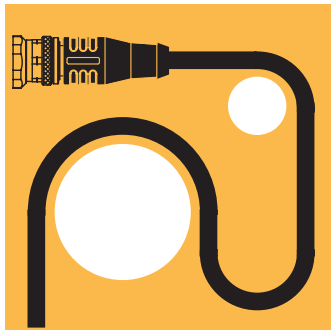
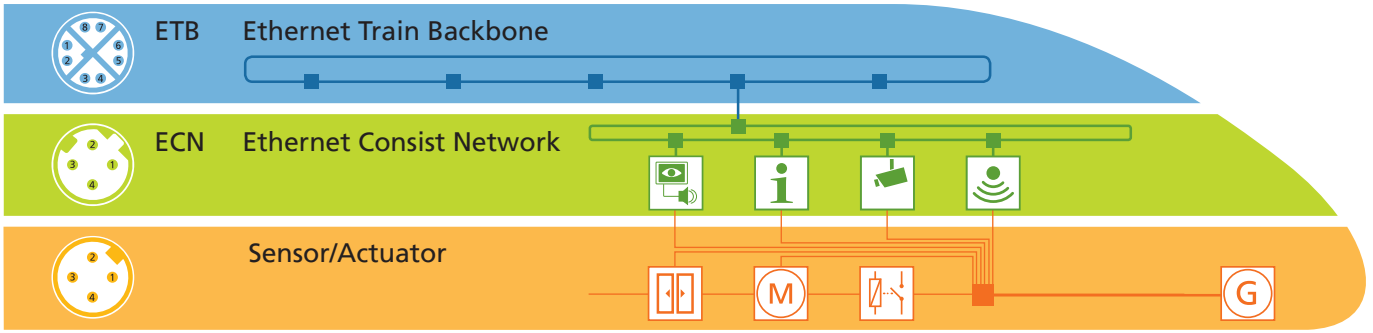
escha.net

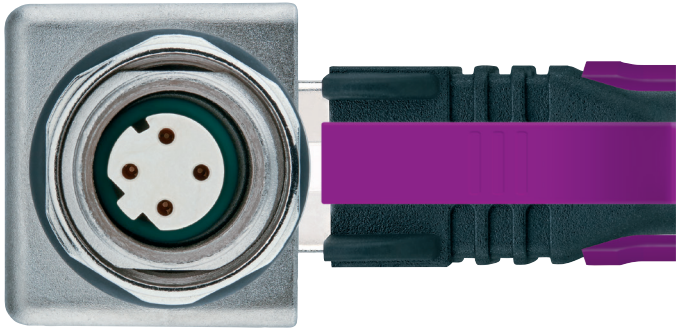
ESCHA



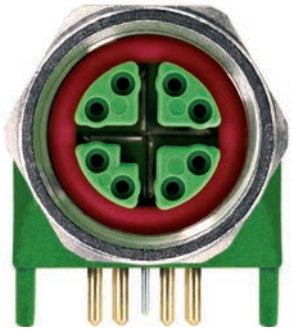


bus approved

rail approved

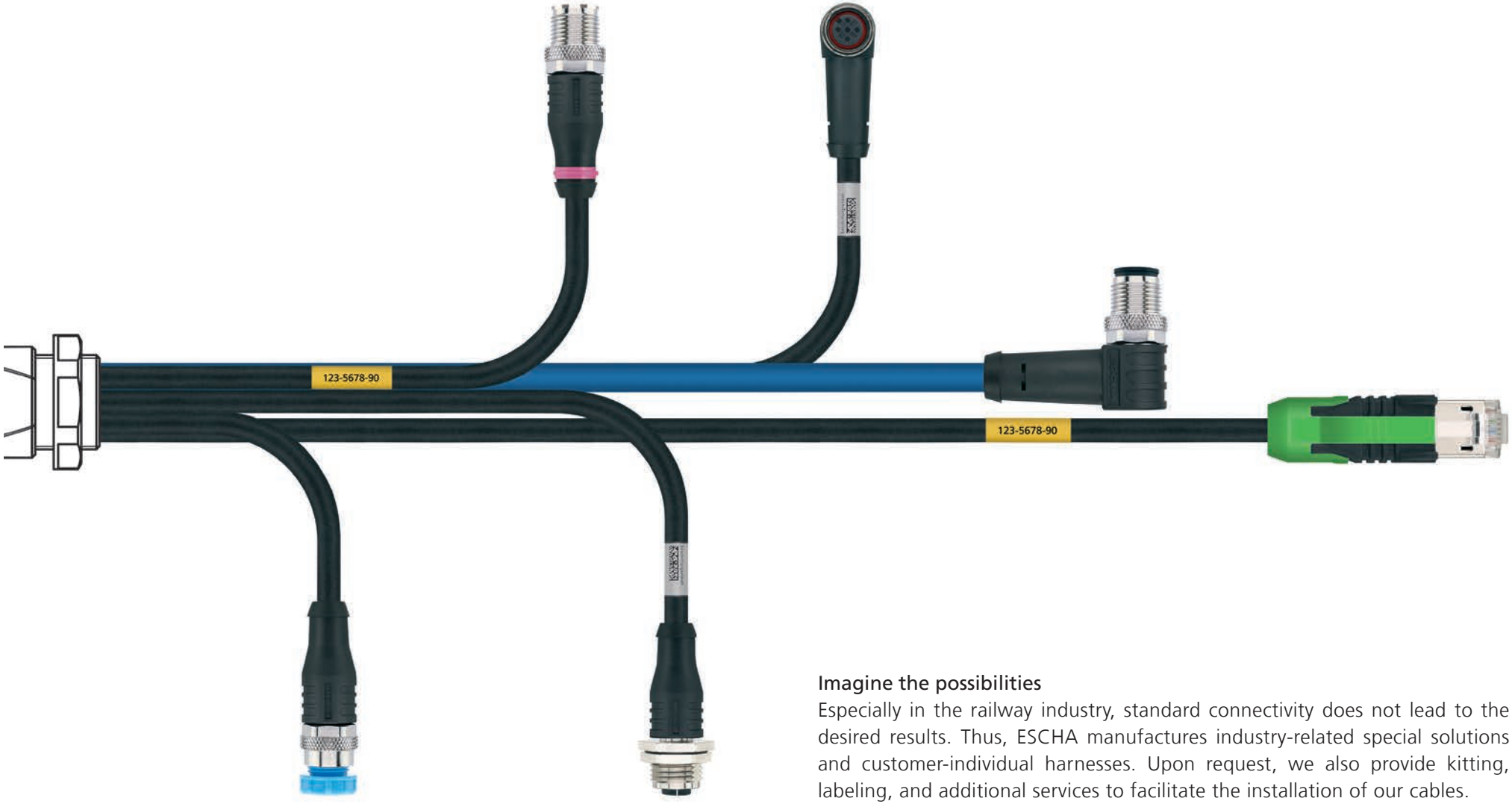


10
GBit/s



100
MBit/s

DIN EN 45545-2



Imagine the possibilities

Especially in the railway industry, standard connectivity does not lead to the desired results. Thus, ESCHA manufactures industry-related special solutions and customer-individual harnesses. Upon request, we also provide kitting, labeling, and additional services to facilitate the installation of our cables.

e d i t o r i a l

Daniel Gottschalk, Business Development Manager bus & rail

'ESCHA rail approved' has been standing for assembled connectors adapted for applications in the railway industry. They stand up to the high industry-specific safety requirements and durably resist the extreme environmental conditions.

Based on the customer experience and feedback gained over the past years, we have extended our rail approved portfolio. Hence, next to a broad range of sensor-/actuator connectivity, you will find lots of novelties for the area of 10GBit ETB-networks on the following pages. As of now, we are offering shielded and unshielded connectors for mechanically high demanded applications, which can be equipped with a protective hose.

The entire rail approved portfolio has been designed for your individual requirements. We do not state standard cable-lengths and supply custom-made according to your needs. Upon request, you receive fully labelled cable sets for your final assembly or sophisticated harnesses.

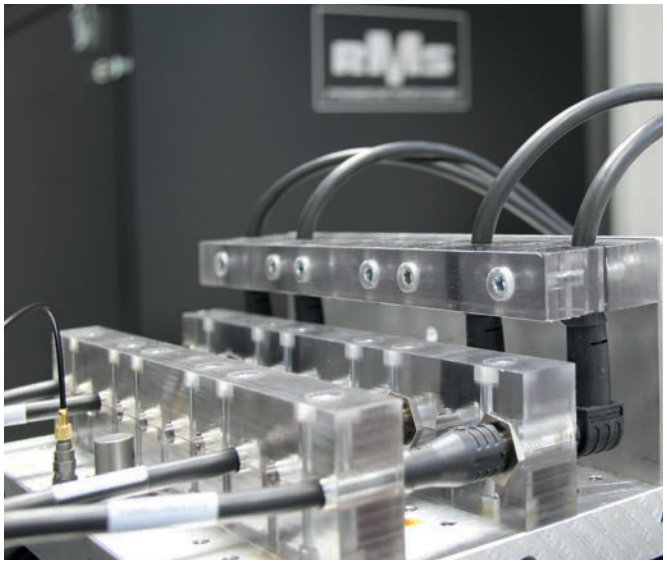
We use the widespread BMEcat format to allow a fast access to our catalog data. ESCHA data is available in the eCl@ss (5.1.4 up to 9.0) and ETIM (4.0 up to 6.0) standardized classification systems.

We are looking forward to your individual requirements and feedback!

rail-approved@escha.net

Protection-class test

High-frequency test



Vibration- and shock test

ESCHA – specialist in connectivity.

For more than 30 years, the ESCHA Group has been developing, manufacturing, and marketing qualitatively high-grade connectivity and housing technology. Our solutions are implemented in automation technology as well as in machinery- and plant engineering. Moreover, we continue to extend our portfolio by new products for various applications.

At ESCHA you get all from one hand: innovative standard connectivity, individual and special solutions, and custom-made automation components in highest protection classes.

Take advantage of our years of experience in connector-, housing-, and tool design, a professional project management, our efficient and modern tool shop as well as the certified production for injection molding, cable manufacturing, and overmolding technology.

Networked worldwide

Our headquarters are based in Germany – where we develop, test and manufacture our products. Through our global sales network and production sites in Europe, America, and Asia, we guarantee consistent product-, quality-, and service standards worldwide.

ESCHA has the status of Authorized Economic Operator. This AEO-Certification provides us with customs-law simplifications and guarantees our customers high security standards within the entire international supply chain.

We want you to experience the extraordinary. Pleasure in service, innovation, and engineering are our road to economic success. Social commitment and sustainable economic operation are our benchmark.

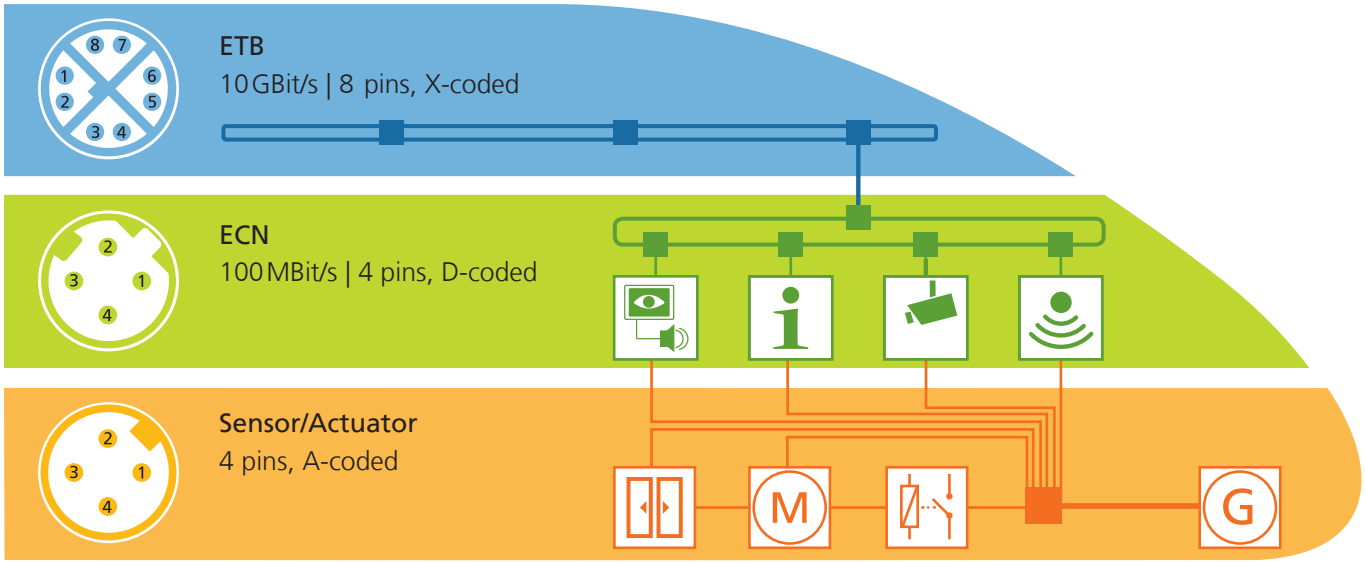
Overmolded connectivity

Coming from automation engineering, ESCHA masters the technology of dust- and waterproof connectivity- and housing solutions. The advantages of this technology can be transferred to the bus- and rail industry: Overmolded connectivity stands for safety, velocity, and economies of scale.

Despite serial production we offer customer-specific cable lengths to facilitate the installation of our cables and to accelerate production sequences on customer side. ESCHA patented 360° double-shell shielding concept (2SSK) and crimped contacts guarantee a safe connection and enhance the reliability of the whole onboard network system.

See technical information on page 37.

Climatic test



ESCHA test lab

All necessary tests to guarantee a safe and reliable use of our products in bus and rail applications are carried out and documented in the ESCHA test lab. This includes IP-tests for highest protection classes, customer-specific shock- and vibration requirements as well as application related climatic tests and temperature shocks.

Furthermore, we have our own high-frequency lab to carry out all tests to secure a stable and durable data transmission with ESCHA connectivity.

As required, we also cooperate with accredited test labs and have our products certified by an independent authority.

rail approved

ESCHA products with the 'rail approved' seal consist of connectors and cables which are tested according the following standards:

- DIN EN 45545-2 (fire performance)
- DIN EN 50155 (mechanical stresses, vibration, shock)
- IEC 61076-2-109 or IEC 61076-2-101 (type-test connector)
- IEC 60529 (IP protection class)

Manufacturer's declaration on testing-processes and results can be seen at escha.net.

bus approved

The 'bus approved' seal combines all products which are adapted to bus applications and are tested according the following standards:

- ECE R118 (fire performance cable)
- IEC 61076-2-109 or IEC 61076-2-101 (type-test connector)
- IEC 60529 (IP protection class)

As standard, ESCHA connectors are electrically tested and comply with categories Cat6$_A$ or Cat5e with regard to their transmission properties.

Nomenclature of patched connectors

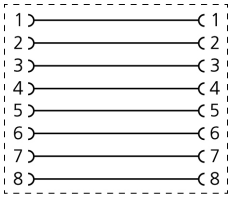
Double-ended cordset

RA –	W	WAS	S	G	X	8.066–	L	– RA–	W	WAS	S	X	8.066	/S5006

- /S5006: Cable quality
- 8.066: Contacts.allocation code
- X: X-coded
- S: Shielded
- WAS: M12x1 male | FKFD: M12x1 female receptacle | RJ45S: male
- W: angled | without: straight
- RA–: Rail Approved
- L: Cable length [m]
- 8.066–: Contacts.allocation code
- X: X-coded
- G: Grip body with thread | C: Field-wireable
- S: Shielded
- WAS: M12x1 male | FKFD: M12x1 female receptacle | RJ45S: male
- W: angled | without: straight
- RA –: rail approved

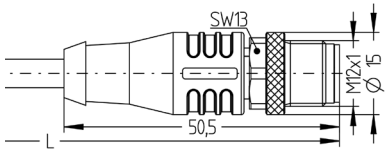
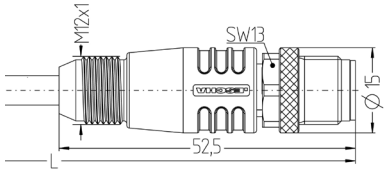
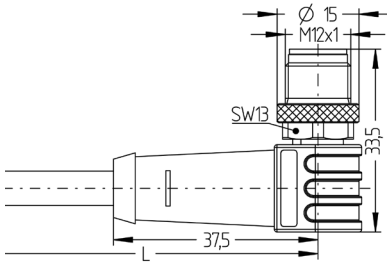
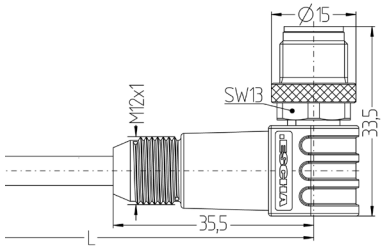
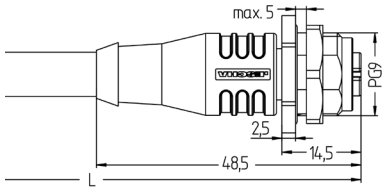
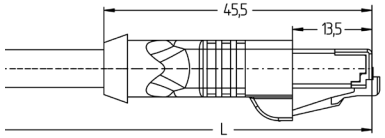
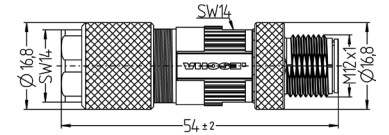
Cable	Short description
S5006 4 x 2 x AWG26/7	Halogen-free, electron-beam cross-linked 1,200-MHz-databus-cable with improved fire performance. Better than Cat7 according to EN 50288 and IEC 61156. Excellent features regarding NEXT, attenuation, skew, and screening characteristics (pair- and overall screen). This cable can be used for fixed and protected installation inside of rail vehicles and busses. It is optimally suited for all Ethernet applications of classes D to F (ECN and ETB) according to IEEE 802.3. For installation the guidelines of EN 50355 and EN 50343 must be considered.

Adapter 8X-8X



Industrial Ethernet 10 GBit/s

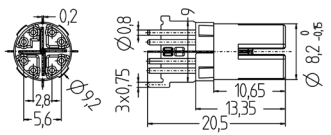
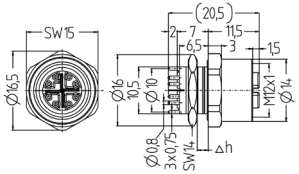
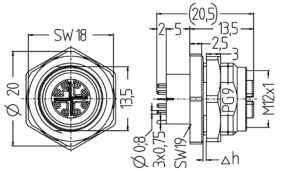
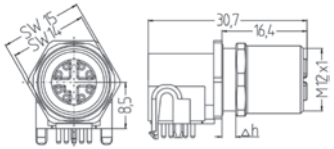
Technical data	M12x1 8 pins | X-coded	RJ45 Molded	Wiring connector 8 pins	Panel feed through M12x1/RJ45 | 8X	Adapter M12x1 | 4D/8X, 8X/8X	Receptacle M12x1 | 8X
Rated voltage	50V$_{AC}$ | 60V$_{DC}$	50V	60V	60V	50V$_{AC}$ | 60V$_{DC}$	50V$_{AC}$ | 60V$_{DC}$
Current load (at 40°C)	0.5A	1A	0.5A	0.5A	0.5A	0.5A
Insulation resistance	≥10^8Ω	≥10^8Ω	≥10^8Ω	≥10^8Ω	≥10^8Ω	≥10^8Ω
Standards	IEC 61076-2-109 DIN EN 50155 DIN EN 45545-2	IEC 60603-7-5	DIN EN 50155	IEC 61076-2-109 IEC 60603-7-5 DIN EN 50155	IEC 61076-2-109 DIN EN 50155	IEC 61076-2-109 DIN EN 50155 DIN EN 45545-2
Ambient temperature product	-40°C...+90°C	-40°C...+70°C	-40°C...+85°C	-25°C...+85°C	-40°C...+85°C	-40°C...+90°C
Degree of pollution	2	1	3/2	2	2	2
Degree of protection (mounted)	IP67 (-30°C...+90°C) IP65 (-40°C...+90°C)	IP20	IP65/IP67	M12x1: IP67 RJ45: IP20	IP65 | IP67	IP67 (-30°C...+90°C) IP65 (-40°C...+90°C)
Mechanical life-cycle	>100 mating cycles	>750 mating cycles	10 connections	>100 mating cycles	>100 mating cycles	>100 mating cycles
Connecting cross-section	AWG26/7-AWG22/7 AWG24/1-AWG22/1		AWG26/7-AWG22/7 AWG26/1-AWG22/1			
Cable outlet	Ø 5.0...9.7mm		Ø 5.0...9.7mm			
Connecting type	Insulation displacement contact		Insulation displacement contact			

			Pins	Cable / Δh[mm]	Item description
		Single-ended cordset male, M12x1, straight shielded Cat6A	8, X	S5006	RA-WASSX8.066-L/S5006
		Single-ended cordset male, M12x1, straight, grip body with thread shielded Cat6A	8, X	S5006	RA-WASSGX8.066-L/S5006
		Single-ended cordset male, M12x1, straight shielded Cat6A	8, X	S5006	RA-WWASSX8.066-L/S5006
		Single-ended cordset male, M12x1, angled, grip body with thread shielded Cat6A	8, X	S5006	RA-WWASSGX8.066-L/S5006
		Receptacle Single-ended cordset female, M12x1, straight Back wall-mounting shielded Cat6A	8, X	S5006	RA-FKFDSX8.066-L/S5006
		Single-ended cordset male, RJ45, straight shielded Cat6A	8	S5006	RA-RJ45SS8.002-L/S5006
		Connector field-wireable male, M12x1, straight Insulation displacement contact shielded Cat6A	8, X		IE-WASCSX8S

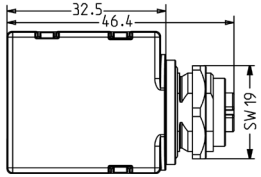
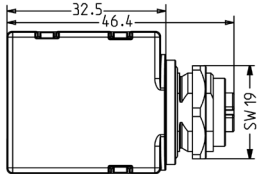
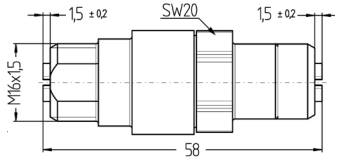
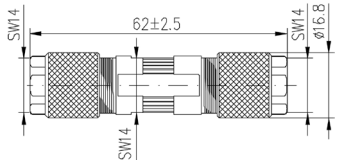
* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

			Pins	Cable / Δh[mm]	Item description
		Double-ended cordset male, M12x1, straight male, M12x1, straight shielded Cat6A	8, X 8, X	S5006	RA-WASSX8.066-L-RA-WASSX8.066/S5006
		Double-ended cordset male, M12x1, angled male, M12x1, straight shielded Cat6A	8, X 8, X	S5006	RA-WWASSX8.066-L-RA-WASSX8.066/S5006
		Double-ended cordset male, M12x1, angled male, M12x1, angled shielded Cat6A	8, X 8, X	S5006	RA-WWASSX8.066-L-RA-WWASSX8.066/S5006
		Double-ended cordset female, M12x1, straight male, M12x1, straight shielded Cat6A	8, X 8, X	S5006	RA-FKFDSX8.066-L-RA-WASSX8.066/S5006
		Double-ended cordset female, M12x1, straight male, M12x1, angled shielded Cat6A	8, X 8, X	S5006	RA-FKFDSX8.066-L-RA-WWASSX8.066/S5006
		Double-ended cordset male, M12x1, straight male, RJ45, straight shielded Cat6A	8, X 8	S5006	RA-WASSX8.066-L-RA-RJ45SS8.002/S5006

* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

			Pins	Cable / Δh[mm]	Item description
		Double-ended cordset male, M12x1, angled male, RJ45, straight shielded Cat6A	8, X 8	S5006	RA-WWASSX8.066-L-RA-RJ45SS8.002/S5006
		Double-ended cordset male, RJ45, straight male, RJ45, straight shielded Cat6A	8 8	S5006	RA-RJ45SS8.002-L-RA-RJ45SS8.002/S5006
		Receptacle female, M12x1, straight Print contact Insert connector Cat6A	8, X		IE-EKSX8P
		Receptacle female, M12x1, straight Print contact Front wall-mounting Cat6A	8, X	0.9...2.5 mm	IE-FKDSX8-P/12
		Receptacle female, M12x1, straight Print contact Front wall-mounting modular Cat6A	8, X	0.9...2.5 mm	IE-FKDHSX8-P/12
		Receptacle female, M12x1, straight Print contact Back wall-mounting Cat6A	8, X	0.9...2.5 mm	IE-FKFDSX8-P
		Receptacle female, M12x1, straight Print contact Back wall-mounting modular Cat6A	8, X	0.9...2.5 mm	IE-FKFDHSX8-P
		Receptacle female, M12x1, angled Print contact Back wall-mounting Cat6A	8, X	1.0...2.5 mm 2.5...4.0 mm 4.0...5.0 mm	IE-WFKFSX8-P/12/S3525 IE-WFKFSX8-P/12/S3540 IE-WFKFSX8-P/12/S3550

* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

			Pins	Cable / Δh[mm]	Item description
		Panel feed through female, M12x1, straight female, RJ45, straight Back wall-mounting Cat6A	8, X 8	0.9...4.0 mm	IE-FKFDSX8-RJ45KS
		Panel feed through female, M12x1, angled female, RJ45, straight Back wall-mounting Cat6A	8, X 8	0.9...4.0 mm	IE-WFKFDSX8-RJ45KS
		Adapter female, M12x1, straight female, M12x1, straight Cat6A	8, X 8, X	1.0...4.0 mm	IE-WAKSX8-IE-WAKSX8
		Wiring connector Insulation displacement contact shielded Cat7	8		IE-LVCS8

* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

Nomenclature of patched connectors

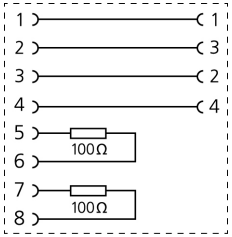
Double-ended cordset

RA –	W	WAS	S	G	Y	4.029–	L	– RA–	W	WAS	S	Y	4.029	/S4002

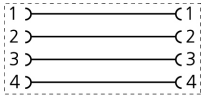
- /S4002: Cable quality
- 4.029: Contacts.allocation code
- Y: D-coded
- S: Shielded
- WAS: M12x1 male | FKFD: M12x1 female receptacle | RJ45S: male
- W: angled | without: straight
- RA–: Rail Approved
- L: Cable length [m]
- 4.029–: Contacts.allocation code
- Y: D-coded
- G: Grip body with thread | C: Field-wireable
- S: Shielded
- WAS: M12x1 male | FKFD: M12x1 female receptacle | RJ45S: male
- W: angled | without: straight
- RA–: rail approved

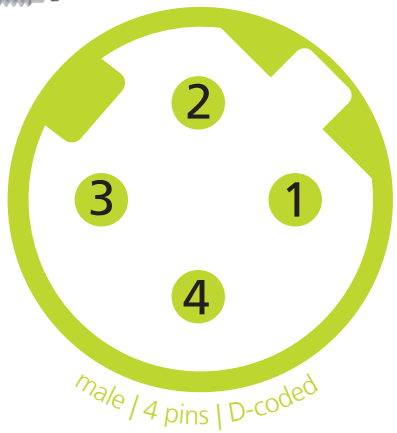
Cable	Short description
S4002 Reduced Wire 1 x 4 x AWG22 Star-quad	Halogen-free irradiated cable with good behavior in case of fire. The cable is adapted to stationary wiring and for the application in Consist Network (ECN) of railway vehicles meeting the fire protection requirements according to DIN EN 45545 Hazardous Level 1 to 3. Data transmission rates up to 100MBit/s are possible. Due to its thin wall thickness it is predestined for RJ45-connectors.
S4003 Standard 1 x 4 x AWG22 Star-quad	Halogen-free irradiated cable with good behavior in case of fire. The cable is adapted to stationary and limited flexible wiring and for the application in Consist Network (ECN) of railway vehicles meeting the fire protection requirements according to DIN EN 45545 Hazardous Level 1 to 3. Data transmission rates up to 100MBit/s are possible. This cable is characterized by a high market acceptance.
S4004 ECO 1 x 4 x AWG22 Star-quad	Halogen-free irradiated cable with good behavior in case of fire. The cable is adapted to stationary and limited flexible wiring and for the application in Consist Network (ECN) of railway vehicles meeting the fire protection requirements according to DIN EN 45545 Hazardous Level 1 to 3. Data transmission rates up to 100MBit/s are possible. Due to the technical further development, S4004 offers a significantly improved price-performance ratio implementing the same technical features as S4003. The blue outer-jacket offers an optical distinction between Ethernet- and sensor/actuator wiring.
S2171 bus approved 1 x 4 x AWG22 Star-quad	Flexible PUR/PE data-cable Industrial Ethernet CAT 5e for medium stresses. Halogen-free, flame retardant, medium drag-chain capability. Good oil- and chemical resistant, UL-style.

Adapter 8X-4D



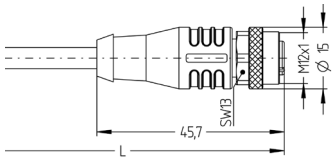
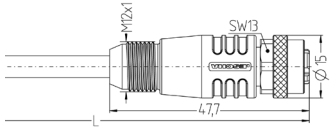
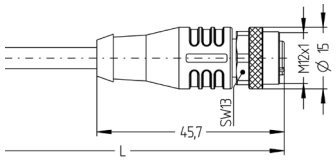
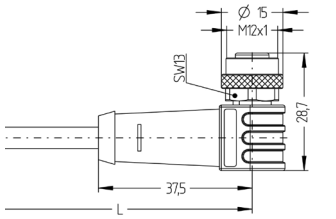
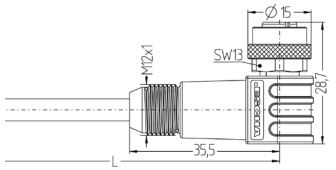
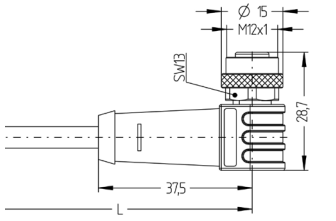
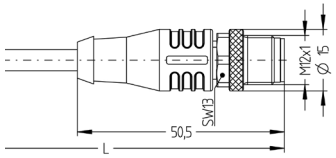
Adapter 4D-4D



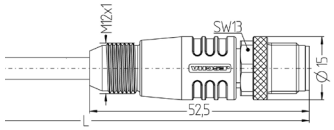
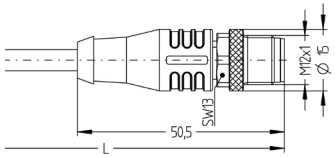
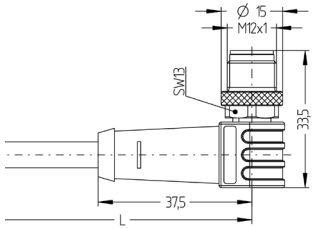
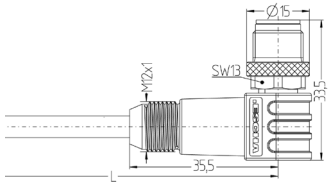
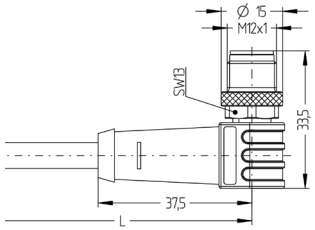
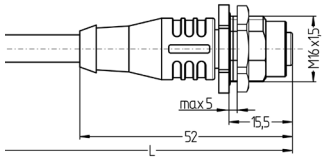
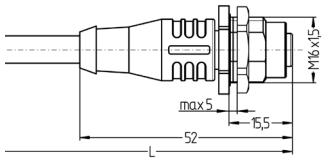


Industrial Ethernet 100 MBit/s

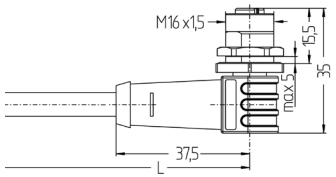
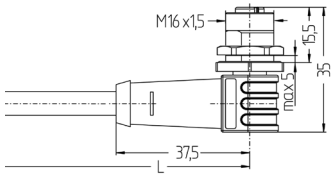
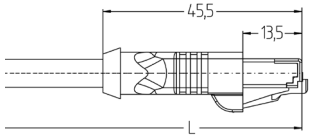
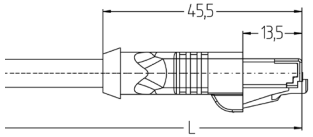
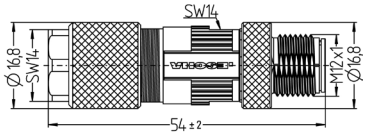
Technical data	M12x1 4 pins | D-coded	RJ45 Molded	Panel feed through M12x1/RJ45 | 4D	Adapter M12x1 | 4D/4D	Adapter M12x1 | 4D/8X	Receptacle 4 pins | D-coded
Rated voltage	250V	50V	50VAC | 60VDC	250V	50VAC | 60VDC	250V
Current load (at 40°C)	4A	1A	0.2A	4A	0.5A	4A
Insulation resistance	≥10^8Ω	≥10^8Ω	≥10^8Ω	≥10^8Ω	≥10^8Ω	≥10^8Ω
Standards	IEC 61076-2-101 DIN EN 50155 DIN EN 45545-2	IEC 60603-7-5	IEC 61076-2-101 IEC 60603-7-5	IEC 61076-2-101 DIN EN 50155	IEC 61076-2-101 IEC 61076-2-109 DIN EN 50155	IEC 61076-2-101 DIN EN 50155 DIN EN 45545-2
Ambient temperature product	-40°C...+90°C	-40°C...+70°C	-25°C...+85°C	-40°C...+85°C	-40°C...+85°C	-40°C...+90°C
Degree of pollution	3	1	2	2	2	3
Degree of protection (mounted)	IP67 (-30°C...+90°C) IP65 (-40°C...+90°C)	IP20	M12x1: IP65 | IP67 RJ45: IP20	IP65 | IP67	IP65 | IP67	IP67 (-30°C...+90°C) IP65 (-40°C...+90°C)
Mechanical life-cycle	>100 mating cycles	>750 mating cycles	>100 mating cycles	>100 mating cycles	>100 mating cycles	>100 mating cycles
Connecting cross-section	AWG 26/7-AWG 22/7 AWG 24/1-AWG 22/1					
Cable outlet	Ø 5.0...9.7mm					
Connecting type	Insulation displacement contact					

			Pins	Cable / Δh[mm]	Item description
		Single-ended cordset female, M12x1, straight shielded Cat5e	4, D	S4002 Reduced Wire	RA-WAKSY4.029-L/S4002
				S4003 Standard	RA-WAKSY4.029-L/S4003
				S4004 ECO	RA-WAKSY4.029-L/S4004
		Single-ended cordset female, M12x1, straight, grip body with thread shielded Cat5e	4, D	S4002 Reduced Wire	RA-WAKSGY4.029-L/S4002
				S4003 Standard	RA-WAKSGY4.029-L/S4003
				S4004 ECO	RA-WAKSGY4.029-L/S4004
		Single-ended cordset female, M12x1, straight shielded Cat5e	4, D	S2171 bus approved	IE-WAKSY4.029-L/S2171
		Single-ended cordset female, M12x1, angled shielded Cat5e	4, D	S4002 Reduced Wire	RA-WWAKSY4.029-L/S4002
				S4003 Standard	RA-WWAKSY4.029-L/S4003
				S4004 ECO	RA-WWAKSY4.029-L/S4004
		Single-ended cordset female, M12x1, angled, grip body with thread shielded Cat5e	4, D	S4002 Reduced Wire	RA-WWAKSGY4.029-L/S4002
				S4003 Standard	RA-WWAKSGY4.029-L/S4003
				S4004 ECO	RA-WWAKSGY4.029-L/S4004
		Single-ended cordset female, M12x1, angled shielded Cat5e	4, D	S2171 bus approved	IE-WWAKSY4.029-L/S2171
		Single-ended cordset male, M12x1, straight shielded Cat5e	4, D	S4002 Reduced Wire	RA-WASSY4.029-L/S4002
				S4003 Standard	RA-WASSY4.029-L/S4003
				S4004 ECO	RA-WASSY4.029-L/S4004

* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

			Pins	Cable / Δh[mm]	Item description
		Single-ended cordset male, M12x1, straight, grip body with thread shielded Cat5e	4, D	S4002 Reduced Wire	RA-WASSGY4.029-L/S4002
				S4003 Standard	RA-WASSGY4.029-L/S4003
				S4004 ECO	RA-WASSGY4.029-L/S4004
		Single-ended cordset male, M12x1, straight shielded Cat5e	4, D	S2171 bus approved	IE-WASSY4.029-L/S2171
		Single-ended cordset male, M12x1, angled shielded Cat5e	4, D	S4002 Reduced Wire	RA-WWASSY4.029-L/S4002
				S4003 Standard	RA-WWASSY4.029-L/S4003
				S4004 ECO	RA-WWASSY4.029-L/S4004
		Single-ended cordset male, M12x1, angled, grip body with thread shielded Cat5e	4, D	S4002 Reduced Wire	RA-WWASSGY4.029-L/S4002
				S4003 Standard	RA-WWASSGY4.029-L/S4003
				S4004 ECO	RA-WWASSGY4.029-L/S4003
		Single-ended cordset male, M12x1, angled shielded Cat5e	4, D	S2171 bus approved	IE-WWASSY4.029-L/S2171
		Receptacle Single-ended cordset female, M12x1, straight Back wall-mounting shielded Cat5e	4, D	S4002 Reduced Wire	RA-FKFDSY4.029-L/S4002
				S4003 Standard	RA-FKFDSY4.029-L/S4003
				S4004 ECO	RA-FKFDSY4.029-L/S4004
		Receptacle Single-ended cordset female, M12x1, straight Back wall-mounting shielded Cat5e	4, D	S2171 bus approved	IE-FKFDSY4.029-L/16/S2171

* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

			Pins	Cable / Δh[mm]	Item description
		Receptacle Single-ended cordset female, M12x1, angled Back wall-mounting shielded Cat5e	4, D	S4002 Reduced Wire	RA-WFKFDSY4.029-L/S4002
				S4003 Standard	RA-WFKFDSY4.029-L/S4003
				S4004 ECO	RA-WFKFDSY4.029-L/S4004
		Receptacle Single-ended cordset female, M12x1, angled Back wall-mounting shielded Cat5e	4, D	S2171 bus approved	IE-WFKFDSY4.029-L/16/S2171
		Single-ended cordset male, RJ45, straight shielded Cat5e	4	S4002 Reduced Wire	RA-RJ45SS4.003-L/S4002
		Single-ended cordset male, RJ45, straight shielded Cat5e	4	S2171 bus approved	IE-RJ45SS4.003-L/S2171
		Connector field-wireable male, M12x1, straight Insulation displacement contact shielded Cat5e	4, D		IE-WASCSY4S
		Double-ended cordset female, M12x1, straight male, M12x1, straight shielded Cat5e	4, D 4, D	S4002 Reduced Wire	RA-WAKSY4.029-L-RA-WASSY4.029/S4002
				S4003 Standard	RA-WAKSY4.029-L-RA-WASSY4.029/S4003
				S4004 ECO	RA-WAKSY4.029-L-RA-WASSY4.029/S4004
		Double-ended cordset female, M12x1, straight male, M12x1, straight shielded Cat5e	4, D 4, D	S2171 bus approved	IE-WAKSY4.029-L-IE-WASSY4.029/S2171
		Double-ended cordset female, M12x1, straight male, M12x1, angled shielded Cat5e	4, D 4, D	S4002 Reduced Wire	RA-WAKSY4.029-L-RA-WWASSY4.029/S4002
				S4003 Standard	RA-WAKSY4.029-L-RA-WWASSY4.029/S4003
				S4004 ECO	RA-WAKSY4.029-L-RA-WWASSY4.029/S4004

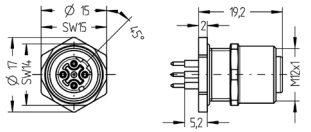
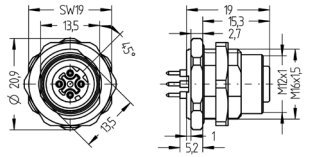
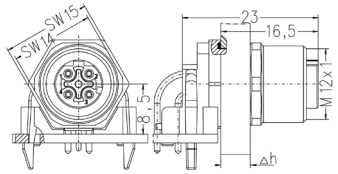
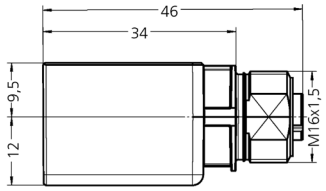
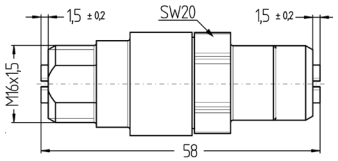
* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

		Pins	Cable / Δh[mm]	Item description
	Double-ended cordset female, M12x1, straight male, M12x1, angled shielded Cat5e	4, D 4, D	S2171 bus approved	IE-WAKSY4.029-L-IE-WWASSY4.029/S2171
	Double-ended cordset female, M12x1, angled male, M12x1, straight shielded Cat5e	4, D 4, D	S4002 Reduced Wire	RA-WWAKSY4.029-L-RA-WASSY4.029/S4002
			S4003 Standard	RA-WWAKSY4.029-L-RA-WASSY4.029/S4003
			S4004 ECO	RA-WWAKSY4.029-L-RA-WASSY4.029/S4004
	Double-ended cordset female, M12x1, angled male, M12x1, straight shielded Cat5e	4, D 4, D	S2171 bus approved	IE-WWAKSY4.029-L-IE-WASSY4.029/S2171
	Double-ended cordset male, M12x1, straight male, M12x1, straight shielded Cat5e	4, D 4, D	S4002 Reduced Wire	RA-WASSY4.029-L-RA-WASSY4.029/S4002
			S4003 Standard	RA-WASSY4.029-L-RA-WASSY4.029/S4003
			S4004 ECO	RA-WASSY4.029-L-RA-WASSY4.029/S4004
	Double-ended cordset male, M12x1, straight male, M12x1, straight shielded Cat5e	4, D 4, D	S2171 bus approved	IE-WASSY4.029-L-IE-WASSY4.029/S2171
	Double-ended cordset male, M12x1, angled male, M12x1, straight shielded Cat5e	4, D 4, D	S4002 Reduced Wire	RA-WWASSY4.029-L-RA-WASSY4.029/S4002
			S4003 Standard	RA-WWASSY4.029-L-RA-WASSY4.029/S4003
			S4004 ECO	RA-WWASSY4.029-L-RA-WASSY4.029/S4004
	Double-ended cordset male, M12x1, angled male, M12x1, straight shielded Cat5e	4, D 4, D	S2171 bus approved	IE-WWASSY4.029-L-IE-WASSY4.029/S2171

* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

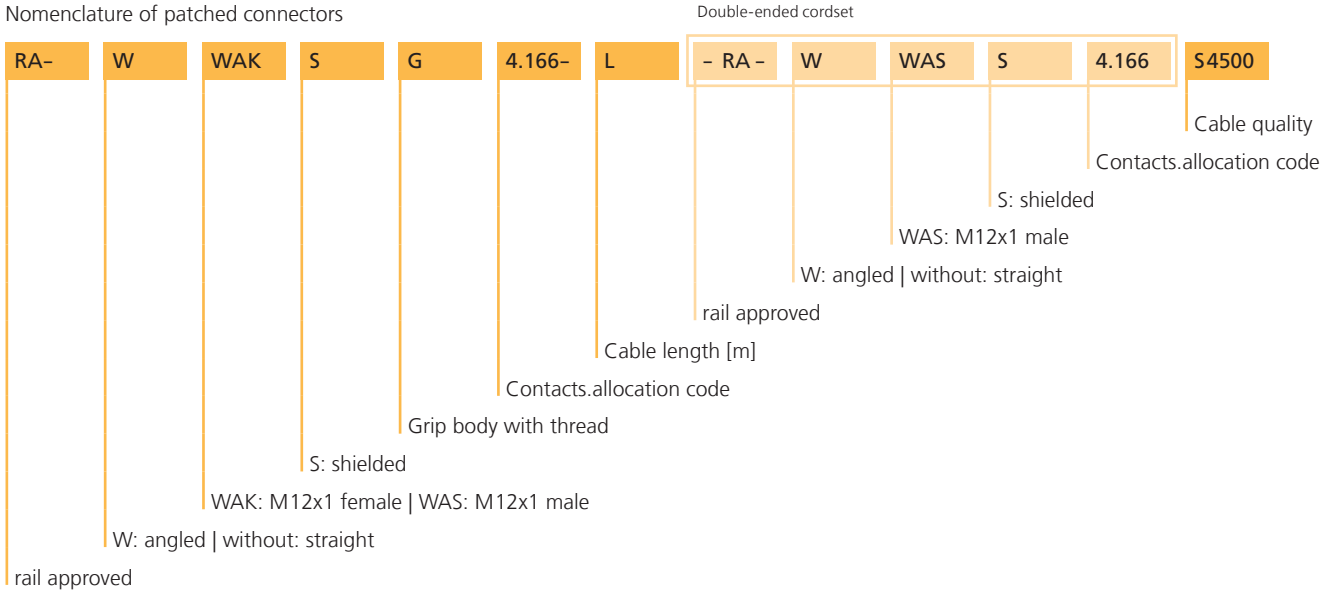
		Pins	Cable / Δh[mm]	Item description
	Double-ended cordset male, M12x1, angled male, M12x1, angled shielded Cat5e	4, D 4, D	S4002 Reduced Wire	RA-WWASSY4.029-L-RA-WWASSY4.029/S4002
			S4003 Standard	RA-WWASSY4.029-L-RA-WWASSY4.029/S4003
			S4004 ECO	RA-WWASSY4.029-L-RA-WWASSY4.029/S4004
	Double-ended cordset male, M12x1, angled male, M12x1, angled shielded Cat5e	4, D 4, D	S2171 bus approved	IE-WWASSY4.029-L-IE-WWASSY4.029/S2171
	Receptacle Double-ended cordset female, M12x1, straight male, M12x1, straight shielded Cat5e	4, D 4, D	S4002 Reduced Wire	RA-FKFDSY4.029-L-RA-WASSY4.029/S4002
			S4003 Standard	RA-FKFDSY4.029-L-RA-WASSY4.029/S4003
			S4004 ECO	RA-FKFDSY4.029-L-RA-WASSY4.029/S4004
	Receptacle Double-ended cordset female, M12x1, angled male, M12x1, straight shielded Cat5e	4, D 4, D	S4002 Reduced Wire	RA-WFKFDSY4.029-L-RA-WASSY4.029/S4002
			S4003 Standard	RA-WFKFDSY4.029-L-RA-WASSY4.029/S4003
			S4004 ECO	RA-WFKFDSY4.029-L-RA-WASSY4.029/S4004
	Double-ended cordset male, RJ45, straight male, RJ45, straight Cat5e	4 4	S4002 Reduced Wire	RA-RJ45SS4.003-L-RA-RJ45SS4.003/S4002
	Double-ended cordset male, RJ45, straight male, RJ45, straight shielded Cat5e	4 4	S2171 bus approved	IE-RJ45SS4.003-L-IE-RJ45SS4.003/S2171
	Double-ended cordset male, M12x1, straight male, RJ45, straight shielded Cat5e	4, D 4	S4002 Reduced Wire	RA-WASSY4.029-L-RA-RJ45SS4.003/S4002
	Double-ended cordset male, M12x1, straight male, RJ45, straight shielded Cat5e	4, D 4	S2171 bus approved	IE-WASSY4.029-L-IE-RJ45SS4.003/S2171

* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

			Pins	Cable / Δh[mm]	Item description
		Double-ended cordset male, M12x1, angled male, RJ45, straight shielded Cat5e	4, D 4	S4002 Reduced Wire	RA-WWASSY4.029-L-RA-RJ45SS4.003/S4002
		Double-ended cordset male, M12x1, angled male, RJ45, straight shielded Cat5e	4, D 4	S2171 bus approved	IE-WWASSY4.029-L-IE-RJ45SS4.003/S2171
		Receptacle female, M12x1, straight Print contact Back wall-mounting Cat5e	4, D	1.0...2.5 mm 2.5...4.0 mm 4.0...5.0 mm	IE-FHM12KUD4-P/M12/S3525 IE-FHM12KUD4-P/M12/S3540 IE-FHM12KUD4-P/M12/S3550
		Receptacle female, M12x1, straight Print contact Back wall-mounting Cat5e	4, D	1.0...5.0 mm	IE-FHM12KUD4-P/M16
		Receptacle female, M12x1, angled Print contact Back wall-mounting	4, D	1.0...2.5 mm 2.5...4.0 mm 4.0...5.0 mm	IE-WFKFSY4-P/12/S3525 IE-WFKFSY4-P/12/S3540 IE-WFKFSY4-P/12/S3550
		Panel feed through female, M12x1, straight female, RJ45, straight Back wall-mounting Cat5e	4, D 8	1.0...2.5 mm	IE-FKFDSY4-RJ45KS
		Panel feed through female, M12x1, angled female, RJ45, straight Back wall-mounting Cat5e	4, D 8	1.0...2.5 mm	IE-WFKFDSY4-RJ45KS
		Adapter female, M12x1, straight female, M12x1, straight Cat5e	8, X 4, D 4, D 4, D	1.0...4.0 mm 1.0...4.0 mm	IE-WAKSX8-IE-WAKSY4 IE-WAKSY4-IE-WAKSY4

* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

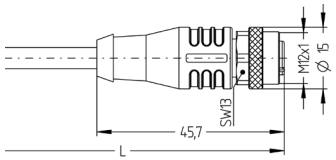
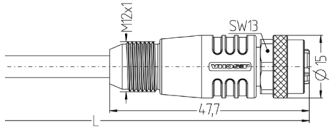
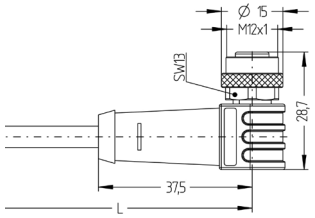
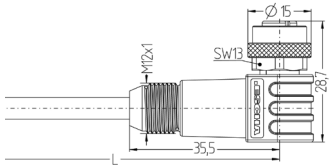
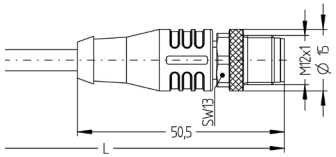
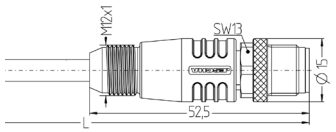
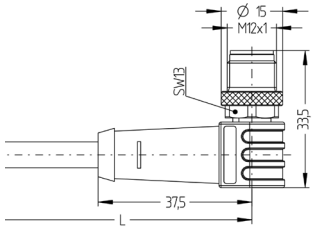
Nomenclature of patched connectors



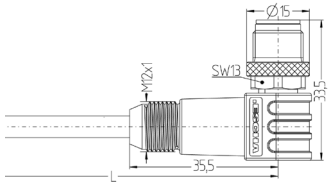
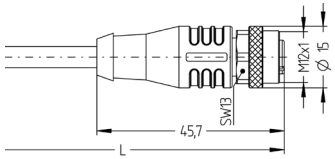
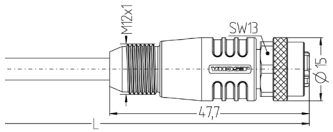
Cable	Short description
S4500 4 x 0.5 mm²	Halogen-free, electron-beam cross-linked cables with improved behaviour in case of fire, easy to strip, soldering resistant and flexible, meets the requirements of EN 50306-4. The cable is intended for fixed, mechanically protected installation inside railway vehicles or for installation in applications where limited alternating bending stresses occur during operation. The cable is characterized by a wide temperature range and a high oil- and fuel resistance.
S4501 4 x 0.75 mm²	Halogen-free, electron-beam cross-linked cables with improved behaviour in case of fire, easy to strip, soldering resistant and flexible, meets the requirements of EN 50306-4. The cable is intended for fixed, mechanically protected installation inside railway vehicles or for installation in applications where limited alternating bending stresses occur during operation. The cable is characterized by a wide temperature range and a high oil- and fuel resistance.
S4502 4 x 1 mm²	Halogen-free, electron-beam cross-linked cables with improved behaviour in case of fire, easy to strip, soldering resistant and flexible, meets the requirements of EN 50306-4. The cable is intended for fixed, mechanically protected installation inside railway vehicles or for installation in applications where limited alternating bending stresses occur during operation. The cable is characterized by a wide temperature range and a high oil- and fuel resistance.

Sensor/Actuator

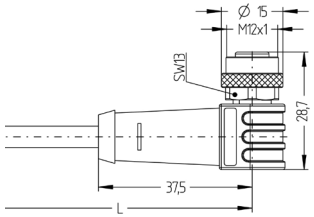
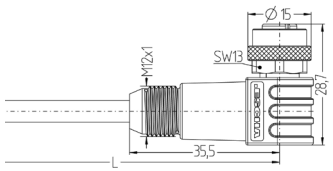
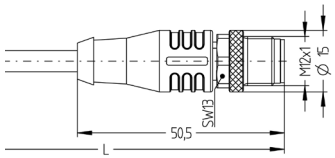
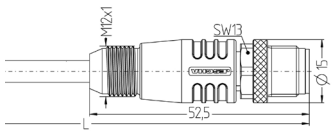
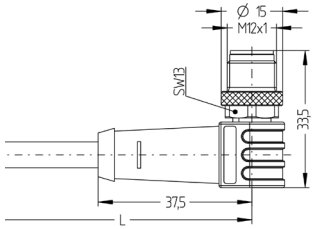
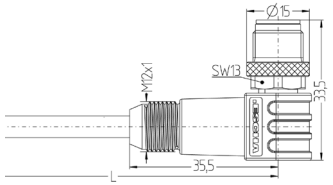
Technical data	M12x1 4 pins | A-coded	Receptacle 4 pins | A-coded
Rated voltage	250V	250V
Current load (at 40°C)	4A	4A
Insulation resistance	≥10^8Ω	≥10^8Ω
Standards	IEC 61076-2-101 DIN EN 50155 DIN EN 45545-2	IEC 61076-2-101 DIN EN 50155 DIN EN 45545-2
Ambient temperature product	-40°C...+90°C	-40°C...+90°C
Degree of pollution	3	3
Degree of protection (mounted)	IP67 (-30°C...+90°C) IP65 (-40°C...+90°C)	IP67 (-30°C...+90°C) IP65 (-40°C...+90°C)
Mechanical life-cycle	>100 mating cycles	>100 mating cycles

			Pins	Cable / Δh[mm]	Item description
		Single-ended cordset female, M12x1, straight	4, A	S4500	RA-WAK4.166-L/S4500
				S4501	RA-WAK4.166-L/S4501
				S4502	RA-WAK4.166-L/S4502
		Single-ended cordset female, M12x1, straight, grip body with thread	4, A	S4500	RA-WAKG4.166-L/S4500
				S4501	RA-WAKG4.166-L/S4501
				S4502	RA-WAKG4.166-L/S4502
		Single-ended cordset female, M12x1, angled	4, A	S4500	RA-WWAK4.166-L/S4500
				S4501	RA-WWAK4.166-L/S4501
				S4502	RA-WWAK4.166-L/S4502
		Single-ended cordset female, M12x1, angled, grip body with thread	4, A	S4500	RA-WWAKG4.166-L/S4500
				S4501	RA-WWAKG4.166-L/S4501
				S4502	RA-WWAKG4.166-L/S4502
		Single-ended cordset male, M12x1, straight	4, A	S4500	RA-WAS4.166-L/S4500
				S4501	RA-WAS4.166-L/S4501
				S4502	RA-WAS4.166-L/S4502
		Single-ended cordset male, M12x1, straight, grip body with thread	4, A	S4500	RA-WASG4.166-L/S4500
				S4501	RA-WASG4.166-L/S4501
				S4502	RA-WASG4.166-L/S4502
		Single-ended cordset male, M12x1, angled	4, A	S4500	RA-WWAS4.166-L/S4500
				S4501	RA-WWAS4.166-L/S4501
				S4502	RA-WWAS4.166-L/S4502

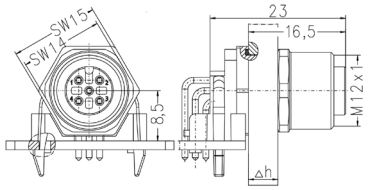
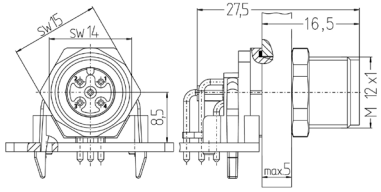
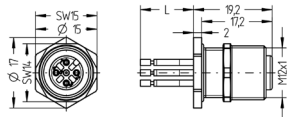
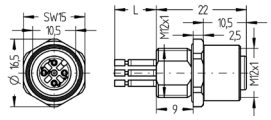
* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

			Pins	Cable / Δh[mm]	Item description
		Single-ended cordset male, M12x1, angled, grip body with thread shielded	4, A	S4500	RA-WWASG4.166-L/S4500
				S4501	RA-WWASG4.166-L/S4501
				S4502	RA-WWASG4.166-L/S4502
		Double-ended cordset female, M12x1, straight male, M12x1, straight	4, A 4, A	S4500	RA-WAK4.166-L-RA-WAS4.166/S4500
				S4501	RA-WAK4.166-L-RA-WAS4.166/S4501
				S4502	RA-WAK4.166-L-RA-WAS4.166/S4502
		Double-ended cordset female, M12x1, straight male, M12x1, angled	4, A 4, A	S4500	RA-WAK4.166-L-RA-WWAS4.166/S4500
				S4501	RA-WAK4.166-L-RA-WWAS4.166/S4501
				S4502	RA-WAK4.166-L-RA-WWAS4.166/S4502
		Double-ended cordset female, M12x1, angled male, M12x1, straight	4, A 4, A	S4500	RA-WWAK4.166-L-RA-WAS4.166/S4500
				S4501	RA-WWAK4.166-L-RA-WAS4.166/S4501
				S4502	RA-WWAK4.166-L-RA-WAS4.166/S4502
		Double-ended cordset female, M12x1, angled male, M12x1, angled	4, A 4, A	S4500	RA-WWAK4.166-L-RA-WWAS4.166/S4500
				S4501	RA-WWAK4.166-L-RA-WWAS4.166/S4501
				S4502	RA-WWAK4.166-L-RA-WWAS4.166/S4502
		Single-ended cordset female, M12x1, straight shielded	4, A	S4500	RA-WAKS4.166-L/S4500
				S4501	RA-WAKS4.166-L/S4501
				S4502	RA-WAKS4.166-L/S4502
		Single-ended cordset female, M12x1, straight, grip body with thread shielded	4, A	S4500	RA-WAKSG4.166-L/S4500
				S4501	RA-WAKSG4.166-L/S4501
				S4502	RA-WAKSG4.166-L/S4502

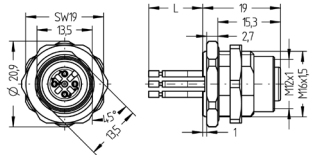
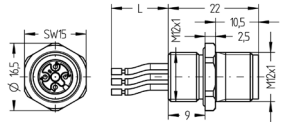
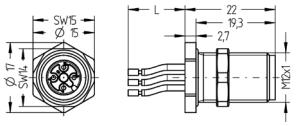
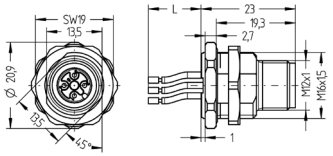
* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

			Pins	Cable / Δh[mm]	Item description
		Single-ended cordset female, M12x1, angled shielded	4, A	S4500	RA-WWAKS4.166-L/S4500
				S4501	RA-WWAKS4.166-L/S4501
				S4502	RA-WWAKS4.166-L/S4502
		Single-ended cordset female, M12x1, angled, grip body with thread shielded	4, A	S4500	RA-WWAKSG4.166-L/S4500
				S4501	RA-WWAKSG4.166-L/S4501
				S4502	RA-WWAKSG4.166-L/S4502
		Single-ended cordset male, M12x1, straight shielded	4, A	S4500	RA-WASS4.166-L/S4500
				S4501	RA-WASS4.166-L/S4501
				S4502	RA-WASS4.166-L/S4502
		Single-ended cordset male, M12x1, straight, grip body with thread shielded	4, A	S4500	RA-WASSG4.166-L/S4500
				S4501	RA-WASSG4.166-L/S4501
				S4502	RA-WASSG4.166-L/S4502
		Single-ended cordset male, M12x1, angled shielded	4, A	S4500	RA-WWASS4.166-L/S4500
				S4501	RA-WWASS4.166-L/S4501
				S4502	RA-WWASS4.166-L/S4502
		Single-ended cordset male, M12x1, angled, grip body with thread shielded	4, A	S4500	RA-WWASSG4.166-L/S4500
				S4501	RA-WWASSG4.166-L/S4501
				S4502	RA-WWASSG4.166-L/S4502
		Double-ended cordset female, M12x1, straight male, M12x1, straight shielded	4, A 4, A	S4500	RA-WAKS4.166-L-RA-WASS4.166/S4500
				S4501	RA-WAKS4.166-L-RA-WASS4.166/S4501
				S4502	RA-WAKS4.166-L-RA-WASS4.166/S4502

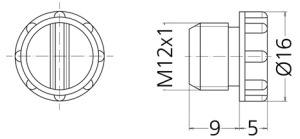
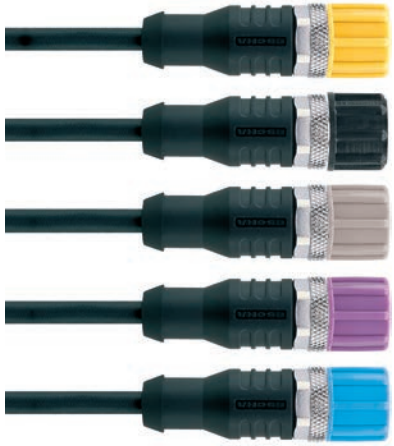
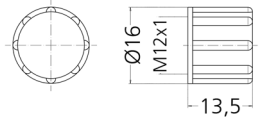
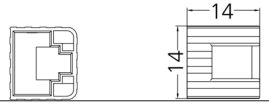
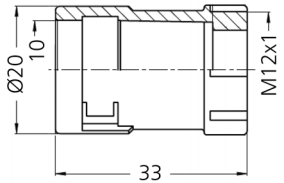
* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

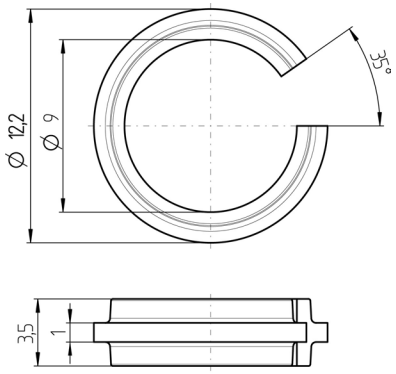
			Pins	Cable / Δh[mm]	Item description
		Double-ended cordset female, M12x1, straight male, M12x1, angled shielded	4, A 4, A	S4500	RA-WAKS4.166-m-RA-WWASS4.166/S4500
				S4501	RA-WAKS4.166-m-RA-WWASS4.166/S4501
				S4502	RA-WAKS4.166-m-RA-WWASS4.166/S4502
		Double-ended cordset female, M12x1, angled male, M12x1, straight shielded	4, A 4, A	S4500	RA-WWAKS4.166-L-RA-WASS4.166/S4500
				S4501	RA-WWAKS4.166-L-RA-WASS4.166/S4501
				S4502	RA-WWAKS4.166-L-RA-WASS4.166/S4502
		Double-ended cordset female, M12x1, angled male, M12x1, angled shielded	4, A 4, A	S4500	RA-WWAKS4.166-L-RA-WWASS4.166/S4500
				S4501	RA-WWAKS4.166-L-RA-WWASS4.166/S4501
				S4502	RA-WWAKS4.166-L-RA-WWASS4.166/S4502
		Receptacle female, M12x1, angled Print contact Back wall-mounting	4, A	1.0...2.5 mm	EC-WFKF4-P/12/S3525
				2.5...4.0 mm	EC-WFKF4-P/12/S3540
				4.0...5.0 mm	EC-WFKF4-P/12/S3550
		Receptacle male, M12x1, angled Print contact Back wall-mounting	4, A	1.0...5.0 mm	EC-WFSF4-P/12
		Receptacle female, M12x1, straight Wire contact Back wall-mounting	4, A	1.0...2.5 mm	RA-FHM12KUA4-0,5/M12/S3525
				2.5...4.0 mm	RA-FHM12KUA4-0,5/M12/S3540
				4.0...5.0 mm	RA-FHM12KUA4-0,5/M12/S3550
		Receptacle female, M12x1, straight Wire contact Front wall-mounting	4, A	1.0...5.0 mm	RA-FVM12KUA4-0,5/M12

* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

			Pins	Cable / Δh[mm]	Item description
		Receptacle female, M12x1, straight Wire contact Back wall-mounting	4, A	1.0...5.0 mm	RA-FHM12KUA4-0,5/M16
		Receptacle male, M12x1, straight Wire contact Front wall-mounting	4, A	1.0...5.0 mm	RA-FVM12SUA4-0,5/M12
		Receptacle male, M12x1, straight Wire contact Back wall-mounting	4, A	1.0...5.0 mm	RA-FHM12SUA4-0,5/M12
		Receptacle male, M12x1, straight Wire contact Back wall-mounting	4, A	1.0...5.0 mm	RA-FHM12SUA4-0,5/M16

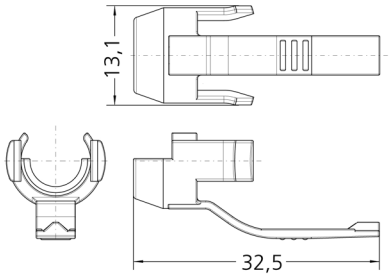
* We deliver individual cable lengths upon request. Just add item description and cable length [L] in meters to your order. For example: cable length L = 5.2m (see dimensioned drawing) | RA-WASSX8.066-5,2-RA-WASSX8.066/S5006

				Color	Material	L [m]	Item-No.
		Safety-stopper, M12x1	cover for M12x1 female	BK, similar RAL9005			8000004
				VT, similar RAL4001			8041992
				BU, similar RAL5012			8041993
				GN, similar RAL6018			8059233
		Safety-cap, M12x1	cover for M12x1 male	YE, similar RAL1021			8000031
				BK, similar RAL9005			8036742
				GY, similar RAL7035			8041994
				VT, similar RAL4001			8041995
				BU, similar RAL5012			8041996
		Safety-cap, RJ45	cover for RJ45	transparent	Plastic		8064715
		Adapter piece, M12x1		BK, similar RAL9005			8081747
		Protective hose		BK, similar RAL9005		50	8081621



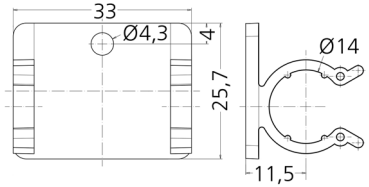
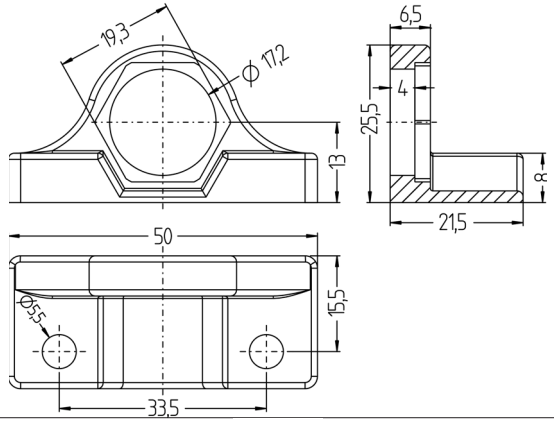
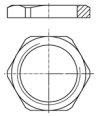
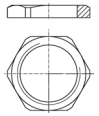
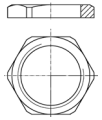
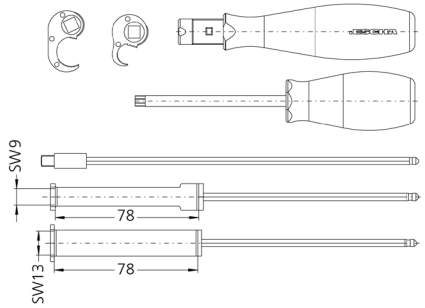
Marking rings Ø 9mm
Packaging unit:100

Color	Material	L [m]	Item-No.
WH, similar RAL9002	POM		8063523
RD, similar RAL3020	POM		8063524
BU, similar RAL5012	POM		8063525
YE, similar RAL1018	POM		8063526
GN, similar RAL6018	POM		8063527
BK, similar RAL9004	POM		8063528
OG, similar RAL2008	POM		8063529
VT, similar RAL4006	POM		8063530
GY, similar RAL7035	POM		8063531
PK, similar RAL4003	POM		8063532
similar RAL1002	POM		8063533



Unlocking clip for RJ45
Packaging unit:10

Color	Material	L [m]	Item-No.
RD, similar RAL3020	POM		8071939
OG, similar RAL2008	POM		8071944
YE, similar RAL1018	POM		8071941
similar RAL1002	POM		8071948
GN, similar RAL6018	POM		8071942
BU, similar RAL5012	POM		8071940
VT, similar RAL4006	POM		8071945
PK, similar RAL4003	POM		8071947
GY, similar RAL7035	POM		8071946
WH, similar RAL9002	POM		8071938
BK, similar RAL9004	POM		8071943

			Color	Material	L [m]	Item-No.
		Mounting-clip, M12x1	1 clip	POM		8047660
		Mounting-set, M12x1 Packaging unit:1	10 clips +10 screws M4x8	POM		8047664
		Wall bracket for IE adapter	for Item-No. 8065952, 8065950 and 8065951	Plastic		8065953
		Spare nuts	for Receptacle M12x1 | M12x1 Wrench size: A/F14 Height: 2.8mm	Metal, CuZn, nickel-plated		8045651
		Spare nuts	for Receptacle M12x1 | PG9 Wrench size: A/F18 Height: 2.8mm	Metal, CuZn, nickel-plated		8004913
		Spare nuts	for Receptacle M12x1 | M16x1,5 Wrench size: A/F19 Height: 2.8mm	Metal, CuZn, nickel-plated		8029359
		Torque-wrench set	in wallet fully fitted for M8x1, M12x1 (knurl, hexagon-nut)			8055431





		S5006	S4002	S4003	S4004	S2171
Materials	Cable-jacket	Betatrans Comp 603	RADOX EM104	RADOX EM104	RADOX EM104	PUR
	Wire insulation	Betatrans Comp 717	RADOX FOAM	RADOX COM	RADOX COM	PE
	Color outer-jacket	BK	BK	BK	BU	GN
Setup	Wire color	WH(OG) | OG, WH(GN) | GN, WH(BN) | BN, WH(BU) | BU	WH, BU, OG, YE	WH, BU, OG, YE	WH, BU, OG, YE	WH, BU, OG, YE
	Conductor structure	7x 0,16mm	7x 0,25mm	7x 0,25mm	7x 0,25mm	7x 0,25mm
	Outer diameter of jacket	Ø 8,10mm	Ø 6,60mm	Ø 7,25mm	Ø 7,25mm	Ø 6,50mm
	Wire cross-section	4x 2x AWG26/7	1x 4x AWG22	1x 4x AWG22	1x 4x AWG22	1x 4x AWG22
Features	Rated voltage	125VAC	300VAC	300VAC	300VAC	600V (UL rating)
	Bending radius (infrequently moved)			10xØ	10xØ	7,5xØ
	Bending radius (fixed)	4xØ	6xØ	6xØ	6xØ	5xØ
	Temperature range ((infrequently moved)			-40°C...+90°C	-40°C...+90°C	-30°C...+70°C
	Temperature range (fixed)	-50°C...+70°C	-50°C...+90°C	-50°C...+90°C	-50°C...+90°C	-40°C...+75°C
	Shielding	✓	✓	✓	✓	✓
	Transmission features	Cat7	Cat5e	Cat5e	Cat5e	Cat5e
Certifications	EN 45545-2	HL 1-3	HL 1-3	HL 1-3	HL 1-3	
	DIN 5510	1-4	1-4	1-4	1-4	
	NF F16-101	A1, A2, B	A1, A2, B	A1, A2, B	A1, A2, B	
	NFPA 130	✓	✓	✓	✓	
	EN 50306-4					
	UN ECE R118	✓	✓	✓	✓	✓
	UL					CMX
	Application	Rail | Bus	Rail | Bus	Rail | Bus	Rail | Bus	Bus
	Connector	M12x1 | 8X RJ45 molded	M12x1 | 4D RJ45 molded	M12x1 | 4D RJ45 field-wireable	M12x1 | 4D RJ45 field-wireable	M12x1 | 4D RJ45 molded
	Item-No. 100m cable	8081244	8063114	8063115	8063116	8036284

S4500		S4501		S4502			
RADOX EM104		RADOX EM104		RADOX EM104		Cable-jacket	Materials
RADOX EI 306		RADOX EI 306		RADOX EI 306		Wire insulation	
BK		BK		BK		Color outer-jacket	
WH1, WH2, WH3, WH4		WH1, WH2, WH3, WH4		WH1, WH2, WH3, WH4		Wire color	Setup
19 x 0,18mm		19 x 0,23mm		19 x 0,26mm		Conductor structure	
Ø 4,90mm	Ø 5,40mm	Ø 5,40mm	Ø 5,90mm	Ø 5,70mm	Ø 6,30mm	Outer diameter of jacket	
4 x 0,5mm²		4 x 0,75mm²		4 x 1,0mm²		Wire cross-section	
U0/U: 300V/500V		U0/U: 300V/500V		U0/U: 300V/500V		Rated voltage	Features
4xØ		4xØ		4xØ		Bending radius (infrequently moved)	
3xØ		3xØ		3xØ		Bending radius (fixed)	
-40°C...+120°C	-50°C...+120°C	-40°C...+120°C	-50°C...+120°C	-40°C...+120°C	-50°C...+120°C	Temperature range ((infrequently moved)	
-40°C...+120°C	-50°C...+120°C	-40°C...+120°C	-50°C...+120°C	-40°C...+120°C	-50°C...+120°C	Temperature range (fixed)	
—	✓	—	✓	—	✓	Shielding	
						Transmission features	
HL 1-3		HL 1-3		HL 1-3		EN 45545-2	Certifications
1-4		1-4		1-4		DIN 5510	
A1, A2, B		A1, A2, B		A1, A2, B		NF F16-101	
—	✓	—	✓	—	✓	NFPA 130	
✓		✓		✓		EN 50306-4	
						UN ECE R118	
						UL	
Rail		Rail		Rail		Application	
M12x1 | 4A		M12x1 | 4A		M12x1 | 4A		Connector	
8074876	8074873	8074877	8074874	8074878	8074875	Item-No. 100m cable	

Comprehensive Information on Connectors

The respective requirements of machinery specifications are binding for the user with connector applications. The relevant standards and specifications according to which our products are made and tested are explained in the following.

DIN EN 45545-2 | Fire behavior

This standard defines the protection requirements against fires and their impacts on busses and rail vehicles. It aims at minimizing the probability of fire outbreak, containing fire development and thus reducing harmful effects on passengers as much as possible. It is to be ensured that the passengers can leave the vehicle without outside help and secure themselves independently especially against heat, smoke, and toxic gases. The resulting requirements for cables and other electronic facilities as well as the necessary testing methods are regulated in part 2 of the standard. In order to most possibly cover all design and operating types of the vehicles, our connectors' materials have been selected according to the R24 requirement type.

ECE R118 | Fire behavior

This regulation specifies the burning behavior of interior materials and cables in busses.

DIN EN 50155 | Mechanical stresses

The DIN EN 50155 requirements for electrical facilities simulate all devisable application conditions under which rail vehicles may operate. The required tests show whether the products still function faultlessly at extreme temperatures, temperature shocks, high humidity, and heat as well as under strong vibrations and mechanical shocks. IP67 protection class test is also carried out within the scope of the entire testing procedure.

IEC60529; 2009-09 | Degrees of Protection by Housing (IP-Code)

This international standard corresponds to the European standard DIN EN 60529 and complies with the German standard DINVDE0470-1, November 92 edition. It determines the designation, requirements and tests for the classification of protection degrees by housings for electrical devices (e.g. connectors). Thereby, protection against access to dangerous parts, protection against solid foreign bodies and protection against water are evaluated. The degree of protection is designated by an IP-Code.

IEC 60664-1; 2008-01 | Coordination of Isolation

This international standard, which complies with the German standard DINVDE0110-1, April 97 edition, is a basic safety standard for achieving the coordination of isolation. It contains the required data to determine air distances, creep distances and solid insulations for electrical devices (e.g. connectors). This is realised considering the micro-ambient conditions and other loads they are exposed to in the course of the expected service life. Processes for the voltage test related to the coordination of isolation are included.

IEC60512; May1994 | Measuring- and Testing-Process

This international standard corresponds to the European standard DINEN60512 and has replaced the previous German standard DIN41640. It determines the measuring- and testing-processes for electromechanical components (e.g. connectors). The standard is very comprehensive and consists of 9 sections in total in which all electrical, mechanical and climatic tests are described. In addition, the standard contains tests on soldering ability, density, shielding and cable pull-out support.

Changes in design are subject to further notice for reasons of quality improvements, refinement or production optimisation. The technical data stated in the cataloge refer to connectors, i.e. components which must not be plugged or unplugged under voltage. In order to secure the correct use of the products, the technical data are listed. It is possible to select the right products using these data. The products are described as well, however the properties are not assured. All ESCHA connectors have been developed and designed for applications in plant-, control and electric device version. It is up to the user to verify the possibility of using the connectors in other application areas as well. Data on properties and sealing refer to torques of 1.0Nm for M12x1-round connectors or 0.6Nm for M8x1-round connectors. All data concerning the IP-degrees of protection are only guaranteed for the connections of ESCHA components.

Characteristic	Standard [1)]	Note
Protection class housing	IEC 60529	Data in plugged condition
Mechanical life cycle	IEC 60512-5/9a	Test is done without electrical load
Rated voltage	IEC 60664-1	The stated value is defined in connection with degree of pollution and overvoltage category
Degree of pollution	IEC 60664-1	
Current load	IEC 60512-3/5b	
Contact resistance	IEC 60512-2/2a	Contact resistance contact-pin/contact-bush in plugged condition throughout a defined range
Insulation resistance	IEC 60512-2/3a	Insulation between two conducting parts (dependent on material)

Supplementary Technical Data

[1)] The technical data represent initial values which can change depending on load. The housings have to be included in the device protective-measures when mounting electrically conductive receptacle housings. The cables to be connected should be insulated in such a way that the distances to electrically conductive parts are not reduced. When soldering the cables, care must be taken that none of the single wires is projecting which can cause short circuits.

	Digit 1	Digit 2
0	Unprotected	Unprotected
1	Protected against access to dangerous parts by hand pressure. Protected against solid foreign bodies Ø50mm.	Protected against dripping water
2	Protected against access to dangerous parts by fingers. Protected against solid foreign bodies Ø12.5mm.	Protected against dripping water when housing is inclined up to 15°
3	Protected against access to dangerous parts by a tool. Protected solid foreign bodies Ø2.5mm.	Protected against spraying water
4	Protected against access to dangerous parts by a wire. Protected against solid foreign bodies Ø1mm.	Protected against sprinkling water
5	Protected against access to dangerous parts by a wire. Protected against dust.	Protected against water-jet
6	Protected against access to dangerous parts by a wire. Protected against dust.	Protected against a strong water-jet
7		Protected against effects due to temporary immersion in water.
8		Protected against effects due to permanent immersion in water. (Conditions to be agreed upon between manufacturer and user. However, conditions must be more difficult than with IP_7).
9		Protected against water by high-pressure steam-jet cleaning

Degrees of Protection | IP: International Protection

For reasons of safety, connectors must be protected against environmental influences, e.g. dust, foreign bodies, touch, humidity and water. In case of industrial connectors, this protection must be provided for by the housing and its locking as well as the insulation on cable outlet.

The degrees of protection are indicated by an abbreviation consisting of two constant characteristic letters IP (International Protection) and two following digits for the protection degree. The first digit indicates the protection degree against touch and foreign bodies. The second digit indicates the protection against damaging ingress of water. All data are only valid in locked condition. Awarding degrees of protection is subject to a standardised testing procedure.

Conversion of American Wire Gauge, AWG in mm²

In some industrial areas, the American Wire Gauge is also used for cables. The following table serves the conversion from AWG in mm². It should be taken into consideration that wires with the same AWG-number but different structures show slightly different cross sections.

AWG	Wire structure [mm]	Wire diameter [mm]	Wire cross-section [mm²]
30	1 x 0.25 | 7 x 0.10	0.25 | 0.36	0.05 | 0.06
28	1 x 0.32 | 7 x 0.13	0.32 | 0.38	0.08 | 0.09
26	1 x 0.4 | 7 x 1.16 | 19 x 0.10	0.40 | 0.48 | 0.51	0.13 | 0.14 | 0.15
24	1 x 0.51 | 17 x 0.20 | 19 x 0.13	0.51 | 0.61 | 0.64	0.21 | 0.22 | 0.25
22	1 x 0.64 | 7 x 0.25 | 19 x 0.16	0.64 | 0.76 | 0.81	0.33 | 0.34 | 0.38
20	1 x 0.81 | 7 x 0.32 | 19 x 0.20	0.81 | 0.97 | 1.02	0.52 | 0.56 | 0.60
18	1 x 1.02 | 19 x 0.25	1.02 | 1.27	0.82 | 0.93
16	19 x 0.29	1.44	1.25
14	19 x 0.36	1.80	1.93
12	19 x 0.46	2.29	3.16
10	37 x 0.40	3.10	4.65

Overview Pg-thread vs. metric thread
(wrench width for cable screwing according to EN50262)

The interim period for DIN46320 "screwing for cables and conducting-lines with Pg-thread" expired on 31 December 1999. Since then, screwing for cables and conductinglines had to comply with the national standard 46319 before this was replaced by EN50262 on 1 March 2001.

Pg	Metric thread	max.Wrench width [mm]	max.Corner length [mm]
Pg7	M10x1.5 | M12x1.5	16	18
Pg9 | Pg11	M16x1.5	21	23
Pg13.5	M20x1.5	25	28

CERTIFICATIONS

UL (Underwriter Laboratories Inc.)
The certification of products, components or materials by the Underwriter Laboratories Inc. is the verified proof that it meets the specific safety requirements. UL-approvals are, above all, required for the American and Canadian market.

GOST-R (ГОСТ - Государственный Стандарт)
Importing goods into the Russian Federation requires the certification by the Federal Agency for Technical Regulation and Metrology which verifies product compliance with the Russian requirements, standards and quality standards.

Guideline 2011/65/EU (RoHS - Restriction of [the use of certain] hazardous substances)
The EU-guideline restricting the use of certain hazardous substances in electrical- and electronic devices does not allow hazardous substances in devices and components above defined limits. Lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBB), and polybrominated diphenyl (PBDE) are among the hazardous substances. For ESCHA products, this means lead-free soldering and no use of flame retardants in plastics and cables.

CE marking
The CE marking indicates the conformity of a product with harmonized EU standard and therein defined requirements.

In addition to the renowned connectors with solder connection, the crimp connection is still considered reliable connectivity and an ideal solution especially in industries with large number of connectors and few variants. This connection method is distinguished through:

- A high repeatability due to adjustable- and controlled process parameters.
- A safe- and reliable connection with good electrical- and mechanical values.
- Maintaining cable flexibility after crimping.
- No damage to wire insulation due to heat effect.
- A wide range of cable cross-sections.

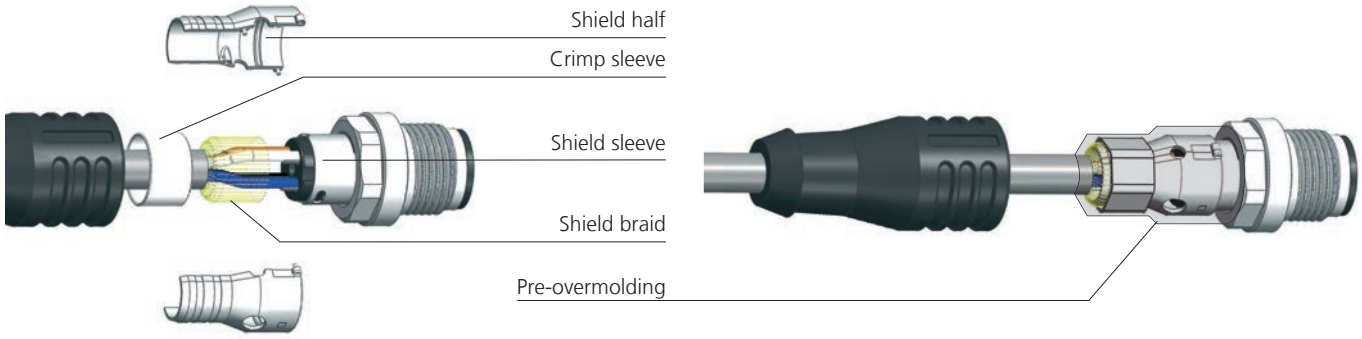
ESCHA 'rail approved' connectors dispose of a safe crimp connection and thus meet another criterion for rail-cars approvals. Considering our in-house process parameters and the perfectly tuned crimping tool, we generate a gastight- and electrically as well as mechanically flawless connection. The process parameters are regularly monitored and the qualitatively high-grade crimp connection is checked by microsections and tensile tests.

EMC of devices has gained more significance since the publication of the law on electromagnetic compatibility.
The devices have to be made in such a way that:

Shielding | ESCHA 360° double-shell shielding concept **(ESCHA 2SSK)**

- The generation of electromagnetic interferences is limited to the extent that a proper operation of these devices is possible.
- The devices have an adequate stability against electromagnetic interferences in order that a proper operation is possible.

The ESCHA two-shell-shielding concept comprises an equipotential surface through two interconnected metal shells encapsulating the round connector at 360°. The shield braid of the molded cable is crimped all around on the shield sleeve. A twofold-overmold provides for 360°-shielding even at high mechanical stresses, dust- and waterproof at high pressure- and steam jet cleaning according to IP67 and IP69.

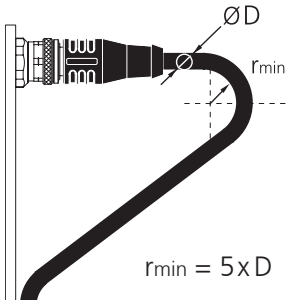


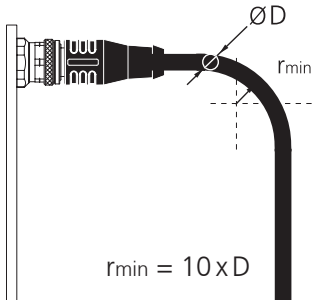
Wiring instructions

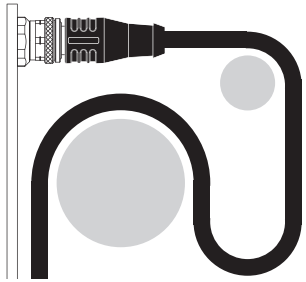
The correct installation of the round connector and a professional wiring are the precondition for properties of a relevantly tight and reliable electrical connection guaranteed by the manufacturer. In order to avoid damage to a round connector and cable, the minimum bending radius of the cable (r_{min}) is to be observed during the wiring.

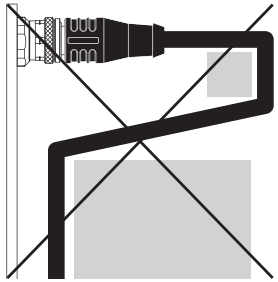
Data lines are high-performance products. Avoid any mechanical influences like squeezing, edgy snapping and tractive forces during mounting and operating to ensure a permanent and safe data transmission. Be careful while mounting at sub-zero temperatures, as plastics boast different features at low temperatures and the end product might be damaged. When using cable ties for cable bundling or permanent wiring, the ties must not cut into or deform the cable to avoid short circuits, cable interruptions or a reduction of the dielectric strength.

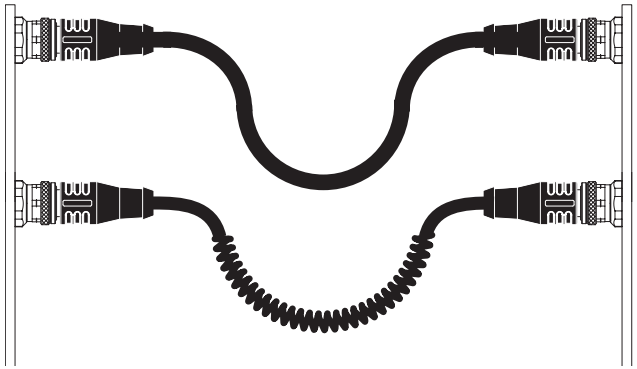
In case of cord sets double ended, sufficient cable length between the connections should be observed in order to absorb the generated energy during movement. The use of cable loops, spiral lines or cable chains guarantees a high life cycle of the round connector system.

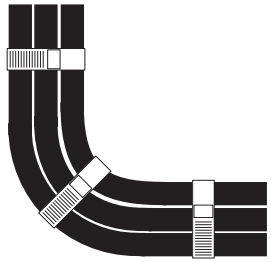


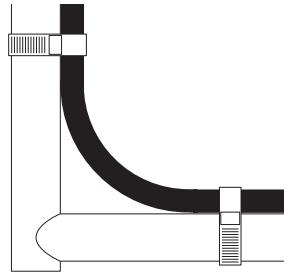












Recommended tightening torque

The use of a torque application tool is recommended for tightening and loosening of round connectors. The recommendations base on internal tests and cover a majority of applications and product combinations. Due to the design variety of products available on the market, specifications have to be checked in individual cases.

Recommended tightening torque according to IEC 61076-2 test requirements:
0.6Nm for M8x1 round connectors | 1.0Nm for M12x1 round connectors

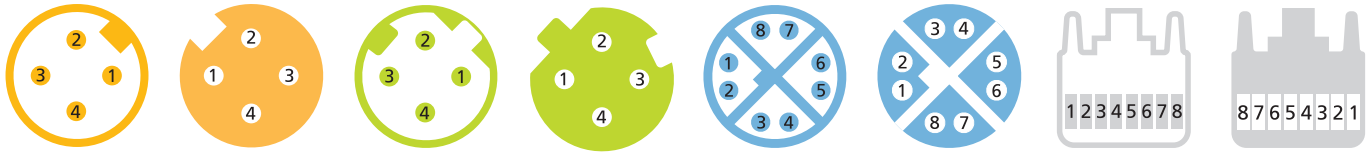
Recommended tightening torque for receptacles according to IEC 61076-2 test requirements:
1.5Nm for M8x1 round connectors | 2.0Nm for M12x1 round connectors

Torque-wrench set M8x1 | M12x1	Item-No.
in wallet fully fitted for M8x1 | M12x1 (knurl, hexagon-nut)	8055431

Colour guide

WH	BN	GN	YE	GY	PK	BU	RD	OG	BK	VT
white	brown	green	yellow	grey	pink	blue	red	orange	black	violet

Pinout



				Pin							
Type	Pins	Coding	Allocation code	1	2	3	4	5	6	7	8
M12x1	4	A	4.166	WH1	WH2	WH3	WH4				
M12x1	4	D	4.029	YE	WH	OG	BU				
M12x1	8	X	8.066	WH(OG)	OG	WH(GN)	GN	WH(BN)	BN	WH(BU)	BU
RJ45	4		4.003	YE	OG	WH			BU		
RJ45	8		8.002	WH(OG)	OG	WH(GN)	BU	WH(BU)	GN	WH(BN)	BN

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