

## Description

The FC01-Ex-CA has been designed to provide monitoring, detection and indication of flow speed, volume/mass flow and temperature of gases and powders.

The calorimetric monitoring head CST-Ex is approved to EN 60079-0:2012, EN 60079-11:2012 and EN 60079-26:2007.

## Ranges of application – flow meter FC01-Ex

The flow meter FC01-Ex (electronic control unit) including safety barriers has been designed for use outside of potentially explosive atmospheres. Only monitoring head CST-Ex is installed in potentially explosive atmospheres.

## Ranges of application – monitoring head CST-Ex

	gases	dust
category 1	zone 0 ✓	zone 20 ✓
category 2	zone 1 ✓	zone 21 ✓
category 3	zone 2 ✓	zone 22 ✓

## Features

- Menu driven (keypads)
- LC-display (2 x 16 digits):
  - indication of actual flow velocity, volume flow or mass flow, temperature
  - bargraph status indication of limit contacts, actual flow velocity/flow quantity or temperature
  - directions for parameter assignment, configuration, diagnosis and error correction
  - peak value indication
- Two scalable analogue outputs
- peak value memory (MIN + MAX)
- Two freely selectable limit contacts
- Quantity related pulse output - counter connection/transistor drive.

## Ordering information

<b>Type</b>	FC01-Ex	Flow Meter, surface mounted (IP54)
<b>Version</b>	CA	for compressed air and gases
<b>Input voltage</b>	U1	DC 24 V (19 ... 32 V)
<b>Signal outputs</b>	R2	2 relay outputs (2 limit values)
	T4	transistor outputs (2 limit values + 2 status or 2 limit values + 1 status + 1 pulse output)
<b>Analogue outputs</b>	V1	0/1-5 Volt
	V2	0/2-10 Volt
	C1	0/4-20 mA (self-powered, physically isolated)
<b>Certification</b>	T5	approval to EC directive 94/9/EG (Atex 100a) *)
<b>Specification of medium</b>	xxx	

FC01-Ex - CA - U1 R2 V1 - T5 ... ordering example

\*) for detailed information please see section 0.

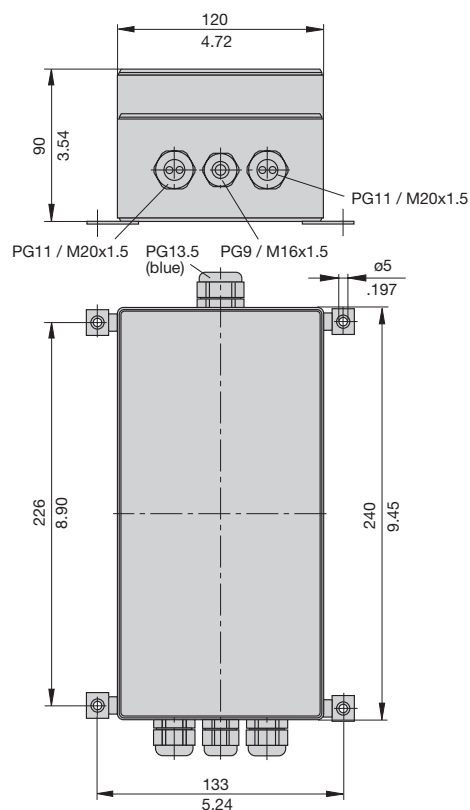


## FC01-Ex-CA

Safety barriers with EC-type-examination Certificate to EN 60079-0:2012, EN 60079-11:2012 and EN 60079-15:2010, ignition protection type

II 3 (1) G Ex nA [ia Ga] IIC T4 Gc  
 II (1) D [Ex ia Da] IIIC

## Dimensions FC01-Ex-CA (surface mounted)



This is a metric design and millimeter dimensions take precedence ( $\frac{\text{mm}}{\text{inch}}$ )

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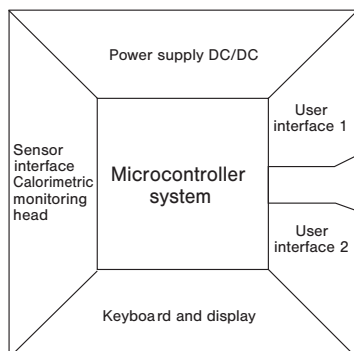
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## TECHNICAL DATA

<b>Flow Meter FC01-Ex-CA</b>		<b>with CST-Ex calorimetric monitoring head</b>																		
<b>General data</b>																				
Suitable for	air, nitrogen, oxygen, sewage gas, methane/natural gas, hydrogen (other gases upon request)																			
Measuring function	flow velocity, volume flow/mass flow, temperature																			
Display	2 x 16-digit LC-display																			
Parameter assignment, calibration by	keypads																			
Temperature range (electronic control unit in circulating air)	-10 °C ... +43 °C/+14 ...+109 °F (room temperature)																			
<b>Electrical data</b>																				
Input voltage	DC 24 V (19 ... 32 V)																			
Current consumption (U <sub>v</sub> = 24 V DC)	170 mA/200 mA *)																			
Analogue outputs (flow and temperature)	0/4-20 mA or 0/2-10 V or 0/1-5 V																			
Signal outputs	2 relay outputs (2 limit values)	2 SPDT contacts AC/DC 50 V/1 A/50 W																		
	4 transistor outputs (2 limit values + 2 status or 2 limit values + 1 status + 1 pulse output)	open collector outputs DC 36 V/150 mA/1,5 W																		
<b>Flow measurement</b>																				
Measuring range (display range) <sup>(5)</sup>	0,7 ... 50 Nm/s (0 ... 75 Nm/s)/2.3 ... 164 fps (0 ... 246 fps) see table next page																			
Accuracy <sup>(4)</sup> (related to velocity at the sensor)	< ± 5 % of measured value (higher accuracy on request)																			
Repeatability <sup>(1)</sup>	< 1 % of measured value																			
Temperature drift (electronic control unit)	0,1 %/°C/measuring range final value/ 0,18 %/°F/measuring range final value																			
Response delay <sup>(2)</sup>	3 s																			
Temperature measurement	measuring range	-40 ... +75 °C/-40 ... +266 °F																		
	accuracy	± 1,5 % of measuring range																		
<b>Mechanical data (surface-mounted housing)</b>																				
Degree of protection	IP54																			
Material	polycarbonate																			
Housing dimensions (LxWxH)	240 x 120 x 90 mm/9.45 x 4.72 x 3.54 in.																			
Weight	1750 g/3.86 lb																			
Cables	voltage supply	3x0,75 mm <sup>2</sup> (AWG 18)																		
	to monitoring head	LiYCY 4x2x0,75 mm <sup>2</sup> (AWG 18), light blue																		
	analogue output	2 x LiYCY 2x0,25 mm <sup>2</sup> (AWG 24)																		
	signal outputs	LifYCY 4x2x0,2 mm <sup>2</sup> (AWG 24)																		
	equipotential bonding	≥ 1,5 mm <sup>2</sup> (H07V-k 1,5 mm <sup>2</sup> ) (AWG 26)																		
Max. cable length to monitoring head	for safety reasons limited to 200 m/656 ft <sup>(3)</sup>																			
<p>* With output C2, the current consumption may be up to 230 mA ± 10 %.</p> <p><sup>(1)</sup> At constant temperature and flow conditions, and stable thermal conductivity</p> <p><sup>(2)</sup> Delay with the switch point set to 10 m/s / 32.8 fps and the flow at 20 m/s / 65.6 fps, after a sudden complete stop.</p> <p><sup>(3)</sup> Mind the equipotential bonding, shield resistance max. 1 Ω (see connection diagram)</p> <p><sup>(4)</sup> The accuracy values were determined under ideal conditions:          - symmetrical complete flow profile          - correct mounting in the pipe          - inlets and outlets according to EN ISO 5167-1</p> <p><sup>(5)</sup> Measuring range (display range) for:</p> <table border="1"> <thead> <tr> <th></th> <th>methane/natural gas</th> <th>hydrogen</th> </tr> </thead> <tbody> <tr> <td>Flow velocity</td> <td>32,2 m/s (49 m/s)</td> <td>22,5 m/s (36,5 m/s)</td> </tr> <tr> <td>Inside pipe diameter 25 mm</td> <td>56,9 Nm<sup>3</sup>/h (86,5 Nm<sup>3</sup>/h)</td> <td>39,7 Nm<sup>3</sup>/h (64,5 Nm<sup>3</sup>/h)</td> </tr> <tr> <td>Inside pipe diameter 50 mm</td> <td>227 Nm<sup>3</sup>/h (346 Nm<sup>3</sup>/h)</td> <td>159 Nm<sup>3</sup>/h (258 Nm<sup>3</sup>/h)</td> </tr> <tr> <td>Inside pipe diameter 100 mm</td> <td>910 Nm<sup>3</sup>/h (1385 Nm<sup>3</sup>/h)</td> <td>636 Nm<sup>3</sup>/h (1032 Nm<sup>3</sup>/h)</td> </tr> <tr> <td>Inside pipe diameter 250 mm</td> <td>5690 Nm<sup>3</sup>/h (8659 Nm<sup>3</sup>/h)</td> <td>3976 Nm<sup>3</sup>/h (6450 Nm<sup>3</sup>/h)</td> </tr> </tbody> </table>				methane/natural gas	hydrogen	Flow velocity	32,2 m/s (49 m/s)	22,5 m/s (36,5 m/s)	Inside pipe diameter 25 mm	56,9 Nm <sup>3</sup> /h (86,5 Nm <sup>3</sup> /h)	39,7 Nm <sup>3</sup> /h (64,5 Nm <sup>3</sup> /h)	Inside pipe diameter 50 mm	227 Nm <sup>3</sup> /h (346 Nm <sup>3</sup> /h)	159 Nm <sup>3</sup> /h (258 Nm <sup>3</sup> /h)	Inside pipe diameter 100 mm	910 Nm <sup>3</sup> /h (1385 Nm <sup>3</sup> /h)	636 Nm <sup>3</sup> /h (1032 Nm <sup>3</sup> /h)	Inside pipe diameter 250 mm	5690 Nm <sup>3</sup> /h (8659 Nm <sup>3</sup> /h)	3976 Nm <sup>3</sup> /h (6450 Nm <sup>3</sup> /h)
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## Block diagram



Input voltage: DC 19 ... 32 V

Keyboard/display: keypads  
LC display  
2 x 16 digits

User interface 1: relay outputs: 2 limit values  
transistor outputs: 2 limit values +  
1 error indication +  
1 busy or quantity-related  
pulse output  
(software selected)

User interface 2: analogue outputs  
current or voltage

Controller system: signal processing  
I/O - controlling  
monitoring  
parameter memory

Sensor interface: calorimetric monitoring head

## Flow measurement range

The flow measurement range is determined by the inner pipe diameter (see table). It can be calculated with the following equation:

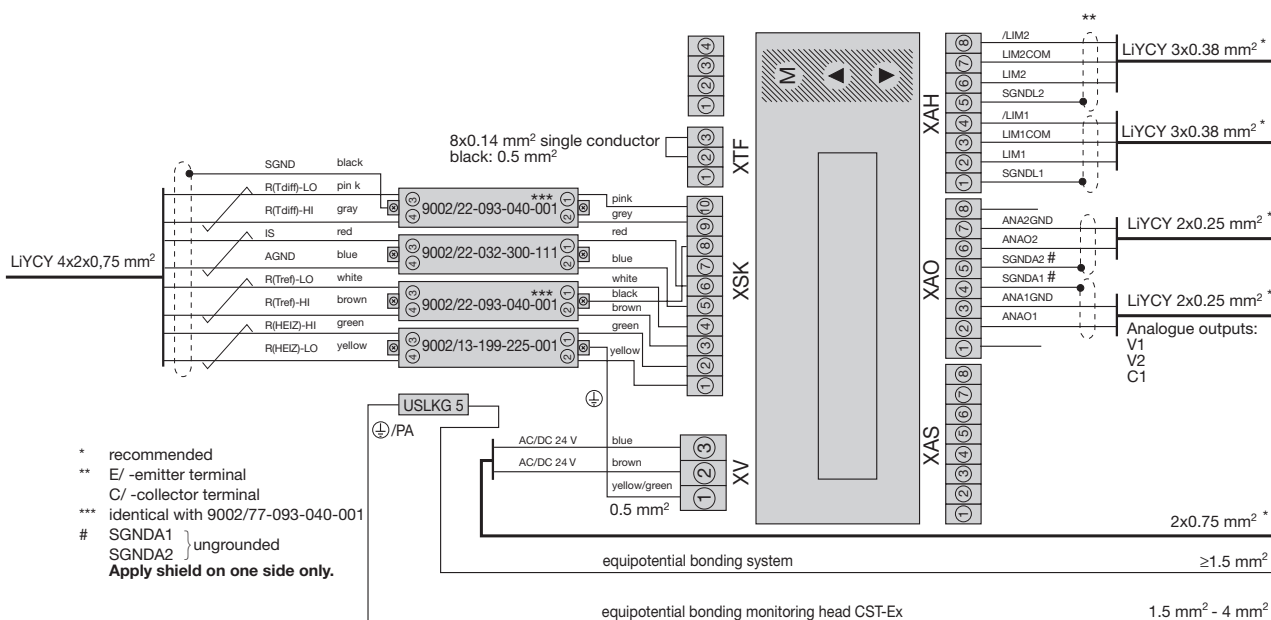
$$Q = V_n \times A_n$$

Q (Nm<sup>3</sup>/h) - flow quantity  
V<sub>n</sub> (Nm/h) - average standard velocity  
A<sub>n</sub> (m<sup>2</sup>) - pipe cross section

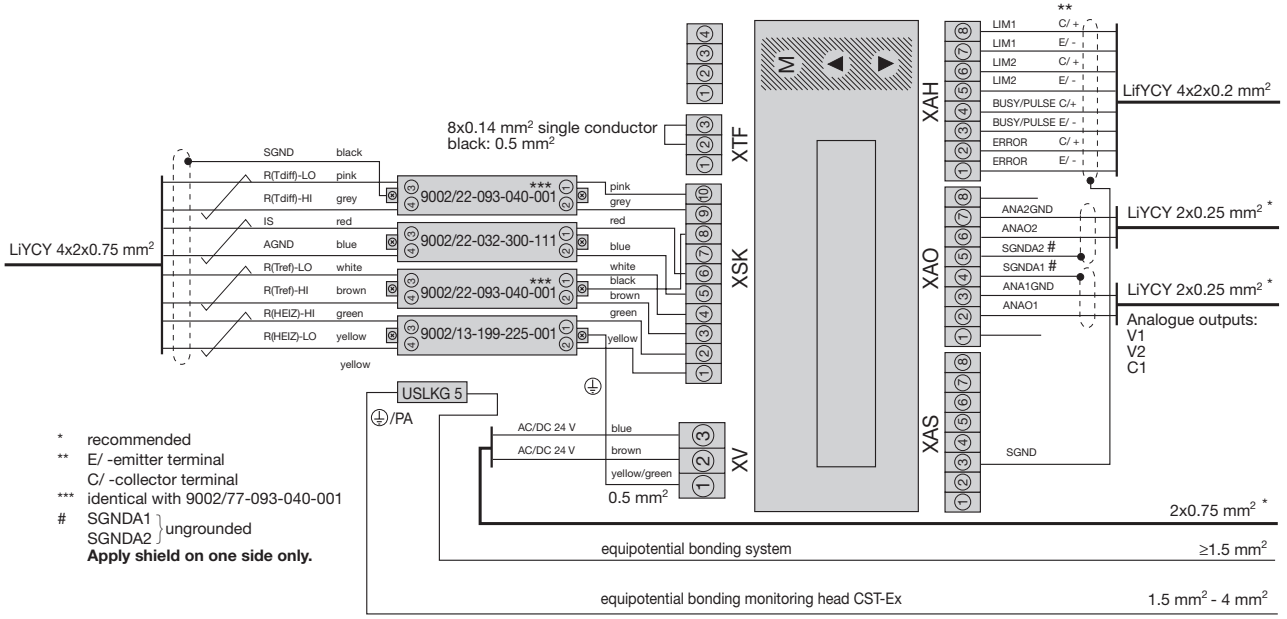
inside pipe diameter in mm	measuring range in Nm <sup>3</sup> /h	display range in Nm <sup>3</sup> /h	inside pipe diameter in mm	measuring range in Nm <sup>3</sup> /h	display range in Nm <sup>3</sup> /h
20	57	84	200	5655	8482
30	127	190	250	8836	13253
40	226	339	300	12723	19085
50	353	530	400	22619	33929
60	509	763	500	35343	53014
70	693	1039	600	50894	76341
80	905	1357	700	69272	103908
90	1145	1717	800	90478	135717
100	1414	2120	900	114511	171766
150	3180	4771	1000	141372	212057

Setting range for inside pipe diameter: 10.0 mm...999.9 mm  
Velocity range: 0...50 Nm/s (75 Nm/s)  
Accuracy: ±5 % of measured value  
Repeatability: ±1 % of measured value  
Temperature drift: ±0.1 %/°C/measuring range final value  
±0.18 %/°F/measuring range final value

## Connection diagram FC01-Ex-CA for relay and analogue outputs V1, V2, C1

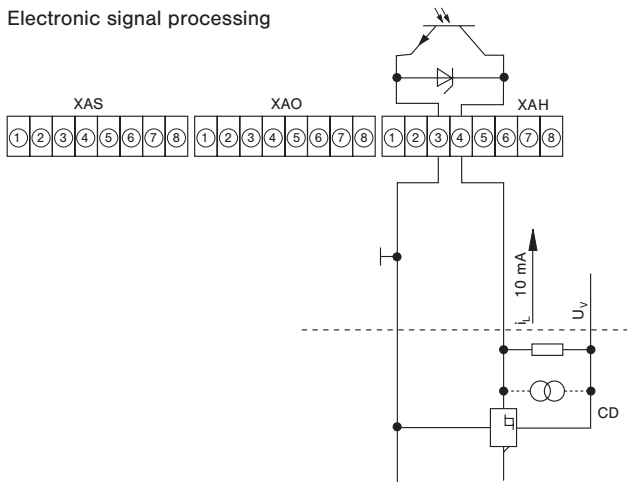


Connection diagram FC01-Ex-CA for transistor and analogue outputs V1, V2, C1

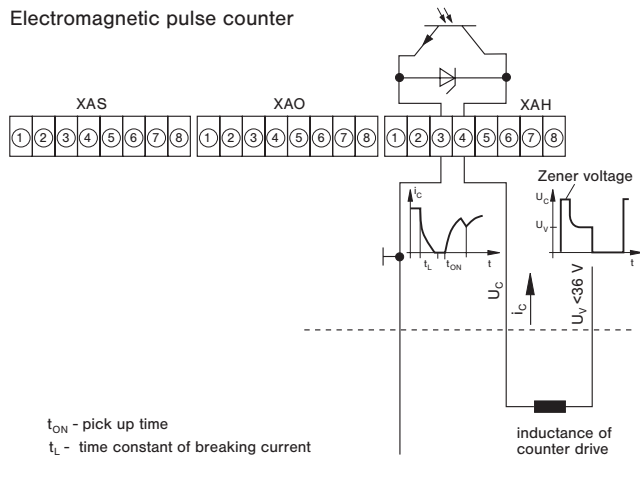


Connection diagram recommended connection of pulse output

Electronic signal processing



Electromagnetic pulse counter



All dimensions without tolerances are for reference only. In the interest of improved design, performance and cost effectiveness the right to make changes in these specifications without notice is reserved. Product markings may not be exactly as the ordering codes. Errors and omissions excepted.

**Description**

Thread-mounted Ex approved calorimetric monitoring head for Flow Meter FC01-Ex-CA. For use in hazardous areas in equipment group II, category 1 (zones 0 and 20).

**Features**

- Medium temperature dust Ex: -40 ... max. +75 °C/-40 ... max. +167 °F (see table „maximum surface temperatures for dust“)
- Medium temperature gas Ex: -40 ... +75 °C/-40 ... +167 °F
- Material of monitoring head:
  - stainless steel 1.4571
  - Hastelloy C4 2.4610
  - Titanium G7 3.7235

**Ordering information**

<b>Type</b>	Thread-mounted monitoring head with calorimetric sensors						
<b>CST-Ex</b>	Thread-mounted monitoring head with calorimetric sensors						
	<b>Process connection</b>						
	<b>11</b>	thread size G1/2A					
		<b>Medium</b>					
		<b>A</b>	air (standard)				
		<b>S</b>	other media (please enquire)				
			<b>Material of areas exposed to medium</b>				
		<b>M1</b>	stainless steel 1.4571 (standard)				
		<b>M2</b>	Hastelloy C4 2.4610				
		<b>M6</b>	Titanium G7 3.7235				
			<b>Length of shank/thread</b>				
		<b>L08</b>	27.5 mm/1.08 in. (standard)				
		<b>L10</b>	36 mm/1.42 in.				
			<b>Electrical connection</b>				
		<b>E20</b>	round connector with gold-plated contacts				
			<b>Certification</b>				
		<b>T5</b>	approval to EC directive 94/9/EG (ATEX 100a) *				
			<b>Specification of medium</b>				
		<b>xxx</b>					
<b>CST-Ex</b>	-	<b>11</b>	<b>A</b>	<b>M1</b>	<b>L08</b>	<b>E20</b>	<b>T5</b> - ... ordering example

\*) for detailed information please see section 0.

**Maximum surface temperatures for dust**

The dust Ex marking contains the maximum surface temperature. The CST-Ex is marked with T100°C ... T130°C. Dependent on maximum admissible medium temperature the maximum surface temperature is between 100 ... 130°C. The following table shows this coherence:

max. medium temperature [°C]	max. surface temperature [°C]
45	100
50	105
55	110
60	115
65	120
70	125
75	130

**Thread-mounted calorimetric monitoring head**



**CST-Ex...**

EC-type-examination Certificate to EN 60079-0:2012, EN 60079-11:2012 und EN 60079-26:2007

type of protection

II 1/2 G Ex ia IIC T4 Ga

II 1 D Ex ia IIC T100°C ... T130°C Da

**Technical data**

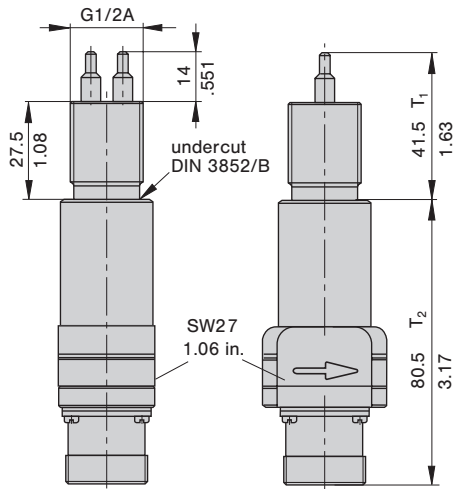
Type of head	thread-mounted
Thread/rated dia.	G1/2A
Length of shank	27.5 mm/1.08 in., 36 mm/1.42 in.
Length of sensor	14 mm/0.55 in.
Suitable for pipe diameter	DN 20 ... DN 50 (... L08 ...) DN 20 ... DN250 (... L10 ...)
Suitable for	gases, depending on the resistance of material and Ex approval (ignitable media: see Ex approval)
Temperature drift	0.05 %/K/measuring range (T=20...75°C)
Temperature range dust Ex (medium + monitoring head zone T <sub>1</sub> , see drawing dimensions)	-40 ... max. +75 °C/-40 ... max. +167 °F (see table „maximum surface temperatures for dust“)
Temperature range gas Ex (medium + monitoring head zone T <sub>1</sub> , see drawing dimensions)	-40 ... +75 °C/-40 ... +167 °F
Temperature range (monitoring head zone T <sub>2</sub> , see drawing dimensions)	-30 ... +75 °C/-22 ... +167 °F
Pressure resistance <sup>(1)</sup>	100 bar/1450 psi
Degree of protection <sup>(2)</sup>	IP67
Material	stainless steel 1.4571/AISI 316 Ti hastelloy C4 2.4610 titanium G7 3.7235
Connector	copper tin (CuZn)
Cable to electronic control unit	LiYCY 4x2x0.75 mm <sup>2</sup> (AWG 18), light blue

<sup>(1)</sup> Admissible operating pressure to DIN 2401, measured at max. temperature (= max. medium temperature).

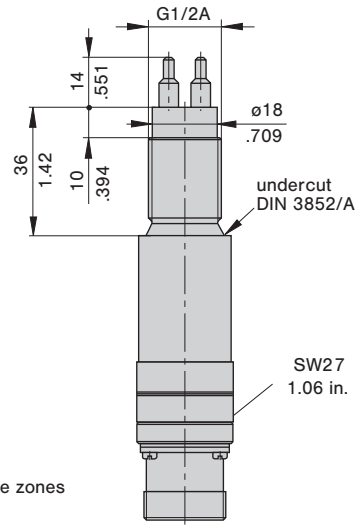
<sup>(2)</sup> with mating connector

**Dimensions**

CST-Ex-11xxxL08xxx



CST-Ex-11xxxL10xxx



T<sub>1</sub>, T<sub>2</sub> - temperature zones

This is a metric design and millimeter dimensions take precedence ( $\frac{mm}{inch}$ )

**Cable type 17 with connectors**



**Do + Ka type 17**

**Technical data**

**Cable type 17**

**Features:** paired control line, fully shielded, light-blue insulation, for intrinsically safe systems, electrical and thermal properties at +20 °C/+68 °F

Conductor resistance	< 25 Ω/km
Insulation resistance	> 200 MΩ/km
Capacity (wire/wire/grounded shield)	110 pF/m ± 20 %
Operating voltage (VDE 0812)	max. 500 V AC
Test voltage (wire/wire/shield)	1200 V AC
Max. load	10 A
Wave impedance	f > 100 kHz/60 ... 70 Ω
Inductance	
wire/wire:	0.7 mH/km
wire/shield:	0.5 mH/km
Capacitive coupling (800 Hz)	0...1200 pF/100 m
Temperature range	-10 °C ... +80 °C/+14 ... +176 °F (operation) -30 °C ... +80 °C/-22 ... +176 °F (transport and storage)

**Ordering information**

**Type** between calorimetric monitoring heads **CST-Ex** and **FC01-Ex-CA**

**Do + Ka type 17** PVC-insulated cable, type LifYCY 4x2x0.75mm<sup>2</sup> (AWG 18) 12-pole round connector + wire end ferrules

**Available cable lengths**

...m 2 m, 3 m, 5 m, 8 m, 10 m, 15 m, 20 m, 25 m, 30 m, 40 m, 50 m, 60 m, 70 m, 80 m, 90 m 100...200 m (10 m steps, up to max. 656 ft)

**Do + Ka type 17 - 2 m/6.56 ft** ordering example

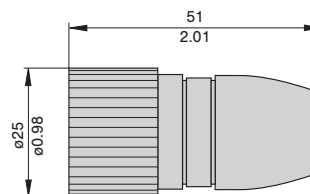
**Description**

Cable between Flow Meter FC01-Ex-CA and calorimetric monitoring head CST-Ex.

- Connection to monitoring head by means of 12-pole round connector
- Connection to FC01-Ex-CA: wire end ferrules for connection to ex-barriers

**Accessories**

**12-pole round connector**  
(without cable, for individual wiring by customer)  
**OZ112Z000172**



This is a metric design and millimeter dimensions take precedence ( $\frac{mm}{inch}$ )

**Caution:** Standard warranty cover will be invalidated if the correct FlowVision monitoring head/control unit connecting cable is not used.

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