

Robotics

Reliable connection solutions for every movement



Connectors and cables for moving applications in industry

Robotics applications place the highest demands on connection technology. Cables and connectors are exposed to continuous bending, torsional and acceleration loads and must reliably transmit data, signals and power even during dynamic movement sequences.

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METZ CONNECT: Connections for moving worlds

METZ CONNECT offers robust, practical connection solutions for industrial robotics applications – from guided cable routing in drag chains to highly flexible cables for torsion-loaded axes. The result: high process reliability, reliable transmission and durable connections for modern automation concepts.



Connection technology for dynamic applications

Whether it's articulated-arm robots, gantry axes, cobots, handling systems or automated production cells; wherever cables are permanently moved, reliable, mechanically resilient and application-specific connection technology is essential.

METZ CONNECT supports you with suitable solutions for:

- Industrial Ethernet in moving applications
- Sensor/actuator cabling
- Robust connectors for harsh industrial environments
- Application-specific connection and connecting cables

From the sensor to the robot arm – M12 connectors in industrial use

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PC board terminal
blocks



IP protected
wall outlets



In a modern production cell with collaborative robots, automated guided vehicles (AGVs) and networked automation components, the versatility of METZ CONNECT connection technology becomes clear: M12 connectors and cable assemblies secure data and signal transmission on robot axes and I/O components, while RJ45 connectors, Single Pair Ethernet, PCB terminal blocks and pin headers and female headers reliably ensure the networking of industrial switches, energy controlling and control technology.

Data network
technology for
the industrial
environment



Pin headers and
female headers



Single Pair
Ethernet – SPE



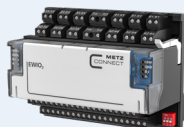
Plugs and
jacks



M12 connection
technology



Energy
controlling



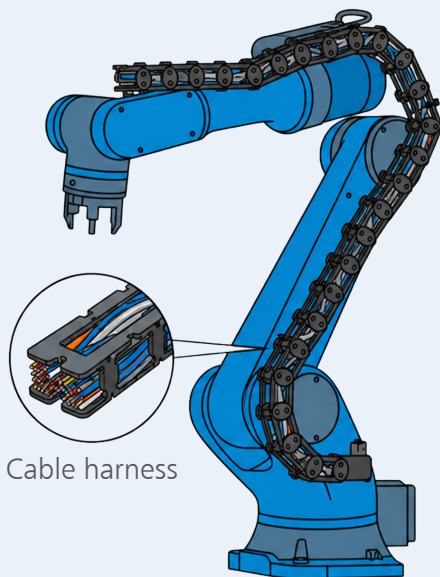
Drag chain or torsion cable?

The type of movement is decisive

In modern robotic systems, cables are subjected to different loads depending on the axis and movement profile. While controlled cable routing is required for linear or guided movements, torsional loads are paramount for rotating axes. For this reason, drag chains and torsion cables are often used in combination.

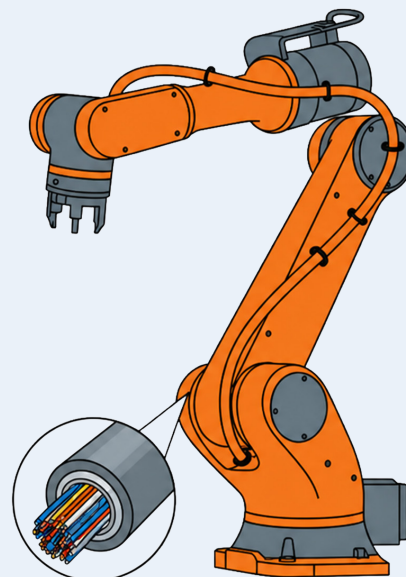
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Drag chain



Cable harness

Torsion cable



Torsion cable

Drag chain – Guided safety in motion

A drag chain, also known as an energy chain, is a mechanical guide system made of plastic or metal. It accommodates cables, wires and hoses inside and guides them in a controlled manner along a defined movement path.

This ensures that the cables are routed safely, protected from mechanical damage, and moved in accordance with the permissible bending radius. This reduces the risk of kinks, abrasion, and premature failure – even with a high number of cycles.

Typical areas of application:

- Linear axes and gantry robots
- Pivot axes on robot arms
- CNC machines and handling systems
- Applications with a defined, predictable movement path

Advantages of the drag chain:

- Controlled cable routing
- Protection against kinking, tangling and abrasion
- High service life with repeated movements
- Structured routing of several cables and hoses

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Torsion cables – Flexibility for every rotation

Torsion cables are specially designed for applications in which cables are permanently twisted around their own longitudinal axis. Such loads typically occur on rotating robot axes, wrists or compact kinematic systems.

Thanks to their highly flexible, multi-layer construction with fine-strand conductors and specially selected materials, torsion cables can withstand continuous twisting motions without the conductors breaking or the shielding being damaged.

Typical areas of application:

- Robot wrists and rotating axes
- SCARA and Delta robots
- Rotary tables and rotary axes
- Applications with no design option for a drag chain

Advantages of the torsion cable:

- Designed for permanent torsional loads
- No additional guide system required
- Ideal for confined installation spaces
- Flexible in bending and torsion

Selection guide at a glance

Criterion	Drag chain	Torsion cable
Type of movement	linear, guided, predictable	rotary, twisting
Typical application	Axes with defined guidance	Axes with torsional movement
Guide system	required	not required
Installation space	larger	compact
Main advantage	Protection and guidance	high torsional flexibility

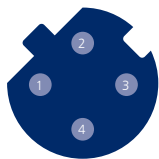


Connection solutions for data transmission

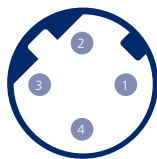
Robust, reliable and suitable for industry

For reliable data transmission in robotics and automation applications, METZ CONNECT offers high-performance connection and connecting cables with industrial-grade connectors.

Depending on the operating environment and interface requirements, solutions with M12 or RJ45 are available. While RJ45 is primarily used in protected environments, M12 offers significant advantages in demanding industrial applications thanks to its robust, lockable design.



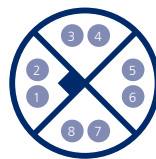
M12 female
connector
4-pin
D-coded



M12 male
connector
4-pin
D-coded



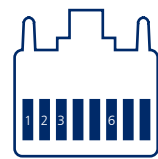
M12 female
connector
8-pin
X-coded



M12 male
connector
8-pin
X-coded



RJ45 jack



RJ45 plug

Industrial-grade interfaces for reliable data transmission in moving applications.

Typical interfaces

- M12 D-coded for Industrial Ethernet applications
- M12 X-coded for higher data requirements
- RJ45 for standardized Ethernet interfaces
- Different mating faces and connection variants for flexible integration

Technical properties of connectors for data transmission

Technical properties	M12	RJ45
Insulation resistance	$\geq 10^8 \Omega$	$\geq 10^8 \Omega$
Contact resistance	$\leq 5 \text{ m}\Omega$	$\leq 5 \text{ m}\Omega$
Ambient temperature	-30 °C to 90 °C	-40 °C to 70 °C
Contact material	Metal, gold-plated	Metal, gold-plated
Contact carrier material	Plastic, TPU	Plastic, TPU
Grip body material	Plastic, TPU	Plastic, TPU
Coupling nut material	Metal, nickel-plated	-
Seal material (female connector)	FPM/FKM	-
Standards	IEC 61076-2-101/-109	IEC 60603-7-5
Degree of protection when mated	IP65, IP67, IP68	IP20
Mechanical service life	> 100 mating cycles	> 750 mating cycles
Pollution degree	3/2	1

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Your advantages in robotics

- Reliable data transmission even under mechanical load
- Robust connectors for industrial environments
- Secure locking for vibration-loaded applications
- Flexible choice of codings, mating faces and cable designs

M12 Industrial Ethernet connection/ connecting cables, D- and X-coded

Shielded M12 Industrial Ethernet connection/connecting cables for secure, industry-standard data transmission in automation and fieldbus technology. Various cable types for increased mechanical loads such as abrasion, bending, vibrations, drag-chain operation and torsion, in various performance classes Cat.5 (100 MBit/s), Cat.6A (10 GBit/s) with D- and X-coded connectors.

Typical interfaces

- > M12 female connector
- > M12 male connector
- > Angled M12 male connector
- > RJ45 plug
- > Free cable end

Create cable in the
configurator:



[metz-connect.com/
configurator-m12](https://metz-connect.com/configurator-m12)



Connection solutions for signal transmission

Compact, robust and flexibly integrable

12 In addition to data transmission, the reliable transmission of sensor and actuator signals also plays a key role in robotics applications. M12 sensor/actuator connection and connecting cables are available in various versions for this purpose.

METZ CONNECT solutions are designed for industrial requirements and enable a secure connection even under dynamic conditions.

The portfolio includes, among other things:

- M12 sensor/actuator connection and connecting cables, A-coded
- Versions in PUR or PVC
- Shielded and unshielded variants
- Different numbers of poles and cable lengths
- Straight and angled connectors
- Variants with free cable end

This makes it possible to cover a wide variety of requirements in robotics, handling technology and mechanical engineering needs as they arise.



Technical properties of connectors for signal transmission

Technical properties	M12
Insulation resistance	$\geq 10^8 \Omega$
Contact resistance	$\leq 5 \text{ m}\Omega$
Ambient temperature	-30 °C to 90 °C
Contact material	Metal, gold-plated
Contact carrier material	Plastic, TPU
Grip body material	Plastic, TPU
Coupling nut material	Metal, nickel-plated
Seal material (female connector)	FPM/FKM
Standards	IEC 61076-2-101/-109
Degree of protection when mated	IP65, IP67, IP68
Mechanical service life	> 100 mating cycles
Pollution degree	3/2

M12 sensor/actuator connection/connecting cables, A-coded

M12 sensor/actuator connection/connecting cables with overmolded M12 A-coded connectors meet the typical requirements of the automation industry. Sensor plugs are available in various designs and with different numbers of poles. The wide range of sensor plugs is supplemented, among other things, by 360° shielded and unshielded variants.

Typical interfaces

- > M12 female connector
- > M12 male connector
- > Angled M12 female connector
- > Angled M12 male connector
- > Free cable end

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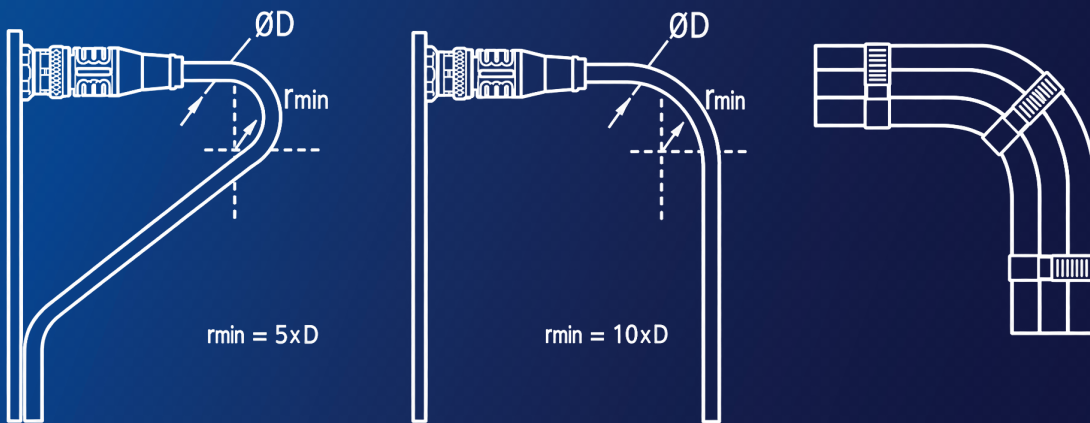


Create cable in the configurator:



[metz-connect.com/
configurator-m12](https://metz-connect.com/configurator-m12)

General installation instructions



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The prerequisite for the properties guaranteed by the manufacturer with regard to a suitably sealed and reliable electrical connection is correct assembly of the connectors and proper installation of the cables. To avoid damage to the connector and cable, observe the minimum bending radius (r_{min}) of the cable during installation.

Data cables are high-performance products. To ensure permanent, reliable data transmission, avoid all mechanical influences such as crushing, sharp kinking, tensile forces, etc. during installation and operation.

Installation at sub-zero temperatures requires special care, since plastics have different properties at low temperatures and the end product may be damaged.

When using cable ties for cable bundling or fixed installation, they must not cut into or deform the cable in order to avoid short circuits, cable interruptions or a reduction in dielectric strength.

For connecting cables, ensure sufficient cable length between the connections to absorb the energy introduced by movement. The use of cable loops, spiral cables or energy chains guarantees a longer service life of the connector system.

Industrial Ethernet

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Cable description	shielded M12 Ethernet cable	shielded M12 Ethernet cable	shielded M12 Ethernet cable	shielded M12 Ethernet cable	shielded M12 Ethernet cable
Number of poles	8-pin	8-pin	8-pin	4-pin	4-pin
Outer sheath diameter	Ø: (7,8 ± 0.2) mm	Ø: (9.4 ± 0.2) mm	Ø: (9.4 ± 0.2) mm	Ø: (4.8 ± 0.2) mm	Ø: (6.5 ± 0.2) mm
Sheath material	PUR	PUR	PUR	PUR	PUR
Core insulation material	FRNC	Foam-Skin Polyolefin	Foam-Skin Polyolefin	PP	PE
Core colours	1 WHOG, 2 OG; 3 WHGN, 4 GN; 5 WHBN, 6 BN; 7 WHBU, 8 BU Profinet	1 WHOG, 2 OG; 3 WHGN, 4 GN; 5 WHBN, 6 BN; 7 WHBU, 8 BU Profinet	1 WHOG, 2 OG; 3 WHGN, 4 GN; 5 WHBN, 6 BN; 7 WHBU, 8 BU Profinet	1 WHOG, 2 WHBU, 3 OG, 4BU	1 YE, 2 WH, 3 OG, 4 BU
Sheath colour	green similar to RAL 6018	green similar to RAL 6018	black similar to RAL 9005	green similar to RAL 6018	green similar to RAL 6018
Core cross-section/ stranding	AWG26/19 4 x 2 x 7 x 0,2	AWG24/7 4 x 2 x 7 x 0,2	AWG24/7 4 x 2 x 7 x 0,2	AWG26/19 4 x 1 x 19 (0,15)	AWG22/19 4 x 1 x 19 (0,75)
Bending radius	• Fixed: 4 x Ø cable • Moving: 7.5 x Ø cable	• Fixed: 8 x Ø cable • Moving: 15 x Ø cable	• Fixed: 8 x Ø cable • Moving: 15 x Ø cable	• Fixed: 4 x Ø cable • Moving: 7.5 x Ø cable	• Fixed: 5 x Ø cable • Moving: 10 x Ø cable
Temperature range	• moving: -30 to 70°C • fixed installation: -40 to 80°C	• moving: -30 to 70°C • fixed installation: -40 to 80°C	• moving: -30 to 70°C • fixed installation: -40 to 80°C	• moving: -20 to 80°C • fixed installation: -40 to 80°C	• moving: -20 to 80°C • fixed installation: -40 to 80°C
Torsion	No	± 180°/m, ≥ 5 million cycles	± 180°/m, ≥ 5 million cycles	± 180°/m, ≥ 5 million cycles	± 180°/m, ≥ 5 million cycles
Suitable for drag chains	max. 3 m/s ² , 4 million cycles	No	No	max. 5 m/s ² , 3 million cycles	max. 20 m/s ² , 5 million cycles
Category	Cat.6	Cat.7	Cat.7	Cat.5	Cat.5e
Shielding	Yes	Yes	Yes	Yes	Yes

Sensor/actuator cables

Cable description	unshielded M12 sensor/actuator cable	unshielded M12 sensor/actuator cable	unshielded M12 sensor/actuator cable	shielded M12 Ethernet cable	shielded M12 Ethernet cable	shielded M12 Ethernet cable
Number of poles	4-pin	5-pin	8-pin	4-pin	5-pin	8-pin
Outer sheath diameter	Ø: (4,7 ± 0,2) mm	Ø: (5,2 ± 0,2) mm	Ø: (5,9 ± 0,2) mm	Ø: (5,1 ± 0,2) mm	Ø: (5,6 ± 0,2) mm	Ø: (6,3 ± 0,2) mm
Sheath material	PUR	PUR	PUR	PUR	PUR	PUR
Core insulation material	PP	PP	PP	PP	PP	PP
Core colours	1 BN, 2 WH, 3 BU, 4 BK	1 BN, 2 WH, 3 BU, 4 BK, 5 GY	1 WH, 2 BN, 3 GN, 4 YE, 5 GY, 6 PK, 7 BU, 8 RD	1 BN, 2 WH, 3 BU, 4 BK	1 BN, 2 WH, 3 BU, 4 BK, 5 GY	1 WH, 2 BN, 3 GN, 4 YE, 5 GY, 6 PK, 7 BU, 8 RD
Sheath colour	black similar to RAL 9005	black similar to RAL 9005	black similar to RAL 9005	black similar to RAL 9005	black similar to RAL 9005	black similar to RAL 9005
Core cross-section/ stranding	4 x 0,34 mm ² ; 42 x 0,10 mm	5 x 0,34 mm ² ; 42 x 0,10 mm	8 x 0,25 mm ² ; 32 x 0,10 mm	4 x 0,34 mm ² ; 42 x 0,10 mm	5 x 0,34 mm ² ; 42 x 0,10 mm	8 x 0,25 mm ² ; 32 x 0,10 mm
Bending radius	- Fixed: 5 x Ø-cable - Moving: 10 x Ø-cable	- Fixed: 5 x Ø-cable - Moving: 10 x Ø-cable	- Fixed: 5 x Ø-cable - Moving: 10 x Ø-cable	- Fixed: 5 x Ø-cable - Moving: 10 x Ø-cable	- Fixed: 5 x Ø-Leitung - Moving: 10 x Ø-Leitung	- Fixed: 5 x Ø-cable - Moving: 10 x Ø-cable
Temperature range	- moving: -30 to 90°C - fixed installation: -40 to 80°C - In drag-chain and torsion operation: -25 to 60°C	- moving: -30 to 90°C - fixed installation: -40 to 80°C - In drag-chain and torsion operation: -25 to 60°C	- moving: -30 to 90°C - fixed installation: -40 to 80°C - In drag-chain and torsion operation: -25 to 60°C	- moving: -30 to 90°C - fixed installation: -40 to 80°C - In drag-chain and torsion operation: -25 to 60°C	- moving: -30 to 90°C - fixed installation: -40 to 80°C - In drag-chain and torsion operation: -25 to 60°C	- moving: -30 to 90°C - fixed installation: -40 to 80°C - In drag-chain and torsion operation: -25 to 60°C
Torsion	± 360°/m, ≥ 2 million cycles	± 180°/m, ≥ 3 million cycles	± 180°/m, ≥ 3 million cycles	± 360°/m, ≥ 2 million cycles	± 180°/m, ≥ 1 million cycles	± 180°/m, ≥ 0,5 million cycles
Suitable for drag chains	max. 5 m/s ² , 5 million cycles	max. 5 m/s ² , 3 million cycles	max. 5 m/s ² , 2 million cycles	max. 5 m/s ² , 5 million cycles	max. 5 m/s ² , 3 million cycles	max. 5 m/s ² , 2 million cycles
Shielding	No	No	No	Yes	Yes	

Product Areas

Innovation and consistency – from the circuit board to the end device

Data Network Technology

Copper and fiber optic components for structured network cabling.



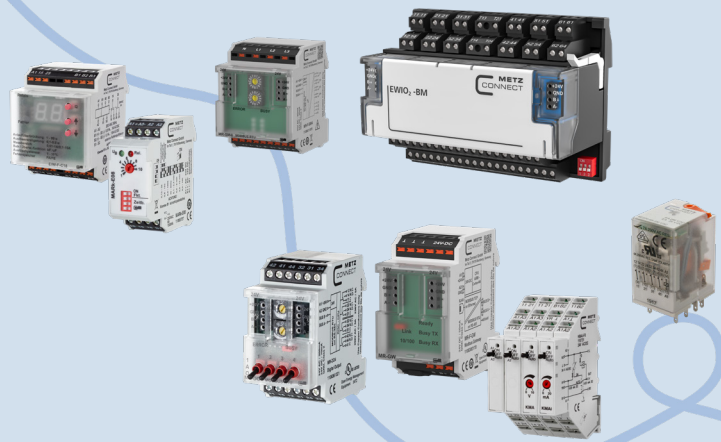
Industrial Data & Signal Transmission

Stable data transmission and protection in demanding industrial environments.



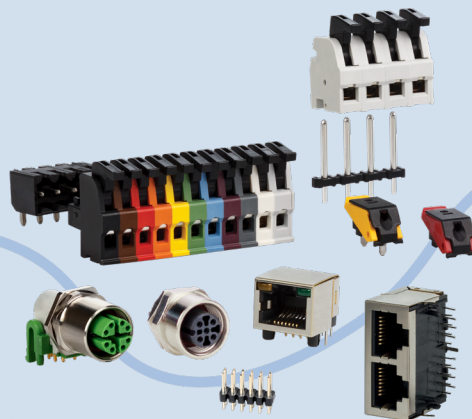
Automation

Reliable connections, precise control and intelligent components for building, process automation and monitoring.



Device Connection Technology

Circuit board connection technology for connecting devices and controllers in building automation.



Do you have any
questions?
We will be happy to
assist you.

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