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General installation guidebook for field-wireable and pre-assembled connectors, with/without cable, with open cable end and as connecting cable



Industrial connector & cable installation requires systematic planning and professional implementation to ensure signal, data and power supply. Compliance with relevant regulations by the user is essential to minimize failures and safety risks.

General knowledge of automation technology or electrical installation is required to understand this document. In addition, the planning and use of automation systems requires specialist technical knowledge that is not provided in this document.

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This guidebook provides an overview of the most important aspects of connector installation in industrial applications, but does not claim to be exhaustive.



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1. Basics of connector and cable installation

The professional installation of connectors and cables are a central component of every industrial electrical installation in decentralized automation technology. In addition to the appropriate selection and design of connectors and cables, correct installation, protection against mechanical, thermal and chemical influences and compliance with relevant standards and safety regulations play a decisive role. Further criteria for the selection and use of connectors with cables are, for example

- Technical requirements
- IP protection class
- Bending cycle, torsion and drag chain properties of the cable
- Temperature ranges
- Environmental influences
- Material properties
- Material resistance

The following notes provide an overview of the basic requirements and best practices for the proper installation of field-wireable and pre-assembled connectors, with/without cable, with a open cable end or as a connecting cable in industrial environments.

For this purpose, the most important instructions have been divided into categories that must be observed when installing Murrelektronik products:

Installation & safety instructions:



- The assembly and installation of industrial connectors may only be carried out by qualified professionals or by comparable trained personnel with documented expertise. Additionally, all applicable regulations, standards, as well as the information provided in the data sheet and installation/operating instructions must be observed. No liability will be assumed for any material or consequential damages resulting from improper use or non-compliance with these instructions.
- In industrial environment, the number of connection points in the field must be limited to a minimum necessary.
- Damaged components (connectors, parts or cables) must not be used and must be replaced immediately.
- Cables must not be pinched, stretched or bent to protect the conductor structure. Observing these guidelines helps prevent insulation damage (see section 2.2).
- Exposed, so-called "flying" connections must be mechanically secured to prevent loose contacts, short circuits and mechanical damage (See section 3.1 ff.).
- When securing cables (e.g. using cable ties, clamps or similar accessories), care must be taken to avoid crushing or damaging them.

Electrical safety and EMC instructions: 

- A high insulation resistance must be ensured to provide protection against electric shocks, minimize electromagnetic interference (EMC) and prevent the occurrence of leakage currents.
- The protective earth conductor (PE) must be properly connected to safely discharge fault currents, thereby providing protection for both personnel and equipment.
- Professional and continuous shielding, particularly for data cables, is essential to mitigate electromagnetic interference. Correct shielding ensures stable transmission quality, prevents transmission errors, and enables the operation in industrial environments with high electromagnetic exposure.
- Open wire ends on connectors or stranded wires on self-connecting plug connectors must only be stripped to the extent specified in the technical documentation. Keeping the stripping length as short as possible reduces the risk of short circuits caused by exposed conductors and simultaneously reduces electromagnetic interference. This enhances electrical safety and lowers the system's vulnerability to faults.
- Unused ports on the module must be sealed with blind plugs to prevent the ingress of dust, moisture or other objects. This protects internal components from damage, preserves electrical safety and prevents potential operational malfunctions.

Temperature and environmental resistance information:

- Connectors and cables must be rated for the applicable temperature ranges.
- For outdoor applications, only UV and ozone-resistant products should be used.
- Depending on the specific application, components must be evaluated for resistance to chemicals, oils, and other media (see section 4: Media Resistance).

Halogen-free & flame retardant requirements:

- Halogen-free cables are recommended in areas with high human traffic or sensitive electronic equipment, as they do not emit corrosive gases in the event of fire.
- Industrial-grade cables should be flame-retardant to prevent fire propagation, limit the release of smoke and toxic gases, comply with regulatory requirements, and protect both human life and property.

2. Product-related installation requirements

2.1 Standard cable types from Murrelektronik - properties and selection



Murrelektronik offers a range of standard cable types specifically designed for use with connectors in industrial automation applications.

Four different cable types are available to ensure a safe and reliable installation that meets mechanical, thermal, and electrical requirements.

All cable types are designed for use in industrial environments. This supports operational reliability, consistent signal-, data- and power-transmission, and a long service life.

Properties of the cable types

Cable types		PVC	PUR	PUR Resistant to welding sparks	TPE
Cable standard		★★	★★★	★★★★★	★★★★
Properties*	Flame retardant	■	■	■	■
	Resistant to chemicals	■	■	■	■
	Resistant to cleaning agents (Ecolab)	■			
	Oil and lubricant supply		■	■	■
	Suitable for drag chains**		10 million	10 million	10 million
	Suitable for torsion (robots)		±180°	±360°	±180°
	Resistant to welding sparks			■	■
	UV-resistant		■	■	■
	Halogen-free		■	■	
	Temperature range (fixed installation)	-30 to +80 °C	-40 to +90 °C	-40 to +90 °C	-40 to +105 °C
	Temperature range (Moving installation)	-5 to +80 °C	-25 to +90 °C	-25 to +90 °C	-20 to +90 °C
	UL approvals	■	■	■	■

* The properties of individual cable types may deviate from these specifications.
** Max. 3.3 m/s at 5 m horizontal travel length and max. acceleration of 5 m/s^2 at 25 °C.

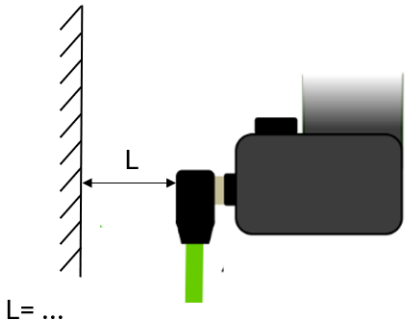
2.2 Avoiding common installation errors

To ensure a safe and reliable installation of Murrelektronik products, the following common errors must be avoided:

- It's prohibited to connect or disconnect connectors under load. Failure to comply may result in serious personal injury due to electrical hazards.



- Only use fully compatible connectors. In cases of uncertainty regarding compatibility, Murrelektronik Customer Service is available for consultation and support.
- When designing the installation space, it must be ensured that the dimensions of the connectors in their mated and locked position are considered. Sufficient space must be provided for mating and unmating of the connector to ensure a stress-free and secure connection.

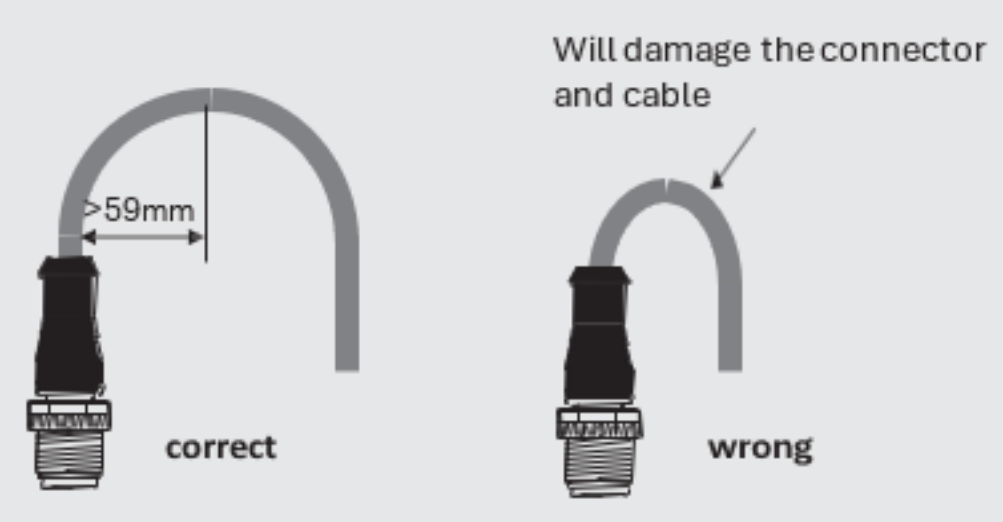


L= ...
M8 = 10mm
M12 = 15mm
MQ15 = 20mm

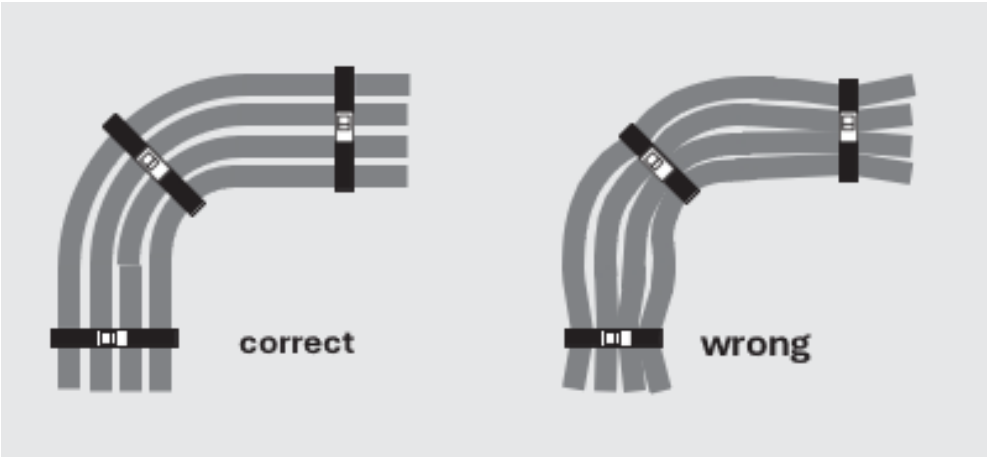
- The tightening torque specified in the technical data must be applied to ensure a standard-compliant and reliable connection. The use of a appropriate torque wrench from Murrelektronik (see section 5 "Accessories") is recommended.



- When installing cables, always maintain the minimum bending radius over the entire length of the cable. A practical example:
  Outer cable diameter = 5.9 mm, bending radius (according to the respective cable data sheet or online-shop) = min. 10 × outer cable diameter → bending radius = min. 59 mm.

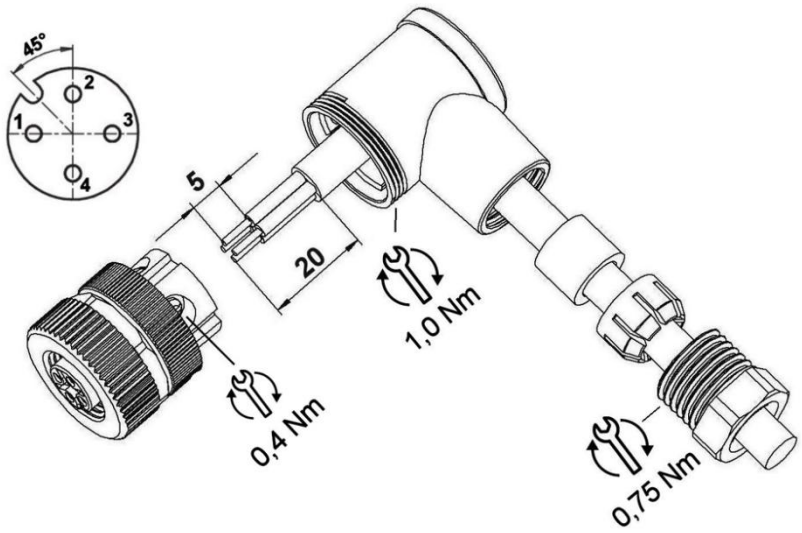


- Connectors shall not be subjected to tensile stress. Cable harnesses shall be provided with appropriate strain relief and shall be routed in such a way that no tensile forces are transmitted to the connector.
- Cable sag shall not occur during horizontal routing, as this may lead to the insertion of tensile stress.
- Strain reliefs elements and cable glands must be installed correctly in order to minimize mechanical loads.
- When using cable ties, ensure they do not cut into or mechanically deform the cable. Improper fastening may impair the dielectric strength, reduce voltage resistance, cause short circuits or lead to mechanical cable damage and failures.



2.3 Notes on installing field-wireable connectors:

- When using field-wireable connectors, it is essential to follow the corresponding installation instructions. Depending on the product, specific information must be observed like screw connections requirements, thread sizes, tightening torques (in Nm), (cable) clamping ranges for cables, stripping lengths as well as the connection types. See example below:



3. Flexible cables - planning, loading and laying

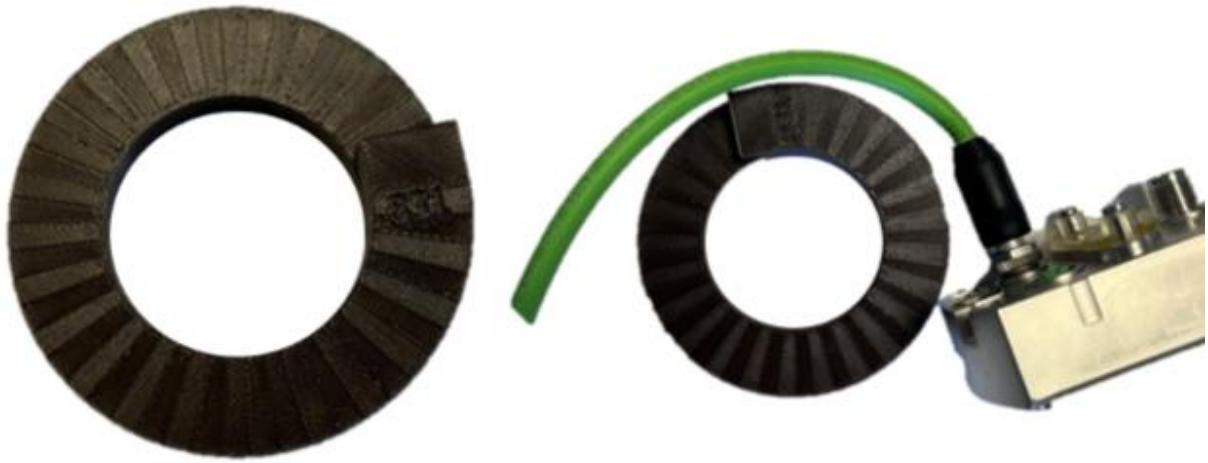
3.1 Mechanical stress - terms, influences and solutions

Flexible cables that are exposed to heavy mechanical loads must, for example, be adequately protected against:

- Abrasion caused by dragging over rough surfaces and sharp edges,
- Buckling due to deflections or improper routing,
- Mechanical stress resulting from guide rollers and winding/unwinding operations.

Important notes on proper cable routing:

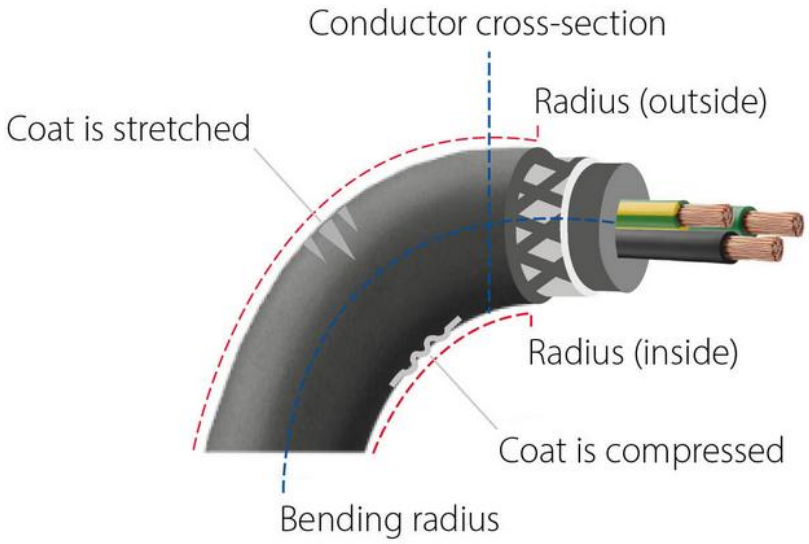
- The service life of cables can be significantly reduced by unfavorable operating conditions. These include high mechanical loads such as tensile stress, tight bending radii, frequent bending cycles or torsional movements.
- Compliance with the permissible bending radius according to the manufacturer's specifications must be ensured. For verification, a radius gauge can be used.



- The selection of appropriate cable types is regulated by additional standards, such as those specified in DIN EN IEC 60204-11.
- Depending on the specific application and mechanical requirements, the installation must be carefully planned and professionally implemented. Suitable fastening components includes cable glands, clamps, conduits, routing systems, velcro tape, top-hat rails, energy and drag chain systems or cable ties.

Mechanical stress is a critical factor in the installation of industrial connectors and cables. The following terms provide clarification:

Tensile stress refers to the mechanical load to a cable as a result of axially pulling forces. This force acts along the longitudinal axis of the cable and can be transferred to the connector. Such stress may occur during installation, through operational movements, vibrations or due to improper routing. Tensile stress can impair the connection integrity and lead to functional failures. To prevent mechanical damage, installation in accordance with standards and strain relief are essential.



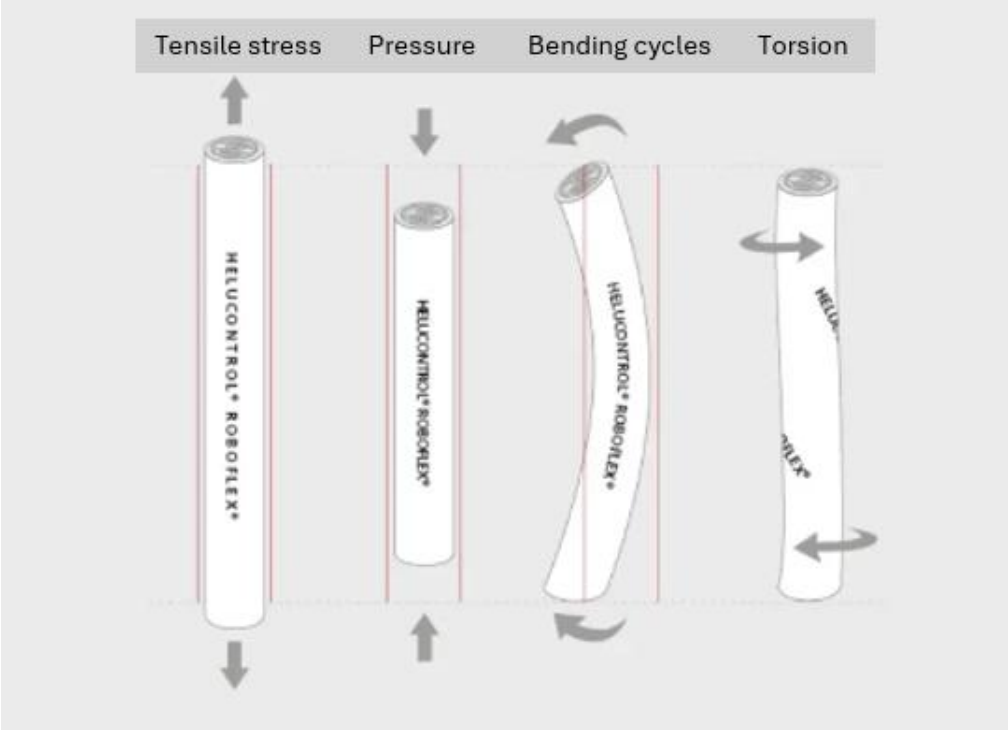
https://stex24.com/guide/strain-relief

Bending cycles refer to the number of repeated flexing movements a connected cable must endure without functional failure.

The **permissible bending radius** and the number of **bending cycles or torsion cycles** are key parameters for evaluating mechanical fatigue strength in dynamic applications—such as robotics, automated production systems, or drag chain installations.
Failure to observe the specified minimum bending radius or maximum bending cycles during cable installation can result in material elongation and compression. This may lead to structural changes within the cable, degradation of electrical performance, and an increased risk of failure (see section 2.2).

Torsion in industrial connectors describes the torsional stress applied when two connected components are rotated relative to one another. Insufficient torsional resistance can damage the internal cable structure and result in malfunction or premature failure.

A complete overview of cable loads:



https://www.helukabel.ch/ch-en/newsroom/item/torsion-cables-wires.html

Other influencing factors include:

- Acceleration forces in dynamic applications,
- Direction and speed of movement,
- Type of cable routing and storage,
- Structure and weight of the cable,
- Cable length and method of installation.

An optimally designed conduit system takes all these parameters into account in order to increase the service life of the cable or the entire system and support safe operation.

3.2 Cable routing for dynamic applications

Flexible cables must be routed according to the specific movement requirements of the application. Bending, tensile, and kinking loads, as well as excessive mechanical forces at fastening points, must be avoided. Cable loops must maintain a minimum bending radius appropriate to the cable specification (see Section 2.2 or the relevant online datasheet).

Important protective measures:
Flexible cables must be installed so that they are protected against mechanical and external influences, e.g. by:

- Preventing cables from being run over by machines or vehicles,
- Avoid contact with moving machine parts,
- Using appropriate cable guidance and routing systems.

The cable jacket must be durable and resistant to mechanical wear and environmental impact such as oil, water, dust, cooling lubricants and chemicals.

Cables in the near moving machine parts:

- A minimum distance of 25 mm must be maintained between the cable and moving machine parts.
- If this distance is not maintained, suitable fixed barriers or protective devices must be used to prevent direct contact.

Avoiding torsion (if the cable is not designed for torsional stress):

The cable routing must ensure that twisting (more than 5°) is avoided during:

- Winding and unwinding operations,
- Installation procedures,
- Entry or exit into or from a cable guidance system.

A typical example is the use of connectors and cable systems in robotic applications within automotive production.
These cables must withstand high levels of dynamic stress including drag chain movement, frequent bending cycles, and torsional loads. For welding applications, such cables must also be resistant to welding sparks to ensure functionality under real operating conditions. Correct cable routing further reduces the risk of welding sparks or slag embedding into the cable. Improper loop formations can lead to the creation of “spark nests”, where sparks accumulate — a condition that must be strictly avoided.



4. Media resistance - selection of suitable materials

The media resistance of connectors and cables is a critical factor influencing their longevity and operational safety in industrial environments. Varying ambient conditions—such as exposure to chemicals, extreme temperatures, or UV radiation—can significantly impact material performance.

It is therefore essential to select materials carefully to ensure optimum resistance to such environmental influences and maintain long-term functionality.

The table below provides an excerpt from the "*Murrelektronik Media Resistance List*" offering a direct comparison of selected media against various material types. If certain media are not explicitly listed in this document, it is recommended to consult your technical contact at Murrelektronik to ensure the correct selection of components.

Abbreviations and media resistances used:

		Cable sheath				Housing/ overmolding							Seal				Potting
Test medium	Conc %	PVC	PUR	TPE-U	TPE-S	PA 6	PP	PBT	PC	TPU	V2A	V4A	NBR	FKM	EPDM	MVQ	Poly-urethane
Hydrocarbons																	
Light petrol		○	○	✓	○	✓	✓	✓	○	✓	✓	✓	✓	✓	✗	✗	✓
Benzene		✗	✗	○	✗	✓	✓	○	✗	✗	✓	✓	✗	✓	✗	✗	✗
Heating oil, diesel oil		○	○	✓	○	✓	✓	✓	✗	✓	✓	✓	✓	✓	✗	○	✓
Alcohols and solvents																	
Acetone		✗	✗	✗	✗	✓	✓	✗	✗	✗	✓	✓	✗	✗	✓	✓	✗
Ethanol		○	○	✓	○	✓	✓	✓	✗	○	✓	✓	✓	✓	✓	✓	○
Glycerine		✓	✓	✓	✓	✓	✓	✓	○	✓	✓	✓	✓	✓	✓	✓	✓
Glycol		✓	✓	✓	✓	✓	✓	✓	○	○	✓	✓	✓	✓	✓	✓	✓
Isopropanol		○	○	✓	○	✓	✓	✓	✗	○	✓	✓	✓	✓	✓	✓	○
Acids																	
Formic acid	10	✓	○	✓	○	○	✓	○	✓	○	✓	✓	✓	✗	✓	✓	✓
Acetic acid	10	✓	○	✓	○	○	✓	○	✓	○	○	✓	○	○	○	○	✓
Lactic acid	15	✓	✓	✓	○	✓	✓	✓	✓	✓	✓	✓	○	✓	✓	✓	✓

Abbreviations and media resistances used:

Test medium		Cable sheath				Housing/ overmolding						Seal					Potting
	Conc %	PVC	PUR	TPE U	TPE-S	PA 6	PP	PBT	PC	TPU	V2A	V4A	NBR	FKM	EPDM	MVQ	Poly-urethane
Acids																	
Lactic acid	80	✓	○	✓	○	✗	✓	○	✓	○	○	✓	○	✓	✓	✓	✓
Phosphoric acid	30	✓	✗	✓	○	✗	✓	○	○	✗	○	✓	✓	✓	✓	○	○
Nitric acid	10	✓	✗	○	✗	✗	○	○	✓	✗	○	✓	○	✓	✓	○	✓
Hydrochloric acid	20	✓	✗	✓	○	✗	✓	○	✓	✗	✗	✗	○	✓	✓	○	✓
Sulphuric acid	30	✓	✗	✓	○	✗	✓	○	✓	✗	✗	✗	✓	✓	✓	✗	○
Citric acid	10	✓	○	✓	✓	○	✓	✓	✓	○	○	✓	✓	✓	✓	✓	✓
Bases																	
Ammonia aq.		✓	○	✓	✓	○	✓	○	✗	✗	✓	✓	✓	✗	✓	○	✓
Caustic soda	10	✓	○	✓	○	○	✓	✗	✗	✗	✓	✓	✓	○	✓	✓	✓
Potassium hydroxide solution	10	✓	○	✓	○	○	✓	✗	✗	✗	✓	✓	✓	○	✓	✓	✓
Oils, fats																	
ASTM reference oil IRM 901		○	✓	✓	○	✓	✓	○	○	✓	✓	✓	✓	✓	✗	✗	✓
Hydraulic oils		✗	✓	✓	○	✓	✓	✓	○	○	✓	✓	✓	✓	✗	✗	✓
Mineral oils		○	✓	✓	○	✓	✓	✓	○	○	✓	✓	✓	✓	✗	✗	✓

✓	Resistant	Little or no impairment. Medium causes no or only a very slight change in the material properties.	✗	Unstable	Severe attack to complete destruction. The material is irrevocably damaged by contact with the medium. Brief contact (e.g. use of the medium as a cleaning agent) may be acceptable. Preliminary tests are advisable.
○	Conditional stability	Weak to moderate attack. Long-term contact with the medium can cause a change in properties. Occasional contact is acceptable in most cases. Practical tests are advisable.		No entry = Not ratedt	There is no data available for an evaluation.

5. Installation accessories

The use of appropriate accessories - such as torque wrenches, universal holders, marking rings, protective caps or Velcro tape - supports proper installation, protects the connection from external influences. In dynamic applications, such as in automation, robotics or mechanical engineering, the deliberate selection of suitable accessories is a key factor for operational safety and reliability.

Recommended accessories for safe installation:

Designation	Item no.	Product image
Set of torque wrenches for M8 SW9; 0.4 Nm	7000-99101-0000000	
Set of torque wrenches for M12 SW13; 0.6 Nm	7000-99102-0000000	
Set of torque wrenches for 7/8"" SW22; 1.5 Nm	7000-99104-0000000	
Set of torque wrenches for 7/8"" SW24"; 1.5 Nm	7000-99105-0000000	
Set of torque wrenches for M12 Power SW17; 0.6Nm	7000-99106-0000000	
Set of torque wrenches for M12 SW14; 0.6 Nm	7000-99107-0000000	
Set of tilt torque wrenches for M12 SW13; 0.6Nm	7000-99111-0000000	
Screwdriver set 6-piece Contents: 4x slotted, 2x cross slot (PH1, PH2)	7000-98001-0000000	
Universal holder for M12 Universal holder 9mm Universal holder 14mm	7000-99045-0000000 7000-99801-0000000 7000-99811-0000000	
T-coupler holder, Slimline Set, profile mounting	7000-99062-0000000	
Velcro base incl. Velcro tape for ITEM profiles	7000-99852-0000000 7000-99872-0000000	
Velcro base incl. Velcro tape for direct mounting	7000-99861-0000000	
Velcro tape on roll (width 10mm) PU = 5m Velcro tape on roll (width 20mm) PU = 5m	7000-99855-0000000 7000-99875-0000000	
Marking rings (various colors)	7000-99301-V01xxxx	
T-piece holder (flat version) T-piece holder (high version) T-piece holder (slimline)	7000-99821-0000000 7000-99831-0000000 7000-99841-0000000	
Protective cap M8 female Protective cap M8 male Protective cap M12 female Protective cap M12 male	7000-99901-0000000 7000-99911-0000000 7000-99931-0000000 7000-99921-0000000	
Protective cap for MQ15 female (VP100) Protective cap for MQ15 female (VP10)	7000-P8906-0000000 7000-P8907-0000000	



PRODUCTS AND ACCESSORIES
This symbol indicates accessories or product recommendations.

6. Glossary

Term	Meaning
Cable jacket material	Outer sheath of a cable that provides mechanical protection (e.g. PVC, PUR)
Conductor cross-section	Cross-section of the conductors determines the maximum current flow and voltage drop
Crimp ferrule	Metal ferrule for stabilizing stranded wires in screw or clamp connections
DIN	German Institute for Standardization
EMC	Electromagnetic compatibility to reduce interference
EN	European standard
IEC	International Electrotechnical Commission
Insulation resistance	Measure of the electrical insulation capacity of a cable
Minimum bending radius	The minimum radius that a cable can be bent without damage
PE	Protective earth - protective conductor that serves to protect against electric shock
PROFINET	Industrial Ethernet standard of the Profibus user organization
Sheat stripping length	Length of the removed outer cable jacket
Shielding	Metallic shielding of a cable and/or connector to reduce electromagnetic interference
Strain relief	Device to prevent mechanical axial stress on the cable connection
Stripping length	Length of the stripped conductor after removing the insulation
Thermal load capacity	Minimum/maximum permissible temperature of a cable under operating conditions
Tightening torque	Required torque in Newton-meters (Nm) to ensure a secure screw connection
UV	Stands for ultraviolet radiation, an electromagnetic radiation with shorter wavelengths than visible light
VP	Packaging unit
Wire strand	Construction of a conductor consisting of individual wire strands

Further terms under https://shop.murrelektronik.com/en/dictionary/

7. Disclaimer and miscellaneous

This document does not claim to be complete. We're not responsible for any warranty or damages that come from incomplete or wrong info, improper installation, or not following the instructions in this document. This doesn't apply in cases of intent.

This document does not release the user from the obligation to have connectors assembled and installed exclusively by qualified personnel or by persons who are demonstrably trained and instructed to a comparable standard.

The user must ensure that the connectors purchased or to be purchased are suitable for the intended application and use. This also includes compliance with applicable regulations, standards, the information in data sheets, and the corresponding installation/operating instructions, as well as compliance with relevant safety regulations.