

The clamp-on-sensors SEMIFLOW CO.66/xxxPI Ex1 combined with Barrier Box ST Ex1 detect the flow rate of liquids in rigid plastic tubes of different diameters within a few milliseconds. Industrial applications in the **semiconductor industry** are typical: use in wafer cleaning equipment, lithography equipment, mixing equipment, chemical supply systems or slurry lines. The sensors have no contact to the fluid and are suitable for all applications with strict hygienic requirements, e.g. **biotechnology, pharmaceutical industries or chemical industry**. Due to the switching output the sensors support industrial dosing applications. The RS-485 interface allows bus operation in rough environments. They have complete built-in electronics and can be easily integrated in machines or apparatuses. The sensors used with the Barrier Box ST Ex1 are protected against explosion hazard by gases, vapors or liquids (gas group IIB). The device protection level is "Gb" for use in Zone 1 in compliance with ATEX, IECEx and KTL standards.

Sensor overview and dimensions

Type SEMIFLOW	Order-No. Sensor ⁽¹⁾	Order-No. Set ⁽¹⁾ (incl. Barrier Box ST Ex1 + cable)	Dimensions (L × W × H)	Fixing holes	Weight (approx.)
CO.66/080PI Ex1	200 08 0106	700 01 0367	44 × 44 × 34 mm	M4, depth 8 mm	70 g
CO.66/120PI Ex1	200 08 0107	700 01 0368	44 × 44 × 38 mm		80 g
CO.66/160PI Ex1	200 08 0108	700 01 0369	44 × 56 × 41 mm		100 g
CO.66/190PI Ex1	200 08 0109	700 01 0370	50 × 76 × 54 mm	M6, depth 12 mm	190 g
CO.66/260PI Ex1	200 08 0110	700 01 0371	50 × 76 × 60 mm		200 g
CO.66/340PI Ex1	200 08 0111	700 01 0372	58 × 84 × 62 mm		240 g

⁽¹⁾ Sensors must be operated solely via the associated Barrier Box ST Ex1 (see corresponding 'Technical Data Sheet')

Tubing properties and dimensions of the measuring channel

Material: Homogeneous rigid plastic tubing (e.g. PFA, PTFE, PA, PU)
For appropriate acoustic coupling, the sensor channels are equipped with flexible inlays.
The use of the inlay is mandatory.

NOTE! Sensors are factory calibrated with inlay and the listed tubing (following table).

Type SEMIFLOW	Measuring Channel Width Width with inlay (see also 'Technical drawings')	Standard Tubing	
		Outer Ø	Inner Ø
CO.66/080PI Ex1	8 mm 5 mm	1/4"	3/16"
CO.66/120PI Ex1	12 mm 8.5 mm	3/8"	1/4"
CO.66/160PI Ex1	16 mm 12 mm	1/2"	3/8"
CO.66/190PI Ex1	19.5 mm 17.8 mm	3/4"	5/8"
CO.66/260PI Ex1	26 mm 23.4 mm	1"	7/8"
CO.66/340PI Ex1	34 mm 32 mm	1 5/16"	1 1/16"

Accuracy

Type SEMIFLOW	Accuracy for: water, standard flow rate, standard tubing, 23 °C ± 2 K, 0 bar		Typical max. flow ⁽²⁾	Calibrated max. flow
CO.66/080PI Ex1	< 800 ml/min: ± 16 ml/min	> 800 ml/min: ± 2 % ⁽¹⁾	6 000 ml/min	5 000 ml/min
CO.66/120PI Ex1	< 1 200 ml/min: ± 24 ml/min	> 1 200 ml/min: ± 2 % ⁽¹⁾	20 000 ml/min	10 000 ml/min
CO.66/160PI Ex1	< 1 600 ml/min: ± 36 ml/min	> 1 600 ml/min: ± 2 % ⁽¹⁾	40 000 ml/min	20 000 ml/min
CO.66/190PI Ex1	< 1 800 ml/min: ± 80 ml/min	> 1 800 ml/min: ± 2 % ⁽¹⁾	60 000 ml/min	40 000 ml/min
CO.66/260PI Ex1	< 4 000 ml/min: ± 140 ml/min	> 4 000 ml/min: ± 2 % ⁽¹⁾	80 000 ml/min	50 000 ml/min
CO.66/340PI Ex1	< 14 000 ml/min: ± 280 ml/min	> 14 000 ml/min: ± 2 % ⁽¹⁾	150 000 ml/min	150 000 ml/min



Customized calibration is documented in the sensor calibration report.

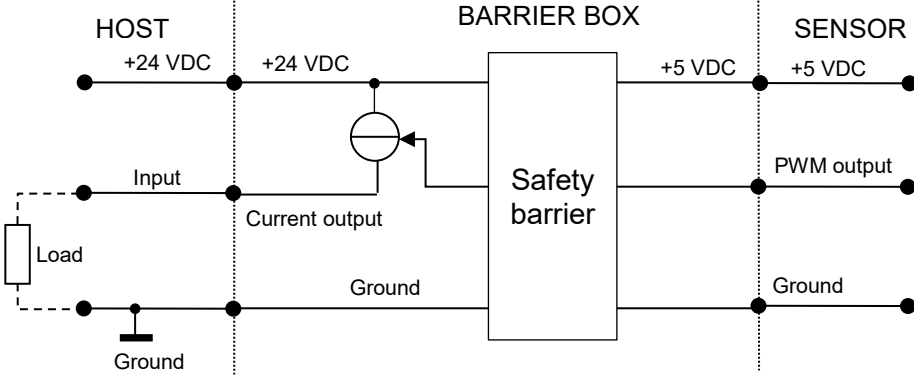
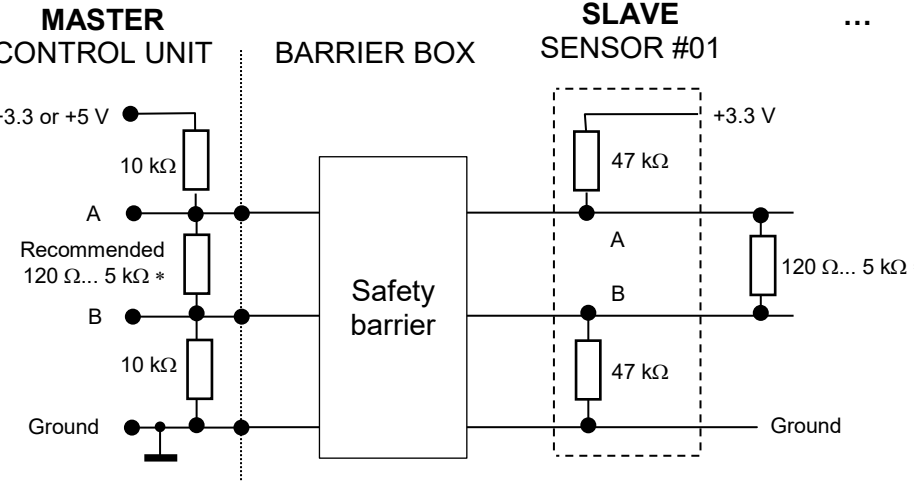
⁽¹⁾ [Percent] of measurement reading. | ⁽²⁾ Unless requested differently. Limited by tubing capacity only.

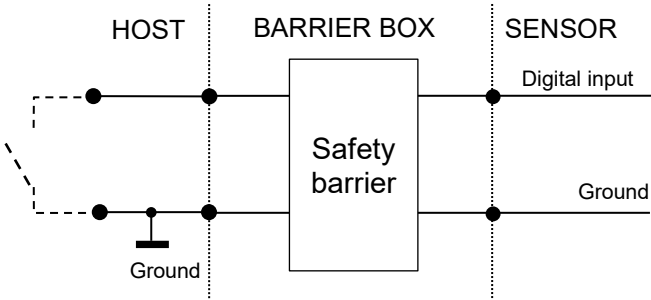
Safety-related parameters

Parameter	Specification	
Explosion protection / intrinsic safety	Max. supply voltage	$U_i = 5.88\text{ V}$
	Max. supply current (1 s)	$I_i = 4130\text{ mA}$
	Max. electric power	$P_i = 1\text{ W}$
	Internal capacitance	$C_i = 142\text{ }\mu\text{F}$
	Internal inductance	$L_i = 8.4\text{ }\mu\text{H}$
	Media temperature (depending on ambient temperature)	$+20\text{ ... }+80\text{ }^\circ\text{C}$ @ $0\text{ ... }+25\text{ }^\circ\text{C}$ ambient temperature $+20\text{ ... }+60\text{ }^\circ\text{C}$ @ $0\text{ ... }+60\text{ }^\circ\text{C}$ ambient temperature
	Storage temperature	$-20\text{ ... }+60\text{ }^\circ\text{C}$
	Suitable for applications in T4; max. surface temperature $135\text{ }^\circ\text{C}$	

Technical data

Parameter	Specification
Measuring method	Ultrasound, two sections of measurements, dry coupling, flexible inlay
Media	Water or other acoustically transparent liquids
Calibration	Sensors are factory calibrated for water at $23\text{ }^\circ\text{C} \pm 2\text{ K}$, tube end depressurized; other calibration on request
Sensor materials	Channel: PMMA black Inlay: silicone rubber (others on request) Housing and cover: PP-H gray similar to RAL7032 (pebble gray) Potting: PU Cover screws: PA natural Connector: PA blue Pins: gold plated brass
Labeling	<div>Sensor front: Flow direction, sensor type, CE marking, certification details [ATEX, IECEx, KTL], production year, serial number, DM code (product No.), manufacturer Cover: Sensor type</div> <div></div> <div></div>

Interfaces (via Barrier Box ST Ex1)	<p>⚠ WARNING: The SEMIFLOW CO.66/xxxPI Ex1 sensors must be operated solely via the associated operating unit “Barrier Box ST Ex1”!</p> <ul style="list-style-type: none"> • Current output for flow rate: 0/4 ... 20 mA • RS-485 interface: bus-capable for up to 12 devices • Switching output: NPN 0 ... 30 V • Digital input
Current output for flow rate (via Barrier Box ST Ex1)	<p>⚠ NOTE: Load to GND. The maximum load depends on the operating voltage. The load at 24 V (recommended) is 1 kΩ.</p> 
RS-485 interface (via Barrier Box ST Ex1)	<p>SONOTEC protocol: Half-duplex operation / 115.200 baud / 8 data bit / no parity / 1 stop bit / no handshaking (Modbus® via software settings)</p> <p>⚠ NOTE: Description of serial protocol upon request.</p> <p>Recommended electrical connection of the RS-485 interface:</p> <p>⚠ CAUTION! If the interface is not used, the pins A and B shall remain open.</p>  <p>* According to bus standard: depending on number of sensors and cable length</p>
RS-485 Bus operation (via Barrier Box ST Ex1)	<p>The sensor supports bus operation of up to 12 devices (SONOTEC protocol). The default address is #01.</p> <p>⚠ NOTE: The address can be changed with the help of the software SEMIFLOW Monitor. Permitted are addresses from #01 ... #12.</p>

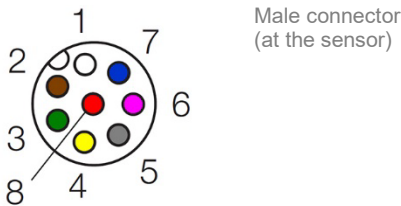
Switching output (via Barrier Box ST Ex1)	<p>NPN, 0 ... 30 V, maximum 100 mA, for applications such as:</p> <ul style="list-style-type: none">• Adapting batch process (dosing)• Threshold switch of flow• Slow pulses of volume (max. 20 Hz)
Digital input (via Barrier Box ST Ex1)	<p>Voltage resistant up to 30 V, freely configurable, for applications such as:</p> <ul style="list-style-type: none">• Zero point calibration of flow• Start dosing processes  <p>The diagram illustrates the electrical connection between three components: a HOST, a BARRIER BOX, and a SENSOR. The HOST is connected to the BARRIER BOX via a dashed line. The BARRIER BOX contains a 'Safety barrier' block. The SENSOR is connected to the BARRIER BOX via a solid line. The SENSOR has two terminals: 'Digital input' and 'Ground'. The BARRIER BOX also has two terminals: 'Ground' and 'Digital input'.</p>
Degree of protection	IP65 (in mated condition)
Pressure	Atmospheric pressure
Directives and standards	<ul style="list-style-type: none">• EMC directive 2014/30/EU• RoHS: 2011/65/EU, exception: III 7cl/ IV 15, RoHS (EU) 2015/863• Acoustic emission: IEC 61157• IEC 60079-0: Equipment – General requirements• IEC 60079-11: Equipment protection by intrinsic safety "i"
Maintenance	Maintenance-free
Scope of supply (Set)	<ul style="list-style-type: none">• SEMIFLOW CO.66/xxxPI Ex1 according to specification (including cover and screws)• Barrier Box ST Ex1 (see corresponding "Technical Data Sheet")• Sensor cable for SEMIFLOW Ex, 10 m, 8-pole connector, Binder 720 (f) open end, 8 wires• User documentation
Optional accessories ⚠ NOT for use in explosion hazard areas.	<p>Software for adjusting parameters, recording measurement data, updating the sensor software:</p> <p>SEMIFLOW Ex1 Monitor software set (all interfaces) consisting of</p> <ul style="list-style-type: none">• USB data converter, type 012• Connecting cable, 5 m, Binder 720 (f), 8-pole open end, 8 wires• Switching power supply, 12 V, incl. international plug adapters• USB cable, A – B, 2 m• Flow Monitor software package (incl. driver for Windows)• User documentation <hr/> <ul style="list-style-type: none">• Calibration protocol

Electrical connection

Parameter	Specification
Operating voltage	5 VDC (via Barrier Box ST Ex1), maximum ripple 1 %, protection against reverse-polarity
Current consumption	Maximum 80 mA (with open switching output); Maximum I _i = 4130 mA, P _i = 1 W
Electrical connection	8-pin connector, Binder 720 (m), see pin assignment, following
Shielding	⚠ Required: Shield of cable must be connected on side of Barrier Box ST Ex1

Assignment of SEMIFLOW CO.66/xxxPI Ex1 connector, for connecting see as well the ‘Technical Data Sheet’ of the Barrier Box ST Ex1.

⚠ **Attention:** Observe all instructions in the ‘Operating Manual’.



Connector	Pin	Color	Connection to Barrier Box ST Ex1
Assignment 8-pin sensor connector to 8-pole cable connector	1	White	Ground
	2	Brown	Operating voltage +5 VDC
	3	Green	PWM A - Current output
	4	Yellow	RS-485 B
	5	Gray	RS-485 A
	6	Pink	PWM B - Current output
	7	Blue	Switching output
	8	Red	Digital input
Shield	Must be connected on side of Barrier Box ST Ex1		

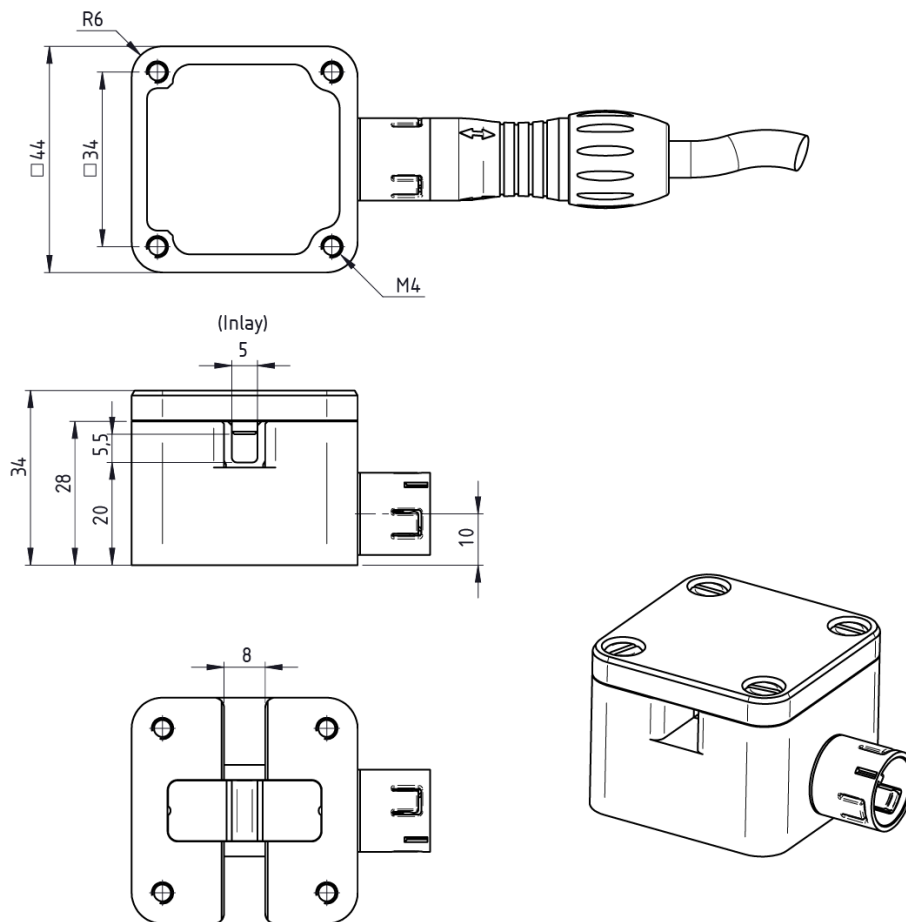
Technical drawings

Drawings are not to scale. Dimensions in mm, unless otherwise specified.

Projection method: ISO 

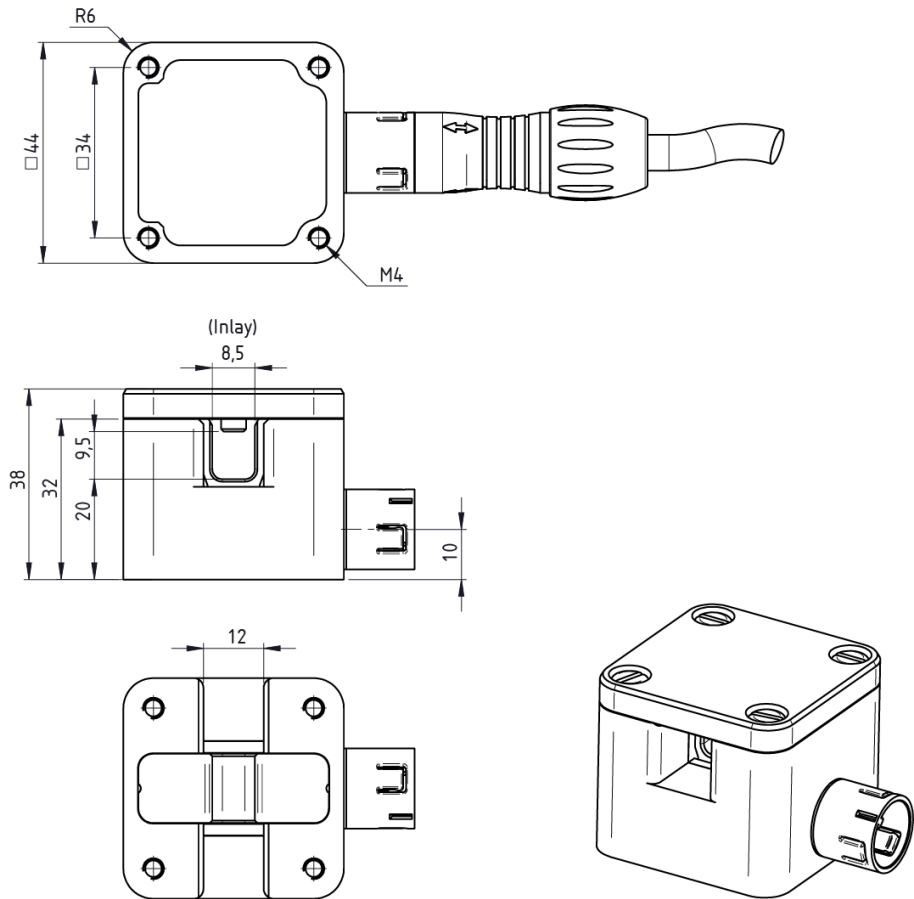
Design data (STEP files) for integration will be provided upon request. Please contact us.

SEMIFLOW CO.66/080PI Ex1



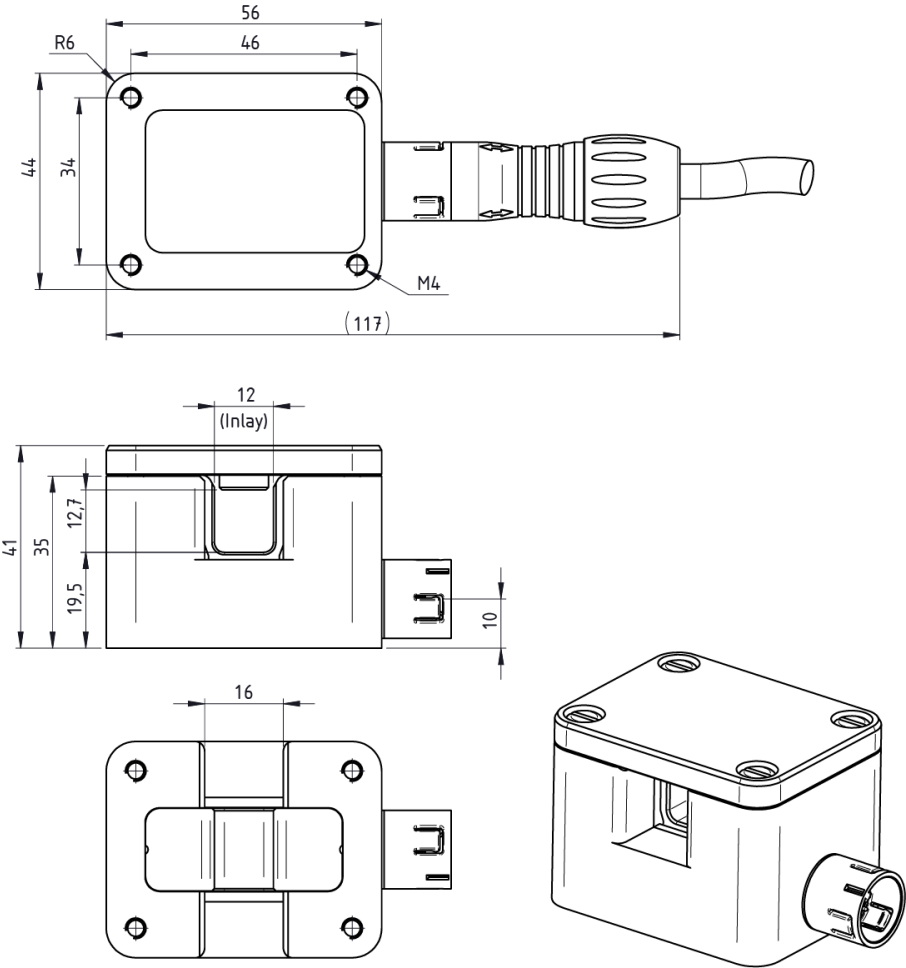
Top view without lid and screws

SEMIFLOW CO.66/120PI Ex1



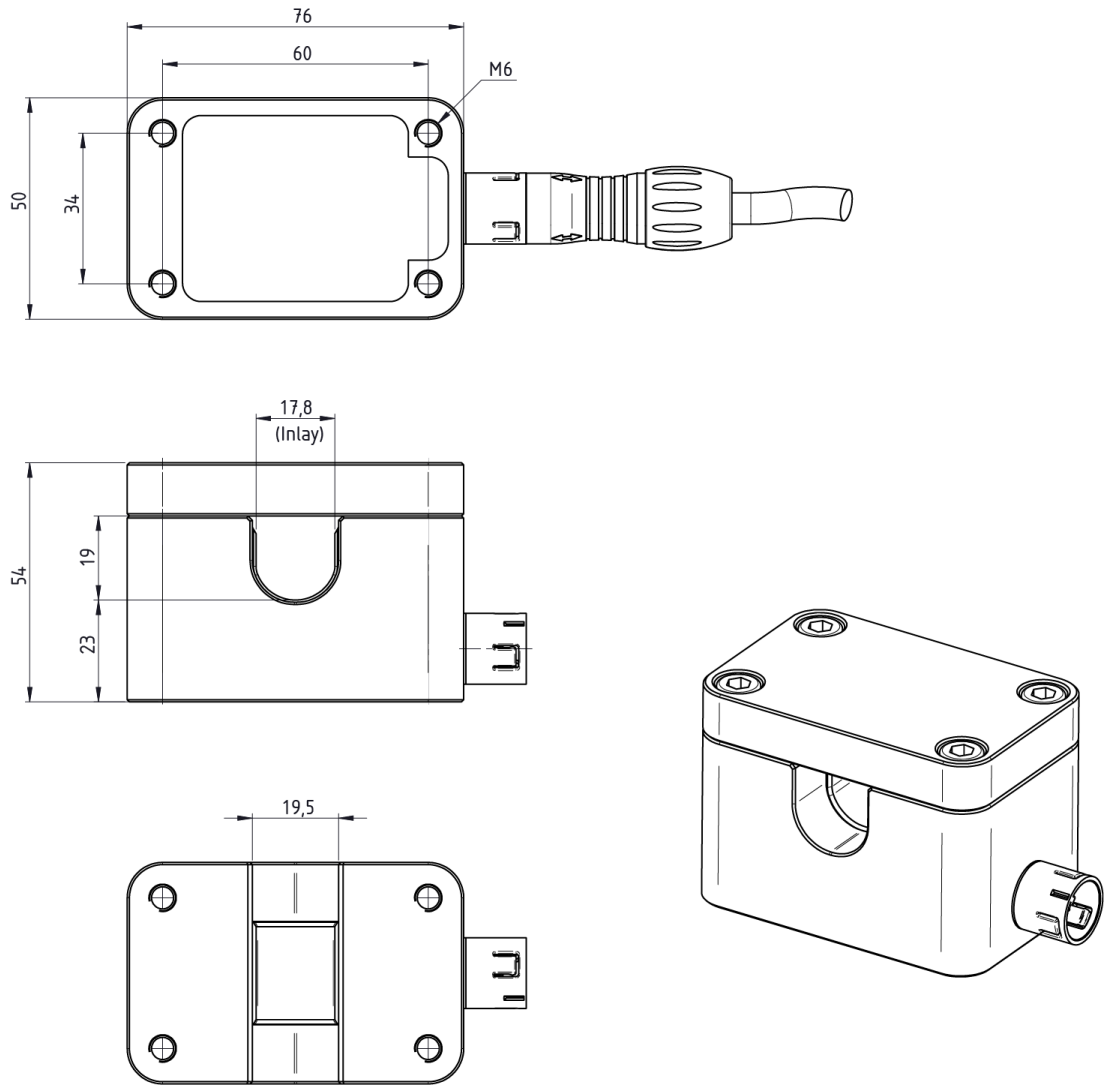
Top view without lid and screws

SEMIFLOW CO.66/160PI Ex1



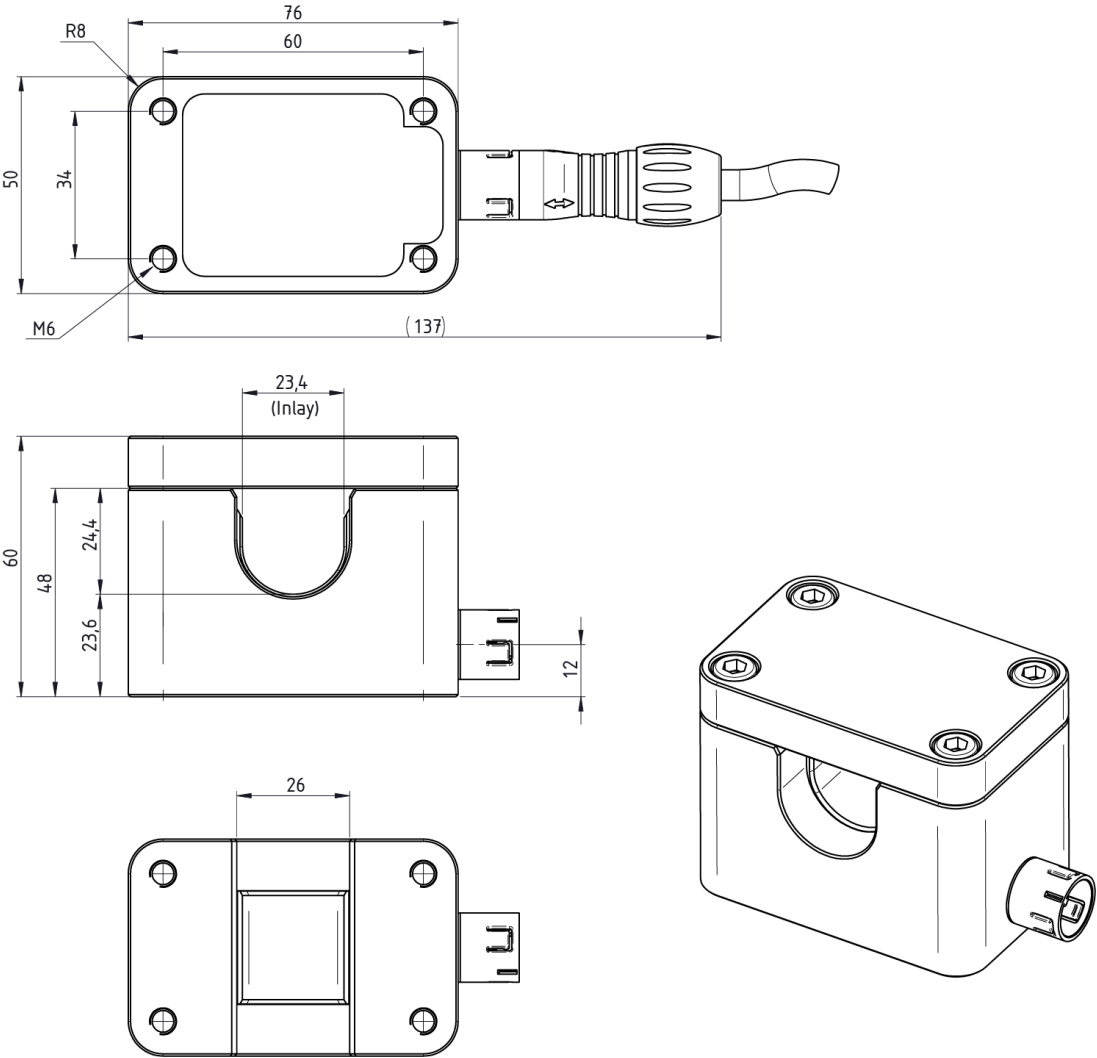
Top view without lid and screws

SEMIFLOW CO.66/190PI Ex1

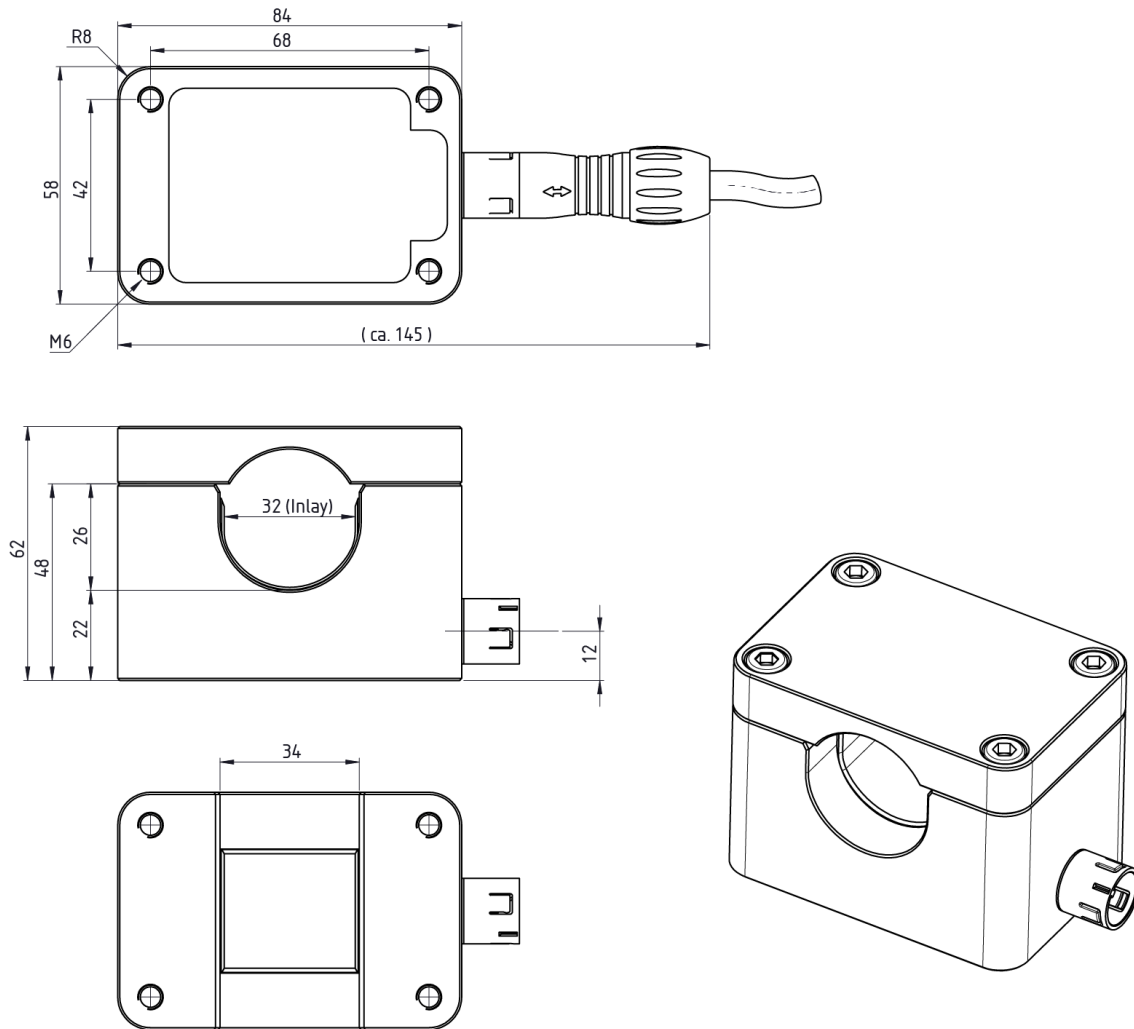


Top view without lid and screws

SEMIFLOW CO.66/260PI Ex1



Top view without lid and screws

SEMIFLOW CO.66/340PI Ex1

Top view without lid and screws

Information is subject to change without notice. Registration according to ElektroG: WEEE Reg. No. DE 22125904.
SONOTEC is a registered trademark.

Manufacturer

SONOTEC GmbH
Thüringer Str. 33
06112 Halle (Saale)
Germany

Site 2:
Nauendorfer Str. 2
06112 Halle (Saale)

Tel.: +49 (0)345 / 133 17- 0
sales_eu@sonotec.de
www.sonotec.eu

Contact USA

SONOTEC US Inc.
10 Newton Pl., Ste. 100
Hauppauge, NY 11788
USA

Phone: +1 631 / 415 4758
sales@sonotecusa.com
www.sonotecusa.com



Barrier Boxes ST Ex1 are associated apparatuses according to IEC 60079-11 (ATEX / IECEx) and KTL standards. They are designed to connect intrinsically safe SONOTEC flow sensors located in hazardous areas with possible fire or explosion risks due to explosive gas atmospheres (Zone 1, Group IIB). The boxes are used to limit the supplied energy for the sensors to avoid ignition. They provide power and all necessary data lines.

Due to the current and switching outputs, the **Barrier Boxes ST Ex1** support industrial dosing applications. Supporting RS-485 interface, the devices allow as well bus operation of up to 12 sets of sensors in rough industrial environments.

Safety-related parameters

Parameter	Specification	
Explosion protection / intrinsic safety	RMS AC voltage	$U_m = 60\text{ V}$
	Max. output voltage	$U_o = 5.88\text{ V}$
	Max. output current	$I_o = 4130\text{ mA}$
	Max. output power	$P_o = 1\text{ W}$
	External capacitance	$C_o = 200\text{ }\mu\text{F}$
	External inductance	$L_o = 10\text{ }\mu\text{H}$
	Storage temperature	$-20 \dots +60\text{ }^\circ\text{C}$

Technical data

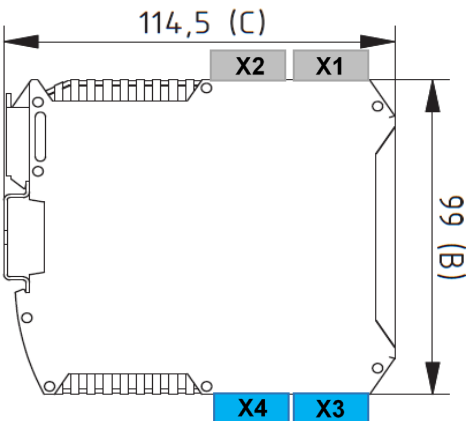
Parameter	Specification
Mounting	DIN rail TH35
Housing materials	Polyamide, UL 94 V0; front plate: polycarbonate
Labeling	See technical drawings (last page)
Operating voltage	24 VDC (22 ... 26 VDC), Maximum ripple 5 %, protection against reverse-polarity ⚠ Caution: The power supply (not included in the scope of supply) must meet Safety Extra Low Voltage (SELV) or Protected Extra-Low Voltage (PELV) requirements.

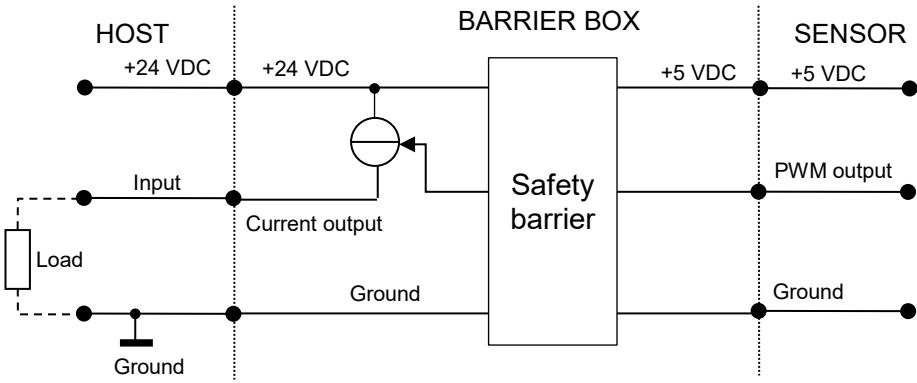
Current consumption	Maximum 60 mA (with open current and switching output)
Shielding	⚠ Required: Shield of connecting cable has to be connected on side of machine

Electrical connection – Barrier Box ST Ex1

Screw terminal blocks: To sensor - blue colored (connection of sensor cable) |
To machine / external interface - gray colored (cable not in scope of supply)

⚠ **Caution:** Observe carefully all instructions in the operating manual.

	X1	1	I _{OUT}		X2	1	+ 24 V
		2	D _{OUT}			2	P _{GND}
		3	D _{IN}			3	RS-485 B
		4	GND			4	RS-485 A
	X3	1	S_PWMA	(Green)	X4	1	S_5V (Brown)
		2	S_PWMB	(Pink)		2	S_GND (White)
		3	S_D _{OUT}	(Blue)		3	S_RS-485 B (Yellow)
		4	S_D _{IN}	(Red)		4	S_RS-485 A (Gray)

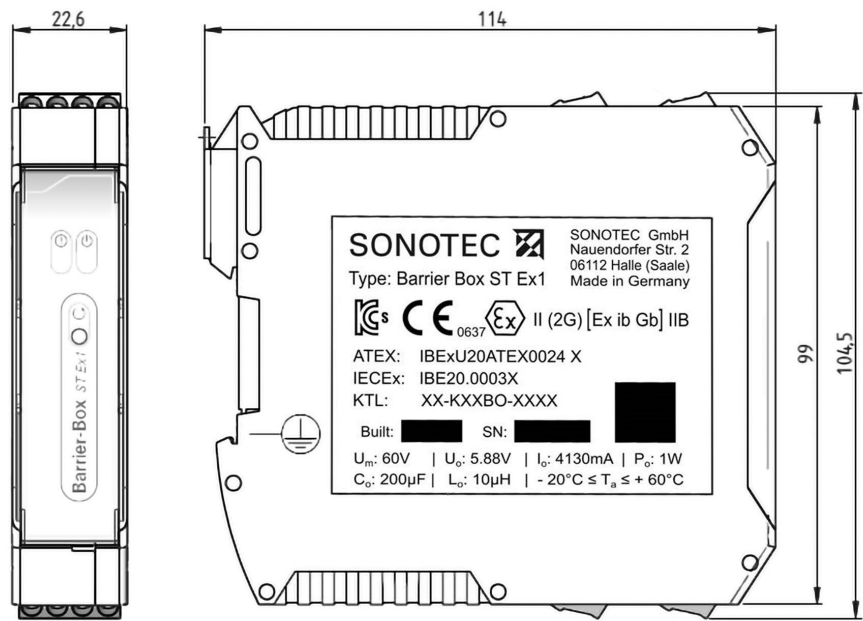
Parameter	Specification
Interfaces	<ul style="list-style-type: none">Current output for flow rate: 0/4 ... 20 mARS-485 interface: bus-capableSwitching output: NPN 0 ... 30 VDigital input
Current output for flow rate	<p>⚠ NOTE: Load to GND. The max. load depends on the operating voltage. At 24 V we recommend 1 kΩ.</p> 

RS-485 interface	<p>Half-duplex operation / 115.200 baud / 8 data bit / no parity / 1 stop bit / no handshaking</p> <p>⚠ NOTE: Description of serial protocol upon request.</p> <p>Recommended electrical connection of the RS-485 interface.</p> <p>⚠ CAUTION! If the interface is not used the pins A & B shall remain open.</p>
RS-485 Bus operation	<p>The Barrier Box ST Ex1 supports bus operation of up to 12 devices (SONOTEC protocol). The default address is #01.</p> <p>⚠ NOTE: The address can be changed using the SEMIFLOW Monitor V2.0. Addresses from #01 ... #12 are permitted. → Menu: Identification RS-485 address</p>
Switching output	<p>NPN, 0 ... 30 V, maximum 100 mA, for applications such as:</p> <ul style="list-style-type: none">• adapting batch process (dosing) or• threshold switch of flow or• slow pulses of volume (max. 20 Hz)
Digital input	<p>Voltage resistant up to 30 V, freely configurable, for applications such as:</p> <ul style="list-style-type: none">• Zero point calibration of flow• Start dosing processes

Degree of protection	IP20
Directives and standards	<ul style="list-style-type: none">• EMC directive 2014/30/EU• RoHS: 2011/65/EU, exception: III 7cl/ IV 15, RoHS (EU) 2015/863• Intrinsic Safety: IEC 60079-11
Maintenance	Maintenance-free
Order number	200 01 0335 (for set information see technical data sheet of sensors)
Scope of delivery	Barrier Box ST Ex1 according to specification

Technical drawings

Drawings are not to scale. Dimensions in mm, unless otherwise specified.



Information on the name-plate: *

- Manufacturer information
- Product designation
- Certification details [ATEX, IECEx, KTL]
- Ex marking and operating conditions
- Year of manufacture
- Serial number

* Illustration exemplary

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Manufacturer

SONOTEC GmbH
Thüringer Str. 33
06112 Halle (Saale)
Germany

Site 2:
Nauendorfer Str. 2
06112 Halle (Saale)

Tel.: +49 (0)345 / 133 17- 0
sales_eu@sonotec.de
www.sonotec.eu

Contact USA

SONOTEC US Inc.
10 Newton Pl., Ste. 100
Hauppauge, NY 11788
USA

Phone: +1 631 / 415 4758
sales@sonotecusa.com
www.sonotecusa.com