TURCK

Your Global Automation Partner

FCS-…-IOL…
Immersion Sensors with IO-Link

Quick Start Guide

Contents

1 About these instructions

These instructions describe the setup, functions and use of the product and help you to operate the product according to its intended purpose. Read these instructions carefully before using the product. This will prevent the risk of personal injury and damage to property. Keep these instructions safe during the service life of the product. If the product is passed on, pass on these instructions as well.

1.1 Target groups

These instructions are aimed at qualified personal and must be carefully read by anyone mounting, commissioning, operating, maintaining, dismantling or disposing of the device.

1.2 Explanation of symbols

The following symbols are used in these instructions:

	**DANGER** DANGER indicates a hazardous situation with a high level of risk, which, if not avoided, will result in death or serious injury.
	**WARNING** WARNING indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in death or serious injury.
	**CAUTION** CAUTION indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in moderate or minor injury.
	**NOTICE** CAUTION indicates a situation which, if not avoided, may cause damage to property.
	**NOTE** NOTE indicates tips, recommendations and important information about special action steps and issues. The notes simplify your work and help you to avoid additional work.
▶	**MANDATORY ACTION** This symbol denotes actions that the user must carry out.
⇨	**RESULT OF ACTION** This symbol denotes the relevant results of an action.

1.3 Feedback about these instructions

We make every effort to ensure that these instructions are as informative and as clear as possible. If you have any suggestions for improving the design or if some information is missing in the document, please send your suggestions to techdoc@turck.com.

2 Notes on the product

2.1 Product identification

These instructions apply to the following sensors:

- FCS-K20-IOL
- FCS-K20-IOL-0.2-RS4T
- FCS-M18-IOL
- FCS-M18-IOL-0.2-RS4T

2.2 Scope of delivery

The delivery consists of the following:

- Immersion flow sensor
- FCS-M18-…: Fastening nuts
- Quick Start Guide

2.3 TURCK service

TURCK supports you in your projects — from the initial analysis right through to the commissioning of your application. The TURCK product database at www.turck.com offers you several software tools for programming, configuring or commissioning, as well as data sheets and CAD files in many export formats.

For the contact details of our branches worldwide, please see page [▷ 23].

3 For your safety

The product is designed according to state of the art technology. Residual hazards, however, still exist. Observe the following safety instructions and warnings in order to prevent danger to persons and property. TURCK accepts no liability for damage caused by failure to observe these safety instructions.

3.1 Intended use

The devices are used to monitor non-explosive, gaseous media in a speed range of 0.5…15 m/s. The evaluation electronics are integrated in the device. The immersion sensors are designed for mounting in the flow channel so that the sensor element can be immersed in the flow.

The device must only be used as described in these instructions. Any other use is not in accordance with the intended use. TURCK accepts no liability for any resulting damage.

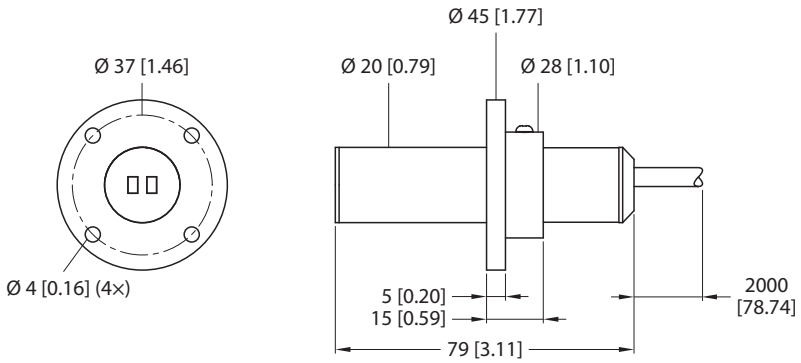
3.2 General safety instructions

- The device must only be fitted, installed, operated, parameterized and maintained by trained and qualified personnel.
- Only use the device in compliance with the applicable national and international regulations, standards and laws.
- The device meets the EMC requirements for the industrial areas. When used in residential areas, take measures to prevent radio frequency interference.
- Protect the device against mechanical damage.
- Before installation, check whether the sensor materials are resistant to external influences in the application.

4 Product description

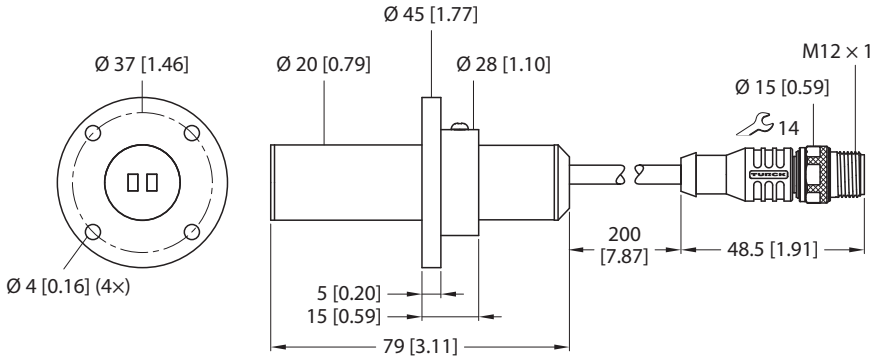
The compact immersion sensors for air flow and temperature monitoring are contained in a metal or plastic housing in protection class IP67, and are available as a connector or cable variant. The connector variants are provided with a metal-bodied M12 connector for connecting the sensor cable. The measured values are displayed and parameterized via IO-Link. The devices have Smart Sensor Profile 4.1.2.

4.1 Device overview



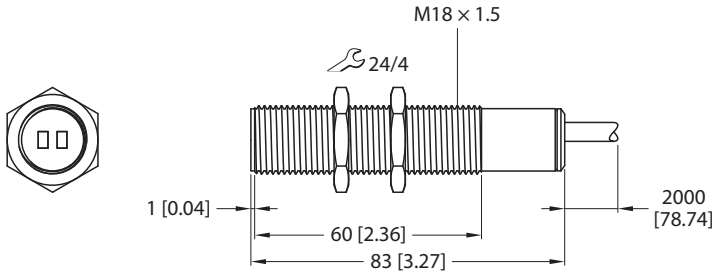
mm [Inch]

Fig. 1: Dimensions FCS-K20-IOL



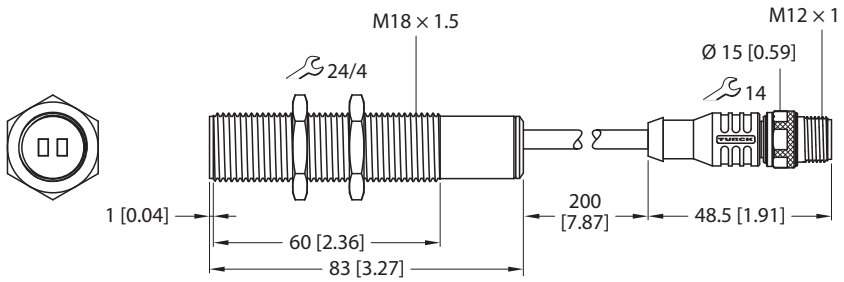
mm [Inch]

Fig. 2: FCS-K20-IOL-0.2-RS4T



mm [Inch]

Fig. 3: Dimensions FCS-M18-IOL



mm [Inch]

Fig. 4: FCS-M18-IOL-0.2-RS4T

4.2 Properties and characteristics

- Flow monitoring for gaseous media
- IO-Link
- Smart Sensor Profile 4.1.2
- Protection class IP67
- Available in K20 or M18 design
- Switching status indication via LED
- NC/NO output functions, single point mode, two point mode, window mode can be configured via IO-Link

4.3 Operating principle

The Flow sensors works calorimetrically. The function is based on the thermo-dynamic principle. When the medium is flowing, thermal energy is dissipated at the sensor. The resulting temperature on the probe is measured and compared to the media temperature. The flow status can be derived directly from the determined temperature difference: The greater the energy dissipation, the higher the flow speed or flow rate.

4.4 Functions and operating modes

The devices measure the air flow and temperature of gaseous media and output the measured values via a switching output in SIO mode or via the IO-Link interface in IO-Link mode.

The switching output is configured in IO-Link mode. The switching output of the sensor can be used either as a normally open or normally closed contact.

A single point mode, two point mode or window mode can be set for the switching output. In single point mode, a limit value is set at which the selected switching output changes its switching state. In two point mode, a lower and an upper limit are set at which the selected switching output changes its switching state as the process value rises or falls. In window mode, a lower and an upper window limit are set. Outside the window, the selected switching output changes its switching state. Only the switching states of SSC1.1 (Switching Signal Channel) are displayed via the LEDs in SIO mode.

The logic of the switching output (high/low) can be inverted.

In addition, an average value of the flow values can be mapped in IO-Link mode. The current flow value (in percent for SSC1…) and the current temperature (in °C for SSC2…) can be saved during operation via a teach-in for SP1 and SP2.

4.4.1 Flow monitoring

The flow speed of the airflow is detected in the flow channel and evaluated by the integrated processing unit. The current flow value —when connected to an IO-Link master—is output via a communication signal.

The Switching channel 1 (SSC1) changes its switching state when the set switching point is reached for the flow rate. The switching state depends on the switching logic as well as on Single Point Mode, Two Point Mode and Window Mode.

4.4.2 Temperature monitoring

The calorimetric measurement method used by the sensors not only monitors the flow rate, but also measures the approximate temperature of the media. Both process variables are recorded and evaluated independently of each other. The current temperature —when connected to an IO-Link master—is output via a communication signal.

The Switching channel 2 (SSC2) is used for temperature monitoring. The devices change their switching state when the set switching point is reached for the temperature. The switching state depends on the switching logic as well as on Single Point Mode, Two Point Mode and Window Mode.

4.4.3 Output functions — switching output

The switching logic can be inverted via IO-Link. The following examples apply to the **HIGH** (0 → 1) switching logic.

Single point mode

In single point mode, the switching behavior is defined via a SP1 limit value and a hysteresis. The output changes its switching state at limit value SP1. The hysteresis is 0…50 % of the process value.

If the process value increases, the switching output is inactive as long as the process value is between the start of the detection range and the SP1 limit value. If the process value increases above the SP1 limit value, the switching output becomes active.

If the process value decreases, the switching output is active as long as the process value is between the end of the detection range and the SP1 limit minus the set hysteresis (SP1-Hyst). If the process value decreases below the limit value (SP1-Hyst), the switching output becomes inactive.

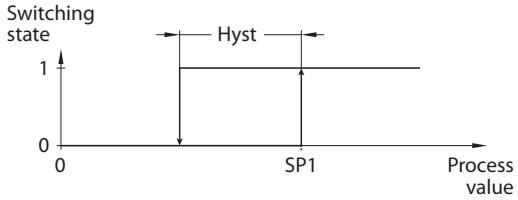


Fig. 5: Single point mode

Two point mode

In two point mode, the switching behavior is defined via a switch-on point SP1 and a switch-off point SP2. This mode can also be used as a freely adjustable hysteresis.

If the process value increases, the switching output is inactive as long as the process value is between the start of the detection range and the switch-on point SP1. If the process value rises above the switch-on point SP1, the switching output becomes active.

If the process value decreases, the switching output is active as long as the process value is between the end of the detection range and the SP2 switch-off point. If the process value decreases below the switch-off point SP2, the switching output becomes inactive.

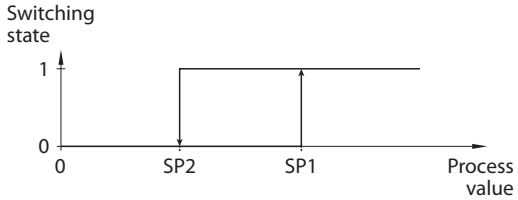


Fig. 6: Two point mode

Window mode

In window mode, an upper and lower window limit are set for the switching output. The hysteresis is 0…50 % of the process value. A hysteresis can be set for the window limits SP1 and SP2. The switching window must be within the detection range.

If the process value increases, the switching output is inactive as long as the process value is between the start of the detection range and the window limit SP2. The switching output remains active until the process value increases above the window limit SP1 plus the hysteresis (SP1+Hyst). If the process value increases above (SP1+Hyst), the switching output becomes inactive again.

If the process value decreases, the switching output is inactive as long as the process value is between the end of the detection range and the window limit SP1. The switching output remains active until the process value decreases below the window limit SP2 minus the hysteresis (SP2-Hyst). If the process value decreases below (SP2- Hyst), the switching output becomes inactive again.

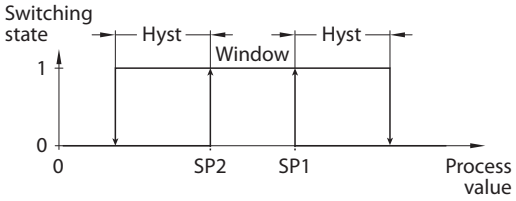


Fig. 7: Window mode

4.4.4 IO-Link mode

In order to operate in IO-Link mode, the device must be connected to an IO-Link master. When the port is configured in IO-Link mode, bidirectional IO-Link communication takes place between the IO-Link master and the device. To make this possible, the device is integrated via an IO-Link master at the control level. First the communication parameters are exchanged, and then the cyclic data exchange of process data (objects) starts.

4.4.5 SIO mode (standard I/O mode)

In standard I/O mode no IO-Link communication takes place between the device and the master. The device only transfers the switching state of its binary outputs and can also be run via a fieldbus device or controller with digital PNP inputs. An IO-Link master is not required for operation.

The device parameters can be set via IO-Link and then operated at the digital inputs with the appropriate settings in SIO mode. Not all functions and properties of the device can be used in SIO mode.

5 Installing

- Mount the sensor in such a way that the sensor's sensing elements are completely surrounded by the medium to be monitored.
- Align the sensor to the flow direction.

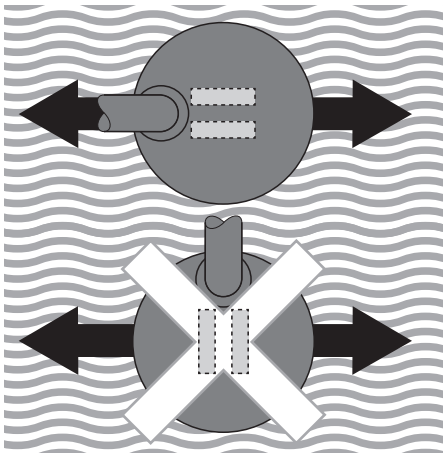


Fig. 8: Aligning FCS…

- FCS-K20…: Mount the sensor on the flow channel using a plastic receptacle (included in delivery).

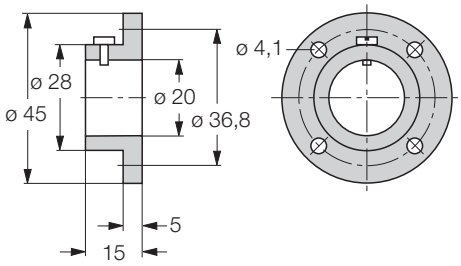


Fig. 9: Installing FCS-K20…

- FCS-M18…: Mount the sensor using two fastening nuts (included in delivery).

6 Connecting

- Connect the female connector of the connection cable to the male connector of the sensor.
- Connect the open end of the connection cable to the power supply and/or processing units.

6.1 Wiring diagrams

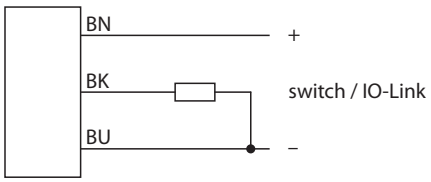


Fig. 10: Pin assignment FCS-…IOL

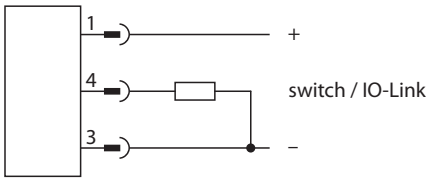


Fig. 11: Pin assignment FCS-…-0.2-RS4T

7 Commissioning

After connecting and switching on the power supply, the device is automatically ready for operation.

8 Operation

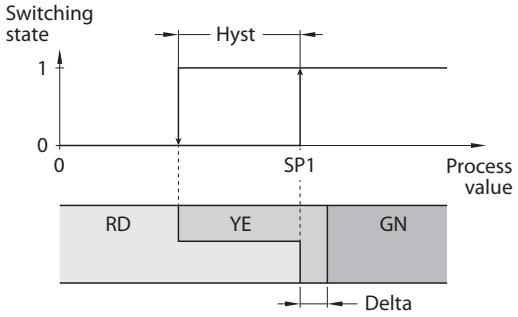
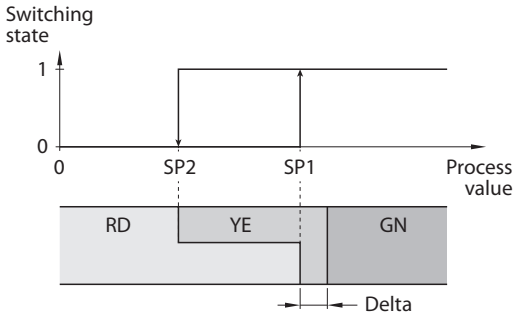
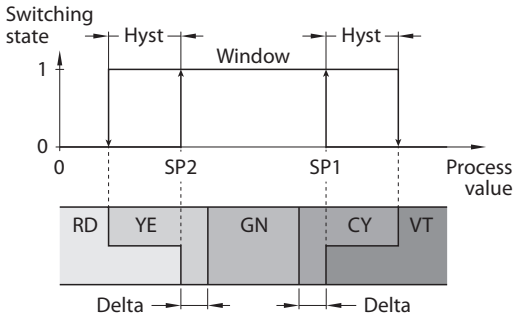
8.1 LEDs

LEDs in IO-Link mode

LED	Meaning
Green flashing	IO-Link mode
Flashes blue	Wink function (locator) active

Operating mode	LED	Switching logic high	Switching logic low
Deactivated	–	Switching output off	
Single point mode (SPM)	Red	Process value below switching point 1 (SP1)	Process value above SP1
	Yellow	Hysteresis	
	Green	Process value above SP1	Process value under SP1
Two point mode (TPM)	Red	Process value under SP1	Process value under SP2
	Yellow	Process value within the switching points	
	Green	Process value above SP1	Process value above SP2
Window mode	Red	Process value under SP2	Process value under SP1
	Yellow	Hysteresis under SP2	Hysteresis under SP1
	Green	Process value within the window limits	
	Cyan	Hysteresis above SP1	Hysteresis above SP2
	Purple	Process value above SP2	Process value above SP1

LED display in SIO mode

Operating mode	Switching status, LED display
Deactivated	Switching output off, LED deactivated
Single point mode (SPM)	
Two point mode (TPM)	
Window mode	

The following color codes apply to the diagram view:

Color code	LED display
RD	Red
YE	Yellow
GN	Green
CY	Cyan
VT	Purple

9 Setting

9.1 Parameters that can be adjusted via IO-Link

Standard command parameters

Parameter	Options	Description
Configuration filter	0 s	Configuration filter for the average flow value **Default: 8 s**
	1 s	
	2 s	
	4 s	
	8 s	
	16 s	
System command	Locator start	Wink function: Device LED flashes green for 10 min.
	Locator stop	Command ends Wink function.
	Application reset	The application parameters are set to default values. Identification parameters (e.g. application TAG) remain unchanged. If activated, an upload to the data memory of the master is carried out.
	Reset Tmax	The memory for the maximum medium temperature is reset.
	Reset Tmin	The memory for the minimum medium temperature is reset.
	Back-to-box	All parameters of the device are set to default values and IO-Link communication is prevented until the next device restart. No upload of the values to the data memory.

Switching channel parameters

The parameters apply to the air flow (SSC1.1, SSC 1.2) and temperature (SSC2.1, SSC2.2) switching channels.

The switching points SP1 and SP2 can be configured during operation via the IO-Link interface.

Parameter		Options	Description
SP1	Switching point 1		Single point mode: Limit value at which the switching output changes its switching state Two point mode: upper limit value at which the switching output changes its switching state as the flow speed or temperature rises Window mode: upper window limit at which the switching output changes its switching state **Default: 70 % or 31 °C**
SP2	Switching point 2		Single point mode: not available Two point mode: lower limit value at which the switching output changes its switching state as the flow speed or temperature falls Window mode: lower window limit at which the switching output changes its switching state **Default: 30 % or 30 °C**
Logic	Invert switching logic	**High active**	0 → 1
		Low active	1 → 0
Mode	Switching type	Deactivated	
		Single point	Single point mode
		Window mode	Window mode
		Two point mode	Two point mode
Hysteresis	Hysteresis		The hysteresis is 0…10 % of the process value. **Default air flow: 5 %** **Default temperature: 0.5 °C**
Delta up to green LED	LED response to switching state (SSC1.1 only)		The “Delta” function extends the LED from 0 → 1 or 1 → 0. It is 0…50 % of the process value. **Default: 10 %**
dS	Switching delay switching point		Switching delay of 0…60 s in increments of 0.1 s **Default: 0.0 s**
dR	Switching delay release point		Switching delay of 0…60 s in increments of 0.1 s **Default air flow: 1.0 s** **Default temperature: 0.0 s**

Teach-in function parameters

Parameter	Options	Description
Teach-in selection	SSC1.1	Selection of switching channel
	SSC1.2	
	SSC2.1	
	SSC2.2	
Teach-in command	Value for SP1	Current teach-in point SP1
	Value for SP2	Current teach-in point SP2
Teach-in result	Idle	No action
	SP1 — success	Switching point 1 taught-in successfully
	SP2 — success	Switching point 2 taught-in successfully
	Wait for command	Standard command active
	Busy	Teach-in points are being processed
	Error	Non-specific error
	Error: maximum fluctuation too high	Fluctuation in the teach-in points is too high
	Error: Medium above the detection range	Medium above the detection range
	Error: Medium below the detection range	Medium below the detection range

9.2 Process data

9.2.1 Process data structure

MSDC1								
Byte	**Bit no.**							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
4	Reserved					Uncertainty flag Subindex: 5	SSC2.2 0 = Low 1 = High Subindex: 4	SSC.2.1 0 = Low 1 = High Subindex: 3
5	Scale: Scale -1 (≙ 10^{-1}) Subindex: 2							
6…7	MDC1: Air flow measured value 1…1000 Subindex: 1							

MSDC2								
Byte	**Bit no.**							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Reserved					Uncertainty flag Subindex: 15	SSC2.2 0 = Low 1 = High Subindex: 14	SSC.2.1 0 = Low 1 = High Subindex: 13
1	Scale: Scale -1 (≙ 10^{-1}) Subindex:12							
2…3	MDC2: Temperature measured value -200…+700 Subindex: 11							

9.2.2 Process data for standard commands

Command (dec.)	Command (hex.)	Command name
126	0x7E	Locator start
127	0x7F	Locator end
129	0x81	Application reset
131	0x83	Back-to-box
180	0xB4	Reset Tmax
181	0xB5	Reset Tmin

10 Troubleshooting

If the device does not function as expected, first check whether ambient interference is present. If there is no ambient interference present, check the connections of the device for faults.

If there are no faults, there is a device malfunction. In this case, decommission the device and replace it with a new device of the same type.

11 Maintenance

The device is maintenance-free. Clean with a damp cloth if required.

12 Repair

The device is not intended for repair by the user. The device must be decommissioned if it is faulty. Observe our return acceptance conditions when returning the device to TURCK.

12.1 Returning devices

If a device has to be returned, bear in mind that only devices with a decontamination declaration will be accepted. This is available for download at
https://www.turck.de/en/return-service-6079.php
and must be completely filled in, and affixed securely and weather-proof to the outside of the packaging.

13 Disposal

The devices must be disposed of properly and do not belong in the domestic waste.

14 Technical data

Type	FCS-K20-IOL	FCS-M18-IOL	FCS-K20-IOL-0.2-RS4T	FCS-M18-IOL-0.2-RS4T
Mounting conditions				
Operating range	0.5…15 m/s			
Stand-by time	20…40 s			
Flow reaction time	Typ. 2 s (2…20 s)			
Temperature reaction time	Typ. 2 s (< 15 s)			
Temperature gradient	≤ 200 K/min			
Media temperature	-20…+70 °C			
Ambient temperature	-20…+70 °C			
Electrical data				
Operating voltage U_B	18…30 VDC			
Current consumption	≤ 32 mA			
Output function	PNP, IO-Link, NO/NC contact (NO contact preset)			
Smart Sensor Profile	4.1.2			
Rated operating current	0.4 A			
Short-circuit protection	Yes			
Reverse polarity protection	Yes			
Switching current	200 mA			
Type of protection	IP67			
IO-Link				
IO-Link specification	V1.1			
IO-Link port type	Class A			
Transfer rate	COM 2 (38.4 kBaud)			
Profile support	Smart Sensor Profile 4.1.2			
Mechanical data				
Design	K20	M18	K20	M18
Housing material	PBT-GF30-V0	Metal, CuZn	PBT-GF30-V0	Metal, CuZn
Electrical connection	PVC cable, 2 m, 3 × 0.5 mm²		PVC cable, 2 m, 3 × 0.5 mm² with connector, M12 × 1	
Pressure resistance	1 bar			
Process connection	PVC flange (included in delivery)	M18 × 1	PVC flange (included in delivery)	M18 × 1
Switching state indication				
SIO Mode	Red/yellow/green/cyan/purple			
IO-Link mode	Green/blue			

15 TURCK branches — contact data

Germany	TURCK GmbH Witzlebenstraße 7, 45472 Mülheim an der Ruhr **www.turck.de**
Australia	Turck Australia Pty Ltd Building 4, 19-25 Duerdin Street, Notting Hill, 3168 Victoria **www.turck.com.au**
Austria	Turck GmbH Graumanngasse 7/A5-1, A-1150 Vienna **www.turck.at**
Belgium	Turck Multiprox N. V. Lion d'Orweg 12, B-9300 Aalst **www.multiprox.be**
Brazil	Turck do Brasil Automação Ltda. Rua Anjo Custódio Nr. 42, Jardim Anália Franco, CEP 03358-040 São Paulo **www.turck.com.br**
Canada	Turck Canada Inc. 140 Duffield Drive, CDN-Markham, Ontario L6G 1B5 **www.turck.ca**
China	Turck (Tianjin) Sensor Co. Ltd. 18,4th Xinghuazhi Road, Xiqing Economic Development Area, 300381 Tianjin **www.turck.com.cn**
Czech Republic	TURCK s.r.o. Na Brne 2065, CZ-500 06 Hradec Králové **www.turck.cz**
France	TURCK BANNER S.A.S. 11 rue de Courtalin Bat C, Magny Le Hongre, F-77703 MARNE LA VALLEE Cedex 4 **www.turckbanner.fr**
Hungary	TURCK Hungary kft. Árpád fejedelem útja 26-28., Óbuda Gate, 2. em., H-1023 Budapest **www.turck.hu**
India	TURCK India Automation Pvt. Ltd. 401-403 Aurum Avenue, Survey. No 109 /4, Near Cummins Complex, Baner-Balewadi Link Rd., 411045 Pune - Maharashtra **www.turck.co.in**
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Malaysia	Turck Banner Malaysia Sdn Bhd Unit A-23A-08, Tower A, Pinnacle Petaling Jaya, Jalan Utara C, 46200 Petaling Jaya Selangor **www.turckbanner.my**
Mexico	Turck Comercial, S. de RL de CV Blvd. Campestre No. 100, Parque Industrial SERVER, C.P. 25350 Arteaga, Coahuila **www.turck.com.mx**
Netherlands	Turck B. V. Ruiterlaan 7, NL-8019 BN Zwolle **www.turck.nl**
Poland	TURCK sp.z.o.o. Wroclawska 115, PL-45-836 Opole **www.turck.pl**
Romania	Turck Automation Romania SRL Str. Siriului nr. 6-8, Sector 1, RO-014354 Bucuresti **www.turck.ro**
Sweden	Turck AB Fabriksstråket 9, 433 76 Jonsered **www.turck.se**
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