenience
- Maximum 256,000 data points for highest resolution
- Loss resolution of 0.001 dB
- 6.4" full VGA touch screen
- Three test modes (auto, advanced and template) fit best to user skills and applications for maximum measurement convenience
- Possible configurations cover all typical fiber applications from long-haul and WDM to metro networks, FTTx as well as LAN
- Easy-to-use post-processing software OSTView with professional report generation function including bidirectional analysis and quick print function
- Powerful Li-Ion battery provide mains independent operation time of 8 hours (Bellcore TR-NWT-001138)
- Diverse storage options (in addition to 80 MB builtin flash memory, two USB ports<sup>2</sup>) and a CF card slot
- Internal memory sufficient for up to 1,500 typical traces
- Numerous connection ports for easy connectivity for convenient download and upgrade
- 10/100 Mb/s Ethernet RJ-45 network interface
- Rugged and waterproof housing for long life time

## Designation

OTDR OV 1000 QUAD MDSD-SC

## Part no.

**802495**

Dimensions and specifications may be changed without prior notice.



## Characteristics

The DTX Compact OTDR is a revolutionary enhancement to the DTX CableAnalyzer. The DTX Compact OTDR is a full featured Optical Time Domain Reflectometer (OTDR) module that snaps onto a DTX CableAnalyzer. In addition to copper testing, it makes this powerful certification tool a complete, easy-to-use OTDR that shoots and analyzes traces on singlemode and multimode fiber. With the DTX Compact OTDR, the DTX CableAnalyzer becomes the only cable tester that can completely certify copper and fiber cabling according to all industry standards. The DTX Compact OTDR makes every technician a fiber expert with unparalleled ease of use, automatic OTDR settings, loss limits for events and fiber links, launch fiber compensation, automatic event analysis, and results management, all with the familiar user interface of the DTX CableAnalyzer.

## Application

- Acceptance and test measurements of all common single- and multi-mode fibre optics (1310/1550nm and 850/1300nm)
- With its compact design, the DTX Compact-OTDR is outstanding for field applications

## Details

- Expanding installation revenue without expanding staff
- Shortening technicians learning curve for fiber testing
- Performing Basic (Tier 1) and Extended (Tier 2) fiber certification with a single tool
- Accelerating troubleshooting with a powerful, single-ended OTDR for fiber and extensive DTX diagnostics for copper
- Delivering integrated copper and fiber reports using LinkWare™ Results Management Software

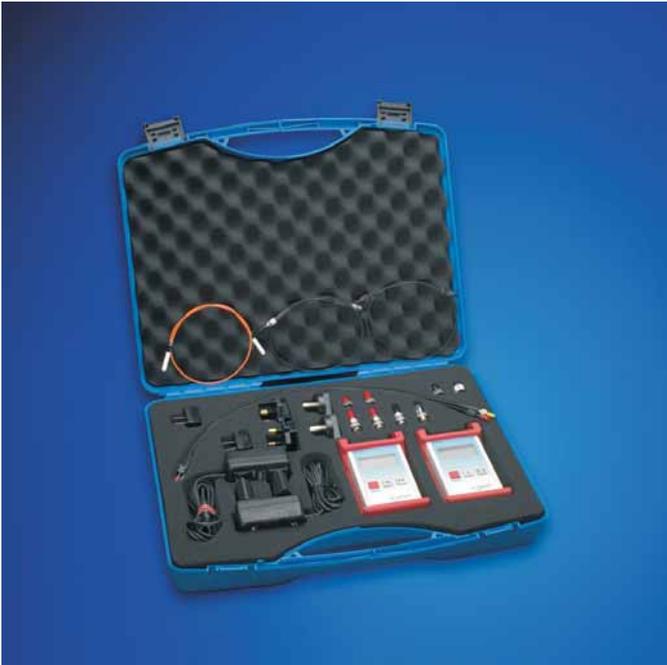
## Designation

DTX Compact OTDR QUAD

## Part no.

**802496**

Dimensions and specifications may be changed without prior notice.



## Characteristics

The output of the signal generator is a modulatable power source, which creates a stabilized optical power output by means of an LED adapter. With the micro process technology used, the measuring instrument permits the measurement of two wavelengths as well as the display of the absolute power in 5W or dBm. For relative power measurements, the measured value is displayed in dB. A change adapter system permits connecting all common fibre-optic cable plug connectors. Systems like TCOP 155, F-SMA, ST, HFBR, F05/ F07 or SC are available.

## Application

The good characteristics and the precise coupling to ready-made fibre-optic cables with the exchangeable adapter system allow using the signal generators and receiver in a variety of applications, such as installation control, quality control, attenuation measurements of fibre-optic cables, laboratory tests, or testing visual transmitters and receivers.

## Details

Measuring instrument OPM1:

- Optical power measuring instrument
- 660nm and 850nm calibrated wavelengths
- M12 change adapter connector
- 25mm x 50mm LC display
- Plastic housing
- sturdy plastic sleeve
- simple operation

Signal generator MS100HU:

- Stabilized power source
- 1, 10, 20 kHz modulating frequency
- BNC female connector
- 9V battery operation or ext. power pack
- 25mm x 50mm LC display
- Plastic housing
- sturdy plastic sleeve
- simple operation

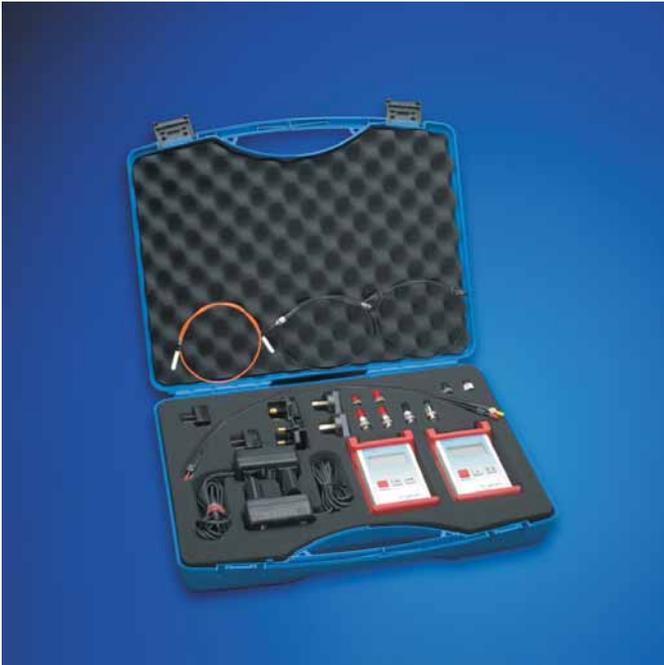
## Designation

Measuring instrument case POF/ TOCP 255/F07

## Part no.

**800597**

Dimensions and specifications may be changed without prior notice.



## Characteristics

The output of the signal generator is a modulatable power source, which creates a stabilized optical power output by means of an LED adapter.

With the micro process technology used, the measuring instrument permits the measurement of two wavelengths as well as the display of the absolute power in 5W or dBm. For relative power measurements, the measured value is displayed in dB. A change adapter system permits connecting all common fibre-optic cable plug connectors. Following systems are available:

- SC Adapter
- FST Adapter
- HFBR Adapter
- TOPCP Adapter

## Application

The good characteristics and the precise coupling to ready-made fibre-optic cables with the exchangeable adapter system allow using the signal generators and receiver in a variety of applications, such as installation control, quality control, attenuation measurements of fibre-optic cables, laboratory tests, or testing visual transmitters and receivers.

## Details

Measuring instrument OPM1:

- Optical power measuring instrument
- 660nm and 850nm calibrated wavelengths
- M12 change adapter connector
- 25mm x 50mm LC display
- Plastic housing
- sturdy plastic sleeve
- simple operation

Signal generator MS100HU:

- Stabilized power source
- 1, 10, 20 kHz modulating frequency
- BNC female connector
- 9V battery operation or ext. power pack
- 25mm x 50mm LC display
- Plastic housing
- sturdy plastic sleeve
- simple operation

## Designation

Measuring instrument toolbox HCS F-SMA

## Part no.

**801465**

Dimensions and specifications may be changed without prior notice.





## Application

Tool for damage-free stripping of fibre optics, cut or uncut mini grooved cable. Also for suitable for rough grooved cables as well as inside of stranding.

## Details

- Multifibre buffer tube diameters to 1.8mm to 4.2mm can be cut by means of replaceable multifibre buffer tube guides
- Tool made of burnished special tool steel with plastic handle
- Simple time and cost-saving operation

## Included in delivery

Cut start tool, core guide set, spatula, hexagon key, and spare knife, supplied in a plastic case

## Designation

HELUCUT I 0.9-4.2

## Part no.

**800380**

Dimensions and specifications may be changed without prior notice.



## Application

Tool for damage-free stripping of fibre optics, cut or uncut maxi grooved cable. This avoids fibre separation when creating of branches.

## Details

- The application area is grooved cables with a diameter of 4.0 - 10,0 mm (expandable to 14.0mm)
- Interchangeable grooved cable guide (5.0/6.0/7.0/8.0/9.0/10.0)
- Diametric cutting technique (with cable supply)
- High continuous cutting performance
- Simple time and cost-saving operation

## Included in delivery

Cut start tool, cutting set, cable shears, toggle and hexagon key, supplied in a plastic case

## Designation

HELUCUT II 4.2-10.5

## Part no.

**800381**

Dimensions and specifications may be changed without prior notice.



## Application

This box can be used for both, mobile applications on site and stationary applications.

**Type for ST (BFOC) connector**

## Details

The assembly toolbox contains all necessary processing tools for professional POF 980/1000µm plug assembly for ST plugs. Essential components are: Crimping pliers 4-notch, positioning sleeve, crimping pliers 5-edge, sheath stripping tool, fibre stripper, Kevlar scissors, cutter, buffing wheels, polishing paper (grain 1000) and aluminum case.

## Options

Naturally, we can also supply toolboxes for processing HP and Toshiba plug systems.

## Designation

POF Connector Assembly Case ST

## Part no.

**801186**

Dimensions and specifications may be changed without prior notice.



## Application

This box can be used for both, mobile applications on site and stationary applications.

**Type for F-SMA connector**

## Details

The assembly toolbox contains all necessary processing tools for professional POF 980/1000µm plug assembly for F-SMA plugs. Essential components are: Crimping pliers 4-notch, positioning sleeve, crimping pliers 5-edge, sheath stripping tool, fibre stripper, Kevlar scissors, cutter, buffing wheels, polishing paper (grain 1000) and aluminum case.

## Options

Naturally, we can also supply toolboxes for processing HP and Toshiba plug systems.

**801401 Tool Box POF Faser HP Stecker**

**801402 Tool Box POF F05 Stecker**

## Designation

POF Connector Assembly Case F-SMA

## Part no.

**801400**

Dimensions and specifications may be changed without prior notice.



## Application

Tool for damage-free cutting and crimping of 2.2 mm synthetic fibres (POF). Repolishing is no longer necessary.

## Details

- The application area is POF fibres with 2.2 mm diameter
- Interchangeable cutting device
- Stripping length of 4.0 - 20.0 mm
- Tool made of burnished special tool steel with plastic handle
- Simple time and cost-saving operation

## Included in delivery

Pliers made from special tool steel with cutting device and stripping knife

## Designation

HELUCUT`n STRIPP

## Part no.

**800382**

Dimensions and specifications may be changed without prior notice.



## Application

Tool for damage-free cutting, stripping and crimping of 2.2 mm synthetic fibres (POF). Repolishing is no longer necessary.

## Details

- The application area is POF fibres with 2.2 mm diameter
- Adaptable to different contacts
- Optimal crimping quality due to safety interlock
- Tool made of burnished special tool steel with plastic handle
- Simple time and cost-saving operation

## Included in delivery

Pliers made from special tool steel with cutting device

## Designation

HELUCUT`n STRIPP Multi

## Part no.

**800383**

Dimensions and specifications may be changed without prior notice.



## Application

Tool for damage-free cutting and stripping of synthetic fibre lines (POF).

## Details

- Field of application are POF fibres with 2.2 mm in diameter and PUR-encased POF fibres (simplex, duplex, quattro), Make: HELUKABEL® art. no. 81611, 81882, 80629, 80630
- Interchangeable cutting device
- Stripping length of 4.0 - 20.0 mm
- Tool made of burnished special tool steel with plastic handle
- Simple time and cost-saving operation

## Included in delivery

Pliers made from special tool steel with cutting device and stripping knife set.

## Designation

POF MULTI STRIPPER TOOL

## Part no.

**81320**

Dimensions and specifications may be changed without prior notice.



## Application

Tool for trouble-free crimping of 2.2 mm synthetic fibres (POF).

## Details

- The application area is POF fibres with 2.2 mm diameter
- Suitable for different contacts (4.85mm diameter + 3.15mm key width)
- Optimal crimping quality due to safety interlock
- Unblocking possibilities in case of possible faulty operation
- Tool made from durable special tool steel with plastic handle
- Very simple operation

## Included in delivery

Tool made from special tool steel

## Designation

HELUcrimp

## Part no.

**800385**

Dimensions and specifications may be changed without prior notice.



## Application

This box can be used for both, mobile applications on site and stationary applications.

## Details

The assembly toolbox contains all necessary processing tools for professional HCS 200/230µm plug assembly "adhesive technique" for ST plugs. Essential components are: Crimping pliers, 3 x fibre strippers (0,6, 0,3, 0,18mm), scoring pin, hardening oven, manual microscope (100x), change adapter ST, polishing paper (grain 0.3µm, 5µm), polishing plate, cutter, polishing disk, epoxy adhesive, syringe and aluminum case.

## Options

Naturally, we can also supply toolboxes for processing HP and Toshiba plug systems.

## Designation

HCS Connector Assembly Case for ST

## Part no.

**801403**

Dimensions and specifications may be changed without prior notice.



## Application

This box can be used for both, mobile applications on site and stationary applications.

## Details

The assembly toolbox contains all necessary processing tools for professional HCS 200/230µm plug assembly "adhesive technique" for F-SMA plugs. Essential components are: Crimping pliers, 3 x fibre strippers (0,6, 0,3, 0,18mm), scoring pin, hardening oven, manual microscope (100x), change adapter ST, polishing paper (grain 0.3µm, 5µm), polishing plate, cutter, polishing disk, epoxy adhesive, syringe and aluminum case.

## Options

Naturally, we can also supply toolboxes for processing HP and Toshiba plug systems.

## Designation

HCS CONNECTOR ASSEMBLY CASE FOR F-SMA PLUG

## Part no.

**801404**

Dimensions and specifications may be changed without prior notice.



## Application

The test equipment is suitable for the error analysis of PROFIBUS DP segments. With its possibility to test these segments systematically without large effort, time-consuming individual tests are unnecessary.

## Details

- Connector PROFESSIONAL BUS RS485 (DB9 socket strip) and RS232 (DB9 socket strip)
- Power supply with rechargeable battery pack 4.8V/1.500 mAh NIMH
- Error detection in 3 steps: without closure, with one closure and with two closure
- Short-circuit display A-B core with distance reading in meters
- Short-circuit display A-B shield with distance reading in meters
- Line and shield break display with distance reading in meters
- Display for interchanged signal lines A-B
- Display for incorrect or missing bus closures
- Display for incorrect position of the bus connectors
- Error due to inadmissible line length
- Error in characteristic impedance
- Incorrectly used cable type
- Reflections
- Error in sending and reception levels
- Error due to use of inadmissible branch lines

## Included in delivery

Basic equipment in the sturdy service toolbox: 2 rechargeable batteries, international charging station, RS232 cable, PROFIBUS branch line, PROFIBUS T line, bus cutter, gender changer (3), documentation

## Designation

Measuring instrument for PROFIBUS NetTEST II

## Part no.

**800657**

Dimensions and specifications may be changed without prior notice.





## Application

Pliers for crimping of shielded modular RJ45 plug connectors.

## Details

- Crimping pliers for shielded RJ45 TYPE Hirose TM11, TM21, TM31
- Crimps the strain relief in the same work step
- particularly suited for manufacturing "on site"

## Included in delivery

RJ45 pliers

## Designation

HELUCRIMP45

## Part no.

**82493**

Dimensions and specifications may be changed without prior notice.



## Application

Tool for crimping Harting Industrial IP20 RJ45 8 - poles (HELUKABEL® type 802258 and 802259).

## Details

- Straight action principle with ratchet release
- Contact positioning with locator
- Ergonomic soft grips

## Included in delivery

Crimping tool made of special steel.

## Designation

Crimping tool for Harting Industrial RJ45 8 - poles

## Part no.

**802375**

Dimensions and specifications may be changed without prior notice.



## Application

Dismantling and stripping the special Profibus SK types.

## Details

- Triple-stage stand-off of sheath, screen, and filler
- Knife block can be inserted on both sides
- Standard port for SK bus lines with outside diameter of 8.0 mm
- Variable tool use thanks to adjustable screw holders or replacement of the knife block for other line types as well, e.g. coaxial cables

## Included in delivery

Stripping tools with brown knife block and adjustment block. As an option, other knife blocks for other diameters are available.

## Options

Knife cartridges for other cable types or constructions

## Designation

Stripper for SK bus cables

## Part no.

**81233**

Dimensions and specifications may be changed without prior notice.



## Application

Dismantling tool for unshielded and shielded data cables.

## Details

- Can cut UTP and STP data cables and other cables of up to 4 mm<sup>2</sup>
- Dismantling of the outer insulation of UTP and STP data cables, as well as other round cables from 0.5 - 12.5 mm
- No damage to shielding or conductor due to stripping knife adjustable to different insulation thicknesses
- Length stop for repeatable cutting and stripping lengths

## Included in delivery

Dismantling tool with length stop

## Designation

HELU-LAN 12

## Part no.

**82902**

Dimensions and specifications may be changed without prior notice.



## Application

Dismantling and stripping the special PROFnet™ types A, B, C.

## Details

- Triple-stage stand-off of sheath, screen, and filler
- Knife block can be inserted on both sides
- Standard port for PROFnet™ lines with outside diameter of 6.5 mm
- Variable tool use thanks to adjustable screw holders or replacement of the knife block for other line types as well, e.g. coaxial cables

## Included in delivery

Stripping tools with green knife block and adjustment block. As an option, other knife blocks for other diameters are available.

## Options

Knife cartridges for other cable types or constructions

## Designation

Stripper for PROFnet cables

## Part no.

**801497**

Dimensions and specifications may be changed without prior notice.



## ■ SERVICES

<b>Designation</b>	<b>Page</b>
Expert planning and project development	<b>366</b>
Working to meet all your business needs	<b>366</b>
Providing you with high-quality services you can rely on	<b>367</b>
Practical training	<b>367</b>

## ■ SERVICES

### Expert planning and project development

For each and every network, the right planning is crucial, regardless of whether you're considering installation of a new network, inter-networking between existing islands or expansion and optimisation of an already present network. When investing in a network, it is essential to choose your products carefully to ensure the quality and security of your investment well into the future.

Here, HELUKABEL® provides you with a proven and well-structured concept that maintains an optimum infrastructure during all stages of planning while focusing on finding the best possible technical solutions.

Taken into account are not only the company's development and its communication targets, but also the need to protect investments made for existing solutions.

Other important factors that must be considered when planning are the investment security and reliability of the network infrastructure of the future. The reliability and efficiency of a network in the future all depends on how well the network was initially planned. At HELUKABEL®, planning is carried out by experts in the field, so you can be sure that your investment is secure.

### Working to meet all your business needs

HELUKABEL® offers a wide array of network solutions to meet your every need. Regardless of your network structure or technology, we can provide you with a turnkey system that meets your individual requirements – from delivery of the cable and on-site installation all the way to final transfer of the system.

Careful and correct installation is essential for reliable and efficient operation of the network. This is especially important in an age of high-speed networks, which place great demands on the quality of the traffic networks that carry the data. To achieve these goals, you need the help of highly qualified experts who are there for you on a daily basis. After installation is complete, the entire network together with all installed components is checked carefully from top to bottom. The result of the measurements and checks are recorded in protocol form. This information is just as important for your documentation as the network-specific plans and component lists.

HELUKABEL® is certified to ISO 9000. For you, this means you can rely on a well-structured work method that guides the project through every stage to completion.





## Providing you with high-quality services

In addition to supplying network components, HELUKABEL® offers a complete line of services, making us your one stop provider complete, turnkey network solutions and comprehensive service. Our employees have extensive experience working with network components. They are constantly being trained to ensure that they are always informed of the latest developments in this innovative field.

We use high-quality equipment ranging from fibre optic splicing devices to LAN analysers to ensure the best possible performance of your network.

We only use the best components available today. Our collaboration with numerous well-known manufactures of IT components makes it possible for us to provide you with the right selection of components for proper installation of your network.

After installation is complete, the entire network together with all installed components is checked with care. The result of the measurements and checks are recorded in protocol form. This information is just as important for your documentation as the network-specific plans and adresses and component lists.

## Practical training

We provide continuing education and training specially designed to meet the growing demands of the market. Our seminars and workshops provide you with the latest information in the field, giving you the edge you need to succeed in your daily works.

As cable specialist, we are interested in sharing with you the extensive knowledge and expertise we have gained in the field.

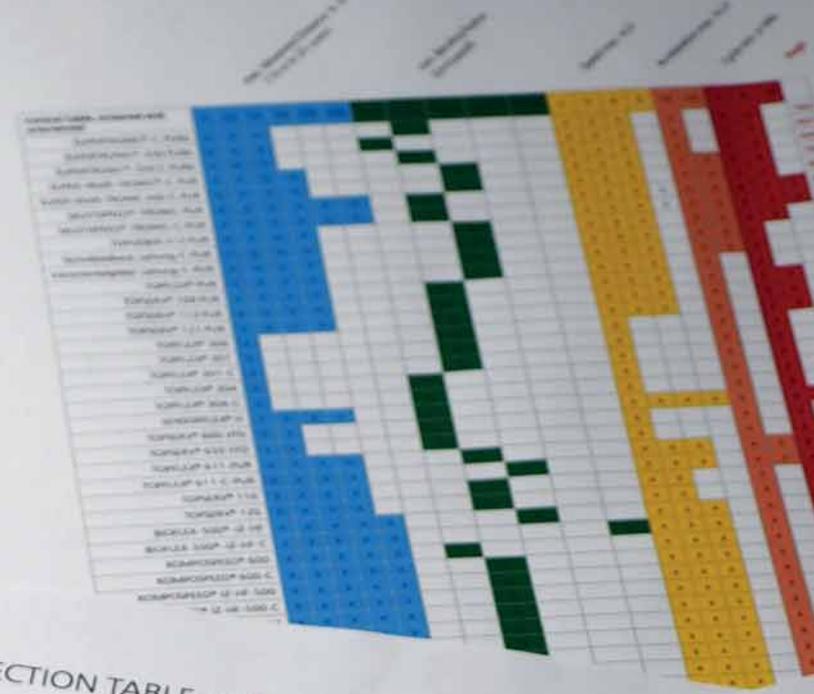
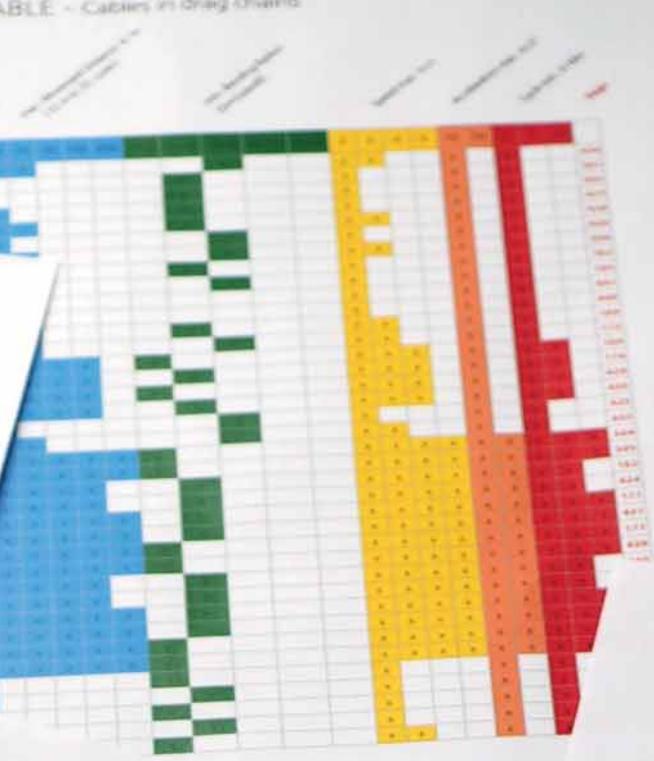
We offer seminars covering all theoretical and practical questions concerning copper and fibre optic cables. In the courses, we familiarise you with the installation and correct application of our products to ensure reliable and lasting operation.

In addition, the course provide useful background information for customer-specific solutions as well as practical exercises.

We offer the following standard training courses: Category 5 / 6 / 7 measuring techniques, The basic of fibre optics, Arc lamp splicing devices, OTDR measuring techniques

If you do not find the course you need, we are happy to provide you with a tailored solution to meet your requirements.





### SELECTION TABLE - Cables in drag chains

max. Movement Distance 8 m (10 m to 25-gauge)

Control Cable, screened and unshielded
JZ-602 RC-C-PUR
Single 602-RC-I/-O
Single 602-RC-CY-I/-O
JZ-602 RC
JZ-602 RC-PUR
JZ-602 RC-CY
JZ-602 RC-C-PUR
JZ-HF
JZ-HF-CY
MULTIFLEX* 600
MULTIFLEX* 600-C
PUR6-JZ-HF
PUR6-JZ-HF-YCP
MULTIFLEX S12*-PUR
MULTIFLEX S12*-C-PUR
MULTIFLEX S12*-PUR UL/CSA
MULTIFLEX S12*-C-PUR UL/CSA
JZ-HF-FCY
PUR6-JZ-HF-FCP
MULTISPEED* 600-PUR-I/-O
MULTISPEED* 600-C-PUR-I/-O
MULTISPEED* 500-PVC
MULTISPEED* 500-PVC UL/CSA
MULTISPEED* 500-PUR
MULTISPEED* 500-PUR UL/CSA

### SELECTION TABLE - CABLES & WIRES

Torsion cables	UL 10678 / 21179 OR300-CE	UL 10169 2570-OR300-CE	UL 10269 2570-OR300-CE	UL 10289 2570-OR300-CE	UL 10553 20234-OR300-CE-VOE	UL 10553 20234-OR300-CE-VOE	UL 10553 20234-OR300-CE-VOE
Wk 103w-T	1000 V	1000 V	1000 V	1000 V	60332-3	60332-3	60332-3
Wk 103w EMV D-T							
Wk 103k-T							
Wk 103k EMV D-Torsion							
Wk 135-T							
Wk 135 EMV D-T							
Wk 137-T FT4							
Wk 137 EMV D-T							
Wk 300w-T							
Wk 305-T							
Wk 784 F-WIND-T							
Wk 101 H							
Wk fire alarm cable-T							
Wk NISGERWOLU-T							
Wk DID 2 K							
Wk Powerline							
Wk THERMFLEX							
Wk (I)							
Tower & Infrastructure							

Index

Part No.	Page	Part No.	Page
65245 - 65285	N 68	71789	Fr 62
65286 - 65349	K 20	71820	
65314 - 65349	N 72	71901	
65350 - 65385	N 73	71990 - 71997	
668XX		72042 - 72043	D 5
66837	N 109	72082	T 5
683	N 32	72106	D 9
	N 29	72184 - 72185	
N 122		72214	
N 123		72872	
		72944 - 72950	
		72951	



### Questionnaire for energy drag chains

Company \_\_\_\_\_

First name, Name \_\_\_\_\_

Street, No. \_\_\_\_\_

Postal Code, Place \_\_\_\_\_

Phone / Fax \_\_\_\_\_

E-Mail \_\_\_\_\_

Installation site \_\_\_\_\_

Kind of machine \_\_\_\_\_

In operation since \_\_\_\_\_

Sender \_\_\_\_\_

#### 1. Drag Chain-Parameter

1. Chain length/chain width \_\_\_\_\_ m/mm

2. Chain pitch \_\_\_\_\_ mm

3. Bending radius \_\_\_\_\_ mm

4. Guide stays existing  yes  no

5. Frame stays existing  yes  no

6. Layout/Installation  horizontal  vertical

#### 2. Installation and Movement-Parameter

1. Movement distance (max.) \_\_\_\_\_ m

2. Speeds \_\_\_\_\_ m/s

3. Acceleration \_\_\_\_\_ m/s<sup>2</sup>

4. Frequency per time unit \_\_\_\_\_ x/h

5. Average movement distance/cycle \_\_\_\_\_ m

6. Daily working duration \_\_\_\_\_ h

7. Feeding at mid of moving distance  yes  no

8. Additional weight/chain \_\_\_\_\_ kg

#### 3. Cable-Parameter

1. Cable length (total) \_\_\_\_\_

### Enquiry Special Cable

Phone +49 7150 9209-0  
 Fax +49 7150 81786  
 E-Mail: anfrage-spezialkabel@helukabel.de

Enquiry \_\_\_\_\_

yearly requirement approx. \_\_\_\_\_ m

Delivery required \_\_\_\_\_

Size \_\_\_\_\_

Application

a)  indoor  outdoor

b)  stationary  for flexing

c)  Drag chain  speed \_\_\_\_\_ m/s

Temperatures ambient \_\_\_\_\_ °C

Make-up Type of Cable \_\_\_\_\_

Acceleration \_\_\_\_\_ m/s<sup>2</sup>

cyclic  non-cyclic

continuous \_\_\_\_\_ °C

# ■ TECHNICAL INFORMATION

Designation	Page
<b>Basics</b>	
OSI reference model	358
Basics of structured cabling (EN 50173)	358
Structured wiring	360
Wiring topology of industrial application	362
Network topologies in the industrial environment	364
Planning and installation instructions Copper Data Cables	365
Optical transmission characteristics	366
Recommendations for installaing and working with fibre optic cables	367
Installation Guidlines for HCS + POF Cables	368
Patchcables	370
Requirements for office and industrial networks	385
The MICE concept	386
IAONA-classification	387
Characteristics* of insulating and sheath materials	388
Essential cable parameters	390
EN (European) Standards	392
Classification of fibre optic cables / transmission ranges	394
Fibrespecifications	395
Networks and field buses	396
<b>Fibre optics</b>	
Fibre-optic cables-Code	398
Cross-Sections of fibre optics and cores	399
Spectral attenuation characteristic of glass	400
The Electromagnetic Spectrum	401
Fibre optic Drawing Tower-Design	402
<b>Copper</b>	
Code-designation-explanations for cables and insulated wire	403
AWG-Wires and AWG-stranded conductors	404
AWG-Wires (Solid-Conductor)	405
Stranded make-up	406
US-american and british units	407
Copper and Alu-price calculation	408
LAN-Cable designation	409
<b>Plug coding</b>	
RJ45 connector pin assignment for ethernet applikations	410
RJ45 wiring options	411
M12 connector pin assignment	412
<b>Standards</b>	
Standards overview	413
IP-Code (protection classes)	414
Fire performance and fire propagation in accordance with	415
Capacity of KTG-Pool drums	416
UL-Listed or UL-Recognized for data cables?	417
Norm-Glossary	418
<b>Glossary</b>	
Glossary	421
<b>General information</b>	
Part No. Index	439

# ■ OSI REFERENCE MODEL

The communication between systems (devices, computers) in an open network architecture is specified schematically and standardised by the OSI reference model. The individual functions for communication between an application process in one system and any other application in another system are classified in seven functional layers. The complex communication process is simplified by this abstraction and divided into logical units.

A further benefit of this modularisation of the individual function tasks is also the possibility of being able to simply replace the technical implementation of one layer independently from the other layers. For example, it is possible to easily change the transmission medium. The functionality of the other layers is maintained without modification.

## Layer 7 Application layer

(also called: processing layer, application level). The application layer is at the top of the seven hierarchical layers. It provides the applications with a multitude of functionalities (for example, data transmission, email, Virtual Terminal or Remote Login etc.).

## Layer 6 Presentation layer

(also called: data presentation layer, data provision level). The presentation layer converts the system-dependent presentation of the data (for example, ASCII, EBCDIC) to an independent form and thus enables syntactically correct data exchange between different systems. Tasks such as data compression and encryption also belong to Layer 6.

## Layer 5 Session layer

(control of logical connections, session level). The session layer provides services for an organised and synchronised data exchange in order to resolve session crashes and similar problems. For this purpose, restart points, so-called tokens, are implemented, using which the session can be resynchronised after a transport connection failure without having to restart the transmission from the beginning.

## Layer 4 Transport layer

(also called: end-to-end control, transport control). The tasks of the transport layer include the segmentation of data packets and congestion control. The transport layer is the bottom layer which provides a complete end-to-end communication between sender and recipient. It provides standard access to the application-oriented layers 5-7 so that these do not need to take account of the characteristics of the communication network. Five differentiated service classes of different quality are defined in Layer 4 and can be used by the upper layers, from the simplest to the most convenient service with multiplexing mechanisms, error protection and error correction methods.

## Layer 3 Network layer

(also called: packet level:). The network layer ensures control of connections for connection-oriented services and the forwarding of data packets for packet-oriented services. In both cases, the data transmission passes over the complete communication network and includes the routing between the network nodes. As a direct connection between the sender and destination is not always possible, packets must be forwarded from nodes which are on the path.

## Layer 2 Data link layer

(also called: connection link layer, connection level, procedure level). The role of the data link layer is to ensure a safe, i.e. transmission as error-free as possible and to control the access to the transmission medium. Splitting the bit data stream into blocks and the insertion of sequence numbers and check numbers are provided for this. Incorrect or lost blocks caused by errors can be requested again by the recipient using acknowledgement and repetition mechanisms. The blocks are also called frames. A so-called flow control makes it possible for a recipient to dynamically control the speed at which the other side is allowed to send blocks.

## Layer 1 Physical layer

(also called: bit transmission layer, physical level). The physical layer is the bottom layer. The specifications for Layer 1 mainly include the mechanical (plug connectors, etc.), electrical (level, type of pulse, etc.) and optical (wavelength) characteristics of the transmission medium (cable, fibre optics, wireless technology etc.).

### OSI reference model

- 7: Application Layer
- 6: Presentation Layer
- 5: Session Layer

#### Application oriented layers

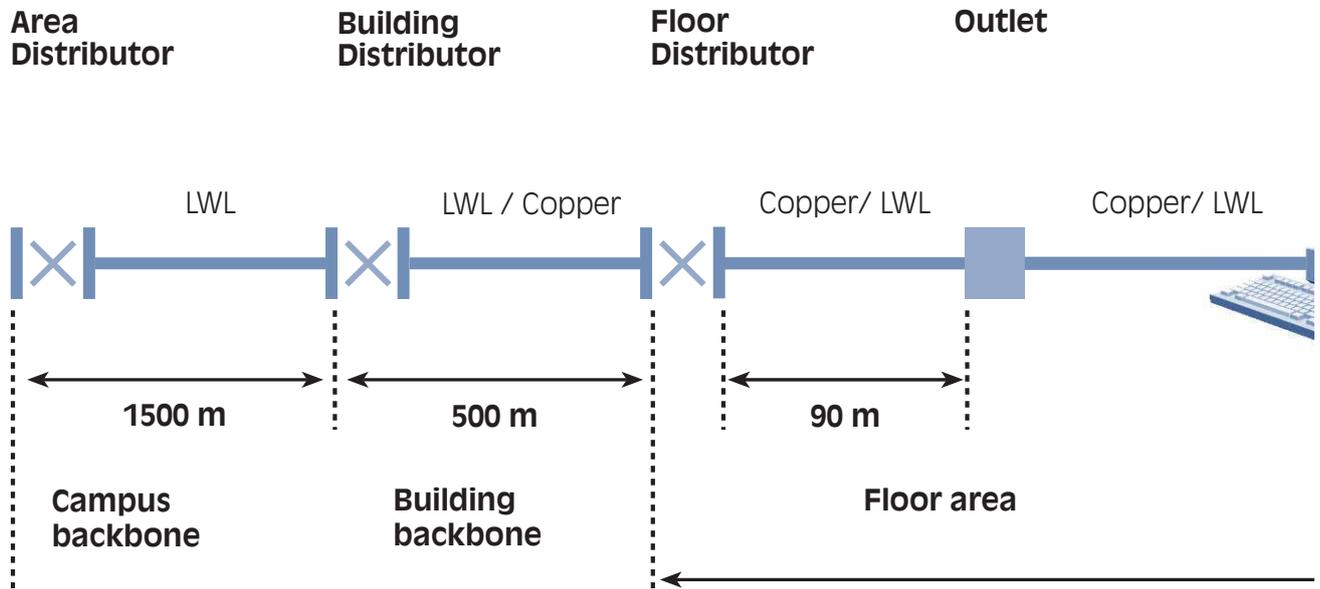
- 4: Transport Layer
- 3: Network Layer

#### Transport Infrastructure

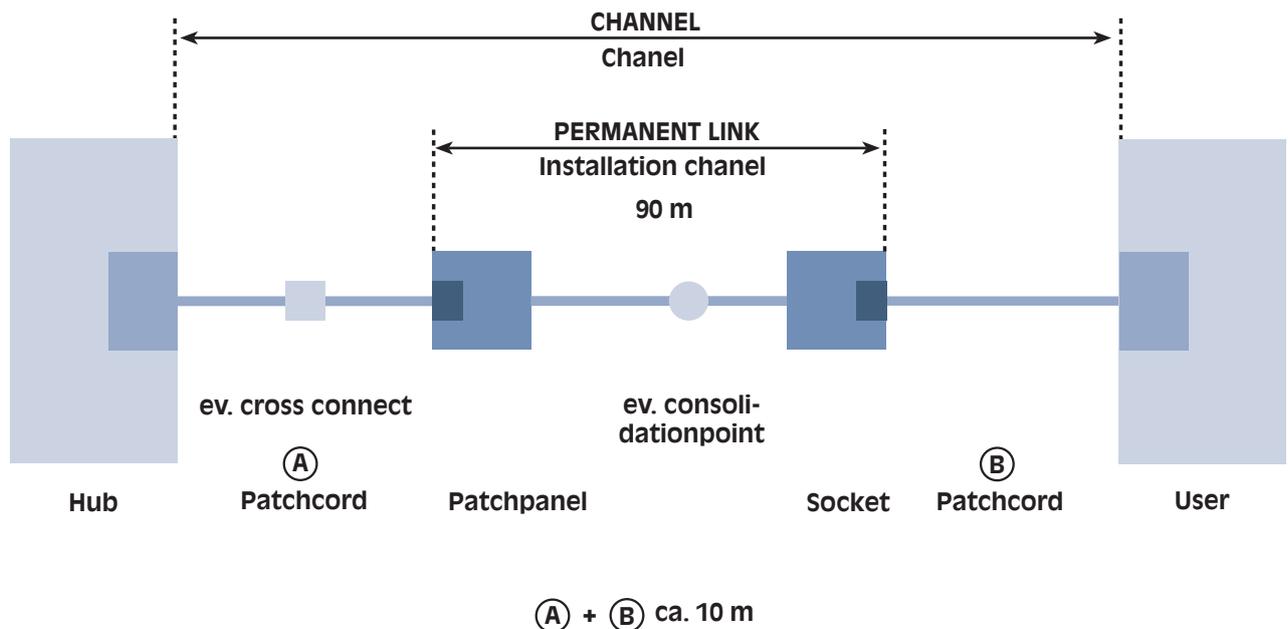
- 2: (Data Link Layer) Logical Link Control (LLC)  
Media Access Control (MAC)
- 1: (Physical Layer)

#### Network hardware

# ■ BASICS OF STRUCTURED CABLING (EN 50173)



The permanent link and the transmission path (channel) are defined as follows in the ISO/IEC 11801 and EN 50173 standards:



# ■ STRUCTURED WIRING

## Device wiring /

### Work Area

#### • Copper data cables

(Chapter 2 HELUKAT®)

1. U/UTP (UTP\*)
2. F/UTP (FTP\*)
3. SF/UTP (S-FTP\*)
4. S/FTP (S-STP\*)

#### • Glas fibre cables

(Chapter 1 HELUCOM®)

1. Installation cables/Zipcord (I-VH)

## Floor Wiring/

### Horizontal Cables

#### • Copper data cables

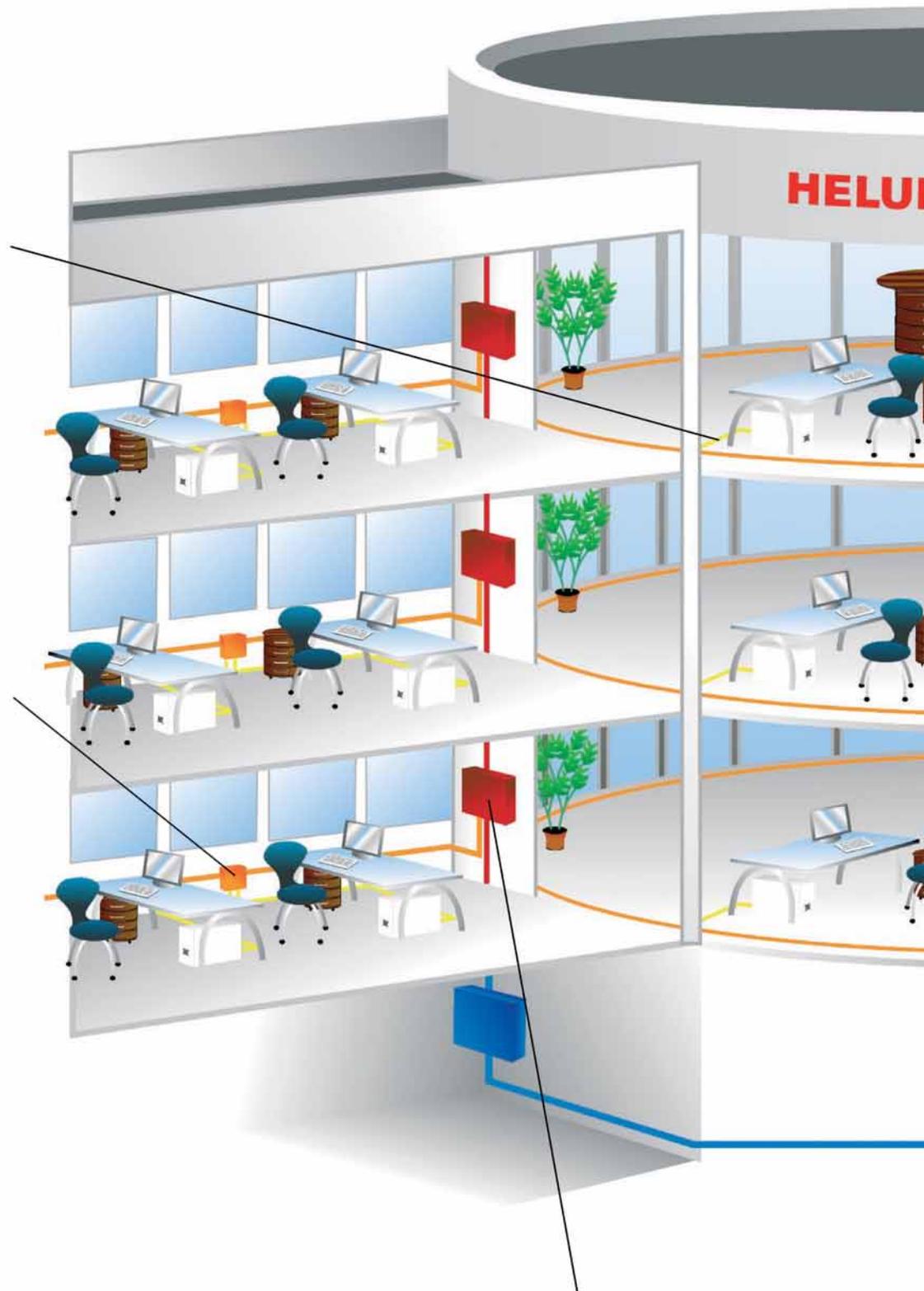
(Chapter 2 HELUKAT®)

1. U/UTP (UTP\*)
2. F/UTP (FTP\*)
3. SF/UTP (S-FTP\*)
4. S/FTP (S-STP\*)

#### • Glas fibre cables

(Chapter 1 HELUCOM®)

1. Breakout-Kabel (z.B. I-V(ZN)HH)
2. Minibreakout-Kabel (z.B. A/I-VQ(ZN)BH)



## Building backbone/Vertical Cables

#### • Copper data cables

(Chapter 2 HELUKAT®)

1. U/UTP (UTP\*)
2. F/UTP (FTP\*)
3. SF/UTP (S-FTP\*)
4. S/FTP (S-STP\*)

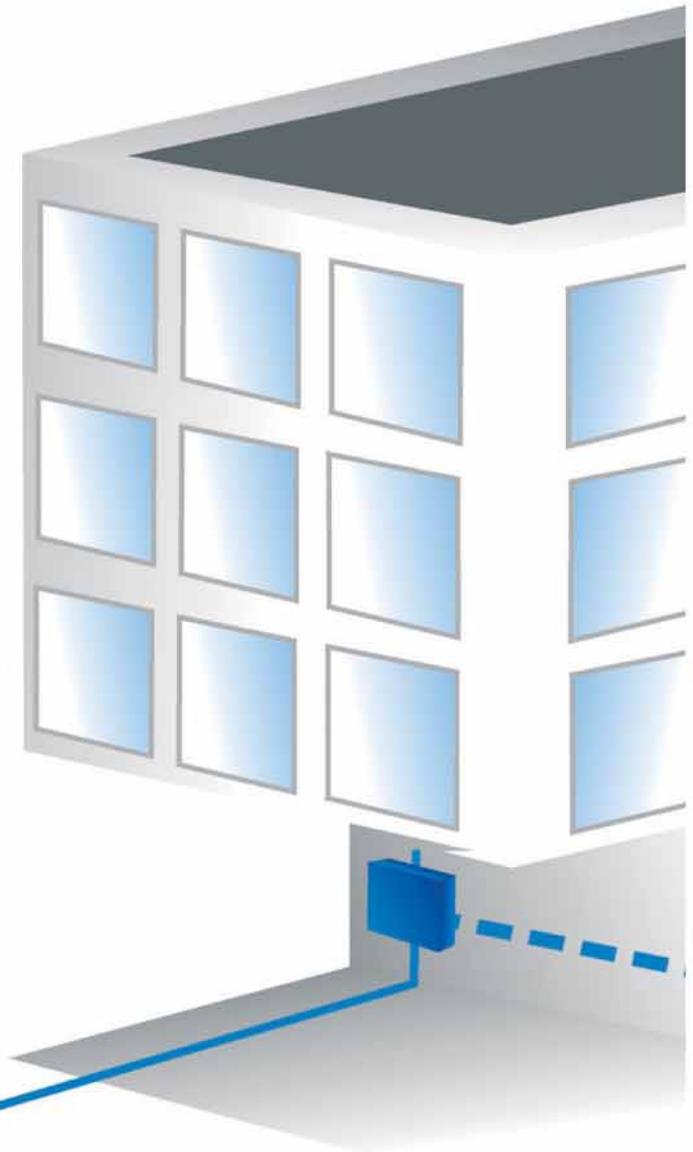
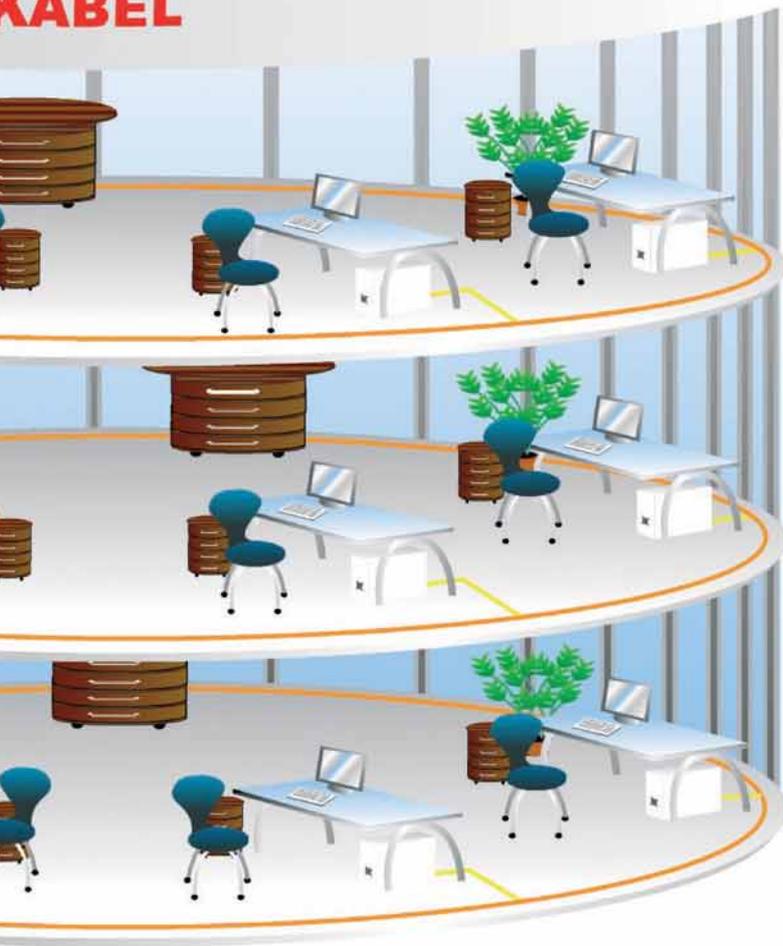
#### • Glas fibre cables

(Chapter 1 HELUCOM®)

1. Breakout-Cable (z.B. I-V(ZN)HH)
2. Minibreakout-Cable (z.B. A/I-VQ(ZN)BH)
3. Loose-tube cable with or without rodent protection (z.B. A/I-DQ(ZN)BH)

\* old description

**KABEL**



## Campus Cables

### • Glass fibre cables

(Chapter 1 HELUCOM®)

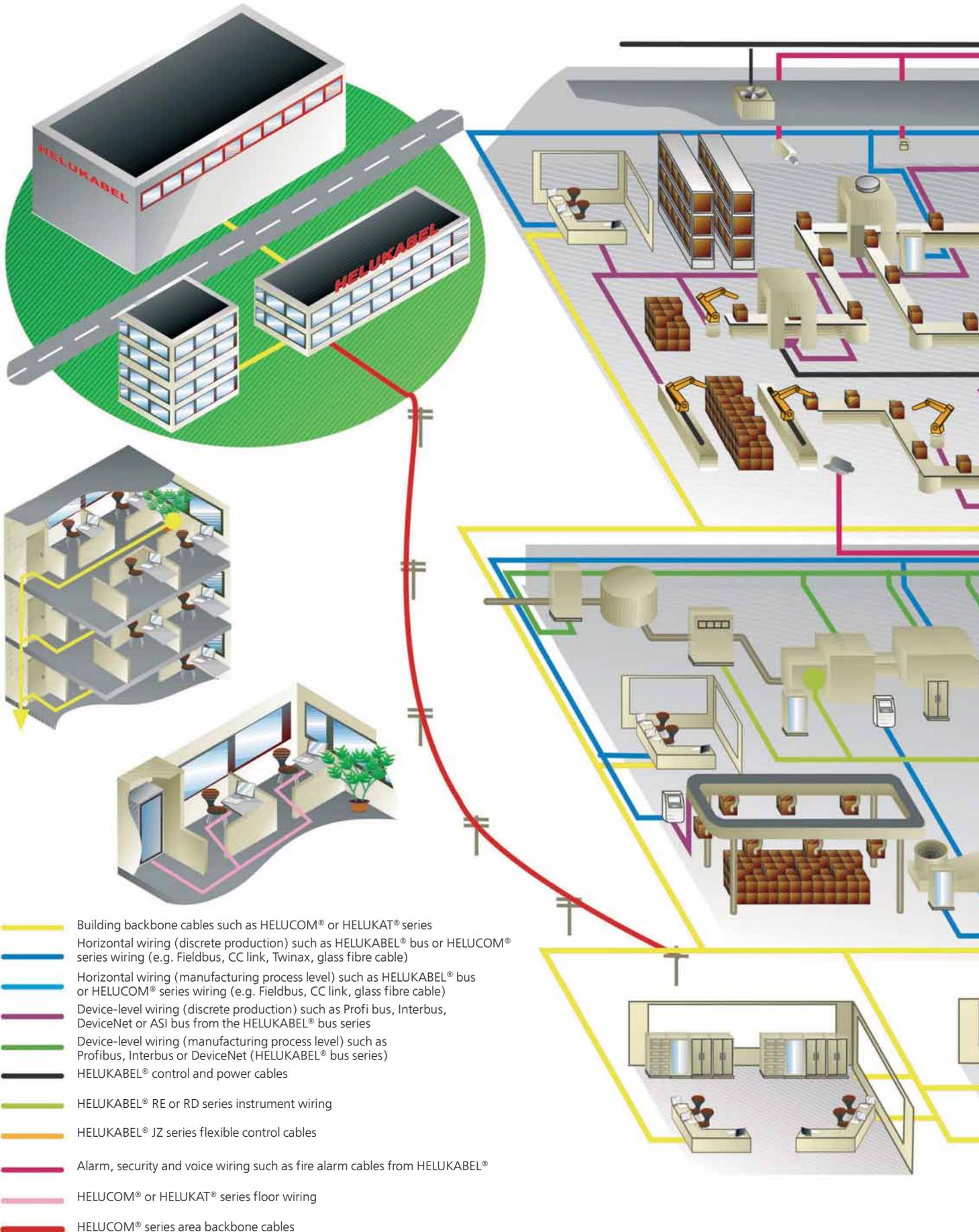
1. Breakout with rodent protection (z.B. AT-V(ZN)HH(BN)2Y)
2. Loose-tube cable with rodent protection (z.B. A-DQ(ZN)B2Y)

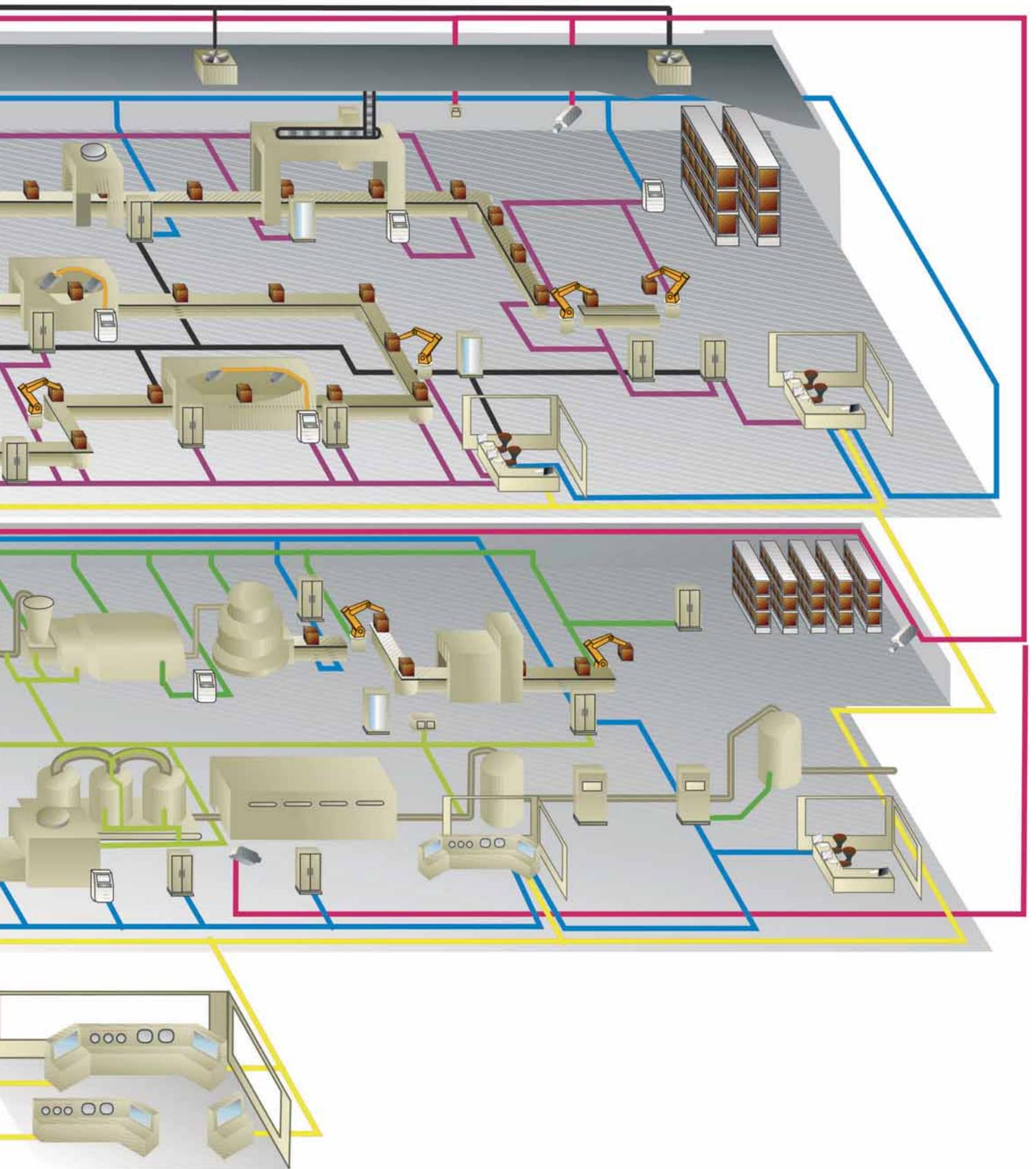
### Application:

**These cables are suitable for use with the following LAN standards:**

Ethernet	10 Mb/s
Token Ring	10 Mb/s
Fast Ethernet	100 Mb/s
FDDI-CDDI	100 Mb/s
ATM	155 Mb/s
ATM	622 Mb/s
Gigabit Ethernet	1 Gb/s
10 Gigabit Ethernet	10 Gb/s

# ■ WIRING TOPOLOGY OF INDUSTRIAL APPLICATION





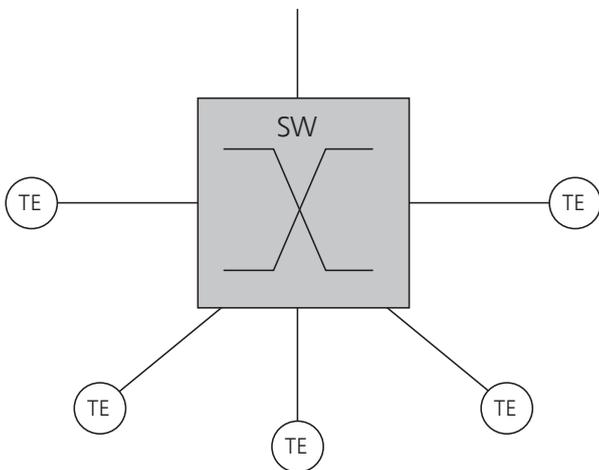
# NETWORK TOPOLOGIES IN THE INDUSTRIAL ENVIRONMENT

The network topologies for Ethernet networks are oriented towards the requirements of the equipment to be networked. The most frequently used are star, point-to-point, tree and ring structures. In practice, a real system often consists of a mixture of the structures considered below.

## Star

The characteristic of the star structure is a central switch with individual connects to all nodes of the network. Applications for star network structures are areas with high node density and low thermal expansion, e.g. small production cells or a single production machine.

SW = Switch  
TE = Terminal Equipment  
(data terminal)

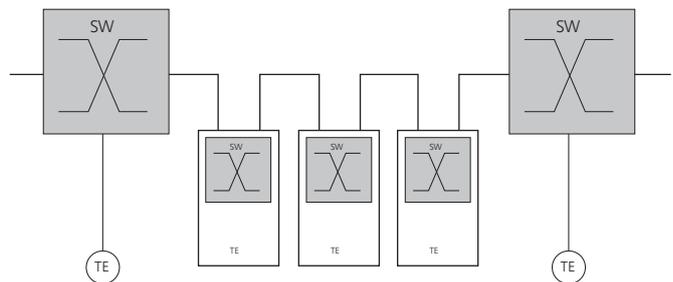


## Tree

The tree topology results from the connection of several stars to a network. It is used for dividing complex systems into subsystems.

## Point-to-point

The point-to-point structure can be realised by a switch in the vicinity of the integrated switch in the node to be connected. The point-to-point structure is preferred for use in systems with remote structure, e.g. conveyor systems and for connecting production cells.

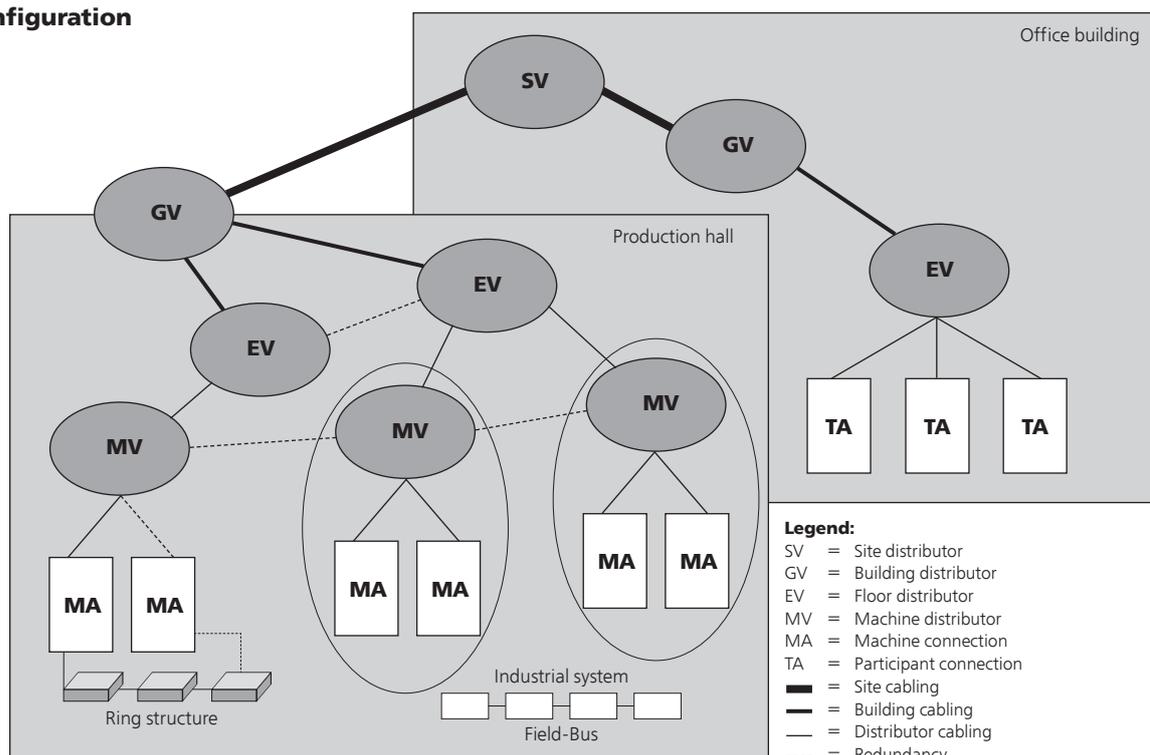


Point-to-point structure  
SW = Switch  
TE = Terminal Equipment

## Ring (redundancy)

A ring structure is produced if the ends of a line are closed with an additional connection. Ring topologies are used in systems with increased availability requirements for protection against cable breaks or failure of network components.

## Example configuration



# ■ PLANNING AND INSTALLATION INSTRUCTIONS COPPER DATA CABLES

Fibre optic cable is recommended for execution of the PRIMARY area, whereby the site distributor is usually connected to the individual building distributors in a star configuration.

The SECONDARY area can be laid out with fibre optic, as well as with copper cable, (fibre optic is recommended and the structure can be either a star configuration or a ring configuration).

The TERTIARY area is executed in a star configuration with copper cable.

The minimum cable structure recommendation is 4 pair with a conductor cross-section of 0.51 mm that is covered with foil shielding. However cable with foil shielding for each pair, and overall braid screening is preferred in order to also handle future applications and requirements. (Higher near-end crosstalk attenuation and better EMC behaviour).

Halogen-free cable is recommended for buildings with higher concentration of material assets or personnel. The system reserves in the type selection should be specified for a service life of 10-15 years. Ensure that all components contained are either screened or non-screened. Existing standards facilitate execution and increase security, and they should be strictly complied with. Due to the high cable density in the tertiary area, sufficiently dimensioned cable routes must be planned.

## Installation instructions

Note that in the tertiary area, the max. cable length between floor distributors and the workstation wiring box is 90 m. (Ethernet according to 802.3, Copper).

Ensure that earthing is carefully equalised. The earth potential difference between any earthing points should not exceed 1 volt.

Ensure that power cables and data cables are separated by a metallic centre web if laid in shared cable routes.

Ensure that the cables are used in enclosed and dry areas and that the cable routes are protected from aggressive chemicals and rodents.

An adjacent fire barrier is required for floor penetrations for the riser line.

## Cable installation guidelines

Never take cable and lines from a reel against their original run direction (Fig. 1); turn around (Fig. 2) is also not permitted. When installing cable, the reel should always be horizontal (Fig. 3), preferably it should be placed on a roll dispenser. This is the only way to ensure that the cable is laid on the ground without incurring damage due to mechanical stress.

In order to avoid a crossover effect with cable rings, they should always be positioned vertically (Fig. 4) and unrolled onto the ground. If cable cannot be unrolled in the required length due to a lack of space, then you must maintain a bend of sufficient dimensions when running back. If, for example, multiple cables are routed parallel in the same channel, then we recommend bundling them using cable ties or insulation tape. The bundle should always be laid out straight to avoid possible jamming when installing.

## Tensile stress during and after the installation

Data lines should only be exposed to low level mechanical stress. In the relevant guidelines, 5daN/qmm Cu-conductor is specified as maximum permissible tensile force. This results in the following permissible tensile stress values depending on number of pairs and execution of the overall screen:

Conductor	Ø	without screened braiding		with screened braiding	
		2 pair	4 pair	2 pair	4 pair
AWG26/7	7 x 0.16	3 daN	6 daN	7 daN	10 daN
AWG24	0.51	5 daN	9 daN	9 daN	15 daN
AWG23	0.55	-	-	13 daN	19 daN
Ø 0.6	0.60	7 daN	12 daN	16 daN	24 daN
AWG22	0.64	8 daN	15 daN	17 daN	25 daN

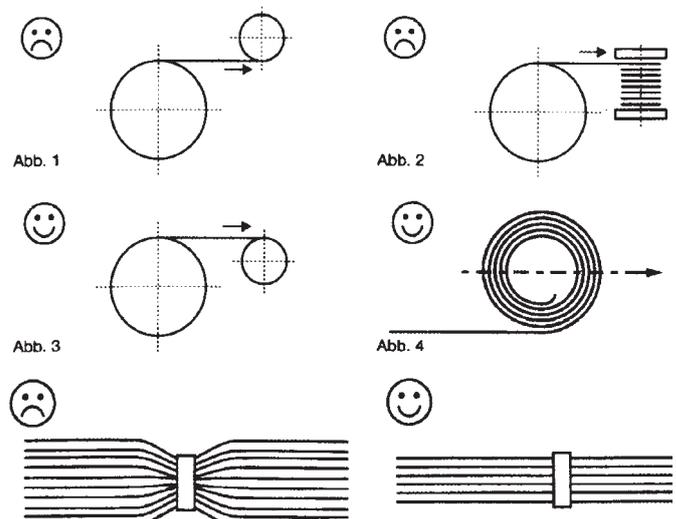
(1daN corresponds to approximately 1kg)

Ensure that the cable is not pulled too forcefully when bending around sharp corners or edges. Excessive mechanical stress can influence the transmissions properties. The **bend radius** must not exceed **8 times** the cable diameter while subject to tensile stress. In installed condition this value can be reduced to **4 times** the cable diameter.

In the design as well as in the production of HELUKAT® lines, care has been taken to achieve cable structure that is as solid and compact as possible, so that no essential losses occur in the transmission parameters if these installation guidelines cannot be complied with due to local conditions.

## Patch cable

The calculation of the maximum. Patch Cable Length = flexible printed circuit, calculated using the formula below. It follows with optimal conditions, a max. 80 m flexible Section (AWG 22, 7-wiry, FM45 industrial connectors, Profinet-B). This patch cable is a channel for a complete route. After installation, it is absolutely necessary to carry out a measurement.



# ■ OPTICAL TRANSMISSION CHARACTERISTICS

## Optical transmission characteristics

**There are two main factors which determine the optical quality of the fibre optic cable: attenuation and bandwidth**

These transmission parameters are always specified for two operating wave lengths (optical windows):

Multimode G50 and G62.5/125  $\mu\text{m}$  -> 850 and 1300 nm  
Singlemode E9/125  $\mu\text{m}$  -> 1310 and 1550 nm

The attenuation characteristic describes the loss in intensity of the light signal sent via the fibre and is specified as fibre attenuation in dB/km. The bandwidth is a unit of measurement for the dispersion characteristic of the fibre optic cable and is expressed in MHz\*km; for singlemode fibres it is the dispersion coefficient in ps/nm\*km.

A fibre optic cable with a bandwidth-length product of 1200 MHz\*km features an impressive usable bandwidth of 2.4 GHz over 500 m. Unlike transmission via copper, transmission via glass does not involve any compromising of the digital signals. As a result, bandwidth and transmission speed are the same: Hz = bit/s.

In addition to the bandwidth-length product, the beginning of the Gigabit age has also made an additional characteristic of multimode fibres important. The guaranteed Gigabit length in m is measured using a special method defined in the standard FOTP 204.

When planning the lengths of fibre optic cables, it is important to consider these three important transmission parameters for the calculations. Of course, it's not always necessary for the fibres to meet the highest standards in terms of optical transmission parameters. In secondary and tertiary cabling, in particular, it is uncommon to exceed lengths of 400 m. In these cases, it is often possible to settle for a lower specification without sacrificing performance or investment security. When it comes to pigtailed or patch cables, the bandwidth and attenuation no longer play a role for the optical quality. At lengths of up to 10 m, these cables have almost unlimited bandwidth, and the attenuation is limited by the connectors – not the fibre between them.

With the incredible rate of progress in IT, the question of "which fibre type?" and, by extension, "what transmission capacities?" has grown in importance. In the multimode range, the answer is clear. The 50  $\mu\text{m}$  fibre is technically far superior to the 62.5  $\mu\text{m}$  in every respect. In the smaller optical core, far fewer discrete modes propagate, with the result of less attenuation, higher bandwidths, and higher Gigabit distances. When it comes to costs, the meter price of 50  $\mu\text{m}$  cable is actually lower. With the latest development, transmission of up to 10 Gbit/s by means of wavelength multiplexing, singlemode fibre is becoming increasingly important. With just a single mode, great distances and almost unlimited bandwidths are possible. The manufacture of the E9/125 is less complex, and as a result more affordable than that of a multimode fibre.

## Jacket materials

There are two materials that are in widespread use for jacketing fibre optic cables: polyethylene PE and halogen-free, flame resistant material (Flame Retardant Non Corrosive).

The only real difference between universal cables and outdoor cables is the halogen-free, flame resistant jacket of the universal cables. The great advantage with universal cables is that there is no need for an interface between outdoor cables and indoor cables where the cables enter the building. This eliminates the need for time consuming, costly splicing work. However, when laying universal cables it should be kept in mind that these must be pulled into HDPE conduits which have been sealed against moisture ingress on both sides of the building. This is because there is one clear difference between the FRNC jacket and the PE jacket. The halogen-free, flame-resistant jacket does not come close to providing the level of protection offered by PE against lateral diffusion of water.

## Armouring

Rodents can pose a hazard in easily accessed conduits or shafts. In these environments, the cables must be provided with armour, to protect them against the rodents' natural gnawing instinct. If the cables happen to block the path of the rodent, the rodents will attempt to gnaw through the problem cable. In general, there are two options: a metallic or non-metallic armour against rodents. The first is a corrugated steel jacket, and the second is a glass roving wrap.

Tests on the rodent-resistance of fibre optic cables have shown that the two types of armour are not equally effective. Cables with a glass roving armour had clear signs of damage after some time, indicating that there would be a negative effect on the transmission performance in the long term. The corrugated steel jacket, on the other hand, was unaffected by the rats. Based on these test results from an independent institute, it is essential to inspect the cable routes when planning the installation of fibre optic cable systems.

An additional important criterion when selecting fibre optic cables is the whether the cable is free of metal. If there is metal in a dielectric cable, it must be completely electrically insulated: i.e. in accordance with DIN VDE 0800, one end of the metal armouring, always in the direction of the main distributor, must be laid on the earthing bar in the distribution cabinet. This additional work can be eliminated if the metal layer is sealed off at the mouth of the cable, for instance with a shrink sleeve. This ensures that in the case of contact, electrostatic discharge would not pose any health hazard for humans.

# RECOMMENDATIONS FOR INSTALLING AND WORKING WITH FIBRE OPTIC CABLES

## Introduction

Cable configuration has the purpose of protecting the fibre optic cable during transport, storage, installation and operation. During each of these stages, the cable is exposed to different influences, such as mechanical stress, different temperatures, humidity, and sunlight.

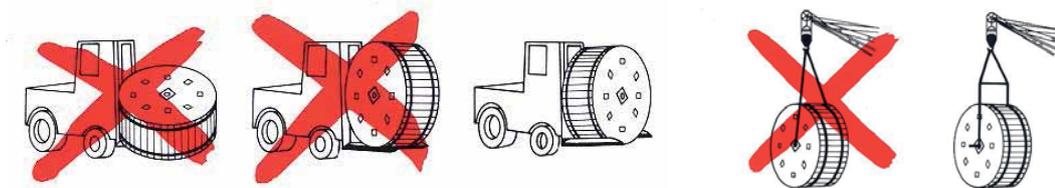
The cable will function reliably in the environment for which it was designed. For example, a cable for underground installation is not suitable for use as an aerial cable. The cable configuration and the materials have been specially selected to ensure that the specified transmission characteristics continue to be fulfilled throughout the service life of the cable. In addition to the cable configuration, the quality of the professional installation or assembly of the cables also is an important factor for ensuring the transmission characteristics over the long term.

## General information

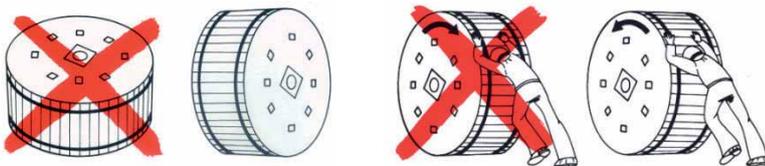
Cables which are stored in unsupervised areas should be protected against vandalism and other potential sources of damage. If there is an interruption during installation, e.g. a break is taken overnight, be sure to protect the cable ends against moisture ingress. Corresponding warning tape should be integrated as part of the installation work. Comply with local ordinances and customer specifications.

## Transport and storage

Cable drums should be handled with care during loading and unloading. Always use a suitable forklift or crane to load the drums. Check the drums for any damage (e.g. broken flange, protruding nails, etc.) to prevent later cable damage during the installation.



Drums of fibre optic cable must always be kept upright during transport. Check that the roll direction is correct (arrow on the drum) to prevent the reel of cable from loosening. Secure the cables during transport. (loading safety)



If the cable will be stored for a longer period, we recommend protecting the cable against continuous sun exposure. Use suitable caps to protect the cable ends from moisture ingress.

## Installation instructions

Observe the cable specification sheets. These contain all of the important information for the installation:

- Minimum bending radius with and without tensile load
- Maximum tensile force
- Minimum and maximum installation temperature
- Maximum transverse pressure

The permissible bending radius depends on the cable configuration. Compliance with the minimum bending radii protects the cable configuration against damage from excessively tight bends during installation and during later operation, ensuring long-term operating reliability.

**Important,** when using wheels to redirect the cable, each individual wheel must meet the specified minimum bending radius.

# RECOMMENDATIONS FOR INSTALLING AND WORKING WITH FIBRE OPTIC CABLES

The maximum permissible tensile force is defined by the strain relief elements in the cable, and is specified so that below this maximum force, the fibres are not subjected to any continuous elongation, which could damage the fibres.

The specifications for the minimum and maximum installation temperature refer to the temperature of the cable and not to the ambient temperature. This means that at low ambient temperatures, the cable can be heated in advance, or in the case of excessive ambient temperatures, be cooled in advance. The heating or cooling phase can range from a few hours up to 24 hours, depending on the cable type, cable length, and the size of the drum. Excessive transverse pressure can damage the cable core and negatively affect the service life of the fibres.

## Laying the cable directly in the ground

When laying cable directly in the ground, without a conduit, make sure that the cables are lying in sand bed, free of stones. Make sure that the cable is at the correct distance from other supply lines and cables.

## Ploughing

Fibre optic cables that are ploughed in must be suitable for this installation method.

## Drawing cable into conduits

If the cable will be drawn in, make sure that all strain relief elements are equally subjected to the tensile load. The pulling grips must be designed for the respective cable type (tensile force, diameter). For stranded cables without glass or Aramid fibre roving over the cable core, it is important that the central strength member takes part in the pulling. We offer high tensile strength capping as an option.

**Important**, the pulling equipment must be equipped with a tensile force limiter, which stops the pulling process if the maximum tensile force is exceeded. The tensile forces must be documented over the entire pulling process. To avoid torsion, use anti-twist ropes and swivel shackles.

If the cables will not be directly pulled from the cable, the cable must be laid out in a figure-eight configuration. Take care to comply with the permissible bending radii.



Wrong



Correct

When using lubricants, make sure that these have been approved by Deutsche Telekom (ZTV-TKNetz, Part 40) or are of equal or higher quality. The use of mechanical "figure eight machines" is often problematic, as many of these machines do not monitor the bending radius.

# ■ RECOMMENDATIONS FOR INSTALLING AND WORKING WITH FIBRE OPTIC CABLES

## **Blowing**

The alternative to the pulling method is to install the cable using the air blown method. Keep in mind that not every duct is suitable for every cable type. The tube and cable diameters must be designed for each other.

Due to their design, microduct cables are only suitable for use in microduct tubes.

With the blowing method, it is possible to blow a second or even a third cable into standard ducts that already contain a cable. However, for the second and third cable, the blowing distance will be shorter. With modern blowing equipment, depending on the routing, it is possible to blow in cable of up to several kilometres in length. The blowing result depends on correctly matching all elements of the blowing equipment (blowing jets, post-cooler, compressor) to the cable to be installed, and is also highly dependent on the qualifications of the operating personnel. For this reason, we recommend having the personnel trained by the respective device manufacturer.

Before starting the blowing process:

- Check the conduit system with a gauge
- Blow a foam carrier through the conduit to clean and pre-lubricate it. Make sure that the lubricant is dosed correctly (see manufacturer specifications)
- Perform the crash test The crash test determines the maximum contact pressure of the blowing machine.

**Important:** The simultaneous introduction of lubricant during the process should only take place downstream from the drive (worm gear, drive wheel) of the blowing machine.

For each cable diameter, there are blowing caps for rounding off the cable end. The use of these caps is obligatory.

Blowing central loose tube cables into conduits is a special case. For the wide conduit diameter, these cables are not really stiff enough to achieve acceptable blowing lengths. To improve the blowing performance, it is necessary to use aids. End caps are available in various sizes for the different tube diameters. With the use of end caps, blowing lengths of 2 km can be achieved, even with central loose tube cables.

## **Aerial cables**

Aerial cables are specially designed to be suspended from poles. The design takes into account the increased tensile forces as well as additional loads such as those from wind and ice. Aerial cables are always specially designed for the given project, as conditions will vary depending on the site of operation. For aerial cables, the strain relief elements must be made of Aramid yarns. Glass rovings should not be used. When laying the aerial cables, take care to comply with the maximum tensile forces as well as the specified minimum bending radii. This is especially important for multiple rolls. Each individual roll must meet the specified minimum bending radius.

Furthermore, the fixtures in use must be designed for the cable. Fixtures that are not seated correctly can reduce the service life of the cable and also result in hazards due to excessive sagging or even falling cable. Preformed spiral fixtures are recommended, as these provide a secure hold with only minimal load on the cable.

## **Tools ideal for processing cables and fibre optics**

When further processing the cables, be sure to use suitable tools, such as: Bevel type cable cutter, fibre optic cleaver, coating stripper, tube splitter

# ■ INSTALLATION GUIDELINES FOR HCS + POF CABLES

## Installation Guidelines for Polymer Fiber Cables (980/1000µm)

### Do Not Exceed Maximum Cable Lengths

- When installing polymer fiber cables, the maximum cable length of 50 or 70 m (depending on the fiber optic system used) between two devices must not be exceeded. The cable length can be further reduced using special cables or joints.

### Do Not Use Cables Shorter Than the Permitted Minimum Lengths

- Fiber optic cables that are shorter than 1 m can result in the receiver being overcontrolled. Only use cables longer than 1 m.

### The Bending Radius Must Be Maintained

- Please ensure that the minimum bending radius is no smaller than the given data/ standard. This is particularly important if fiber optic cables are led through housing or installed in right angle cable ducts.

### Do Not Exceed Tensile Load and Lateral Strength

- The permanent tensile load of a polymer fiber cable must not exceed the maximum standard.
- Squeezing the cable, for a period longer than just stepping on it, must be avoided (attend to the maximum lateral strength).

## Installation Guidelines for HCS Cables (200/230 µm)

### Do Not Exceed Maximum Cable Lengths

- When installing HCS cables, the maximum cable length of 300 or 400 m between two devices must not be exceeded.

### The Bending Radius Must Be Maintained

- Please note that the bending radius must not fall below the minimum value. This is particularly important if fiber optic cables are led through housing or installed in right angle cable ducts.

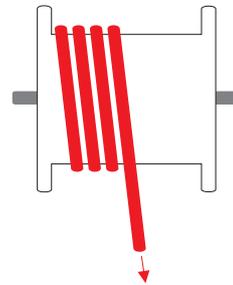
### Do Not Exceed Tensile Load and Lateral Strength

- The permanent tensile load of an HCS cable must not exceed maximum standard.
- Squeezing the cable, for a period longer than just stepping on it, must be avoided (attend to the maximum lateral strength).

## Installing HCS- + POF-Cables

### Use an Uncoiling Device to Uncoil the Fiber Optic Cable

- The fiber optic cable must only be uncoiled from the cable drum using an uncoiling device.



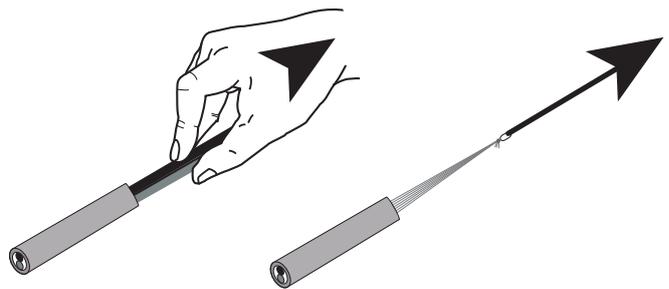
### Do Not Twist the Cable

- With short cable runs, avoid twisting the cable (torsion).



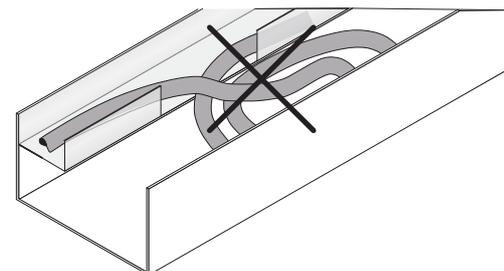
### Insert the Fiber Optic Cable Correctly

- Do not pull the cable by the individual fibers. Do not pull the cable forcefully if the cable becomes caught. If you install the fiber optic cable using a cable-pulling device you must secure the device to the strain relief (e.g., aramide yarn).



### Install Cables in Cable Ducts

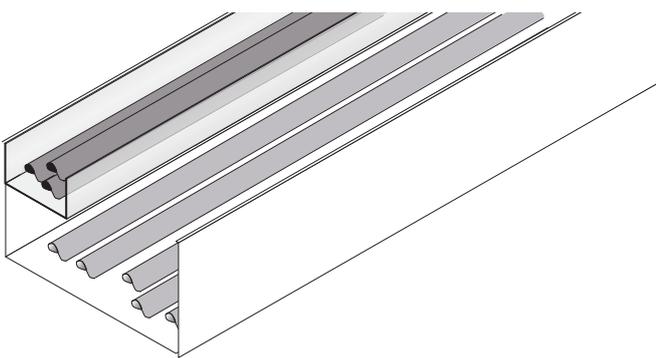
- Install the cables in cable ducts without loops.



## ■ INSTALLATION GUIDELINES FOR HCS + POF CABLES

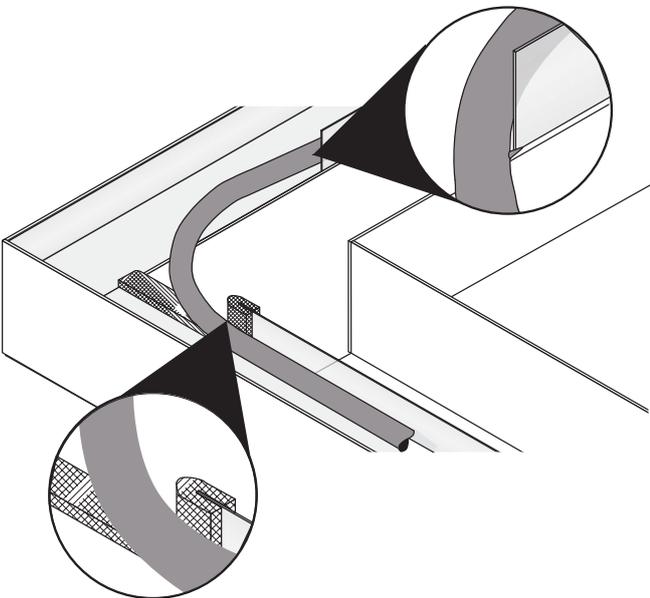
### Install Fiber Optic Cables Separately

- Fiber optic cables are installed in cable ducts or cable conduits. If these cables are installed in ducts together with heavy power cables, the fiber optic cables should be installed in a separated area of the duct or as the uppermost cable. This is to protect fiber optic cables against increased bending and tensile loads.



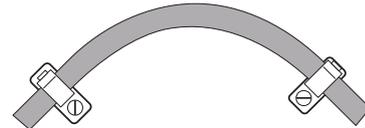
### Protect Fiber Optic Cables from Sharp Edges

- Protect the fiber optic cables from sharp edges. Insert an edge protector. Smooth or remove any sharp edges.



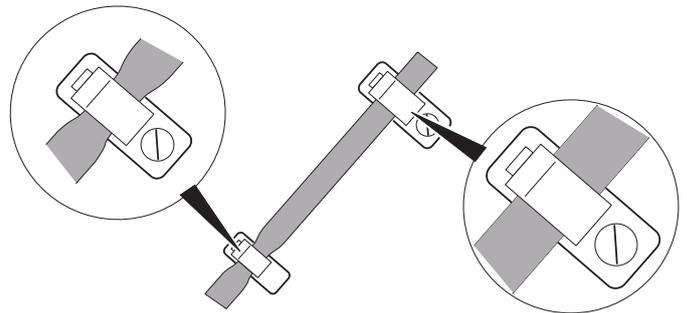
### Secure the Bending Radius: Cable

- If the fiber optic cable has to be installed at a right angle, secure it with cable binders. This prevents the bending radius falling below its permissible range.



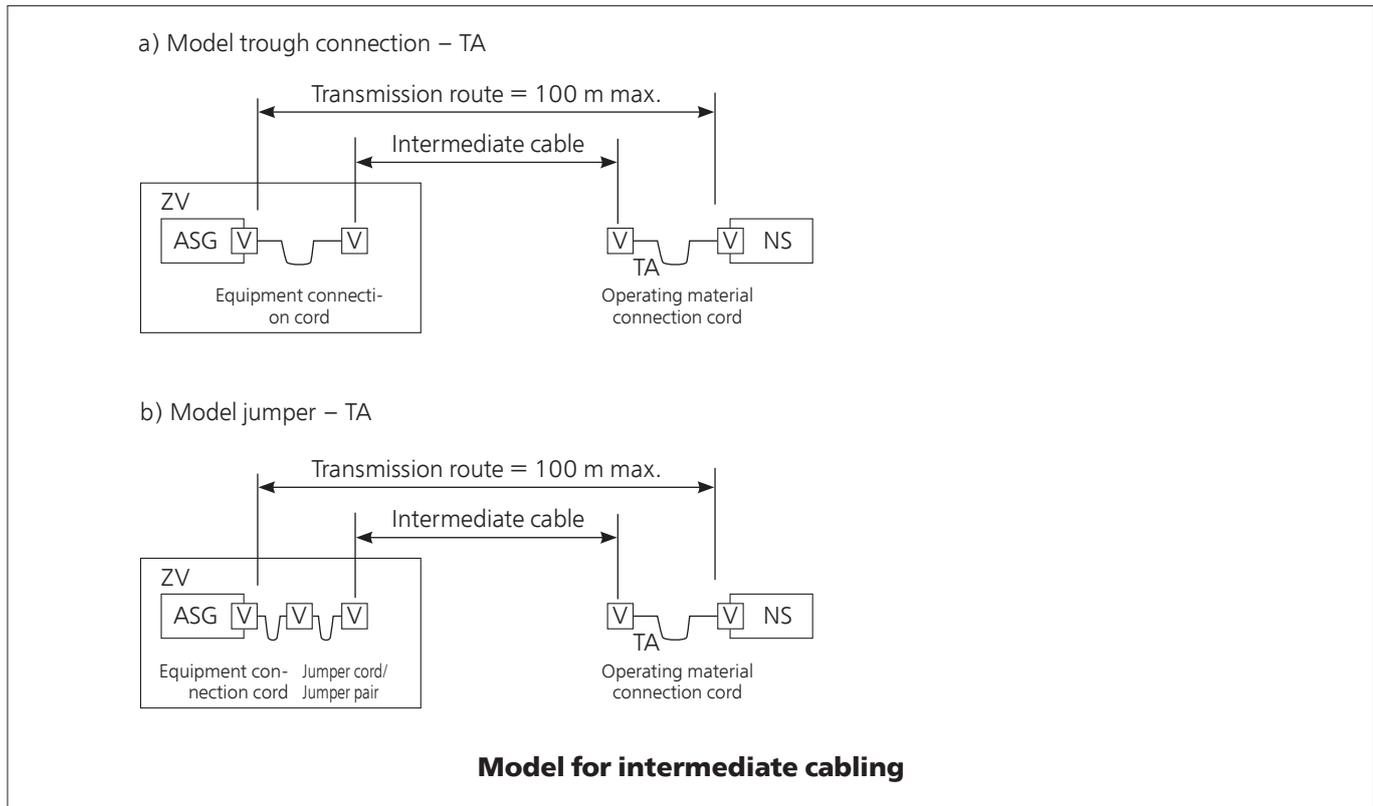
### Do Not Squeeze Fiber Optic Cables When Securing

- When securing cable binders, clamps, and control cabinet inlets, ensure the cable is not squeezed.
- Preferably use plastic fastening elements with a large surface to avoid squeezing.
- The fastening elements must have a width of at least 5 mm and should be carefully tightened manually.



# PATCH CABLES

EN 50173-3:2007



## Equations for the transmission routes of intermediate cabling

Model	Image	Model equation		
		Class D	Class E	Class F
Through connection – TA	a)	$H = 109 - F \times X$	$H = 107 - 3^a - F \times X$	$H = 107 - 2^a - F \times X$
Jumper ring – TA	b)	$H = 107 - F \times X$	$H = 106 - 3^a - F \times X$	$H = 106 - 3^a - F \times X$

$H$  largest length of the intermediate cable (m).

$F$  total length of the jumper cable, jumper pairs, operating material connection and equipment connection cords (m).

$X$  Ratio of damping of flexible cables (dB/m) to the damping of permanently installed intermediate cables (dB/m) – see section 9 (> 1)

<sup>a</sup> The length reduction represents an allocated reserve to consider the insertion damping variations.

For operating temperatures above 20 °C,  $H$  must be reduced by 0.2% for shielded cables and by 0.4% for unshielded cables for each °C (20 °C to 40 °C) and by 0.6% for each °C (> 40 °C to 60 °C). The documents of the manufacturer or the supplier must be consulted if the intended operating temperature exceeds 60 °C.

The following general restrictions apply:

- The physical length of the transmission distance must not exceed 100 m;
- the physical length of the intermediate cable must not exceed 90 m and – depending on the cord used and the number of plug connection – it can be less;
- the individual length of the jumper cords or jumper pairs must not exceed 5 m.

The largest length of the intermediate cable depends on the total length of the cord, which must be supported on a transmission route.

An administration system must be installed during the operation of the installed cabling to ensure that the cords used for the generation of the transmission route are in accordance with the draft rules for the floor, the building or the installation.

# ■ REQUIREMENTS FOR OFFICE AND INDUSTRIAL NETWORKS

The international standard ISO/IEC 11801 and its European equivalent EN 50173 define an application-neutral, standard IT networking for a building complex. Their contents are largely identical. Both standards assume an office environment usage of the building and require application neutrality. The specific requirements for Ethernet networks in industrial environments such as:

- system specific cable layout
- individual connectivity for each machine / system
- point-to-point network structures
- robust industry-compatible cables and plug connectors with particular requirements for EMC, temperature, moisture, dust and vibration are not considered in both these standards. The comparison is below:

	<b>Office area</b>	<b>Production and field area</b>
<b>Installation conditions</b>	<ul style="list-style-type: none"> <li>• fixed basic installation in the building</li> <li>• laying in false floors</li> <li>• variable equipment connection at the work place</li> <li>• prefabricated equipment connection cables</li> <li>• mainly standard work places (desk with PC, ...)</li> <li>• tree-shaped network structures</li> </ul>	<ul style="list-style-type: none"> <li>• strongly system-dependent cabling</li> <li>• system specific cable layout</li> <li>• connection points are seldom changed</li> <li>• equipment connections can be assembled in the field</li> <li>• each machine / system requires individual connectivity</li> <li>• frequent point-to-point network structures and (redundant) ring structures</li> </ul>
<b>Transmission performance</b>	<ul style="list-style-type: none"> <li>• big data packets (for ex. pictures)</li> <li>• medium network availability</li> <li>• transmission time in seconds range</li> <li>• high proportion of not cyclic transmission</li> <li>• no isochrony</li> </ul>	<ul style="list-style-type: none"> <li>• small data packets (measured values)</li> <li>• very high network availability</li> <li>• transmission time in microseconds range</li> <li>• high proportion of cyclic transmission</li> <li>• isochrony</li> </ul>
<b>Environmental requirements</b>	<ul style="list-style-type: none"> <li>• moderate temperatures</li> <li>• low dust contamination</li> <li>• no moisture</li> <li>• hardly any vibration</li> <li>• low EMC load</li> <li>• low mechanical hazard</li> <li>• low UV radiation</li> <li>• hardly any chemical hazard</li> </ul>	<ul style="list-style-type: none"> <li>• extreme temperatures</li> <li>• high dust contamination</li> <li>• possible moisture</li> <li>• vibrating machines</li> <li>• high EMC load</li> <li>• risk of mechanical damage</li> <li>• UV exposure outdoors</li> <li>• chemical contamination by oily or aggressive atmospheres</li> </ul>

# THE MICE CONCEPT

## The MICE concept – explanation using cabling solutions as an example

**M**echanical                      Mechanical properties  
**I**ngress                            Leak tightness properties  
**C**limatic                           Climatic properties  
**E**lectromagnetic                Electromagnetic properties

cables used in the industrial environment is crucially important for a fault-free and above all, reliable operation of communication and data networks.

In contrast to the cables used in the office environment, the selection of the correct insulation material for communication

First drafts of the future cabling standard show an interesting approach which could help the user with the selection of the correct cable.



	<b>M<sub>1</sub></b>	<b>M<sub>2</sub></b>	<b>M<sub>3</sub></b>
<b>Mechanical properties</b>			
Impacts (maximum acceleration)	40 ms <sup>2</sup>	100 ms <sup>2</sup>	250 ms <sup>2</sup>
Vibrations (oscillation amplitude 2-9 Hz)	1,5 mm	7,0 mm	15,0 mm
Vibrations (acceleration amplitude 9-500 Hz)	5 ms <sup>2</sup>	20 ms <sup>2</sup>	50 ms <sup>2</sup>
Tensile force	see note*	see note*	see note*
Pressure	45 N over 25 mm (linear) min.	1.100 N over 150 mm (linear) min.	2.200 N over 150 mm (linear) min.
Impact	1 J	10 J	30 J
Torsion	see note*	see note*	see note*
<b>Leak tightness properties</b>	<b>I<sub>1</sub></b>	<b>I<sub>2</sub></b>	<b>I<sub>3</sub></b>
Particle entry (max. diameter)	12,5 mm	50 µm	50 µm
Immersion	none	Liquid spray interval ≤ 12-5 l/min/≥ 6,3 mm spray/> 2-5 m distance	Liquid spray interval ≤ 12-5 l/min/≥ 6,3 mm spray/> 2-5 m distance and immersion (≤ 1 m for ≤ 30 minutes)
<b>Climatic properties</b>	<b>C<sub>1</sub></b>	<b>C<sub>2</sub></b>	<b>C<sub>3</sub></b>
Ambient temperature	-10°C to +60°C	-25°C to +70°C	-40°C to +70°C
Rate of temperature range	0,1°C per Minute	1,0°C per Minute	3°C per Minute
Humidity	5% - 85% (non-condensing)	5% - 95% (non-condensing)	5% - 95% (non-condensing)
Solar irradiation	700 Wm <sup>2</sup>	1120 Wm <sup>2</sup>	1120 Wm <sup>2</sup>
<b>Contamination by liquids foreign substances</b>	<b>Max.</b>	<b>Max.</b>	<b>Max.</b>
Sodium chlorid (Saltwater/seawater) (ppm)	0	0,3	0,3
Oil (ppm)	0	5,0	500
Sodium stearate (soap)	none	5% aqueous, not gelatinous	5% aqueous, not gelatinous
Cleaning agents	none	ffs	ffs
Dissolved carriers	none	temporary (condensation)	current
<b>Contamination by gases foreign substances (cm<sup>3</sup>/m<sup>3</sup>=ppm)</b>	<b>Average value/maximum value</b>	<b>Average value/maximum value</b>	<b>Average value/maximum value</b>
Hydrogen sulphide	<0,003/<0,01	<0,05/<0,5	<10/<50
Sulphur dioxide	<0,01/<0,03	<0,1/<0,3	<5/<15
Sulphur trioxide	<0,01/<0,03	<0,1/0,3	<5/<15
Wet chlorine (<50% humidity)	<0,0005/<0,001	<0,005/<0,03	<0,05/<0,3
Dry chlorine (<50% humidity)	<0,002/<0,01	<0,02/<0,1	<0,2/<1,0
Hydrogen chloride	-/<0,06	<0,06/<0,3	<0,6/3,0
Hydrogen fluoride	<0,001/<0,005	<0,01/<0,05	<0,1/<1,0
Ammonia	<1/<5	<10/<50	<50/<250
Nitrogen oxide	<0,05/<0,1	<0,57/<1	<5/<10
Ozone	<0,002/<0,005	<0,025/<0,05	<0,1/<1
<b>Electromagnetic properties</b>	<b>E1</b>	<b>E2</b>	<b>E3</b>
Electromagnetic discharge Contact (0,667µC)	4 kV	4 kV	4 kV
Electromagnetic discharge - Air (0,132µC)	8 kV	8 kV	8 kV
Solar irradiation	700 Wm <sup>2</sup>	1.120 Wm <sup>2</sup>	1.120 Wm <sup>2</sup>
EMC-Emission HF-AM	3 V/m at 80-2.000 MHz 1V/m at 2.000-2.700 MHz	3 V/m at 80-2.000 MHz 1V/m at 2.000-2.700 MHz	10 V/m at 80-1.000 MHz 3V/m at 1.400-2.000 MHz
Conducted HF	3 V at 150 kHz - 80 MHz	3 V at 150 kHz - 80 MHz	10 V at 150 kHz - 80 MHz
EFT/B			
Alternating current	500 V	1.000 V	2.000 V
Volatage surge (earth potential difference)			
Signal, earthing line	500 V	1.000 V	2.000 V
Magnetic field (50/60 Hz)	1 Am <sup>-1</sup>	3 AM <sup>-1</sup>	30 Am <sup>-1</sup>
Magnetic field (60-20.000 Hz)	ffs	ffs	ffs
	Surge: Long term effect of repeated surges on the channel must be taken into account		

\* Installation-specific according to IEC 61918 / Draft standard CD ISO/IEC 24702

# THE MICE CONCEPT

## Application Examples

Area of application	properties								environment class
	Humidity	Vibration	Irradiation	Electrical	UV light	Aggressiv Fields	Oil	H <sup>2</sup> O	
									Solution proposals
Chemical industry	x	x		x		x	x	x	M <sub>2</sub> I <sub>3</sub> C <sub>2</sub> E <sub>2</sub>
Car manufacturing		x		x		x	x		M <sub>3</sub> I <sub>3</sub> C <sub>2</sub> E <sub>3</sub>
Airport	x				x		x		M <sub>2</sub> I <sub>2</sub> C <sub>1</sub> E <sub>1</sub>
Transmission line	x				x		x	x	M <sub>2</sub> I <sub>2</sub> C <sub>1</sub> E <sub>1</sub>
Oil production facility	x	x			x		x	x	M <sub>3</sub> I <sub>3</sub> C <sub>2</sub> E <sub>1</sub>
Mining	x	x							M <sub>3</sub> I <sub>3</sub> C <sub>1</sub> E <sub>1</sub>
Power station	x	x	x	x					M <sub>3</sub> I <sub>3</sub> C <sub>2</sub> E <sub>3</sub>
Nuclear power station	x	x	x	x		x	x		M <sub>3</sub> I <sub>3</sub> C <sub>2</sub> E <sub>3</sub>
Steelworks	x	x		x					M <sub>3</sub> I <sub>3</sub> C <sub>2</sub> E <sub>3</sub>

Possible classification criteria of environmental requirements

# IAONA-CLASSIFICATION

General requirements for cabling components in the industrial environment according to IAONA recommendations

Parameter	Value	Notes
Operating temperature	0°C ... +55°C	Installation >5°C
Storage temperature	-25°C ... +70°C	IEC 61131-2
Storage temperature	5°C ... +55°C, 3°C/min. Test N b	IEC 6068-2-14
Humidity	10% ... 95% non-condensing	IEC 60068-2-14
Shock test	15 G, 11 ms according to EN 60068-2-27 or IEC 60068-2-27 Criterion: no mechanical or functional damage	
Vibration	5 G at 10 Hz ... 150 Hz according to EN 60068-2-6 or IEC 60068-2-6, Kriterium A	
Earthing		
Cabling class (min. requirements)	EN 50173; 2002 or ISO/IEC 11801, Klasse D	

**There are also two protection classes defined in addition to these general requirements which, on closer examination, are aimed at the protection of the connection components:**

### Light Duty (IP20)

This class contains components which are installed in a protected distribution cabinet. These requirements must be limited by those for the office environment as these cabinets are also installed in the vicinity of moving system parts. The protection class IP20 according to EN 60529 is defined for this

class which states that the components are protected against penetration by solid foreign substances no larger than 12.5 mm. Protection against penetration by moisture is not included.

### Heavy Duty (IP67)

The components in this protection class are completely exposed to the aggressive industrial environment. According to the IP67 protection class, the components are constructed absolutely dustproof and protected against damage by temporary immersion in water.

	Light Duty	Heavy Duty
Protection class Degree of contamination	IP 20 + IP 30 according to IEC 60529, EN 60529	IP 67 + IP 69 according to IEC 60529, EN 60529
Relative humidity	95% non-condensing	Temperature cycles (25°C-50°C-25°C) at 80% to 95% Relative humidity condensing according to IEC 60068-2-30
Operating temperature	0°C at +55°C	-20°C at +65°C
Shock test	15 G, 11 ms according to EN 60068-2-27 and IEC 60068-2-27 no mechanical and functional damage	15 G, 11 ms according to EN 60068-2-27 and IEC 60068-2-27 no mechanical and functional damage
Vibration	5 G at 10 Hz ... 150 Hz according to EN 60068-2-6 and IEC 60068-2-6, Krit. A	5 G at 10 Hz ... 150 Hz according to EN 60068-2-6 and IEC 60068-2-6, Krit. A

# CHARACTERISTICS\* OF INSULATING AND SHEATH MATERIALS

Designation				Electrical					Thermic			
VDE Initial Code	Abbreviations	Materials	Density	Break-down-voltage	Spezific volume resistivity	Dielectric constant	Dielectric lossfactor	Working temperature		Melting-temperature	Flame resistance	
			g/m <sup>3</sup>	KV/mm (20°C)	Ohm·cm 20°C	50 Hz/ 20°C	tan δ	permanent °C	short time °C	+°C		
Thermoplastic	Y	PVC	Polyvinylchloride compounds	1,35-1,5	25	10 <sup>13</sup> -10 <sup>15</sup>	3,6-6	4x10 <sup>-2</sup> - 1x10 <sup>-1</sup>	-30 +70	+100	> 140	self-extinguishing
	Yw	PVC	Heat resistant 90°C	1,3-1,5	25	10 <sup>12</sup> -10 <sup>15</sup>	4-6,5		-20 +90	+120	> 140	
	Yw	PVC	Heat resistant 105°C	1,3-1,5	25	10 <sup>12</sup> -10 <sup>15</sup>	4,5-6,5		-20 +105	+120	> 140	
	Yk	PVC	Cold resistant	1,2-1,4	25	10 <sup>12</sup> -10 <sup>15</sup>	4,5-6,5		-40 +70	+100	> 140	
	2Y	LDPE	low density Polyethylene	0,92-0,94	70	10 <sup>17</sup>	2,3	2x10 <sup>-4</sup>	-50 +70	+100	105-110	flammable
	2Y	HDPE	high density Polyethylene	0,94-0,98	85	10 <sup>17</sup>	2,3	3x10 <sup>-4</sup>	-50 +100	+120	130	
	2X	VPE	crossed-linked Polyethylene	0,92	50	10 <sup>12</sup> -10 <sup>16</sup>	4-6	2x10 <sup>-3</sup>	35 +90	+100	-	
	O2Y		foamed Polyethylene	-0,65	30	10 <sup>17</sup>	~1,55	5x10 <sup>-4</sup>	-40 +70	+100	105	
	3Y	PS	Polystrole	1,05	30	10 <sup>16</sup>	2,5	1x10 <sup>-4</sup>	-50 +80	+100	> 120	
	4Y	PA	Polyamide	1,02-1,1	30	10 <sup>15</sup>	4	2x10 <sup>-2</sup> - 1x10 <sup>-3</sup>	-60 +105	+125	210	
	9Y	PP	Polypropylene	0,91	75	10 <sup>16</sup>	2,3-2,4	4x10 <sup>-4</sup>	-10 +140	+140	160	
	11Y	PUR	Polyurethane	1,15-1,2	20	10 <sup>10</sup> -10 <sup>12</sup>	4-7	2,3x10 <sup>-2</sup>	-55 +80	+100	150	
	TPE-E (12Y)		Polyester; Elastomer	1,2-1,4	40	> 10 <sup>10</sup>	3,7-5,1	1,8x10 <sup>-2</sup>	-50 +100	+140	190	
TPE-O		Polyolefine; Elastomer	0,89-1,0	30	> 10 <sup>14</sup>	2,7-3,6	+130		150			
Elastomere	G	NR/SBR	Natural rubber Styrol-Butadiene-rubber-compunds	1,5-1,7	20	10 <sup>12</sup> -10 <sup>15</sup>	3-5	1,9x10 <sup>-2</sup>	-65 +60	+120	-	flammable
	2G	SiR	Silicon rubber	1,2-1,3	20	10 <sup>15</sup>	3-4	6x10 <sup>-3</sup>	-60 +180	+260	-	high flammable
	3G	EPR	Ethylen-Propylene rubber compounds	1,3-1,55	20	10 <sup>14</sup>	3-3,8	3,4x10 <sup>-3</sup>	-30 +90	+160	-	flammable
	4G	EVA	Ethylen-Vinylacetat Copolymer-compunds	1,3-1,5	30	10 <sup>12</sup>	5-6,5	2x10 <sup>-2</sup>	-30 +125	+200	-	
	5G	CR	Polychloropren compounds	1,4-1,65	20	10 <sup>10</sup>	6-8,5	5x10 <sup>-2</sup>	-40 +100	+140	-	self-extinguishing
	6G	CSM	Chlorsulfonated Polyethylene compounds	1,3-1,6	25	10 <sup>12</sup>	6-9	2,8x10 <sup>-2</sup>	-30 +80	+140	+160	
High temp. materials	10Y	PVDF	Polyvinylidene fluoride Kynar/ Dyflor	1,7-1,9	25	10 <sup>14</sup>	9-7	1,4x10 <sup>-2</sup>	-40 +135	+160	> 170	self-extinguishing
	7Y	ETFE	Ethylene-tetrafluor ethylene	1,6-1,8	36	10 <sup>16</sup>	2,6	8x10 <sup>-4</sup>	-100 +150	+180	> 265	
	6Y	FEP	Fluorine ethylene propylene	2,0-2,3	25	10 <sup>18</sup>	2,1	3x10 <sup>-4</sup>	-100 +205	+230	> 225	
	5YX	PFA	Perfluoralkoxypolimeric	2,0-2,3	25	10 <sup>18</sup>	2,1	3x10 <sup>-4</sup>	-190 +260	+280	> 290	
	5Y	PTFE	Polytetrafluorethylene	2,0-2,3	20	10 <sup>18</sup>	2,1	3x10 <sup>-4</sup>	-190 +260	+300	> 325	
halogen-free compounds	H	uncross-linked	halogen-free Polymer-compunds	1,4-1,6	25	10 <sup>12</sup> -10 <sup>14</sup>	3,4-5	~10 <sup>-1</sup>	-30 +70	+100	> 130	self-extinguishing
	HX	crosslinked	halogen-free Polymer-compunds	1,4-1,6	25	10 <sup>13</sup> -10 <sup>14</sup>	3,4-5	10 <sup>-2</sup> - 10 <sup>-1</sup>	-30 +90	+150	-	

\* The characteristics valid for unprocessed materials

Thermic				Mechanical							Halogen-free	Weather	
Oxygen index LOI (% O <sub>2</sub> )	Heating value H <sub>0</sub> MU kg <sup>-1</sup>	Thermal-conductivity W K <sup>-1</sup> m <sup>-1</sup>	Corrosive gases in case of fire	Radiation resistance max. Mrad	tensile strength N/mm <sup>2</sup>	Elongation at break %	Shorehardness	Abrasion resistance	Abrasion resistance	halogenfree	Weather resistance	Cold resistance	
23-42	17-25	0,17	Hydrogen chlorid	80	10-25	130-350	70-95 (A)	medium	0,4	no	medium in black	moderate good	
	16-22												
	24-42												16-20
	17-24												
≤22	42-44	0,3	no	100	10-20	400-600	43-50 (D)	good	0,1	yes	good	very good	
		0,4			20-30	500-1000	60-63 (D)					medium good	
0,3		12,5-20	300-400		40-45 (D)	-	-						-
18-30	0,25	80	55-65	300-400	35-50 (D)	good	0,4	yes	-	moderate good	moderate good		
≤22	40-43		0,25	10	50-60	50-170	-		very good	1,0-1,5	good	good	
	27-31	0,23	20-35		300	55-60 (D)	medium good	0,1	yes <sup>2)</sup>	medium	good		
20-26	20-26	0,25	100 (500)	30-45	500-700	70-100(A)	very good	1,5	yes	very good	very good		
≤29	20-25	0,5	10	30	>300	85 (A) 70 (D)	good		yes	very good	very good		
≤25	23-28	1,5		20		55 (A) 70 (D)							
≤22	21-25	-	no	100	5-10	300-600	60-70 (A)	moderate	1,0	yes	very good	very good	
25-35	17-19	0,22		50			40-80 (A)						
≤22	21-25	-		200	200-400	65-85 (A)	70-80 (A)					good	
	19-23	-		100	8-12	25-350							
30-35	14-19	-	Hydrogen chlorid	50	10-20	400-700	55-70 (A)	moderate	1,5	no	very good	moderate good	
	19-23	-				35-600	60-70 (A)					medium	
40-45	15	0,17	Hydrofluoric	10	50-80	150	75-80 (D)	very good	no	very good	very good	very good	
30-35	14	0,24	yes		40-50	150	70-75 (D)						
>95	5	0,26			1	15-25	250						55-60 (D)
		0,21	0,1		25-30	80							
0,26	80	50											
≤40	17-22	0,17	no	100	8-13	150-250	65-95 (A)	moderate	0,2-1,5	yes	medium in black: good	medium	
	16-25	0,20		200	8-13	150-250							

# ■ ESSENTIAL CABLE PARAMETERS

## Wave impedance

Characteristic impedance is the terminating resistance of a cable at which no line reflections occur, i.e. the total power fed into the cable by a signal source is transmitted at the characteristic impedance on the output, except for the losses caused by cable attenuation. A data cable's task is transmitting electrical pulse groups. The higher the desired data bit rate, the greater the frequency bandwidth that must be selected for the transmission channel (e.g. cable). Output impedance and input impedance of the devices connected to the cable must match (or must be adapted) to the characteristic impedance of the data cable. If this is not the case, then pulse distortions occur, which means defective transmission. The characteristic impedances of symmetric cables for telecommunications engineering are standardised in EN 50173 or ISO/IEC 11801: 100, 120 and 150.

## Wave attenuation $\alpha$ [dB]

Cable attenuation reduces the signal amplitude arriving at the output, and thus limits the free cable lengths that can be implemented. Ohmic loss resistance in the longitudinal direction occurs due to the conductor material and the conductor cross section. In addition the skin effect (current displacement) reduces the effective conductor cross section as frequency increases. The frequency dependence of the selected core insulation material also determines additional capacitive loss resistances between the conductors. Cable attenuation, which is usually specified at a reference length of 100 m, defines the ratio of transmission level to reception level.

## Near-end crosstalk NEXT, $\alpha_{NN}$ [dB]

Cross-talk describes the undesired passover of signal energy into a neighbouring line channel. In this process, the electromagnetic field of the wanted signal of a conductor pair generates an interference signal on the same cable side (NEAR-END) in a neighbouring core pair. Near-end crosstalk (NEXT) results from the power ratio "Input power on the interfering pair to output power on the disturbed pair", but at the same end of the cable.

## Far-end crosstalk FEXT, $\alpha_{FN}$ [dB]

The electromagnetic field of the wanted signal at the input of the pair generates an interference signal at the output side (FAR-END) of a neighbouring pair. Far end crosstalk (FEXT) results from the power ratio "Input power on the interfering core pair to output power on the disturbed pair", but at the opposite end of the cable.

## ELFEXT

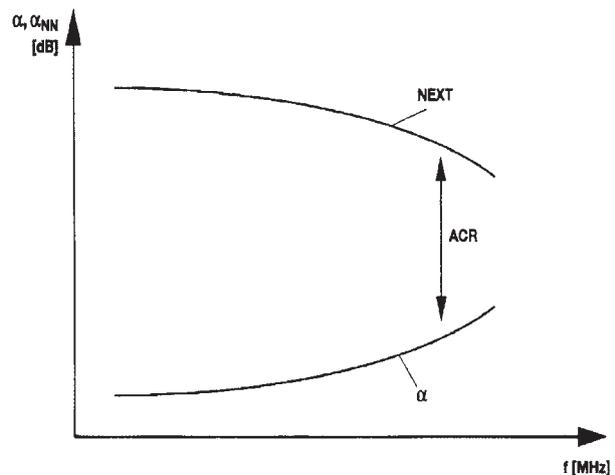
ELFEXT is a relative value that defines the ratio of the crosstalk output level to the actual output level. The interference level interspersed on the second pair is placed in the ratio to the output level. The ELFEXT value has the advantage relative to the FEXT value that it is not dependent on channel length, because the interference signal as well as the output signal depend on the channel length, and are determined on the same remote point.

## Attenuation to Crosstalk Ratio - ACR [dB]

The ACR value is determined by the difference of near-end crosstalk and line attenuation, measured at the same frequency.

## $ACR(f) = NEXT(f) - \alpha(f)$

Thus, in order to ensure problem-free transmission, the ACR must be as high as possible (high NEXT and low wave attenuation). The ACR value is a characteristic value used for simple evaluation of a cable's transmission quality. For cables, the ACR should be at least 10dB at the highest signal transmission frequency.



## Power Sum NEXT [dB]

Crosstalk is the signal portion induced in one line channel from a neighbouring line channel. The power sum is calculated from the addition of the crosstalk values of all elements contained in the cable.

# ■ ESSENTIAL CABLE PARAMETERS

## PSACR

Power Sum ACR defines the sum of all ACRs detected for the individual pairs (difference NEXT to attenuation).

## PSELFEXT

The power sum FEXT comprises the powersum of the far-end crosstalk. This is the sum of all interference signals that are coupled in a pair. For 2 pair cable the PSFEXT corresponds to the FEXT; if the number of conductor pairs is higher, then the differences become ever greater because the interference signals from all pairs are interspersed in one pair.

## Return loss attenuation [dB]

If there are different wave resistances (e.g. between cable and a component), then a portion of the supplied signal energy is reflected at this interference point. Such reflections must be kept to a minimum to ensure problem-free transmission.

## Delay Skew

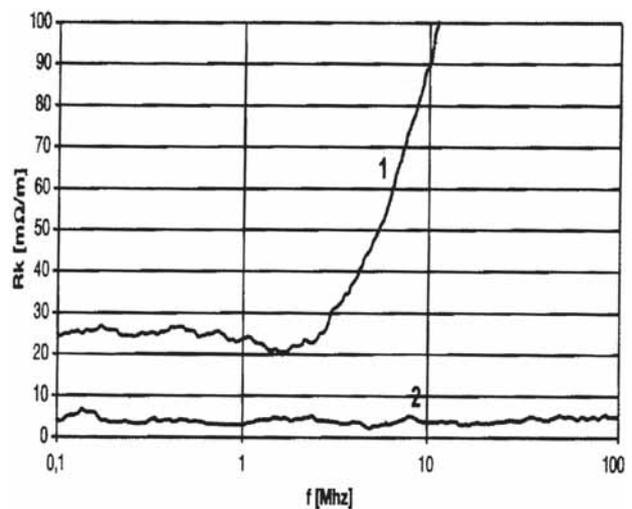
This refers to the runtime differences of the individual pairs.

## Transfer impedance $R_k$ [ $\Omega/m$ ]

As the transmission frequency for data lines increases, electromagnetic compatibility (EMC) becomes increasingly more important. To protect the cables from the effects of unwanted interference or to protect any surrounding electrical systems from disruptive emanations from the cable, more attention is being paid to adequate shielding for data transmission lines.

The magnetic field of a pair of conductors can largely be compensated for by twisting the wires, but the electrical field has to be countered by attaching sheet shielding and/or braided shielding. The transfer impedance (coupling resistance) is frequency-dependent and increases with the length of the cable (linear). The coupling resistance is therefore specified in

$\Omega/m$  and should be as low as possible. The lower the coupling resistance, the more efficient the shielding effect and the more significantly it contributes toward optimizing the EMC values of the entire system. Another important factor for the shielding effect is the choice and quality of the grounding point, which should have as low a resistance value as possible over the entire frequency range. By using double shielding (sheet and braided shielding), a vastly improved shielding effect can be obtained, particularly in the higher frequency range.



- 1 ... Foilenshirm
- 2 ... Folien- und Geflechtershirm
- 1 ... Sheet shielding
- 2 ... FSheet and braided shielding

# ■ EN (EUROPEAN) STANDARDS

## EN 50173 Channel Class C / Cat. 3, low-frequency (phone, DSL)

Wire Map	Resolution $\Omega$	Length Max.	Prop. Delay nS	Delay Skew nS	Freq. MHz	Insertion Loss dB	NEXT dB	RL dB	ACR-N dB	ACR-F dB	PS NEXT dB	PS ACR-N dB	PS ACR-F dB
12345678	40	i	555	50	1	4,2	39,1	15,0	34,9				
12345678					4	7,6	29,2	15,0	21,6				
					8	10,4	24,3	15,0	13,9				
12345678S					10	11,5	22,7	15,0	11,2				
12345678S					16	14,4	19,4	15,0	5,0				

## EN 50173 Channel Class D / Cat. 5, Ethernet to 100 MBit/s (4-pairs)

Wire Map	Resolution $\Omega$	Length Max.	Prop. Delay nS	Delay Skew nS	Freq. MHz	Insertion Loss dB	NEXT dB	RL dB	ACR-N dB	ACR-F dB	PS NEXT dB	PS ACR-N dB	PS ACR-F dB
12345678	25	i	555	50	1	4,2	60,0	17,0	56,0	57,4	57,0	53,0	54,4
12345678					4	4,5	53,5	17,0	49,0	45,4	50,5	46,0	42,4
					8	6,4	48,6	17,0	42,2	39,3	45,6	39,2	36,3
12345678S					10	7,2	47,0	17,0	39,8	37,4	44,0	36,8	34,4
12345678S					16	9,1	43,6	17,0	34,5	33,3	40,6	31,5	30,3
					20	10,2	42,0	17,0	31,8	31,4	39,0	28,8	28,4
					25	11,5	40,3	16,0	28,9	29,4	37,3	25,9	26,4
					31,25	12,9	38,7	15,1	25,8	27,5	35,7	22,8	24,5
					62,5	18,6	33,6	12,0	15,0	21,5	30,6	12,0	18,5
					100	24,0	30,1	10,0	6,1	17,4	27,1	3,1	14,4

## EN 50173 Channel Class E / Cat. 6, Ethernet 200 MBit/s (4-pair), up to 1000 MBit/s

Wire Map	Resolution $\Omega$	Length Max.	Prop. Delay nS	Delay Skew nS	Freq. MHz	Insertion Loss dB	NEXT dB	RL dB	ACR-N dB	ACR-F dB	PS NEXT dB	PS ACR-N dB	PS ACR-F dB
12345678	25	i	555	50	1	4,0	65,0	19,0	61,0	63,3	62,0	58,0	60,3
12345678					4	4,2	63,0	19,0	58,9	51,2	60,5	56,4	48,2
					8	5,9	58,2	19,0	52,3	45,2	55,6	49,7	42,2
12345678S					10	6,6	56,6	19,0	50,0	43,3	54,0	47,4	40,3
12345678S					16	8,3	53,2	18,0	44,9	39,2	50,6	42,3	36,2
					20	9,3	51,6	17,5	42,3	37,2	49,0	39,7	34,2
					25	10,5	50,0	17,0	39,6	35,3	47,3	36,9	32,3
					31,25	11,7	48,4	16,5	36,7	33,4	45,7	34,0	30,4
					62,5	16,9	43,4	14,0	26,5	27,3	40,6	23,7	24,3
					100	21,7	39,9	12,0	18,2	23,3	37,1	15,4	20,3
					200	31,7	34,8	9,0	3,1	17,2	31,9	0,1	14,2
					250	35,9	33,1	8,0	-2,8	15,3	30,2	-5,8	12,3

## EN 50173 Channel Class EA / Cat. 6A, Ethernet up to 10 Gbit/s, short-length

Wire Map	Resolution $\Omega$	Length Max.	Prop. Delay nS	Delay Skew nS	Freq. MHz	Insertion Loss dB	NEXT dB	RL dB	ACR-N dB	ACR-F dB	PS NEXT dB	PS ACR-N dB	PS ACR-F dB
12345678	25	i	555	50	1	4,0	65,0	19,0	61,0	63,3	62,0	58,0	60,3
12345678					4	4,2	63,0	19,0	58,9	51,2	60,5	56,4	48,2
					8	5,8	58,2	19,0	52,4	45,2	55,6	49,8	42,2
12345678S					10	6,5	56,6	19,0	50,1	43,3	54,0	47,5	40,3
12345678S					16	8,2	53,2	18,0	45,0	39,2	50,6	42,4	36,2
					20	9,2	51,6	17,5	42,5	37,2	49,0	39,8	34,2
					25	10,2	50,0	17,0	39,8	35,3	47,3	37,1	32,3
					31,25	11,5	48,4	16,5	36,9	33,4	45,7	34,2	30,4
					62,5	16,4	43,4	14,0	27,0	27,3	40,6	24,2	24,3
					100	20,9	39,9	12,0	19,0	23,3	37,1	16,2	20,3
					200	30,1	34,8	9,0	4,7	17,2	31,9	1,8	14,2
					250	33,9	33,1	8,0	-0,8	15,3	30,2	-3,7	12,3
					350	40,6	30,6	6,6	-10,0	12,4	27,6	-13,0	9,4
					500	49,3	27,9	6,0	-21,4	9,3	24,8	-24,5	6,3

## ■ EN (EUROPEAN) STANDARDS

EN 50173 Channel Class F / Cat. 7, Ethernet up to 1000 Mbit/s, Ethernet up to 10 Gbit/s, short length													
Wire Map	Resolution	Length	Prop. Delay	Delay Skew	Freq.	Insertion Loss	NEXT	RL	ACR-N	ACR-F	PS NEXT	PS ACR-N	PS ACR-F
	$\Omega$	Max.	nS	nS	MHz	dB	dB	dB	dB	dB	dB	dB	dB
12345678	25	i	555	30	1	4,0	65,0	19,0	61,0	65,0	62,0	58,0	62,0
12345678					4	4,1	65,0	19,0	60,9	65,0	62,0	57,9	62,0
					8	5,7	65,0	19,0	59,3	62,4	62,0	56,3	59,4
12345678S					10	6,4	65,0	19,0	58,6	60,8	62,0	55,6	57,8
12345678S					16	8,1	65,0	18,0	56,9	57,5	62,0	53,9	54,5
					20	9,1	65,0	17,5	55,9	55,9	62,0	52,9	52,9
					25	10,2	65,0	17,0	54,8	54,4	62,0	51,8	51,4
					31,25	11,4	65,0	16,5	53,6	52,8	62,0	50,6	49,8
					62,5	16,3	65,0	14,0	48,7	47,8	62,0	45,7	44,8
					100	20,8	62,9	12,0	42,1	44,4	59,9	39,1	41,4
					200	30,0	58,3	9,0	28,4	39,4	55,3	25,4	36,4
					250	33,8	56,9	8,0	23,1	37,8	53,9	20,1	34,8
					600	54,6	51,2	8,0	-3,4	31,3	48,2	-6,4	28,3

EN 50173 Channel Class FA / Cat. 7A, Ethernet up to 10 Gbit/s (IEEE 802.3an)

Wire Map	Resolution	Length	Prop. Delay	Delay Skew	Freq.	Insertion Loss	NEXT	RL	ACR-N	ACR-F	PS NEXT	PS ACR-N	PS ACR-F
	$\Omega$	Max.	nS	nS	MHz	dB	dB	dB	dB	dB	dB	dB	dB
12345678	25	i	555	30	1	4,0	65,0	19,0	61,0	65,0	62,0	58,0	62,0
12345678					4	4,1	65,0	19,0	60,9	65,0	62,0	57,9	62,0
					8	5,7	65,0	19,0	59,3	65,0	62,0	56,3	62,0
12345678S					10	6,4	65,0	19,0	58,6	65,0	62,0	55,6	62,0
12345678S					16	8	65,0	18,0	57,0	63,3	62,0	54,0	60,3
					20	9	65,0	17,5	56,0	61,4	62,0	53,0	58,4
					25	10	65,0	17,0	55,0	59,4	62,0	52,0	56,4
					31,25	11,2	65,0	16,5	53,8	57,5	62,0	50,8	54,5
					62,5	15,9	65,0	14,0	49,1	51,5	62,0	46,1	48,5
					100	20,3	65,0	12,0	44,7	47,4	62,0	41,7	44,4
					200	28,9	60,9	9,0	32,0	41,4	57,9	29,0	38,4
					250	32,5	59,1	8,0	26,7	39,4	56,1	23,7	36,4
					600	51,4	51,2	8,0	0,7	31,8	49,1	-2,3	28,8

(STAND 07/2010)

# ■ CLASSIFICATION OF FIBRE OPTIC CABLES / TRANSMISSION RANGES

Transmission distance according to ISO/IEC 11801 (2<sup>nd</sup> Edition) bzw. EN 50173

Attenuation of the transmission distance

Class	Attenuation [dB]			
	Multimode LWL ; 50 µm und 62,5 µm		Singlemode LWL	
	850 nm	1300 nm	1310 nm	1550 nm
OF 300	2,55	1,95	1,80	1,80
OF 500	3,25	2,25	2,00	2,00
OF 2000	8,50	4,50	3,50	3,50

OF ... = Optical Fiber mit Übertragungsstrecke in m.

Specification for 10 Mbit/s bis 1 Gbit/s

Application	Fibre type							
	OM 1		OM 2		OM 3		OS 1	
	850 nm	1300 nm	850 nm	11300 nm	850 nm	1300 nm	1310 nm	1550 nm
FOIRL	OF 2000		OF 2000		OF 2000			
10 BASE-FL, FP und -FB	OF 2000		OF 2000		OF 2000			
100 BASE-FX		OF 2000		OF 2000		OF 2000		
1000 BASE-SX	OF 300		OF 500		OF 500			
1000 BASE-LX		OF 500		OF 500		OF 500	OF 2000	

Specification for 10 Gbit/s

Application	Fibre type							
	OM 1		OM 2		OM 3		OS 1	
	850 nm	1300 nm	850 nm	11300 nm	850 nm	1300 nm	1310 nm	1550 nm
10 BASE-LX4		OF 300		OF 300				
10 BASE-ER/EW								OF 2000
10 BASE-SR/SW					OF 300			
10 BASE-LR/LW							OF 2000	

Ranges for 10/100/1000/10000 Mbit/s-Ethernet

	Medium	Cable	Range <sup>1)</sup>
Ethernet	AUI		50 m
	10BASE2	Thin Ethernet	185 m
	10BASE5	Thin Ethernet	500 m
	10BASE-T	Twisted Pair	100 m
	10BASE-FL	62,5 µm, 50µm Multimode-LWL	2.000 m
Fast Ethernet	100BASE-TX	Twisted Pair	100 m
	100BASE-FX	62,5 µm, 50µm Multimode-LWL HDX	412 m
		62,5 µm, 50µm Multimode-LWL FDX	2.000 m
Gigabit Ethernet	1000BASE-CX	Koax	25 m
	1000BASE-T	Twisted Pair, Cat. 5	100 m
	1000BASE-SX	62,5 µm Multimode LWL	275 m
		50 µm Multimode LWL	550 m
	1000BASE-LX	62,5 µm Multimode LWL	550 m
		50 µm Multimode LWL	550 m
10 Gigabit Ethernet	10GBASE-LX4	Multimode LWL	300 m
	10GBASE-SR/SW	Multimode LWL	66 m
	10GBASE-LR/LW	Singlemode LWL	10.000 m
	10GBASE-ER/EW	Singlemode LWL	40.000 m

<sup>1)</sup>minimum supported value

## FIBRESPECIFICATIONS

<b>Graded index fibres</b>			
<b>Specification</b>		<b>Fibre type G 50/125</b>	<b>Fibre type G 62,5/125</b>
Fibre categorie		OM2 Standard fibre	OM1 Standard fibre
Core diameter		50 ± 3 µm	62,5 ± 3 µm
Numerical aperture		0,200 ± 0,015	0,275 ± 0,015
Typ. attenuation	850 nm	2,5 dB/km	3,0 dB/km
	1300 nm	0,7 dB/km	1,0 dB/km
Min. bandwidth	850 nm	500 MHz x km	200 MHz x km
	1300 nm	500 MHz x km	500 MHz x km
Cladding diameter		125 ± 1 µm	
Primary coating diameter		245 ± 10 µm	
Core noncircularity		< 5 %	
Cladding concentricity error		< 3,0 µm	
Cladding nonconcentricity		< 2,0 %	
<b>Specification</b>		<b>Fibre type G 50/125</b>	
Fibre categorie		OM3 Standard fibre	OM4 Standard fibre
Core diameter		50 ± 3 µm	50 ± 3 µm
Numerical aperture		0,200 ± 0,015	0,200 ± 0,015
Typ. attenuation	850 nm	2,5 dB/km	2,4 dB/km
	1300 nm	0,5 dB/km	0,7 dB/km
Min. bandwidth	850 nm	1500 MHz x km	3500 MHz x km
	1300 nm	500 MHz x km	500 MHz x km
Cladding diameter		125 ± 1 µm	125 ± 1 µm
Primary coating diameter		245 ± 10 µm	245 ± 10 µm
Core noncircularity		< 5 %	< 5 %
Cladding concentricity error		< 3,0 µm	< 6,0 µm
Cladding nonconcentricity		< 2,0 %	< 2,0 %

<b>Single-Mode-Fibre</b>			
<b>Specification</b>		<b>Fibre type E9...10/125 (single mode)</b>	
Fibre categorie		ITU-T G. 652.d	ITU-T G 657.A1
Attenuation	1310 nm	≤ 0,35 dB/km	≤ 0,34 dB/km
	1550 nm	≤ 0,24 dB/km	≤ 0,20 dB/km
Dispersion	1550 nm	≤ 22 ps/(nm x km)	
	1625 nm	≤ 18 ps/(nm x km)	≤ 17,5 ps/(nm x km)
Wave length		1304 - 1324 nm	1300 - 1322 nm
Mode field diameter at 1310 nm		9,2 ± 0,4 µm	9,0 ± 0,3 µm
Cladding diameter		125 ± 1 µm	125 ± 0,7 µm
Primary coating diameter		245 ± 10 µm	245 ± 5 µm
Cut-off wavelength		≤ 1260 nm	≤ 1260 nm
Cladding concentricity error		≤ 0,8 µm	≤ 0,5 µm
Cladding nonconcentricity		< 1,0 %	< 0,7 %

\*ITU-T G 657 A2, B3 on request

<b>POF and HCS-Fibre</b>			
<b>Specification</b>		<b>Fibre type POF P980/1000</b>	<b>Fibre type HCS K200/230</b>
Core diameter		980 µm	200 µm
Numerical aperture		0,5	0,37
Typ. attenuation	650nm	160 dB/km	10 db/km
	850nm	-	8 dB/km
Min. Bandwidth	650nm	10 MHz x 100m	17 MHz x km
	850nm	-	20 MHz x km
Wallthickness		1000 µm	230 µm

Fibres with other parameters on request

# ■ NETWORKS AND FIELD BUSES

## Ethernet

## Profibus



<b>Topology</b>	Star topology where star points are made via active equipment (hub or switch)	Profibus-DP is designed as point-to-point topology. The bus is terminated at both ends with a resistance network connected to the power supply.																															
<b>Electrical interface, Data transmission</b>	Symmetrical interface, full duplex. Galvanic Decoupling via carrier.	based on symmetrical interface RS 485																															
<b>Data transfer rate</b>	10/100/1000/10.000 Mbit/s	9,6 Kbit/s - 12 Mbit/s																															
<b>Electrical interface, Energy transfer</b>	RJ 45, 8-pin PoE+, 8023at, 802.3af	RS 485																															
<b>Signal designation, Core assignment</b>	<table border="0"> <tr><td>Transmit +</td><td>orange</td></tr> <tr><td>Transmit -</td><td>white/orange</td></tr> <tr><td>Receive +</td><td>green</td></tr> <tr><td>Receive -</td><td>green/white</td></tr> </table>	Transmit +	orange	Transmit -	white/orange	Receive +	green	Receive -	green/white	<table border="0"> <tr><td>A-line</td><td>green</td></tr> <tr><td>B-line</td><td>red</td></tr> </table>	A-line	green	B-line	red																			
Transmit +	orange																																
Transmit -	white/orange																																
Receive +	green																																
Receive -	green/white																																
A-line	green																																
B-line	red																																
<b>Plug connector for IP20 or higher</b>	RJ 45 for Light-Duty	D-SUB 9, M12																															
<b>Plug connector for IP67 or higher</b>	RJ 45 for Heavy-Duty M12, 4-pole, D-coded	D-SUB 9, M12, 5-pole, B-coded																															
<b>Pin assignment</b>	<table border="1"> <thead> <tr> <th rowspan="2">Signal designation</th> <th colspan="2">Plug connector</th> </tr> <tr> <th>RJ 45</th> <th>M12</th> </tr> </thead> <tbody> <tr><td>Transmit +</td><td>2</td><td>1</td></tr> <tr><td>Transmit -</td><td>1</td><td>3</td></tr> <tr><td>Receive +</td><td>6</td><td>2</td></tr> <tr><td>Receive -</td><td>3</td><td>4</td></tr> </tbody> </table>	Signal designation	Plug connector		RJ 45	M12	Transmit +	2	1	Transmit -	1	3	Receive +	6	2	Receive -	3	4	<table border="1"> <thead> <tr> <th rowspan="2">Signal designation</th> <th colspan="2">Plug connector</th> </tr> <tr> <th>D-SUB 9</th> <th>M12</th> </tr> </thead> <tbody> <tr><td>A-line</td><td>8</td><td>2</td></tr> <tr><td>B-line</td><td>3</td><td>4</td></tr> <tr><td>shield</td><td>1</td><td>5</td></tr> </tbody> </table>	Signal designation	Plug connector		D-SUB 9	M12	A-line	8	2	B-line	3	4	shield	1	5
Signal designation	Plug connector																																
	RJ 45	M12																															
Transmit +	2	1																															
Transmit -	1	3																															
Receive +	6	2																															
Receive -	3	4																															
Signal designation	Plug connector																																
	D-SUB 9	M12																															
A-line	8	2																															
B-line	3	4																															
shield	1	5																															
<b>Bus length</b>	up to 100m from the Hub/switch to the terminal device	up to 1200m per Segment																															
<b>Number of participants</b>	unlimited	up to 126, bis 32 per Bus segment																															
<b>Directive</b>	Industrial Ethernet Planning, EN 50173 and Installation Guide, PNO (Profinet)	Guideline 2.142, PNO																															
<b>Standardisation</b>	IEE 802.3	EN 50170																															

## CAN



CAN is designed as point-to-point topology. The bus is terminated at both ends with a terminating resistor

Symmetrical interface, with special definition using CAN transceiver chips

up to 1Mbit/s

not in the standard configuration

CAN_L	green
CAN_H	yellow
CAN_GND	brown

COMBICON  
D-SUB 9  
RJ 45

M12, 5-pole, A-coded  
7/8", 5-pole

Signal designation	Plug connector				
	COMBICON	D-SUB 9	M12	RJ 45	7/8"
CAN_L	2	2	5	2	5
CAN_H	4	7	4	1	4
CAN_GND	1	3	3	3	3

up to 1000m

up to 640

CiA DR-303-1

not specified

## Interbus



The Interbus is designed as an active ring. In order to overcome the disadvantage of doubled cable layout, the outgoing and return signals are included in one cable so that the user has the impression of a point-to-point topology.

based on symmetrical S 485 interface

500 kBit/s or 2 Mbit/s

not in the standard configuration

DO	yellow
DO	green
DI	grey
DI	pink
COM	brown

D-SUB 9

D-SUB 9  
M12, 5-pole, B-coded

Signal designation	Plug connector	
	D-SUB 9	M12
<u>DO</u>	1	1
DO	6	2
<u>DI</u>	2	3
DI	7	4
COM	3	5

up to 400m between two participants, up to 13 km total length

up to 4096

INTERBUS-conformity test

IEC 61158

## Device Net



Like CAN, another power supply is also transmitted. The series line is called the "trunk line" and the stubs are called "drop lines". The "thick cable" is used for the trunk line and "thin cable" is used for the drop or trunk line.

Symmetrical interface with special definition using CAN transceiver chips

up to 500 KBits/s

24 V DC  
8 A for thick cable  
3 A for thin cable

CAN_L	blue
CAN_H	white
V-	red
V+	black
Drain	colourless

COMBICON

M12, 5-pole, A-coded  
7/8", 5-pole

Signal designation	Plug connector		
	COMBICON	M12	7/8"
CAN_L	2	5	5
CAN_H	4	4	4
V+	5	2	2
V-	1	3	3
Drain	3	1	1

up to 500m

up to 2048

DeviceNet Connector Profiles

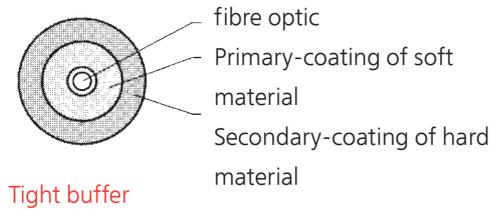
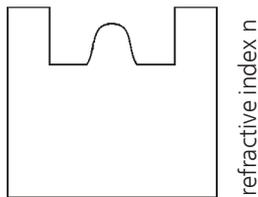
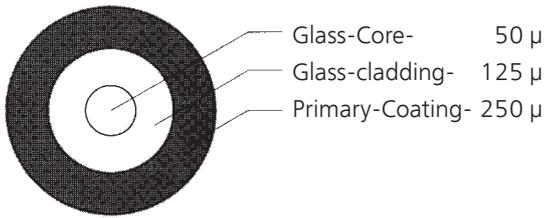
not specified

# FIBRE-OPTIC CABLES-CODE ACC. TO DIN VDE 0888

□	—	□	□	□	□	□	□	□	□	□	□	□	□	□
1		2	3	4	5	6	7	8	9	10	11	12	13	14
														Lg layerstranding
														Bandwidth in MHz x km (GF) dispersion parameter in $\frac{\text{ps}}{\text{nm} \times \text{km}}$
														Wavelength B $\hat{=}$ 850 nm F $\hat{=}$ 1300 nm H $\hat{=}$ 1550 nm
														Attenuation coefficient in dB/km
														Cladding diameter in $\mu\text{m}$
														Core diameter in $\mu\text{m}$ of graded index fibre Field diameter in $\mu\text{m}$ of single mode fibre
														Design E Single mode fibre G Graded index fibre
														Number of fibres Number of fibres per buffer Number of multifibres per buffer
														Y PVC-sheath H Sheath with halogenfree material B Armouring BY Armouring with PVC-protective covering sheath B2Y Armouring mit PE-protective covering sheath
														Y PVC-sheath 2Y PE-sheath 4Y PA-sheath 11Y PUR-sheath (L)2Y PE-Laminated sheath (ZN)2Y PE-sheath with nometallic strength member (L)(ZN)2Y PE-Laminated sheath with nometallic strength member
														F Filling of the cable core with petroleum jelly Q Swellingmaterial
														S Metallic element in the cable core
														V Tight buffer K Composite buffer fibre H Loose buffer nonfilled W Loose buffer, filled B Multifibre buffer nonfilled D Multifibre buffer filles
														I Indoor cable AI Outdoor / Indoor cable (universal) A Outdoor cable AT Outdoor fan out cable

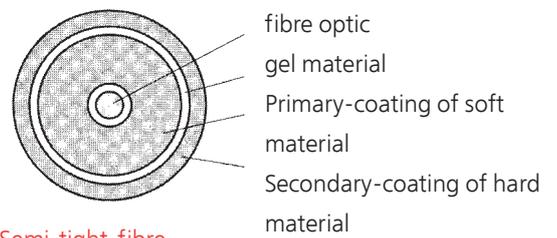
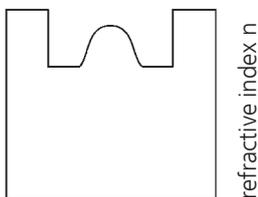
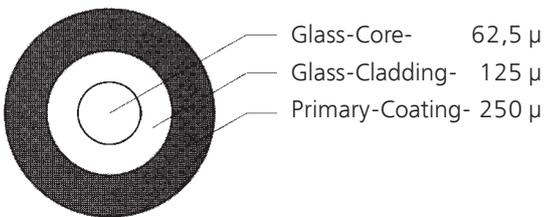
# CROSS-SECTIONS OF FIBRE OPTICS AND CORES

## Graded index fibre G 50/125



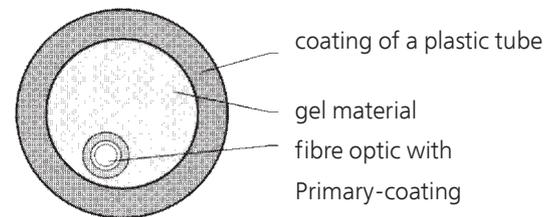
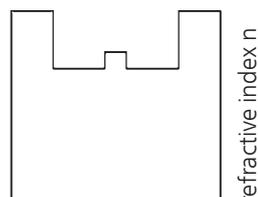
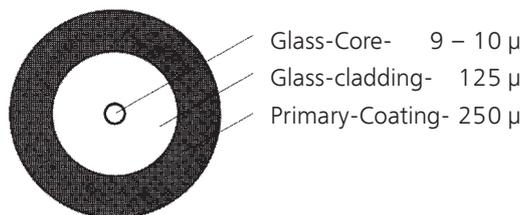
Tight buffer

## Graded index fibre G 62,5/125

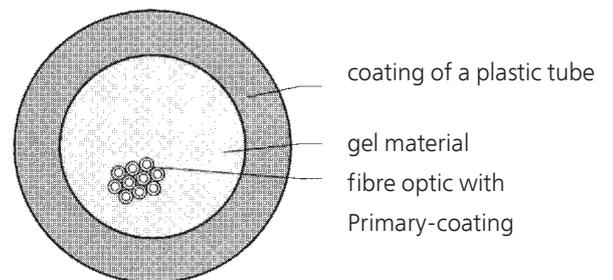


Semi-tight-fibre

## Single-mode fibre E . . 10/125

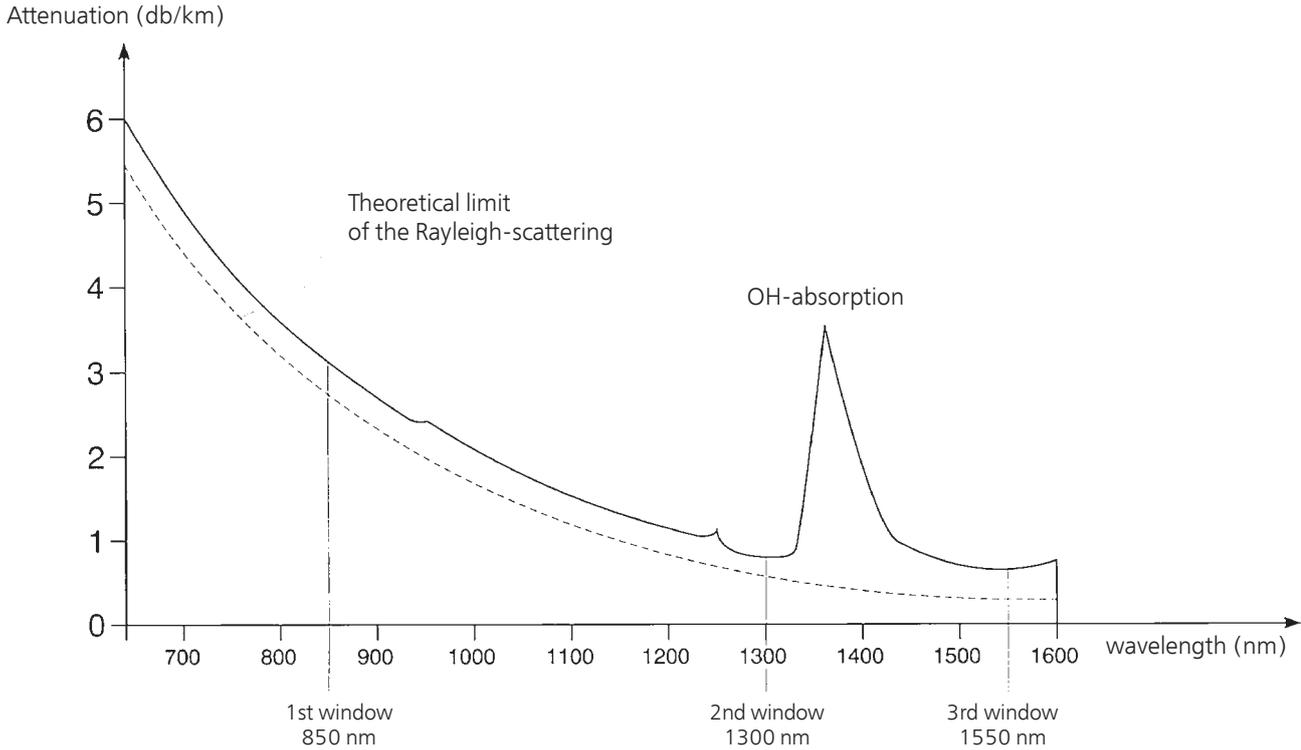


Loose buffer filled



Multifibre buffer filled

# SPECTRAL ATTENUATION CHARACTERISTIC OF GLASS

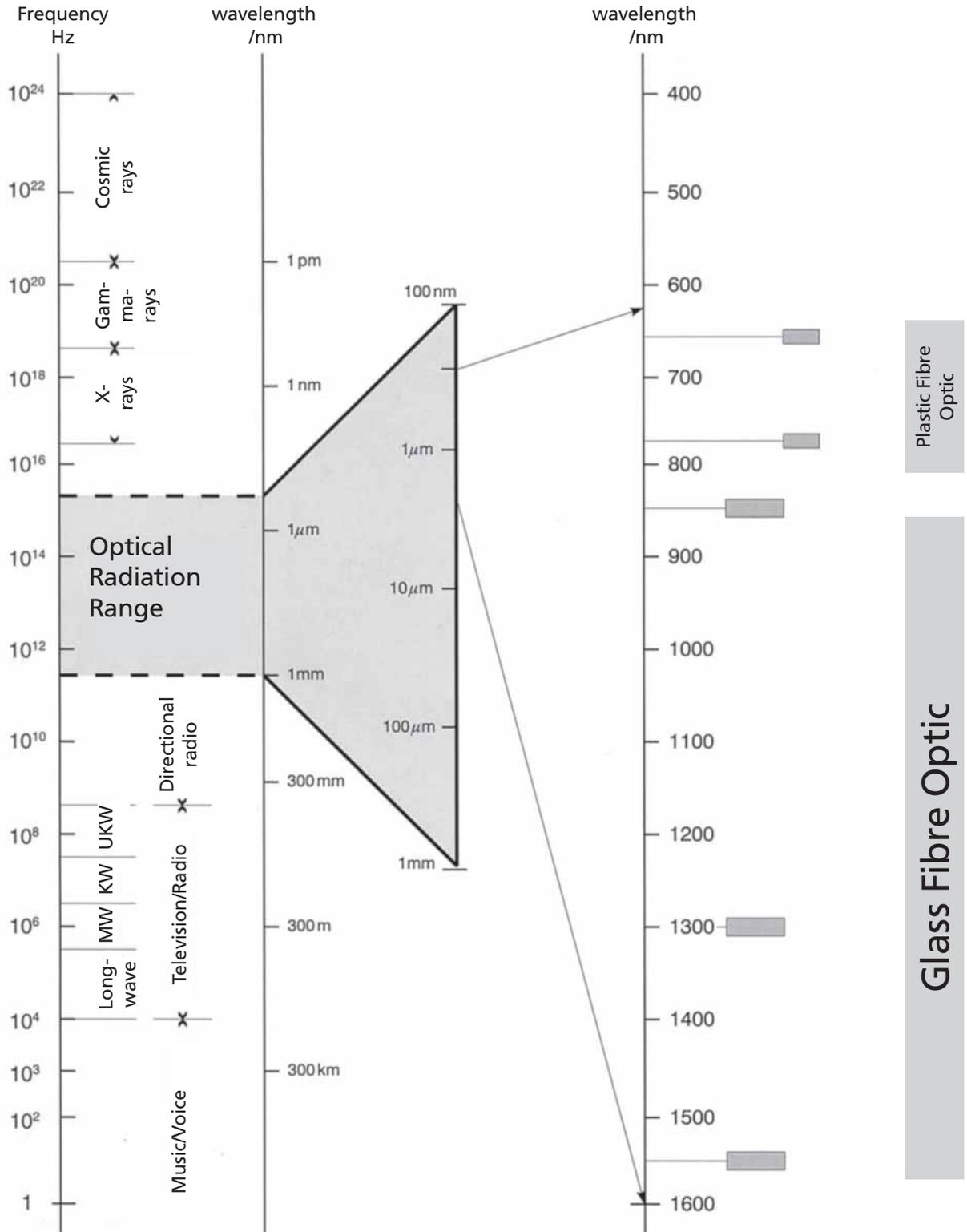


Rayleigh-scattering means the losses that result from the continuous dispersion of light. This continuous dispersion originates in a local change of the refractive index. The refractive index is changed by irregularities of the density of fused silica glass. The Rayleigh-scattering decreases with the increasing of wavelength. Entering of moisture produces OH-ions which cause limited but very high peaks of attenuation at ca. 950, 1200 and 1400 nm.

## Index profiles and characteristics

Fibre-cross-section	Profile of refractive index	Wave propagation (modes) and change of pulse	Characteristics
<p>Step index</p>	<p>Multimode fibre</p>	<p>Input pulse</p> <p>Output pulse</p>	<ul style="list-style-type: none"> <li>• Bandwidth &lt; 100 MHz / km</li> <li>• Dispersion 10...150 ns / km</li> <li>• Long impulse spreading for short distances &lt; 500 m</li> <li>• Attenuation: middle-high</li> </ul>
<p>Graded index</p>	<p>Multimode fibre</p>	<p>Input pulse</p> <p>Output pulse</p>	<ul style="list-style-type: none"> <li>• Bandwidth &lt; 1 GHz / km</li> <li>• Dispersion 1...5 ns / km</li> <li>• Short impulse spreading for middle distances &gt; 500 m</li> <li>• Attenuation: low</li> </ul>
<p>Step index</p>	<p>Single mode fibre</p>	<p>Input pulse</p> <p>Output pulse</p>	<ul style="list-style-type: none"> <li>• Bandwidth &lt; 10 GHz / km</li> <li>• Dispersion 4...150 ns / km</li> <li>• No impulse spreading for long distances &gt; 500 m</li> <li>• Attenuation: very low</li> </ul>

# THE ELECTROMAGNETIC SPECTRUM



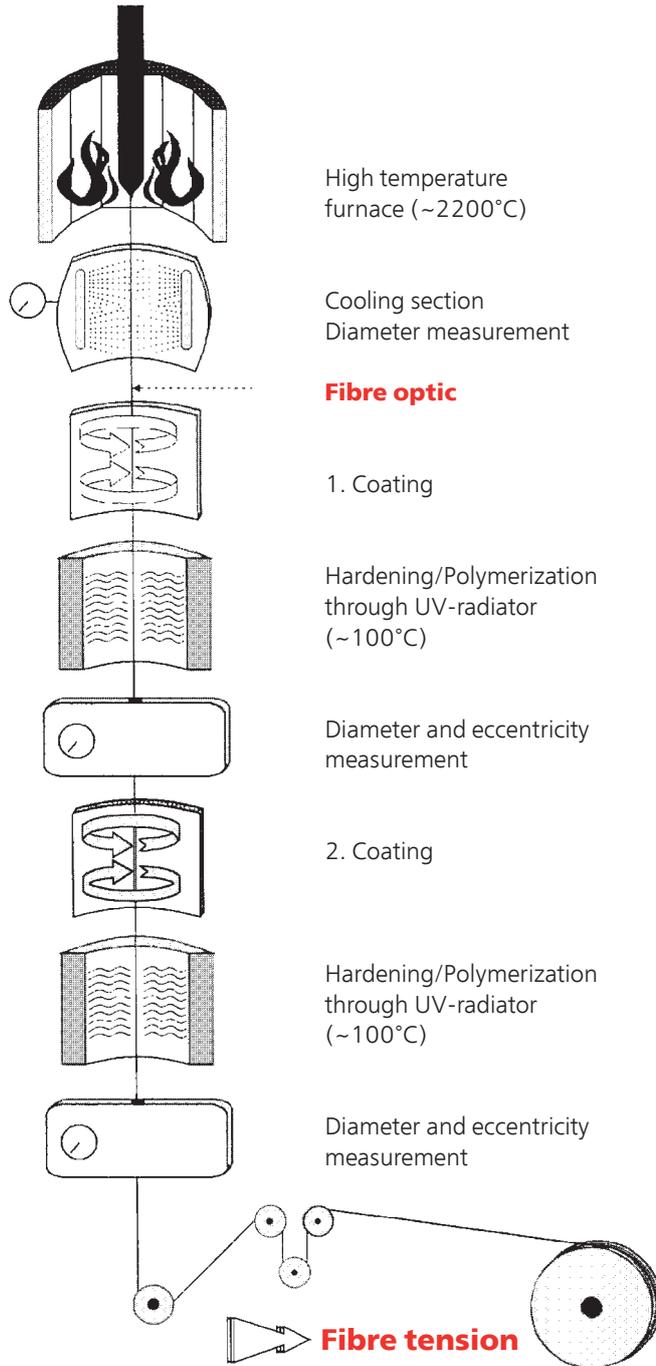
## Visible rays, light

- violett 380 - 420 nm
- blue 420 - 490 nm
- green 530 - 650 nm
- red 650 - 780 nm

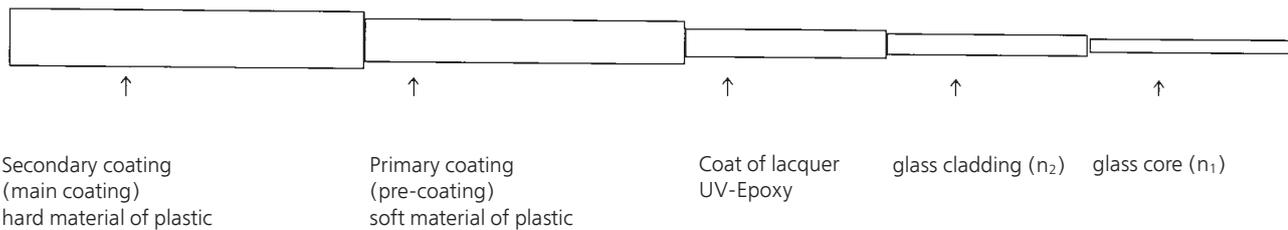
## Infra-red ray

780 nm - 1 mm

# FIBRE OPTIC DRAWING TOWER-DESIGN



## Faser mit Kunststoffbeschichtung



### Diameter range and coating thickness:

- glass core diameter - 10 to 100  $\mu\text{m}$
- glass cladding diameter - 125 to 150  $\mu\text{m}$
- thickness of lacquer coating - 2 to 5  $\mu\text{m}$
- primary coating diameter - 150 to 500  $\mu\text{m}$
- secondary coating diameter - 250 or 900  $\mu\text{m}$

# CODE-DESIGNATION-EXPLANATIONS FOR CABLES AND INSULATED WIRE

A-	Outdoor cable	(H...)	maximal value of mutual capacitance (nF /km)	TIC	triple in copper wire braid
A	approved national design	(HS)	semi-conducting tape of layer	TIMF	triple in metal foil
AB	Outdoor cable with lighting protection	HX	cross-linked, halogen-free polymer compound	U	braiding of textile fibres
AD	Outdoor cable with differential protection	...IMF	individual stranding element (pairs or single cores etc.) in metal foil and drain wire	VGD	gold-plated
AJ-	Outdoor cable with induction protection	IMF	several stranding elements in metalfoil and drain wire	VN	ickel-plated; VS silver-plated
ASLH	self-supporting communication cables for high voltage overhead lines	-J	cable with green-yellow earth core	VZK	galvanized; VZN tinned
B	armouring	-JZ	cable with green-yellow earth core and cores with imprinted numbers	W	corrugated steel sheath
B	spinning of textile yarn	K	copper-tape	W	high heat resistant
b	armouring	(K)	inner sheath and longitudinally folded copper tape	W	corrugated steel sheath
(1B...)	one layer of steel tape... thickness of the steel tape in mm	LA	tinsel conductor (flat copper wire stranded over the thread of synthetic fibres)	X	cross-linked polyvinylchlorid (X-PVC) or other materials
(2B...)	two layers of steel tape... thickness of the steel tape in mm	LD	corrugated aluminium sheath	XPE	cross-linked polyethylene (X-PE)
BD	unit-type stranding	Lg	in layers stranding	2X	cross-linked polyethylene
BLK	bare copper-conductor without insulation	Li	stranded wires conductor	7X	cross-linked Ethylentetrafluorethylen (X-ETFE)
BZ	bronze conductor	(LY)	laminated sheath Al-tape and PVC-jacket	10X	cross-linked Polyvinylidenfluorid (X-PVDF)
C	screen of copper wire braiding	(L)ZY	laminated sheath Al-tape and PE-jacketl	Y	PVC, polyvinylchloride
C	screen of copper wire spinning	2L	double enamel coating as insulation	Yu	PVC, polyvinylchloride, non-flammable, flame-retardant
C	outer protection of jute and viscous compound	M	plastic-sheath cable	Yv	PVC, polyvinylchloride, with reinforced sheath
Cu	copper wire	M	lead sheath	YV	Equipment wires with tinned conductor
(-Cu)	total cross-section of copper screens (mm <sup>2</sup> )	Mz	alloyed lead sheath	Yw	PVC, polyvinylchlorid, heat resistant up to 90°C
D	screen of copper wires	(mS)	magnetic shield	2Y	Polyethylene (PE)
(D)	screen of helically applied copper wires	N	VDE standard	2Yv	Polyethylene, reinforced sheath
DM	Dieselhorst-Martin quad	(N)	in adapted to VDE standard	02Y	Cellular polyethylene
Dreier	three cores in triple stranded	NC	non-corrosiv, smoke-gase	02YS	insulation of cellular polyethylene with outer PE-skin
E	copper drain wire	NF	natural colour	2YHO	insulation of air-spaced polyethylene
E(e)	protective covering of viscous compound with embedded layer of plastic tape	-O	cable without green-yellow earth core	3Y	insulation polystyrene (PS), Styroflex
e	single wire, solid	-OZ	cable without green-yellow earth core and cores with imprinted numbers	4Y	insulation or jacket of polyamide (PA)
F	cable cores assembly with petrol-jelly	ö	oil-resistant	5Y	insulation or jacket of polytetrafluorethylene (PTFE), HELUFLO <sup>®</sup>
F	foil wrapping	02Y	Foam-PE, insulation (cellular PE)	5YX	Perfluoralkoxy (PFA)
F	flat cable	Q	Steel wire braiding	6Y	Perfluoroethylene-propylene (FEP), HELUFLO <sup>®</sup>
F	star quad for railway cable	(R...)	round wire, diameter in mm	7Y	insulation or jacket of ethylentetrafluorethylen (ETFE)
F	star quad for phantom circuits	RAGL-	Compensating cable for thermocoupling	8Y	insulation of polyimid (PI), Kapton <sup>®</sup>
(F...)	flat wire armouring... thickness in mm	RD-	Rhenomatic cable	9Y	polypropylen (PP)
OF	jelly filled cable core, filling compound of hard substances	RE	Computer cable	10Y	PVDF, Polyvinylidene fluoride
FR	flame retardant	RG-	Coaxial cable according MIL specification	11Y	polyurethan (PUR)
f	flexible, fine wire stranding	re	round, single wire	12Y	TPE-E, TPE
ff	extra fine wire stranding	rm	round, multiwire	13Y	TPE-EE, TPE on base of Polyester-Ester
G	insulation or sheath material of rubber (NR) or (SBR)	RS-	computer switchboard cable	31Y	TPE-S, TPE on base of Polystyrol
G-	Mining cable	S	silk whipping	41Y	TPE-A, TPE on base of Polyamide
GJ	Mining cable with induction protection	S	signal cables for railways	51Y	PFA, Perfluor-Alkoxyalkane
GS	glass fibre whipping or braiding	(S...)	nominal value of mutual capacitance (nF /km)	71Y	ECTFE, Monochlorotrifluorethylene
2G	insulation or jacket of silicone rubber, (SIR)	-S	signal cable for German Railway	91Y	TPE-O, TPE on base of Polyester-Ester
3G	insulation or jacket of ethylene propylene rubber, (EPR)	S-	Switchboard cable	-Z	core imprinted with numbers
4G	insulation or jacket of ethylene vinylacetate rubber (EVA)	SL	flexible sheathed cable	Z	twin cable
5G	insulation or jacket of chloroprene rubber (CR)	2S	two layers of silk whipping	(Z)	high-tensile braid of steel wires
6G	insulation or jacket of chlorosulphonated polyethylene (CSM), Hypalon	St	star quad for phantom circuits	(ZG)	high-tensile element of glass fibre yarn
7G	insulation or jacket of Flouroelastomer (FKM)	St I	star quad in telephone cables for lager distance	(ZN)	high-tensile of non-metallic elements
8G	insulation or jacket of Nitrile rubber (NBR)	St III	star quad in local cables		
9G	PE-C rubber (CM)	(St)	static screen		
53G	CM, chlorinated Polyethylene	Staku	copper clad steel wire		
H	insulation or jacket of halogen-free compound	Staku-Li	copper clad steel stranded wires		
H	Harmonized Documents	...t	termite protection		
		T	supporting element for overhead cable		
		T-	fan out cable		
		TF	carrier frequency of pairs or quads triple		

# AWG-WIRES AND AWG-STRANDED CONDUCTORS

## CONDUCTOR MAKE-UP, CROSS-SECTION, RESISTANCE AND WEIGHT

AWG No.	AWG-make-up n x AWG	conductor make-up mm	crosssection mm <sup>2</sup>	conductor outer-Ø mm	conductor resistance Ohm/km	conductor weight kg/km
36	solid	solid	0,013	0,127	1460,0	0,116
36	7/44	7 x 0,05	0,014	0,152	1271,0	0,125
34	solid	solid	0,020	0,160	918,0	0,178
34	7/42	7 x 0,064	0,022	0,192	777,0	0,196
32	solid	solid	0,032	0,203	571,0	0,284
32	7/40	7 x 0,078	0,034	0,203	538,0	0,302
32	19/44	19 x 0,05	0,037	0,229	448,0	0,329
30	solid	solid	0,051	0,254	365,0	0,45
30	7/38	7 x 0,102	0,057	0,305	339,0	0,507
30	19/42	19 x 0,064	0,061	0,305	286,7	0,543
28	solid	solid	0,080	0,330	232,0	0,71
28	7/36	7 x 0,127	0,087	0,381	213,0	0,774
28	19/40	19 x 0,078	0,091	0,406	186,0	0,81
27	7/35	7 x 0,142	0,111	0,457	179,0	0,988
26	solid	solid	0,128	0,409	143,0	1,14
26	10/36	10 x 0,127	0,127	0,533	137,0	1,13
26	19/38	19 x 0,102	0,155	0,508	113,0	1,38
26	7/34	7 x 0,160	0,141	0,483	122,0	1,25
24	solid	solid	0,205	0,511	89,4	1,82
24	7/32	7 x 0,203	0,227	0,610	76,4	2,02
24	10/34	10 x 0,160	0,201	0,582	85,6	1,79
24	19/36	19 x 0,127	0,241	0,610	69,2	2,14
24	41/40	41 x 0,078	0,196	0,582	84,0	1,74
22	solid	solid	0,324	0,643	55,3	2,88
22	7/30	7 x 0,254	0,355	0,762	48,4	3,16
22	19/34	19 x 0,160	0,382	0,787	45,1	3,4
22	26/36	26 x 0,127	0,330	0,762	52,3	2,94
20	solid	solid	0,519	0,813	34,6	4,61
20	7/28	7 x 0,320	0,562	0,965	33,8	5,0
20	10/30	10 x 0,254	0,507	0,889	33,9	4,51
20	19/32	19 x 0,203	0,615	0,940	28,3	5,47
20	26/34	26 x 0,160	0,523	0,914	33,0	4,65
20	41/36	41 x 0,127	0,520	0,914	32,9	4,63
18	solid	solid	0,823	1,020	21,8	7,32
18	7/26	7 x 0,404	0,897	1,219	19,2	7,98
18	16/30	16 x 0,254	0,811	1,194	21,3	7,22
18	19/30	19 x 0,254	0,963	1,245	17,9	8,57
18	41/34	41 x 0,160	0,824	1,194	20,9	7,33
18	65/36	65 x 0,127	0,823	1,194	21,0	7,32
16	solid	solid	1,310	1,290	13,7	11,66
16	7/24	7 x 0,511	1,440	1,524	12,0	12,81
16	65/34	65 x 0,160	1,310	1,499	13,2	11,65
16	26/30	26 x 0,254	1,317	1,499	13,1	11,72
16	19/29	19 x 0,287	1,229	1,473	14,0	10,94
16	105/36	105 x 0,127	1,330	1,499	13,1	11,84
14	solid	solid	2,080	1,630	8,6	18,51
14	7/22	7 x 0,643	2,238	1,854	7,6	19,92
14	19/27	19 x 0,361	1,945	1,854	8,9	17,31
14	41/30	41 x 0,254	2,078	1,854	8,3	18,49
14	105/34	105 x 0,160	2,111	1,854	8,2	18,79

AWG No.	AWG-make-up n x AWG	conductor make-up mm	crosssection mm <sup>2</sup>	conductor outer-Ø mm	conductor resistance Ohm/km	conductor weight kg/km
12	solid	Solid	3,31	2,05	5,4	29,46
12	7/20	7 x 0,813	3,63	2,438	4,8	32,30
12	19/25	19 x 0,455	3,09	2,369	5,6	27,50
12	65/30	65 x 0,254	3,292	2,413	5,7	29,29
12	165/34	165 x 0,160	3,316	2,413	5,2	29,51
10	solid	solid	5,26	2,59	3,4	46,81
10	37/26	37 x 0,404	4,74	2,921	3,6	42,18
10	49/27	49 x 0,363	5,068	2,946	3,6	45,10
10	105/30	105 x 0,254	5,317	2,946	3,2	47,32
8	49/25	49 x 0,455	7,963	3,734	2,2	70,87
8	133/29	133 x 0,287	8,604	3,734	2,0	76,57
8	655/36	655 x 0,127	8,297	3,734	2,0	73,84
6	133/27	133 x 0,363	13,764	4,676	1,5	122,49
6	259/30	259 x 0,254	13,123	4,674	1,3	116,79
6	1050/36	1050 x 0,127	13,316	4,674	1,3	118,51
4	133/25	133 x 0,455	21,625	5,898	0,80	192,46
4	259/27	259 x 0,363	26,804	5,898	0,66	238,55
4	1666/36	1666 x 0,127	21,104	5,898	0,82	187,82
2	133/23	133 x 0,574	34,416	7,417	0,50	306,30
2	259/26	259 x 0,404	33,201	7,417	0,52	295,49
2	665/30	665 x 0,254	33,696	7,417	0,52	299,89
2	2646/36	2646 x 0,127	33,518	7,417	0,52	298,31
1	133/22	133 x 0,643	43,187	8,331	0,40	384,37
1	259/25	259 x 0,455	42,112	8,331	0,41	374,80
1	817/30	817 x 0,254	41,397	8,331	0,42	368,43
1	2109/34	2109 x 0,160	42,403	8,331	0,41	377,39
1/0	133/21	133 x 0,724	54,75	9,347	0,31	487,28
1/0	259/24	259 x 0,511	53,116	9,347	0,32	472,73
2/0	133/20	133 x 0,813	69,043	10,516	0,25	614,48
2/0	259/23	259 x 0,574	67,021	10,516	0,25	596,49
3/0	259/22	259 x 0,643	84,102	11,786	0,20	748,51
3/0	427/24	427 x 0,511	87,570	11,786	0,19	779,37
4/0	259/21	259 x 0,724	106,626	13,259	0,16	948,97
4/0	427/23	427 x 0,574	110,494	13,259	0,15	983,39

## ■ AWG-WIRES (SOLID-CONDUCTOR)

AWG No.	Wire-Ø mm						
44	0,050	30	0,254	18	1,024	6	4,115
41	0,070	29	0,287	17	1,151	5	4,620
40	0,079	28	0,320	16	1,290	4	5,189
39	0,089	27	0,363	15	1,450	3	5,827
38	0,102	26	0,404	14	1,628	2	6,543
37	0,114	25	0,455	13	1,829	1	7,348
36	0,127	24	0,511	12	2,052	1/0	8,252
35	0,142	23	0,574	11	2,304	2/0	9,266
34	0,160	22	0,643	10	2,588	3/0	10,404
33	0,180	21	0,724	9	2,906	4/0	11,684
32	0,203	20	0,813	8	3,268		
31	0,226	19	0,912	7	3,665		

# STRANDED MAKE-UP (DIN VDE 0295, IEC 60228 bzw. HD 383)

cross-section	stranded wires		multistranded wires		fine wires		extra-fine wires							
	Class 2 DIN VDE 0295				Class 5 DIN VDE 0295		Class 6 DIN VDE 0295							
	column 1		column 2		column 3		column 4		column 5		column 6		column 7	
	wire number x	single of wire-Ø	wire number x	single of wire-Ø	wire number x	single of wire-Ø	wire number x	single of wire-Ø	wire number x	single of wire-Ø	wire number x	single of wire-Ø	wire number x	single of wire-Ø
mm		mm		mm		mm		mm		mm		mm		
0,14					18x0,1		18x0,1		18x0,1		36x0,07		72x0,5	
0,25					14x0,15		32x0,1		32x0,1		65x0,07		128x0,5	
0,34			7x0,25		19x0,15		42x0,1		42x0,1		88x0,07		174x0,5	
0,38			7x0,27		12x0,2		21x0,15		48x0,1		100x0,07		194x0,5	
0,5	7x0,30		7x0,30		16x0,2		28x0,15		64x0,1		131x0,07		256x0,5	
0,75	7x0,37		7x0,37		24x0,2		42x0,15		96x0,1		195x0,07		384x0,5	
1,0	7x0,43		7x0,30		32x0,2		56x0,15		128x0,1		260x0,07		512x0,5	
1,5	7x0,52		7x0,37		30x0,25		84x0,15		192x0,1		392x0,07		768x0,5	
2,5	7x0,67		7x0,43		50x0,25		140x0,15		320x0,1		651x0,07		1280x0,5	
4	7x0,85		7x0,52		56x0,3		224x0,15		512x0,1		1040x0,07			
6	7x1,05		19x0,41		84x0,3		192x0,2		768x0,1		1560x0,07			
10	7x1,35		19x0,52		80x0,4		320x0,2		1280x0,1		2600x0,07			
16	7x1,70		19x0,64		128x0,4		512x0,2		2048x0,1					
25	7x2,13		49x0,65		200x0,4		800x0,2		3200x0,1					
35	7x2,52		84x0,62		280x0,4		1120x0,2							
50	19x1,83		133x0,58		400x0,4		705x0,3							
70	19x2,17		133x0,69		356x0,5		990x0,3							
95	19x2,52		189x0,69		485x0,5		1340x0,3							
120	37x2,03		259x0,69		614x0,5		1690x0,3							
150	37x2,27		336x0,67		765x0,5		2123x0,3							
185	37x2,52		392x0,69		944x0,5		1470x0,4							
240	61x2,24		494x0,69		1255x0,5		1905x0,4							
300	61x2,50		627x0,70		1530x0,5		2385x0,4							
400	61x2,89		790x0,70		2035x0,5									
500	61x3,23				1768x0,6									

1) The number of individual wires are without obligation.

2) The diameters of the single wires for each conductor are not allowed to exceed the values stated to DIN VDE 0295. The single wires of a stranded conductor must have all the same nominal diameters.

3) Minimum-number of single wires of stranded conductor (up to 35 mm<sup>2</sup>). The single wires of a stranded conductor must have all the same nominal diameters.

2) **Note:** permissible maximal diameter of single wires:

	nominal value	maximal value
	mm	mm
	0,2	0,21
	0,25	0,26
	0,3	0,31
	0,4	0,41
	0,5	0,51
	0,6	0,61

## Comparison AWG-measurements to metrical cross-sections (mm<sup>2</sup>)

AWG	mm <sup>2</sup>	AWG	mm <sup>2</sup>	AWG	mm <sup>2</sup>	AWG	mm <sup>2</sup>
30	0,05	18	0,75	6	16	300 MCM	150
28	0,08	17	1,00	4	25	350 MCM	185
26	0,14	16	1,50	2	35	500 MCM	240
24	0,25	14	2,50	1	50	600 MCM	300
22	0,34	12	4	2/0	70	750 MCM	400
21	0,38	10	6	3/0	95	1000 MCM	500
20	0,50	8	10	4/0	120		

This cross reference list shows equivalent nominal values. Actual cross sections may vary. The AWG values are approximate, if the cables are made to European Standards (mm<sup>2</sup>) and vice versa. In critical applications, where the current reaches upper limits. The deviating operation conditions for installation and laying according to standards are to be taken into consideration.

# US-AMERICAN AND BRITISH UNITS

## Conversion of usual measuring units

In the USA the measurements are mainly used in AWG-numbers (AWG = American Wire Gauge). The AWG-numbers conform the british B&S-numbers (BS = Brown & Sharp) überein.

AWG No.	Crosssection mm <sup>2</sup>	Diameter mm	Conductor resistance Ohm/km
1000 MCM*	507	25,4	0,035
750	380	22,0	0,047
600	304	19,7	0,059
500	254	20,7	0,07
400	203	18,9	0,09
350	178	17,3	0,10
300	152	16,0	0,12
250	127	14,6	0,14
4/0	107,20	11,68	0,18
3/0	85,00	10,40	0,23
2/0	67,50	9,27	0,29
0	53,40	8,25	0,37
1	42,40	7,35	0,47
2	33,60	6,54	0,57
3	26,70	5,83	0,71
4	21,20	5,19	0,91
5	16,80	4,62	1,12
6	13,30	4,11	1,44
7	10,60	3,67	1,78
8	8,366	3,26	2,36
9	6,63	2,91	2,77
10	5,26	2,59	3,64
11	4,15	2,30	4,44
12	3,30	2,05	5,41
13	2,62	1,83	7,02

4/0 wird auch geschrieben: 0000; 1 mil = 0,001 inch = 0,254 mm  
\* bei größerem Querschnitt Maßangaben in MCM (circular mils)

AWG No.	Crosssection mm <sup>2</sup>	Diameter mm	Conductor resistance Ohm/km
14	2,08	1,63	8,79
15	1,65	1,45	11,20
16	1,31	1,29	14,70
17	1,04	1,15	17,80
18	0,8230	1,0240	23,0
19	0,6530	0,9120	28,3
20	0,5190	0,8120	34,5
21	0,4120	0,7230	44,0
22	0,3250	0,6440	54,8
23	0,2590	0,5730	70,1
24	0,2050	0,5110	89,2
25	0,1630	0,4550	111,0
26	0,1280	0,4050	146,0
27	0,1020	0,3610	176,0
28	0,0804	0,3210	232,0
29	0,0646	0,2860	282,0
30	0,0503	0,2550	350,0
31	0,0400	0,2270	446,0
32	0,0320	0,2020	578,0
33	0,0252	0,1800	710,0
34	0,0200	0,1600	899,0
35	0,0161	0,1430	1125,0
36	0,0123	0,1270	1426,0
37	0,0100	0,1130	1800,0
38	0,00795	0,1010	2255,0
39	0,00632	0,0897	2860,0

1 CM = 1 Circ. mi. = 0,0005067 mm<sup>2</sup>  
1 MCM = 1000 Circ. mils = 0,5067 mm<sup>2</sup>

## General measuring units

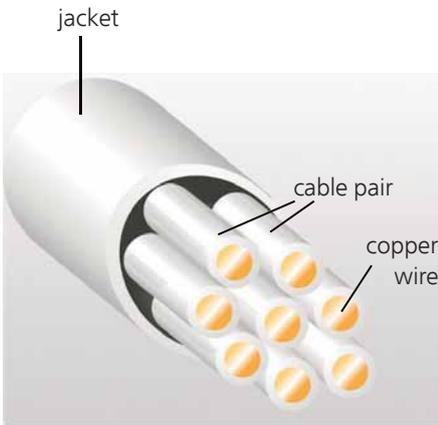
Length	
1 mil	= 0,0254 mm
1 in (Inch)	= 25,4 mm
1 ft (foot)	= 0,3048 m
1 yd (yard)	= 0,9144 m
1 ch (chain)	= 20,1 m
1 mile (land mile)	= 1,609 km/ 1760 yards
1 mile (nautic mile)	= 1,852 km
1 mm	= 0,039370 inches
1 m	= 39,370079 inches
Area	
1 CM (circ. mil)	= 0,507 · 10 <sup>-3</sup> mm <sup>2</sup>
1 MCM	= 0,5067 mm <sup>2</sup>
1 sq. inch	= 645,16 mm <sup>2</sup>
1 sq. foot	= 0,0929 m <sup>2</sup>
1 square yard	= 0,836 m <sup>2</sup>
1 acre	= 4047 m <sup>2</sup>
1 square mile	= 2,59 km <sup>2</sup>
Density	
1 cu. in. (cubic inch)	= 16,39 cm <sup>3</sup>
1 cu. ft. (cubic foot)	= 0,0283 m <sup>3</sup>
1 cu. yd. (cubic yard)	= 0,7646 m <sup>3</sup>
1 gal. (US gallon)	= 3,785 l
1 gal. brit gallon	= 4,546 l
1 US pint	= 0,473 l
1 US quart	= 0,946 l
1 US barrel	= 158,8 l
Temperature	
F (Fahrenheit)	= (1,8 · C) + 3°
C (Celsius)	= 0,5556 · (F-32°)

Weight	
1 grain	= 64,8 mg
1 dram	= 1,77 g
1 oz (ounce)	= 28,35 g
1 lb (pound)	= 0,4536 Kp
1 stone	= 6,35 Kp
1 qu (quarter)	= 12,7 Kp
1 US-cwt (hundred-weight)	= 45,36 Kp
1 US ton (short ton)	= 0,907 t
1 brit. ton (long ton)	= 1,016 t
Force	
1 lb	= 4,448 N
1 brit. ton	= 9954 N
1 pdl (Poundal)	= 0,1383 N
1 kp	= 9,81 N
1 N	= 1,02 kp
Velocity	
1 mile/h	= 1,609 km/h
1 Knoten	= 1,852 km/h
1 ft/s	= 0,305 m/s
1 ft/min	= 5,08 · 10 <sup>-3</sup> m/s
Energy	
1 lb/mile	= 0,282 kg/m
1 lb/yard	= 0,496 kg/m
1 lb/foot	= 1,488 kg/m
Radiation absorbed dose	
1 Gray	= 1J/kg
1 rad	= 10 <sup>-2</sup> J/kg = 1 Centi Gy
1 Centi	= 100 Joule
1 rad	= cJ/kg = 0,01 Gy

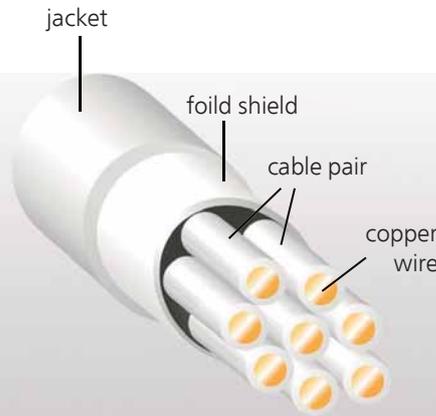
1 Mrad	= 1 · 10 <sup>6</sup> cJ/kg
Pressure	
1 psi (lb/sq.)	= 68,95 mbar = 6,895 · 10 <sup>-3</sup> Nmm <sup>2</sup>
1 lb/sq. ft	= 0,478 mbar
1 pdl/sq. ft.	= 1,489 N/m <sup>2</sup>
1 in Hg	= 33,86 mbar
1 ft H <sub>2</sub> O	= 29,89 mbar
1 in H <sub>2</sub> O	= 2,491 mbar
1 N/mm <sup>2</sup>	= 145 psi / 10 bar
1 kp/mm <sup>2</sup>	= 1422 psi
1 at	= 736 Torr / 1 kp/cm <sup>2</sup>
1 Torr	= 1 mm Hg
1 bar	= 0,1 H Pa
1 Pa	= 1 N/m <sup>2</sup>
Density	
1 lb/cu. ft	= 16,02 kg/m <sup>3</sup>
1 lb/cu. in.	= 27,68 t/m <sup>3</sup>
Horse power	
1 hp · h	= 1,0139 PS · h
	= 2,684 · 10 <sup>6</sup> Joule
	= 746 W · h
1 BTU (brit. therm. unit)	= 1055 Joule
Electrical units	
1 ohm/1000 yd	= 1,0936 Ω/km
1 ohm/1000ft	= 3,28 Ω/km
1 μF/mile	= 0,62 μF/km
1 megohm/mile	= 1,61 MΩ/km
1 μF/foot	= 3,28 pF/m
1 decibel/mile	= 71,5 mN/m
Power rate	
1 PS	= 0,736 kW
1 kW	= 1,36 PS
1 hp	= 0,7457 kW
1 kW	= 1,31 hp

# LAN-CABLE DESIGNATION

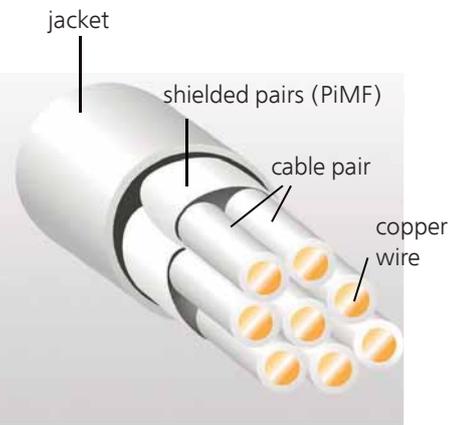
**U/UTP (UTP\*)**



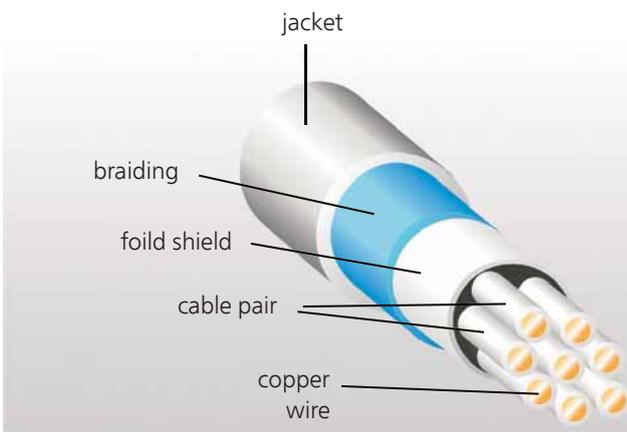
**F/UTP (FTP\*)**



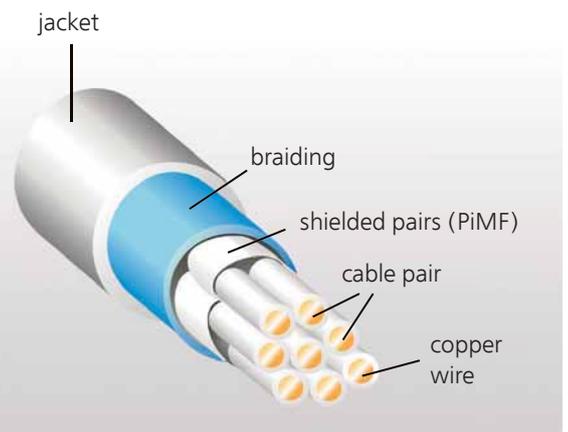
**U/FTP (STP\*)**



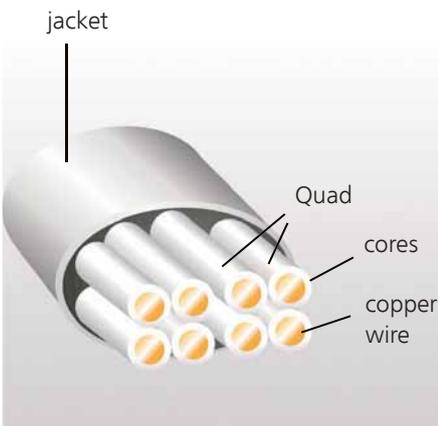
**SF/UTP (S-FTP\*)**



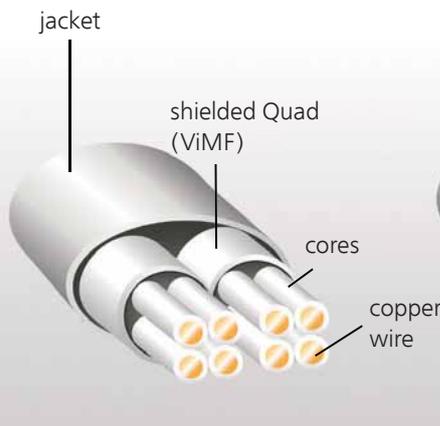
**S/FTP (S-STP\*)**



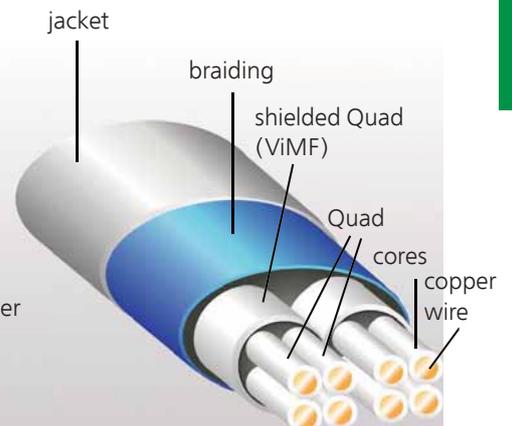
**U/UTP (UTQ\*)**



**U/FTP (S-STQ\*)**



**S/FTP (S-STQ\*)**



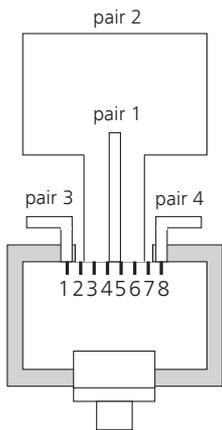
\*Old term

# RJ45 CONNECTOR PIN ASSIGNMENT FOR ETHERNET APPLIKATIONS

## Ethernet RJ45

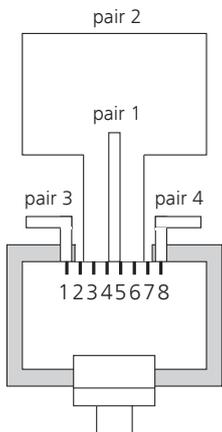
The 8-pole RJ45 is available with the connection diagram according to EIA/TIA T568A and EIA/TIA T568B has the 8-pole RJ45 plug connector. The twisted pair cable must be connected to 8-pole RJ45 sockets and comply with one of the two standards. The standard mainly used is EIA/TIA T568B while EIA/TIA T568A (AT&T) is less common.

### MDI (EIA/TIA T568A)



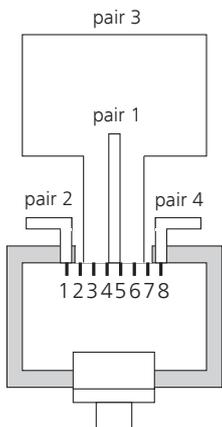
Pin	Colour code Wire	Assignment 10BASE-T, 100BASE-TX	Assignment 1000BASE-TX
1	WHT/GRN	Tx+	BI_DA+
2	GRN	Tx-	BI_DA-
3	WHT/ORG	Rx+	BI_DB+
4	BLU		BI_DC+
5	WHT/BLU		BI_DC-
6	ORG	Rx-	BU_DB+
7	WHT/BRN		BI_DD+
8	BRN		BI_DD-

### MDI-X



Pin	Colour code Wire	Assignment 10BASE-T, 100BASE-TX	Assignment 1000BASE-TX
1	WHT/ORG	Rx+	BI_DB+
2	ORG	Rx-	BI_DB-
3	WHT/GRN	Tx+	BI_DA+
4	BLU		BI_DD+
5	WHT/BLU		BI_DD-
6	GRN	Tx-	BU_DA-
7	WHT/BRN		BI_DC+
8	BRN		BI_DC-

### MDI (EIA/TIA T568B)



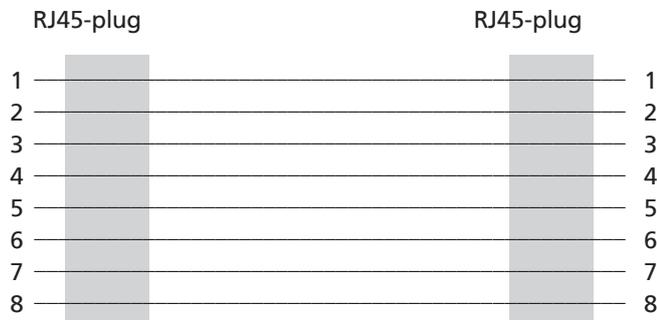
Pin	Colour code Wire	Assignment 10BASE-T, 100BASE-TX	Assignment 1000BASE-TX
1	WHT/ORG	Tx+	BI_DA+
2	ORG	Tx-	BI_DA-
3	WHT/GRN	Rx+	BI_DB+
4	BLU		BI_DC+
5	WHT/BLU		BI_DC-
6	GRN	Rx-	BU_DB-
7	WHT/BRN		BI_DD+
8	BRN		BI_DD-

**Note:** Other technologies such as Token Ring, FDDI etc. use different pin assignments

## RJ45 WIRING OPTIONS

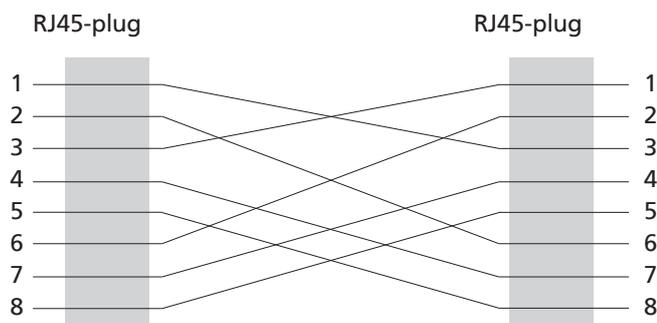
Two different patch cables are used in Ethernet networks - the straight-through and the crossover cable.

### Straight-through patch cable



A straight-through cable is used if an Ethernet switch should be connected to the network connection of a computer.

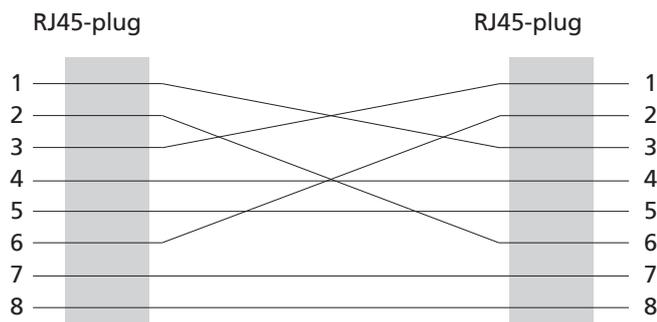
### Crossover cable



A crossover cable is used if two Ethernet switches or two computers should be connected with each other via their network connections.

**Note:** Suitable for all Ethernet technologies

### Semi crossover



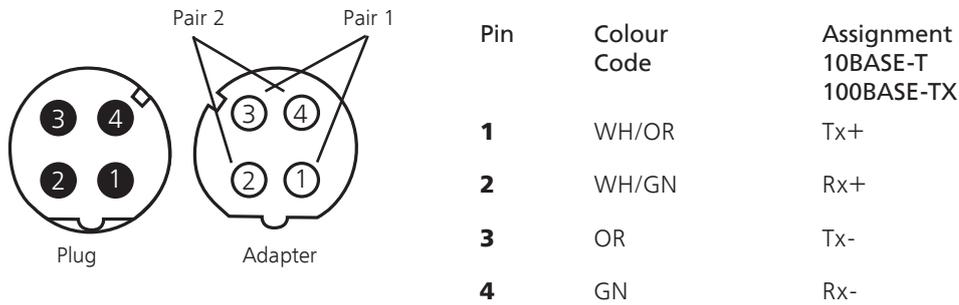
A crossover cable is used if two Ethernet switches or two computers should be connected with each other via their network connections.

**Note:** Not suitable for Gigabit Ethernet because this technology uses all pins.

# M12 CONNECTOR PIN ASSIGNMENT

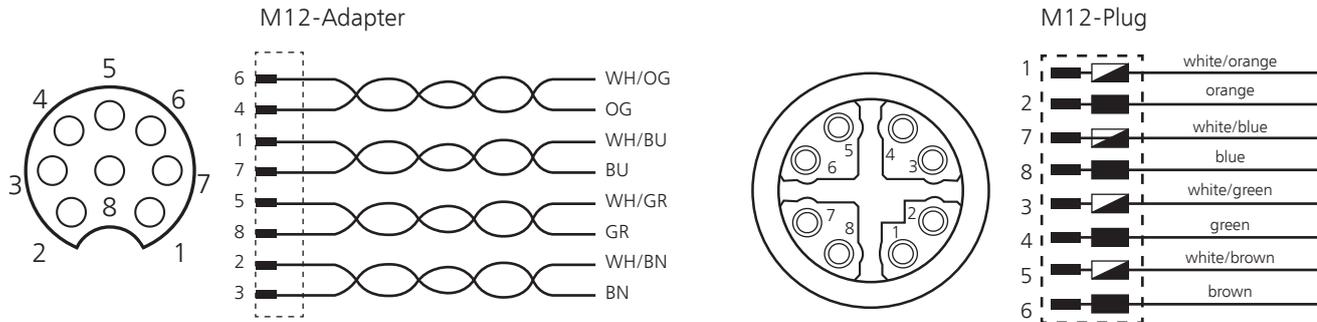
## Ethernet M12 connection diagram 4-poled

(IEC 61076-2-101)



D-Coding for Industrial Ethernet

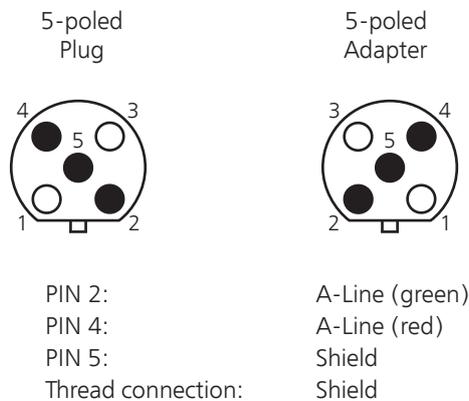
## Ethernet M12 connection diagram 8-poled



A-Coded Kat.5

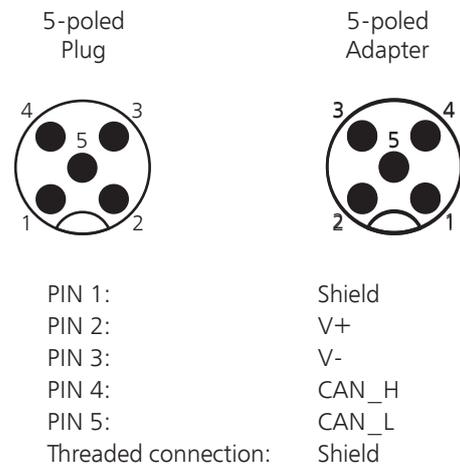
X-Coding Kat.5 / 6 or 6<sub>A</sub>

## Profibus M12 connection diagram



B-Coding for Profibus

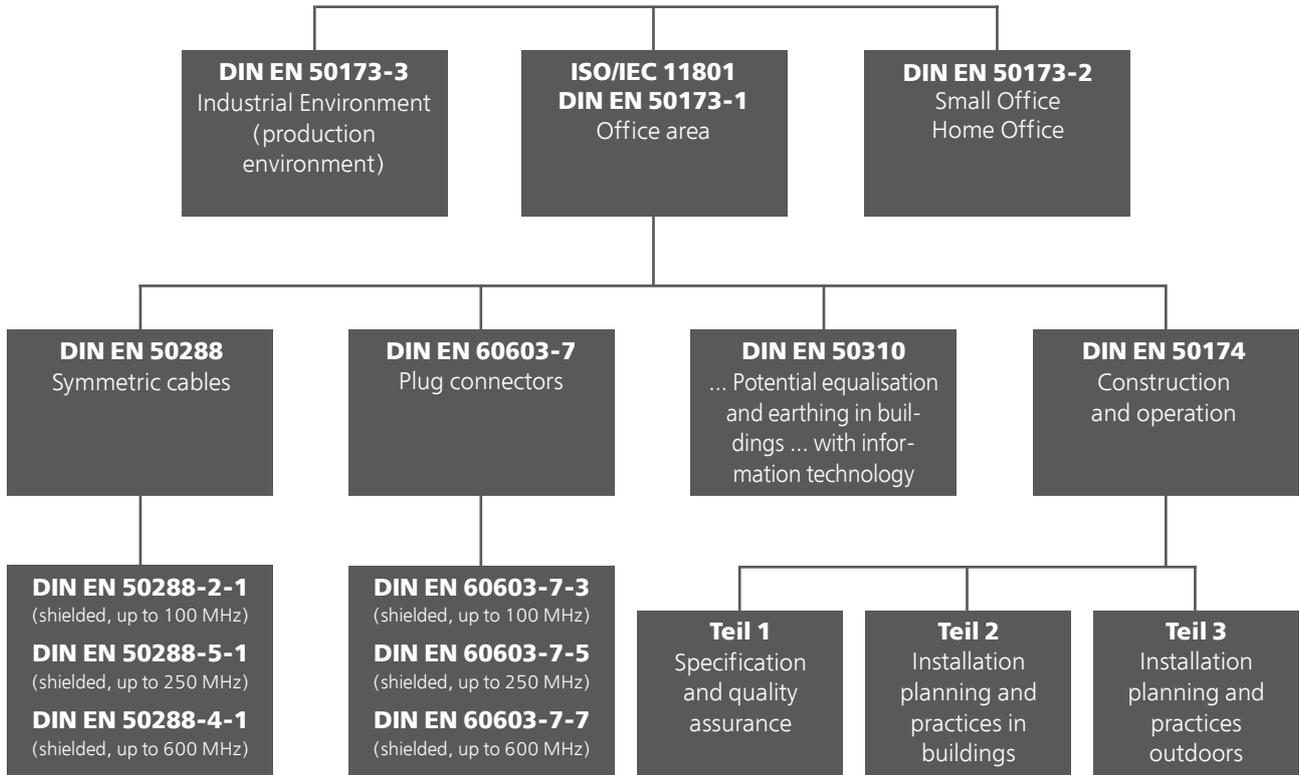
## DeviceNet™ M12 connection diagram



A-Coding for DeviceNet™

# STANDARDS OVERVIEW

## Standards overview: application-neutral cabling systems



The EN 50173 and ISO/IEC 11801 standards today are largely identical and contain the same requirements for cables and components.

Both standards are currently being revised and a complete harmonisation is being striven for.

The requirements for components (categories) are also specified in the following standards:

- Cables EN 50288
- Mating faces EN 60603-7 and IEC 61076-3-104
- Measuring equipment EN 651935

The EN standards also include the European EMC regulations:

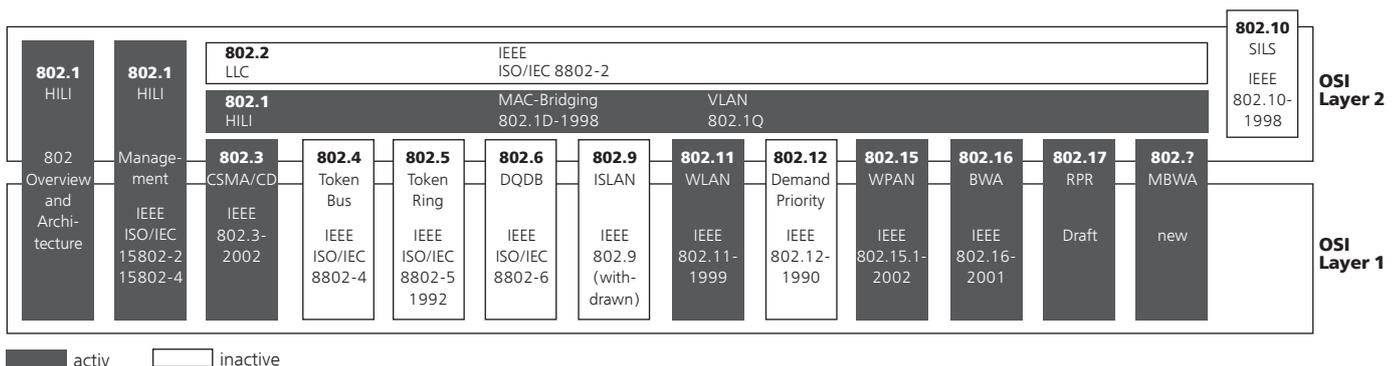
- Radiation Class A/B EN 55022
- Interference resistance EM 50082-1

Building cabling in EN 50173 just like in ISO/IEC 11801 is divided into three areas:

- Primary or campus area for connecting the buildings of one site with each other
- Secondary or vertical area for connecting the separate floors of a building
- Tertiary or horizontal area for connecting the connection units (e.g. wall sockets) with the floor distributor

The IEEE Standards Association (IEEE-SA) is an organisation where all activities and programmes concerning IEEE standards are carried out under one roof.

The IEEE 802 LAN/MAN Standards Committee develops standards for local area networks and metropolitan area networks.



■ activ □ inactive

# ■ IP-CODE (PROTECTION CLASSES)

## Definition of protection classifications according to EN 60529

The IEC 60529 standard „Protection classifications using enclosure (IP Code)“ provides a system for classifying the protection ratings of electrical operating materials by enclosure. This standard defines terms for the protection classifications by enclosure concerning:

- Protection of persons against access to dangerous parts inside the enclosure
- Protection of operating material inside the enclosure against ingress by solid foreign substances
- Protection of operating material inside the enclosure against damage by the ingress of water

Protection level against solid foreign bodies			Protection level against water		
First number	Short description	Definition	Second number	Short description	Definition
0	Not protected	The object sensor, a 50 mm ball, must not fully penetrate.	0	Not protected	Vertically falling droplets must not have a damaging effect.
1	Protected against solid foreign bodies of 50 mm diameter and larger	The object sensor, a 12.5 mm ball, must not fully penetrate.	1	Protected against dripping water	Vertically falling droplets must not have a damaging effect if the enclosure is tilted by an angle of up to 15° on both sides of the perpendiculars.
2	Protected against solid foreign bodies of 12.5 mm diameter and larger	The object sensor, a 2.5 mm diameter ball, must not penetrate at all.	2	Protection against dripping water if the enclosure is tilted by up to 15°.	Water sprayed at both sides of the perpendiculars at an angle of up to 60° must not have a damaging effect.
3	Protected against solid foreign bodies of 2.5 mm diameter and larger	The object sensor, a 2.5 mm diameter ball, must not penetrate at all.	3	Protected against spray water	Water sprayed against the enclosure from one direction must not have a damaging effect.
4	Protected against solid foreign bodies of 1.0 mm diameter and larger	The object sensor, a 1.0 mm diameter ball, must not penetrate at all.	4	Protected against spray water	Water sprayed against the enclosure in a jet from every direction must not have a damaging effect. Protected against spray water at increased pressure
			4K	Protected against water with high pressure	Water sprayed against the enclosure from any direction at increased pressure must not have any damaging effects. (Only applies to road vehicles according to DIN 40 050 Part 9)
			5	Protected against	Water sprayed against the enclosure in a strong jet from every direction must not have a damaging effect.
			6	Protected against strong hose water	Water sprayed against the enclosure in a strong jet from every direction must not have a damaging effect.
			6K	Protected against hose water at increased pressure	Water sprayed against the enclosure in a jet at increased pressure from every direction must not have any damaging effects. (Only applies to road vehicles according to DIN 40050 Part 9)
			7	Protected against the effect when temporarily submerged in water	Water may not enter in harmful quantities when the enclosure is held submerged.
			8	Protected against the effect when permanently submerged in water	The volume of penetrating water must not have a damaging effect when the enclosure is temporarily submerged in water at a certain pressure.
			9K	Protected against the effect when permanently submerged in water	The volume of penetrating water must not have a damaging effect when the enclosure is permanently submerged in water.
<p><b>Example:</b> <b>Letters IP 65</b></p> <p>First index: Protection against contact and ingress by foreign bodies</p> <p>Second index: Protection against liquid</p>					

# ■ FIRE PERFORMANCE AND FIRE PROPAGATION IN ACCORDANCE WITH NACH EN 60332-X

European standards EN 50167, EN 50168, and EN 50169, require not only data lines with shielding, they also require data lines with halogen-free sheathing. Consideration and compliance with these standards is particularly recommended for public facilities such as hospitals, schools, and airports. We also recommend the use of halogen-free cable for buildings with high concentration of personnel or material assets.

## Cable with PVC sheath

If there is a fire, standard PVC materials can propagate fires and form hydrochloric acid through the liberation of hydrogen chloride gas (HCl) in combination with moisture (e.g. water for fire fighting). In addition, burning PVC (polyvinyl chloride) produces high smoke density and the corrosive damage to buildings and equipment can often assume devastating proportions that far exceed the actual fire damage. HELUKAT® data lines are manufactured in accordance with IEC 60332-1-2 relative to fire propagation behaviour.

## Cable with halogen-free sheath

Here materials are used that do not contain halogens (such as chloride) and that do not release corrosive gases in the event of fire. The portion of toxic gases is also reduced to a minimum, and smoke density and fire propagation are hardly present or possible. Markings on the cable include the abbreviations FRNC or LSOH. These markings specifically refer to the following:

- FR flame retardant (inhibits fire propagation)
- NC non-corrosive (no corrosive components)
- LS low smoke (low smoke density)
- OH zero halogen (halogen-free)

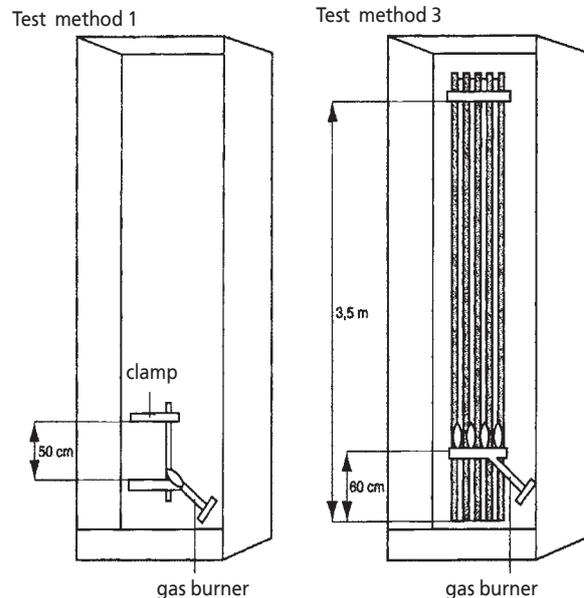
For safety, when using such materials, it is essential that the view of passageways and emergency exits remains unobstructed. For this, however, it is necessary to also consider the use of such materials for other products such as power cables or cable guide channels. In terms of fire propagation behaviour, HELUKAT® data lines are manufactured in accordance with IEC 60332-1-2 or in accordance with the more rigorous IEC 60332-3-24.

## Caloric load [kWh/m] [MJ/m]

There is a wide variety of different combustible fixtures or products in every building. These include (even if concealed in suspended ceilings or channels) cables and lines that can represent a significant part of the facility, particularly in commercial premises. These cables have different energies (heating values) and they can significantly increase the total caloric value of a building. Consequently, in the planning stage ensure that caloric value quantities are kept as low as possible.

## Test methods for fire propagation

The verification or definition of how effectively or how well cable must counter fire propagation and thus the spread of the fire is specified in the standards IEC 60332-1-2, IEC 60332-2 and IEC 60332-3-24. For test method 1, a 50 cm long cable is exposed to flame from a gas burner for 1 minute, and must then extinguish any flame on its own, and it may be burned up to a maximum of 5 cm under the upper clamp. For test method 3, an entire bundle of cable, 3.5 m long is mounted vertically on a ladder in a cabinet and exposed to flame for 20 minutes. After turning off the gas burner, the flame must extinguish on its own within 1 hour and the distance between burner and the fire damage on the cables furthest removed from the burner must not exceed 2.5 m.



**This test is a very realistic representation of a possible fire in a cabling chute.**

# ■ UL-LISTED OR UL-RECOGNIZED FOR DATA CABLES?

North America is an important market for German machinery and plant manufacturers. Customers often demand “UL approval” without, however, being acquainted with the possibilities, advantages and disadvantages of the range of approval types.

As a rule, a UL Mark tends to open up doors in this market. However, there is no approval type that applies across the board for all applications. Sometimes an approved cable will nevertheless fail to be accepted by the customer at the site. The rude awakening often comes too late, after the product has already been installed in the plant and the local inspector refuses the acceptance. In such a case, the installed cable must be removed, either completely or in part.

For example: A drag chain cable 800655 with PUR jacket has UL-Recognized AWM Style or UL-Listed CMX approval. PUR is an excellent material for cables that are in continuous motion, but is not highly flame resistant. If this cable is used not just in the chain or on the plant, but is also used in the cable trays as a connection between the machines, it is very likely that the inspector will refuse the acceptance. This is because in the USA there are different flammability requirements for stationary cable installations. For this application, the version 800653 with PVC jacket and UL-Listed CMG should be used to prevent problems with the acceptance.

## UL Recognized

UL’s Recognized Components are AWM Styles that can be listed on what is known as a “Yellow Card”. This approval type is similar to the VDE registration number: A product for the wiring of machinery/equipment is submitted to the UL with set application specifications for the voltage level, flame resistance, temperature range, etc. UL tests whether the product complies with the specified requirements and then issues either an existing AWM Style or, if the parameters do not match an existing Style, issues a new UL AWM Style. AWM (Appliance Wiring Material) components are used in UL-Listed or UL-Classified end products. The final acceptance depends on the installation and use of the complete plant.

## UL-Listed

UL-Listed, on the other hand, is an actual standard, and applies for cabling in buildings, in cabled factory equipment, as well as for field cable installations for machinery and plants. Data cables are described in the standard UL444. Depending on the application and flame resistance, the applicable standard is listed in the individual chapters, according to the respective criteria for data cables (CM, CMG, CMX...). The great advantage is that the standard is universally recognized and has a higher status / level of acceptance in the field. The inspector normally will know most of the commonly found standards without having to look them up, allowing the inspector to make a quicker decision. This approval simplifies and accelerates the acceptance in plants in these markets, and for machinery and plant manufacturers, it also significantly cuts the time and costs involved in the inspection and acceptance.

Listing Type	Typical application	Flammability test	relevant for industrial automation
<b>CMP</b> (Plenum)	highest safety requirement in respect to flame resistance (Steiner tunnel) Installation without additional protection	FT6	no
<b>CMR</b> (Riser)	Cabling in multi-storey buildings as riser, minimum 2 stories (vertical duct)	UL 1666	no
<b>CM, CMG</b> (General Purpose)	Cabling for buildings, with general use (no risers / plenum) optional PLTC approval (vertical duct)	CSA FT4	yes, Cabling in factor halls, cable trays, and in the field and machinery
<b>CMX</b> (Dwellings)	Limited use within buildings	UL 2556 VW-1 CSA FT 1	yes Field and machinery cabling

# ■ CAPACITY OF KTG-POOL DRUMS

## Wooden drums (standard)

Drumcode-numbers	Drumsize	Flange Ø	Drum-Barrel Ø	Bore Ø	Widthover all	Width for windings	Load bearing capacity max.	Drumweight
		Fd	Kd	Bd	I1	I2		
		mm	mm	mm	mm	mm	kg	kg
051	05	500	150	56	470	410	100	8
061	06	630	315	56	415	315	250	17
071	07	710	355	80	520	400	250	25
081	08	800	400	80	520	400	400	31
091	09	900	450	80	690	560	750	47
101	10	1000	500	80	710	560	900	71
121	12	1250	630	80	890	670	1700	144
141	14	1400	710	80	890	670	2000	175
161	16/8	1600	800	80	1100	850	3000	280
181	18/10	1800	1000	100	1100	840	4000	380
201	20/12	2000	1250	100	1350	1045	5000	550
221	22/12	2240	1400	125	1450	1140	6000	710
250	25/14	2500	1400	125	1450	1140	7500	875
251	25/16	2500	1600	125	1450	1130	7500	900
281	28/18	2800	1800	140	1635	1280	10000	1175

## Plastic drums

Drumcode-numbers	Flange Ø	Bore Ø	Widthover all	Width for windings	Load bearing capacity max.	Drumweight
	Fd	Bd	I1	I2		
	mm	mm	mm	mm	kg	kg
050	500	150	456	404	100	4
070	710	355	510	400	250	15
080	800	400	510	400	350	16
090	900	450	680	560	400	23
100	1000	500	704	560	500	32

## One-way wooden drums

Drumcode-numbers	Flange Ø	Bore Ø	Widthover all	Width for windings	Load bearing capacity max.	Drumweight
	Fd	Bd	I1	I2		
	mm	mm	mm	mm	mm	kg
HE 350	350	150	320	300	56	1,8
HE 400	400	150	320	300	56	2,1
HE 401	400	150	425	405	56	2,3
HE 501	500	150	320	300	56	3,0
HE 500	500	150	425	405	56	3,3
HE 600	600	150	425	405	56	4,5
HE 760	760	300	425	400	80	8,0

# NORM-GLOSSARY

<b>IEEE 802</b>	Overview and Architecture	<b>IEEE 802.3q-1993 (Clause 5)</b>	10 Mb/s Layer Management, GDMO Format
<b>IEEE 802</b>	LMSC; LAN MAN Standard Committee	<b>IEEE 802.3r-1996 (8.8)</b>	Type 10BASE5 Medium Attachment Unit PICS proforma
<b>IEEE 802.1</b>	Higher Layer Interface Standards	<b>IEEE 802.3s-1995</b>	Maintenance 4
<b>IEEE 802.1B-1995</b>	LAN/MAN Management (ISO/IEC 15802-2:1995)	<b>IEEE 802.3t-1995</b>	120 Ohm informative annex to 10BASE-T
<b>IEEE 802.1D-1998</b>	Media access control (MAC) bridges (includes IEEE 802.1p Priority and Dynamic Multicast Filtering, GARP, GMRP)	<b>IEEE 802.3u-1995 (Clauses 21-30)</b>	Type 100BASE-T MAC parameters, Physical Layer, MAUs and Repeater for 100 Mb/s
<b>IEEE 802.1E-1994</b>	System load protocol (ISO/IEC 15802-4 : 1994)	<b>IEEE 802.3v-1995</b>	150 Ohm informative annex to 10BASE-T
<b>IEEE 802.1F-1993</b>	Common Definitions and Procedures for IEEE 802 Management Information	<b>IEEE 802.3x-1997 and 802.3y-1997</b>	(Revisions to 802.3, Clauses 31 and 32), Full Duplex Operation and Type 100BASE-T2
<b>IEEE 802.1G-1998</b>	Remote Media Access Control (MAC) bridging (ISO/IEC 15802-5 : 1998)	<b>IEEE 802.3z-1998 (Clauses 34-39,41-42)</b>	Type 1000BASE-X MAC Parameters, Physical Layer, Repeater and Management Parameters for 1000 Mb/s Operation
<b>IEEE 802.1H-1997</b>	Media Access Control (MAC) Bridging of Ethernet V2.0 in Local Area Networks (ISO/IEC TR 11802-5 : 1997)	<b>IEEE 802.3aa-1998</b>	Maintenance 5
<b>IEEE 802.1Q-1998</b>	IEEE Standard for Virtual Bridged Local Area Networks (VLAN Tagging, GVRP)	<b>IEEE 802.9ac-1998</b>	Frame Extensions for Virtual Bridged Local Area Network (VLAN) Tagging on 802.3 Networks
<b>IEEE 802.1W-2001</b>	IEEE Standard for Rapid Reconfiguration	<b>IEEE 802.3ab-1999 (Clause 40)</b>	Physical Layer Parameters and Specifications for 1000 Mb/s Operation Over 4 Pair of Category 5 Balanced Copper Cabling, Type 1000BASE-T
<b>IEEE 802.1X-2001</b>	IEEE Standard for Port-Based Network Access Control	<b>IEEE 802.3ad-2000 (Clause 43)</b>	Aggregation of Multiple Link Segments
<b>IEEE 802.2</b>	LLC; Logical Link Control	<b>An additional standard, 1802.3</b>	provides conformance test information for 10BASE-T
<b>IEEE 802.3</b>	CSMA/CD; Carrier Sense Multiple Access with Collision Detection (Ethernet)	<b>IEEE 802.3ae-2002</b>	Media Access Control (MAC) Parameters, Physical Layer, and Management Parameters for 10 Gb/s Operation
<b>IEEE 802.3a-1988 (Clause 10)</b>	10 Mb/s MAU 10BASE2	<b>IEEE 802.af</b>	in work DTE Power via MDI
<b>IEEE 802.3b-1985 (Clause 11)</b>	10 Mb/s Broadband MAU, 10BROAD36	<b>IEEE 802.3ah</b>	in work Ethernet in the First Mile
<b>IEEE 802.3c-1985 (9.1-9.8)</b>	10 Mb/s Baseband Repeater	<b>IEEE 802.4</b>	TBUS; Token bus
<b>IEEE 802.3d-1987 (9.9)</b>	10 Mb/s Fibre MAU, FOIRL	<b>IEEE 802.5</b>	TRING; Token Ring
<b>IEEE 802.3e-1987 (Clause 12)</b>	1 Mb/s MAU and Hub 1BASE5	<b>IEEE 802.6</b>	DQDB; Distributed Queue Dual Bus
<b>IEEE 802.3h-1990 (Clause 5)</b>	10 Mb/s Layer Management, DTEs	<b>IEEE 802.7</b>	BBTAG; Broadband Technical Advisory Group
<b>IEEE 802.3i-1990 (Clauses 13 and 14)</b>	10 Mb/s UTP MAU, 10 BASE-TP	<b>IEEE 802.8</b>	FOTAG; Fibre Optic Technical Advisory Group
<b>IEEE 802.3j-1993 (Clauses 15-18)</b>	10 Mb/s Fibre MAUs 10BASE-FP, FB and FL	<b>IEEE 802.9</b>	ISLAN; Integrated Services LAN
<b>IEEE 802.3k-1993 (Clause 19)</b>	10 Mb/s Layer Management, Repeaters	<b>IEEE 802.10</b>	SILS; Standard for Interoperable LAN Security
<b>IEEE 802.3l-1992 (14.10)</b>	10 Mb/s PICS proforma 10BASE-T MAU	<b>IEEE 802.11</b>	WLAN; Wireless LANs
<b>IEEE 802.3m-1995</b>	Maintenance 2	<b>IEEE 802.12</b>	DPAP; Demand Priority Access Protocol
<b>IEEE 802.3n-1995</b>	Maintenance 3	<b>IEEE 802.14</b>	CATV; LANs in Cable Television Networks
<b>IEEE 802.3p-1993 (Clause 20)</b>	Management, 10 Mb/s Integrated MAUs	<b>IEEE 802.15</b>	WPAN; Wireless Personal Area Networks
		<b>IEEE 802.16</b>	BWA; Broadband Wireless Access
		<b>IEEE 802.17</b>	RPR; Resilient Packet Ring
		<b>IEEE 802.18</b>	RRTAG; Radion Regulatory Technical Advisory Group

# NORM-GLOSSARY

<b>IEEE 802.19</b>	CTAG; Coexistence Technical Advisory Group	<b>DIN EN 60068-1</b>	Environmental tests - Part 1: General and guideline (IEC 60068-1:1988 + Corrigendum 1988 + A1: 1992)
<b>IEEE 802.20</b>	MBWA; Mobile Broadband Wireless Access	<b>DIN EN 60068-2-2</b>	Environmental tests - Part 2: Tests; Test group B: Dry heat (IEC 60068-2-2:1974 + IEC 68-2-2A:1976 + A1:1993)
<b>Important standards for network components and network environments DIN EN</b>		<b>DIN EN 60068-2-6</b>	Environmental tests - Part 2: Tests; Test Fc: vibrations, sinusoidal (IEC 60068-2-6:1995 + Corrigendum 1995)
<b>DIN EN 50081-1</b>	Electromagnetic compatibility (EMC) Generic standards: emission standard; Part 1: residential, commercial and light industrial environments	<b>DIN EN 60068-2-14</b>	Environmental tests - Part 2: Tests; Test N; temperature change (IEC 60068-2-14:1984 + A1:1986)
<b>DIN EN 50082-1</b>	Electromagnetic compatibility (EMC) Generic standards: emission standard; Part 1: residential, commercial and light industrial environments	<b>DIN EN 60068-2-27</b>	Environmental tests - Part 2: Tests; Test Ea and guideline: Shocks (IEC 60068-2-27:1987)
<b>DIN EN 50098-1</b>	Information technology cabling of building complexes - Part 1: ISDN basic connection	<b>DIN EN 60068-2-30</b>	Environmental tests - Part 2: Tests Db and guideline: moist heat, cyclic (12+12 hours cycle) (IEC 60068-2-30:1980+A1:1985)
<b>DIN EN 50173-1</b>	Information technology - application-neutral communication cable systems, general requirements and office environments (cf ISO/IEC 11801)	<b>DIN EN 60068-2-32</b>	Environmental tests - Part 2: Tests: Test Ed: free falling (IEC 60068-2-32:1975+A1:1982 +A2:1990)
<b>DIN EN 50173-2</b>	Information technology - application-neutral communication systems, residential (cf ISO/IEC 11801) (SOHO area)	<b>DIN EN 60603-7-3</b>	Connectors, shielded up to 100 MHz
<b>DIN EN 50173-3</b>	Information technology - application-neutral communication systems, industrial (cf ISO/IEC 11801)	<b>DIN EN 60603-7-5</b>	Connectors, shielded up to 250 MHz
<b>DIN EN 50174-1</b>	Information technology - installation of communication cabling - Part 1: Specification and quality assurance	<b>DIN EN 60603-7-7</b>	Connectors, shielded up to 600 MHz
<b>DIN EN 50174-2</b>	Information technology - installation of communication cabling - Part 2: Installation planning and practices in buildings	<b>DIN EN 60794-3</b>	Fibre optic cables - Part 3: pipeline, underground and aerial cables: generic specification (IEC 60794-3:1998)
<b>DIN EN 50174-3</b>	Information technology - installation of communication cabling - Part 3: Installation planning and practices outdoors	<b>DIN EN 60811-1-1</b>	Insulation and sheathing materials for cables and insulated conductors - General test method - Part 1-1: General application; measuring the wall thickness and the external dimensions; method for determining the mechanical properties (IEC 60811-1-1:1993 + A1:2001)
<b>DIN EN 50288-4-1</b>	Multicore metallic data and control cables for analogue and digital transmission - Part 2-1: Generic specification for shielded cable up to 600 MHz; cables for the horizontal and vertical area	<b>DIN EN 60825-2</b>	Safety of laser equipment - Part 2: safety of fibre optic cable communication systems (IEC 60825-2:2000)
<b>DIN EN 50288-4-2</b>	Multicore metallic data and control cables for analogue and digital transmission - Part 2-2: Generic specification for shielded cable up to 600 MHz; device connection cables and switchboard cables	<b>DIN EN 60950</b>	Safety of information technology equipment
<b>DIN EN 50288-2-1</b>	Symmetric cable, shielded up to 100 MHz	<b>DIN V ENV 61000-2-2</b>	Electromagnetic compatibility (EMC) Part 2-2: Environmental conditions; main section 2: Compatibility level for low frequency cable propagated interference factors and signal transmission in public low voltage networks (IEC 61000-2-2:1990, modified)
<b>DIN EN 50288-5-1</b>	Symmetric cable, shielded up to 250 MHz	<b>DIN EN 61000-3-2</b>	Electromagnetic compatibility (EMC) Part 3-2: Limits; Limits for harmonic current emissions (equipment Input current up to and Including 16 A per conductor) (IEC 6100-3-2:2000, modified)
<b>DIN EN 50288-4-1</b>	Symmetric cable, shielded up to 600 MHz	<b>DIN EN 61000-4-1</b>	Electromagnetic compatibility (EMC) Part 4-1: Test and measuring methods; Overview of the series IEC 61000-4 (IEC 61000-4-1:2000)
<b>DIN EN 50310</b>	Application of measures for potential equalisation and earthing in buildings with information technology equipment	<b>DIN EN 61000-4-2</b>	Electromagnetic compatibility (EMC) - Part 4: Test and measuring methods - Main section 2: Interference resistance to static electricity discharge - EMC Basic standard (IEC 61000-4-2:1995)
<b>DIN EN 55022</b>	Information technology equipment - radio interference properties . thresholds and measuring methods (IEC/CISPR 22:1997, modified + A1:2000)	<b>DIN EN 61000-4-3</b>	Electromagnetic compatibility (EMC) Part 4-3: Test and measuring methods; Testing the interference resistance against high frequency magnetic fields (IEC 61000-4-3:2002)
<b>DIN EN 55024</b>	Information technology equipment - interference resistance characteristics - thresholds and test methods (IEC/CISPR 24:1997, modified)	<b>DIN EN 61000-4-4</b>	

# NORM-GLOSSARY

<b>DIN EN 61000-4-5</b>	Electromagnetic compatibility (EMC) - Part 4: Test and measuring methods - Main section 4: Testing the Interference resistance against fast transient electrical interference factors/Burst-EMC Basic standard (IEC 61000-4-4:1995)	<b>IEC 1156-3</b>	Generic specification for floor cables
<b>DIN EN 61000-4-6</b>	Electromagnetic compatibility (EMC) - Part 4: Test and measuring methods - Main section 5: Testing the interference resistance against surge voltages (IEC 61000-4-5:1995)	<b>IEC 1156-4</b>	Generic specification for patch and device connection cables
<b>DIN EN 61000-6-1</b>	Electromagnetic compatibility (EMC) - Part 4: Test and measuring methods - Main section 6: Cable-propagated interference factors, induced by high frequency fields (IEC 61000-4-6:1996)	<b>EN ISO/IEC</b>	Generic specification for building connection and vertical cables
<b>DIN EN 61000-6-2</b>	Electromagnetic compatibility (EMC) Part 6-1: Generic standards - immunity for residential, commercial and light industrial environments (IEC 61000-6-1:1997, modified)		DIN EN ISO/IEC 9314-3 Information processing systems - distributed data interface with fibre optics (FDDI) - Part 3: Medium-specific specifications for the bit transmission layer (PMD) (ISO/IEC 9314-3:1990)
<b>DIN EN 61000-6-3</b>	Electromagnetic compatibility (EMC) Part 6-2: Generic standards; interference resistance for industrial environment (IEC 61000-6-2:1999, modified)	<b>ISO/IEC</b>	ISO/IEC 11801 Information technology - application-neutral site cabling (cf EN 50173) 2nd edition 2003 ISO/IEC 24702
<b>DIN EN 61000-6-4</b>	Electromagnetic compatibility (EMC) Part 6-3: Generic standards; Generic standard Interference emission for residential, commercial and light industrial environments (IEC 61000-6-3:1996, modified)	<b>DIN VDE</b>	DIN VDE 0100-540 Erection of power installations with rated voltages up to 1000 V; selection and setting up electrical equipment; earthing, earth conductor, potential equalisation conductor
<b>DIN EN 61131-2</b>	Electromagnetic compatibility (EMC) Part 6-4: Generic standards; Generic standard interference emission for industrial environment (IEC 61000-6-4:1997, modified)	<b>UL</b>	UL 508 Industrial Control Equipment; Standard for Safety UL 1604 Industrial Control Equipment for Use in Hazardous Locations
<b>DIN EN 187000</b>	Programmable Logic Controllers - Part 2: Equipment requirements and testing (IEC 61131-2:1992)	<b>UL 60950</b>	Safety of Information Technology Equipment
<b>DIN EN 187101</b>	Generic standard specification; Fibre optic cable	<b>Germanischer Lloyd</b>	Safety of Information Technology Equipment
<b>DIN EN 188000</b>	Family specification: Fibre optic telephone, underground and pipeline cables	<b>CENELEC-Normen</b>	Germanischer Lloyd; Classification and construction regulations, VI-7-3-Part 1
<b>DIN EN 188100</b>	Generic specification: Fibre optics	<b>EN 50173</b>	European guidelines, in Europe "normative" (CENELEC is the European committee for electronic standardisation)
<b>DIN EN 188101</b>	Generic specification: Single mode fibre optics	<b>HD 608</b>	describes the performance requirements for the application-neutral cabling system
<b>DIN EN 188201</b>	Family specification: Non-dispersion-shifted single mode fibre optic cables (Type B1:1)	<b>EN 50167</b>	Generic specification of the symmetric data cable for message transmission
<b>DIN EN 188202</b>	Family specification: Multimode fibre optic cables - Category A1a	<b>EN 50168</b>	Generic specification for shielded floor cables
<b>IEC</b>	Family specification: Multimode fibre optic cables - Category A1b	<b>EN 50169</b>	Generic specification for shielded patch and device connection cables
<b>IEC 60793-2</b>	IEC 60096-1 High frequency cables; Part 1: General requirements and measurement methods IEC 60793-2	<b>EN 55022</b>	Generic specification for shielded building connection and vertical cables  (concerning EMC). Contains limits and methods for measuring radio interference for information technology equipment.
<b>IEC 60794-2</b>	Fibre optics - Part 2: Product specification	<b>Note</b>	In the standards EN 50167 EN 50168 and EN 50169 data cables with shielding and halogen-free outside covering are specified
<b>IEC 60874-10</b>	Fibre optic cables; Part 2: Indoor cables - product specification		
<b>IEC 1156-1</b>	Connectors for fibre optics; Part 10: Generic specification; Fibre optics connector Type BFOC/2,5 (ST)		
<b>IEC 1156-2</b>	Generic specification of the symmetric data cable for message transmission		

# ■ GLOSSARY

<b>10 Base FX</b>	Standard for 10 Mbit/s Ethernet data transfer on fibre optic cables. Every connection is made using two fibres, one fibre for "send data" and another one for "receive data".	<b>Alignment</b>	Optimal positioning of the ends of the optical fibre for splice connections (splicing). When connecting single-mode fibre optics, the alignment of the fibres is made with the LID system.
<b>10 Base T</b>	Standard for 10 Mbit/s Ethernet data transfer on twisted pair cables. Every connection is made using two pairs of cores, one pair for "send data" and another one for "receive data".	<b>Analogue signal</b>	Signal whose information parameter can take any of many values within technically specified limits. Theoretically an infinite resolving capacity, however limited practically.
<b>100 Base FX</b>	Standard for 100 Mbit/s Ethernet data transfer on fibre optic cables. Every connection is made using two fibres, one fibre for "send data" and another one for "receive data".	<b>Analogue signal</b>	A physically measurable value (such as a voltage for example), modifiable in frequency and amplitude for information transfer.
<b>100 Base TX</b>	Standard for 100 Mbit/s Ethernet data transfer on twisted pair cables. Every connection is made using two pairs of cores, one pair for "send data" and another one for "receive data".	<b>ANSI</b>	American National Standards Institute promotes and manages industry standards
<b>1000 Base FX</b>	Standard for 1000 Mbit/s Ethernet data transfer on fibre optic cables. Every connection is made using two fibres, one fibre for "send data" and another one for "receive data".	<b>APC</b>	Advanced Process Control - advanced methods of process control. They imply model predictive control (MPC) rules, fuzzy control, KNN and softensors. APC methods are used particularly in the process industry. In chemical mass production for example, they are used for controlling reactors, distillation columns, centrifuges and coupled systems and for the optimal control of starting, loading and product change procedures. Critical process factor fluctuations can be reduced, faults can be rectified more quickly and thus raw material and energy consumption can be minimised and output and product quality can be increased.
<b>1000 Base TX</b>	Standard for 1000 Mbit/s Ethernet data transfer on twisted pair cables. Every connection is made using two pairs of cores, one pair for "send data" and another one for "receive data".	<b>API</b>	Application Programming Interface - interface which the applications use for communication.
<b>Absorption</b>	The weakening (loss) of radiation when passing through material. A part of the radiant energy of light is converted, for example, to heat.	<b>Appartus</b>	Equipment, device, machine, tool, mechanism. For the purpose of the EMC law, an apparatus is an end product with an independent function, its own enclosure and if needed interfaces and connections for the functional and proper power supply integration in its usage environment.
<b>Access protocol</b>	Access method. Regulates access to the medium. Ethernet: CSMA/CD ; Token-Ring: Token; FDDI: Append Token; WLAN: CSMA/CA	<b>Application Layer</b>	Application Layer - layer 7 of the OSI reference model. Applications access network services. Services are provided which support the applications, e.g. software for data transfer.
<b>Account</b>	Account	<b>Arcnet</b>	Real-time capable field bus for industrial high-speed applications, especially for networking intelligent units, e.g. for communication between controllers or PLC systems with PC applications.
<b>ACL</b>	Agent Communication Language - communication language for information exchange between agents.	<b>ARP</b>	Address Resolution Protocol requests the associated MAC address via the IP address.
<b>ACR (attenuation to crosstalk ratio):</b>	The ACR value shows the difference between near-end crosstalk and wave attenuation. The value should be as large as possible.	<b>AS</b>	Active star coupler
<b>Active components</b>	In electrical engineering: Conductors and conductive parts of operating materials which are usually earthed when live.	<b>AS</b>	Australian Standard
<b>Active redundancy</b>	Action for increasing system availability. During fault-free operation, all of several available system components are involved in performing the function. In the case of failure, the intact components take over the task of the defective components.	<b>ASI</b>	Actuator Sensor Interface - bus systems for the lowest automation level. Enables the simple connection of sensors, actuators and integrated systems to the first control level.
<b>Actuator, actor</b>	Control components, e.g. adjustment motor, switch coupling, power switch for accessing the process, i.e. for using information for influencing material or energy flows in a well-controlled object.	<b>ASIC</b>	Application Specific Integrated Circuit
<b>ADM</b>	User Association DIN-Messbus.	<b>ASN.1</b>	Abstract Syntax Notation One. Programming language of the MIB
<b>ADSL</b>	Asymmetric Digital Subscriber Line - digital subscriber connection line with asymmetrically distributed bandwidth from and to the subscriber.	<b>ASRS</b>	Automatic Storage and Retrieval System - automatic high bay warehouse
<b>AFNOR</b>	Association Française de NORmalisation (France)	<b>ASTM</b>	American Standard of Testing Materials (USA)
<b>Aging</b>	Process for updating data, special address storage. After expiry of a time period, an address is flagged as "old" and is deleted on the next cycle if it has not been detected at a port by then.		

# ■ GLOSSARY

<b>ATM</b>	Asynchronous Transfer Mode. Based on cells of 53 bytes. Suitable for telephone, video and other data transfer. Mainly used in WAN applications.	<b>Bandwidth</b>	As well as the attenuation, the bandwidth is the second parameter for designating the properties of a fibre optic cable. The bandwidth represents a measure of the dispersion behaviour of a fibre optic cable.
<b>Attenuation</b>	Reduction of the signal output between two cross section areas of a fibre. It is dependent on the wavelength: Main causes: Dispersion, absorption. Its unit of measure is "dB", specified as 10log P(L1)/P(L2).	<b>Bandwidth</b>	Amount of data which can be transported within one second. For an individual connection, this is analogous to speed, e.g. 10 Mbit/s, 100 Gbit/s.
<b>Attenuation coefficient</b>	This is the attenuation of the cable in relation to the length in stationary condition (unit: dB/km or dB/100 m)	<b>Batch-Processing</b>	Batch-Processing - processing a quantity of objects in a defined sequence, e.g. a list of requests, instructions or other data to be transmitted.
<b>Attenuation</b>	Damping	<b>Baud rate</b>	Measure for the number of symbols transferred per second. Also called symbol rate, symbol speed or step speed. Unit = baud. If a symbol is only represented by one bit [0 or 1], the baud rate corresponds to the bit rate. If a symbol has several bits, the bit rate is larger than the baud rate.
<b>AUI</b>	Attachment Unit Interface. Interface for physical separation of transceivers from Ethernet controllers.	<b>BDM</b>	Basic Drive Module: includes the converter part and the drive specific controller and regulation.
<b>Auto negotiation</b>	A process defined in Fast Ethernet using which the participants agree a common transfer mode before the actual data transfer (100 Mbit/s or 10 Mbit/s, Full Duplex or Half Duplex)	<b>Bending radius</b>	Smallest radius which the conductor can be bent without additional attenuation.
<b>Auto negotiation</b>	Detects the transfer parameters such as speed, duplex mode, flow control at the port of the connected device and sets the optimal values accordingly.	<b>BFOC</b>	Bayonet Fibre Optical Connector. Also known as ST connector. Fibre optic connector with bayonet connection. Standardised as the only connector for 10 Mbit/s Ethernet. Also available for multi-mode and single mode glass fibres and for POF.
<b>Autocrossing</b>	Automatic crossover of the send and receive lines at twisted pair interfaces is possible with this function. Participants, e.g. switches, which support this function can be connected with each other using a straight through cable instead of a crossover cable.	<b>BGP</b>	Border Gateway Protocol Routing Protocol in the WAN.
<b>Automatic machine</b>	An automatic machine, derived from the Greek "automatos" = self-moving, from the technical realisation perspective is every piece of equipment which automatically runs an intended process after fulfilling specified start conditions after the granting of the start command.	<b>Binary signal</b>	Signal whose information parameter can only take two values.
<b>Automation</b>	Application of technology, using which operating equipment completely or partially performs specified operations according to preset programs without human intervention.	<b>Bit</b>	Binary Digit - binary position, binary character, binary number. Basic unit for information in digital transfer systems (0/1, On/Off).
<b>Automation pyramid</b>	Classically consists of five levels: field level (sensor / actuator), control level (process control, forming production cells), HMI level, MES level, ERP level	<b>Bit rate</b>	Number of bits which are transferred within a time unit. Measure for the transfer speed of binary data.
<b>AWG</b>	American Wire Gauge, a unit for wire diameter. Back scattering technique a method for measuring length, reflection and attenuation curve in a data cable. A small proportion of the signal is reflected to the sender and evaluated.	<b>bit serial</b>	The individual bits of a character are transferred one after the other in time on a single line.
<b>Backbone (-network)</b>	Connects several LAN or WAN networks to a large network.	<b>BITBUS</b>	Field bus based on standard technologies such as RS485 and SDLC. Easy to use communication system.
<b>Backpressure</b>	Simulates a collision in HDX mode by generating a jam signal.	<b>BLP</b>	Bandwidth length product
<b>Balun</b>	Device for joining balanced (the currents are equal in magnitude and opposite in phase such as twisted pair) and unbalanced (one side is connected to earth and the other carries the signal such as coax) lines, but also for resistance transformation (wave resistance adaptation).	<b>BOOTP</b>	Bootstrap Protocol. Provides the statically assigned IP address to a given MAC address.
		<b>BPDU</b>	Bridge Protocol Data Unit. Signalisation packet between switches, used for spanning tree.
		<b>bps</b>	Bits per second: Measure for data transfer speed.
		<b>Bridge</b>	A device which connects two LANs with each other.
		<b>Broadcast telegram</b>	Broadcast to all network participants.
		<b>BS</b>	British Standard (UK)
		<b>BSI</b>	British Standards Institute (UK)

# ■ GLOSSARY

<b>BT</b>	Bit time. Duration of a bit.	<b>CATV</b>	Community Antenna Television (International)
<b>Buffered fibre cable</b>	Consists of several loose fibres in a common sleeve.	<b>CC-Link</b>	Control & Communication Link - field bus system which makes high- speed communication up to 10 Mbps possible between the field equipment.
<b>Building automation</b>	Computer based control, observation and monitoring of all relevant functions for the operation or use of one or several buildings, e.g. heating, ventilation, air conditioning, lighting, ...	<b>CDM</b>	Complete Drive Module - it consists of a so-called Basic Drive Module (BDM) and possible accessories such as power supply equipment for example.
<b>Bundles</b>	The fibres are arranged parallel to each other and joined flat with each other at equal spacing (e.g. directly glued or between two adhesive films). Several bundles can be grouped in stacks in one cable.	<b>CEBEC</b>	Comite Electrotechnique Belge (Belgium)
<b>Bus, Bus system</b>	Basically, a distinction between serial and parallel buses must be made. Serial bus systems (cable bus systems) transfer data bit serial between widely distributed components of a system using a common medium (two-wire or four-wire, coaxial cable, fibre optic cable or radio waves) and in this way drastically reduce the wiring complexity as compared with a conventional star configuration.	<b>CEE</b>	International Commission on Rules for the Approval of Electrical Equipment (international commission)
<b>BV</b>	Bureau Veritas (France)	<b>CEI</b>	Commission Electrotechnique Internationale (International)
<b>Byte</b>	Data format or unit for characterising information quantities and storage capacities. 1 byte = 8 bits. Common multiples: kB, MB, GB	<b>CEMP</b>	Centre d'Etude des Matières Plastiques (France)
<b>Cable</b>	Means for transferring signals. It consists of one or several electric conductors insulated from each other in a common sleeve installed in the cable covering.	<b>CEN</b>	Comité Européen de Normalisation (European Committee for Standardisation)
<b>Cable core</b>	The whole of the stranded elements present in the cable and the wrapping over all these elements.	<b>CENELEC</b>	Comité Européen de Normalisation Electrotechnique (European Committee for Electrical Engineering Standardisation) Responsible for the harmonisation of electrical engineering standards in the European Union.
<b>Cable covering</b>	Sheath, generally made of polyethylene (PE), polyvinyl chloride (PVC) or halogen-free material (H) which protects the cable core from environmental influences.	<b>Channel</b>	Connection path between two operating points from and including distribution equipment (e.g. hub) up to and including work place connection cable.
<b>Cable screen</b>	Conductive sleeve of a cable or a conductor for protecting individual cores or the complete stranded elements against electromagnetic influences from the outside.	<b>Central drive technology</b>	Design technique for drive concepts with several motors where the central power supply, the converter, the motor controller, possibly required motor regulators and diverse switching equipment are combined in one switch cabinet.
<b>CAE</b>	Computer Aided Engineering - computer supported planning, design, development and project planning. (computer supported engineering work in the broadest sense)	<b>CiA</b>	CAN in Automation e.V.: International user and manufacturer association founded in 1992. This provides technical, product-specific and general information with the aim of disseminating knowledge about CAN.
<b>Caloric load</b>	Total of the caloric load values of all combustible materials in a room (unit for cable: MJ/m or in kWh/m)	<b>CIP</b>	Control & Information Protocol.
<b>CAM</b>	Computer Aided Manufacturing - computer supported production (production in computer automated manufacturing systems).	<b>Client</b>	A workstation connected to a network, e.g. a PC, which uses the services of a server. The client sends user requests in a special protocol to the server, receives its responses and displays these in legible form on the user's screen.
<b>CAN</b>	Controller Area Network: Serial bus system, car manufacturing, industrial control equipment, design according to ISO 11898 bus medium twisted pair conductor.	<b>Client Server Network</b>	Tasks are clearly divided. The server provides services and the clients use these services.
<b>CAP</b>	Computer Aided Planning - computer supported planning (e.g. of processes, work operations, work sequences, operating material usage etc.).	<b>CLPA</b>	CC-Link Partner Association
<b>CAQA</b>	Computer Aided Quality Assurance - computer supported quality assurance (planning and realisation of the operational quality assurance tasks).	<b>CNC</b>	Computerised Numerical Control.
		<b>CNET</b>	Centre National d'Etude de Télécommunication (France)
		<b>CNOMO</b>	Comité de Normalisation des Moyens de Production (France) - commission for standardisation of tools and machine tools in the French automobile industry
		<b>Coating</b>	A plastic coating applied to the fibre covering surface as mechanical protection.

# GLOSSARY

<b>Coaxial cable</b>	Concentric conductor pair consisting of an inside and an outside conductor which completely encloses the inside conductor. Inside conductor and outside conductor are insulated from each other with a homogenous material or a combination of fixed supporting shells and a gas.	<b>Crosstalk</b>	Interference produced in a neighbouring pair from the usage signal in a wire pair.
<b>Collision domain</b>	For the CSMA/CD access method, the runtime of a data packet from one participant to the other is limited. Dependent on the data rate, this produces a spatially limited network, the so-called collision domain. The maximum expansion of a collision domain is 4250 m for 10 Mbit/s (Ethernet) and 412 m for 100 Mbit/s (Fast Ethernet). Full duplex operation of a connection makes expansion beyond these limits possible as it rules out collisions. The precondition for this is the use of bridges or switches.	<b>Crosstalk</b>	Undesired transfer of energy, e.g. between two neighbouring fibres of a cable.
<b>Compact fibre</b>	A combination of single fibre loose buffer and tight buffered cable. The small hollow space between fibre and sheathing is filled with a non-stick coating.	<b>CSA</b>	Canadian Standards Association (Canada)
<b>Component based automation</b>	New concept at TIA for applications with distributed intelligence. It is based on the new PROFINET standard of the PROFIBUS user organisation (PNO) and supports consequent modularisation using the component technology in machine construction and engineering.	<b>CSMA/CD method</b>	Carrier Sense Multiple Access/Collision Detection - access method for Ethernet according to IEEE 802.3. Each participant checks whether the transfer medium is free before sending a message. (Carrier Sense). Afterwards, it begins to send and simultaneously checks whether other participants (Multiple Access) have also started to transmit data. A collision occurs if two or more participants send at the same time. The participants end their data transmission (Collision Detection). The next attempt for a free line is started after a random time. For the CSMA/CD method, the network expansion is determined by a maximum permissible running time of the data signals on the network which is dependent on the data rate.
<b>Conductor</b>	The conductor is used for forwarding the electrical carriers and thus consists of an electrically conductive material (metal). The conductor is usually round.	<b>CSTB</b>	Centre Scientifique et Technique du Bâtiment (France)
<b>Conductor resistance</b>	The conductor resistance is determined by the quality of the copper used and the conductor cross section. It increases linearly with the length of the cable and is decisive for the attenuation.	<b>Cut-Through</b>	Switching process where a packet is already forwarded after recognition of the destination address. In this way, the latency time is low; however defective packets are also forwarded. Also known as "on the fly packet switching".
<b>Core</b>	The core is a conductor enclosed in an insulation sleeve. The insulation sleeve can be air or any other non-conductive material (usually plastic).	<b>CVI</b>	Complete Vertical Integration: This means the continuous information flow in automated production from the sensors and actuators via the control level to the management level. Its efficient realisation requires that office and factory automation are based on the same information technology platform and that the interfaces between the individual levels are standardised across all manufacturers.
<b>Corrosivity</b>	Produced by corrosive gases and acids when burning cables and wires. Non-corrosive cables should be used for laying in buildings. Halogen-free cables are generally non-corrosive.	<b>Data</b>	Characters or continuous functions which represent information based on known or implied arrangements for processing purposes.
<b>Coupler</b>	Passive component for transferring / branching light to one or several fibres. The arriving optical light power is divided or combined from another view direction.	<b>Data Link Layer</b>	Layer 2 in the OSI reference model: the data packets to be sent are converted unto so-called frames and sent, whereby the receiving side acknowledgement of the frames transmitted is waited for.
<b>Coupling mechanism</b>	Physical mechanism over which electromagnetic interferences, assuming sources affect sinks and based on the electromagnetic interference energy process from source to sink are transferred.	<b>dB</b>	Decibel: Unit which has been used to express the level for logarithmic relationship factors such as transfer factor, amplification factor, attenuation factor as the logarithm of the decimal logarithm. 1 dB 0.115 Np
<b>Coupling resistance</b>	Measurement for the quality of the screening. It is defined as the ratio of the voltage along the screen of the disturbed system to the current of the interfering system.	<b>DCOM</b>	Decentralised Control Systems
<b>CP</b>	Communication Processor - controls the process of the communication protocol between the components of a system	<b>DCS</b>	Digital Communications System
<b>CPU</b>	Central Processing Unit	<b>DCS</b>	Distance Control System
<b>Crimping</b>	A mechanical protection is made by pressing a sleeve around the fibres.	<b>DDL</b>	Device Description Language
		<b>DDR-SDRAM</b>	Double Data Rate SDRAM: new type of memory which uses the rising and the falling edge of the clock signal for data transfer. Read/write speed increases.

# ■ GLOSSARY

<b>Decentralised drive technology</b>	In contrast to centralised drive technology, here only the power supply and parts, if needed, of a central controller are installed in a switch cabinet for drive systems with several motors while all other functional parts such as converters and regulators are installed directly at the location for the individual motors.	<b>DIN Messbus</b>	Bus system designed for the reliable and cost-effective communication of equipment for measuring, monitoring and recording process and operation data. Practically any bus and branching cables, transfer rates 110 bps to 1 Mbps, full duplex operation. Areas of application: production measuring technology, quality assurance, statistical process control, operating and machine data recording and also in conjunction with programmable logic controllers.
<b>Decibel (dB)</b>	Unit for transmission strength, attenuation and output level.	<b>DIS</b>	Draft International Standard
<b>DEMKO</b>	Danmarks Elekriske Materielkontrol (Denmark)	<b>Dispersion</b>	Light impulses in a fibre have time diversification due to the dispersion. Distinctions are made between mode, material and wave dispersion.
<b>DES</b>	Data Encryption Standard	<b>DKE</b>	Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE. As national organisation for developing standards in electrical engineering and information technology, the DKE ensures important cross section concerns such as safety, EMC, components and performance of classic electricity grids through mobile radio communication up to software and Internet protocols.
<b>DESINA</b>	Decentralised and standardised installation technology for machine tools and production systems (comprehensive overall concept for the standardisation and decentralisation of the fluid technical and electrical Installation of machines and systems).	<b>DMA</b>	Digital Motion Access
<b>Destination address</b>	Destination address for Ethernet.	<b>DMC</b>	Digital Motion Control
<b>Device Description</b>	DD - Device Description: it provides an expanded text description of every individual device in the virtual field device.	<b>DNS</b>	Domain Name System. Translates host names to IP addresses via DNS server or statically with the "hosts" file.
<b>DeviceNet</b>	Simple CAN-based communication system for networking industrial automation equipment with superordinate controllers. Two twisted pair shielded pairs within a cable are used for transmission. One is used for communication and the other for supplying power to the connected equipment.	<b>Domains</b>	Broadcast domain - network segment only limited by routers where a broadcast spreads freely. Collision domain: Network segment limited by switches or routers where collisions spread freely.
<b>DFÜ</b>	Dial-up connection	<b>DP</b>	Decentralised Periphery (Profibus application layer, layer 7 in the OSI reference model)
<b>DHCP</b>	Dynamic Host Configuration Protocol. On request, communicates its IP address to a device which is permanently allocated via the associated MACaddress or is dynamically granted.	<b>DPI</b>	Dots Per Inch
<b>Dielectric</b>	An electrically non-conductive substance which an electrical field goes through. Increases the capacity of a plate condenser.	<b>DTE</b>	Data Terminal Equipment
<b>Dielectric constant</b>	Dielectric value. Substance-specific constant for the polarisability factor of the substance. The higher the dielectric constant of a dielectric the higher the capacity of the corresponding condenser.	<b>Duplex connector</b>	Two fibre optic connectors combined with a clip or their design which are usually used as send and receive line.
<b>Digital signal</b>	A digital signal has several information parameters, e.g. 8, 16, 32 or 64, which are provided one after the other chronologically for serial signals and in parallel chronologically for parallel signals. The 1/0 coded representation of information such as digits and letters or the bit patterns from analogue signals (sounds, images, videos, measurement values etc) produced by scanning and quantisation.	<b>DVMRP</b>	Distance Vector Multicast Routing Protocol. Internetwork Gateway Protocol, largely based on RIP. DVMRP uses IGMP to exchange routing datagrams with its neighbours.
<b>Digital/Analogue converter</b>	Functional unit which converts a digital signal to an analogue signal.	<b>DWDM</b>	Dense Wavelength Division Multiplex
<b>DIN</b>	Deutsches Institut für Normung	<b>EANTC</b>	European Advanced Networking Test Centre.
<b>DIN rail</b>	Support rail, construction element for simple mounting of modules. As well as the mechanical support function, support rails are very often used as PE collecting bars.	<b>Earth</b>	In the context of electrotechnical matters, this means the more or less good electrically conductive earth which shows no potential differences outside the influence range of earth connections or other electrical phenomena.
		<b>Earth conductor</b>	Conductor which connects the body of an apparatus to be earthed with an earth connector or several earth connectors provided this conductor is insulated in the earth or laid outside it.
		<b>EC Motors</b>	Electronically Commutated Motors - electronic motors

# GLOSSARY

<b>EFAC</b>	European Factory Automation Committee	<b>Encoder</b>	Coder, encrypter - in information technology, an encoder is a hardware or software based system for converting data in order to convey a certain amount of information faster over a slow transport path for example, or to require less storage space for archiving. In both cases, the information content remains the same, but the amount of data is reduced. Afterwards, at the other end of the line or after reading the stored data, the reverse procedure is required in order to restore the original data format. This is done using a decoder. An encoder is called a rotary encoder in industrial automation. This is an electromechanical precision device which converts analogue angle values at the input side on its shaft as compared with a reference point into electric digital output signals. Encoding A mechanical device on a connection system which ensures a non-reversed connection or prevents the insertion of a plug into a socket of the same connector type, i.e.. switched to a different use.
<b>EIA</b>	Electronic Industries Alliance (USA)	<b>EPC</b>	Electronic Product Code - electronic numbering system for physical objects such as, e.g. products, pallets, packets, individually packaged goods and also livestock.
<b>EIA</b>	Electronic Industries Association	<b>EPDM</b>	Ethylene Propylene Diene Monomer - synthetic rubber Produced by polymerisation.
<b>EIB</b>	European Installation Bus	<b>EPSPG</b>	Ethernet Powerlink Standardisation Group
<b>EIBA</b>	EIB Association	<b>ESD</b>	Electrostatic Discharge
<b>Elastomer</b>	Materials which can be reversibly expanded to at least double their starting length and have a low elasticity modulus and high recoil elasticity.	<b>ETG</b>	EtherCAD Technology Group
<b>Electric motors</b>	are electromechanical energy converters which can operate as motor and generator i.e. driving and braking.	<b>EtherCAT</b>	Ethernet for Control and Automation Technology. Ethernet solution for industrial automation. Thanks to the optimal usage of the Ethernet bandwidth, small quantities of data can also be transferred efficiently with EtherCAT. Extremely short cycle times and high transfer performance are the result. For example, any 1,000 distributed digital I/Os can be queried with EtherCAT in 30 µs with reading and writing in full duplex. 50 µs are needed for 200 analogue values and 100 axes are checked in 100 µs. EtherCAT is particularly suitable for fast PCbased control technology. The master does not need any special plug-in card and can be implemented with a very simple interface on any available Ethernet controllers. EtherCAT is also well suited for small and medium control technology and will also open up completely new application areas for distributed I/Os there.
<b>Electromagnetic interference</b>	Irradiation of interference during signal transmission caused by electromagnetic fields.	<b>Ethernet</b>	Based on the CSMA/CD access method. Coaxial cable or twisted pair wires are used as transfer medium. Widely used technology for networking computers in a LAN. Ethernet technology has generally established itself in the office environment.
<b>ELM</b>	Electrical Link Module		is an expansion of the standard Ethernet. It enables data exchange under hard real-time conditions with cycle times down to 200 µs and jitter of less than 1 µs. Thus, Ethernet can be used in automation technology on all communication levels from the control level to the I/Os.
<b>EMC</b>	Electromagnetic compatibility is the capability of an electric apparatus to operate satisfactorily in its electromagnetic environment without abnormally influencing this environment (which also includes other equipment) or itselfbeing influenced by it.	<b>Ethernet-IP</b>	Ethernet Industrial Protocol
<b>EMC</b>	Electromagnetic compatibility RFI immunity and emissions behaviour, Class A/B.		
<b>EMC Directive Cable</b>	European Commission Electromagnetic Compatibility Directive 89/336/EC. Plays a role in passive cabling in conjunction with the active components. Therefore, shielded systems should be used exclusively for information technology cabling.		
<b>EMC Directive, general</b>	Basic requirements for electromagnetic compatibility are specified in this new EMC Directive which equipment must comply with so that it can be placed on the market and put into service. "Equipment" is the higherlevel concept for the objects included in the Directive, which on the one hand are "apparatus" and on the other hand "stationary systems". For the purposes of the Directive, equipment also means components and assemblies installed in a device by the end user and mobile systems, which are defined as a combination of devices and other components which can be operated at various locations. Stationary systems in the new EMC Directive also includes large machines, high-voltage systems, electricity grids and telecommunication networks. These must be designed according to the recognised technology regulations, however do not require a conformity assessment before being put into service.		
<b>EN</b>	European Norm		

# ■ GLOSSARY

<b>EtheNet/IP</b>	Protocol stack for Ethernet which has been developed for industrial applications. It is based on the standard TCP/IP protocol and uses a common application layer with DeviceNet. It this makes information exchange between device level networks and information systems at the operating level easier.	<b>Field bus barrier</b>	Device for increasing the number of field bus participants in the Ex-area.
<b>ETSI</b>	European Telecommunication Standards Institute	<b>FIP</b>	Factory Implementation Protocol or Flux Information Process
<b>Factory automation</b>	Factory Automation	<b>FITL (Fiber In The Loop)</b>	FITL (Fibre In The Loop) Fibre in the local connection network. The following are distinguished depending on the end point of the fibre path: FTTB Fibre to the building; FTTC Fibre to the curb / kerb; FTTH Fibre to the home; FTTD Fibre to the desk
<b>Failure rate</b>	Measure for the failure behaviour of system units (e.g. components). The proportion of failures per time period with respect to the total number of a system quantity is designated as the failure rate.	<b>Flame resistance</b>	Description of the behaviour of products against fire propagation
<b>FAN</b>	Field Area Network - field bus system: Network for real-time capable exchange of data and information between automation components, equipment and power units inside the technology area of systems.	<b>Flame retardant</b>	Flame retardant, i.e. fire propagation in the case of fire is delayed (FR)
<b>FAR</b>	Federal Air Regulation	<b>Frequency</b>	Number of complete oscillations per second (in Hz)
<b>Fast Ethernet</b>	100 Mbps transfer rate	<b>Frequency converters</b>	are devices based on power electronic semiconductor components which operate in switched mode, i.e. only in the on-state or in the off-state. Especially in variable speed alternating current drive systems, they have the task of producing a usually three-phase modifiable frequency and voltage amplitude for feeding the rotary motor from a single or three phase mains alternating current constant frequency and amplitude.
<b>FCS</b>	Frame Check Sequence. Checksum at the end of the Ethernet packet; calculated and recorded by the sender. The recipient calculates the checksum based on the packet received and compares this with the value entered.	<b>FRNC</b>	Flame retardant and non corrosive
<b>FDDI (Fiber Distributed Data Interface)</b>	FDDI (Fibre Distributed Data Interface) Fibre optic network with dual opposite ring topology and 100 Mbit/s transfer rate. The FDDI is fault tolerant to cable or node failure.	<b>FTP</b>	File Transfer Protocol: Rules for transferring data from one computer via a network to another computer. The protocol is based on TCP/IP which has established itself as quasi standard for data transfer via Ethernet networks. FTP is one of the most used protocols on the Internet. It is defined in RFC 959 in the official regulations for Internet communication.
<b>FDIS</b>	Final Draft International Standard	<b>FTP</b>	1. File Transfer Protocol. Protocol on Layer 5, uses TCP for transport, therefore usage in WAN 2. Foiled Twisted-Pair.
<b>FDMA</b>	Frequency Division Multiple Access - multiple access in the frequency multiplex	<b>FTTD</b>	Fibre To The Desk
<b>FDT</b>	Field Device Tool: industry standard created by ZVEI and PNO, which makes the integration of measuring and automation equipment in the process and system control systems easier.	<b>FTZ</b>	Fernmeldetechnisches Zentralamt
<b>FDX</b>	Full duplex - transfer mode of a component: sending and receiving is possible simultaneously. No access method is necessary.	<b>Full duplex</b>	Data transfer process in which information is transmitted simultaneously in both directions.
<b>FEXT</b>	A form of crosstalk where signals from participants on the opposite side of a twisted pair line overlap.	<b>Full duplex operation (two-way transfer)</b>	Information transfer in both directions on one fibre.
<b>FF</b>	Field bus Foundation	<b>GARP</b>	Generic Attribute Registration Protocol. Protocol family for exchanging parameters between switches on Layer 2 gateway device for connecting two networks which have different protocols.
<b>Fibre core</b>	Core of a glass fibre with a higher refractive index than the cladding glass.	<b>Gbit</b>	GigaBit, 109 Bit
<b>Fibre multiplex</b>	Transmission method where one fibre is assigned to each transmission channel.	<b>Gbps</b>	Gigabits per second
<b>Fibre optics</b>	Transparent dielectric waveguide for transferring electromagnetic waves in the visible light range. Conductor based on glass fibre or plastic fibre; not sensitive to electromagnetic interference.	<b>Gigabit Ethernet</b>	Fast data network specified in 1999 in IEEE 802.3
<b>Field bus</b>	Bus system near the process for direct connection of sensors and actuators with their own intelligence. Small quantities of data are transferred in digital form between sensors, actuators and controller on a field bus.	<b>Glass cladding</b>	The glass enclosing the core of a glass fibre; the cladding glass has a lower refractive index than the core glass.
		<b>GMA</b>	VDE/VDI-Gesellschaft Mess- und Automatisierungstechnik
		<b>GOST</b>	USSR-Standards

# ■ GLOSSARY

<b>Graded index fibre</b>	The graded index fibre is a fibre optic cable with a graded index profile	<b>Hybrid cable</b>	Consists of at least two different types of cable (e.g. fibre optic and copper cables) in a common sleeve.
<b>Graded index profile</b>	Fibre whose refraction index profile decreases parabolically from the inside to the outside across the cross section of the core surface.	<b>IAONA</b>	Industrial Automation Open Networking Alliance: Alliance of leading international automation equipment manufacturers for dissemination of open network standards such as Ethernet as world wide standard for industrial communication.
<b>GRP Element Gradientenfaser</b>	Antibuckling and strength, ember made of glass filaments (GRP: Glass Reinforced Plastic).	<b>ICMP</b>	Internet Control Message Protocol. Most well-known command: Ping.
<b>Half duplex</b>	Operating mode, where a device can either send or receive data. Ethernet collision detection is active for half duplex. The network expansion is limited by the runtime delays of the equipment and transmission media.	<b>ID</b>	Identifier
<b>Half-life</b>	(A radionuclid) is the time in which the activity is reduced by half.	<b>IDA</b>	Interface for Distributed Automation. Open interface on top of the TCP/IP stack for automation applications.
<b>Halogen-free</b>	No halides (e.g. chlorine) in use. Halogen-free cables are used for increased fire protection requirements with respect to protection of persons or on account of high material concentration. In the case of fire they release noncorrosive gases and the released quantity of toxic gases is significantly lower than for PVC materials.	<b>IEA</b>	International Ethernet Association - association for promoting the use of industrial Ethernet
<b>HCS</b>	Half duplex - transfer mode of a component: either sending or receiving is possible.	<b>IEC</b>	International Electrotechnical Commission
<b>HD</b>	Harmonisation Document (international)	<b>IEE</b>	Institution of Electrical Engineers (Great Britain)
<b>HID</b>	Human Interface Devices - user interfaces: any device for interaction between human and computer.	<b>IEEE</b>	Institute of Electrical and Electronics Engineers
<b>HMI</b>	Human Machine Interface	<b>IETF</b>	Internet Engineering Task Force.
<b>HN</b>	Harmonisation des Normes (France)	<b>IFG</b>	Inter Frame Gap. minimum gap between two packets.
<b>Hollow core</b>	Consists of a fibre and a loose sleeve enclosing it.	<b>IGMP</b>	Internet Group Management Protocol. Layer 3 protocol for multicast transport.
<b>Horizontal Integration</b>	Connects the MES solutions with each other in an enterprise pyramid. In this way, all information is available online and multiple data entries and doubled data retention are avoided.	<b>IGP</b>	Interior Gateway Protocol.
<b>HRTS</b>	Hard Real-Time System - system that is able to meet hard real-time requirements.	<b>IGRP</b>	Interior Gateway Routing Protocol.
<b>HSE</b>	High Speed Ethernet Industrial Ethernet solution of the Fieldbus Foundation FF	<b>Impedance</b>	Impedance of the electrical quadripole; it is composed of the ohmic resistance and the reactance, the frequency-dependent resistances and capacitances. The impedance is constructively specified by the dimensions of the internal conductor, dielectric and shielding.
<b>HSLAN</b>	High Speed LAN: local network with transfer rates around 100 Mbps and higher.	<b>Indoor cable</b>	Cable for applications inside buildings. They are not suitable for laying outdoors.
<b>HTML</b>	Hyper Text Markup Language - programming language with hypertext links. Language used for most Websites.	<b>Industrial Ethernet</b>	Designation for Ethernet in automation technology. Due to the industrial usage environments, the network components must comply with expanded temperature ranges and increased requirements with respect to the reliability and safety of the network.
<b>HTTP</b>	Hyper Text Transfer Protocol - data transfer protocol for the transfer of HTML pages and the files of all kinds linked to them. It is the protocol on which the whole World Wide Web is based; this means it regulates the interaction between Web browser and Web server. It is active for every mouse click on a hyperlink and ensures that the browser is provided with the respective next piece of desired information.	<b>Insertion loss</b>	For assessment of the transfer quality of a plug connector, its insertion loss is taken into account, i.e. it is determined what amount the attenuation of an optical transmission path increases when a plug connection is inserted into this transmission path.
<b>Hub</b>	Central connecting device in a network with star topology which distributes arriving data packets to all connected end devices.	<b>Insulation resistance</b>	It is determined by the insulation material whereby the material properties are more significant than the insulation thickness. The insulation resistance is dependent on the length. The higher the specific resistance of a material, the more suitable the material is for insulation; the unit is [m]; for cables and wires, the derived units [Mkm] or [Gkm] are common.

# ■ GLOSSARY

<b>INTERBUS</b>	Bus system which is designed from its technical characteristics specially for use with industrial sensors/actuators and continuous networking from the controller level right up to the last limit switch.	<b>L-PAS</b>	Alignment System) is a system for splice process control. The ends of the fibres to be spliced are constructed with one or several CCD cameras. The video signal is used on the one hand for displaying the fibres on the monitor and for controlling the fibre positioning and on the other hand for the splice attenuation assessment.
<b>Interface</b>	Intersection point at which two different systems are connected for the purpose of data transfer.	<b>LACP</b>	Link Aggregation Control Protocol.
<b>Interface</b>	From the hardware standpoint, an interface identifies the connection point between two assemblies/devices/systems.	<b>LAN</b>	Local Area Network: spatially limited system for high speed information transfer between a limited number of independent terminals with equal rights.
<b>Inteference</b>	Fault, adverse effect, reduction of functionality	<b>LAN</b>	Local Area Network e.g. Ethernet, FDDI and Token Ring
<b>Interference resistance</b>	Ability of a device, of a unit or of a system to operate without reduction of functionality in the presence of electromagnetic interference.	<b>LAP</b>	Link Access Protocol.
<b>Intrinsic safety</b>	Protection class of explosion proof electrical equipment. This is achieved in the course of designing this equipment by limiting the energy in the intrinsic electrical circuits.	<b>LASER</b>	Light Amplification by Stimulated Emission of Radiation: Amplifier for electromagnetic waves in the visible light spectrum.
<b>IP</b>	Internet Protocol : protocol according to which the data within a network, e.g. in the Internet or intranet reach one computer from another. Every computer present in the network is uniquely identified by its IP address.	<b>Latency</b>	Delay time
<b>IP Adress</b>	Internet Protocol address: numeric address which is assigned to a computer in the Internet and which makes it uniquely identifiable. It consists of a sequence of four groups of numbers, each with maximum three digits, separated by periods.	<b>Latency time</b>	Period of time needed by a device to react to an input event at the output or also the time which, e.g. a data packet needs to traverse a network from sender to recipient or how long it remains in a network device before it is forwarded.
<b>IP protection classes</b>	They characterise the protection of electrical equipment by enclosure, cover or casing and in fact the protection of persons against access to dangerous parts inside the cover and protection against the ingress of foreign bodies and water.	<b>Launch angle</b>	Angle between the propagation direction of the light occurring and the optical axis of a fibre optic cable. In order for the light occurring to be couples, this angle must be between zero and a maximum value which depends on the location on the front surface of the thread or on its local refraction difference as compared with the switching.
<b>IPC</b>	Industrial PC	<b>Lay-length</b>	The axial length along the centre axis of a cable according to which a stranding element is wrapped completely (360°) once around the axis.
<b>ISDN</b>	Integrated Services Digital Network. A digital network in which all types of data such as, e.g. voice, text or images are transmitted to and from the participant via a single line.	<b>LCIE</b>	Laboratoire Central des Industries Electriques (France)
<b>ISDN</b>	Integrated Services Digital Network. WAN transfer protocol.	<b>LED</b>	Light Emitting Diode
<b>ISO</b>	International Standards Organisation: world wide federation of national standards institutions from more than 130 countries.	<b>LID-System (Local Injection and Detection System)</b>	The LID system provides highly precise positioning of the fibres in the x/y and z directions. It consists of two bending couplers (sender and receiver). The light is coupled into the fibres on the sending side. The transmitted light power is measured at the receiving side. Criterion for the optimal alignment of the fibres is the maximum of the light power transmitted over the splice.
<b>ISO/OSI</b>	OSI reference model	<b>Light speed</b>	v0 2, 998 x 108 m/sec
<b>ITU-T</b>	International Telecommunication Union, Telecommunication Standardisation Sector Standardisation Committee	<b>Light waves</b>	Electromagnetic waves in the optical frequencies range. The term "light" originally referred to the visible radiation with the human eye with a wavelength between 400 and 800 nm. However, it is also common to describe radiation in the adjacent spectral ranges (e.g. infrared) as light.
<b>Jabber</b>	Defective frames for Ethernet with more than 1518 bytes.	<b>Link</b>	Connection path between two nodes from and including the distribution patch panel up to and including the work place connection socket.
<b>Jitter</b>	Term for time fluctuations of cyclic events.		
<b>KB</b>	Kilobyte -> 1 KB = 210 or 1024 bytes		
<b>kbps</b>	Kilobits per second		
<b>KEMA</b>	Keuring van Elektrotechnische Materialen (Netherlands) The video image evaluation L-PAS (Lens Profile		

# ■ GLOSSARY

<b>Link Aggregation</b>	Combination of several ports (max, 4) into one virtual port. Parallel connection transfer with redundancy if a port fails. Standard IEEE 802.3. Commonly called "Trunking".	<b>MIB</b>	Management Information Base. Contains the description of the connected objects and functions in a network.
<b>LON</b>	Local Operating Network: open bus system which makes possible the interaction of components from different manufacturers.	<b>Microbending</b>	Bending of a fibre which produces light losses and thus attenuation increases.
<b>Loop resistance</b>	Ohmic complete resistance from transmit and return conductors (unit: W/km)	<b>Migration</b>	Process of porting data or software to a different technical platform
<b>Low Voltage Directive</b>	The aim of the directive is to ensure the safety of the consumers. It concerns all electrical equipment for generating, transmitting, distributing, storing electrical energy, e.g. generators, cables, switches, sockets and many others, for use with a rated voltage between 50 and 1,000 Volts for alternating current and between 75 and 1,500 Volts for direct current. Exceptions are regulated in Appendix II of the Directive. Such equipment, according to the Directive, is only allowed to be brought into circulation if it is manufactured according to the state of safety technology specified in the European Union, it does not endanger people, productive livestock and property during proper installation and maintenance and during proper use, it has been subjected to a conformity assessment procedure by the manufacturer, there is a corresponding declaration of conformity and it is marked with the CE marking.	<b>MII</b>	Media Independent Interface
<b>LSOH</b>	Low smoke and halogen-free (LS = low smoke) (OH = zero halogen)	<b>MIL</b>	Military Specification (USA)
<b>LWL</b>	Fibre optics	<b>MLPPP</b>	Multi Link PPP. See also PPP.
<b>MAC</b>	Medium Access Control	<b>MMI</b>	Man Machine Interface
<b>Machine</b>	According to the Machines Directive, a machine means a totality of parts, at least one of which is moveable, connected with each other. As well as the mechanical components, operating, control and energy components also belong to the machine.	<b>MMS</b>	Man Machine Interface (MMI)
<b>MAN</b>	Metropolitan Area Network (large area network, e.g. connection of several LANs within a city).	<b>MODbus</b>	Master / Slave network which makes it possible, for example, for a master computer to communicate with one or several PLCs or Remote I/Os, to perform program processes, data transfers or other operations.
<b>MAP</b>	Manufacturing Automation Protocol - data transfer protocol for automated manufacturing.	<b>Modem</b>	Device which converts the signals from one form into another in order to make the compatibility with another system.
<b>Master</b>	Central bus participant which regulates the bus access. All other participants operate as slaves.	<b>Modes</b>	All waveguides capable of propagation in a fibre optic cable
<b>Master/Slave Concept</b>	Master element determines, slave element follows the instructions of the master. For example, an automation device as master element grants the access rights for the other components for the decentralised bus controller.	<b>Motion Control</b>	Motion control
<b>MC</b>	Motion Control	<b>MPLS</b>	Multiprotocol Label Switching. Layer 3-Protocol.
<b>MDI</b>	Medium Dependent Interface	<b>MSB</b>	Most Significant Bit.
<b>MDI-X</b>	MDI-Crossover	<b>MTBF</b>	Mean Time Between Failure.
<b>Meshed structure</b>	Every participant is connected with several others. Several independent transmission paths can exist between two stations. This redundancy can be used for assurance of the data transport if there is an interruption of one transmission path.	<b>Multi-vendor system</b>	in such a system, the problem-free collaboration of automation components from different manufacturers is made possible based on manufacturer-neutral communication media and transfer protocols.
		<b>Multicast</b>	Data packet which is destined for a group of devices, e.g. to all Hirschmann equipment.
		<b>Multicast telegramm</b>	is sent to a group of defined recipients. This group can be reached using one address.
		<b>Multimode fibre</b>	Fibre optic cable whose core diameter is large in comparison with the wavelength of the light so that two or more modes are capable of propagation.
		<b>Multiplexing</b>	Combination of two or several information channels on a common transfer medium.
		<b>Multistage profile</b>	Fibre with a sharp drop of the refraction index between core and cladding, whereby the refraction indexes of core and cladding in themselves remain constant. Transmitting width: The frequency at which the amount of the transfer function of a fibre optic cable has dropped to a specified value. The transmitting width of a fibre optic cable is approximately reciprocal to its length.
		<b>NAT</b>	Network Address Translation
		<b>NC</b>	Numerical Control

# ■ GLOSSARY

<b>NEC</b>	National Electrical Code (USA)	<b>OLP</b>	Optical Link Plug: Bus component, slave connection, industrial communication.
<b>NEMA</b>	National Electrical Manufacturers Association (USA)	<b>OPC</b>	OLE for Process Control. Protocol in process automation for the standardised data exchange between Windows applications.
<b>NEMKO</b>	Norges Elektriske Materiekkontroll (Norway)	<b>Open Systems</b>	An Open System is not sectioned off, but has active connections to its environment, i.e. it can exchange material, energy and information flows with its environment. According to IEEE, an open technical system provides the precondition for the portability of applications to many platforms from different manufacturers, the ability for the collaboration of different applications and for a consistent appearance to the user. This requires the manufacturer-neutral free choice of software and hardware components based on uniform and standardised interfaces and the simple configurability of application-specific system options according to the plug and play principle.
<b>NEN</b>	Nederlands Normalisatie Instituut (Netherlands)	<b>Operating capacity</b>	Effective line capacity
<b>NetBEUI</b>	NetBIOS Extend User Interface. Extended version of the NetBIOS protocol which is used by network software such as LAN Manager, LAN Server, Windows for Workgroups and Windows NT.	<b>Operation control level</b>	Level at which the relevant decisions for operation management are made. The occurrence of technical and organisation data from various areas is characteristic. The required communication system can range over several enterprise components or premises.
<b>Network</b>	Connection structure made up of individual elements which are connected with each other and/or which have a defined interaction with each other (road networks, electricity supply grids, communication networks)	<b>OSI</b>	Open Systems Interconnection. International standardisation programme, established by ISO and ITU-T in order to create standards for data networks which ensure the compatibility of equipment from different manufacturers.
<b>Network</b>	System with the associated transfer method that is supported by message coding cabling.	<b>OSI reference model</b>	Has been presented by the ISO with the objective of making it possible to connect networks from different manufacturers with different topologies. The OSI reference model thereby describes a standard which classifies and specifies according to which principles the communication, using various protocols, between the components to a network takes place. Altogether, it consists of seven Layers: Physical Layer; Data Link Layer; Network Layer; Transport Layer; Session Layer; Presentation Layer and Application Layer.
<b>Network Layer</b>	Layer 3 in the OSI reference model: The data packets are addressed here and logical names and addresses are converted into physical ones and the transmission paths are determined.	<b>OTDR</b>	Optical Time Domain Reflectometer. Measuring apparatus.
<b>NEXT</b>	Near End Crosstalk, in dB, calculated from the power ratio of the wanted signal power to the interference signal power at the same end of the cable.	<b>OUI</b>	Organisationally Unique Identifier. The first three bytes of the MAC address identify the manufacturer of the component.
<b>NF</b>	Normes Françaises (France)	<b>Outdoor cable</b>	Cables which are constructed so that they are sufficient for all requirements such as those which occur for underground and pipeline cable systems.
<b>NFC</b>	Normes Françaises Class C (France)	<b>ÖVE</b>	Austrian Association of Electrotechnique
<b>NIC</b>	Network Interface Card. network interface in the computer.	<b>P-NET</b>	Field bus for process automation. The electrical specification of P-Net is based on the RS-485 standard and uses a shielded two-wire cable. This allows cable lengths up to 1,200 m without repeaters.
<b>NMS</b>	Network Management System	<b>Packet size</b>	Frame size
<b>Node</b>	Branching point in a network.		
<b>Node</b>	Participant in the data network, e.g. computer, printer, hub, switch, ...		
<b>NRZ</b>	Non Return to Zero. Signal code.		
<b>NVP</b>	Nominal Velocity of Propagation - reduction factor of a data cable in [%] as compared to a line with a dielectric constant of 1 of the insulating material (air). Among other things, it is used for calculating the runtime (e.g. NVP 77 % produces a runtime of approx. 0.33 / NVP 4.2 ns/m).		
<b>ODVA</b>	Open DeviceNet Vendor Association: independent organisation which supports the further development, use and dissemination of DeviceNet world wide.		
<b>ODVA</b>	Open Device Vendor Association - is an organisation which promotes the world wide dissemination of DeviceNet and EtherNet/IP network technologies and standards in industrial automation.		
<b>OLE</b>	Object Linking and Embedding - is a technology for transferring various data between devices.		
<b>OLM</b>	Optical Link Module: Bus component for the construction of fibre optics networks and the transition from copper conductors to fibre optic cable.		

# ■ GLOSSARY

<b>Parallel Detection</b>	Partial function of auto negotiation in order to adjust to a partner which does not support auto negotiation. A port detects the speed due to FLP or NLP and adjusts accordingly to 100 Mbit/s or 10 Mbit/s. HDX is always used as duplex mode.	<b>Potential equalisation</b>	Electrical connection which brings the bodies of electrical equipment and external conductive parts to approximately the same potential.
<b>PAS</b>	Process Automation System	<b>Power switch</b>	Circuit breaker, mechanical switch hat can switch on the current under proper operating conditions, carry this without time limit and switch off, which can also under defined extraordinary conditions, e.g. short-circuit currents, switch on, carry for a specified time and switch off.
<b>Patch cable</b>	Flexible connection cable for connecting two components e.g. in a distribution cabinet.	<b>Presentation Layer</b>	Presentation layer: Layer 6 in the OSI reference model: This layer determines the text formatting and display. Furthermore, it is responsible for data security. It also makes data compression possible.
<b>PB</b>	Petabyte -> 1PB = 250	<b>Pressure sensor</b>	Measuring element which converts the physical pressure factor into an output factor proportional to the pressure.
<b>PD</b>	Powered Device - describes the end device in the draft of the IEEE P802.3af standard. IEEE 3af defines how a power supply can be done using an Ethernet twisted pair cable.	<b>Primary cabling</b>	A connection of the individual building distributors on the works premises.
<b>PDU</b>	Protocol Data Unit	<b>Priorisierung</b>	Prioritisation Data packets are processed in priority order according to defined criteria.
<b>PFM</b>	Plant Floor Machinery - production system	<b>Process</b>	Process, procedure or sequence in which time continuous or discontinuous quantitative or qualitative modification of the parameters and/or the status of a real or virtual observation object or medium are ensured.
<b>PHY</b>	Physical sublayer. Physical layer / component.	<b>Process automation</b>	In the context of the given explanations of process and automation, this generally means the use of technical equipment resources for the automatic execution of any processes.
<b>Physical Layer</b>	Layer 1 in the OSI reference model: Bit transfer layer, lowest level, electrical and mechanical specifications for cables and network adapters are defined and also the mode for how the bits are sent via the cable.	<b>Process industry</b>	Designation for industrial sectors in whose systems there are technical processes running, i.e. those in which the material, bulk goods or energy flows involved in the main process are treated or processed continuously or discontinuously such as, for example, in chemical large systems, in pharmaceutical industry systems, steel production and cement manufacturing, foodstuffs, semi-luxury food and drinks industry, and in waste incineration plants, foundries and others.
<b>Pigtail</b>	Short piece of fibre optic cable for coupling components where one end has a connector and the other end is spliced.	<b>Process optimisation</b>	The processes running in technical systems are always operated with the objective, taking account of certain given conditions, of achieving the best possible process result.
<b>PIMF</b>	Pair in metal foil.	<b>Product bandwidth length</b>	This describes the effect that the bandwidth of a given product is inversely proportional to its length. The product bandwidth length is usually stated in Mhz x km or GHz x km.
<b>PLC</b>	Programmable Logic Controller - calculation based control device whose functionality is specified by a so-called application program.	<b>Product bandwidth length</b>	Used for estimating the distance supported by a multimode fibre for a specified data rate (speed). Thereby, the gross rate must be used, e.g. 125 Mbit/s for Fast Ethernet.
<b>PLS</b>	Process control system	<b>Production automation</b>	Automation market segment for the industrial areas of circuit, assembly, component, device and power unit production.
<b>PLT</b>	Process control technology	<b>PROFIBUS</b>	Process Field Bus
<b>Plug connection</b>	Easily removable connection with plugs. The insertion loss of a plug connection is usually higher than the transfer loss of a splice connection.		
<b>PMD</b>	PROFInet Machine Distributor: central signal distributor with individual connections to all terminal equipment of the network.		
<b>PMD</b>	Physical Medium Dependent. Physical Layer / Component on Level 1a.		
<b>PNO</b>	Profibus Nutzerorganisation (Profibus User Organisation)		
<b>POF</b>	Polymer Optical Fibre - designation for a fibre optic cable whose optical core and sheath are made using plastic. POF fibres have a typical core diameter of 0.98 mm.		
<b>Point-to-point structure</b>	All participants are on a common transmission path. Only one message can be transported from one station to another at a time.		
<b>Polling</b>	Method for synchronisation during the data transfer. During polling one partner queries the master and the other slaves cyclically whether they want to send something or can receive something.		
<b>Port-Mirroring</b>	The data traffic of one port is mirrored at a different port in order to, for example, examine this with an analyser.		

# ■ GLOSSARY

<b>PROFIBUS-DP</b>	Profibus for the area of “decentralised peripherals”. Simple digital and analogue input / output components and intelligent signal and process data processing units can be relocated locally and thus, among other things, significantly reduce costs for the cabling complexity. Mainly for time-critical applications in production automation.	<b>RARP</b>	Remote Access System.
<b>PROFIBUS-FMS</b>	Profibus Fieldbus Message Specification: Field bus for use at the system level with relatively low real-time requirements, industry standard.	<b>RAS</b>	Remote Access System.
<b>PROFIBUS-PA</b>	Process Field Bus for Process Automation	<b>Real-time</b>	A system operates in real-time or is capable of real-time operation if it accepts input factors in a defined time period, processes these and provides the results in good time for a partner system or the system environment.
<b>PROFINet</b>	Open component-based industrial communication system based on Ethernet for distributed automation systems. Load-bearing components are the object-oriented modelling of systems and their functional parts based on COM, runtime communication based on TCP/IP and DCOM and manufacturer-independent engineering concept for the system project planning of a PROFINet system with a graphical circuit diagram editor. Technology promoted and supported by PNO.	<b>Real-time classes</b>	The real-time requirements for calculation, control, regulation and communication systems are determined by the partner systems they interact with.
<b>Profinet CbA</b>	Solution for distributed decentralised intelligence. Standardised module specification. Open communication between modules. Engineering with drag and drop.	<b>Real-time requirements</b>	Real-time systems have the characteristic of reliably reacting to an external stimulation within a defined time period. As regards compliance with the time limitation, a distinction must be made between hard and soft real-time requirements. Hard real-time requirement: if all required system responses to an external stimulation must be made absolutely reliably within a fixed, specified time period. Soft real-time requirement: if exceeding a specified time limit can be tolerated to a certain extent.
<b>Profinet IO</b>	Direct connection of decentralised field equipment to Ethernet is possible.	<b>Real-time system</b>	System which responds to an external event within a specified time period. The focus here is not absolutely on speed. Rather, the necessary reaction speed depends on the environment or partner object which the system is co-operating with in a concrete application. For example, fast digital regulations require real-time systems whose reaction times are in microseconds; on the other hand, automation solutions with programmable logic controllers have reaction times in milliseconds, and for slower systems in the process industry, e.g. temperature regulations, reaction times in seconds or even minutes are sufficient. As regards compliance with the time limit, a distinction must be made between hard and soft real-time requirements. There is a hard real-time requirement if all required system responses to an external stimulation must absolutely be made reliably under all possible conditions within a fixed, specified time period, otherwise there is a risk of serious damage. On the other hand, there is a soft real-time requirement if exceeding a specified time limit can be tolerated to a certain extent as no serious consequences are to be expected. The real-time capability of a system is itself dependent on many influencing factors. Especially for automation technology, signal running times, cycle times, latency times, jitter, synchronicity requirements and the data throughput play a significant role.
<b>Profinet IRT</b>	Isochronous Real Time: is hardware supported real-time communication with isochronous data transfer.		
<b>ProfiSafe</b>	Safety profile: allows the transfer of safety-integrated and standard data on one bus line.		
<b>Proprietary</b>	Property rights assigned		
<b>Protocol</b>	Series of procedures for making and controlling a communication.		
<b>PSE</b>	Power Sourcing Equipment - describes the power providing device in the draft of the IEEE P802.3af standard. IEEE 3af defines how a power supply can be done using an Ethernet twisted pair cable.		
<b>PVV</b>	Path Variability Value. Expressed in bit times.		
<b>QoS</b>	Quality of Service. Quality of the transfer, e.g. speed, bandwidth, latency, safety or priority. Only realised for priority on Layer 2 in IEEE 802.1D.		
<b>Quadro Star</b>	Strand element which consists of four wires twisted with each other whereby the respectively opposite wires form a transmission path (trunk). Front surface coupling (star surface coupling) Signal transfer via fibre ends connected at the front.	<b>Receiver</b>	Assembly for converting optical signals to electrical signals. It consists of a photo diode which converts the incoming optical signal into photocurrent which is amplified afterwards in a (low-noise) amplifier; if needed there are other downstream electronic circuits, e.g. decoder, for the signal preparation.
<b>Queue/Queuing</b>	Generally describes the queue of elements or tasks. A queue in a data transfer system is a queue of messages or data packets which are waiting for further processing or forwarding. They are sorted temporarily and processed one after the other using a corresponding queuing method.	<b>Redundancy</b>	Abundance, excess, surplus
<b>RAM</b>	Random Access Memory. Volatile memory.	<b>Reflection</b>	Reflection of rays (waves) at border surfaces between two different substances.

# GLOSSARY

<b>Refraction</b>	Direction change made by an electromagnetic wave (e.g. light) when it passes from one material into another and there is a large difference in the refraction index for both materials.	<b>RS232</b>	Recommended Standard Number 232, the oldest and most widely used interface standard, also called V.24 Interface; all signals are related to earth so that it is an unbalanced to ground interface.
<b>Refraction index</b>	The factor at which the light speed in an optical medium (e.g. glass) is smaller than in a vacuum.	<b>RS422</b>	Recommended Standard Number 422; balanced to ground operation, thus higher interference resistance. High Level: 2 -6 V; Low Level: +2...+6 V; four-wire connection
<b>Reinforcement</b>	Protection element (usually made of steel wires or belts) used for cables with special usage conditions such as for use at sea and in mines.	<b>RS485</b>	Recommended Standard Number 485; expanded interface standard as compared with RS422; High Level: 1.5 -6 V; Low Level: +1,5...+6 V; two-wire connection -> half duplex operation or four-wire connection -> full duplex operation.
<b>Repeater</b>	Repeater, amplifier - apparatus for amplifying and regenerating signals and a network. It can cover larger distances. Simple, economic means of extending a LAN.	<b>RSVP</b>	Resource Reservation Protocol. reserved bandwidths in the WAN.
<b>Repeater</b>	Component for signal regeneration on level 1. Regenerates amplitude, signal edge and clock signal. Repeaters with more than two ports are called hubs.	<b>RTCP</b>	Real-time Transport Control Protocol.
<b>Resistance difference</b>	Difference of the ohmic resistance between two cores of a cable (unit W)	<b>Rx</b>	Receive
<b>Return loss</b>	Measure for matching systems; when the correct termination resistance of a cable (wave resistance) is selected, the reflection factor is 0 and thus also the return loss.	<b>SA</b>	Source Address
<b>RG58</b>	Coaxial cable with 50 Ohm wave resistance. Also called Thin Wire or 10BASE2.	<b>SAE</b>	Society of Automotive Engineers
<b>Ring structure</b>	All participants are connected with each other in a ring. There is no centre. All participants have equal rights.	<b>SafetyBUS</b>	Field bus system for serial transfer of safety-related information. Safety systems and products such as light barriers, safety door and emergency stop circuits can thus be safely and decentralised connected with each other.
<b>RIP</b>	Routing Information Protocol - for exchanging routing information between routers in the LAN. There are two versions: RIP V1 and RIP V2.	<b>SAN</b>	Storage Area Network - network for connecting servers and storage subsystems such as discs, RAID and tape systems. Usually based on Fibre Channel.
<b>RJ45</b>	Connector for twisted pair.	<b>SC</b>	Straight Connector. Connector.
<b>RMON</b>	Remote Monitoring.	<b>Screen</b>	Cable structural element for shielding. The design of the screen depends on whether protection against electrical fields (capacitive coupling) or against magnetic fields (inductive coupling) or both is aimed for. The screen material against magnetic fields should always have high electrical conductivity and low inductivity which is why copper is usually used for the conductor.
<b>Rotary encoders</b>	Are small electromechanical precision devices which convert the angle positions of a mechanical shaft which they are connected to into coded data which can be evaluated electrically. They are also called angle sensors, angle encoders and angle coders. Basically, a distinction between incremental and absolute systems must be made.	<b>SDLC</b>	Synchronous Data Link Control - synchronous data transfer procedure
<b>Rotary field magnets</b>	are alternating current asynchronous motors with squirrel cage rotor which are designed for permanent standstill operation. This means they are thermally dimensioned so that they can remain switched on at the rated voltage with a fully braked shaft and thereby develop their greatest torque.	<b>Secondary cabling</b>	Internal building connection of the building distributor with the individual floor distributors. (Backbone).
<b>Rotary magnets</b>	are electromagnetic actuators with and without return springs activated by direct or alternating current which enable limited angle movements. They are used for demanding applications in automation technology.	<b>Segmentation/ Network segmentation</b>	Provides the limit of collision domains and enables a performance improvement of Ethernet networks. The network segmentation is achieved using, e.g. switches.
<b>Router</b>	Component on Layer 3 of the ISO/OSI reference model. Connects networks on Layer 3. Using additional routes to the destination, it provides a choice of routes depending on definable criteria such as route costs.	<b>SEK</b>	Svenska Elektriska Kommissionen (Sweden)
		<b>Selfcentering effect</b>	The selfcentering effect is the striving caused by the surface tension of the melted glass by the glass fibre to form an homogenous, preferably not offset connection.
		<b>SEMKO</b>	Svenska Elektriska Materielkontrollanstalten (Sweden)

# ■ GLOSSARY

<b>Sensor</b>	Apparatus which converts a physical factor based on a physical effect into an electric, pneumatic or hydraulic signal for further processing. These sensors are used in automation technology to obtain necessary information for process execution. For example, the recording of power unit and machine statuses or for recording process data such as temperature, pressure, speed, filling level, flow rate, paths, angles etc.	<b>Smoke density</b>	Measure for smoke development when burning a cable. Attention should be paid to a low smoke density for laying in buildings (typical value: 50%).
<b>SERCOS Interface</b>	Serial Real-time Communications Standard Interface - digital drive position. Communications standard for precise Motion Control applications, e.g. for information exchange between a CNC controller and digital servo drives and decentralised I/Os. Enables very fast and precise real-time communication between a master and several slaves using a fibre optic cable.	<b>SMTP</b>	Simple Mail Transfer Protocol. Internet protocol which provides email services.
<b>Servomotors</b>	Electric motors for activating mechanical components, for example valves or for position-controlled return or positioning of mechanical axes in machine tools, robots and in many other applications.	<b>SNAP</b>	Subnetwork Access Protocol.
<b>Session Layer</b>	Session layer / communication control layer in the OSI reference model, Layer 5: This allows using two applications on different computers and ending them again. It realises the dialogue management, regulates the length of the data transfer and takes care of which participant sends or receives when, and the session synchronisation and the recreation of sessions after a failure	<b>SNMP</b>	Simple Network Management Protocol
<b>SETI</b>	Sähkötarkastuslaitos (Finland)	<b>SNV</b>	Schweizerischer Normenverband
<b>SEV</b>	Schweizerischer Elektrotechnischer Verein (Switzerland)	<b>SOHO</b>	Small Office Home Office. Networks for small offices / branches and teleworkers
<b>Shield</b>	Screening which should prevent the transfer of interference signals, e.g. those from electrical fields for data cables, usually braided with aluminium or copper.	<b>Spanning Tree</b>	Protocol which automatically resolves network loops. When switches are installed, effects redundant paths for additional security in the case of a connection failure. Changeover time 30s to 60s.
<b>Signal</b>	Time-modifiable physical factor, e.g. a voltage or a current, which has a parameter that gives concrete information about further processing of a different physical factor.	<b>Splice</b>	A permanent cable connection, e.g. a splicing of two fibres for fibre optic cables.
<b>Shielding attenuation</b>	Measure of the reduction or attenuation of the electromagnetic field strength at a point in the room, caused by inserting an electromagnetic shield between the field source and this point; usually expressed in dB.	<b>Splitter</b>	Optical component for dividing the light output from one onto several fibres.
<b>Single mode fibre</b>	Fibre optic cable whose core diameter is so small in comparison with the wavelength of the light that only one mode is capable of propagation.	<b>SQE</b>	Signal Quality Error. Signal returned to the LAN controller from a transceiver to communicate whether the packet has been sent correctly. Also called heartbeat.
<b>Skin Effekt</b>	The tendency of alternating current to flow on the surface of a conductor as the frequency increases (reduction of the effective conductor cross section and thus increase of the electrical resistance).	<b>SRS</b>	Safety Requirements Specification: it forms the starting point for the development of safe systems.
<b>Slave</b>	Participant in a network which can only participate in data transfer after being approached by the master.	<b>SRTS</b>	Soft Real-Time System - real-time system which can only meet soft real-time requirements.
<b>SLIP</b>	Serial Line Internet Protocol. Standard protocol for serial point-to-point connections, uses serial interface for IP traffic.	<b>Star coupler</b>	Active or passive component which ensures a uniform light output distribution for an equally large number of incoming and outgoing fibres.
<b>Slotted core cable</b>	Cable where the fibres are in grooves made in the surface of the central element.	<b>Star topology</b>	All participants are connected to a central node. Every communication runs via this node. Direct communication between the participants is not possible.
		<b>Store &amp; Forward</b>	Switching process where a packet is first completely stored and then forwarded.
		<b>STP</b>	Shielded Twisted Pair.
		<b>STQ</b>	Shielded Twisted Quad.
		<b>Switch</b>	Device, similar to a hub, which forwards received data packets in a network in contrast to a hub not to all network nodes but only to the respective addresses. This means, that in contrast to a hub, a switch looks after targeted communication within a network which only plays back a message between sender and receiver. Network nodes not involved are not affected.
		<b>Switched Network</b>	Designation for an Ethernet network which is constructed with switches.
		<b>System</b>	Interconnection of apparatus, systems or electrical or electronic components at a given location. These components perform a specific task with each other.
		<b>System part (unit)</b>	Consists of various devices. Each device usually contains one or more instrument loops which operate in parallel with each other. Examples: pump, compressor, pipeline, ...

# ■ GLOSSARY

<b>System safety</b>	Avoidance of dangerous operating conditions in process systems or their environment. This often concerns avoidance of the risk of explosion.	<b>Transport Layer</b>	Layer 4 in the OSI reference model: is responsible for the correct provision of data. For this, it converts the flow of transmission data into small data packets for the transfer or when receiving converts the data packets back into a data stream. This layer is also responsible for sending acknowledgements. The main tasks are thus the creation and dismantling of participant connections and the safe transfer of the data.
<b>System types</b>	Subdivision in single-purpose systems or single-product systems which are designed for precise manufacture of one product and into multipurpose systems and multiple product systems.	<b>Tree structure</b>	Combination of star structure, point-to-point structure, ring structure and meshed structure
<b>Tag field</b>	Optional field inserted in Ethernet packets after the source data.	<b>Tx</b>	Transmit
<b>TCO</b>	Total Cost of Ownership.	<b>UDP</b>	User Datagram Protocol - network protocol
<b>TCP</b>	Transmission Control Protocol: Protocol which is used together with the Internet Protocol (IP) to transfer data from one computer to another in the Internet.	<b>UL</b>	Underwriters Laboratories. Independent authority in the USA, which carries out product safety examinations.
<b>Tertiary cabling</b>	Horizontal connection of the floor distributor with the connection units at the work place.	<b>UL</b>	Unterwriters Laboratories Inc. (USA)
<b>TGL</b>	DDR-Standards: Technical standards, "Product regulations and delivery conditions" (former German Democratic Republic)	<b>UNI</b>	Unificazione nazionale Italiana (Italy)
<b>TIA</b>	Telecommunication Industry Association. Standardisation Committee	<b>Unicast</b>	Data packet which is only addressed to one recipient, in contrast to multicast and broadcast.
<b>Time multiplex</b>	Transfer process where several pieces of information are transferred simultaneously with different wavelengths on one fibre.	<b>Unsymmetrical to ground/earth</b>	Often also called e-coupling - is the difference between the earthing capacities of both conductors.
<b>Token</b>	Mark, character, sign: Transmission authorisation token in networks with collision-free access	<b>UPS</b>	Uninterruptible Power Supply
<b>Token-Process</b>	Bus access process: during this process, the token is forwarded from one participant to the next. The participant in possession of the token has permission to send and can access the common transfer medium.	<b>UTE</b>	Union Technique de l' Electricité
<b>Topology</b>	The physical or logical structure of network connections and nodes (star ring and bus configuration).	<b>Utility Automation</b>	Automation market segment for the public supply areas of electricity, water/sewerage, pipelines etc.
<b>TOS</b>	Type of Service. Field in the IP packet for prioritisation.	<b>UTP</b>	Unshielded Twisted Pair.
<b>TP</b>	Twisted-Pair. Data cable.	<b>UTQ</b>	Unshielded Twisted Quad.
<b>TPDDI</b>	Twisted Pair Distributed Data Interface.	<b>Validation of Profibus Systems</b>	Guideline which specifies the validation supporting functions in conjunction with the use of Profibus in foodstuffs or pharmaceutical systems.
<b>Traceability</b>	Traceability	<b>VDE</b>	Verband der Elektrotechnik Elektronik Informati-onstechnik e.V.
<b>Transceiver</b>	Transmitter/Receiver - data transmitter/receiver combined in one unit.	<b>VDEW</b>	Vereinigung Deutscher Elektrizitätswerke e.V.
<b>Transfer rate</b>	Speed of the transfer, also bandwidth. Ethernet: 10,100,1000,10000 Mbit/s ; Token-Ring: 4 Mbit/s, 16 Mbit/s ; FDDI: 100 Mbit/s	<b>VDI</b>	Verein Deutscher Ingenieure
<b>Transponder</b>	In measuring and monitoring technology, this means a microchip with a sending and receiving antenna, a control logic and data and energy storage which enables contactless communication with a corresponding reading system.	<b>VDMA</b>	Verband Deutscher Maschinen- und Anlagenbau e.V.
		<b>VDSI</b>	Verband Deutscher Sicherheitsingenieure e.V.
		<b>VLAN</b>	Virtual LAN, constructed with switches. Goal: broadcast limitation to the network area where the broadcast is useful. Is also used for segmenting networks for security reasons.
		<b>VPN</b>	Virtual Private Network. The complete data traffic is encrypted in a VPN for secure transfer via public TCP/IP networks. A VPN uses "tunnelling" in order to encrypt all information at the IP level.
		<b>VRRP</b>	Virtual Redundant Router Protocol. Protocol for controlling redundant routers.

## ■ GLOSSARY

<b>WAN</b>	Wide Area Network Network which includes the connection between elements over a large geographic distance.
<b>Wave resistance</b>	Complex specification factor of the relationship of the wave voltages to the wave currents at every point of the conductor.
<b>Wave length</b>	Length of a complete oscillation (period) of a wave. Three wavelength ranges are usually used in optical message technology. These are 850 nm, 1310 nm and 1550 nm.
<b>Wavelength multiplex</b>	Transfer process where several parallel incoming data signals are transferred on a fibre in one serial data stream.
<b>WDM</b>	Wavelength Division Multiplex.
<b>WFQ</b>	Weighted Fair Queuing. Method for elaborating the priority queues in a switch. The highest priority queue, for example, receives 50% of the bandwidth, the next receives 25%, etc. .
<b>WLAN</b>	Wireless LAN
<b>Work Area cabling</b>	Connection of the connection unit at the work place with the data terminal equipment.
<b>WWDM</b>	The transfer capacity of the optical fibres in fibre optic networks can be increased with the WWDM system. The system multiplexes several optical single mode signals to an optical composite signal. Thus several applications can be transferred simultaneously using one fibre optic cable pair. This makes the installation of additional fibre optic cables unnecessary and this significantly reduces costs.
<b>XML</b>	Extended Markup Language.
<b>ZVEH</b>	Zentralverband der Deutschen Elektrohandwerke e.V.
<b>ZVEI</b>	Zentralverband Elektrotechnik- und Elektronikindustrie e.V.



# Glossary of Cables and Wires

Type	Page	Type	Page
Aerial Fibre Optic Cable	58 – 59	Patch Cables INDUSTRIAL ETHERNET extraflex	282
BUS Cables	158 – 199, 202 – 220	Patch Cables INDUSTRIAL ETHERNET flexible	258, 261, 264, 283 – 286
Copper Connecting Technics	296 – 297	Patch Cables INDUSTRIAL ETHERNET high flexible	278 – 281, 287 – 290
Fibre Optic Breakout Cable	64	Patch Cables PROFIBUS high flexible	292 – 293
Fibre Optic Breakout Cable flexible	73	Patch Cables PROFINet A	252 – 257
Fibre Optic Breakout Cable PROFIBUS + PROFINet	65 – 69	Patch Cables PROFINet B	259 – 260, 262 – 263, 265
Fibre Optic Breakout Cable robust	74	Patch Cables PROFINet C (PUR)	266 – 272
Fibre Optic Breakout Cable robust, flexible	71 – 72	Patch Cables PROFINet C (PVC)	273 – 277
Fibre Optic Breakout-Cable	35	Patch Cables RJ45	236 – 239, 242 – 244
Fibre Optic Cable flexible	60 – 63	Patch Cables RJ45 unscreened	240 – 241
Fibre Optic Cable robust	70	Patch Cables USB INDUSTRY	291
Fibre Optic Cable with Functionality	42 – 43	Patch-Panels	331
Fibre Optic Connecting Technics	308, 310 – 317	Patch-Panels RJ45	228 – 229, 231
Fibre Optic Connection Technics	309, 332 – 334	Patch-Panels RJ45 unscreened	230
Fibre Optic enclosures	319 – 320	Plastic Fibre Cable Automotive	78
Fibre Optic Indoor Cable	34, 37	Plastic Fibre cable industry	75
Fibre Optic Indoor/Outdoor Cable	39 – 41	Plastic Fibre Cable PROFIBUS	77
Fibre Optic Indoor/Outdoor Minibreakout Cable	38	Plastic Fibre Cable PROFINet	76
Fibre Optic Minibreakout Cable	36	Processing Technic	342 – 347, 349 – 351
Fibre Optic Outdoor Cable	44 – 55	Rubber Cable Reels	246, 318
Fibre Optic Outdoor Cable Hybrid	56 – 57	Technic of Measurement	338
Fibre Optics Processing Technic	343	Technic of Measurement	339 – 341
Fittings for metal-free optical fibre aerial cables (ADSS)	322 – 326		
General Accessories	245		
Industrial Ethernet	121 – 156		
LAN Cable	84 – 87, 91 – 94, 96 – 107, 111 – 114, 117		
LAN Cable direct Burial	109		
LAN Cable direct Burial / armoured	110		
LAN Cable Outdoor	108		
LAN-Cable	88 – 89		
LAN-Cable, Outdoor	90, 95		
Measurements	348		
Multimedia Cable	115 – 116		
Outlets RJ45	232 – 233, 235		
Outlets RJ45 unscreened	234		

# Part Number Index

Part no.	Page	Part no.	Page	Part no.	Page
80000 – 80028	48	80606	313	81041	313
80031	49	80627	50	81043	315
80032 – 80041	48	80629 – 80630	75	81044 – 81046	313
80043	91	80631	37	81050 – 81055	315
80045	37	80636	315	81062 – 81070	312
80046 – 80051	48	80672	50	81072 – 81075	311
80053	84	80681	40	81077	218
80055	88	80688	35	81081	216
80068	117	80691	50	81085	220
80084 – 80116	49	80699	34	81108 – 81121	46
80118	50	80725	40	81123	97
80120 – 80130	49	80732 – 80735	50	81133 – 81136	46
80180 – 80187	45	80743 – 80753	35	81137 – 81149	49
80188 – 80195	46	80759	49	81155	146
80196 – 80204	45	80764	48	81186	159
80207 – 80211	46	80771	49	81202	198
80212 – 80218	45	80774 – 80777	48	81203	199
80219	46	80778	198	81209	56
80220	45	80782 – 80791	34	81233	350
80223 – 80227	46	80792	159	81246	37
80264 – 80265	40	80793	37	81254	98
80267	163	80795 – 80806	35	81255 – 81260	56
80270 – 80281	40	80809	50	81278	92
80294	107	80810	105	81286 – 81287	186
80307 – 80309	317	80813 – 80821	35	81320	346
80316	34	80824 – 80825	202	81354 – 81359	308
80363 – 80382	60	80826	216	81362 – 81365	317
80384	158	80846	41	81382	46
80388	75	80851	40	81446	106
80396	312	80868 – 80894	37	81447	220
80418 – 80435	36	80895	50	81448	158
80457	313	80896 – 80908	37	81495	41
80473 – 80475	48	80912 – 80914	48	81501	171
80495 – 80518	57	80915 – 80959	50	81609 – 81610	96
80532	75	80983	315	81611	75
80534	60	80996	309	81663	217
80576 – 80578	50	81003	163	81675 – 81676	308
80605	312	81036 – 81038	60	81699	113

# Part Number Index

Part no.	Page	Part no.	Page	Part no.	Page
81882	75	82902	350	801164 – 801167	308
81900	34	82913 – 800044	164	801168 – 801174	309
81903 – 81904	170	800067	147	801175 – 801176	315
81905	171	800068	140	801182	57
81906	173	800088	145	801186	344
81909 – 81910	210	800109	166	801190	42
81911 – 81912	195	800126	70	801191	175
82008	235	800260	245	801192	176
82010	231	800378	342	801193	177
82025 – 82026	312	800380 – 800381	343	801194	148
82190	55	800382 – 800383	345	801195	150
82390 – 82401	59	800385	346	801196	74
82408 – 82412	34	800423 – 800424	315	801197	121
82431	40	800497	211	801200 – 801202	78
82434	204	800571	191	801217 – 801221	42
82493	349	800597	340	801280	77
82501	100	800647	114	801332 – 801337	268
82502	101	800648	161	801342 – 801347	254
82509	187	800649	166	801352	64
82561	56	800650	169	801365 – 801367	254
82648	46	800651 – 800652	212	801378 – 801394	334
82695	245	800653	148	801400	344
82696	199	800654	151	801403 – 801404	347
82786	56	800655	154	801410 – 801413	332
82792 – 82803	39	800657	348	801414 – 801416	333
82804 – 82818	38	800681 – 800682	209	801418 – 801420	334
82821	334	800683 – 800684	208	801465	341
82822	204	800685	191	801471 – 801475	332
82824	160	800708 – 800710	55	801476	333
82835 – 82836	167	800713 – 800714	334	801497	351
82838	142	800715	169	801572 – 801573	189
82839	144	800720 – 800738	312	801616	41
82847	233	800753	57	801650	150
82848	229	800754 – 800762	44	801651	152
82852	245	800812 – 800817	292	801659	173
82853	235	800818 – 800823	293	801686	245
82857 – 82864	238	800980	72	801727	60
82869 – 82875	308	801147	108	801733	71

# Part Number Index

Part no.	Page	Part no.	Page	Part no.	Page
801772	245	802401 – 802407	296	803284	55
801832	334	802423 – 802429	255	803295	153
801836	316	802442 – 802444	315	803344	190
801846 – 801847	207	802445 – 802452	316	803346 – 803349	62
801982	188	802453 – 802460	308	803354	174
802024	228	802461	310	803356 – 803357	296
802025 – 802034	232	802464 – 802468	291	803364	63
802073 – 802076	246	802469	181	803378	102
802131 – 802142	44	802470	182	803379	103
802143 – 802145	39	802471	178	803380	111
802167	109	802482	316	803381	112
802168	110	802495	338	803382	126
802169	115	802496	339	803383 – 803384	194
802170	116	802792	61	803387	137
802172	85	802800	219	803576 – 803577	296
802173	94	802908	230	803658 – 803661	52
802174	99	802909	234	803664	51
802177	160	802914	154	803668	52
802178 – 802179	165	802917 – 802918	53	803672	179
802180 – 802181	168	802936	319	803693	131
802182	196	802991 – 802998	239	803722	192
802184	127	802999 – 803014	238	803844 – 803845	296
802185	153	803015 – 803030	239	803917 – 803920	43
802186	155	803033	234	803923 – 803924	47
802187 – 802188	213	803037 – 803038	47	803925 – 803928	53
802207 – 802208	246	803049 – 803056	242	803929	51
802223 – 802231	318	803057 – 803064	243	803930 – 803932	52
802248 – 802249	39	803065 – 803080	242	803934 – 803935	61
802252	312	803081 – 803096	243	804042	217
802260	73	803097 – 803104	240	804043	104
802261 – 802276	41	803105 – 803112	241	804045	93
802277 – 802278	39	803113 – 803128	240	804254 – 804256	34
802280	41	803129 – 803144	241	804268 – 804269	193
802293	141	803145 – 803156	308	804275 – 804276	59
802339	196	803157 – 803160	309	804287	236
802375	349	803161 – 803165	315	804299	185
802380 – 802385	236	803166 – 803176	316	804300	319
802395 – 802400	269	803194 – 803208	296	804301 – 804302	320

# Part Number Index

Part no.	Page	Part no.	Page	Part no.	Page
804303 – 804307	331	805680	123	806393 – 806400	252
804408 – 804409	203	805681	135	806401 – 806408	259
804410 – 804411	205	805683	90	806409 – 806416	266
804646 – 804648	244	805684	124	806417 – 806424	273
804682 – 804683	44	805685	197	806425 – 806432	253
804700	62	805686	76	806433 – 806440	260
804705 – 804706	39	805687	65	806441 – 806448	274
804733 – 804744	58	805689	66	806449 – 806456	267
804766	86	805690	67	806457 – 806464	256
804767	180	805691	66	806465 – 806472	262
804797	53	805692	69	806473 – 806480	275
804972 – 804977	237	805693 – 805694	206	806481 – 806488	270
804996	89	805696	197	806489 – 806496	257
805045 – 805046	316	805697 – 805698	215	806497 – 806504	263
805055	237	805699 – 805700	138	806505 – 806512	271
805057	184	805701 – 805702	139	806513 – 806520	276
805074 – 805077	316	805703 – 805704	132	806521 – 806531	265
805078 – 805079	315	805705 – 805706	162	806532 – 806538	261
805080 – 805110	313	805709	297	806539 – 806545	264
805111 – 805112	312	805712	315	806546 – 806554	278
805160 – 805161	58	805713 – 805714	316	806555 – 806563	279
805179	87	805715	315	806564 – 806572	280
805194 – 805195	297	805716 – 805717	316	806573 – 806581	281
805244 – 805247	54	805718 – 805725	313	806582 – 806590	287
805287	183	805726 – 805730	314	806591 – 806599	288
805445	68	805731 – 805733	322	806600 – 806608	289
805548	133	805734 – 805736	323	806609 – 806617	290
805572	95	805737 – 805741	244	806618 – 806626	283
805614	125	805747 – 805749	322, 323	806627 – 806635	284
805653	149	805751 – 805752	322, 324	806636 – 806644	285
805654	151	805753	323	806645 – 806653	286
805655	134	805756 – 805777	325	806740	156
805656 – 805657	172	805778	326	11007406 – 11007413	277
805658	136	805790 – 805801	315	11007718 – 11007746	258
805661	214	805802 – 805807	316	11007747 – 11007757	282
805664 – 805671	52	805828	125	11007769	258
805672 – 805673	51	805838	76	11007775	122
805674 – 805675	52	806253 – 806256	238	11007776	130

# Part Number Index

<b>Part no.</b>	<b>Page</b>
11007777	128
11007778	129
11007779	143
11008341 – 11008348	272

## NOTES

### Technical modifications

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