OPERATING INSTRUCTIONS

FLOWSIC30
Gas Meter
for Wellhead Applications

Installation
Operation
Maintenance

SICK
Sensor Intelligence.

Document information

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Original documents
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Glossary

AGA 8	American Gas Association Report 8
ATEX	Atmosphères Explosifs: Abbreviation for European standards that govern safety in potentially explosive atmospheres
EVC	Electronic Volume Converter
a. c.	actual condition
IEC	International Electrotechnical Comission
IECEx	IEC system for certification in accordance with standards for devices for use in potentially explosive atmospheres
s. c.	standard condition
IP*xy*	Ingress Protection: Degree of protection of a device according to IEC/DIN EN 60529; *x* designates protection against contact and impurities, *y* protection against moisture.
LVF	Liquid Volume Fraction
SPU	Signal Processing Unit
SOS	Speed of Sound

Warning symbols


IMMEDIATE HAZARD
of severe injuries or death


Hazard (general)


Hazards by electrical voltage

Hazard in potentially explosive atmospheres


Hazard by explosive substances/mixtures


Hazard by unhealthy substances


Hazards by toxic substances

Warning levels / signal words

DANGER
Risk or hazardous situation which *will* result in severe personal injury or death.

WARNING
Risk or hazardous situation which *could* result in severe personal injury or death.

CAUTION
Hazard or unsafe practice which could result in personal injury or property damage.

NOTICE
Hazards which *could* result in property damage

Information symbols

Information on product condition with regard to protection against explosions (general)


Information on product characteristics related to European Directive ATEX

Information on product characteristics related to explosion protection in accordance with the IECEx scheme.


Important technical information for this product


Important information on electric or electronic functions


Nice to know


Supplementary information


Link referring to information at another place

FLOWSIC30

1 Important information

About this document
Main hazards
Intended use
Responsibility of user

1.1 About this document

These Operating Instructions contain essential information on the function, installation, start-up and maintenance of the FLOWSIC30.

1.2 Main hazards

The FLOWSIC30 is directly integrated into gas-carrying pipelines.

The operating company is responsible for safe operation and for complying with additional national and company-specific regulations.

WARNING: Hazards through the gas in the system

The following conditions can increase the risk:

- Toxic gas or gas dangerous to health
- Chemically aggressive gas
- Explosive gas
- High gas pressure
- High gas temperature

► Only carry out installation work when the system is out of operation and does not contain dangerous gas.

Otherwise escaping gas can possibly be dangerous to health and cause injuries (e.g. poisoning, burns).

WARNING: Hazards through leaks

Operation in leaky condition is not allowed and possibly dangerous.

► Check leak tightness of equipment regularly.

1.3 Intended use

1.3.1 Purpose of the device

The FLOWSIC30 serves measuring the gas volume, volume flow, gas temperature, gas pressure (optional), speed of sound and methane content of gases in pipelines.

The FLOWSIC30 may only be used as specified by the manufacturer and as set forth below. Make sure the use of the equipment complies with the technical data, information about the permitted use as well as assembly, installation, ambient and operating conditions.

Relevant information is provided in the order documentation, type plate, certification documents and this manual.

1.3.2 Product identification

Product name:	FLOWSIC30
Manufacturer	SICK Engineering GmbH Bergener Ring 27 D-01458 Ottendorf-Okrilla Germany

For identification use the information on the main type plate.

For detailed information on the type plates and examples, please refer to → p. 79, §8.3.

Fig. 1 Location of type plates

1 Main type plate on the SPU
2 Type plate on the meter body
3 Flange designation

1.3.3 Operation in potentially explosive atmospheres

The FLOWSIC30 is suitable for use in potentially explosive atmospheres:
IECEx: Ex db eb ia [ia] IIA T4 Gb
ATEX: II 2G Ex db eb ia [ia] IIA T4 Gb

Further information on potentially explosive atmospheres, see → p. 39, § 3.4.6.

1.3.4 Operation in pressure applications

Design, manufacture and inspection of the FLOWSIC30 measuring system is performed in compliance with the safety requirements set forth in the ASME standard B31.3.

1.3.5 Operation in applications with wet gas

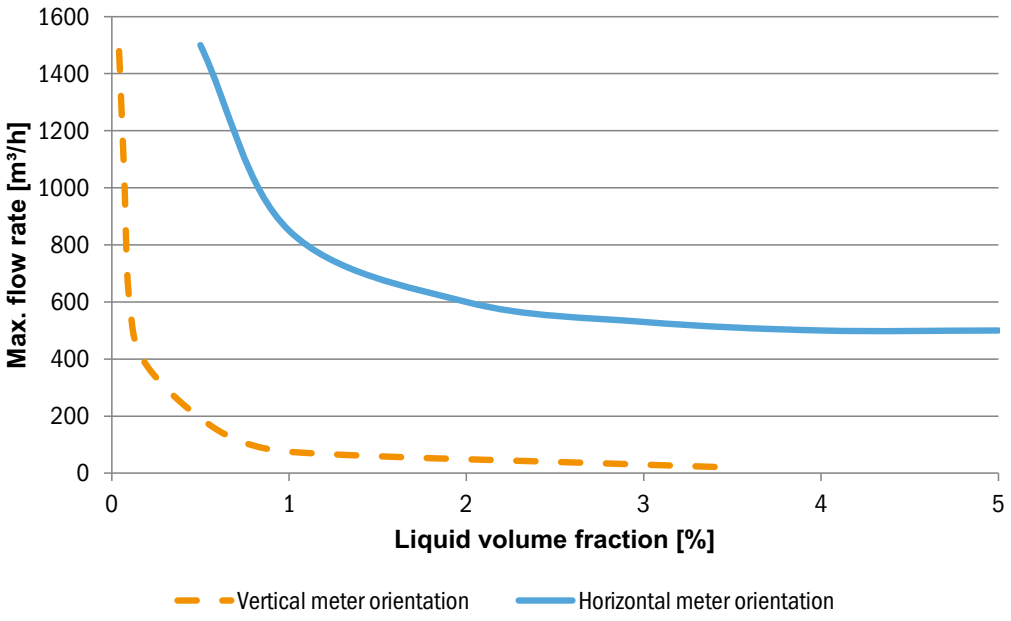
FLOWSIC30 has been designed for robust and reliable operation in challenging gas production applications. In these applications, wet gas may also be existent in the gas stream.

However, FLOWSIC30 is a gas meter. All specifications of the gas meter apply for dry gas only. Any wet gas in the gas stream may adversely affect the certainty of the measured values and meter function.

→ Fig. 2 shows the gas meter's operating range at low pressure in horizontal and in vertical meter orientation. Horizontal installation of the gas meter is recommended for wet gas applications.

Since the effects of 2-phase streams with mixtures of liquid and gas are very complex, a general operation guarantee cannot be given for the gas meter in these conditions.

Fig. 2 Wet gas operation



1.3.6 Restrictions of use

- ► Refer to the type plate for the configuration of your FLOWSIC30.
- ► Check that the FLOWSIC30 is suitably equipped for your application (e.g. gas conditions).

1.4 Responsibility of user

- ► Only put the FLOWSIC30 into operation after reading the Operating Instructions.
- ► Observe all safety information.
- ► If anything is not clear: Please contact SICK Customer Service.

Designated users

The FLOWSIC30 may only be operated by skilled technicians who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

> ***NOTICE:***
> Skilled persons are persons in accordance with DIN VDE 0105 or IEC 364, or directly comparable standards.
> These persons must have exact knowledge on hazards arising from operation, e.g. through hot, toxic, explosive gases or gases under pressure, gas-liquid mixtures or other media as well as adequate knowledge of the measuring system gained through training.

Correct use

- ► Only use the FLOWSIC30 as described in these Operating Instructions. The manufacturer bears no responsibility for any other use.
- ► Do not carry out any work or repairs on the FLOWSIC30 not described in this manual.
- ► Do not remove, add or modify any components to or on the FLOWSIC30 unless described and specified in the official manufacturer information.

  Otherwise
  - any warranty by the manufacturer becomes void,
  - the device may become dangerous,
  - the approval for use in potentially explosive atmospheres is no longer valid,
  - the approval for use in lines pressurized above 0.5 bar (7.25 psi) bar is no longer valid.

Special local conditions

- ► Follow all local laws, regulations and company-internal operating directives applicable at the installation location.

Retention of documents

- ► Keep these Operating Instructions and all associated documents available for reference.
- ► Pass the documents on to a new owner.

FLOWSIC30

2 Product description

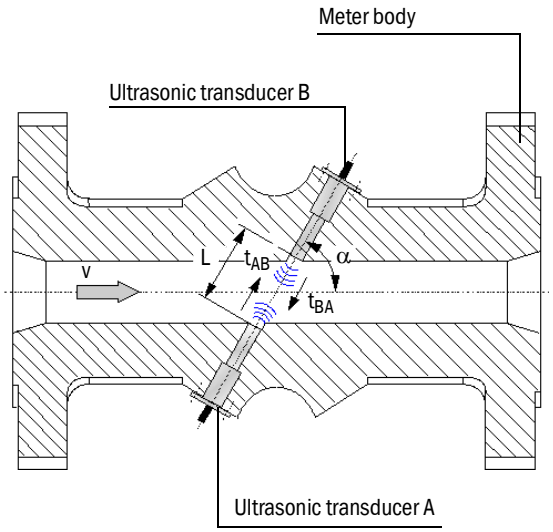
Functional principle
Volume conversion (option)
System overview
Interfaces
FLOWgate™ operating software

2.1 Functional principle

The FLOWSIC30 works according to the principle of ultrasonic transit time difference measurement. Measured signal travel times t_{AB} and t_{BA} are defined by the current sound and flow velocity of the gas.

Gas velocity v is determined from the difference between the signal travel times. Therefore changes in the sound velocity caused by pressure or temperature fluctuations do not affect the calculated gas flow rate with this method of measurement.

Fig. 3 Measuring principle FLOWSIC30



v = Gas velocity in m/s
L = Measuring path in m
α = Angle of inclination in °
t_{AB} = Sound transit time in flow direction
t_{BA} = Sound transit time against the flow direction

2.2 Calculations

2.2.1 Determining the gas velocity

Measuring path L is equal to the active measuring path, that is, the area through which the gas flows. Given measuring path L, sound velocity c, and angle of inclination α between the sound and flow direction, the sound transit time in the direction of the gas flow (forward direction) when the signal is transmitted can be expressed as:

$$t_{AB} = \frac{L}{c + v \cdot \cos \alpha} \qquad (2.1)$$

Valid against the flow is:

$$t_{BA} = \frac{L}{c - v \cdot \cos \alpha} \qquad (2.2)$$

After the resolution to v:

$$v = \frac{L}{2 \cdot \cos \alpha} \cdot \left(\frac{1}{t_{AB}} - \frac{1}{t_{BA}} \right) \qquad (2.3)$$

i.e. a relation in which, except for the two transit times measured, only the active measuring path and the path angle exist as constants.

2.2.2 Determining the sound velocity

Sound velocity c can be calculated by resolving formulas 2.1 and 2.2.

$$c = \frac{L}{2} \cdot \left(\frac{t_{AB} + t_{BA}}{t_{AB} \cdot t_{BA}} \right) \qquad (2.4)$$

2.2.3 Calculating the volume flow rate a. c.

The volume flow rate in actual condition (a. c.) is calculated from the gas velocity and the geometric dimensions of the meter body diameter D.

$$Q = v \cdot \left(\frac{D^2 \cdot \pi}{4} \right) \qquad (2.5)$$

2.2.4 Calculating the methane content

The calculation of the methane content is made by a simple model based on the measured speed of sound in the medium. It can be used to identify changes in the gas composition that may require appropriate action by the plant operator. The underlying model has been created primarily for unconventional natural gas with high contents of methane.

The algorithm is based on the following assumptions:

- The main components are N_2, CO_2 and CH_4, all other components exist only in negligible amounts.
- The portion of N_2 is roughly twice the portion of CO_2.
- Significant amounts of other substances may lead to deviations.

Application limits of the methane algorithm

-10 °C < T < 85 °C

1 bar (a) < p < 20 bar (a)

The output value is without unit and refers to 1, uncertainty < 0.5%.

2.2.5 Volume conversion (option)

As an option, FLOWSIC30 can be ordered with electronic volume conversion.

The optional Electronic Volume Converter (EVC) provides the capability to convert the measured values in actual condition (a. c.) to standard condition (s. c.). Various standard conditions can be defined.

Table 1 Measured values

In actual condition	In standard condition
Gas volume a. c.	Gas volume s. c.
Error volume a. c.	Error volume s. c.
Volumetric flow a. c.	Volumetric flow s. c.

The gas compressibility calculation is made acc. to AGA 8 Gross method 1 or 2. It requires input of certain process values such as gas pressure and temperature. Settings can be made in the FLOWgate™ operating software or via HART® protocol.

Prerequisites for volume conversion

- Actual process pressure is fed into FLOWSIC30 by one of the methods below:
  - The process pressure is set to a fix value in FLOWSIC30.
  - The process pressure is read in from an external HART® pressure sensor connected to the HART® bus. The p sensor is then loop powered.
  - The process pressure is read in from an internal pressure sensor.
- The p sensor and the FLOWSIC30 are configured as follows:
  - The p sensor and the FLOWSIC30 are in multidrop mode.
  - The p sensor is in burst mode or must be polled periodically by HART® master.
- The p sensor has been fully configured in FLOWSIC30.

Table 2 AGA8, ranges of applicability

Quantity	Gross calculation
Relative Density (Gr)	0.56 to 0.87
Gross Heating Value	477 to 1150 Btu/scf (16.8 - 40.5 MJ/m³)
Mol Percent Methane	45.0 to 100.0
Mol Percent Nitrogen	0.0 to 50.0
Mol Percent Carbon Dioxide	0.0 to 30.0
Mol Percent Ethane	0.0 to 10.0
Mol Percent Propane	0.0 to 4.0
Mol Percent Butanes	0.0 to 1.0
Mol Percent Pentanes	0.0 to 0.3
Mol Percent Hexanes Plus	0.0 to 0.2
Mol Percent Helium	0.0 to 0.2
Mol Percent Hydrogen	Assumed 0.0
Mol Percent Carbon Monoxide	Assumed 0.0
MolPercent Argon	Assumed 0.0
Mol Percent Oxygen	Assumed 0.0
Mol Percent Water	0.0 to 0.05
Mol Percent Hydrogen Sulfide	0.0 to 0.02
Flowing Pressure	1200 psia (8.3 MPa)
Flowing Temperature	32 to 130 Deg F (0 to 55 Deg C)

2.2.6 Energy flow rate (option)

Based on standardized volume flow rate and heating value, the energy flow rate is calculated as follows:

$$E_t = \frac{E}{t} = Q_{ref.} \cdot HV_{ref.} \qquad (2.6)$$

The energy flow rate can be visualized on the device display and in the FLOWgate™ operating software.

Prerequisites for energy flow rate

- Fully configured volume conversion (option), → p. 16, §2.2.5
- Heating value set by user via HART® or RS485 (option)
- Heating value and volume conversion need to refer to the same reference conditions

2.3 System overview

The FLOWSIC30 is designed for use in natural gas production applications for gases such as coal bed methane. The dual-path meter comes with a robust carbon steel meter body and full-titanium transducers.

The ultrasonic measurement technology has no moving parts and is virtually maintenance free. The rugged design with integrated wires protects the gas meter from harsh ambient conditions while the large turn-down ratio covers all well flow rates. FLOWSIC30 is equipped with integrated diagnostics that monitor the meter status and indicate the presence of liquids in the gas stream.

With integrated temperature and pressure measurement and optional volume conversion according to AGA 8, the gas meter calculates the volumetric flow s. c. and reduces installation efforts. Power consumption of only 65 mW and the two-wire loop powered concept make integration easy while HART® and Modbus communication provide versatility in data transfer.

FLOWSIC30 is available as wet-gas robust or wet-gas tolerant design.

Wet-gas robust design

The wet-gas robust design was designed specifically for wet gas applications in natural gas production with installation upstream of separators. The device is also suitable for continuous wet gas operation with a high liquid loading.

Wet-gas tolerant design

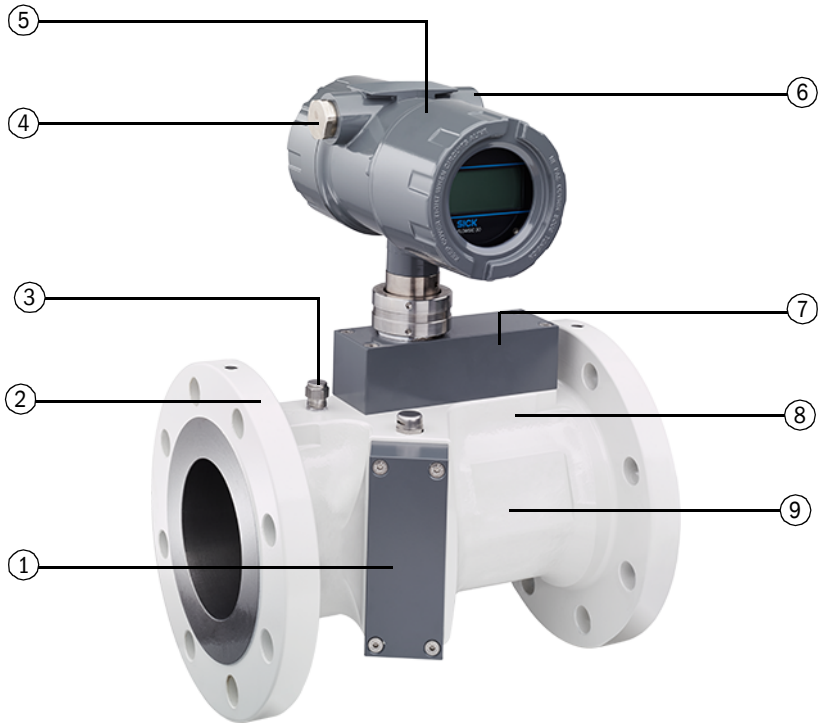
The wet-gas tolerant device design was designed for installation behind separators. The device can measure in continuous wet gas operation with low liquid loading. Temporary high liquid loads can lead to limited measuring availability. As the liquid load decreases, the gas meter recovers completely, e.g. in case of temporarily reduced separator performance. The lower wet gas robustness enables improved measurement accuracy.

System components

The FLOWSIC30 measuring system comprises the following hardware components:

- Meter body
- Ultrasonic transducers
- Temperature sensor (option)
- Internal pressure sensor (optional)
- Signal processing unit (SPU)

Fig. 4 System components



1 Transducer cover with internal wiring
2 Flange, full ANSI #150
3 Pressure tap
4 Two-wire loop power
5 SPU (Signal Processing Unit)
6 HART® and Modbus interface
7 Integrated temperature and pressure sensor (both optional)
8 Marking for direction of flow (forward)
9 Meter body

2.4 Interfaces

As a standard, FLOWSIC30 comes with loop-powered 4..20 mA output. The current loop supports digital HART® communication for setup and diagnosis of the gas meter. The interface can be used also to transmit additional measurement data. Optionally, FLOWSIC30 can be ordered with an additional Modbus RS485 interface.

2.4.1 Analog output 4..20mA (passive)

The following measurement values can be assigned. The same value is used as primary variable of the HART® interface.

1 Volumetric flow, a. c. (default)
2 Volumetric flow s. c.
3 Pressure
4 Temperature
5 Velocity of sound
6 Velocity of gas
7 Methane content

2.4.2 HART® compatible interface

Impedance value of the HART® interface

R_x = 160 kΩ

C_x = 10 nF

Conformities

The FLOWSIC30 complies with the following specifications:

- HCF_SPEC-127, revision 5.0
- HCF_SPEC-301, revision 6.0
- HCF_SPEC-151, revision 8.0
- HCF_SPEC-99, revision 8.0
- HCF_SPEC-183, revision 13.0
- HCF_SPEC-81, revision 8.0

The device type code of the FLOWSIC30 gas meter is 0xC782 (FieldComm/HART® Foundation registration pending) .

Point to point wiring

The device supports point-to-point connections. A host and/or a field communicator can be integrated into the bus as communication master(s). Communication may run through Ex isolators according to the HART® specification. Any polling address in the HART® address range can be used to address the device. The polling address must be configured by the software using the command #6 (default: 0).

Network (Multidrop)

The device can also be integrated into a network. Polling addresses must not be used more than once in the network. If the device is integrated into a network, its polling address must be greater than zero. In this mode the signal of the analog loop does not represent a quantity measured by the device. A host and/or a field communicator can be integrated into the bus as communication master(s). The number of devices in the network is limited by the number of possible device addresses.

Values for PV, SV, TV, QV

The following values can be assigned. PV is used for the analog output.

1 Volumetric flow, a. c. (default PV)
2 Volumetric flow s. c. (default SV)
3 Pressure
4 Temperature
5 Velocity of sound (Default QV)
6 Velocity of gas (Default TV)
7 Methane content

For detailed information, please refer to the document “Short manual HART® compatible interface FLOWSIC30”.

2.4.3 RS485 interface (passive, option)

The optional RS485 interface supports the following protocols:

- Modbus ASCII
- Modbus RTU

The RS485 serial interface allows full access to measurement values and diagnostic data via serial communication. Access can also be realized from remote.

The RS485 serial interface must be externally powered. For electrical connection please refer to → p. 36, § 3.4.2 and → p. 39, § 3.4.5.

For details about Modbus communication, refer to “Short manual Modbus FLOWSIC30”.

2.5 Wet gas detection

The FLOWSIC30 firmware has a diagnostic feature for detection of wet gas inside the meter (wet gas detection, patent pending).

The wet gas detection uses real-time monitoring of multiple diagnostic parameters of the FLOWSIC30 in order to identify wet gas conditions (liquids in the gas stream such as liquid hydrocarbons, water and oil). Liquids in the gas stream are usually undesired in the gas production process and may require appropriate actions such as process optimization or consideration for meter readings.

The wet gas detection typically detects wet gas with more than 0.5 % LVF (Liquid Volume Fraction).

Since the wet gas detection uses common standard diagnostic meter parameters, the wet gas warning may be activated in parallel to other user warnings. In this case, a thorough analysis of the operating and process conditions may be beneficial to find the root cause. Contact SICK Customer Service should you require technical support.

2.6 Data processing in FLOWSIC30

2.6.1 Event logbook

The FLOWSIC30 stores events and parameter changes in the event logbook. All events are saved with time stamp, user logged on and totalizer reading. The event logbook can be accessed via HART® or the FLOWgate™ operating software. A list of the last 30 events is displayed via HART®. All events can be accessed via the FLOWgate™ operating software.

2.6.2 Diagnostic archive

Diagnostic data are saved in cyclic intervals in the diagnostic archive.

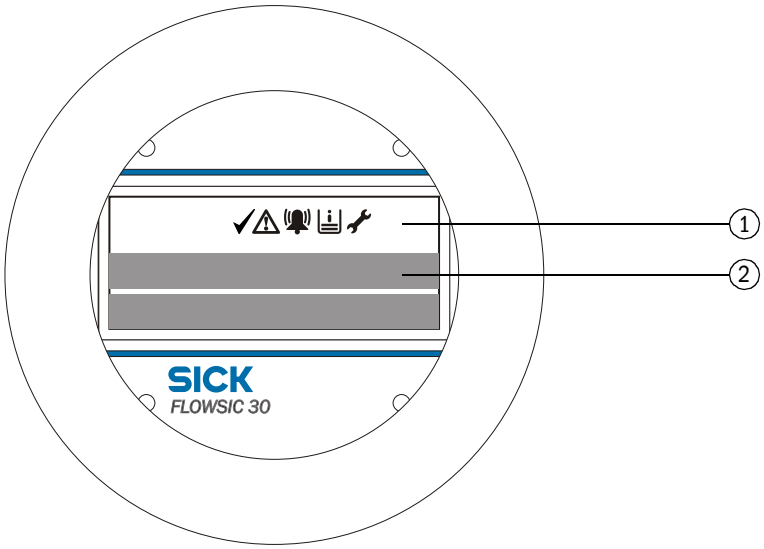
Dataset number, timestamp, various global measured values, status information and path information are saved. The archive has a capacity of more than 40,000 entries and is circulating by default. The archive serves primarily for analysis of historical measured data.

2.7 Display and operating elements

The measured values shown on the LC display of the SPU can be defined using the FLOWgate™ operating software or via HART® access. Up to ten measured values can be defined which are shown on the display alternating. They embrace the most often industrially used parameters.

If an event occurred the event is displayed alternating with the measured values. When in configuration mode, the display will also show the message: “I-1013 config mode”

Fig. 5 LCD FLOWSIC30



1 Symbol bar
2 Measured values

Table 3 Symbols in the symbol bar

Symbol	Significance	Description
✓	Device status: Meter ok	The FLOWSIC30 is working normally.
⚠	Device status: Warning	The device has a warning, the measured value is still valid.
	Device status: Malfunction	The device has an error, the measured value is invalid.
	Registered events	Events have occurred since the last event summary reset.
	Configuration mode	Device parameters can be changed.

NOTICE:
In device status “Malfunction” or “Warning”, the respective symbols are shown blinking on the display.

2.8 FLOWgate™ operating software

The FLOWgate™ operating software provides a user friendly access to diagnostic, configuration and measurement data of the gas meter via the service interface..

2.8.1 System requirements

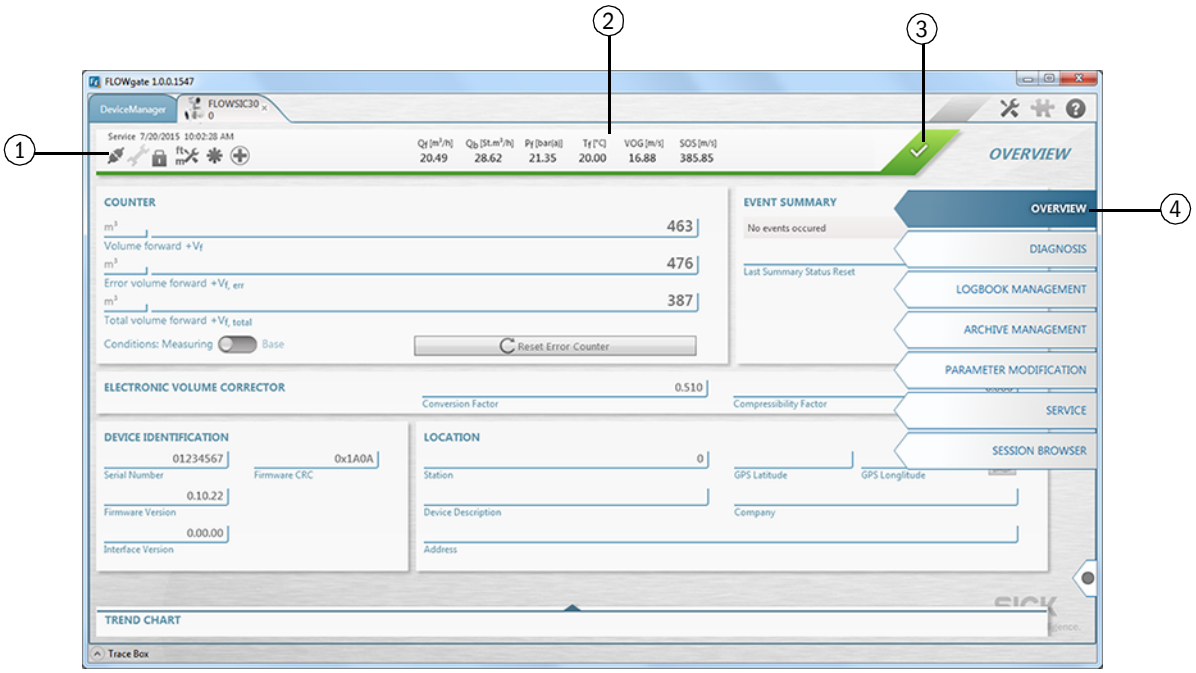
- Microsoft Windows 7/8/10
- Min. 1.8 GHz CPU
- Min. 1 GB RAM
- About 500 MB free disk capacity (without .NET framework)
- USB or serial interface
- Recommended minimum screen resolution: 1024 x 768 pixel, optimal screen resolution: 1368 x 768 pixel
- Microsoft .NET framework 4.6

2.8.2 Overview

The FLOWgate™ operating software is easy to use because of its activity-oriented menu navigation and supports all typical user activities. The Overview Page shows the most important measuring values for the gas meter and the electronic volume conversion and provides convenient access to:

- Diagnosis
- Logbook Management
- Archive Management
- Commissioning
- Parameter Modification

Fig. 6 FLOWgate Overview Page



1 Status information and quick access
2 Meter readings
3 Meter status
4 Menu navigation

For detailed information on the FLOWgate™ operating software, please refer to “FLOWgate Software Manual” on the product CD.

FLOWSIC30

3 Installation

Hazards during installation
General information
Mechanical installation
Electrical installation

3.1 Hazards during installation

WARNING: Hazards during installation work

- ► Do not carry out any welding work on lines with meters fitted.
- ► Comply exactly with mandatory and approved methods.
- ► Observe and comply with regulations of the plant operator.
- ► Meticulously check completed work. Ensure leak tightness and strength.

Otherwise hazards are possible and safe operation is not ensured.

CAUTION: General risks during installation

- ► Observe applicable valid regulations, general standards and guidelines.
- ► Observe local safety regulations, operating instructions and special regulations.
- ► Observe the safety information in → p. 8, § 1.2.
- ► Comply with the safety requirements of ASME B31.3 when installing pressure devices including connection of various pressure devices.
- ► Persons carrying out installation work must be familiar with the directives and standards applicable for pipeline construction and have the corresponding qualifications, e.g. in accordance with DIN EN 1591-4.

3.2 General information

3.2.1 Delivery

The FLOWSIC30 is delivered preassembled in sturdy packaging.

- ► Inspect for damage when unpacking the device.
- ► Document any damage found and report this to the manufacturer.
  Do not put the FLOWSIC30 into operation if you notice any damage!
- ► Check the scope of delivery for completeness.

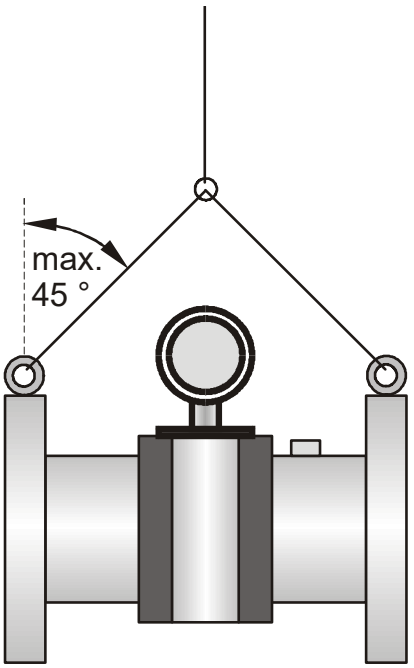
The standard scope of delivery comprises:

- FLOWSIC30 (meter body and SPU)
- Optional sun shade
- Optional p-sensor
- Documentation package

3.2.2 Transport and storage

- ► During all and storage work, ensure:
  - the FLOWSIC30 is always well secured,
  - measures to prevent mechanical damage have been taken,
  - ambient conditions are within specified limits.

Fig. 7 Lifting requirements



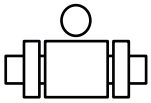
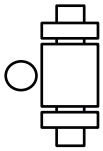
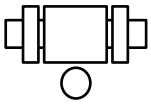
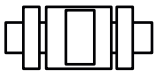
3.3 Mechanical installation

3.3.1 Preparations

The following tools and materials are required to install the FLOWSIC30:

- Hoisting equipment (lifting capacity according to the weight specifications on the type plate),
- Box wrench with size suitable for flange installation,
- Torque wrench,
- Flange gaskets,
- Bolt lubricant,
- Leak detection spray.

3.3.2 Meter orientation

A	Horizontal, electronics up		 1)
B	Vertical		 2)
C	Horizontal, electronics down		
D	Horizontal, electronics at side		

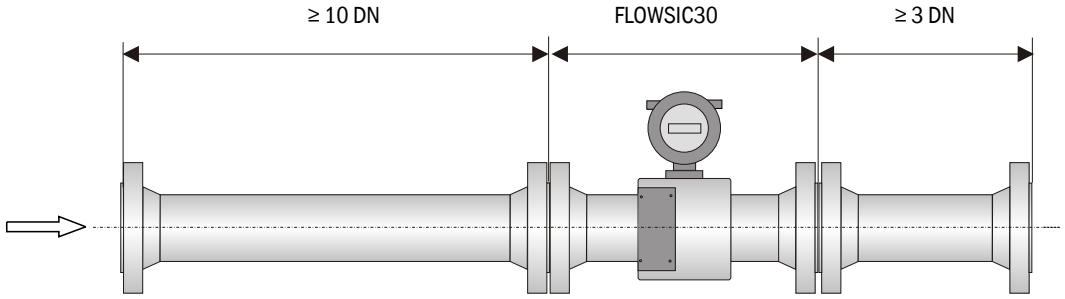
1) Horizontal position of ultrasonic sensors must not deviate by more than ±3°

2) Only for dry gas

3.3.3 Inlet and outlet piping

FLOWSIC30 should be installed upstream of piping equipment such as valves, pumps, tees or elbows if possible.

Fig. 8 Installation instructions



In order to achieve the specified meter accuracy, ensure 10D of straight inlet and 3D of straight outlet pipe length as a minimum.

For upstream equipment that causes swirl in the gas flow, the use of a flow conditioner is recommended. A flow conditioner should be installed at least 8D upstream of FLOWSIC30.

NOTICE:

In order to achieve best diagnostic capabilities and measurement performance, it is beneficial to set meter orientation and upstream piping installation details in the meter during the commissioning process (refer to → p. 45, § 4).

3.3.4 Choosing flanges, gaskets and other components

For flange connections only use pipeline flanges, bolts, nuts and gaskets suitable for the maximum operating pressure, maximum operating temperature as well as ambient and operating conditions (external and internal corrosion).

3.3.5 Fitting the FLOWSIC30 in the pipeline

***NOTICE:* Observe the gas flow direction**

The prescribed flow direction is marked on the FLOWSIC30 with an arrow.

Arrow direction and gas flow direction must match.

► Install the FLOWSIC30 in flow direction.
The device signals a malfunction when the FLOWSIC30 is installed against the prescribed flow direction.

1 Position the FLOWSIC30 at the desired location of the pipeline using the lifting gear. Only use the lifting eyes provided to lift and transport the device. If lifting straps are used, wrap them around the meter body.

   Lay the pipelines without tension to the device to be installed!

2 Check for correct seating and alignment of the flange gasket after installing the fastening bolts, but prior to tightening.

3 Align the FLOWSIC30 such that the offsets between inlet pipe, meter body and outlet pipe are minimized.

4 Insert the fastening bolts and tighten the nuts cross-wise. The tightening torque applied must not be lower than specified in the project planning.

5 Fill the pipeline and check the installed FLOWSIC30 and piping connections for leaks.

WARNING: Hazard through material fatigue

The FLOWSIC30 has been designed for use under mainly static loads.

► The pressure change within the measuring section must not exceed 5 bar/min (72.5 psi/min) in order to protect transducers and seals.

The number of complete pressure application and release processes should be kept low during operation.

► Replace the device when 500 cycles have been reached.

6 Carry out a leak tightness check on the pipeline (in accordance with the pipeline manufacturer's specifications).

3.3.6 SPU alignment

The signal processing unit (SPU) can be turned so that the display can be easily read and that cable routing is facilitated (see → Fig. 9).

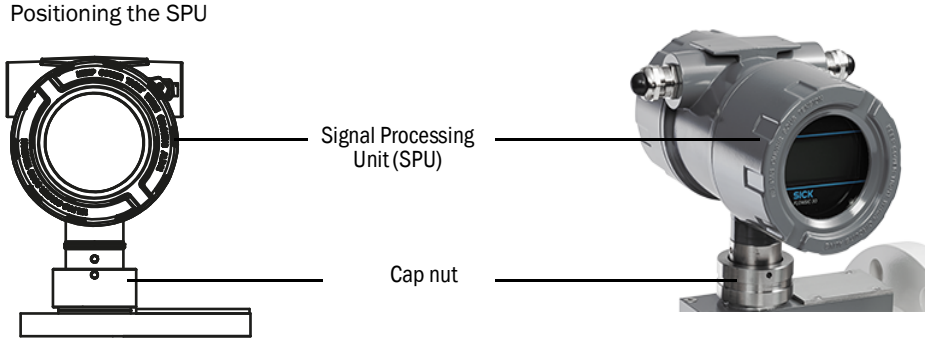
1 Loosen the allen screw at the cap nut with an allen key.

2 Loosen the cap nut with a hexagon wrench.

3 Rotate the SPU 270 ° maximum.

4 Tighten the cap nut and allen screw to prevent unintended loosening of the electronics.

Fig. 9 Positioning the SPU

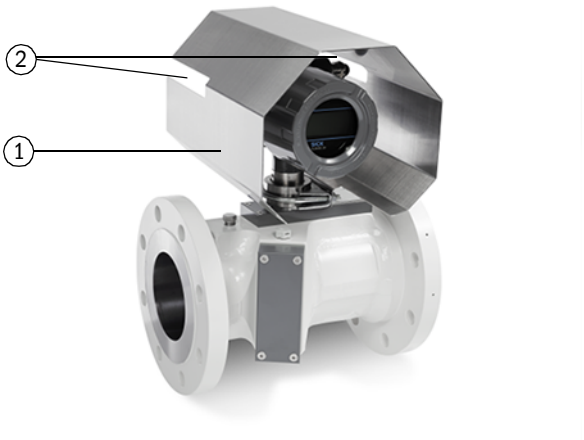


3.3.7 Sun shade for electronics (accessory)

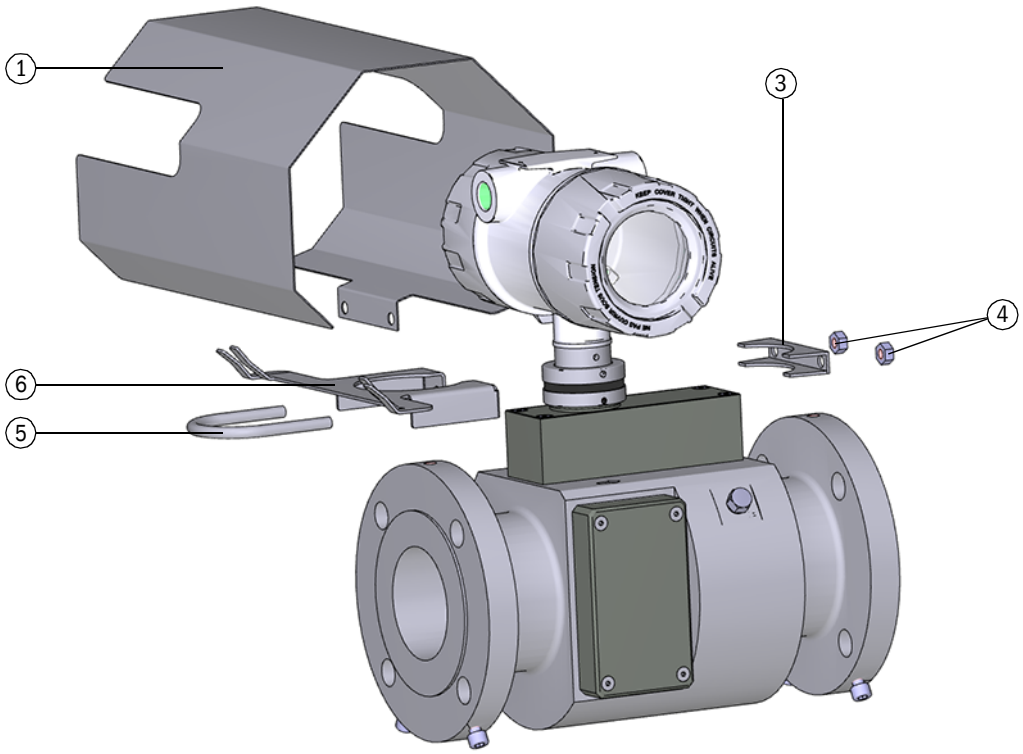
Sun shade

- ► The sun shade should be mounted after complete mechanical and electrical installation of the meter.
- ► The sun shade is made of stainless steel and fitted to the meter using the provided mounting accessories.
- ► Remove the sun shade before any work on the meter electronics.

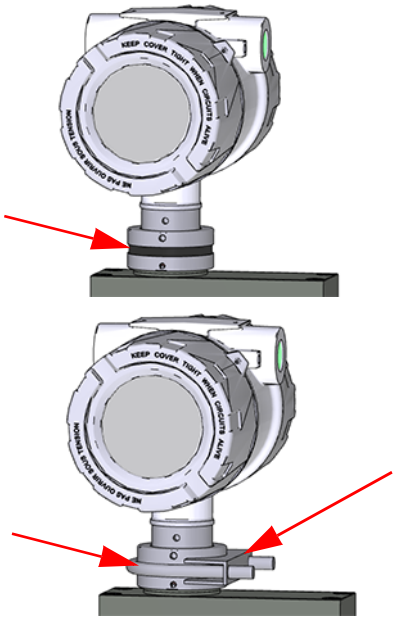
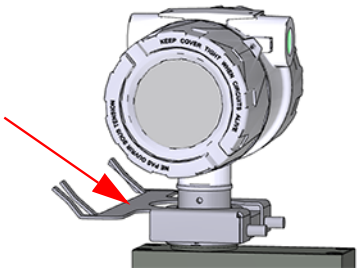
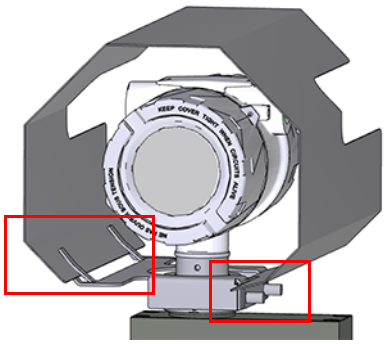
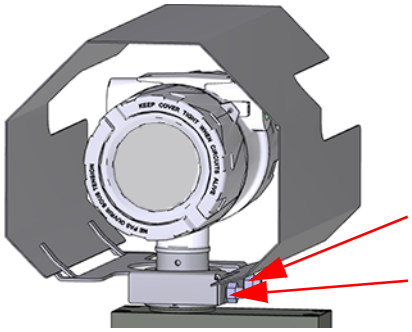
Fig. 10 Overview



1 Sun shade
2 Notches for cables
3 Supporting plate
4 Hex nuts
5 Pipe clamp
6 Connection bracket



Mounting the sun shade

1 Attach the pipe clamp to the electronics neck with the supporting plate. Make sure the pipe clamp sits properly in the groove of the cap nut.	
2 Position the connection bracket on the pipe clamp.	
3 Slide the sun shade into the connection bracket and attach it to the pipe clamp.	
4 Secure the sun shade with the hex nuts.	

3.4 Electrical installation

3.4.1 General information

Prerequisites

Wiring work (routing and connecting the power supply and signal cables), which is necessary when installing the FLOWSIC30, is not included in the scope of delivery. The mechanical installation described in Section →3.3 must be completed first. Comply with the minimum cable specification requirements set out in Section →3.4.2.

Cable routing

- ► Keep cables in conduits or laid on cable trays to provide protection from mechanical damage.
- ► Observe the permitted bending radiuses (generally, min. six times the cable diameter for multi-conductor cables).
- ► Keep all connections outside of conduits as short as possible.

WARNING: DANGER

- ► Always observe the general safety regulations and safety instructions given in Section 1 when carrying out any installation work.
- ► Installation work shall only be carried out by trained staff and in accordance with the relevant regulations issued by the operating company.
- ► Take all necessary precautions to avoid local or plant-specific dangers.

Examples for electrical installation

A	Remote Terminal Unit (RTU) / Programmable Logic Controller (PLC)
B	Safety barrier
C	Resistor for HART® Communication (≥ 250 Ω) if not contained in B
D	Connection for HART® Communication devices (e.g. Field Communicator)
E	Ex ia analog display unit

The optional internal pressure and temperature sensors do not require extra device external cabling. Extra cabling is only required, if the optional RS485 or an external pressure or temperature sensor (not included in scope of delivery) is used.

Fig. 11 Intrinsically safe installation, HART® Output

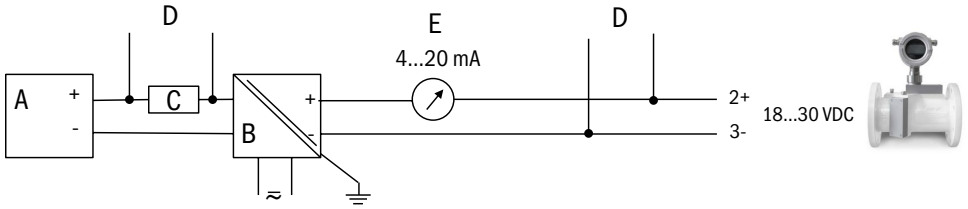


Fig. 12 Intrinsically safe installation, HART® + Modbus RS485 output

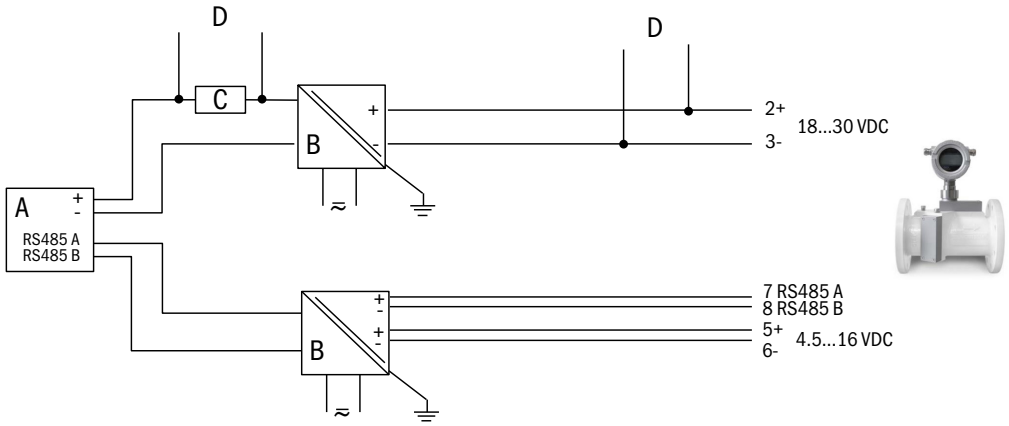


Fig. 13 Intrinsically safe installation, HART® + Modbus RS485 output + external pressure sensor

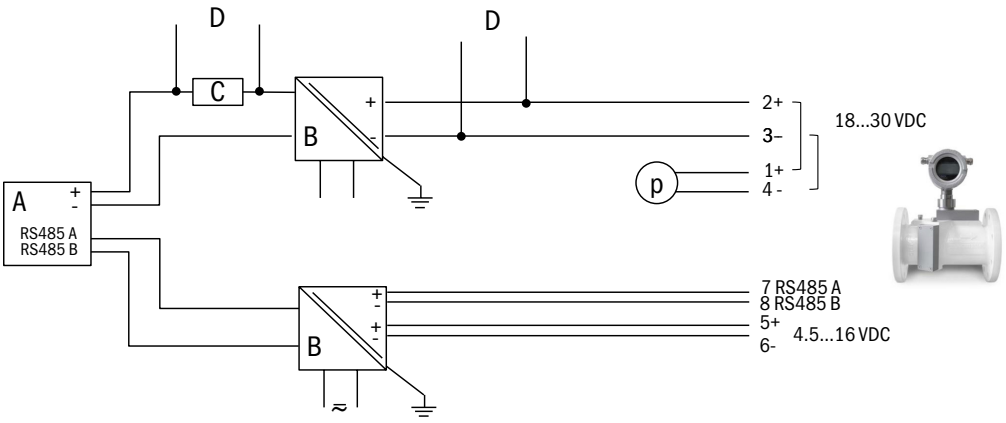


Fig. 14 Non-intrinsically safe installation, HART® output

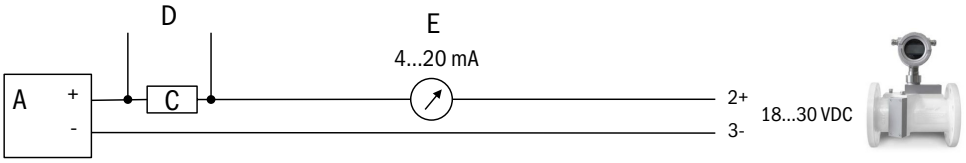


Fig. 15 Non-intrinsically safe installation, HART® output + external pressure sensor

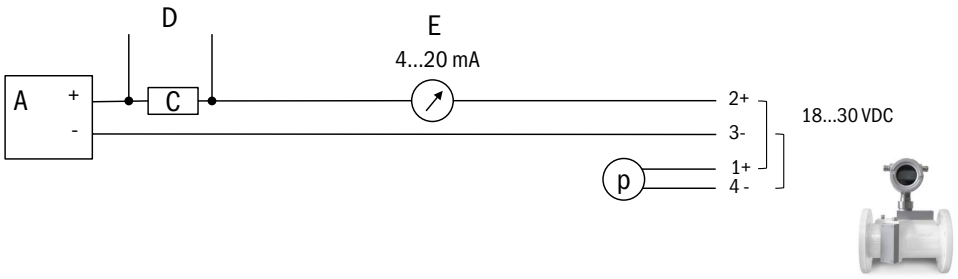
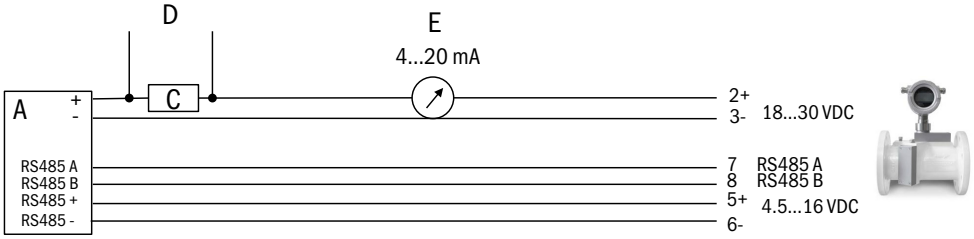


Fig. 16 Non-intrinsically safe installation, HART® + Modbus RS485 output



3.4.2 Cable specifications

WARNING:
The cables must fulfil the requirements for use in hazardous areas (e.g. set forth in EN /IEC 60079-14 or other relevant standards).

Current output, loop powered

	Specification	Notes
Type of cable	Twisted pair, shielded	Connect shielding at other end to ground terminal
Maximum cable length	Loop resistance	Depends on voltage and current in the loop; voltage must not fall below 18 V
Cable diameter	6 ... 12 mm (1/4 to 1/2 inch)	Fixing range of the cable glands

Optional Serial Interface (RS485), externally powered

	Specification	Notes
Type of cable	Twisted pair, shielded, impedance approx. 100...150Ω low cable capacitance: ≤ 100 pF/m	Connect shielding at other end to ground terminal
Min./ max. cross-sectional area	2 x 0.5/1 mm^2 (2 x 20-18 AWG)	
Maximum cable length	300 m at 0.5 mm^2 (1600 ft for 20 AWG) 500 m at 0.75 mm^2 (3300 ft for 20 AWG)	Do not connect unused conductor pairs and prevent them from accidental short-circuit
Cable diameter	6 ... 12 mm (1/4 to 1/2 inch)	Fixing range of the cable glands

WARNING: Explosion hazard
► Do not open the window cover when an explosive atmosphere is present.

NOTICE:
Incorrect cabling may cause failure of the FLOWSIC30. This will invalidate warranty claims. The manufacturer assumes no liability for consequential damage.

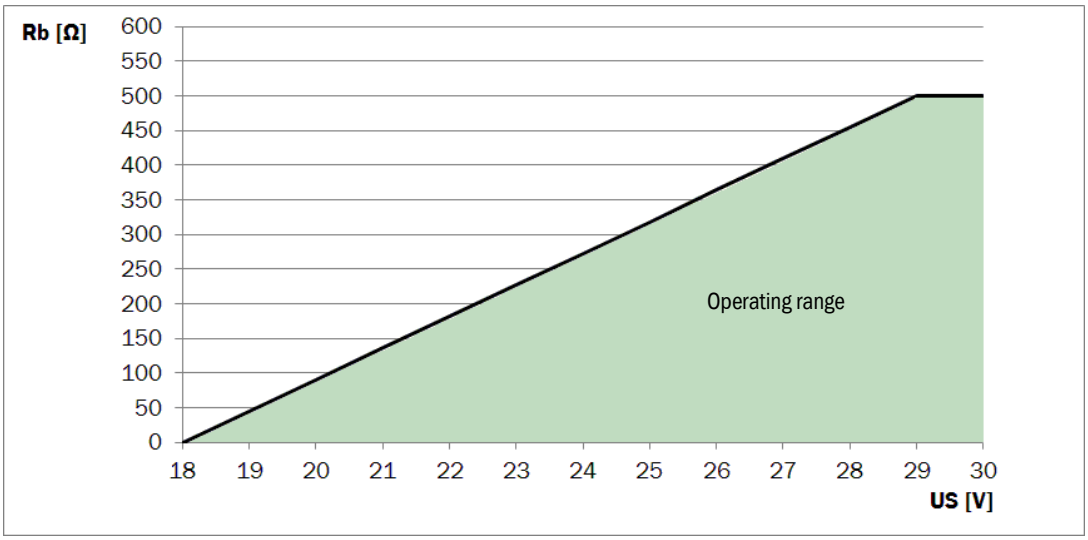
3.4.3 Maximum resistance for analog loop

Maximum resistance: 0 ... 500 Ω (depending on power supply voltage)

In order to ensure sufficient voltage at FLOWSIC30, the maximum loop resistance [Rb] in relation to the power supply voltage [US] must be considered. The operating range of the FLOWSIC30 is given in →Fig. 17.

Maximum resistance can be calculated: Rb ≤ (US – 18 V) / 0.022 A; max. 500 Ω

Fig. 17 Operating range of FLOWSIC30



3.4.4 Terminal compartment on the SPU

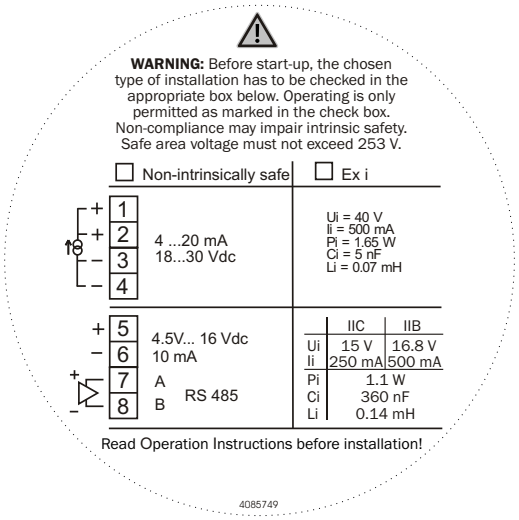
Opening the rear housing cover

- ► Loosen the securing clip using a 3 mm Allen key.
- ► Turn the rear housing cover counter-clockwise and take it off.

> ***NOTICE:* Lubricant**
> Only use LOCTITE 8156 as lubricant for front and rear housing cover.

Fig. 18 SPU housing

Fig. 19 Marking of terminal assignment inside the rear cover



> ***NOTICE:* Potential equalization**
> PE: Potential Equalization terminals must be connected to earth ground.
> IEC 60079-14 must be considered.

3.4.5 Operating the FLOWSIC30

Assign the terminals in the SPU terminal box (→ Fig. 19) in accordance with the following table.

No.	Connection for	Function	Terminal	Value	Notes
1	Current loop, 4 ... 20 mA		1 ... 4	18 ... 30 V DC	
2	Serial port	MODBUS (RS485)	7, 8	38.4 kBaud, 8 data bits, no parity, 1 stop bit	Baud rate to be set through software
3	Serial port	Auxiliary power supply	5, 6	4.5 ... 16 V DC	

3.4.6 Requirements for use in hazardous areas with potentially explosive atmospheres

Intended use

The FLOWSIC30 is suitable for use in hazardous areas classified as Zone 1 and Zone 2.

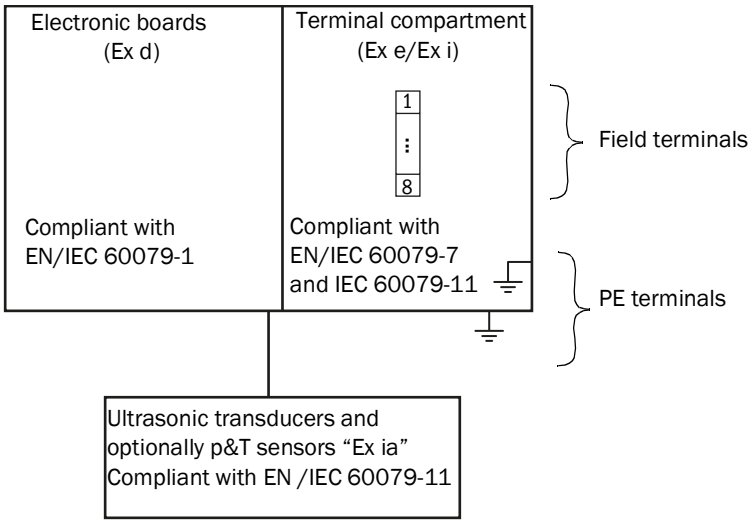
Certification in accordance with ATEX

II 2G Ex db eb ia [ia] IIA T4 Gb
Permitted ambient temperature range:
-25 °C to +60 °C
EC TYPE Examination Certificate: FTZU 15 ATEX 0150X

IECEx Certification

Ex db eb ia [ia] IIA T4 Gb
Permitted ambient temperature range:
-25 °C to +60 °C
IECEx Certificate of Conformity: IECEx FTZU 15.0032X

Fig. 20 FLOWSIC30 components and their type of protection



Operating conditions for the ultrasonic transducers

The FLOWSIC30 is designed for use in hazardous areas with potentially explosive atmospheres only under normal atmospheric conditions. The atmospheric conditions must be within the following ranges:

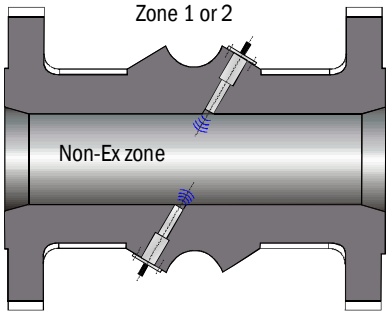
- Ambient pressure range 80 kPa (0.8 bar) to 110 kPa (1.1 bar)
- Air with normal oxygen content, typically 21% v/v

The ambient temperature must be within the range specified at the SPU type plate.

Once the FLOWSIC30 is installed in the pipeline, the meter body becomes a part of the pipeline. The wall of the pipeline and the meter body is then deemed a zone-separating barrier. The figure below helps in understanding the different situations for a possible application and shows what operating conditions apply.

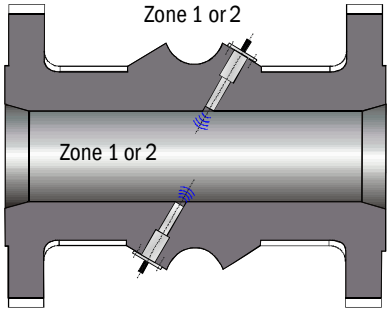
Fig. 21 Ex-Zones

Case 1:



- The pipeline contains a non-explosive mixture. The gas mixture may be combustible.
- Gas pressure and gas temperature may be within the range specified by the tag on the meter body.

Case 2:



- The area inside the pipeline is classified as hazardous area Zone 1 or 2.
- Gas pressure must be in the range from 80 kPa to 110 kPa (normal atmospheric condition)
- Gas temperature must be within the permitted ambient temperature range specified by the type plate on the SPU

NOTICE:

The rise in the ambient temperature outside the pipeline due to a hot pipeline must be taken into account.

The user must ensure that the ambient temperature around the electronics housing does not exceed the maximum permitted ambient temperature marked on the type plate of the FLOWSIC30

General requirements for installation

- The documentation for hazardous area classification (zone classification) according to EN/IEC 60079-10 must be available.
- The equipment must be verified as suitable for use in the classified area.
- After installation an initial test run of the complete equipment and the plant according to EN/IEC 60079-17 must be performed before regular operation is started.

Requirements regarding cabling

- Cables must fulfill the requirements set forth in EN/IEC 60079-14.
- Cables that are subject to exceptional thermal, mechanical or chemical stress must be specially protected, e.g. by laying them in protective tubing.
- Cables that are not installed fire proof must be flame retardant according to IEC 60332-1.
- Observe the clamping range of the cable glands for cable selection.
- Replace the existing cable glands with suitable cable glands if installation with armored cables is intended.
- When delivered, the cable glands are secured by default with a sealing plug. If the cable glands are not used, only sealing plugs with Ex e approval must be used.
- Conduit systems must comply with EN/IEC 60079-14, section 9.4 and 10.5. In addition, compliance with national and other relevant regulations is required
- “Conduits” according to IEC 60614-2-1 and IEC 60614-2-5 are not suitable.
- Conduits must be protected against vibration.
- Use a suitable thread sealant, as detailed in EN/IEC 60079-14.
- Protect stranded wires against fraying with ferrules.
- Keep clearance and creepage distances for the connected wires in accordance with EN/IEC 60079-7 in case of non-intrinsically safe wiring, respectively in accordance with IEC 60079-11 in case of intrinsically safe wiring.
- Connect unused wires to ground or safeguard so that a short circuit with other conductive parts is excluded.
- Carry out potential equalization in accordance with EN/IEC 60079-14
- The meter body and the electronic housing must be connected to the potential equalization.
- Where the FLOWSIC30 is installed in a grounded metal duct, no additional grounding is required for the meter body. The electronics housing must nevertheless be separately grounded.

Connection of the FLOWSIC30 with associated equipment

The terminal compartment of the FLOWSIC30 complies with the requirements of EN/IEC 60079-7 and IEC 60079-11.

The FLOWSIC30 provides non-intrinsically safe wiring as well as intrinsically safe wiring with the interconnected associated equipment in the following manner:

1 Power supply connection and all other field connections as non-intrinsically safe wiring

2 Power supply connection and all other field connections as intrinsically safe wiring to Exi certified equipment in a Zone 1 or Zone 2 classified hazardous area or to [Exi] certified associated equipment in the safe area.

A combination of intrinsically safe and non-intrinsically safe wiring is not permitted.

Before start-up the chosen type of installation has to be checked in the appropriate boxes on the type label.

All the time, operating is only permitted as marked on the type plate. Non-compliance may impair intrinsic safety. Safe area voltage must not exceed the max. voltage as indicated on the terminal assignment label in the rear cover of the SPU (→ Fig. 19).

The use of SELV-/PELV power supply units or safety power converters acc. IEC 61558-2-6, IEC 60950 or IEC 61010-1 is mandatory, if the maximum safe area voltage U_m < 253 V.

For intrinsically safe wiring:

- The safety-relevant data in the EC Type Examination Certificate and the IECEx Certificate of Conformity must be observed.
- Intrinsic safety for each circuit must be assessed in accordance with EN/IEC 60079-14 section 16.
- The safety-relevant parameters of interconnected equipment must comply with the following values: $U_o \leq U_i$, $I_o \leq I_i$, $P_o \leq P_i$, $C_i + C_{cable} \leq C_o$, $L_i + L_{cable} \leq L_o$

The interconnection of two or more intrinsically safe outputs may require an additional assessment of intrinsic safety in accordance with EN /IEC 60079-11.

For intrinsically safe wiring, the rear cover can be removed and connecting and disconnecting is permitted while the circuits are live and as long as the safe separation between the circuits has been kept.

WARNING: Explosion hazard

- Do not open the enclosure while energized.
- The window cover must not be opened while an explosive atmosphere is present.
- Do not open the cover of the terminal compartment while energized unless wiring is intrinsically safe.
- Do not connect or disconnect while circuits are live unless the area is known to be non-hazardous or wiring is intrinsically safe.
- Do not use the equipment if damaged (includes cables or terminals).

The connections of the ultrasonic transducers are intrinsically safe and are safely separated from one another and from other non-intrinsically safe circuits. The transducers may be connected and disconnected during operation as long as the safe separation of circuits has been preserved in every respect. In order to ensure this, the respective transducer connection cable should be disconnected at both ends (disconnect the electronics side first, and then if necessary, the transducer side unless the MCX connector is suitably fixed to prevent any uncontrolled movement). Operation using sensors or cables not part of the original delivery or with sensors/components from other manufacturers is not permitted.

Notes for safe operation in hazardous areas

WARNING:
Always observe the temperature specifications for use in hazardous areas.

- The ambient temperature range is between -25 °C and +60 °C.
- The type of protection for the field connections and power supply connection is determined by the external circuits that are connected (for options see “Connection options” above).
- If terminals are assigned with intrinsically safe circuits, it is recommended that the metal cable glands are replaced with the light-blue plastic ones.
- Safety-relevant data for intrinsically safe circuits is provided in the table below, respectively in the EC Type Examination Certificate and the IEC Certificate of Conformity.
- If the meter body is thermally insulated, the insulation thickness must not exceed 50 mm. The SPU housing must not be insulated.
- The standard paint of the FLOWSIC30 meter body consists of a double layer: Epoxy and Acrylic RAL9002. This combination is the ideal protection of the meter body against corrosion. The layer thickness is less than 0.2 mm.

WARNING: Ignition hazard through electrostatic discharges
Ignition hazards through electrostatic discharges exist when gas meters with special paint and a layer thickness >0.2 mm are used in applications with ignition group IIC in accordance with ATEX and IECEx.

- ► For installation, the risk of electrostatic charging of the surface must be reduced to a minimum.
- ► Use appropriate caution when performing maintenance and cleaning work. For example, the surfaces should only be cleaned with a damp cloth.
- ► A warning sign fitted at the factory identifies this type of device:

Safety-relevant data of inputs and outputs for ATEX/IECEx certified FLOWSIC30 only

Power circuit	Intrinsically safe Ex ia IIA/IIC	Non-intrinsically safe
Power supply Terminals 1 ... 4	U_i = 40 V, I_i = 500mA, C_i = 5nF, L_i = 70 µH	18...30 V DC, max. 24 mA
RS485 Terminals 5 ... 8	U_i = IIC: 15 V; IIA/IIB:16.8 V I_i = IIC: 250 mA; IIA/IIB: 500 mA P_i = 1.1 W C_i = 360 nF L_i = 0.14 mH	Auxiliary power supply (7,8) 4.5 V...16 V DC, max. 10 mA

WARNING:

Before start-up the chosen type of installation has to be checked in the appropriate boxes on the type label. At all times, operation is only permitted as marked on the type plate. Non-compliance may impair intrinsic safety.

Safe area voltage must not exceed the max. voltage as indicated on the terminal assignment label in the rear cover of the SPU (→ Fig. 19).

Fig. 22 Example: Non-intrinsically safe installation marked on type plate and terminal assignment label

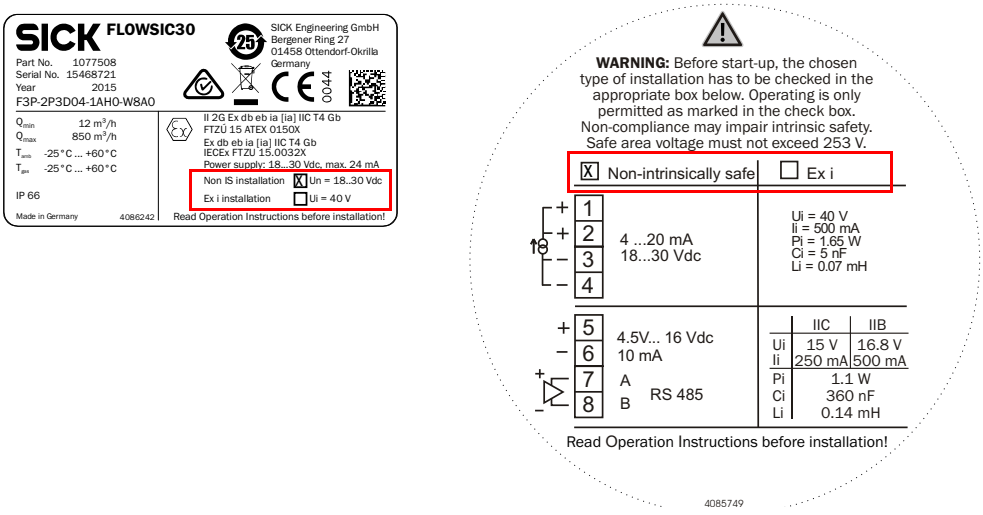
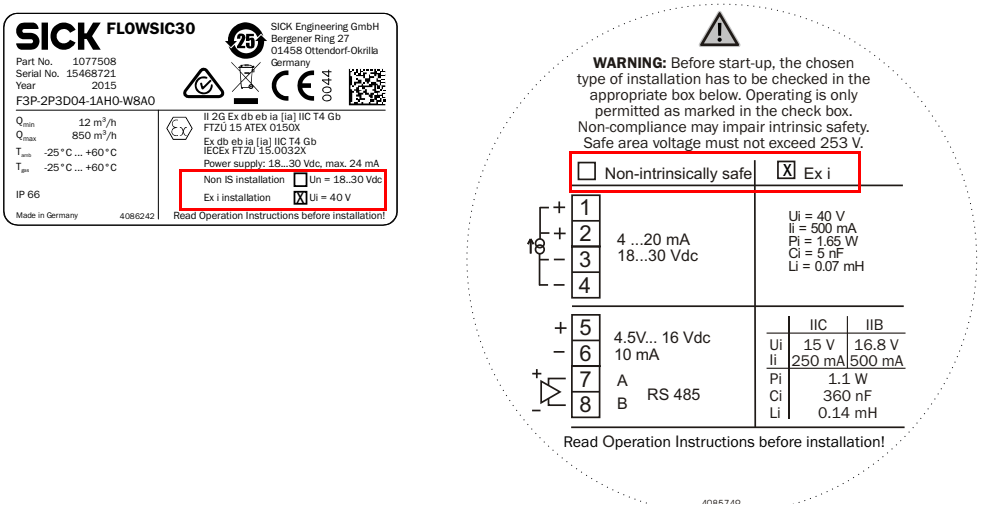


Fig. 23 Example: Intrinsically safe installation marked on type plate and terminal assignment label



FLOWSIC30

4 Commissioning and operation

General information
Commissioning via HART®
Commissioning with the FLOWgate™ operating software

4.1 General information

Communication to the FLOWSIC30 can be established via the following options:

- ► HART® communication via the current loop and with Field Communicator
- ► Service interface, located in the front of the SPU. This requires opening of the front cover. Please contact your local SICK service representative.
- ► RS485 communication (option)

Fig. 24 FLOWSIC30 communication

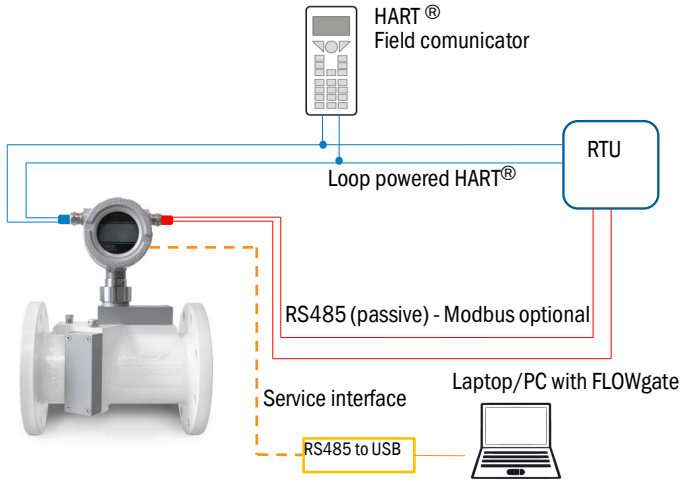


Table 4 Operation concept

	Display	HART® device	Modbus interface	Service interface
Commissioning		●		●
Meter readings	o	●	●	●
Active warnings/errors	●	●	●	●
Diagnostic data		o	o	●
Detailed meter status		●	●	●
Logbooks		o	o	●
Service activities				●

● Full access

o Limited access

4.2 Commissioning via HART®

4.2.1 Required tools and accessories

- Field Communicator with .dd file of the FLOWSIC30 (provided on the product CD)

4.2.2 Establish the connection to FLOWSIC30

In order to start the commissioning procedure via HART®, proceed as follows:

1 Connect the FLOWSIC30 to the HART® loop and power on the system.

> Due to pre-charge processes of internal energy storage capacitors, an initial delay of approximately 1 minute can be expected when powering up the FLOWSIC30. The device is running when the LC display starts operation.

2 Connect the 475 Field Communicator to the HART® loop according to the HART® operating specifications.

3 Start the HART® application module in the Field Communicator Main Menu to scan for active devices. Found devices will be listed subsequently.

4 Select the device identified by “0: @@@@@@@@”. This tag indicates the FLOWSIC30 default factory configuration.

5 In case of a confirmation warning, press CONT to proceed.
Proper communication with the meter is indicated by a flashing heart on the display of the Field Communicator above the display device main page.

The meter is now ready for commissioning.

4.2.3 Login procedure

In order to customize the meter configuration for commissioning purposes, you have to login to the Field Communicator.

> After initial power up and power losses, the device is always write protected. To unlock the device, you have to login first.

In the display device main page, proceed as follows to login:

1 “1 Device setup” > “3 Setup” > “1 Login” > Enter Default Password: 3333
The password can only be changed via modbus access.

2 Press ENTER.
The information “Login succeeded” indicates that the meter is now unlocked.

3 Press OK to continue.
The “Setup” menu now shows that the meter is unlocked: “3 Write protect No”

4.2.4 Meter installation

Depending on the meter orientation and the upstream piping, a distinct setup code has to be set. An overview of all options is provided in →Table 5.

For instance, for a gas meter being vertically installed in straight upstream piping, the set-up code is 5 (also refer to →Fig. 38 on p. 63).

The setup code is 3 for a gas meter with horizontal orientation and elbow from the top. The default setup code is 0.

Table 5 Setup code depening on meter orientation and upstream piping

Configuration of upstream piping	Meter orientation	
	Horizontal	Vertical
Straight (>20D)	0	5
Elbow right	1	6
Elbow left	2	7
Elbow from top	3	8
Elbow from bottom	4	9

In order to change the parameter for the meter installation, proceed as follows:

1 “1 Device setup” > “3 Setup” > “7 Volume Flow” > “3 Setup Code” > Enter Setup Code
2 Press ENTER
3 Press SEND to write the new setup code to the meter

4.2.5 Pressure value

In case that no pressure sensor is available, the device can be switched to a mode with fixed pressure value:

1 “1 Device setup” > “3 Setup” > “8 Pressure” > “1 Pressure Source” > Select “Fix Value”
2 Press ENTER
3 Press SEND to write to the meter
4 Select in the same menu “8 Pres Fix/Repl. Val.”
5 Insert the fixed pressure value to be used
6 Press ENTER
7 Press SEND to write to the meter

4.2.6 HART® dynamic variables

In order to change the HART® dynamic variables (PV, SV, TV, QV) to your needs, follow below steps:

1 “1 Device setup” > “3 Setup” > “4 HART/Loop current” > “Dyn. Var. Assign.”
2 Chose the corresponding variable (e.g. 1 PV) and select from the list
3 Press ENTER
4 Press SEND to write the value to the meter

4.2.7 Analog out

For a setup of the analog out, the primary value relations to 4 mA (LRV) and 20 mA (URV) have to be assigned for the defined Primary Variable (PV).

The default PV is the volumetric flow s. c.

To assign the value for 4 mA, proceed as follows:

1 “1 Device setup” > “3 Setup” > “4 HART/Loop current” > “6 PV LRV” > select “2 PV LRV”
2 Insert the assigned value for 4 mA (default is 0.000 Cum/h)
3 Press ENTER
4 Press SEND to write the value to the meter

To assign the value for 20 mA, proceed as follows:

1 “1 Device setup” > “3 Setup” > “4 HART/Loop current” > “6 PV URV” > select “1 PV URV”
2 Insert the assigned value for 20 mA (default is 1600.000 Cum/h)
3 Press ENTER
4 Press SEND to write the value to the meter

The analog damping of the defined PV may be changed as follows:

1 “1 Device setup” > “3 Setup” > “4 HART/Loop current” > “8 PV Analog damp”
2 Insert the damping value (default is 1 s)
3 Press ENTER
4 Press SEND to write the value to the meter

4.2.8 Electronic volume conversion

The volume conversion can be performed for a fixed compressibility, AGA 8 – Gross method 1 or AGA 8 – Gross method 2.

To set one of these options, proceed as follows:

1 “1 Device setup” > “3 Setup” > “Volume Correction” > “1 Algorithm”
2 Select the appropriate option
3 Press ENTER
4 Press SEND to write the value to the meter

To change the compressibility:

1 “1 Device setup” > “3 Setup” > “Volume Correction” > “3 Fix Compressibility”
2 Insert the appropriate value
3 Press ENTER
4 Press SEND to write the value to the meter

To get a correct conversion between actual and standard flow conditions a. c. and s. c., the reference of the EVC can be modified according to your preferences.

The following reference sets are available:

Table 6 Reference sets

	T1: Combustion Reference Temperature	T2: Gas-Metering Reference Temperature	P2: Gas-Metering Reference Pressure
Set 0	25 °C	0 °C	1.01325 bar
Set 1	20 °C	0 °C	1.01325 bar
Set 2	15 °C	15 °C	1.01325 bar
Set 3	60 °F	60 °F	101.592 kPa
Set 4	60 °F	60 °F	101.560 kPa
Set 5	25 °C	20 °C	1.01325 bar
Set 6	20 °C	20 °C	1.01325 bar

In order to select the appropriate reference set, proceed as follows:

1 “1 Device setup” > “3 Setup” > “Volume Correction” > “2 Ref. Conditions”
2 Chose the appropriate reference
3 Press ENTER
4 Press SEND to write the value to the meter

Fig. 25 HART® menu structure (1)

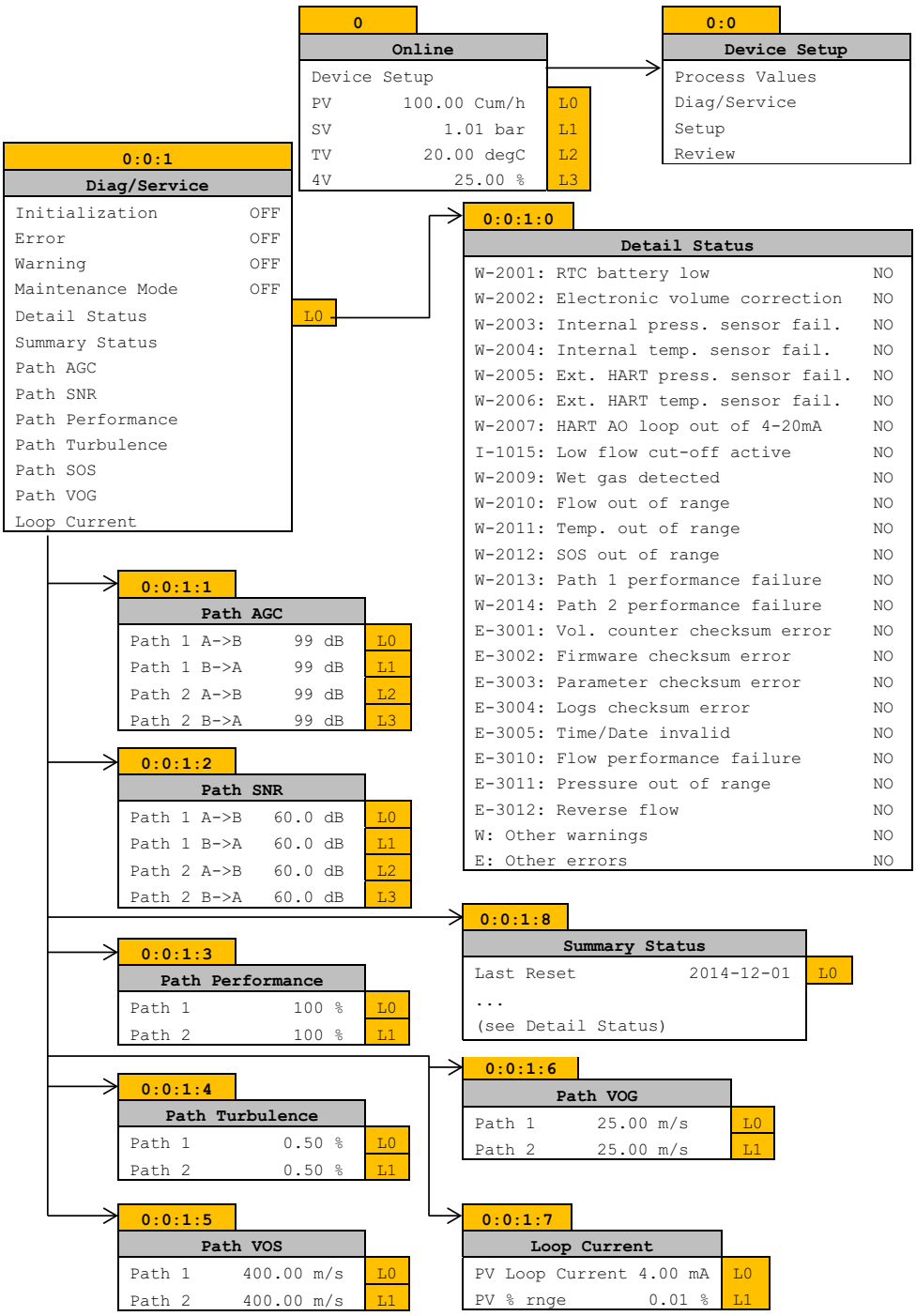


Fig. 26 HART® menu structure (2)

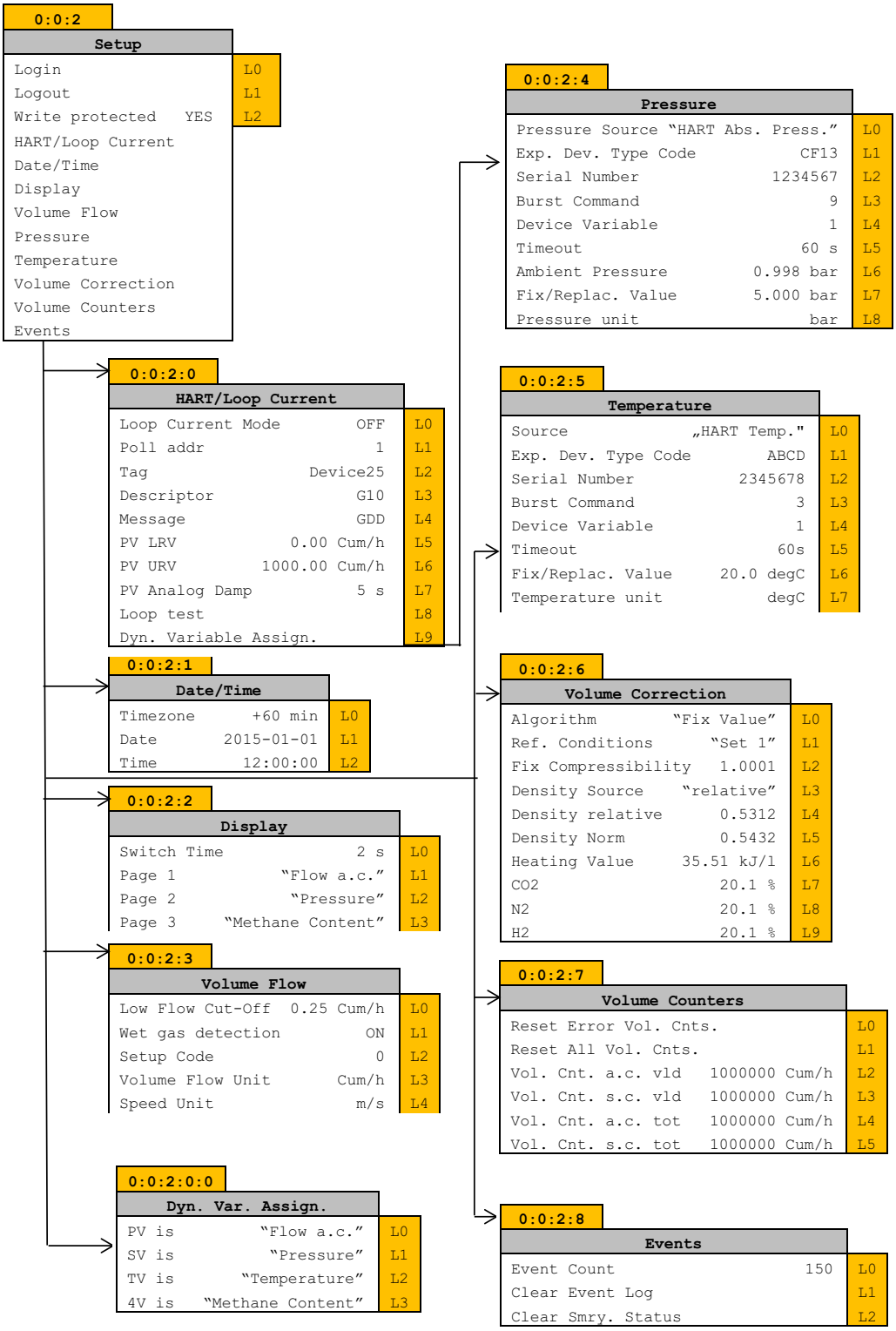
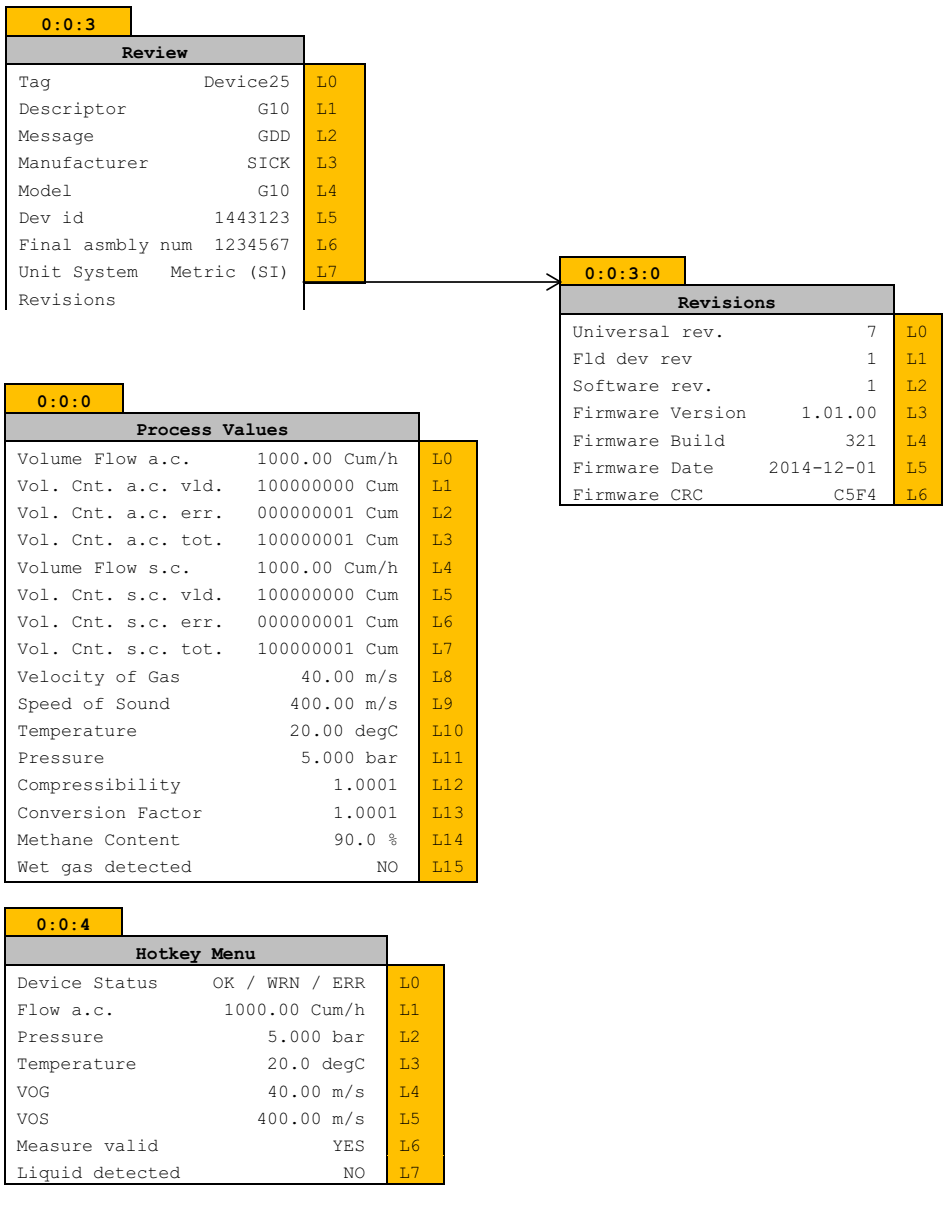


Fig. 27 HART® menu structure (3)



4.3 Commissioning with the FLOWgate™ operating software

4.3.1 Required tools and accessories

- Service adapter (included in service toolbox, part no. 2089847)
- Service adapter drivers installed on the laptop/PC
- USB cable with connector type A to type B (not included in service toolbox)
- FLOWgate™ operating software and manual (provided on the product CD delivered with the meter)
- Rights for parameter modification (see → p. 56, § 4.3.5,“User rights“)

4.3.2 Connecting to the device

For detailed information, please refer to the FLOWgate software manual.

1 Install the FLOWgate™ operating software on a laptop/PC.
2 Connect the FLOWSIC30 to this laptop/PC using the service adapter, → p. 55, § 4.3.3.
3 Start FLOWgate™, either by selecting the “FLOWgate” entry in the program group “SICK” or by double-clicking on the desktop icon.
4 Add the FLOWSIC30 to the device manager of the FLOWgate™ operating software and connect to the device.

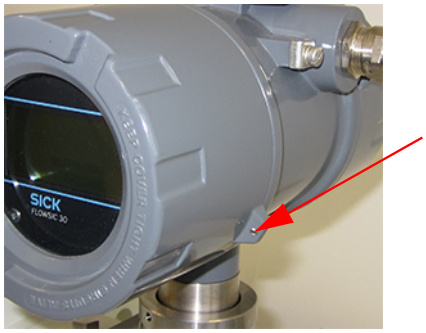
4.3.3 Connecting the FLOWSIC30 with a laptop or PC

► Observe all safety and warning notes given in p. 11, §1.4 “Responsibility of user” and →p. 39, §3.4.6 “Requirements for use in hazardous areas with potentially explosive atmospheres”.

WARNING: Explosion hazard

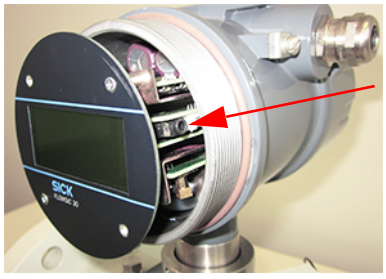
- ► Do not open the enclosure while the device is energized, unless an explosive atmosphere can be safely ruled out.
- ► Never open the window cover when an explosive atmosphere is present.
- ► The terminal compartment cover must not be opened either when an explosive atmosphere is present, unless the FLOWSIC30 is installed intrinsically safe.
- ► In the closed housing a pollution degree 2 according to IEC 60664-1 is assumed. Opening the housing is only allowed if the ambience does not put the pollution degree 2 inside the housing at risk (e. g. through ingress of conductive dust or moisture).

1 Release the cover lock.



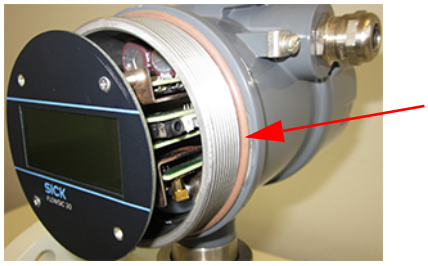
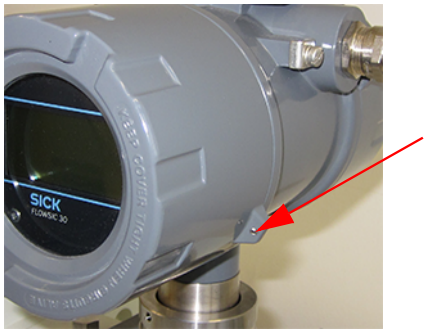
2 Unscrew the window cover.

3 Insert the jack plug of the service adapter.



4	Connect the service adapter and laptop or PC with the USB cable.
5	Establish a connection to the device.
6	After completion of work, close the FLOWSIC30 properly,→ p. 56, § 4.3.4.

4.3.4 Closing the FLOWSIC30

1 Check the seal on the signal processing unit adapter. The seal must not be damaged; otherwise the IP protection degree might be endangered.	
2 Screw the window cover tight again.	
3 Tighten the cover lock, so the cover is blocked.	

4.3.5 User rights

	Guest	User	Authorized User	Admin
General Status	X	X	X	X
Summarized Sub-Status		X	X	X
Event Summary		X	X	X
Commissioning				X
Parameter Modification			X	X
User Management				X

4.3.6 Commissioning wizard

► Establish an online connection between FLOWSIC30 and the FLOWgate™ operating software.

► Log-in as user level “Admin” (standard password: 3333).

► Expand the menu navigation on the right border of the application window. Click on “Commissioning” and switch the meter into Configuration Mode.

The commissioning wizard leads you step by step through the following procedures:

1 Identification
- Serial numbers
- Device name

2 System/User
- Units
- Device display settings
- User accounts

3 Analog Output
- Configuration

4 Communication
- HART®
- RS485
- Low flow cut-off

5 Pressure / Temperature Sensor
- Common settings
- Pressure sensor settings
- Temperature sensor settings

6 Volume Converter
- Volume conversion
- Compressibility calculation

7 Archive / Logbook
- Diagnostic Archive

8 Wet gas detection
- Detection of wet gas
- Limits

> ***NOTICE:*** Function wet gas detection is automatically disabled when changing the meter orientation from horizontal to vertical.

9 Installation
- Meter installation

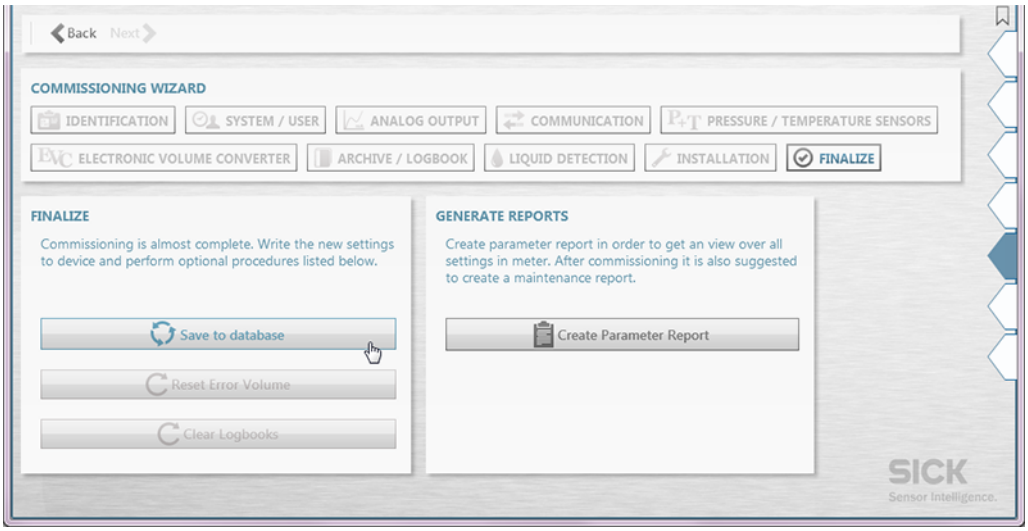
10 Finalize
- Finalize
- Generate reports

► Check the options and values in each step and adjust them according to the application, if necessary.

► Create and print out a parameter report for reference purposes.

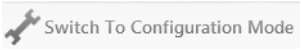
► Save to database.

Fig. 28 Commissioning wizard



Individual parameters can also be checked and changed at a later time after commissioning via the menu “Parameter Modification”, →Fig. 29.

Fig. 29 FLOWSIC30 Parameter Modification

For an adjustment of the parameters, switch to the “Configuration mode” by clicking 

4.3.6.1 Identification

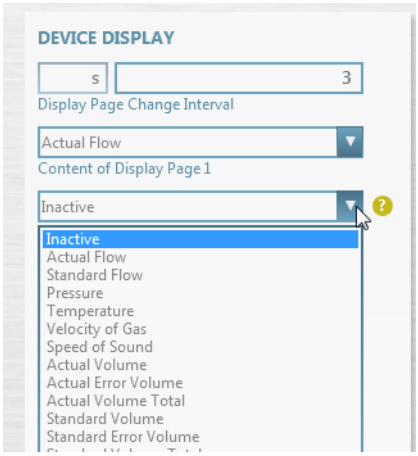
The “Identification” view provides information on the Serial Number of the device and the firmware CRC and version used on it. Furthermore, it enables an authorized user or administrator to define an identifier/tag for the device.

4.3.6.2 System/User

The “System/User” view comprises three different panels for the configuration of the following settings:

- Device date and time
- Display
- User Management (requires admin rights)

Fig. 30 Display configuration in FLOWgate™



4.3.6.3 Archive/Logbook

The interval for storage of diagnosis data is adjustable. Data can be stored from 10 seconds up to 24 hours (default is 60 min).

Fig. 31 Diagnostic Archive

After having applied changes as an authorized user or higher, proceed as follows:

1 Click “Write to Device” to update the meter with the new information.
2 Click “Close” to return to the “Parameter Modification” view.

4.3.6.4 **Analog output**

The analog signal can represent a variety of different output value sources (→ Fig. 32):

Fig. 32 List of output value sources

To adapt the FLOWSIC30 to the different application conditions, the analog output has to be configured. The adjustment of the analog output requires the change of various parameters.

The output current Iout is calculated as follows:

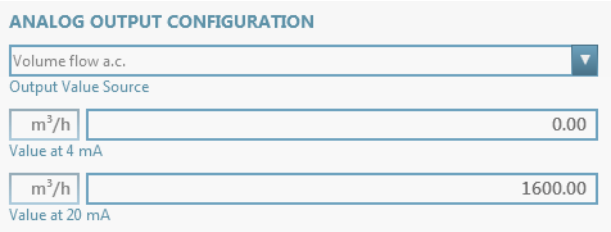
$$I_{out} = 4\ mA + \frac{Q - AORangeLow}{AORangeHigh - AORangeLow} \cdot 16\ mA$$

Here, the following parameters have to be set (see also → Fig. 33):

Table 7 AO parameters

Parameter	Description
Q	Output value source, as given in the drop-down list displayed in above figure
AORangeLow	Lower range limit (Q value at 4 mA)
AORangeHigh	Upper range limit (Q value at 20 mA)

Fig. 33 AORangeLow and AORangeHigh



Further parameters such as damping, error value, gain and current offset can be set.

Fig. 34 Analog Output Configuration

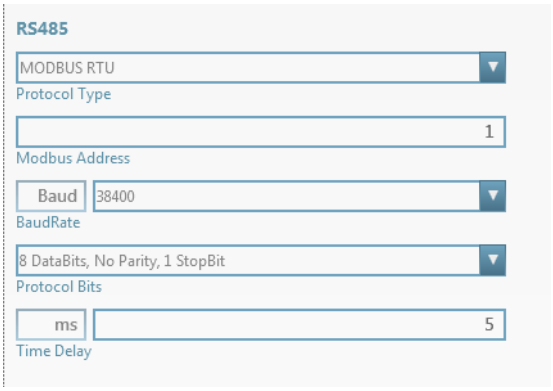
4.3.6.5 **Communication**

The “Communication” view provides information on the optional MODBUS RS485 and HART® bus interfaces, respectively. Only authorized users are allowed to apply changes to these parameter settings.

RS485

Drop-down menus support the user to set for the serial MODBUS RS485 protocol types and bits and the baud rate.

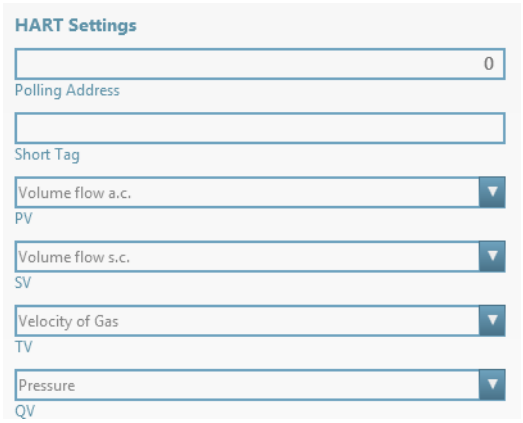
Fig. 35 RS485 settings



HART®

For HART® protocol, drop-down menus support the user to assign polling address, short tag and HART® variables (PV, SV, TV, QV) to the desired parameters.

Fig. 36 HART® settings

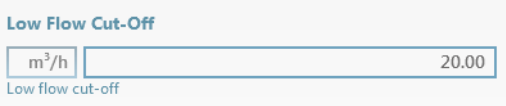


Low flow cut-off

A third panel in the “Communication” view provides the “Low Flow Cut-Off” parameter. For volume flow rates being below this threshold, flow rate output will be set to “0”.

Once dropping below this threshold, an information message will be provided via the LC display: I-1015 Low Flow Cut Off. The administrator user level is required for changing this threshold.

Fig. 37 Low flow cut-off



After having applied changes, proceed as follows:

1 Press “Write to Device” to update the meter with the new information

2 Click on “Close” to return to the “Parameter Modification” view

4.3.6.6 **Pressure/Temperature Sensors**

The “Pressure/Temperature Sensors” view allows an authorized user to select pressure and temperature value sources and define common settings such as units to be displayed on the LCD and the update interval.

The following pressure sources are available:

- Fixed value
- HART® pressure sensor (absolute or relative)
- External live value (absolute or relative)

The following temperature sources are available:

- Fixed value
- Internal Sensor
- External
- HART® temperature sensor

The option “Fixed value” is used when no temperature or pressure sensor is connected.

After having applied changes, proceed as follows:

1 Press “Write to Device” to update the meter with the new information.

2 Click on “Close” to return to the “Parameter Modification” view.

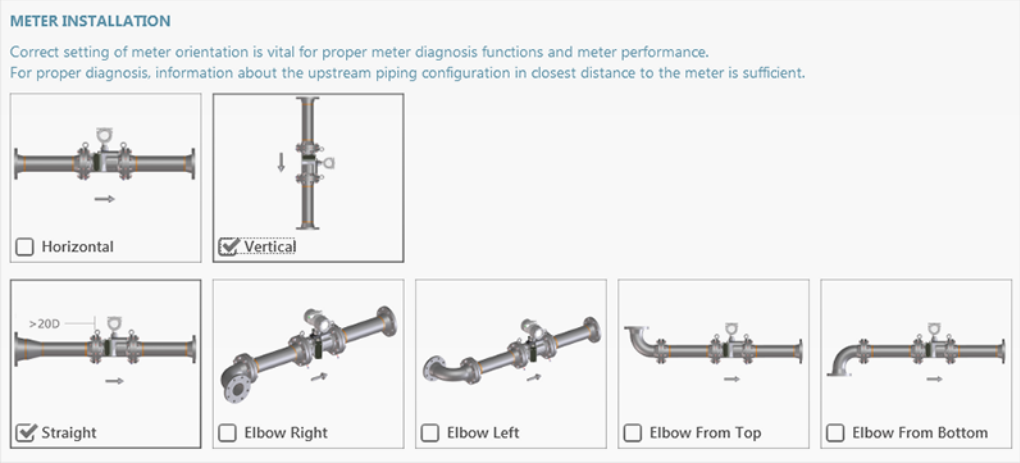
4.3.6.7 **Installation**

A correct meter setting and installation is vital for proper meter diagnosis functionality and meter performance. Hence, further information on the installation and configuration of adjacent piping upstream of the meter is mandatory for proper diagnosis purposes.

In order to specify further details on the installation and upstream piping, proceed as follows:

1 Click on “Installation” in the “Parameter Modification” menu
2 Specify the meter orientation: horizontal or vertical
3 Specify the upstream piping configuration
  Choose a setting, that is most similar to the meter installation. If you are unsure about a proper setting, please contact SICK for consultancy.

Fig. 38 Meter installation settings



After having applied changes, proceed as follows:

1 Press “Write to Device” to update the meter with the new information
2 Click on “Close” to return to the “Parameter Modification” view

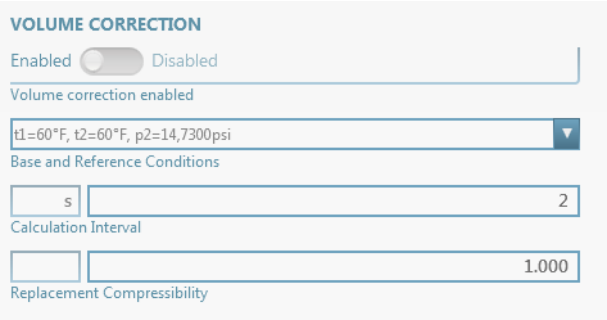
NOTICE: Wet gas detection is automatically disabled when changing the meter orientation from horizontal to vertical.

4.3.6.8 **Electronic Volume Conversion**

The following parameters can be set-up in the “Volume Correction” panel:

- Base and reference conditions
- Calculation interval
- Compressibility

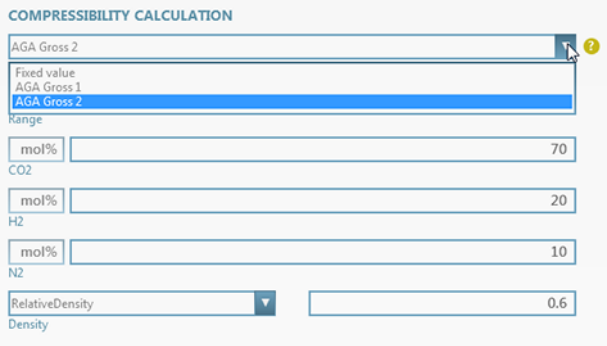
Fig. 39 Volume correction



The following options are available for compressibility calculation:

- Fixed value
- AGA 8 – Gross method 1
- AGA 8 – Gross method2

Fig. 40 Compressibility caclulation



4.3.6.9 **Finalize**

► First write the data to the device.

► SICK recommends creating a Parameter report and archiving the report with the delivery documentation.

► Log out from user level “Service“.
For further actions log in with user levels up to “Authorized User“.

FLOWSIC30

5 Maintenance and repair

Routine checks
Repair

5.1 Routine checks

5.1.1 Comparing theoretical and measured Speed of Sound (SOS)

One of the most important criteria for the correct operation of a gas meter is the consistency between the theoretical SOS, calculated for the actual gas composition, temperature and pressure, and the SOS measured by the gas meter.

The Speed of Sound Calculator (SOS Calculator) available in FLOWgate™ calculates a theoretical SOS for a specific gas composition at a specified temperature and pressure.

The calculation of thermodynamic properties is based on the "GERG-2004 XT08 Wide-Range Equation of State for Natural Gases and other Mixtures". The algorithms that are implemented in the SOS calculator were developed by the Ruhr-University Bochum (Germany).

Please refer to the FLOWgate software manual or further details on the SOS calculator.

5.1.2 Checking the meter health

The FLOWSIC30 provides the user with further details on alarms, warnings and status information in the following manner:

- The LCD display indicates active system alarms and warnings. If a current error or warning is active, a corresponding message will be displayed providing further information on the event.
- The meter event list can be read via HART®
- To get visual feedback about the meter's health, the "Device Information Bar" in the FLOWgate™ operating software provides a compact overview (refer to FLOWgate software manual).

► If any errors or warnings occurred, please refer to → p. 71, § 7 "Troubleshooting"

5.1.3 Creating a parameter report

► Use the FLOWgate™ operating software to create a parameter report (refer to FLOWgate Software Manual).

5.2 Repair

Any repair work on the measuring system may be carried out by the SICK service or by specially trained persons only. The training is provided by the manufacturer. The successfully completed SICK service training must be proved by a certificate.

The following parts can be replaced:

- SPU
- Temperature sensor and thermowell
- Internal pressure sensor
- Ultrasonic sensors (pairwise)

FLOWSIC30

6 Decommissioning

Return delivery
Disposal Information

6.1 Return delivery

6.1.1 Contact

Contact your local SICK representative for assistance.

6.1.2 Clearance certificate

A clearcance certificate will be provided by your local SICK representative, if necessary.

6.1.3 Packaging

Make sure, the FLOWSIC30 cannot be damaged during transport.

6.2 Disposal Information

6.2.1 Materials

- The FLOWSIC30 is mainly made of steel, aluminium and plastic materials.
- It does not contain any toxic, radioactive or other environmentally harmful substances.
- Substances from the pipeline can possibly penetrate, or deposit on seals.

6.2.2 Disposal

► Dispose of electronic components as electronic waste.

► Check whether materials that had contact with the pipeline need to be disposed of as special waste.

FLOWSIC30

7 Troubleshooting

General troubleshooting
System alarms and warnings
Checking the meter values via FLOWgate
Creating a diagnosis session

7.1 General troubleshooting

Due to pre-charge processes of internal energy storage capacitors, an initial delay of approximately 1 minute can be expected when powering up the FLOWSIC30. The device is running when the LC display starts operation.

General troubleshooting

Problem	Possible causes	Actions
● No display ● No communication via HART®/Modbus	Faulty power supply	► Check input voltage. ► Check all cables and the hardware. ► Check cables and terminal connections. **Caution** Take the relevant safety precautions!
	Device defective	► If possible, start a diagnosis session (→ p. 73, § 7.4) and contact your local SICK representative.

7.2 System alarms and warnings

Table 8 System warnings

Code	Display text
W-2001	RTC battery low
W-2002	Electronic volume conversion
W-2003	Internal pressure sensor failure
W-2004	Internal temperature sensor failure
W-2005	External HART® pressure sensor failure
W-2006	External HART® temperature sensor failure
W-2007	HART® AO loop out of 4-20 mA
W-2009	Wet gas detected
W-2010	Flow rate out of range
W-2011	Temperature out of range
W-2012	SOS out of range
W-2013	Path 1 performance failure
W-2014	Path 2 performance failure

Table 9 System alarms

Code	Display text
E-3001	Volume counter checksum error
E-3002	Firmware checksum error
E-3003	Parameter checksum error
E-3004	Logs checksum error
E-3005	Date/time invalid
E-3010	Flow performance failure
E-3011	Pressure out of range
E-3012	Reverse flow

7.3 Checking the meter values via FLOWgate

If there are any errors indicated on the “Meter Values” page, proceed as described in → Table 10.

Table 10 Troubleshooting

Problem	Possible causes	Actions
Implausible speed of sound	Gas composition, pressure or temperature measurement is incorrect	Check gas composition, pressure and temperature. Start a Diagnosis Session according to → p. 73, § 7.4 and contact your trained staff or your local SICK representative.
Different speed of sound in the individual paths	Faulty transducer or electronic module	Start a Diagnosis Session according to → p. 73, § 7.4 and contact your trained staff or your local SICK representative
Lower SNR and reception sensitivity (AGC)	Damaged or blocked transducer	Start a Diagnosis Session according to → p. 73, § 7.4 and contact your trained staff or your local SICK representative
	Additional sources of noise due to a valve that is not fully open, fittings, noise sources near the device	Check the measurement plausibility and number of rejected measurements. If possible, eliminate noise sources Start a Diagnosis Session according to → p. 73, § 7.4 and contact your trained staff or your local SICK representative
Increased receiver sensitivity (AGC)	Different gas composition or process pressure	No action required on the device
	Transducer(s) are dirty	Start a Diagnosis Session according to → p. 73, § 7.4 and contact your trained staff or your local SICK representative

7.4 Creating a diagnosis session

Use the FLOWgate™ operating software to create a diagnosis session for remote support.

A diagnosis session can be started in the FLOWgate™ operating software by clicking on the following symbol in the device information bar:

For detailed information, please refer to the FLOWgate user manual provided on the product CD or via the FLOWgate software.

FLOWSIC30

8 Specifications

Conformities and technical data
Type plate
Dimensional drawings

8.1 Conformities and technical data

8.1.1 Conformities

> ***NOTICE:***
> Applied European standards and harmonized standards are listed in the valid version of the manufacturer's CE conformity declaration.

- EU directive 2014/30/EU (EMC)
- EU directive 2014/34/EU (ATEX)
- AGA Report No. 8, Gross Characterization (GC) method 1/2
- ACMA Radiocommunications Act. 1992, section 182 (RCM label)
- Qualification acc. to ASME
- IECEx: IEC 60079-0, IEC 60079-1, IEC 60079-7, IEC 60079-11
- EN 60079-0, EN 60079-1, EN 60079-7, EN 60079-11

8.1.2 Technical data

Table 11 Technical data

Meter characteristics and measuring parameters				
Measured variables	Gas volume s. c., gas volume a. c., error volume s. c., error volume a. c., volume flow s. c., volume flow a. c., gas temperature, speed of sound, methane content			
Number of measuring paths	2			
Measurement principle	Ultrasonic transit time difference measurement			
Measuring medium	Coal seam gas, natural gas, methane			
Measuring ranges	Volumetric flow, a. c.			
		Q_{min} [m^3/h]	Q_t [m^3/h]	Q_{max} [m^3/h]
	3 inch	12	60	850
	4 inch	20	100	1600
Repeatability	≤ ± 0.5 % of the measured value			
Accuracy	Volumetric flow, a. c.			
			Q_{min}... Q_t	Q_t ... Q_{max}
	Wet-gas tolerant FLOWSIC30		≤ ± 3%	≤ ± 1.5%
	Wet-gas robust FLOWSIC30		≤ ± 4%	≤ ± 2%
	Reference conditions: Dry air at ambient pressure and ambient temperature Verified with pipe configurations according to OIML R-137:2012 Annex B (mild)			
Diagnostics functions	Integrated device diagnosis, wet gas detection			
Gas temperature	-10 °C ... +80 °C			
Operating pressure	0 bar (g) ... 19.6 bar (g)			
Nominal pipe size	DN80/3 inch, Schedule STD; DN100/4 inch, Schedule STD			
Connection flanges	ANSI B16.5, Class 150 RF			
Meter body material	LTCS (ASTM A352 Gr. LCC or ASTM 350 LF2 or equivalent)			
Ambient conditions				
Ambient temperature	-25 °C ... +60 °C			
Storage temeprature	-25 °C ... +70 °C			
Ambient humidity	≤ 95 % relative humidity			
Approvals				
Ex approvals	IECEx: Ex db eb ia [ia] IIA T4 Gb ATEX: II 2G Ex db eb ia [ia] IIA T4 Gb			
Type of protection	IP66/IP67			
Outputs and interfaces				
Analog outputs	1 outlet: 4...20 mA			
Interfaces	RS485, externally powered			
Bus protocol	HART® compatible			
	Modbus ASCII/RTU (option)			
Installation				
Dimensions (W x H x D)	See dimensional drawings			
Weight	4 inch: 32 kg; 3 inch: 28 kg			
Electrical connection				
Voltage	18 ... 30 V DC loop power via analog loop, 2-wire concept			
Power consumption	< 65 mW			

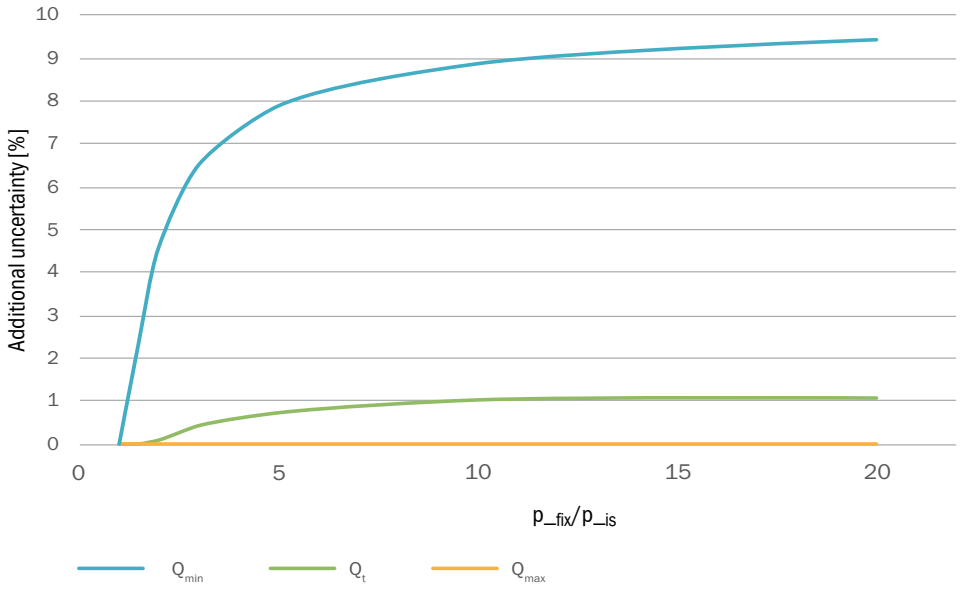
Table 12 Technical data (volume conversion)

Volume conversion	
Accuracy	≤ ± 0.5%, depending on accuracy of pressure measurement
Conversion method	pTZ or TZ
Compressibility	AGA 8 Gross method 1 AGA 8 Gross method 2
Integrated temperature sensor (option)	
Type	Digital sensor, mounted into thermowell
Measuring range	-10 °C ... +80 °C
Measurement accuracy	≤ ± 0.3% of measured value in K
Integrated relative pressure sensor (option)	
Measuring range	0 ... 2000 kPag
Measurement accuracy	± 0.1% of full scale value

8.2 Application limits

Wet-gas robust devices without integrated pressure sensor or without external live pressure value will be parameterized with a constant pressure value (p_fix) during commissioning. If the process pressure (p_is) varies from the constant pressure value (p_fix), these devices may show an additional measurement uncertainty of the volumetric flow a. c. The additional measurement uncertainty is shown in → Fig. 41 as the ratio of the constant pressure value (p_fix) to the process pressure (p_is).

Fig. 41 Additional measurement uncertainty as compared with specifications for wet-gas robust devices



8.3 Type plate

Fig. 42 Main type plate on the SPU (example)

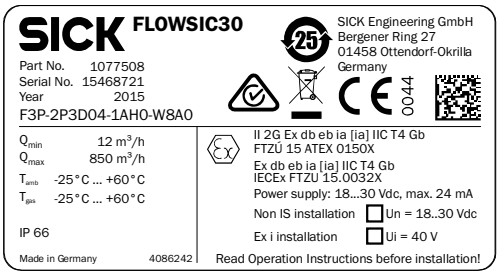
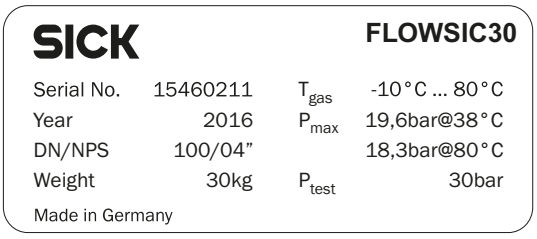


Fig. 43 Type plate on the meter body (example)



8.4 Dimensional drawings

Fig. 44 Dimensional drawings

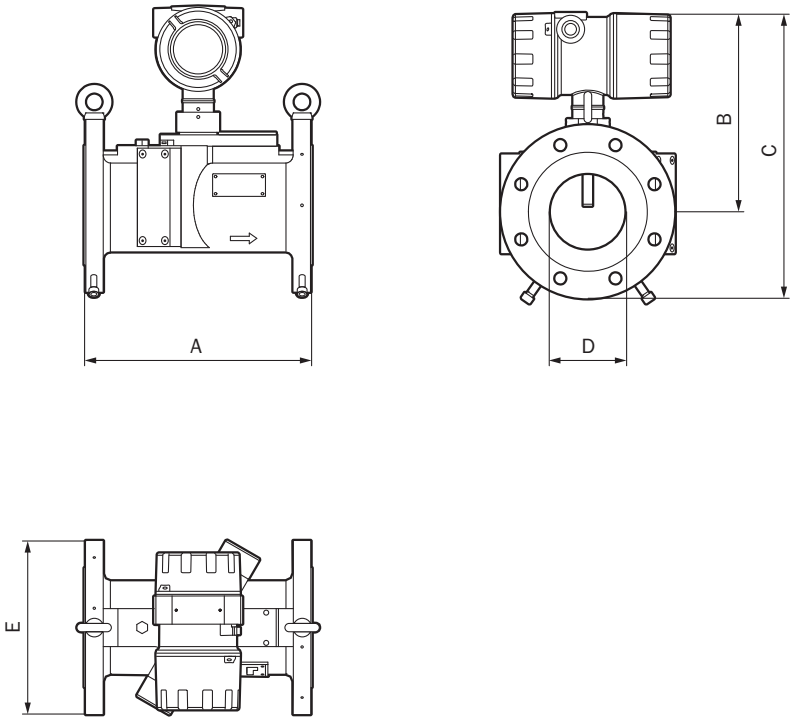


Table 13 Dimensions in mm (inch)

Nominal pipe size					
	A	B	C	D	E
3 inch	320 (12.60)	290 (11.41)	379 (14.92)	77.9 (3.07)	190 (7.48)
4 inch	300 (11.81)	293 (11.54)	407 (16.02)	102.3 (4.03)	229 (9.01)

8.5 Wiring diagrams

The optional internal pressure and temperature sensors do not require extra device external cabling. Extra cabling is only required, if the optional RS485 or an external pressure or temperature sensor (not included in scope of delivery) is used.

Fig. 45 Intrinsically safe installation/Ex i (9239655)

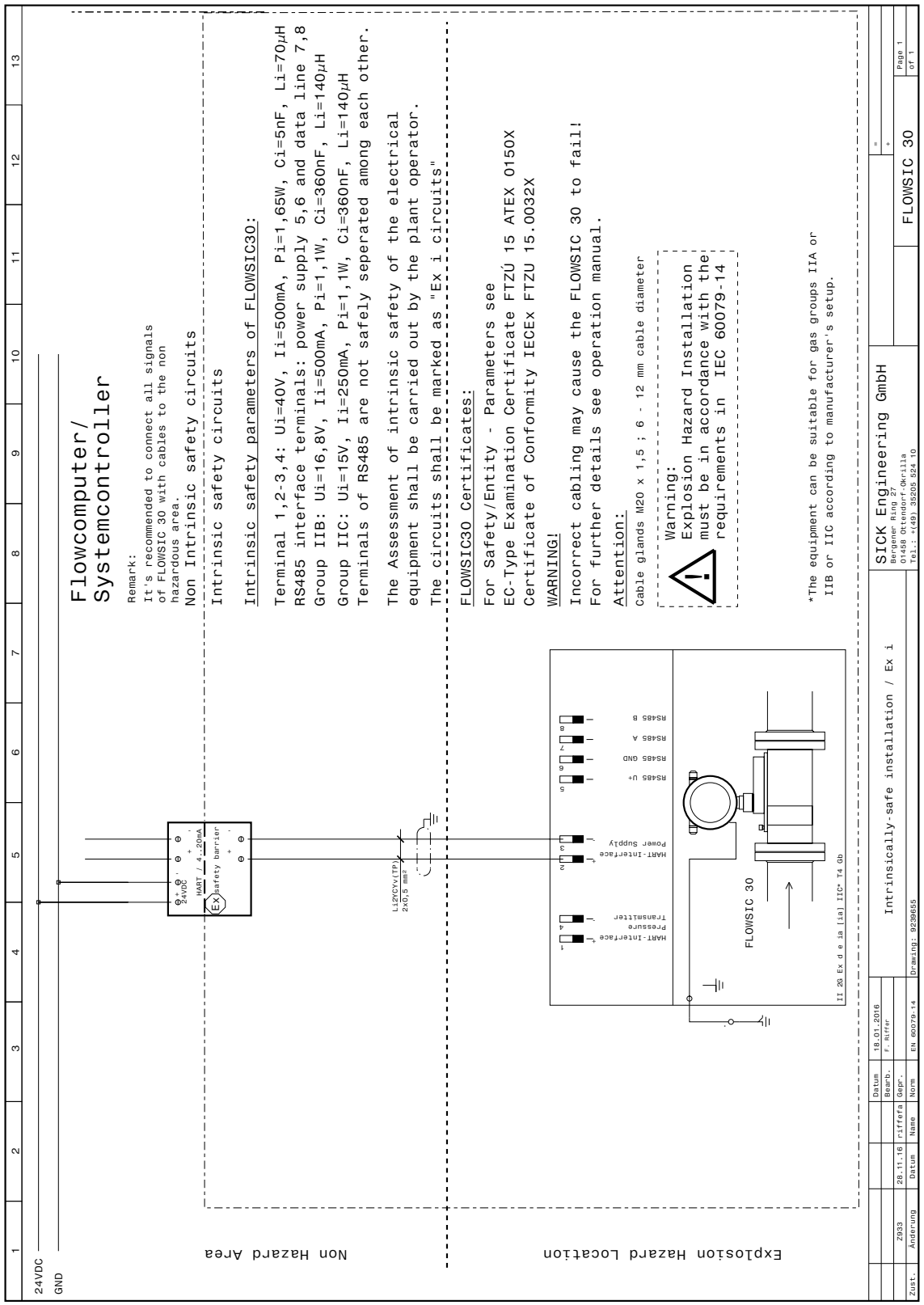


Fig. 46 Intrinsically safe installation/Ex i (9239659)

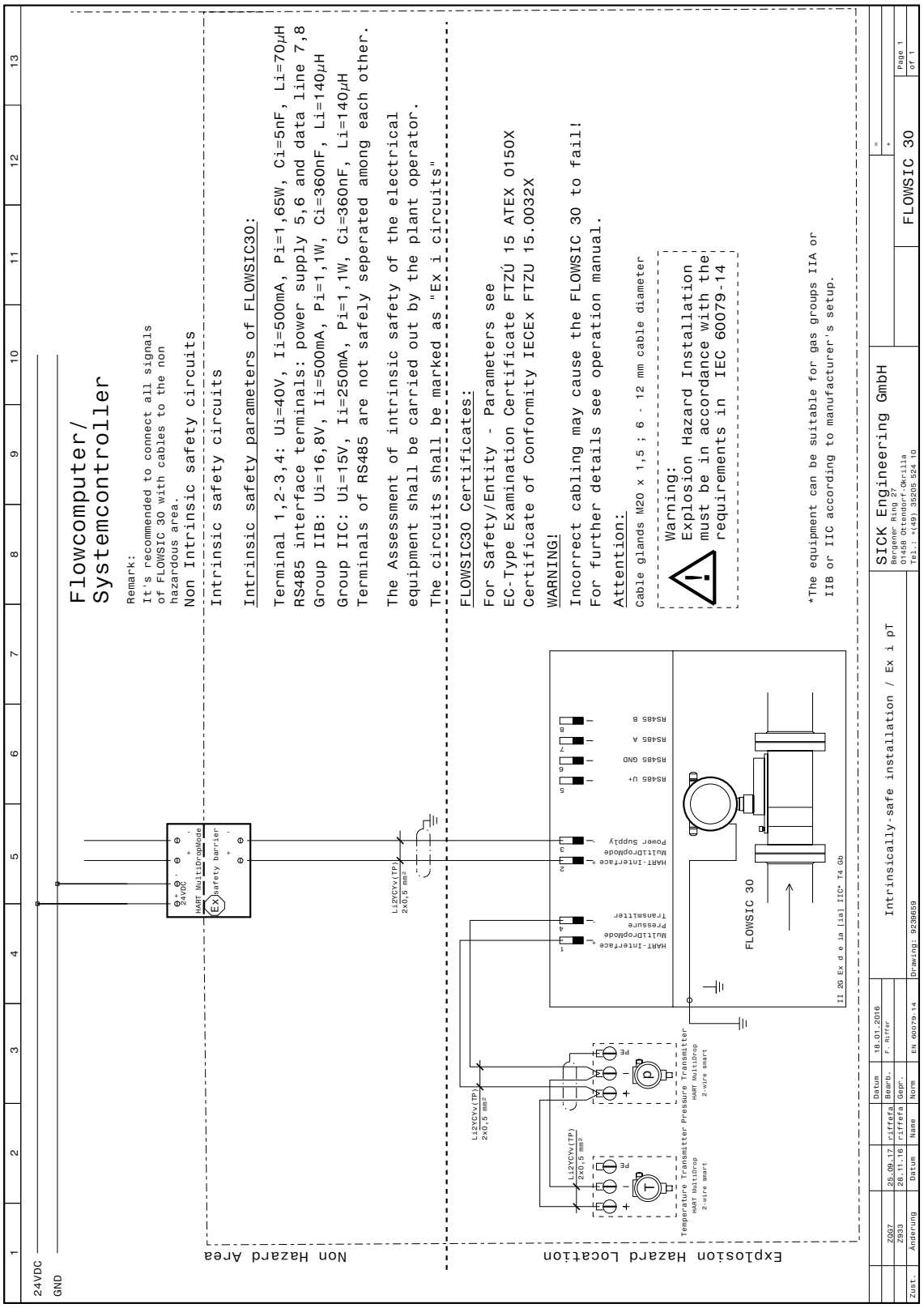


Fig. 47 Intrinsically safe installation/Ex i RS485 (9257234)

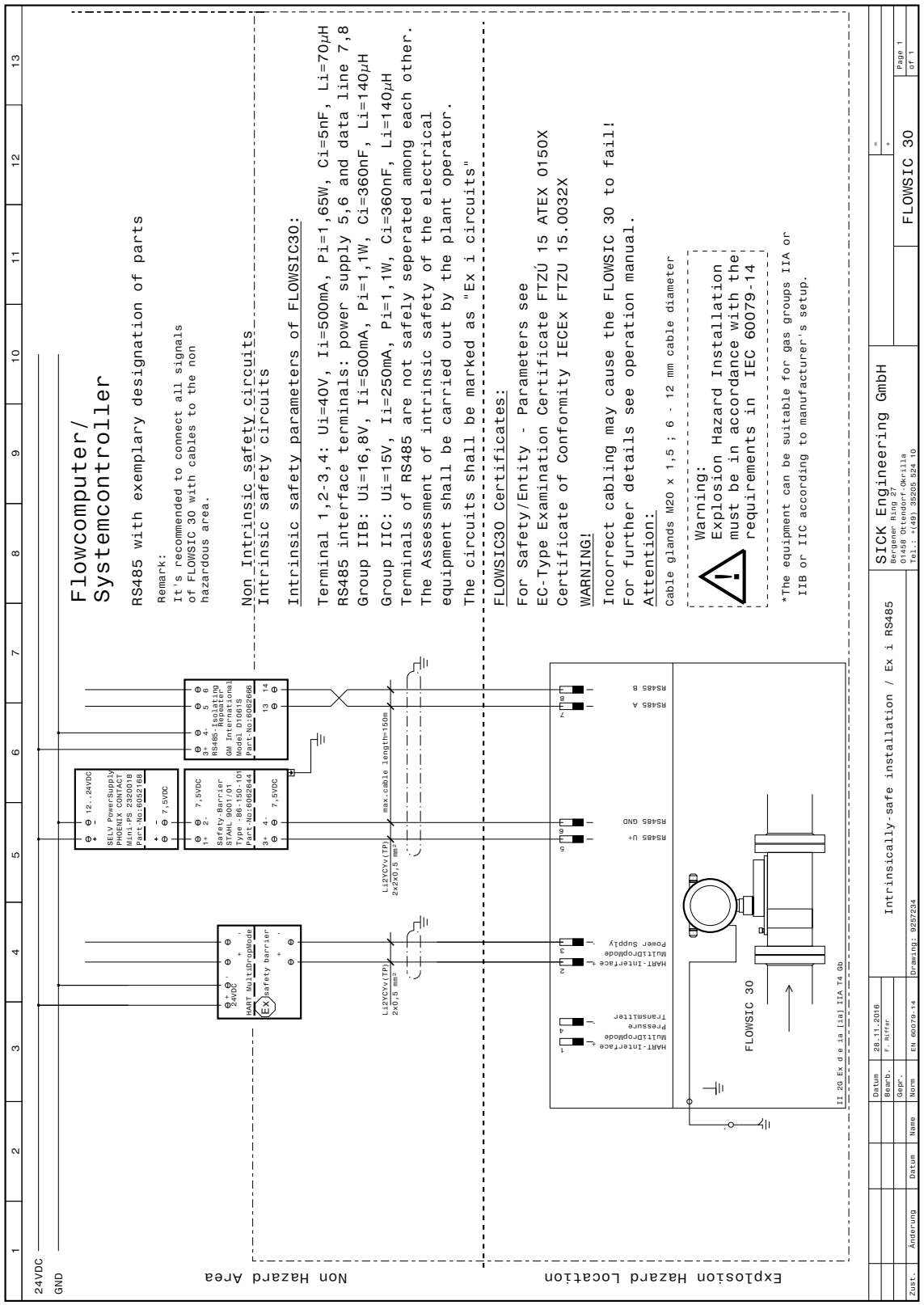


Fig. 48 Increased safety installation/Ex e (9239656)

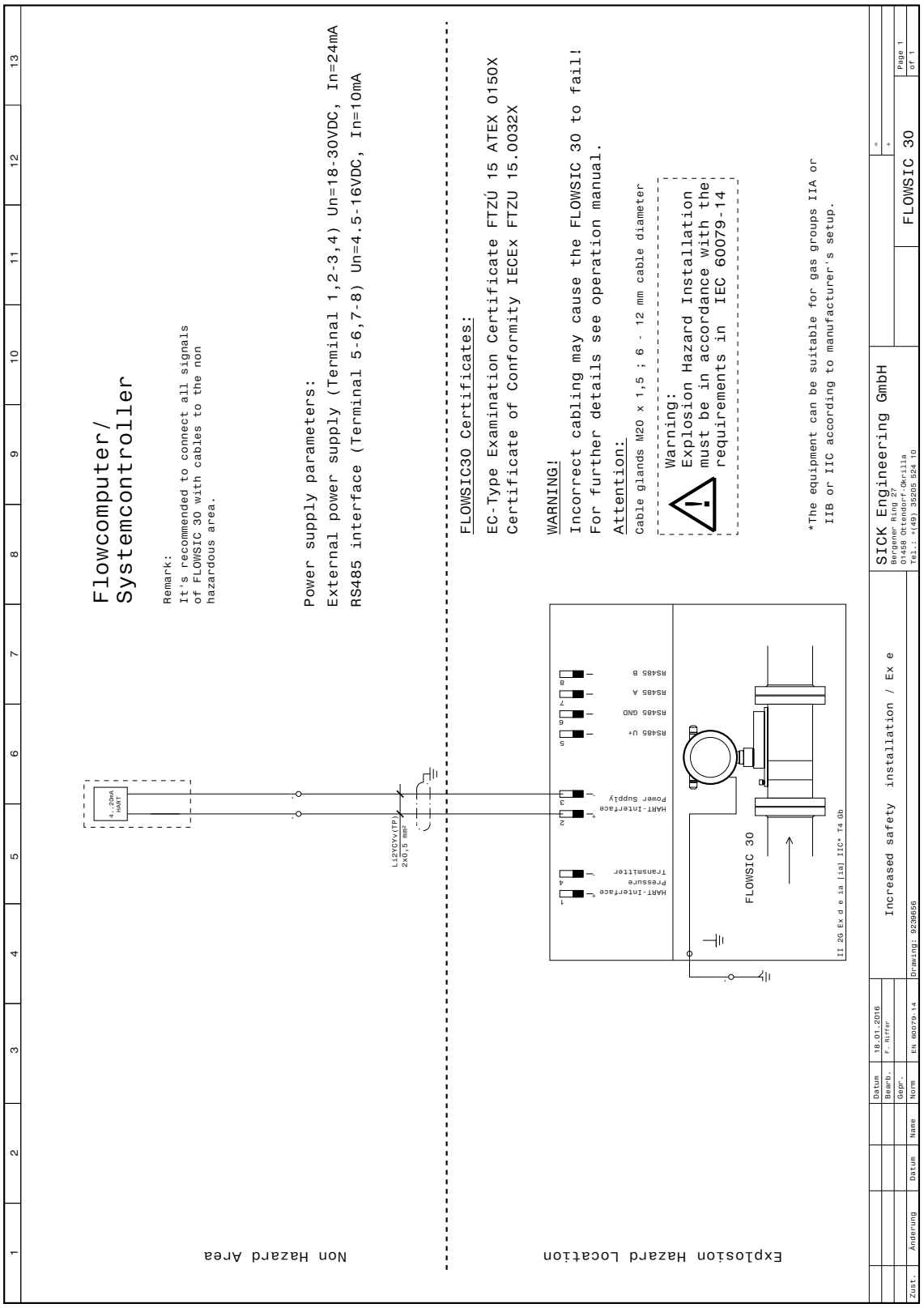


Fig. 49 Increased safety installation/Ex e pT (9239657)

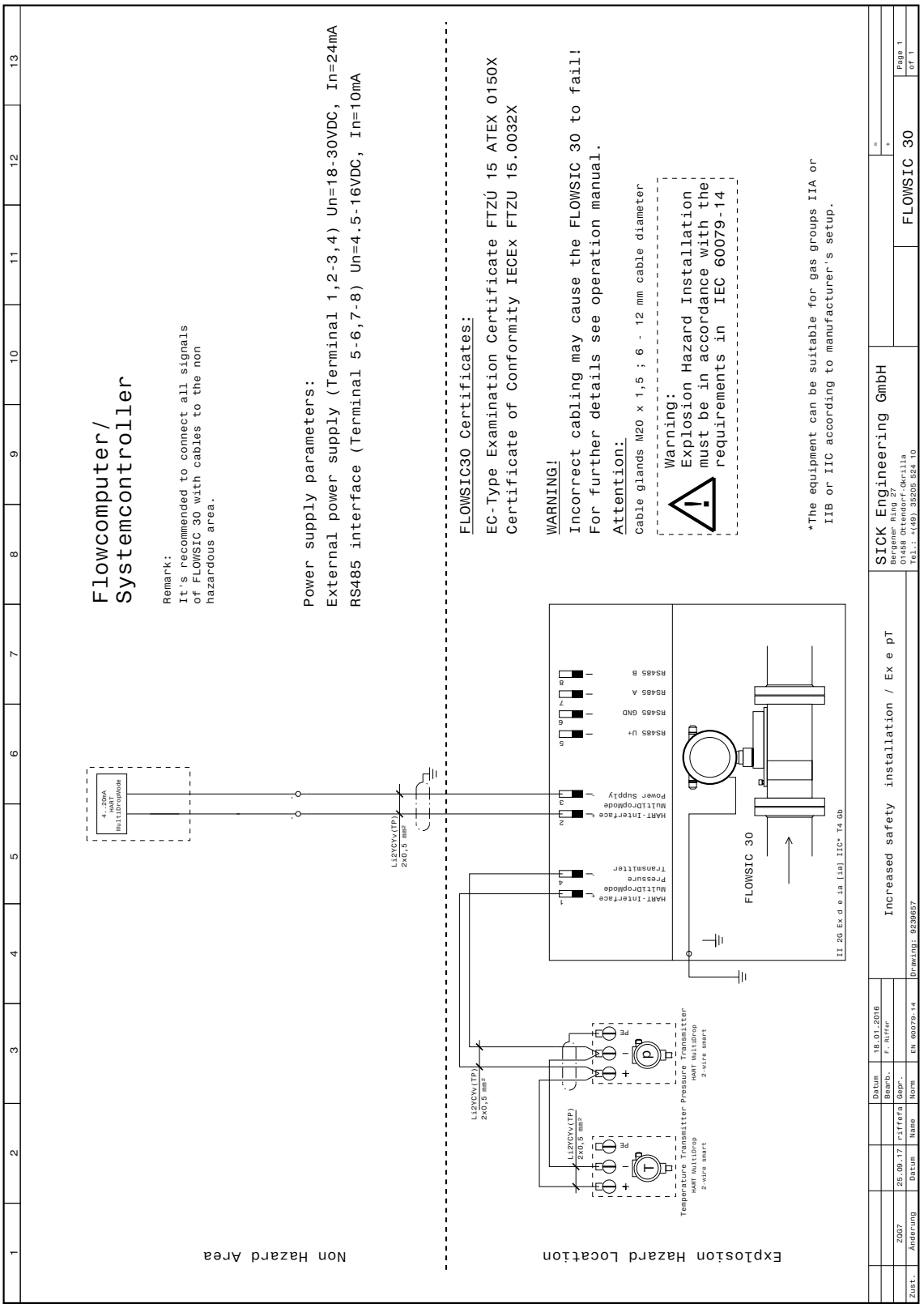
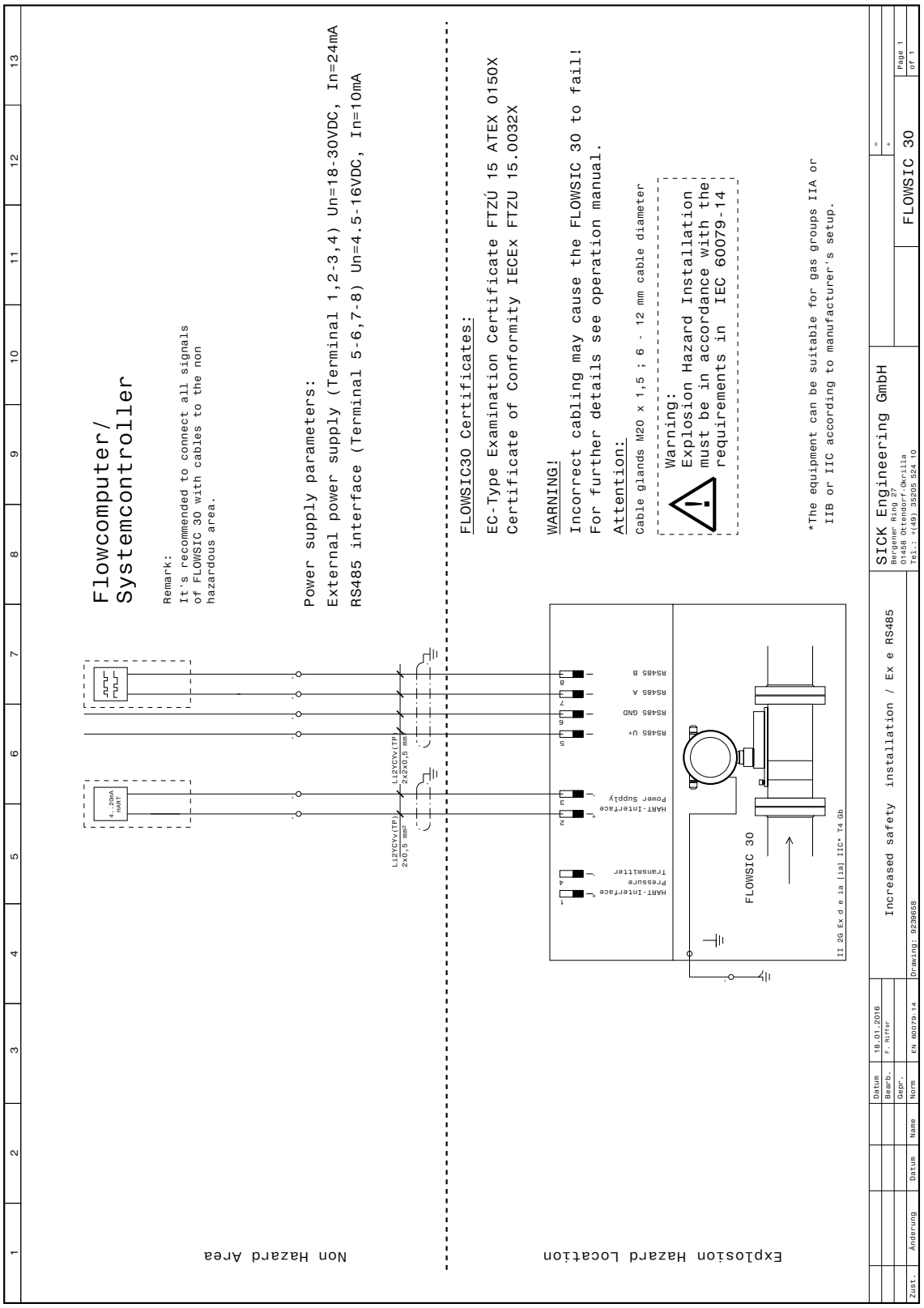


Fig. 50 Increased safety installation/Ex e RS485 (9239658)



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