SIEMENS

SIMATIC NET

Industrial Ethernet / PROFINET Passive network components

System Manual

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Preface

1

Purpose of the system manual

The available system manual explains the connection and the commissioning of the passive Industrial Ethernet network components and their basic functions.

Orientation in the documentation

Apart from the System Manual you are currently reading, the following documentation is also available from SIMATIC NET on the topic of Network Manual:

- System manual "Industrial Ethernet"

  This System manual provides you with an overview of the structure and configuration of Industrial Ethernet networks with the aid of SIMATIC NET. On the one hand, the target groups are decision makers and planners; with this document, they can gain an overview of the technical principles, the SIMATIC NET product range and the most important practical applications. On the other hand, it provides configuration engineers and commissioning personnel with extensive information data to which they can refer when setting up their network systems.

- Compact operating instructions
  These contain wide-ranging descriptions of the components of the product, installation and setting up of SIMATIC NET devices and the relevant dimension drawings.

- System manual "RCoax"

  This system manual contains both an explanation of the fundamental technical aspects as well as a description of the individual RCoax components and their functionality. Installation/commissioning and connection of RCoax components and their operating principle are explained. The possible applications of the various SIMATIC NET components are described.

- System manual - "Passive Network Components IWLAN"

  This system manual explains the entire IWLAN cabling that you require for your IWLAN application. For a flexible combination and installation of the individual IWLAN components both indoors and outdoors, a wide ranging selection of compatible coaxial accessories are available. The system manual also covers connecting cables as well as a variety of plug-in connectors, lightning protectors, a power splitter and an attenuator.

Operating Instructions and other documents

Despite every effort being made to provide a complete and thorough picture, this System manual cannot replace the Operating Instructions and reference documents of the individual devices and components. You will find the detailed documentation of the individual components on the Manual Collection DVD.

1.1 Note on the SIMATIC NET glossary

SIMATIC NET glossary

Explanations of many of the specialist terms used in this documentation can be found in the SIMATIC NET glossary.

You will find the SIMATIC NET glossary on the Internet at the following address:

50305045 (https://support.industry.siemens.com/cs/ww/en/view/50305045)

1.2 Contacts for special cables and special lengths

You can find current information on cabling systems under Cabling systems. (https://siemens.com/fastconnect)

Contact for cabling technology

Technical advice for the SIMATIC NET cabling spectrum is available from

Jürgen Hertlein
SIEMENS DI PA CI PRM 4
E-mail: juergen.hertlein@siemens.com
Tel.: + 49 (911) 750 - 44 65
Telefax: + 49 (911) 750 - 13 44 65

Electrical networks

2

2.1 Overview - electrical cables

For the various topologies, requirements or areas of application the following electrical Industrial Ethernet cables are available.

Cabling	Cable type	Features	Area of application
TP Cord	IE TP Cord 2x2 IE TP XP Cord 2x2 IE TP Cord 4x2 IE TP XP Cord 4x2	Patch cable preassembled with RJ-45	For connecting nodes to network components within a cabinet. Up to 10 m cable length with IE TP Cord 2x2, up to 50 m cable length with IE TP Cord 4x2
Fast Connect		FC installation manuals Insulation displacement method Sold by the meter	For a direct connection between node and network component for structured cabling fast and light contacting of the cables on FC contacts.
IE FC TP 2x2 4-wire cable for Fast Ethernet networks	IE FC TP standard cable GP		Standard bus cable with rigid cores and specially designed for fast assembly, 4 rigid cores stranded to form a star quad.
	IE FC TP robust standard cable GP		Rugged standard bus cable with rigid cores for universal application
	IE FC TP flexible cable GP		Flexible bus cable for special applications with occasional movement; 4 wires (stranded) arranged as a star quad
	IE FC TP robust flexible cable GP		Robust standard cable with flexible cores for machine parts that occasionally move
	IE FC TP FRNC cable GP		Flexible, halogen-free cable for use in buildings (FRNC= Flame Retardant Non Corrosive); 4 cores (stranded) arranged as a star quad for occasional movement.
	IE FC TP Trailing Cable GP IE FC TP Trailing Cable		Highly flexible bus cable for special applications with constant movement in a drag chain, for example for permanently moving machine parts; four cores (stranded) arranged as star quad.
	IE FC festoon cable GP		Flexible bus cable for special applications with constant movement in a drag chain/festoon; e.g. a crane system, 4 wires (stranded) arranged as a star quad.

Cabling	Cable type	Features	Area of application
	IE FC TP food cable		Flexible cable specially for use in the food and beverages industry, 4 cores (stranded) arranged as star quad
	IE FC TP marine cable GP		Flexible bus cable for special applications on ships; 4 cores (stranded) arranged as a star quad.
	IE FC TP Train Cable (AWG22/7, Type C)		Flexible cable for laying in rail vehicles and buses
	IE FC TP torsion cable		Highly flexible bus cable for special applications with constant movement, for example for use in robots; 4 cores (stranded).
	IE FC TP Ground Cable		Standard cable with rigid wires with additional PE outer sheath for laying in the earth
IE FC TP 4x2 8-wire cable for Gigabit Ethernet networks	IE FC TP Standard Cable GP (AWG 22)		For setting up Industrial Ethernet networks up to 100 m in conjunction with the IE FC Modular Outlet and the TP cords.
	IE FC TP Standard Cable GP (AWG 24, Type C)		For direct connection up to 100 m without patch technology with IE FC RJ45 Plug 4x2
	IE FC TP Flexible Cable GP (AWG 24, Type C)		Cable with flexible cores suitable for applications with occasional movement
	IE FC TP Trailing Cable GP (AWG 24, Type C)		Cable with highly flexible wires for fast installation, for installation in cable carriers
	IE FC TP Ground Cable (AWG 24, Type C)		Standard cable with rigid cores with additional PE outer sheath for laying in the earth
	IE FC TP Train Cable (AWG24/7)		For laying in rail vehicles and buses
IE connecting cable	IE Connecting Cable M12-180/M12-180	Preassembled cable with two 4-pin M12 plugs	Plug-in cable with two 4-pin M12 plugs (D-coded) for connecting Industrial Ethernet notes with degree of protection IP65/IP67
	Power Connecting Cable M12-180/M12-180		Plug-in cable with one 4-pin M12 plug (A-coded) and one 4-pin M12 socket (A-coded) for 24 V power supply
	IE Connecting Cable M12-180/IE FC RJ45 Plug	Preassembled cable with a 4-pin M12 plug and an IE FC R-45 plug.	Plug-in cable with a 4-pin M12 plug (D-coded) and an IE FC R-45 plug with 145° cable outlet. The plug-in cable is used to connect Industrial Ethernet nodes
	IE Robust Connecting Cable M12-180/M12-180	Preassembled cable with one 4-pin M12 plug (A-coded) and one 4-pin M12 socket (both D-coded). Also available by the meter without connectors.	Oil- and UV-resistant cable in a flame retardant version that is particularly suitable for use in the food industry

Cabling	Cable type	Features	Area of application
	IE Connecting Cable IE FC RJ45-180 / IE FC RJ45-180 2x2	Preassembled cable IE FC TP Trailing Cable GP with two connectors RJ45-180	Cable suitable for cable carriers for connecting Industrial Ethernet nodes with RJ45 interface (10/100 Mbps)
	IE Connecting Cable IE FC RJ45-180 / IE FC RJ45-180 4x2	Preassembled cable IE FC TP Flexible Cable GP with two connectors RJ45-180	Cable for connecting Industrial Ethernet nodes with RJ45 interface (10/100/1000/10000 Mbps)
	IE TP Cord M12 • M12-180/M12-180 4x2 • M12-90/M12-90 4x2	Preassembled cable IE FC TP Flexible Patch Cord 2x M12 plugs (X-coded) either with straight or 90 degree cable outlet	Cable for connecting Industrial Ethernet nodes with M12 interface (1/10 Gbps)

2.2 General

FastConnect (FC) Twisted Pair (TP)

For structured cabling within a factory, the FC TP cabling system is ideal. Using the FastConnect (FC) system for Industrial Ethernet, structured cabling from the office environment has been further developed for use in factories.

FC cables can be assembled fast and simply on site. This means that RJ-45 cabling technology, an existing standard, is also available in a version suitable for industry and making such cabling possible in an industrial environment.

Thanks to the VD technology, up to 1000 m cable length can be reached with the IE RJ45 PLUG 4x2 and a PROFIBUS cable.

Twisted pair (TP) Cord

The TP cord is used to connect end devices to the Industrial Ethernet FC cabling system. It is intended for use in cabinets and is used mainly as a jumper cable. The jumper cable is also now as a patch cable.

The maximum total length of the TP cord in a point-to-point connection is 50 m (IE TP cord RJ4-5/RJ-45 4x2, CAT6A).

Standards

The EN 50173 standard series describes the structured cabling of office buildings. ISO/IEC 11801-3 describes the structured building networking of an industrial building. The generally valid description of networking an automated plant within an industrial building can be found in IEC 61918. The profile-specific networking rules for PROFINET can be found in IEC 61784-5-3.

Structured cabling

Structured cabling describes the cabling of building complexes for information technology purposes regardless of the applications used. A building is divided into the following areas:

- Primary area: Interconnection of buildings of a site
- Secondary area: Interconnection between floors of a building
- Tertiary area: Information technology connectors for the end devices of a floor

The TP cord can be used as a patch cable and connecting cable between devices and on patch panels.

The structured cabling that can be implemented with the Industrial Ethernet FC system corresponds to tertiary cabling according to the ISO/IEC 11801, IEC 24702 and EN 50173 standards.

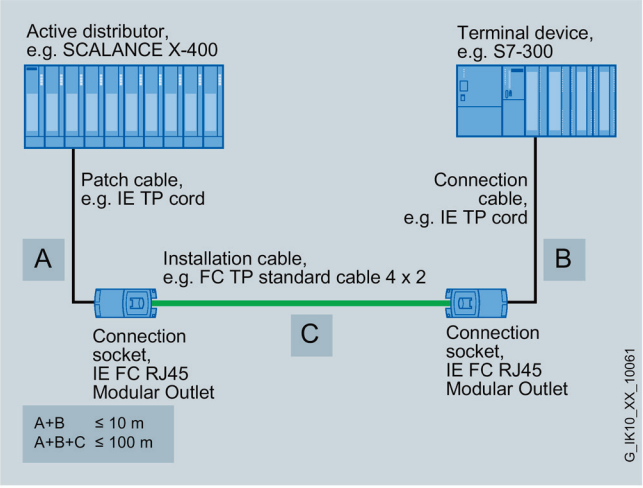


Figure 2-1 Structured cabling

Table 2- 1 Cables for structured cabling to EN 50173

Use	SIMATIC NET cable	Maximum length
Patch cable	IE TP cord	A+B max. 10 m
Tertiary cable	IE FC standard cable GP	C max. 100 m
	IE FC Flexible Cable GP	C max. 80 m
	IE FC torsion cable GP	C max. 75 m
	IE FC trailing cable GP	C max. 85 m
	IE FC trailing cable	C max. 85 m
	IE FC marine cable	C max. 85 m
	IE FC TP FRNC cable GP	C max. 85 m
	IE FC food cable	C max. 85 m
	IE FC festoon cable GP	C max. 85 m

1000Base-T

The twisted pair interfaces of the SCALANCE products comply with the standard IEEE 802.3z: 1000Base-T. Depending on the variant, the devices have one or more RJ-45 or M12 sockets.

Maximum lengths of twisted pair cables

The twisted pair cables to be inserted between two neighboring devices must not exceed the following maximum lengths:

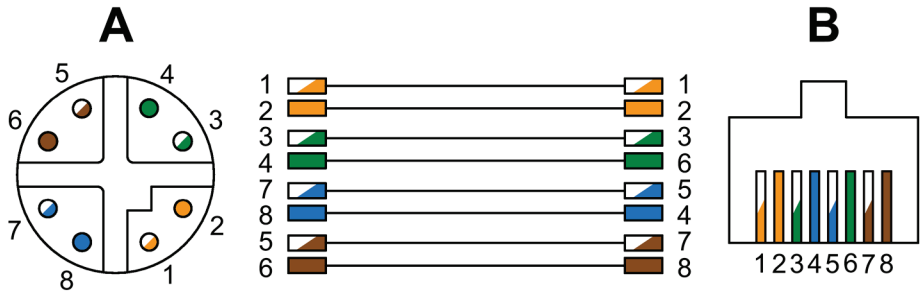
Cabling structure	Cable type	Max. length	Max. total of the patch cables (TP cord)
In one piece The setup is created without a patch cable	IE FC standard cable GP	100 m	
	IE FC Flexible Cable GP	85 m	
	IE FC torsion cable GP	55 m	
	IE FC trailing cable GP	85 m	
	IE FC trailing cable	85 m	
	IE FC marine cable	85 m	
	IE FC TP FRNC cable GP	85 m	
Structured The setup is created with patch cable and IE FC Outlet RJ45 or IE FC RJ45 Modular Outlet	IE FC standard cable GP	100 m	10 m
	IE FC Flexible Cable GP	80 m	10 m
	IE FC torsion cable GP	75 m	10 m
	IE FC trailing cable GP	85 m	10 m
	IE FC trailing cable	85 m	10 m
	IE FC marine cable	85 m	10 m
	IE FC TP FRNC cable GP	85 m	10 m
In one piece Incl. D-sub male connectors	ITP standard 2x2	100 m	

2.3 Connector system M12/X-coded according to IEC 61076-2-109

Description

M12 connectors with X coding are also suitable for transmission rates up to 10 Gbps (Cat6A) because the shields of the wire pairs can be led into the connectors. A further advantage is the availability of connectors with degree of protection IP67 with which the equipped devices are also suitable for adverse environmental conditions (dust, dampness). Due to the locking technology standardized for the M12 connectors a high resistance to vibration is achieved. Numerous SCALANCE devices therefore provide connection options for X coded M12 connectors.

Pin assignment



A Front view of M12 connector, X coded according to IEC61076-2-109

B Front view of RJ-45 connector, latching nose at the top, with pin assignment according to EIA/TIA 568B

Pin	M12/X coded		RJ-45 according to EIA/TIA 568B	
	Wire color	Signal	Wire color	Signal
1	White / orange	TX+	White / orange	TX+
2	Orange	TX-	Orange	TX-
3	White / green	RX+	White / green	RX+
4	Green	RX-	Blue	
5	White / brown		White / blue	
6	Brown		Green	RX-
7	White / blue		White / brown	
8	Blue		Brown	

2.4 IE TP cord

2.4.1 Introduction to TP cord

The TP cords are used inside buildings for distances up to 10 m. TP cord is also known as patch cable. A maximum of 10 m of TP cord can be used between two devices. With structured cabling using two TP cords, this length is the maximum for both patch cables together.

Compared with the IE FC TP cables, the TP cords are thinner and more flexible. Standardized RJ-45 plugs are used as the connectors.

- The TP cords 2x2 are suitable for a transmission rate of 10/100 Mbps.
- The TP cords 4x2 are suitable for 10/100/1000/10 000 Mbps transmission rates.

The 2 wires are twisted into a pair (PIMF). Each pair of wires is shielded by a plastic laminated aluminum foil with an external contact surface. All the pairs making up the cable are surrounded by a braided shield of tinplated copper braid with coverage of approximately 88 %. The outer sheath is PVC.



IE TP cord and IE TP XP cord

The TP cords are available as straight-through cable with the description "IE TP Cord" and as a crossover cable with the description "IE TP XP Cord".

To distinguish straight-through and crossover cables, the RJ-45 plugs are color-coded.

- not crossed over: RJ-45 plug, green at both ends
- crossed over: RJ-45 plug, red at both ends

2.4.2 IE TP cord 2x2

Description

The TP Cord 2x2 is available as a preassembled cable with two RJ45 plugs in the following variants:

- IE TP Cord RJ45/RJ45
- IE TP XP Cord RJ45/RJ45

Features and functions

Cable type [1]	**IE TP (XP) cord 2x2**
Areas of application	Cabling between an end device and a network component
Cable specification	Cat 5e
Maximum cable length [2]	
• with IE FC outlet RJ-45	10 m
• Device with RJ-45 connector	10 m
Cable type (standard designation)	LI 02YSCY 2x2x0.15/0.98 PIMF ICCS GN

Cable type [1]	**IE TP (XP) cord 2x2**
Sheath	PVC Ø 5.8 ± 0.2 mm; green
Environmental conditions	
Operating temperature	-40 ºC ... +70 °C
Transportation/storage temperature	-40 ºC ... +70 °C
Installation temperature	-40 ºC ... +70 °C
Resistance to fire	Flame retardant to IEC 60332-1
Resistance to oil	Conditionally resistant
Product characteristics	
Halogen-free	No
Silicone-free	Yes

1) Electrical properties at 20 °C, tested to DIN 0472

2) In the case of structured cabling with two TP cords, this length must be distributed on both patch cables.

Article numbers

IE TP cord RJ45/ RJ45	Preassembled TP installation cable 2x2 with two RJ45 plugs	
	• 0.5 m	6XV1850-2GE50
	• 1 m	6XV1850-2GH10
	• 2 m	6XV1850-2GH20
	• 6 m	6XV1850-2GH60
	• 10 m	6XV1850-2GN10
IE TP XP cord RJ45/ RJ45	Preassembled crossover TP installation cable 2X2 with two RJ45 plugs	
	• 0.5 m	6XV1850-2HE50
	• 1 m	6XV1850-2HH10
	• 2 m	6XV1850-2HH20
	• 6 m	6XV1850-2HH60
	• 10 m	6XV1850-2HN10

2.4.3 IE TP cord 4x2

Description

The IE TP Cord 4x2 is required for Gigabit Ethernet networks. The IE TP cord RJ-45/RJ-45 4x2 is available as a preassembled cable with two RJ-45 plugs. With the XP version the send and receive lines are crossed over.

Features and functions

Cable type [1]	**IE TP cord RJ-45/RJ-45 4x2**
Areas of application	Cabling between an end device and a network component
Cable specification	Cat 6A
Maximum cable length [2]	
• with IE FC outlet RJ-45	50 m
• IE device with D-sub connector	50 m
• Device with RJ-45 connector	50 m
Cable type (standard designation)	LI 02YSCH 4x2x0.15 PIMF GN FRNC
Sheath	FRNC Ø 6.2 ± 0.3 mm; green
Permitted ambient conditions	
Operating temperature	-25 ºC ... +70 °C
Transportation/storage temperature	-25 ºC ... +70 °C
Installation temperature	-25 ºC ... +70 °C
Resistance to fire	Flame retardant to IEC 60332-1
Resistance to oil	Conditionally resistant
Product characteristics	
Halogen-free	Yes
Silicone-free	Yes

[1] Electrical properties at 20 °C, tested to DIN 0472

[2] In the case of structured cabling with two TP cords, this length must be distributed on both patch cables.

Article numbers

IE TP cord RJ45/ RJ45	Preassembled TP installation cable 4x2 with two RJ45 plugs	
	0.5 m	6XV1870-3QE50
	1 m	6XV1870-3QH10
	2 m	6XV1870-3QH20
	3 m	6XV1870-3QH30
	4 m	6XV1870-3QH40
	6 m	6XV1870-3QH60

	10 m	6XV1870-3QN10
	15 m	6XV1870-3QN15
	20 m	6XV1870-3QN20
	25 m	6XV1870-3QN25
	30 m	6XV1870-3QN30
	35 m	6XV1870-3QN35
	40 m	6XV1870-3QN40
	45 m	6XV1870-3QN45
	50 m	6XV1870-3QN50
IE TP XP Cord RJ45/ RJ45	Preassembled crossover TP installation cable 4x2 with two RJ45 plugs	
	0.5 m	6XV1870-3RE50
	1 m	6XV1870-3RH10
	2 m	6XV1870-3RH20
	6 m	6XV1870-3RH60
	10 m	6XV1870-3RN10

2.5 IE FC TP cable

The FastConnect (FC) twisted-pair (TP) cables are shielded cables with a symmetrical radial design and 100 ohms characteristic impedance.

The combination of twisted cores, foil screen and braided shield makes the FC cables especially suitable for installation in industrial environments subject to electromagnetic interference. When installed, the design also ensures a high degree of stability of electrical and mechanical data.

Using the IE FC stripping tool, the outer jacket and shield of the FC TP cables can be stripped to correct lengths in a single action.

All FC TP cables are UL-listed products and suitable for use in the USA and Canada. Cables with this certification have the letters GP (General Purpose) in their names.

IE FC TP cable 2x2

The 4-wire FC TP cables are suitable for a transmission rate of 10 / 100 Mbps. The 4 wires are twisted into a star quad.

Cable cross-section

The IE FC TP Standard Cable and the IE FC TP Food Cable include massive wires, the other cables include stranded wires.



Figure 2-2 IE FC TP Standard CABLE 2x2



Figure 2-3 IE FC TP Train Cable 2x2 AWG 22/7

Note

You will find information about PROFINET conformity for the electrical cable types of the IE FC cable 2x2 in the PROFINET Installation Guide. This document is available as a download under: PROFIBUS (https://www.profibus.com/download/)

IE FC TP cable 4x2

To operate 1 gigabit Ethernet networks, 8-wire FC TP cables are required. The 8-wire IE FC TP cables correspond to the category 6 (Cat6) or for the IE FC TP Train Cable of Category 7 (Cat7) of the international cabling standards ISO/IEC 11801 and EN 50173.

The 8-wire FC TP cable can also be operated at lower data rates, for example 100 Mbps.

Cable cross-section



Figure 2-4 IE FC TP Standard Cable 4x2 GP AWG 22



Figure 2-5 IE FC TP Standard Cable 4x2 GP AWG 24



Figure 2-6 IE FC TP Train Cable 4x2 AWG 24/7

2.5.1 IE FC TP standard cable GP 2x2

Description

The cable IE FC TP standard cable GP is the standard cable for Fast Ethernet cabling. The cable with solid copper cores (AWG 22) is intended for fixed installation.

Features and functions

Cable type [1]	**IE FC TP standard cable GP 2x2 (PROFINET type A)**
Areas of application	Universal application
Cable specification	Cat 5e
Maximum cable length	
• with IE FC RJ-45 plug	100 m
• with IE FC outlet RJ-45	90 m
Cable type (standard designation)	2YY (ST) CY 2x2x0.64/1.5-100 GN SF/UTP
Mechanical data	
Number of electrical conductors	4
Sheath	PVC Ø 6.5 ± 0.2 mm; green
Permitted ambient conditions	

Cable type [1]	**IE FC TP standard cable GP 2x2 (PROFINET type A)**
Operating temperature Transportation/storage temperature Installation temperature	-40 °C to +75 °C -40 °C to +75 °C -20 °C to +60 °C
Resistance to fire	Flame retardant to UL 1685 (CSA FT 4)
Resistance to oil	Conditionally resistant
UV resistance	resistant
Product characteristics	
Halogen-free	No
Silicone-free	Yes

[1] Electrical properties at 20 °C, tests according to DIN 47 250, Part 4, or DIN VDE 0472

Article number

IE TP Standard Cable GP 2x2 (PROFINET Type B)	4-wire, shielded TP installation cable for connection to IE FC Outlet RJ45/ IE FC RJ45 Plug, PROFINET compliant, with UL approval	6XV1840-2AH10

2.5.2 IE FC TP Robust Standard Cable GP 2x2

Description

The IE FC TP robust standard cable GP 2 x 2 (type A) is a standard cable with rigid cores for fast installation. The cable with solid copper cores (AWG 22) is intended for fixed installation for connection to FC RJ45 Plug a FC Outlet RJ45.

Features and functions

Cable type [1]	**IE FC TP robust standard cable GP 2x2 (PROFINET type A)**
Areas of application	Universal application
Cable specification	Cat 5e
Maximum cable length	
• with IE FC RJ-45 plug	100 m
• with IE FC outlet RJ-45	90 m
Cable type (standard designation)	2YH (ST) C99Y 2x2x0.64/1.5-100 GN SF/UTP
Mechanical data	
Number of electrical conductors	4
Sheath	TPE (FR-TPE), Ø 6.5 ± 0.2 mm, green

Cable type [1]	**IE FC TP robust standard cable GP 2x2 (PROFINET type A)**
Permitted ambient conditions	
Operating temperature	-40 °C ... +75 °C
Transportation/storage temperature	-40 °C ... +75 °C
Installation temperature	-20 °C ... +60 °C
Resistance to fire	Flame retardant to IEC 60332-1-2
Resistance to oil	Oil-resistant to DIN EN 50290-2-22, (7 x 24 h / 90 °C) UL 13 Sec.40 (96 h / 100 °C)
UV resistance	Resistant
Product characteristics	
Halogen-free	No
Silicone-free	Yes

[1] Electrical properties at 20 °C, tests according to DIN 47 250, Part 4, or DIN VDE 0472

Article number

IE FC TP robust standard cable GP 2x2 (PROFINET type A)	Standard cable, 4-wire, sold by the meter	6XV1841-2A

2.5.3 IE FC TP flexible cable GP 2x2

Description

The IE FC TP Flexible Cable GP 2x2 with its flexible wires is suitable for applications in which occasional movement is required. It is intended for connection to IE FC RJ45 Plug 2x2.

Features and functions

Cable type [1]	**IE FC TP flexible cable GP 2x2 (PROFINET type B)**
Areas of application	Occasional movement
Cable specification	Cat 5e
Maximum cable length	
• with IE FC RJ-45 plug	85 m
• with IE FC outlet RJ-45	75 m
Cable type (standard designation)	2YY (ST) CY 2x2x0.75/1.5-100 LI GN SF/UTP

Cable type [1]	**IE FC TP flexible cable GP 2x2 (PROFINET type B)**
Mechanical data	
Number of electrical conductors	4
Sheath	PVC Ø 6.5 ± 0.2 mm
Permitted ambient conditions	
Operating temperature Transportation/storage temperature Installation temperature	-25 ºC ... +75º C -25 ℃ ... +75 °C -10 ℃ to +60 ℃
Resistance to fire	Flame retardant to UL 1685 (CSA FT 4)
Resistance to oil	Conditionally resistant
UV resistance	resistant
Product characteristics	
Halogen-free	No
Silicone-free	Yes

[1] Electrical properties at 20 °C, tested to DIN 0472

Article number

IE FC TP Flexible Cable GP 2x2 (PROFINET Type B)	4-wire, shielded TP installation cable for connection to IE FC Outlet RJ45/ IE FC RJ45 Plug for occasional movement; PROFINET-compliant, with UL approval	
	Sold by the meter	6XV1870-2B
	Cable length 1000 m	6XV1870-2BU10

2.5.4 IE FC TP Robust Flexible Cable GP 2x2

Description

The IE FC TP Robust Flexible Cable GP 2x2 (Type B) is a standard cable for Fast Ethernet cabling with flexible cores for machine parts that move occasionally.

Features and functions

Cable type [1]	**IE FC TP robust flexible cable GP 2x2 (PROFINET type B)**
Areas of application	Occasional movement
Cable specification	Cat 5e

Cable type [1]	**IE FC TP robust flexible cable GP 2x2 (PROFINET type B)**
Maximum cable length	
• with IE FC RJ-45 plug	85 m
• with IE FC outlet RJ-45	75 m
Cable type (standard designation)	2YH (ST) C99Y 2x2x0.75/1.5-100 LI GN SF/UTP
Mechanical data	
Number of electrical conductors	4
Sheath	TPE (FR-TPE), Ø 6.5 ± 0.2 mm
Permitted ambient conditions	
Operating temperature	-40 ºC ... +75º C
Transportation/storage temperature	-40 °C ... +75 °C
Installation temperature	-20 ºC ... +60 °C
Resistance to fire	Flame retardant to IEC 60332-1-2
Resistance to oil	Oil-resistant to DIN EN 50290-2-22 (VDE 0819) 7 x 24 h / 90 °C UL 13 Sec.40 (96 h / 100 °C)
UV resistance	Resistant
Product characteristics	
Halogen-free	no
Silicone-free	yes

[1] Electrical properties at 20 °C, tested to DIN 0472

Article number

IE FC TP Robust Flexible Cable GP 2x2 (PROFINET Type B)	Standard cable with 4 flexible cores for machine parts that occasionally move, sold by the meter	6XV1841-2B

2.5.5 IE FC TP FRNC cable GP 2x2

Description

The halogen-free IE FC TP FRNC cable is suitable for installation in areas in which special fire prevention conditions prevail, for example in buildings open to the public.

The jacket is FRNC (Flame Retardant Non Corrosive): FRNC materials are halogen-free, flame-retardant or self extinguishing and do not release any aggressive gases or acids when burned.

Features and functions

Cable type [1]	**IE TP FRNC cable GP2x2 (PROFINET type B)**
Areas of application	Occasional movement
Cable specification	Cat 5e
Maximum cable length	
• with IE FC RJ-45 plug	85 m
• with IE FC outlet RJ-45	75 m
Cable type (standard designation)	02YS (ST) C11Y 1 x 4 x 0.75/1.5-100LI GN VZN FRNC
Mechanical data	
Number of electrical conductors	4
Sheath	FRNC Ø 6.5 ± 0.2 mm, green
Permitted ambient conditions	
Operating temperature	-25 ºC ... +70 ºC
Transportation/storage temperature	-45 ºC ... +75 ºC
Installation temperature	0 ºC ... +50 ºC
Resistance to fire	Flame retardant to IEC 60332-3-22 Category A/F
Resistance to oil	Conditionally resistant
UV resistance	resistant
Product characteristics	
Halogen-free	Yes
Silicone-free	Yes

[1] Electrical properties at 20 °C, tests according to DIN 47 250, Part 4, or DIN VDE 0472

Article number

IE TP FRNC Cable GP 2x2 (PROFINET Type B)	4-wire, shielded, halogen-free TP installation cable for connection to IE FC outlet RJ-45/ IE FC RJ-45 plug for occasional movement. PROFINET compliant, with UL approval.	6XV1871-2F

2.5.6 IE FC TP trailing cable 2x2

Description

In contrast to the IE FC TP standard cable 2x2, with the IE FC TP trailing cable 2x2, the wires are stranded copper. In conjunction with the special combination of braid shield, fleece foil shield, and the sheath material of polyurethane (PUR), the cable achieves a bending radius of 100 mm and highly constant electrical characteristics. The cable is designed for 4 000 000 bending cycles with a bending radius of 100 mm, a velocity of 4 m/s and an acceleration of 4 m/s^2.

Features and functions

Cable type [1]	**IE FC TP trailing cable 2x2 (PROFINET type C)**
Areas of application	Continuous motion control in a drag chain
Cable specification	Cat 5e
Maximum cable length	
• with IE FC RJ-45 plug	85 m
• with IE FC outlet RJ-45	75 m
Cable type (standard designation)	2YH (ST) C11Y 2x2x0.75/1.5-100 LI GN VZN FRNC SF/UTP
Mechanical data	
Number of electrical conductors	4
Sheath	PUR Ø 6.5 ± 0.2 mm, green
Permitted ambient conditions	
Operating temperature	-40 °C to +75 °C
Transportation/storage temperature	-50 °C to +75 °C
Installation temperature	-20 °C to +60 °C
Resistance to fire	Flame retardant to IEC 60332-1-2
Resistance to oil	Conditionally resistant
UV resistance	resistant
Product characteristics	
Halogen-free	Yes
Silicone-free	Yes

[1] Electrical properties at 20 °C, tested to DIN 0472

Article number

IE FC TP Trailing Cable 2x2 (PROFINET Type C)	4-wire, shielded TP installation cable for connection to IE FC outlet RJ-45/ IE FC RJ-45 plug 180/90 for use in drag chains; PROFINET-compliant; with UL approval	6XV1840-3AH10

2.5.7 IE FC TP trailing cable GP 2x2

Description

In contrast to the IE FC TP standard cable 2x2, with the IE FC TP trailing cable GP 2x2, the wires are stranded copper. The cable is designed for 3 000 000 bending cycles with a bending radius of 100 mm, a speed of 4 m/s and an acceleration of 4 m/s^2.

Features and functions

Cable type [1]	**IE FC TP trailing cable GP 2x2 (PROFINET type C)**
Areas of application	Continuous motion control in a drag chain
Cable specification	Cat 5e
Maximum cable length	
• with IE FC RJ-45 plug	85 m
• with IE FC outlet RJ-45	75 m
Cable type (standard designation)	2YY (ST) CY 2x2x0.75/1.5-100 LI GN SF/UTP
Mechanical data	
Number of electrical conductors	4
Sheath	PVC Ø 6.5 ± 0.2 mm; green
Permitted ambient conditions	
Operating temperature	-25 °C to +75 °C
Transportation/storage temperature	-25 ºC to +75 ºC
Installation temperature	-10 ºC to +60 ºC
Resistance to fire	Flame retardant to UL 1685 (CSA FT 4)
Resistance to oil	Conditionally resistant
UV resistance	resistant
Product characteristics	
Halogen-free	No
Silicone-free	Yes

[1] Electrical properties at 20 °C, tested to DIN 0472

Article number

IE FC TP Trailing Cable 2x2 (PROFINET Type C)	4-wire, shielded TP installation cable for connection to IE FC outlet RJ-45/ IE FC RJ-45 plug for use with drag chains; PROFINET-compliant; with UL approval;	6XV1870-2D

2.5.8 IE FC TP Festoon Cable GP 2x2

Description

The IE FC TP Festoon Cable GP 2x2 with its stranded wires and a PUR outer sheath is specifically designed for festoon applications on cranes. The cable is designed for 5 000 000 bending cycles with a bending radius of 70 mm, a velocity of 4 m/s and an acceleration of 4 m/s^2.

Features and functions

Cable type [1]	**IE FC TP Festoon Cable GP 2x2 (PROFINET Type B)**
Areas of application	For continuous motion in a drag chain, use of garlands
Cable specification	Cat 5e
Maximum cable length	
• with IE FC RJ-45 plug	85 m
• with IE FC outlet RJ-45	75 m
Cable type (standard designation)	2YY (ST) CY 2x2x0.75/1.5 LI GN SF/UTP
Mechanical data	
Number of electrical conductors	4
Sheath	FRNC Ø 6.5 ± 0.2 mm, green
Permitted ambient conditions	
Operating temperature Transportation/storage temperature Installation temperature	-40 °C to +75 °C -50 °C to +75 °C -20 °C to +60 °C
Resistance to fire	Flame retardant to UL 1685 (CSA FT 4)
Resistance to oil	Conditionally resistant
UV resistance	resistant
Product characteristics	
Halogen-free	No
Silicone-free	Yes

[1] Electrical properties at 20 °C, tested to VDE 0472

Article numbers

IE FC TP Festoon Cable GP 2x2 (PROFINET Type B)	4-wire, shielded TP installation cable for connection to IE FC outlet RJ-45/ IE FC RJ-45 plug 180/90 for use in festoon applications; PROFINET-compliant; with UL approval	6XV1871-2S

2.5.9 IE FC TP food cable 2x2

Description

The IE FC TP food cable 2x2 with its PE outer jacket and stranded wires is specifically designed for use in the food, beverages and tobacco industry.

Features and functions

Cable type [1]	**IE FC TP food cable 2x2 (PROFINET type C)**
Areas of application	Food, beverages and tobacco industry
Cable specification	Cat 5e
Maximum cable length	
• with IE FC RJ-45 plug	85 m
• with IE FC outlet RJ-45	75 m
Cable type (standard designation)	2YH (ST) C2Y 2X2X0.75/1.5-100 LI SF/UTP
Mechanical data	
Number of electrical conductors	4
Sheath	PUR Ø 6.5 ± 0.2 mm, black
Permitted ambient conditions	
Operating temperature	-40 ºC to +75 ºC
Transportation/storage temperature	-50 ºC to +75 ºC
Installation temperature	-20 ºC to +60 ºC
Resistance to fire	Flammable
Resistance to oil	Conditionally resistant
UV resistance	resistant
Product characteristics	
Halogen-free	Yes
Silicone-free	Yes

[1] Electrical properties at 20 °C, tested to DIN 0472

Article number

IE FC TP Food Cable GP 2x2 (PROFINET Type C)	4-wire, shielded TP installation cable for connection to IE FC Outlet RJ45/IE FC RJ45 Plug 180/90 for food, beverages and tobacco industry; PROFINET-compliant, sold in meters	6XV1871-2L

2.5.10 IE FC TP marine cable 2x2 GP

Description

The halogen-free IE FC TP marine cable has the following shipbuilding certifications:

- American Bureau of Shipping Europe Ltd. (ABS)
- Bureau Veritas (BV)
- Det Norske Veritas (DNV)
- Germanischer Lloyd (GL)
- Lloyds Register of Shipping (LRS)

The jacket is FRNC (Flame Retardant Non Corrosive): FRNC materials are halogen-free, flame-retardant or self-extinguishing and do not release any aggressive gases or acids when burned.

Features and functions

Cable type [1]	**IE FC TP Marine Cable 2x2 (PROFINET Type B)**
Areas of application	Marine and offshore use
Cable specification	Cat 5e
Maximum cable length	
• with IE FC RJ-45 plug	85 m
• with IE FC outlet RJ-45	75 m
Cable type (standard designation)	L-9YH (ST) CH 2 x 2 x 0,34/1,5-100 GN VZN FRNC SF/UTP
Mechanical data	
Number of electrical conductors	4
Sheath	FRNC Ø 6.5 ± 0.2 mm, green
Permitted ambient conditions	
Operating temperature	-25 ºC to +70 ºC
Transportation/storage temperature	-40 °C to +85 °C
Installation temperature	0 ºC to +50 ºC
Resistance to fire	Flame retardant to IEC 60332-3-22 Category A/F
Resistance to oil	Resistant to a certain extent IEC 60811-2-1 (4 h / 70 °C)
UV resistance	resistant
Product characteristics	
Halogen-free	Yes
Silicone-free	Yes

[1] Electrical properties at 20 °C, tested to DIN 0472

Article number

IE FC TP Marine Cable 2x2 (PROFINET Type B)	4-wire, shielded TP installation cable for connection to IE FC Outlet RJ45/ IE FC RJ45 Plug 180/90, certified for shipbuilding	6XV1840-4AH10

2.5.11 IE FC TP Train Cable 2x2

Description

The IE FC TP Train Cable 2x2 (Type C, 22/7 AWG) is a flexible cable for routing in rail vehicles and buses.

Features and functions

Cable type [1]	**IE FC TP Train Cable 2x2 (Type C, AWG22/7)**
Areas of application	Railway applications; for connection to FC RJ45 Plug 2x2, FC M12 Plug Pro 2x2
Cable specification	Cat 5
Maximum cable length	
• with IE FC RJ-45 plug	100 m
• with IE FC outlet RJ-45	90 m
Cable type (standard designation)	SF/UTP
Mechanical data	
Number of electrical conductors	4
Sheath	Elastomer electron beam cross-linked Ø 6.6 ± 0.2 mm, black
Permitted ambient conditions	
Operating temperature	-40 °C to +80 °C
Transportation/storage temperature	-40 °C to +80 °C
Installation temperature	-20 °C ... +60 °C
Note: Briefly in short-circuit situation	160 °C
Resistance to fire	Flame resistant to BS 6853, DIN 5510-2 Fire Protection Level 1 - 4, prEN 45545-2 Hazard Level HL1 - HL3, EN 50306-4, NF F 16-101, NFPA 130
Resistance to oil	Resistant according to EN 50306-4 (72 h / 100 °C, IRM 902, 168 h / 70 °C, IRM 903)
UV resistance	Resistant
Product characteristics	
Halogen-free	Yes
Silicone-free	Yes

[1] Electrical properties measured at 20 °C, tested to EN 50288-2-1

Article number

IE FC TP Train Cable 2x2 (Type C, AWG22/7)	Flexible cable for rail applications, sold by the meter	6XV1871-2T

2.5.12 IE FC TP torsion cable 2x2

Description

In contrast to IE FC TP Standard Cable 2x2 with the IE FC TP torsion cable 2x2, the wires are stranded copper. In conjunction with the special combination of braid shield, fleece foil shield, and the sheath material of polyurethane (PUR), the cable achieves a torsional strength of ±180° and highly constant electrical characteristics. The cable has been tested for 5,000,000 torsion movements on 1 m cable length (±180°).

The cable is suitable for networking moving parts of plant, for example robots. For applications using festoon supports the cable is not suitable.

Features and functions

Cable type [1]	**IE FC TP Torsion Cable GP 2x2 (PROFINET Type C)**
Areas of application	Constant motion when used with robots
Cable specification	Cat 5e
Maximum cable length	
• with IE FC RJ-45 plug	55 m
• with IE FC outlet RJ-45	45 m
Cable type (standard designation)	2YY (ST) CY 2x2x0.75/1.5-100 LI GN
Mechanical data	
Number of electrical conductors	4
Sheath	PVC Ø 6.5 ± 0.2 mm
Permitted ambient conditions	
Operating temperature	-40 ºC ... +80 ºC
Transportation/storage temperature	-40 ºC ... +80 ºC
Installation temperature	-20 ºC ... +60 ºC
Resistance to fire	Flame retardant to UL 1685 (CSA FT 4)
Resistance to oil	Conditionally resistant
UV resistance	resistant

Cable type [1]	IE FC TP Torsion Cable GP 2x2 (PROFINET Type C)
Product characteristics	
Halogen-free	No
Silicone-free	Yes

[1] Electrical properties at 20 °C, tested to DIN 0472

Article number

IE TP Torsion Cable GP 2x2 (PROFINET Type C)	4-wire, shielded TP installation cable for connection to IE FC Outlet RJ45/ IE FC RJ45 Plug for use with robots; PROFINET-compliant; with UL approval	6XV1870-2F

2.5.13 IE FC TP Ground Cable 2x2

Description

The IE FC TP Ground Cable 2x2 (Type C) is a standard cable with rigid cores for laying in the earth.

Note

Plugs assembled only after removing the outer jacket

This cable as an additional PE outer jacket with a diameter of 9 mm. An RJ-45 or M12 plus can only be assembled when this outer jacket is removed.

Features and functions

Cable type [1]	IE FC TP Ground Cable 2x2 (Type C)
Areas of application	Can be laid underground
Cable specification	Cat 5e
Maximum cable length	
• with IE FC RJ-45 plug	100 m
• with IE FC outlet RJ-45	90 m
Cable type (standard designation)	2YY (ST) CY2Y 2x2x0.64/1.50-100 SF/UTP
Mechanical data	
Number of electrical conductors	4
Sheath	PVC, Ø 9 ± 0.2 mm, black
Permitted ambient conditions	

Cable type [1]	IE FC TP Ground Cable 2x2 (Type C)
Operating temperature	-40 °C to +70 °C
Transportation/storage temperature	-40 °C to +70 °C
Installation temperature	-5 °C to +50 °C
Resistance to fire	Flammable
Resistance to oil	Conditionally resistant
UV resistance	Resistant
Product characteristics	
Halogen-free	No
Silicone-free	Yes

1) Electrical properties at 20 °C, tested to EN 50288-2-1

Article number

IE FC TP Ground Cable 2x2 (Type C)	Ground cable	6XV1871-2G

2.5.14 IE FC TP Standard Cable GP 4x2

Description

The IE FC TP Standard Cable GP 4x2 is available in two variants:

- IE FC TP standard cable 4x2 (22 AWG)

  The cable is used to set up Industrial Ethernet networks up to 100 m for 1000Base-T.
- IE FC TP Standard Cable 4x2 (AWG24)

  The cable is used for direct connection up to 90 m without patch cables for 10GBase-T.

Features and functions

Cable type [1]	IE FC TP Standard Cable GP 4x2 (AWG 22)	IE FC TP Standard Cable GP 4x2 (AWG 24)
Areas of application	Universal application	Universal application
Cable specification	Cat 6	Cat 6_A
Maximum cable length		
• For Industrial Ethernet 100BaseTX, 1000BaseT	100 m	100 m
• At Industrial Ethernet 10GBaseT	-	90 m
Cable type (standard designation)	2YH (ST) C 4x2x0.64/1.25-100 GN 4x2 AWG22	2YH (ST) CY 4x2x0.5/1.0-100 GN 4x2 AWG24

Cable type [1]	IE FC TP Standard Cable GP 4x2 (AWG 22)	IE FC TP Standard Cable GP 4x2 (AWG 24)
Mechanical data		
Number of electrical conductors	8	8
Sheath	PVC Ø 9.6 ± 0.3 mm; green	PVC Ø 8 ± 0.2 mm; green
Permitted ambient conditions		
Operating temperature	-40 ºC ... +80 °C	-40 ºC ... +80 °C
Transportation/storage temperature	-40 ℃ to +80 ℃	-40 ℃ to +80 ℃
Installation temperature	-40 °C to +80 °C	-40 °C to +80 °C
Resistance to fire	Flame retardant to IEC 60332-1	Flame retardant to IEC 60332-3-24 (Category C)
Resistance to oil	Resistant according to IEC 60811-2-1 (4 h / 70 °C)	Resistant according to IEC 60811-2-1 (4 h / 70 °C)
UV resistance	resistant	resistant
Product characteristics		
Halogen-free	No	No
Silicone-free	Yes	Yes

[1] Electrical properties at 20 °C, tested to DIN 0472

Article numbers

IE FC TP Standard Cable GP 4x2	8-wire shielded TP installation cable for universal application; with UL approval.	
	• 22 AWG	6XV1870-2E
	• 24 AWG	6XV1878-2A

2.5.15 IE FC TP flexible cable GP 4x2

Description

The IE FC TP Flexible Cable GP 4x2 with its flexible wires is suitable for applications in which occasional movement is required. The cable has the FC design and can be stripped with the IE FC stripping tool. This allows the IE FC RJ-45 4x2 plug-in connector to be connected to the IE FC flexible cable GP 4x2.

Features and functions

Cable type [1]	IE FC TP flexible cable GP 4x2
Areas of application	Occasional movement
Cable specification	Cat 6_A

Cable type [1]	IE FC TP flexible cable GP 4x2
Maximum cable length	
• At Industrial Ethernet 100BaseTX, 1000BaseT	80 m
• At Industrial Ethernet 10GBaseT	70 m
Cable type (standard designation)	LI02YSH (ST) CY 4x2x0.22/1.1-100 GN
Mechanical data	
Number of electrical conductors	8
Sheath	PVC Ø 8 ± 0.2 mm; green
Permitted ambient conditions	
Operating temperature	-40 ºC ... +80 °C
Transportation/storage temperature	-40 ºC ... +80 °C
Installation temperature	-40 °C to +80 °C
Resistance to fire	Flame retardant to IEC 60332-3-24 (Category C)
Resistance to oil	Conditionally resistant
UV resistance	resistant
Product characteristics	
Halogen-free	No
Silicone-free	Yes

[1] Electrical properties at 20 °C, tested to DIN 0472

Article number

IE FC TP Flexible Cable GP 4x2	8-wire shielded TP installation cable for universal application; with UL approval	6XV1878-2B

2.5.16 IE FC TP Trailing Cable GP 4x2

Description

The IE FC TP TRAILING CABLE GP 4x2 is a shielded non-preassembled 8-wire TP installation cable with flexible wires for connection to IE FC RJ45 Plug 4x2 and IE FC M12 Plug PRO 4x2 (x-coded). The cable is designed for 1 000 000 bending cycles with a bending radius of 120 mm, a speed of 4 m/s and an acceleration of 4 m/s².

Features and functions

Cable type [1]	IE FC TP Trailing Cable GP 4x2
Areas of application	Flexible cable for fast installation, for installation in drag chains
Cable specification	Cat 6_A

Cable type [1]	IE FC TP Trailing Cable GP 4x2
Maximum cable length	
• For Industrial Ethernet 100BaseTX, 1000BaseT	50 m
• At Industrial Ethernet 10GBaseT	50 m
Cable type (standard designation)	2YH(ST)C11Y 4X2X0.6/1.04-100 LI GN
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
Mechanical data	
Number of electrical conductors	8
Sheath	PVC ∅ (8 ± 0.2) mm, green
Permitted ambient conditions	
Operating temperature	-30 °C to +70 °C
Transportation/storage temperature	-40 °C to +80 °C
Installation temperature	-30 °C to +70 °C
Remark	For permanent installation -40 °C to 80 °C
Resistance to fire	Flame retardant to IEC 60332-1-2
Resistance to oil	Resistant according to IEC 60811-404 (7 x 24 h / 90 °C)
UV resistance	resistant
Product characteristics	
Halogen-free	Yes
Silicone-free	yes

[1] Electrical properties at 20 °C, tested to DIN 0472

Article numbers

IE FC TP Trailing Cable GP 4x2	AWG 24, Type C, shielded TP installation cable (8-wire), sold by the meter, without connectors	6XV1878-2C

2.5.17 IE FC TP Ground Cable 4x2

Description

The cable IE FC TP Ground Cable 4x2 (AWG 24, Type C) is a shielded 8-wire TP installation cable with rigid cores for connection to IE FC RJ45 plug 4x2 and IE FC M12 plug PRO 4x2 (x-coded). The cable is intended for fixed installation in outdoors and underground.

Note

Plugs assembled only after removing the outer jacket

This cable as an additional PE outer jacket with a diameter of 9 mm. An RJ-45 or M12 plus can only be assembled when this outer jacket is removed.

Features and functions

Cable type [1]	**IE FC TP Ground Cable 4x2 (Type C)**
Areas of application	Ground installation
Cable specification	Cat 6_A
Maximum cable length	
• For Industrial Ethernet 100BaseTX, 1000BaseT	90 m
• At Industrial Ethernet 10GBaseT	70 m
Cable type (standard designation)	2YH(ST)CY2Y 4X2X0.5/1.0 BK
Standards, approvals	
• RoHS conformity	Yes
• UL approval	No
Mechanical data	
Number of electrical conductors	8
Sheath	PVC, Ø 10.5 ± 0.5 mm, black Note: IE FC standard cable GP 4x2 (diameter 8 mm) with additional PE outer sheath (diameter 10.5 mm)
Permitted ambient conditions	
Operating temperature	-40 °C to +80 °C
Transportation/storage temperature	-40 °C to +80 °C
Installation temperature	-40 °C to +80 °C
Remark	For permanent installation -40 °C to 85 °C
Resistance to fire	Fca
Water resistance	Good resistance
UV resistance	Resistant

Cable type [1]	IE FC TP Ground Cable 4x2 (Type C)
Product characteristics	
Halogen-free	No
Silicone-free	Yes

[1] Electrical properties at 20 °C, tested to EN 50288-2-1

Article number

IE FC TP Ground Cable 4x2	AWG 24, Type C, ground cable, 8-wire, sold by the meter, without connectors	6XV1878-2G

2.5.18 IE FC TP Train Cable 4x2

Description

The IE FC TP Train Cable 4x2 (24/7 AWG) is a shielded flexible bus cable with tin-plated copper stranded wires for routing in rail vehicles and buses. This cable is exclusively suitable for preassembly with the FC M12 Plug PRO 4x2.

Features and functions

Cable type	IE FC TP Train Cable 4x2
Areas of application	Rail vehicles and buses
Cable specification	Cat 7
Maximum cable length	
• in Industrial Ethernet 100BaseTX, 1000BaseT	100 m
Cable type (standard designation)	02Y(ST)C99Y 4x2x0.61/1.45-100 PIMF
Mechanical data	
Number of electrical conductors	8
Sheath	Elastomer electron beam cross-linked Ø 8.1 ± 0.2 mm, black
Permitted ambient conditions	
Operating temperature	-40 °C to +80 °C
Transportation/storage temperature	-40 °C to +80 °C
Installation temperature	-20 °C ... +60 °C

Cable type	IE FC TP Train Cable 4x2
Resistance to fire	Meets the following standards: • BS 6853 • DIN5510-2 fire protection level 1-4 • prEN 45545-2 hazard level HL 1-HL 3 • EN 50306-4 • NF F 16-101 • NFPA130
Resistance to oil	EN 50306-4 (72h/100 °C, IRM 902, 168h/70 °C, IRM 903)
UV resistance	Resistant
Product characteristics	
Halogen-free	Yes
Silicone-free	Yes

Article number

IE FC TP Train Cable 4x2	8-wire shielded TP installation cable for use in rail vehicles and buses, with railway approval, sold in meters, without connectors	6XV1878-2T

2.6 IE connecting cable M12

Description

The IE connecting cable M12 is an assembled connecting cable for connecting Industrial Ethernet nodes. As the connecting cable, the IE FC TP trailing cable GP is used. Due to the 4-wire IE FC TP trailing cable GP that is used, the connecting cable is suitable for drag chains. The IE connecting cable M12 is suitable for drag chains for 3,000,000 bending cycles at a bending radius of 100 mm, a speed of 4 m/s and an acceleration of 4 m/s².



The IE connecting cable M12 is available in the following variants:

- IE connecting cable M12-180/M12-180

  Plug-in cable with two 4-pin M12 plugs (D-coded) for connecting Industrial Ethernet nodes with degree of protection IP65/IP67, for example, SIMATIC ET 200, SCALANCE X208 PRO and SIMATIC RF systems

- IE connecting cable M12-180/IE FC RJ-45-145

  Connecting cable with one 4-pin M12 plug (D-coded) and one IE FC RJ-45 connector. The plug-in cable is used to connect Industrial Ethernet nodes, for example, SIMATIC ET 200, SCALANCE X208 PRO and SIMOTION.

- IE Connecting Cable M12-90/IE FC RJ45 Plug-180

  Connecting cable with one 4-pin M12 plug (D-coded, 90 degree angled) and one IE FC RJ45 connector. The plug-in cable is used to connect Industrial Ethernet nodes, for example SIMATIC ET200pro, SCALANCE X208PRO und SIMOTION.

- IE Connecting Cable M12-90/M12-90

  Flexible connecting cable, 4-wire, preassembled with two 4-pin M12 plugs (D-coded, 90° cable outlet). For connecting Industrial Ethernet nodes (for example SIMATIC ET200 and SCALANCE XP-200) in degree of protection IP 65/67

Features and functions

Cable type [1)]	**IE connecting cable M12**
Areas of application	For connecting Industrial Ethernet nodes
Cable specification	Cat 5e
Cable type (standard designation)	2YY (ST) CY 2x2x0.75/1.5-100 LI GN
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
Mechanical data	
Number of electrical conductors	4
Sheath	PVC ∅ (6.5 ± 0.2) mm, green
Number of bending cycles	3000000; suitable for cable carriers for 3 million bending cycles at a bending radius of 100 mm, a velocity of 4 m/s and an acceleration of 4 m/s².
Maximum tensile load	150 N
Permitted ambient conditions	
Operating temperature	-25 °C to +75 °C
Transportation/storage temperature	-25 °C to +75 °C
Installation temperature	-10 °C to +60 °C
Resistance to fire	Flame retardant to UL 1685 (CSA FT 4)
Resistance to oil	Conditionally resistant
UV resistance	resistant

Cable type [1]	IE connecting cable M12
Product characteristics	
Halogen-free	no
Silicone-free	yes

[1] Electrical properties at 20 °C, tested to DIN 0472

Article numbers

IE Connecting Cable M12-180/M12-180	Preassembled IE FC TP Trailing Cable GP, with 2x M12 plugs (D-coded) 180° cable outlet, IP65/IP67	
	• 0.3 m	6XV1870-8AE30
	• 0.5 m	6XV1870-8AE50
	• 1.0 m	6XV1870-8AH10
	• 1.5 m	6XV1870-8AH15
	• 2.0 m	6XV1870-8AH20
	• 3.0 m	6XV1870-8AH30
	• 5.0 m	6XV1870-8AH50
	• 10.0 m	6XV1870-8AN10
	• 15.0 m	6XV1870-8AN15
IE Connecting Cable M12-180/IE FC RJ45 Plug-145	Preassembled IE FC TP Trailing Cable GP, with 1 x M12 plug (D-coded) and 1x IE FC RJ45 Plug	
	• 2.0 m	6XV1871-5TH20
	• 3.0 m	6XV1871-5TH30
	• 5.0 m	6XV1871-5TH50
	• 10.0 m	6XV1871-5TN10
	• 15.0 m	6XV1871-5TN15
IE Connecting Cable M12-90/IE FC RJ45 Plug-180	Preassembled IE FC TP Trailing Cable GP, with 1x M12 plugs (D-coded, 90 degree angled) and 1x IE FC RJ45 Plug 180	
	• 5.0 m	6XV1871-5MH50
IE Connecting Cable M12-90/M12-90	Preassembled IE FC TP Trailing Cable GP, with 2x M12 plugs (D-coded) 90° cable outlet, IP65/IP67	
	• 0.3 m	6XV1870-8GE30
	• 0.5 m	6XV1870-8GE50
	• 1.0 m	6XV1870-8GH10
	• 1.5 m	6XV1870-8GH15
	• 2.0 m	6XV1870-8GH20
	• 3.0 m	6XV1870-8GH30

	• 5.0 m	6XV1870-8GH50
	• 10.0 m	6XV1870-8GN10
	• 15.0 m	6XV1870-8GN15

2.7 IE Robust Connecting Cable M12

Description

The IE robust connecting cable M12 is an oil and UV resistant cable in a flame retardant version that is particularly suitable for use in the food industry. The preassembled cables are fitted with two 4-pin M12-180 connectors (D-coded) in the degree of protection IP69. This product is also available by the meter without connectors.

Features and functions

Cable type [1]	**FC TP robust food cable 2x2 (PROFINET type B) CAT5 Plus**
Areas of application	Particularly resistant cable also suitable for use in the food industry.
Cable specification	Cat 5e
Maximum cable length	
• with IE FC RJ-45 plug	100 m
• with IE FC outlet RJ-45	90 m
Cable type (standard designation)	2YY(ST)CY6Y 2x2x0.75/1.55 LI VZN
Mechanical data	
Number of electrical conductors	4
Sheath	FEP Ø 6.5 ± 0.2 mm, transparent (inner jacket green)
Permitted ambient conditions	
Operating temperature	-40 °C to +80 °C
Transportation/storage temperature	-40 °C to +80 °C
Installation temperature	-40 °C to +80 °C
Resistance to fire	Flame retardant to IEC 60332-1-2 and UL 1685 (CSA FT 4)
Resistance to oil	Oil-resistant to IEC 60811-404 (24 h / 100 °C)
UV resistance	Resistant acc.to UL 2556 Sec. 4.2.8.5
Product characteristics	
Halogen-free	No
Silicone-free	Yes

[1] Electrical properties at 20 °C, tested to DIN 0472

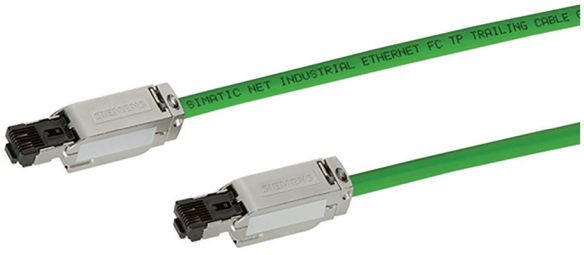
Article numbers

FC TP Robust Food Cable 2x2 (PROFINET TYPE B) CAT5 Plus	4-wire, shielded TP installation cable Sold by the meter, minimum order 20 m, maximum order 1000 m.	6XV1881-2A
IE Robust Connecting Cable M12	4-wire shielded TP installation cable, preassembled with two 4-wire M12-180 connectors (D-coded) with degree of protection IP69	
	• 1.0 m	6XV1881-5AH10
	• 2.0 m	6XV1881-5AH20
	• 3.0 m	6XV1881-5AH30
	• 5.0 m	6XV1881-5AH50

2.8 IE Connecting Cable with 2x IE FC RJ45 Plug-180 2x2

Description

The IE Connecting Cable IE FC RJ45-180 / IE FC RJ45-180 2x2 is a preassembled connecting cable for connecting Industrial Ethernet nodes with RJ45 interface (10/100 Mbps). As the connecting cable, the IE FC TP trailing cable GP is used. Thanks to the 4-wire IE FC TP trailing cable GP 2x2 Cat5e that is used, the connecting cable is suitable for drag chains. The IE connecting cable RJ45-180 is suitable for drag chains for 3 000 000 bending cycles at a bending radius of 100 mm, a speed of 4 m/s and an acceleration of 4 m/s².



Features and functions

Cable type [1]	**IE Connecting Cable IE FC RJ45-180 / IE FC RJ45-180 2x2**
Areas of application	For connecting Industrial Ethernet nodes (SIMATIC S7, ET 200SP, ET 200MP, SCALANCE X, S, M)
Cable specification	Cat 5e

Cable type [1]	**IE Connecting Cable IE FC RJ45-180 / IE FC RJ45-180 2x2**
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
Mechanical data	
Number of electrical conductors	4
Sheath	PVC ∅ (6.5 ± 0.2) mm, green
Permitted ambient conditions	
Operating temperature	-25 ℃ to +75 °C
Transportation/storage temperature	-25 ℃ to +75 °C
Installation temperature	-25 ℃ to +75 °C
Resistance to fire	Flame retardant to UL 1685 (CSA FT 4)
Resistance to oil	Conditionally resistant
UV resistance	resistant
Product characteristics	
Halogen-free	no
Silicone-free	yes

[1] Electrical properties at 20 °C, tested to DIN 0472

Article numbers

IE Connecting Cable IE FC RJ45 Plug-180/IE FC RJ45 Plug-180	Preassembled IE FC Trailing Cable GP with 2x IE FC RJ45 Plug 180	
	• 1.0 m	6XV1871-5BH10
	• 1.5 m	6XV1871-5BH15
	• 2.0 m	6XV1871-5BH20
	• 3.0 m	6XV1871-5BH30
	• 5.0 m	6XV1871-5BH50
	• 10.0 m	6XV1871-5BN10
	• 15.0 m	6XV1871-5BN15
	• 20.0 m	6XV1871-5BN20
	• 30.0 m	6XV1871-5BN30

2.9 IE Connecting Cable with 2x IE FC RJ45 Plug-180 4x2

Description

The IE Connecting Cable IE FC RJ45-180 / IE FC RJ45-180 4x2 is a preassembled connecting cable for connecting Industrial Ethernet nodes with RJ45 interface (1/10 Mbps). The 8-wire IE FC TP Flexible Cable GP 4x2, Cat 6A is used as the connecting cable.



Features and functions

Cable type [1]	**IE Connecting Cable IE FC RJ45-180 / IE FC RJ45-180 4x2**
Areas of application	For connecting Industrial Ethernet nodes (SCALANCE X, S, M), degree of protection IP20/30
Cable specification	Cat 6A
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
Mechanical data	
Number of electrical conductors	8
Sheath	PVC ∅ (8 ± 0.2) mm, green
Permitted ambient conditions	
Operating temperature	-40 °C to +80 °C
Transportation/storage temperature	-40 °C to +80 °C
Installation temperature	-40 °C to +80 °C
Resistance to fire	Flame retardant to IEC 60332-3-24 (Category C)
Resistance to oil	Resistant according to IEC 60811-2-1 (4 h / 70 °C)
UV resistance	resistant
Product characteristics	
Halogen-free	no
Silicone-free	yes

[1] Electrical properties at 20 °C, tested to DIN 0472

Article numbers

IE Connecting Cable IE FC RJ45 Plug-180/IE FC RJ45 Plug-180	Preassembled IE Connecting Cable IE FC Trailing Cable GP with 2x IE FC RJ45 Plug 180	
	• 2.0 m	6XV1878-5BH20
	• 3.0 m	6XV1878-5BH30
	• 5.0 m	6XV1878-5BH50
	• 10.0 m	6XV1878-5BN10
	• 15.0 m	6XV1878-5BN15
	• 20.0 m	6XV1878-5BN20
	• 25.0 m	6XV1878-5BN25
	• 30.0 m	6XV1878-5BN30

2.10 IE TP Cord M12 4x2

Description

The IE TP Cord M12 is a preassembled connecting cable for connecting Industrial Ethernet nodes with M12 interface (1/10 Gbps). The 8-wire IE FC TP Flexible Patch Cord 4x2 is used as the connecting cable.



Figure 2-7 IE TP Cord 2x M12-180



Figure 2-8 IE TP Cord 2x M12-90

The IE TP Cord M12 is available in the following variants:

- IE TP Cord M12-180/M12-180

  With 2x M12 plugs (X-coded) with straight cable outlet
- IE TP Cord M12-90/M12-90

  With 2x M12 plugs (X-coded) with 90 degree cable outlet

Features and functions

Cable type [1]	**IE TP Cord M12**
Areas of application	For connecting Industrial Ethernet nodes (XP-200 and SCALANCE W), degree of protection IP65/IP67
Cable specification	Cat 6_A
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
Mechanical data	
Number of electrical conductors	8
Sheath	PVC ∅ (6.5 ± 0.3) mm, green
Permitted ambient conditions	
Operating temperature	-30 °C to +80 °C
Transportation/storage temperature	-40 °C to +80 °C
Installation temperature	-40 °C to +80 °C
Resistance to fire	Flame retardant to IEC 60332-1-2
Resistance to oil	Resistant according to DIN EN 60811-2-1
UV resistance	resistant
Product characteristics	
Halogen-free	no
Silicone-free	yes

[1] Electrical properties at 20 °C, tested to DIN 0472

Article numbers

IE TP Cord M12-180/M12-180	Preassembled IE Flexible Cable with 2x M12 plugs (X-coded); 180 degree cable outlet	
	• 0.3 m	6XV1878-5HE30
	• 0.5 m	6XV1878-5HE50
	• 1.0 m	6XV1878-5HH10
	• 1.5 m	6XV1878-5HH15
	• 2.0 m	6XV1878-5HH20

	• 3.0 m	6XV1878-5HH30
	• 5.0 m	6XV1878-5HH50
	• 10.0 m	6XV1878-5HN10
	• 15.0 m	6XV1878-5HN15
IE TP Cord M12-90/M12-90	Preassembled IE Flexible Cable with 2x M12 plugs (X-coded); 90 degree cable outlet	
	• 0.3 m	6XV1878-5GE30
	• 0.5 m	6XV1878-5GE50
	• 1.0 m	6XV1878-5GH10
	• 1.5 m	6XV1878-5GH15
	• 2.0 m	6XV1878-5GH20
	• 3.0 m	6XV1878-5GH30
	• 5.0 m	6XV1878-5GH50
	• 10.0 m	6XV1878-5GN10
	• 15.0 m	6XV1878-5GN15

2.11 Plugs

2.11.1 IE FC RJ-45 plugs 2x2

Description

The IE FC RJ-45 plugs 2x2 are compact and rugged plug-in connectors. The connectors have a robust metal casing suitable for industry that provides protection from interference for the data communication. The connectors comply with the standards EN 50173 (RJ-45) and ISO/ IEC 11801

The IE FC RJ-45 plugs 2x2 are used to install 4-wire IE FC TP cables in the field.

The connector allows point-to-point connections (10/100 Mbps) to be implemented for Industrial Ethernet between two end devices/network components up to 100 m without patch cables.

The IE FC RJ-45 plugs 2x2 are available in three versions:

- With 180° (straight) cable outlet
  Due to their design, the IE FC RJ-45 plug 180 can be used both for devices with individual jacks and for devices with multiple jacks (blocks). The connector is particularly suitable for connecting IE FC TP cables to SIMATIC NET modules and SCALANCE devices.



- With 90° (angled) cable outlet

  The connector is particularly suitable for connecting IE FC TP cables to ET200 or PN/PN links.



Figure 2-9 IE FC RJ-45 PLUG 902X2

- With 145° (angled) cable outlet

  The connector is intended for connecting IE FC TP cables to SIMOTION and SINAMICS modules.



Features and functions

Connection type	IE FC RJ-45 plug 180 (2x2)	IE FC RJ-45 plug 90 (2x2)	IE FC RJ-45 plug 145 (2x2)
Cabling specification	Cat5	Cat5	Cat5
Standards, approvals			
• RoHS conformity	yes	yes	yes
• UL approval	yes	yes	yes
Transmission speed			
Industrial Ethernet	10 / 100 Mbps	10 / 100 Mbps	10 / 100 Mbps

Connection type	IE FC RJ-45 plug 180 (2x2)	IE FC RJ-45 plug 90 (2x2)	IE FC RJ-45 plug 145 (2x2)
Interfaces			
Number of electrical connectors for IE FC TP cables	4	4	4
version IE FC TP	Integrated insulation-piercing contacts for 4-wire IE FC TP cables	Integrated insulation-piercing contacts for 4-wire IE FC TP cables	Integrated insulation-piercing contacts for 4-wire IE FC TP cables
Version for network components or end devices	RJ-45 plug	RJ-45 plug	RJ-45 plug
Design			
Cable outlet	180°	90°	145°
Housing material	Metal	Metal	Metal
Permitted ambient conditions			
Operating temperature	-20 ºC to +70 ºC	-20 ºC to +70 ºC	-20 ºC to +70 ºC
Transportation/storage temperature	-40 ºC to +80 ºC	-40 ºC to +80 ºC	-40 ºC to +80 ºC
IP degree of protection	IP20	IP20	IP20
Product property			
Silicone-free	yes	yes	yes

Article numbers

IE FC RJ45 Plug 180	RJ-45 cable connector Industrial Ethernet with rugged metal casing and integrated insulation displacement contacts for connection of the 4-wire IE FC TP cables. With 180° cable outlet	
	1 pack of 1	6GK1901-1BB10-2AA0
	1 pack of 10	6GK1901-1BB10-2AB0
	1 pack of 50	6GK1901-1BB10-2AE0
IE FC RJ45 Plug 90	RJ-45 cable connector for Industrial Ethernet with rugged metal casing and integrated insulation piercing contacts for connection of the 4-wire IE FC TP cables. With 90° cable outlet	
	1 pack of 1	6GK1901-1BB20-2AA0
	1 pack of 10	6GK1901-1BB20-2AB0
	1 pack of 50	6GK1901-1BB20-2AE0
IE FC RJ45 Plug 145	RJ-45 cable connector for Industrial Ethernet with rugged metal casing and integrated insulation piercing contacts for connection of the 4-wire IE FC TP cables. With 145° cable outlet	
	1 pack of 1	6GK1901-1BB30-0AA0
	1 pack of 10	6GK1901-1BB30-0AB0
	1 pack of 50	6GK1901-1BB30-0AE0

2.11.2 IE FC RJ45 Plug 180 4x2

Description

The IE FC RJ-45 PLUG 180 (4x2) is an RJ-45 data plug-in connector with a metal housing suitable for industry and straight cable outlet (180°). The plug is suitable for fitting to 8-wire IE FastConnect cables (24 AWG) and meets the requirements of the standard Cat6A acc. to EIA/TIA 568. The maximum transmission rate is 10 Gbps. Due to the FastConnect technology assembly in the field is possible without problems. The design of the housing matches all SIMATIC NET modules and SCALANCE devices.

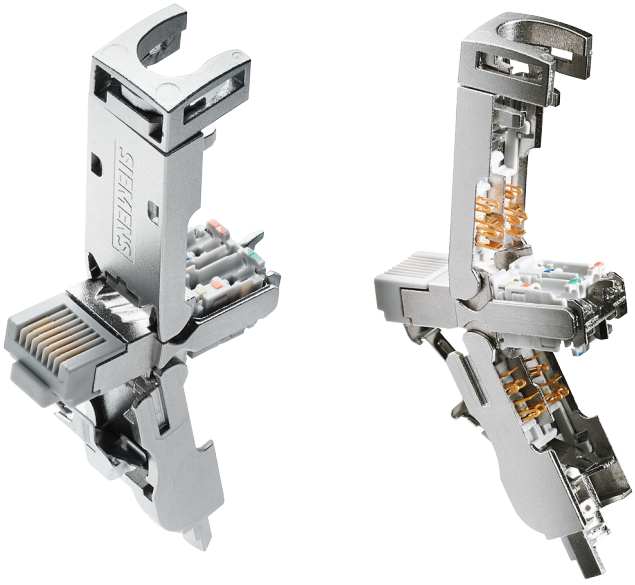


Figure 2-10 IE FC RJ-45 PLUG 180 (4x2) opened

Features and functions

Connection type	**IE FC RJ45 Plug 180 (4x2)**
Cabling specification	$Cat6_A$
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
• cULus approval	Yes
Transmission speed	
Industrial Ethernet	10 Mbps, 100 Mbps, 1000 Mbps or 10000 Mbps
Interfaces	
Number of electrical connectors for IE FC TP cables	8
IE FC TP version	Integrated insulation displacement contacts for 8-wire IE FC TP cables, FastConnect technology

Connection type	IE FC RJ45 Plug 180 (4x2)
Version for network components or end devices	RJ-45 plug.
Design	
Cable outlet	180°
Housing material	Metal
Permitted ambient conditions	
Operating temperature	-40 ºC ... +85 ºC
Transportation/storage temperature	-40 ºC ... +85 ºC
IP degree of protection	IP 20
Product property	
Silicone-free	Yes
Number of re-uses	10

Article numbers

IE FC RJ45 Plug 180 (4x2)	RJ-45 plug for Industrial Ethernet with rugged metal casing and integrated insulation displacement contacts for connection of the 8-wire IE FC TP cables.	
	1 pack of 1	6GK1901-1BB12-2AA0
	1 pack of 10	6GK1901-1BB12-2AB0
	1 pack of 50	6GK1901-1BB12-2AE0

2.11.3 IE M12 Panel Feedthrough 4x2

Description

The IE M12 panel feedthrough 4x2 allows the transition from M12 connector technology to RJ-45 connector technology. The metal housing with 90° cable outlet is designed for ambient temperatures up 85 °C. The M12 connector (X-coded) has degree of protection IP67, the RJ-45 connector has degree of protection IP20. The product is intended for use with 8-wire Cat6A cables, the maximum transmission rate is 10 Gbps.



Figure 2-11 IE M12 panel feedthrough 4x2

Features and functions

Connection type	**IE M12 panel feedthrough 4x2**
Cabling specification	$Cat6_A$
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
• cULus approval	Yes
Transmission speed	
Industrial Ethernet	10 Mbps, 100 Mbps, 1000 Mbps or 10000 Mbps
Interfaces	
Version for network components or end devices	M12 socket (X-coded) and RJ-45 plug
Design	
Cable outlet	90°
Housing material	Metal
Permitted ambient conditions	
Operating temperature	-40 ºC ... +85 ºC
Transportation/storage temperature	-40 ºC ... +85 ºC
IP degree of protection	M12 socket: IP67 RJ-45 plug: IP20
Product property	
Silicone-free	Yes
Dimensions (W x H x D)	22 x 29 x 46 mm

Article number

IE M12 Panel Feedthrough 4x2	Cabinet feedthrough for the transition from M12 connector technology to RJ-45 connector technology. 1 pack of 5	6GK1901-0DM40-2AA5

2.11.4 IE M12 Panel Feedthrough PRO

Description

The IE M12 panel feedthrough PRO has an M12 socket (D-coded) on both sides with degree of protection IP65/67. The maximum ambient temperature is 60 °C. The product is intended for use with 4-wire Cat5 cables, the maximum transmission rate is 100 Mbps.



Figure 2-12 IE M12 Panel Feedthrough PRO

Features and functions

Connection type	**IE M12 Panel Feedthrough PRO**
Cabling specification	Cat5e
Standards, approvals	
• RoHS conformity	Yes
• UL approval	No
• cULus approval	No
Transmission speed	
Industrial Ethernet	10 Mbps, 100 Mbps
Interfaces	
Version for network components or end devices	2 x M12 socket (D-coded)
Design	
Cable outlet	180°
Housing material	Metal
Permitted ambient conditions	
Operating temperature	-5 ºC ... +60 ºC
Transportation/storage temperature	-5 ºC ... +60 ºC
IP degree of protection	IP65/IP67

Connection type	IE M12 Panel Feedthrough PRO
Product property	
Silicone-free	Yes
Dimensions (W x H x D)	35.6 x 22.6 x 44.5 mm

Article number

IE M12 Panel Feedthrough PRO	Panel feedthrough with M12 connector technology. 1 pack of 5	6GK1901-0DM30-2AA5

2.11.5 IE FC M12 plug PRO 2x2

Description

The plug-in connector IE FC M12 plug PRO 2x2 can be used in conjunction with end devices and network components with degree of protection IP65/67 in systems without cabinets.

The connector is a 4-pin M12 plug with which you can connect industrial Ethernet devices with M12 Fast Ethernet sockets via a 4-wire IE FC TP cable to a Fast Ethernet network, for example SCALANCE X208 PRO, IM 154-4 PN and SIMATIC RF systems.

With IE FC cable 2x2 and IE M12 plug PRO 2x2, an overall cable length of up to 100 m is permitted between two devices depending on the cable type.



Figure 2-13 IE FC M12 plug PRO

Features and functions

Connection type	IE FC M12 plug PRO 2x2
Cabling specification	Cat5
Standards, approvals	
• RoHS conformity	yes
• UL approval	yes
• cULus	Yes
Transmission speed	
Industrial Ethernet	10/100 Mbps

Connection type	IE FC M12 plug PRO 2x2
Interfaces	
Number of electrical connectors for IE FC TP cables	Integrated insulation-piercing contacts for 4-wire IE FC TP cables
Version for network components or end devices	M12 plug (D-coded)
Design	
Cable outlet	180°
Housing material	Metal
Permitted ambient conditions	
Operating temperature	-40 °C to +85 °C
Transportation/storage temperature	-40 °C to +85 °C
IP degree of protection	IP 65/67
Product property	
Silicone-free	yes

Article numbers

IE FC M12 Plug PRO 2x2	M12 plug-in connector 4-pin, D-coded, for fitting to 4-wire IE FC TP cables with rugged metal casing and FastConnect technology; 180° cable outlet, with UL approval	
	1 pack of 1	6GK1901-0DB20-6AA0
	1 pack of 8	6GK1901-0DB20-6AA8

2.11.6 IE FC M12 Plug PRO 4x2

Description

The IE M12 plug PRO is a 4-pin, X-coded M12 plug with degree of protection IP67. The connector is particularly suitable for use with devices with the relevant degree of protection, such as SCALANCE XP-200. The plug can be fitted to cables with an outer diameter of 6 mm to 8 mm. The connector is suitable for preassembling IE FC cables with transmission rates of up to 100/1000 Mbps. This allows the IE FastConnect stripping tool to be used. By using the insulation piercing technique, assembly is simple and fast and requires no additional special tools.

With IE FC Cable 2 x 4 and IE M12 Plug PRO an overall cable length of up to 100 m is permitted between two devices depending on the cable type.



Figure 2-14 IE FC M12 plug PRO 4 x 2

Features and functions

Connection type	**IE FC M12 Plug PRO 4x2**
Cabling specification	$Cat6_A$
Standards, approvals	
• RoHS conformity	yes
• UL approval	Yes
• cULus	Yes
• Railway application to EN 50155	Yes
• Fire prevention according to EN 45545-2	Yes
Transmission speed	
Industrial Ethernet	10 / 100 / 1000 / 10000 Mbps
Interfaces	
Number of electrical connectors for IE FC TP cables	Integrated insulation-piercing contacts for 8-wire IE FC TP cables
Version for network components or end devices	M12 plug (X-coded)
Design	
Cable outlet	180°
Housing material	Metal
Permitted ambient conditions	
Operating temperature	-40 °C to +85 °C
Transportation/storage temperature	-40 °C to +85 °C
IP degree of protection	IP 65/67
Product property	
Silicone-free	yes

Article numbers

IE FC M12 Plug PRO 4x2	M12 plug-in connector 8-pin, X-coded, for fitting to 8-wire IE FC TP cables with rugged metal casing and FastConnect technology; 180° cable outlet, with UL approval and railway approval according to EN 50155	
	1 pack of 1	6GK1901-0DB50-6AA0
	1 pack of 8	6GK1901-0DB50-6AA8

2.11.7 IE FC M12 Cable Connector PRO (PROFINET)

Description

The IE FC M12 cable connector PRO (PROFINET) is an 8-pin M12 data plug-in connector (X-coded) with a metal housing suitable for industry. Due to the design and the degree of protection IP67 the main application is to connect electrical cables to the M12 interfaces of SCALANCE W devices. When using Cat6A cables, the maximum transmission rate is 10 Gbps. Due to the FastConnect technology assembly in the field is possible without problems.



Figure 2-15 IE FC M12 cable connector PRO (PROFINET)

Features and functions

Connection type	**IE FC M12 cable connector PRO (PROFINET)**
Cabling specification	Cat6A
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
• cULus approval	Yes
Transmission speed	
Industrial Ethernet	10 Mbps, 100 Mbps, 1000 Mbps or 10000 Mbps

Connection type	IE FC M12 cable connector PRO (PROFINET)
Interfaces	
Number of electrical connectors for IE FC TP cables	8
IE FC TP version	Integrated insulation displacement contacts for 8-wire IE FC TP cables, FastConnect technology
Version for network components or end devices	
Design	
Cable outlet	180°
Housing material	Metal
Permitted ambient conditions	
Operating temperature	-40 ºC ... +85 ºC
Transportation/storage temperature	-40 ºC ... +85 ºC
IP degree of protection	IP67
Product property	
Silicone-free	Yes

Article numbers

IE FC RJ45 Plug 180 (4x2)	M12 plug (X-coded) for Industrial Ethernet with rugged metal casing and integrated insulation displacement contacts for connection of the 8-wire IE FC TP cables	
	1 pack of 1	6GK1901-0DB40-6AA0
	1 pack of 8	6GK1901-0DB40-6AA8

2.11.8 IE FC RJ-45 plug PRO (push-pull)

Description

The plug with push pull device connector can be used with end devices and network components with degree of protection IP65/67 in systems without cabinets.

The IE FC RJ-45 plug PRO is used to assemble 4-wire IE FC TP cables in the field.



Figure 2-16 IE FC RJ-45 plug PRO

The push pull mechanism allows the IE FC RJ45 plug PRO plug-in connector to be plugged in and pulled easily with SCALANCE X-200IRT PRO, ET 200pro and SIMATIC RF systems. The mechanism also increases the bending and strain the plug-in connector can withstand and protects the RJ-45 socket from mechanical strain in an industrial area.

In contrast to the plug-in connector IE FC RJ-45 Plug PRO (push pull) with the IE RJ-45 Plug PRO the electrical connector is not FastConnect.



Figure 2-17 IE RJ45 Plug PRO

Features and functions

Connection type	IE RJ-45 plug PRO (push pull)	IE FC RJ-45 plug PRO (push pull)
Cabling specification	Cat 5e	Cat 5e
Standards, approvals		
• RoHS conformity	Yes	Yes
• UL approval	Yes	Yes
• cULus approval	No	No
Transmission speed		
Industrial Ethernet	10 / 100 Mbps	10 / 100 Mbps
Interfaces		
Number of electrical connectors for IE FC TP cables	4	4
IE FC TP version	Integrated insulation displacement contacts for 4-wire IE FC TP cables	Integrated insulation-piercing contacts for 4-wire IE FC TP cables
Version for network components or end devices	RJ-45 plug (push pull device connector)	RJ-45 plug (push pull device connector)
Design		
Cable outlet	180°	180°
Housing material	Plastic	Plastic
Permitted ambient conditions		
Operating temperature	-40 ºC to +70 ºC	-40 ºC to +70 ºC
Transportation/storage temperature	-40 ºC to +70 ºC	-40 ºC to +70 ºC
Chemical resistance to water	Resistant	Resistant
IP degree of protection	IP65/67	IP65/67
Product property		
Silicone-free	yes	yes

Article numbers

IE RJ45 Plug PRO (push pull)	RJ45 plug-in connector with push pull device connector with rugged plastic housing and integrated insulation displacement contacts for connection of the Industrial Ethernet FC installation cables. With 180° cable outlet, for SCALANCE X-200IRT PRO switches, ET 200pro and SIMATIC RF systems with Industrial Ethernet interface 1 pack of 1	6GK1901-1BB10-6AA0
IE FC RJ45 Plug PRO (Push Pull)	RJ45 plug-in connector with push pull device connector with rugged plastic housing and integrated insulation displacement contacts for connection of the IE FC TP cables. With 180° cable outlet 1 pack of 1	6GK1901-1BB20-6AA0

2.11.9 IE FC RJ-45 PLUG PRO

Description

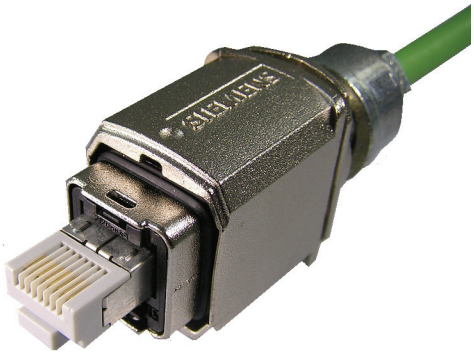


Figure 2-18 IE FC RJ-45 PLUG PRO

The IE FC RJ-45 PLUG PRO has a metal housing with degree of protection IP65/67 and is intended to assemble 8-wire IE FC TP cables in the field. The push pull mechanism allows the IE FC RJ45 plug PRO plug-in connector to be plugged in and pulled easily with SCALANCE X-200IRT PRO, ET 200pro and SIMATIC RF systems. The mechanism also increases the bending and strain the plug-in connector can withstand and protects the RJ-45 socket from mechanical strain in an industrial area.

Features and functions

Connection type	**IE RJ-45 plug PRO (metal version)**
Cabling specification	Cat 6_A
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
• cULus approval	Yes
Transmission speed	
Industrial Ethernet	10 Mbps, 100 Mbps, 1 Gbps, 10 Gbps
Interfaces	
Number of electrical connectors for IE FC TP cables	8
IE FC TP version	Integrated insulation displacement contacts for 8-wire IE FC TP cables
Version for network components or end devices	RJ-45 plug (push pull device connector)
Design	
Cable outlet	180°
Housing material	Metal
Permitted ambient conditions	
Operating temperature	-40 °C ... +70 °C
Transportation/storage temperature	-40 °C ... +70 °C
Chemical resistance to water	Resistant
IP degree of protection	IP65/67
Product property	
Silicone-free	yes

Article number

IE RJ45 Plug PRO (metal version)	RJ45 plug-in connector with push pull device connector with rugged metal housing and integrated insulation displacement contacts for connection of the Industrial Ethernet FC installation cables. With 180° cable outlet, for SCALANCE X-200IRT PRO switches, ET 200pro and SIMATIC RF systems with Industrial Ethernet interface 1 pack of 1	6GK1901-1BB21-6AA0

2.11.10 IE RJ-45 COUPLER PRO

Description



Figure 2-19 IE RJ-45 COUPLER PRO

The RJ-45 COUPLER PRO has a rugged metal housing and is designed for wall mounting. This component is used when setting up flexible cabling as an optional connector for data cables. On both sides there is a socket for push-pull plugs, one side is also equipped with a protective cap. If both sockets have a plug or protective cap, the requirements of degree of protection IP65 are met.

Features and functions

Connection type	**RJ-45 COUPLER PRO**
Cabling specification	Cat5e
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
• cULus approval	No
Transmission speed	
Industrial Ethernet	10 Mbps, 100 Mbps, 1000 Mbps
Interfaces	
Version for network components or end devices	2 x push-pull mountings with RJ45 socket
Design	
Cable outlet	180°
Housing material	Aluminum extruded section, zinc die casting
Permitted ambient conditions	
Operating temperature	-40 °C to +70 °C
Transportation/storage temperature	-40 °C to +70 °C

Connection type	RJ-45 COUPLER PRO
IP degree of protection	IP65
Product property	
Silicone-free	Yes
Dimensions with protective cap (W x H x L)	46 x 58 x 99 mm

Article number

RJ-45 COUPLER PRO	Flexible connection option with push-pull fastenings 1 pack of 1	6GK1901-0BP10-6AA0

2.11.11 IP 67 hybrid cable connector

General

The IP67 hybrid plug-in connector is used to connect SCALANCE W700 to Industrial Ethernet. In conjunction with the hybrid cable 2x2 + 4x0.34 and the IE FC RJ-45 modular outlet with power insert in addition to the data transmission the supply voltage for the target device can also be transferred. The connection of a voltage is possible with Power over Ethernet (PoE). The IP67 hybrid plug-in connector is supplied with the SCALANCE W700.

Features and functions

Connection type	IP67 hybrid plug-in connector
Cabling specification	Cat 5
Transmission speed	
Industrial Ethernet	10 / 100 Mbps
Interfaces	
Number of electrical connectors for hybrid cables	1
IE FC TP version	integrated insulation displacement contacts for 4-wire TP FC installation cables
Cable outlet	180°
Housing material	Plastic
Permitted ambient conditions	
Ambient temperature	-40 °C to + 70°C
IP degree of protection	IP67

Article number

IP67 hybrid plug-in connector	Plug-in connector to connect SCALANCE W700 to Industrial Ethernet and Power over Ethernet (PoE) with assembly instructions 1 pack of 1 can be ordered directly from: HARTING Germany GmbH & Co KG Postfach 24-51 D-32381 Minden Tel. +49 571-8896-0 Fax. +49 571-8896-354 E-mail: de.sales@HARTING.com Internet: http://www.HARTING.com	09 45 125 1300.00

2.12 Outlets

2.12.1 IE FC RJ-45 modular outlet

Description

The rugged metal housing allows the mounting of the IE FC modular outlet on a DIN rail. Direct wall mounting is also possible.



Figure 2-20 IE FC RJ45 Modular Outlet - basic module

The Industrial Ethernet FC RJ-45 modular outlet basic module exists with three inserts:

- Insert 2 FE: Basic module with insert for two Fast Ethernet connections for connection of two 10/100 Mbps end devices/network components



Figure 2-21 Modular outlet, 2x LAN

- Insert 1 GE: Basic module with insert for one Gigabit Ethernet connection for connecting a 10/100/1000 Mbps end device/network component



Figure 2-22 Modular outlet insert 1GE

By replacing the insert, it is possible to upgrade a 100 Mbps double connection to a gigabit connection. The requirement for this is that the wiring was done with an IE FC standard cable GP 4 x 2. In this case, only the insert 2FE needs to be replaced with an insert of the type 1GE.

To supply detached nodes with power and data, the IE FC RJ45 Modular Outlet with Power Insert is connected to the hybrid cable IE Hybrid Cable 2x2 + 4x 0.34. A maximum of 80 m can be bridged between the outlet and the IP67 hybrid plug-in connector. The connection between the outlet and end device can be established with a maximum 6 m long patch cable.

Features and functions

Connection type	IE FC RJ45 modular outlet insert 2FE	IE FC RJ45 modular outlet insert 1GE
Cabling specification	Cat 6	Cat 6
Standards, approvals		
• RoHS conformity	yes	yes
• UL approval	yes	yes
Transmission speed		
Industrial Ethernet	10/100 Mbps	10/100/1000 Mbps
Interfaces		
Number of electrical connectors for IE FC TP cables	1	1

Connection type	IE FC RJ45 modular outlet insert 2FE	IE FC RJ45 modular outlet insert 1GE
IE FC TP version	integrated insulation displacement contacts for 8-wire TP FC installation cables	integrated insulation displacement contacts for 8-wire TP FC installation cables
Version for network components or end devices	RJ-45 plug	RJ-45 plug
Design		
Cable outlet	180°	180°
Housing material	Metal	Metal
Permitted ambient conditions		
Operating temperature	-20 ºC to +70 ºC	-20 ºC to +70 ºC
Transportation/storage temperature	-40 °C to +80 °C	-40 °C to +80 °C
IP degree of protection	IP40	IP40

Article numbers

IE FC RJ45 Modular Outlet (basic module)	IE FC RJ45 Modular Outlet Basic module for Industrial Ethernet with interface for inserting an insert 1 pack of 1	6GK1901-1BE00-0AA0
IE FC RJ45 Modular Outlet Insert 2FE	IE FC RJ45 Modular Outlet basic module with insert; 2x RJ45 for 2x 100 Mbps interface 1 pack of 1	6GK1901-1BE00-0AA1
IE FC RJ45 Modular Outlet Insert 1GE	IE FC RJ45 Modular Outlet basic module with insert; 1x RJ45 for 1x 1000 Mbps interface 1 pack of 1	6GK1901-1BE00-0AA2
IE FC RJ45 Modular Outlet Power Insert	IE FC RJ45 Modular Outlet basic module with insert; 1x RJ45 for 1x 100 Mbps interface and 1x 24 V DC 1 pack of 1	6GK1901-1BE00-0AA3
Insert 2 FE	Insert for IE FC RJ45 Modular Outlet basic module; 2x RJ45 for 2x 100 Mbps interface 1 package = Pack of 4	6GK1901-1BK00-0AA1
Insert 1 GE	Insert for IE FC RJ45 Modular Outlet basic module; 2x RJ45 for 2x 100 Mbps interface 1 package = Pack of 4	6GK1901-1BK00-0AA2

2.12.2 IE FC outlet RJ-45

Description

The IE FC Outlet RJ45 serves as a transition from the rugged IE FC cables used in the industrial environment to preassembled TP cord cables with an RJ45 socket.

The IE FC outlet RJ-45 has a rugged metal housing and meets the requirements of category 5 of the international cabling standards ISO/IEC 11801 and EN 50173. The IE FC outlet RJ-45 is suitable for installation on a DIN rail or for wall mounting.

The IE FC outlet RJ-45 can be mounted behind a metal plate with a cutout, e.g. a cabinet.

By lining up several IE FC outlets RJ-45 it is possible to set up a patch field with any connection density.

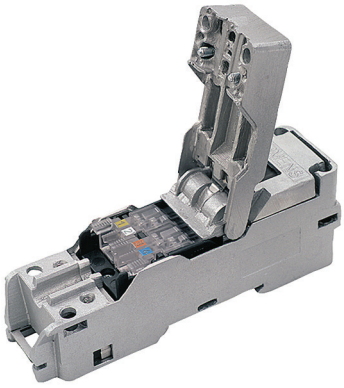


Figure 2-23 Industrial Ethernet FC outlet RJ-45 (opened)

Features and functions

Connection type	**IE FC Outlet RJ45**
Cabling specification	Cat 5
Standards, approvals	
• RoHS conformity	yes
• UL approval	yes
Transmission speed	
Industrial Ethernet	10/100 Mbps
Interfaces	
Number of electrical connectors for IE FC TP cables	1
IE FC TP version	Integrated insulation-piercing contacts for 4-wire FC TP installation cables
Version for network components or end devices	RJ-45 plug
Design	
Cable outlet	180°
Housing material	Metal
Permitted ambient conditions	
Operating temperature	-25 ºC to +70 ºC
Transportation/storage temperature	-40 ºC to +70 ºC
IP degree of protection	IP20

Article number

IE FC Outlet RJ 45	IE FC outlet RJ45 for connecting Industrial Ethernet FC TP cables and TP cords 1 pack of 1	6GK1901-1FC00-0AA0

2.12.3 IE FC RJ45 Keystone RJ45

Description

The IE FC Keystone RJ45 allows simple and rapid installation of the Industrial Ethernet FastConnect installation cables 4 x 2 (8-wire twisted pair AWG24 cables) in the field.

The IE FC Keystone RJ45 4x2 is used to establish Ethernet connections with patch technology and serves in the 19" cabinet as the transition from rugged industrial cables to patch cables. The IE FC Keystone RJ45 4x2 has an 180° (straight) cable outlet. With the integrated insulation piercing contacts, the AWG 24 wires of the end of the cable prepared with the stripping tool can be simply contacted by pressing the housing parts.

Through its frame size, the IE FC Keystone RJ45 can be latched easily into a 19" module rack or be installed by means of a protective housing (included in the scope of delivery) on a standard rail in the cabinet.

Features and functions

Connection type	**IE FC RJ45 Keystone RJ45**
Cabling specification	Cat 6_A
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
Transmission speed	
Industrial Ethernet	10/100/1000/10 000 Mbps
Interfaces	
Number of electrical connections for IE FC TP cables	1
IE FC TP version	Integrated insulation displacement contacts for FC TP cables (AWG26/1, AWG26/7)
Version for network components or end devices	RJ45 socket assembled in the field
Design	
Cable outlet	180°
Housing material	Metal
Permitted ambient conditions	
Operating temperature	-40 °C to +70 °C

Connection type	IE FC RJ45 Keystone RJ45
Transportation/storage temperature	-40 °C to +70 C
IP degree of protection	IP20

Article number

IE FC RJ45 Keystone RJ45	IE FC Keystone RJ45 4 x 2 RJ45 outlet that can be fitted in the field; 8-pin; Cat6A; metal housing; FC FastConnect technology. For installation on standard rail and 19" panel; 1 pack of 1	6GK1901-0BE10-0AA0

Optical networks

3

3.1 Optical transmission technology

Fiber-optic cables (FO cables)

On fiber-optic cables (FO) data is transmitted by modulating electromagnetic waves in the range of visible and invisible light.

The materials used are highquality plastic and glass fibers

Only the fiber-optic cables intended for SIMATIC NET for Industrial Ethernet are described below. The various FO cable types allow solutions for connecting the components with each other adapted to the operating and environmental conditions.

The following fiber-optic cables are available for industrial Ethernet:

- Glass FO cables
- PCF FO cables (Polymer Cladded Fiber)
- POF FO cables (Polymer Optical Fiber)

Compared with electrical cables, fiber-optic cables have the following advantages:

Advantages

- Electrical isolation of nodes and segments
- No grounding problems,
- No shield currents,
- Transmission path immune to external electromagnetic noise,
- No lightning protection required,
- No noise emission along the transmission path,
- Light weight,
- Depending on the fiber type, cables several kilometers long can be used even at higher transmission rates.
- The transmission rate does not affect the maximum permitted cable length
- The meter markers printed on the cable make it easier to identify the length. (Serve as orientation; accuracy ±5 %.)

Point-to-point link

Fiber-optic technology only allows the implementation of point-to-point links; in other words, one transmitter is connected to only one receiver. The transmission path between two nodes requires two fibers (one for each transmission direction). With the optical components for Industrial Ethernet, bus, star and ring structures can be implemented.

3.2 Overview of optical cables

For the various topologies, requirements or areas of application, the following fiber-optic cables are available:

Cabling	Cable type	Description	Area of application
Glass fiber FO cable	FO Standard Cable GP 50/125 µm OM2++	Glass fiber, sold by the meter or pre-assembled with connectors: 2x2 ST/BFOC, 2x2 SC or 2x LC Duplex	Standard cable for universal application
	MM FO Robust Cable GP 50/125 µm OM2+	Glass fiber, sold by the meter or pre-assembled with 2x LC duplex connectors	Rugged multimode cable also for outdoors and laying in the earth
	SM FO Robust Cable GP 9/125 µm OS1/OS2	Glass fiber sold by the meter	Rugged single-mode cable also for outdoors and laying in the earth, with rodent protection
	FO FRNC Cable GP 50/125 µm OM2++	Glass fiber sold by the meter	Multimode cable with halogen-free and flame retardant design for laying in buildings
	FO FRNC Cable GP 50/125 µm OM4	Glass fiber sold by the meter	Multimode cable with halogen-free and flame retardant design for laying in buildings
	INDOOR FO cable 62.5/125 µm OM1	Glass fiber, sold by the meter or pre-assembled with 2x2 ST/BFOC connectors	Multimode cable with halogen-free and flame retardant design for laying in buildings. Orange FRNC cable sheath with flat cross section
	FO Trailing Cable GP 50/125 µm OM2++	Glass fiber, sold by the meter or pre-assembled with connectors: 2x2 ST/BFOC or 2x2 SC	Cable for use in cable carriers
	FO Trailing Cable 50/125 µm OM2++	Glass fiber, sold by the meter or pre-assembled with connectors: 2x2 ST/BFOC, 2x2 SC or 2x LC Duplex	Cable for use in cable carriers
	FO Ground Cable 50/125 µm OM2++	Glass fiber, sold by the meter or pre-assembled with connectors: 2x2 ST/BFOC or 2x2 SC	Longitudinally and laterally watertight cable for use outdoors, with non-metal rodent protection, laying in the earth possible
	Flexible FO trailing cable 62.5/125 µm OM1	Glass fiber, sold by the meter or pre-assembled with 2x2 ST/BFOC connectors	Multimode cable for use in cable carriers indoors and outdoors.
	SIENOPYR duplex fiber-optic marine cable 62.5/125 µm OM1	Glass fiber sold by the meter	Multimode cable for use on ships and offshore platforms with numerous shipbuilding approvals.

Cabling	Cable type	Description	Area of application
	FO standard cable 62.5/125 µm OM1	Glass fiber, sold by the meter or pre-assembled with 2x2 ST/BFOC connectors	Standard cable for universal application indoors and outdoors
	SM FO CORD 9/125 G.652D	Glass fiber, length 1 m, pre-assembled with connectors: 2x LC Duplex; 1x SC Duplex and 1x LC Duplex; 1x SC Duplex and 2x ST/BFOC; 2x SC Duplex plug; 2x ST/BFOC plugs and 1x SC Duplex plug	Single mode cable for usage in the cabinet
	MM FO CORD 2x50/125 µm OM2	Glass fiber, length 1 m, pre-assembled with connectors: 2x LC Duplex; 1x SC Duplex and 1x LC Duplex; 1x SC Duplex and 2x ST/BFOC; 2x SC Duplex plug; 2x ST/BFOC plugs and 1x SC Duplex plug	Multimode cable for use in the cabinet
Fiber glass FO cable with FastConnect technology	FC FO standard cable GP 62.5/200/230 µm	Glass fiber FC sold by the meter	Multimode cable for fixed installation in cable channels and pipes with round PVC cable sheath.
	FC FO trailing cable 62.5/200/230 µm	Glass fiber FC sold by the meter	Flexible multimode cable for use in cable carriers indoors and outdoors
Plastic FO cable	POF Standard Cable GP 980/1000	Plastic fiber-optic cables, sold in meters	POF FO standard cable for fixed installation indoors up to 50 m with PVC sheath
	POF trailing cable 980/1000	Plastic fiber-optic cables, sold in meters	POF FO trailing cable for moving applications (e.g. drag chains) up to 50 m with rugged PUR sheath
	PCF standard cable GP 200/230	PCF fiber-optic cable with plastic cladding, sold by the meter	PCF FO standard cable for fixed installation indoors and outdoors with cable lengths up to 100 m with rugged PVC sheath
	PCF trailing cable 200/230	PCF fiber-optic cable with plastic cladding, sold by the meter or preassembled with 2x2 BFOC connectors	PCF FO trailing cable for high mechanical load indoors and outdoors with cable lengths up to 100 m with rugged PUR sheath
	PCF trailing cable GP 200/230	PCF fiber-optic cable with plastic cladding, sold by the meter or preassembled with 2x2 BFOC connectors	PCF FO trailing cable for lower mechanical load indoors and outdoors with cable lengths up to 100 m with PVC sheath
	PROFIBUS Plastic Fiber Optic (980/1000) standard cable	Plastic fiber-optic cables, sold in meters, 50 m ring, 100 m ring or preassembled with 4 BFOC plugs	For the setup of optical PROFIBUS DP networks indoors
	PROFIBUS PCF fiber-optic standard cable	PCF fiber-optic cable with plastic cladding, preassembled with 4x PCF-BFOC connectors or 4x PCF simplex connectors	For the setup of optical PROFIBUS DP networks indoors

3.3 Glass FO cables

3.3.1 FOC links

Standard Fast Ethernet

The switches equipped with interfaces for 100BASE-FX correspond to the standard IEEE 802.3u. They operate at a wavelength of 1300 nm.

For the connection, multimode glass fibers of the type 50/125 µm are suitable.

Switches or media modules that are equipped with an optical interface for single mode glass fibers of the type 9/125 µm have the supplement "LD" (Long Distance) in their names.

The maximum length of the insertable FO section is decided by:

- the fiber type multimode / single mode
- the link attenuation of the FO cable at the wavelength being used
- the bandwidth length product of the FO cable

SIMATIC NET multimode glass FO cables

The SIMATIC NET product range for Industrial Ethernet contains various multimode glass fiber-optic cables with 50/125 µm and 62.5/125 µm fibers. When linking SIMATIC NET Industrial Ethernet switches that are connected by SIMATIC NET Multimode glass fiber-optic cables, distances of up to 5000 m or 4000 m between two neighboring components are possible.

Table 3- 1 Maximum distance with multimode glass FO cables between two switches

Fiber-optic cable type	FO cable attenuation, dB/km	Bandwidth length product, GHz·m	Max. cable length, m		
	at 1300 nm	At 1300 nm	100BaseFX	1000BaseSX	1000BaseLX
50/125 µm	0.7 to 0.8	600 to 1300	5,000	750	2,000 m
62.5/125 µm	0.8 to 1.0	<= 600	4,000	350	550

SIMATIC NET single-mode glass FO cables

Table 3- 2 Maximum distance with single-mode glass FO cables between two switches equipped to this purpose

Fiber-optic cable type	FO cable attenuation at 1300 nm	Max. length for 100Base FX
9/125 µm	<=0,5 dB/km	26,000 to 40,000 m

Note

Single mode glass fiber-optic cables with the fiber type 9/125 µm are available as special cables. You will find a contact in the section "Contacts for special cables and special lengths" in this manual.

Standard 1 Gbps Ethernet

Similar to Fast Ethernet, with Gbps Ethernet a distinction is made between two versions that are both described in the standard IEEE 802.3z.

1000BASE-SX is the designation for the version with multimode glass fibers. It operates with a wavelength of 850 nm. Due to its properties, the same 50/125 µm fiber from the SIMATIC NET product spectrum can be used that is also used for 100BASE-FX. The distance between two points is 750 m. Taking into account the distance cabling with this fiber can be upgraded later from 100 Mbps Ethernet to 1 Gbps without laying new cables.

The version for single mode glass fibers is called 1000BASE-LX. Here it operates with a wavelength of 1300 nm.

In terms of the laying of the insertable FO section, the same dependencies apply as with 100 Mbps Ethernet.

3.3.2 FO Standard Cable GP 50/125 µm

Description

The FO standard cable contains 2 multimode graded index fibers of type 50/125 µm. The FO standard cable GP is the universal cable for use indoors and outdoors. The standard cable is suitable for connecting optical interfaces operating in the wavelength range around 850 nm and 1300 nm.

The FO Standard Cable GP is available, sold by the meter, without connectors as well as in fixed lengths, preassembled with the following connectors:

- 2x2 ST/BFOC
- 2x2 SC
- 2x LC duplex

Features and functions

Cable type		**FO standard cable GP 50/125**
Areas of application		Universal cable for use indoors and outdoors
Cable type (standard designation)		AT-W(ZN)YY 2x1G50/125
Design of the preassembled fiber-optic cable		• ST/BFOC plug • SC plug • LC duplex
Standards, approvals		
• RoHS conformity		yes
• UL approval		yes
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Multimode graded-index fiber 50/125 µm, OM2
Maximum tensile load		500 N
Optical data		
Attenuation	850 nm	≤ 2.7 dB/km
	1300 nm	≤ 0.7 dB/km
Bandwidth length product	850 nm	600 GHz *m
	1300 nm	1200 GHz *m
Permitted ambient conditions		
Operating temperature		–25 °C to +80 °C
Transportation/storage temperature		–25 °C to +80 °C
Installation temperature		5 °C to +50 °C
Resistance to fire		Flame-retardant to IEC 60332 -1-2 and IEC 60332 -3-22 (Cat A)
Resistance to oil		Conditionally resistant
UV resistance		resistant
Product characteristics		
Silicone-free		yes
Halogen-free		no
Rodent protection		no
Cable length	100BaseFX	5000 m
	1000BaseSX	750 m
	1000BaseLX	2000 m

Article numbers

FO standard cable GP 50/125 [1)]	Standard cable; UL approval; splittable, without connectors, sold by the meter	6XV1873–2A
FO standard cable GP 50/125	Preassembled fiber-optic cable with 2x 2 ST/BFOC connectors	
	• 0.5 m	6XV1873-3AH05
	• 1 m	6XV1873-3AH10
	• 2 m	6XV1873-3AH20
	• 3 m	6XV1873-3AH30
	• 5 m	6XV1873-3AH50
	• 10 m	6XV1873-3AN10
	• 15 m	6XV1873-3AN15
	• 20 m	6XV1873-3AN20
	• 30 m	6XV1873-3AN30
	• 40 m	6XV1873-3AN40
	• 50 m	6XV1873-3AN50
	• 80 m	6XV1873-3AN80
	• 100 m	6XV1873-3AT10
	• 150 m	6XV1873-3AT15
	• 200 m	6XV1873-3AT20
	• 300 m	6XV1873-3AT30
FO standard cable GP 50/125	Preassembled fiber-optic cable with 2x 2 SC connectors	
	• 0.5 m	6XV1873-6AH05
	• 1 m	6XV1873-6AH10
	• 2 m	6XV1873-6AH20
	• 3 m	6XV1873-6AH30
	• 5 m	6XV1873-6AH50
	• 10 m	6XV1873-6AN10
	• 15 m	6XV1873-6AN15
	• 20 m	6XV1873-6AN20
	• 30 m	6XV1873-6AN30
	• 40 m	6XV1873-6AN40
	• 50 m	6XV1873-6AN50
	• 80 m	6XV1873-6AN80
	• 100 m	6XV1873-6AT10

	• 150 m	6XV1873-6AT15
	• 200 m	6XV1873-6AT20
	• 300 m	6XV1873-6AT30
FO Standard Cable GP 50/125	Preassembled fiber-optic cable with 2x LC duplex connectors	
	• 1 m	6XV1873-5AH10
	• 2 m	6XV1873-5AH20
	• 3 m	6XV1873-5AH30
	• 5 m	6XV1873-5AH50
	• 10 m	6XV1873-5AN10
	• 15 m	6XV1873-5AN15
	• 20 m	6XV1873-5AN20
	• 30 m	6XV1873-5AN30
	• 40 m	6XV1873-56AN40
	• 50 m	6XV1873-5AN50
	• 80 m	6XV1873-5AN80
	• 100 m	6XV1873-5AT10
	• 150 m	6XV1873-5AT15
	• 200 m	6XV1873-5AT20
	• 300 m	6XV1873-5AT30

[1] Special tools and trained personnel are required to assemble glass fiber-optic cables

3.3.3 MM FO Robust Cable GP 50/125 µm

Description

The MM FO robust cable GP is for use indoors and outdoors - also suitable for laying in the earth. It also has rodent protection. The multimode graded index fiber 50/125/245 used allows transmission distances up to 5000 m. The product is available by the meter or preassembled with two LC Duplex plugs.

Features and functions

Cable type		**MM FO robust cable GP (2G50/125)**
Areas of application		Universal cable for use indoors and outdoors and for direct installation underground
Design of the preassembled fiber-optic cable		The non-preassembled cable can be fitted with the following plugs: • BFOC plug • SC plug • LC Duplex plug The preassembled cables are supplied with two LC Duplex plugs.
Cable type (standard designation)		AT-V(ZN)H(ZN)BH 2G50/125
Standards, approvals		
• RoHS conformity		Yes
• UL approval		Yes
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Multimode graded-index fiber 50/125/245 µm, OM 2
Maximum tensile load		1000 N
Optical data		
Attenuation	850 nm	≤ 2.7 dB/km
	1300 nm	≤ 1 dB/km
Bandwidth length product	850 nm	600 GHz *m
	1300 nm	1200 GHz *m
Permitted ambient conditions		
Operating temperature		-40 °C ... +70 °C
Transportation/storage temperature		-40 °C ... +70 °C
Installation temperature		-5 °C to +50 °C
Resistance to fire		Flame retardant to IEC 60332-1-24
Resistance to oil		Resistant to a certain extent
UV resistance		Resistant
Product characteristics		
Halogen-free		yes
Silicone-free		yes
Rodent protection		yes
Cable length	100BaseFX	5000 m
	1000BaseSX	750 m
	1000BaseLX	2000 m

Article number

MM FO robust cable GP (2G50/125)[1]	Cables for indoors and outdoors, also for laying in the earth, rodent protection Sold by the meter without connectors, minimum order 20 m, maximum length 2000 m	6XV1873-2R
MM FO Robust Cable GP (2G50/125)	Cables for indoors and outdoors, also for laying in the earth, rodent protection Preassembled with two LC Duplex plugs	
	1 m	6XV1873-5RH10
	2 m	6XV1873-5RH20
	3 m	6XV1873-5RH30
	10 m	6XV1873-5RN10
	30 m	6XV1873-5RN30
	50 m	6XV1873-5RN50
	100 m	6XV1873-5RT10
	150 m	6XV1873-5RT15

[1] Special tools and trained personnel are required to assemble glass fiber-optic cables

3.3.4 SM FO Robust Cable GP 4E9/125 µm

Description

The 4-fiber single mode (SM) FO Robust Cable GP can be used to bridge distances of more than 3 km.

The SM FO Robust Cable GP can be used to set up optical networks with devices that have an LC (Lucent Connector) interface, for example, SCALANCE X devices.

To connect to the LC interface, the SM FO robust cable GP is cemented to the SM FO LC duplex plug.

Features and functions

Cable type	**SM FO robust cable GP (4E9/125)**
Areas of application	Cable for use indoors and outdoors and for direct installation underground
Design of the preassembled fiber-optic cable	Can be assembled with two • ST/BFOC plugs • SC plugs • LC Duplex connectors
Cable type (standard designation)	AT-V(ZN)H(ZN)BH 2G50/125
Standards, approvals	
• RoHS conformity	yes

Cable type		SM FO robust cable GP (4E9/125)
• UL approval		yes
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		4
Fiber material		Single mode fiber 9/125 µm, OS2
Maximum tensile load		1000 N
Optical data		
Attenuation	1300 nm	≤ 0.5 dB/km
	1550 nm	≤ 0.5 dB/km
Permitted ambient conditions		
Operating temperature		-40 °C to +70 °C
Transportation/storage temperature		-40 °C to +70 °C
Installation temperature		- 20 °C to +60 °C
Resistance to fire		flame retardant to IEC 60332-1-24
Resistance to oil		Conditionally resistant
UV resistance		resistant
Product characteristics		
Halogen-free		yes
Silicone-free		yes
Rodent protection		yes
Cable length	100BaseFX	26,000 m
	1000BaseLX	5,000 m

Article number

SM FO Robust Cable GP (4E9/125)[1)]	Cable for outdoors, rodent protection, splittable, without connectors, sold by the meter	6XV1843-2R

1) Special tools and trained personnel are required to assemble glass fiber-optic cables

3.3.5 FO FRNC Cable GP 50/125 µm

Description

The FO FRNC Cable with two 50/125 µm cores is halogen-free and flame retardant and is suitable for fixed installation in buildings. With this cable design, little smoke that is free of halogens is produced in the case of fire therefore reducing secondary damage significantly. The cable is splittable and therefore suitable for direct fitting of connectors.

Features and functions

Cable type		**FO FRNC Cable 50/125**
Areas of application		Halogen-free cable for fixed installation indoors and outdoors
Design of the preassembled fiber-optic cable		Can be assembled with four • ST/BFOC plugs • SC plugs
Cable type (standard designation)		AT-W(ZN)HH 2G50/125 UV
Standards, approvals		
• RoHS conformity		yes
• UL approval		yes
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Multimode graded-index fiber 50/125 µm, OM2
Maximum tensile load		500 N
Optical data		
Attenuation	850 nm	≤ 2.7 dB/km
	1300 nm	≤ 0.7 dB/km
Bandwidth length product	850 nm	600 GHz *m
	1300 nm	1200 GHz *m
Permitted ambient conditions		
Operating temperature		-40 °C to +85 °C
Transportation/storage temperature		-40 °C to +85 °C
Installation temperature		-5 °C to +50 °C
Resistance to fire		Flame-retardant to IEC 60332 -1-2 and IEC 60332 -3-22 (Cat A)
Resistance to oil		Resistant according to IEC 60811-404 with test oil IRM 902 (acc. to ISO 1817), +70 °C, 4 h and +25 °C, 168 h
UV resistance		Resistant
Product characteristics		
Halogen-free		no
Silicone-free		Yes
Rodent protection		Yes
Cable length	100BaseFX	5000 m
	1000BaseSX	750 m
	1000BaseLX	2000 m

Article number

FO FRNC Cable 50/125 [1]	Halogen-free cable, splittable, for fixed installation, without connectors, sold by the meter	6XV1873-2B

[1] Special tools and trained personnel are required to assemble glass fiber-optic cables

3.3.6 FO FRNC Cable GP 50/125 µm

Description

The FO FRNC Cable with two 50/125 µm cores is halogen-free and flame retardant and is suitable for fixed installation in buildings. With this cable design, little smoke that is free of halogens is produced in the case of fire therefore reducing secondary damage significantly. The cable is splittable and therefore suitable for direct fitting of connectors.

Features and functions

Cable type		**FO FRNC cable 50/125/OM4**
Areas of application		Halogen-free cable for fixed installation indoors and outdoors
Design of the preassembled fiber-optic cable		Can be assembled with four • ST/BFOC plugs • SC plugs
Cable type (standard designation)		AT-W(ZN)HH 2G 50/125 OM4BI UV
Standards, approvals		
• RoHS conformity		yes
• UL approval		yes
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Multimode graded-index fiber 50/125 µm, OM4
Maximum tensile load		500 N
Optical data		
Attenuation	850 nm	≤ 2.5 dB/km
	1300 nm	≤ 0.7 dB/km
Bandwidth length product	850 nm	3500 GHz *m
	1300 nm	500 GHz *m

Cable type		FO FRNC cable 50/125/OM4
Permitted ambient conditions		
Operating temperature		-40 °C to +85 °C
Transportation/storage temperature		-40 °C to +85 °C
Installation temperature		-5 °C to +50 °C
Resistance to fire		Flame-retardant to IEC 60332 -1-2 and IEC 60332 -3-22 (Cat A)
Resistance to oil		Resistant according to IEC 60811-404 with test oil IRM 902 (acc. to ISO 1817), +70 °C, 4 h and +25 °C, 168 h
UV resistance		Resistant
Product characteristics		
Halogen-free		Yes
Silicone-free		Yes
Maximum cable length	100BaseFX	5000 m
	1000BaseSX	1040 m
	1000BaseLX	600 m
	10GBaseSR	550 m
	10GBaseLX4	300 m

Article number

FO FRNC Cable 50/125/OM4 [1]	Halogen-free cable, splittable, for fixed installation, without connectors, sold by the meter	6XV1873-2E

[1] Special tools and trained personnel are required to assemble glass fiber-optic cables

3.3.7 FO trailing cable 50/125 µm

Description

The FO trailing cable contains 2 multimode graded index fibers of type 50/125 µm.

The FO trailing cable is available in the following variants:

- FO Trailing Cable (standard)
  Cable for high mechanical strain, PUR outer sheath, without UL approval
- FO trailing cable GP (general purpose)
  Cable for low mechanical strain, PVC outer jacket, with UL approval

The FO Trailing Cable is available as sold by the meter without connectors as well as in fixed lengths, preassembled with the following connectors:

- 2x2 ST/BFOC
- 2x2 SC
- 2x LC Duplex (only with the FO Trailing Cable standard cable)

Features and functions

Cable type		FO trailing cable 50/125	FO trailing cable GP 50/125
Areas of application		Use in drag chains	Use in drag chains
Design of the preassembled fiber-optic cable		• ST/BFOC plug • SC plug • LC Duplex plugs	• ST/BFOC plug • SC plug
Cable type (standard designation)		AT-W(ZN)Y(ZN)11Y 2G 50/125 OM2++	AT-W(ZN)Y(ZN)Y 2G 50/125 OM2++
Standards, approvals			
• RoHS conformity		yes	yes
• UL approval		no	yes
Mechanical data			
Number of fibers per FO core		1	1
Number of FO cores per FO cable		2	2
Fiber material		Multimode graded-index fiber 50/125 µm, OM2	Multimode graded-index fiber 50/125 µm, OM2
Number of bending cycles		5 000 000	3 500 000
Maximum tensile load		800 N	800 N
Optical data			
Attenuation	850 nm	≤ 2.7 dB/km	≤ 2.7 dB/km
	1300 nm	≤ 0.7 dB/km	≤ 0.7 dB/km
Bandwidth length product	850 nm	600 GHz *m	600 GHz *m
	1300 nm	1200 GHz *m	1200 GHz *m
Permitted ambient conditions			
Operating temperature		-40 °C to +80 °C	-25 °C to +80 °C
Transportation/storage temperature		-40 °C to +80 °C	-25 °C to +80 °C
Installation temperature		-5 °C to +50 °C	-5 °C to +50 °C
Resistance to fire		Flammable	Flame-retardant to IEC 60332 -1-2 and IEC 60332 -3-22 (Cat. A)
Resistance to oil		Conditionally resistant	Conditionally resistant
UV resistance		resistant	resistant
Product characteristics			
Halogen-free		no	no
Silicone-free		yes	yes
Rodent protection		no	no
Cable length	100BaseFX	5000 m	5000 m
	1000BaseSX	750 m	750 m
	1000BaseLX	2000 m	2000 m

Article numbers

FO Trailing Cable 50/125[1)]	Trailing cable, splittable, without connectors, sold by the meter	6XV1873-2C
FO Trailing Cable 50/125	Preassembled FO cable with 2x2 ST/BFOC connectors	
	• 3 m	6XV1873-3CH30
	• 5 m	6XV1873-3CH50
	• 10 m	6XV1873-3CN10
	• 20 m	6XV1873-3CN20
	• 50 m	6XV1873-3CN50
	• 100 m	6XV1873-3CT10
FO Trailing Cable 50/125	Preassembled FO cable with 2x LC Duplex connectors	
	• 5 m	6XV1873-5CH50
	• 10 m	6XV1873-5CN10
	• 15 m	6XV1873-5CN15
	• 20 m	6XV1873-5CN20
FO Trailing Cable 50/125	Preassembled FO cable with 2x2 SC connectors	
	• 3 m	6XV1873-6CH30
	• 5 m	6XV1873-6CH50
	• 10 m	6XV1873-6CN10
	• 20 m	6XV1873-6CN20
	• 50 m	6XV1873-6CN50
	• 100 m	6XV1873-6CT10
FO Trailing Cable GP 50/125[1)]	Trailing cable, UL approval, splittable, without connectors, sold by the meter, minimum length available 20 m, maximum length 1000 m	6XV1873–2D
FO Trailing Cable GP 50/125	Preassembled FO cable with 2x2 ST/BFOC connectors	
	• 3 m	6XV1873-3DH30
	• 5 m	6XV1873-3DH50
	• 10 m	6XV1873-3DN10
	• 20 m	6XV1873-3DN20
	• 50 m	6XV1873-3DN50
	• 100 m	6XV1873-3DT10
FO Trailing Cable GP 50/125	Preassembled FO cable with 2x2 SC connectors	
	• 3 m	6XV1873-6DH30
	• 5 m	6XV1873-6DH50
	• 10 m	6XV1873-6DN10
	• 20 m	6XV1873-6DN20

	• 50 m	6XV1873-6DN50
	• 100 m	6XV1873-6DT10

1) Special tools and trained personnel are required to assemble glass fiber-optic cables

3.3.8 FO Ground Cable 50/125 µm

Description

The FO ground cable contains 2 multimode graded index fibers of type 50/125 µm. The FO ground cable is a standard cable for laying directly in the ground, in pipes, cable channels or on cable racks, also suitable for cable ladders.

The FO Ground Cable is available as sold by the meter without connectors in fixed lengths, preassembled with 2x2 ST/BFOC plugs or 2x2 SC connectors.

Features and functions

Cable type		**FO ground cable 50/125**
Areas of application		Outdoors and for direct installation underground
Design of the preassembled fiber-optic cable		• ST/BFOC plug • SC plug
Cable type (standard designation)		AT-WQ(ZN)Y(ZN)B2Y 2G 50/125
Standards, approvals		
• RoHS conformity		yes
• UL approval		no
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Multimode graded-index fiber 50/125 µm, OM2
Maximum tensile load		800 N
Optical data		
Attenuation	850 nm	≤ 2.7 dB/km
	1300 nm	≤ 0.7 dB/km
Bandwidth length product	850 nm	600 GHz *m
	1300 nm	1200 GHz *m

Cable type		FO ground cable 50/125
Permitted ambient conditions		
Operating temperature		-40 °C to +75 °C
Transportation/storage temperature		-40 °C to +75 °C
Installation temperature		-5 °C to +50 °C
Resistance to fire		Flammable
Resistance to oil		resistant
UV resistance		resistant
Product characteristics		
Silicone-free		yes
Halogen-free		no
Rodent protection		yes
Cable length	100BaseFX	5000 m
	1000BaseSX	750 m
	1000BaseLX	2000 m

Article numbers

FO Ground Cable 50/125 [1]	Outdoor cable with rodent protection, splittable, without connectors, sold by the meter	6XV1873–2G
FO Ground Cable 50/125	Preassembled FO cable with 2x2 ST/BFOC connectors	
	• 100 m	6XV1873-3GT10
	• 200 m	6XV1873-3GT20
	• 300 m	6XV1873-3GT30
FO Ground Cable 50/125	Preassembled FO cable with 2x2 SC connectors	
	• 100 m	6XV1873-6GT10
	• 200 m	6XV1873-6GT20
	• 300 m	6XV1873-6GT30

[1] Special tools and trained personnel are required to assemble glass fiber-optic cables

3.3.9 INDOOR FO cable 62.5/125 µm

Description

The INDOOR fiber-optic cable is intended for use indoors in areas protected from the weather, for example in factories and in building automation.

The indoor cable is suitable for connecting optical interfaces operating in the wavelength range around 850 nm and 1300 nm.

Is available as sold by the meter in fixed lengths, preassembled with four ST/BFOC connectors.

Features and functions

Cable type		**Indoor FO cable GP (62.5/125)**
Areas of application		Non-crush, halogen-free and extremely flame-retardant cable for use indoors
Design of the preassembled fiber-optic cable		• ST/BFOC plug
Cable type (standard designation)		I-V(ZN)HH 2x1 G 62.5/125
Standards, approvals		
• RoHS conformity		yes
• UL approval		no
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Multimode graded-index fiber 62.5/125 µm, OM 2
Maximum tensile load		1000 N
Optical data		
Attenuation	850 nm	≤ 3.1 dB/km
	1300 nm	≤ 0.8 dB/km
Bandwidth length product	850 nm	200 GHz *m
	1300 nm	600 GHz *m
Permitted ambient conditions		
Operating temperature		-40 °C to +70 °C
Transportation/storage temperature		-40 °C to +70 °C
Installation temperature		-5 °C to +50 °C
Resistance to fire		Flame resistant to IEC 60332-1-2, IEC 60332-3-22 (Cat. A) and acc. to DIN VDE 0472 Part 804, test type B
Resistance to oil		Conditionally resistant
UV resistance		resistant
Product characteristics		
Halogen-free		yes
Silicone-free		yes
Rodent protection		no
Cable length	100BaseFX	4000 m
	1000BaseSX	350 m
	1000BaseLX	550 m

Article numbers

INDOOR Fiber Optic indoor cable[1)]	Cable for indoors; flame retardant, splittable, without connectors, sold by the meter	6XV1820-7AH10
INDOOR fiber-optic indoor cable	preassembled with 2x2 BFOC connectors	
	• 0.5 m	6XV1820-7BH05
	• 1 m	6XV1820-7BH10
	• 2 m	6XV1820-7BH20
	• 3 m	6XV1820-7BH30
	• 5 m	6XV1820-7BH50
	• 10 m	6XV1820-7BN10
	• 15 m	6XV1820-7BN15
	• 20 m	6XV1820-7BN20
	• 25 m	6XV1820-7BN25
	• 50 m	6XV1820-7BN50
	• 75 m	6XV1820-7BN75
	• 100 m	6XV1820-7BT10

1) Special tools and trained personnel are required to assemble glass fiber-optic cables

3.3.10 Flexible FO trailing cable (62.5/125 µm)

Description

The flexible fiber-optic trailing cable was developed for applications in which the cable must be flexible enough to move, for example when attached to moving machine parts (drag chains).

The cable is mechanically designed for 100,000 bending cycles through ±90° (at the specified minimum bending radius). The trailing cable can be used both indoors and outdoors.

The trailing cable is available as sold by the meter without connectors or in fixed lengths, preassembled with four ST/BFOC connectors.

Features and functions

Cable type		**Flexible fiber-optic trailing cable**
Areas of application		Flexible cable for installation in drag chains indoors and outdoors
Design of the preassembled fiber-optic cable		• ST/BFOC plug
Cable type (standard designation)		AT-W11Y(ZN)11Y 2 G 62,5/125
Standards, approvals		
• RoHS conformity		yes
• UL approval		no
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Multimode graded-index fiber 62.5/125 µm, OM 2
Maximum tensile load		1000 N
Bending cycles		100,000
Optical data		
Attenuation	850 nm	≤ 3.1 dB/km
	1300 nm	≤ 0.8 dB/km
Bandwidth length product	850 nm	200 GHz *m
	1300 nm	600 GHz *m
Permitted ambient conditions		
Operating temperature		–30 °C to +60 °C
Transportation/storage temperature		–30 °C to +70 °C
Installation temperature		–30 °C to +60 °C
Resistance to fire		acc. to IEC 60332-1, flammable
Resistance to oil		According to IEC 60811-404 with test oil IRM 902 (acc. to ISO 1817), +100 °C, 168 h, drawing speed 250 mm/min
UV resistance		resistant
Product characteristics		
Halogen-free		yes
Silicone-free		yes
Rodent protection		no
Cable length	100BaseFX	4000 m
	1000BaseSX	350 m
	1000BaseLX	550 m

Article numbers

Flexible fiber-optic trailing cable [1]	Cable for indoors; flame retardant, splittable, without connectors, sold by the meter	6XV1820-6AH10
Flexible fiber-optic trailing cable	Preassembled with 2x2 ST/BFOC connectors	
	• 1 m	6XV1820-6BH10
	• 2 m	6XV1820-6BH20
	• 3 m	6XV1820-6BH30
	• 5 m	6XV1820-6BH50
	• 10 m	6XV1820-6BN10
	• 15 m	6XV1820-6BN15
	• 20 m	6XV1820-6BN20
	• 25 m	6XV1820-6BN25
	• 50 m	6XV1820-6BN50
	• 75	6XV1820-6BN75
	• 100	6XV1820-6BT10

[1] Special tools and trained personnel are required to assemble glass fiber-optic cables

3.3.11 SIENOPYR Duplex FiberOptic Marine Cable 62.5/125 µm

Description

The SIENOPYR Duplex fiber-optic marine cable has 2 multimode graded-index fibers 62.5/125 µm. The cable also has 2 multiwire, rubber-insulated copper wires with 1 mm^2 cross-section. The SIENOPYR duplex fiber-optic marine cable is intended for fixed installation on ships and offshore facilities in all enclosed spaces and on open decks. The cable is not, however, suitable for permanent installation in water.

The halogen-free cable is certified for shipbuilding by the following organizations:

- Lloyds Register of Shipping
- Germanischer Lloyd
- Registro Staliano Navale
- Bureau Veritas

Features and functions

Cable type		**SIENOPYR duplex fiber-optic marine cable**
Areas of application		Fixed installation on ships and offshore facilities in all enclosed spaces and on free decks
Design of the preassembled fiber-optic cable		Can be assembled with four multimode FO connectors: • ST/BFOC plugs • SC plugs
Cable type (standard designation)		MI-VHH 2G 62.5/125 3.1B200 + 0.8F600 + 2x1Cu 300V
Standards, approvals		
• RoHS conformity		Yes
• UL approval		No
• Shipbuilding		Bureau Veritas (BV) Det Norske Veritas (DNV) Germanischer Lloyd (GL) Lloyds Register of Shipping (LRS)
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Multimode graded-index fiber 62.5/125 µm, OM 2
Maximum tensile load		250 N
Bending cycles		100,000
Optical data		
Attenuation	850 nm	≤ 3.1 dB/km
	1300 nm	≤ 0.8 dB/km
Bandwidth length product	850 nm	200 GHz *m
	1300 nm	600 GHz *m
Permitted ambient conditions		
Operating temperature		-40 °C to +80 °C
Transportation/storage temperature		-40 °C to +80 °C
Installation temperature		-10 °C to +50 °C
Environmental conditions for operation		At ambient temperatures of -10 °C, the cables must not be subjected to any motions beyond the normal vibration and oscillation on ships.
Resistance to fire		Flame retardant acc. to IEC 60332-3 (Cat. A)
Resistance to oil		not resistant
UV resistance		resistant
Product characteristics		
Halogen-free		yes
Silicone-free		yes
Rodent protection		no

Article number

SIENOPYR duplex fiber-optic marine cable [1)]	Glass SIENOPYR fiber-optic marine cable, sold in meters, without connectors	6XV1830-0NH10

[1)] Special tools and trained personnel are required to assemble glass fiber-optic cables

3.3.12 Fiber-optic standard cable 62.5/125 µm

Description

The FO standard cable contains 2 multimode graded fibers of the type 62.5/125 µm, OM1. It is the universal cable for indoor and outdoor use. The standard cable is suitable for connecting optical interfaces operating in the wavelength range around 850 nm and 1300 nm.

The FO standard cable 62.5/125 µm is available as sold by the meter without connectors or in fixed lengths, preassembled with 2x2 ST/BFOC connectors.

Features and functions

Cable type		**Fiber-optic standard cable**
Areas of application		Cable for use indoors and outdoors
Design of the preassembled fiber-optic cable		• ST/BFOC plug
Cable type (standard designation)		AT-V(ZN)YY 2X1 G 62,5/125 OM1
Standards, approvals		
• RoHS conformity		yes
• UL approval		no
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Multimode graded-index fiber 62.5/125 µm, OM1
Maximum tensile load		1500 N
Bending cycles		-
Optical data		
Attenuation	850 nm	≤ 3.1 dB/km
	1300 nm	≤ 0.8 dB/km
Bandwidth length product	850 nm	200 GHz *m
	1300 nm	600 GHz *m

Cable type		Fiber-optic standard cable
Permitted ambient conditions		
Operating temperature		-40 °C to +85 °C
Transportation/storage temperature		-40 °C to +85 °C
Installation temperature		-5 °C to +50 °C
Resistance to fire		Flame-retardant acc. to IEC 60332 -1-2 and IEC 60332 -3-22 (Cat. A)
Resistance to oil		not resistant
UV resistance		resistant
Product characteristics		
Halogen-free		no
Silicone-free		yes
Rodent protection		yes
maximum cable length	100BaseFX	4000 m
	1000BaseSX	350 m
	1000BaseLX	550 m

Article numbers

Fiber-optic standard cable [1)]	Standard cable; can be walked on; splittable; without connectors, sold by the meter	6XV1820-5AH10
Fiber-optic standard cable	Preassembled FO cable with 2x2 ST/BFOC connectors	
	• 1 m	6XV1820-5BH10
	• 2 m	6XV1820-5BH20
	• 3 m	6XV1820-5BH30
	• 4 m	6XV1820-5BH40
	• 5 m	6XV1820-5BH50
	• 10 m	6XV1820-5BN10
	• 15 m	6XV1820-5BN15
	• 20 m	6XV1820-5BN20
	• 30 m	6XV1820-5BN30
	• 40 m	6XV1820-5BN40
	• 50 m	6XV1820-5BN50
	• 55 m	6XV1820-5BN55
	• 60 m	6XV1820-5BN60
	• 65 m	6XV1820-5BN65
	• 70 m	6XV1820-5BN70
	• 75 m	6XV1820-5BN75

	• 80 m	6XV1820-5BN80
	• 100 m	6XV1820-5BT10
	• 120 m	6XV1820-5BT12
	• 130 m	6XV1820-5BT13
	• 150 m	6XV1820-5BT15
	• 200 m	6XV1820-5BT20
	• 250 m	6XV1820-5BT25
	• 300 m	6XV1820-5BT30

[1] Special tools and trained personnel are required to assemble glass fiber-optic cables

3.3.13 FC FO standard cable GP 62.5/200/230 µm

Description

The FC Fiber Optic Standard Cable GP contains 2 multimode graded fibers of type 62.5/200/230 µm Thanks to the fiber construction (62.5/200/230), the cable can be worked on like normal PCF fibers (Polymer Cladded Fiber). This means that users have the advantages of glass FO cables (longer distances, resistant to temperature) and the advantages of PCF fibers when fitting connectors.

With the FC cables, glass FO sections of up to 3 km (100 Mbps Industrial Ethernet, PROFIBUS) can be set up and the cable assembled on site. The combination of already installed, traditional 62.5/125 µm multimode glass FO sections with the new FastConnect FO cables is also possible.

Features and functions

Cable type	**FC FO standard cable GP**
Areas of application	Cable for fixed installation in cable channels and pipes
Design of the preassembled fiber-optic cable	• FC FO ST/BFOC connectors • FC FO SC connectors
Cable type (standard designation)	AT-V(ZN)YY 2GK 62.5/200/230
Standards, approvals	
• RoHS conformity	yes
• UL approval	no
Mechanical data	
Number of fibers per FO core	1
Number of FO cores per FO cable	2
Fiber material	Multimode graded-index fiber 62.5/200/230 µm
Maximum tensile load	100 N

Cable type		FC FO standard cable GP
Optical data		
Attenuation	850 nm	≤ 3.2 dB/km
	1300 nm	≤ 0.9 dB/km
Bandwidth length product	850 nm	200 GHz *m
	1300 nm	500 GHz *m
Permitted ambient conditions		
Operating temperature		-40 °C to +85 °C
Transportation/storage temperature		-40 °C to +85 °C
Installation temperature		-5 °C to +50 °C
Resistance to fire		Flame-retardant acc. to IEC 60332 -1-2 and IEC 60332 -3-22 (Cat. A)
Resistance to oil		Resistant to a certain extent to mineral oils and greases
UV resistance		Resistant
Product characteristics		
Halogen-free		no
Silicone-free		yes
Rodent protection		no
Cable length	100BaseFX	3000 m
	1000BaseSX	350 m
	1000BaseLX	550 m

Article number

C FO Standard Cable GP [1)]	FC FO standard cable for fixed installation indoors with PVC jacket	6XV1847-2A

[1)] Special tools and trained personnel are required to assemble glass fiber-optic cables

3.3.14 FC FO trailing cable 62.5/200/230 µm

Description

The FC fiber-optic trailing cable is the universal cable for use in drag chains indoors and outdoors. The FC Fiber Optic Trailing Cable contains 2 multimode graded fibers of type 62.5/200/230 µm. The outer jacket with the outer diameter 8.8 ± 0.5 mm is made of TPE-U (polyurethane).

Features and functions

Cable type		**FC fiber-optic trailing cable**
Areas of application		Cable for high mechanical load for use in drag chains indoors and outdoors
Design of the preassembled fiber-optic cable		Can be assembled with four • BFOC plugs • SC plugs
Cable type (standard designation)		AT-V(ZN)Y(ZN)11Y 2GK 62,5/200/230 OM1
Standards, approvals		
• RoHS conformity		yes
• UL approval		no
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Multimode graded-index fiber 62.5/200/230 µm
Maximum tensile load		800 N
Bending cycles		5 000 000
Optical data		
Attenuation	850 nm	≤ 3.2 dB/km
	1300 nm	≤ 0.9 dB/km
Bandwidth length product	850 nm	200 GHz *m
	1300 nm	500 GHz *m
Permitted ambient conditions		
Operating temperature		–25 °C to +70 °C
Transportation/storage temperature		–30 °C to +75 °C
Installation temperature		–5 °C to +50 °C
Resistance to fire		flame retardant to IEC 60332-1-2
Resistance to oil		resistant
UV resistance		resistant
Product characteristics		
Halogen-free		no
Silicone-free		yes
Rodent protection		no
Cable length	100BaseFX	4000 m
	1000BaseSX	350 m
	1000BaseLX	550 m

Article number

FC Fiber Optic Trailing Cable [1]	Trailing cable, splittable, without connectors, sold by the meter	6XV1847-2C

[1] Special tools and trained personnel are required to assemble glass fiber-optic cables

3.3.15 SM FO CORD 9/125 µm

Description

The preassembled 1 fiber single mode cable SM FO CORD is available with different plugs. This product is intended for use in the control cabinet. The cable length is 1 m.

Features and functions

Cable type		**SM FO CORD LC/LC, 9/125** **SM FO CORD SC/LC, 9/125** **SM FO CORD SC/BFOC, 9/125** **SM FO CORD SC/SC, 9/125** **SM FO Cord BFOC/LC, 9/125**
Areas of application		Cable for use in the cabinet (degree of protection IP20)
Cable type (standard designation)		I-V(ZN)H 2E9/125 G.652D
Design of the preassembled fiber-optic cable		• LC/LC connector • SC/LC connector • SC/BFOC connector • SC/SC connector • BFOC/LC
Standards, approvals		
• RoHS conformity		Yes
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Single mode glass fiber 9/125 µm
Maximum tensile load		500 N
Optical data		
Attenuation	1300 nm	≤ 0.4 dB/km
	1550 nm	≤ 0.3 dB/km
Permitted ambient conditions		
Operating temperature		-20 °C to +70 °C
Transportation/storage temperature		-25 °C to +70 °C
Installation temperature		-10 °C to +70 °C
Resistance to fire		Flame retardant to IEC 60332-3-22 (Cat. A)

Cable type	**SM FO CORD LC/LC, 9/125** **SM FO CORD SC/LC, 9/125** **SM FO CORD SC/BFOC, 9/125** **SM FO CORD SC/SC, 9/125** **SM FO Cord BFOC/LC, 9/125**
Product characteristics	
Silicone-free	Yes
Halogen-free	Yes
Rodent protection	no

Article numbers

SM FO CORD LC/LC	Single-mode glass FO cable, preassembled with 2x SC Duplex connectors, length 1 m	6XV1843-5FH10-0AA0
SM FO CORD SC/LC	Single mode glass FO cable, preassembled with 1x SC Duplex connector and 1x LC Duplex connector, length 1 m	6XV1843-5FH10-0CA0
SM FO CORD SC/BFOC	Single-mode glass FO cable, preassembled with 1x SC Duplex connectors and 2x ST/BFOC connectors, length 1 m	6XV1843-5FH10-0CB0
SM FO CORD SC/SC	Single-mode glass FO cable, preassembled with 2x SC Duplex connectors, length 1 m	6XV1843-5FH10-0CC0
SM FO CORD BFOC/LC	Single-mode glass FO cable, preassembled with 2x ST/BFOC connectors and 1x SC Duplex connector, length 1 m	6XV1843-5FH10-0AB0

3.3.16 MM FO CORD 50/125 µm

Description

The preassembled 1 fiber multimode cable graded index cable MM FO CORD is available with different plugs. This product is intended for use in the control cabinet. The cable length is 1 m.

Features and functions

Cable type	**MM FO CORD LC/LC, 50/125** **MM FO CORD SC/LC, 50/125** **MM FO CORD SC/BFOC, 50/125** **MM FO CORD SC/SC, 50/125** **MM FO Cord BFOC/LC, 50/125**
Areas of application	Cable for use in the cabinet (degree of protection IP20)
Cable type (standard designation)	I-V(ZN)H 2x50/125 OM2

Cable type		**MM FO CORD LC/LC, 50/125** **MM FO CORD SC/LC, 50/125** **MM FO CORD SC/BFOC, 50/125** **MM FO CORD SC/SC, 50/125** **MM FO Cord BFOC/LC, 50/125**
Design of the preassembled fiber-optic cable		• LC/LC connector • SC/LC connector • SC/BFOC connector • SC/SC connector • BFOC/LC
Standards, approvals		
• RoHS conformity		Yes
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Multimode graded-index fiber 50/125 µm, OM 2
Maximum tensile load		500 N
Optical data		
Attenuation	850 nm	≤ 3.5 dB/km
	1300 nm	≤ 1.5 dB/km
Bandwidth length product	850 nm	500 GHz *m
	1300 nm	1300 GHz *m
Permitted ambient conditions		
Operating temperature		-20 °C to +70 °C
Transportation/storage temperature		-25 °C to +70 °C
Installation temperature		-10 °C to +70 °C
Resistance to fire		Flame retardant to IEC 60332-3-22 (Cat. A)
Product characteristics		
Silicone-free		Yes
Halogen-free		Yes
Rodent protection		no

Article numbers

MM FO CORD LC/LC	Multimode glass FO cable, preassembled with 2x SC Duplex connectors, length 1 m	6XV1843-5EH10-0AA0
MM FO CORD SC/LC	Multimode glass FO cable, preassembled with 1x SC Duplex connector and 1x LC Duplex connector, length 1 m	6XV1843-5EH10-0CA0
MM FO CORD SC/BFOC	Multimode glass FO cable, preassembled with 1x SC Duplex connector and 2x ST/BFOC connectors, length 1 m	6XV1843-5EH10-0CB0

MM FO CORD SC/SC	Multimode glass FO cable, preassembled with 2x SC Duplex connectors, length 1 m	6XV1843-5EH10-0CC0
MM FO CORD BFOC/LC	Multimode glass FO cable, preassembled with 2x ST/BFOC connectors and 1x SC Duplex connectors, length 1 m	6XV1843-5EH10-0AB0

3.4 Plastic fiber-optic cables

3.4.1 Overview

The plastic fiber-optic cable is available with PCF fibers (Polymer Cladded Fiber) and POF fibers (Plastic Optical Fiber).

Properties

Plastic fibers have several properties that differ from those of glass fibers. For example, the maximum possible cable length is shorter with glass fibers due to the higher attenuation and the bandwidth is smaller. Plastic fibers require far less effort to assemble on site compared with glass fibers.

The use of plastic fibers is particularly attractive when networking islands for example with the ET 200. In this case, small distances up to a maximum of 50 m can be covered with the plastic fibers.

3.4.2 POF Standard Cable GP 980/1000 µm

Description

The Plastic Optical Fiber (POF) standard cable GP consists of two plastic fibers with a rugged polyamide inner jacket. The inner jacket is surrounded by Kevlar strengthening elements and a green PVC outer jacket. The POF standard cable GP can be assembled on site. The cable is fitted with SC RJ connectors for devices with an integrated optical interface.

Devices with an integrated optical interface include, for example SCALANCE X200-4P IRT, SCALANCE X201-3P IRT, SCALANCE X202-2P IRT, SCALANCE X101-1POF, ET 200S.

Features and functions

Cable type	POF standard cable GP 980/1000
Areas of application	Fixed installation indoors, PROFINET
Version of the preassembled FO cable	• SC RJ plug • SC RJ POF plug Pro
Cable type (standard designation)	I-V4Y(ZN)Y 2P 980/1000

Cable type		POF standard cable GP 980/1000
Standards, approvals		
• RoHS conformity		yes
• UL approval		yes
Mechanical data		
Number of fibers / per FO core		1
Number of FO cores / per FO cable		2
Fiber material		POF FO cable fiber 980/1000 µm
Maximum tensile load		100 N
Optical data		
Attenuation	650 nm	≤ 160 dB/km
Bandwidth length product	650 nm	1 GHz *m
Permitted ambient conditions		
Operating temperature		-30 °C to +70 °C
Transportation/storage temperature		-30 °C to +70 °C
Installation temperature		5 °C to +50 °C
Resistance to fire		flame retardant to IEC 60332-1-2
Resistance to oil		Conditionally resistant
UV resistance		resistant
Product characteristics		
Halogen-free		no
Silicone-free		yes
Rodent protection		no
Cable length for Industrial Ethernet		Max. 50 m

Article numbers

POF Standard Cable GP 980/1000	Standard cable; without connectors, UL approval, sold by the meter	6XV1874-2A

3.4.3 POF Trailing Cable 980/1000 µm

Description

The Plastic Optical Fiber (POF) trailing cable consists of two plastic fibers with a rugged polyamide inner jacket. The inner jacket is surrounded by Kevlar strengthening elements and a green PUR outer jacket. The POF trailing cable can be assembled on site with SC RJ or SC RJ Plug PRO connectors.

The cable can be used for devices with an integrated optical interface: For example, SCALANCE X200-4P IRT, SCALANCE X201-3P IRT, SCALANCE X202-2P IRT, SCALANCE X101-1POF, ET 200S

Features and functions

Cable type		**POF trailing cable**
Areas of application		Cable for moving applications (e.g. drag chains)
Version of the preassembled FO cable		• SC RJ plug • SC RJ POF plug Pro
Cable type (standard designation)		I-V4Y(ZN)11Y 2P 980/1000 FLEX UL
Standards, approvals		
• RoHS conformity		yes
• UL approval		yes
Mechanical data		
Number of fibers / per FO core		1
Number of FO cores / per FO cable		2
Fiber material		POF FO cable fiber 980/1000 µm
Maximum tensile load		100 N
Bending cycles		5 000 000
Optical data		
Attenuation	650 nm	≤180 dB/km
Bandwidth length product	650 nm	1 GHz *m
Permitted ambient conditions		
Operating temperature		–20 °C to +70 °C
Transportation/storage temperature		–40 °C to +80 °C
Installation temperature		5 °C to +50 °C
Resistance to fire		flame retardant to IEC 60332-1-2
Resistance to oil		resistant
UV resistance		resistant
Product characteristics		
Free of halogens		no
Rodent protection		no
Silicone-free		yes
Cable length for Industrial Ethernet		Max. 50 m

Article number

POF Trailing Cable	Trailing cable, with poly-optic fiber; without connectors, sold by the meter	6XV1874-2B

3.4.4 PCF Standard Cable GP 200/230 µm

Description

The PCF standard cable GP consists of two PCF fibers. The fibers are surrounded by aramid strengthening elements and a green PVC outer jacket. The cable is intended for fixed installation indoors and outdoors with cable lengths up to 100 m.

The PCF standard cable GP 200/230 is available in meters and is suitable for fitting connectors directly.

Features and functions

Cable type		**PCF standard cable GP 200/230**
Areas of application		Fixed installation indoors and outdoors
Design of the preassembled fiber-optic cable		Assembled with SC RJ, SC RJ Plug PRO, BFOC and Simplex connectors
Cable type (standard designation)		AT-V(ZN)YY 2K 200/230
Standards, approvals		
• RoHS conformity		yes
• UL approval		cULus OFN
• CSA approval		OFN FT4
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Graded index fiber 200/230 µm
Maximum tensile load		100 N
Optical data		
Attenuation	650 nm	≤10 dB/km
	660 nm	≤10 dB/km
Bandwidth length product	650 nm	17 GHz *m
Permitted ambient conditions		
Operating temperature		–40°°C to +90 °C
Transportation/storage temperature		–40°°C to +90 °C
Installation temperature		–40°°C to +90 °C
Resistance to fire		Flame-retardant acc. to IEC 60332 -1-2 and IEC 60332 -3-22 (Cat. A)
Resistance to oil		Conditionally resistant
UV resistance		resistant
Product characteristics		
Halogen-free		no
Silicone-free		yes

Cable type	PCF standard cable GP 200/230
Rodent protection	no
Cable length for Industrial Ethernet	≤ 100 m

Article number

PCF Standard Cable GP 200/230	Standard cable; UL approval; without connectors, sold by the meter	6XV1861-2A

3.4.5 PCF Trailing Cable 200/230 µm

Description

The PCF trailing cable 200/230 consists of two PCF fibers. The fibers are surrounded by aramid strengthening elements and a green PUR outer jacket. The cable is intended for moving applications such as drag chains indoors and outdoors with cable lengths up to 100 m. The recommended wavelength is 660 nm.

The PCF Trailing Cable is available as sold by the meter for direct connection of connectors as well as preassembled in fixed lengths with 2x2 BFOC connectors.

Features and functions

Cable type	PCF trailing cable 200/230
Areas of application	Cable for high mechanical load and moving applications, for example drag chains
Design of the preassembled fiber-optic cable	• Sold by the meter can be assembled with four BFOC or SC connectors • Preassembled with 2x2 BFOC
Cable type (standard designation)	AT-V(ZN)Y(ZN)11Y 2K200/230
Standards, approvals	
• RoHS conformity	yes
• UL approval	no
Mechanical data	
Number of fibers per FO core	1
Number of FO cores per FO cable	2
Fiber material	Graded index fiber 200/230 µm
Maximum tensile load	800 N
Bending cycles	5 000 000

Cable type		**PCF trailing cable 200/230**
Optical data		
Attenuation	650 nm	≤10 dB/km
	660 nm	≤10 dB/km
Bandwidth length product	650 nm	17 GHz *m
Permitted ambient conditions		
Operating temperature		–25 °C to +75 °C
Transportation/storage temperature		–30 °C to +75 °C
Installation temperature		–30 °C to +75 °C
Resistance to fire		Flame-retardant to IEC 60332 -1-2 and IEC 60332 -3-22 (Cat. A)
Resistance to oil		resistant
UV resistance		resistant
Product characteristics		
Halogen-free		no
Silicone-free		Yes
Rodent protection		no
Cable length for Industrial Ethernet		≤ 100 m

Article numbers

PCF Trailing Cable 200/230	PCF fiber-optic cable with plastic cladding, splittable, without connectors, sold by the meter	6XV1861-3C
	Preassembled with 2x2 BFOC connectors	
	• 75 m	6XV1861-3CN75
	• 100 m	6XV1861-3CT10
	• 150 m	6XV1861-3CT15
	• 200 m	6XV1861-3CT20
	• 250 m	6XV1861-3CT25
	• 300 m	6XV1861-3CT30
	• 400 m	6XV1861-3CT40

3.4.6 PCF Trailing Cable GP 200/230 µm

Description

The PCF trailing cable GP 200/230 is a rugged round cable with a green PVC outer jacket and Kevlar strengthening elements and two glass fibers with a rugged PVC inner jacket. The cable is intended for moving applications such as drag chains indoors and outdoors with cable lengths up to 100 m. The recommended wavelength is 660 nm.

The PCF Trailing Cable GP is available sold by the meter for direct connection of connectors as well as preassembled in fixed lengths with 2x2 BFOC connectors.

Features and functions

Cable type		**PCF trailing cable GP 200/230**
Areas of application		Cable for high mechanical load and moving applications, for example drag chains.
Design of the preassembled fiber-optic cable		• Sold by the meter can be assembled with SC RJ, SC RJ plug PRO, BFOC and Simplex connectors • Preassembled with 2x2 BFOC
Cable type (standard designation)		AT-V(ZN)Y(ZN)Y 2K200/230
Standards, approvals		
• RoHS conformity		yes
• UL approval		cULus OFN
• CSA approval		OFN 90 Cel, FT1, FT4
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Graded index fiber 200/230 µm
Maximum tensile load		800 N
Bending cycles		5 000 000
Optical data		
Attenuation	650 nm	≤10 dB/km
	660 nm	≤10 dB/km
Bandwidth length product	650 nm	17 GHz *m
Permitted ambient conditions		
Operating temperature		–25 °C to +75 °C
Transportation/storage temperature		–30 °C to +75 °C
Installation temperature		–30 °C to +75 °C
Resistance to fire		Flame-retardant to IEC 60332 -1-2 and IEC 60332 -3-22 (Cat. A)
Resistance to oil		Conditionally resistant
UV resistance		resistant
Product characteristics		
Halogen-free		no
Silicone-free		Yes
Rodent protection		no
Cable length for Industrial Ethernet		≤ 100 m

Article numbers

PCF Trailing Cable GP 200/230	PCF fiber-optic cable with plastic cladding, splittable, without connectors, sold by the meter	6XV1861-2D
	Preassembled with 2x2 BFOC connectors	
	• 75 m	6XV1861-3DN75
	• 100 m	6XV1861-3DT10
	• 150 m	6XV1861-3DT15
	• 200 m	6XV1861-3DT20
	• 250 m	6XV1861-3DT25
	• 300 m	6XV1861-3DT30
	• 400 m	6XV1861-3DT40

3.4.7 PROFIBUS plastic fiber-optic standard cable

Description

PROFIBUS Plastic Fiber Optic (980/1000) standard cable is a rugged fiber-optic cable with purple PVC outer sheath and Kevlar tension elements as well as two plastic fibers with rugged polyamide inner sheath. It is suitable for setting up PROFIBUS networks or for optical connection of PROFIBUS segments in RS485 technology indoors. It protects the transmission path against electromagnetic failures and is safe from eavesdropping.

The cable is available as sold by the meter without plug and in fixed lengths, preassembled with four BFOC connectors. The maximum cable length between two OLM/Ps amounts to 80 m.

Features and functions

Cable type	**PROFIBUS plastic fiber-optic standard cable**
Areas of application	Cable for indoor applications
Design of the preassembled fiber-optic cable	• BFOC plug
Cable type (standard designation)	I-V4Y(ZN)Y 2P 980/1000
Standards, approvals	
• RoHS conformity	yes
• UL approval	cULus OFN FT1
• CSA approval	OFN
Mechanical data	
Number of fibers per FO core	1
Number of FO cores per FO cable	2

Cable type		**PROFIBUS plastic fiber-optic standard cable**
Fiber material		Graded index fiber 980/1000 µm
Maximum tensile load		100 N
Optical data		
Attenuation	650 nm	Max. 160 dB/km
	660 nm	Max. 230 dB/km
Bandwidth length product	650 nm	1 GHz *m
Permitted ambient conditions		
Operating temperature		–30 °C to +70 °C
Transportation/storage temperature		–30 °C to +70 °C
Installation temperature		–30 °C to +70 °C
Resistance to fire		Flame retardant to IEC 60332-1-2
Resistance to oil		Resistant to a certain extent
UV resistance		Not resistant
Product characteristics		
Halogen-free		No
Silicone-free		yes
Rodent protection		no
Cable length		Max. 50 m

Article numbers

PROFIBUS plastic fiber-optic standard cable [1]	Cable for indoors; splittable, without connectors	
	Sold by the meter	6XV1821-0AH10
	50 m ring	6XV1821-0AN50
	100 m ring	6XV1821-0AT10
PROFIBUS plastic fiber-optic standard cable	Preassembled with 4 BFOC connectors	
	• 1 m	6XV1821-0BH10
	• 2 m	6XV1821-0BH20
	• 5 m	6XV1821-0BH50
	• 10 m	6XV1821-0BN10
	• 15 m	6XV1821-0BN15
	• 20 m	6XV1821-0BN20
	• 25 m	6XV1821-0BN25
	• 30 m	6XV1821-0BN30
	• 50 m	6XV1821-0BN50

[1] Special tools and trained personnel are required to assemble glass fiber-optic cables

3.4.8 PROFIBUS PCF fiber-optic standard cable

Description

PROFIBUS Fiber Optic standard cable is a rugged fiber-optic cable with purple PVC outer sheath and Kevlar tension elements as well as two quartz glass fibers with rugged polyamide inner sheath. It is suitable for setting up PROFIBUS networks or for optical connection of PROFIBUS segments in RS485 technology indoors. It protects the transmission path against electromagnetic failures and is safe from eavesdropping.

The cable is supplied in fixed lengths, preassembled with four PCF-BFOC connectors or four PCF Simplex connectors. The maximum cable length between two OLM/Ps amounts to 400 m.

Features and functions

Cable type		**PROFIBUS PCF fiber-optic standard cable**
Areas of application		Cable for indoor applications
Design of the preassembled fiber-optic cable		• ST/BFOC plug • Simplex plug
Cable type (standard designation)		I-V(ZN)Y 2K 200/230
Standards, approvals		
• RoHS conformity		yes
• UL approval		no
• CSA approval		No
Mechanical data		
Number of fibers per FO core		1
Number of FO cores per FO cable		2
Fiber material		Graded index fiber 200/230 µm
Maximum tensile load		200 N
Optical data		
Attenuation	650 nm	Max. 10 dB/km
	660 nm	Max. 10 dB/km
Bandwidth length product	650 nm	17 GHz *m
Permitted ambient conditions		
Operating temperature		–30 °C to +70 °C
Transportation/storage temperature		–30 °C to +70 °C
Installation temperature		–30 °C to +70 °C
Resistance to fire		Flame retardant to IEC 60332-1-2
Resistance to oil		Resistant to a certain extent
UV resistance		Not resistant

Cable type	PROFIBUS PCF fiber-optic standard cable
Product characteristics	
Halogen-free	No
Silicone-free	yes
Rodent protection	no
Cable length	Max. 400 m

Article numbers

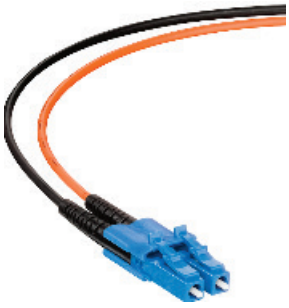
PROFIBUS PCF fiber-optic standard cable	Preassembled with 4 PCF-BFOC connectors	
	• 75 m	6XV1821-1BN75
	• 100 m	6XV1821-1BT10
	• 150 m	6XV1821-1BT15
	• 200 m	6XV1821-1BT20
	• 250 m	6XV1821-1BT25
	• 300 m	6XV1821-1BT30
	• 400 m	6XV1821-1BT40
PROFIBUS PCF fiber-optic standard cable	Preassembled with 4 PCF Simplex connectors	
	• 50 m	6XV1821-1CN50
	• 75 m	6XV1821-1CN75
	• 100 m	6XV1821-1CT10
	• 150 m	6XV1821-1CT15
	• 200 m	6XV1821-1CT20
	• 250 m	6XV1821-1CT25
	• 300 m	6XV1821-1CT30

3.5 Cable connectors for FO cables

3.5.1 Single-mode FO LC duplex plug

Description

The SM FO LC duplex plug-in connector is used to assemble SM FO Robust Cable GP. The plug-in connector is used to connect to Ethernet/PROFINET devices with an integrated single-mode interface, for example SCALANCE XR-300EEC, SCALANCE XR-300, SCALANCE X308-2M.



Features and functions

Connection type	SM FO LC cable connectors
Standards, approvals	
• RoHS conformity	yes
• UL approval	no
Transmission speed	
Industrial Ethernet	100/1000 Mbps
Interfaces	
Number of optical connectors for glass fiber-optic cable	2
Version for optical interface	Duplex plug-in connector (push-pull device connection)
Version for network components or end devices	no
Design	
Cable outlet	180°
Housing material	Plastic
IP degree of protection	IP20
Product property	
Silicone-free	yes

Article number

SM FO LC plug [1]	LC Duplex plug for SM FO robust cable GP (4E9/125) 1 pack of 10	6GK1901-0SB10-2AB0

[1] Special tools and trained personnel are required to assemble glass fiber-optic cables.

3.5.2 Multimode FO LC Duplex Plug

Description

The MM FO LC duplex plug-in connector is used to assemble MM FO Robust Cables. Numerous SCALANCE products support the Lucent Connector (LC) interface, for example, X308-2M, XR-300 and X-300EEC.

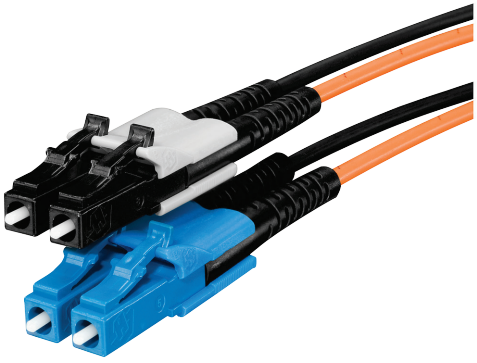


Figure 3-1 Multimode FO LC plug

Features and functions

Connection type	MM FO LC Duplex plug-in connector
Standards, approvals	
• RoHS conformity	yes
• UL approval	no
Transmission speed	
Industrial Ethernet	100/1000 Mbps
Interfaces	
Number of optical connectors for glass fiber-optic cable	2
Version for optical interface	Duplex plug-in connector (push-pull device connection)
Version for network components or end devices	no

Connection type	MM FO LC Duplex plug-in connector
Design	
Cable outlet	180°
Housing material	Plastic
IP degree of protection	IP20
Product property	
Silicone-free	yes

Article number

MM FO LC Duplex plug [1]	LC Duplex connectors for MM FO Robust Cable GP (2G50/125) 1 pack of 10	6GK1901-0RB10-2AB0

[1] Special tools and trained personnel are required to assemble glass fiber-optic cables.

3.5.3 FC FO LC Plug

Description

The FC FO LC plug is used to assemble the following cables:

- SIMATIC NET FC FO Standard Cable (multimode fiber-optic cable, article number 6XV1847-2A)
- SIMATIC NET FC FO Trailing Cable (multimode fiber-optic cable, article number 6XV1847-2C)



Figure 3-2 FC FO LC plug

To preassemble these cables the following set of tools is required:

- SIMATIC NET FC FO Termination Kit (article number 6GK1900-0RL00-0AA0)

Features and functions

Connection type	FC FO LC plug
Standards, approvals	
• RoHS conformity	yes
• UL approval	no
Transmission speed	
Industrial Ethernet	100/1000 Mbps
Interfaces	
Number of optical connectors for glass fiber-optic cable	2
Version for optical interface	Duplex plug (push pull device connection)
Version for network components or end devices	no
Design	
Cable outlet	180°
Housing material	Plastic
IP degree of protection	IP20
Product property	
Silicone-free	yes

Article number

FC FO LC Plug [1)]	LC Duplex plug for multimode FC FO standard cable and FC FO trailing cable. 1 pack of 10	6GK1900-1RB00-2AB0

[1)] Special tools and trained personnel are required to assemble glass fiber-optic cables.

3.5.4 FC FO Termination Kit for the FC FO LC Plug

Description



Figure 3-3 FC FO termination kit FC for the FO LC plug

The FC FO Termination Kit is a set of tools for assembling the FC FO LC plug with the following fiber-optic cables:

- SIMATIC NET FC FO Standard Cable (multimode fiber-optic cable, article number 6XV1847-2A)
- SIMATIC NET FC FO Trailing Cable (multimode fiber-optic cable, article number 6XV1847-2C)

The set of tools contains the following parts:

- Stripping pliers
- Crimping pliers
- Cleave tool
- Kevlar scissors
- Cleaning cloths
- Container for cable remnants

Article number

FC FO termination kit	Tool set for assembling the FC FO LC Plug and multimode fiber-optic cables	6GK1900-0RL00-0AA0

3.5.5 FO FC SC plug

Description

The FO FC SC plug is used to preassemble FO FC glass fiber-optic cable (62.5/200/230).

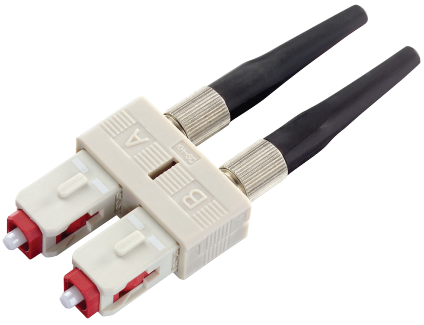


Figure 3-4 FO FC SC plug

To assemble the cable on site a case is available. The case contains the tools required for assembly.

Features and functions

Connection type	**FO FC SC plug**
Standards, approvals	
• RoHS conformity	yes
• UL approval	no
Transmission speed	
Industrial Ethernet	100/1000 Mbps
Interfaces	
Number of optical connections for POF fiber-optic cables	1
Version for optical interface	SC plug
Version for network components or end devices	yes, FC
Design	
Cable outlet	180°
Housing material	Metal and plastic
IP degree of protection	IP20
Product property	
Silicone-free	yes

Article numbers

FC FO SC Plug	Screw-in plug for on-site assembly with FC FO cable 1 pack of 10 Duplex plugs + cleaning cloths	6GK1900-1LB00-0AC0
FC FO Termination Kit	Assembly case for on-site assembly of FC SC plugs on FC glass fiber-optic cable	On request

3.5.6 Multimode FO ST/BFOC plug

Description

The ST/BFOC plug is used to assemble glass fiber-optic cables with the following fiber type:

- Glass fiber-optic cables 50/125 µm
- Glass fiber-optic cables 62.5/125 µm



Features and functions

Connection type	ST/BFOC plug-in connectors
Standards, approvals	
• RoHS conformity	yes
• UL approval	no
Transmission speed	
Industrial Ethernet	100/1000 Mbps
Interfaces	
Number of optical connections for POF fiber-optic cables	1
Version for optical interface	ST/BFOC plug-in connector (bayonet lock)
Version for network components or end devices	no
Design	
Cable outlet	180°
Housing material	Metal and plastic
IP degree of protection	IP20

Connection type	ST/BFOC plug-in connectors
Product property	
Silicone-free	yes

Article number

Multimode FO ST/BFOC connector set [1]	Connector set for on-site assembly of FO standard cable (50/125/1400), FO ground cable (50/125/1400), flexible FO trailing cable, INDOOR FO cable (62.5/125/900) 1 pack of 20	6GK1901-0DA20-0AA0

[1] Special tools and trained personnel are required to assemble glass fiber-optic cables.

3.5.7 FO FC ST/BFOC plug

Description

The FO FC ST/BFOC plug is used to preassemble FO FC glass fiber-optic cables.



To assemble the cable on site a case is available. The case contains the tools required for assembly.

Features and functions

Connection type	FC FO ST/BFOC plugs
Standards, approvals	
• RoHS conformity	Yes
• UL approval	no
Transmission speed	
Industrial Ethernet	100 / 1000 Mbps
Interfaces	
Number of optical connections for POF fiber-optic cables	1
Version for optical interface	ST/BFOC plug
Version for network components or end devices	yes, FC

Connection type	FC FO ST/BFOC plugs
Design	
Cable outlet	180°
Housing material	Metal and plastic
IP degree of protection	IP20
Product property	
Silicone-free	yes

Article numbers

FC FO ST/BFOC Plug	Screw-in plug for on-site assembly with FC FO cables 1 pack of 10 Duplex plugs + cleaning cloths	6GK1900-1GB00-0AC0
FC FO Termination Kit (ST/BFOC)	Assembly case for on-site assembly of FC ST/BFOC plugs on FC glass fiber-optic cables	6GK1900-1GL00-0AA0
PCF-FO Termination Kit (ST/BFOC)	Assembly case for on-site assembly of BFOC connectors at PCF fiber-optic cables	6GK1900-0HL00-0AA0

3.5.8 FC FO Termination Kit for the FC ST/BFOC Plug

Description



Figure 3-5 FC FO Termination Kit for FC ST/BFOC Plug

The FC FO Termination Kit is a set of tools for assembling the FC ST/BFOC Plug at FC fiber-optic cables (multimode 62.5/200/230).

The set of tools contains the following parts:

- Stripping pliers
- Cleave tool
- Kevlar scissors

- Microscope
- Container for cable remnants

Article number

FC FO termination kit	Set of tools for assembling the FC ST/BFOC Plug at FC fiber-optic cables	6GK1900-1GL00-0AA0

3.5.9 IE SC RJ plug

Description

The SC RJ plug is used to assemble POF and PCF fiber-optic cables.



The Sc RJ plug is available in two versions:

- SC RJ POF plug
  For assembling fiber-optic cables. The maximum cable length between two Industrial Ethernet devices is 50 m.
- SC RJ PCF plug
  For assembling PCF fiber-optic cables. The maximum cable length between two Industrial Ethernet devices is 100 m.

To assemble the cable on site a case is available. The case contains the tools required for assembly.

Features and functions

Connection type	**SC RJ POF plug** **SC RJ PCF plug**
Standards, approvals	
• RoHS conformity	yes
• UL approval	no
Transmission speed	
Industrial Ethernet	100 Mbps
Interfaces	
Number of optical connections for POF fiber-optic cables	1

Connection type	**SC RJ POF plug** **SC RJ PCF plug**
Version for optical interface	SC RJ plug (push pull device connection)
Version for network components or end devices	no
Design	
Cable outlet	180°
Housing material	Plastic
IP degree of protection	IP65/67
Product property	
Silicone-free	yes

Article numbers

IE SC RJ POF Plug	Screw-in plug for on-site assembly with POF FO cables 1 pack of 20	6GK1900-0MB00-0AC0
Termination kit SC RJ POF plug	Assembly case for on-site assembly of SC RJ POF plugs; consisting of stripping tool, Kevlar scissors, SC RJ polishing set grinding disc, sandpaper and micro-scope	6GK1900-0ML00-0AA0
IE SC RJ PCF Plug	Screw-in plug for on-site assembly with PCF FO cables 1 pack of 10	6GK1900-0NB00-0AC0
Termination kit SC RJ PCF plug	Assembly case for on-site assembly of SC RJ PCF plugs; consisting of stripping tool, buffer stripping tool, Kevlar scissors, fiber breaking tool, microscope	6GK1 900-0NL00-0AA0

3.5.10 IE SC RJ Plug Pro

Description

The SC RJ Plug Pro is a plug that can be fitted in the field for the push-pull device connection with a high degree of protection IP65/67.



The SC RJ plug Pro is available in two versions:

- SC RJ POF plug Pro
  For assembling POF fiber-optic cables. The maximum cable length between two Industrial Ethernet devices is 50 m.
- SC RJ PCF plug Pro
  For assembling PCF fiber-optic cables. The maximum cable length between two Industrial Ethernet devices is 100 m.

Features and functions

Connection type	SC RJ POF plug Pro SC RJ PCF plug Pro
Standards, approvals	
• RoHS conformity	yes
• UL approval	no
Transmission speed	
Industrial Ethernet	100 Mbps
Interfaces	
Number of optical connections for POF fiber-optic cables	1
Version for optical interface	SC RJ plug (push-pull device connection)
Version for network components or end devices	no
Design	
Cable outlet	180°
Housing material	Plastic
IP degree of protection	IP65/67
Product property	
Silicone-free	yes

Article numbers

IE SC RJ POF Plug PRO	Duplex plug for on-site assembly with POF FO cables 1 pack of 1	6GK1900-0MB00-6AA0
IE SC RJ PCF Plug PRO	Duplex plug for on-site assembly with PCF FO cables 1 pack of 1	6GK1900-0NB00-6AA0

3.5.11 FC FO Termination Kit for the SC RJ Plug

Description



Figure 3-6 Termination Kit for the SC RJ POF Plug

For the on-site fitting of connectors of SC RJ connectors at POF or PCF fiber-optic cables two assembly cases with the suitable tool set can be delivered.

The tool set for the preassembly of the SC RJ POF Plug contains the following parts:

- Stripping pliers
- Kevlar scissors
- Polishing set consisting of the SC RJ grinding plate, sandpaper and the abrasive surface
- Microscope

The tool set for the preassembly of the SC RJ PCF connectors contains the following parts:

- Stripping tool
- Buffer stripping tool
- Kevlar scissors
- Fiber breaking tool
- Microscope

Article number

Termination kit SC RJ POF plug	Tool set for preassembling the SC FO PCF Plug	6GK1900-0NL00-0AA0
Termination kit SC RJ PCF plug	Tool set for the preassembling the SC RJ POF Plug	6GK1900-0NL00-0AA0

Power supply

4

4.1 Power cable

Different types of cables are required for the power supply in Industrial Ethernet/PROFINET.

The power cables are used for devices with degree of protection IP65/67 to connect the signaling contact or 24 V supply of the SCALANCE X and SCALANCE W components (energy cable 2 x 0.75) and to supply power (energy cable 5 x 1.5) for the ET 200.

Preassembled power cables are also available to supply power for the ET 200 in different lengths (M12 power connecting cable).

For the different areas of application, the following cables are available for supplying power:

Cabling	Cable type	Features	Area of application
Power	Energy cable 2 x 0.75	Power cable, sold by the meter	To connect the signaling contact or 24 VDC power supply
	Energy cable 5 x 1.5		
	Power connecting cable M12-180/M12-180	Preassembled cable with two 4-pin M12 plugs	Plug-in cable with one 4-pin M12 plug (A-coded) and one 4-pin M12 socket (A-coded) for the 24 V power supply.
	Power Connecting Cable M12-90/M12-90	Preassembled cable with two 4-pin M12 plugs	Plug-in cable with one 4-pin M12 plug (A-coded) and one 4-pin M12 socket (A-coded) for 24 V power supply
	Robust Power Connecting Cable	Power cable, preassembled or sold by the meter	Preassembled cable with one 4-pin M12 plug and one 4-pin M12 socket (both A-coded) for the power supply. Also available by the meter without connectors.

4.1.1 Energy cable 2 x 0.75

Description

Rugged cable that can be dragged with 2 copper cores for connecting the signaling contact and 24 VDC power supply to SCALANCE X and SCALANCE W components.

The Energy Cable 2 x 0.75 is preassembled with the following M12 plug-in connectors:

- Signaling contact M12 cable connector
  For connection to SCALANCE X208Pro for the signaling contact
- Power M12 cable connector
  For connecting to SCALANCE X208Pro and SCALANCE W700 for the 24 VDC power supply.

Features and functions

Cable type [1]	**Energy Cable 2 x 0.75**
Areas of application	Connection for signaling contact and power supply
Cable type (standard designation)	L-YY-2x1x0.75 GR
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
Mechanical data	
Number of electrical conductors	2
Sheath	PVC Ø (7.4 ± 0.3) mm, gray
Conductor category	5
Maximum tensile load	100 N
Number of bending cycles	100 000
Electrical data	
Operating voltage (rms value)	600 V
Continuous current of the power cores	6 A
Permitted ambient conditions	
Operating temperature	–20 °C to +80 °C
Transportation/storage temperature	–20 °C to +80 °C
Installation temperature	–20 °C to +80 °C
Resistance to fire	flame retardant to IEC 60332-1-2
Resistance to oil	Conditionally resistant
UV resistance	resistant
Product characteristics	
Halogen-free	no
Silicone-free	yes

[1] Electrical properties at 20 °C, tests according to DIN 47 250, Part 4, or DIN VDE 0472

Article number

Energy Cable 2 x 0.75	2-core power cable (2x 0.75 mm^2) for connection to M12 plug-in transceiver, sold by the meter, without connectors	6XV1812-8A

4.1.2 Energy cable 5 x 1.5

Description

The Energy Cable 5 x 1.5 is used to connect the 24 V power supply for ET 200 modules via 7/8" plug-in connectors.

The power supply concept of the ET 200 involves the voltage being supplied by a central power supply unit and being looped through from device to device. The load and device supply are via separate circuits. The devices have a 7/8" male connector on the input side and a socket on the output side.

The Energy Cable 5 x 1.5 is suitable for cable carriers for 5 million bending cycles at a bending radius of 75 mm, an acceleration of 4 m/s and a speed of 180 m/min.

The Energy Cable 5 x 1.5 is available both in meters to allow connectors to be fitted on-site and preassembled in various lengths as 7/8" plug-in cable with degree of protection IP65.

At one end the 7/8" cable has a 5-pin 7/8" plug-in connector with a pin insert and at the other end a 5-pin 7/8" plug-in connector with a socket insert.

Features and functions

Cable type [1)]	**Energy Cable 5 x 1.5**
Areas of application	Power supply of ET 200 modules with 7/8" power interface
Cable type (standard designation)	L-Y11Y-Z 5x1x1.5 GR
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
Mechanical data	
Number of electrical conductors	5
Sheath	PUR Ø (10.5 ± 0.3) mm, gray
Conductor category	5
Maximum tensile load	500 N
Number of bending cycles	5 000 000
Electrical data	
Operating voltage (rms value)	600 V
Continuous current of the power cores	16 A
Permitted ambient conditions	
Operating temperature	-40 °C to +80 °C
Transportation/storage temperature	-40 °C to +80 °C
Installation temperature	-40 °C to +80 °C
Resistance to fire	flame retardant to IEC 60332-1-2
Resistance to oil	Resistant according to EN 60811-2-1

Cable type [1]	**Energy Cable 5 x 1.5**
UV resistance	resistant
Product characteristics	
Halogen-free	no
Silicone-free	yes

[1] Electrical properties at 20 °C, tests according to DIN 47 250, Part 4, or DIN VDE 0472

Article numbers

Energy Cable 5 x 1.5	5-core power cable (5 x 1.5 mm^2) for connection to 7/8" plug-in connector, sold by meter, without connectors	6XV1830-8AH10
7/8" plug-in cable	Preassembled Energy cable 5x1.5 with two 5-pin 7/8" plugs/sockets. Maximum cable length 50 m	
	• 0.3 m	6XV1822-5BE30
	• 0.5 m	6XV1822-5BE50
	• 1.0 m	6XV1822-5BH10
	• 1.5 m	6XV1822-5BH15
	• 2.0 m	6XV1822-5BH20
	• 3.0 m	6Xv1822-5BH30
	• 5.0 m	6XV1822-5BH50
	• 10 m	6XV1822-5BN10
	• 15 m	6XV1822-5BN15

4.1.3 Power connecting cable M12-180/M12-180

Description

The power connecting cable M12 is a preassembled plug-in cable for 24 V power supply of the ET 200 and XP-200.

The power connecting cable M12 has a 4-pin M12 plug at one end and a 4-pin M12 socket at the other. The M12 plug and the M12 socket are A-coded and have a straight cable outlet.

Features and functions

Cable type [1]	**Power connecting cable M12-180/M12-180**
Areas of application	Connection of the 24 V power supply to ET 200 und XP-200 with degree of protection IP65/67
Design of the preassembled fiber-optic cable	Preassembled with 4-pin M12 male connector/female connector each (A-coded, 180° cable outlet)

Cable type [1)]	**Power connecting cable M12-180/M12-180**
Cable type (standard designation)	LI9YH-Y 4x0.75
Standards, approvals	
• RoHS conformity	Yes
• UL approval	No
Mechanical data	
Number of electrical conductors	4
Sheath	PVC Ø (5.7 ± 0.2) mm, gray
Conductor category	5
Maximum tensile load	15 N
Number of bending cycles	100 000
Electrical data	
Operating voltage (rms value)	300 V
Continuous current of the power cores	-
Permitted ambient conditions	
Operating temperature	–25 °C to +80 °C With a moving application, a maximum operating temperature of –5 °C to +80 °C is permissible
Transportation/storage temperature	–25 °C to +80 °C
Installation temperature	–5 °C to +80 °C
Resistance to fire	Flame retardant to UL 758 (CSA FT 1)
Resistance to oil	Conditionally resistant
UV resistance	not resistant
Product characteristics	
Halogen-free	no
Silicone-free	yes
Degree of protection	IP65/67

1) Electrical properties at 20 °C, tests according to DIN 47 250, Part 4, or DIN VDE 0472

Article numbers

Power Connecting Cable M12-180/M12-180	Flexible 4-core plug-in power cable, preassembled with A-coded 4-pin M12 plug and A-coded 4-pin M12 socket to supply the ET 200 with 24 V DC.	
	• 0.3 m	6XV1801-5DE30
	• 0.5 m	6XV1801-5DE50
	• 1.0 m	6XV1801-5DH10
	• 1.5 m	6XV1801-5DH15
	• 2.0 m	6XV1801-5DH20

	• 3.0 m	6XV1801-5DH30
	• 5.0 m	6XV1801-5DH50
	• 10 m	6XV1801-5DN10
	• 15 m	6XV1801-5DN15

4.1.4 Power Connecting Cable M12-90/M12-90

Description

The power connecting cable M12 is a preassembled plug-in cable for 24 V power supply of the ET 200 and XP-200.

The power connecting cable M12 has a 4-pin M12 plug at one end and a 4-pin M12 socket at the other. The M12 plug and the M12 socket are A-coded and have a 90° cable outlet.

Features and functions

Cable type [1]	**Power Connecting Cable M12-90/M12-90**
Areas of application	Connection of the 24 V power supply to ET 200 und XP-200 with degree of protection IP65/67
Design of the preassembled fiber-optic cable	Preassembled with 4-pin M12 male connector/female connector each (A-coded, 90° cable outlet)
Cable type (standard designation)	LI9YH-Y 4x0.75
Standards, approvals	
• RoHS conformity	Yes
• UL approval	No
Mechanical data	
Number of electrical conductors	4
Sheath	PVC Ø (5.7 ± 0.2) mm, gray
Conductor category	5
Maximum tensile load	15 N
Number of bending cycles	100 000
Electrical data	
Operating voltage (rms value)	300 V
Continuous current of the power cores	-

Cable type [1]	Power Connecting Cable M12-90/M12-90
Permitted ambient conditions	
Operating temperature	–25 °C to +80 °C With a moving application, a maximum operating temperature of –5 °C to +80 °C is permissible
Transportation/storage temperature	–25 °C to +80 °C
Installation temperature	–5 °C to +80 °C
Resistance to fire	Flame retardant to UL 758 (CSA FT 1)
Resistance to oil	Conditionally resistant
UV resistance	not resistant
Product characteristics	
Halogen-free	no
Silicone-free	yes

[1] Electrical properties at 20 °C, tests according to DIN 47 250, Part 4, or DIN VDE 0472

Article numbers

Power Connecting Cable M12-90/M12-90	Flexible 4-core plug-in power cable, preassembled with A-coded 4-pin M12 plug and A-coded 4-pin M12 socket to supply the ET 200 with 24 V DC.	
	• 0.3 m	6XV1801-5GE30
	• 0.5 m	6XV1801-5GE50
	• 1.0 m	6XV1801-5GH10
	• 1.5 m	6XV1801-5GH15
	• 2.0 m	6XV1801-5GH20
	• 3.0 m	6XV1801-5GH30
	• 5.0 m	6XV1801-5GH50
	• 10 m	6XV1801-5GN10
	• 15 m	6XV1801-5GN15

4.1.5 Robust Power Connecting Cable

Description

The Robust Power Connecting Cable is a 4-wire cable for power supply in the degree of protection IP65/67/69. The preassembled cables have a 4-pin M12 plug at one end and a 4-pin socket at the other (both A-coded). This product is also available by the meter without connectors.

Features and functions

Cable type [1]	**Robust Power Connecting Cable**
Areas of application	Cable for power supply for use in in the food and beverages industry.
Design of the preassembled fiber-optic cable	Preassembled with 4-pin M12 male connector/female connector each (A-coded, 90° cable outlet)
Cable type (standard designation)	LI9YY6Y 4x1x0.75 GR
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
Mechanical data	
Number of electrical conductors	4
Sheath	FEP Ø 5.7 ± 0.2 mm, transparent (inner jacket gray)
Conductor category	5
Maximum tensile load	150 N
Number of bending cycles	500 000, acceleration 4 m/s²
Number of torsion cycles / at torsion by ± 180° on 1 m cable length	1 000 000
Electrical data	
Operating voltage (rms value)	300 V
Continuous current of the power cores	4.5 A
Permitted ambient conditions	
Operating temperature	-40 °C to +80 °C
Transportation/storage temperature	-40 °C to +80 °C
Installation temperature	-40 °C to +80 °C
Resistance to fire	Flame retardant to IEC 60332-1-2
Resistance to oil	Resistant according to DIN EN 60811-404 (7x24h/90 °C)
UV resistance	Resistant according to UL 2556 Sec. 4.2.8.5
Product characteristics	
Halogen-free	No
Silicone-free	Yes
Degree of protection	IP65/67/69

[1] Electrical properties at 20 °C, tests according to DIN 47 250, Part 4, or DIN VDE 0472

Article numbers

Robust Energy Cable	4-wire cable for the power supply, sold by the meter	6XV1801-2A
Robust Power Connecting Cable	4-wire cable for the power supply, preassembled with an M12 plug and an M12 socket (both A-coded) in the degree of protection IP69	
	• 1.0 m	6XV1801-5AH10
	• 2.0 m	6XV1801-5AH20
	• 3.0 m	6XV1801-5AH30
	• 5.0 m	6XV1801-5AH50

4.2 Cable connectors

4.2.1 Power Plug Pro

Description

The IE Power Plug PRO is 5-pin power plug-in connector that can be fitted in the field for on-site assembly. The plug-in connector is used for the 2 x 24 V power supply for SCALANCE X-200IRT PRO switches and the SIMATIC ET200pro. The Energy Cable 5 x 1.5 is assembled with the plug-in connector.

The silicone-free design allows it to be used in the automobile industry, for example in paint spraying lines.



Features and functions

Connection type	IE power plug PRO
Standards, approvals	
• RoHS conformity	Yes
• UL approval	yes
Interfaces	
Number of electrical connectors for network components / end devices	1
Version for network components or end devices	Power contacts (push-pull housing)
Feed-out to cable	integrated spring contacts for 5-wire power cables
Cable outlet	180°
Housing material	Plastic
Permitted ambient conditions	
Operating temperature	-40 °C to +70 °C
Transportation/storage temperature	-40 °C to +70 °C
IP degree of protection	IP 65/67
Silicone-free	yes

Article number

IE Power Plug PRO	5-pin power plug-in connector for on-site assembly with push-pull device connection 1 pack of 1	6GK1907-0AB11-6AA0

4.2.2 7/8" plug-in connector

Description

The 7/8" plug-in connector is a 5-pin plug-in connector that can be fitted in the field for on-site assembly. The plug-in connector is used for the power supply of PROFIBUS nodes (e.g. SIMATIC ET 200) with degree of protection IP65. The energy cable 5x1.5 is assembled with the plug-in connector.



The 7/8" plug-in connector is available in the following versions:

- Pin insert
  For feeding in the supply voltage
- Socket insert
  For looping through the supply voltage

Features and functions

Connection type	**7/8" plug-in connector**
Standards, approvals	
• RoHS conformity	Yes
• UL approval	no
Interfaces	
Number of electrical connectors for network components / end devices	1
Version for network components or end devices	7/8" plug (socket insert or pin insert)
Feed-out to cables	Screw terminal
Cable outlet	180°
Housing material	Plastic
Permitted ambient conditions	
Operating temperature	-40 °C to +70 °C
Transportation/storage temperature	-40 °C to +80 °C
IP degree of protection	IP 65/67
Silicone-free	yes

Article numbers

7/8" plug-in connector	Plug-in connector with axial cable outlet for field preassembly for ET 200, 5-pin, metal housing	
	Pin insert 1 pack of 5	6GK1905-0FA00
	Socket insert 1 pack of 5	6GK1905-0FA00

4.2.3 Power M12 plug Pro

Description

The Power M12 Plug PRO is a 4-pin A-coded M12 power plug-in connector for connection to the energy cable 2 x 0.75.

The Power M12 Plug PRO is suitable for connection to power supply PS791-1PRO for 24 V DC power supply.



Features and functions

Connection type	**Power M12 plug PRO**
Standards, approvals	
• RoHS conformity	Yes
• UL approval	no
Interfaces	
Number of electrical connectors for network components / end devices	1
Version for network components or end devices	M12 connector plug (pin insert, A-coded, 4-pin)
Feed-out to cable	integrated screw contacts for 2-wire power cables
Cable outlet	180°
Housing material	Plastic
Permitted ambient conditions	
Operating temperature	-40 °C to +70 °C
Transportation/storage temperature	-40 °C to +80 °C
IP degree of protection	IP 65/67
Silicone-free	yes

Article number

Power M12 Plug PRO	Plug-in connector for connection to power supply PS791-1 PRO; 4-pin, A-coded 1 pack of 3	6GK1907-0DB10-6AA3

4.3 Power supply

4.3.1 Power supply PS791-1PRO

Description

The power supply PS791-1PRO is an AC/DC power supply unit for input voltages of 90 to 265 VAC for all SCALANCE products. The metal housing provides protection from water and dust with a degree of protection IP65.



Figure 4-1 Power supply PS791-1PRO

The following options are available for mounting the power supply PS791-1PRO:

- Directly on the SCALANCE W700 devices and SCALANCE X200 devices
- Wall
- S7-300 standard rail

The M12 power cord supplied with the products can be used to connect the M12 socket X2 with SCALANCE W-700 PRO and SCALANCE X-200 PRO. Alternatively, a self-assembled cable can be used.

Overview

	Power supply PS791-1PRO
Standards, approvals	
• RoHS conformity	Yes
• UL approval	Yes
Interfaces	
Type of electrical connection	
• At the input	AC Power 3+PE Cable Connector for AC 100-240V power supply
• At the input	Power M12 Plug PRO or Power Cord M12 for 24 VDC output voltage

	Power supply PS791-1PRO
Design of the control elements	On/off switch
Electrical data	
Input voltage	90 to 265 VAC at 47 Hz to 63 Hz
Output voltage	24 VDC, +-7%, 0.42 A
Output power	10 W
Network disruption	Bypass min. 20 ms 230 VAC
Permitted ambient conditions	
Operating temperature	–20 °C to +60 °C
Transportation/storage temperature	–40 °C to +85 °C
Installation temperature	–40 °C to +85 °C
Degree of protection	IP65

Article numbers

Power Supply PS791-1PRO	AC/DC power supply unit for input voltages from 90 to 265 VAC for numerous SCALANCE products in degree of protection IP65	6GK5791-1PS00-0AA6
AC Power 3+PE Cable Connector	Connecting socket for connecting the power supply PS791-1PRO to an AC power supply 1 pack of 5	6GK1 907-0FC10-0AA5

4.3.2 Power M12 cable connector PRO

Description

The Power M12 Cable Connector PRO is a 4-pin M12 power connection socket that can be assembled on site. The connection socket is used for the 24 V DC power supply of the devices SCALANCE X208PRO and SCALANCE W788-x PRO.



Figure 4-2 Power M12 cable connector PRO

Features and functions

	Power M12 cable connector PRO
Standards, approvals	
• RoHS conformity	Yes
• UL approval	yes
Interfaces	
Number of electrical connectors for network components / end devices	1
Version for network components or end devices	M12 plug (socket insert, A-coded, 4-pin)
Cable outlet	180°
Housing material	Plastic
Permitted ambient conditions	
Operating temperature	-40 °C to +70 °C
Transportation/storage temperature	-40 °C to +80 °C
IP degree of protection	IP 65/67
Silicone-free	yes

Article number

Power M12 Cable Connector PRO	Connection socket for connection of SCALANCE W-700/X208PRO for 24 V DC power supply, 4-pin, A-coded 1 pack of 3	6GK1907-0DC10-6AA3

4.3.3 7/8" Power T-Trap PRO

Description

The plug-in connector consists of two 7/8" socket inserts and a 7/8" pin insert, both 5-pin.

The 7/8" Power T-Trap PRO is used for power supply and power distribution to ET200pro modules.



Figure 4-3 7/8" Power T-Trap PRO

Features and functions

	7/8" Power T-Trap PRO
Standards, approvals	
• RoHS conformity	Yes
• UL approval	no
Interfaces	
Number of electrical connections for network components / end devices	3
Version for network components or end devices	7/8" plug-in connector (2x socket insert, 1x pin insert)
Cable outlet	180°
Housing material	Metal
Permitted ambient conditions	
Operating temperature	-40 °C to +70 °C
Transportation/storage temperature	-40 °C to +80 °C
IP degree of protection	IP 65/67
Silicone-free	yes

Article number

7/8" Power T-Trap PRO	Power T piece for ET 200 with two 7/8" socket inserts and one 7/8" pin insert. 1 pack of 5	6GK1905-0FC00

4.3.4 Signaling contact M12 cable connector PRO

Description

The signaling contact M12 cable connector PRO is a 5-pin M12 cable connector that is B-coded for the signaling contact. The component has degree of protection IP65 and is used with the SCALANCE X208PRO.



Features and functions

	Signaling contact M12 cable connector PRO
Standards, approvals	
• RoHS conformity	Yes
• UL approval	no
Interfaces	
Number of electrical connectors for network components / end devices	1
Version for network components or end devices	M12 connecting plug (socket insert, B-coded, 4-pin)
Cable outlet	180°
Housing material	Plastic
Permitted ambient conditions	
Operating temperature	-40 °C to +70 °C
Transportation/storage temperature	-40 °C to +80 °C
IP degree of protection	IP 65/67
Silicone-free	yes

Article number

Signaling contact M12 cable connector PRO	Connection socket for connection of SCALANCE X208PRO for signaling contact, 5-pin, B-coded with assembly instructions 1 pack of 3	6GK1908-0DC10-6AA3

Instructions for fitting connectors, attachments and devices

5

5.1 Note on the installation instructions

This section contains installation instructions for several of the most common components.

You will find more detailed information in the documentation accompanying the particular product.

5.2 Industrial Ethernet FastConnect Stripping Tool

The section describes how to use the IE FC stripping tool.

Note the instructions in the instructions for use that accompany the IE FC stripping tool.

⚠ CAUTION
Improper use The IE FC stripping tool is only approved for the stripping of SIMATIC NET Industrial Ethernet FastConnect cables. If used for other purposes, this can cause accidents or destroy the tool and cable. • Use the IE FC stripping tool solely to strip the IE FC cables. • Make sure before stripping that the affected cable is not under voltage.

Requirement for the qualification of the personnel.

In the sense of these operating instructions or warning notices, qualified personnel are people familiar with the setting up, installation, commissioning and operation of the product and who have suitable qualification for their activities and have been trained in first aid.

IE FC stripping tool

With the IE FC stripping tool the outer jacket and shield of IE FC cables can be stripped to the correct length. The IE FC cable prepared in this way is connected via insulation displacement contacts to the plug or the outlet. For the IE FC stripping tool, there are two blade cassettes with different knife distances. The IE FC stripping tool is supplied with a yellow blade cassette.

Note

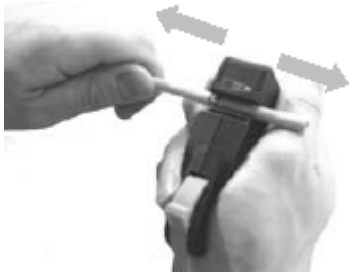
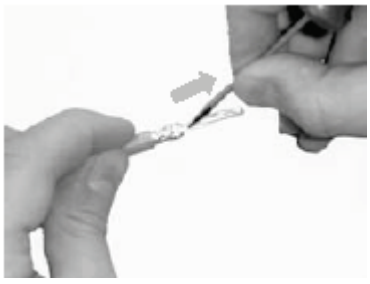
Notes on using the IE FC stripping tool

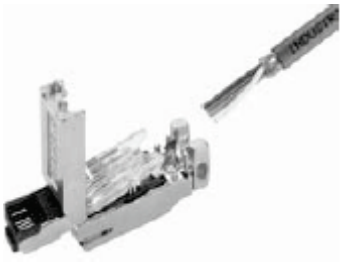
- The insulation piercing contacts of the plug or outlet can be released and recontacted up to 10 times.
- Once the ends of cables have made contact, do not make contact with them again but cut them off.
- Replace the knife cassette if the cut is not clean or after stripping approximately
  - 1500 operations on cables with a PVC outer jacket
  - 150 cable on line with PUR outer jackets.

Article numbers

IE FC Stripping Tool	Preset insulation stripping tool for stripping of IE FC cables	6GK1901-1GA00
IE FC blade cassettes (5 mm), green	Blade cassette with a knife distance of 5 mm for: • IE FC RJ-45 plugs (6GK1901-1BB....) • IE FC modular outlet (6GK1901-1B....) 1 pack of 5	6GK1901-1GB01
IE FC blade cassettes (12 mm), yellow	Blade cassette with a knife distance of 12 mm for: • IE FC outlet RJ-45 (6GK1901-1FC00-0AA0) • ELS TP40 and ELS TP40M (6GK1102-6A...) • RJ-45 pug-in connector from the HARTING company 1 pack of 5	6GK1901-1GB00

Procedure

		
Fit the required blade cassette in the stripping tool. If necessary, adjust the cutting depth of the knife cassette using the center Allen screw.	Measure the cable length against the measuring template. Use your left index finger as the limit stop.	Place the measured end of the cable in the stripping tool. The index finger of your left hand is used as a limit stop.
		
Clamp the stripping tool as far as it will go.	To strip the insulation, turn the tool in the direction of the arrow 4 times for the PVC insulation or 8 times for PUR insulation.	Keeping the it closed, pull the stripping tool with jacket and remnants of the shield off the end of the cable.
		
After releasing the tool, remove the remnants remaining in the tool.	If the white filler was not removed off when you stripped the cable, remove the rest by pulling it with your hand.	Score the protective foil between the wires with a screwdriver so that it is easier to remove.

		
Pull the protective foil off the wires.	For assembling the cable, follow the assembly instructions accompanying your plug or outlet.	Replace the knife cassette after approximately: • 1500 operations on cables with PVC outer jackets • 150 cables with PUR outer jackets

5.3 Electrical networks

5.3.1 Fitting IE FC cable 2 x 2 with an IE FC RJ-45 plug 180 2x2

The individual steps required to pre-assemble a 4-wire IE FC cable and an IE FC RJ45 Plug 180 are explained below.

Note

Fitting the IE FC RJ-45 plug 90 and the IE FC RJ-45 plug 145

The figures show the installation of an IE FC RJ45 Plug 180. Installation of the IE FC RJ45 Plug 145 and the IE FC RJ45 Plug 90 is carried out analogously.

Refer to the information in this section "Industrial Ethernet FastConnect stripping tool (Page 147)" and the installation instructions for the plug.

Note

Instructions for assembly

- The insulation-piercing contacts of the IE FC RJ-45 plug can be released and recontacted up to 10 times.
- Once the ends of cables have made contact, do not make contact with them again but cut them off.
- Do not pull on the plug when releasing it.
- To assemble a cable with crossed over wires, connect the color-coded wires at one end of the cable in the connector as shown below:
  - connect white with yellow
  - connect blue with orange

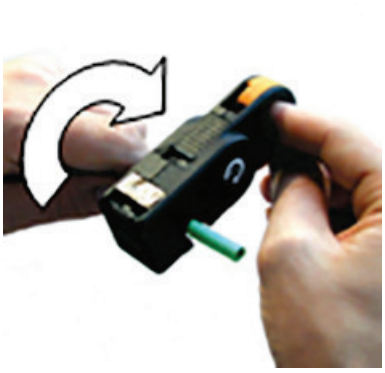
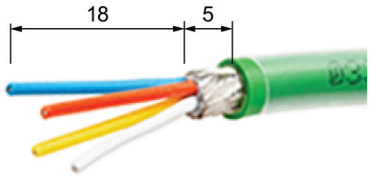
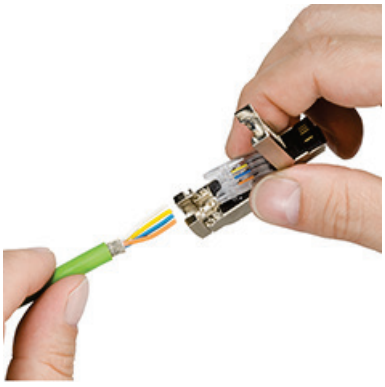
Connector pinout

With the four integrated insulation piercing contacts, establishing contact with the FC cable variants is simple and error-proof. With the casing open, colored markers on the contact cover make it simple to connect the cores to the insulation piercing contacts. The transparent synthetic material of the contact cover allows the user to check the contacts at any time.

Pins of RJ-45	Wire color	Signal on switch	Signal on end device
1	Yellow	RX+	TX+
2	Orange	RX-	TX-
3	White	TX+	RX+
6	Blue	TX-	RX-

Procedure

		
Fit the required blade cassette in the stripping tool, use the green knife cassette (5.1 mm). If necessary, adjust the cutting depth of the knife cassette using the center Allen screw.	Place the cable on the measuring template. Use your left index finger as the limit stop.	Place the cable in the stripping tool. The index finger of your left hand is the limit stop. Tighten the stripping tool.

		
To strip the insulation, turn the tool in the direction of the arrow 4 times for the PVC insulation or 8 times for PUR insulation.	Keeping the it closed, pull the stripping tool with jacket and remnants of the shield off the end of the cable.	Remove the remaining white filler and the transparent protective foil with your fingers. Cut off the dummy cores. **Note:** If a core is damaged, the section of cable must be cut off and stripped again.
		
Spread out the cores according to their colors on the contact elements of the plug.	Insert the cores as far as they will go into the contact elements of the plug. Check that the cores are seated correctly in the wire guide slots.	Press the contact elements down as far as the limit stop.

		
Close the housing of the plug. Insert a 2.5 mm screwdriver into the hole in the locking mechanism and continue turning it until it stops.	**Correct interlock**: The opening of the locking mechanism faces the side, and the side edges are flush with the connector.	

5.3.2 Fitting IE FC cable 2 x 2 with an IE FC RJ-45 plug PRO

The individual steps required to assemble a 4-wire IE FC cable and an IE FC RJ45 Plug Pro are explained below.

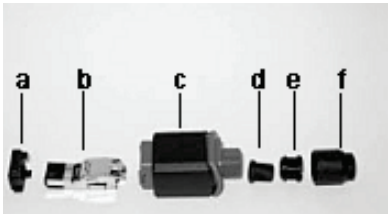
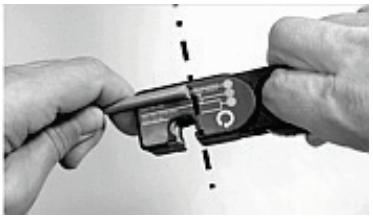
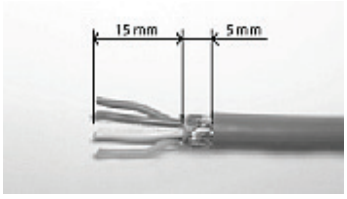
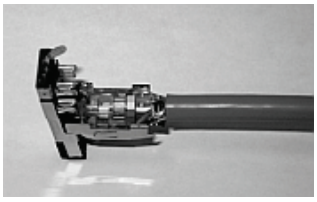
Refer to the information in this section "Industrial Ethernet FastConnect stripping tool (Page 147)" and the installation instructions for the plug.

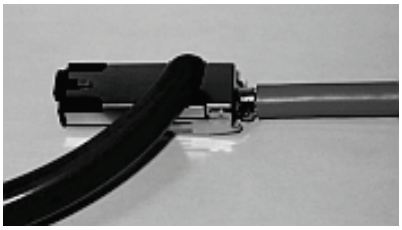
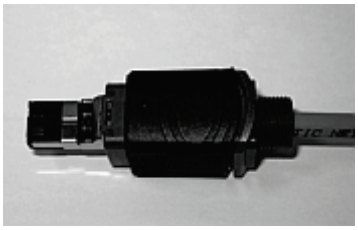
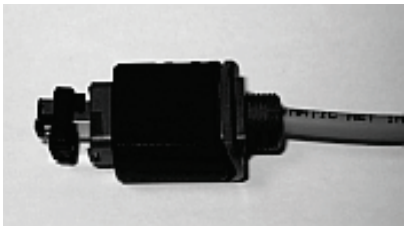
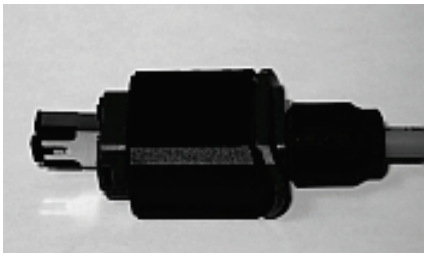
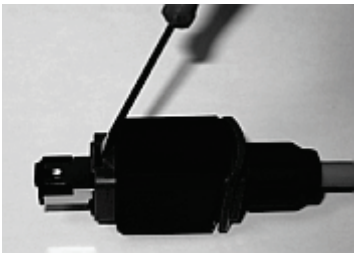
Note

Instructions for assembly

- The insulation-piercing contacts of the IE FC RJ-45 plug Pro can be released and recontacted up to 10 times.
- Once the ends of cables have made contact, do not make contact with them again but cut them off.
- Do not pull on the plug when releasing it.
- To assemble a cable with crossed over wires, connect the color-coded wires at one end of the cable in the connector as shown below:
  - connect white with yellow
  - connect blue with orange

Procedure

<table>
<tr>
<td>
</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The IE FC RJ45 plug PRO consists of:
a - Catch
b - Contact holder
c - Casing
d - Seal
e - Sealing ring
f - Forcing nut</td>
<td>Fit the required blade cassette in the stripping tool, use the yellow knife cassette (12 mm).
If necessary, adjust the cutting depth of the knife cassette using the center Allen screw.</td>
<td>Place the cable on the measuring template.
Use your left index finger as the limit stop.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Place the cable in the stripping tool. The index finger of your left hand is the limit stop.
Tighten the stripping tool.</td>
<td>To strip the insulation, turn the tool in the direction of the arrow 4 times for the PVC insulation or 8 times for PUR insulation.</td>
<td>Remove the cable sheath, the shield and the white filler with your hand.</td>
</tr>
<tr>
<td>
</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cut back the wires to a length of 15 mm and + 5 mm shield.</td>
<td>Push the parts a to d onto the cable in the order shown.</td>
<td>Open the cover of the contact holder (b).
Place the wires in the guide slots according to the colored markers on the contact holder.
Align the cable so that the shield lies between the shield clips of the contact holder.</td>
</tr>
</table>

		
Contact the wires by pressing down the cover with a tool or hard object.	Push the contact holder into the casing. Make sure that the contract holder is in the correct position.	Push the catch onto the casing.
		
Slide the seal, the sealing ring and the forcing nut in the direction of the casing. Tighten the forcing nut clockwise.	**Opening the plug:** Press back the catch, for example with a slotted screwdriver so that the contact holder can be taken out. Loosen the forcing nut.	Pull back the seal and sealing ring. Turn and open the forcing nut. Push back the sealing ring, the seal and the forcing nut. You can now remove the contact holder.

5.3.3 Fitting an IE FC cable 2 x 2 with an IE RJ-45 plug PRO

The individual steps required to pre-assemble a 4-wire IE FC cable and an IE RJ45 Plug Pro are explained below.

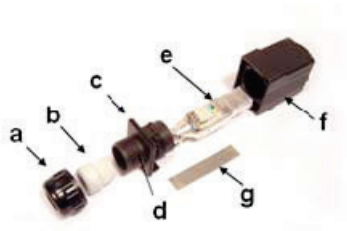
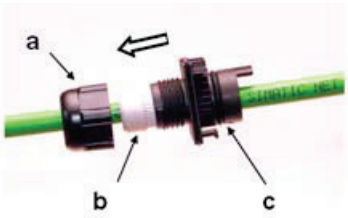
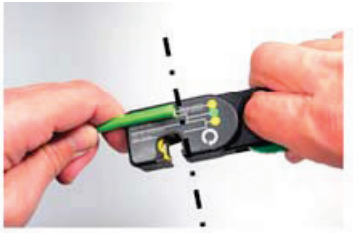
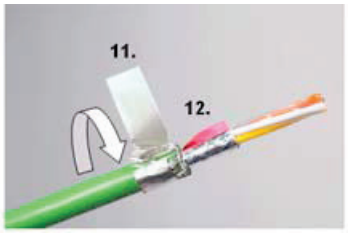
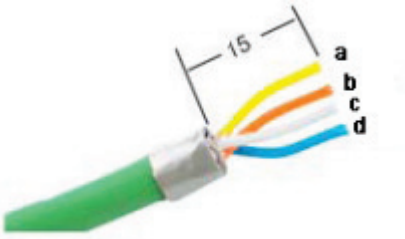
Refer to the information in this section "Industrial Ethernet FastConnect stripping tool (Page 147)" and the installation instructions for the plug.

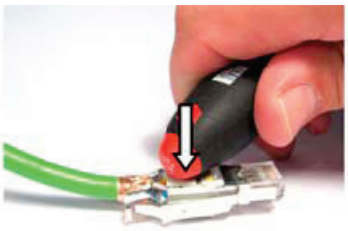
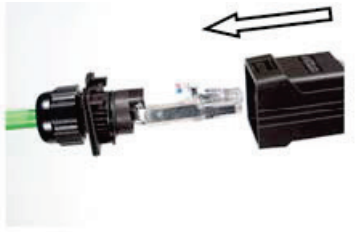
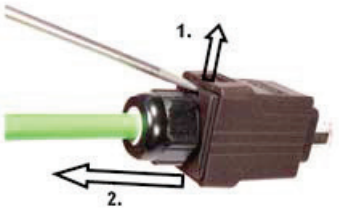
Note

Instructions for assembly

- The insulation-piercing contacts of the IE RJ-45 plug Pro can be released and recontacted up to 10 times.
- Once the ends of cables have made contact, do not make contact with them again but cut them off.
- Do not pull on the plug when releasing it.
- To assemble a cable with crossed over wires, connect the color-coded wires at one end of the cable in the connector as shown below:
  - connect white with yellow
  - connect blue with orange

Procedure

		
The IE RJ45 Plug Pro consists of: a: Forcing nut b: Sealing ring c: Rear wall d: Latch e: Contact holder f: Casing g: Metal foil	Release the forcing nut (a) and the sealing ring (b) from the rear (c) of the connector. Slide the forcing nut (a), the sealing ring (b) and the back wall (c) loosely over the cable.	Fit the required blade cassette in the stripping tool, use the yellow knife cassette (12 mm). If necessary, adjust the cutting depth of the knife cassette using the center Allen screw.
		
Place the cable on the measuring template. Use your left index finger as the limit stop.	Place the cable in the stripping tool. The index finger of your left hand is the limit stop. Tighten the stripping tool.	To strip the insulation, turn the tool in the direction of the arrow 4 times for the PVC insulation or 8 times for PUR insulation.
		
Remove the cable sheath, the shield and the white filler with your hand.	Turn back the braid over the cable sheath and secure it with the supplied adhesive metal cable foil. Remove the exposed foil shield and white filler below it.	Arrange the wires according their colors: a: Yellow b: Orange c: White d: blue Cut back the wires to a length of 15 mm.

		
Open the cover of the contact holder. Place the wires in the guide slots according to the colored markers on the contact holder.	Contact the wires by pressing down the cover with a tool or hard object. Align the cable so that the shield foil lies between the shield clips of the contact holder.	Push the sealing ring into the rear wall and screw the forcing nut over it loosely. Turn the rear wall so that the latch is on the same side as the RJ-45 release catch. Push the contact holder into the rear wall as far as the limit stop. The limit stop must not jut out over the cover of the contact holder.
		
Secure the position of the contact holder by tightening the forcing nut. Push the housing over the contact holder. The latch of the rear wall must be on the same side as the labeling of the casing.	Press the rear wall into the housing until it clicks into place audibly. Avoid pressing on the seal around the rear wall. Tighten the forcing nut completely.	**Opening the plug:** 1. To open the plug, lever the catch in the housing towards the side wall with a slotted screwdriver. 2. Pull the rear wall out of the housing by the cable while holding down the screwdriver.

5.3.4 Fitting IE FC cable 2 x 2 with an IE FC RJ-45 plug 180 4x2

The individual steps required to pre-assemble a 4-wire IE FC cable and an IE RJ45 Plug 180 4x2 are explained below.

Refer to the information in this section "Industrial Ethernet FastConnect stripping tool (Page 147)" and the installation instructions for the plug.

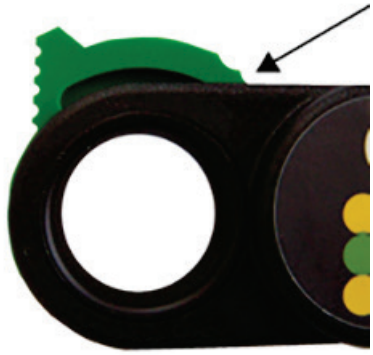
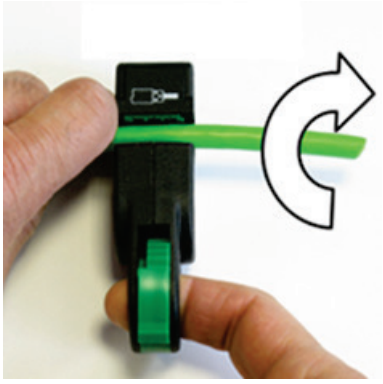
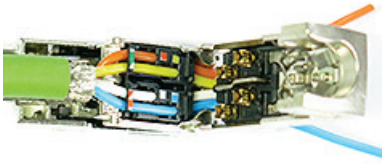
Note

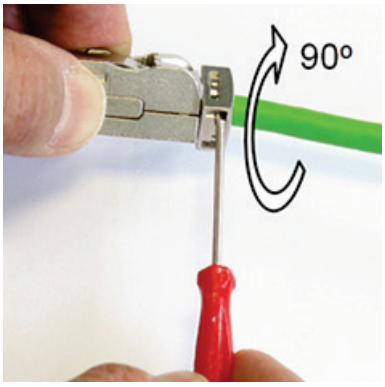
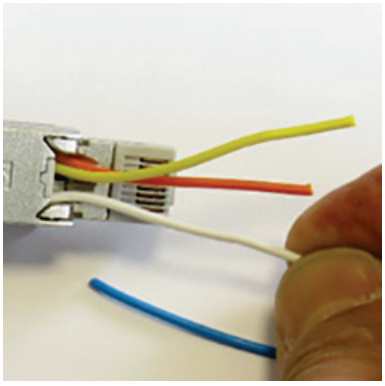
Instructions for assembly

- The insulation piercing contacts of the IE FC RJ45 Plug 4x2 can be released and re-contacted up to 10 times with the same cable cross-section.
- Once the ends of cables have made contact, do not make contact with them again but cut them off.
- Do not pull on the plug when releasing it.
- To assemble a cable with crossed over wires, connect the color-coded wires at one end of the cable in the connector as shown below:
  - connect white with yellow
  - connect blue with orange

Procedure

		
Fit the green knife cassette (6GK1901-1GB01) with 5.1 mm knife distance in the stripping tool. If necessary, adjust the cutting depth of the knife cassette using the center Allen screw.	Measure approx. 10 cm from the cable. Use your left index finger as the limit stop.	Place the cable in the stripping tool. The index finger of your left hand is the limit stop. Make sure that a length of approximately 10 cm is stripped.

		
Clamp the cable with the stripping tool by pressing the lever fully forward.	To strip the insulation, turn the tool in the direction of the arrow 4 times for the PVC insulation or 8 times for PUR insulation. Keeping the stripping tool closed, pull the remnants of the sheath and shield off the end of the cable.	Fan out the wires and cut off the filler as close as possible to the shield braid. Make sure that the ends are not crushed. **Note:** If a core is damaged, the section of cable must be cut off and stripped again.
		
If subsequent cutting is required, cut off the yellow and white wires 10 mm shorter than the other ones.	Open the housing of the plug. Insert the wires according to the colors into the plug (see frame). Make sure the cable shield is connected to the shield contacts and the sheath to the strain relief mandrel of the plug. **Note:** Tweezers can be used to thread the wires into the wire guide slits.	Press the upper and lower housing covers together. In order to ensure that the wires in the connector contact properly, press the connector housing in the middle by means of pliers. Make sure that you do not put any pressure on the latch spring in order to not damage them.

		**Note**: Once the connector has been fitted to a cable it may no longer be fitted to cables with a different cable cross-section.
Turn the locking mechanism with your hand as far as possible in the direction of the arrow. Insert a screwdriver (2.5 mm) into the slit in the locking mechanism and turn it as far as the limit stop. **Correct interlock**: The opening of the locking mechanism faces the side, and the side edges are flush with the connector.	Pull the excess wires off the plug.	

5.3.5 Fitting an IE FC cable 4 x 2 with an IE FC RJ-45 plug 180 4x2

The individual steps required to pre-assemble an 8-wire IE FC cable and an IE RJ45 plug 180 4x2 are explained below.

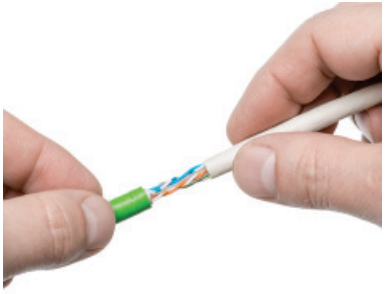
Refer to the information in this section "Industrial Ethernet FastConnect stripping tool (Page 147)" and the installation instructions for the plug.

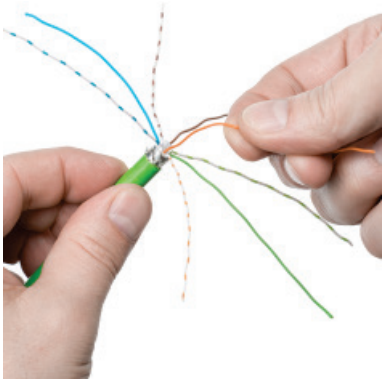
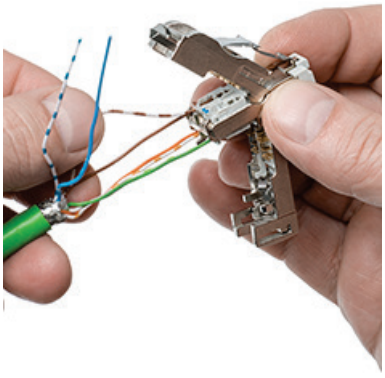
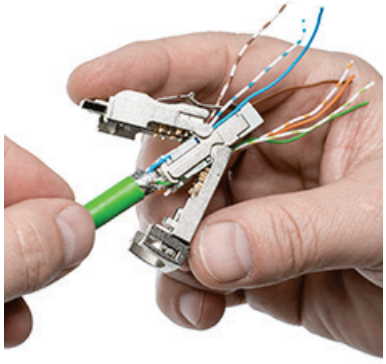
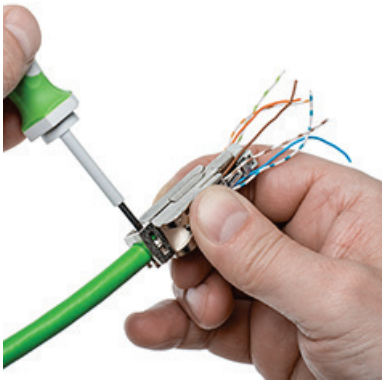
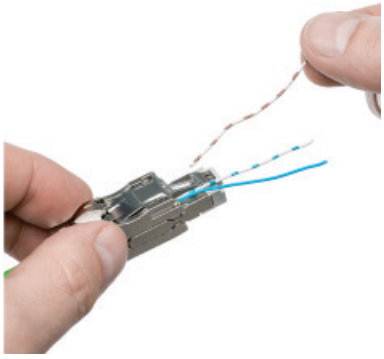
Note

Instructions for assembly

- The insulation piercing contacts of the IE FC RJ45 Plug 4x2 can be released and re-contacted up to 10 times with the same cable cross-section.
- Once the ends of cables have made contact, do not make contact with them again but cut them off.
- Do not pull on the plug when releasing it
- To assemble a cable with crossed over wires, connect the color-coded wires at one end of the cable in the connector as shown below:
  - Connect orange-white with green-white
  - Connect orange with green
  - Connect brown-white with blue
  - Connect brown with blue-white

Procedure

		
Fit the required blade cassette in the stripping tool, use the green knife cassette (5.1 mm). If necessary, adjust the cutting depth of the knife cassette using the center Allen screw.	Measure the cable length against the measuring template. Use your left index finger as the limit stop.	Place the cable in the stripping tool. The index finger of your left hand is the limit stop. Tighten the stripping tool.
		
To strip the insulation, turn the tool in the direction of the arrow 4 times for the PVC insulation or 8 times for PUR insulation. Keeping the stripping tool closed, pull the remnants of the sheath and shield off the end of the cable.	Remove the cable sheath, the shield and the white filler with your hand. **Note:** If a core is damaged, the section of cable must be cut off and stripped again.	Cut off the inner cable spacer as close to the shield braid as possible. Also shorten the cable spacer between the two pairs orange/orange-white, green/green-white, and blue/blue-white, brown/brown-white.

		
Spread out the cores according to their colors on the contact elements of the FC RJ-45 plug 180 4x2.	Open the housing of the plug. Insert the core pairs in accordance with the color markings of the contact elements above and below through the contact element. **Note:** Tweezers can be used to thread the wires into the wire guide slits.	Push the contact element on the cable as far as the limit stop. Check the correct course of the wires into the wire guide slots.
		
Close the housing of the plug. Use pliers to this purpose.	Insert a screwdriver (3 mm) into the slit in the locking mechanism and turn it as far as the limit stop.	Cut off the protruding wires off at the contact element.

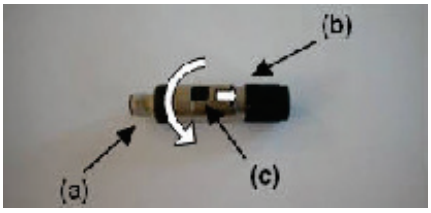
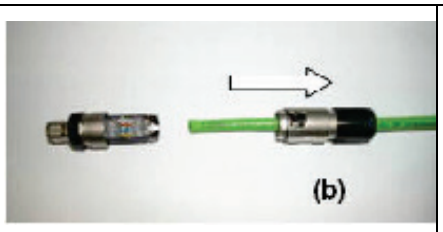
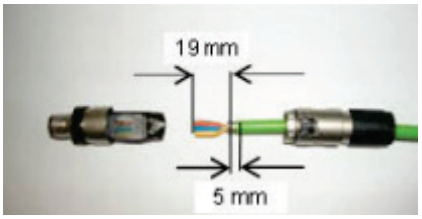
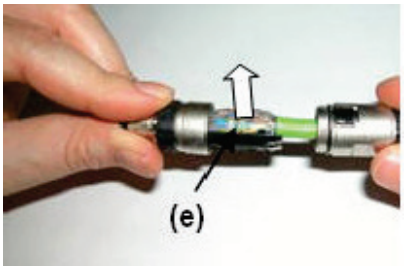
	**Note**: Once the connector has been fitted to a cable it may no longer be fitted to cables with a different cable cross-section.
Correct interlock: The opening of the locking mechanism faces the side, and the side edges are flush with the connector.	

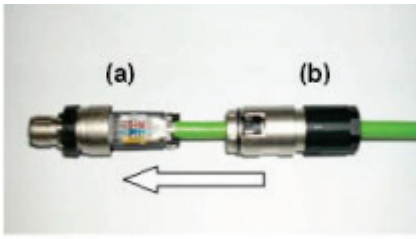
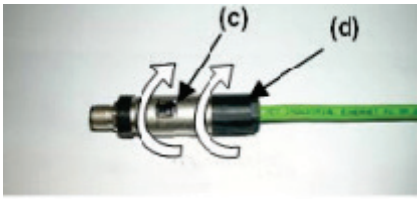
5.3.6 Fitting the IE FC TP cable with an IE FC M12 plug PRO

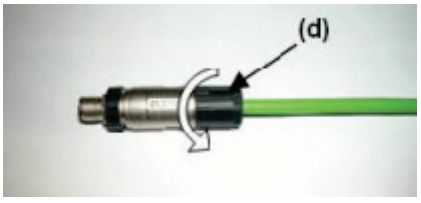
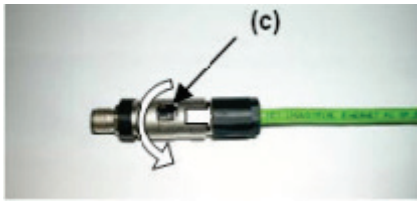
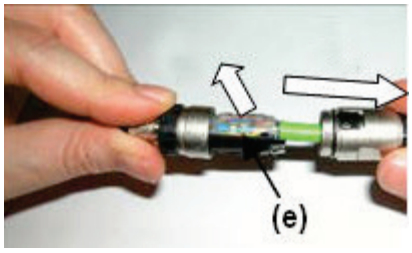
The individual steps required to assemble an IE FC TP cable and an IE FC M12 Plug Pro are explained below.

Note the information in the assembly instructions of the plug.

Procedure

		
The IE FC M12 Plug PRO consists of: a: Front part of connector b: Connector housing c: Catch	Fit the connector housing (b) over the cable.	Strip the cable as shown in the drawing using a suitable stripping tool with the required cutting depth or using the IE Stripping Tool*. * The stripping tool is not suitable for cables other than FC cables.
Press the catch (c) in the direction of the arrow. While holding the catch open, unscrew the connector housing (b) from the front part of the connector (a).		
		
Use the stripping tool 6GK1 901-1GA00 with the green knife cassette 6GK1 901-1GB01. Measure the cable length against the measuring template. The correct length is indicated by the marker with the number 6GK1901-0DB.... **Note:** If the required marks are not available on the stripping tool, make a mark manually 32 mm from the left-hand edge.	Insert the cable. Your index finger acts as the limit stop. Clamp the stripping tool as far as it will go. Turn the tool in the direction of the arrow 4 times for PVC insulation or 8 times for PUR insulation. Remove remnants of the sheath and if necessary nip off the dummy elements.	Open the flap (e) and push the wires according to the colored marking* as far into the holder as they will go. Press down the holder flap (e) until it is fully closed. Make sure that the jacket shield fully covers the shield contact surface. * To create a crossover cable, connect white with yellow and blue with orange at **one** end of the cable.

		**Note** Replace the knife cassette if the cut is not clean or after stripping • 1500 operations on cables with PVC outer jackets • 150 operations on cables with PUR outer jackets The piercing contacts of the IE FC M12 Plug PRO can be released and re-used up to 10 times. Cable ends that have already been pierced must not be used again but must be cut off. Screw the IE FC M12 plug PRO to devices with a torque of 0.6 Nm +/- 0.1.
Push the connector housing (b) up to the front part of the connector (a).	Screw the connector housing and the front of the connector together until the catch (c) locks in position. Screw the pressure nut (d) and the connector housing together with a torque of 1.3 Nm +0.2.	

Dismantling the plug		
		
Release the pressure nut (d).	Press the catch (c) in the direction of the arrow and at the same time unscrew the connector housing from the front part of the connector in an anti-clockwise direction.	Push the connector housing to the back. Open the holder flap (e) of the front of the part connector. To this purpose press the holder through the inserted cable upwards. Remove the cable from the holder (e) and thread the connector housing from the cable.

5.3.7 Installation IE FC Cable 4x2 with an IE FC M12 Plug PRO 4x2

The individual steps required to assemble an IE FC TP Cable 4x2 and an IE FC M12 Plug PRO 4x2 are explained below.

Note the information in the assembly instructions of the plug.

Note

Instructions for assembly

- The insulation piercing contacts of the IE FC M12 Plug PRO 4x2 can be released and re-contacted up to 10 times with the same cable cross-section.
- Once the ends of cables have made contact, do not make contact with them again but cut them off.
- Do not pull on the plug when releasing it

Procedure

		
The IE FC M12 Plug PRO 4x2 consists of: • Front part • Wire manager • Sleeve	In the stripping tool (6GK1901-1GA00), use the green knife cassette (6GK1901-1GB01) with 5 mm knife distance. Measure approx. 10 cm from the end of the cable. Use your left index finger as the limit stop.	Place the cable in the stripping tool. The index finger of your left hand is the limit stop. Clamp the cable with the stripping tool by pressing the lever fully forward up to the second-last position. To strip the insulation, turn the tool in the direction of the arrow 4 times for the PVC insulation or 8 times for PUR insulation.

		
Release and remove the remnants remaining in the stripping tool. The insulating cover of the cable is notched twice.	Remove the cable sheath, the shield and the white filler with your hand. **Note**: If a core is harmed, cut off the piece of cable and cut the cable to length again.	Fan out the cores and cut off the inner cable spacer as close as possible to the shield braid.
		
Twist the wire pairs.	Push the wire pairs through the sleeve.	Make sure that the cable shield is visible.
		
Place the wires in the guides according to the colors.	Slide the front part onto the wire manager. Make sure that the right coding, the arrow symbols on the wire manager and the front part must be located on the same side.	Align the wires to the recesses of the front part.

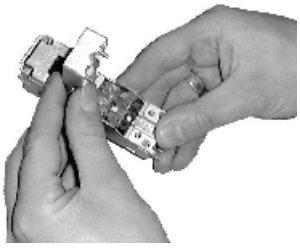
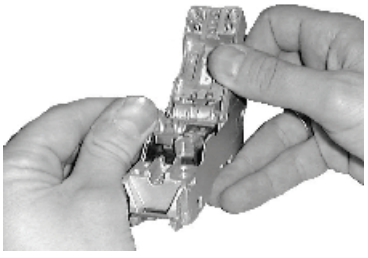
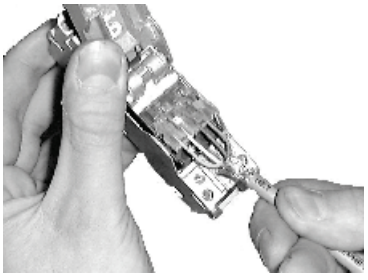
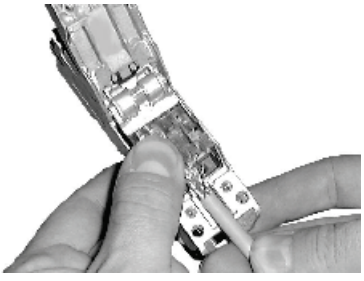
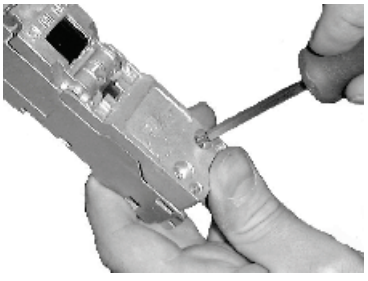
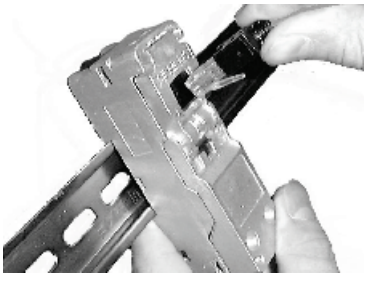
		
Fold in the wing.	Remove the cut wires.	Push the wings to the front, until they lock in place.
		
Push the sleeve onto the front part.	Screw the sleeve to the front part.	There is a defined stop for the threading of the front part and the sleeve. Use two open-ended wrenches with a width of 17 across the flats.
	**Dismantling the plug** Dismantling is carried out in the reverse order to mounting.	

5.3.8 Fitting IE FC outlet RJ-45

The individual steps required to assemble an IE FC cable and an IE FC outlet RJ-45 are explained below.

Note the information in the assembly instructions of the outlet.

Procedure

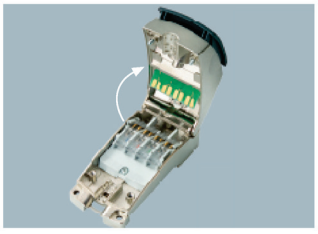
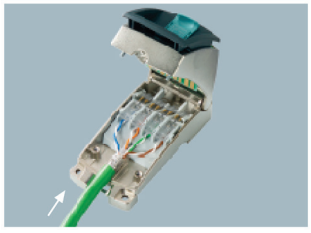
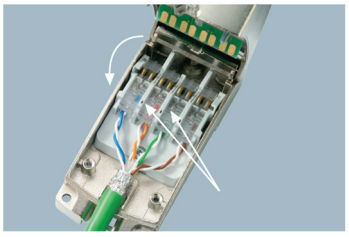
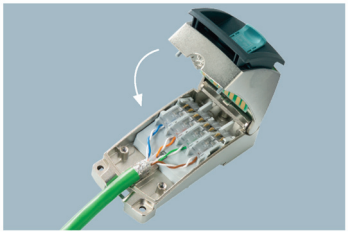
		
Strip the IE FC cable with the IE FC stripping tool; refer to the section "Industrial Ethernet FastConnect Stripping Tool (Page 147)".	Pull the protective foil off the wires. Remove the support elements between the wires.	Spread out the wire pairs according to the colors marked on the contact cover.
		
Open the casing cover of the IE FC outlet RJ-45.	Open both contact covers.	Push the pairs into the contact cover according to the color marking.
		
Press down both contact covers to contact the wires.	Close the housing cover of the FC outlet RJ45 casing and screw down the housing cover.	Connect the end device or the network component using a suitable RJ45 patch cable.

5.3.9 Fitting the IE FC RJ-45 modular outlet

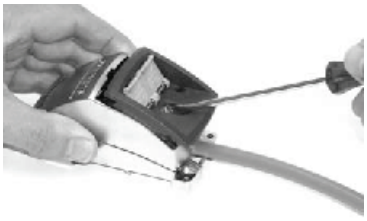
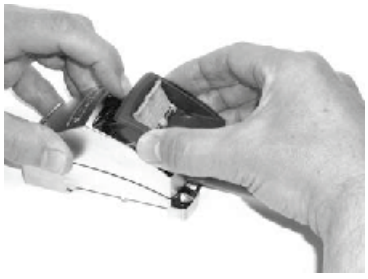
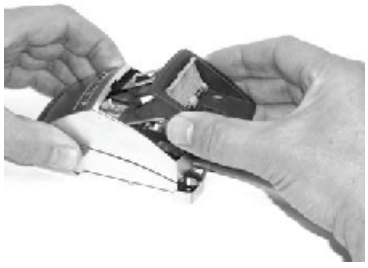
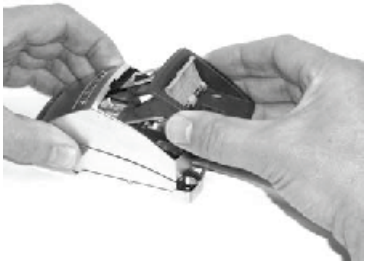
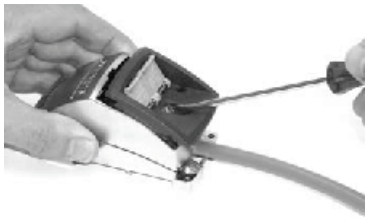
5.3.9.1 Connecting the RJ-45 Modular Outlet

Below, you will see the individual steps in connecting the RJ-45 modular outlet.

Procedure

		
The modular outlet consists of: **a**: Insert **b**: Basic module	Remove the locking screw of the insert. Pull the insert forward as far as the limit stop.	Now release the two cover screws that are now accessible.
		
Lift up the cover of the IE FC RJ-45 modular outlet.	Insert the wires into the contact element of the FC RJ-45 modular outlet as far as the limit stop according to the color markings.	Clamp the placed wires. To this purpose press the connecting terminals until they stop. Make sure that the wires remain in the guide slots.
		
Close the cover.	Tighten the two cover screws. Push the insert into the base model as far as the limit stop. Tighten the securing screw of the insert until the insert is flush with the base module.	

Replacing the insert

		
Remove the locking screw of the insert. Pull the insert forward as far as the limit stop.	Unlock the insert by pressing on the locking spring that is now accessible from above.	Remove the insert completely from the base module.
		
Push the insert into the base model as far as the limit stop.	Tighten the securing screw of the insert until the insert is flush with the base module.	

5.3.9.2 Assembling IE FC TP standard cable 4x2 GP and IE FC RJ-45 modular outlet

The individual steps required to assemble an IE FC TP Standard Cable 4x2 (AWG22) to an IE FC RJ45 Modular Outlet are explained below. Note the information in the assembly instructions of the plug.

To assemble 8-wire FC cables, the following inserts are available:

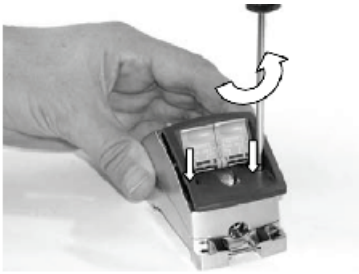
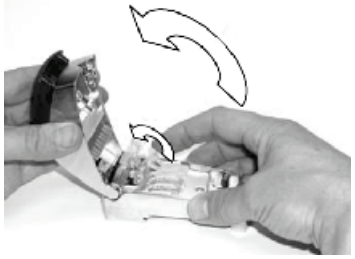
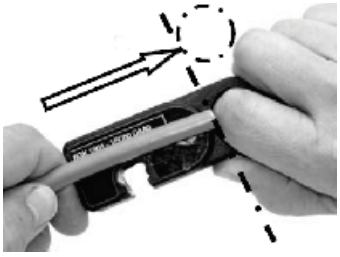
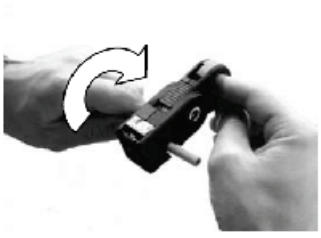
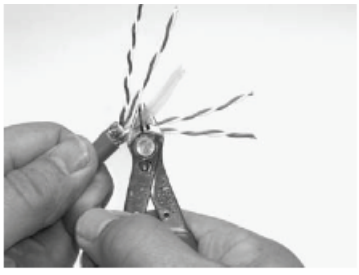
- Insert 2 FE
- Insert 1GE

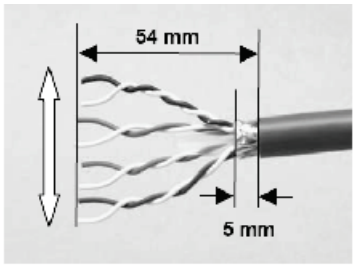
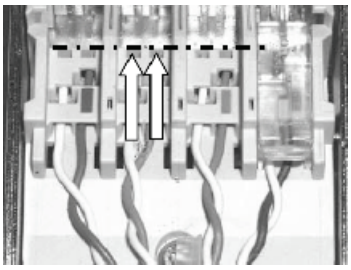
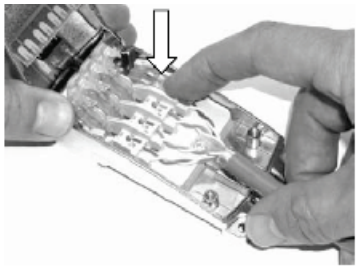
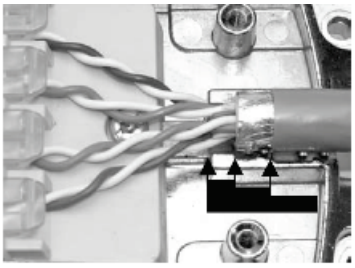
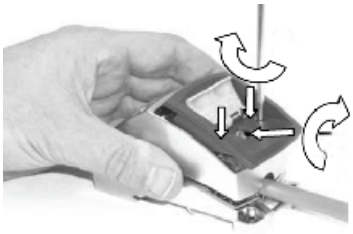
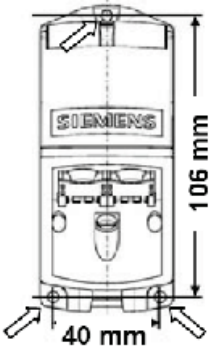
Note

Instructions for assembly

- The IE hybrid cable 2x2 + 4x0.34 6XV1870-2J and 4-wire FC cables (Cat 5) are not suitable for insert 2 FE and insert 1 GE
- The insulation piercing contacts of the IE FC RJ45 Plug 4x2 can be released and re-contacted up to 10 times with the same cable cross-section.
- Once the ends of cables have made contact, do not make contact with them again but cut them off.

Procedure

		
Turn the locking screw of the insert out. Pull the insert forward as far as the limit stop.	Now release the two cover screws that are now accessible.	Fold up the cover of the IE FC RJ45 Modular Outlet. Fold up the 4 connecting terminals of the terminal block.
		
In the stripping tool, use the green knife cassette (5.1 mm). If necessary, adjust the cutting depth of the knife cassette using the middle hexagon socket-head screw.	Measure the cable length against the measuring template. Use your left index finger as the limit stop.	Place the cable in the stripping tool. The index finger of your left hand is the limit stop. Tighten the stripping tool until it latches in the first time (clicking noise).
		
To strip the insulation, turn the tool in the direction of the arrow 4 times for the PVC insulation or 8 times for PUR insulation.	Remove the cable sheath, the shield and the white filler with your hand.	Cut off the central support element.

		
Spread out the wires according to the colors marked on the connecting block of the Modular Outlet. Do not untwist the wires more than is necessary to carry out the connection. Shorten the two center wire pairs so that all the wires end in a line.	Insert the wires according to the colors in pairs into the wire ducts of the insulation displacement connectors until they stop at the rear wall. The wire ends must be visible in the last view of the terminal block.	Clamp the placed wires. To this purpose press the connecting terminals until they stop. Repeat the procedure until all 4 wire pairs are connected.
		
Align the cable so that the shield braid is applied centered in the middle section of the shield collar. Fold the cover down.	Tighten the two cover screws. Turn the insert screw until the insert is flush with the outlet housing.	Place the outlet on a standard DIN rail or screw it onto a plane surface through the 3 housing holes.

5.3.9.3 Fitting IE hybrid cable 2x2 + 4x0.34 and IE FC RJ-45 modular outlet

The individual steps required to assemble an IE Hybrid Cable 2x2 + 4x0.34 to an IE FC RJ45 Modular Outlet are explained below.

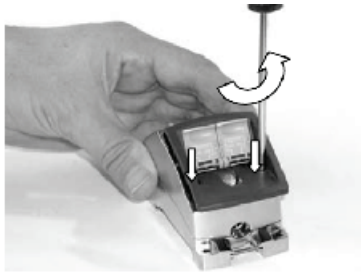
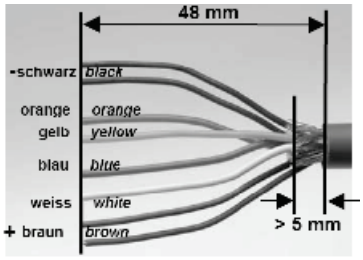
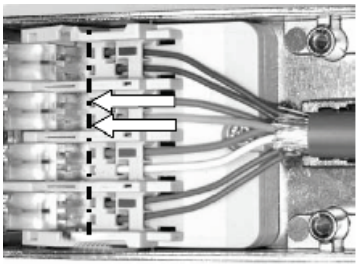
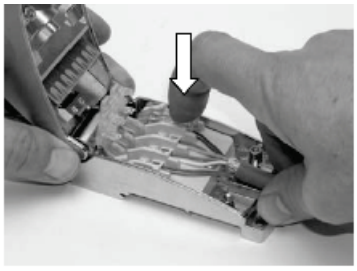
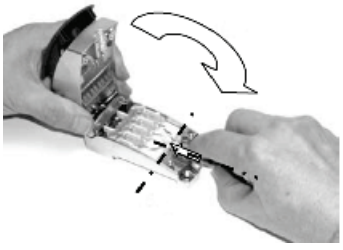
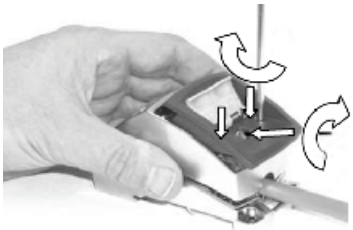
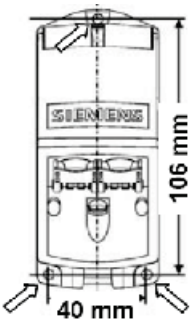
Note the information in the assembly instructions of the plug.

Note

Instructions for assembly

- The IE Hybrid Cable 2x2 + 4x0.34 6XV1870-2J is not suitable for operation with the insert 2FE and insert 1GE.
- The insulation piercing contacts of the IE FC RJ45 Plug 4x2 can be released and re-contacted up to 10 times with the same cable cross-section.
- Once the ends of cables have made contact, do not make contact with them again but cut them off.

Procedure

		
Remove the locking screw of the insert. Pull the insert forward as far as the limit stop.	Now release the two cover screws that are now accessible.	Fold up the cover of the IE FC RJ45 Modular Outlet. Fold up the 4 connecting terminals of the terminal block.
		
Strip the sheath of the IE Hybrid Cable 2x2 + 4x0.34 approx. 55 mm. Shorten the shield of the data wires to approx. 5 to max. 20 mm. Cut off all the dummy wires. Spread out the wires in accordance with the color specifications in the figure above. Cut off all the wires in a straight line at a distance of 48 mm from the cable sheath.	Insert the wires in pairs into the wire ducts of the insulation displacement connectors until they stop at the rear wall according to the colors specified in the figure on the left. **The color markings on the connection block of the Modular Outlet are not relevant for the Hybrid Cable!** The wire ends must be visible in the last view of the terminal block.	Clamp the placed wires. To this purpose press the connecting terminals until they stop. Repeat the procedure until all 4 wire pairs are connected.
		
Align the cable so that the shield braid is applied centered in the middle section of the shield collar. Fold the cover down. Ensure that the power wires do not get out of place are are not jammed in between the side metal webs.	Tighten the two cover screws. Tighten the insert screw until the insert is flush with the casing of the outlet.	Place the outlet on a standard DIN rail or screw it onto a plane surface through the 3 housing holes.

5.3.10 Assembly of Industrial Twisted Pair connectors

5.3.10.1 Assembling Industrial Twisted Pair Connectors

General

To maintain the excellent EMC and transmission characteristics of the twistedpair cabling system, connectors must be fitted with extreme care.

Note the assembly instructions.

How to fit 9pin and 15pin connectors is explained in detail on the following pages.

Note

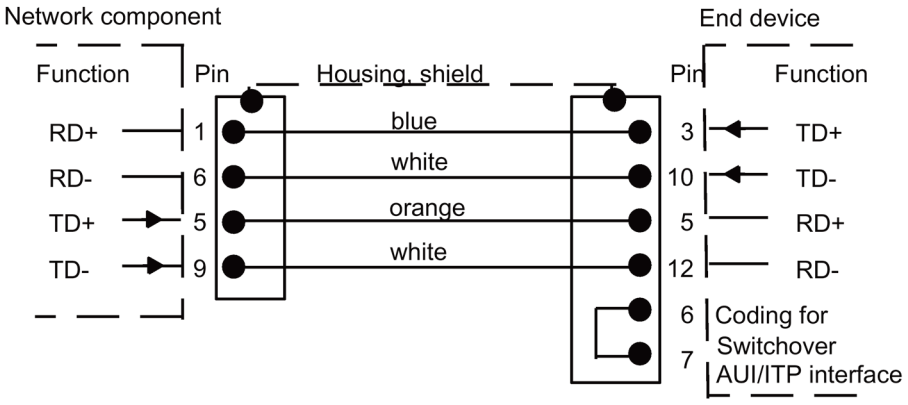
Instructions for assembly

Fit the D-sub plugs for self-assembly only to the ITP standard cable or the ITP FRNC cable. The cable clamp used for contacting the shield is designed for the diameter of this cable.

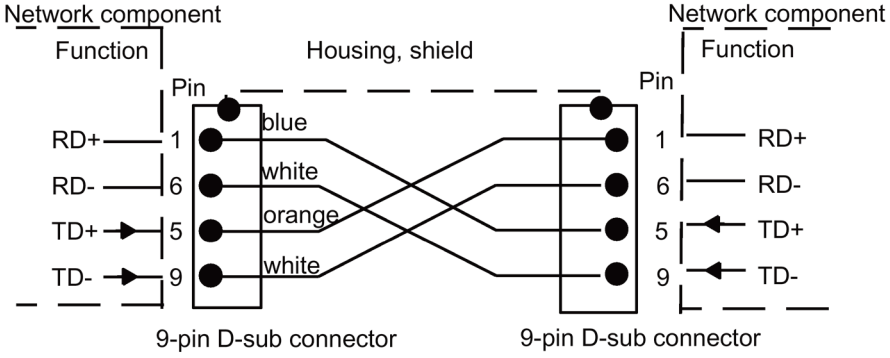
The two ITP cables are not suitable for connection to the IE FC outlet RJ-45, IE FC RJ-45 plug and IE FC RJ-45 modular outlet due to their diameters. Use the FastConnect (FC) twisted pair cables for this.

Connector pinout

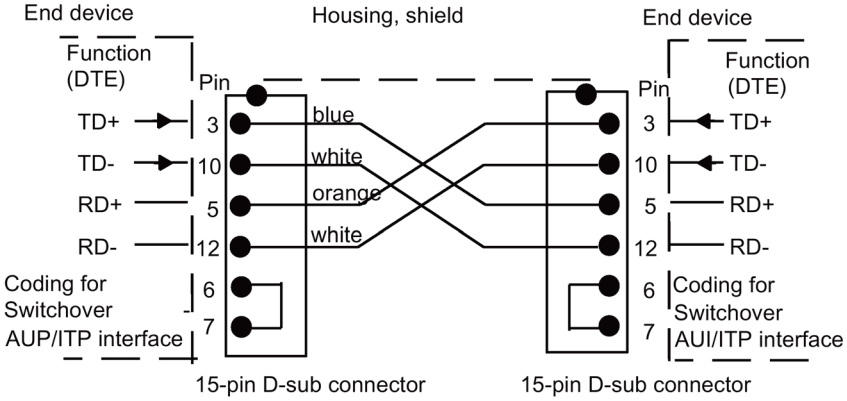
During assembly, the pairs of wires are assigned to the screw terminals. The following figures show the connector pinout:



a) Connector pinout of the ITP Standard Cable 9/15



b) Connector pinout of the ITP XP Standard Cable 9/ 9



c) Connector pinout of the ITP XP Standard Cable 15/15

5.3.10.2 Fitting a 9-pin D-sub plug

9-pin D-sub plug

The figure shows the components of a 9-pin D-sub male connector.

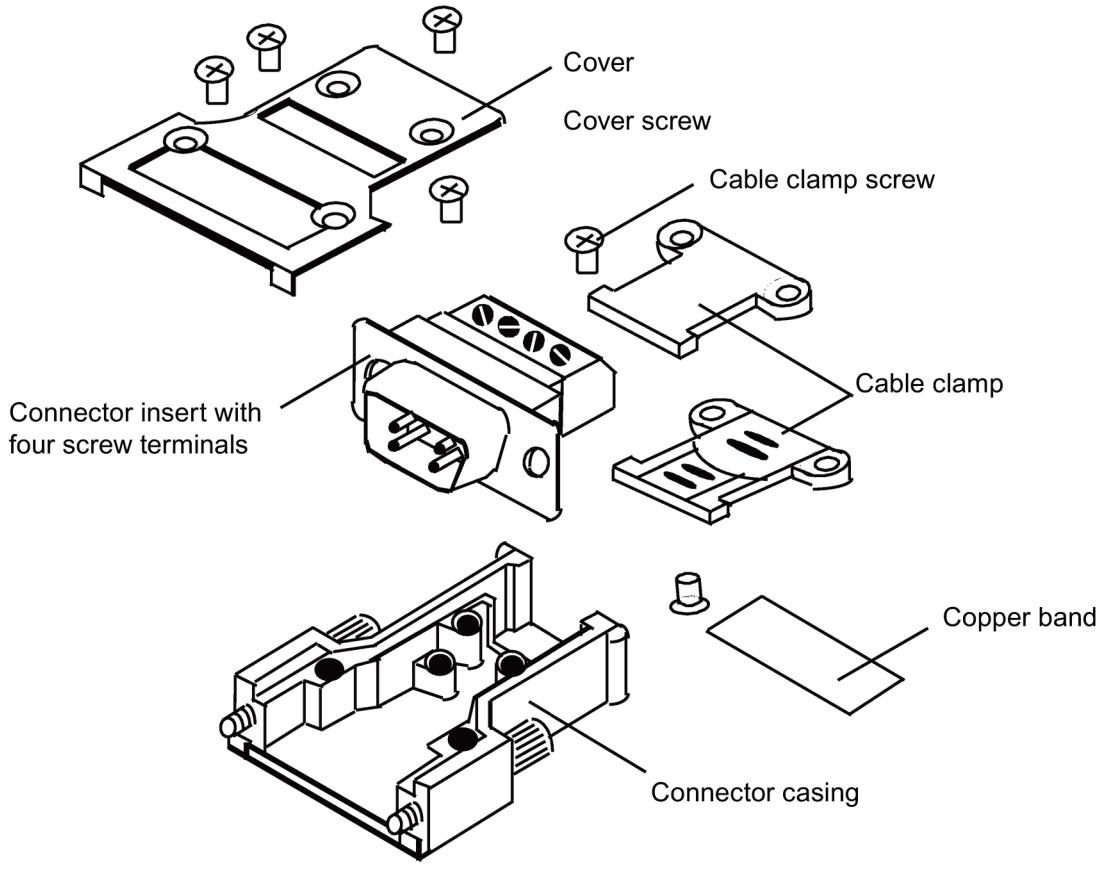
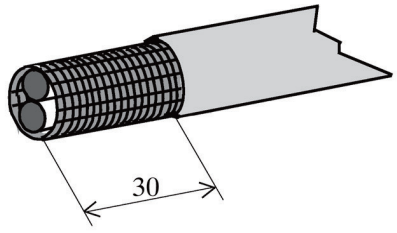
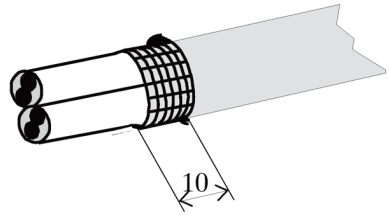
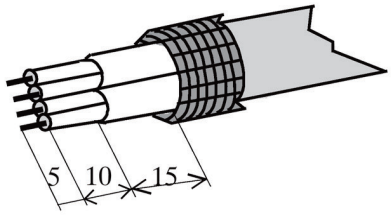
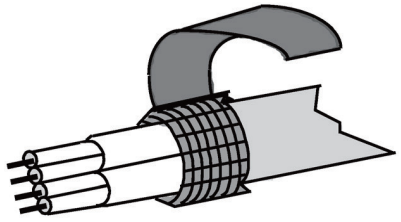
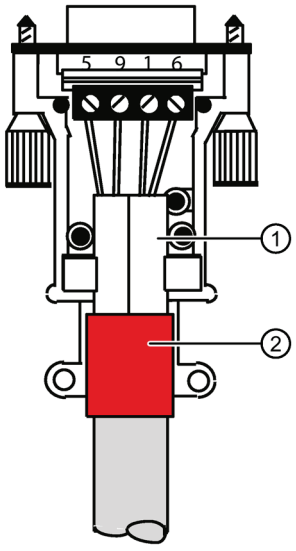
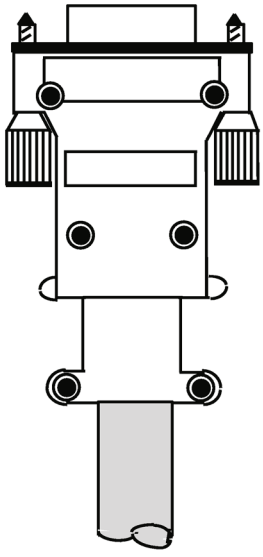


Figure 5-1 Industrial Twisted Pair D-sub plug (9-pin) for user assembly

Procedure

	Remove the cable outer sheath over the shield braid at a length of approx. 30 mm.
	Cut radially into the shield braid approx. 10 mm before the cable outer sheath and pull it from the cable.
	Pull the projecting shield braid over the cable outer sheath. Unwind the aluminum foil shield up to a length of approx. 15 mm before the folded-back braid and cut it off. Remove the plastic foil and the blind elements. Remove the single wire sheath from the wires at a length of approx. 5 mm.
	Wind the shield braid with the copper band.

 ① Shield foil ② Shield braid wrapped with copper band	Install the connector as follows: Insert the plug insert into the connector housing Insert the lower cable collar into the grooves of the connector housing. Assign the wire pairs to the screw-type terminals. The assignment required for a specific cable type is specified under Pin assignment (Page 175). Insert the cable into the connector housing in such a way that the shield braid is inserted into the cable collar with copper band. Insert the upper cable collar into the grooves of the connector housing and screw the wires into the terminals.
	Place the cover on the connector housing and screw it tight.

5.3.10.3 Fitting a 15-pin D-sub plug

15-pin D-sub plug

The figure shows the components of a 15-pin D-sub male connector.

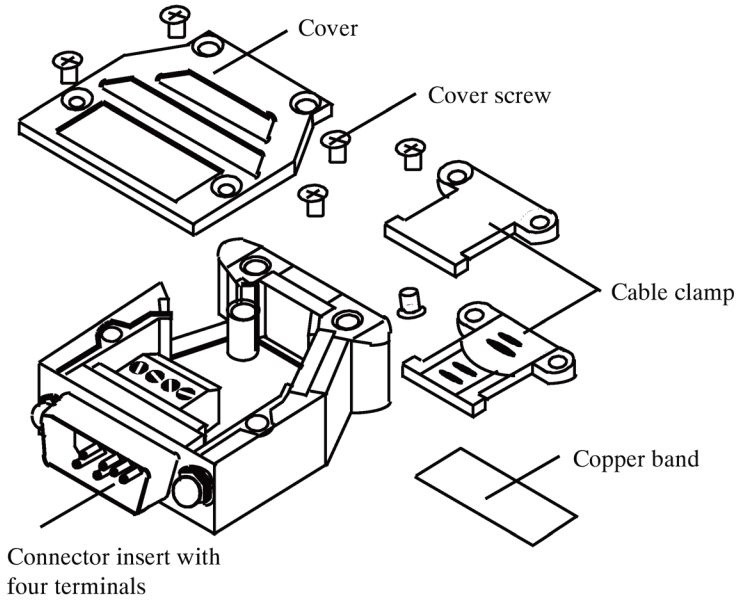
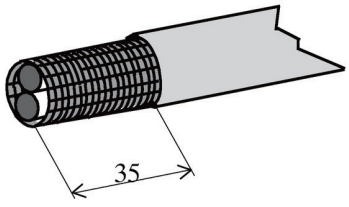
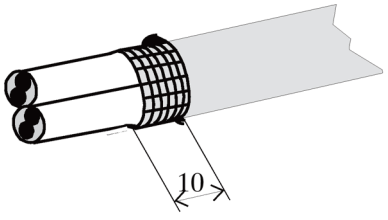
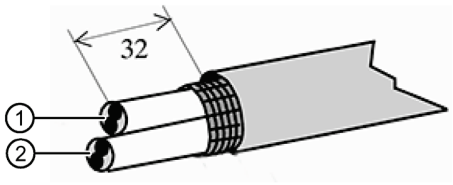
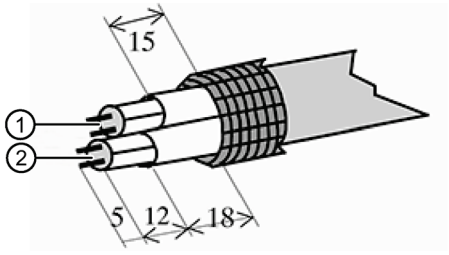
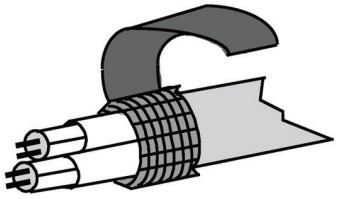
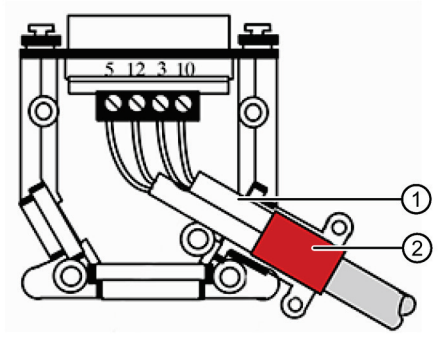
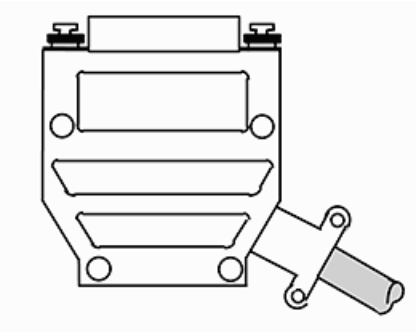


Figure 5-2 15-pin D-sub plug for user assembly

Procedure

	Remove the cable outer sheath over the shield braid at a length of approx. 30 mm.
	Cut radially into the shield braid approx. 10 mm before the cable outer sheath and pull it from the cable.

 ① White/blue ② White/orange	Shorten the wire pair white/ blue ① by approx. 3 mm to 32 mm.
 ① White/blue ② White/orange	Pull the projecting shield braid over the cable outer sheath. Unwind the aluminum foil shield up to a length of approx. 15 mm at the wire pair ① or respectively approx. 18 mm at the wire pair② before the folded-back braid and cut it off. Remove the plastic foil and the blind elements. Remove the single wire sheath from the wires at a length of approx. 5 mm.
	Wind the shield braid with the copper band.
 ① Shield foil ② Shield braid wrapped with copper band	Install the connector as follows: Insert the lower cable collar into the grooves of the connector housing. Insert the cable into the connector housing in such a way that the shield braid is inserted into the cable clamp with copper band. Insert the upper cable collar into the grooves of the connector housing and screw them tight. Assign the wire pairs to the screw-type terminals. The assignment required for a specific cable type is specified under Pin assignment (Page 175). Screw the wires into the screw-type terminals.

 15-pin D-sub male connector	Place the cover on the connector housing and screw it tight.

5.4 Optical networks

5.4.1 Notes on mounting

CAUTION

Risk of injury due to material remnants

During preassembly, fibers of the fiber-optic cable are separated with the cleave tool. These material remnants can cause injuries.

- Wear protective glasses during cleaving.
- Dispose of the fiber remnants in the fiber container that ships with the termination kit.

NOTICE

Damage to cables and devices

Improper handling can result in damage to cables and devices. Please note the following:

- Never exceed the maximum permitted forces (tensile strain, transverse compression, etc.) specified in the data sheet of the cable you are using. Excessive transverse compression can, for example, arise when using screw-down clamps to secure the cable.
- Install FO cables so that exposed wires and LC connectors are not subjected to tensile stress.
- When cutting cable sections to length, make sure that no loops result and that the cable is not twisted. Loops and torsion can cause kinks or tears under tensile load and cause damage to the cable.
- Never insert dirty LC connectors or LC connectors with protruding fibers into the device sockets. This can destroy the optical transmit and receive elements.

General notes on installation

Suitability of the components used

Make sure that the selected cable is suitable for your particular application, in particular regarding the following properties.

- Required temperature range
- Resistance of the sheath materials to chemicals, water, oils, rodents, etc. to which your cable will be exposed when in use.
- Required mechanical properties (bending radii, tensile strain, transverse compression)
- Requirements regarding the behavior of the cable in fire
- Suitability of the cable and connectors for the devices being connected

Only use FC FO fiber-optic cables in conjunction with devices approved for these cables. Observe the maximum permitted cable lengths.

If in doubt, use a special cable to meet your requirements. Contact the SIEMENS contact person.

Fitting connectors

- Follow the steps described in these installation instructions and use only the tools specified here.
- Use only suitable stripping pliers when stripping the wire sheath.
- If you find that uneven edge breaks are on the increase, the cleave tool should be sent in for inspection.
  When used correctly, up to 2000 preassemblies are possible. If you need to return the tool, talk to your Siemens contact person.
- As soon as the nut of a preassembled connector has been loosened, the connector must be reassembled.

Using the preassembled cables

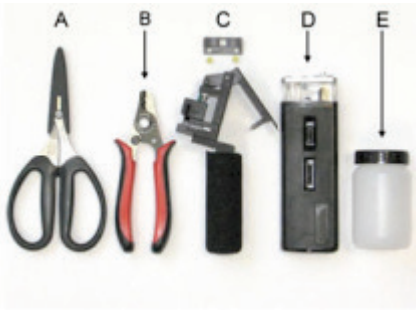
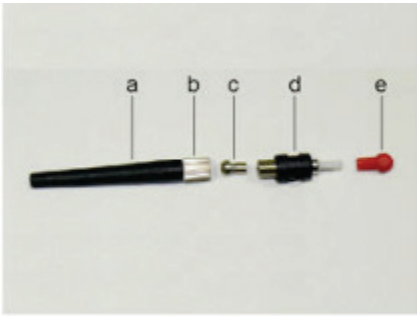
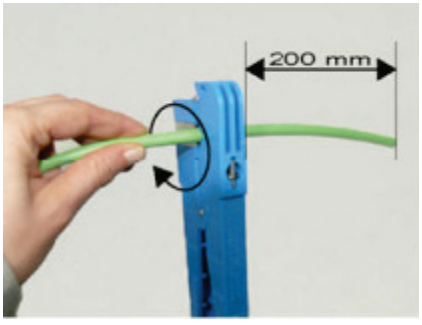
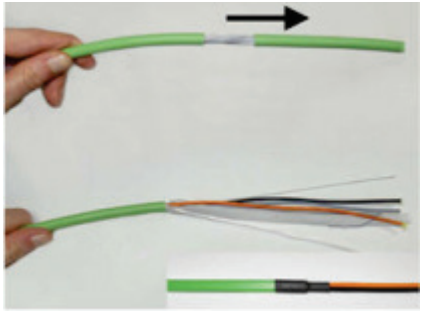
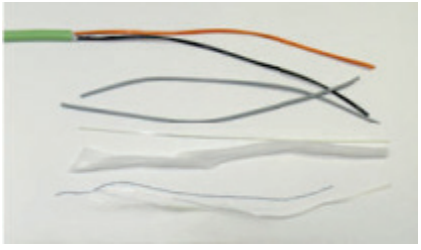
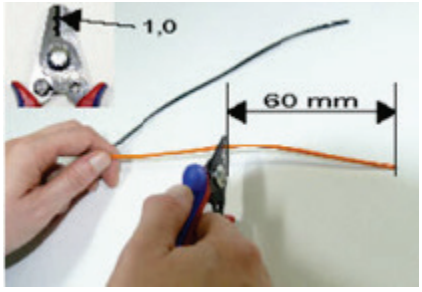
- Make sure that the outer sheath, the sheath of the cores, and the FC FO optical fibers are not damaged.
- Close unused connectors with dust protection caps. Remove the dust protection caps only immediately before connecting cables together or plugging cables into devices.
- When assembling adapters for connectors or when connecting the cable to them, make sure that send and receive lines are crossed over.

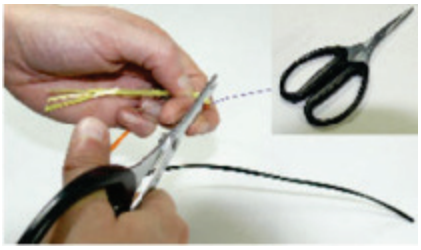
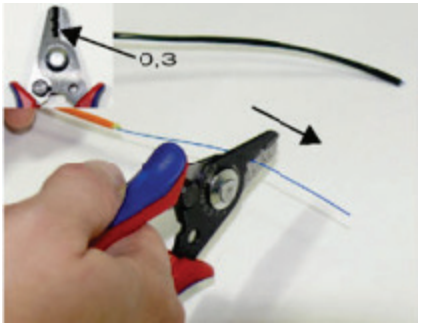
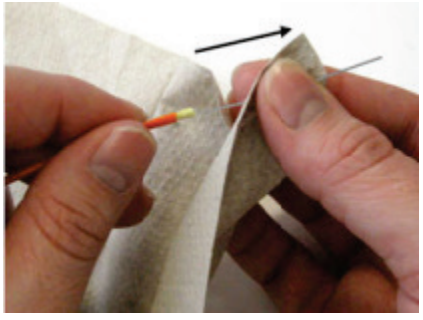
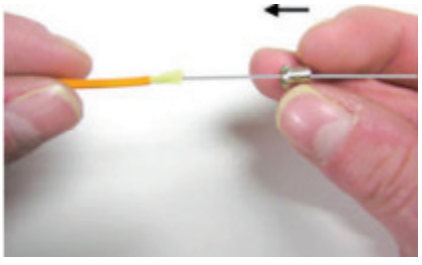
5.4.2 Fitting an IE FC FO cable with an ST/ BFOC plug

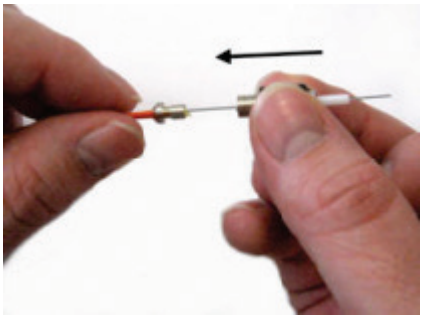
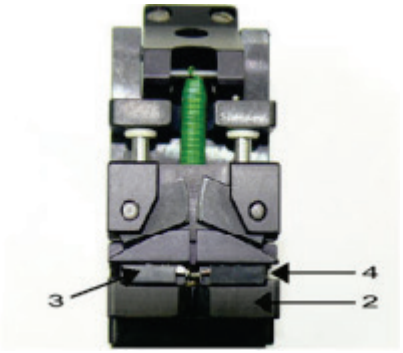
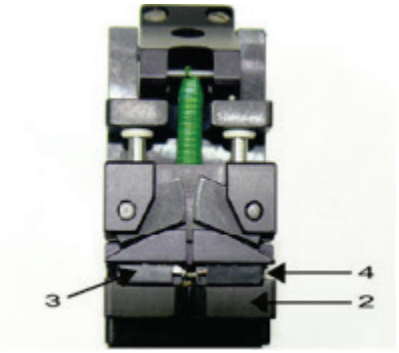
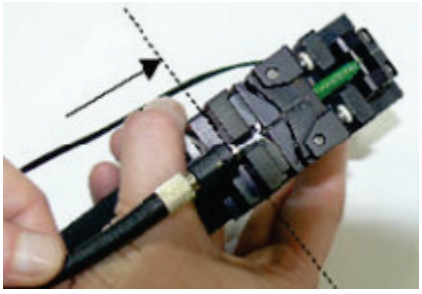
Below, we will show the individual steps involved in preassembling an IE FC FO cable and an ST/BFOC plug with the FC FO Termination Kit for ST/BFOC plugs.

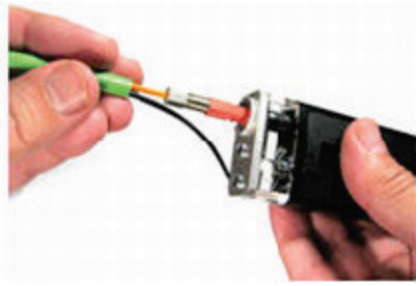
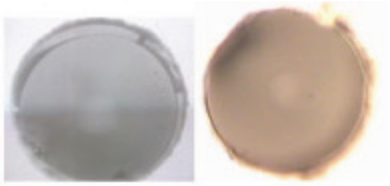
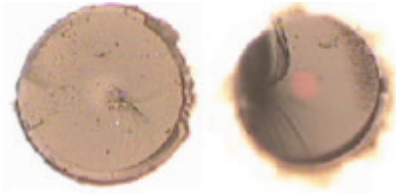
Note the instructions in the assembly instructions that accompany the FC FO termination kit for ST/BFOC plugs.

Procedure

<table>
<tr>
<td>
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<tr>
<td>The FC FO Termination Kit consists of:
A: Kevlar scissors
B: Stripping pliers
C: Cleave tool
D: Microscope
E: Fiber container</td>
<td>The ST/BFOC connector consists of:
a: Anti-kink sleeve
b: Screw-down nut
c: Buffer and Kevlar clamp
d: Body of plug-in connector
e: Dust protection cap</td>
<td>Remove the cable sheath using a suitable stripping tool.
Recommendation: The minimum length of the stripped piece of cable should amount to 200 mm.</td>
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<td>Pull off the outer jacket.
Recommendation: To provide additional mechanical protection, a shrink tube can be pulled over the cable for later handling.
Expose the individual elements.</td>
<td>Cut the fleece (white) and the remaining threads with the Kevlar scissors (A) as close as possible to the cable sheath.
Cut off the blind elements (gray) and the support element (white) as close as possible to the conductor sheath using the side cutter.</td>
<td>Position the ø 1.0 mm opening of the stripping pliers (B) approximately 60 mm from the end of the wire.</td>
</tr>
</table>

		
Cut into the wire jacket and pull the jacket off without skewing.	Cut back the Kevlar with the Kevlar scissors (A) leaving 3 mm.	Place the ø 0.3 mm opening of the stripping pliers (B) on the buffer (blue). Cut into the buffer and pull off the buffer parallel to the axis of the fiber without skewing. **Note:** It is advisable to remove the buffer in 2 to 3 steps. 3 mm of the buffer must be left (same length as the Kevlar).
		
Clean the fiber of remnants of the buffer with a lint-free cloth.	Remove the screw-down nut (b) and the buffer and Kevlar clamp (c) from the body of the connector (d). First push the anti-kink sleeve (a) and then the screw-down nut (b) over the fiber and the wire sleeve.	Push the buffer and Kevlar clamp (c) over the fiber as far as the wire sleeve. Feed the Kevlar yarn through the opening. Remove the dust protection cap (e) from the body of the connector (d). **Note:** It is easier to maneuver the Kevlar threads through with twisting movements.

		
Thread the connector body (d) with the ferrule on to the fiber as far as it will go.	Screw the screw-down nut (b) and connector body (d) tight. When screwing them together, make sure that the buffer and Kevlar clamp (c) do not skew. Push the anti-kink sleeve (a) onto the screw-down nut (b). **Note:** The fiber should extend at least 30 mm out of the ferrule. Otherwise the connector must be fitted again.	The cleave tool consists of: 1: Stripper 2: Adapter plate 3: Jaws for fiber limit stop 4: Jaws with diamond
		
Make sure that the adapter plate (2) with the correct labeling (ST for BFOC connector) is fitted to the cleave tool (C). **Note:** How to change adapter plates is described in the appendix.	Insert the connector into the cleave tool (C) as far as the limit stop and hold the connector in position. The fiber extends out of the cleave tool (C).	Press the trigger (1) slowly until you hear a click. Dispose of the fiber remnants in the supplied container (E).

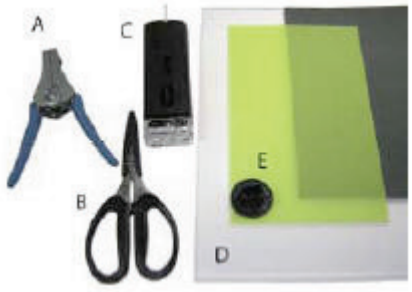
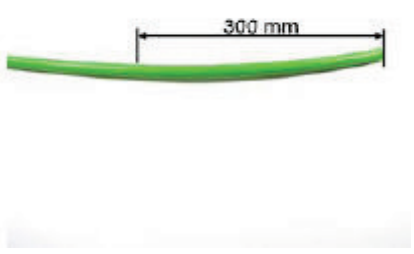
		
Check the assembled connector with the microscope (D). If the connector is dirty, clean it with the supplied lint-free cloths. If it is badly contaminated, dampen the cloth with isopropanol. Place the dust protection cap (e) on the connector ferrule.	**Good result:** The surface of the fiber-optic cable is even and free of scratches. Slight irregularities at the edge are of no significance. Follow the same steps with the other cores.	**Bad result:** The connector surface has irregularities in the core. Left-hand figure: The speckled pattern indicates an unevenly broken core. Right-hand figure: The stripe pattern suggests damaged cladding. In the case of a bad cleave result, repeat the connector assembly.

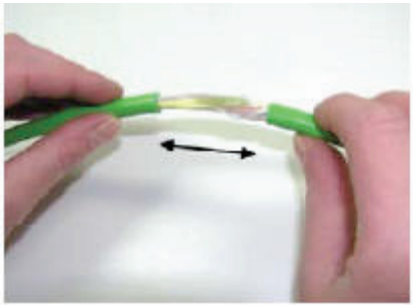
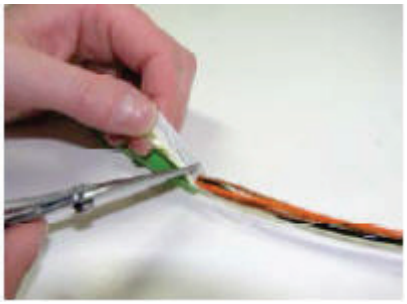
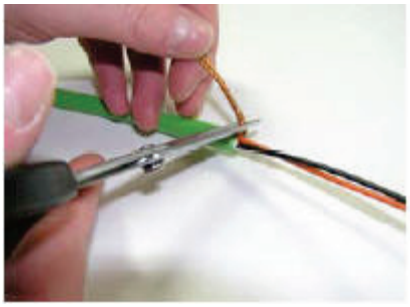
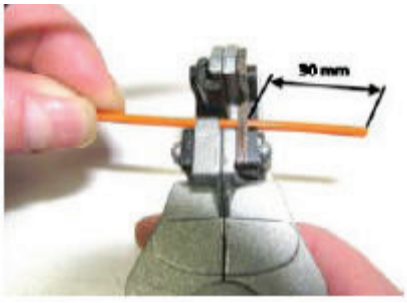
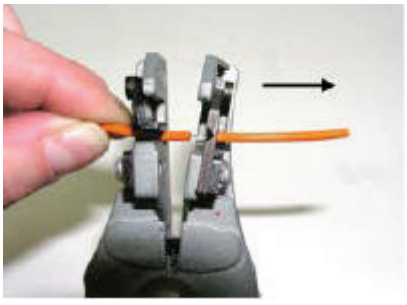
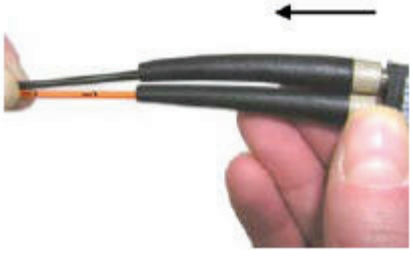
5.4.3 Fitting an SC RJ plug to a plastic FO cable (POF)

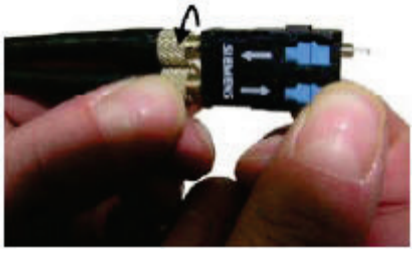
Below, we will show the individual steps involved in fitting a PCF FO cable to an SC RJ connector by using the IE termination kit SC RJ POF Plug.

You should also refer to the assembly instructions supplied with the IE termination kit for SC RJ POF plug.

Procedure

				
The IE Termination Kit SC RJ POF Plug consists of:		The SC RJ plug consists of:		Remove the cable sheath using a suitable stripping tool. Set the cutting depth of the stripping tool so that the inner cores cannot be damaged. The minimum length of the stripped piece of cable amounts to 300 mm.
A: Stripping pliers B: Kevlar scissors C: Microscope	D: Grinding and polishing base E: Polishing plate, abrasive and polishing paper	a: Anti-kink sleeve b: Knurled nut c: SC RJ housing	d: Body of plug-in connector e: Dust protection	

		
Pull off the outer jacket.	Cut off the Kevlar yarn and fleece wrapping with the Kevlar scissors.	Cut off the cable strain relief elements (brown) with the side cutter.
		
Place the ø 1.6 mm opening of the stripping pliers marked with a white dot on the orange colored conductor.	Position the stripping pliers approximately 30 mm from the end of the wire.	Press the pliers to strip the wire sleeve. Repeat the steps for stripping the black cores.
		
Remove the protection caps from the connector. Push the preassembled plug onto both cores at the same time as far as it will go.	The fibers of the plastic fiber-optic cable extend 5 to 10 mm out of the connector ferrules. The arrow on the orange core points in the same direction as the arrow on the SC RJ housing.	

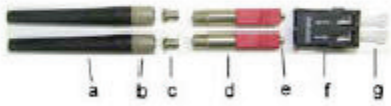
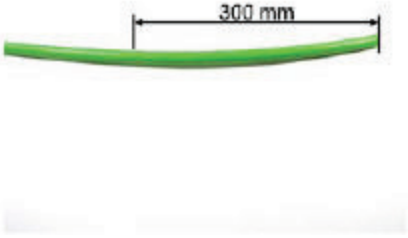
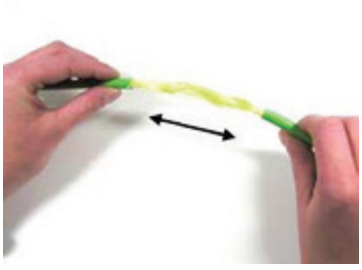
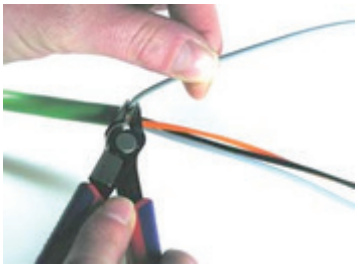
		
Tighten the two knurled nuts in the direction of the arrow.	Shorten the excess fiber to 1 mm with a sharp side cutter.	Insert the plug into the SC RJ grinding plate. The coding (stud) on the connector housing is inserted into the groove (1) of the grinding plate.
		
Place the abrasive paper and polishing foil on the polishing base. Take hold of the SC RJ plug housing and press down gently. Grind the excess fiber with approximately 10 figure-of-eight movements on the 1500 grade abrasive paper (gray) until it is flush.	Polish the plug in the same way on the matt side of the 1 µm polishing foil (green), approx. 10 figure-of-eight movements.	Remove any resulting dust with a clean, lint-free cloth.
		
Check the assembled plug with the microscope.	You can also use the magnifier of the microscope to check the results.	**Good result:** The surface of the fiber-optic cable is even and free of scratches. Slight irregularities at the edge are of no significance.

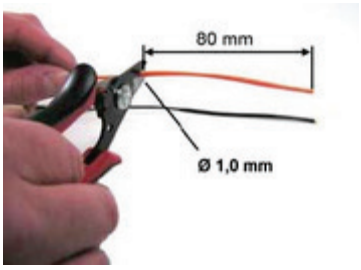
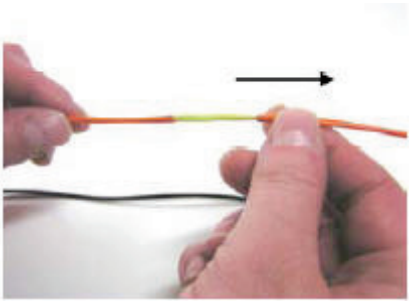
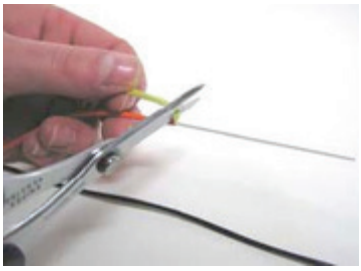
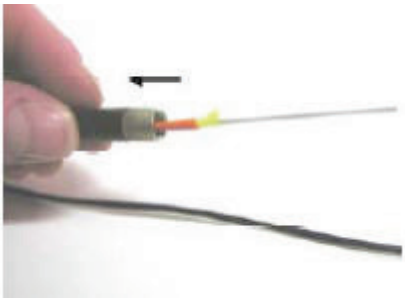
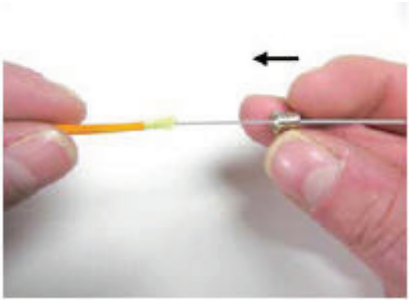
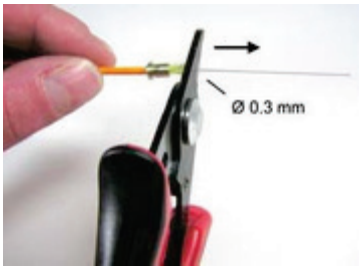
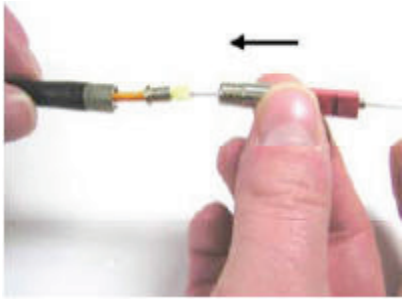
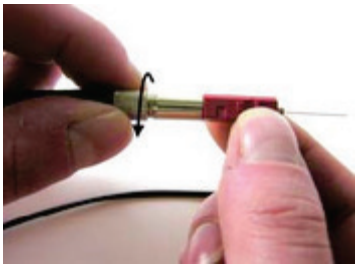
5.4.4 Fitting an SC RJ plug to PCF FO cable

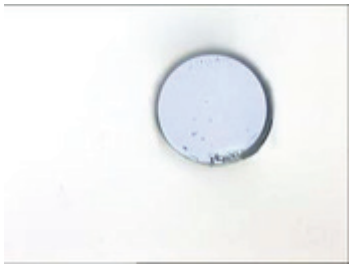
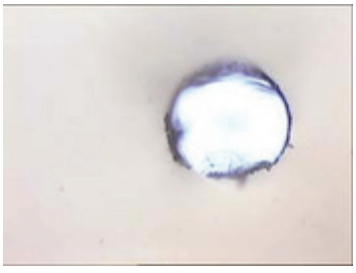
Below, we will show the individual steps involved in fitting a PCF FO cable to an SC RJ connector by using the IE termination kit SC RJ PCF Plug.

You should also refer to the assembly instructions supplied with the IE termination kit for SC RJ PCF plug.

Procedure

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<tr>
<td colspan="2">The IE Termination Kit SC RJ PCF Plug consists of:</td>
<td colspan="2">The SC RJ plug consists of:</td>
<td rowspan="2">Remove the cable sheath using a suitable stripping tool. Set the cutting depth of the stripping tool so that the inner cores cannot be damaged.
The minimum length of the stripped piece of cable amounts to 300 mm.</td>
</tr>
<tr>
<td>A: Stripping pliers
B: Kevlar scissors
C: Cleave tool</td>
<td>D: Fiber container
E: Card cleaner
F: Microscope</td>
<td>a anti-kink sleeve
b union nut
c buffer and Kevlar clamp</td>
<td>d body of connector
e ferrules
f SC RJ housing
g dust protection</td>
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<tr>
<td colspan="2">Pull off the outer jacket.</td>
<td colspan="2">Cut off the Kevlar yarn and fleece wrapping with the Kevlar scissors.</td>
<td>Cut off the blind elements (gray) and the support element (white) with the side cutter.</td>
</tr>
</table>

		
Position the ø 1 mm opening of the stripping pliers approximately 80 mm from the end of the core.	Cut into the core jacket and pull the jacket partly off without skewing.	Remove the loose core sleeve with your hand.
		
Cut back the Kevlar with the Kevlar scissors leaving 5 mm.	Push the anti-kink sleeve over the fiber and the core jacket.	Push the buffer and Kevlar clamp onto the fiber as far as the core sleeve. Feed the Kevlar yarn through the opening.
		
Cut into the buffer with pliers opening ø 0.3 mm and pull off the buffer without skewing. Approximately 5 mm of the buffer remain.	Push the connector body with the ferrule on to the fiber.	Screw the connector body and union nut together.

		
Turn the "Clamp" wheel to "Open" (1) and the "Cleave" wheel to the "0" (2) setting.	Feed the fiber into the cleave tool and lock the plug. The fiber projects through the clamp wheel.	Turn the "Clamp" wheel gently towards the "Lock" direction to clamp the fiber.
		
Turn the "Cleave" wheel slowly from setting "0" to setting "2".	Turn the "Clamp" wheel in the direction of "Open" and remove the fiber remnant. Unlock the connector and remove it.	Dispose of the fiber remnants in the supplied container.
		
Check the assembled plug with the microscope. Then place the dust protection cap on the ferrule.	**Good result:** The surface of the fiber-optic cable is even and free of scratches. Slight irregularities at the edge are of no significance. Follow the same steps with the other cores.	**Bad result:** The connector surface has irregularities in the core. Greater irregularities in the broken edges and irregular light distribution indicate a damaged connector surface. Repeat the connector assembly.

	
Clean the soiled connector with the card cleaner. In the process you rub the connector in one direction over a clean area.	Insert the connector main body into the SC RJ housing until it stops. In the process the flat side of the main body contacts the inner bar. The arrow on the orange core points in the same direction as the arrow on the SC RJ housing.

Note

If you find that the edge breaks are on the increase, send in the cleave tool for inspection. When used correctly, up to 2000 assemblies are possible.

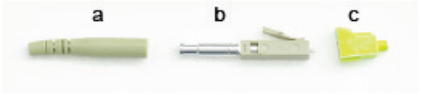
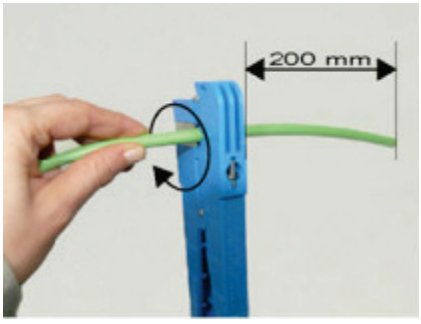
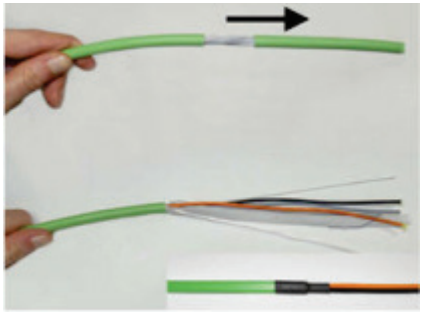
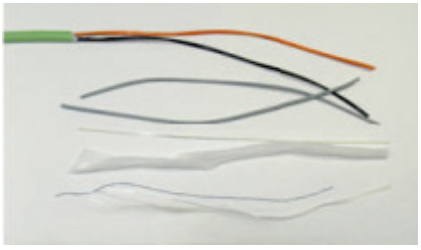
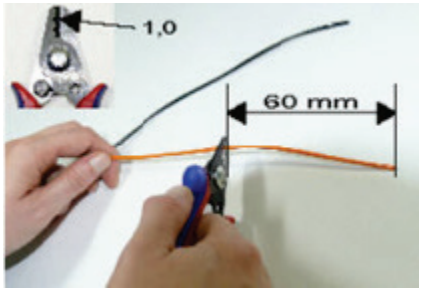
If you need to return the tool, talk to your Siemens contact.

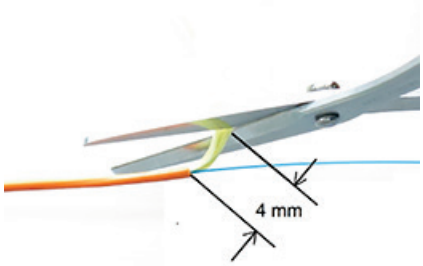
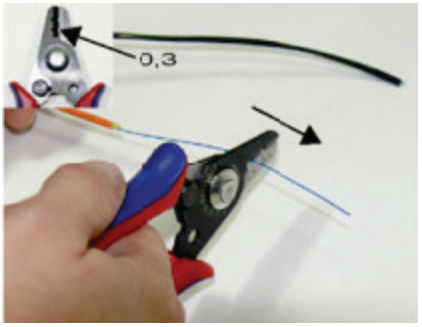
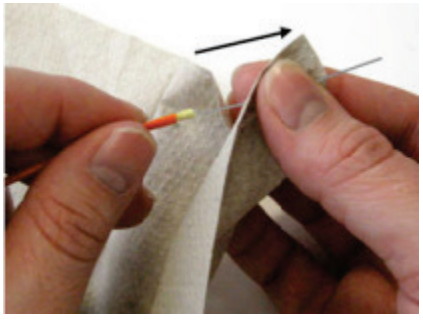
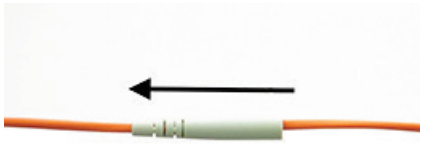
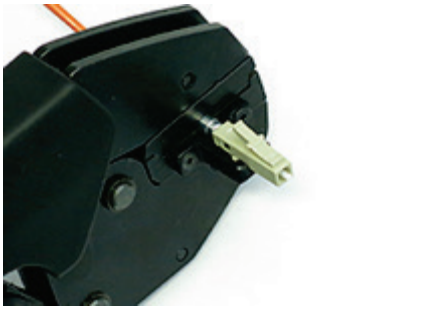
5.4.5 Mounting an FC FO LC plug on an IE FC FO Standard Cable or FC FO Trailing Cable

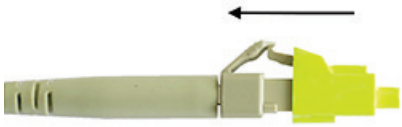
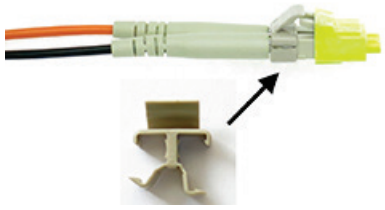
Below, we will show the individual steps involved in preassembling the IE FC FO Standard Cable or IE FC FO Trailing Cable to an LC plug with the FC FO Termination Kit.

Note the instructions in the assembly instructions that accompany the FC FO Termination Kit for LC plugs.

Procedure

<table>
<tr>
<td>
</td>
<td>
</td>
<td>
</td>
</tr>
<tr>
<td colspan="2">The FC FO Termination Kit (LC) consists of:
A: Crimping pliers
B: Kevlar scissors
C: Stripping pliers
D: Cleave tool
E: Cleaning cloths
F: Fiber container</td>
<td>The LC connector consists of:
a: Anti-kink sleeve
b: LC connector
c: Dust protection cap</td>
<td>Remove the cable sheath using a suitable stripping tool.
Recommendation: The minimum length of the stripped piece of cable should amount to 200 mm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>
</td>
</tr>
<tr>
<td>Pull off the outer jacket.
Recommendation: To provide additional mechanical protection, a shrink tube can be pulled over the cable for later handling.
Expose the individual elements.</td>
<td>Cut the fleece (white) and the remaining threads with the Kevlar scissors (B) as close as possible to the cable sheath.
Cut off the blind elements (gray) and the support element (white) as close as possible to the conductor sheath using the side cutter.</td>
<td>Position the ø 1.0 mm opening of the stripping pliers (C) approximately 60 mm from the end of the wire.</td>
</tr>
</table>

		
Cut into the wire sheath and pull the sheath off without skewing.	Cut back the Kevlar with the Kevlar scissors (B) leaving 4 mm.	Place the ø 0.3 mm opening of the stripping pliers (C) on the buffer (blue). Cut into the buffer and pull off the buffer parallel to the axis of the fiber without skewing. **Note:** It is advisable to remove the buffer in 2 to 3 steps. 3 mm of the buffer must be left (same length as the Kevlar).
		
Clean the fibers of remnants of the buffer using a lint-free cloth.	Push on the anti-kink sleeve (a) via the fiber.	Push the fibers into the LC connector (b). Make sure that part of the Kevlar is pushed into the crimp opening.
		
Place the LC connector in the crimping pliers (A). Close the crimping pliers as far as the limit stop.	Push the anti-kink sleeve (a) onto the LC connector (b).	The cleave tool (D) consists of: 1: Stripper 2: Adapter plate 3: Jaws for fiber limit stop 4: Jaws with diamond

		
Insert the LC connector with the fiber into the cleave tool. Close the cleave tool and dispose of the fiber remnants in the supplied container (F).	Push on the protective cap.	For use of the LC connector as a duplex variant, reverse the double clips.

Article numbers

FC LC Plug (10 duplex plugs)	Pack of 10	6GK1900-1RB00-2AB0
SIMATIC NET FC FO standard cable 62.5/200/230	Sold by the meter	6XV1847-2A
SIMATIC NET FC FO trailing cable 62.5/200/230	Sold by the meter	6XV1847-2C
FC FO termination kit (LC)	1 case	6GK1900-0RL00-0AA0

5.5 Power supply

5.5.1 Fitting the energy cable 5 x 1.5 with a power plug PRO

The next section explains the individual steps assembling an energy cable with a power plug PRO.

Note the information in the assembly instructions of the plug.

Connector pinout

An IE M12 Plug PRO / IE FC M12 Plug PRO with the pin assignment shown in the following table must be connected to both ends of the IE FC cable.

Table 5- 1 Pinning at both ends of a straight-through cable

Pin number	Pinning as a network component	Color
Pin 1	RX+	Yellow
Pin 2	TX+	White
Pin 3	RX-	Orange
Pin 4	TX-	Blue

The signal assignment in the table corresponds to the pin assignment of the 4-pin 10/100BaseTX M12 socket of the SCALANCE X208 PRO.

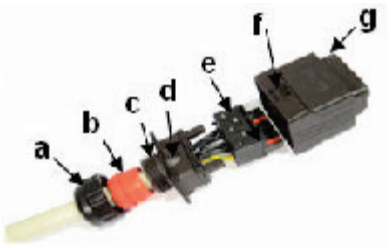
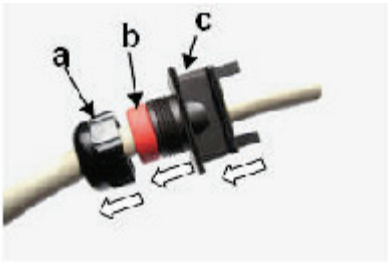
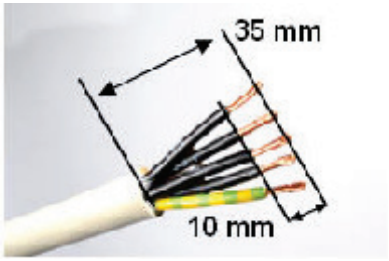
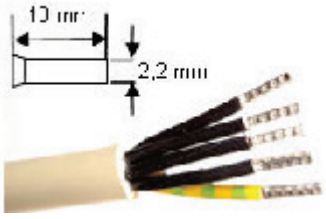
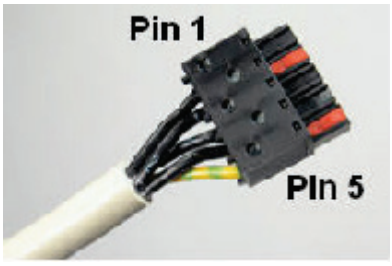
The pin assignment of the M12 socket of a network component on the other hand is as follows:

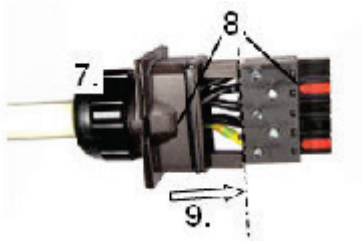
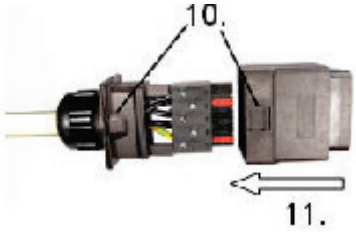
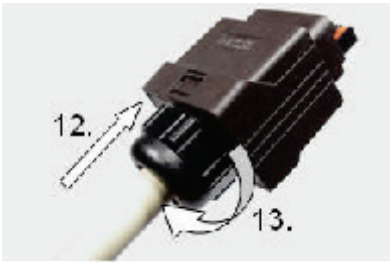
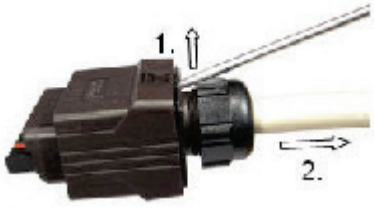
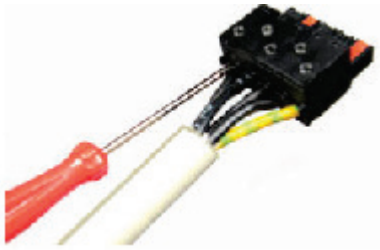
Table 5- 2 Crossover pin assignment at one end of a crossover cable

Pin number	Assignment	
Pin 1	TX+	White
Pin 2	RX+	Yellow
Pin 3	TX-	Blue
Pin 4	RX-	Orange

The difference is that the send pin at one end must connect to the receive pin at the other end. With straight-through cables, this is only the case if the connector pin assignment is not the same at both ends. With devices that have autocrossing, a transmission would work even if the pin assignment was the same.

Procedure

<table>
<tr><td colspan="3">Only use cables with the Power Plug PRO that meet the following specifications:</td><td rowspan="2">
</td><td rowspan="2">
</td></tr>
<tr><td>Cable diameter</td><td colspan="2">9 to 13 mm</td></tr>
<tr><td>Cable cross section mm²</td><td>2.5</td><td>1.5</td><td rowspan="3">a forcing nut
b sealing ring
c rear wall
d latch
e plug insert
f Housing notch
g housing</td><td rowspan="3">Thread the forcing nut (a), the sealing ring (b) and the back wall (c) loosely over the cable.</td></tr>
<tr><td>Cable cross section AWG</td><td>10 x 2.2</td><td>10 x 1.7</td></tr>
<tr><td>Max. current at ambient temperature</td><td>16 A
58 °C
13 A
73 °C</td><td>16 A
45 °C
13 A
60 °C</td></tr>
<tr><td colspan="3">
</td><td>
</td><td>
</td></tr>
<tr><td colspan="3">Strip off 35 mm of the cable sheath.
Remove 10 mm of the insulation from the wires.</td><td>With a wire cross section of 2.5 mm² (AWG14), crimp the ferrules DIN 46228-A2.5-10 (dimensions see figure) to the wire ends. For a wire cross section of 1.5 mm² (16 AWG), use the DIN 46228-A1.5-10 ferrules.
Push the wires into the spring terminal clamps as shown in the table.</td><td><table>
<tr><th>PIN</th><th>PROFINET</th></tr>
<tr><td>1</td><td>L1</td></tr>
<tr><td>2</td><td>N1</td></tr>
<tr><td>3</td><td>L2</td></tr>
<tr><td>4</td><td>N2</td></tr>
<tr><td>5</td><td>FE</td></tr>
</table>
Check that good contact is established by pulling lightly on the wires.</td></tr>
</table>

		
Put the sealing ring into the rear wall and screw the forcing nut over it loosely. Turn the latch of the rear wall to the same side as the red coding bars of the plug insert. Push the rear wall as far as the limit stop of the plug insert.	Turn the latch of the rear wall and the notch in the housing to the same side. Push the housing over the plug insert as far as the limit stop.	Press the rear wall into the housing until it clicks in place audibly. Screw the pressure nut tight.
Dismantling the plug		
		
To open the plug, lever the catch in the housing towards the side wall with a slotted screwdriver. Pull the rear wall out of the housing by the cable while holding down the screwdriver.	Press open the cage springs with a slotted screwdriver. Pull the wires out of the contact clamps one by one.	

5.5.2 Fitting a 7/8" energy connector to an energy cable

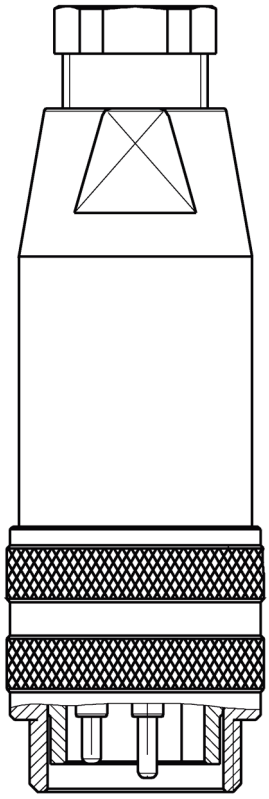


Figure 5-3 7/8" energy connector

7/8" energy connectors are intended for making connections to the SIMATIC NET energy cable (5 x 1.5 mm^2). The stranded wires of the energy cable must be fitted with 0.75 mm^2 wire-end ferrules.

Note

The mechanical data of the 7/8" energy connector are tailored to the SIMATIC NET energy cables (6XV1 830-8AH10). Fitting 7/8" energy connectors to cables with different electrical or mechanical properties can cause problems during operation!

Procedure

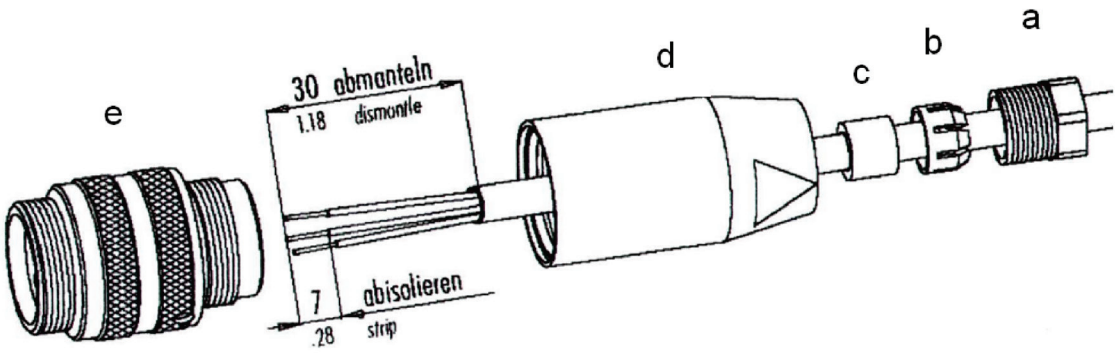
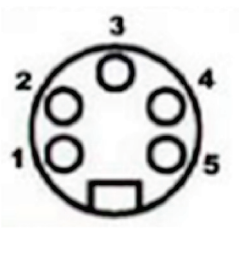


Figure 5-4 Energy connector - fitting

Fit the energy connector to the energy cable (6XV1 830-0AH10) as follows:

1. Push the clamping screw (a), pinch ring (b) and sealing ring (c) over the cable.
2. Strip the cable and wires as shown in the drawing.
3. Fit the 0.75 mm² wire-end ferrules to the stranded wires.
4. Push the connector sleeve (d) over the wires.
5. Screw the wires into the screw terminals of the female or male connector insert as shown in the chart.
6. Push the connector sleeve (d) onto the female or male insert (e) and screw the two parts together.
7. Push the pinch ring (b) over the sealing ring (c) and press the two parts together with the pressure nut (a) into the connector sleeve.
8. Screw the pressure nut tight.

Pin assignment

View of the connector face	Pin (6GK1905-0EA00)	Cable	Socket (6GK1905-0EB00)	View of the connector face
	Pin 1	Wire 1	Pin 1	
	Pin 2	Wire 2	Pin 2	
	Pin 3	PE	Pin 3	
	Pin 4	Wire 3	Pin 4	
	Pin 5	Wire 4	Pin 5	

5.5.3 Connecting the 7/8" energy connector to a module

Properties

The 7/8" energy connector of a device consists of a 7/8" male incoming connector and a 7/8" female outgoing connector. Correspondingly, the 7/8" connector must be equipped with female contacts at the incoming energy cable and with male contacts at the outgoing energy cable.

Note

Insert or remove the 7/8" energy connector only when the power supply is turned off.

Procedure

To connect the 7/8" energy connector to the device, follow the steps below:

1. Turn off the power supply.
2. Turn the connector so that the slot and key of the coding mechanism fit together.
3. Plug the 7/8" energy connector loosely into the module.
4. Check that the connector and socket are properly interlocked (slot and key) by carefully turning the male connector.
5. Tighten the locking nut to secure the 7/8" energy connector to the module.

Note

Close all unused 7/8" connection points with sealing caps (6ES7 194-3JA00-0AA0) to achieve degree of protection IP65 or IP67.

Installing network components in cabinets

6

6.1 SIMATIC NET components

Ventilation openings

The casings of most SIMATIC NET network components have ventilation openings. To allow more effective cooling of the electronics components, ambient air can flow through the casing. The maximum operating temperatures quoted in the technical specifications apply only when there is unrestricted flow of air through the ventilation openings.

Depending on the size of the ventilation openings, such modules comply with degree of protection IP 20, IP 30 to IP 40. You will find the precise degree of protection of a SIMATIC NET component in its operating instructions.

Components with the degrees of protection mentioned above do not provide protection against dust and water! If the installation site requires such protection, the components must be installed in an additional enclosure such as a switching cubicle that provides the higher degree of protection (for example IP65/ IP67).

If you install these components in an additional enclosure, make sure that the conditions required for operation are maintained!

Heat dissipation

Make sure that the temperature inside the additional enclosure does not exceed the permitted ambient temperature for the installed components. Select an enclosure with adequate dimensions or use heat exchangers.

Outdoor installation

If you install the equipment outdoors, make sure that the additional enclosure is not subjected to direct sunlight. This can lead to a considerable rise in temperature within the enclosure.

Clearances

Make sure that there is adequate clearance around the component so that

- the convection cooling of the component is not restricted
- components do not cause neighboring components to heat up more than permitted

- there is enough space for installing cabling
- there is enough space to remove components for maintenance or repair.

Note

Regardless of the degree of protection of the casing, the electrical and optical ports are always sensitive to

- mechanical damage

- damage caused by electrostatic contact discharge when touched

- contamination by dust and fluids

On devices with degree of protection IP65, always close unused ports with the supplied dust protection caps. Remove these caps only immediately before connecting up the cables to the ports.

Standards

EN 60529:2000 degree of protection due to casing (IP code) (IEC 60529:1999)

6.2 IP degrees of protection

General

Electrical equipment is normally surrounded by a protective casing.

The purpose of this casing includes

- Protection of persons from touching live components or moving parts (accidental contact protection)
- Protection of equipment from intrusion of solid foreign matter (foreign matter protection)
- Protection of equipment from ingress of water (protection against water)

IEC 60529, EN 60529 /15/

The degree of protection specifies the degree to which the casing meets the three protective functions mentioned above.

The degrees of protection are specified uniformly in the International Standard IEC 60529 or in the identical European standard EN 60529.

The degree of protection of a casing is indicated by a code. The code consists of the letters IP (International Protection) followed by a code number for contact, solid body and water protection as shown below:

In some situations, the degree of protection is specified in even greater detail by adding characters to the code numbers.

Scope of protection

The various degrees of protection are shown and explained briefly in Table 1-1 and 1-2. Detailed information as well as the exact test conditions of the individual degrees of protection is available in the standards listed above.

Table 6- 1 Accidental contact protection (short form)

First digit	Protection of equipment from ingress of solid foreign bodies	Protection of persons against access to dangerous parts
0	Not protected	Not protected
1	≥ 50.0 mm diameter	Back of the hand
2	≥ 12.5 mm diameter	Finger
3	≥ 2.5 mm diameter	Tool
4	≥ 1.0 mm diameter	Wire
5	Dust protected	Wire
6	Dust-tight	Wire

Table 6- 2 Protection against water (short form)

Second digit	Protection of equipment from ingress of water
0	Not protected
1	Vertical drops
2	Drops (15° incline)
3	Spray water
4	Splash water
5	Spray water
6	Strong jet water
7	Temporary submersion
8	Continuous submersion

6.3 Guidelines for setting up networked automation systems in buildings

6.3.1 General notes on networking bus cables

Bus cables in plants

Bus cables are important connections for communication between individual components of an automation system. Mechanical damage or repeated electrical interference affecting these bus connections reduces the transmission capacity of the system. In extreme cases, such problems can lead to failure of the entire automation system. The following sections explain how to protect cables from mechanical and electrical impairment.

Shielding and grounding concept

Bus cables connect programmable controllers. These in turn are connected to transducers, power supply units, peripheral devices etc. over cables.

All the components together form a complex electrically networked automation system.

When connecting system components via electrical cables (in this case bus cables), remember to take into account the requirements of the overall system structure.

Connecting cables, in particular, influence the shielding and grounding concept. Shielding and grounding an electrical installation serves the following purposes:

- Protects both humans and animals from dangerous network voltages
- Prevents unacceptable noise emission and susceptibility to noise
- Protects the system from overvoltage (for example lightning protection)

Networking SIMATIC with SIMATIC NET

SIMATIC NET network components and SIMATIC automation components are designed to operate together taking into account the aspects listed above. By keeping to the installation instructions described in the system manuals and in the following sections of this book, your automation system will meet the legal and normal industrial requirements for safety and noise immunity.

6.3.2 Protection from electric shock

Twisted pair signal level

The signal levels on twisted pair cables are low voltage. Properly installed twisted pair cables do not have dangerous electrical voltages.

Remember, however, the following rules when installing the power supply for all components (end devices,
bus components, etc.) that you want to connect to a twisted pair cable.

Operation with 24 V DC

Numerous SIMATIC NET components require a voltage of 24 V DC as the operating voltage or contact auxiliary voltage. This supply voltage must fulfil the requirements for low voltage with secure electrical separation of the network according to IEC 60950 or EN 60950 /18/.

Operation with line voltage

Components operated with line voltage have to fulfill the protection requirements against electrical shock in accordance with EN 60950 /18/, EN 61131-2 /20/, EN 61010 /19/ or other product standards applying to them.

All signals of the twisted pair interface must fulfil the requirements of the secure electrical separation from the network according to IEC 60950 or EN 60950 /18/.

Cabling components

Leading cable path systems, barriers and accessories must be included in the protective measures against indirect touching (protection against impermissible touch voltage).

Protective conductors (PE) and equipotential bonding conductors must be installed in accordance with the requirements for systems and plants in buildings to HD 384.4.41 (protective measures against electrical shock) and HD 384.5.54 (grounding and protective conductors). Application of EN 50174-2 is recommended for the separation of low-voltage cabling and IT cabling.

The requirements of HD 384.4.47 S2 (Application of the measures for protection against electrical shock) and HD 384.4.482 S1 (Selection of protective measures as a function of external influences) or the corresponding national or local regulations are to be observed.

Safe basic state of the system or plant in case of faults

Faults in the communication connections may not result in a hazard to the other system or plant users. Cable or wire breaks must not lead to undefined statuses in the plant or system.

6.3.3 Mechanical protection of bus cables

Protection of electrical and optical bus cables

Mechanical protection is required to protect bus cables from interruptions or mechanical damage.

Note

The measures described here for mechanical protection apply both to electrical and optical cables.

Mechanical protection measures

We recommend the following measures to protect bus cables from physical damage:

- If there is no cable carrier (for example, cable racks, mesh cable trays, etc.), install the bus cables in a conduit (for example PG 11-16)
- In areas where the bus cables are subject to mechanical stress, install them in an aluminum armored conduit or in a plastic armored conduit (see Figure 1-5)
- In the case of 90° bends and junctions between buildings (for example expansion joints), an interruption of the conduit is acceptable only when there is no likelihood of damage to the cable, for example, due to falling objects (see Figure 1-6).
- In areas where the cable is likely to be walked on or driven over, the cable must be protected from damage by a closed heavy-gauge aluminum or steel conduit. As an alternative, the cable can be laid in a metal cable trough.

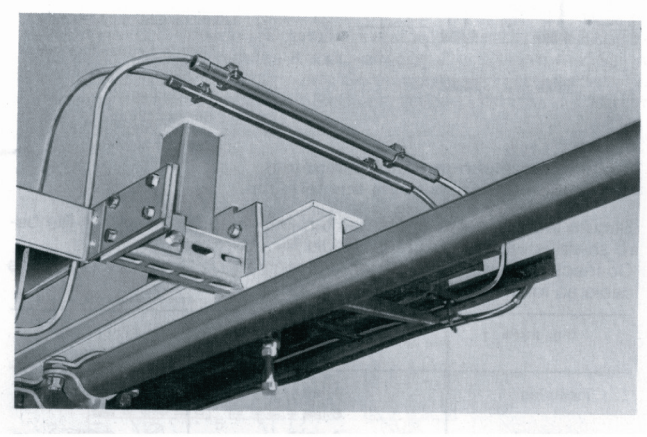


Figure 6-1 Mechanical protection of the bus cable through protection mounting

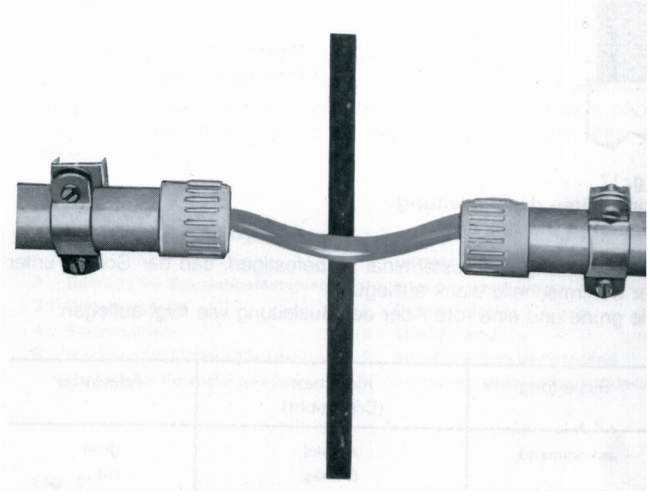


Figure 6-2 Interruption of the conduit at an expansion joint

Redundant bus cables

The installation of redundant bus cables involves special requirements. Redundant cables should always be installed on separate cable racks to avoid simultaneous damage by the same event.

Install bus cables separately

To prevent accidental damage to bus cables, they should be clearly visible and should be routed separate from all other wiring and cables. To improve EMC, it is often advisable to install the bus cables in a separate cable duct or in conductive metal tubes. Such measures also make it easier to localize a faulty cable.

6.3.4 Electromagnetic compatibility of fiberoptic cables

The use of fiber optic cables is generally recommended for communication connections between buildings and/or external facilities. Due to the optical transmission principle, fiber-optic cables are not sensitive to electromagnetic interference. Measures for equipotential bonding and for overvoltage protection are unnecessary with fiber optic cables.

Note

Fiber optic cables are ideally suited for bus connections in areas with high EMC loads. Remember, however, that bus components operating on an electrical basis may require additional interference protection measures in such areas. These must be protected using the measures already mentioned such as shielding, grounding, greater clearance to sources of interference, etc.

6.3.5 Use of glass FO cables

Plug-in connector for fiber-optic cables

Fiber-optic cables are connected to each other with plug-in connectors or with other network components. The following connection technologies are available:

- ST/BFOC plug-in connector
  The ST/BFOC plug-in connector has a metal and plastic housing and a ceramic or metal 2.5 mm ferrule usually made of ceramic. It is also suitable for single-mode and multimode applications. The average insertion loss is 0.3 dB, the maximum 0.4 dB.
- SC plug-in connector
  The SC plug-in connector has a compact rectangular plastic housing in push-pull technology and ceramic or metal 2.5 mm ferrule. It is often implemented as a duplex connector and is suitable for single-mode and multimode fiber-optic cables. The average insertion loss is about 0.2 dB.

- **LC plug-in connector**
  The LC plug-in connector with a clamp fastener is about half as large as an SC plug-in connector. As a duplex connector, it offers a high port density and is used, among other things, to connect modular SFP modules. The LC plug-in connector has a plastic housing and a ceramic or metal ferrule with a diameter of 1.25 mm. It is used in multimode or single-mode fibers. The average insertion loss lies between 0.1 and 0.3 dB.

Note

Plug-in connectors for glass FO cables should only be fitted by trained personnel. When fitted correctly, they allow extremely low insertion loss and the value is highly reproducible even after multiple plugging cycles.

Assembled cables

To be able to use glass fiber-optic cables with untrained personnel, glass fiber-optic cables are also available with various connectors already fitted. For more detailed information, refer to section "Glass FO cables (Page 76)".

Fitting connectors on site

If assembly on-site is required:
– Plug-in connectors for fiber-optic cables and suitable special tools can be procured
– SIEMENS offers this as a service.

If necessary, get in touch with your contact person for special cables and special lengths.

NOTICE
Protecting FO plug-in connectors from contamination
Fiber-plug-in connectors are susceptible to contamination and mechanical damage to the face. Protect open connectors with the supplied dust caps. Remove the dust protection only immediately before establishing the connection.

6.3.6 Electromagnetic compatibility of bus cables

The electromagnetic compatibility (EMC) is the capacity of an electric installation to function satisfactorily in their electromagnetic environment without inadmissibly influencing this environment which also includes other installations (according to DIN VDE 0870).

Reciprocal influencing can occur through electric, magnetic and electromagnetic effects. These can propagate both through the cable connections (for example, shared power supply) as well as through non-cable-specific irradiation and emission.

To avoid interference affecting electrical systems, these effects must be reduced to a certain level. The measures involved in achieving this limitation include the design, construction, and correct connection of bus cables. The components and bus cables for SIMATIC NET

Industrial Ethernet meet the requirements of the European standards for devices used in an industrial environment. This is documented by the CE marking.

Meeting of the specified limit values can only be guaranteed if components from the SIMATIC NET Industrial Ethernet product spectrum are used consistently and the installation regulations specified in this manual are observed.

6.3.6.1 Equipotential bonding system

Aims of equipotential bonding

The noise immunity of extended electronic automation systems or, in general, information technology systems largely depends on the suitable design of the grounding and equipotential bonding system of the building.

Equipotential bonding and grounding have two essential aims:

- Protection from the dangers of electricity
  - by limiting the contact voltage and creating a fault to ground path
- Improvement of electromagnetic compatibility
  - by creating a reference potential and equalizing potential differences between parts of the system
  - by shielding.

Causes of potential differences

Wherever electric currents flow, magnetic fields are produced that in turn induce stray currents in electrically conductive materials. Induced stray currents can therefore not be avoided in the vicinity of electrical consumers (drives, electronic controls, lighting etc.) and their power supply cables. They spread in all conductor loops. Conductor loops are formed by parts of buildings such as metal banisters on staircases, water pipes or central heating pipes as well as through the shields of electrical data cables and the protective ground connectors of electrical devices (PE). The flow of current produces a voltage drop. This can be measured as a potential difference between two locations within the system.

Extremely high potential differences between two grounding points result from lightning strikes.

Effects of potential differences in information technology systems

If locations with different grounding potential are connected via cables, currents will flow. The currents flow on all connections between these two points, for example also on the signal cables or cable shields connecting them. Attached devices can be disturbed or even destroyed.

The aim of a grounding and equipotential bonding system is to ensure that the currents flow in the grounding system and not in the electronic circuits.

Measures for grounding and equipotential bonding

According to EN 50310 /21/, a "common bonding network CBN" with a fine mesh of conductive elements must be created in buildings with information technology systems. Systems that extend beyond one floor and that are interconnected by electrical bus cables require a three dimensional CBN with a lattice construction resembling a Faraday cage.

With the following measures, you can create a grounding and bonding system that will improve EMC:

- Include all the metal parts of a building in a common bonding network (CBN) with low impedance and high current carrying capacity. To this network, you should then connect the main grounding terminal or bar, grounding conductors, metal conduits, reinforcing rods, equipotential bonding ring conductor, cable racks and any additional bonding conductors.
- Connect all inactive metal parts in the immediate vicinity of your automation components and bus cables to the bonding system ensuring good conductivity. This includes all metal parts of cabinets, machine parts etc. that have no electrical function in the automation system.
- Include metal, conductive cable channels/racks in the equipotential bonding of the building and between the individual parts of the system. The individual segments of the channels/racks must be connected together with low inductance and low resistance and connected to the CBN system as often as possible. Expansion joints and angled connections should be bridged by additional flexible grounding bands. The connections between the individual segments of channels must be protected from corrosion to ensure long-term stability.
- The effectiveness of equipotential bonding is greater when the impedance of the bonding conductor is low.
- The impedance of the additional bonding conductor must not exceed 10% of the shield impedance of parallel Industrial Twisted Pair cables.
- Protect the bonding conductor from corrosion.

- Install the bonding conductor so that the area enclosed by the bonding conductor and signal cables is as small as possible.
- Use copper or galvanized steel for the bonding conductor.

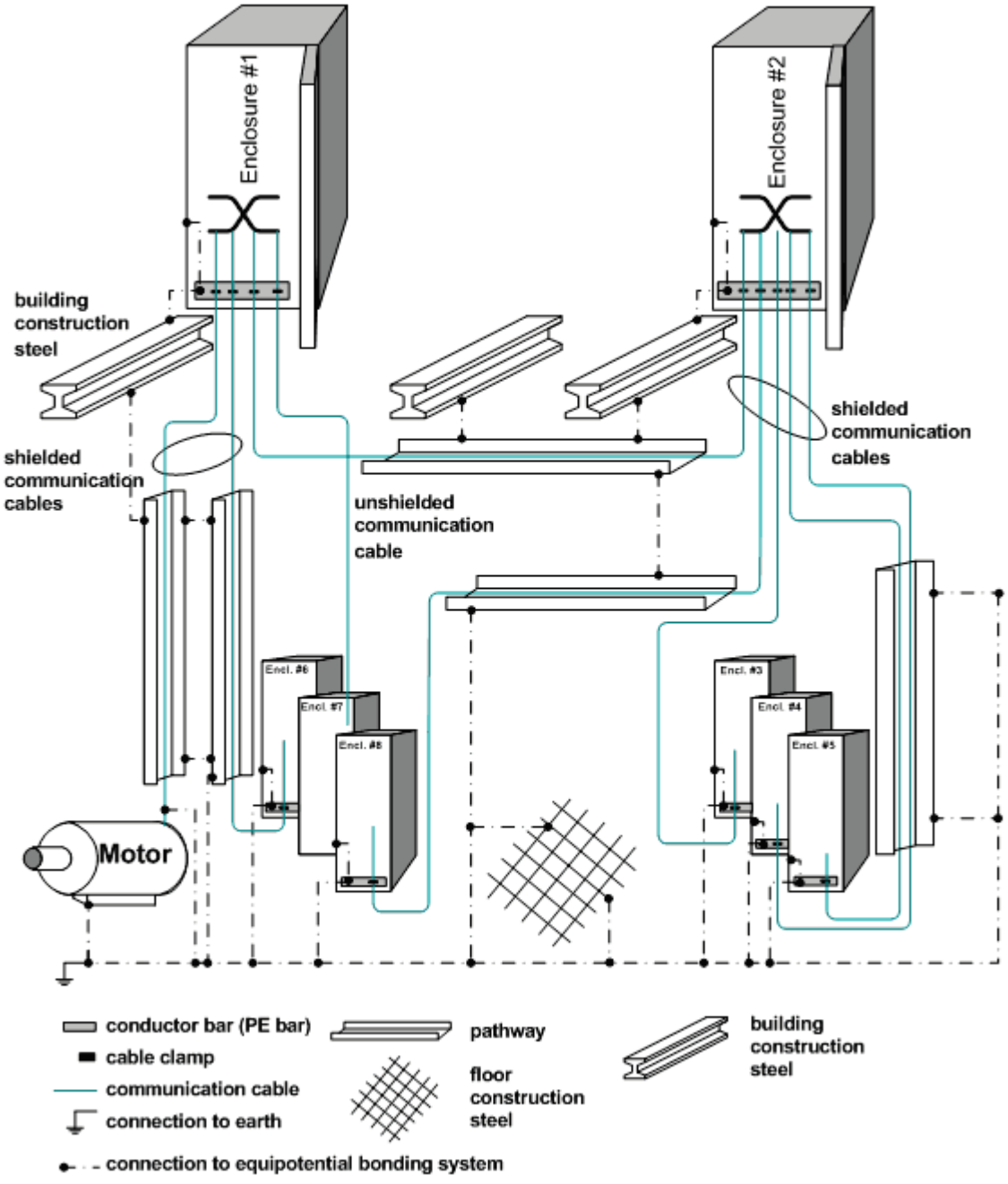


Figure 6-3 Example of meshed bonding system

For information about grounding and bonding techniques, refer to the system manuals of the SIMATIC S7300 /9/, S7400 /10/ programmable controllers.

Note

Equipotential bonding is unnecessary if the sections of a system are connected exclusively using fiberoptic cable (FO).

6.3.6.2 Requirements of the AC power distribution system

General

In HD 384.3 S2 (IEC 60364-3:1993, modified, /22/) different electricity distribution facilities (TN-S, TN-C-S, TN-C, TT and IT system) are described. Supplementary national or local regulations specify the measures to be observed as protection against electrical shock and lay down corresponding requirements for a grounding system (see also Section 1.2 Protection against electrical shock).

The outer surfaces of control cabinets, device housings, connectors and bus cables, that are conductive for shielding reasons, have to be connected with this grounding system under safety aspects. So that they can fulfill their EMC shielding effect optimally, they place additional requirements of the grounding system and the grounding of the power distribution system. These result in an AC distribution system with zero-current protective conductors, for example, in accordance with the TN-S system.

Cable shields are part of the equipotential bonding system of a plant

Because the shields of the Twisted Pair cables form part of the equipotential bonding system, all the currents flow there that are coupled into the equipotential bonding system of a building or of a plant.

Depending on the intensity and frequency range, these shield currents cause malfunctions of the data communication. It should therefore be avoided that the AC supply system of a plant integrates the equipotential bonding system into the energy return line. These requirements are fulfilled, for example, by a TN–S system with separate conductors for N and PE. Detailed guidelines on structuring a network system for supplying information-specific systems are provided in the standard EN 50310:2000 /21/.

Note

End devices and/or network components that are connected via shielded Twisted Pair cables may only be supplied from AC distribution systems whose protective conductors are not/cannot be used for power transmission. A PEN conductor must not exist in the entire plant. This condition is fulfilled, for example, by a TN-S system.

Signal links in existing installations

If inexplicable, sporadic interferences occur in data processing systems or their communication connections, it is advisable to carry out a check for impermissible shielding currents. These can be measured easily by inserting the (data) cable to be checked into a tong-test ammeter. Even currents from approximately 0.1 A indicate a problematic electrical installation, for example, in accordance with the TN–C system.

If the AC network supplies a high number of electronic devices or electronically regulated consumers, the highest interference currents usually exist at the 3rd harmonic of the power frequency.

Further indications of an unsuitable AC power supply system are:

- Currents on the PE conductor
- Currents of water pipes and heating pipes
- Rapid progression of corrosive damage at ground connections, lightning conductors, water pipes.

Note that sporadic events such as switching processes, short-circuits or atmospheric discharges (lightning strike) in the system can result in peak currents that exceed the average measured value many times over.

Troubleshooting

The following measures are suitable as troubleshooting

- Conversion of the power distribution system (for example to a TN-S system)
- Replace the electrical data cable by a fiber optic cable system.
- The installation of an equipotential bonding conductor parallel to the interfering data cables.

Note

If shielding currents on bus cables result in communication faults, the most reliable and usually most inexpensive solution is to replace the interfering electrical bus connection by a fiber optic cable system.

Installation example for fiber-optic cable in TN-C-S system

The graphic below schematically shows the correlations between AC network form, equipotential bonding system and information-specific cabling in a building.

Three PCs and three S7-300 units each represent the information technology system. The system is connected via two SCALANCE X devices. The housings of all end devices as well as of the SCALANCE X devices are connected to specifications with the grounding and equipotential bonding system of the building. At the PC, the connection is made via the protective contact (PE) of its power supply cable. The housings of the SCALANCE X devices and the racks of the S7-300 are connected either directly or via a control cabinet housing that encloses them locally with the equipotential bonding system CBN. The shields of the Twisted Pair cables interconnect all device housings and are therefore also applied at both ends to the grounding and equipotential bonding system.

The horizontal power distribution within a building story fulfill the requirements for a TN-S system. Neutral conductor N and protective conductor PE are routed as separate conductors. The protective conductor PE does not supply power to the devices. The cable shields of the Twisted Pair cables which are routed circuit-specifically in parallel are then also free of neutral conductor currents.

The vertical power distribution between the building floors is designed as a TN-C system (shared PEN conductor for N and PE). The PEN is the return conductor of the power supply for all connected consumers. A connection of the two SCALANCE X devices on the right of the figure by means of shielded Twisted Pair cables would let the return conductor current of the PEN flow through the complete equipotential bonding system, all the PE conductors and all the cable shields in both building stories. We therefore highly recommend that you implement the connections between the floors and the two SCALANCE X devices with fiber optic cables.

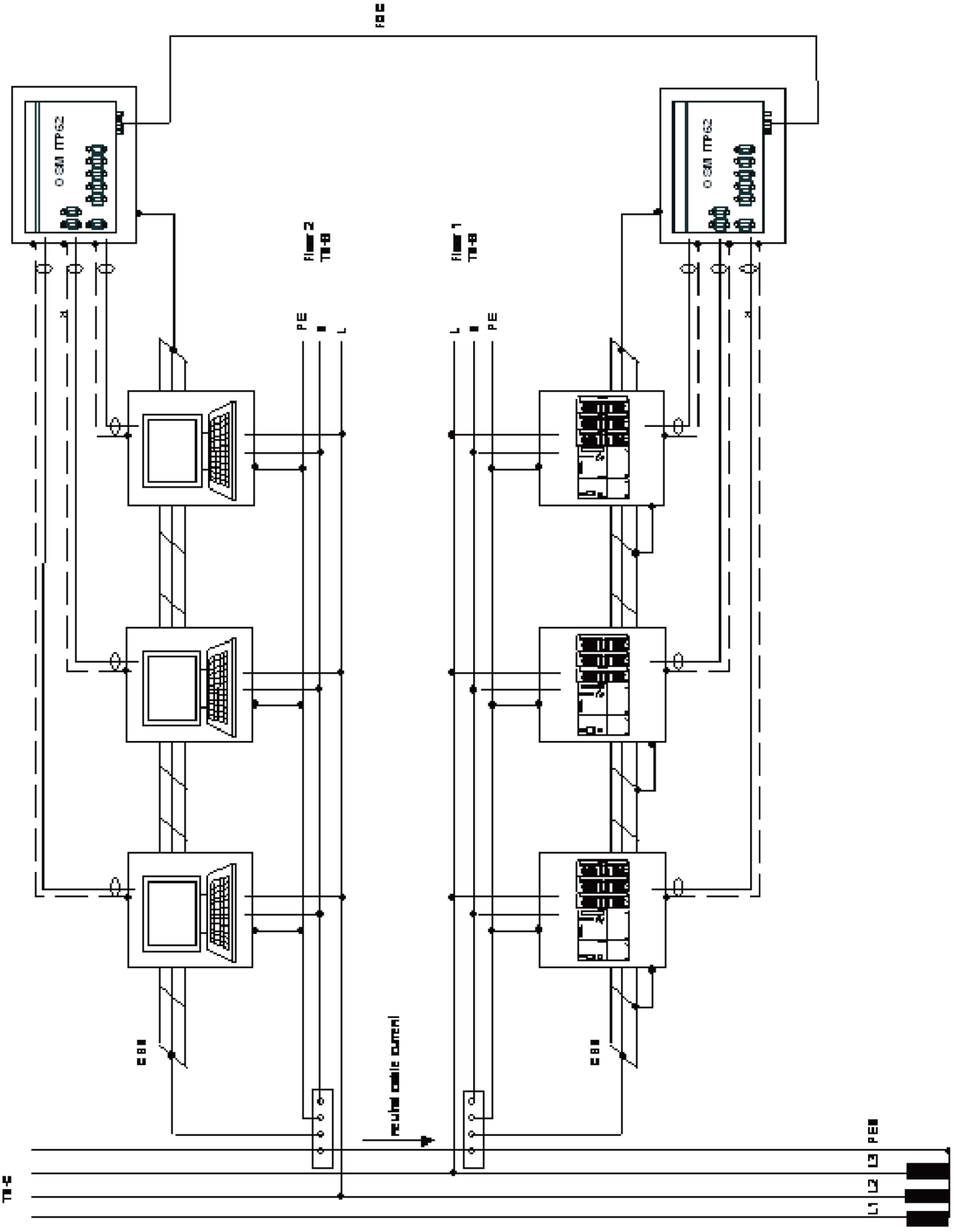

SIMATIC IPC62
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PE
L
L
PE
L1 L2 L3 PEN

Figure 6-4 Fiber-optic cables avoid shield currents in the TN-C-S network

6.3.6.3 Shielding devices and cables

Cable shielding

The high immunity to interference of SIMATIC NET Twisted Pair networks using copper technology is ensured by the exclusive usage of shielded Twisted Pair cables. The highly symmetrical twisted signal conductors are enclosed by a combination of foil and braided shield. The shield is connected at both ends of the Twisted Pair cable via the connected connector/outlet extensively and with good conductive properties to the housing of the connected end device or network components. The complete communication electronics, consisting of sending and receiving blocks as well as the signal cables, is protected against electromagnetic influences from the outside by a closed envelope of electrically conductive device housings and cable shield.

Note

The values specified for interference emissions and interference immunities in the technical data of all SIMATIC NET Industrial Ethernet components require the usage of shielded Twisted Pair cables.

In accordance with the installation instructions of the devices, the shields of the Twisted Pair cable have to be connected with good conductive properties to the device housing at **both** ends. This is ensured by the SIMATIC NET connectors matched to the devices.

If, contrary to these regulations, unshielded cables are used or the housing contact on both sides is prevented at the shield, fulfillment of the technical specifications with regard to interference emission and interference immunity is no longer ensured. In this case the owner-operator of the plant or system is themselves responsible for the fulfillment of statutory limits for interference emission and interference immunity (CE marking).

Handling bus cable shields

Note the following points when shielding cables:

- Use SIMATIC NET twisted pair cables throughout your system. The shields of these cables have an adequate density to meet the legal requirements regarding noise emission and immunity.
- Always contact the shields of bus cables at both ends. The legal requirements for noise emission and noise immunity in your system (CE marking) can only be achieved when the shields make contact at both ends.

- Secure the shield of the bus cable to the connector housing.
- If cables are installed permanently, it is advisable to remove the insulation of the shielded cable and to establish contact on the shield/PE conductor bar.

Note

If there is a potential difference between the grounding points, an impermissibly high compensating current can flow through the shield grounded at both ends. To rectify the problem, do not, under any circumstances, open the shield of the bus cable.

- Install an additional equipotential bonding cable parallel to the bus cable that takes over the shield current or
- Carry out the bus connection with fiber optic cables (most reliable solution).

Implementing contacting shields

Please note the following points when contacting cable shields:

- Secure the braided shield with metal cable clamps.
- The clamps must make good and large area contact with the shield.
- Contact SIMATIC NET twisted pair cables only by using the braided copper shield and not the aluminum foil shield. The foil shield is applied on one side to a plastic foil to increase tearing strength and is therefore non-conductive.
- Contact the shield with the shielding bar directly at the point at which the cable enters the cabinet.

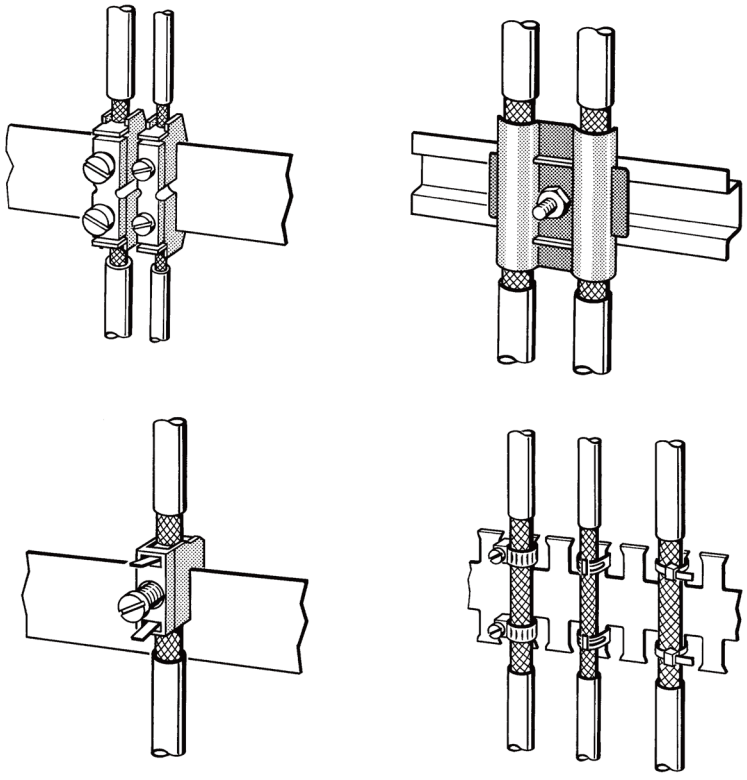


Figure 6-5 Securing shielded cables with cable clamps and ties (schematic representation)

- When removing the sheath of the cable, make sure that the braid shield of the cables is not damaged.
- To allow good contact between grounding elements, tin-plated or galvanically stabilized surfaces are ideal. In the case of galvanized surfaces, the required contact has to be achieved by using suitable screws. Coated surfaces are unsuitable at the contact points.
- Do not use shield clamps/contacts for strain relief - in as far as not expressly designed for this purpose. The contact with the shielding bar could be impaired or be disrupted altogether.

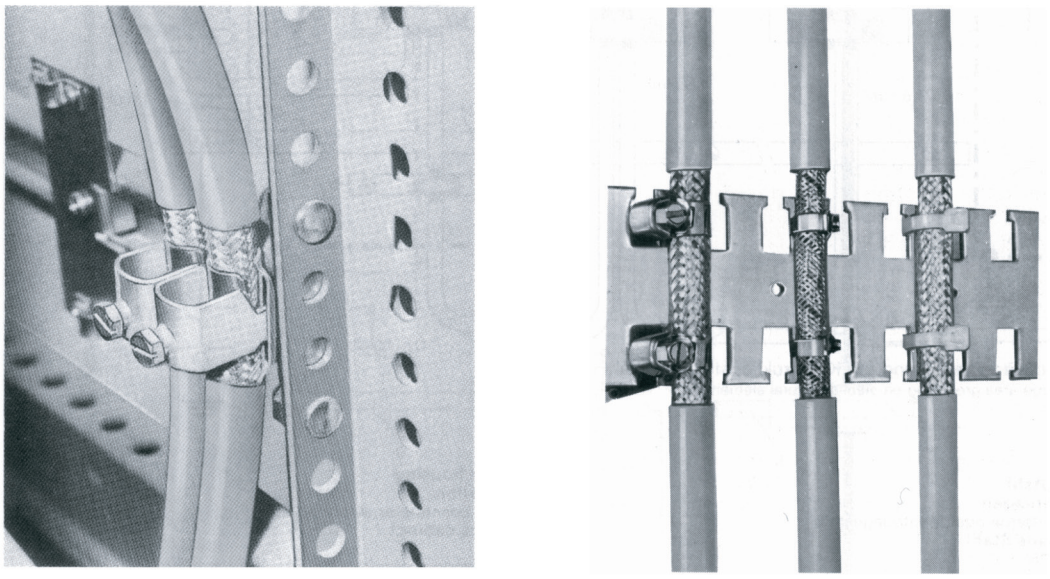


Figure 6-6 Shield contacting at the point of entry to a cabinet

6.3.6.4 Special noise suppression measures

Connecting switched inductances to suppressors

Some inductive switching devices (for example relays) create interference voltages that are a multiple of the connected operating voltage. The SIMATIC S7-300 /9/ and S7-400 /10/ system manuals contain suggestions on how to limit the interference voltages caused by inductance by connecting them to suppressors.

Power supply for programming devices

It is advisable to include a power socket for programming devices in each cabinet. The socket must be supplied by the same system to which the PE conductor for the cabinet is connected.

Cabinet lighting

Use bulbs for the cabinet lighting, for example LINESTRA lamps. Avoid the use of fluorescent lamps since they cause interference. If you need to use fluorescent lamps, take the measures shown in the figure below.

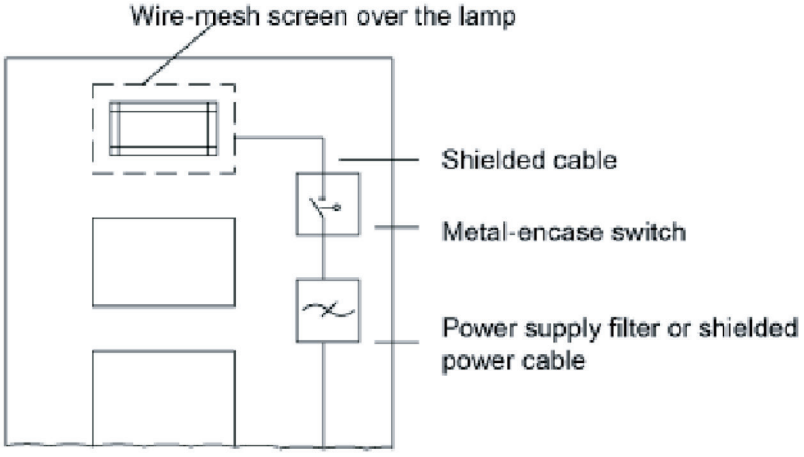


Figure 6-7 Measures for interference suppression of fluorescent lamps in a cabinet

6.3.7 Arrangement of devices and cables

Reducing interference by maintaining clearance

A simple and effective way of reducing disturbing influences is to maintain clearances between the interfering and interfered devices or cables. Inductive and capacitive disturbances decrease as a square value of the distance between the elements involved. This means that doubling the distance reduces the effect of the disturbance by a factor 4. If placement considerations are taken into account in the planning of a building, these measures can usually be implemented very inexpensively.

Standard recommendations for positioning of devices and cables

Recommendations on the arrangement of devices and cables with the aim of achieving the lowest mutual influence possible can be found in the standard EN 50174-2 /13/.

6.3.7.1 The influence of power distribution systems (EN 501742, 6.4.4.2)

Planning of the electrical installation

In order to avoid interference to sensitive devices by the power distribution system, the following points have to be taken into consideration during the planning of the electrical installation:

- Possible interference sources, such as voltage sub-distribution voltage transformers, elevators, high currents in power supply bars, have to be placed away from sensitive devices.
- Metal pipes (for example, for water, gas, heating) and cables should enter the building at the same point.
- Metal surfaces, shields, metal pipes and connections of these have to be connected and then connected with low-resistance cables to the equipotential bonding cable of the building.
- The selection of a common route for low-voltage cables and signal cables with sufficient isolation (through distance or shielding) between the two in order to avoid large induction loops that are formed by the different low-voltage cable routings.
- The usage either of a single multiple-conductor cable for all power supplies or - in the case of a higher output level - of power rails with low magnetic fields.

6.3.7.2 Cable categories and clearances

Fiber-optic cables

When fiber-optic cables are used, mechanical protection is necessary, but EMC influences do not have to be taken into account.

Grouping in categories

It is useful to group wires and cables into various categories according to the signals they carry, possible interference signals, and their sensitivity to interference. Minimum clearances can be specified for these categories so that interference-free operation can be expected under normal operating conditions if the clearance is adhered to.

Constraints

Grouping cables according to voltage classes assumes that the interference voltages relate directly to the power supply voltage conducted (the lower the supply voltage, the lower the interference voltage). Remember, however, that DC or 50 Hz power supply voltages do not represent any interference danger to Industrial Ethernet bus cables. The critical interference voltages in the kHz to MHz frequency range are created by the consumers connected to the cable. A 24 V DC cable with which a relay is switched regularly has a far more critical interference range than a 230 V cable supplying a lightbulb.

In the specifications below, it is assumed that all components in an automation system and all plant components controlled by it (for example machines, robots, etc.) meet at least the

requirements of the European standards for electromagnetic compatibility in an industrial environment. If devices are defective or incorrectly installed, higher interference voltages are possible!

The following is assumed:

- The cables for analog signals, data signals and process signals are always shielded.
- The distance from the cables to the chassis surface of the system (cabinet wall, grounded and conductive cable channel, etc.) does not exceed 10 cm.

Note

In general, the greater the distance between cables and the shorter the distances over which the cables run parallel to each other, the less the danger of interference.

How to read the table

To check how cables two of different types have to be laid, follow the steps outlined below:

1. Find the cable type of the first cable in Column 1 (Cables for ...).
2. Find the cable type of the second cable in the relevant section in Column 2 (And cables for ...).
3. Read the guidelines for laying the cables in column 3 (Lay ...).

Table 1-1 Cabling within buildings

Cables for ...	And cables for ...	Lay ...
Bus signals, shielded (PROFIBUS, Industrial Ethernet) Bus signals, unshielded (AS interface)	Bus signals, shielded (PROFIBUS, Industrial Ethernet) Bus signals, unshielded (AS interface) Data signals, shielded (programming devices, operator panels, printers, counter inputs, etc.) Analog signals, shielded DC voltage (v 60 V), unshielded Process signals (v 25 V), shielded AC voltage (v 25 V), unshielded Monitors (coaxial cable)	In common bundles or cable ducts
	DC voltage (> 60 V and 400 V), unshielded AC voltage (u 25 V and v 400 V), unshielded	In separate bundles or cable ducts (no minimum clearance required)

Cables for ...	And cables for ...	Lay ...
	DC and AC voltage (u 400 V), unshielded	**Within cabinets:** In separate bundles or cable ducts (no minimum clearance required) **Outside of cabinets:** On separate cable paths with at least 10 cm clearance
	RF cables for transmission output modules and transmission antennas with voltages from 10 V to 1000 V	Route RF cables in a steel tubing with multiple grounding; at least 30 cm spacing

6.3.7.3 Cabling within closets

Cabling within closets

When running cables within cubicles and cabinets, remember the following rules:

- Install the cables in metallic, electrically conductive cable channels.
- Screw the cable channels to the struts of the rack or cubicle walls approximately every 50 cm making low resistance and low inductance contact.
- Separate the cables according to the categories as shown in table 1-1.
- Maintain the minimum clearance between the cables of different categories as explained in table 1-1. In general, the risk of interference due to crosstalk is less the greater the clearance between the cables.
- Where cables of different categories cross, they should cross approximately at right angles (wherever possible avoid sections where the cables run parallel).
- The shields of all cables entering the wiring closet should make large area contact with closet ground as close as possible to the point of entry.

6.3.7.4 Cabling within buildings

Cabling within buildings

When laying cables outside cabinets but within buildings, note the following points:

- Install the cables in metallic, electrically conductive cable channels.
- Include the metal cable channels and racks in the bonding system of the building or plant. Note the information on equipotential bonding in Section 1.3 in this manual.
- Separate the cables according to the categories as described in table 11 and run the various categories in their own channels/racks.
- If there is only one common metal channel available for all categories, either the clearances shown in Table 11 must be maintained or the individual categories should be

separated from each other by metallic partitions. The partitions must be connected to the channel making low resistance and low inductance contact.

- Cable racks should cross each other at right angles.

6.3.7.5 Cabling outside buildings

Using fiberoptic cables

Industrial Twisted Pair is intended for use within buildings (tertiary area). The installation of Industrial Twisted Pair cables between buildings in not permitted. LAN connections between buildings and between buildings and external facilities are only possible with fiberoptic cables (FO). Due to the optical transmission principle, fiberoptic cables are not affected by electromagnetic interference. Measures for equipotential bonding and overvoltage protection are unnecessary with fiberoptic cables.

6.3.8 Laying bus cables

6.3.8.1 Installation instructions for electrical and optical bus cables

General

During installation, remember that bus cables can only be subjected to a certain amount of mechanical strain. Cables can be damaged or even destroyed by too much tensile stress or pressure, by torsion or by bending them too sharply. The following instructions will help you to avoid damage when installing bus cables. If cables are subjected to too much strain or stress for one or more reasons, they should always be replaced.

Storage and transport

During storage, transportation and cabling, the open ends of the bus cable (without connectors) must be kept closed with a shrink-on cover to prevent oxidation of the cores and to keep dampness out of the cable.

Temperatures

During transportation, cabling and operation, the cable must not be exposed to temperatures below the specified minimum temperature or above the specified maximum temperature otherwise the electrical and mechanical characteristics of the cables can deteriorate. The permitted temperature ranges of your bus cable can be found in the technical data sheets of the particular bus cables.

Tensile strength

The tensile force exerted on the cables during or after installation must not exceed the limits of tensile strength of the cables. The permitted tensile loads of your bus cable can be found in the technical data sheets of the particular bus cables.

Pull in assembled cables using cable grips

To pull in assembled cables, make sure that you use cable grips. These surround the fitted plugs and protect them from damage while pulling them in.

Fitting strain relief

Make sure that you provide strain relief approximately 1 m from the connection point on all cables subject to tensile loading. Shield clamps are not adequate for strain relief!

Pressure load

Too much pressure on the cables must also be avoided, for example pinching the cable when securing it in position.

Torsoion

Torsion can lead to the elements of a cable being displaced and degrading the electrical characteristics of cables. Bus cables must therefore not be twisted.

Bending radii

To avoid damage within the bus cables, they must at no time be bent more sharply than the minimum bending radius. Note:

- When pulling in cables under tensile load, larger bending radii must be adhered to than when the cable is in its final installed status.
- Bending radii for non-circular cables apply only to bending the flat, broader surface. Bends in the narrower surface require much greater radii.

The permitted bending radii of your bus cable can be found in the technical data sheets of the particular bus cables.

Avoid loops

When laying bus cables, unwind them at a tangent from the cable drum or use appropriate rotary tables. This prevents loops forming and resulting in kinks and torsion.

Installing other cables

When laying bus cables remember that bus cables must not be subjected to excessive strain and stress when installed. This can, for example, happen when cables have been installed along with other cables on a common rack or in a common duct (providing this is electrically permitted) and then new cables are pulled along the same path later (during repairs or when extending a system).

6.3.8.2 Additional instructions on installing fiberoptic cables

Protecting connectors from contamination

Fiber-optic cable connectors are sensitive to contamination. Unconnected plugs and sockets must be protected with the supplied dust caps.

Attenuation variations under load

During installation, fiber-optic cables must not be twisted, stretched or squashed. The specified limit values for tensile strain, bending radii and temperature ranges must be adhered to. During installation, the attenuation values can vary slightly, these variations are, however, reversible providing the strain limits are not exceeded.

Pulling cables using cable grips and protect connectors

To pull in cables without Kevlar pull-in aids use cable grips. Before fitting the cable grip, make sure that the connectors of preassembled cables are protected from the pressure exerted by the cable grip, for example using a piece of protective tube.

Fitting strain relief

Although the ST/BFOC plugs have their own strain relief and kink protection, it is advisable to arrange for additional strain relief as close as possible to the connected device to protect against mechanical strain.

Plan adequate attenuation reserves

When installing the cables over long distances, it is advisable to plan in one or more repair splice connections in the attenuation budget.

EMC robustness

Fiber-optic cables are immune to electromagnetic interference. Installing cables in cable channels along with other cables (for example 230 V/380 V power supply cables) causes no problems. When installing in cable channels, however, make sure that the permitted strain on the fiber-optic cables is not exceeded when pulling in other cables later.

WARNING

Adherence to the technical specifications

During installation and operation, all mechanical requirements for the cable such as bending radii, tensile strain etc. must be kept to. If these limits are exceeded, permanent deterioration of the transmission characteristics may result that can cause temporary or permanent failure of data transmission.

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