## Description

The FC01-Ex has been designed to provide monitoring, detection and indication of flow speed, volume flow and medium temperature of liquids, gases and powders.
The calorimetric monitoring head CST-Ex is approved to EN 60079-0:2012+A11:2013, EN 60079-11:2012 and EN 60079-26:2015.

## 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)
- LCD-display (2 x 16 digits):
  - indication of actual flow velocity, volume 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.

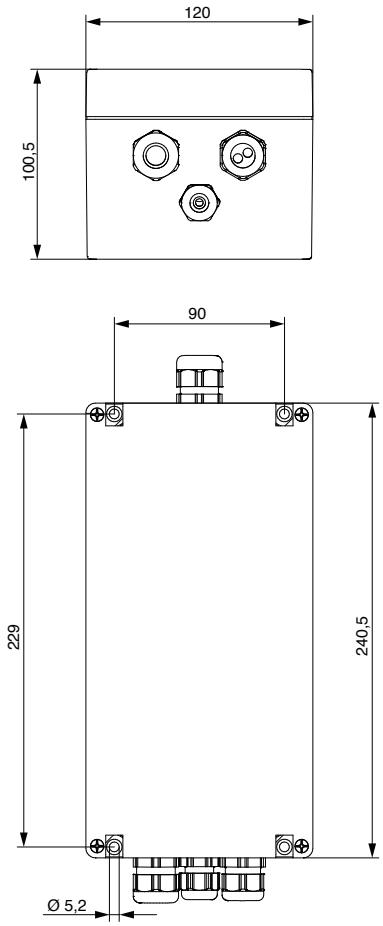
## Ordering information

| Type | | | | | | | |
|---|---|---|---|---|---|---|---|
| **FC01-Ex** | Flow Meter, surface mounted (IP54) | | | | | | |
| | **Input voltage** | | | | | | |
| | **U1** | DC 24 V (19 ... 32 V) | | | | | |
| | | **Signal outputs** | | | | | |
| | | **R2** | 2 relay outputs (2 limit values) | | | | |
| | | **T4** | 4 transistor outputs (2 limit values + 2 status or 2 limit values + 1 status + 1 pulse output) | | | | |
| | | | **Analogue outputs** | | | | |
| | | | **C1** | 0/4-20 mA (self-powered, physically isolated) | | | |
| | | | | **Certification** | | | |
| | | | | **T5** | approval to EC directive 94/9/EG (ATEX 100a) *) | | |
| | | | | | **Specification of medium** | | |
| | | | | | **xxx** | | |
| **FC01-Ex -** | **U1** | **R2** | **C1-** | **T5** | **...** | ordering example | |

*) for detailed information please see section 0.

**FC01-Ex**
Safety barriers with EU-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 (surface mounted)



## TECHNICAL DATA

| Flow Meter FC01-Ex | | | | with CST-Ex calorimetric monitoring head | |
|---|---|---|---|---|---|
| **General Data** | | | | | |
| Suitable for | | | | water, air, other media (please enquire) | |
| Measuring function | | | | flow velocity, volume flow, temperature | |
| Display | | | | 2 x 16-digit LC-display | |
| Parameter assignment, calibration by | | | | keypads | |
| Temperature range (electronic control unit in circulating air) | | | | -10 ... +43 °C/+14 ... +109 °F (ambient temperature) | |
| **Electrical data** | | | | | |
| Input voltage | | | | DC 24 V (19 ... 32 V) | |
| Current consumption ($U_v$ = 24 V DC) | | | | 170 mA / 200 mA *) | |
| Analogue output (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 | |
| **Flow measurement** | | | | | |
| Measuring range (display range) | | water | oil | 0,05 ... 3 m/s (0 ... 3,3 m/s) | 0,1 ... 5 m/s (0 ... 5,5 m/s) |
| | | air | | 0,1 ... 20 m/s (0 ... 22 m/s) standard flow speed referred to 20 °C and 1,01325 bar | |
| Accuracy [5] (related to velocity available at sensor) | | water, oil | | < ± 5 % of measured value (higher accuracy on request) | |
| | | air | | < ± 5 % of measured value (higher accuracy on request) | |
| Repeatability [1] | | water, oil | | < 1 % of measured value | |
| | | air | | < 1 % of measured value | |
| Temperature drift (electronic control unit) | | water, oil | | 0,35 %/°C/measuring range final value 0,63 %/°F/measuring range final value | |
| | | air | | 0,1 %/°C/measuring range final value 0,18 %/°F/measuring range final value | |
| Response delay | | water [2], oil | | 2,5 s | |
| | | air [3] | | 3 s | |
| Temperature measurement | | measuring range | | -40 ... +75 °C/-40 ... +167 °F | |
| | | accuracy | | ± 1,5 % of measuring range | |
| **Mechanical data (surface-mounted housing)** | | | | | |
| 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 mm² (AWG 18) | |
| | to monitoring head | | | LiYCY 4 x 2 x 0,75 mm² (AWG 18), light blue | |
| | analogue output | | | 2 x LifYCY 2 x 0,25 mm² (AWG 24) | |
| | signal outputs | | | LifYCY 4 x 2 x 0.2 mm² (AWG 24) | |
| | Equipotential bonding | | | ≥ 1,5 mm² (H07V-k 1,5 mm²) (AWG 26) | |
| Max. cable length to monitoring head | | | | 200 m/656 ft [4] | |

* With output C2, the current consumption may be up to 230 mA ± 10 %.

(1) at constant temperature and flow conditions, and stable thermal conductivity

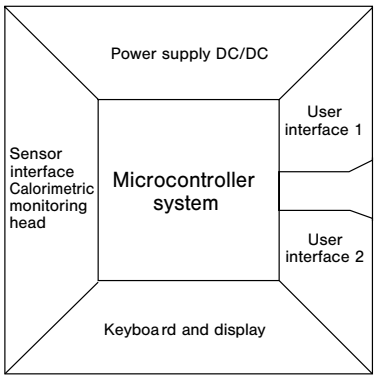
(2) Delay with the switch point set to 1 m/s / 3.28 fps and the flow at 2 m/s / 6.56 fps, after a sudden complete stop.

(3) 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.

(4) Mind the equipotential bonding, shield resistance max. 1 Ω (see connection diagram)

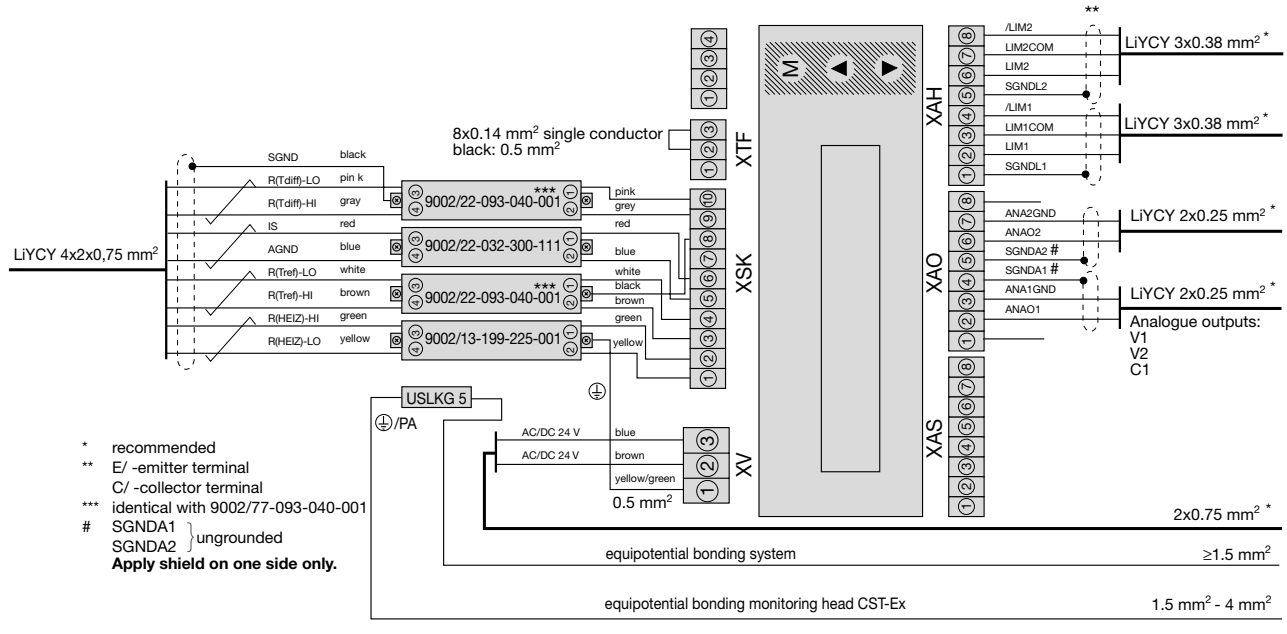
(5) The accuracy values were determined under ideal conditions:
- symmetrical complete flow profile
- correct mounting in the pipe
- inlets and outlets according to EN ISO 5167-1

## Block diagram

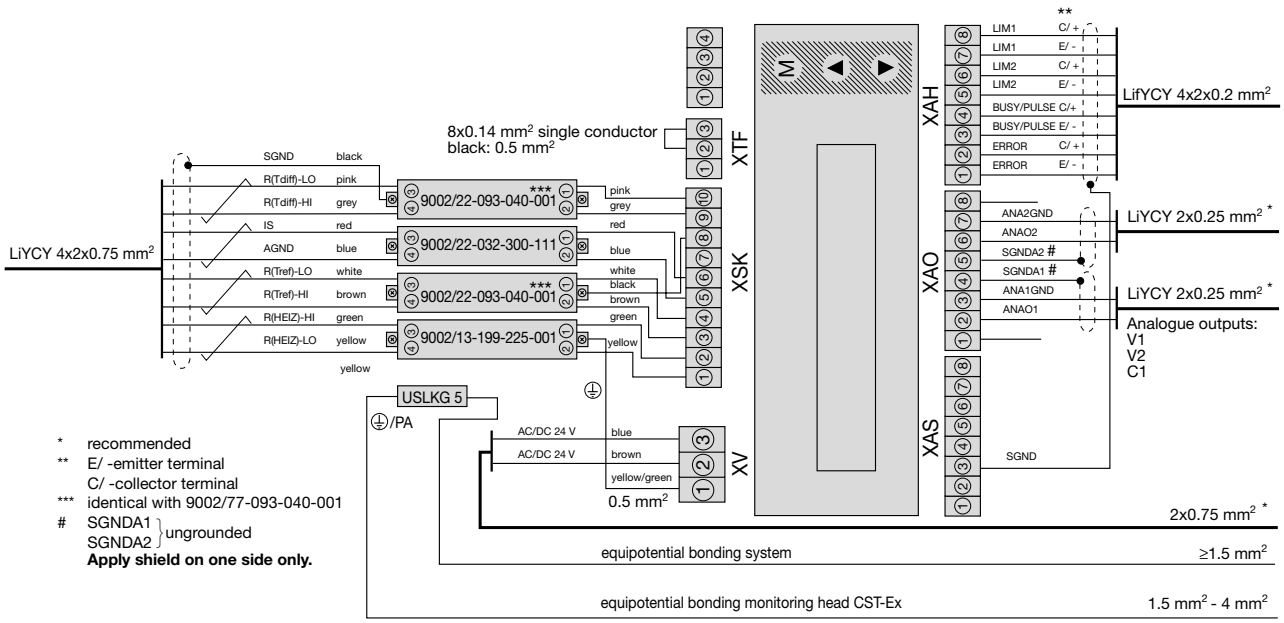



| | | |
|---|---|---|
| Input voltage: | DC 19 ... 32 V | |
| Keyboard/display: | keypads<br>LC display<br>2 x 16 digits | |
| User interface 1: | relay outputs:<br>transistor outputs: | 2 limit values<br>2 limit values +<br>1 error indication +<br>1 busy or quantity-related pulse output<br>(software selected) |
| User interface 2: | analogue outputs<br>current or voltage | |
| Controller system: | signal processing<br>I/O - controlling<br>monitoring<br>parameter memory | |
| Sensor interface: | calorimetric monitoring head | |

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



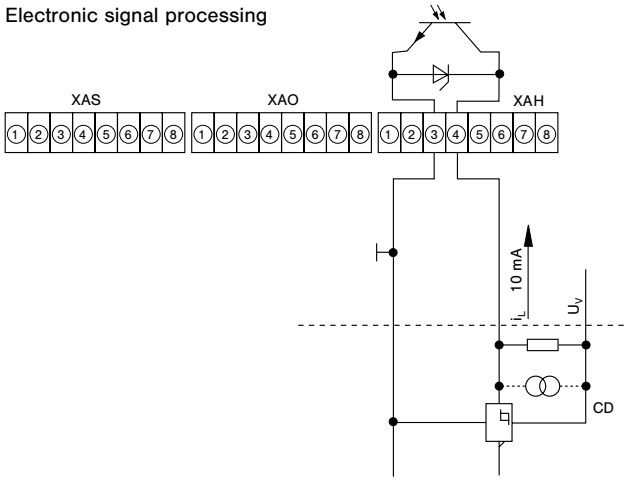
## Connection diagram FC01-Ex for transistor and analogue outputs V1, V2, C1



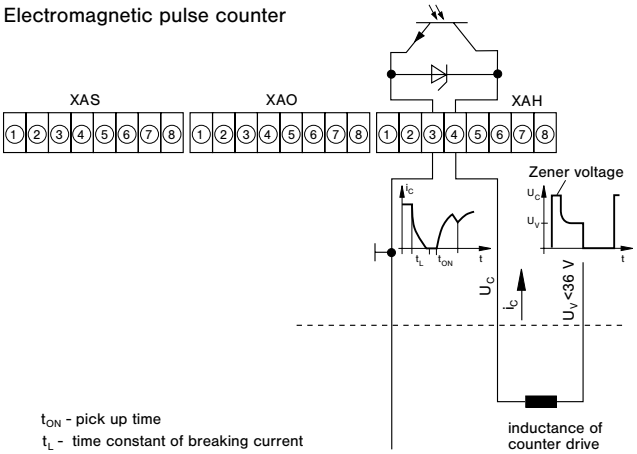

* recommended
** E/ -emitter terminal
C/ -collector terminal
*** identical with 9002/77-093-040-001
\# SGNDA1, SGNDA2 } ungrounded
**Apply shield on one side only.**

## Recommended connection of pulse output

Electronic signal processing




Electromagnetic pulse counter




$t_{ON}$ - pick up time
$t_L$ - time constant of breaking current

**The FC01-Ex should only be used with monitoring head CTS-Ex..., i.e. the electronic control unit and the monitoring head are supplied as a package.**

## Description

Thread-mounted Ex approved calorimetric monitoring head for Flow Meter FC01-Ex. 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

| Type No. | | |
|---|---|---|
| **CST-Ex** | Thread-mounted monitoring head with calorimetric sensors | |
| | **Process connection** | |
| | **01** | thread size G1/2A |
| | **Medium** | |
| | **A** | air |
| | **W** | water |
| | **S** | other media, e.g. oil (please enquire) |
| | **Material of areas exposed to medium** | |
| | **M1** | stainless steel 1.4571 (standard) |
| | **M2** | Hastelloy C4 2.4610 |
| | **M6** | Titanium G7 3.7235 |
| | **Length of shank/thread** | |
| | **L08** | 27.5 mm/1.08 in. (standard) |
| | **L10** | 36 mm/1.42 in. |
| | **Electrical connection** | |
| | **E20** | round connector with tinned contacts |
| | **Certification** | |
| | **T5** | approval to EC directive 94/9/EG (ATEX 100 a) *) |
| | **Specification of medium** | |
| | **xxx** | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CST-Ex** | - | **01** | **W** | **M1** | **L08** | **E20** | **T5** | - | **...** 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-...**

EU-type-examination Certificate to EN 60079-0:2012+A11:2013, EN 60079-11:2012 and EN 60079-26:2015
type of protection
II 1/2 G Ex ia IIC T4 Ga/Gb
II 1 D Ex ia IIIC T100°C ... T130°C Da

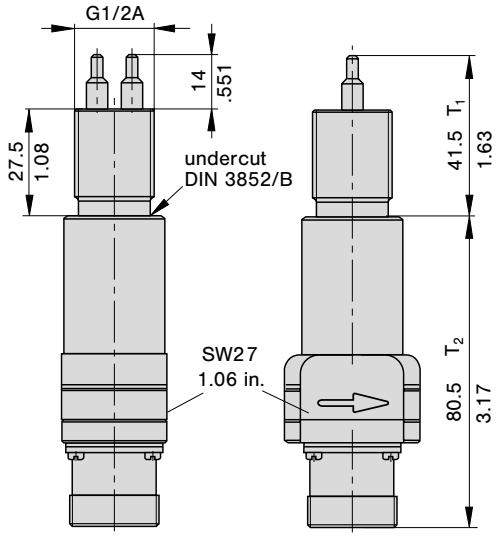
## Technical data

| | |
|---|---|
| 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 | all media, 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 $T_1$, 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 $T_1$, see drawing dimensions) | -40 ... +75 °C/-40 ... +167 °F |
| Temperature range (monitoring head zone $T_2$, see drawing dimensions) | -30 ... +75 °C/-22 ... +167 °F |
| Pressure resistance (1) | 100 bar/1450 psi |
| Degree of protection (2) | IP67 |
| Material | stainless steel 1.4571/AISI 316 Ti<br>Hastelloy C4 2.4610<br>Titanium G7 3.7235 |
| Connector | copper tin (CuZn) |
| Cable to electronic control unit | LiYCY 4 x 2 x 0.75 mm² (AWG 18), light blue |

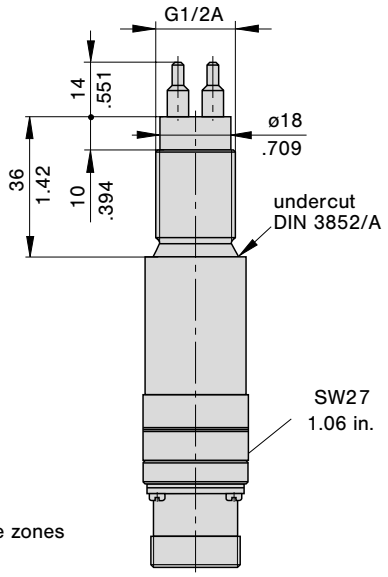
(1) Admissible operating pressure to DIN 2401, measured at max. temperature (= max. medium temperature).
(2) with mating connector

## Dimensions

CST-Ex-01xxxL08xxx




CST-Ex-01xxxL10xxx




$T_1$ , $T_2$ - temperature zones

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

## Cable type 17 with connectors

Do + Ka type 17

## Description

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

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

## 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

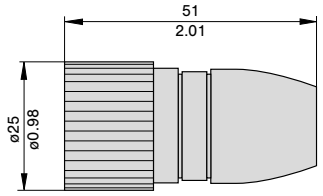
| | |
|---|---|
| Conductor resistance | < 25 Ω/km |
| Insulation resistance | > 200 MΩ/km |
| Capacity (wire/wire/grounded shield) | 110 pF/m ± 20 % |
| Operating voltage (VDE 0812) | max. 500 V AC |
| Test voltage (wire/wire/shield) | 1200 V AC |
| Max. load | 10 A |
| Wave impedance | f > 100 kHz/60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

## Ordering information

| | | |
|---|---|---|
| **Type** | between calorimetric monitoring heads **CST-Ex** and **FC01-Ex** | |
| **Do + Ka type 17** | **PVC**-insulated cable, type LifYCY 4x2x0.75mm² (AWG 18)<br>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 |

## Accessories

**12-pole round connector**
(without cable, for individual wiring by customer)
**0Z112Z000172**




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.