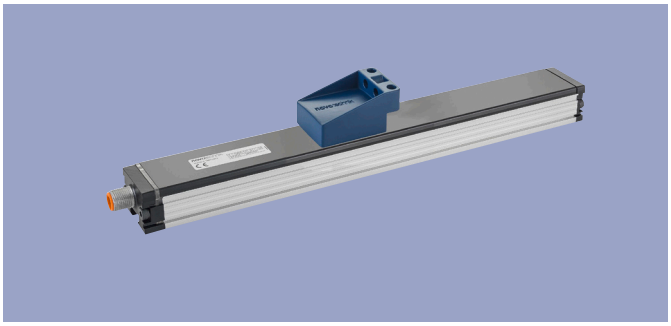
novotechnik
Siedle Group

NOVOPAD
Transducer
up to 1000 mm
touchless

Series TF1

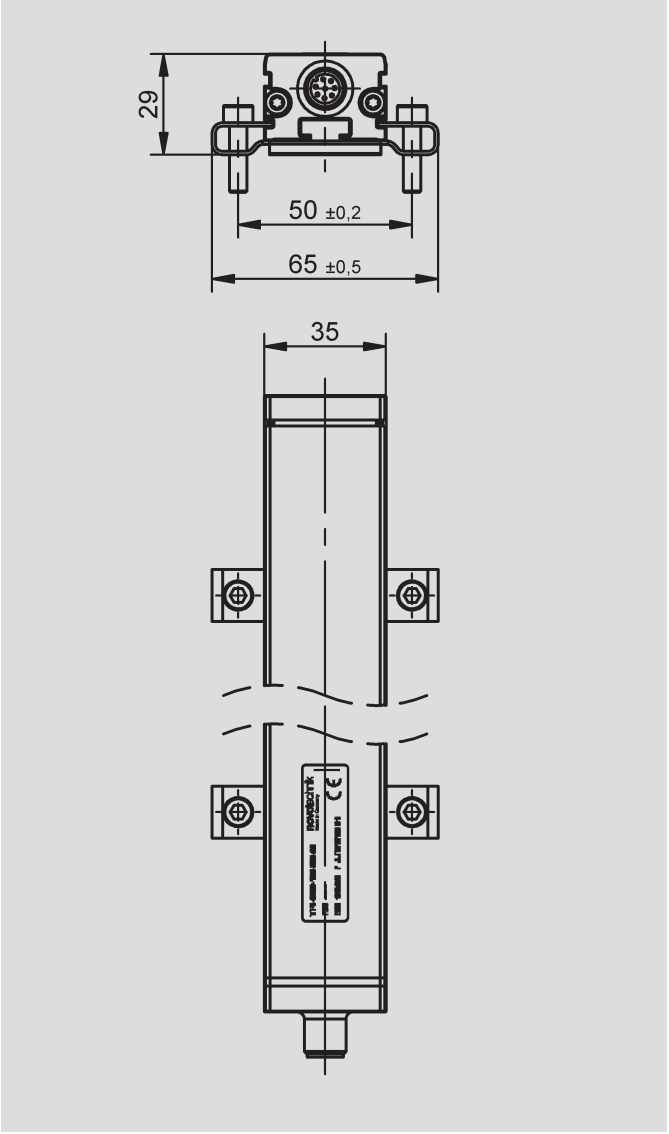


Special features

- Inductive measurement technology
- Magnetic field resistant
- Touchless, wear-free
- High dynamic, 10 kHz update rate
- Reproducibility up to 5 µm
- Protection class IP67: a GORE membrane ensures pressure equalization due to temperature change
- Offset tolerance up to ±2 mm
- Low temperature coefficient <15 ppm/K
- Insensitive to shock and vibration
- Position-Teach-In
- Interfaces: Analog, SSI, CANopen, IO-Link

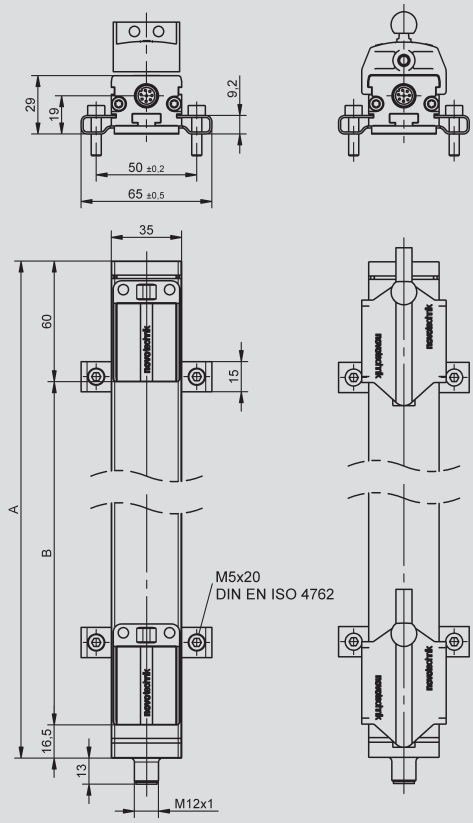
Applications

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



Contents

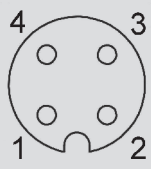
Mechanical Data



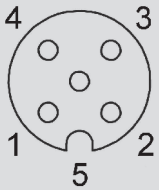
Description		
Materials	Housing: anodized aluminum AlMgSi0,5 F22, 3.3206.71 Inner housing: PA6 GF30 End flanges: aluminum G AlSi12Cu1 (FE) Status display (LED): PC	
Mounting	Adjustable clamps (included in delivery) or slot nut f.e. nut M8 DIN 439	
Position marker	Floating position marker, plastic Guided position marker, plastic, with angle or axial joint	
Electrical connections	Connector M12x1, 4-pin / 5-pin / 8-pin, shielded	
Electronic	Connector casing is connected to the sensor housing Housing is capacitively decoupled to the electronics	
Others	2 x multifunction LED as an indicator of operating voltage and status	
Mechanical Data		
Dimensions	see dimension drawing	
Length of housing (dimension A)	Dimension B + 76.5	mm
Electrical measuring range (dimension B)	0100 up to 1000 mm in 100 mm steps, other lengths on request	
Weight	220 +1.1 x B (in mm)	g
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 pressure equalization via GORE membrane, with fastened connector	
Life	Mechanically unlimited (with floating position marker)	
Operating temperature range	-40 ... +85 (CANopen: -40 ... +75)	°C
Storage temperature range	-40 ... +85	°C
Operating humidity range	0 ... 95 (no condensation)	% R.H.

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

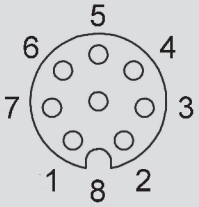
Pin assignment M12
A-coded



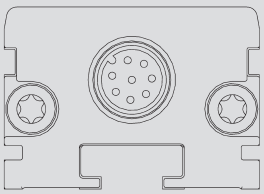
Pin assignment M12
A-coded



Pin assignment M12
A-coded



Orientation of connector M12



Technical Data
Analog Versions

Type designations	TF1- _ _ _ _-001 - 41 _ - 102 Voltage	TF1- _ _ _ _-001 - 42 _ - 102 Current	
Electrical Data			
Electrical measuring range (dimension B)	0100 up to 1000		mm
Output signal	0,1 ... 10 V (load ≥ 5 kΩ)	4 ... 20 mA (burden ≤ 500 Ω)	
Number of channels	1		
Update rate (internal)	> 10		kHz
Signal propagation delay	< 1		ms
Resolution			
Dimension B ≤ 400 mm	10		µm
Dimension B > 400 mm	20		µm
Absolute linearity	≤ 0.025 (min. ± 100 µm)		±% FS
Tolerance of electr. zero point	1		± mm
Reproducibility			
Dimension B ≤ 400 mm	10		µm
Dimension B > 400 mm	20		µm
Hysteresis	≤ 10		µm
Temperature error	≤ 15 (min. 0.01 mm/K)		ppm/K
Supply voltage	24 (18 ... 32)		VDC
Supply voltage ripple	≤ 10		% Vss
Power drain (w/o load)	2.4		W
Overvoltage protection	36 (permanent)		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)	> 20		Years
Functional safety	If you need assistance in using our products in safety-related systems, please contact us		
EMC compatibility CE	EN 61000-4-2 Electrostatic discharges (ESD) 4 kV, 8 kV EN 61000-4-3 Electromagnetic fields 10 V/m EN 61000-4-4 Fast transients (burst) 1 kV EN 61000-4-6 Conducted disturbances, induced by RF-fields 10 V eff. EN 55016-2-3 Radiated disturbances class B		

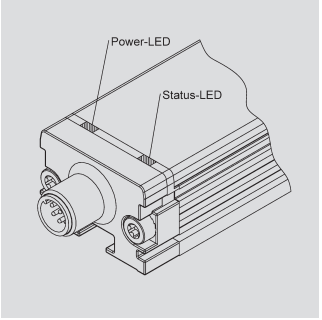
Pin assignment

Connector M12 code 102	Connector with cable (Accessories)	Analog voltage	Analog current
PIN 1	WH	do not connect	4 ...20 mA
PIN 2	BN	Signal GND	Signal GND
PIN 3	GN	do not connect	do not connect
PIN 4	YE	PROG_L *	PROG_L *
PIN 5	GY	0 ... +10 V	do not connect
PIN 6	PK	GND	GND
PIN 7	BU	Supply voltage	Supply voltage
PIN 8	RD	PROG _H *	PROG_H *

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

LED functionality

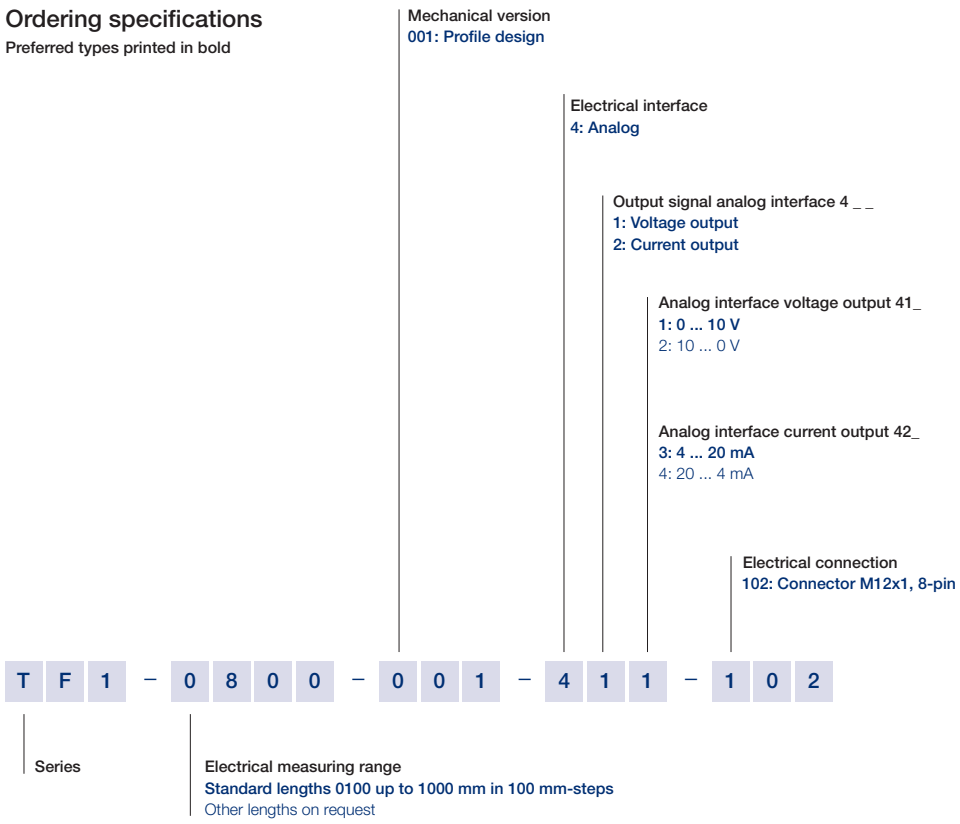
LED colour	Power LED for operating mode indication	Status LED for measuring range indication / functional test
Off	Sensor out of operation (no supply)	
Green	Sensor in operation	Position marker is within measuring range
Red flashing		Position marker is outside of measuring range
Red		Sensor error, internal diagnosis allows no valid signal output (f.e. absence of position marker)
Further conditions see operating manual		



Ordering Specifications Analog Versions - Voltage - Current

Ordering specifications

Preferred types printed in bold



Important: Avoid equalizing currents in the cable shield caused by potential differences.
Shielded cable is recommended.

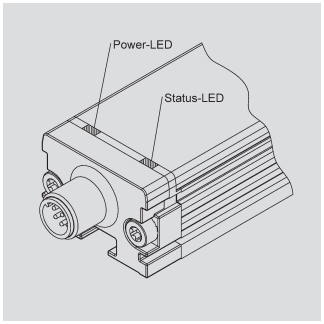
Technical Data
SSI-Interface

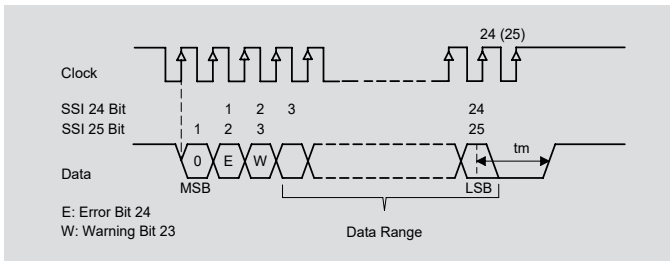
Type designations	**TF1 - _ _ _ _ - 001 - 2_ _ - 102** **Synchronous-serial interface (SSI)**			
Electrical Data				
Electrical measuring range (dimension B)	0100 up to 1000			mm
Protocol	SSI 24 and 25 bit			
Inputs	RS422, CLK lines galvanically isolated by optocouplers			
Monoflop time (tm)	20			µs
Encoding	Gray, Binary			
Update rate	> 10			kHz
Resolution (LSB)	1, 5 or 10			µm
Reproducibility (rounded to LSB)	High prec mode	Balanced mode	High speed mode	
Dimension B ≤ 400 mm	< 5	< 10	< 20	µm
Dimension B > 400 mm	< 8	< 15	< 40	µm
Signal propagation delay	< 3	< 1	< 0.2	ms
Hysteresis	≤ 5	≤ 10	≤ 10	µm
Absolute linearity	≤ 100			± µm
Tolerance of electr. zero point	1			± mm
Temperature error	≤ 15 (min. 0.01 mm/K)			ppm/K
Supply voltage	24 (18 ... 32)			VDC
Supply voltage ripple	≤ 10			% Vss
Power drain (w/o load)	2.4			W
Overvoltage protection	36 (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
Max. clock rate	1.5			MHz
Insulation resistance (500 VDC)	≥ 10			MΩ
Environmental Data				
MTTF (DIN EN ISO 13849-1, parts count method, w/o load, wc)	> 20			Years
Functional safety	If you need assistance in using our products in safety-related systems, please contact us			
EMC compatibility CE	EN 61000-4-2 Electrostatic discharges (ESD) 4 kV, 8 kV EN 61000-4-3 Electromagnetic fields 10 V/m EN 61000-4-4 Fast transients (burst) 1 kV EN 61000-4-6 Conducted disturbances, induced by RF-fields 10 V eff. EN 55016-2-3 Radiated disturbances class B			

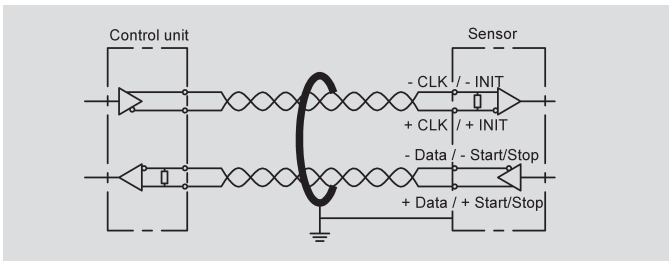
Technical Data
SSI-Interface

Pin assignment		
Output connector code 102	**Connector with cable (Accessories)**	**SSI-Interface**
PIN 1	WH	Clk +
PIN 2	BN	Data +
PIN 3	GN	Clk -
PIN 4	YE	do not connect
PIN 5	GY	Data -
PIN 6	PK	GND
PIN 7	BU	Supply voltage
PIN 8	RD	do not connect

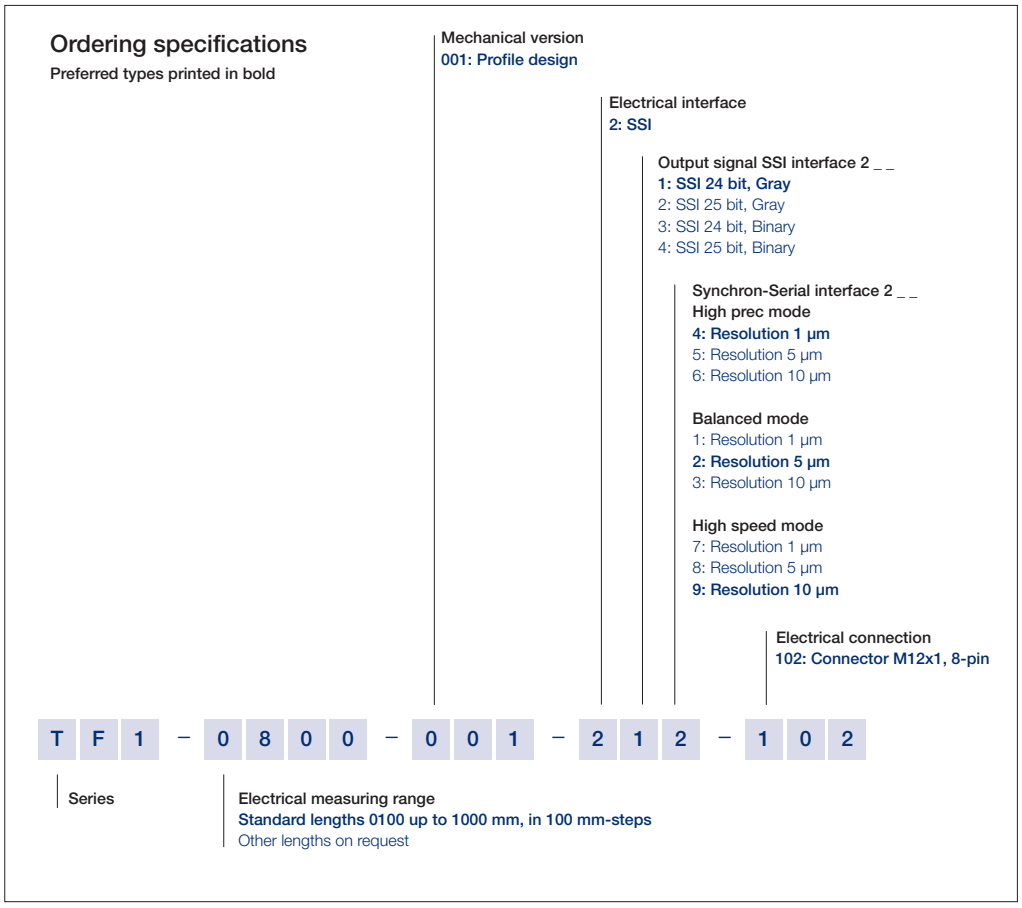
LED functionality		
LED colour	**Power LED for operating mode indication**	**Status LED for measuring range indication / functional test**
Off	Sensor out of operation (no supply)	
Green	Sensor in operation	Position marker is within measuring range
Red flashing		Position marker is outside of measuring range
Red		Sensor error, internal diagnosis allows no valid signal output (f.e. absence of position marker)
Further conditions see operating manual		







Ordering Specifications Digital Versions SSI-Interface



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

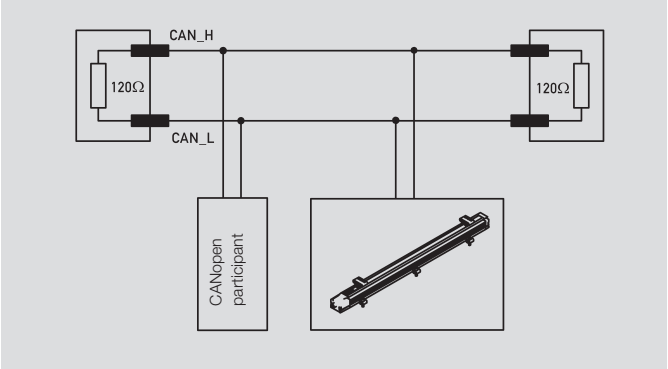
Technical Data

CANopen®

Type designations	**TF1 - _ _ _ _ -001- 6 _ _ - 106** **CANopen** (available 2nd quarter 2019)		
Electrical Data			
Measured variables	Position, speed and temperature		
Electrical measuring range (dimension B)	0100 up to 1000		mm
Measuring range speed	0 ... 10		ms^{-1}
Output signal / protocol	CANopen protocol to CiA DS-301 V4.2.0, Device profile DS-406 V3.2 Encoder class 1, LSS services to CiA DS-305 V1.1.2		
Programmable parameter	Cams, working areas, node-ID, baud rate		
Node-ID	1 ... 127 (default 127)		
Baud rate	20 ... 1000		kBaud
Update rate (output)	1		kHz
Resolution Position Resolution Speed	1 0.1	5 0.5	µm mms^{-1}
Reproducibility (rounded to resolution) Dimension B ≤ 400 mm Dimension B > 400 mm	High prec mode < 5 < 8	Balanced mode < 10 < 15	 µm µm
Signal propagation delay	< 3	< 1	ms
Hysteresis	≤ 5	≤ 10	µm
Absolute linearity	≤ 100		± µm
Tolerance of electr. zero point	1		± mm
Temperature error	≤ 15 (min. 0.01 mm/K)		ppm/K
Supply voltage	24 (18 ... 32)		VDC
Supply voltage ripple	≤ 10		% Vss
Power drain (w/o load)	2.4		W
Overvoltage protection	36 (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 (internal load resistance 120 Ω on request)		
Environmental Data			
MTTF (DIN EN ISO 13849-1 parts count method, w/o load, wc)	> 20		Years
Functional safety	If you need assistance in using our products in safety-related systems, please contact us		
EMC compatibility CE	EN 61000-4-2 Electrostatic discharges (ESD) 4 kV, 8 kV EN 61000-4-3 Electromagnetic fields 10 V/m EN 61000-4-4 Fast transients (burst) 1 kV EN 61000-4-6 Conducted disturbances, induced by RF-fields 10 V eff. EN 55016-2-3 Radiated disturbances class B		

Technical Data

CANopen®



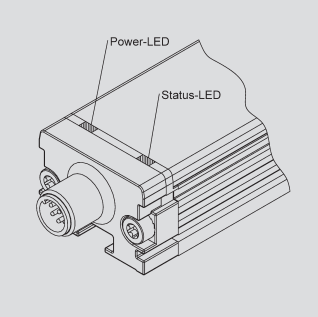
Pin assignment

Connector M12 code 106	Connector with cable (Accessories)	CAN
PIN 1	CAN-SHLD *	CAN_SHLD *
PIN 2	RD	Supply voltage
PIN 3	BK	GND
PIN 4	WH	CAN_H
PIN 5	BU	CAN_L

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

LED functionality

LED colour	Power LED for operating mode indication	Status-LED for measuring range indication / functional test
Off	Sensor out of operation (no supply)	
Green	Sensor in operation	Position marker is within measuring range
Red flashing		Position marker is outside of measuring range
Red		Sensor error, internal diagnosis allows no valid signal output (f.e. absence of position marker, CAN controller bus off)
Fast red flashing (flickering), green flashing (blinking) etc.		Sensor indicates CANopen bus status according to DS303-3
Further conditions see operating manual		



Technical Data
IO-Link

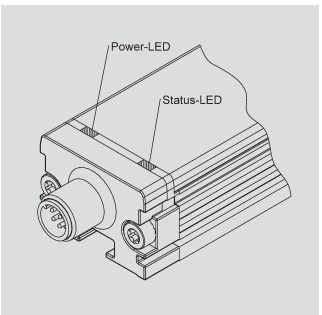
Type designations	**TF1 - _ _ _ _ -001- A _ _ - 107** **IO-Link** (available 2nd quarter 2019)		
Electrical Data			
Measured variables	Position, speed and temperature		
Electrical measuring range (dimension B)	0100 up to 1000		mm
Output signal / protocol	IO-Link Spec V1.1 to IEC 61131-9, Smart Sensor Profil (V1.0 compatible)		
Configurability	Measured variables (position, speed) The product variants listed in the ordering specifications (e.g., 1 x position) are also customer side configurable (to, e.g. 1 x position and 1 x speed)		
Programmable parameter	Zero point offset, resolution, averaging		
Transfer rate	COM 3 (230.4 kB)		
Frame type	2.2		
Minimum cycle time	1		ms
Update rate (output)	1		kHz
Resolution Position Resolution Speed	1 0.1	5 0.5	µm mms^{-1}
Reproducibility (rounded to resolution) Dimension B ≤ 400 mm Dimension B > 400 mm	High prec mode < 5 < 8	Balanced mode < 10 < 15	 µm µm
Signal propagation delay	4	1	ms
Hysteresis	≤ 5	≤ 10	µm
Absolute linearity	≤ 100		± µm
Tolerance of electr. zero point	1		± mm
Temperature error	≤ 15 (min. 0.01 mm/K)		± ppm/K
Supply voltage	24 (18 ... 32)		VDC
Supply voltage ripple	max. 10		%Vss
Power drain (w/o load)	2.4		W
Overvoltage protection	36 (permanent)		VDC
Reverse voltage	yes, up to supply voltage max.		
Short circuit protection	yes (output 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)	> 20		Years
Functional safety	If you need assistance in using our products in safety-related systems, please contact us		
EMC compatibility CE	EN 61000-4-2 Electrostatic discharges (ESD) 4 kV, 8 kV EN 61000-4-3 Electromagnetic fields 10 V/m EN 61000-4-4 Fast transients (burst) 1 kV EN 61000-4-6 Conducted disturbances, induced by RF-fields 10 V eff. EN 55016-2-3 Radiated disturbances class B		

Pin assignment

Connector M12 Code 107	**Connector with cable (Accessories)**	**IO-Link**
PIN 1	BN	Supply voltage
PIN 2	WH	do not connect (alternatively to GND)
PIN 3	BU	GND
PIN 4	BK	C/Q

LED functionality

LED colour	**Power LED for operating mode indication**	**Status-LED for measuring range indication / functional test**
Off	Sensor out of operation (no supply)	
Green	Sensor in operation	Position marker is within measuring range
Red flashing		Position marker is outside of measuring range
Red		Sensor error, internal diagnosis allows no valid signal output (f.e. absence of position marker)
Further conditions see operating manual		



Ordering Specifications

CANopen
IO-Link

Ordering specifications

Preferred types printed in bold

Mechanical version
001: Profile design

Electrical Interface
6: CANopen
A: IO-Link

Interface parameter for CANopen 6 _ _
1: Resolution 5 µm, balanced mode, position and speed
3: Resolution 1 µm, high prec mode, position and speed

Interface parameter for IO-Link A _ _
11: Resolution 5 µm, balanced mode, position
12: Resolution 5 µm, balanced mode, position and speed
31: Resolution 1 µm, high prec mode, position
32: Resolution 1 µm, high prec mode, position and speed

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

Electrical Connection CANopen
106: Connector M12x1, 5-pin

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

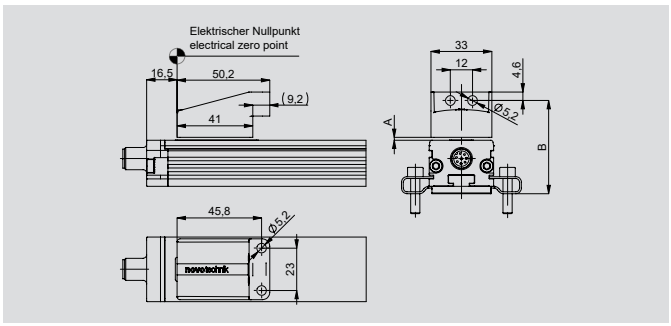
T	F	1	–	0	8	0	0	–	0	0	1	–	6	1	3	–	1	0	6

Series

Electrical measuring range
Standard lengths 0100 up to 1000 mm, in 100 mm-steps
Other lengths on request

Important for CANopen interface: Avoid equalizing currents in the cable shield caused by potential differences.
Shielded twisted pair cable (STP) is recommended.

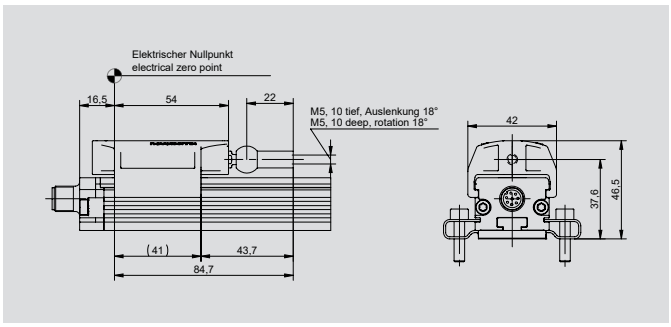
Position Markers



Floating position marker Z-TF1-P01

Working distance A Nominal distance	0 ... 4 mm 1.5 mm
Mounting (dimension B)	49 ... 53 mm
Perm. lateral offset	±2 mm
Material	PA6 GF30
Weight	approx. 40 g
P/N	400104343

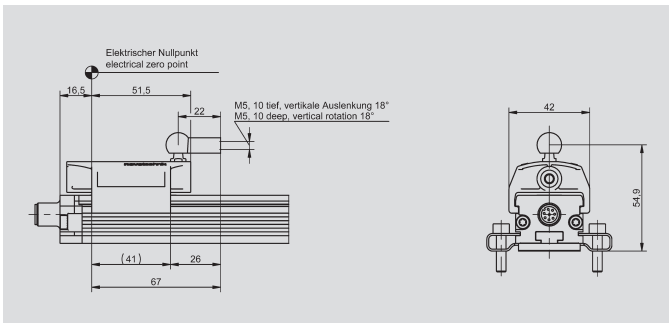
The position marker can be mounted in both directions.



Guided position marker with axial joint Z-TF1-P02

Material	POM
Material joint	Steel, galvanized
Weight	approx. 60 g
P/N	400104344

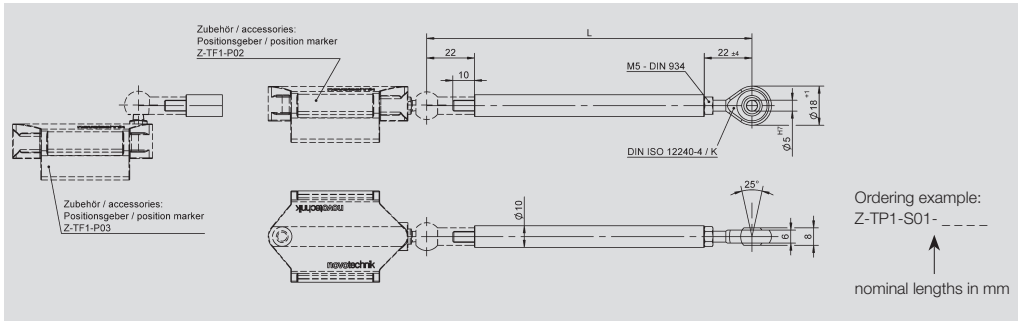
The position marker can be mounted in both directions.



Guided position marker with angle joint Z-TF1-P03

Material	POM
Material joint	Steel, galvanized
Weight	approx. 60 g
P/N	400104345

The position marker can be mounted in both directions.

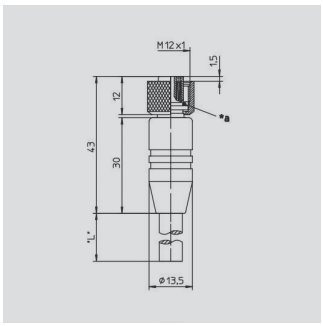


Actuating rod for guided position marker Z-TF1-P02/-P03

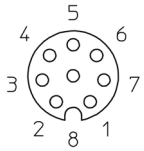
Material	Aluminum
Weight	approx. 150 g
Standard-nominal lengths (mm)	0075, 0100, 0125, 0150, 0200, 0250, 0300, 0350, 0400, 0450, 0500, 0600, 0800, 1000, 1500, 2000

Z-TP1-S01-_ _ _ _

Connector System M12



Pin assignment



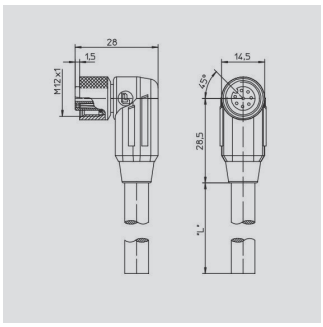
1 = white
2 = brown
3 = green
4 = yellow
5 = grey
6 = pink
7 = blue
8 = red

IP67 UL

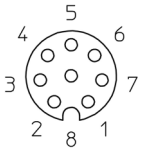
M12x1 Mating female connector, 8-pin, straight, A-coded, with molded cable, shielded, IP67, open ended

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

Length	Type	P/N
2 m	EEM 33-86	400005629
5 m	EEM 33-90	400005635
10 m	EEM 33-92	400005637



Pin assignment



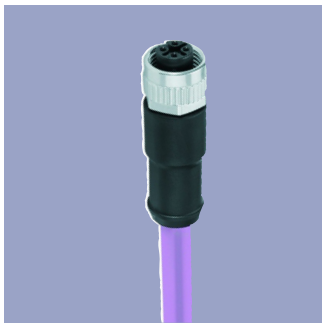
1 = white
2 = brown
3 = green
4 = yellow
5 = grey
6 = pink
7 = blue
8 = red

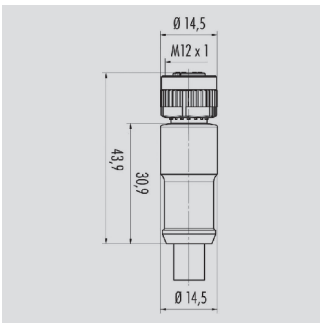
IP67 UL

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

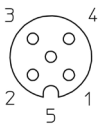
Connector housing	Plastic PA
Cable sheath	PUR; Ø = max. 8 mm, -25 °C...+80 °C (moved) -50 °C...+80 °C (fixed)
Wires	PP, 0.25 mm²

Length	Type	P/N
2 m	EEM 33-87	400005630
5 m	EEM 33-91	400005636
10 m	EEM 33-93	400005638





Pin assignment



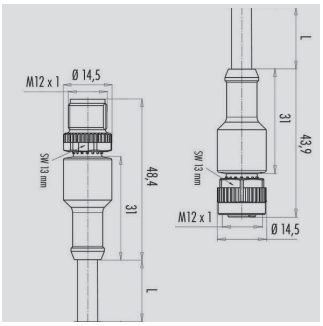
1 = Shield
2 = red (0.34 mm²)
3 = black (0.34 mm²)
4 = white (0.25 mm²)
5 = blue (0.25 mm²)

IP67 UL CANopen

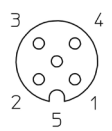
M12x1 Mating female connector, 5-pin, straight, A-coded, with molded cable, IP67, shielded, open ended, CAN-bus

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

Length	Type	P/N
2 m	EEM 33-41	400056141
5 m	EEM 33-42	400056142
10 m	EEM 33-43	400056143



Pin assignment



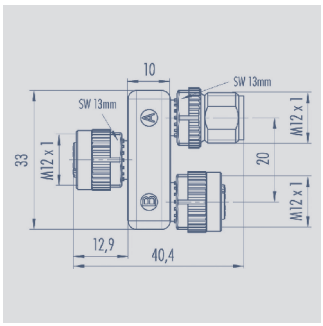
IP68 UL CANopen

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

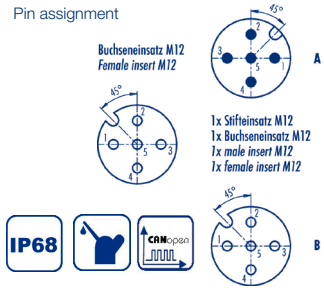
Connector housing	PUR
Cable sheath	PUR; Ø 7.2 mm -25 °C... +85 °C (fixed)

Length	Type	P/N
5 m	EEM 33-44	400056144

Connector System M12



Pin assignment

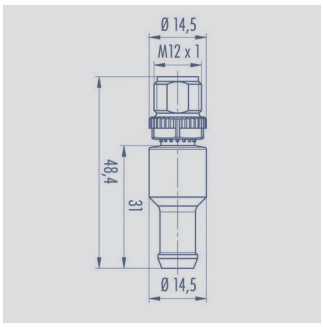


IP68 CANopen

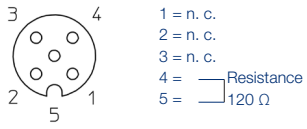
T-connector M12x1, 5-pin, A-coded, IP68, 1:1 connection, female - male - female, CAN-bus

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

Type EEM 33-45, P/N 400056145



Pin assignment

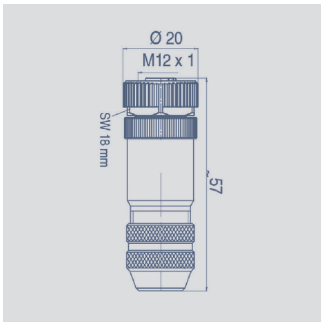


IP67 CANopen

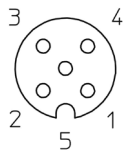
Terminating resistor M12x1, 5-pin, A-coded, IP67, 120 Ω resistance, CAN-bus

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

Type EEM 33-47, P/N 400056147



Pin assignment

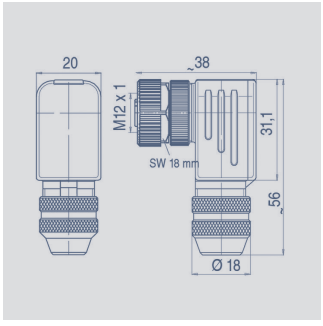


IP67 CANopen

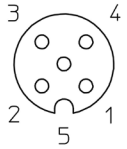
M12x1 Mating female connector, 5-pin, straight, A-coded, with coupling nut, screw termination, IP67, shieldable, CAN-bus

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

Type EEM 33-73, P/N 400005645



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 -40 °C...+85 °C
For wire gauge	6...8 mm, max. 0.75 mm²

Type EEM 33-75, P/N 400005646

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

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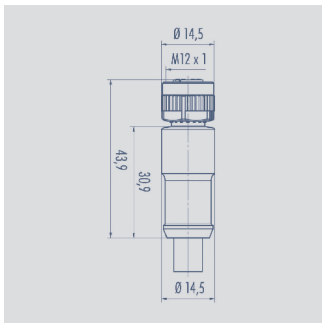
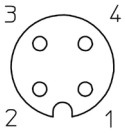


Pin assignment

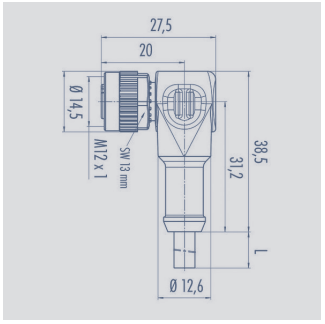


1 = brown
2 = white
3 = blue
4 = black

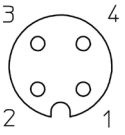
M12x1 Mating female connector, 4-pin, straight, A-coded, with molded cable, not shielded, IP67, open ended

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	400056135
5 m	EEM 33-36	400056136
10 m	EEM 33-37	400056137



Pin assignment



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

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	400056138
5 m	EEM 33-39	400056139
10 m	EEM 33-40	400056140

IP67 — Protection class IP67 to DIN EN 60529

IP68 — Protection class IP68 to DIN EN 60529

CAN-bus

IO-Link

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.