

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.

### General sensor specification

Specification SEMIFLOW	Order-No. Sensor <sup>(1)</sup>	Order-No. Set <sup>(1)</sup> (incl. Barrier Box ST Ex1 and cable)	Measuring Channel Width   Width with Inlay (see also 'Technical drawings')	Standard Tubing OD	Dimensions (L x W x H)	Weight
CO.66/080PI Ex1	200 08 0106	700 01 0367	8 mm   6 mm	1/4"	44 x 44 x 34 mm	90 g
CO.66/120PI Ex1	200 08 0107	700 01 0368	12 mm   8.5 mm	3/8"	44 x 44 x 38 mm	100 g
CO.66/160PI Ex1	200 08 0108	700 01 0369	16 mm   12 mm	1/2"	44 x 56 x 41 mm	130 g
CO.66/190PI Ex1	200 08 0109	700 01 0370	19.5 mm   17.8 mm	3/4"	50 x 76 x 54 mm	260 g
CO.66/260PI Ex1	200 08 0110	700 01 0371	26 mm   23.4 mm	1"	50 x 76 x 60 mm	280 g
CO.66/340PI Ex1	200 08 0111	700 01 0372	34 mm   32 mm	1.32"	58 x 84 x 62 mm	340 g

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

## Tubing properties

Defined by customer; preferably PFA.

For appropriate coupling, the sensors are equipped with flexible inlays. The use is mandatory.

**NOTE!** The sensors are factory calibrated with the flexible inlay and specified tubing.

## Accuracy

Specification SEMIFLOW	Accuracy for water with standard flow rate and standard tubing, adjusted at 23 °C ± 2 K and 1 bar		Typical max. flow
CO.66/080PI Ex1	< 800 ml/min: ± 16 ml/min	> 800 ml/min: ± 2 % <sup>(1)</sup>	6 000 ml/min <sup>(2)</sup>
CO.66/120PI Ex1	< 1 200 ml/min: ± 24 ml/min	> 1 200 ml/min: ± 2 % <sup>(1)</sup>	20 000 ml/min <sup>(2)</sup>
CO.66/160PI Ex1	< 1 600 ml/min: ± 32 ml/min	> 1 600 ml/min: ± 2 % <sup>(1)</sup>	40 000 ml/min <sup>(2)</sup>
CO.66/190PI Ex1	< 1 800 ml/min: ± 36 ml/min	> 1 800 ml/min: ± 2 % <sup>(1)</sup>	60 000 ml/min <sup>(2)</sup>
CO.66/260PI Ex1	< 4 000 ml/min: ± 80 ml/min	> 4 000 ml/min: ± 2 % <sup>(1)</sup>	80 000 ml/min <sup>(2)</sup>
CO.66/340PI Ex1	< 14 000 ml/min: ± 280 ml/min	> 14 000 ml/min: ± 2 % <sup>(1)</sup>	150 000 ml/min <sup>(2)</sup>

Customized calibration is documented in the sensor calibration report.

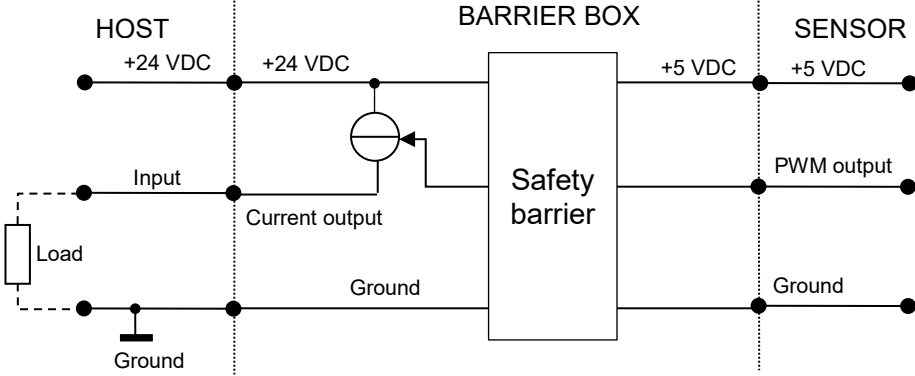
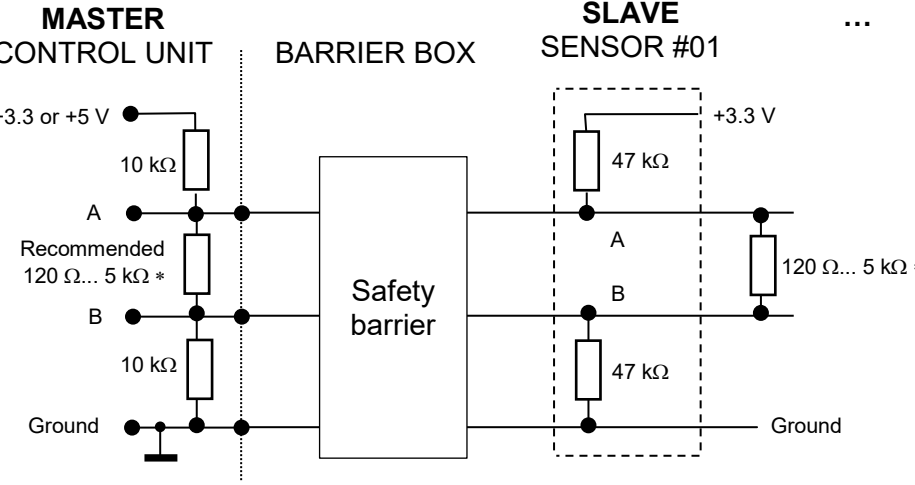
## Technical data

### Safety-related parameters

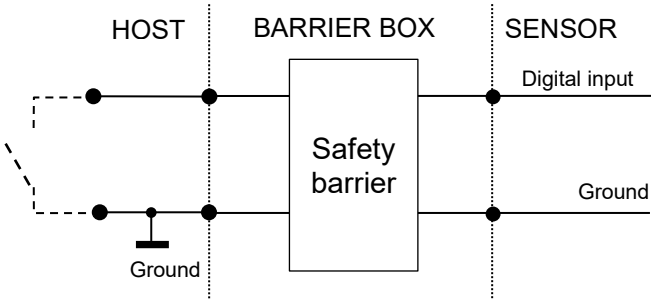
Explosion protection / intrinsic safety	Max. supply voltage	U <sub>i</sub> = 5.88 V
	Max. supply current (1 s)	I <sub>i</sub> = 4130 mA
	Max. electric power	P <sub>i</sub> = 1 W
	Internal capacitance	C <sub>i</sub> = 142 µF
	Internal inductance	L <sub>i</sub> = 8.4 µH
	Media temperature (depending on ambient temperature)	+20 ... +80 °C @ 0 ... +25 °C ambient temperature +20 ... +60 °C @ 0 ... +60 °C ambient temperature
	Storage temperature	-20 ... +60 °C
	Suitable for applications in T4; max. surface temperature 135 °C	

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

SEMIFLOW CO.66/xxxPI Ex1 – Flow Sensor for Liquids											
<b>Measuring method</b>	Ultrasound, two sections of measurements, dry coupling, flexible inlay										
<b>Media</b>	Water or other acoustically transparent liquids										
<b>Calibration</b>	Sensors are factory calibrated for water at 23 °C ± 2 K, tube end depressurized; other calibration on request										
<b>Mounting</b> (screws not included)	<table border="0"> <tr> <td rowspan="2">Fixed installation: 4 fixing holes</td> <td>CO.66/080PI Ex1 ...</td> <td>M4, depth 8 mm</td> </tr> <tr> <td>CO.66/160PI Ex1</td> <td></td> </tr> <tr> <td rowspan="2"></td> <td>CO.66/190PI Ex1 ...</td> <td>M6, depth 10 mm</td> </tr> <tr> <td>CO.66/340PI Ex1</td> <td></td> </tr> </table>	Fixed installation: 4 fixing holes	CO.66/080PI Ex1 ...	M4, depth 8 mm	CO.66/160PI Ex1			CO.66/190PI Ex1 ...	M6, depth 10 mm	CO.66/340PI Ex1	
Fixed installation: 4 fixing holes	CO.66/080PI Ex1 ...		M4, depth 8 mm								
	CO.66/160PI Ex1										
	CO.66/190PI Ex1 ...	M6, depth 10 mm									
	CO.66/340PI Ex1										
<b>Sensor materials</b>	Channel: PMMA black   Inlay: silicone   Housing: PVC-C grey   Potting: PU   Cover screws: PA natural   Connector: PA blue   Pins: gold plated brass										
<b>Labeling</b>	<p>Flow direction, sensor type, certification details [ATEX, IECEx, KTL] and CE marking, year of production, serial number, barcode, manufacturer</p>  <p>                 SEMIFLOW CO.66/080PI Ex1                  K s C E 0637 Ex II 2G Ex ib IIB T4 Gb                  ATEX: IBE<sub>x</sub>U20ATEX1024 X                  IECEx: IBE20.0003X                  KTL: 20-KA4BO-0574X                  BUILT: 2020 SN: 10008                  U<sub>i</sub>: 5.88V   I<sub>i</sub>: 4130mA SONOTEC GmbH                  P<sub>i</sub>: 1W Nauendorfer Str.2                  C<sub>j</sub>: 142µF   L<sub>i</sub>: 8.4µH 06112 Halle (Saale)                  -20°C ≤ T<sub>a</sub> ≤ +60°C Made in Germany             </p>										
	Customized labeling (if applicable): see 'Addition to Technical Data Sheets'										
<b>Operating voltage</b>	5 VDC (via Barrier Box ST Ex1), maximum ripple 1 %, protection against reverse-polarity										
<b>Current consumption</b>	Maximum 80 mA (with open switching output); Maximum I <sub>i</sub> = 4130 mA, P <sub>i</sub> = 1 W										
<b>Electrical connection</b>	8-pin connector (Binder 720 male)										
<b>Shielding</b>	⚠ Required: Shield of cable has to be connected on side of Barrier Box ST Ex1										

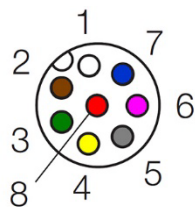
<p><b>Interfaces</b> (via Barrier Box ST Ex1)</p>	<p><b>⚠ WARNING:</b> The SEMIFLOW CO.66/xxxPI Ex1 sensors must be operated solely via the associated operating unit “Barrier Box ST Ex1”!</p> <ul style="list-style-type: none"> <li>• Current output for flow rate: 0/4 ... 20 mA</li> <li>• RS-485 interface: bus-capable for up to 12 devices</li> <li>• Switching output: NPN 0 ... 30 V</li> <li>• Digital input</li> </ul>
<p><b>Current output for flow rate</b> (via Barrier Box ST Ex1)</p>	<p><b>⚠ NOTE:</b> Load to GND. The maximum load depends on the operating voltage. The load at 24 V (recommended) is 1 kΩ.</p> 
<p><b>RS-485 interface</b> (via Barrier Box ST Ex1)</p>	<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><b>⚠ NOTE:</b> Description of serial protocol upon request.</p> <p>Recommended electrical connection of the RS-485 interface.</p> <p><b>⚠ CAUTION!</b> 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>
<p><b>RS-485 Bus operation</b> (via Barrier Box ST Ex1)</p>	<p>The sensor supports bus operation of up to 12 devices (SONOTEC protocol). The default address is #01.</p> <p><b>⚠ NOTE:</b> The address can be changed with the help of the software SEMIFLOW Monitor. Permitted are addresses from #01 ... #12. → Menu: Identification   RS-485 address</p>

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<p><b>Switching output</b> (via Barrier Box ST Ex1)</p>	<p>NPN, 0 ... 30 V, maximum 100 mA, for applications such as:</p> <ul style="list-style-type: none"> <li>• Adapting batch process (dosing)</li> <li>• Threshold switch of flow</li> <li>• Slow pulses of volume (max. 20 Hz)</li> </ul>
<p><b>Digital input</b> (via Barrier Box ST Ex1)</p>	<p>Freely configurable. For applications such as:</p> <ul style="list-style-type: none"> <li>• Zero point calibration of flow</li> <li>• Start dosing processes</li> </ul> <p>Voltage resistant up to 30 V</p> 
<p><b>Degree of protection</b></p>	<p>IP65 (in mated condition)</p>
<p><b>Pressure</b></p>	<p>Atmospheric pressure</p>
<p><b>Directives and standards</b></p>	<ul style="list-style-type: none"> <li>• EMC directive 2014/30/EU</li> <li>• RoHS: 2011/65/EU, exception: III 7c/ IV 15</li> <li>• Acoustic emission: IEC 61157</li> <li>• IEC 60079-0: Equipment – General requirements</li> <li>• IEC 60079-11: Equipment protection by intrinsic safety "i"</li> </ul>
<p><b>Maintenance</b></p>	<p>Maintenance-free</p>
<p><b>Scope of supply (Set)</b></p>	<ul style="list-style-type: none"> <li>• SEMIFLOW CO.66/xxxPI Ex1 according to specification (including cover and screws)</li> <li>• Barrier Box ST Ex1 (see corresponding Technical Data Sheet)</li> <li>• Sensor cable SEMIFLOW, 8 pole (Binder 720)   8 wire, 10 m</li> </ul>
<p><b>Optional accessories</b></p> <p>⚠ NOT for use in explosion hazard areas.</p>	<p>SEMIFLOW Monitor V2.0 for setting parameters and recording measurements. It contains:</p> <ul style="list-style-type: none"> <li>• USB Data Converter, type 013 for connection to a computer</li> <li>• Plug-in power supply (24 VDC)</li> <li>• Sensor cable SEMIFLOW, 8 poles (Binder 720), 8 wires, length 10 m</li> <li>• USB cable, type A-B, length 2 m</li> <li>• CD with Software "SONOFLOW Monitor V2.0" and Windows drivers</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Sensor cable SEMIFLOW, 8 pole (Binder 720)   8 wire, 10 m</li> <li>• Calibration protocol</li> </ul>

## Electrical connection

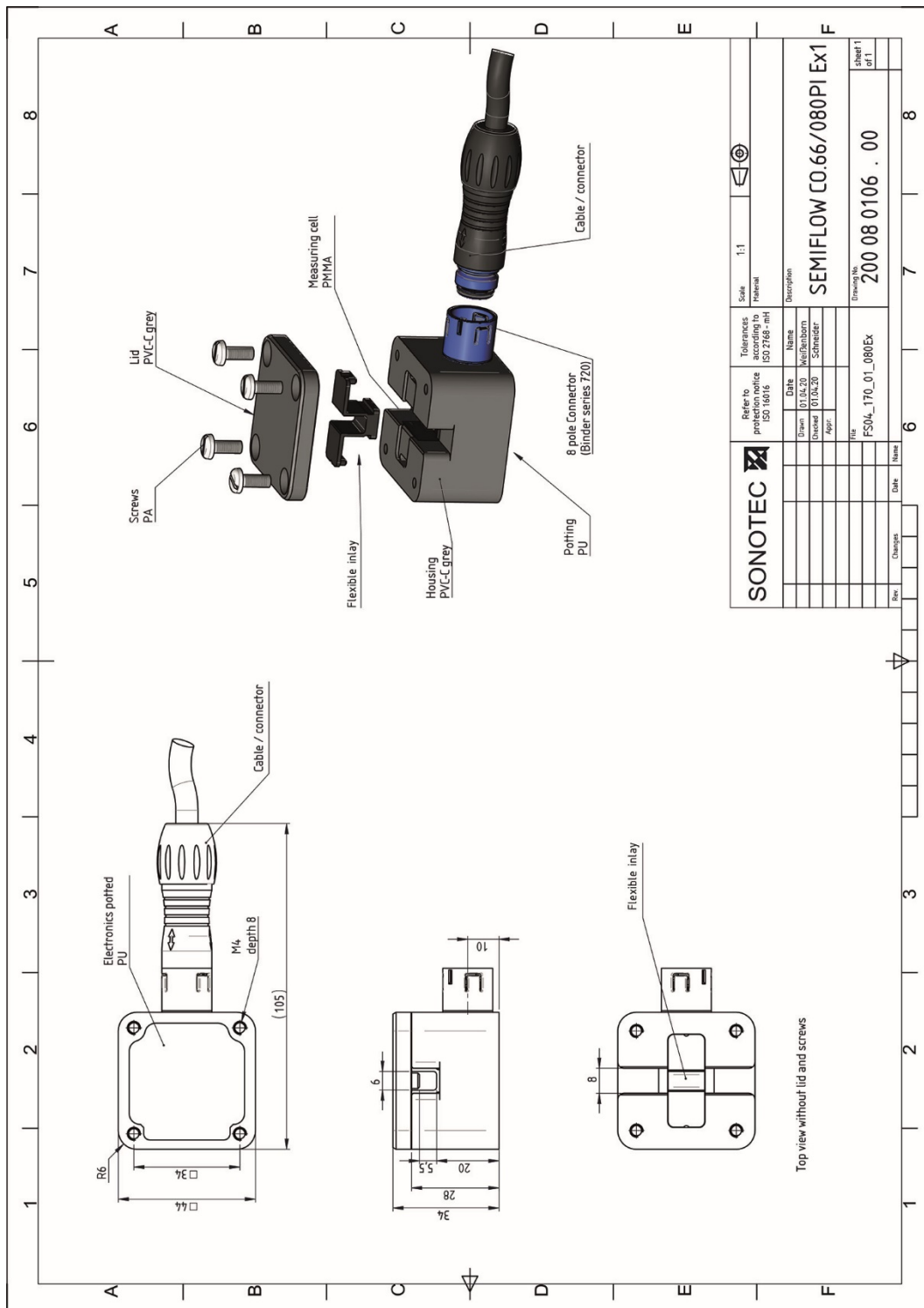
SEMIFLOW CO.66/xxxPI Ex1 to Barrier Box ST Ex1, see also corresponding 'Technical Data Sheet'.

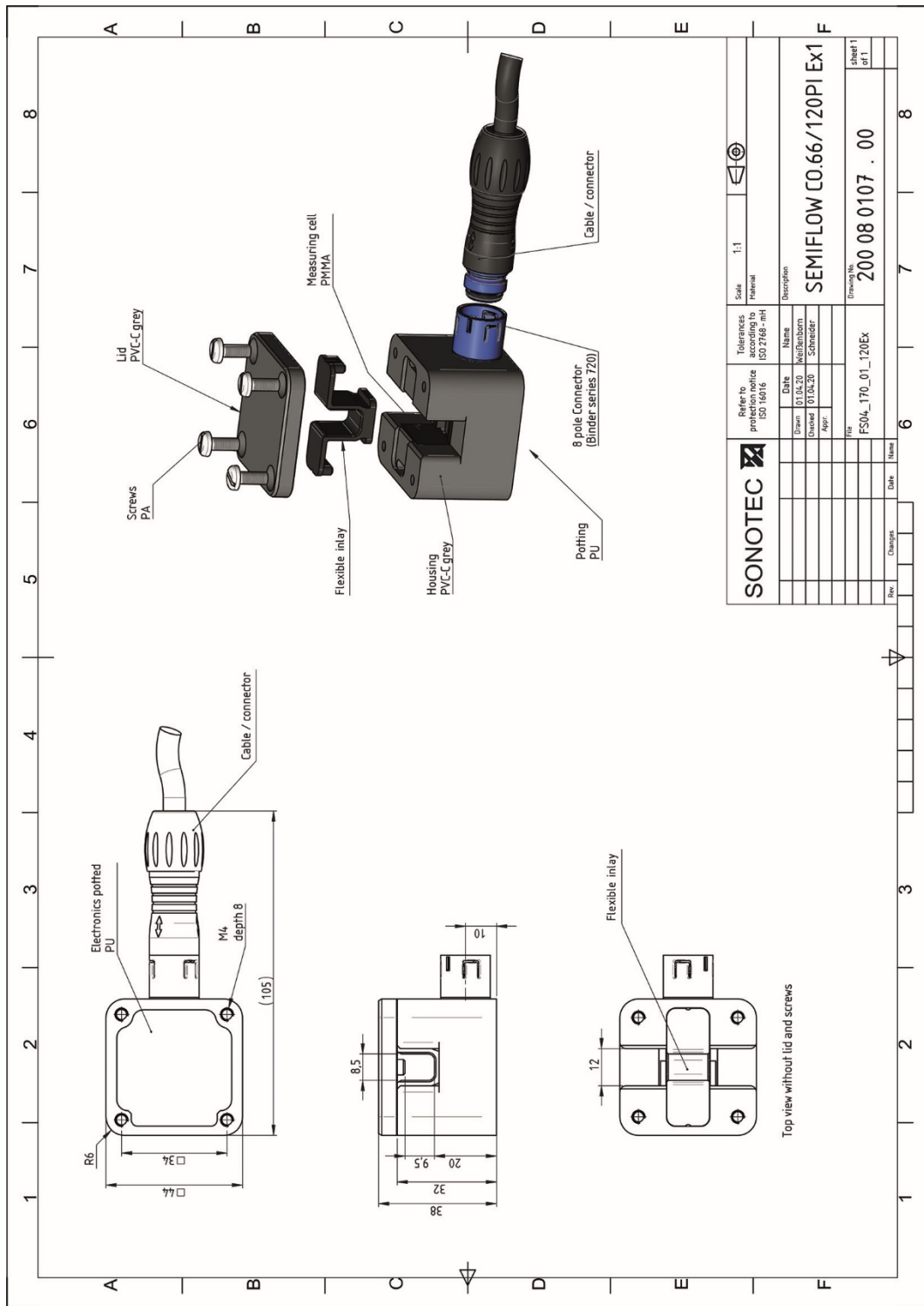


Male connector  
(at the sensor)

Connecting cable	Pin	Color	Connection
<b>Assignment</b> 8 pin connector to 8 pole cable	1	White	Ground
	2	Brown	Operating voltage +5 VDC
	3	Green	PWM A - Current output (0/4 ... 20 mA)
	4	Yellow	RS-485 B
	5	Grey	RS-485 A
	6	Pink	PWM B - Current output (0/4 ... 20 mA)
	7	Blue	Switching output: NPN
	8	Red	Digital input
	Shield		

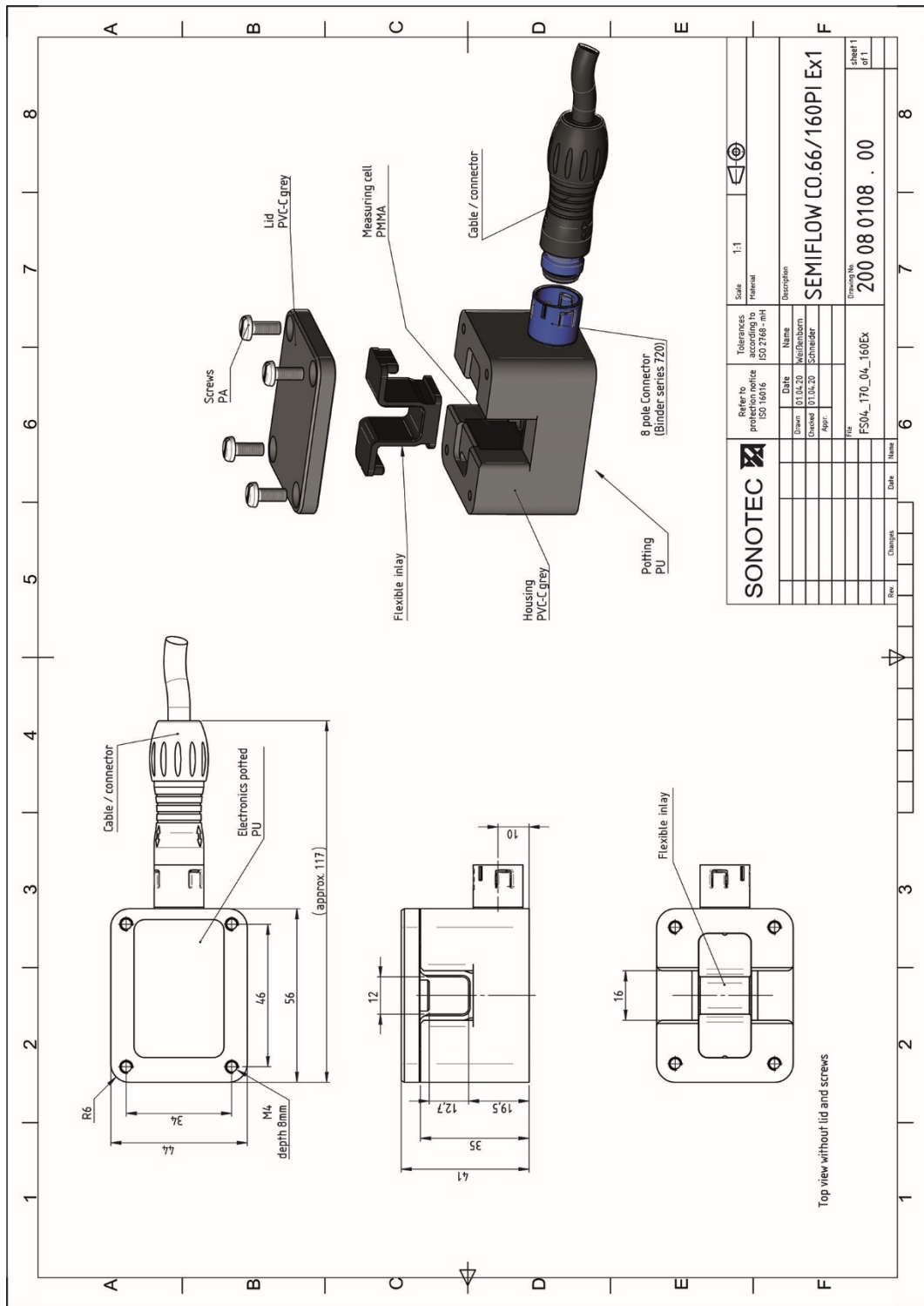
Technical drawings

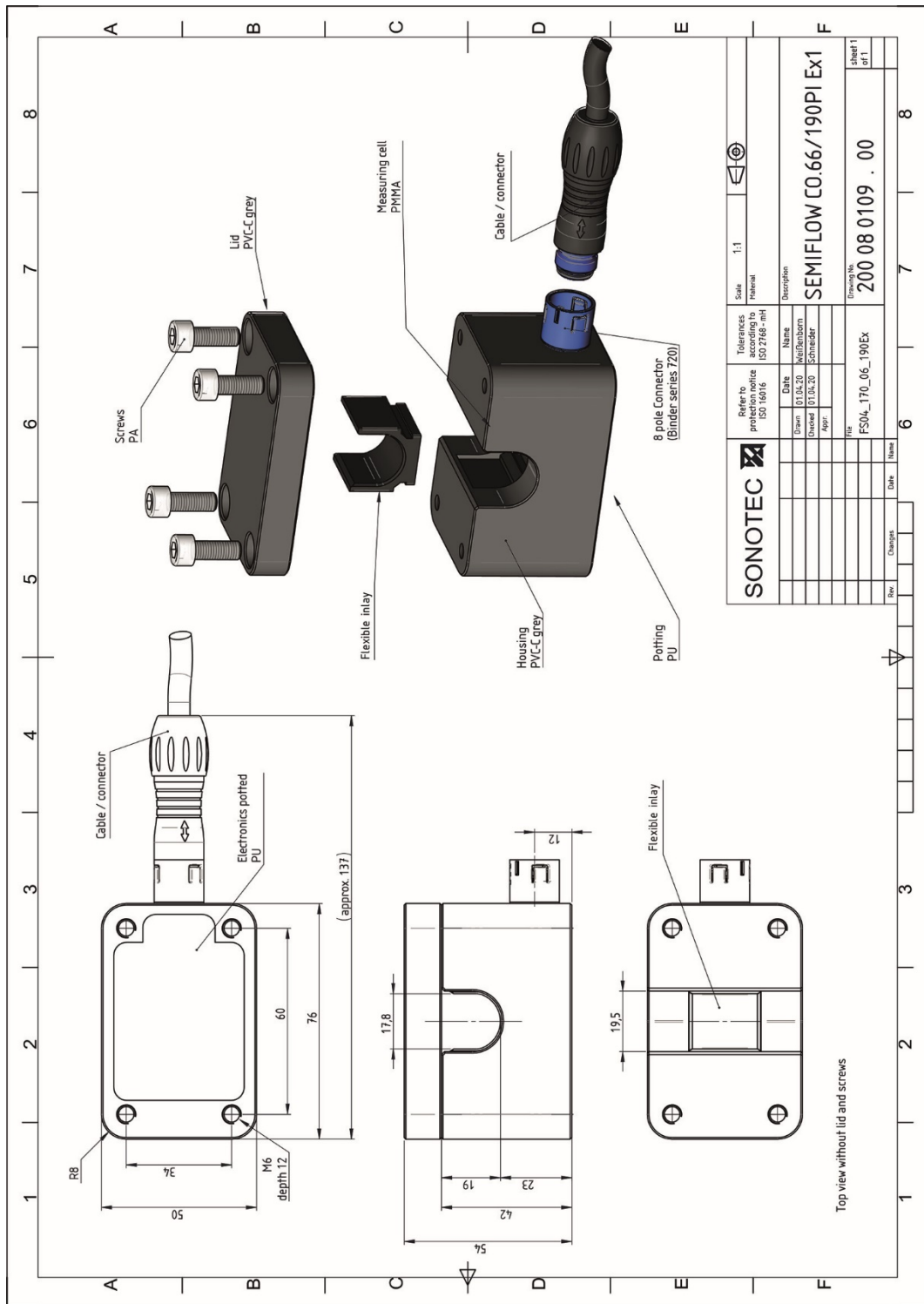




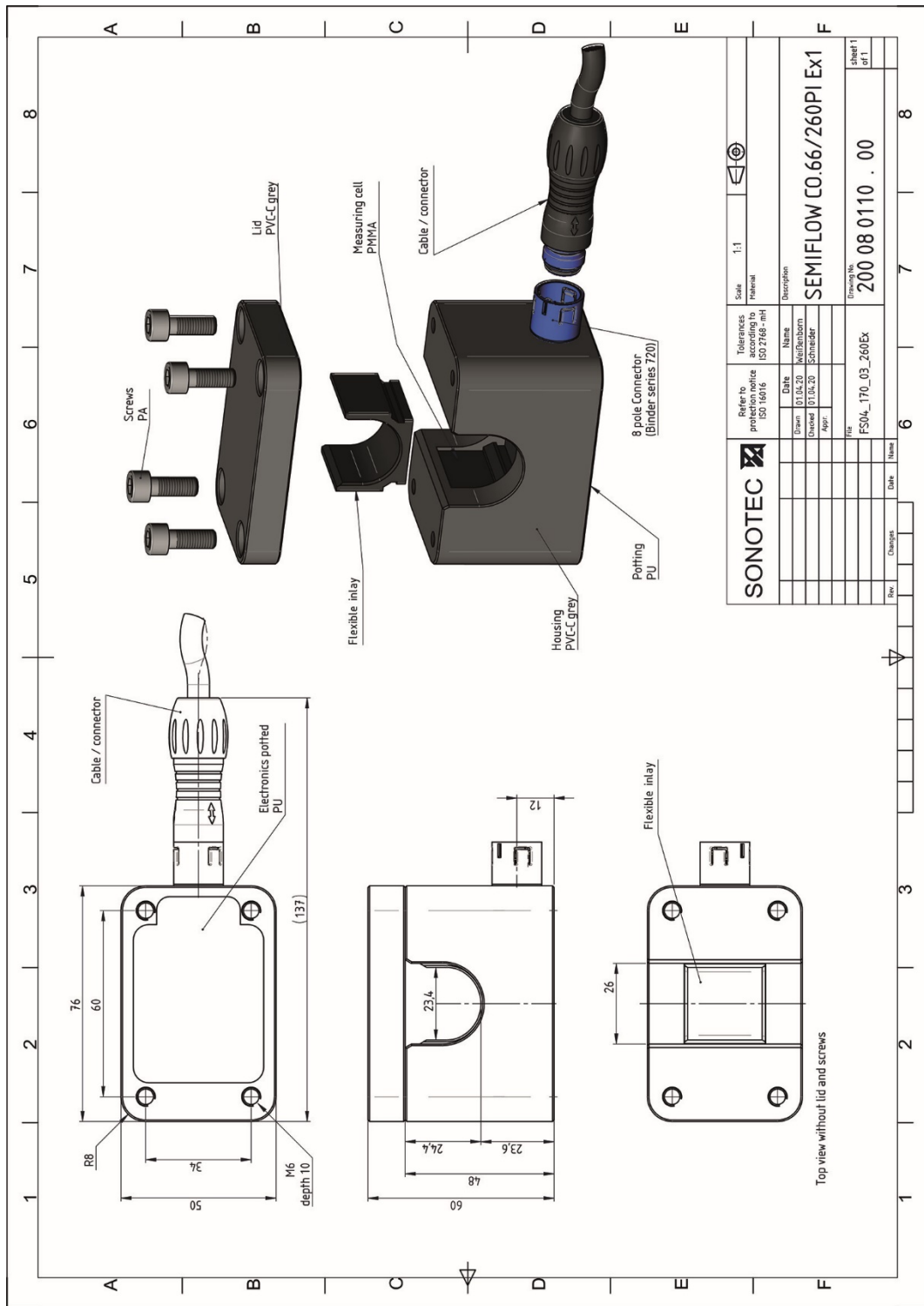
<b>SONOTEC</b>		Refer to protection notice according to ISO 2768 - mH	Scale: 1:1
Drawn: 01.04.20 Checked: 01.04.20 Appr:	Name: Muffelborn Scheduler	Tolerances according to ISO 2768 - mH	Material:
Description: SEMIFLOW CO.66/120PI Ex1		Drawing No: 200 08 0107 . 00	
File: F504_170_01_120EX		Sheet 1 of 1	
Rev:	Changes:	Date:	Name:



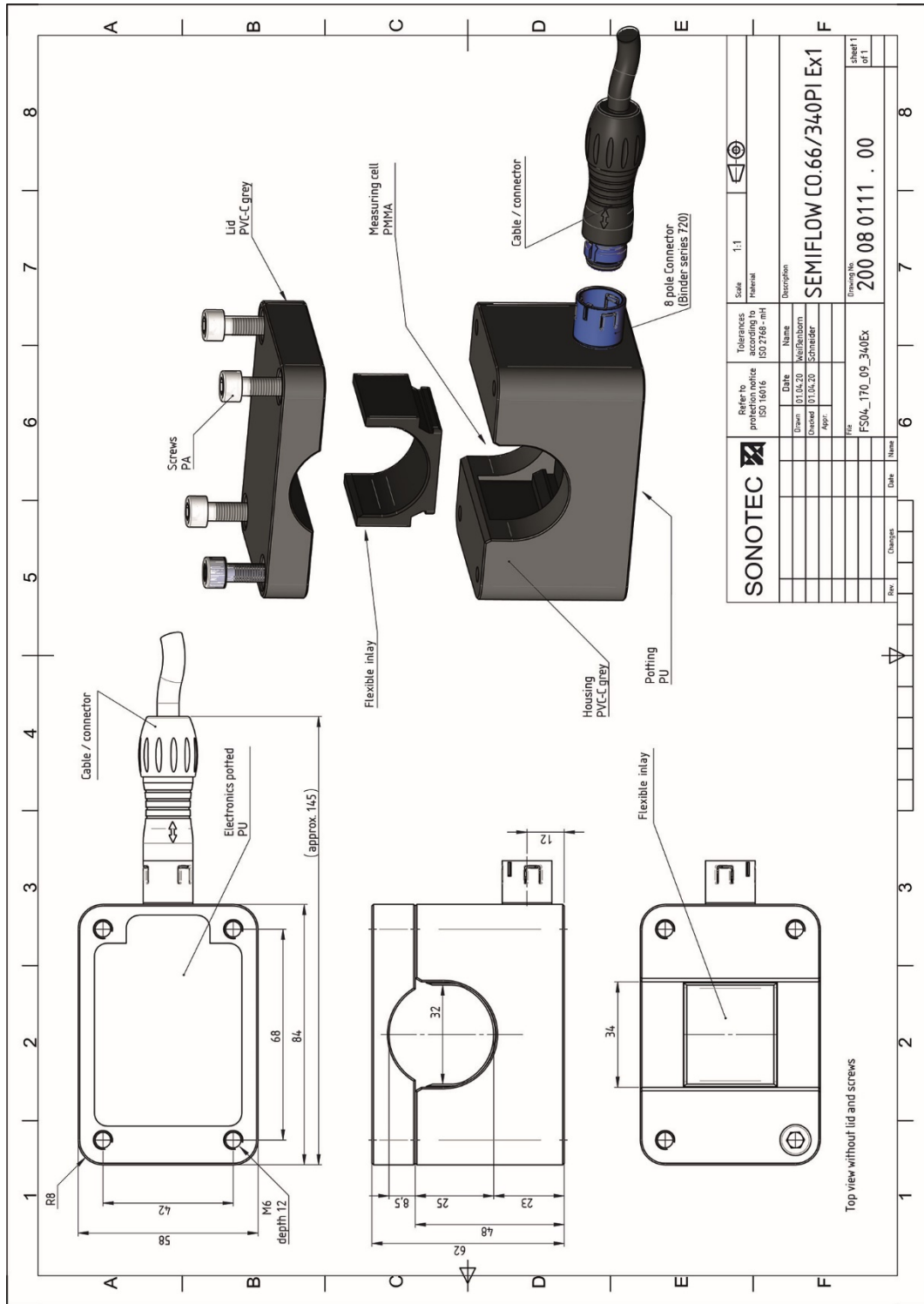




Scale		1:1	
Tolerances according to ISO 2768-mH		Material	
Refer to protection notice ISO 16016		Description	
Drawn	01.04.20	Name	SEMIFLOW CO.66/190PI Ex1
Checked	01.04.20	Name	
Appr.		Name	
Title		Drawing No.	
FS04_170_06_190EX		200 08 0109 . 00	
		Sheet 1 of 1	



Scale: 1:1		Tolerances according to ISO 2768-mH	
Refer to protection notice ISO 16016		Name: Muffelborn	
Drawn: 01.04.20	Appr: Schneider	Description: SEMIFLOW CO.66/260PI Ex1	
Drawn: 01.04.20	Appr: Schneider	Drawing No: 200 08 0110 . 00	
File: FS04_170_03_260EX		Sheet 1 of 1	
Rev	Changes	Date	Name



Drawings are not to scale. Dimensions in mm, unless otherwise specified. Information is subject to change without notice.  
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**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.

## Technical data

### Safety-related parameters

<b>Explosion protection / intrinsic safety</b>	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	$-20 \dots +60 \text{ }^\circ\text{C}$

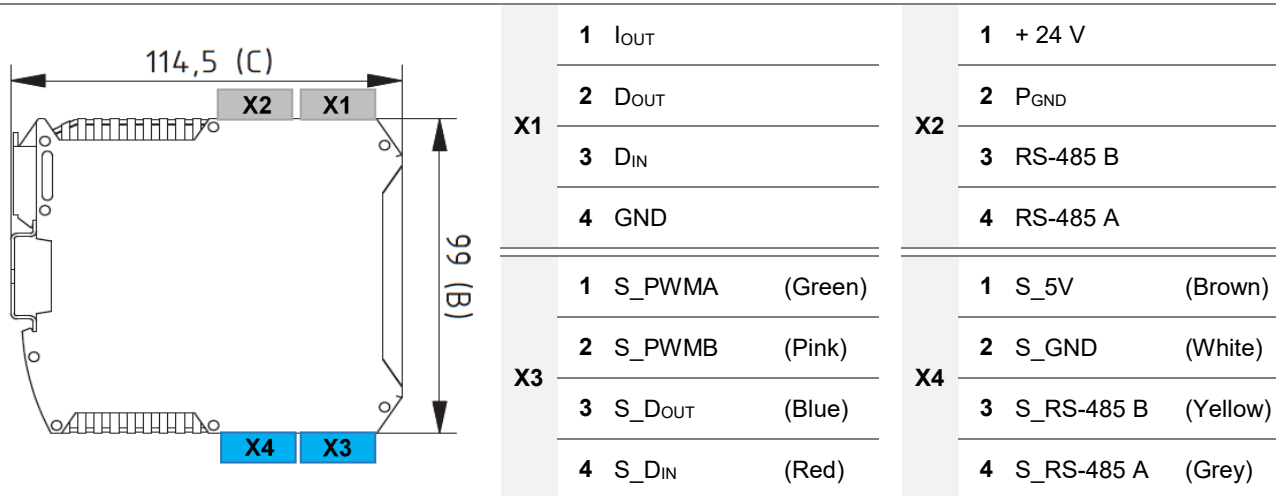
### Barrier Box ST Ex1 – Operating Unit for Ex Flow Sensor

<b>Mounting</b>	DIN rail TH35
<b>Housing materials</b>	Polyamide, UL 94 V0; Front plate: Polycarbonate
<b>Labeling</b>	See technical drawings (last page)
	Customized labeling (if applicable): see 'Addition to Technical Data Sheets'
<b>Operating voltage</b>	24 VDC (22 ... 26 VDC), maximum ripple 5 %, protection against reverse-polarity ⚠ <b>Note:</b> The power supply (not included in the scope of supply) must meet Safety Extra Low Voltage (SELV) or Protected Extra-Low Voltage (PELV) requirements

<b>Current consumption</b>	Maximum 60 mA (with open current and switching output)
<b>Shielding</b>	⚠ 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 - grey colored (cable not in scope of supply)

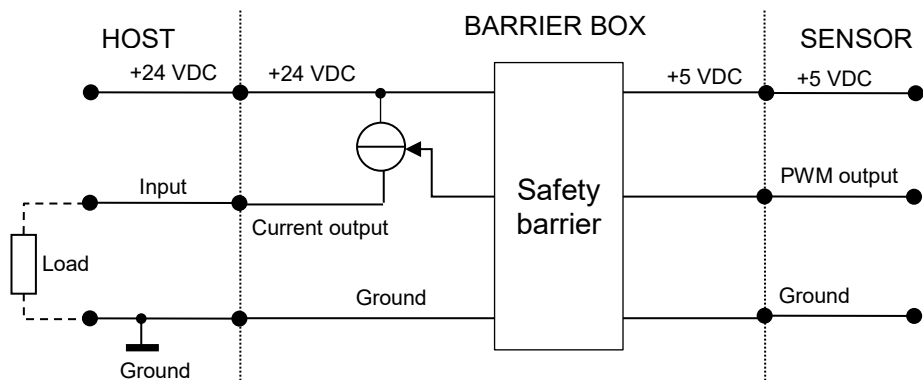


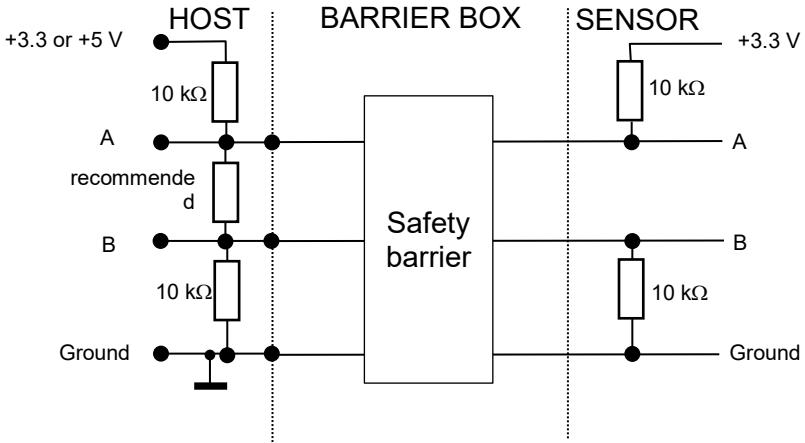
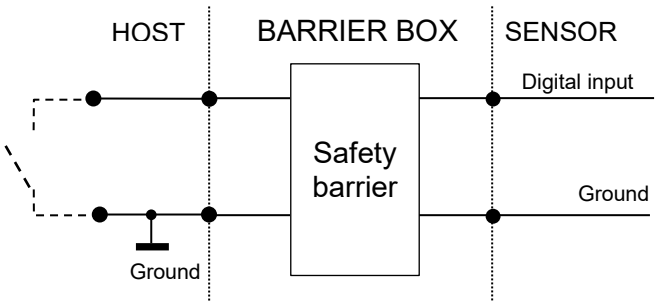
**Interfaces – Barrier Box ST Ex1**

- Current output for flow rate: 0/4 ... 20 mA
- RS-485 interface: bus-capable
- Switching output: NPN 0 ... 30 V
- Digital input

**Current output for flow rate**

⚠ **NOTE:** Load to GND. The max. load depends on the operating voltage. At 24V we recommend 1 kΩ.

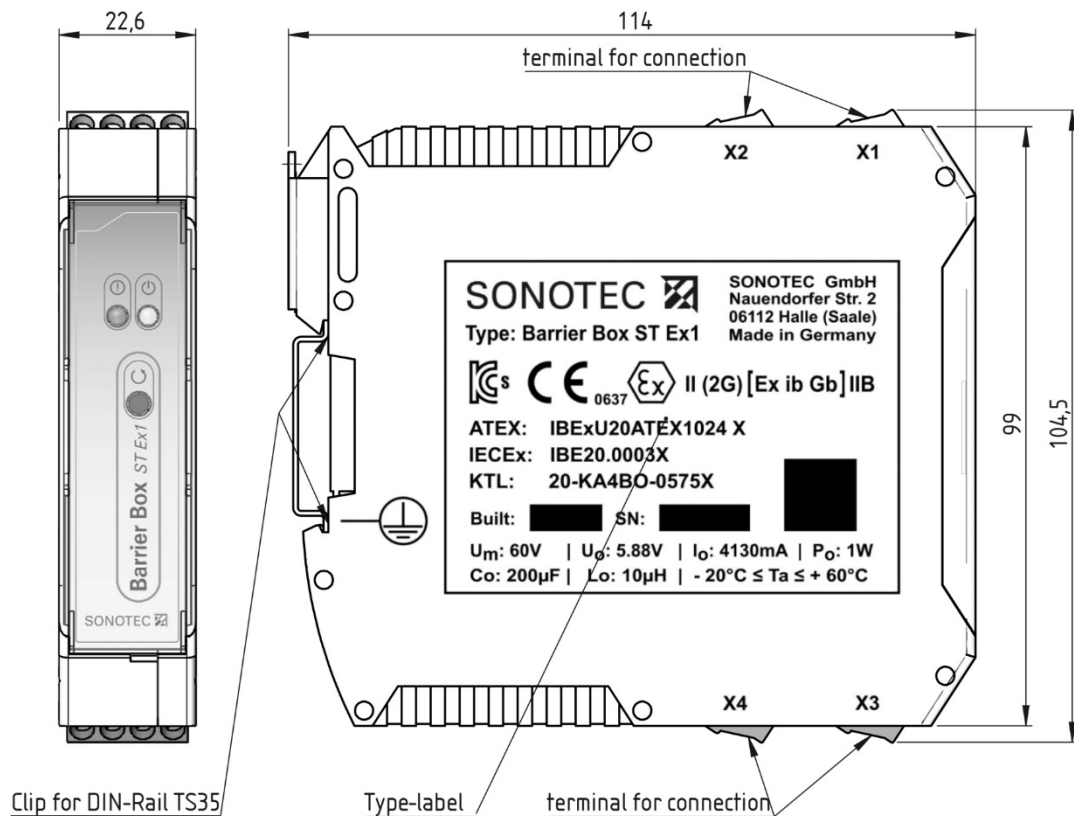


<p><b>RS-485 interface</b></p>	<p>Half-duplex operation / 115.200 baud / 8 data bit / no parity / 1 stop bit / no handshaking</p> <p>⚠ <b>NOTE:</b> Description of serial protocol upon request.</p>  <p>Recommended electrical connection of the RS-485 interface.</p> <p>⚠ <b>CAUTION!</b> If the interface is not used the pins A &amp; B shall remain open.</p>
<p><b>RS-485 Bus operation</b></p>	<p>The Barrier Box ST Ex1 supports bus operation of up to 12 devices (SONOTEC protocol). The default address is #01.</p> <p>⚠ <b>NOTE:</b> The address can be changed using the SEMIFLOW Monitor V2.0. Addresses from #01 ... #12 are permitted. → Menu: Identification   RS-485 address</p>
<p><b>Switching output</b></p>	<p>NPN, 0 ... 30 V for applications:</p> <ul style="list-style-type: none"> <li>• adapting batch process (dosing) or</li> <li>• threshold switch of flow or</li> <li>• slow pulses of volume (max.. 20 Hz)</li> </ul> <p>Maximum 100 mA</p>
<p><b>Digital input</b></p>	<p>Freely configurable: for example for zero point calibration of flow or start dosing processes Voltage resistant up to 30 V</p> 
<p><b>Degree of protection</b></p>	<p>IP20</p>

Associated Operating Unit to Flow Sensors for Use in Potentially Explosive Atmospheres

<b>Directives and standards</b>	<ul style="list-style-type: none"> <li>• EMC directive 2014/30/EU</li> <li>• RoHS: 2011/65/EU, exception: III 7cI/ IV 15</li> <li>• Intrinsic Safety: IEC 60079-11</li> </ul>
<b>Maintenance</b>	Maintenance-free
<b>Order number</b>	200 01 0335 (for set information see Technical Data Sheet of sensors)
<b>Scope of delivery</b>	Barrier Box ST Ex1 according to specification
<b>Optional accessories</b>	Sensor cable SEMIFLOW, 8 pole (Binder 720)   8 wire, 10 m

## Technical drawings



Drawings are not to scale. Dimensions in mm, unless otherwise specified. Information is subject to change without notice.  
 Revision: 1.2 | 2021-03-18

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