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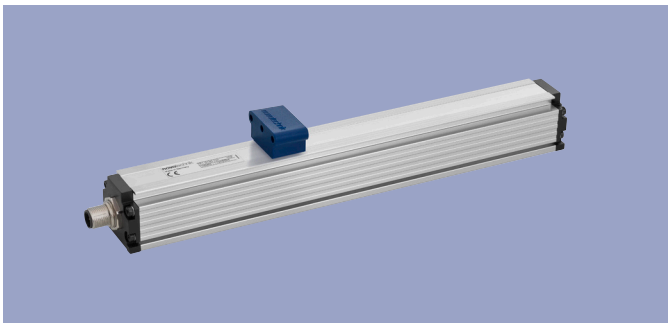
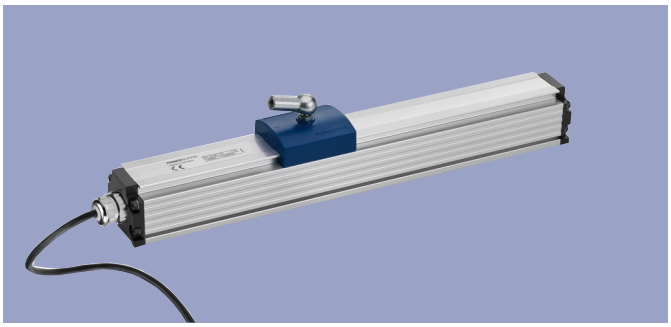
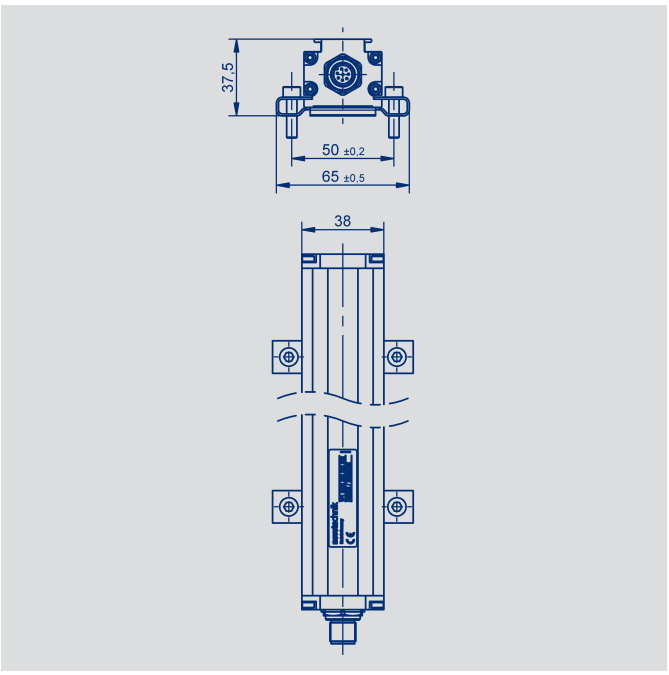
Siedle Group

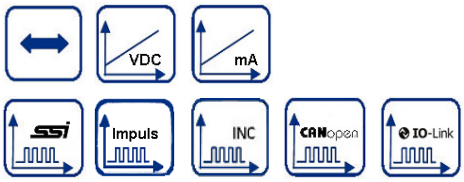
# NOVOSTRICTIVE Transducer up to 4250 mm touchless

## Series TP1








### Special features

- Non-contacting magnetostrictive measurement technology
- Touchless position detection
- Wear-free, unlimited mechanical life
- Resolution up to 1 µm, independently of length
- Low temperature coefficient <15 ppm/K
- Insensitive to shock and vibration
- Protection class IP67 / IP68
- Position-Teach-In
- Optionally galvanic isolated
- Interfaces: Analog, SSI, Impulse, Incremental, CANopen, IO-Link

### Applications

- Manufacturing Engineering
  - Plastic injection molding
  - Textile
  - Packaging
  - Sheet metal working
  - Woodwork
- Automation Technology

**Transducer in profile design with magnetostrictive technology** for highly accurate and reproducible position measurement for lengths up to 4250 mm. Mechanically decoupled and therefore wear-free when the floating position marker is used.

The transducer TP1 is insensitive to dirt, dust or moisture and thus proves itself in harsh industrial environments.
Depending on the interface, up to three positions and speed can be measured.

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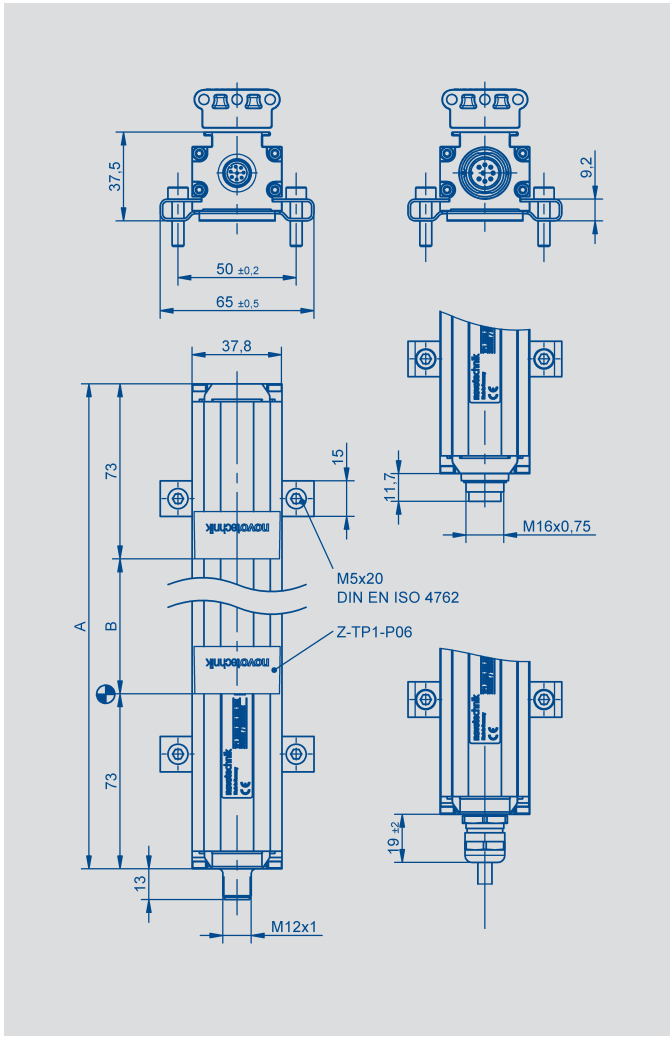
# Contents

# Mechanical Data




| Description | | |
|---|---|---|
| Materials | Housing: Anodized aluminum, AlMgSi0,5 F22, 3.3206.71<br>End flanges: Aluminum G AlSi12Cu1 (FE) | |
| Mounting | Adjustable clamps (included in delivery) | |
| Position marker | Floating position marker, plastic<br>Guided position marker, plastic, with ball coupling | |
| Electrical connections | Connector M12x1, 4-pin / 5-pin / 8-pin, shielded<br>Connector M16x0.75 (IEC 130-9), 6-pin / 8-pin, shielded<br>PUR-cable, 8 x 0.25 mm², shielded: 1 m, 3 m oder 5 m length | |
| Electronic | SMD with ASIC, integrated<br>Connector casing (shield) is connected to the sensor housing.<br>Housing is capacitively decoupled to the electronics | |
| **Mechanical Data** | | |
| Dimensions | see dimension drawing | |
| Length of housing (dimension A) | Dimension B + 146 | mm |
| Electrical measuring range (dimension B) | 0050 up to 0500 mm in 25 mm steps,<br>500 up to 1000 mm in 50 mm steps,<br>1000 up to 2000 mm in 100 mm steps,<br>2000 up to 4250 mm in 250 mm steps<br>other lengths on request | |
| Max. operational speed with valid output signal | 10 | $ms^{-1}$ |
| Max. operational acceleration with valid output signal | 200 | $ms^{-2}$ |
| Shock (IEC 60068-2-27) | 100 (11 ms) (single hit) | g |
| Vibration (IEC 60068-2-6) | 20 (5...2000 Hz, Amax = 0.75 mm) | g |
| Protection class (DIN EN 60529) | IP67 with fastened connector<br>IP68 with cable connection | |
| Life | Mechanically unlimited<br>(with floating position marker) | |
| Operating temperature range | -40 ... +85 | °C |
| Storage temperature range | -40 ... +105 | °C |
| Operating humidity range | 0 ... 95 (no condensation) | % R.H. |

CAD data see
www.novotechnik.de/en/download/cad-data/

# Technical Data
# Analog Versions

| Type designations | TP1- _ _ _ _-101 - 41 _ - _ _ _<br>Voltage | TP1- _ _ _ _-101 - 42 _ - _ _ _<br>Current | |
|---|---|---|---|
| **Electrical Data** | | | |
| Electrical measuring range (dimension B) | 0050 up to 4250 | | mm |
| Output signal | 0.1 ... 10 V (load ≥ 5 kΩ)<br>-10 ... 10 V (load ≥ 5 kΩ) | 0.1 ... 20 mA (burden ≤ 500 Ω)<br>4 ... 20 mA (burden ≤ 500 Ω) | |
| Number of channels | 2 | 1 | |
| Update rate | ≤ 16 * | | kHz |
| Resolution | 16 | | bit |
| Absolute linearity | ≤ ± 0.02 (min. ± 50 µm) ** | | % FS |
| Tolerance of electr. zero point | ± 0.5 (min. 2 x reproducibility) | | mm |
| Reproducibility | ≤ 0.03 | | % FS |
| Hysteresis | ≤ 0.01 | | % FS |
| Temperature error | ≤ 30 (min. 0,01 mm/K) | | ppm/K |
| Supply voltage | 24 (19 ... 30) | | VDC |
| Supply voltage with galvanic isolation | 24 (18 ... 36) | | VDC |
| Supply voltage ripple | ≤ 10 | | % Vss |
| Current consumption | ≤ 100 | | mA |
| Overvoltage protection | 40 (temporary / 1 min.) | | VDC |
| Polarity protection | Yes, up to supply voltage max | | VDC |
| Short circuit protection | Yes (outputs vs.GND and supply voltage max.) | | |
| Insulation resistance (500 VDC) | ≥ 10 | | MΩ |
| **Environmental Data** | | | |
| MTTF (DIN EN ISO 13849-1 parts count method, w/o load, wc) | 23 | | Years |
| Functional safety | If you need assistance in using our products in safety-related systems, please contact us | | |
| EMC compatibility<br>CE | EN 61000-4-2 Electrostatic discharges (ESD) 4 kV, 8 kV<br>EN 61000-4-3 Electromagnetic fields 10 V/m<br>EN 61000-4-4 Electrical fast transients (burst) 2 kV<br>EN 61000-4-6 Conducted disturbances, induced by RF-fields 10 V eff.<br>EN 55011 Radiated disturbances class B | | |

*) Data are extrapolated, internal measuring rate depends on measuring length.
**) Valid for channel 1; channel 2 with additional offset and gradient tolerances (inverted signal from channel 1).
Measured with position marker Z-TP1-P06.

**Pin assignment**

| Connector code 101, 102 | Cable code 20_ | Connector with cable (Accessories) | Analog voltage | Analog current |
|---|---|---|---|---|
| Pin 1 | YE | WH | do not connect | 0(4)...20 mA |
| Pin 2 | GY | BN | Signal GND | Signal GND |
| Pin 3 | PK | GN | +10...0 (-10) V | do not connect |
| Pin 4 | RD | YE | DIAG *** | DIAG *** |
| Pin 5 | GN | GY | 0 (-10)...+10 V | do not connect |
| Pin 6 | BU | PK | GND | GND |
| Pin 7 | BN | BU | Supply voltage | Supply voltage |
| Pin 8 | WH | RD | PROG *** | PROG *** |

***) connect only for Teach-In-function (see manual).

| Connector code 103 | Connector with cable (Accessories) | Analog voltage | Analog current |
|---|---|---|---|
| Pin 1 | WH | 0 (-10)...+10 V | 0 (4)...20 mA |
| Pin 2 | BN | Signal GND | Signal GND |
| Pin 3 | BU | +10...0 (-10) V | do not connect |
| Pin 4 | BK | GND | GND |
| Pin 5 | GY | Supply voltage | Supply voltage |
| Pin 6 | GN | GND | GND |

# Ordering Specifications Analog Versions - Voltage - Current

## Ordering specifications

Preferred types printed in bold

**Mechanical version**
**101: Profile design**

**Electrical interface**
**4: Analog interface**

**Output signal analog interfaces 4 _ _**
**1: Voltage output**
**2: Current output**

**Analog interface voltage output 41_**
**1: 0 ... 10 V and 10 ... 0 V ***
4: 0 ... 10 V and 10 ... 0 V galvanic isolated
6: -10 ... +10 V and +10 ... -10 V galvanic isolated

**Analog interface current output 42_**
1: 0 ... 20 mA *
2: 20 ... 0 mA *
**3: 4 ... 20 mA ***
4: 20 ... 4 mA *

*) With Teach-In-function

**Electrical connection**
101: Connector M16x0.75 (IEC 130-9), 8-pin
**102: Connector M12x1, 8-pin**
103: Connector M16x0.75 (IEC 130-9), 6-pin
**201: Cable, 8-pole, shielded, 1 m**
203: Cable, 8-pole, shielded, 3 m
205: Cable, 8-pole, shielded, 5 m

| T | P | 1 | – | 0 | 8 | 0 | 0 | – | 1 | 0 | 1 | – | 4 | 1 | 1 | – | 1 | 0 | 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**Series**

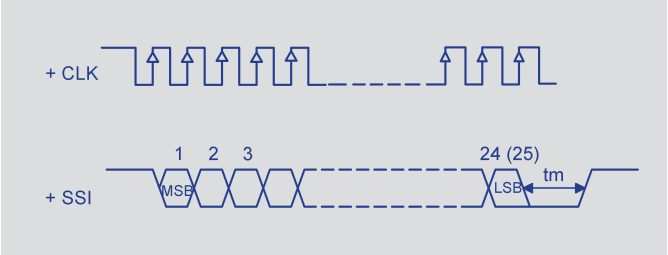
**Electrical measuring range**
**Standard lengths 0050 up to 4250 mm**
0050 up to 0500 mm in 25 mm-steps, 0500 up to 1000 mm in 50 mm-steps,
1000 up to 2000 mm in 100 mm-steps, 2000 up to 4250 mm in 250 mm-steps.
Other lengths on request

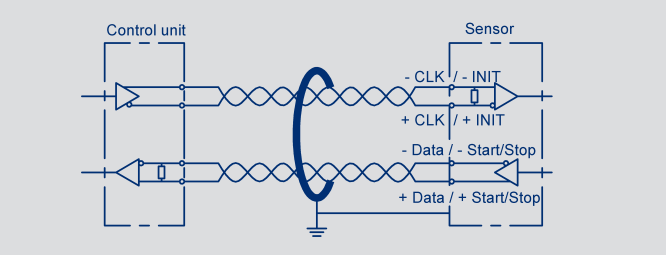
**Important:** Avoid equalizing currents in the cable shield caused by potential differences.
Twisted pair cable (STP) is recommended.

# Technical Data
# SSI-Interface

| Type designations | TP1 - _ _ _ _ - 101 - 2_ _ - _ _ _<br>Synchronous-serial interface (SSI) | |
|---|---|---|
| **Electrical Data** | | |
| Electrical measuring range (dimension B) | 0050 up to 4250 | mm |
| Protocol | SSI 24 und 25 bit (26 bit on request) | |
| Inputs | RS422 | |
| Monoflop time (tm) | 30 | µs |
| Encoding | Gray, Binary | |
| Update rate | 16 * | kHz |
| Resolution (LSB) | 1, 5 or 10 (see ordering specifications. Other resolutions on request) | µm |
| Absolute linearity | ≤ ±10 µm up to 1000 mm, ≤ ±25 µm up to 2500 mm, ≤ ±40 µm up to 4250 mm ** | |
| Tolerance of electr. zero point | ± 0.5 | mm |
| Reproducibility (rounded to LSB) | ≤ 6 | µm |
| Hysteresis (rounded to LSB) | ≤ 4 | µm |
| Temperature error | ≤ 15 (min. 0.01 mm/K) | ppm/K |
| Supply voltage | 24 (13 ... 34) | VDC |
| Supply voltage ripple | ≤ 10 | % Vss |
| Overvoltage protection | 40 (permanent) | VDC |
| Current consumption | ≤ 100 | mA |
| Polarity protection | Yes, up to supply voltage max. | |
| Short circuit protection | Yes (outputs vs. GND and supply voltage up to 7 V) | |
| Ohmic load at outputs | > 120 | Ω |
| Max. clock rate | 2 | MHz |
| Insulation resistance (500 VDC) | ≥ 10 | MΩ |
| **Environmental Data** | | |
| MTTF (DIN EN ISO 13849-1, parts count method, w/o load, wc) | 27 | Years |
| Functional safety | If you need assistance in using our products in safety-related systems, please contact us | |
| EMC compatibility<br>CE | EN 61000-4-2 Electrostatic discharges (ESD) 4 kV, 8 kV<br>EN 61000-4-3 Electromagnetic fields 10 V/m<br>EN 61000-4-4 Electrical fast transients (burst) 2 kV<br>EN 61000-4-6 Conducted disturbances, induced by RF-fields 10 V eff.<br>EN 55011 Radiated disturbances class B | |

*) Data are extrapolated, internal measuring rate depends on measuring length.
**) Measured with resolution 1 µm.
At higher resolution, the permissible linearity error is increased by the resolution.



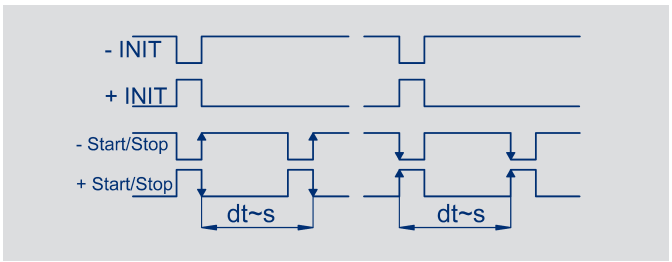

**Pin assignment**

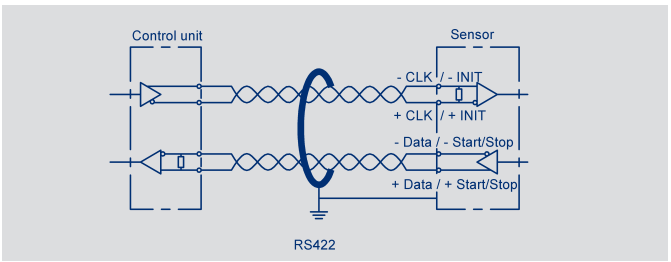
| Connector code 101, 102 | Cable code 20 _ | Connector with cable (Accessories) | SSI Interface |
|---|---|---|---|
| Pin 1 | YE | WH | Clk + |
| Pin 2 | GY | BN | Data + |
| Pin 3 | PK | GN | Clk - |
| Pin 4 | RD | YE | do not connect |
| Pin 5 | GN | GY | Data - |
| Pin 6 | BU | PK | GND |
| Pin 7 | BN | BU | Supply voltage |
| Pin 8 | WH | RD | do not connect |

| Connector code 103 | Connector with cable (Accessories) | SSI Interface |
|---|---|---|
| Pin 1 | WH | Data - |
| Pin 2 | BN | Data + |
| Pin 3 | BU | Clk + |
| Pin 4 | BK | Clk - |
| Pin 5 | GY | Supply voltage |
| Pin 6 | GN | GND |

# Technical Data
# Impulse-Interface

| Type designations | TP1- _ _ _ _ - 101 - 11 _ - _ _ _<br>Start-Stop-Impulse-Interface | |
|---|---|---|
| **Electrical Data** | | |
| Electrical measuring range (dimension B) | 0050 up to 4250 | mm |
| Number of position markers | 1 up to 3 | |
| Protocol | Impulse | |
| Inputs | RS422 | |
| Update rate | 0.25 ... 1 (internal measuring rate depends on measuring length) | kHz |
| Resolution | Depending on interpretation, normalized to 2800 $ms^{-1}$ | |
| Absolute linearity | ≤ ± 50 | µm |
| Tolerance of electr. zero point | ± 0.5 | mm |
| Reproducibility | ≤ 6 | µm |
| Hysteresis | ≤ 4 | µm |
| Temperature error | ≤ 15 (min. 0,01 mm/K) | ppm/K |
| Supply voltage | 24 (13 ... 34) | VDC |
| Supply voltage ripple | ≤ 10 | % Vss |
| Overvoltage protection | 40 (permanent) | VDC |
| Current consumption | ≤ 100 | mA |
| Polarity protection | Yes, up to supply voltage max. | |
| Short circuit protection | Yes (outputs vs. GND and supply voltage up to 7 V) | |
| Insulation resistance (500 VDC) | ≥ 10 | MΩ |
| **Environmental Data** | | |
| MTTF (DIN EN ISO 13849-1, parts count method, w/o load, wc) | 27 | Years |
| Functional safety | If you need assistance in using our products in safety-related systems, please contact us | |
| EMC compatibility<br>CE | EN 61000-4-2 Electrostatic discharges (ESD) 4 kV, 8 kV<br>EN 61000-4-3 Electromagnetic fields 10 V/m<br>EN 61000-4-4 Electrical fast transients (burst) 2 kV<br>EN 61000-4-6 Conducted disturbances, induced by RF-fields 10 V eff.<br>EN 55011 Radiated disturbances class B | |




**Pin assignment**

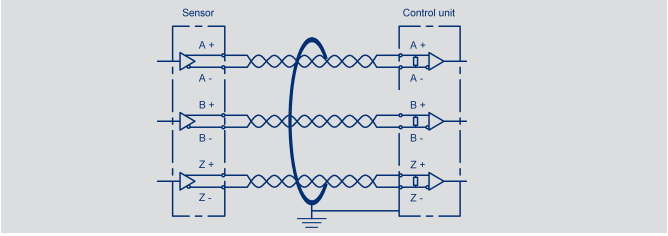
| Connector code 101, 102 | Cable code 20 _ | Connector with cable (Accessories) | Start/Stop-Impulse-Interface |
|---|---|---|---|
| Pin 1 | YE | WH | INIT + |
| Pin 2 | GY | BN | Start/Stop + |
| Pin 3 | PK | GN | INIT - |
| Pin 4 | RD | YE | do not connect |
| Pin 5 | GN | GY | Start/Stop - |
| Pin 6 | BU | PK | GND |
| Pin 7 | BN | BU | Supply voltage |
| Pin 8 | WH | RD | do not connect |

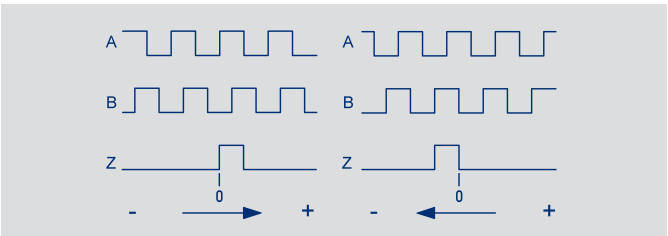
| Connector code 103 | Connector with cable (Accessories) | Start/Stop-Impulse-Interface |
|---|---|---|
| Pin 1 | WH | Start/Stop - |
| Pin 2 | BN | Start/Stop + |
| Pin 3 | BU | INIT + |
| Pin 4 | BK | INIT - |
| Pin 5 | GY | Supply voltage |
| Pin 6 | GN | GND |

# Technical Data Incremental-Interface

| Type designations | TP1- _ _ _ _ - 101 - 8 _ _ - _ _ _<br>Incremental-Interface | | |
|---|---|---|---|
| **Electrical Data** | | | |
| Electrical measuring range (dimension B) | 0050 up to 4250 | | mm |
| Outputs | A+ / A- / B+ / B- / Z+ / Z- | | |
| Level | RS422 differential | | |
| Update rate | 16 * | | kHz |
| Resolution (with 4-fold interpretation) | 1 or 5 | | µm |
| Max. pulse frequency at power-on (initialising) | 156 high speed mode<br>78 low speed mode | | kHz<br>kHz |
| Frequency A/B-signal | Variable, depending on operational speed, max. 148 | | kHz |
| Missing increments when exceeding the max. operational speed | none | | |
| Length Z-pulse | Distance between 2 edges A / B | | |
| Absolute linearity | ≤ ±10 µm up to 1000 mm, ≤ ±25 µm up to 2500 mm, ≤ ±40 µm up to 4250 mm ** | | |
| Tolerance of electr. zero point | ±0.5 | | mm |
| Reproducibility | ≤ 6 | | µm |
| Hysteresis | ≤ 4 | | µm |
| Temperature error | ≤ 15 (min. 0.01 mm/K) | | ppm/K |
| Supply voltage | 24 (13 ... 34) | | VDC |
| Supply voltage ripple | ≤ 10 | | % Vss |
| Current consumption | ≤ 100 | | mA |
| Overvoltage protection | 40 (permanent) | | VDC |
| Polarity protection | Yes, up to supply voltage max. | | |
| Short circuit protection | Yes (outputs vs. GND and supply voltage up to 7 V) | | |
| Ohmic load at outputs | ≥ 120 | | Ω |
| Insulation resistance (500 VDC) | ≥ 10 | | MΩ |
| **Environmental Data** | | | |
| Max. operating speed ***<br>High speed mode<br>Low speed mode | Resolution 1 µm<br>0.45<br>0.22 | Resolution 5 µm<br>2.2<br>1.1 | <br>$ms^{-1}$<br>$ms^{-1}$ |
| MTTF (DIN EN ISO 13849-1, parts count method, w/o load, wc) | 27 | | Years |
| Functional safety | If you need assistance in using our products in safety-related systems, please contact us | | |
| EMC compatibility<br>CE | EN 61000-4-2 Electrostatic discharges (ESD) 4 kV, 8 kV<br>EN 61000-4-3 Electromagnetic fields 10 V/m<br>EN 61000-4-4 Electrical fast transients (burst) 2 kV<br>EN 61000-4-6 Conducted disturbances, induced by RF-fields 10 V eff.<br>EN 55011 Radiated disturbances class B | | |

*) Data are extrapolated, internal measuring rate depends on measuring length.
**) Measured with resolution 1 µm.
At higher resolution, the permissible linearity error is increased by the resolution.
***) With valid output signal, when using a floating position marker.




**Pin assignment**

| Connector code 102 | Cable code 20 _ | Connector with cable (Accessories) | Incremental Interface |
|---|---|---|---|
| Pin 1 | YE | WH | A+ |
| Pin 2 | GY | BN | B+ |
| Pin 3 | GN | GN | B- |
| Pin 4 | WH | YE | Z+ |
| Pin 5 | RD | GY | Z- |
| Pin 6 | BU | PK | GND |
| Pin 7 | BN | BU | Supply voltage |
| Pin 8 | PK | RD | A- |

# Ordering Specifications Digital Versions - SSI - Start-Stop-Impulse - Incremental

## Ordering specifications

Preferred types printed in bold

**Mechanical version**
**101: Profile design**

**Electrical Interface**
**1: Impulse-Interface**
**2: SSI-Interface**
**8: Incremental-Interface (A / B / Z)**

**Output signal Impulse-Interface 1 _ _**
**1: Impulse-Interface Start-Stop Signal**

**Output signal SSI-Interface 2 _ _**
**1: SSI 24 bit**
2: SSI 25 bit
7: SSI 26 bit (25 = alarm, 26 = parity even) on request

**Output signal Incremental-Interface 8 _ _**
**4: Resolution 5 µm, high speed mode, power-on burst**
6: Resolution 1 µm, high speed mode, power-on burst
7: Resolution 5 µm, low speed mode, power-on burst
9: Resolution 1 µm, low speed mode, power-on burst

**Impulse-Interface Start-Stop Signal 11_**
**1: For 1 position marker**
2: For 2 position markers
3: For 3 position markers

**Synchronous-Serial Interface 2 _ _**
**1: Binary code; resolution 5 µm**
2: Gray code; resolution 5 µm
4: Binary code; resolution 1 µm
5: Gray code; resolution 1 µm
7: Binary code; resolution 10 µm
8: Gray code; resolution 10 µm

**Incremental-Interface 8 _ _**
**1: RS422 differential (A / B / Z)**

**Electrical connection**
101: Connector M16x0.75 (IEC 130-9), 8-pin *
**102: Connector M12x1, 8-pin**
103: Connector M16x0.75 (IEC 130-9), 6-pin *
**201: Cable, 8-pole, shielded, 1 m**
203: Cable, 8-pole, shielded, 3 m
205: Cable, 8-pole, shielded, 5 m
*) not for incremental interface

| T | P | 1 | – | 0 | 8 | 0 | 0 | – | 1 | 0 | 1 | – | 2 | 1 | 1 | – | 1 | 0 | 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**Series**

**Electrical measuring range**
**Standard lengths 0050 up to 4250 mm**
0050 up to 0500 mm in 25 mm-steps, 0500 up to 1000 mm in 50 mm-steps,
1000 up to 2000 mm in 100 mm-steps, 2000 up to 4250 mm in 250 mm-steps.
Other lengths on request

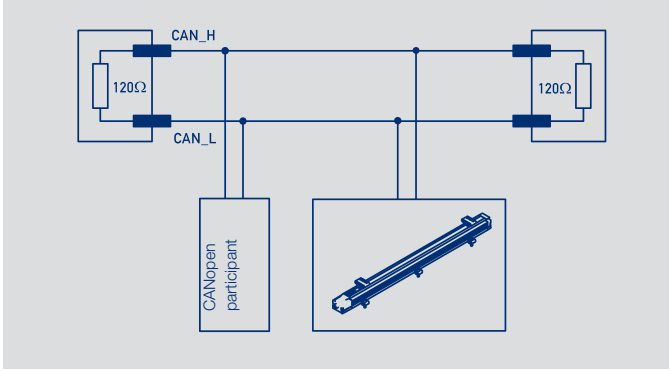
**Important:** Avoid equalizing currents in the cable shield caused by potential differences.
Twisted pair cable (STP) is recommended.

# Technical Data

CANopen®

| Type designations | TP1 - _ _ __ -101- 6 _ _ - _ _ _<br>CANopen-Interface | | |
|---|---|---|---|
| **Electrical Data** | | | |
| Measured variables | Position and speed | | |
| Electrical measuring range (dimension B) | 0050 up to 4250 | | mm |
| Measuring range speed | 0 ... 10 | | $ms^{-1}$ |
| Number of position markers | 1 / 2 (see ordering specifications) | | |
| Output signal / protocol | CANopen protocol to CiA DS-301 V4.2.0,<br>Device profile DS-406 V3.2 Encoder class C2, LSS services to CiA DS-305 V1.1.2 | | |
| Programmable parameters | Position, speed, cams, working areas, temperature, node-ID, baud rate | | |
| Node-ID | 1 ... 127 (default 127) | | |
| Baud rate | 10 ... 1000 (see ordering specifications) | | kBaud |
| Resolution<br>Position<br>Speed | <br>1<br>0.1 | <br>5<br>0.5 | <br>µm<br>$mms^{-1}$ |
| Update rate | 1 (Internal measuring rate depends on measuring length) | | kHz |
| Absolute linearity | ≤ ±10 µm up to 1000 mm, ≤ ±25 µm up to 2500 mm, ≤ ±40 µm up to 4250 mm * | | |
| Tolerance of electr. zero point | 0.5 | | ±mm |
| Reproducibility (rounded to resolution) | ≤ 6 | | µm |
| Hysteresis (rounded to resolution) | ≤ 4 | | µm |
| Temperature error | ≤ 15 (min. 0.01 mm/K) | | ppm/K |
| Supply voltage | 24 ( 13 ... 34) | | VDC |
| Supply voltage ripple | ≤ 10 | | % Vss |
| Current consumption | ≤ 100 | | mA |
| Overvoltage protection | 40 (permanent) | | VDC |
| Polarity protection | Yes, up to supply voltage max. | | |
| Short circuit protection | Yes (outputs vs. GND and supply voltage max.) | | |
| Insulation resistance (500 VDC) | ≥ 10 | | MΩ |
| Bus termination internal | no | | |
| **Environmental Data** | | | |
| MTTF (DIN EN ISO 13849-1<br>parts count method, w/o load, wc) | 25 | | Years |
| Functional safety | If you need assistance in using our products in safety-related systems, please contact us | | |
| EMC compatibility<br>CE | EN 61000-4-2 Electrostatic discharges (ESD) 4 kV, 8 kV<br>EN 61000-4-3 Electromagnetic fields 10 V/m<br>EN 61000-4-4 Electrical fast transients (burst) 1 kV<br>EN 61000-4-6 Conducted disturbances, induced by RF-fields 10 V eff.<br>EN 55016-2-3 Noise radiation class B | | |

*) Measured with resolution 1 µm.
At higher resolution, the permissible linearity error is increased by the resolution.




**Pin assignment**

| Connector code 106 | Connector code 105 | CANopen interface |
|---|---|---|
| Pin 1 | Pin 3 | CAN_SHLD *** |
| Pin 2 | Pin 5 | Supply voltage |
| Pin 3 | Pin 6 | GND |
| Pin 4 | Pin 2 | CAN_H |
| Pin 5 | Pin 1 | CAN_L |
| - | Pin 4 | n/a |

***) CAN_SHLD: CAN-shield, internally connected to housing

# Technical Data
# IO-Link

| Type designations | TP1 - _ _ _ _ -1 _ _- A _ _ - _ _ _<br>IO-Link | | |
|---|---|---|---|
| **Electrical Data** | | | |
| Measured variables | Position, speed and temperature | | |
| Electrical measuring range (dimension B) | 0050 up to 4250 | | mm |
| Number of position markers | 1 up to 3 | | |
| Output signal / protocol | IO-Link Spec V1.1 to IEC 61131-9, Smart Sensor Profil (V1.0 compatible) | | |
| Programmable parameters | Zero point offset, resolution, averaging | | |
| Configurability | Number of position markers and measured variables (position, speed).<br>All product versions listed in the ordering specifications (e.g. 1 x position) are also configurable by the customer (e.g. into 2 x position and 2 x speed) | | |
| Transfer rate | COM 3 (230.4 kB) | | |
| Frame type | 2.2 | | |
| Minimum cycle time | 1 | | ms |
| Update rate | 1 (Internal measuring rate depends on measuring length) | | kHz |
| Resolution<br>Position<br>Speed | <br>1<br>0.1 | <br>5<br>0.5 | <br>µm<br>$mms^{-1}$ |
| Reproducibility (rounded to resolution) | ≤ 6 | | µm |
| Hysteresis (rounded to resolution) | ≤ 4 | | µm |
| Absolute linearity | ≤ ±10 µm up to 1000 mm, < ±25 µm up to 2500 mm, < ±40 µm up to 4250 mm * | | |
| Zero point tolerance | 0.5 | | ±mm |
| Temperature error | ≤ 15 (min. 0,01 mm/K) | | ±ppm/K |
| Supply voltage | 24 (18 ... 30) | | VDC |
| Ripple | max. 10 | | %Vss |
| Current consumption (w/o load) | ≤ 100 | | mA |
| Reverse voltage | yes, up to supply voltage max. | | |
| Short circuit protection | yes (C/Q vs. GND and supply voltage) | | |
| Overvoltage protection | 36 (permanent) | | VDC |
| Insulation resistance (500 VDC) | ≥ 10 | | MΩ |
| **Environmental Data** | | | |
| MTTF (DIN EN ISO 13849-1 parts count method, w/o load, wc) | > 28.6 | | Years |
| Functional safety | If you need assistance in using our products in safety-related systems, please contact us | | |
| EMC compatibility<br>CE | EN 61000-4-2 Electrostatic discharges (ESD) 4 kV, 8 kV<br>EN 61000-4-3 Electromagnetic fields 10 V/m<br>EN 61000-4-4 Electrical fast transients (burst) 1 kV<br>EN 61000-4-6 Conducted disturbances, induced by RF-fields 10 V eff.<br>EN 55016-2-3 Noise radiation class B | | |

*) Measured with resolution 1 µm.
At higher resolution, the permissible linearity error is increased by the resolution.

**Pin assignment**

| Connector M12<br>Code 107 | Connector with cable<br>(accessories) | IO-Link |
|---|---|---|
| PIN 1 | BN | Supply voltage (L+) |
| PIN 2 | WH | do not connect ** |
| PIN 3 | BU | GND (L-) |
| PIN 4 | BK | C/Q |

**) alternatively on GND

# Ordering Specifications

CANopen®
IO-Link

## Ordering specifications

Preferred types printed in bold

**Mechanical version**
**101: Profile design**

**Electrical Interfaces**
**6: CANopen-Interface**
**A: IO-Link**

**Interface parameters for CANopen 6 _ _**
**1: Resolution 5 µm, 1 x position and speed, 1 position marker fix**
3: Resolution 1 µm, 1 x position and speed, 1 position marker fix
5: Resolution 5 µm, 2 x position and speed, 2 position markers fix
6: Resolution 1 µm, 2 x position and speed, 2 position markers fix

**Interface parameters for IO-Link A _ _**
**11: Resolution 5 µm, 1 x position, 1 position marker fix**
**12: Resolution 5 µm, 1 x position and speed, 1 position marker fix**
13: Resolution 5 µm, 2 x position, 2 position markers fix
14: Resolution 5 µm, 2 x position and speed, 2 position markers fix
15: Resolution 5 µm, 3 x position, 3 position markers fix

31: Resolution 1 µm, 1 x position, 1 position marker fix
32: Resolution 1 µm, 1 x position and speed, 1 position marker fix
33: Resolution 1 µm, 2 x position, 2 position markers fix
34: Resolution 1 µm, 2 x position and speed, 2 position markers fix
35: Resolution 1 µm, 3 x position, 3 position markers fix

**Baudrate CANopen 6 _ _**
1: Baud rate 1000 kBaud
2: Baud rate 800 kBaud
**3: Baud rate 500 kBaud**
4: Baud rate 250 kBaud
5: Baud rate 125 kBaud
7: Baud rate 50 kBaud
8: Baud rate 20 kBaud
9: Baud rate 10 kBaud

**Electrical Connection CANopen**
105: Connector M16x0.75 (IEC130-9), 6-pin
**106: Connector M12x1, 5-pin**

**Electrical Connection IO-Link**
**107: Connector M12x1, 4-pin**

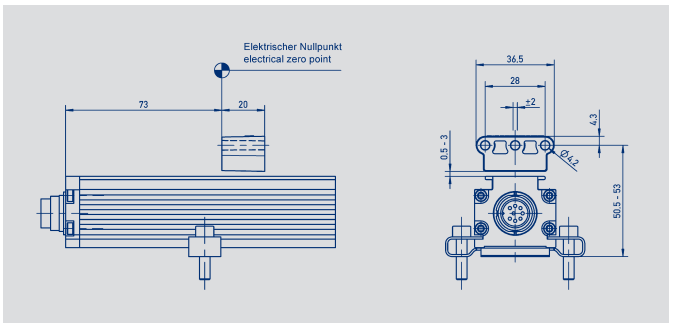
| T | P | 1 | – | 0 | 8 | 0 | 0 | – | 1 | 0 | 1 | – | 6 | 1 | 3 | – | 1 | 0 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**Series**

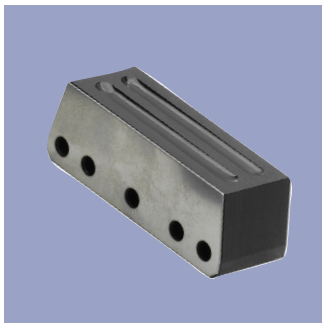
**Electrical measuring range**
**Standard lengths 0050 up to 4250 mm**
0050 up to 0500 mm in 25 mm-steps, 0500 up to 1000 mm in 50 mm-steps,
1000 up to 2000 mm in 100 mm-steps, 2000 up to 4250 mm in 250 mm-steps.
Other lengths on request

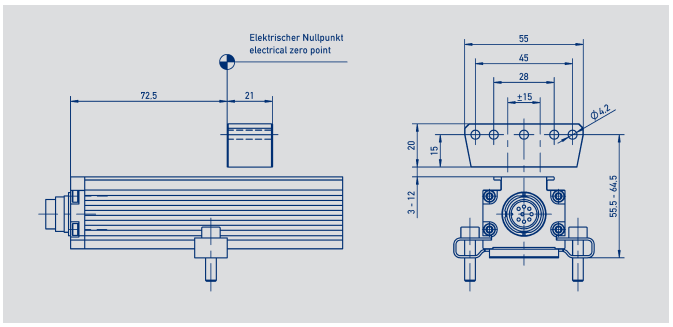
**Important:** Avoid equalizing currents in the cable shield caused by potential differences.
Only CANopen: Twisted pair cable (STP) is recommended.

# Position Marker

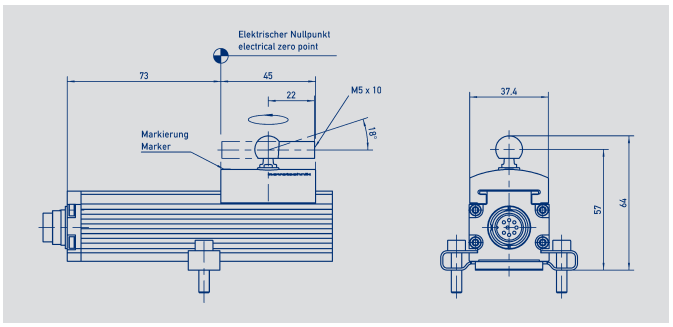



| Floating positon marker | |
|---|---|
| Material | PA6 GF254 |
| Working distance | 0.5 ... 3 mm |
| Weight | approx. 10 g |
| P/N 005693, Z-TP1-P06 | |

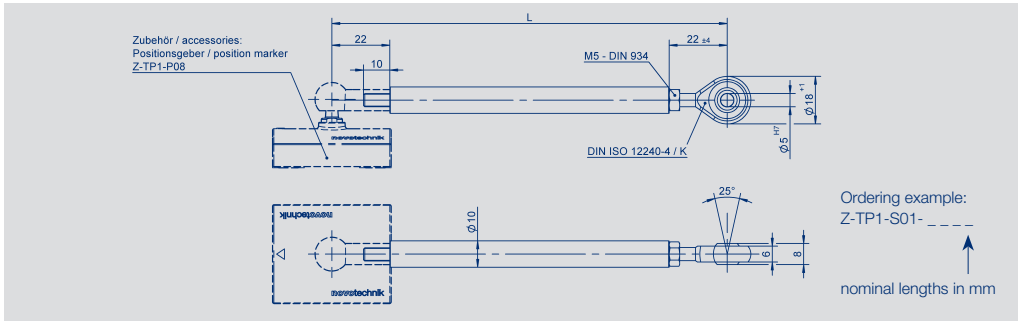





| Floating positon marker for large distances | |
|---|---|
| Material | POM |
| Working distance | 3 ... 12 mm |
| Weight | approx. 40 g |
| P/N 005694, Z-TP1-P07 | |

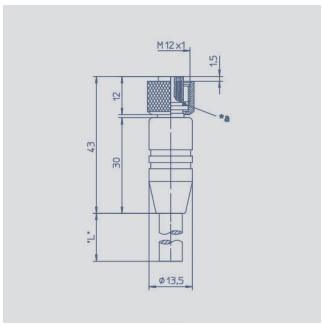



| Guided position marker | |
|---|---|
| Matreial | POM |
| Weight | approx. 30 g |
| P/N 005695, Z-TP1-P08 | |

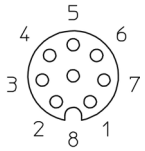



| Actuating rod for guided position marker Z-TP1-P08 | |
|---|---|
| Material | Aluminum |
| Weight | approx. 150 g |
| Standard-nominal lengths (mm) | 0075, 0100, 0125, 0150, 0200, 0250, 0300, 0350, 0400, 0450, 0500, 0600, 0800, 1000, 1500, 2000 |
| Z-TP1-S01-_ _ _ _ | |

# Connector System M12




Pin assignment



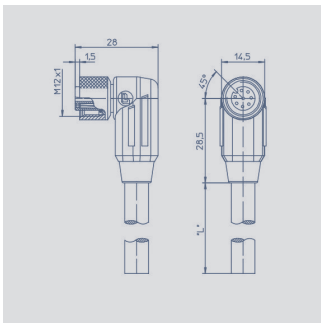

1 = white
2 = brown
3 = green
4 = yellow
5 = grey
6 = pink
7 = blue
8 = red

IP67 UL

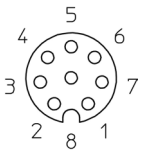
**M12x1 Mating female connector, 8-pin, straight, A-coded, with molded cable, shielded, IP67, open ended**

| | |
|---|---|
| Connector housing | Plastic PA |
| Cable sheath | PUR; Ø = max. 8 mm<br>-25 °C...+80 °C (moved)<br>-50 °C...+80 °C (fixed) |
| Wires | PP, 0.25 mm² |

| Length | Type | P/N |
|---|---|---|
| 2 m | EEM 33-86 | 005629 |
| 5 m | EEM 33-90 | 005635 |
| 10 m | EEM 33-92 | 005637 |




Pin assignment



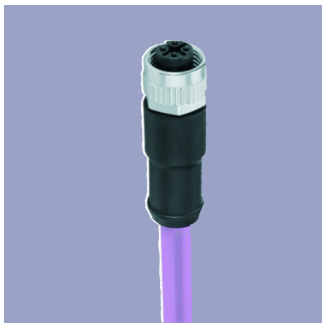

1 = white
2 = brown
3 = green
4 = yellow
5 = grey
6 = pink
7 = blue
8 = red

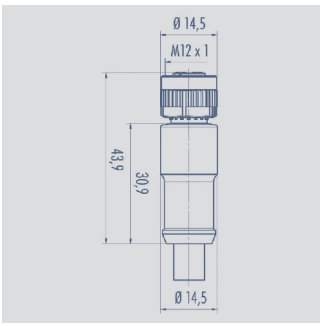
IP67 UL

**M12x1 Mating female connector, 8-pin, angled, A-coded, with molded cable, shielded, IP67, open ended**

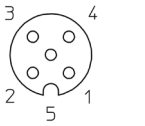
| | |
|---|---|
| Connector housing | Plastic PA |
| Cable sheath | PUR; Ø = max. 8 mm,<br>-25 °C...+80 °C (moved)<br>-50 °C...+80 °C (fixed) |
| Wires | PP, 0.25 mm² |

| Length | Type | P/N |
|---|---|---|
| 2 m | EEM 33-87 | 005630 |
| 5 m | EEM 33-91 | 005636 |
| 10 m | EEM 33-93 | 005638 |






Pin assignment



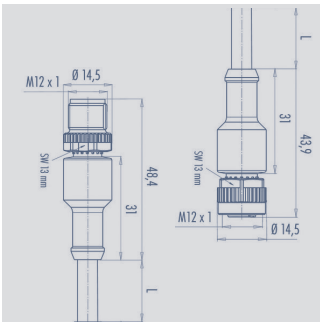

1 = Shield
2 = red (0.34 mm²)
3 = black (0.34 mm²)
4 = white (0.25 mm²)
5 = blue (0.25 mm²)

IP67 UL CANopen

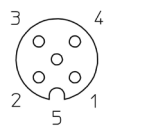
**M12x1 Mating female connector, 5-pin, straight, A-coded, with molded cable, IP67, shielded, open ended, CAN-bus**

| | |
|---|---|
| Connector housing | PUR |
| Cable sheath | PUR Ø = max. 7.2 mm,<br>-25 °C...+85 °C (moved) |
| Wires | PP 2x 0.25 mm²<br>+ 2 x 0.34 mm² |

| Length | Type | P/N |
|---|---|---|
| 2 m | EEM 33-41 | 056141 |
| 5 m | EEM 33-42 | 056142 |
| 10 m | EEM 33-43 | 056143 |




Pin assignment



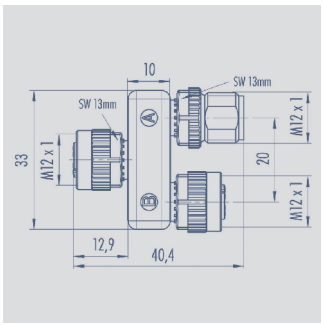

IP68 UL CANopen

**M12x1 Mating female connector, 5-pin, straight, A-coded, with molded cable, IP68, shielded, CAN-bus**

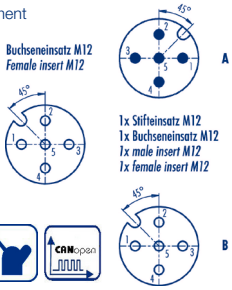
| | |
|---|---|
| Connector housing | PUR |
| Cable sheath | PUR; Ø 7.2 mm<br>-25 °C... +85 °C (fixed) |

| Length | Type | P/N |
|---|---|---|
| 5 m | EEM 33-44 | 056144 |

# Connector System M12




Pin assignment

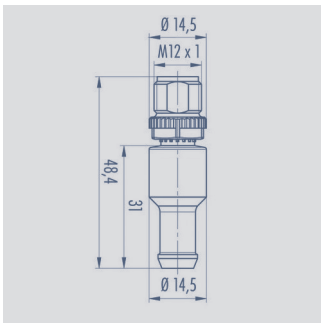



IP68 CANopen

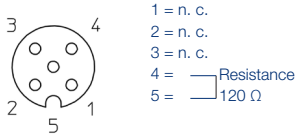
**T-connector M12x1, 5-pin, A-coded, IP68, 1:1 connection, female - male - female, CAN-bus**

| | |
|---|---|
| Connector housing | PUR |
| Temperature range | -25 °C... +85 °C |

Type EEM 33-45, P/N 056145




Pin assignment

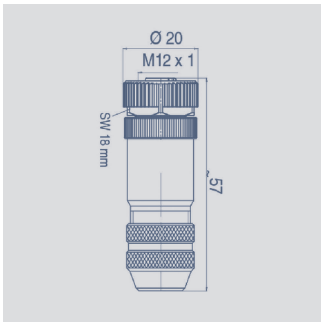



IP67 CANopen

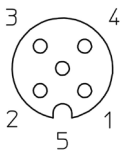
**Terminating resistor M12x1, 5-pin, A-coded, IP67, 120 Ω resistance, CAN-bus**

| | |
|---|---|
| Connector housing | PUR |
| Temperature range | -25 °C... +85 °C |

Type EEM 33-47, P/N 056147




Pin assignment

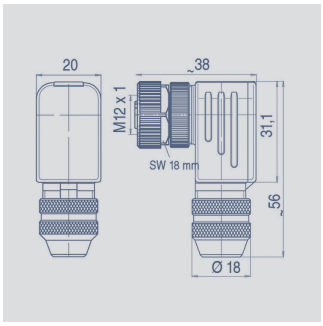



IP67 CANopen

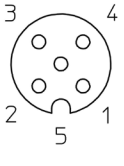
**M12x1 Mating female connector, 5-pin, straight, A-coded, with coupling nut, screw termination, IP67, shieldable, CAN-bus**

| | |
|---|---|
| Connector housing | Metal<br>-40 °C...+85 °C |
| For wire gauge | 6...8 mm,<br>max. 0.75 mm² |

Type EEM 33-73, P/N 005645




Pin assignment




IP67 CANopen

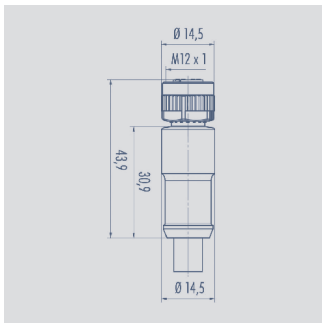
**M12x1 Mating female connector, 5-pin, angled, A-coded, with coupling nut, screw termination, IP67, shieldable, CAN-bus**

| | |
|---|---|
| Connector housing | Metal<br>-40 °C...+85 °C |
| For wire gauge | 6...8 mm,<br>max. 0.75 mm² |

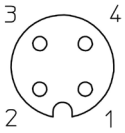
Type EEM 33-75, P/N 005646

It is possible to turn and fix the contact carrier in 90° positions.

# Connector System M12




Pin assignment



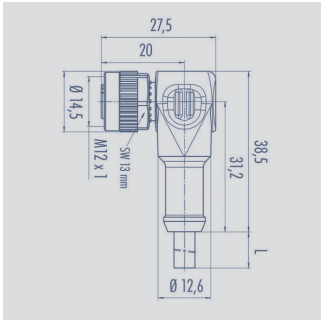

1 = brown
2 = white
3 = blue
4 = black

IP67 UL

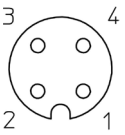
**M12x1 Mating female connector, 4-pin, straight, A-coded, with molded cable, not shielded, IP67, open ended**

| | |
|---|---|
| Connector housing | Plastic PA |
| Cable sheath | PUR; Ø = max. 6 mm, -40 °C...+85 °C (fixed) |
| Wires | PP, 0.34 mm² |

| Length | Type | P/N |
|---|---|---|
| 2 m | EEM 33-35 | 056135 |
| 5 m | EEM 33-36 | 056136 |
| 10 m | EEM 33-37 | 056137 |




Pin assignment



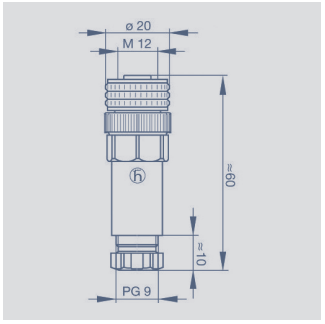

1 = brown
2 = white
3 = blue
4 = black

IP67 UL

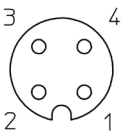
**M12x1 Mating female connector, 4-pin, angled, A-coded, with molded cable, not shielded, IP67, open ended**

| | |
|---|---|
| Connector housing | Plastic PA |
| Cable sheath | PUR; Ø = max. 6 mm, -40 °C...+85 °C (fixed) |
| Wires | PP, 0.34 mm² |

| Length | Type | P/N |
|---|---|---|
| 2 m | EEM 33-38 | 056138 |
| 5 m | EEM 33-39 | 056139 |
| 10 m | EEM 33-40 | 056140 |




Pin assignment

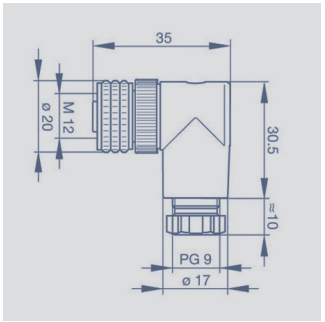



IP67

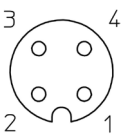
**M12x1 Mating female connector, 4-pin, straight, A-coded, with coupling nut, screw termination, IP67, not shielded**

| | |
|---|---|
| Connector housing | Plastic PBT -25 °C...+90 °C |
| For wire gauge | 6...8 mm, max. 0.75 mm² |

Type EEM 33-88, P/N 005633




Pin assignment



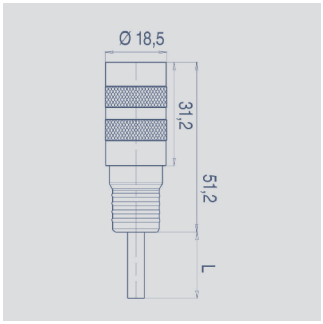

IP67

**M12x1 Mating female connector, 4-pin, angled, A-coded, with coupling nut, screw termination, IP67, not shielded**

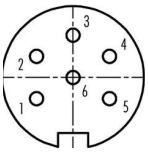
| | |
|---|---|
| Connector housing | Plastic PBT -25 °C...+90 °C |
| For wire gauge | 6...8 mm, max. 0.75 mm² |

Type EEM 33-89, P/N 005634

# Connector System M16




Pin assignment




1 = red
2 = black
3 = yellow
4 = blue
5 = white
6 = green

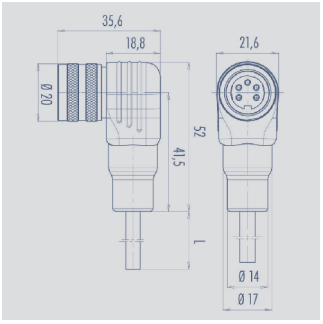
IP67

**M16x0.75 Mating female connector, 6-pin, straight, with molded cable, 2 m length, shielded, IP67, open ended**

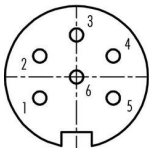
| | |
|---|---|
| Connector housing | PUR |
| Cable sheath | PUR; Ø max. 6 mm, -5...+70 °C (moved) -20...+70 °C (fixed) |
| Wires | PVC, 6 x 0.25 mm² |

Type EEM 33-26, P/N 056126

This coupling can can be used in combination with 5-pin M16 connectors. Than „pin 6/ green“ is open.




Pin assignment




1 = red
2 = black
3 = yellow
4 = blue
5 = white
6 = green

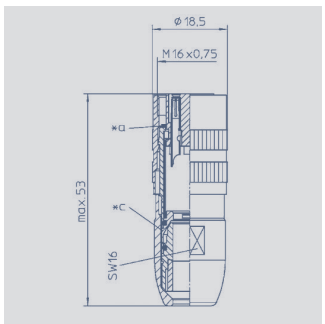
IP67

**M16x0.75 Mating female connector, 6-pin, angled, with molded cable, 2 m length, shielded, IP67, open ended**

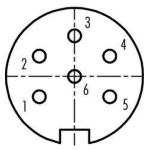
| | |
|---|---|
| Connector housing | PUR |
| Cable sheath | PUR; Ø max. 6 mm, -5...+70 °C (moved) -20...+70 °C (fixed) |
| Wires | PVC, 6 x 0.25 mm² |

Type EEM 33-27, P/N 056127

This coupling can can be used in combination with 5-pin M16 connectors. Than „pin 6 / green“ is open.




Pin assignment

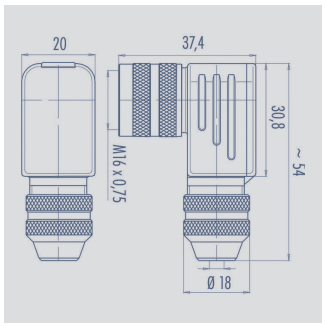



IP68

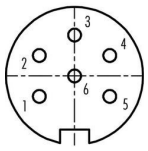
**M16x0,75 Mating female connector, 6-pin, straight, with coupling nut, solder terminal, IP68, shielded**

| | |
|---|---|
| Connector housing | CuZn (Brass, nickel plated) -40 °C... +85 °C |
| For wire gauge | 4...8 mm, max. 0.75 mm² |

Type EEM 33-82, P/N 005639




Pin assignment




IP67 UL

**M16x0,75 Mating female connector, 6-pin, angled, with coupling nut, solder terminal, IP67, shielded**

| | |
|---|---|
| Connector housing | CuZn (Brass, nickel plated) -40 °C... +95 °C |
| For wire gauge | 6...8 mm, PG 9 max. 0.75 mm² |

Type EEM 33-94, P/N 005648

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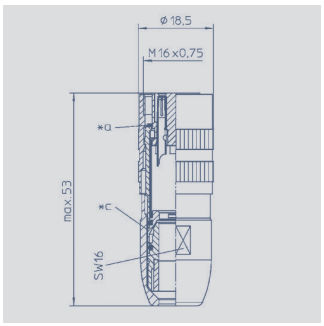
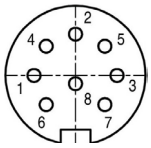



Pin assignment

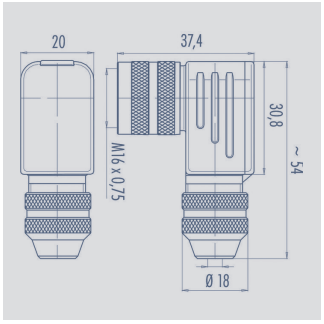



IP68

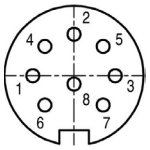
**M16x0.75 Mating female connector, 8-pin, straight, with coupling nut, solder terminal, IP68, shielded**

| | |
|---|---|
| Connector housing | CuZn (Brass, nickel plated) -40 °C... +85 °C |
| For wire gauge | 4...8 mm, max. 0.75 mm² |

Type EEM 33-84, P/N 005627




Pin assignment




IP67 UL

**M16x0.75 Mating female connector, 8-pin, angled, with coupling nut, solder terminal, IP67, shielded**

| | |
|---|---|
| Connector housing | CuZn (Brass, nickel plated) -40 °C... +95 °C |
| For wire gauge | 6...8 mm, PG 9 max. 0.75 mm² |

Type EEM 33-85, P/N 005628

IP67 Protection class IP67 to DIN EN 60529

IP68 Protection class IP68 to DIN EN 60529

CAN-bus

Very good Electromagnetic Compatibility (EMC) and shield systems

Very good resistance to oils, coolants und lubricants

UL - approved

Suited for applications in dragchains

**Note:** The protection class is valid only in locked position with its plugs.
The application of these products in harsh environments must be checked in particular cases.