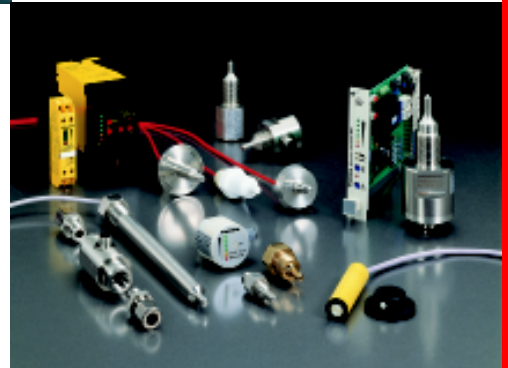


TURCK

**FLOW
CONTROLS**

cm/sec
ml/min



TURCK is one of the leading manufacturers in industrial automation and was one of the first companies to recognise the possibilities of automating production processes using electronic components. Specialising initially in the production of sensors, today we offer solutions for the ever more complex field of automation, ranging from sensors for the periphery, through various switching and interface devices to system technology. Moreover, TURCK develops and manufactures customised hybrid switching circuits and SMD assemblies.

This makes TURCK your first choice for all these products.

In order to meet the special requirements of our North American customers, the products for this market are manufactured in the United States.

This is just one of the reasons why TURCK has achieved the leading position in the inductive sensor market in the United States. We focus on offering individual customer support and made-to-measure solutions. The basis of our success is the close co-operation with our customers, using the most advanced production technologies and a world-wide distribution network.



The **sensor** range comprises more than 1500 standard sensors; the **interface** line features 600 different devices for hazardous area and standard applications. Furthermore, our *busstop*® programme includes **fieldbus** components for the most frequently used fieldbus systems. These products feature protection degree IP67 as a standard.

TURCK products not only fulfil national (DIN) but also European (EN) and international standards (IEC) and are manufactured according to DIN ISO 9001. For the European market, there are three production sites in Germany and one in Switzerland.

With more than 1400 employees in 12 countries and representatives in over 60 countries, TURCK ensures competent support and solutions directly for the field and on the spot.

TURCK

Your Satisfaction is our Success!

The product range

TURCK offers a wide range of flow controls for almost any flow sensing need.

They are available as inline or insertion devices, as self contained sensors with integrated control logic or sensors with remote signal processors. All these devices encompass state of the art electronics and are designed to meet specific industry standards with regard to function, construction and versatility.

Not only the sensors but also the self-contained devices are completely encapsulated units.

TURCK also customizes flow devices to meet special needs with regard to construction, housing material and type of connection. Alongside pure flow rate monitoring, there are additional functions such as temperature monitoring available. Our range of flow controls is used in diverse applications in all branches of industry.



TURCK utilizes a special construction and the reliable calorimetric sensing method to ensure accurate detection of excessive or insufficient flow rates, even during changes in temperature.

TURCK provides solutions for special requirements such as:

- increased pressure
- higher flow temperatures
- aggressive fluids
- hazardous area applications
- special constructions for the food industry

Typical applications demonstrating the diversity of functions of this line include monitoring of hydraulic, cooling and lubricating processes in the automotive industry or run-dry protection in pump systems in the petrochemical sector.

This is why TURCK flow controls provide made-to-measure solutions for process optimisation.

Flow controls

Process optimisation through reliable detection, monitoring and display of process parameters



- **In the chemical, petrochemical and process industry:**
pump function, leakage and level control, flow monitoring in explosion hazardous areas, monitoring of corrosive flow media



- **In the pharmaceutical and food industry, system engineering:**
food production (aseptic), cleaning processes, filter status



- **In air conditioning and ventilation systems, system engineering:**
ventilation and aircondition systems, suction control, air cooling blowers



- **Waste disposal, utilities:**
pumps in water distribution systems (run-dry protection), draining systems



- **In the automotive, the metal and steel industry:**
cooling and lubrication circuits, hydraulic systems and supply circuits

Trust in our application know-how combined with state-of-the-art flow control technology to solve your applications!

Flow controls

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Flow controls

SELF-CONTAINED DEVICES

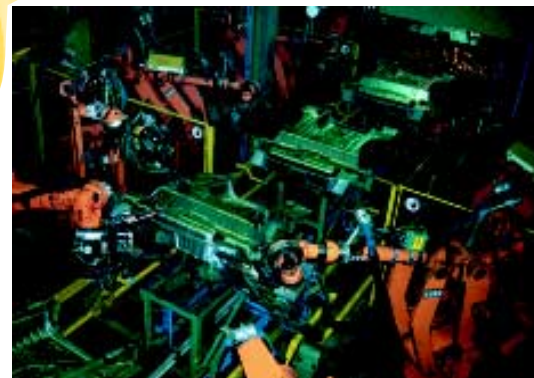
STANDARD RANGE

Our range of self-contained flow controls is available in stainless steel or plastic housings; the sensor and processor form a compact unit suited to all kinds of applications.

The various output types – transistor, relay or analogue output – enable adjustment to the individual sensing task by providing a versatile product range to match a large variety of applications.

Adjustments are conveniently accomplished by means of a potentiometer which serves to set the switch point (transistor/relay) or measuring range (analogue version).

Standard threads (G1/4, G1/2, GL1/2 or NPT1/2) are designed for simple mounting in a pipe tee or welding socket while providing a pressure resistance of 100 bar.



Flow controls – standard range

Self-contained devices stainless steel transistor output



- **Sensor and signal processor in one compact housing**
- **Simple adjustment by means of potentiometer**
- **Enclosure meets protection degree IP67**
- **LED chain for flow status indications**
- **Transistor, relay or analogue output**
- **Pressure resistance up to 100 bar**

Self-contained devices for standard applications are available in stainless steel or plastic housings. With this series of self-contained devices, the sensor and the signal processor are incorporated in one compact housing. These devices are ideal for monitoring liquid flows in the 1...300 cm/s range.

The LED chain provides trend indications of the flow status. The switch point is adjusted by means of a potentiometer located under the protective screw cap on the front of the device.

The device is designed to be installed directly into the flow lines via a pipe tee or a welding pipe socket with the sensing probe inserted into the flow. The sensing probe is made of stainless steel AISI316Ti (1.4571) and is available with a variety of thread types (G1/4, G1/2, GL1/2 or NPT 1/2). Other thread types and special lengths are available on request.

This range provides a choice of transistor, relay or analogue output versions.

The LED indications of the transistor and relay output versions are as follows:

- red LED below setpoint (output disabled/relay de-energised)
- yellow LED at or above setpoint (output activated/relay energised)
- yellow and green LEDs degree of set-point overrange (1, 2, 3 or 4 LEDs are lit together with yellow LED)

The LED indications of analogue devices are defined as follows:

- red LED = 4 mA
- 1 x green > 4 mA
- 2 x green > 8 mA
- 3 x green > 12 mA
- 4 x green > 16 mA
- 5 x green ≥ 20 mA

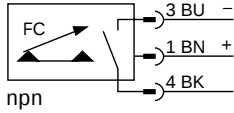
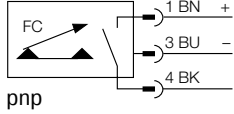
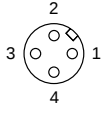
The number of illuminated LEDs is related to the output signal (4...20 mA).

Operating ranges (depending on flow media):

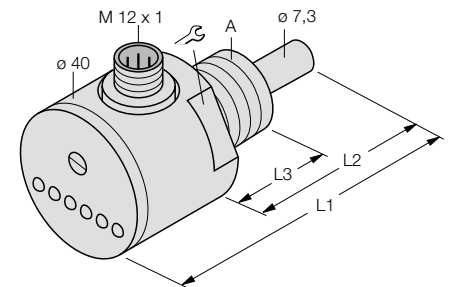
- water 1...150 cm/s
- oil 3...300 cm/s

Self-contained devices: transistor output, stainless steel

Mounting guidelines see section 8, "Technology and handling"

Supply voltage U_B Current consumption	19.2...28.8 VDC (incl. ripple) ≤ 70 mA
Output Switching current Voltage drop (at I_{max})	transistor, pnp/npn, short-circuit and reverse polarity protection ≤ 400 mA ≤ 1.5 V
Temperature range (medium)	-20...+80 °C
Operating range (flow speed) – water – oil	1...150 cm/s 3...300 cm/s
Availability Switch-on time Switch-off time Response time to change in temperature or temperature gradient	typ. 8 s (2...15 s) typ. 2 s (1...13 s) typ. 2 s (1...15 s) ≤ 12 s max. 250 K/min
Pressure resistance	100 bar
LED indications – below setpoint – at setpoint, output switched – setpoint exceeded	red yellow 4 x green (in addition to yellow LED)
Housing material (acc. to DIN 2462/17440) Protection degree (IEC 60529/EN 60529) Ambient temperature Fixing torque	stainless steel A4 (AISI316Ti - no. 1.4571) IP67 -20...+80 °C 100 Nm
Connection – pin configuration: connector, system <i>eurocon</i> (M 12 x 1) connectors (seen from the view of contacts)	 npn BN = brown BU = blue BK = black  pnp 
Accessories	2 seals for G threads, 1 screwdriver

Dimensions



- Connector device

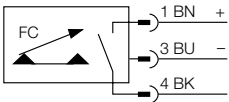
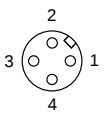
Selection table

Type	Ident.-no.	Output	Thread A	 AF	Dimensions		
					L1	L2	L3
FCS-G1/4A4-AP8X-H1141	68 701 01	pnp	G1/4	19	73	25	10
FCS-G1/2A4-AN8X-H1141	68 700 34	npn	G1/2	36	66	30	12
FCS-G1/2A4-AP8X-H1141	68 700 04	pnp	G1/2	36	66	30	12
FCS-G1/2A4-AP8X-H1141/L080	68 700 08	pnp	G1/2	36	116	80	12
FCS-GL1/2A4-AP8X-H1141	68 702 04	pnp	G1/2 long	36	84	48	29
FCS-N1/2A4-AP8X-H1141	68 710 04	pnp	NPT1/2	36	76	40	19

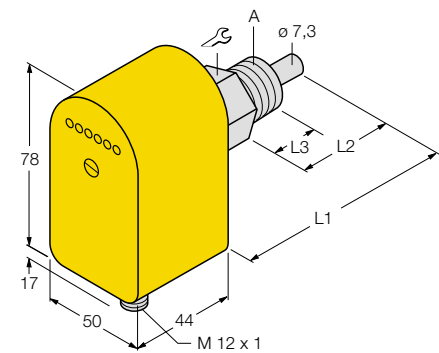
Flow controls – standard range

Self-contained devices: plastic, transistor output

Mounting guidelines see section 8, "Technology and handling"

Supply voltage U_B Current consumption	19.2...28.8 VDC (incl. ripple) ≤ 60 mA
Output Switching current Voltage drop (at I_{max})	transistor, pnp, short-circuit and reverse polarity protection ≤ 400 mA ≤ 1.5 V
Temperature range (medium)	-20...+80 °C
Operating range (flow speed) – water – oil	1...150 cm/s 3...300 cm/s
Availability Switch-on time Switch-off time Response time to change in temperature or temperature gradient	typ. 8 s (2...15 s) typ. 2 s (1...13 s) typ. 2 s (1...15 s) ≤ 12 s max. 250 K/min
Pressure resistance	100 bar
LED indications – below setpoint – at setpoint, output switched – setpoint exceeded	red yellow 4 x green (in addition to yellow LED)
Sensor material (acc. to DIN 2462/17440) Housing material Protection degree (IEC 60529/EN 60529) Ambient temperature Fixing torque	stainless steel A4 (AISI316Ti - no. 1.4571) PBT IP67 -20...+70 °C 100 Nm
Connection – pin configuration: connector, system <i>eurocon</i> (M 12 x 1) connectors (seen from the view of contacts)	 BN = brown BU = blue BK = black  pnp
Accessories	2 seals for G threads 1 screwdriver

Dimensions



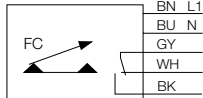
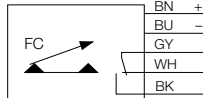
– Connector device

Selection table

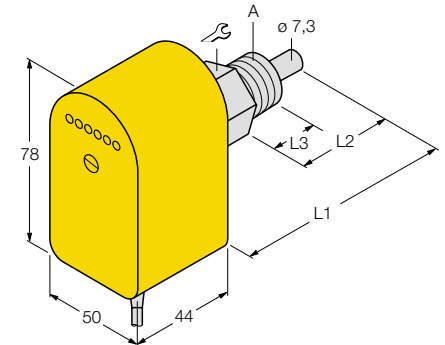
Type	Ident-no.	Thread A	 AF	Dimensions		
				L1	L2	L3
FCS-G1/4A4P-AP8X-H1141	68 700 82	G1/4	27	42	27	11
FCS-G1/2A4P-AP8X-H1141	68 700 92	G1/2	27	46	31	15
FCS-G1/2A4P-AP8X-H1141/L080	68 703 64	G1/2	27	95	80	15
FCS-GL1/2A4P-AP8X-H1141	68 702 42	G1/2 long	27	63	48	29
FCS-N1/2A4P-AP8X-H1141	68 710 32	NPT1/2	27	57	42	17

Self-contained devices: plastic, relay output

Mounting guidelines see section 8, "Technology and handling"

Supply voltage U_B	195.5...264.5 VAC or 19.2...28.8 VDC
Current consumption	≤ 30 mA or ≤ 80 mA
Output	1 relay output (SPDT)
Switching voltage	≤ 250 VAC/60 VDC
Switching current	≤ 4 A
Switching capacity	≤ 1000 VA/60 W
Temperature range (medium)	-20...+80 °C
Operating range (flow speed)	
– water	1...150 cm/s
– oil	3...300 cm/s
Availability	typ. 8 s (2...15 s)
Switch-on time	typ. 2 s (1...13 s)
Switch-off time	typ. 2 s (1...15 s)
Response time to change in temperature or temperature gradient	≤ 12 s max. 250 K/min
Pressure resistance	100 bar
LED indications	
– below setpoint	red
– at setpoint, output switched	yellow
– setpoint exceeded	4 x green (in addition to yellow LED)
Sensor material (acc. to DIN 2462/17440)	stainless steel A4 (AISI316Ti - no. 1.4571)
Housing material	PBT
Protection degree (IEC 60529/EN 60529)	IP67
Ambient temperature	-20...+70 °C
Fixing torque	100 Nm
Connection	
– PVC cable (5 x 0.5 mm ²)	
2 m long (other lengths on request)	
	 
	BN = brown, BU = blue, WH = white GY = grey, BK = black
Accessories	2 seals for G threads, 1 screwdriver

Dimensions



– Cable device

Selection table

Type	Ident-no.	Supply voltage	Thread A	AF	Dimensions	L1	L2	L3
FCS-G1/2A4P-VRX/24VDC	68 700 96	19.2...28.8 VDC	G1/2	27		46	31	15
FCS-G1/2A4P-VRX/230VAC	68 700 94	195.5...264.5 VAC	G1/2	27		46	31	15
FCS-GL1/2A4P-VRX/24VDC	68 700 97	19.2...28.8 VDC	G1/2 long	27		63	48	29
FCS-GL1/2A4P-VRX/230VAC	68 700 98	195.5...264.5 VAC	G1/2 long	27		63	48	29

Flow controls – standard range

Self-contained devices: plastic, linearised
analogue output, medium water

Mounting guidelines see section 8,
"Technology and handling"

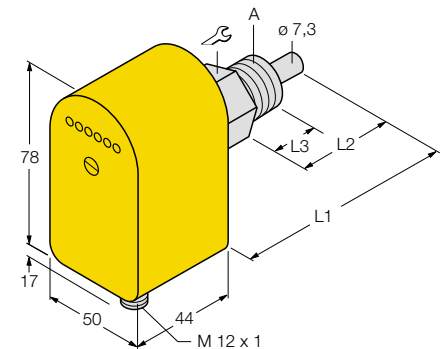
Supply voltage U _B Current consumption	21.6...26.4 VDC (incl. ripple) ≤ 100 mA
Output Load Output current Linearity tolerance	current output ≤ 500 Ω 4...20 mA ≤ 10 %
Temperature range (medium)	-20...+70 °C
Operating range – water	5...150 cm/s
Availability Response time	approx. 10 s 1...15 s
Pressure resistance	100 bar
LED indications – output signal indication Illumination of 1 to 6 LEDs:	5 x green, 1 x red = 4 mA > 4 mA > 8 mA > 12 mA > 16 mA = 20 mA
Housing material Sensor material (acc. to DIN 2462/17440) Protection degree (IEC 60529/EN 60529) Ambient temperature Fixing torque	PBT stainless steel A4 (AISI316Ti - no. 1.4571) IP67 -20...+70 °C 100 Nm
Connection – pin configuration: connector, system <i>eurocon</i> (M 12 x 1) connectors (seen from the view of contacts)	BN = brown BU = blue BK = black
Accessories	2 seals for G threads 1 screwdriver

Attention: Please note that the ex-factory setting of the sensor is 4 mA at approx. 5 cm/s and 0 mA at approx. 150 cm/s (medium: water at 20 °C).

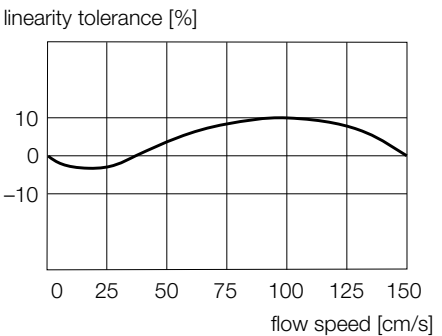
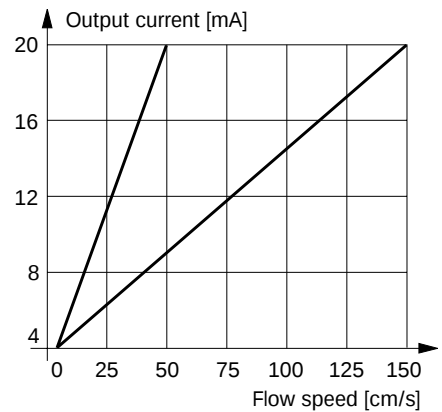
Selection table

Type	Ident-no.	Thread A	 AF	Dimensions		
				L1	L2	L3
FCS-G1/2A4P-LIX-H1141	68 700 56	G1/2	27	46	31	15
FCS-GL1/2A4P-LIX-H1141	68 702 32	G1/2 long	27	63	48	29

Dimensions

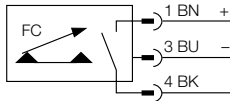
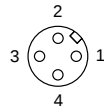


- Connector device



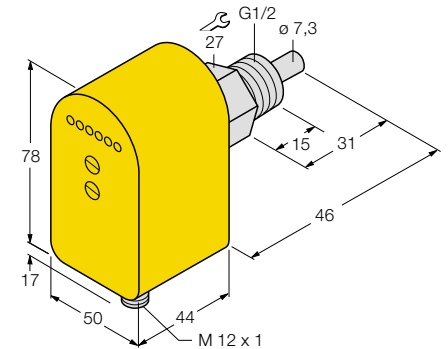
Self-contained devices: plastic, analogue output medium water und oil

Mounting guidelines see section 8, "Technology and handling"

Supply voltage U_B	21.6...26.4 VDC (incl. ripple)
Current consumption	≤ 100 mA
Output	current output
Load	≤ 500 Ω
Output current	4...20 mA
Temperature range (medium)	-20...+70 °C
Operating range	
– water	1...150 cm/s
– Öl ¹⁾	3...300 cm/s
Availability	approx. 10 s
Response time	1...15 s
Pressure resistance	100 bar
LED indications	
– output signal indication	5 x green, 1 x red
Illumination of 1 to 6 LEDs:	
– red LED	= 4 mA
– 1 green LED	> 4 mA
– 2 green LEDs	> 8 mA
– 3 green LEDs	> 12 mA
– 4 green LEDs	> 16 mA
– 5 green LEDs	= 20 mA
Housing material	PBT/PA
Sensor material (acc. to DIN 2462/17440)	stainless steel A4 (AISI316Ti - no. 1.4571)
Protection degree (IEC 60529/EN 60529)	IP67
Ambient temperature	-20...+70 °C
Fixing torque	100 Nm
Connection	
– pin configuration: connector, system <i>eurocon</i> (M 12 x 1)	
connectors (seen from the view of contacts)	 1 BN + 3 BU - 4 BK BN = brown BU = blue BK = black 
Accessories	2 seals for G threads, 1 screwdriver

¹⁾ The operating range in oil depends on the thermal characteristics of the oil.

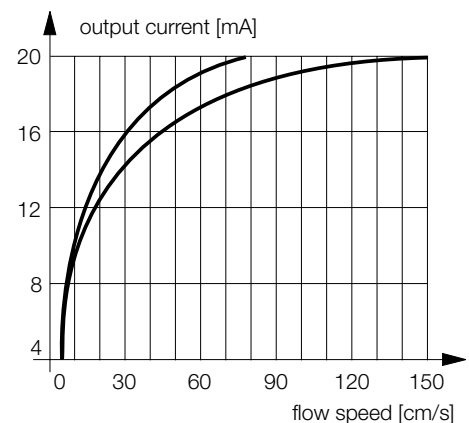
Dimensions



- Connector device

Adjustment of devices

The processor is adjusted to the required operation range via potentiometers. First the lower limit of the operating range (4 mA) is set with potentiometer 2. The lower limit accords to the preset minimum flow. The red LED illuminates. Then the upper value of the operating range is adjusted with potentiometer 1. At the upper limit, the maximum flow velocity accords to an output of 20 mA. The output signal is indicated via six LEDs.



Selection table

Type	Ident.-no.	AF	Thread
FCS-G1/2A4P-LIX-H1141/D037	68 700 58	27	G1/2

Flow controls – standard range

INSERTION AND INLINE SENSORS

STANDARD RANGE

Flow controls with separate processors come with different threads (G1/4, G1/2, G3/4, GL1/2 und NPT1/2) and are primarily suited for monitoring of liquid media.

TURCK offers a special range of sensors for higher medium temperatures. These are equipped with a Teflon cable and withstand temperatures of up to 120 °C; their short-term rating ranges up to 135 °C.

Sensors with an especially high pressure resistance of up to 600 bar enable flow control in compressor or hydraulic systems.

Special lengths are available on request to allow flow monitoring in applications with large pipe diameters.

The standard range comprises sensor lengths of 80, 120 and 200 mm which provide diverse mounting possibilities in combination with a flange cover.



Just like for high flow rates, we have special sensors for very low flow rates: our inline sensors detect liquid media in a range of 5...1800 ml/min.

We have the right solution for your application!

Flow controls – standard range

Insertion style sensors stainless steel (AISI316TI)



- **Sensors with separate processor**
- **Stainless steel AISI316TI (1.4571) sensor housing**
- **Pressure resistance:**
 - standard: up to 100 bar
 - extended: up to 500 bar
- **Temperature range:**
 - standard: -20...+80 °C
 - extended: +10...+120 °C
- **Protection degree:**
 - connector versions: IP67
 - cable versions: IP68
- **Special lengths up to 200 mm**
- **Customized versions with regard to:**
 - construction
 - connection
 - housing material

The insertion sensors, series FCS-...-NA..., serve to monitor liquid media in a range of 1...300 cm/s.

The sensor is designed to be directly installed into the flow line by means of a pipe-tee or welded pipe socket, with the probe inserted into the flow.

These sensors require a remote signal processor to operate.

The following signal processors are available:

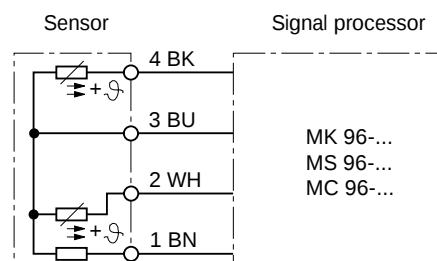
- MK96... (18 mm wide terminal housing, series *multisafe*®)
- MS96... (50 mm wide modular housing, series *multimodul*)
- MC96... (19" Eurocard format, series *multicart*®)

All necessary settings for the correct function of these sensors are programmed on the signal processor (for mounting and operating instructions see section 8).

The processor types MC96-... and MS96-... used in conjunction with the sensor provide additional **fluid temperature monitoring** and **switch off delay functions**.

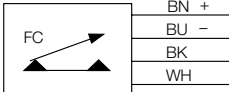
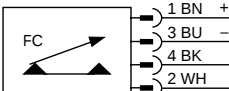
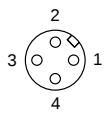
Operating ranges (depending on flow media)

- water 1...150 cm/s
- oil 3...300 cm/s

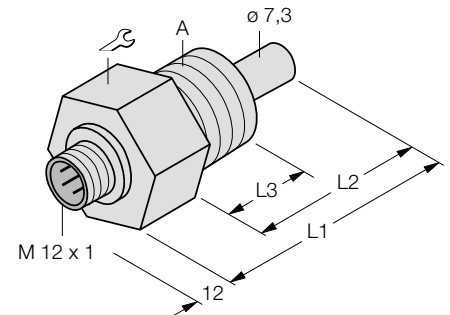


Insertion sensors: stainless steel (AISI316Ti)

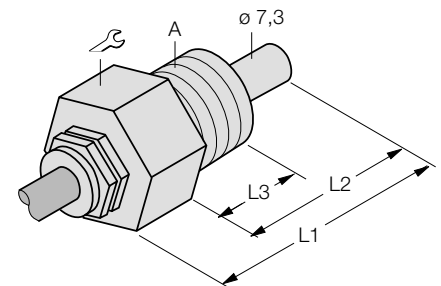
Mounting guidelines see section 8, "Technology and handling"

Temperature range (medium)	-20...+80 °C
Operating range (flow speed)	
– water	1...150 cm/s
– oil	3...300 cm/s
Availability	typ. 8 s (2...15 s)
Switch-on time	typ. 2 s (1...13 s)
Switch-off time	typ. 2 s (1...15 s)
Response time to change in temperature or temperature gradient	≤ 12 s max. 250 K/min
Pressure resistance	100 bar
Housing material (acc.to DIN 2462/17440)	stainless steel A4 (AISI316Ti - no. 1.4571)
Protection degree (IEC 60529/EN 60529)	
– connector devices	IP67
– cable devices	IP68
Ambient temperature	-20...+80 °C
Fixing torque	100 Nm
Connection	
– PVC cable (4 x 0.25 mm ²) 2 m long (other lengths on request)	
– pin configuration: connector, system <i>eurocon</i> (M 12 x 1) connectors (seen from the view of contacts)	 
Accessories	2 seals for G threads

Dimensions



– Connector device



– Cable device

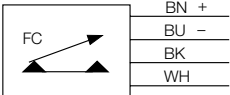
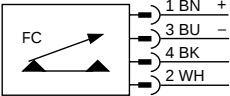
Selection table

Type	Ident-no.	Cable	Connector	Thread A	AF	Dimensions		
						L1	L2	L3
FCS-G1/4A4-NA-H1141	68 703 04	•	•	G1/4	19	37	25	10
FCS-G1/2A4-NA	68 703 38	•	•	G1/2	27	46	31	15
FCS-G1/2A4-NA-H1141	68 703 03	•	•	G1/2	27	46	31	15
FCS-GL1/2A4-NA	68 704 02	•	•	G1/2 long	27	63	48	29
FCS-GL1/2A4-NA-H1141	68 704 03	•	•	G1/2 long	27	63	48	29
FCS-G3/4A4-NA-H1141	68 703 06	•	•	G3/4	32	47	32	15
FCS-N1/2-A4-NA	68 713 09	•	•	NPT1/2	27	55	40	19
FCS-N1/2A4-NA-H1141	68 713 03	•	•	NPT1/2	27	55	40	19

Flow controls – standard range

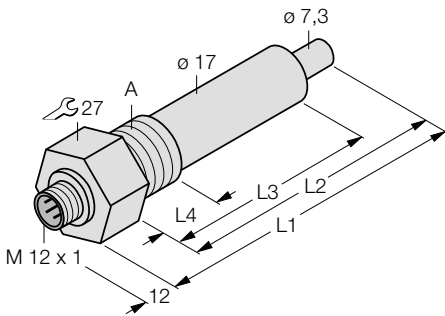
Insertion sensors: long housing style

Mounting guidelines see section 8, "Technology and handling"

Temperature range (medium)	-20...+80 °C
Operating range (flow speed)	
– water	1...150 cm/s
– oil	3...300 cm/s
Availability	typ. 8 s (2...15 s)
Switch-on time	typ. 2 s (1...13 s)
Switch-off time	typ. 2 s (1...15 s)
Response time to change in temperature or temperature gradient	≤ 12 s max. 250 K/min
Pressure resistance	100 bar
Housing material (acc. to DIN 2462/17440)	stainless steel A4 (AISI316Ti - no. 1.4571)
Protection degree (IEC 60529/EN 60529)	IP67
Ambient temperature	-20...+80 °C
Fixing torque	100 Nm
Connection	
– PVC cable (4 x 0.25 mm²) 2 m long (other lengths on request)	
– pin configuration: connector, system <i>eurocon</i> (M 12 x 1) connectors (seen from the view of contacts)	

Accessories	2 seals for G threads
-------------	-----------------------

Dimensions



Insertion sensors: extended temperature range

Mounting guidelines see section 8, "Technology and handling"

Temperature range (medium) +10...+120 °C (continuous temperature)
up to +135 °C (short-term)

Dimensions

Operating range (flow speed)

– water 1...150 cm/s
– oil 3...300 cm/s

Availability

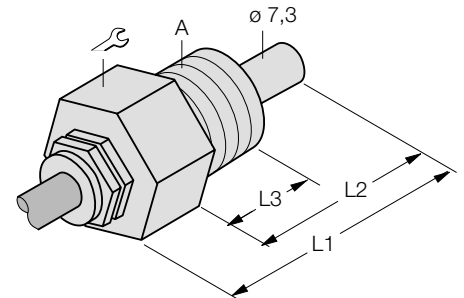
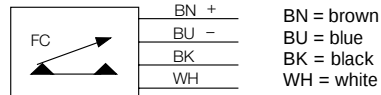
Switch-on time typ. 8 s (2...15 s)
Switch-off time typ. 2 s (1...13 s)
Response time to change in temperature or temperature gradient typ. 2 s (1...15 s)
≤ 12 s
max. 250 K/min

Pressure resistance 100 bar

Housing material (acc. to DIN 2462/17440) stainless steel A4 (AISI316Ti - no. 1.4571)
Protection degree (IEC 60529/EN 60529) IP68
Ambient temperature -20...+80 °C
Fixing torque 100 Nm

Connection

– PTFE cable (4 x 0.25 mm²)
2 m long (other lengths on request)



- Cable device

Accessories 2 seals for G threads

Selection table

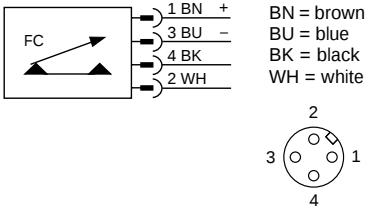
Type	Ident-no.	Thread A	 AF	Dimensions		
				L1	L2	L3
FCS-G1/4A4-NA/D100	68 704 11	G1/4	19	37	25	10
FCS-G1/2A4-NA/D100	68 704 12	G1/2	27	46	31	15
FCS-GL1/2A4-NA/D100	68 704 18	G1/2 long	27	63	48	29
FCS-N1/2A4-NA/D100	68 714 12	N1/2	27	55	40	19

Flow controls – standard range

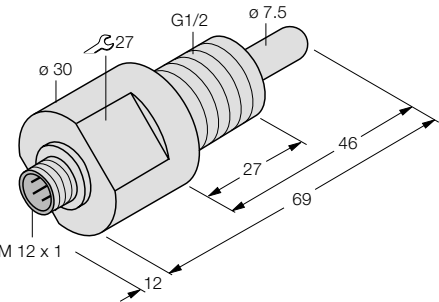
Insertion sensors: for high pressures up to 500 bar

Mounting guidelines see section 8, "Technology and handling"

Temperature range (medium)	-20...+80 °C
Operating range (flow speed)	
– water	1...150 cm/s
– oil	3...300 cm/s
Availability	typ. 8 s (2...15 s)
Switch-on time	typ. 2 s (1...13 s)
Switch-off time	typ. 2 s (1...15 s)
Response time to change in temperature or temperature gradient	≤ 12 s max. 250 K/min
Pressure resistance	500 bar
Dynamic pressure conditions	400 bar
Static pressure conditions	600 bar
Housing material (acc. to DIN 2462/17440)	stainless steel A4 (AISI316Ti - no. 1.4571)
Protection degree (IEC 60529/EN 60529)	IP67
Ambient temperature	-20...+80 °C
Fixing torque	100 Nm
Connection	
– pin configuration: connector, system <i>eurocon</i> (M 12 x 1)	
connectors (seen from the view of contacts)	



Dimensions

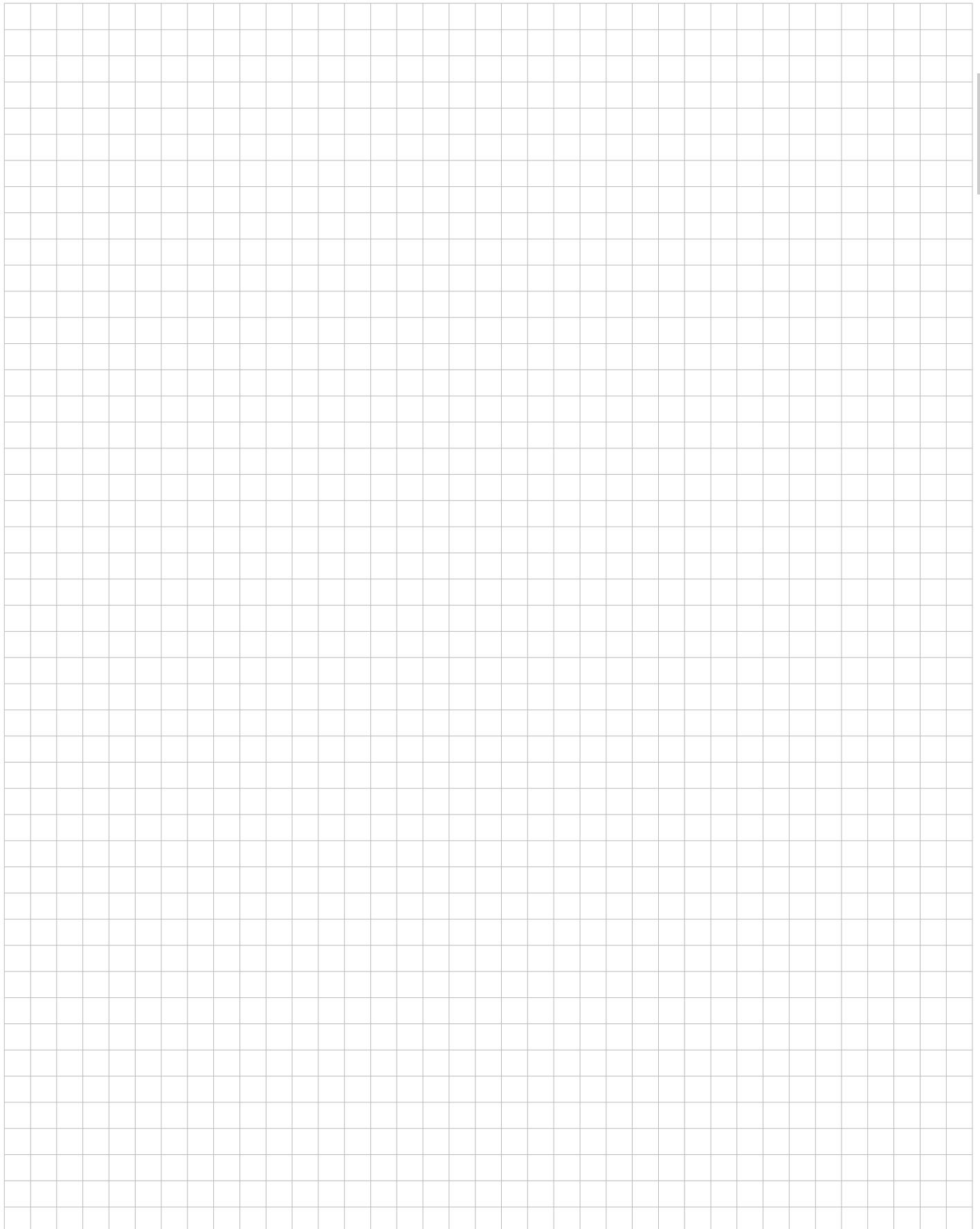


- Connector device

Accessories	2 seals for G-thread
-------------	----------------------

Selection table

Type	Ident-no.	AF	Thread
FCS-GL1/2A4-NA-H1141/D500	68 704 25	27	G1/2 long



Flow controls – standard range

Inline sensors for low flow rates



- **Sensors with separate processor**
- **Protection degree IP67**
- **Pressure resistance 5/10/16 bar (depending on type)**
- **Temperature range -20...+80 °C**
- **Sensor housing made of stainless steel AISI316Ti (1.4571) or Delrin**

FCI-D... series sensors are designed to be inserted directly ("in-line") into pipelines. There are all-metal sensors and plastic devices available.

The all-metal sensors are offered with an interior diameter of 3.5 mm and 9.3 mm. The various self-tapping screw connections are suited for 6, 10 oder 12 mm diameter pipe sizes. This type of connection is hermetical and pressure resistant.

The plastic devices are mounted via 4 mm tube connections. With pressures of more than 0.5 bar it is required to use tube clips.

The following signal processors are available:

- MK96... (18 mm wide terminal housing, series *multisafe*®)
- MS96... (50 mm wide modular housing, series *multimodul*)
- MC96... (19" Eurocard format, series *multicart*®)

All necessary settings for the correct function of these sensors are programmed on the signal processor (for mounting and operating instructions see section 8).

The processor types MC96-... and MS96-... used in conjunction with the sensor provide additional **fluid temperature monitoring** and **switch off delay functions**.

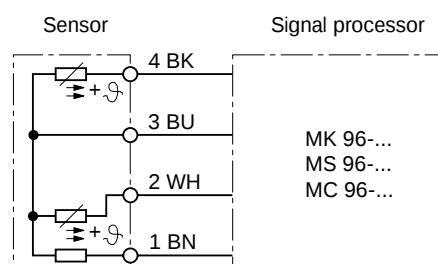
Operating ranges (depending on flow medium):

Interior diameter 3.5 or 4 mm:

- water 5 ... 150 ml/min
- oil 15 ... 300 ml/min

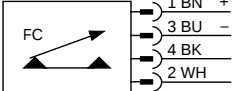
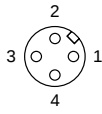
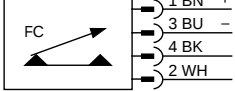
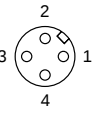
Interior diameter 9.3 mm:

- water 30 ... 900 ml/min
- oil 90 ... 1800 ml/min



Inline sensors: stainless steel (AISI316Ti)

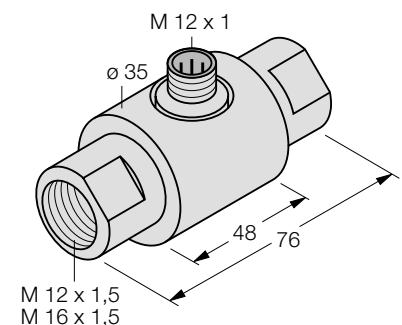
Mounting guidelines see section 8, "Technology and handling"

Interior diameter	3.5 mm	9.3 mm
Temperature range (medium)	-20...+80 °C	-20...+80 °C
Operating range (flow rate)		
– water	5...150 ml/min	30...900 ml/min
– oil	15...300 ml/min	90...1800 ml/min
Availability		
Switch-on time	typ. 8 s (2...15 s)	typ. 8 s (2...15 s)
Switch-off time	typ. 2 s (1...15 s)	typ. 2 s (1...15 s)
Response time to change in temperature or temperature gradient	typ. 2 s (1...15 s) ≤ 12 s max. 250 K/min	typ. 2 s (1...15 s) ≤ 12 s max. 250 K/min
Pressure resistance	10 bar	16 bar
Maximum flow rate	300 l/h	1800 l/h
Housing material	stainless steel A4 (AISI316Ti - no. 1.4571)	stainless steel A4 (AISI316Ti - no. 1.4571)
Protection degree (IEC 60529/EN 60529)	IP67	IP67
Connection	– pin configuration: connector, system <i>eurocon</i> (M 12 x 1) connectors (seen from the view of contacts)  BN = brown BU = blue BK = black WH = white   BN = brown BU = blue BK = black WH = white 	

Accessories

Self-tapping screw connection acc. to DIN 2353 (see section 7 "Accessories")
These are not included in delivery; please order 2 self-tapping screws per device.

Dimensions



- Connector device

Selection table

Type	Ident-no.	Interior diameter mm	Type of self-tapping screw depending on pipe diameter		
			6 mm	10 mm	12 mm
FCI-D03A4-NA-H1141/M12	68 706 35	3.5	FSV-D06/M12 68 730 02	–	–
FCI-D03A4-NA-H1141/M16	68 706 33	3.5	–	FSV-D10/M16 68 730 01	FSV-D12/M16 68 730 03
FCI-D09A4-NA-H1141/M16	68 706 31	9.3	–	FSV-D10/M16 68 730 01	FSV-D12/M16 68 730 03

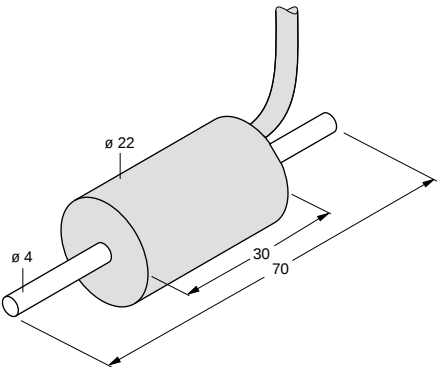
Flow controls – standard range

Inline sensors: Delrin

Mounting guidelines see section 8,
„Technology and handling“

Temperature range (medium)	-5...+70 °C
Operating range (Durchflussmenge)	
– water	5...150 ml/min
– oil	15...300 ml/min
Availability	typ. 8 s (2...15 s)
Switch-on time	typ. 2 s (1...15 s)
Switch-off time	typ. 2 s (1...15 s)
Response time to change in temperature or temperature gradient	≤ 12 s max. 250 K/min
Pressure resistance	5 bar
Max. flow rate	300 l/h
Housing material	Delrin
Material of measuring pipe	stainless steel A4 - AISI316TI (no. 1.4571)
Protection degree (IEC 60529/EN 60529)	IP68
Connection	
– PVC cable (4 x 0.25 mm²) 2 m long (other lengths on request)	FC BN + BU – BK WH BN = brown BU = blue BK = black WH = white

Dimensions



- Cable device

Selection table

Type	Ident-no.	Measuring pipe	Diameter
FCI-D03A4P-NA	68 706 37	AISI316TI	4 mm

FLOW SENSORS FOR THE FOOD AND PHARMA- CEUTICAL INDUSTRY

In the food and pharmaceutical industry, detection, monitoring and display of flows are challenging tasks. DIN norms and other regulations clearly define constructional standards to ensure the highest level of hygiene within the production process.

Standard such as

- DIN 11864 - (aseptic) threaded pipe connections
- DIN 11851 - pipe connections in the dairy industry
- 3 A Sanitary standard US No. 803/28-02
- DIN 32676 - threaded clamp connections

are aimed both at equipment manufacturers and equipment users. Their goal is to implement the highest level of hygiene and thus to prevent microbiological contamination of products.

Some essential features of flow controls in these areas of application are:

- the housing style
- the housing material
- the surface quality
- excellent temperature rating and resistance

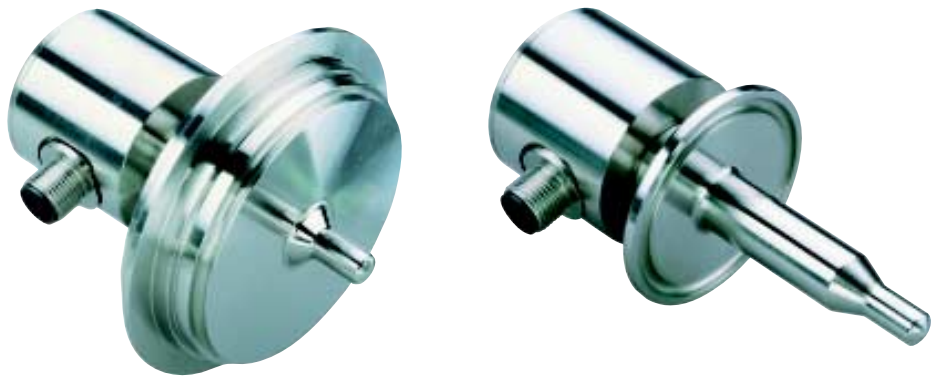


The diversity of our housing styles matches the specific constructions of frequently installed aseptic pipe connections. TURCK has paved the way for many new developments in this field by reacting flexibly to customer needs, in particular with regard to housing style and function. TURCK provides made-to-measure solutions for your application!



Flow controls for the food and pharmaceutical industry

Self-contained devices stainless steel AISI316L transistor output



- **Suited for the food industry**
- **Sensor and processor incorporated in a compact stainless steel housing**
- **Pressure resistant up to 10 bar**
- **Protection degree IP67**
- **Temperature compensation**
- **Simple adjustment via potentiometer**
- **Transistor output, pnp, short-circuit protected**

This range of self-contained devices has been designed particularly for the food industry. The high requirements of this branch of industry are fulfilled by providing appropriate housing materials and special housing designs which are usually specified by the system engineer.

Depending on the type of DIN connection and housing material, these devices can be used in the

- chemical, pharmaceutical and cosmetics industry
- bio-medical industry
- food and beverage industry.

The connections are built to match the respective measuring junctions. The devices are made of stainless steel AISI316L (no 1.4404) .

A potentiometer located under the protective screw cap on the front of the device serves to adjust the setpoint.

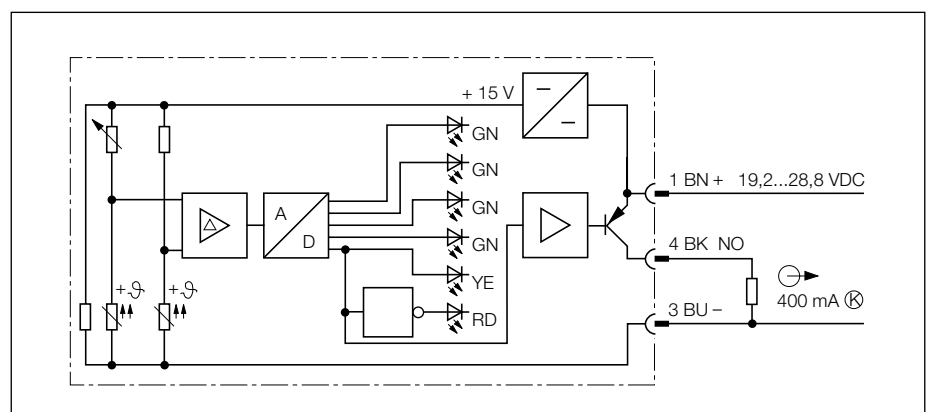
6 LEDs indicate the actual flow conditions relative to the setpoint:

- red LED: flow is below setpoint
- yellow LED: flow is at or above setpoint
- green LEDs: degree of setpoint overrange (1, 2, 3 or 4 LEDs are lit)

When the red LED illuminates, the output is de-energised; when the yellow LED illuminates, the output is energised.

Operating ranges (depending on flow media):

- water 1...150 cm/s
- oil 3...300 cm/s

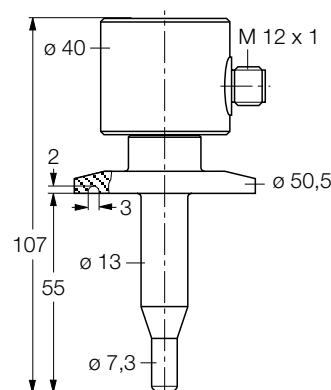


Self-contained devices: stainless steel, transistor output

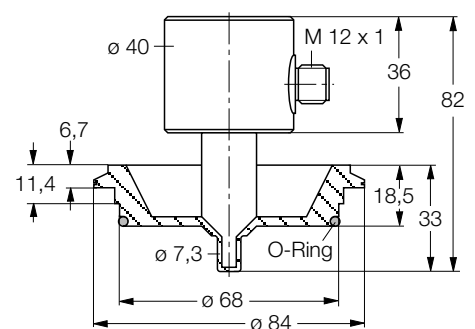
Type Ident-no.	FCS-50A4-AP8X-H1141/D014 68 720 25	FCS-68A4-AP8X-H1141/D003 68 720 03
Supply voltage U_B Current consumption	19.2...28.8 VDC ≤ 65 mA	19.2...28.8 VDC ≤ 65 mA
Output Switching current Voltage drop (at I_{max})	transistor, pnp, short-circuit and reverse polarity protection 400 mA ≤ 1.5 V	transistor, pnp, short-circuit and reverse polarity protection ≤ 400 mA ≤ 1.5 V
Temperature range (medium)	0...+80 °C (continuous temperature) up to +100 °C (for approx. 10 min)	0...+80 °C (continuous temperature) up to +100 °C (for approx. 10 min)
Operating range (flow rate) – water – oil	1...150 cm/s 3...300 cm/s	1...150 cm/s 3...300 cm/s
Availability Switch-on time Switch-off time Response time to change in temperature or temperature gradient	typ. 8 s (2...15 s) typ. 2 s (1...13 s) typ. 2 s (1...15 s) ≤ 12 s 250 K/min	typ. 8 s (2...15 s) typ. 2 s (1...13 s) typ. 2 s (1...15 s) ≤ 12 s 250 K/min
Pressure resistance	10 bar	10 bar
LED indications – below setpoint – at setpoint, output switched – above setpoint	red yellow 4 x green (in addition to yellow LED)	red yellow 4 x green (in addition to yellow LED)
Housing material (acc. to DIN 2462/17440) Protection degree (IEC 60529/EN 60529) Ambient temperature	stainless steel AISI316L (no. 1.4404) IP67 -20...+60 °C	stainless steel AISI316L (no. 1.4404) IP67 -20...+60 °C
Connection	connectors, system <i>eurocon</i> (M 12 x 1)	connectors, system <i>eurocon</i> (M 12 x 1)
Accessories	1 screwdriver for switch point adjustment	1 screwdriver for switch point adjustment 1 O-ring seal, 65 x 3, Viton

Dimensions

Tri-Clamp connection

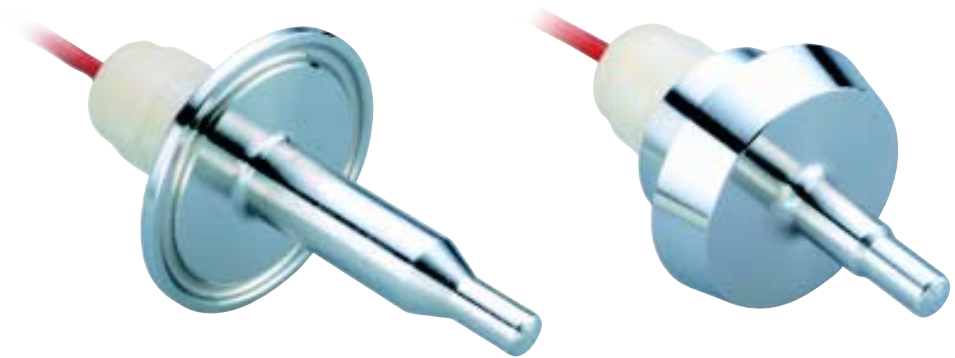


Varivent connection



Flow controls for the food and pharmaceutical industry

Insertion style sensors stainless steel AISI316



- Suited for the food industry
- Sensor with PTFE cable
- Pressure resistant up to 10 bar
- Excellent response time
- Protection degree IP68
- Temperature compensation

This range of sensors has been designed particularly for the food industry. The high requirements of this branch of industry are fulfilled by providing appropriate housing materials and special housing designs which are usually specified by the system engineer.

Depending on the type of DIN connection and housing material, these devices can be used in the

- chemical, pharmaceutical and cosmetics industry
- bio-medical industry
- food and beverage industry.

The connections are built to match the respective measuring junctions.

The devices are made of stainless steel AISI316L (no 1.4404) .

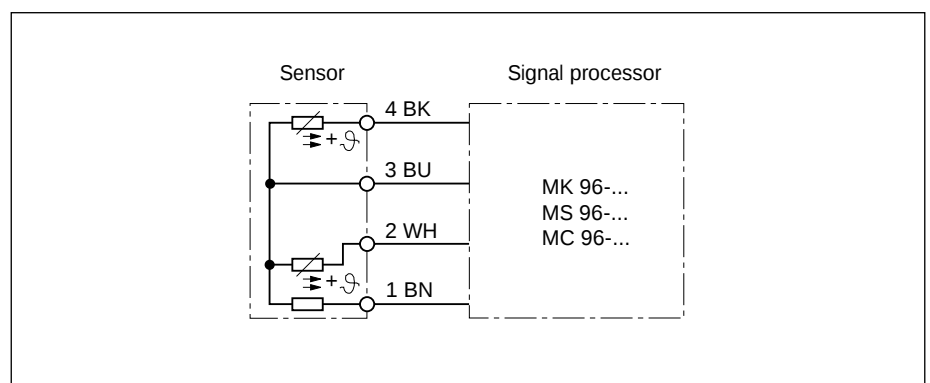
These sensors require a remote signal processor to operate.

The following signal processors are available:

- MK96... (18 mm wide terminal housing, series *multisafe*®)
- MS96... (50 mm wide modular housing, series *multimodul*)
- MC96... (19" Eurocard format, series *multicart*®)

Operating ranges (depending on flow media)

- water 1...150 cm/s
- oil 3...300 cm/s





Insertion sensors: stainless steel AISI316L, acc. to 3A sanitary standard

3A Certificate no. 803
Sanitary Standard 28-02
(flow controls for milk and dairy products)

Temperature range (medium) +10...+120 °C

Operating range (flow rate)

- water 1...150 cm/s
- oil 3...300 cm/s

Availability

- Switch-on time typ. 8 s (2...15 s)
- Switch-off time typ. 2 s (1...13 s)
- Response time to change in temperature or temperature gradient typ. 2 s (1...15 s)
- ≤ 12 s
- max. 250 K/min.

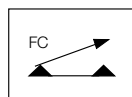
Pressure resistance 10 bar

Housing material (acc. to DIN 2462/17440) stainless steel AISI316L (no. 1.4404)

- Surface quality ≤ 0.8 µm
- Protection degree (IEC 60529/EN 60529) IP68
- Ambient temperature -20...+80 °C
- Cable screw connection PVDF

Connection

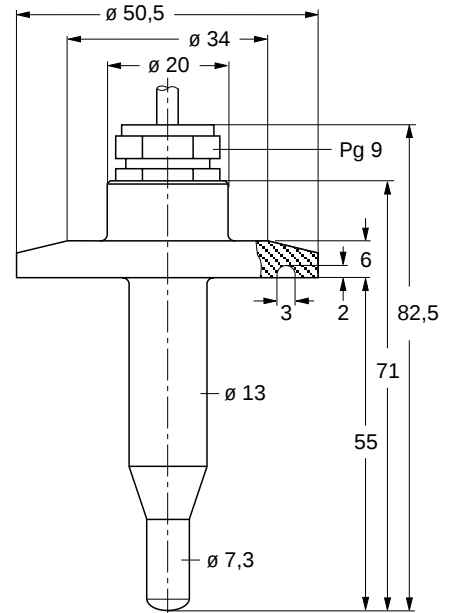
- PTFE cable (4 x 0.25 mm²)
- 2 m long (other lengths on request)



BN +
BU -
BK
WH

BN = brown
BU = blue
BK = black
WH = white

Dimensions



- Tri-Clamp connection

Selection table

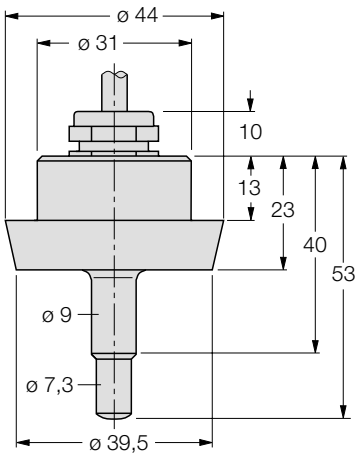
Type	Ident-no.	Housing material	Cable length
FCS-50A4-NA/D014	68 720 09	AISI316L - A4 (no.1.4404)	2 m

Flow controls for the food and pharmaceutical industry

Insertion sensors: stainless steel AISI316L, for pipe connections acc. to DIN 11851

Temperature range (medium)	+10...+120 °C
Operating range (flow rate)	
– water	1...150 cm/s
– oil	3...300 cm/s
Availability	typ. 8 s (2...15 s)
Switch-on time	typ. 2 s (1...13 s)
Switch-off time	typ. 2 s (1...15 s)
Response time to change in temperature or temperature gradient	≤ 12 s max. 250 K/min.
Pressure resistance	10 bar
Housing material (acc. to DIN 2462/17440)	stainless steel AISI316L (no. 1.4404)
Surface quality	≤ 0.8 µm
Protection degree (IEC 60529/EN 60529)	IP68
Ambient temperature	-20...+80 °C
Connection	
– PTFE cable (4 x 0.25 mm²) 2 m long (other lengths on request)	FC BN + BU - BK WH BN = brown BU = blue BK = black WH = white

Dimensions

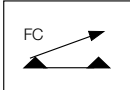


– Conical connection acc. to DIN 11851

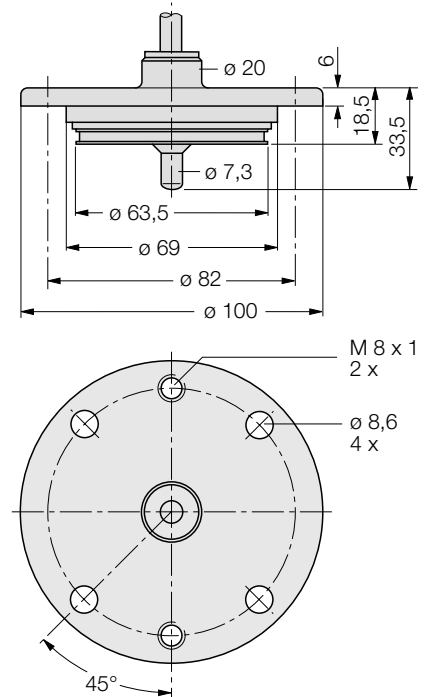
Selection table

Type	Ident-no.	Housing material	Cable length
FCS-DN25A4-NA/D100	68 720 17	AISI316L - A4 (no.1.4404)	2 m

Insertion sensors: stainless steel AISI316TI

Temperature range (medium)	+10...+120 °C
Operating range (flow rate)	
– water	1...150 cm/s
– oil	3...300 cm/s
Availability	typ. 8 s (2...15 s)
Switch-on time	typ. 2 s (1...13 s)
Switch-off time	typ. 2 s (1...15 s)
Response time to change in temperature or temperature gradient	≤ 12 s max. 250 K/min.
Pressure resistance	10 bar
Housing material (acc. to DIN 2462/17440)	stainless steel AISI316TI (no. 1.4571)
Surface quality	≤ 0.8 µm
Protection degree (IEC 60529/EN 60529)	IP68
Ambient temperature	-20...+80 °C
Connection	
– PTFE cable (4 x 0.25 mm ²) 2 m long (other lengths on request)	 BN + BU - BK - WH - BN = brown BU = blue BK = black WH = white

Dimensions

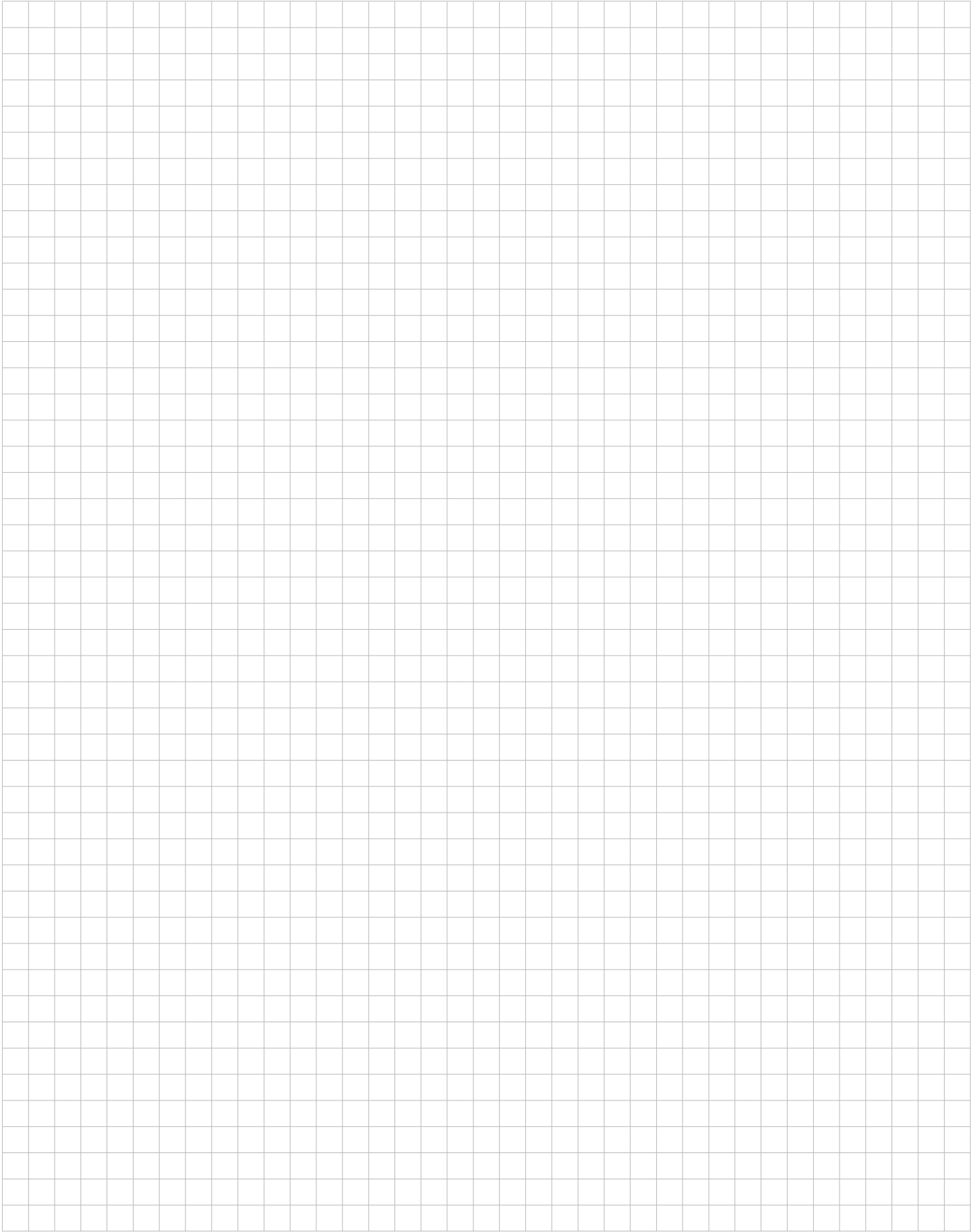


– Varivent connection

Selection table

Type	Ident-no.	Housing material	Cable length
FCS-68A4-NA/D011	68 720 06	AISI316TI - A4 (no.1.4571)	2 m

Flow controls for the food and pharmaceutical industry



FLOW CONTROLS WITH CHEMICAL RESISTANCE

In applications with hostile and corrosive fluids the housing material stainless steel quite often does not provide the degree of chemical resistance needed. TURCK has met this challenge by developing flow sensors made of chemically resistant plastics such as Teflon (PTFE) and Dyflor (PVDF), stainless steel alloys or Titanium.

Teflon and Dyflor sensors are most often used in applications where corrosion is a prime consideration. Due to the low thermal conductivity of these plastic materials compared to stainless steel sensors, they are slower and their operating range is rather limited.

An alternative are stainless steel alloys which combine the advantages of stainless steel and plastic sensors. These alloys feature chemical resistance, good thermal conductivity and high pressure resistance. In this range, TURCK offers devices made of Hastelloy, Monel and Tantal.

Titanium sensors with a ceramic metal coating are the ideal choice if an especially abrasion-resistant material is needed. This special coating provides the sensor with approx. the same chemical resistance as Teflon.



For those applications, which are not only subject to corrosion but also to explosion hazards, TURCK offers intrinsically safe sensors with chemical resistance.

Flow sensors with chemical resistance

Self-contained devices Insertion style sensors



- Protection degree IP67
- A variety of housing materials for aggressive media: PVDF, PTFE, Titanium, Hastelloy
- Customer-specific housing materials possible

Chemically resistant flow controls

If the material stainless steel AISI316Ti is not resistant enough to withstand the corrosive medium, it is of great importance to select the appropriate housing material. A basic principle is: the sensor housing should be made of the same material as the pipes, containers, or other system parts in which the sensor is to be installed.

Following please find some information on chemically resistant materials and their fields of application. When selecting the housing material, please observe that not only the concentration of the corrosive material but also the temperature has a significant influence on the material's resistance.

We recommend consulting Turck prior to selecting a material for such applications.

PVDF (Dyflor)

PVDF (Dyflor) has properties that are almost chemically inert against abrasion and corrosion. Some exceptions are sulfuric acid, nitric acid, hydrofluoric acid, acetic acid, aqueous sodium hydroxide, and several other solvents.

PTFE (Teflon)

PTFE is a thermoplastic material which withstands frictional wear and is thus ideally suited for highly abrasive media. It is also resistant against almost all media used in hydraulic systems, fuels and solvents. It is not resistant against elementary fluor.

In addition to plastic materials, it is also possible to use Titanium and extremely corrosion resistant alloys (more information in section 8, "Technology and handling").

Titanium

Titanium housings with ceramic metal coating are used in applications in which the resistance of steel is not sufficient, or when an especially abrasion resistive material is required. The combination of the Titanium body and the ceramic metal coating provides the sensor with properties similar to PTFE (Teflon); the exception are acids composed of halogen (e. g. Cl, F). Another field of application are chloride-bearing substances, saline fluids, e.g. sea water.

Hastelloy

Hastelloy B2 (2.4617), a nickel-molybdenum alloy, features an excellent resistance against sulfuric acids, acetic acids, phosphoric acids and hydrogen chloride.

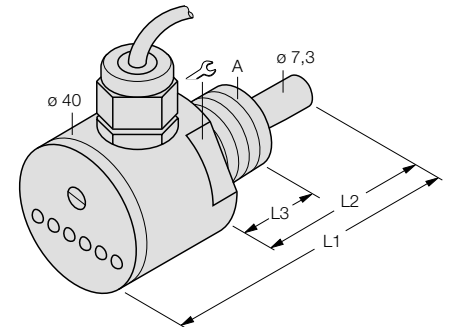
Hastelloy C22 (2.4602) is especially resistant against corrosion caused by reducing and chloride-bearing media.

Self-contained devices: PVDF (Dyflor) housings, transistor output

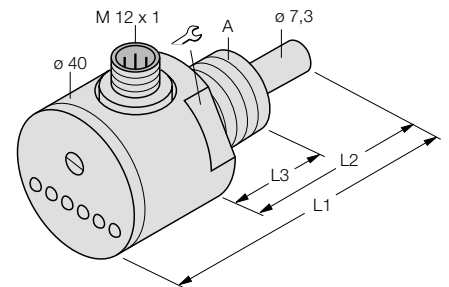
For mounting guidelines see section 8, "Technology and handling"

Supply voltage U_B	19.2...28.8 VDC (incl. ripple)
Current consumption	≤ 70 mA
Output	transistor, pnp short-circuit and reverse polarity protection
Switching current	≤ 400 mA
Voltage drop (at I_{max})	≤ 1.5 V
Temperature range (medium)	-10...+80 °C
Operating range (flow rate)	
– water	1...70 cm/s
– oil	2...100 cm/s
Availability	typ. 60 s (40...100 s)
Switch-on time	typ. 30 s (5...50 s)
Switch-off time	typ. 30 s (5...50 s)
Response time to change in temperature or temperature gradient	typ. 100 s (50...150 s) typ. 30 K/min. (60...20)
Pressure resistance	5 bar
LED indications	
– below setpoint	red
– at setpoint, output switched	yellow
– setpoint exceeded	4 x green (in addition to yellow LED)
Housing material	PVDF (Dyflor)
Sensor material	PVDF (Dyflor)
Protection degree(IEC 60529/EN 60529)	IP67
Ambient temperature	-10...+70 °C
Fixing torque	5 Nm

Dimensions



– Cable device



– Connector device

- PTFE cable (3 x 0.25 mm²) 2 m long (other lengths on request) - Pin configuration: connectors, system <i>eurocon</i> (M 12 x 1) connectors (from the view of the contacts)		BN = brown BU = blue BK = black

Accessories	seals for G threads 1 screwdriver
--------------------	--------------------------------------

Selection table

Type	Ident.-no.	Cable	Connector	Thread A	AF	Dimensions		
						L1	L2	L3
FCS-G1/2DY-AP8X	68 700 05	●	●	G1/2	36	67	30	12
FCS-G1/2DY-AP8X-H1141	68 700 03			G1/2	36	67	30	12

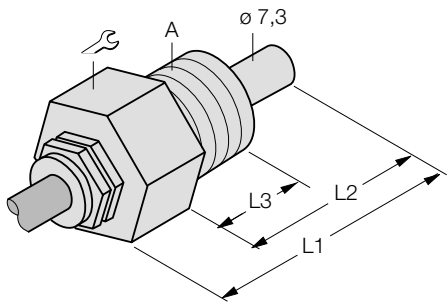
Flow sensors with chemical resistance

Insertion sensors: PTFE (Teflon) housings

For mounting guidelines see section 8, "Technology and handling"

Temperature range (medium)	-10...+70 °C
Operating range (flow rate)	
– water	1...70 cm/s
– oil	2...100 cm/s
Availability	typ. 60 s (40...100)
Switch-on time	typ. 30 s (10...50)
Switch-off time	typ. 30 s (10...50)
Response time to change in temperature or temperature gradient	typ. 100 s (50...150) typ. 1 K/min. (60...20)
Pressure resistance	5 bar
Housing material	PTFE
Protection degree(IEC 60529/EN 60529)	IP67
Ambient temperature	-10...+70 °C
Fixing torque	5 Nm
Cable coupling	PVDF
Crimp seal	PVC
Connection	
– PTFE cable (4 x 0.25 mm²) 2 m long (other lengths on request)	FC BN + BU - BK WH BN = brown BU = blue BK = black WH = white
Accessories	2 seals for G threads

Dimensions



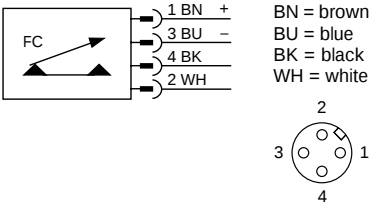
– Cable device

Selection table

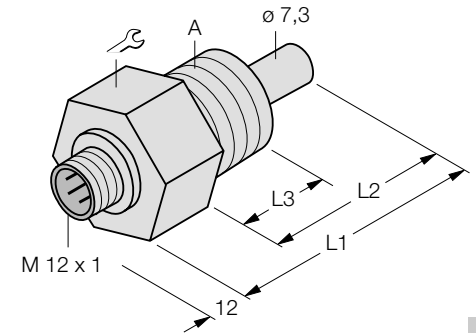
Type	Ident-no.	Thread A	 AF	Dimensions		
				L1	L2	L3
FCS-GL1/2T-NA	68 704 22	G1/2 lang	27	63	48	29
FCS-N1/2T-NA	68 714 22	NPT 1/2	27	55	40	19

Insertion sensors: Titanium housings with ceramic metal coating

For mounting guidelines see section 8, "Technology and handling"

Temperature range (Medium)	-20...+80 °C
Operating range (flow rate)	
– water	1...150 cm/s
– oil	3...300 cm/s
Availability	typ. 8 s (2...15 s)
Switch-on time	typ. 2 s (1...13 s)
Switch-off time	typ. 2 s (1...15 s)
Response time to change in temperature or temperature gradient	≤ 12 s max. 250 K/min.
Pressure resistance	100 bar
Housing material	Titanium with ceramic-metal coating
Protection degree(IEC 60529/EN 60529)	IP67
Ambient temperature	-20...+80 °C
Fixing torque	100 Nm
Connection	
– Pin configuration: connectors, system <i>eurocon</i> (M 12 x 1)	
connectors (from the view of the contacts)	
Accessories	2 seals for G-threads

Dimensions



– Connector device

3

Attention: In order to avoid any damage to the sensor coating during installation, use a Teflon ribbon in the metal thread couplings.

Selection table

Type	Ident-no.	Thread A	 AF	Dimensions		
				L1	L2	L3
FCS-G1/2TN-NA-H1141	68 703 11	G1/2	27	46	31	15
FCS-GL1/2TN-NA-H1141	68 704 08	G1/2 long	27	63	48	29

Flow sensors with chemical resistance



FLOW CONTROLS FOR EXPLOSION HAZARDOUS AREAS

In explosion hazardous areas it is required to use electrical equipment with constructional features that exclude ignition of a potentially explosive atmosphere.

TURCK flow controls for application in explosion hazardous areas meet protection type "intrinsic safety (i)". Here, the electrical energy in the intrinsically safe circuit is limited to such an extent that ignition of an explosive atmosphere is impossible.

All our intrinsically safe flow controls offer the same technical characteristics as TURCK's proven standard devices:

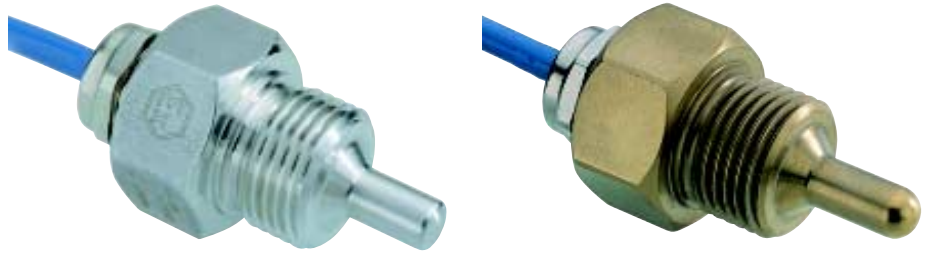
- robust housings
- switch-point stability even during temperature fluctuations
- short response times
- pressure resistance
- large temperature range



Intrinsically safe flow controls are suited for a wide range of applications: flow/no-flow monitoring, run-dry protection, leakage detection and level control are exemplary for the manifold monitoring tasks accomplished by this versatile sensor line.

Intrinsically safe flow controls for explosion hazardous areas

Intrinsically safe insertion sensors



- **Operating ranges:**
1... 200 cm/s for liquid media
2...20 m/s for gaseous media
- **Degree of protection:**
IP67 for connector versions and sensors with terminal chamber;
IP68 for sensors with integrated cable
- **Switch point stability even during fluctuations of medium temperature**
- **Standard housing material:**
stainless steel AISI316Ti (1.4571)
- **Variety of customer-specific designs**
- **For use in conjunction with processors approved for hazardous area applications**

Areas of application – Ex zones

TURCK offers special sensor series and types for monitoring of liquids and gases in explosion hazardous areas. These meet the specific requirements of the respective explosion zones.

Zone 0 is used to classify areas where a dangerous explosive atmosphere is present continuously or frequently.

Zone 1 is used to classify areas where a hazardous explosive atmosphere is present occasionally.

Devices with an approval for zone 0 may also be used in zone 1.

The device FC-BSEX-01 is an accessory especially designed for **lightning protection systems** according to German standards "TRbF" and "VbF" (see page 48).

Detailed **information on explosion protection and approvals** is contained in section 8 "Technology and handling".

Installation of sensors

Insertion style sensors, series FCS... , are mounted via a tee piece or a welded pipe socket so that the sensing probe inserts directly into the flow, which makes the sensor suited for a wide variety of pipe diameters. FCI... series sensors are inserted directly ("in-line") into the pipe line, i.e. the medium passes directly through the sensor.

Self-tapping screw couplings ensure pressure-proof and tight connections.

Electrical connection

Both insertion and inline sensors require the use of an approved processor suited for hazardous area applications.

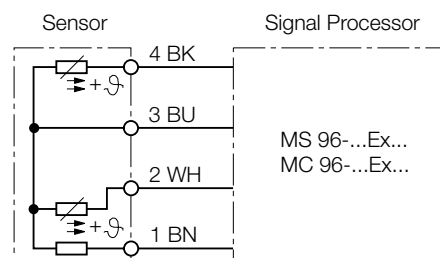
Please note that the processor must be mounted outside the explosion hazardous area or, if installed inside the explosion hazardous area, requires a special mechanical protection technique, e.g. a pressurised enclosure.

Our range of processors is available in 50 mm modular housings and on 19" Eurocard (see section 6, "Signal processors"). Eurocard versions also offer medium temperature monitoring.

Special designs/ customer-specific constructions

Alongside the standard range of intrinsically safe sensors, TURCK offers an extensive spectrum of customer-specific designs (see also page 47):

- special housing materials such as Tantal, Hastelloy, Titanium and coated sensors
- special housing lengths up to 300 mm
- high temperature versions up to 120 °C
- high pressure versions up to 500 bar
- intrinsically safe sensors for the food and pharmaceutical industry



Insertion sensor: zone 1, for liquid media

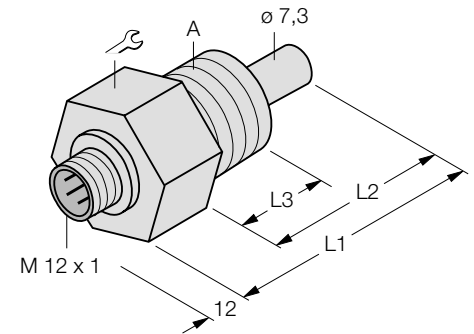
Mounting guidelines see section 8, "Technology and handling"

Ex-approval acc. to EC type examination certificate

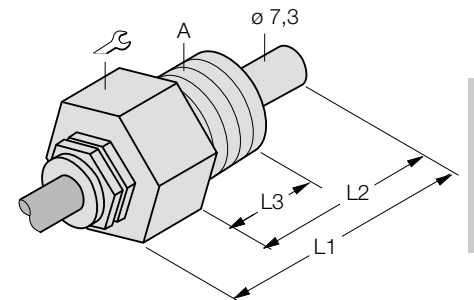
Marking	TÜV 99 ATEX 1518
Max. values	EEx ib IIC T6
– Power P_i	0.69 W
Internal inductances/capacitances	negligible
Temperature class depending on T_m (T_m = medium temperature)	T6: $T_m < 50\text{ °C}$ T5: $T_m < 65\text{ °C}$ T4: $T_m < 85\text{ °C}$



Dimensions



– Connector device



– Cable device

Temperature range (medium) -20...+85 °C

Operating range (flow speed)

– water	1...100 cm/s
– oil	3...200 cm/s

Availability

Switch-on time	typ. 8 s (2...18 s)
Switch-off time	typ. 2 s (1...13 s)
Response time to change in temperature	typ. 2 s (1...15 s)
Temperature gradient	≤ 12 s
	max. 250 K/min

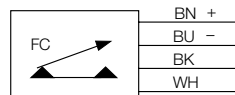
Pressure resistance 60 bar

Housing material (acc. to DIN 2462/17440)

Degree of protection (IEC 60529/EN 60529)	stainless steel A4 (AISI316Ti - no. 1.4571)
Ambient temperature	IP67 for connector versions
Fixing torque	IP68 for cable versions
	-20...+80 °C
	100 Nm

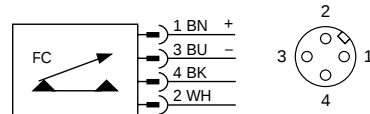
Connection

- PUR cable (4 x 0.25 mm²), 2 m long (other lengths on request)



BN = brown
BU = blue
BK = black
WH = white

- Connection: connectors, system *eurocon* (M 12 x 1); pin configuration (seen from the view of contacts)



Accessories

2 seals (for G-thread)

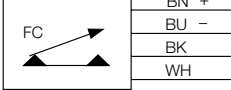
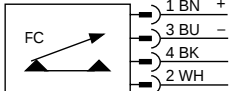
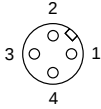
Series FCS B – selection table

Type	Ident-no.	Cable	Connector	Thread A	AF	Dimensions		
						L1	L2	L3
FCS-G1/4A4-NAEX	68 703 15	●		G1/4	19	37	25	10
FCS-G1/4A4-NAEX-H1141	68 703 41		●	G1/4	19	37	25	10
FCS-G1/2A4-NAEX	68 703 20	●		G1/2	27	46	31	15
FCS-G1/2A4-NAEX-H1141	68 703 22		●	G1/2	27	46	31	15
FCS-GL1/2A4-NAEX	68 704 30	●		G1/2 long	27	63	48	29
FCS-GL1/2A4-NAEX-H1141	68 704 32		●	G1/2 long	27	63	48	29
FCS-N1/2A4-NAEX	68 714 23	●		NPT1/2	27	55	40	18
FCS-N1/2A4-NAEX-H1141	68 713 22		●	NPT1/2	27	55	40	19

Intrinsically safe flow controls for explosion hazardous areas

Insertion sensors: zone 1, for gases

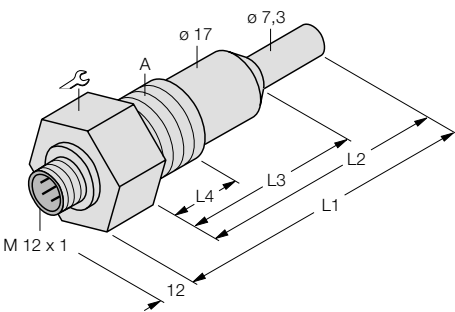
Mounting guidelines see section 8, "Technology and handling"

Ex-approval acc. to EC type examination certificate	
Marking	TÜV 99 ATEX 1518
Max. values	EEx ib IIC T6
– Power P_i	0.69 W
Internal inductances/capacitances	negligible
Temperature class depending on T_m (T_m = medium temperature)	T6: $T_m < 50\text{ °C}$ T5: $T_m < 65\text{ °C}$ T4: $T_m < 85\text{ °C}$
Temperature range (medium)	-20...+85 °C
Operating range (flow speed)	
– air	2...20 m/s
Availability	10...40 s
Response time to change in temperature Temperature gradient ¹⁾	120 s max. 1 K/min
Pressure resistance	10 bar
Housing material (acc. to DIN 2462/17440)	stainless steel A4 (AISI316Ti - no. 1.4571)
Degree of protection (IEC 60529/EN 60529)	IP67 for connector versions IP68 for cable versions
Ambient temperature	-20...+80 °C
Fixing torque	100 Nm
Connection	
– PUR cable (4 x 0.25 mm ²) 2 m long (other lengths on request)	 BN = brown BU = blue BK = black WH = white
– Connection: connectors, system <i>eurocon</i> (M 12 x 1); pin configuration (seen from the view of contacts)	 

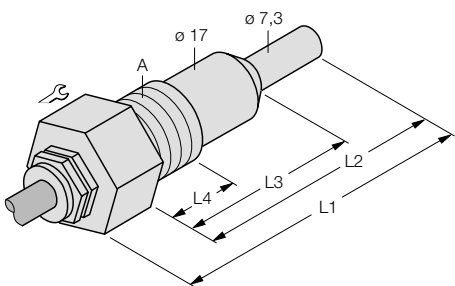
Accessories	2 seals (for G-thread)
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¹⁾ medium: air; flow speed 20 m/s

Dimensions



– Connector device



– Cable device

Series FCS B – selection table

Type	Ident.-no.	Cable	Connector	Thread A	 AF	Dimensions			
						L1	L2	L3	L4
FCS-G1/2A4-NAEX/AL065	68 703 24	●	●	G1/2	27	80	65	45	25
FCS-G1/2A4-NAEX-H1141/AL065	68 703 33	●	●	G1/2	27	80	65	45	25

Insertion sensors: zone 1, dual probe, for gases

Mounting guidelines see section 8, "Technology and handling"

Ex-approval acc. to EC type examination certificate

TÜV99 ATEX 1518
EEx ib IIC T6



Marking

Max. values

– Power P_i

0.69 W

Internal inductances/capacitances

negligible

Temperature class depending on T_m

T6: $T_m < 50\text{ °C}$

T5: $T_m < 65\text{ °C}$

T4: $T_m < 85\text{ °C}$

(T_m = medium temperature)

Temperature range (medium)

-20...+85 °C

Operating range (flow speed)

– air

2...20 m/s

Availability

5...20 s

Response time to change in temperature

60 s

Temperature gradient¹⁾

max. 20 K/min

Pressure resistance

10 bar

Housing material (acc. to DIN 2462/17440)

stainless steel A4 (AISI316Ti - no. 1.4571)

Degree of protection (IEC 60529/EN 60529)

IP67 for connector versions

IP68 for cable versions

Ambient temperature

-20...+80 °C

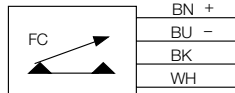
Fixing torque

100 Nm

Connection

– PUR cable (4 x 0.25 mm²)

2 m long (other lengths on request)



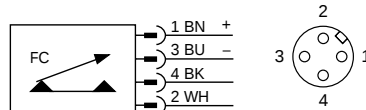
BN = brown
BU = blue
BK = black
WH = white

– Connection: connectors,

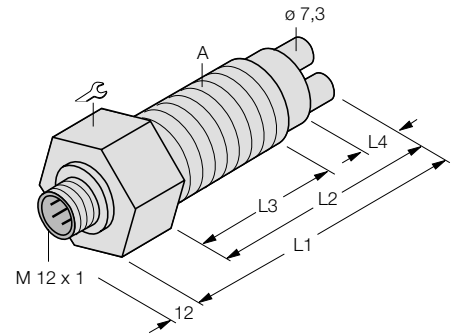
system *eurocon* (M 12 x 1);

pin configuration

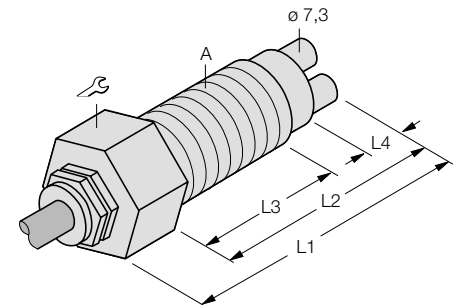
(seen from the view of contacts)



Dimensions



– Connector device



– Cable device

Accessories

2 seals

¹⁾ medium: air; flow speed 20 m/s

Series FCS B – selection table

Type	Ident-no.	Cable	Connector	Thread A	AF	Dimensions			
						L1	L2	L3	L4
FCS-GL1/2A4-NAEX/A	68 704 40	●	●	G1/2 long	27	63	48	30	9,5
FCS-GL1/2A4-NAEX-H1141/A	68 704 39			G1/2 long	27	63	48	30	9,5

Intrinsically safe flow controls for explosion hazardous areas

Inline sensors: zone 1, for liquid media

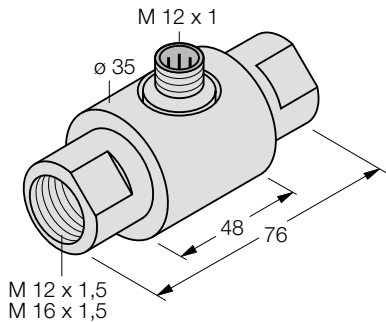
Mounting guidelines see section 8, "Technology and handling"

Ex-approval acc. to EC type examination certificate

Marking	TÜV 96 ATEX 1101
Max. values	EEx ib IIC T6...T4
– Power P_i	0.69 W
Internal inductances/capacitances	$L_i \leq 0.01$ mH; $C_i \leq 100$ pF
Temperature class depending on T_m	T6: $T_m < 50$ °C
(T_m = medium temperature)	T5: $T_m < 65$ °C
	T4: $T_m < 70$ °C



Dimensions



– Connector device

Temperature range (medium)

-20...+70 °C

Operating range (flow rate)

Interior diameter 3.5 mm	
– water	10...150 ml/min
– oil	25...300 ml/min
Interior diameter 9.3 mm	
– water	50...900 ml/min
– oil	150...1800 ml/min

Availability

Switch-on time	typ. 8 s (2...15 s)
Switch-off time	typ. 2 s (1...15 s)
Response time to change in temperature	typ. 2 s (1...15 s)
Temperature gradient	≤ 12 s
	max. 250 K/min

Pressure resistance

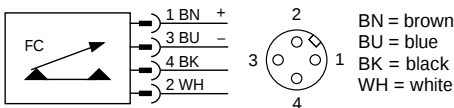
Maximum flow rate	6 bar
	300 (1800) l/h

Housing material

Degree of protection (IEC 60529/EN 60529)	stainless steel A4 (AISI316Ti - no. 1.4571)
Ambient temperature	IP67
	-20...+70 °C

Connection

- Connection: connectors, system *eurocon* (M 12 x 1); pin configuration (seen from the view of contacts)



Accessories

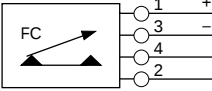
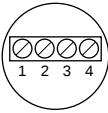
Self-tapping screw couplings to DIN 2353 (see section 7 "Accessories"). These screw couplings are not included in delivery, please order 2 pcs. per sensor.

Series FCI – selection table

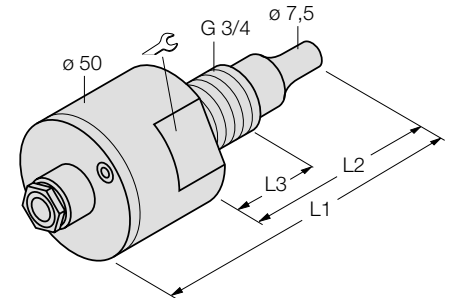
Inline sensors (self-tapping screw couplings DIN 2353)		Internal diameter	Required screw couplings (type/ident-no.) depending on pipe/diameter		
Type	Ident-no.		6 mm	10 mm	12 mm
FCI-D03A4-NAEX-H1141/M12	68 706 32	3.5 mm	FSV-D06/M12 68 730 02	–	–
FCI-D03A4-NAEX-H1141/M16	68 706 36	3.5 mm	–	FSV-D10/M16 68 730 01	FSV-D12/M16 68 730 03
FCI-D09A4-NAEX-H1141/M16	68 706 34	9.3 mm	–	FSV-D10/M16 68 730 01	FSV-D12/M16 68 730 03

Insertion sensors: zone 0, for liquid media

Mounting guidelines see section 8, "Technology and handling"

Ex-approval acc. to conformity certificate	PTB no. Ex-94.C.4014X	
Marking	EEX ib [ia] IIC T4	
Max. values		
– Power P_i	0.866 W	
Internal inductances/capacitances	$L_i \leq 0.01$ mH; $C_i \leq 100$ pF	
Temperature class	T4	
Temperature range (medium)	-20...+60 °C	
Operating range (flow speed)		
– water	1...100 cm/s	
– oil	3...200 cm/s	
Availability	typ. 8 s (2...8 s)	
Switch-on time	typ. 2 s (1...13 s)	
Switch-off time	typ. 2 s (1...15 s)	
Response time to change in temperature	≤ 12 s	
Temperature gradient	max. 250 K/min	
Pressure resistance	60 bar	
Housing material (acc. to DIN 2462/17440)	stainless steel A4 (AISI316Ti - no. 1.4571)	
Degree of protection (IEC 60529/EN 60529)	IP67	
Ambient temperature	-20...+60 °C	
Fixing torque	100 Nm	
Connection		
– Terminal chamber with PVC cable (4 x 0.75 mm ²), shielded, 2 m long (other lengths on request)		
Accessories	2 seals	

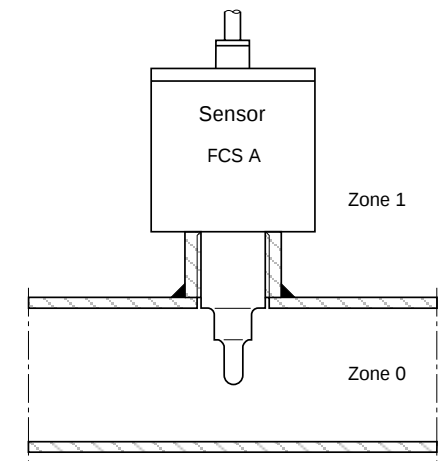
Dimensions



– Terminal chamber (with cable)

Mounting instructions:

The sensors must be installed in such a way that only the sensing tip and the thread are located in zone 0. The output of the sensor (see figure) is approved for zone 1.



Series FCS A – selection table

Type	Ident-no.	Terminal chamber	Thread	 AF	Dimensions		
					L1	L2	L3
FCS-GL3/4A4-NAEX0	68 704 28	●	G3/4 long	41	118	68	43

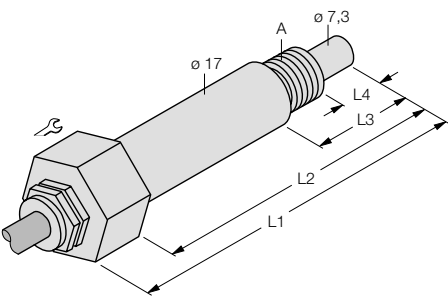
Intrinsically safe flow controls for explosion hazardous areas

Insertion sensors: zone 0, for liquid media

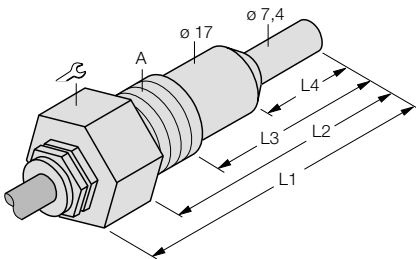
Mounting guidelines see section 8, "Technology and handling"

Ex-approval acc. to EC type examination certificate	
Marking	TÜV 99 ATEX 1517X
Max. values	EEx ia IIC T6
– Power P_i	0.866 W
Internal inductances/capacitances	$L_i \leq 0.01$ mH; $C_i \leq 100$ pF
Temperature class depending on T_m (T_m = medium temperature)	T6: $T_m < 45$ °C T5: $T_m < 60$ °C T4: $T_m < 60$ °C T3: $T_m < 60$ °C
Temperature range (medium)	-20...+60 °C
Operating range (flow speed)	
– water	1...100 cm/s
– oil	3...200 cm/s
Availability	typ. 8 s (2...8 s)
Switch-on time	typ. 2 s (1...13 s)
Switch-off time	typ. 2 s (1...15 s)
Response time to change in temperature	≤ 12 s
Temperature gradient	max. 250 K/min
Pressure resistance	60 bar
Housing material (acc. to DIN 2462/17440)	stainless steel A4 (AISI316Ti - no. 1.4571)
Degree of protection (IEC 60529/EN 60529)	IP68
Ambient temperature	-20...+60 °C
Fixing torque	100 Nm
Connection	
– PUR cable (4 x 0.25 mm ²), 2 m long (other lengths on request)	BN + BU – BK WH BN = brown BU = blue BK = black WH = white
Accessories	2 seals

Dimensions



– Cable device, thread G1/4



– Cable device, thread G1/2

Series FCS C – selection table

Type	Ident-no.	Thread A	 AF	Dimensions			
				L1	L2	L3	L4
FCS-G1/4A4-NAEX0/L065	68 703 43	G1/4	19	87	65	30	15
FCS-G1/2A4-NAEX0/L065	68 703 35	G1/2	27	87	65	45	18

Special versions for potentially explosive atmospheres – a versatile selection

Alongside the extensive standard line of flow controls for explosion hazardous areas, TURCK offers a wide range of special devices. These comprise customer-specific solutions with regard to housing style, housing material and connection mode as well as intrinsically safe devices for special conditions such as increased pressure, corrosive media and high temperatures.



Special threads, e.g. rear thread for system-specific mounting requirements.

The devices shown here present only a small selection of all the available varieties. Please consult TURCK for your specific application - we are looking forward to assisting you in finding the right device!



Sensors with screw or welded flange plates for installation in containers or pipes and for applications in the food and pharmaceutical industry.

Special housing materials such as Tantal, Hastelloy, Titanium or coated sensors for hazardous area applications withstand corrosive media.



Sensors with a length of up to 300 mm for large pipe diameters and long welded pipe couplings.

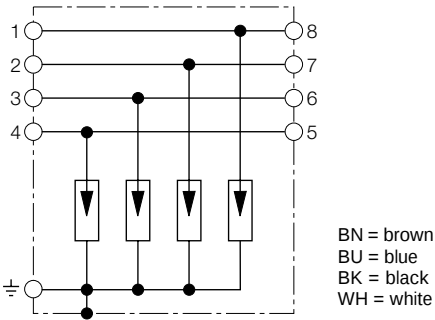
High pressure sensors for up to 500 bar and high temperature versions for up to 120 °C for the chemical industry complement this line of products.

Intrinsically safe flow controls for explosion hazardous areas

Accessories: lightning protection system

Type	FC-BSEX-01	
Ident-no.	6875020	
Ex approval acc. to conformity certificate	PTB-no. Ex-94.C.4014X	

Connection



Application

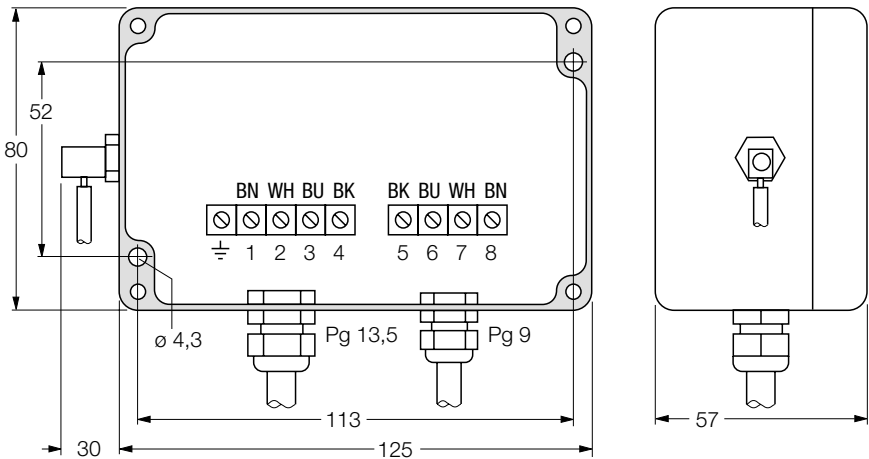
When using intrinsically safe sensors, e.g. for level control in surface containers, the use of a lightning protection system may be prescribed by the governing regulations, e.g. in Germany the standards "TRbF " (technical regulations for flammable liquids) and the "VbF" (directive on combustible liquids) contain such regulations. Always install the lightning protection system in direct proximity to the cable entry of the cable leading to zone 0.

Switching device conductor colours	FC-BSEX-01	FC-BSEX-01	Sensor conductor colours
BN WH BU BK	terminal 1 terminal 2 terminal 3 terminal 4	terminal 8 terminal 7 terminal 6 terminal 5	BN WH BU BK

Mounting instructions

With pipe lengths of more than 3 m, it is required to use either a protective cable conduit or a shielded cable. The conduit and cable must be earthed.

Dimensions



AIR FLOW MONITORING

Permanent detection and control of gaseous flow media are constantly gaining in importance in all fields of advanced system engineering.

No matter whether for air, explosive gases, corrosive media or temperature cycling, TURCK's air flow monitors are proven and wear-free systems which are optimally suited to such challenging applications.

Typical fields of application are:

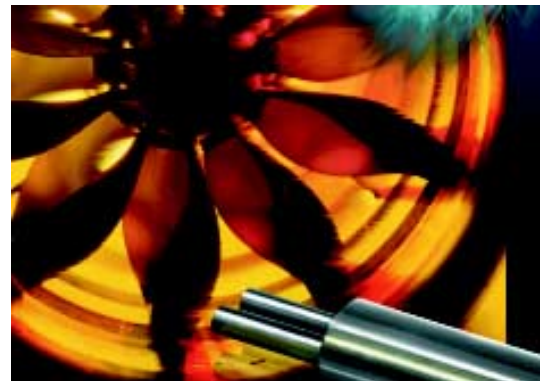
- air-conditioning systems
- heat-exchanger units and filtering systems
- filtering systems in filling lines, paint works and saw mills
- ventilation control in heat exchangers, motors, cubicles and computer systems

The large variety of housing styles and materials enables simple selection of the most appropriate and economical solution.

The product line ranges from compact devices (sensors with integrated processor) to sensors for use in explosion hazardous areas, zone 0.

Depending on the housing style and the sensing task, these devices provide different features:

- detection range: 0.5...30 m/s
- pressure resistance: 5...30 bar
- temperature gradient: up to 20 K/min (rapid changes of temperature)
- materials: A2 (AISI303), A4 (AISI316Ti)
- supply voltages: 24 VDC, 115 VAC, 230 VAC



- output signal: digital (transistor or relay), analogue (4...20 mA)
- connection: various cable lengths or connectors
- explosion hazardous areas: zone 0, zone 1 and versions for zone 1 plus temperature rating for 120 °C

Air Flow Controls

Self-contained devices with transistor or analogue output



- **Sensor and processor in one compact housing**
- **Degree of protection IP67**
- **Fast response**
- **Simple adjustment via potentiometer**
- **Plastic or metal housings**
- **Analogue output, 4...20 mA, or transistor output, pnp, short-circuit protected**
- **Temperature compensation**

These flow sensors are self-contained devices: sensor and signal processor are incorporated in one compact housing. The sensor monitors **non-explosive** gaseous media in a flow speed range from 0.5...15 m/s.

The devices can be used with various pipe diameters.

There are versions with analogue output (4...20 mA) or short-circuit protected transistor outputs. The switch point (set-point value of monitored flow), or the monitoring range, is adjusted via potentiometers.

Devices with transistor output are equipped with a dual colour LED, while the analogue devices feature a green LED.

Devices with transistor output - mounting and adjustment

The air flow control installs directly into the flow line with the probe inserted into the flow.

The switch point (setpoint value of the monitored flow is adjusted via a 20-turn potentiometer.

A dual colour LED signals the flow status relative to the pre-adjusted setpoint:

- red LED : below setpoint
- green LED : at setpoint or setpoint exceeded

Operating range

– Air 0.5...15 m/s

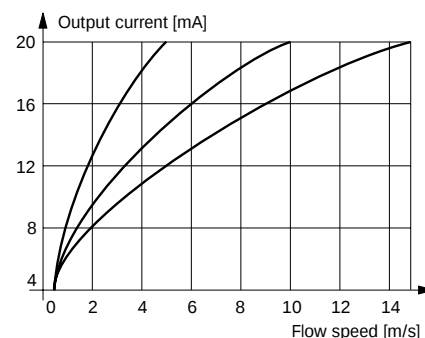
If the red LED illuminates, the output is disabled. If the green LED illuminates, the output activates.

Devices with analogue output – mounting and adjustment

The air flow control installs directly into the flow line with the probe inserted into the flow.

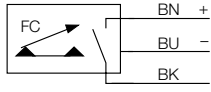
The sensing range is adjusted via a potentiometer. The adjusted maximum flow rate accords to an upper range value of 20 mA. The lower range value of 0.5 m/s (air) is fixed. The adjustable upper range value is between 5 and 15 m/s.

The characteristic curve shows the typical correlation between output signal and flow rate.

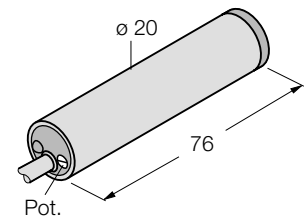


Self-contained devices: transistor output

Mounting guidelines see section 8, "Technology and handling"

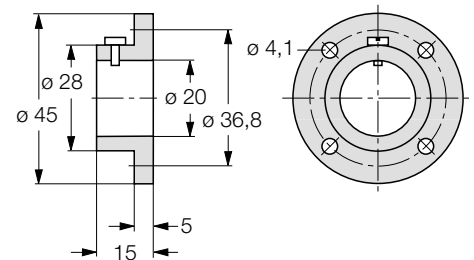
Supply voltage U_B	19.2...28.8 VDC (incl. ripple)
Current consumption	70 mA
Output	transistor, pnp, short-circuit protected
Switching current	≤ 400 mA
Temperature range (medium)	-20...+70 °C
Operating range (flow speed)	
– air	0.5...15 m/s
Availability	typ. 25 s (20...40 s)
Switch-on/switch-off time	typ. 2 s (1...20 s)
Response time to change in temperature or temperature gradient	200 K/min
LED indications (dual colour LED)	
– below setpoint	red
– at setpoint/setpoint exceeded, output switched	green
Housing material (acc. to DIN 2462)	PBT-GF30-V0
Degree of protection (IEC 60529/EN 60529)	IP67
Connection	
– PVC cable (3 x 0.5 mm ²), 2 m long (other lengths on request)	 BN = brown BU = blue BK = black pnp
Accessories	1 screwdriver for switch point adjustments plastic flange

Dimensions



- Cable device

Accessories (included in delivery)



- Plastic flange

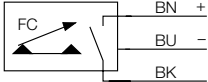
Selection table

Type	Ident.-no.	Housing material
FCS-K20-AP8X	68 707 02	PBT-GF30-V0

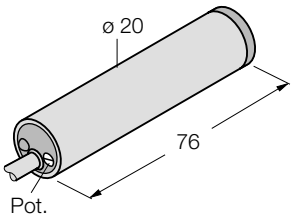
Air Flow Controls

Self-contained devices: analogue output

Mounting guidelines see section 8, "Technology and handling"

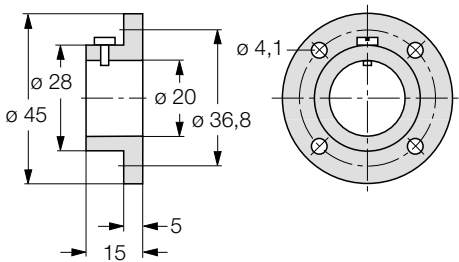
Supply voltage U_B Current consumption	19.2...28.8 VDC (incl. ripple) ≤ 70 mA
Output Load	4...20 mA 200...500 Ω
Temperature range (medium)	-20...+70 °C
Temperature gradient	200 K/min
Operating range (flow speed) – air	0.5...15 m/s
Availability Response time Response time to change in temperature or temperature gradient	typ. 25 s (20...40 s) typ. 2 s 200 K/min
LED indications – operational readiness	green
Housing material (acc. to DIN 2462) Degree of protection (IEC 60529/EN 60529)	PBT-GF30-V0 IP67
Connection – PVC cable (3 x 0.5 mm ²), 2 m long (other lengths on request)	 BN = brown BU = blue BK = black
Accessories	1 screwdriver for range adjustments, plastic flange

Dimensions



- Cable device

Accessories (included in delivery)



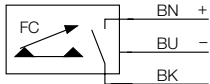
- Plastic flange

Selection table

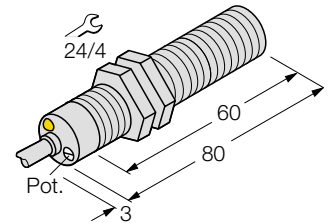
Type	Ident-no.	Housing material
FCS-K20-LIX	68 707 03	PBT-GF30-V0

Self-contained devices: transistor, threaded barrel

Mounting guidelines see section 8, "Technology and handling"

Supply voltage U_B	19.2...28.8 VDC (incl. ripple)
Current consumption	≤ 70 mA
Output	transistor, pnp, short-circuit protected
Switching current	≤ 400 mA
Temperature range (medium)	-20...+70 °C
Temperature gradient	200 K/min
Operating range (flow speed)	
– air	0.5...15 m/s
Availability	typ. 25 s (20...40 s)
Switch-on/switch-off time	typ. 2 s (1...20 s)
Response time to change in temperature or temperature gradient	200 K/min
LED indications (dual colour LED)	
– below setpoint	red
– at setpoint/setpoint exceeded, output switched	green
Housing material (acc. to DIN 2462)	chrome-plated brass
Degree of protection (IEC 60529/EN 60529)	IP67
Connection	
– PVC cable (3 x 0.5 mm ²), 2 m long (other lengths on request)	 BN + BU - BK BN = brown BU = blue BK = black pnp
Accessories	1 screwdriver for switch point adjustments

Dimensions



- Cable device

Selection table

Type	Ident-no.	Housing material
FCS-M18-AP8X	68 707 04	chrome-plated brass

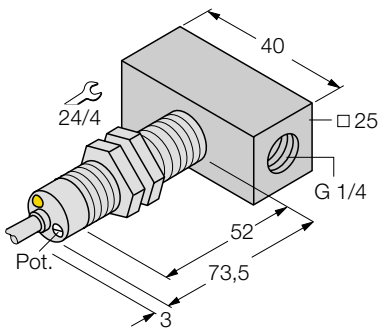
Air Flow Controls

Self-contained devices: inline version

Mounting guidelines see section 8, "Technology and handling"

Supply voltage U _B Current consumption	19.2...28.8 VDC (incl. ripple) 70 mA
Output Switching current	transistor, pnp, short-circuit protected ≤ 400 mA
Temperature range (medium)	-20...+70 °C
Operating range (flow speed) – air	0.5...15 m/s
Availability Switch-on/switch-off time Response time to change in temperature or temperature gradient	typ. 25 s (20...40 s) typ. 2 s (1...20 s) 200 K/min
LED indications (dual colour LED) – below setpoint – at setpoint/setpoint exceeded, output switched	red green
Sensor material (acc. to DIN 2462) Material of mounting block Degree of protection (IEC 60529/EN 60529)	chrome-plated brass brass IP67
Connection – PVC cable (3 x 0.5 mm ²), 2 m long (other lengths on request)	FC BN + BU – BK pnp BN = brown BU = blue BK = black
Accessories	1 screwdriver for switch point adjustments

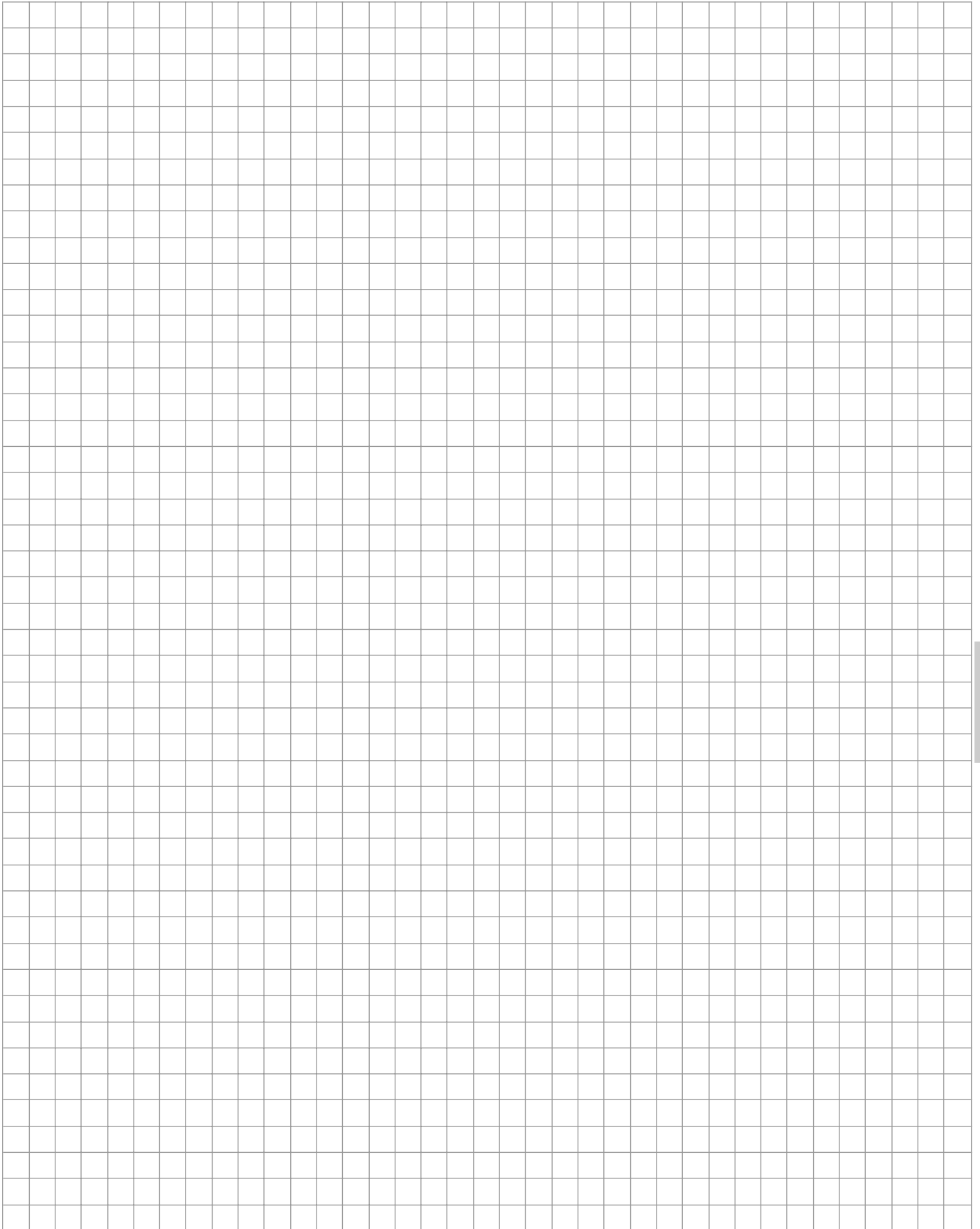
Dimensions



- Mounting block installation

Selection table

Type	Ident-no.	Housing material
FCS-M18-AP8X/D041	68 707 05	chrome-plated brass



Air Flow Controls

Dual probe self-contained devices with transistor, relay or analogue output



- **Sensor and processor in one compact housing**
- **Measuring system enclosed in stainless steel housing to withstand high mechanical strain**
- **Degree of protection IP67**
- **Pressure resistant up to 30 bar**
- **Simple adjustment via potentiometer**
- **Analogue output, 4...20 mA, relay output, or transistor output, pnp, short-circuit protected**
- **Temperature compensation**
- **Indications via 6 LEDs**

Dual probe flow sensors are self-contained devices: sensor and signal processor are encapsulated in one compact housing. The sensor monitors **non-explosive** gaseous media in a flow speed range 0.5...30 m/s.

The devices are designed to withstand high mechanical strain due to the stainless steel enclosure of the measuring system.

These sensors require a particular mounting position (see fig. "mounting position").

Devices with transistor or relay output – mounting and adjustment

The air flow control is mounted into the flow line with the probe inserting into the flow.

The switch point (setpoint value of the monitored flow) is adjusted via a potentiometer, which is located under a protective cover on the device front.

Six LEDs serve to indicate the flow status relative to the setpoint:

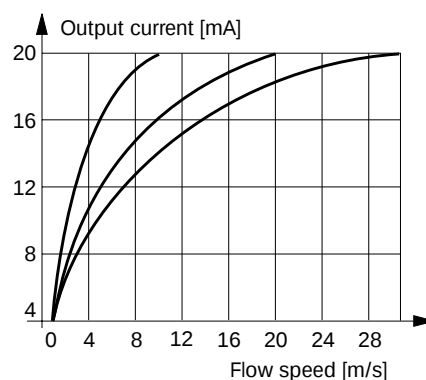
- red LED: below setpoint
- yellow LED: at setpoint or setpoint exceeded
- green LEDs: relative degree of setpoint overrange (1, 2, 3 or 4 green LEDs are lit)

If the red LED illuminates, the output is disabled. If the green LED illuminates, the output is activated.

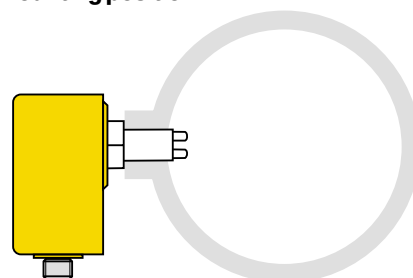
Devices with analogue output – mounting and adjustment

The air flow control is mounted into the flow line with the probe inserting into the flow. The output is a current output.

The sensor's sensing range is adjusted via a potentiometer. The adjusted maximum flow accords to an upper range value of 20 mA. The characteristic curve shows the typical correlation between output signal and flow rate.



Mounting position

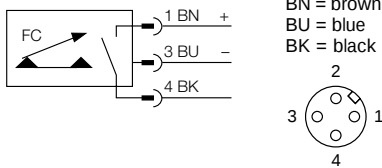


Operating range

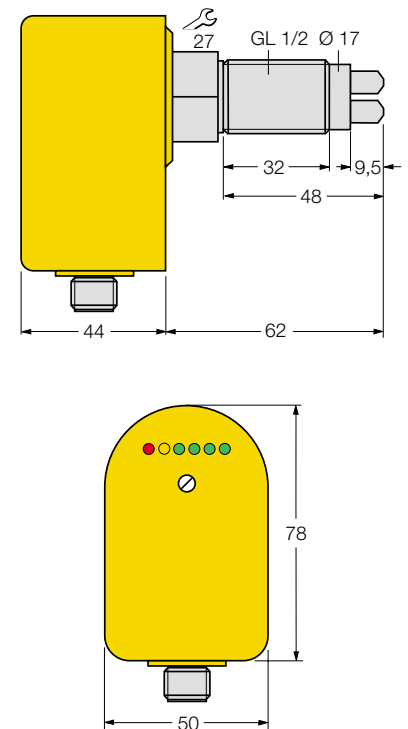
- Air 0.5...30 m/s

Self-contained devices: threaded dual-probe sensor with transistor output

Mounting guidelines see section 8, "Technology and handling"

Supply voltage U_B	19.2...28.8 VDC (incl. ripple)
Current consumption	80 mA
Output	transistor, pnp, short-circuit protected
Switching current	≤ 400 mA
Temperature range (medium)	-20...+80 °C
Operating range (flow speed)	
– air	0.5...30 m/s
Availability	10...90 s
Switch-on time	2...30 s
Switch-off time	5...30 s
Response time to change in temperature or temperature gradient	20 K/min
Pressure resistance	30 bar
LED indications	
– below setpoint	red
– at setpoint	yellow
– at setpoint or setpoint exceeded	yellow and green
Housing material	PBT/PA
Sensor material (acc. to DIN 2462/17440)	stainless steel A4 (AISI316Ti)
Degree of protection (IEC 60529/EN 60529)	IP67
Ambient temperature	-20...+70 °C
Fixing torque	100 Nm
Connection	
– Pin configuration: plug-in connectors, system <i>eurocon</i> (M 12 x 1)	
connectors (view of contacts)	
Accessories	1 screwdriver for switch point adjustments 2 seals for G-threads

Dimensions



– Connector device

Selection table

Type	Ident-no.	 AF	Thread
FCS-GL1/2A2P-AP8X-H1141/A	68 704 57	27	GL 1/2

Air Flow Controls

Self-contained devices: threaded dual probe sensor with relay output

Mounting instructions see section 8, „Technology and handling“

Supply voltage U_B	200...260 VAC (incl. ripple)
Current consumption	≤ 30 mA
Output	1 relay output (SPDT)
Switching voltage	≤ 250 VAC/60 VDC
Switching current	≤ 4 A AC/4 A DC
Switching capacity	≤ 1000 VA/60 W
Temperature range (medium)	-20...+80 °C
Operating range (flow speed)	
– air	0.5...30 m/s
Availability	10...90 s
Switch-on time	2...30 s
Switch-off time	5...30 s
Response time to change in temperature or temperature gradient	20 K/min
Pressure resistance	30 bar
LED indications	
– below setpoint	red
– at setpoint, output switched	yellow
– setpoint exceeded	4 x green (in addition to yellow LED)
Housing material	PBT/PA
Sensor material (acc. to DIN 2462/17440)	stainless steel A2 (AISI303)
Degree of protection (IEC 60529/EN 60529)	IP67
Ambient temperature	-20...+70 °C
Fixing torque	100 Nm

Connection

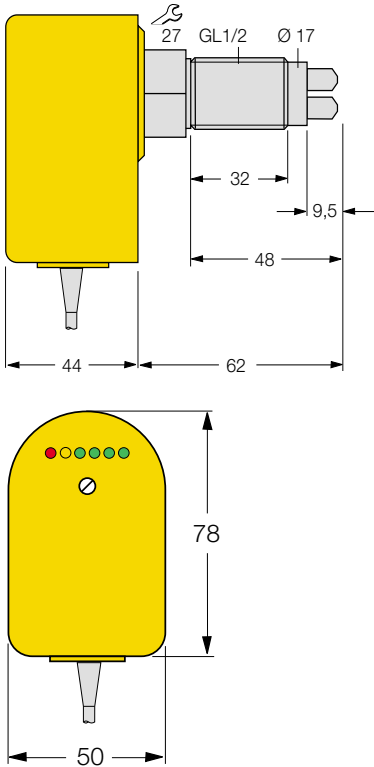
– PVC cable (5 x 0.5 mm²)
2 m long (other lengths on request)

$U_B = 230$ VAC

$U_B = 24$ VDC

BN = brown
BU = blue
BK = black
GY = grey
WH = white

Dimensions



– Cable device

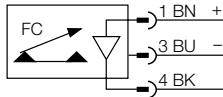
Accessories	1 screwdriver for switch point adjustments 2 seals for G-threads
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Selection table

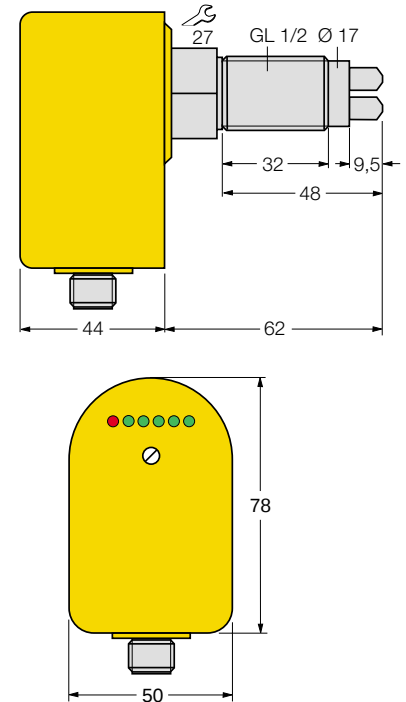
Type	Ident-no.	AF	Supply voltage U_B
FCS-GL1/2A2P-VRX/230VAC/A	68 704 58	27	200...260 VAC
FCS-GL1/2A2P-VRX/24VDC/A	68 703 63	27	21.6...26.4 VDC

Self-contained devices: threaded dual-probe sensor with analogue output

Mounting guidelines see section 8, "Technology and handling"

Supply voltage U_B	200...260 VAC / 19.2...28.8 VDC (incl. ripple)
Current consumption	$\leq 30 \text{ mA}$ / $\leq 80 \text{ mA}$
Output	current output
Load	$\leq 500 \Omega$
Output current	4...20 mA
Temperature range (medium)	-20...+80 °C
Operating range (flow speed)	
– air	0.5...30 m/s
Pressure resistance	30 bar
Availability	20...90 s
Response time	4...30 s
Response time to change in temperature or temperature gradient	$\leq 100 \text{ s}$ 20 K/min.
LED indications	
– output signal indication	5 x green, 1 x red
Illumination of 1 to 6 LEDs:	
– red LED	= 4 mA
– 1 green LED	> 4 mA
– 2 green LEDs	> 8 mA
– 3 green LEDs	> 12 mA
– 4 green LEDs	> 16 mA
– 5 green LEDs	= 20 mA
Housing material	PBT
Sensor material (acc. to DIN 2462/17440)	stainless steel A2 (no. 1.4305/AISI303)
Degree of protection (IEC 60529/EN 60529)	IP67
Ambient temperature	-20...+70 °C
Fixing torque	100 Nm
Connection	
– Pin configuration; plug-in connectors, system <i>eurocon</i> (M 12 x 1)	
connectors (view of contacts)	
Accessories	1 screwdriver for range adjustments 2 seals for G-threads

Dimensions



– Connector device

Selection table

Type	Ident-no.	 AF	Thread
FCS-GL1/2A2P-LIX-H1141/A	68 704 55	27	GL 1/2

Air Flow Controls

**Self-contained devices,
dual probe version
with coupling nut,
relay or analogue output**



- **Sensor and processor in one compact housing**
- **Degree of protection IP67**
- **Pressure resistant up to 3 bar**
- **Simple adjustment via potentiometer**
- **Analogue output, 4...20 mA, or relay output**
- **Temperature compensation**
- **Flow status indications via 6 LEDs**

Dual probe flow sensors are self-contained devices: sensor and signal processor are encapsulated in one compact housing. The sensor monitors **non-explosive** gaseous media in a range of 0.5...30 m/s.

These sensors require a particular mounting position (see fig. "mounting position").

Devices with relay output – mounting and adjustment

The air flow control is mounted into the flow line with the probe inserting into the flow.

The switch point (setpoint value of the monitored flow) is adjusted via a potentiometer, which is located under a protective cover on the device front.

Six LEDs serve to indicate the flow status relative to the adjusted setpoint:

- red LED: below setpoint
- yellow LED: at setpoint or setpoint exceeded
- green LEDs: relative degree of setpoint overrange (1, 2, 3 or 4 green LEDs are lit)

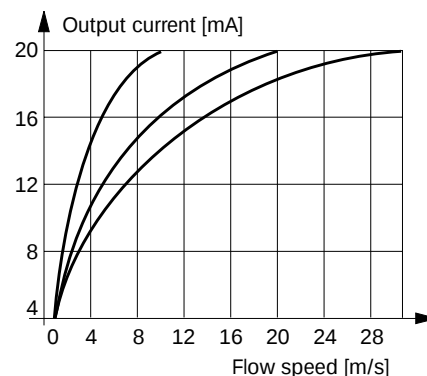
If the red LED illuminates, the output is disabled. If the yellow LED illuminates, the output is activated.

Devices with analogue output – mounting and adjustment

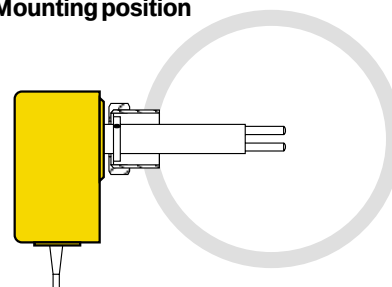
The air flow control is mounted into the flow line with the probe inserting into the flow.

The sensing range is adjusted via a potentiometer. The maximum flow accords to an upper range value of 20 mA.

The characteristic curve shows the typical correlation between output signal and flow rate.



Mounting position

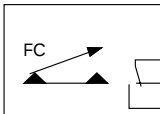


Operating range

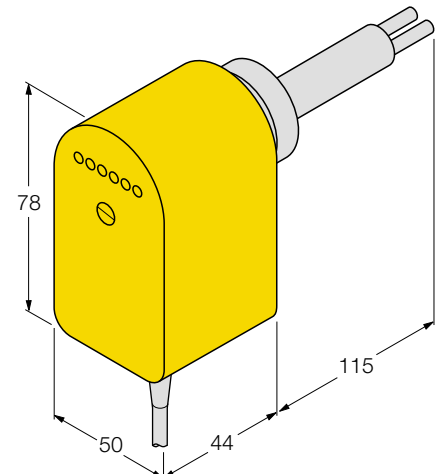
- Air 0.5...30 m/s

Self-contained devices: dual probe version with coupling nut and relay output

Mounting guidelines see section 8, "Technology and handling"

Supply voltage U_B	200...260 VAC										
Current consumption	≤ 30 mA										
Output	1 relay output (SPDT)										
Switching voltage	≤ 250 VAC/60 VDC										
Switching current	≤ 4 A										
Switching capacity	≤ 1000 VA/60 W										
Temperature range (medium)	-20...+80 °C										
Operating range (flow speed)											
– air	0.5...30 m/s										
Pressure resistance	3 bar										
Availability	10...60 s										
Switch-on time	2...30 s										
Switch-off time	5...30 s										
Response time to change in temperature or temperature gradient	20 K/min										
LED indications											
– below setpoint	red										
– at setpoint	yellow										
– at setpoint or setpoint exceeded	yellow and green										
Housing material (acc. to DIN 2462)	PBT-GF30-V0										
Sensor material	stainless steel A2 (AISI303)										
Degree of protection (IEC 60529/EN 60529)	IP67										
Ambient temperature	-20...+70 °C										
Fixing torque	100 Nm										
Connection											
– PVC cable (5 x 0.5 mm ²) 2 m long (other lengths on request)	 <table> <tr><td>BN</td><td>L1</td></tr> <tr><td>BU</td><td>N</td></tr> <tr><td>GY</td><td></td></tr> <tr><td>WH</td><td></td></tr> <tr><td>BK</td><td></td></tr> </table> BN = brown BU = blue BK = black GY = grey WH = white	BN	L1	BU	N	GY		WH		BK	
BN	L1										
BU	N										
GY											
WH											
BK											
Mechanical connection	coupling nut G1 interior thread										
Accessories											
1 screwdriver for switch point adjustments											

Dimensions



– Cable device

Mounting accessories

The device is mounted via the coupling nut (G1 interior thread)

Selection table

Type	Ident.-no.	Supply voltage U_B
FCS-HA2-VRX/230VAC/AL115	68 707 24	200...260 VAC

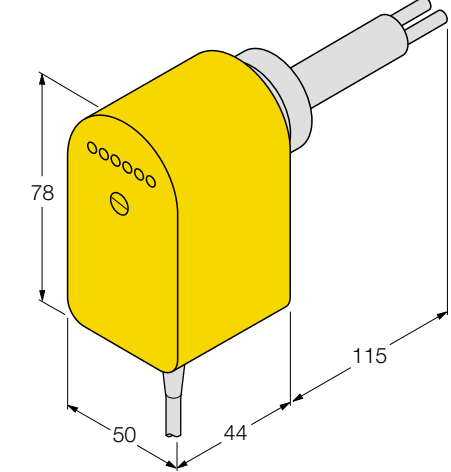
Air Flow Controls

Self-contained devices: dual probe version with coupling nut and analogue output

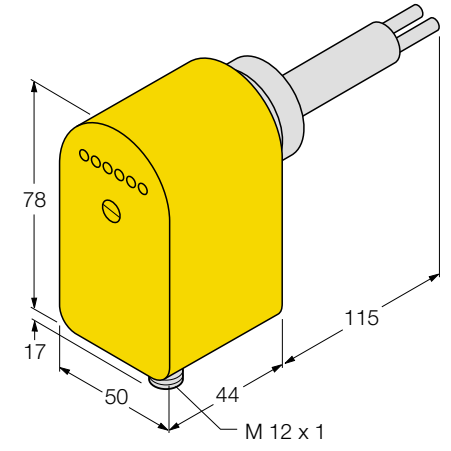
Mounting guidelines see section 8, "Technology and handling"

Output	current
Load	$\leq 500\ \Omega$
Output current	4...20 mA
Temperature range (medium)	-20...+80 °C
Operating range (flow speed)	
– air	0.5...30 m/s
Pressure resistance	3 bar
Availability	20...90 s
Response time	4...30 s
Response time to change in temperature or temperature gradient	$\leq 100\text{ s}$ max. 20 K/min.
LED indications	
– output signal indication	5 x green, 1 x red
Illumination of 1 to 6 LEDs:	
– red LED	= 4 mA
– 1 green LED	> 4 mA
– 2 green LEDs	> 8 mA
– 3 green LEDs	> 12 mA
– 4 green LEDs	> 16 mA
– 5 green LEDs	= 20 mA
Housing material	PBT
Sensor material (acc. to DIN 2462/17440)	stainless steel A2 (AISI303)
Degree of protection (IEC 60529/EN 60529)	IP67
Ambient temperature	-20...+70 °C
Fixing torque	100 Nm
Connection	
– Cable, PVC (3 x 0.5 mm ²), 2 m long (other lengths on request)	 BN = brown BU = blue BK = black
– Pin configuration: plug-in connectors, system <i>eurocon</i> (M 12 x 1) connector s (view of contacts)	
Mechanical connection	coupling nut G1 interior thread
Accessories	1 screwdriver for adjustments

Dimensions



– Cable device



– Connector device

Mounting accessories

The device is mounted via the coupling nut (G1 interior thread).

Selection table

Type	Ident-no.	Supply voltage U _B	Current consumpt.	Cable	Connector
FCS-HA2-LiX/AL115	68 707 22	19.2...28.8 VDC	$\leq 80\text{ mA}$	•	•
FCS-HA2-LiX-H1141/AL115	68 707 20	19.2...28.8 VDC	$\leq 80\text{ mA}$		



Air Flow Controls

Insertion sensors intrinsically safe and standard versions single/dual probe versions



- **Sensor for gaseous media**
- **Degree of protection IP67/ IP68**
- **Pressure resistance 30 bar**
(intrinsically safe version 10 bar)
- **Single and dual probe versions**
- **Various threads**
- **Temperature range**
-20...+80 °C
- **Housing material: stainless steel**
A2 (AISI303/1.4305)
A4 (AISI316Ti/1.4571)
- **Cable or connector versions,**
system *eurocon* (M 12 x 1)

This line of air flow controls is available for intrinsically safe and standard applications. The insertion style sensors are designed to detect **explosive** gaseous media in a range of 2...20 m/s and **non-explosive** gaseous media in a range of 0.5...30 m/s.

The sensor installs directly into the flow stream via a pipe-tee or welded pipe socket with the sensing probe positioned into the flow.

These sensors require a signal processor for operation.

Depending on the application, there are intrinsically safe and standard processors available:

- MK96... 18 mm wide coupler housing (style *multimodul*)
- MS96... 50 mm wide modular housing (style *multisafe*®)
- MC96... 19" Eurocard (style *multicart*®)

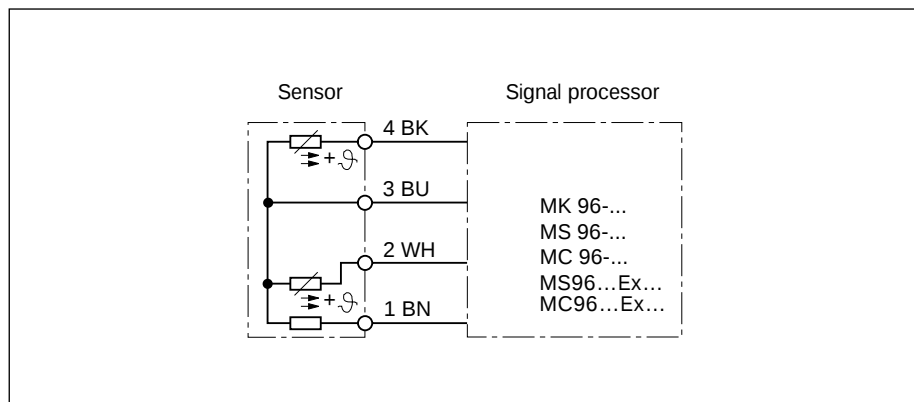
Processors for explosion hazardous areas:

- MS96...Ex... 50 mm wide modular housing (style *multisafe*®)
- MC96...Ex... 19" Eurocard (style *multicart*®)

All necessary settings for the correct function of the sensor are programmed on the signal processor (see section 8 "Technology and handling" for installation and set-up).

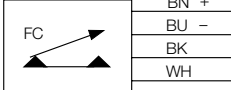
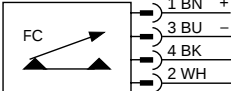
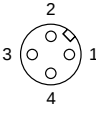
Operating range

- **non-intrinsically safe version:**
air 0.5... 30 m/s
- **intrinsically safe version:**
air 2 ... 20 m/s

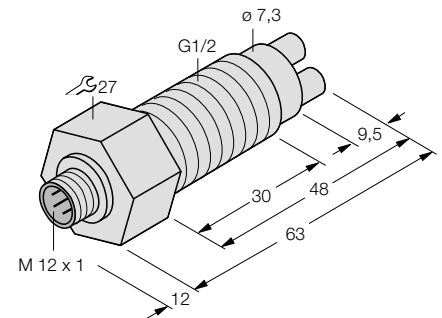


Insertion sensors: dual probe version

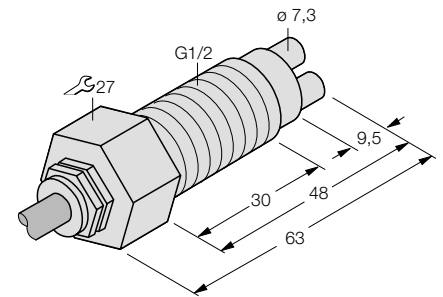
Mounting guidelines see section 8, "Technology and handling"

Temperature range (medium)	-20...+80 °C
Operating range – air	0.5...30 m/s
Availability Switch-on time Switch-off time Response time to change in temperature or temperature gradient	10...90 s 2...30 s 5...30 s 20 K/min.
Pressure resistance	30 bar
Housing material Ambient temperature Degree of protection (IEC 60529/EN 60529) – connector version – cable version Fixing torque	stainless steel A2 (AISI303) -20...+70 °C IP67 IP68 100 Nm
Connection – PVC cable (4 x 0.5 mm ²), 2 m long (other lengths on request) – Pin configuration: plug-in connectors, system <i>eurocon</i> (M 12 x 1) connectors (view of contacts)	 BN = brown BU = blue BK = black  
Accessories	2 seals for G-threads

Dimensions



- Connector device



- Cable device

Selection table

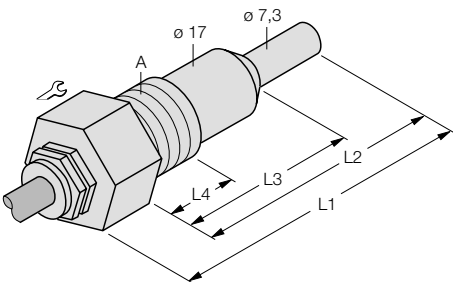
Type	Ident-no.	Cable	Connector	Thread
FCS-GL1/2A2-NA-H1141/A	68 704 04	●	●	G1/2 long
FCS-GL1/2A2-NA/A	68 704 09	●	●	G1/2 long

Insertion sensors: single probe, Ex zone 1

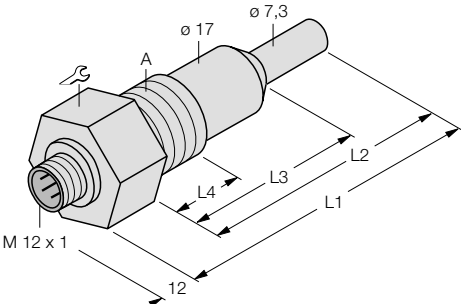
Mounting guidelines see section 8, "Technology and handling"

Ex-approval acc. to EC type examination certificate	
Marking	TÜV 99 ATEX 1518
Maximum values	EEX ib IIC T6
– Power P_i	0.69 W
Internal inductances/capacitances	negligible
Temperature class depending on T_m (T_m = medium temperature)	T6: $T_m < 50\text{ °C}$ T5: $T_m < 65\text{ °C}$ T4: $T_m < 85\text{ °C}$
Temperature range (medium)	-20...+85 °C
Operating range (flow speed)	
– air	2...20 m/s
Availability	10...40 s
Response time to change in temperature or temperature gradient ¹⁾	120 s max. 1 K/min
Pressure resistance	10 bar
Housing material (acc. to DIN 2462/17440)	stainless steel A4 (AISI316Ti)
Degree of protection (IEC 60529/EN 60529)	IP67 for connector versions IP68 for cable versions
Ambient temperature	-20...+80 °C
Fixing torque	100 Nm
Connection	
– PUR cable (4 x 0.25 mm ²) 2 m long (other lengths on request)	BN + BU - BK WH BN = brown BU = blue BK = black WH = white
– Pin configuration: plug-in connectors, system <i>eurocon</i> (M 12 x 1) connectors (view of contacts)	1 BN + 3 BU - 4 BK 2 WH
Accessories	2 seals for G-threads

Dimensions



– Cable device



– Connector device

¹⁾ Medium: air; flow speed 20 m/s

Series FCS B - selection table

Type	Ident-no.	Cable	Connector	Thread A	 AF	Dimensions			
						L1	L2	L3	L4
FCS-G1/2A4-NAEX/AL065	68 703 24	●	●	G1/2	27	80	65	45	25
FCS-G1/2A4-NAEX-H1141/AL065	68 703 33			G1/2	27	80	65	45	25

Insertion sensors: dual probe, Ex zone 1

Mounting guidelines see section 8, "Technology and handling"

Ex-approval acc. to EC type examination certificate

Marking

Maximum values

– Power P_i

Internal inductances/capacitances

Temperature class depending on T_m

(T_m = medium temperature)

TÜV 99 ATEX 1518
EEX ib IIC T6



0.69 W

negligible

T6: $T_m < 50\text{ °C}$

T5: $T_m < 65\text{ °C}$

T4: $T_m < 85\text{ °C}$

Temperature range (medium)

-20...+85 °C

Operating range (flow speed)

– air

2...20 m/s

Availability

Response time to change in temperature
or temperature gradient¹⁾

5...20 s

60 s

max. 20 K/min

Pressure resistance

10 bar

Housing material (acc. to DIN 2462/17440)

Degree of protection (IEC 60529/EN 60529)

stainless steel A4 (AISI316Ti)

IP67 for connector versions

IP68 for cable versions

Ambient temperature

Fixing torque

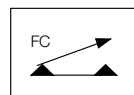
-20...+80 °C

100 Nm

Connection

– PUR-cable (4 x 0.25 mm²)

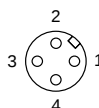
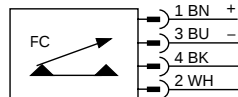
2 m long (other lengths on request)



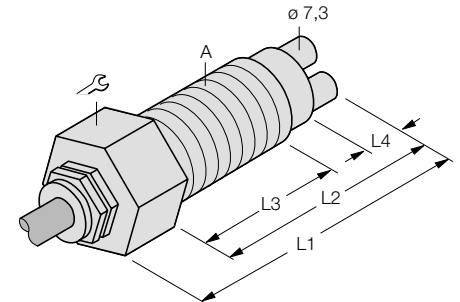
BN +
BU –
BK
WH

BN = brown
BU = blue
BK = black
WH = white

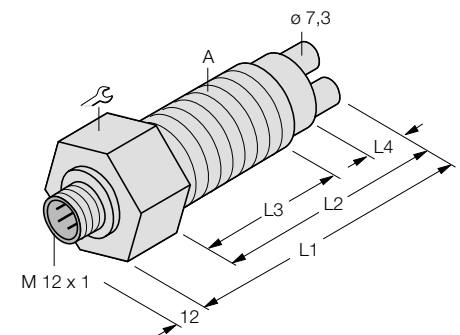
– Pin configuration: plug-in connectors,
system *eurocon* (M 12 x 1)
connectors
(view of contacts)



Dimensions



– Cable device



– Connector device

Accessories

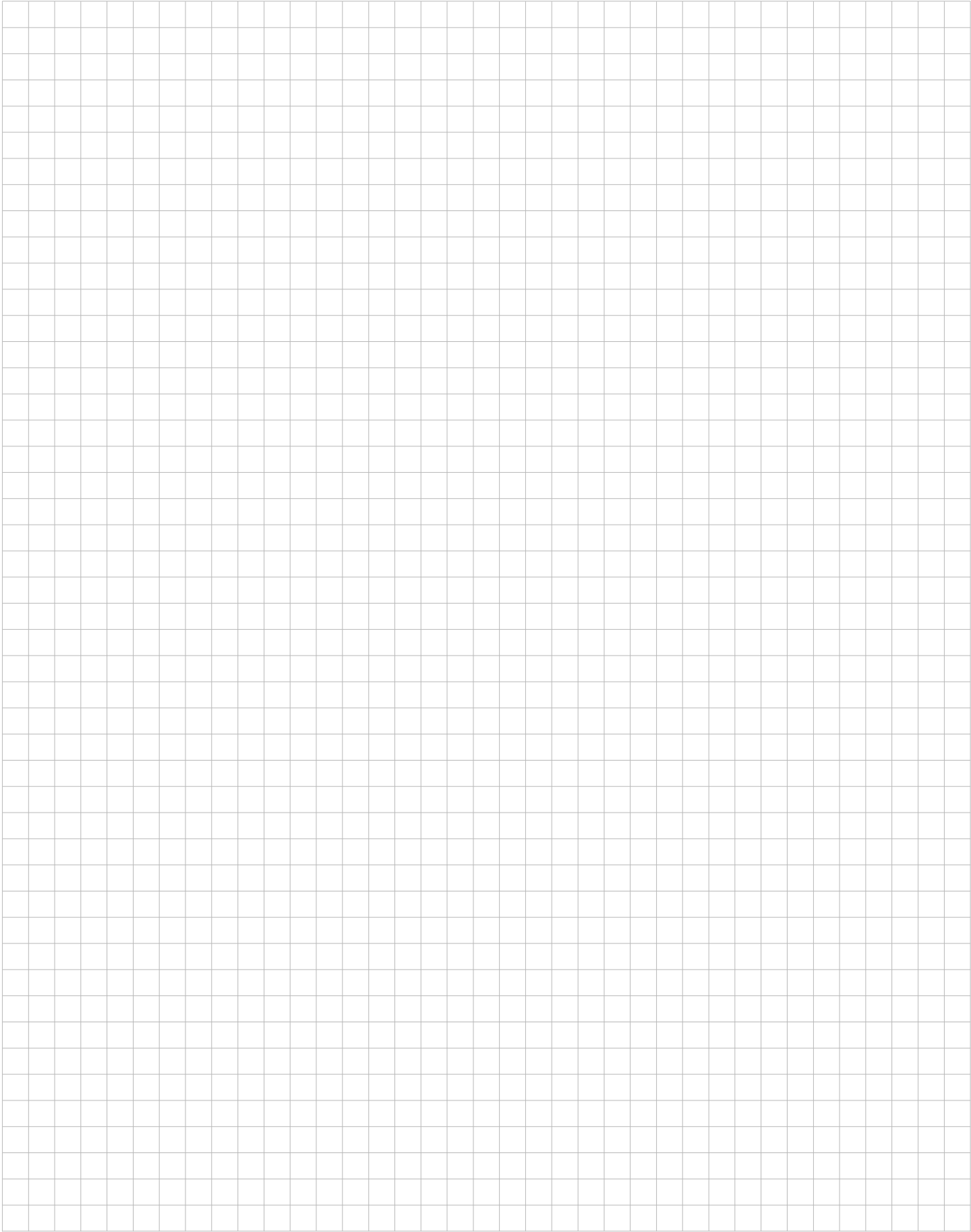
2 seals for G-threads

¹⁾ Medium: air; flow speed 20 m/s

Series FCS-B - selection table

Type	Ident-no.	Cable	Connector	Thread A	 AF	Dimensions			
						L1	L2	L3	L4
FCS-GL1/2A4-NAEX/A	68 704 40	●	●	G1/2 long	27	63	48	30	9,5
FCS-GL1/2A4-NAEX-H1141/A	68 704 39			G1/2 long	27	63	48	30	9,5

Air Flow Controls



SIGNAL PROCESSORS

TURCK offers a large range of signal processors, including MK96, MS96 and MC96 type devices which are suited for insertion and inline sensors. The various styles differ in their housing styles, functions, output configurations and supply voltage ranges.

Intrinsically safe flow sensors require the use of our processor series MS96...Ex...and MC96...Ex... with intrinsically safe input circuits.

MK96

- Compact housing, 18 mm wide, for rail mounting according to DIN 50022
- Finger protection according to VBG 4 and VDE 0470, part 1
- Flammability class of housing material: V-0 according to UL94

MS96

- Contactor-type housing, 50 mm wide
- For panel or hat rail mounting according to DIN 50022
- Finger protection according to VBG 4 and VDE 0470, part 1
- Removeable terminals
- Flammability class of housing material: V-0 according to UL94

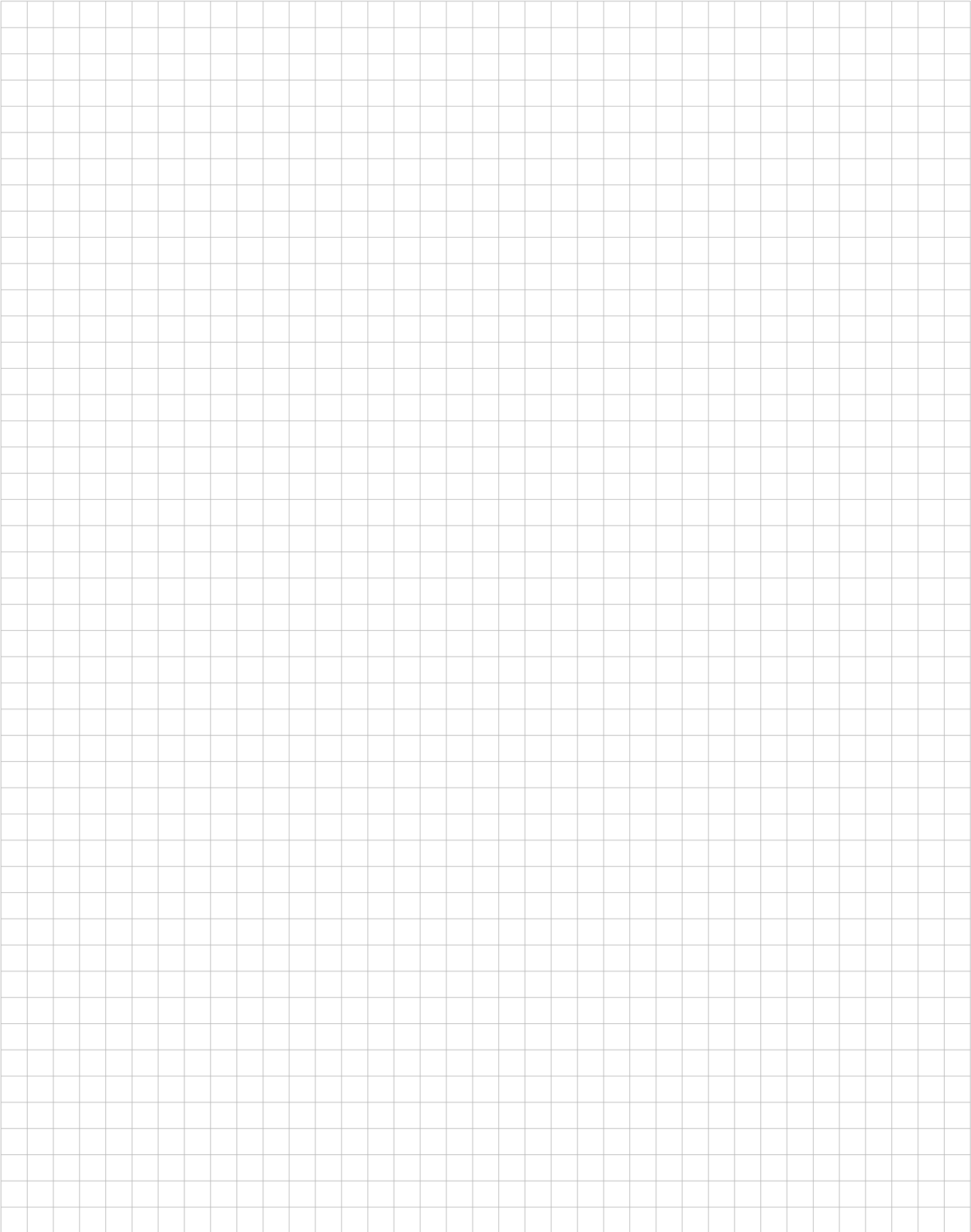


MC96

- 19" Eurocard format for racks according to DIN 41494
- Space-saving construction: 100 x 160 x 4 TE



Flow controls – signal processors



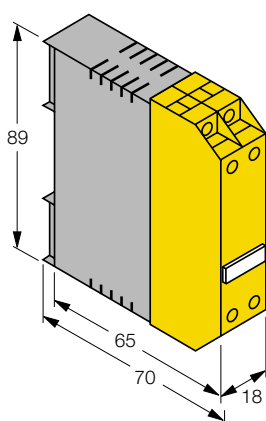
Signal processors - housing styles and functions

Housing Functions and special features	<i>multi modul</i> ®	<i>multi safe</i> ®	<i>multi cart</i> ®	<i>multi safe</i> ® Ex	<i>multi cart</i> ® Ex
Flow monitoring	•	•	•	•	•
Temperature monitoring		•	•		•
Output					
1 channel	•	•	•	•	•
2 channels			•		
Transistor	•				
Relay	•	•	•	•	•
Analogue		•			
Ex applications¹⁾					
[EEx ia] IIC				•	•
[EEx ib] IIC				•	•
Supply voltage					
24 VDC	•	•	•	•	•
115 VAC		•		•	
230 VAC		•		•	
Switch-on delay			•		•
Switch-off delay		•	•	•	•
Wire-break monitoring		• ²⁾	• ²⁾	• ²⁾	•
from page	72	78	82	80	84

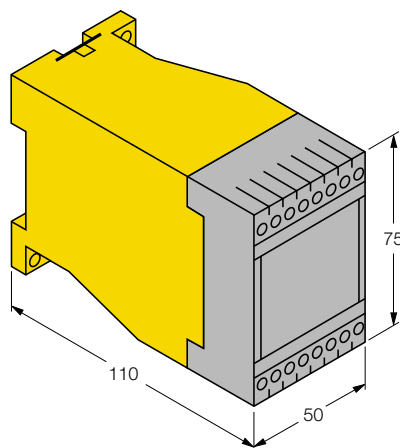
¹⁾ TURCK's signal processors feature international approvals and conformity certificates, see section 8 "Technology and handling".

²⁾ Wire-break monitoring applies to the sensor's heating circuit only.

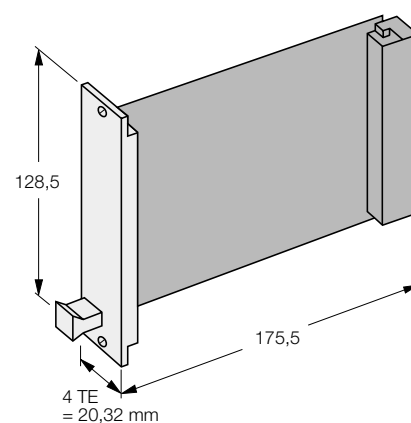
Housing *multimodul*



Housing *multisafe*®



Housing *multicart*®



Flow controls – signal processors

Processors type *multimodul* transistor output/ relay output



- **Single channel processor**
- **Various output types:**
 - two complementary, short-circuit protected pnp/npn transistor outputs
 - relay output, n.o., 230 VAC, 1 A AC
 - 60 VDC, 2 A DC
- **Simple adjustments with potentiometer**
- **6 LEDs for flow status indications**

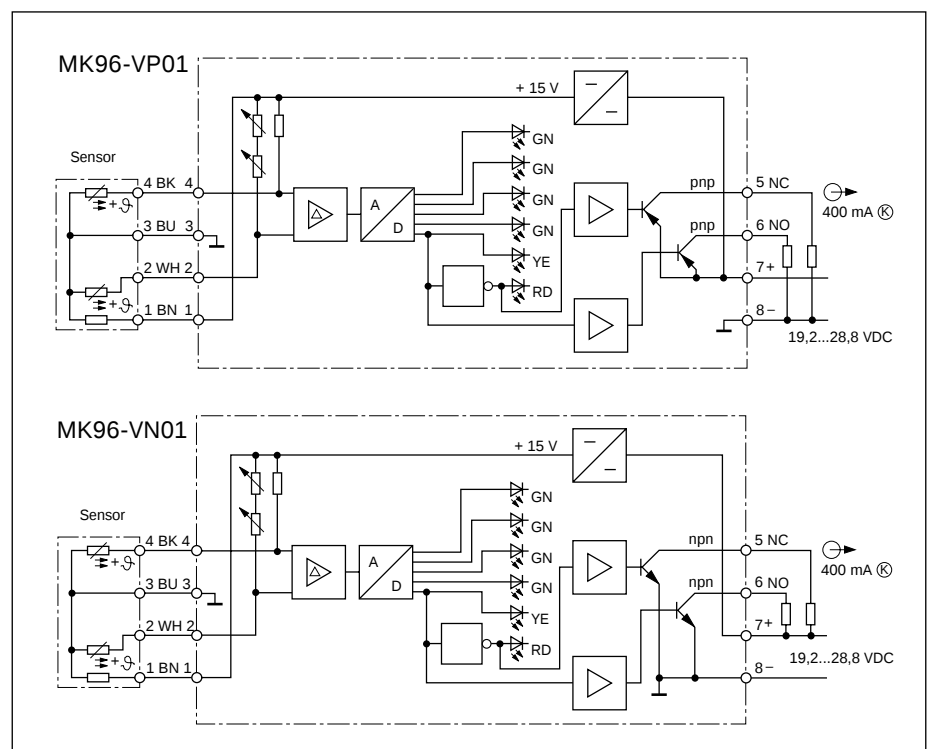
These single channel devices are designed for use with insertion style sensors and in-line sensors.

Flow setpoint adjustments are achieved by means of a coarse potentiometer and a fine potentiometer. The coarse potentiometer serves to adapt the signal processor to the operating ranges of the various sensor types and to the thermal conductivity of the medium. The fine potentiometer calibrates the flow setpoint to the exact desired flow speed.

6 LEDs indicate the actual flow conditions relative to the adjusted setpoint:

- red LED: flow is below setpoint
- yellow LED: flow is at or above setpoint
- green LEDs: degree of setpoint overrange (1, 2, 3 or 4 LEDs are lit)

If the red LED illuminates, the output is disabled or the relay is de-energised. If the yellow LED is lit, the output is tripped or the relay is energised.

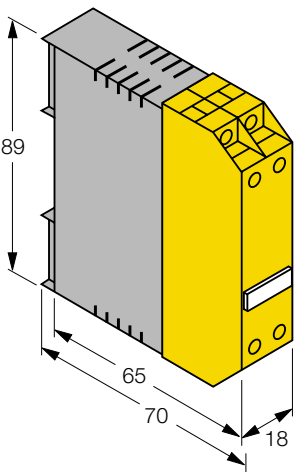


Style *multimodul*: transistor output

For further information see section 8, "Technology and handling"

Supply voltage U_B Current consumption	19.2...28.8 VDC (incl. ripple) ≤ 65 mA
Output	two transistor outputs pnp (MK96-VP01)/nnp (MK96-VN01) complementary, short-circuit and reverse polarity protection
Switching current Voltage drop (I_{max})	≤ 400 mA ≤ 1.5 V
Operating range (flow speed)	depending on sensor
LED indications	
– below setpoint	red
– at setpoint, output switched	yellow
– setpoint exceeded	4 x green (in addition to yellow LED)
Housing	8-pole terminal housing, 18 mm wide, Polycarbonate/ABS
Mounting	flammability class V-0 per UL 94 snap-on clamps for top-hat rail (DIN 50022) or screw terminals for panel mounting
Connection Connection profile	via flat terminals with self-lifting pressure plates ≤ 2 x 2.5 / 2 x 1.5 mm ² with wire sleeves
Protection degree (IEC 60529/EN 60529)	
– terminals	IP20
– housing	IP40
Ambient temperature	-20...+60 °C
Accessories	1 screwdriver for switch point adjustments

Dimensions



Selection table

Type	Ident-no.	Transistor output	
		pnp	nnp
MK96-VP01	75 250 02	●	
MK96-VN01	75 250 03		●

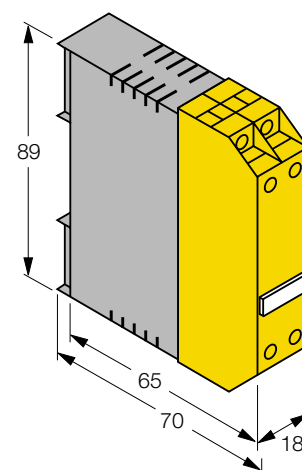
Flow controls – signal processors

Style *multimodul*: relay output

For further information see section 8, "Technology and handling"

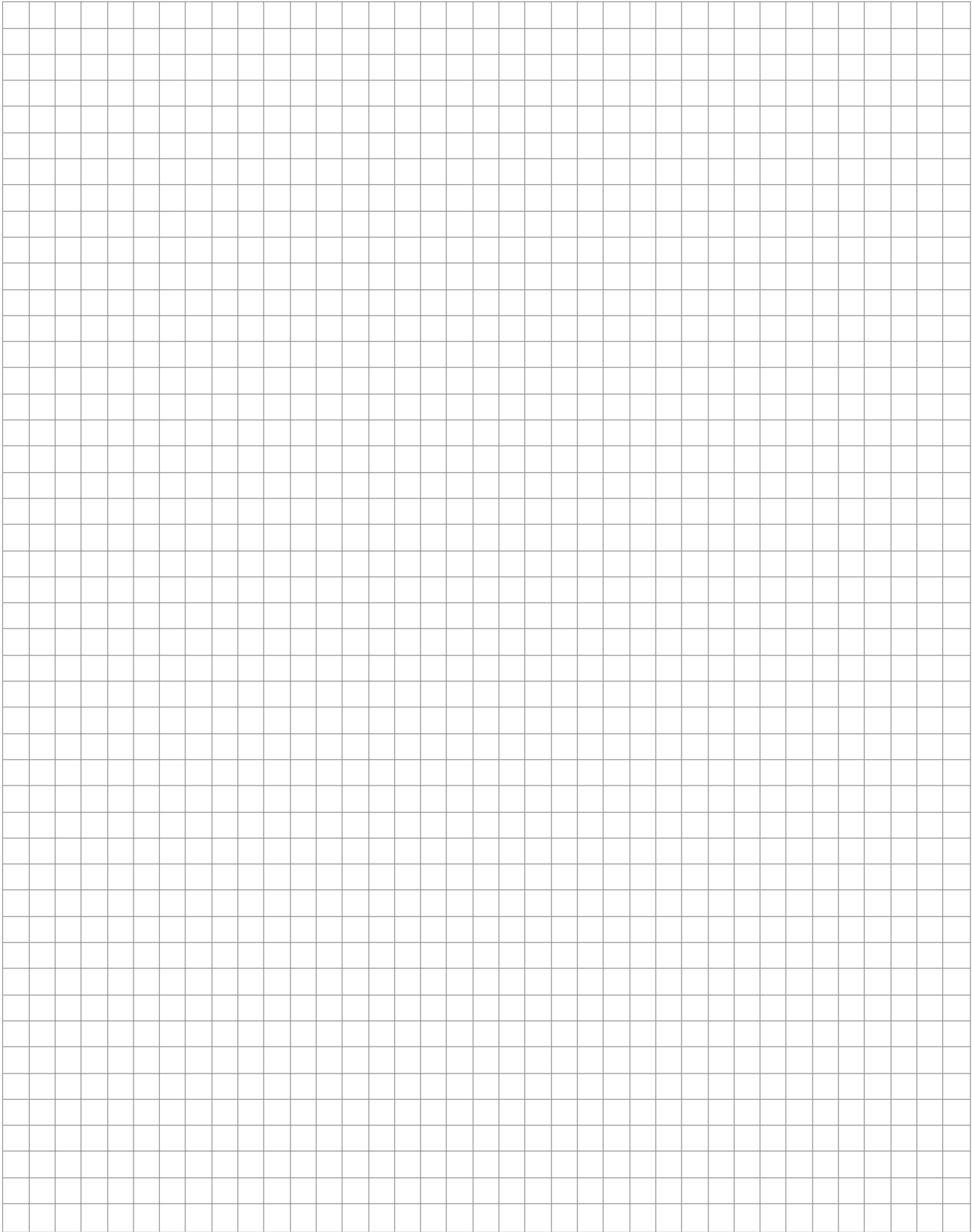
Type	MK96-11-R/24VDC
Ident-no.	75 250 00
Supply voltage U_B	19.2...28.8 VDC (incl. ripple)
Current consumption	≤ 70 mA
Output	relay, n.o.
Switching voltage	≤ 230 VAC/60 VDC
Switching current	≤ 1 A AC/2 A DC
Switching capacity	≤ 120 VA/60 W
Operating range (flow speed)	depending on sensor
LED indications	
– below setpoint	red
– at setpoint, output switched	yellow
– setpoint exceeded	4 x green (in addition to yellow LED)
Housing	8-pole terminal housing, 18 mm wide, Polycarbonate/ABS
Mounting	flammability class V-0 per UL 94 snap-on clamps for top-hat rail (DIN 50022) or screw terminals for panel mounting
Connection	via flat terminals with self-lifting pressure plates
Connection profile	$\leq 2 \times 2.5 / 2 \times 1.5$ mm ² with wire sleeves
Protection degree (IEC 60529/EN 60529)	
– terminals	IP20
– housing	IP40
Ambient temperature	-20...+60 °C
Accessories	1 screwdriver for switch point adjustments

Dimensions



Please note:

The MK96-11-R is also available with UL-approval (different technical data)



Flow controls – signal processors

Processors type *multimodul* analogue output



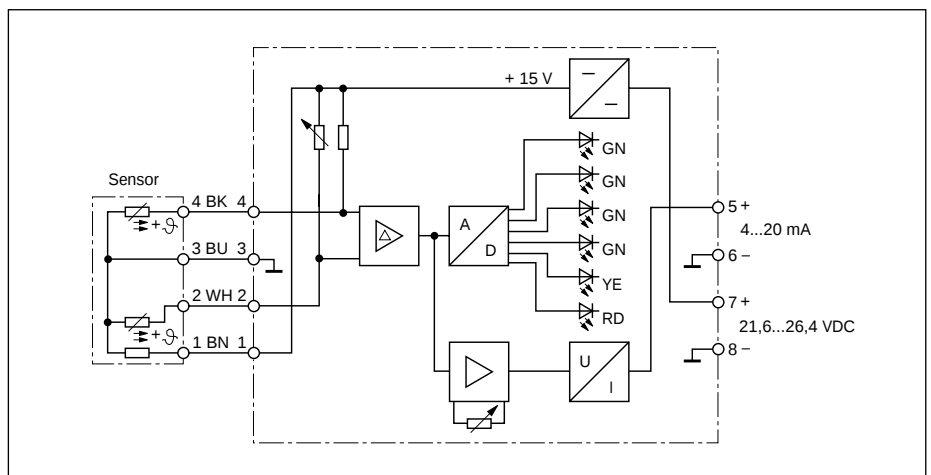
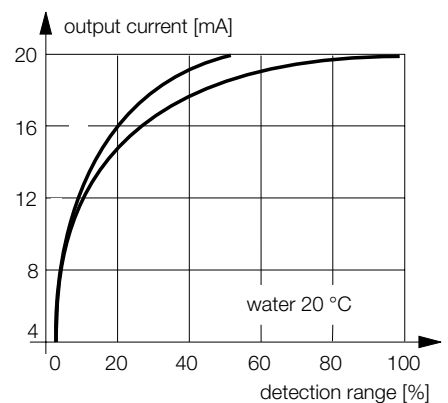
- **Analogue output 4...20 mA**
- **Single channel devices**
- **Simple adjustment via potentiometer**
- **6 LEDs for flow status indications**

The single channel processor MK96-LI01 is equipped with an analogue output with a standard DC current signal (4...20 mA).

The operating range is adjusted by means of two potentiometers. Potentiometer 2 is used to set the 4 mA output at minimum flow speed. The high level setting of the operating range is adjusted with potentiometer 1. The output at maximum flow speed is 20 mA.

The characteristic curve shows the typical correlation between output signal and flow speed:

6 LEDs indicate the status of the output signal.

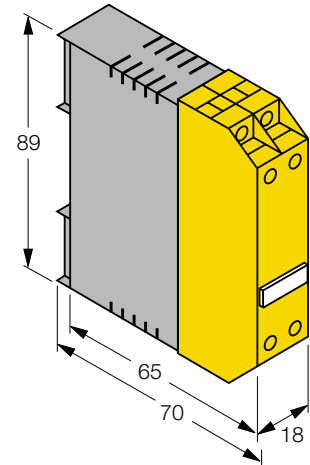


Style *multimodul*: analogue output

For further information see section 8, "Technology and handling"

Type	MK96-Li01
Ident-no.	75 250 04
Supply voltage U_B	19.2...28.8 VDC (incl. ripple)
Current consumption	≤ 100 mA
Output	current
Load	$\leq 500 \Omega$
Output current	4...20 mA
Operating range (flow speed)	depending on sensor
LED indications	
Indication of output signal via 1 to 6 LEDs:	4 x green, 1 x yellow, 1 x red
– LED 1 (red)	= 4 mA
– LED 2 (yellow)	> 4 mA
– LED 3	> 8 mA
– LED 4	> 12 mA
– LED 5	> 16 mA
– LED 6	≥ 20 mA
Terminal housing	8-pole terminal housing, 18 mm wide, Polycarbonate/ABS
Mounting	flammability class V-0 per UL 94 snap-on clamps for top-hat rail (DIN 50022) or screw terminals for panel mounting
Connection	via flat terminals with self-lifting pressure plates
Connection profile	$\leq 2 \times 2.5 / 2 \times 1.5$ mm ² with wire sleeves
Protection degree (IEC 60529/EN 60529)	
– terminals	IP20
– housing	IP40
Ambient temperature	-20...+60 °C
Accessories	1 screwdriver for operating range adjustments

Dimensions



Flow controls – signal processors

Processors type *multisafe*®



- **Single channel device**
- **Two relay outputs:**
each with one SPDT contact
for flow and temperature
monitoring
- **Simple adjustment via
potentiometers**
- **6 LEDs for flow status indications**

6 LEDs indicate the actual flow conditions relative to the setpoint:

- red LED: flow is below setpoint
- yellow LED: flow is at or above setpoint
- green LEDs: degree of setpoint overrange
(1, 2, 3 or 4 LEDs are lit)

If the red LED illuminates, the output relay is de-energised; if the yellow LED illuminates, the output relay is energised.

Temperature monitoring

The setpoint value for flow temperatures in the -20...+100 °C range is also adjustable by a potentiometer. Deviations from the preset value are recognised by the output relay and signalled by a red LED. If the temperature is at or above the setpoint, the relay will energise (red LED is on);

if the temperature is below the setpoint, the relay de-energises and the red LED goes out.

Switch-off delay

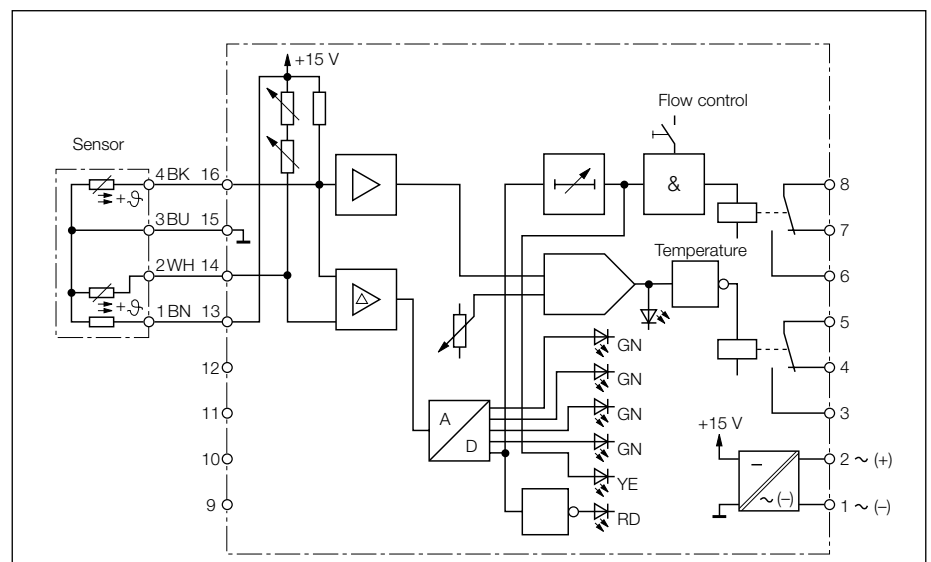
The switch-off delay feature is used to override short duration underflow conditions that could otherwise produce a switching signal. The time (between 0... 25 s) is set by a potentiometer on the front of the device. When the switch-off delay feature is activated, both the red and the yellow LED will illuminate at the same time.

Section 8 "Technology and handling" contains further information on mounting and setup.

Flow monitoring

The coarse potentiometer serves to adapt the signal processor to the operating ranges of the various sensor types and to the thermal conductivity of the medium.

The switch point is adjusted with the fine potentiometer located on the front of the device.

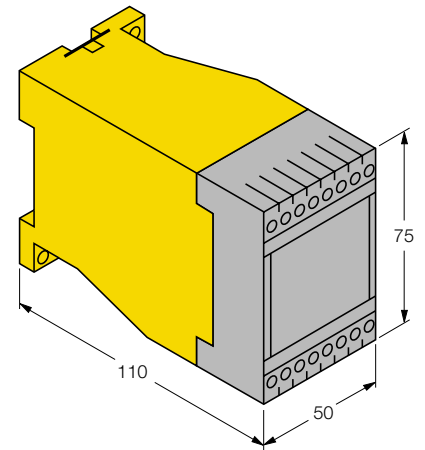


Style *multisafe*®: 2 relay outputs

For further information see section 8, "Technology and handling"

Output	1 relay output (SPDT) for flow 1 relay output (SPDT) for temperature
Switching voltage	≤ 250 VAC / 60 VDC
Switching current	≤ 2 A AC/2 A DC
Switching capacity	≤ 500 VA/60 W
Operating range (flow speed)	depending on sensor
Additional functions	
Temperature monitoring	-20...+100 °C (adjustable via potentiometer)
– repeat accuracy	≤ ± 2 °C
– tolerance	≤ ± 10 °C
– LED indications	1 x red
switch-off delay	0...25 s (adjustable via potentiometer)
LED indications	
– below setpoint	red
– at setpoint, output switched	yellow
– setpoint exceeded	4 x green (in addition to yellow LED)
– temperature monitoring	1 x red
Modular housing	
Mounting	50 mm wide, Polycarbonate/ABS panel mounting or snap-on clamps for top-hat rail (DIN 50022)
Connection	2 x 8 screw terminals (removable)
Connection profile	≤ 2 x 2.5/1.5 mm ² with wire sleeves
Protection degree (IEC 60529/EN 60529)	IP 20
Ambient temperature	-20...+60 °C
Accessories	1 screwdriver for switch point adjustments

Dimensions



Selection table

Type	Ident-no.	Supply voltage U _B	Current consumpt.
MS96-12R/230 VAC	52 310 00	184...265 VAC	≤ 35 mA
MS96-12R/115 VAC	52 310 02	92...127 VAC	≤ 90 mA
MS96-12R/24 VDC	52 310 07	19...29 VDC	≤ 120 mA

Flow controls – signal processors

Processors type *multisafe*[®] intrinsically safe input circuit



- Single channel processor for connection of intrinsically safe sensors
- Intrinsically safe input circuit [Ex ib] IIC, [Ex ia] IIC
- PTB and ATEX approval
- Relay output: 1 SPDT for flow monitoring
- Simple adjustment via potentiometers
- Flow status indications via 6 LEDs

Flow monitoring

Flow setpoint adjustments are achieved by means of a coarse potentiometer and a fine potentiometer. The coarse potentiometer serves to adapt the signal processor to the operating ranges of the various sensor types and to the thermal conductivity of the medium. The fine potentiometer calibrates the flow setpoint to the exact desired flow speed.

6 LEDs indicate the actual flow conditions relative to the setpoint:

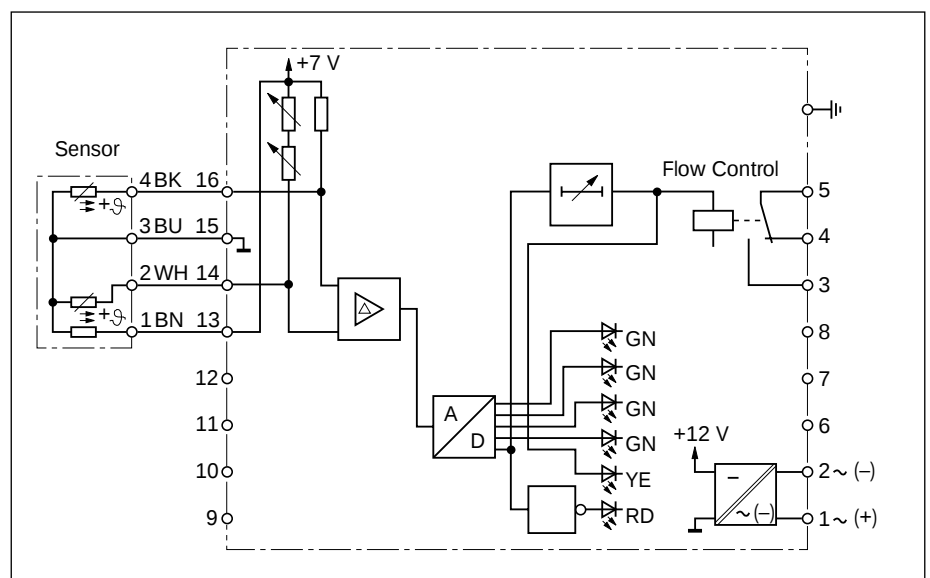
- red LED: flow is below setpoint
- yellow LED: flow is at or above setpoint
- green LEDs: degree of setpoint overrange (1, 2, 3 or 4 LEDs are lit)

If the red LED illuminates, the output relay is de-energised; if the yellow LED illuminates, the output relay is energised.

Switch-off delay

The switch-off delay feature is used to override short duration underflow conditions that could otherwise produce a switching signal. The time (between 0... 25 s) is set by a potentiometer on the front of the device. When the switch-off delay feature is activated, both the red and the yellow LED will illuminate at the same time.

See section 8 "Technology and handling" for further information on mounting and setup.



Style *multisafe*[®]: relay output, intrinsically safe input circuit

For further information see section 8,
"Technology and handling"

Type	MS96-11Ex-R...	MS96-11Ex0-R..
Output Switching voltage Switching current $\cos \varphi$ / LIR	1 relay output (SPDT) ≤ 250 VAC/60 VDC ≤ 4 A AC/0.5 A DC ≥ 0.7 / ≤ 50 ms	1 relay output (SPDT) ≤ 250 VAC/60 VDC ≤ 4 A AC/0.5 A DC ≥ 0.7 / ≤ 50 ms
Ex approval acc. to conformity certificate Protection type Max. values – no-load voltage U_0 – short-circuit current I_k External inductances/capacitances – internal resistance	PTB No. Ex-93.C.2039 intrinsically safe, [EEx ib] IIC  ≤ 12.6 V ≤ 200 mA $L_0 \leq 0.5$ mH; $C_0 \leq 1200$ nF $R_i = 68.5 \Omega$ (trapezoidal curve)	TÜV 96 ATEX 1098 intrinsically safe, [EEx ia] IIC  ≤ 12.6 V ≤ 200 mA $L_0 \leq 0.5$ mH; $C_0 \leq 170$ nF $R_i = 68.5 \Omega$ (trapezoidal curve)
Operating range	depending on sensor (FCS-...NAEx...)	depending on sensor (FCS-...NAEx0...)
Additional functions Switch-off delay	0...25 s (adjustable via potentiometer)	0...25 s (adjustable via potentiometer)
LED indications – below setpoint – at setpoint, output switched – setpoint exceeded	red yellow 4 x green (in addition to yellow LED)	red yellow 4 x green (in addition to yellow LED)
Modular housing Mounting Connection Connection profile Protection degree (IEC 60529/EN 60529) Ambient temperature	50 mm wide, Polycarbonate/ABS panel mounting or snap-on clamps for top-hat rail (DIN 50022) 2 x 8 screw terminals (removable) $\leq 2 \times 2.5/1.5$ mm ² with wire sleeves IP20 -20...+60 °C	50 mm wide, Polycarbonate/ABS panel mounting or snap-on clamps for top-hat rail (DIN 50022) 2 x 8 screw terminals (removable) $\leq 2 \times 2.5/1.5$ mm ² with wire sleeves IP20 -20...+60 °C
Accessories	1 screwdriver for switch point adjustments	1 screwdriver for switch point adjustments

Selection table

Type	Ident-no.	Supply voltage U_B	Current consumption	Intrinsic safety
MS96-11Ex-R/230VAC	52 312 00	207...253 VAC	≤ 28 mA	[EEx ib] IIC
MS96-11Ex-R/115VAC	52 312 02	104...127 VAC	≤ 75 mA	[EEx ib] IIC
MS96-11Ex-R/24VDC	52 312 07	22...26 VDC	≤ 125 mA	[EEx ib] IIC
MS96-11Ex0-R/230VAC	52 314 00	198...242 VAC	≤ 28 mA	[EEx ia] IIC
MS96-11Ex0-R/115VAC	52 314 02	99...121 VAC	≤ 75 mA	[EEx ia] IIC
MS96-11Ex0-R/24VDC	52 314 07	21...28 VDC	≤ 125 mA	[EEx ia] IIC

Flow controls – signal processors

Processors type *multicart*®



- **Dual channel processor**
- **Four relay outputs:**
1 SPDT contact per channel for flow monitoring and 1 SPDT contact for temperature monitoring
- **Simple adjustment via potentiometers**
- **Flow status indications via 6 LEDs**

If the red LED illuminates, the output relay is de-energised; if the yellow LED illuminates, the output is energised.

Temperature monitoring

The setpoint value for flow temperatures in the -20...+100 °C range is also adjustable by a potentiometer on the PCB. Deviations from the preset value are recognised by the output relay and signalled by a red LED. If the temperature is at or above setpoint, the relay will energise (red LED is on); if the temperature is below the setpoint, the relay de-energises and the red LED goes out.

Switch-on/switch-off delay

The switch on/off delay feature is used to override short duration underflow conditions that could otherwise produce a switching signal.

The desired function (off or on delay) is programmed via a DIP-switch on the PCB.

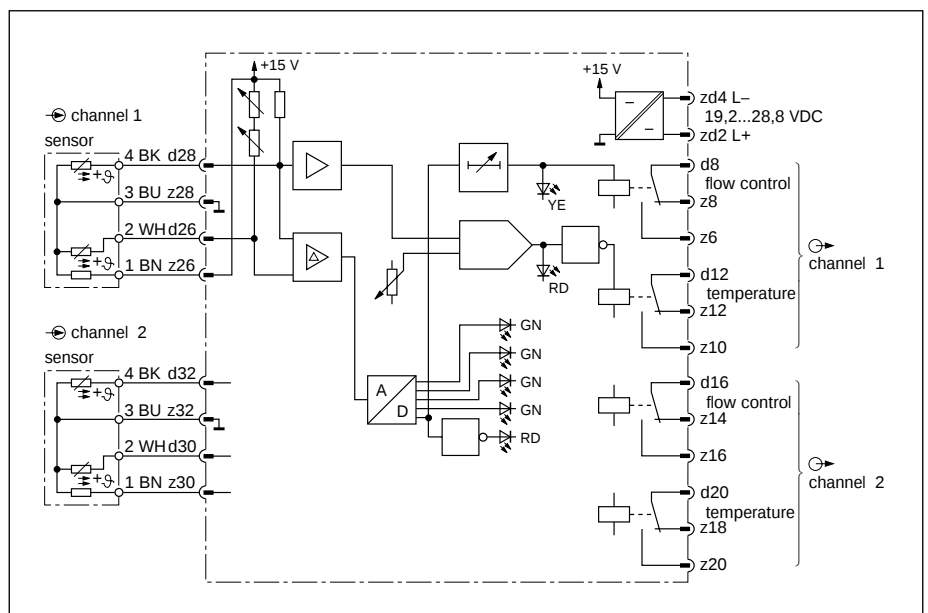
The delay time (between 0...25 s) is set by means of a potentiometer (also on the PCB). When the switch-off delay feature is activated, both the red and the yellow LED will illuminate at the same time.

Flow monitoring

Flow setpoint adjustments are achieved by means of a coarse potentiometer and a fine potentiometer. The coarse potentiometer serves to adapt the signal processor to the operating ranges of the various sensor types and to the thermal conductivity of the medium. The fine potentiometer calibrates the flow setpoint to the exact desired flow speed.

6 LEDs indicate the actual flow conditions relative to the setpoint:

- red LED: flow is below setpoint
- yellow LED: flow is at or above setpoint
- green LEDs: degree of setpoint overrange (1, 2, 3 or 4 LEDs are lit)

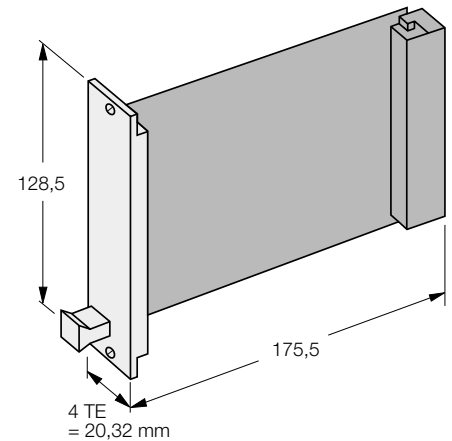


Style *multicart*[®]: 2 channels, 4 relay outputs

For further information see section 8, "Technology and handling"

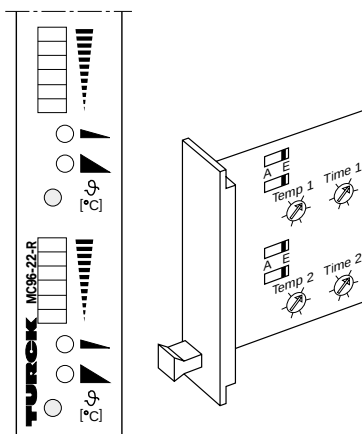
Type Ident-no.	MC96-22-R/24VDC 90 785 01
Supply voltage U_B Current consumption	19.2...28.8 VDC 2.5 W
Output Switching voltage Switching current Switching capacity	4 relay outputs (SPDT) ≤ 30 VAC/36 VDC ≤ 2 A ≤ 60 VA/50 W
Operating range	depending on sensor
Additional functions Temperature monitoring – repeat accuracy R – tolerance – LED indications – switch-on/switch-off delay	-20...+100 °C (adjustable via potentiometer) $\leq \pm 2$ °C $\leq \pm 10$ °C 1 x red 0...25 s (adjustable via potentiometer), function (switch-on/switch-off delay), programmable via DIP-switches
LED indications – below setpoint – at setpoint, output switched – setpoint exceeded – temperature monitoring	red yellow 4 x green (in addition to yellow LED) 1 x red
Eurocard Base material Front plate Connection Protection degree Ambient temperature	100 x 160 mm (DIN 41494) glass-fibre reinforced epoxy resin, quality class FR4 plastic/aluminium, 4 TE = 20.32 mm, individually interlocking connector per DIN 41612, type F, 32-pole (series z+d) IP20 -20...+40 °C
Accessories	1 screwdriver for switch point adjustments

Dimensions



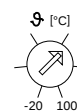
Mounting & set-up

LED display for flow status indications:

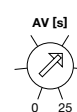


- 4 x green: relative degree of setpoint overrange (illumination of 1, 2, 3 or 4 green LEDs)
- 1 x yellow: at or above setpoint
- 1 x red: below setpoint
- potentiometer (coarse) for coarse adjustment of the flow switch point
- potentiometer (fine) for precise adjustment of the flow switch point

○ the red LED illuminates if the temperature setpoint is reached or exceeded



potentiometer for adjustment of the temperature setpoint (from -20 °C...+100 °C)



potentiometer for adjustment of the switch-off delay (from 0...25 s), affects the output for flow monitoring

DIP-switch (function: switching delay):

in pairs in pairs
left = right =
switch-off switch-on
delay delay

Flow controls – signal processors

Processors type *multicart*[®] intrinsically safe input circuit



- **Single channel device for intrinsically safe sensors**
- **Intrinsically safe input circuit, [EEx ib] IIC, [EEx ia] IIC**
- **Two relay outputs: each with one SPDT contact for flow and temperature monitoring**
- **Simple adjustment via potentiometers**
- **6 LEDs for flow status indications**

6 LEDs indicate the actual flow conditions relative to the setpoint:

- red LED: flow is below setpoint
- yellow LED: flow is at or above setpoint
- green LEDs: degree of setpoint overrange (1, 2, 3 or 4 LEDs are lit)

If the red LED illuminates, the output relay is de-energised; if the yellow LED illuminates, the output relay is energised.

Temperature monitoring

The setpoint value for flow temperatures in the -20...+100 °C range is also adjustable by a potentiometer. Deviations from the preset value are recognised by the output relay and signalled by a red LED. If the temperature is at or above the setpoint, the relay will energise (red LED is on);

if the temperature is below the setpoint, the relay de-energises and the red LED goes out.

Switch-on/switch-off delay

The switch on/off delay feature is used to override short duration underflow conditions that could otherwise produce a switching signal.

The desired function (off or on delay) is programmed via a DIP-switch on the PCB.

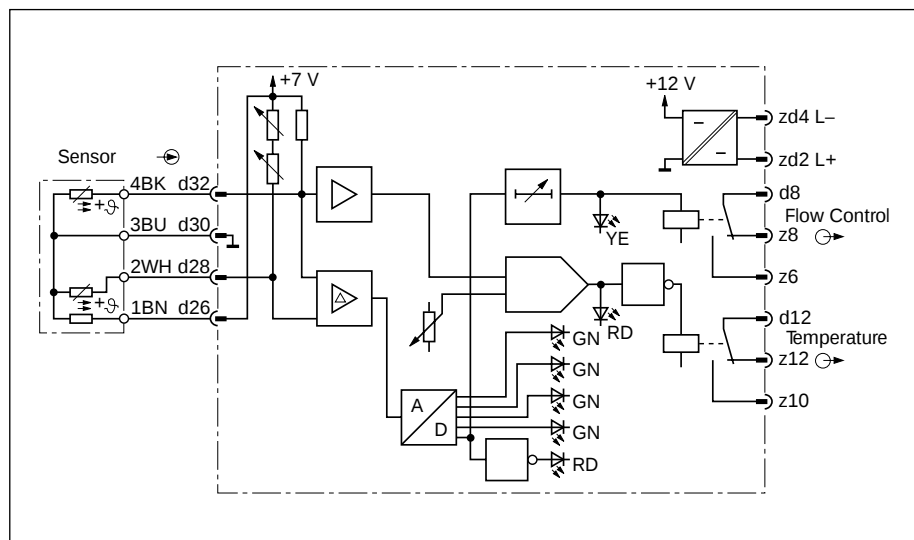
The delay time (between 0...25 s) is set by means of a potentiometer (also on the PCB). When the switch-off delay feature is activated, both the red and the yellow LED will illuminate at the same time.

Flow monitoring

The single channel MC96-12Ex-... signal processor features an intrinsically safe input circuit for connection of intrinsically safe insertion sensors. In addition to the flow rate monitoring function, it is also possible to monitor the medium temperature.

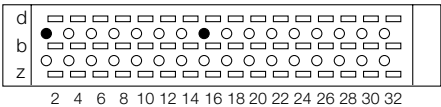
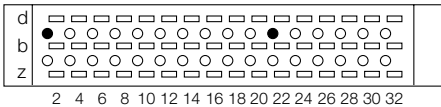
The coarse potentiometer  serves to adapt the signal processor to the operating ranges of the various sensor types and to the thermal conductivity of the medium.

The switch point is adjusted with the fine potentiometer  located on the front of the device.



Style *multicart*[®]: 1 channel, 2 relay outputs, intrinsically safe input circuit

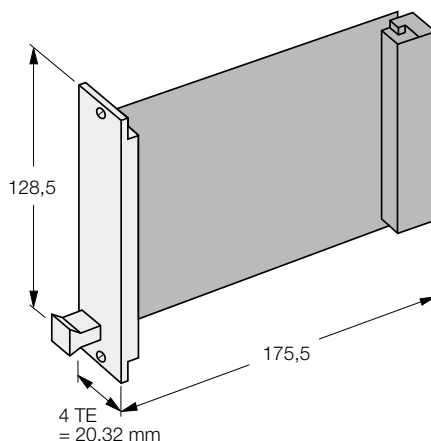
For further information see section 8, "Technology and handling"

Type Ident-no.	MC96-12Ex-R/24VDC 90 785 10	MC96-12Ex0-R/24VDC 90 785 11
Supply voltage U_B Current consumption Intrinsic safety	19.2...28.8 VDC (incl. ripple) approx. 2.5 W [EEx ib] IIC	19.2...28.8 VDC (incl. ripple) approx. 2.3 W [EEx ia] IIC
Output Switching voltage Switching current Switching capacity	2 relay outputs (SPDT) ≤ 30 VAC/36 VDC ≤ 2 A ≤ 60 VA/50 W	2 relay outputs (SPDT) ≤ 30 VAC/36 VDC ≤ 2 A ≤ 60 VA/50 W
Ex approval acc. to conformity certificate Protection type Max. values – no-load voltage U_0 – short-circuit current I_0 – internal resistance R_i – max. power P_0 External inductances/capacitances	PTB No. Ex-94.C.4034X intrinsically safe, [EEx ib] IIC 12.6 V 200 mA 68.5 Ω (trapezoidal curve) 0.69 W $L_0 \leq 0.86$ mH; $C_0 \leq 1400$ nF	TÜV 97 ATEX 1183X intrinsically safe, [EEx ia] IIC 13.65 V 200 mA 68.5 Ω (trapezoidal curve) 0.69 W $L_0 \leq 0.87$ mH; $C_0 \leq 150$ nF
Operating range	depending on sensor (FCS-...NAEx...)	depending on sensor (FCS-...NAEx0...)
Additional functions Temperature monitoring – repeat accuracy R – tolerance – LED indications Switch-on/switch-off delay	-20...+100 °C (adjustable via potentiometer) ≤ ± 2 °C ≤ ± 10 °C 1 x red 0...25 s (adjustable via potentiometer), function (switch-on/switch-off delay) programmable via DIP-switches on pcb	-20...+100 °C (adjustable via potentiometer) ≤ ± 2 °C ≤ ± 10 °C 1 x red 0...25 s (adjustable via potentiometer), function (switch-on/switch-off delay) programmable via DIP-switches on pcb
LED indications – below setpoint – at setpoint, output switched – setpoint exceeded – temperature monitoring	red yellow 4 x green (in addition to yellow LED) 1 x red	red yellow 4 x green (in addition to yellow LED) 1 x red
Eurocard Base material Front plate Connection Ambient temperature	100 x 160 mm (DIN 41494) glass-fibre reinforced epoxy resin, quality class FR4 plastic/aluminium, 4 TE = 20.32 mm, individually interlocking connector per DIN 41612, type F, 32-pole (series z+d) -20...+40 °C	100 x 160 mm (DIN 41494) glass-fibre reinforced epoxy resin, quality class FR4 plastic/aluminium, 4 TE = 20.32 mm, individually interlocking connector per DIN 41612, type F, 32-pole (series z+d) -20...+40 °C
Codierung	(no. 108)	(no. 111)
		
Accessories	1 screwdriver for switch point adjustments	1 screwdriver for switch point adjustments



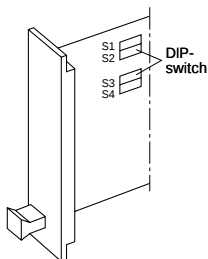
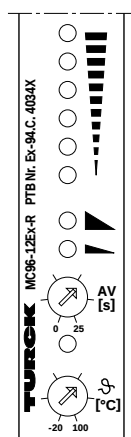
Signal processors – type *multicart*[®]: mounting instructions

1. The signal processor must be mounted outside the explosion hazardous area.
2. When mounting the signal processor, it must be assured that at least protection degree IP20 according to IEC 60529 is met.
3. When mounting the signal processor, it is required to separate the intrinsically safe and non-safe connections by a barrier. A minimum distance of 50 mm (thread measure) must be observed. Alternatively, it is possible to cover each connection with a non-slip shrink sleeve or to use crimp technology.



Operation

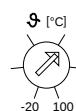
Signal processor MC96



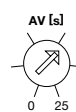
LEDs for flow status indications:

- 4 x green: relative degree of setpoint overrange (illumination of 1, 2, 3 or 4 green LEDs)
- 1 x yellow: at or above setpoint
- 1 x red: below setpoint
- potentiometer (coarse) for coarse adjustment of the flow switch point
- potentiometer (fine) for precise adjustment of the flow switch point

the red LED illuminates if the temperature setpoint is reached or exceeded



potentiometer for adjustment of the temperature setpoint (from -20 °C...+100 °C)



potentiometer for adjustment of the switch-off delay (from 0...25 s), affects the output for flow monitoring (terminals d8, z8, z6)

DIP-switch (function: switching delay)

S1 all left = switch-off
S2 delay
S3
S4

S1 all right = switch-on
S2 delay
S3
S4

CONNECTION PRODUCTS ACCESSORIES

In order to achieve optimum and error-free performance of flow controls, the use of matching top quality mounting aids and connection products is essential.

TURCK offers an extensive range of flange connections, seals, cables, connectors and mounting blocks for appropriate mounting of the flow monitors.



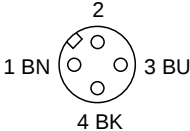
Connector, 3 poles, system *eurocon*

Contact carrier material	Thermopl. PUR
Contact carrier colour	black
Cable sleeve/grip material	Thermopl. PUR
Cable sleeve/grip colour	blue
Contact material/galvanic coating	CuZn, nickel and gold-plated
Coupling nut material/galvanic coating	CuZn, nickel-plated

Contact rating	
Rated current	4.0 A
Rated voltage	250 V

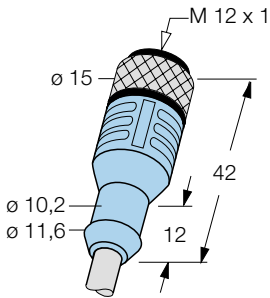
Cable	2 m long (other cable lengths on request)
Cable jacket material	PVC (other materials on request)
Cable jacket colour	grey
Outer diameter	5.2 mm ± 0.2 mm
Shielding	–
Conductor insulation material	PVC
Conductor insulation colour	BN, BU, BK
No. of conductors/cross section	3 x 0.5 mm ²
Litz wire construction	16 x 0.2 mm Ø

General data	
Insulation resistance	≥ 10 ⁹ Ω
Connector temperature rating	-40...+80 °C
Cable temperature rating	-25...+80 °C ¹⁾
Protection degree (IEC 60529/EN 60529)	
– connected	IP67
Spacings (VDE 0110b)	250 VAC/300 VDC, Gr. C

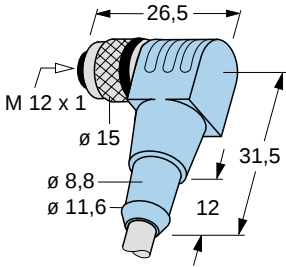
Configuration (view of contacts)	
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Dimensions

Type WAK3-2/P00
Ident-no. 80 070 31



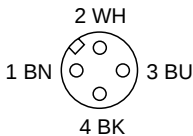
Type: WWAK3-2/P00
Ident-no. 80 071 33



Further information on connection products, (e.g. stainless steel coupling nuts, PUR cables and LED indications) is contained in our connector catalogue (D800447).

¹⁾ At temperatures below -25 °C it is not permitted to move the cables.

Connector, 4 poles, system *eurocon*

Contact carrier material	Thermopl. PUR
Contact carrier colour	black
Cable sleeve/grip material	Thermopl. PUR
Cable sleeve/grip colour	blue
Contact material/galvanic coating	CuZn, nickel and gold-plated
Coupling nut material/galvanic coating	CuZn, nickel-plated
Contact rating	
Rated current	4.0 A
Rated voltage	250 V
Cable	
Cable jacket material	2 m long (other cable lengths on request) PVC (other materials on request)
Cable jacket colour	grey
Outer diameter	5.2 mm ± 0.2 mm
Shielding	–
Conductor insulation material	PVC
Conductor insulation colour	BN, BU, BK, WH
No. of conductors/cross section	4 x 0.5 mm ²
Litz wire construction	16 x 0.2 mm Ø
General data	
Insulation resistance	≥ 10 ⁹ Ω
Connector temperature rating	-40...+80 °C
Cable temperature rating	-25...+80 °C ¹⁾
Protection degree (IEC 60529/EN 60529)	
– connected	IP67
Spacings (VDE 0110b)	250 VAC/300 VDC, Gr. C
Configuration (view of contacts)	

¹⁾ At temperatures below -25 °C it is not permitted to move the cables.

Length of cable between sensor and signal processor

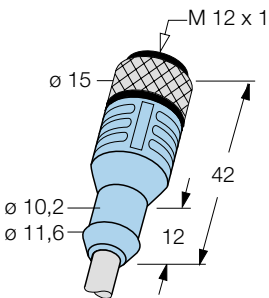
The length of the cable between the sensor and the processor has an influence on the sensitivity of the sensor. The versions with integrated cable feature a cable that is 2 m long with a conductor cross section of 0.25 mm². If the cable is to be extended or if a sensor with plug-in connections is to be connected, it is required to observe the minimum conductor cross sections. If the conductor cross sections quoted in

the table are used, the sensitivity of the flow control is reduced by 10 % max. The conductor cross sections mentioned apply to all four conductors.

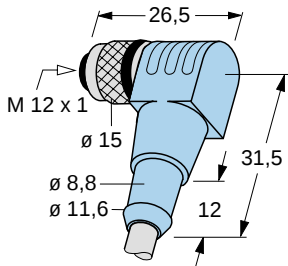
Attention: Keep machine supply cables or interference fields away from the sensor cable or use shielded cables.

Dimensions

Type: WAK4-2/P00
Ident-no. 80 070 46



Type: WWAK4-2/P00
Ident-no. 80 071 48



Further information on connection products, (e.g. stainless steel coupling nuts, PUR cables and LED indications) is contained in our connector catalogue (D800447).

Cond. cross section (mm ²)	Max. cable length up to			
	30 m	50 m	100 m	200 m
0.25	•			
0.50	•	•		
0.75	•	•	•	
1.50	•	•	•	•

Cable lengths and conductor cross sections

Connector, 4-poles, system eurocon, for intrinsically safe sensors

Contact carrier material	Thermopl. PUR
Contact carrier colour	black
Cable sleeve/grip material	Thermopl. PUR
Cable sleeve/grip colour	blue
Contact material/galvanic coating	CuZn, nickel and gold-plated
Coupling nut material/galvanic coating	CuZn, nickel-plated

Contact rating	
Rated current	4.0 A
Rated voltage	250 V

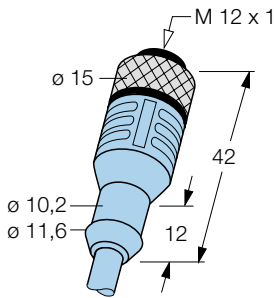
Cable	2 m long (other cable lengths on request)
Cable jacket material	PVC (other materials on request)
Cable jacket colour	blue
Outer diameter	5.2 mm ± 0.2 mm
Shielding	–
Conductor insulation material	PVC
Conductor insulation colour	BN, BU, BK, WH
No. of conductors/cross section	4 x 0.34 mm ²
Litz wire construction	7 x 0.25 mm Ø

General data	
Insulation resistance	≥ 10 ⁹ Ω
Connector temperature rating	-40...+80 °C
Cable temperature rating	-25...+80 °C ¹⁾
Protection degree (IEC 60529/EN 60529)	
– connected	IP67
Spacings (VDE 0110 b)	250 VAC/300 VDC, Gr. C

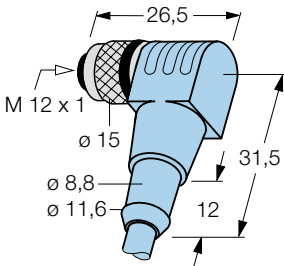
Configuration	
(view of contacts)	

Dimensions

Type: WAK4.41T-2/P00
Ident-no. –



Type: WWAK4.41-2/P00
Ident-no. 80 141 58



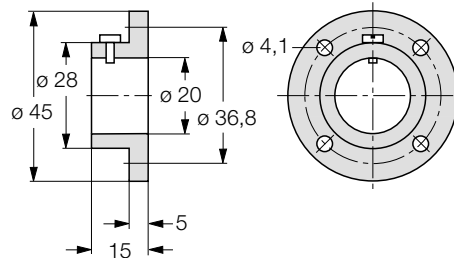
Further information on connection products, (e.g. stainless steel coupling nuts, PUR cables and LED indications) is contained in our connector catalogue (D800447).

¹⁾ At temperatures below -25 °C it is not permitted to move the cables.

Mounting accessories

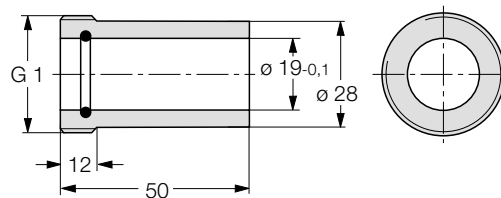
Plastic flange

Type: FSK-20 P
Ident-no. 68 730 10



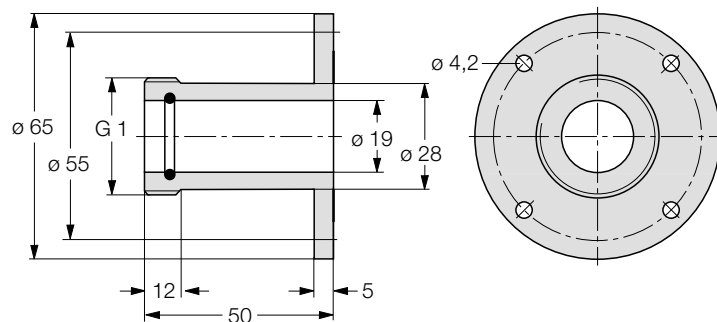
Welded pipe adapter, St37

Type: FCF-003
Ident-no. 68 730 18



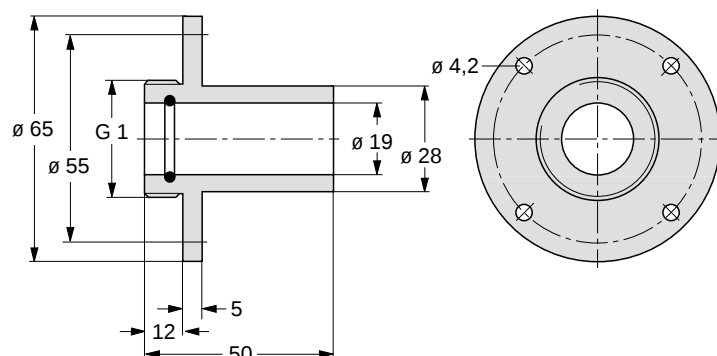
Screw-in pipe adapter, nickel-plated brass

Type: FCF-002
Ident-no. 68 730 17



Screw-in pipe adapter, nickel-plated brass

Type: FCF-001
Ident-no. 68 730 16

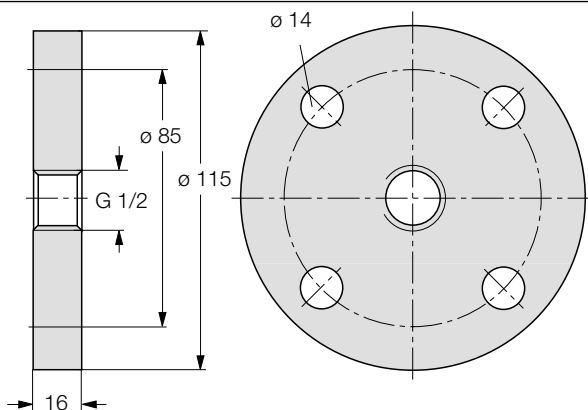


Flow controls – mounting accessories

Flange cover, stainless steel A4 (1.4571/ASI316TI) acc. to DIN 2527

Type: FCF-DN25/PN40-A4

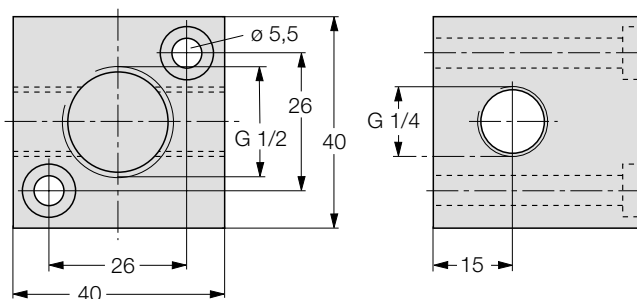
Ident-no. 68 703 65



Adapter block, stainless steel A4 (1.4571/ASI316TI), for FCS-G1/2 type sensors, flow rates from 10 ml/min

Type: FCI-1/2-1/4-1/4-A4

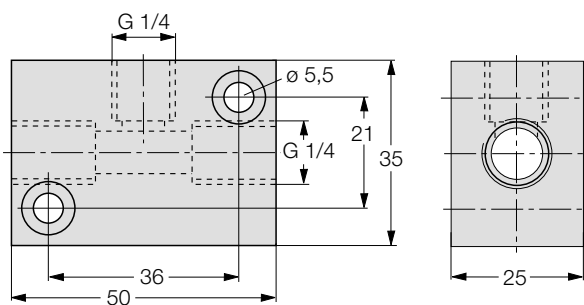
Ident-no. 68 730 19



Adapter block, stainless steel A4 (1.4571/ASI316TI), for FCS-G1/4 type sensors, flow rates from 10 ml/min

Type: FCI-1/4-1/4-1/4-A4

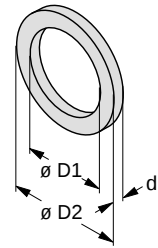
Ident-no. 68 730 12



1/4" seals/1/2"seals, AFM 30/34

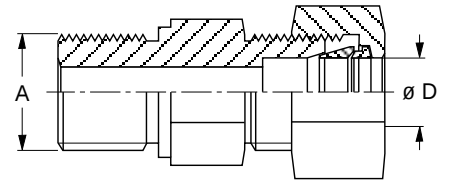
Dimensions

Type	Ident-no.	Thread	D2	D1	d
FD-G1/4AFM30/34	68 750 10	G1/4	19	13	1,5
FD-G1/2AFM30/34	68 750 13	G1/2	27	21	2,0



Self-tapping screw connection, stainless steel A4 (1.4571/AISI316Ti)

Type	Ident-no.	D	A
FSV-D06/M12	68 730 02	6	M12 x 1,5
FSV-D10/M16	68 730 01	10	M16 x 1,5
FSV-D12/M16	68 730 03	12	M16 x 1,5

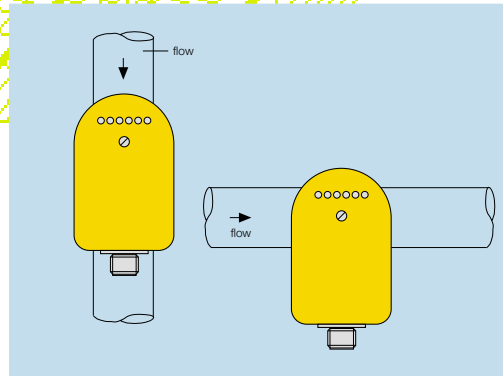


Flow controls

TECHNOLOGY AND HANDLING

This section contains useful information on selection, mounting and application of flow controls:

- Technical reference section
- Flow controls – selection guidelines
- Materials and resistance
- Mounting and set-up
- Calibration and adjustments
- Nomograms
- Explosion protection and ATEX 100a



Technical Reference Section

Calorimetric flow measurement (based on thermal conditions)

TURCK flow controls operate on the calorimetric principle (heat transport/heat loss process). The sensor uses two temperature dependent resistors (similar, but not standard RTDs) connected to a wheatstone bridge. One of the resistors is affected by the temperature of the surrounding fluid to be monitored, the other resistor is connected to a heating element (shown in fig. 8-1 as heater coil).

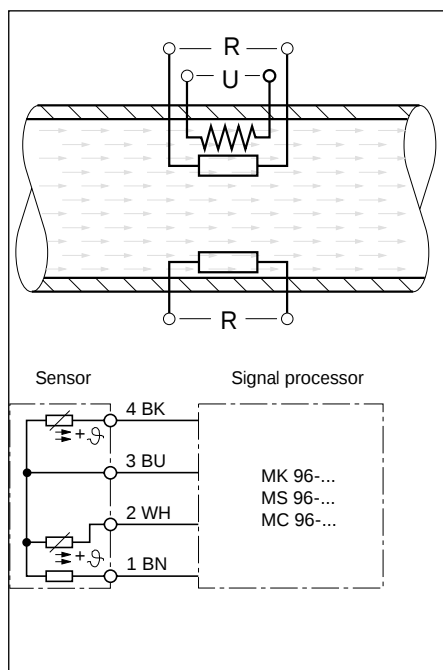


Fig. 8 - 1: Calorimetric flow measurement

When power is applied to the heating element, the electrical energy is transformed into thermal energy. The difference in temperature between both resistors at non flowing mass is indicated by a fixed value.

As fluid moves over the sensor, heat is conducted away from the heating element, causing the temperature on the heated resistor to decrease. This heat loss changes the difference in temperature between the two resistors and therefore the voltage on the connected bridge. By comparing these differences it is possible to determine actual flow conditions.

Operating range

Heat loss on the heating element will likewise determine the sensitivity of the sensor. This heat loss becomes a function of flow velocity and thermal conductivity of the fluid: the lower the thermal conductivity of the fluid, the faster the fluid has to flow to be detected.

Sensor operating ranges vary from one type of fluid to the other. These operating ranges are proportional to the speed of the fluid that the sensor can detect.

At the same flow rate compared to water, air can conduct away from the heating element only a fraction of the heat. For example, for A4 stainless steel insertion type sensors the operating range for water is from 1...150 cm/s. For oil, the range is between the 3...300 cm/s.

Fig. 8 - 2 shows the typical correlation between heat loss and flow rate. The rate-of-heat-loss increases with increasing flow speed and approaches the value 1. When the value 1 has been reached, the system is saturated, i. e. no further heat removal can be detected.

Temperature gradient and thermal sensitivity shift/ temperature rise time

The temperature gradient of a fluid indicates the change in fluid temperature within a specified time
(unit of measure: °C/min. or K/min.).

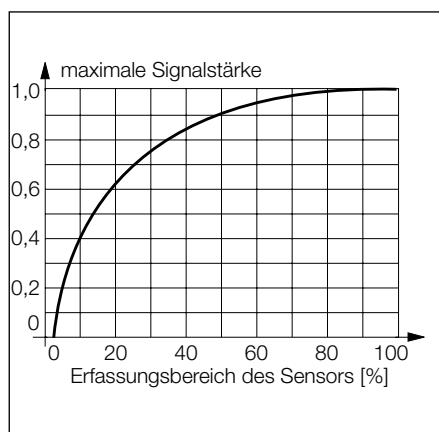


Fig. 8 - 2: Characteristic curve of sensor
(housing: stainless steel, fluid: water).

The temperature gradient of a device defines the max. temperature rise that can be compensated by the sensor without malfunction.

The sensor has the ability to compensate for **sudden thermal shifts within the specified extremes**. Sudden temperature changes exceeding the specified tolerances (temperature error) may cause the device to malfunction.

Only when the sensor has adapted to the new temperature, will it provide an accurate measurement.

The temperature gradient of TURCK flow controls is 250 °C/min. – 15 times higher than standard flow devices which makes for a particularly accurate switch-point and stability during variations in temperature.

The sensitivity to temperature rise of TURCK flow controls has been reduced to a minimum (< 12 s) and can accurately be determined in advance.

This characteristic is the result of the optimum calorimetric principle and special sensors construction (see figure 8 -3):

- housing thickness 0.8 mm
- symmetrically positioned sensor probes
- fully potted sensors
- components, quality and layout

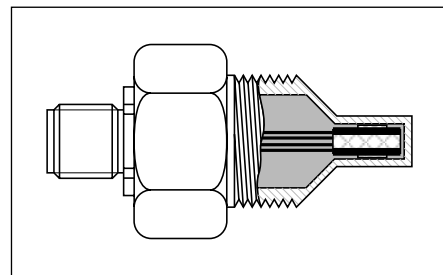


Fig. 8 - 3: Construction of TURCK sensors

TURCK's innovative construction brings additional practical advantages such as:

- immersion depth only 5 mm
- extended pressure resistance up to 100 bar

Calculation of thermal sensitivity Shift/temperature rise time (fault response time due to temperature errors)

Example (see figure 8 - 4): For this sample the temperature gradient T_{g2} given for the fluid is 1500 °C/min., that is the ambient fluid temperature changes within 50 °C.

This change in temperature exceeds the temperature gradient of the device ($T_{g1} = 250$ °C/min.) i.e. it is outside the allowable range (grey shaded area). A false response is likely to occur and flow measurements are inaccurate – they do not reflect actual flow conditions.

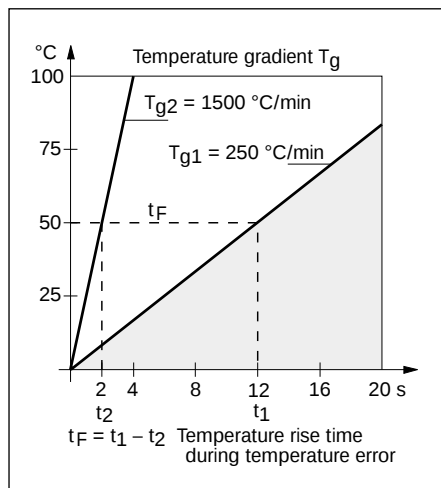


Figure 8-4:
Thermal sensitivity shift/temperature rise
Time as a function of temperature gradient
(T_{g1} = Temperature gradient of TURCK sensors
 T_{g2} = Temperature gradient of fluid)

The temperature rise time during temperature error (t_F) or fault response time indicates the length of time the sensor needs to adjust to the new temperature.

For TURCK sensors, the fault response time is time limited and can be calculated as follows:

$$\begin{aligned} T_F &= t_1 - t_2 \\ &= 12 \text{ s} - 2 \text{ s} \\ &= 10 \text{ s} \end{aligned}$$

At a temperature rise of 50 °C within 2 s (i.e. a temperature gradient of 1500 °C/min), it will take the sensor 10 s to pick up and indicate the actual flow rate.

Because of their extremely high temperature gradients (15 times higher than conventional devices) TURCK sensors respond particularly well to changes in temperature.

A time delay can be added to overcome these 10 seconds within which a false reaction is likely to occur.

Housing material

The sensors are available e. g. in Teflon or stainless steel housings (A4). The selection criteria for the proper housing material is not only influenced by the fluid to be monitored, but also by special application requirements such as the use in hazardous areas, high pressures, high temperatures etc.

Teflon sensors are suitable for most applications that involve corrosive liquids. Because of the low thermal conductivity of Teflon, these sensors have a slower response time than stainless steel sensors.

Temperature range (flow)

The range of temperatures given for the sensor refers to the temperature of the fluid to be monitored.

Standard stainless steel sensors are calibrated for a temperature range from -25...+80 °C (100 °C over a short period of time). Other sensors are available with a temperature range from 0...+100 °C (120 °C over a short period of time).

Ambient temperature

The ambient temperature refers to room conditions under which the remote signal processors connected to the sensors must operate.

Commonly, this temperature is the air temperature surrounding the signal processors. When devices are mounted in close proximity to each other, the temperature of the neighbouring device must be considered.

Availability time

The availability time is the length of time required for the sensor to reach a stable condition after it has been turned on, provided the flow is at a nominal value and the sensor has already adjusted to the temperature of the fluid.

Switch-on/switch-off time

The switch on time is the length of time required by the sensor to produce an output reading under specified conditions.

The switch off time is – in reverse – the length of time required by the flow device to detect and indicate that flow is decreasing.

Stainless steel devices typically have a switch-on/off time of 2 s.

Response time

The response time is the time needed by a flow sensor with analogue output to detect and display a change in the flow speed.

Flow controls

Sensor selection/material resistance

Flow controls – selection criteria

Please consult Turck, if you are not sure which sensor suits your application needs. We will help you find exactly the right sensor.

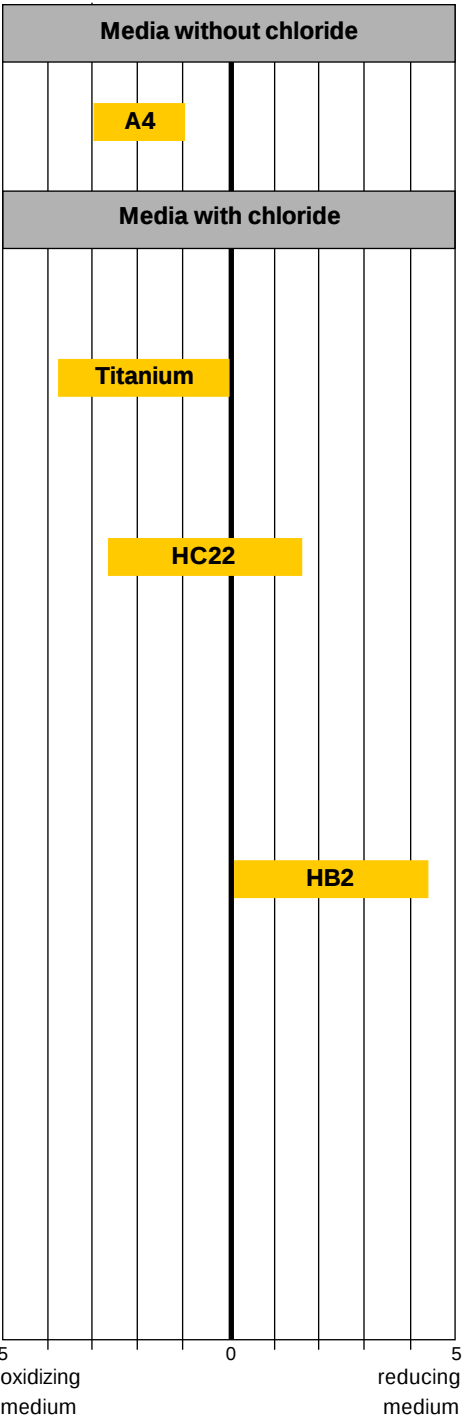
The following technical details facilitate selection of the appropriate sensor type, especially if problematic applications are concerned:

- application description
- customer or user-specific standards and regulations
- the specific flow medium
- flow rate (min./max.)
 - in cm/s
 - in l/min
- output
 - transistor/relay
 - analogue (4...20 mA)
- switch point (measuring range)
- pipe diameter
- pipe material
- required housing style:
 - self-contained device
 - insertion style sensor
 - inline sensor
- connection mode/thread size
- selection of standard sensor materials:
 - A2 (1.4305/AISI303)
 - A4 (1.4571/AISI316Ti)
 - Titanium
 - Teflon
 - Dyflor
 - Hastelloy B 2
 - Hastelloy C4/C22
 - ...
- system parameters:
 - temperature
 - pressure
 - explosion hazardous area
 - ...
- type of signal processor
- supply voltage rating

Information on material selection

The following table provides an overview over various alloys which are particularly suited for installation in chemically aggressive media. The table is intended to give merely a general idea of chemical resistance and different media.

It is a basic principle that the flow sensor and the pipe should always be made of the same material, i.e. it is recommended to select both the sensor and the pipe material at the same time.



Stainless steel (A4/1.4571/AISI316Ti)

This type of stainless steel belongs to the group of chromium-nickel alloys. It can only be used in chloride-bearing and corrosive environments under certain conditions.

Titanium (3.7035)

belongs to the group of light metals and has a good resistance against chloride-bearing substances and salt water.

Hastelloy C22 (2.4602)

belongs to the group of extremely corrosion resistant nickel-chromium-molybdenum-Tungsten alloys. It features excellent resistance against corrosive media, incl. strong oxidizers such as ferric (III) and cupric (II) chloride, sulfuric acid, nitric acid, phosphoric acid, chlorine (dry) and acetic acid.

Hastelloy B2 (2.4617)

belongs to the group of highly corrosion resistant nickel-molybdenum alloys and exhibits excellent resistance against reducing media such as hydrochloric acid (at all concentrations). It can also be used in the presence of hydrogen chloride, sulfuric, hydrofluoric, acetic and phosphoric acids. Hastelloy B2 is not recommended in the presence of oxidizing substances such as ferric and cupric salts. In addition, Hastelloy B2 provides good protection against pitting and knife-line corrosion and corrosion in the heat-affected zone.

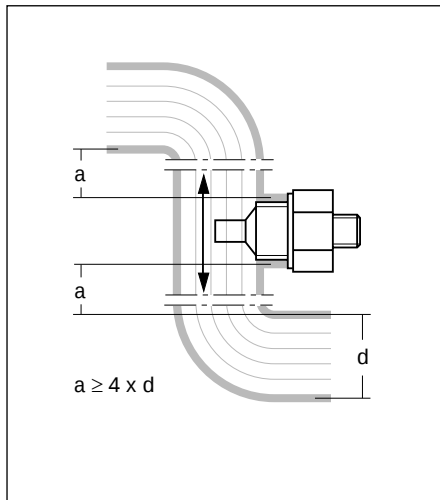
Mounting instructions

TURCK flow controls are equipped with standard threaded electrical terminations and sealings which make replacements fast and simple.

Installation of the devices depends on the specific requirements of the application and on the type of sensor used.

For best results, use the sealing rings supplied with insertion flow sensors.

Note: To avoid false signals due to air pockets, do not install flow sensors near pipe elbows or intersections (minimum distance is $> 4 \times$ pipe diameter).

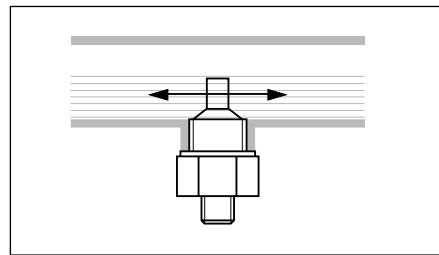


Installation of insertion style sensors

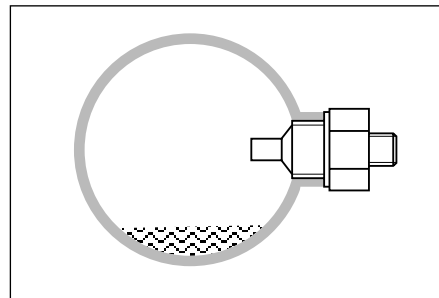
Probe devices are ideal for large pipe sizes. They are particularly suited for applications where it is necessary to monitor flow rates in the 1...150 cm/s range for water, and in the 3...300 cm/s range for oil. These devices resist pressures up to 100 bar.

Guidelines for installation

If the sensor is installed horizontally and the pipes are not completely filled by the medium, the sensor must be mounted from below into the flow line.

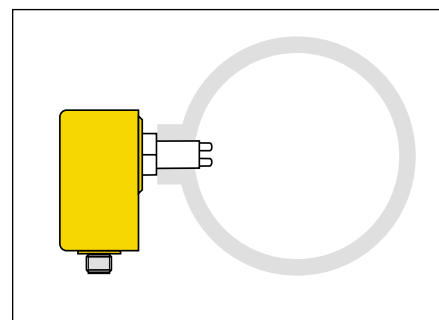


If the sensor is installed horizontally and a possibility of deposit build-up exists, the sensor must be mounted from the side.



Mounting of dual probe systems

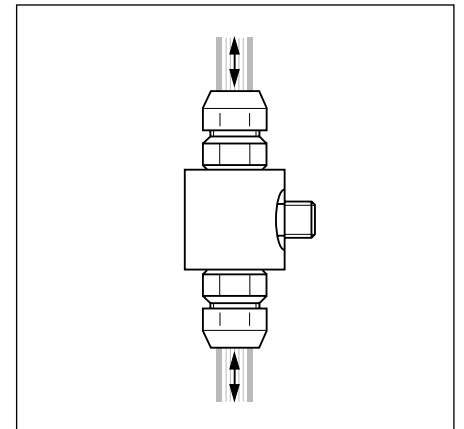
These sensors require to be mounted as shown below.



Installation of inline sensors

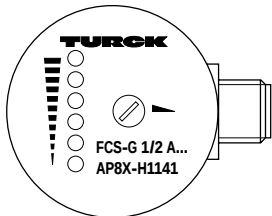
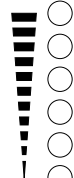
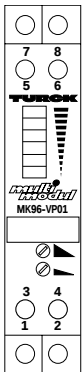
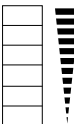
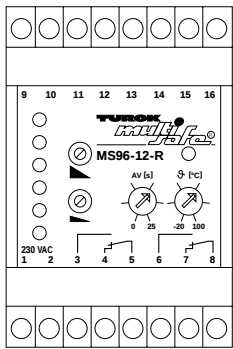
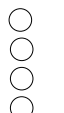
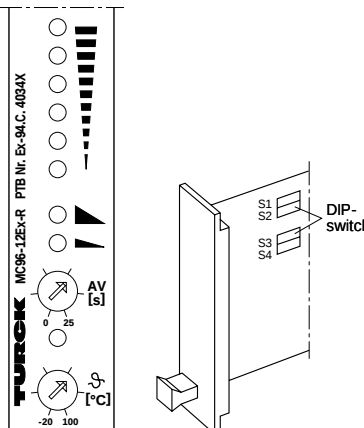
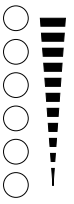
Inline sensors are ideal for pipe sizes up to 10 mm. They are particularly suitable for fluids in the 5...150 (30...900) ml/min range for water and 15...300 (90...1800) ml/min for oil. Inline sensors resist pressures up to 5 (10) bar.

For best results, mount inline sensors horizontally, with the *eurocon* connector at the top.



Flow controls

Set-up – operating and display functions

Self-contained device		6 LEDs for flow rate status indication:	 4 x green: degree of setpoint overrange (1, 2, 3 or 4 green LEDs are lit) 1 x yellow: flow is at/above setpoint 1 x red: flow is below setpoint	 Sealing screw (on front of device) covers the potentiometer for switch point adjustment  Potentiometer for adjustment of flow switch point (with analogue devices the potentiometer is used to set the measuring range)								
Processor MK96		LED display for flow rate status indication:	 4 x green: degree of setpoint overrange (1, 2, 3 or 4 green LEDs are lit) 1 x yellow: flow is at/above setpoint 1 x red: flow is below setpoint	 Potentiometer (coarse) for operating range adjustment  Potentiometer for fine adjustment of switch point value Analogue versions  2 calibration potentiometer for adjustment of minimum flow to 4 mA  1 calibration potentiometer for adjustment of maximum flow to 20 mA								
Processor MS96		6 LEDs for flow rate status indication:	 4 x green: degree of set-point overrange (1, 2, 3 or 4 green LEDs are lit) 1 x yellow: flow is at/above setpoint 1 x red: flow is below setpoint  Potentiometer (coarse) for operating range adjustment  Potentiometer for fine adjustment of set-point trip value	 Red LED illuminates when flow is at or above preset temperature.  9 [°C] Potentiometer for temperature set-point adjustment (from -20 °C...+100 °C)  AV [s] Potentiometer to set switch-off delay time (from -20 °C...+100 °C), which affects the flow monitoring output (terminals 6...8)								
Processor MC96		6 LEDs for flow rate status indication:	 4 x green: degree of set-point overrange (1, 2, 3 or 4 green LEDs are lit) 1 x yellow: flow is at/above setpoint 1 x red: flow is below setpoint  Potentiometer (coarse) for operating range adjustment  Potentiometer for fine adjustment of switch-point value	 Red LED illuminates when flow is at or above preset temperature.  9 [°C] Potentiometer for temperature setpoint adjustment (from -20 °C...+100 °C)  AV [s] Potentiometer to set switch-off delay time (from -20 °C...+100 °C), which affects the flow monitoring output (terminals d8, z8, z6) DIP switch (for time delay functions): <table><tr><td></td><td>S1 S2</td><td></td><td>S3 S4</td></tr><tr><td colspan="2">all left = switch-off delay</td><td colspan="2">all right = switch-on delay</td></tr></table>		S1 S2		S3 S4	all left = switch-off delay		all right = switch-on delay	
	S1 S2		S3 S4									
all left = switch-off delay		all right = switch-on delay										

Set-up – LED indications and output status

LED indications of devices with transistor/relay output

Active LED indications	Meaning	Output
green      green      green      green      yellow      red     	Fluid moves at a speed that exceeds the pre-programmed setpoint. The number of illuminated green LEDs indicates to what extent the flow rate exceeds the setpoint.	energised
green   green   green   green   yellow   red  	Flow speed according to preset value.	energised
green   green   green   green   yellow   red  	Flow speed below preset value.	not energised
green   green   green   green   yellow   red  	Flow rate is below the setpoint; the switch-off delay function is activated. (with MS96-12 and MC96 signal processors only).	energised, switch-off delay

LED indications of analogue devices

Active LED indications	Meaning	Output
green  $\geq$ 20 mA green  $>$ 16 mA green  $>$ 12 mA green  $>$ 8 mA green  $>$ 4 mA red  $\leq$ 4 mA	The higher the flow speed, the more green LEDs are lit.	4...20 mA depending on flow speed within the operating range

Flow controls

Adjustment and calibration

Devices with transistor or relay output

have several monitoring possibilities:

1. Medium flows/flows less
2. Flow/no flow
3. Medium present/not present

Calibration must be carried out as follows:

Medium flows/reduced flow

- install sensor
- generate minimum flow
- adjust potentiometer so that the red LED starts illuminating
- with an increase in flow the yellow and at least one green LED should illuminate

Alternatively:

- install sensor
- generate standard flow
- adjust potentiometer so that the yellow and one green LED illuminate (in case of fluctuating flows two green LEDs)
- if the standard flow is underranged, first the green and then the yellow LED will turn dark. If the flow is below the setpoint, the red LED illuminates and the transistor is disabled (or the relay de-energises).

Flow/no flow (flow standstill monitoring)

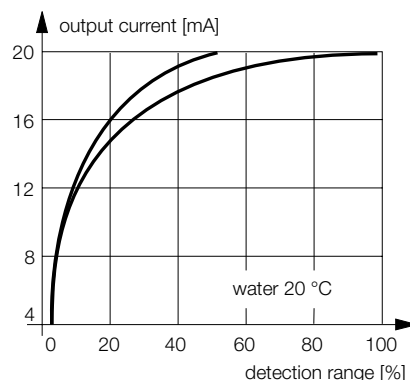
- install sensor
- adjust potentiometer so that the red LED illuminates when there is no flow
- if the flow sets in, the yellow and at least one green LED should illuminate

Medium present/not present (run-dry protection)

- install sensor
- turn potentiometer until the red LED illuminates when there is no flow present
- if the medium is present or the flow sets in, the yellow and at least one green LED should illuminate

Analogue devices with potentiometer

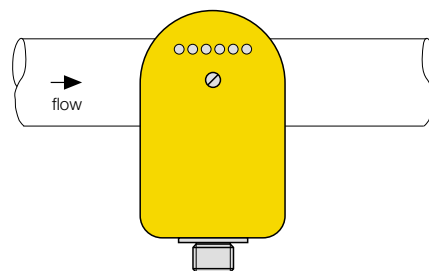
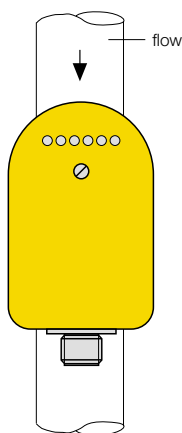
The self-contained devices with analogue output have a potentiometer for measuring range adjustments. The minimum flow accords to 4 mA. The potentiometer serves to adjust the upper range value (20 mA).



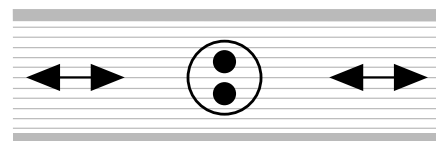
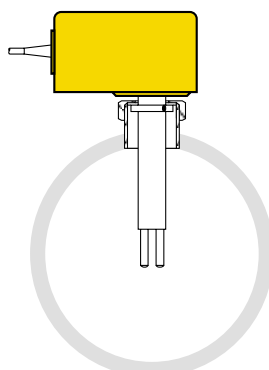
Analogue devices with two potentiometers

These devices (self-contained version and signal processor) feature two separate potentiometers for adjustment of the low (4 mA) and upper range value (20 mA).

When using **analogue self-contained devices (single probe systems)** it is required to observe the mounting direction as shown below:



When using **dual probe sensors (self-contained devices and insertion sensors)** it is required to observe the mounting position as shown below:



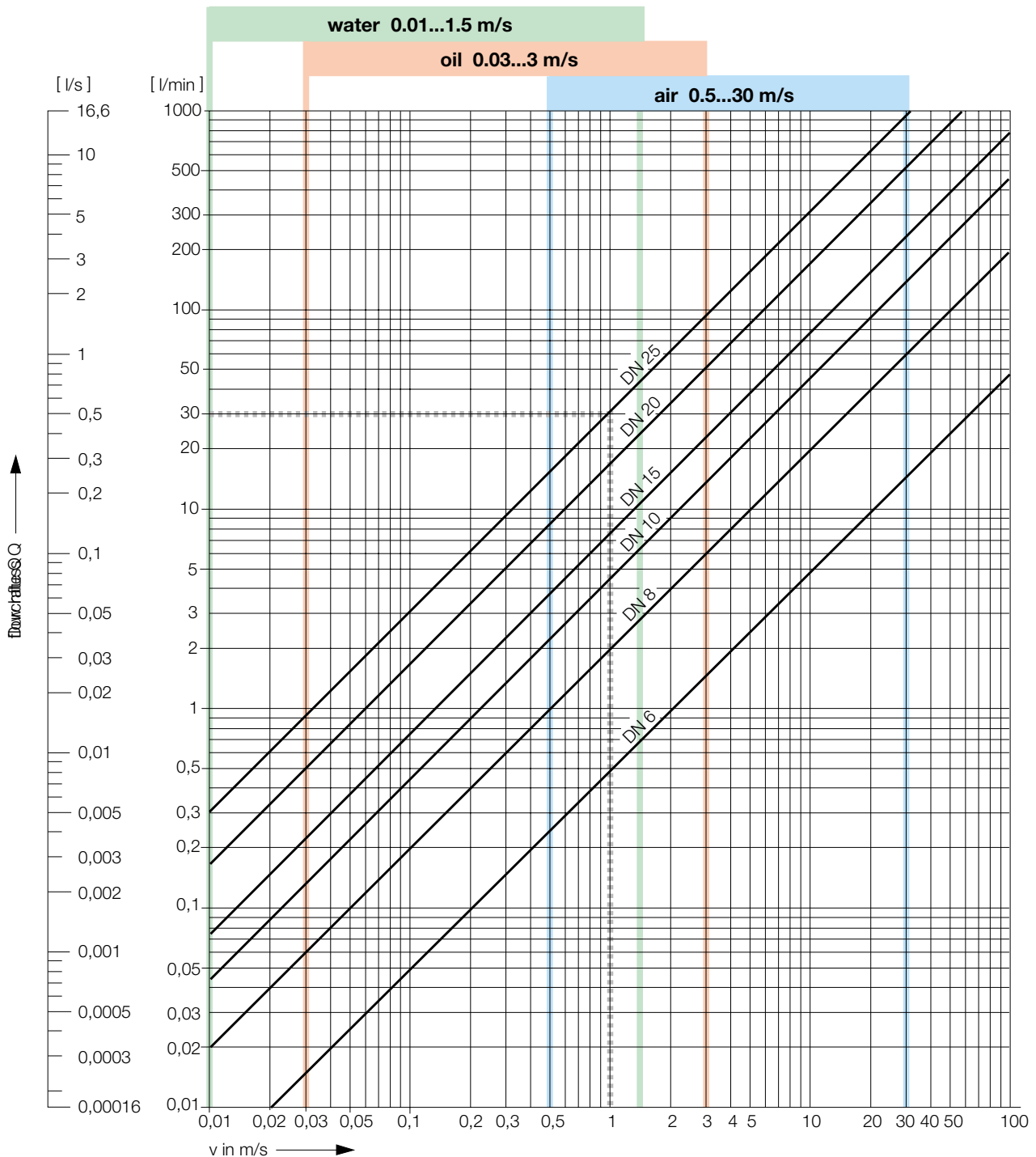
Positioning of sensing probes in the flow channel

Nomogram (pipe profile DN 6...25)

The nomogram serves to convert volume flow rates (l/min) into flow speeds (m/s), depending on the pipe diameter (DN).

The example shown illustrates this correlation. If the flow rate is outside the detection range of the sensor, it is possible

to increase or reduce the flow speed in order to assure secure function by changing the pipe diameter.



Example: A flow rate of 30 l/min at a nominal pipe profile of DN25 results in a flow speed of 1 m/s.

Conversion units: 1 imp.gallon = 4.546 liter 1 US gallon = 3.785 liter

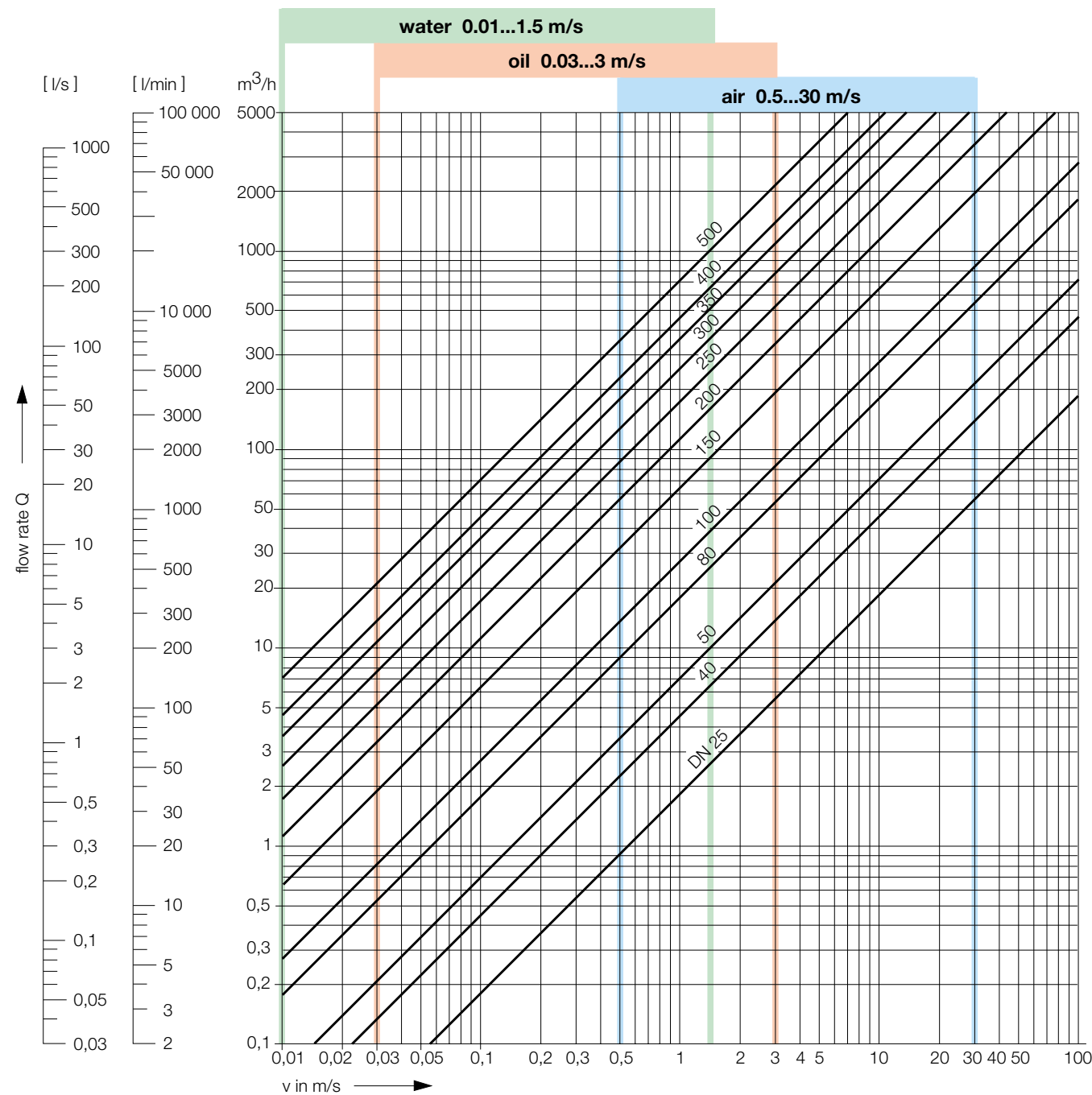
Flow controls

Nomogram (pipe profile DN 25...500)

The nomogram serves to convert volume flow rates (l/min) into flow speeds (m/s), depending on the pipe diameter (DN).

The example shown illustrates this correlation. If the flow rate is outside the detection range of the sensor, it is possible

to increase or reduce the flow speed in order to assure secure function by changing the pipe diameter.

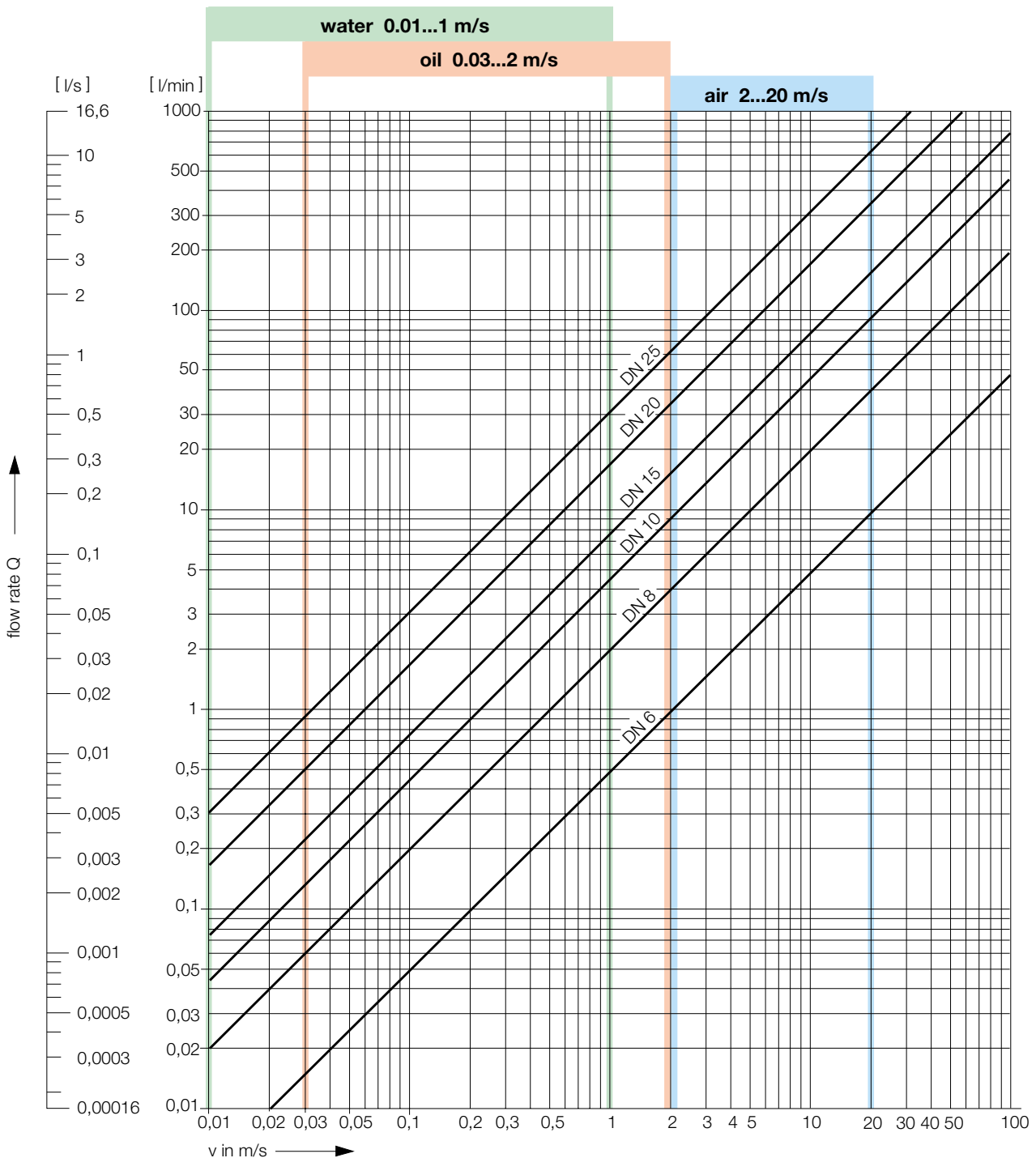


Nomogram for intrinsically safe flow sensors (pipe profile DN 6...25)

The nomogram serves to convert volume flow rates (l/min) into flow speeds (m/s), depending on the pipe diameter (DN).

The example shown illustrates this correlation. If the flow rate is outside the detection range of the sensor, it is possible

to increase or reduce the flow speed in order to assure secure function by changing the pipe diameter.



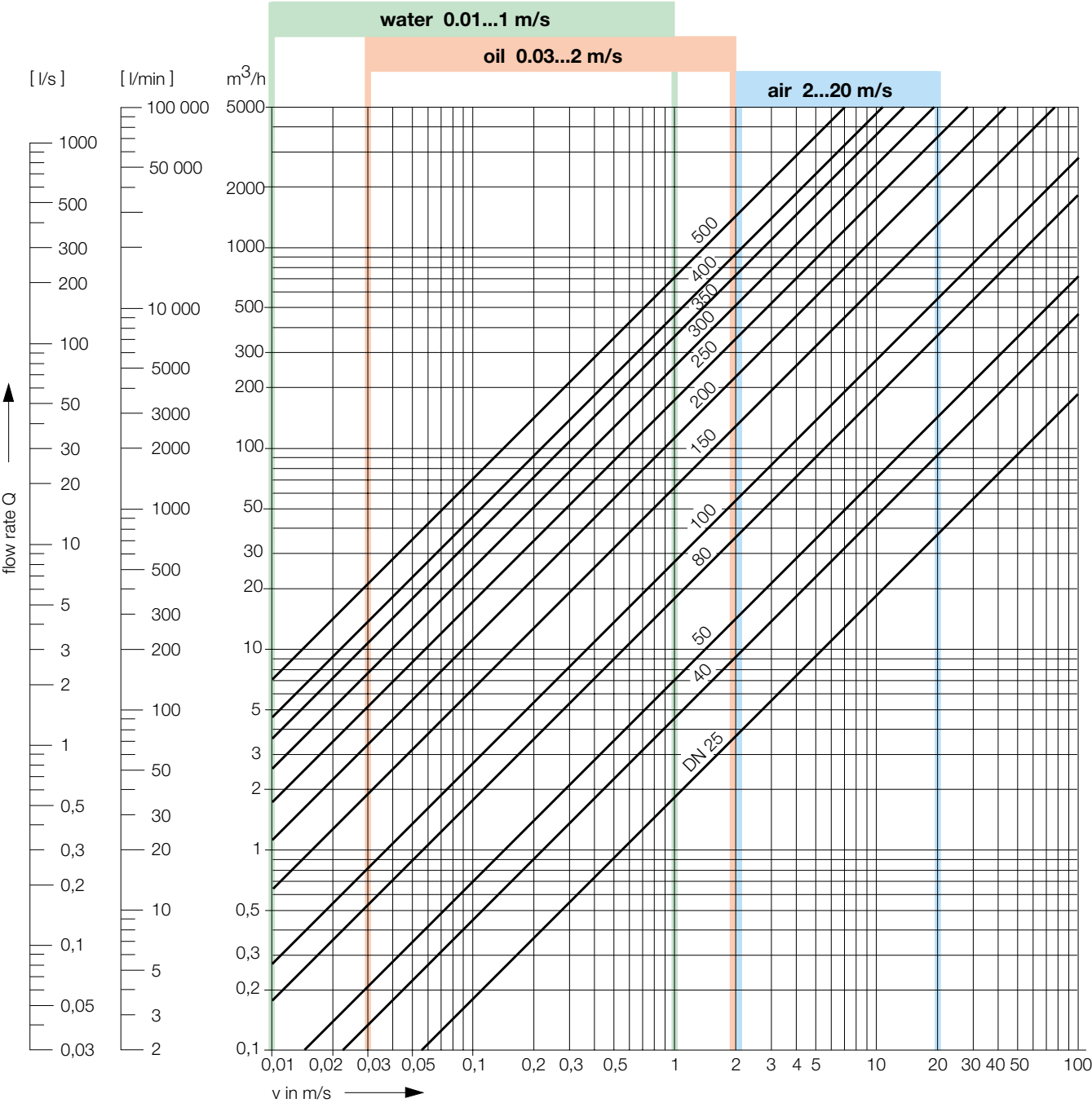
Flow controls

Nomogram for intrinsically safe flow sensors (pipe profile DN 25...500)

The nomogram serves to convert volume flow rates (l/min) into flow speeds (m/s), depending on the pipe diameter (DN).

The example shown illustrates this correlation. If the flow rate is outside the detection range of the sensor, it is possible

to increase or reduce the flow speed in order to assure secure function by changing the pipe diameter.



The new explosion protection directive ATEX 100a

The process of harmonisation of regulations in the of explosion protection within the member states of the European Union was initiated in 1996. The different regulations existing in the individual member states presented a trade barrier which was the major reason for this initiative. The transitional period, during which both the new and the previous regulations are applicable, has been extended until 30 June 2003. The new harmonised regulations will take effect in all member states of the European Union from 1 July 2003.

Following please find a brief overview over the old and new regulations.

Directives and Standards

History

Until the end of 1975, numerous national directives covering the field of explosion protection existed in the individual European states. On 18 December 1975, the first framework directive on explosion protection (mining excluded) came into effect, applying in the member states of the European Union: 76/117/EWG.

Until 1990 there were frequent amendments of this directive. This directive referred to the characteristics and structure of the equipment at issue and was directly related to standards. It applied exclusively to electrical equipment and explosion protection (except mining). The fact that national directives were still in effect restricted free trade in this area.

In the beginning of 1994, the „Framework Directive 94/9/EC of the European Parliament and Council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres“ was passed. This directive has regard to the „European Treaty“ of 1985, in particular article 100a (amendment of 2 February 1992), establishing the European Community. To find a general abbreviation for this new directive it was agreed to use the name **ATEX 100a**. ATEX is an abbreviation of the French translation of „explosive atmosphere“ (**atmosphère explosible**) and 100a refers to the article 100a. Apart from the article 100a, there

are further articles which have not yet been fully transposed into according directives. TURCK catalogues always use the term **ATEX** to relate to the new directives on explosion protection conforming to ATEX 100a.

Within the member states of the European Union the ATEX 100a was translated into national legislation, e.g. in the Federal Republic of Germany by the „Geräte-sicherheitsgesetz (§11 GSGV)“ and the „Explosionsschutzverordnung (EXVO)“.

The presently valid regulations on explosion protection will have effect until 30 June 2003. Even though the new regulations came into effect in 1996, a transitional period was created to adopt the new regulations complying with ATEX.

Installation and operation of electrical equipment in hazardous areas – standards and requirements

Involved with installation, approval and operation of electrical equipment are:

The legislator having industrial supervision, trade organizations, TÜV, and experts as supervisory authorities.

All **plant personnel** are required to observe strict guidelines such as health and safety and other work regulations that govern the maintenance and operation of electrical equipment located in the hazardous area.

The system installer who must meet the installer's safety requirements according to IEC 31 (CO) 43, ATEX137, EN 60079-14.

The manufacturers of components bound by construction requirements set forth by EN 50014...20, 28 and 39 and ATEX 100a.

EN 60079-14 Installation of intrinsically safe systems in explosion hazardous areas

This standard includes the safety requirements (e. g. identification and classification of explosion hazardous locations, temperature classes, cabling and wiring, requirements for the installation of electrical devices in zones 0 and 1).

Contrary to the standards described, which are primarily for manufacturers, this standard applies to maintenance, operators and test personnel.

As EN 60079-14 this standard also complies with the requirements of ATEX. Please note that the former exemption clause for components is no longer included. Partly an approval for individual components is now required.

ElexV – regulations on electrical equipment in explosion hazardous locations (old) / areas (new)

As a national directive, the ElexV is addressed to those responsible in Germany for the technological causes of the formation of explosive mixtures.

The former ElexV of 1980 related to European regulations on explosion protection of industrial electrical equipment. This „old“ version constituted the legal basis for almost the entire field of explosion protection of electrical equipment. By defining explosion hazardous areas and especially by dividing these into specific zones, ElexV gained major importance as a standard for explosion protection measures. Since the introduction of the ATEX directive in 1996 a lot has changed. Definitions relating to the non-electrical aspects of new electrical equipment are now covered by the new „Explosion Protection Directive“ (ExVO). The amended version of ElexV of 1996 refers only to those parts which have not yet been translated into national regulations.

ATEX 137 - directive for system operators

The directive 1999/92/EC of the European Parliament and Council of 16 December concerning the essential health and safety requirements is intended to guard workers against the potential hazards of an explosive atmosphere. It is addressed to system operators and employers and contains binding regulations. Among other things, it requires to assess the risks resulting from a potentially explosive atmosphere, to classify areas exposed to potentially explosive atmospheres and to keep an explosion protection document.

The new explosion protection directive ATEX 100a

The explosion protection directive – (ExVO)

The ExVO determines the placing on the market of devices, protective systems and components intended for use in potentially explosive atmospheres and is the German transposition of the directive 94/9/EC. It describes the essential health and safety requirements and mandatory conformity assessment procedures. The ExVO is mainly aimed at manufacturers of devices, maintenance and test personnel.

In compliance with the directive 94/9/EC, ExVO excludes the following equipment from its scope (summarised): medical devices, explosive substances, or unstable chemicals, personal protection equipment, seagoing vessels, offshore systems and products for military purposes.

EN 50014 – electrical apparatus for use in potentially explosive atmospheres – general requirements

EN 50014 contains general requirements for the construction and testing of any electrical apparatus to be used in hazardous areas.

EN 50015...20, 28 and 39 describe the technical requirements of different methods of protection:

- oil immersion (EN 50015)
- pressurised apparatus (EN 50016)
- powder filling (EN 50017)
- flameproof enclosure (EN 50018)
- increased safety (EN 50019)
- intrinsic safety (EN 50020)
- encapsulation (EN 50028)
- intrinsically safe electrical systems (EN 50039)

EN 50020 – protection type „intrinsic safety (i)“

All other methods of protection attempt to contain an explosion to the inside of the housing and to prevent penetration of an ignitable gaseous mixture.

The method of „Intrinsic Safety“ is based on a different approach. It limits the

electrical energy to such an extent, that elevated temperatures, sparks or arcs are incapable of generating the energy needed to ignite an explosive atmosphere.

Due to the limitation of electrical energy, these circuits are especially suited to application in the field of measuring, control and instrumentation. The method of „intrinsic safety“ has some significant advantages over other protection methods, e.g. maintenance and wiring of live circuits. These systems are easy to handle and cost effective due to inexpensive intrinsically safe components.

Device groups and categories according to the ATEX directive

The ATEX directive includes a new kind of device marking which describes the application and the constructional level of safety.

This new marking per ATEX does not replace standardised marking including temperature class, explosion group and protection type.

Marking according to ATEX contains information on the area of application and the safety level achieved by the device. Marking according to EN 50020 provides detailed information on how the protection measures were realised and which applications are permitted. EN 50020 and ATEX use similar terms but the information provided may be essentially different.

The first criterion is the **equipment group**. This classification accords to the groups described on page 11 and defines the location in which a device may be installed.

- Device Group I: for mining underground with a potential hazard due to firedamp and/or combustible dusts.
- Device Group II: for all other locations in which a potentially explosive atmosphere exists

The second criterion is the **equipment category**, defining the level of safety:

- 1: very high level of safety: devices featuring two independent means of protection; even in the event of rare device disturbances, the device

remains functional and maintains the requisite level of protection

- 2: high level of safety: devices featuring one means of protection. Even in the event of frequently occurring device disturbances or equipment faults which normally have to be taken into account the device provides the requisite level of safety
- 3: normal safety; the device ensures the requisite level of protection during normal operation.

Equipment classified as Group I (underground mining susceptible to firedamp) uses the prefix M, e. g. M1, in addition to the category classification.

The third and last criterion is the **substance group** which characterises the application of devices in particular atmospheres:

- G: explosion protection in explosive atmospheres due to gases, vapours or mists (G: gas)
- D: explosion protection in explosive atmospheres due to dusts (D: dust)

The equipment category also determines whether the device is an associated apparatus or an intrinsically safe apparatus. If it is an associated apparatus the equipment category is put into round brackets, e.g. II (1) G.

Zone classification

According to EN 60079-10 and EN 1127-1 explosion hazardous areas are divided into zones such as flammables gases, vapours, mists and combustible dust. The classification is based on the likelihood that a dangerous explosive atmosphere occurs. The ATEX directive has re-defined the zone division as follows:

- zone 0, 1 and 2 for gases and vapours
- former zones 10 and 11, now zones 20, 21 and 22 for dusts
- zones G and M for locations used for medical purposes

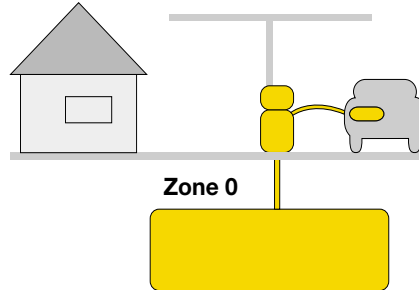
The area classifications covered here are zones 0, 1 and 2 including gases and vapours.

Gases and vapours

Zone 0

Zone 0 is a location in which ignitable concentrations of flammable gases or vapours are continuously present, or present for long periods. The example shows a gas station with zone 0 locations.

According to the previous national regulations any apparatus or parts thereof used in a zone 0 location had to be specially certified and approved for use in zone 0 locations. Further, the certificate of conformity had to mention explicitly that the equipment and parts thereof were permitted for use in zone 0. When using intrinsically safe and associated equipment as an interconnected assembly, both parts used to require a system approval.



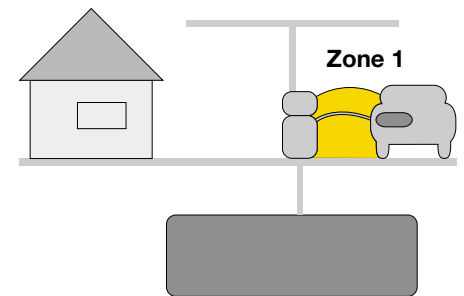
This restriction is not included to the ATEX directive. If both parts of equipment meet the regulations for installation in zone 0, it is permitted to use the equipment accordingly without an extra approval. When electrical equipment approved by both previous and new regulations is used as an interconnected assembly, it is required to meet all requirements set forth by both directives. Additionally a system approval is needed.

Intrinsically safe apparatus designed for use in zone 0 must meet category "ia" safety standards and must have no live contacts. Galvanic isolation between intrinsically safe and non-safe equipment is the method of choice. If earthing of the intrinsically safe circuit is required for functionality, this must be done outside zone 0, but as close as possible to zone 0.

Zone 1

Zone 1 covers locations in which an explosive air/gas mixture is likely to occur under normal operation. Here ATEX does not incorporate any changes. The example identifies the area near the gas pump during refuelling as a zone 1 location. Generally the following areas in industrial plants are considered to be zone 1 locations:

- in the vicinity of zone 0
- close to inspection openings
- near filling and draining devices
- inside of machinery



Any equipment certified for zone 1 must be Group IIA, IIB or IIC and at least category "ib".

Zone classification	Likelihood of an explosive atmosphere	Compliance with safety requirements by	Requirements fulfilled by		
			equipment group	related equipment category	additional equipment category
Zone 0 (gas, ...) Zone 20 (dust)	continuously, for long periods or frequently	2 independent means of protection	II	1 G (for gas, ...) 1 D (for dust)	–
Zone 1 Zone 21	occasionally	1 independent means of protection	II	2 G 2 D	1
Zone 2 Zone 22	unlikely or infrequently - for a short period only	normal operation	II	3 G 3 D	1 or 2

Zone classification – equipment category

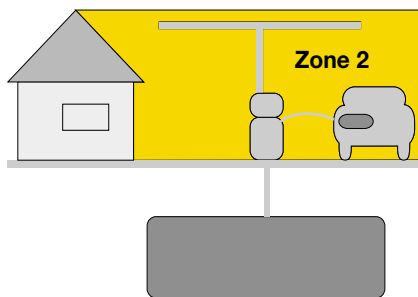
Flow controls

The new explosion protection directive ATEX 100a

Zone 2

Zone 2 comprises areas in which an explosive and dangerous atmosphere is unlikely to occur, but, if it does, only for a short period. The ATEX definition of zone 2 differs slightly: An explosive atmosphere should not occur, but, if it does, only infrequently and for a short period.

- any areas near zone 0 and 1
- areas near flange seals whenever standard flange joints are used
- areas near pipe lines in closed rooms



Unlike apparatus for zones 0 and 1, equipment for use in zone 2 does not require a test certificate by an authorised body. Devices for zone 2 must conform to category 3 and must meet the following criteria (EN 50021):

- **restricted breathing enclosures**
(10 K overtemperature only)
- **sealed enclosures**
(various test methods/requirements)
- **simple pressurized enclosure**
(like „p“ without purging)
- **limited energy**
(intrinsic safety without safety factor)
- **encapsulated switching devices**
(simple „pressurized enclosure“)
- **lower requirements for equipment in zone 1, e.g.**
 - clearances and creepages
 - housing impact test
 - plastic materials
 - construction of lampholders and starters

Installation of devices in zone 0 to 2

For installation in zones 0 to 2 (gas, vapour) it is required that intrinsically safe and associated equipment must meet at least those requirements applying to the zone in which the intrinsically safe apparatus is to be installed. If the equipment meets higher requirements, operation is obviously permitted.

The national regulations apply to inter-connected assembly and installation of devices.

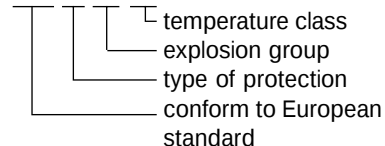
Marking of devices

Equipment for explosion protected areas must be clearly marked. There are two different types of marking. According to CENELEC marking of an apparatus conforming to EN 50014/20 must provide the following information:

- manufacturer's name or trademark
- part number
- EEx-symbol
- ignition category (e. g. „ia“)
- designated group together with the respective subdivision (e. g. IIC)
- temperature class or maximum surface temperature (for group II devices only)
- serial number (may be omitted if space is restricted)
- test authority, date and file number
- „X“ after the test certificate number indicates that special conditions must be met (see certificate for special conditions)

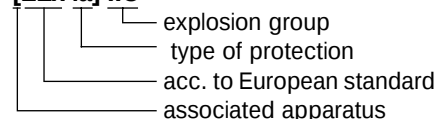
An intrinsically safe apparatus could have the following marking:

EEx ia IIC T6



An associated apparatus could have the following marking:

[EEx ia] IIC



To date, the test certificate number of the test authority used to contain the generation number of the applicable standard to indicate the amendment status, e.g.:

PTB Nr. Ex-85.B.2128X

PTB Nr.	authorised body
Ex-	explosion protected apparatus
85.	year of issue
B.	generation indicator
2128	serial certificate number
X	special conditions

According to ATEX marking must be as follows:

PTB 97 ATEX 2128X

PTB	authorised body
97	year of issue
ATEX	accord. to 94/9/EC
2128	serial certificate number
X	special conditions

Within the European Union the devices must meet the respective requirements. If the manufacturer fulfills these, he is permitted to affix the CE sign. The ATEX directive extends marking. The identification number of the notified body, which carried out the quality assurance system approval, is added to the CE sign.



For example, the test body of the TÜV Hannover uses the identification code 0032 and the PTB in Braunschweig has the code number 0102. Additionally the year of production and the constructional level of safety must be contained in the device's marking. Marking of intrinsically safe apparatus according to ATEX would be:

II 1 G

explosion protected against gas, vapour and mist
very high safety level
suited for zone 0
all areas except mining

Associated equipment is identifiable by round brackets enclosing the device category:

II (1) G

may not be installed in hazardous areas

Manufacturer obligations

Certificates of conformity and EC type test certificates

An authorised body is entitled to test and certify that devices are suited for use in explosion hazardous areas and comply with the relevant regulations and standards.

Previous regulations required the manufacturer to submit a test sample to the test body and to ensure compliance with existing regulations. The authorised test body then issued the certificate of conformity and passed it on to the manufacturer. The certificate of conformity contains all relevant data associated with explosion protection.

Here, the ATEX directive also implements a change. The manufacturer is requested to supply a type test sample to an authorised inspection body, which draws up a test report to be submitted to the notified body entitled to issue the EC type examination certificate after verifying conformity. Notified bodies and external inspection bodies are registered centrally. The EC type examination certificate contains all data relevant for explosion protection.

The obligation to keep a copy of this certificate is the responsibility of the manufacturer of the device. Along with the certificate, the manufacturer provides an instruction manual with all relevant Ex data. In addition, the manufacturer issues a declaration of conformity, stating that all applicable standards and directives are met. The user needs these documents to document compliance of the system installation.

Approvals and certificates of conformity via internet

TURCK offers their customers to view all valid approvals and to download these as PDF files (Acrobat Reader, version 3.0):

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Flow controls

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FCS-G1/2A4-AP8X-H1141/L080	68 700 08	9	FCS-GL1/2A4-NAEX-H1141	68 704 32	41
FCS-G1/2A4-NA	68 703 38	17	FCS-GL1/2A4-NAEX-H1141/A	68 704 39	43
FCS-G1/2A4-NA/D100	68 704 12	19	FCS-GL1/2A4-NA-H1141	68 704 03	17
FCS-G1/2A4-NA/L080	68 703 45	18	FCS-GL1/2A4-NA-H1141/D500	68 704 25	20
FCS-G1/2A4-NA/L120	68 703 59	18	FCS-GL1/2A4P-AP8X-H1141	68 702 42	10
FCS-G1/2A4-NA/L200	68 703 28	18	FCS-GL1/2A4P-LIX-H1141	68 702 32	12
FCS-G1/2A4-NAEX	68 703 20	41	FCS-GL1/2A4P-VRX/230VAC	68 700 98	11
FCS-G1/2A4-NAEX/AL065	68 703 24	42	FCS-GL1/2A4P-VRX/24VDC	68 700 97	11
FCS-G1/2A4-NAEX/L065	68 703 35	46	FCS-GL1/2T-NA	68 704 22	36
FCS-G1/2A4-NAEX-H1141	68 703 22	41	FCS-GL1/2TN-NA-H1141	68 704 08	37
FCS-G1/2A4-NAEX-H1141/AL065	68 703 33	42	FCS-GL3/4A4-NAEX0	68 704 28	45
FCS-G1/2A4-NA-H1141	68 703 03	17	FCS-HA2-LIX/AL115	68 707 22	62
FCS-G1/2A4-NA-H1141/L080	68 703 17	18	FCS-HA2-LIX-H1141/AL115	68 707 20	62
FCS-G1/2A4-NA-H1141/L120	68 703 16	18	FCS-HA2-VRX/230VAC/AL115	68 707 24	61
FCS-G1/2A4-NA-H1141/L200	68 703 61	18	FCS-K20-AP8X	68 707 02	51
FCS-G1/2A4P-AP8X-H1141	68 700 92	10	FCS-K20-LIX	68 707 03	52
FCS-G1/2A4P-AP8X-H1141/L080	68 703 64	10	FCS-M18-AP8X	68 707 04	53
FCS-G1/2A4P-LIX-H1141	68 700 56	12	FCS-M18-AP8X-D041	68 707 05	54
FCS-G1/2A4P-LIX-H1141/D037	68 700 58	13	FCS-N1/2A4-AP8X-H1141	68 710 04	9
FCS-G1/2A4P-VRX/230VAC	68 700 94	11	FCS-N1/2A4-NA	68 713 09	17
FCS-G1/2A4P-VRX/24VDC	68 700 96	11	FCS-N1/2A4-NA/D100	68 714 12	19
FCS-G1/2DY-AP8X	68 700 05	35	FCS-N1/2A4-NAEX	68 714 23	41
FCS-G1/2DY-AP8X-H1141	68 700 03	35	FCS-N1/2A4-NAEX-H1141	68 713 22	41
FCS-G1/2TN-NA-H1141	68 703 11	37	FCS-N1/2A4-NA-H1141	68 713 03	17
FCS-G1/4A4-AP8X-H1141	68 701 01	9	FCS-N1/2A4P-AP8X-H1141	68 710 32	10
FCS-G1/4A4-NA/D100	68 704 11	19	FCS-N1/2T-NA	68 714 22	36
FCS-G1/4A4-NAEX	68 703 15	41			
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- ☐ CD-ROM Sensortechnik

Interfacetechnik

- ☐ Interfacetechnik im Aufbau-gehäuse
 - Bauform *multimodul*
 - Bauform *multisafe*®
- ☐ Allgemeine Informationen
- ☐ Interfacetechnik auf 19"-Karte
 - Bauform *multicart*®
- ☐ Miniaturrelais, Industrirelais, Zeitwürfel, Sockel
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- ☐ CD-ROM Interfacetechnik

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- ☐ *busstop*®-Feldbuskomponenten
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- ☐ *uprox*® inductive sensors
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- ☐ magnetic-field sensors
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- ☐ machine safety equipment
- ☐ ultrasonic sensors
- ☐ flow controls
- ☐ pressure controls
- ☐ temperature controls
- ☐ connectors
- ☐ CD-ROM Sensors

Interface technology

- ☐ devices in modular housings
 - *multimodul* style
 - *multisafe*® style
- ☐ general information
- ☐ devices on 19" card
 - *multicart*® style
- ☐ miniature relays, industrial relays, time cubes, sockets
- ☐ programmable relays and timers
- ☐ explosion protection – basics for practical application (overview poster)
- ☐ CD-ROM Interface technology

Fieldbus technology

- ☐ *busstop*® fieldbus components
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