Operating Instructions
FLOWSIC900

Flow Meter

Endress+Hauser
People for Process Automation

Described product
Product name: FLOWSIC900

Manufacturer
Endress+Hauser SICK GmbH+Co. KG
Bergener Ring 27
01458 Ottendorf-Okrilla
Germany

Legal information

Original document
This document is an original document of Endress+Hauser SICK GmbH+Co. KG.

CE

Inhalt

1 About this document

1.1 Function of this document

These Operating Instructions describe:

- Device components
- Mounting
- Electrical installation
- Operation
- Maintenance work required for reliable operation
- Troubleshooting
- Decommissioning

They contain the main safety information for safe operation of the FLOWSIC900.

1.2 Scope of application

These Operating Instructions are only applicable for the measuring device described in the product identification.

They are not applicable to other Endress+Hauser measuring devices.

These Operating Instructions cover standard applications which conform with the technical data specified. Additional information and assistance for special applications are available from your Endress+Hauser representative. It is generally recommended to take advantage of qualified consulting services provided by Endress+Hauser experts for your specific application.

1.3 Target groups

This Operating Instructions is intended for persons installing, operating and maintaining the device.

Operation

The device may only be operated by authorized persons who, based on their training on, and knowledge of the specific device, as well as knowledge of the relevant regulations can assess the tasks given and recognize the hazards involved.

Installing and maintaining

Skilled persons are required for installation and maintenance.

Please observe the information at the beginning of the respective Sections.

1.4 Further information

Observe the supplied documents.

1.5 Abbreviations used

Abbreviation	Significance
s.c.	At standard condition, base condition, reference condition
a.c.	At actual conditions, operating conditions
BLE	Bluetooth® Low Energy
LNG	Liquefied natural gas
SOS	Speed of sound, sound velocity
SPU	Signal processing unit
VOF	Velocity of fluid, flow velocity, liquid velocity

1.6 Symbols and document conventions

1.6.1 Warning symbols

Symbol	Significance
	Hazard (general)
	Hazard by electrical voltage

1.6.2 Warning levels and 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 less severe or minor injuries.

NOTICE:
Hazard which *could* result in property damage.

Note:
Hints

1.6.3 Information symbols

Symbol	Significance
	Important technical information for this product
	Important information for electrical or electronic functions

2 For your safety

2.1 Basic safety information

- Read and observe these Operating Instructions.
- Observe all safety instructions.
- If there is something you do not understand: Contact the manufacturer.

Retention of documents

- These Operating Instructions must be kept available for reference.
- These Operating Instructions must be passed on to new owners.

Correct use

- Only use the measuring device 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 measuring device not described in this manual.
- Do not remove, add or change any components in or on the measuring device unless such changes are officially allowed and specified by the manufacturer.
- Only use accessories approved by the manufacturer.
- Do not use damaged components or parts.
- If you do not follow these guidelines, the following applies:
  - The measuring device can become dangerous
  - The measuring device can lose function.
  - The approval for use in potentially explosive atmospheres is no longer valid.
  - The approval for use in lines pressurized above 50 kPa (0.5 bar) is no longer valid.

Special local conditions

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

2.2 Warning information on device

WARNING: Danger identification on device
The following symbol draws attention to important dangers directly on the device:

- Consult the Operating Instructions in all cases where the symbol is attached to the device or shown on the display.

2.3 Intended use

FLOWSIC900 is an ultrasonic liquid flow meter designed to measure the actual volumetric flow and volume of liquefied natural gas (LNG) in pipelines.

Using the device for purposes other than those intended can lead to safety-critical conditions. The manufacturer bears no responsibility for any other use.

2.4 Operation in potentially explosive atmospheres

The FLOWSIC900 is suitable for use in potentially explosive atmospheres classified in Zone 1/Division 1.

Note:

- ATEX
  ⟨Ex⟩ II 2(1) G Ex db ia [ia Ga] IIA T4 Gb
- IECEx
  Ex db ia [ia Ga] IIA T4 Gb
- NEC/CEC (US/CA)
  Ex db ia [ia Ga] IIA T4 Gb
  Class I Zone 1 AEx db ia [ia Ga] IIA T4 Gb
- NEC (US)
  Class I Division 1 Group D T4

Specific conditions for use (denoted by X after the certificate number)

Valid for IECEx, ATEX, cCSAus:

- The flameproof joints of the flameproof enclosure are not intended to be repaired.
- For the painted enclosures – Potential electrostatic charge hazard. The enclosure shall not be installed in a location where the external conditions can build-up the electrostatic charge on the non-metallic surface of an enclosure. In addition, the enclosure shall only be cleaned with a damp cloth.
- The threaded entries to the flameproof enclosure must be closed with suitably certified cable entry devices.
- The maximum piezo-electric energy released by impact on the ultrasonic sensor/ transducer exceeds the limits specified in Clause 10.7 of IEC 60079-11:2011 / EN 60079-11:2012 / CSA/UL 60079-11. The end user must ensure that the meter body is suitably protected against danger from impact.
- The non-intrinsically safe field wiring of FLOWSIC900 must be supplied with a SELV/PELV or similar power supply compliant with U_m = 60 V voltage.
- The maximum prospective short circuit current at the connections to non-intrinsically safe circuits shall not exceed 50 A.
- An external earth conductor is required between the external Grounding terminal of the enclosure and earth. This earth conductor should have a copper cross-sectional area of no less than 4 mm^2, be permanently installed and adequately mechanically protected.

Additionally valid for cCSAus:

- The device shall only be powered by a power supply unit in accordance with CSA/UL/EN/ IEC 61010-1:2010 or class 2 according to CSA 223 / UL 1310 with output voltages below the limits of 6.3.1/6.3.2 and 9.4 max. 24 V DC +30 %/-20 %.
- Equipment shall be mounted to an external pipeline in end-use installation.
- Equipment is only to be installed by trained personnel in accordance with the operating instructions.
- For Class I Division 1 applications, the equipment shall only be used in hazardous locations consisting of aliphatic hydrocarbons (e. g. Hexane, LNG).
- The temperature of cable entry point and branching point can be more than +60 °C, temperature-resistant connecting cables shall be used. Please see operating instructions before installation.

2.5 Restrictions of use

- Refer to the type plate for the configuration of your measuring device.
- Check the measuring device is suitably equipped for your application (e.g. fluid conditions).
- The measuring device is suitable for use in pressurized lines within the combination of maximum allowable temperature and pressure specified on the type plate.
- It is the user's responsibility to ensure these maximum allowable values are not exceeded during operation.

NOTICE:
The device has been tested for electromagnetic compatibility in industrial environments according to IEC 61326-1. Additional measures may be required for use in electromagnetic environments with higher interference levels.

2.6 Responsibility of user

The measuring device may only be operated by skilled persons who are knowledgeable of relevant regulations and able to assess potential hazards related to its operation.

Skilled persons are persons according to DIN VDE 0105, DIN VDE 1000-10 or IEC 60050-826 or directly comparable standards.

NOTICE:
Skilled persons must have exact knowledge of hazards arising from operation, e.g. through hot, toxic, explosive gases or gases under pressure, liquids, gas-liquid mixtures or other media as well as adequate knowledge of the measuring system gained through training.

2.7 Information on cybersecurity threats

Protection against cybersecurity threats requires a comprehensive cybersecurity concept that must be continuously reviewed and maintained.

A suitable concept comprises organizational, technical, procedural, electronic and physical defense levels and takes into account appropriate measures for the different types of risk. The measures implemented in this product can only support protection against cybersecurity threats when the product is used within such a concept.

Visit www.endress.com/cybersecurity for more information, such as:

- General information on cybersecurity
- Contact option for reporting vulnerabilities
- Information on known vulnerabilities (security advisories)

CDBT100 Bluetooth® connection device

The CDBT100 connection device provides transparent communication.

It does not offer any functions for securing the connection, so it is not part of the cybersecurity concept.

Ethernet-to-serial converters

If Ethernet-to-serial converters are used in the communication to the device, e.g. Modbus TCP to Modbus RTU, which enable several connections (multiplexers), only connections that do not require a login may be used.

For connections that require a login, it must be ensured that only one connection is possible (e.g. via firewall), as otherwise access rights will be extended to all other connections.

Securing the communication

Modbus is used as the communication protocol. To secure the communication, it must be operated in a secure environment.

An additional security layer must be used for transmission through unsecured networks (e.g. VPN).

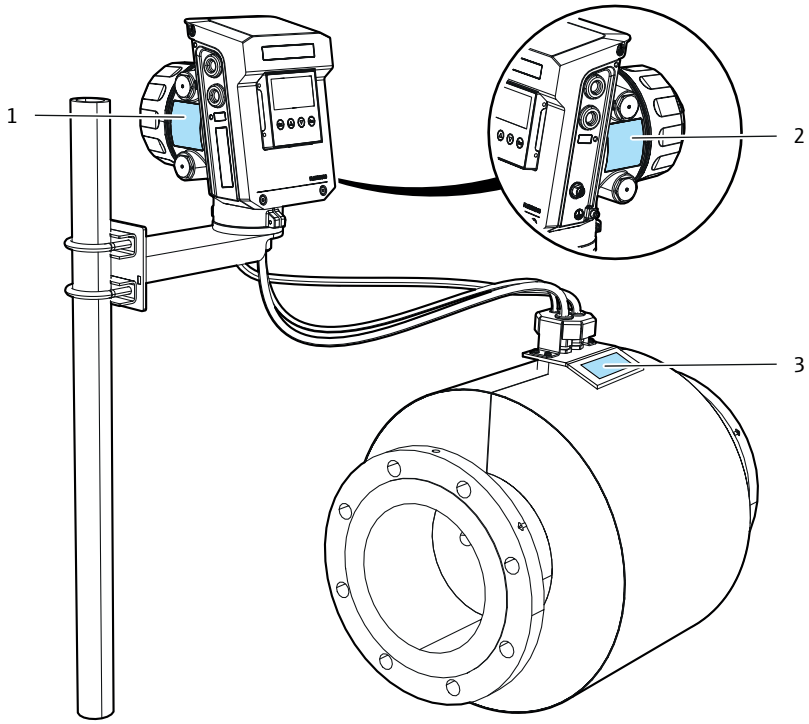
3 Product description

3.1 Product identification

Product name:	FLOWSIC900
Manufacturer:	Endress+Hauser SICK GmbH+Co. KG Bergener Ring 27 01458 Ottendorf-Okrilla Germany

The type plates are located on the SPU and on the meter body.

▶ For a detailed view of the type plates, see “Type plates”, page 89.

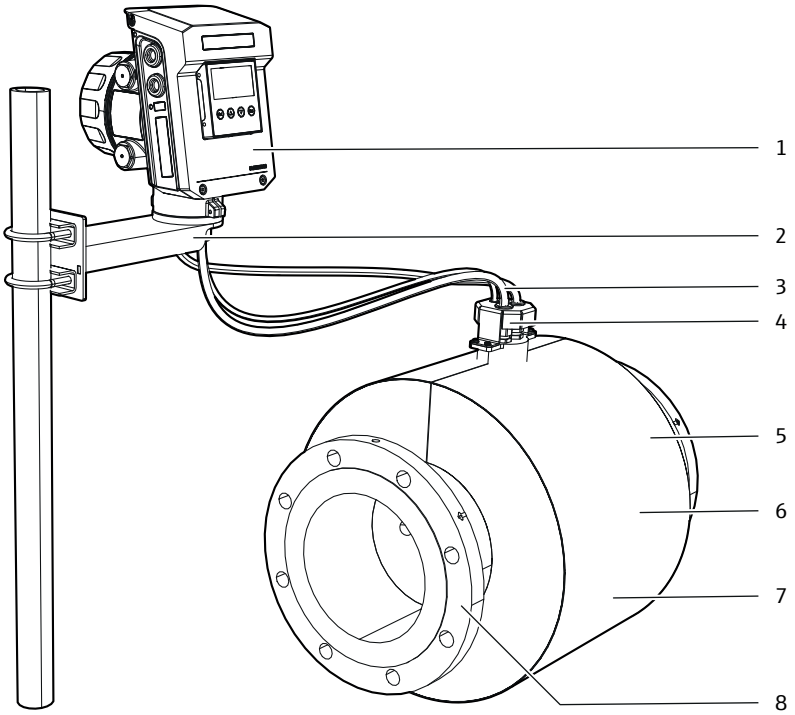


1 Main type plate on SPU (includes Metrology and Ex identification)
2 Ex type plate on SPU (includes Ex identification)
3 Meter body type plate

Fig. 1: Position of type plates

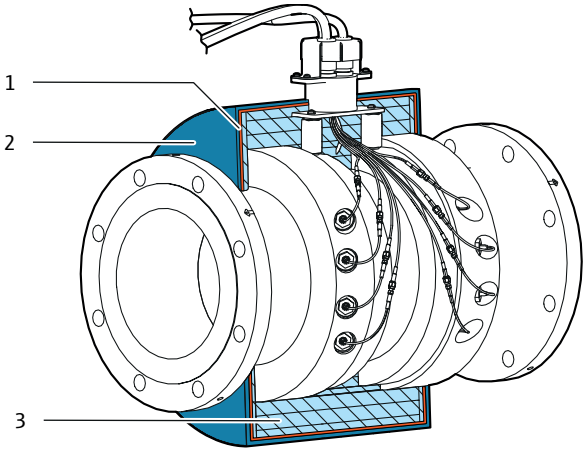
3.2 Layout and function

Overview



1 SPU (Signal Processing Unit)
2 SPU bracket
3 Connection cables (for ultrasonic transducers and temperature sensor)
4 Meter body neck (neck)
5 Jacketing (optional)
6 Meter body
7 Thermal factory pre-insulation (ultrasonic transducers under the insulation)
8 Meter body flange (flange)

Fig. 2: FLOWSIC900 components



1 Jacketing (optional, permanent weather protection)
2 Film (temporary weather protection)
3 Thermal insulation

Fig. 3: Meter body, view of the transducers (insulation removed for better visualization)

3.2.1 Meter body

The meter body is available in various flange standards and fitting lengths to connect the flow meter to the system pipeline.

3.2.2 Ultrasonic transducers

Ultrasonic transducers optimally tuned to system requirements are fitted on the measuring device. The high quality of the transducer design provides the basis for accurate and highly stable transit time measurement of the ultrasonic signals.

The transducers are designed to be maintenance-free and to last for the complete meter life time.

3.2.3 Signal processing unit (SPU)

The signal processing unit (SPU) contains all the electrical and electronic components for controlling the ultrasonic transducers. It generates transmission signals and analyzes the received signals to calculate the measured values. The SPU also contains several interfaces for communication with a PC or standardized process control system.

3.2.4 Internal temperature sensor

FLOWSIC900 has an internal temperature sensor. This sensor measures the meter body temperature. The measured temperature is used to correct the meter body geometry and to determine the current Reynolds number.

The sensor is not subject to (re-)calibration intervals. Its measurement uncertainty is sufficiently accurate for the geometry and Reynolds number correction.

3.3 Interfaces

Process interface

2 x RS485 Modbus RTU/ASCII (for further information see Modbus manual (9390182))

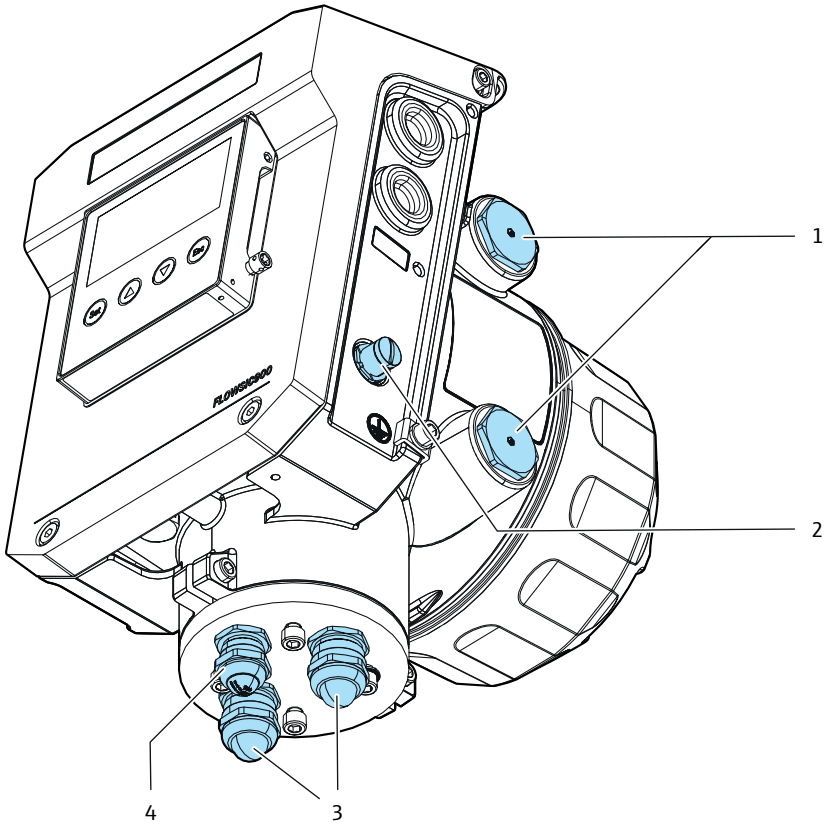
4 x Digital output

Commissioning and service

1 x BLE (Bluetooth® Low Energy)

or 1 x USB

via accessory adapter on SPU



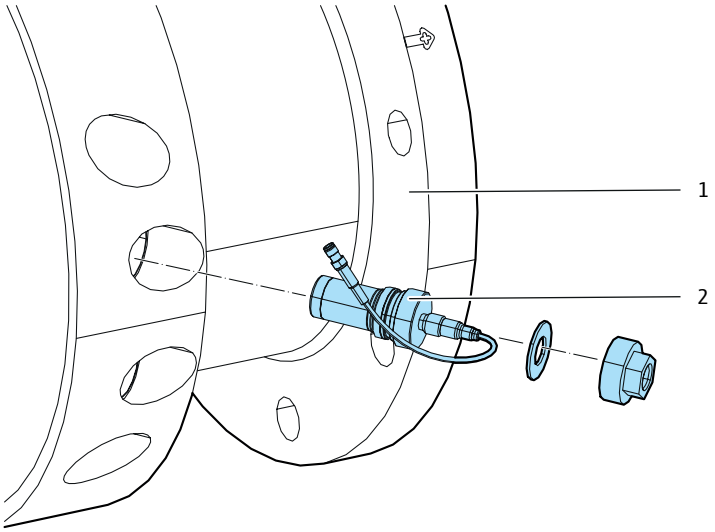
1 Power and process Interface (I/O)
2 Commissioning and service
3 Cable entries for transducer connection cables
4 Cable entry for temperature sensor cable

Fig. 4: SPU connections

3.4 Material for wetted parts (parts with media contact)

Wetted parts

- Meter body: Stainless Steel (EN 1.4401/1.4404 / ASTM A182 Gr. F316/316L)
- Transducer: Titan grade 5 (Ti 3.7164)
- Transducer sealing: PTFE+ Stainless Steel 1.4310



1 Meter body
2 Transducer with transducer sealing

Fig. 5: Overview: Wetted parts

3.5 FLOWgate™ operating software

3.5.1 Overview

The FLOWgate™ operating software allows user-friendly access to operating actions and measured values of the device.

Software functions

- Measured values overview
- Diagnosis data
- Logbook and archive management
- Commissioning
- Parameter modification
- Logbooks and archives
- Session browser

Fig. 6: FLOWgate™ operating software (example overview page)

3.5.2 System requirements

- Microsoft Windows 7/8/10/11
- Min. 1,8 GHz CPU
- Min. 1 GB RAM
- About 500 MB free disk capacity (without .NET framework)
- Bluetooth®, USB or serial interface
- Recommended minimum screen resolution: 1024 x 768 pixels, optimum screen resolution 1368 x 768 pixels
- Microsoft .NET framework 4.6

3.6 User management

3.6.1 Users and roles

The device provides up to 16 configurable users and 6 user roles with different access rights. 4 users are created by default at time of delivery, so up to 12 more users can be created and adjusted individually during commissioning.

For details on user roles and their access rights see tables see “Overview user roles”, page 20.

For details on users see table see “Overview users”, page 21.

Table 1: Overview user roles

Function	User roles			
	Guest	Operator	Service	Admin
Access priority level	0	1	2	3
Login required	-	X	X	X
Diagnostic status reading	X	X	X	X
Writeing of process conditions (e.g. pressure)	X	X	X	X
Diagnostic session	-	X	X	X
Archive readout	-	X	X	X
Commissioning	-	X	X	X
Field service	-	-	X	-
Calibration	-	X	X	X
User account readout	-	X	X	X
User management	-	-	-	X
Own password change	-	X	X	X
Firmware update	-	-	X	-
Factory parameter change	-	-	-	-

Table 2: Overview users

Users	Role	Password	User is by default ...	User can be deleted ...
Admin	Admin	see delivery documentation	activated[1]	no
Calibration	Operator		activated[1]	yes
-	Factory Service	-	deactivated[2]	no
-	Factory	-	deactivated[2]	no
Up to 12 more users	adjustable	adjustable	-	yes
-	Service	Admin to create user for trained service personal if service is needed for e.g. repairs / part replacement	-	yes

[1] can only be deactivated if a second admin account is created and activated
[2] needs to be activated by Admin in case of service intervention by Endress+Hauser factory service

3.6.2 User sessions

The device has a single user concept, so only one user can be active at any point of time. The user is restricted to the serial interface used at login. Access via other interfaces is possible, but with “Guest” level only.

If another user wants to login and terminate a running session, this is only allowed for user roles with equal or higher priority level. If a user is logged in, a logbook entry is generated with the user id, interface id and the user role.

3.6.3 Login procedure

For security reasons passwords are never stored or transmitted in plain text.

Technical information:

- Passwords are stored as “salted hashes” inside the device.
- Transmitting passwords using a challenge response mechanism to secure the transfer.

3.7 Data processing in FLOWSIC900

3.7.1 Logbooks

Custody logbook

Maximum number of entries: 1000

The custody logbook stores legally relevant events. These events contain any legally relevant warnings or errors and parameter changes. The logbook can be switched between rolling and stopping mode. If rolling mode is set, the oldest entries will be erased first. If stopping mode is set, the logbook stops event recording when it is completely full. In this case an error is generated and the measurement values are marked invalid. The logbook can only be cleared with opened hardware lock switch.

Additionally, a fill warning can be enabled for the logbook. If this mode is enabled, the device will generate a warning at 90% fill level of the logbook. In the stopping mode, the fill warning is enabled automatically.

If stopping mode is enabled, the logbook can be further configured to support the tracing of metrological parameter changes with closed hardware lock switch (metrological logbook function).

The traced change of metrological parameters with closed hardware lock is only possible below 90% of fill level. The following values can be changed this way:

- Impulse#1 factor
- Impulse#2 factor
- Replacement values for pressure and temperature
- Configuration of custody logbook

The logbook stores timestamp, totalizer, user identification, event number and additional event specific data. In case of parameter changes the previous and the new value will be stored.

Non-custody logbook

Maximum number of entries: 1000

The non-custody logbook stores non-legally relevant events. These events contain any non-legally relevant warnings or errors and parameter changes. The logbook works in a rolling mode. The logbook can be cleared with closed hardware lock switch.

The logbook stores timestamp, totalizer, user identification, event number and additional event specific data. In case of parameter changes the previous and the new value will be stored.

3.7.2 Archives

Diagnostic archive

Maximum number of entries: 10000

The diagnostic archive stores diagnostic data cyclically.

The storage period can be adjusted in the range of 15 minutes to 6 hours. The archive works in a rolling mode. With the standard storage periode of one hour, the archive history is one year.

The primary use of this archive is the analysis of historical measurement data. No totalizer data is recorded. The archive stores the timestamp, global measurement data, status and path measurement data. During one period the logged data is averaged.

The data recording is synchronized to the accounting hour, a reference point of day for billing purposes.

Hourly archive

Maximum number of entries: 10000 (1 year history)
The hourly archive stores totalizer, a maximum load monitor and additional data for billing purposes cyclically. The storage period is fixed to 1h. The archive stores 2 selectable totalizers.

Daily archive

Maximum number of entries: 2000 (5 years history)

The daily archive stores totalizer, a maximum load monitor and additional data for billing purposes cyclically. The storage period is fixed to 24h. The archive stores 2 selectable totalizers.

3.7.3 Protection of parameters from undesired changes

User identification and authentification

Every single communication item can only be read and written by a user with a dedicated user role. This applies for accesses via any serial interface with service protocol setting.

To access protected data elements the user must identify and authenticate with a login procedure. Within the login, a user session begins that gives access according to the user role. The session is terminated on logout or automatically with a configurable timeout. Users can be created, deleted and deactivated.

All credentials can be changed. Valid and invalid login attempts can be traced. A brute force protection mechanism protects with time limitation of login attempts. The communication of credentials is protected against man-in-the-middle attacks.

The device has a single user concept, so only one user can be active in any point of time.

Configuration mode

All configuration parameters are protected against unwanted changes with a configuration mode. This mode can only be activated with a valid user session with minimum level "Operator". The change of configuration mode is traced in the custody logbook. The measurement is invalid, if the hardware lock switch is open.

Locking switches

The device provides two sealable locking switches inside the housing.

- A metrological hardware lock switch protects against any changes of legally-relevant firmware, parameters and measured data.
  Some configuration parameters can be changed with open metrological hardware lock if the metrological logbook tracing has been enabled for the custody logbook.

- A software download lock switch protects against the remote download and installation of new firmware on closed metrological hardware lock

Interface write protection

Every serial communication line can be protected against changes by an additional interface write protection mechanism. If enabled by parametrization, only login and logout actions are still available.

Deactivation of insecure interfaces

The serial communication interfaces RS485#1 and RS485#2 can be deactivated. The local service interface can not be deactivated.

4 Transport and storage

4.1 Transport

During all transport and storage work, ensure:

- The measuring device is always well secured.
- Measures to prevent mechanical damage have been taken.
- Ambient conditions are within specified limits, see “Technical data”, page 82.

WARNING: Hazard due to heavy loads

When transporting the measuring device, there is a risk of crushing and impact due to the high weight.

- The measuring device may only be transported by competent persons.
- Only use lifting gear and equipment (e.g. lifting straps) suitable for the weight to be lifted.
- The lifting lugs are designed for transporting the measuring device only. Do not lift or transport the measuring device with additional loads using these lugs.
- Never attach lifting gear to the meter body neck and avoid contact between these parts and the lifting gear.

NOTICE: Avoid damage to the insulation

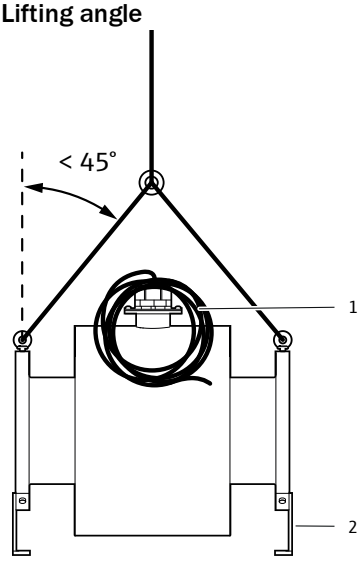
- Place the measuring device on a stable surface so that it cannot tip over. Otherwise, the insulation could be damaged.

NOTICE: Avoid damage to the cables

The connection cables to the remote SPU are pre-assembled on the meter body. The cables are attached to the meter body neck for transport.

- Make sure that the cables are not crushed during transportation
- Protect the cable ends.
- Attach the cable to the meter body neck in a suitable manner for each transport; bending radius: 100 mm.

Lifting angle



1 Connection cables (for ultrasonic transducers and temperature sensor)
2 Pipe shoes

Fig. 7: Lifting angle

The pipe shoes are used to ensure a secure stand during transportation and storage and to protect the insulation. They must be removed before the device is put into operation. We recommend storing the pipe shoes for later use when transporting the device.

4.2 Storage

- Ensure that storage conditions are within specified limits, see “Technical data”, page 82.
- If the device is stored outdoors, protect the measuring device from rain, UV radiation and other weather influences.
  The insulation is protected for short-term exposure to light weather during installation, but not for outdoor storage. Material: Tembutil 316
  Final weather protection is either given by field insulation (installed by plant operator) or by Endress+Hauser jacketing (optional).
- Make sure that open cable ends are protected against weather influences.

5 Project planning

5.1 Preparing the measuring point

- Select a suitable installation location.
- Ensure adequate assembly clearances.
- We recommend installing the flow meter at a low point in the system. Installation at the highest point should be avoided. It is recommended to install the flow meter in a lower section of pipe which also has a slight incline of 1° to 3°.
- Accurate thermal insulation upstream and at the meter is required for stable measurement and the promised measurement uncertainty.
- Pressure-influencing installations (flow conditioners, thermowells, expansions, tapers) that can cause cavitation or boil-off are not recommended to position too close to the meter.
- The meter must not be installed turned sideways for horizontal installation (neck / cable connection must be at the top or bottom).

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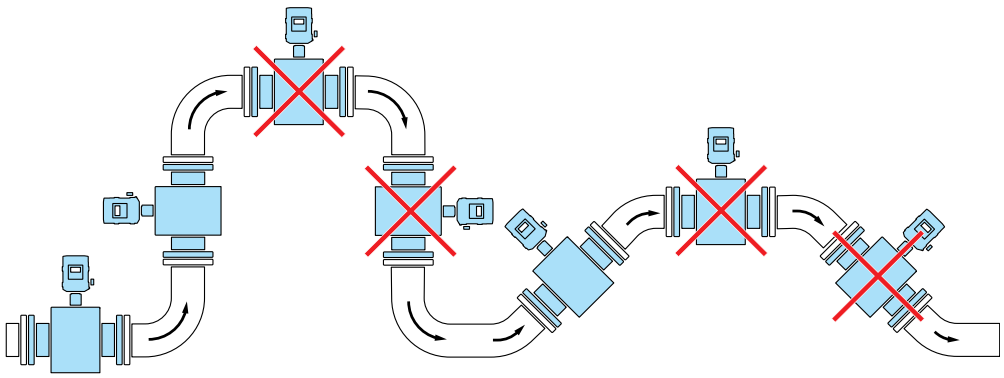


Fig. 8: Mounting locations

5.2 Choosing flanges, seals and other components

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

The FLOWSIC900 can be installed in straight inlet and outlet pipes depending on the installation configuration:

The inlet and outlet pipes must have the same nominal size as the meter body. The inner diameter is shown in the Data Sheet and is based on the nominal flange value and the standard.

The max. permitted difference of the inner diameter of the inlet pipe from that of the meter body is 1%. Any welding beads and burs on the flanges of the inlet pipe must be removed.

The same permitted difference applies for meters with butt welded process connections.

The root elevation of a weld seam on the inner part of the pipe after welding shall not exceed 1% of the inner diameter of the meter.

5.3 Installation location

Fit the measuring device in an easily accessible and protected position. Carry out all assembly work on-site.

The following must be taken into account:

- Maintain the ambient temperature range in accordance with the technical data under consideration of possible radiant heat (shield if necessary).
- Provide sufficient clearance for cables and opening the front panel.
- Select an installation location free of chemical influence.

It is recommended to:

- Protect against harsh atmospheric conditions (optional: use SPU weather and sun protection).
- Select an installation location free from vibrations and stabilize vibrations if necessary.

6 Mounting

6.1 Safety

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.

WARNING: Hazards through the measuring medium in the system

The following conditions can increase the risk:
- Toxic measuring medium or measuring medium dangerous to health
- Explosive measuring medium
- High pressure
- Hot or cold measuring medium

- ▶ Only carry out installation, maintenance and repair work when the system is non-pressurized.

WARNING:
- ▶ Observe applicable valid regulations, general standards and guidelines.
- ▶ Observe local safety regulations, operating instructions and special regulations.
- ▶ Observe the safety information in this document.
- ▶ Persons carrying out installation work must be familiar with the directives and standards applicable for pipeline construction and have the corresponding qualifications.

NOTICE:

The plant operator is responsible for the safety of the system under mechanical load.

6.2 Scope of delivery

The measuring device is delivered pre-assembled in sturdy packaging.

- ▶ Inspect for transport damage when unpacking the device.
- ▶ Document any damage found and report this to the manufacturer.

NOTICE:

Do not put the measuring device into operation if you notice any damage!

Scope of delivery

- ▶ Please see the delivery documents for the scope of delivery.
- ▶ Check the scope of delivery for completeness.

6.3 Required tools and auxiliary material

All screw drives on the meter are metric type. All tool sizes mentioned here refer to metric sizes.

Meter body

- Lifting gear or fork lift (load according to the specifications on the type plate)
- Box wrench or jaw wrench of suitable size for flange mounting
- Torque wrench
- Hex key, size 4, 5
- Thread seal (e.g. PTFE tape) and flange gaskets
- Bolt lubricant
- Cutter knife

SPU

- Hex keys size, 3, 4, 5, 10
- Small slotted screwdriver (size 2.5)
- Torx key, size 8
- Loctite
- Wrench, size 17

Replacement of RTC battery

- Torx screwdriver, size 10
- Small slotted screwdriver (max. 0.3 mm thickness)

6.4 Flow direction

Observe the fluid flow direction

- The fluid flow direction is indicated by direction arrows on the meter body flanges.
- The forward or main flow direction is marked with “+” and the reverse direction with “-”.
- In case of unidirectional use, ensure the meter is flowed through in the main flow direction marked with “+”.
- The measured volume is displayed with a negative sign when the meter is flowed through in reverse direction marked with “-”.

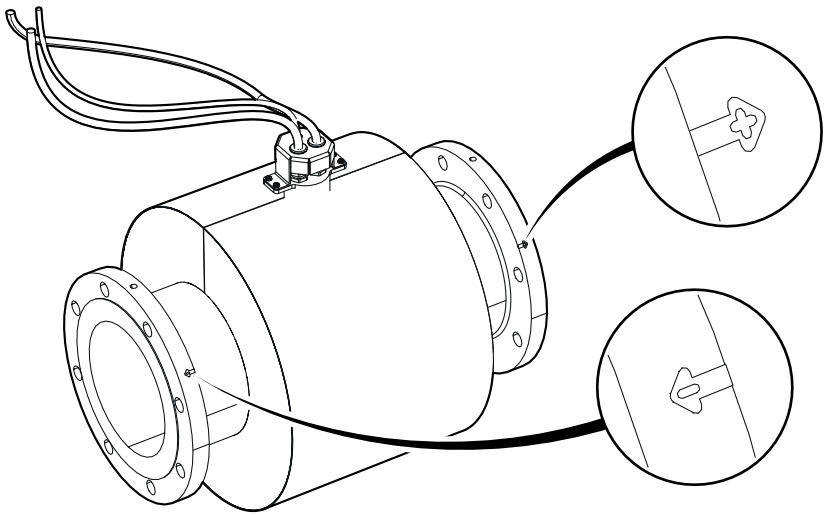


Fig. 9: Flow direction

6.5 Installation configurations

Custody transfer measurement

Number of measuring paths	Metrological standard	A
4	OIML R 117, Class 0.3	20 DN
8	OIML R 117, Class 0.3	5 DN

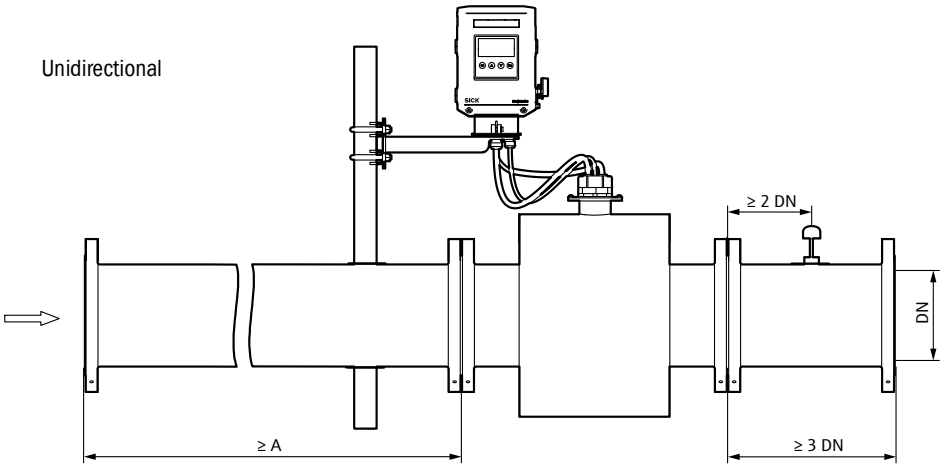
Process measurement

Number of measuring paths	Metrological standard	A
4	-	20 DN
8	-	5 DN

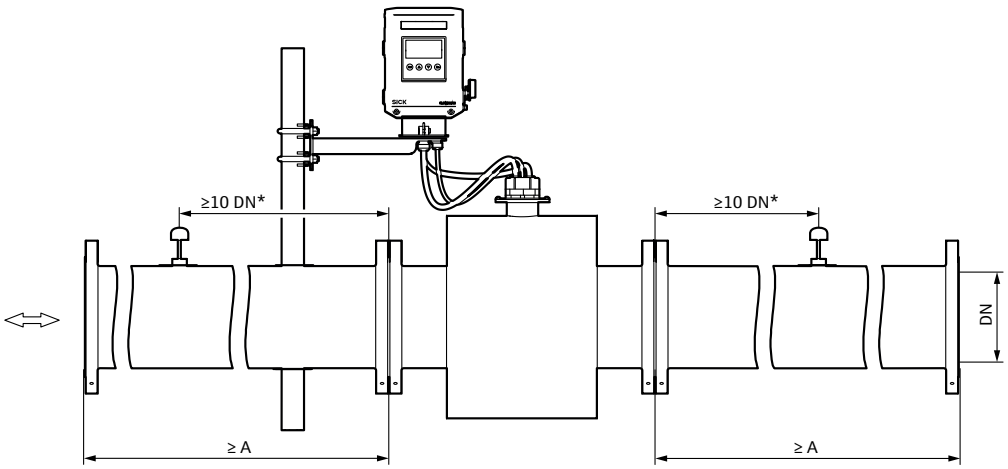
FLOWSIC900 with remote SPU

Note: Bidirectional operation
Recommendation for positioning the temperature measuring point for bidirectional operation: Downstream of the main flow direction used.

Unidirectional



Bidirectional



6.6 Fitting the meter body in the pipeline

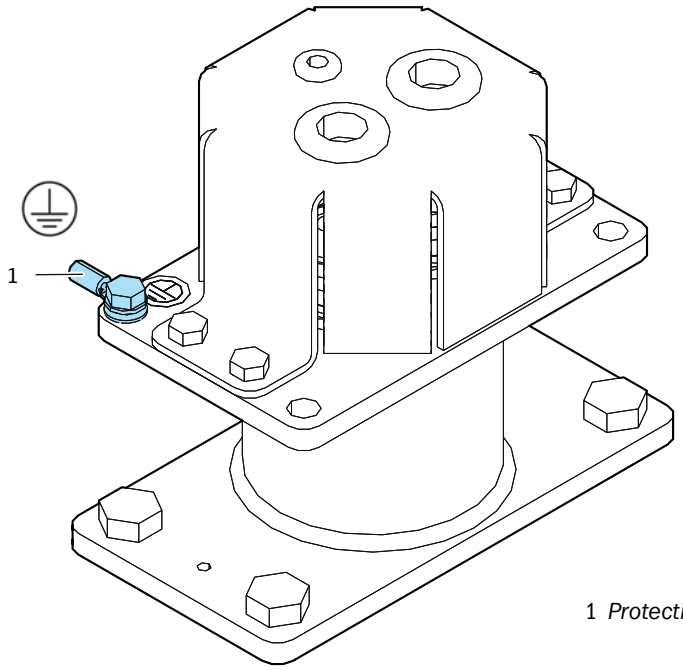
Installation in pipeline

1 Select suitable bolts.
2 Position the measuring device in the desired location in the pipeline. Lay the pipelines without tension to the device to be installed!
3 Check for correct seating and alignment of the flange gaskets after installing the flange bolts, but prior to tightening. The gaskets must not project into the area through which the fluid flows.
4 Align the FLOWSIC900 so that the offset of the inner diameters (bore) between inlet section, meter body and outlet section is as small as possible.
5 Insert the remaining fastening bolts and tighten the nuts cross-wise until the specified tightening torque is reached. The tightening torque applied must not be lower than specified in the project planning.
6 Slowly increase the pressure in the pipeline.
7 Carry out a leak tightness check on the pipeline with suitable means in accordance with the pipeline operating company's specifications.
8 Remove the pipe shoes after the device has been installed in the pipeline.We recommend storing the pipe shoes for later use when transporting the device.

Protective ground connection (meter body)

NOTICE:
The cable for protective ground connection for the meter body must not be longer than 3 meters.

▶ Connect the protective ground connection on the meter body neck.
Tighten the M6 screw with a tightening torque of 5 Nm (key size 10).



1 *Protective ground connection*

Fig. 10: Protective ground connection

6.7 Mounting the SPU

6.7.1 Wall fitting

NOTICE:

- ▶ Use suitable fixing material for mounting.
- ▶ Observe the total weight of the SPU (see “Technical data”, page 84) as well as local and legal regulations for the design of the wall construction and fastening material.

- ▶ Ensure sufficient mounting clearance.
  Dimensions, see “Dimensional drawings”, page 82.
- ▶ Maintain a general clearance of 25 cm around the enclosure to ensure sufficient air circulation for cooling the SPU.

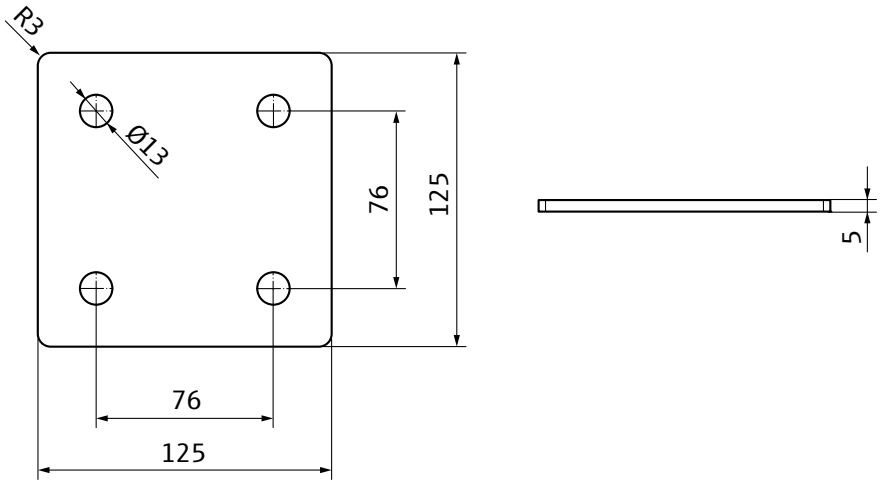
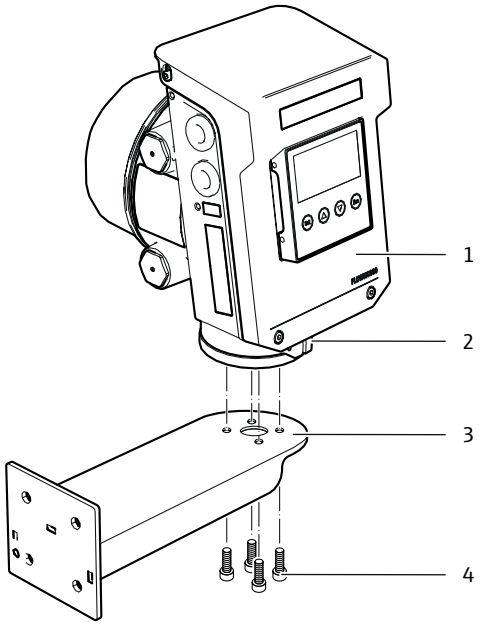


Fig. 11: Drilling pattern for wall mounting of the SPU bracket

- ▶ Mount the SPU bracket on the wall with suitable means.



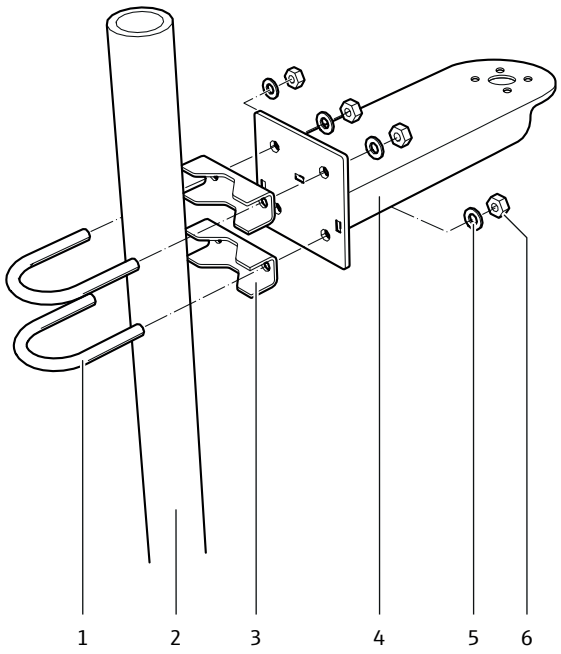
1 SPU (Signal Processing Unit)
2 Screws on the SPU neck (Front and back of the neck)
3 Bracket
4 SPU mounting screws

Fig. 12: Mounting the SPU on the bracket

- ▶ Place the SPU on the bracket.
- ▶ Secure the SPU on the bracket with the four screws from below with a hex key, size 5. Tightening torque: 6 Nm
- ▶ Adjust the SPU and secure the two screws on the SPU neck with a hex key, size 5. Tightening torque: 6 Nm

6.7.2 Mounting on a 2-inch pipe

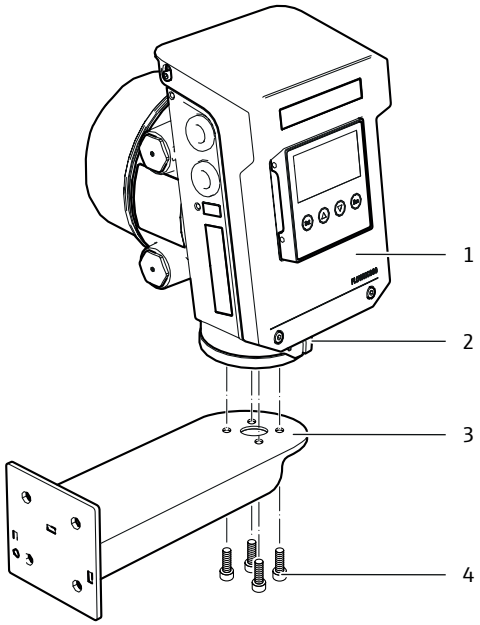
▶ Mount the SPU bracket on the 2-inch pipe.



1 Round steel bow
2 2-inch pipe
3 Fixture
4 Bracket
5 Washer
6 Nut

Fig. 13: Mounting the SPU on a 2-inch pipe

▶ Tighten the nuts hand-tight using an open-end wrench.



1 SPU (Signal Processing Unit)
2 Screws on the SPU neck (Front and back of the neck)
3 Bracket
4 SPU mounting screws

Fig. 14: Mounting the SPU on the bracket

- ▶ Place the SPU on the bracket.
- ▶ Secure the SPU on the bracket with the four screws from below with a hex key, size 5. Tightening torque: 6 Nm
- ▶ Adjust the SPU and secure the two screws on the SPU neck with a hex key, size 5. Tightening torque: 6 Nm

7 Electrical installation

7.1 Safety

All assembly work previously described must be completed (as far as applicable) before starting installation work.

WARNING: Electrical hazard
Incorrect cabling can cause device malfunctions, failure of the measurement system or serious injuries.
- ▶ Observe the relevant safety regulations as well as the safety notices during all installation work, see “For your safety”, page 10.
- ▶ Take suitable protection measures against possible local hazards or hazards arising from the equipment.
- ▶ All work may only be carried out when the device is disconnected from the power supply.

NOTICE:
- ▶ Disconnect power supply lines before working on power connections or parts carrying main voltage.
- ▶ The device must not be used if the electrical wiring (cables, terminals, ...) is damaged.

7.2 Cable specifications

WARNING: Electrical hazard
- ▶ The cables and wires must be permanently installed. The plant operator must provide adequate strain relief.
- ▶ Cables must have a permitted operating temperature of min. 85 °C.

NOTICE: Requirements on cables and installation
- ▶ Pay attention to the requirements in EN 60079-14 when selecting the cables and during installation!
- ▶ Further legal requirements must be observed for use in explosive atmospheres.
- ▶ Only copper wires may be used.

Cables

- ▶ Protect cables especially endangered by thermal, mechanical or chemical stress, e.g. by laying in protective tubes.
- ▶ Cables must be flame-retardant according to DIN VDE 0472 Part 804. The fire behavior according to B / IEC 60332-1 must be approved.
- ▶ The existing air and creepage paths according to EN 60079-7 or EN 60079-15 may not be reduced by cable connections in the terminal box.
- ▶ Protect the wire ends with connector sleeves against fraying.
- ▶ Connect or safeguard unused wires to ground so that a short circuit with other conductive parts is excluded.
- ▶ Carry out potential equalization in accordance with EN 60079-14 (see also the following Section).
- ▶ Cable cross-sections and see “Terminal assignment Ex-d terminal compartment”, page 46.

Specific requirements for installation in the USA and Canada

- ▶ Installations in USA must be carried out according to NEC (ANSI/NFPA70).
- ▶ Installations in Canada must be carried out according to CEC part 1.

7.3 Cable entries

The FLOWSIC900 has four cable entries: 4 x 3/4" NPT or 4 x M25x1.5, see “Electrical connections”, page 41.

- Depending on the device version, all device inputs are installed with certified cable glands, certified blind plugs or non-certified transport plugs.
  Be aware that all non-certified transport blind plugs have to be changed to certified cable glands or blind plugs!
- Only installation material approved for the applied hazard zone may be used. The user is responsible for correct selection.
- Observe the clamping range of the cable glands for cable selection.
- Unused cable glands must be sealed with the plugs already fitted at the factory.

NOTICE:
If smaller cable entries are required, the user can use suitable and certified reducers. The user is responsible for correct selection.

7.4 Requirements for installation in the Ex zone

WARNING: Dangerous voltage

- It must be ensured that the rated voltage U_m 60 V is not exceeded when connected to devices not belonging to the system, in particular external power supply devices, power supply units, etc.
- For the power supply, power supplies categorized as “CLASS 2” and “SELV” according to the Canadian Electrical Code, C22.1 and the National Electrical Code NFPA 70 or comparable standards must be used for the DIV systems.
- For IECEx applications, SELV /PELV power supplies or power supplies conforming to the IEC 60950 or IEC 61010-1 or comparable standards must be used.
- A suitable main power switch must be provided.
- Take the device out of operation immediately and do not switch it on again when cables, terminals, the enclosure or Ex components are damaged.

WARNING: Dangerous voltage

- Do not open when energized.

WARNING: Ignition hazard through electrostatic discharge

The electronic housing is painted in the factory with a layer thickness of more than 0.2 mm. 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. The respective devices will be identified by the manufacturer with a warning notice.

WARNING: Risk of explosion

DO NOT OPEN WHEN ENERGIZED!

- The equipment contains a shunt Zener diode barrier, which requires connection to a barrier earth in accordance with IEC 60079-14.
- In non-intrinsically safe installations, the terminal boxes may only be opened if the system is disconnected from the power supply.
- In non-intrinsically safe installations, the cables may only be disconnected if the system is disconnected from the power supply.
- The terminal compartment cover must only be opened if the system is disconnected from the power supply and only 10 minutes or more after the system has been switched off, or the area is known to be non-hazardous.

WARNING: Risk of ignition through impacts or friction

The ultrasonic transducers are made from titanium. Parts of the electronic enclosure are made from Aluminium. In rare cases, ignition sources due to impact and friction sparks could occur.

- The user must ensure that the enclosure is suitably protected against danger from impact or friction. (see Clause 8.3 of IEC 60079-0)

WARNING: Ignition hazard through impacts

The maximum piezoelectric energy that can be released through impacts on the ultrasonic transducers exceeds the limit for Gas group IIA specified in §10.7 of EN60079-11:2012.

- The user must ensure the ultrasonic transducers are protected adequately against hazards caused by impacts.

General operating conditions

The FLOWSIC900 is designed solely for use under normal atmospheric conditions in potentially explosive atmospheres.

The atmospheric conditions must be within the described ranges, see “Technical data”, page 84.

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

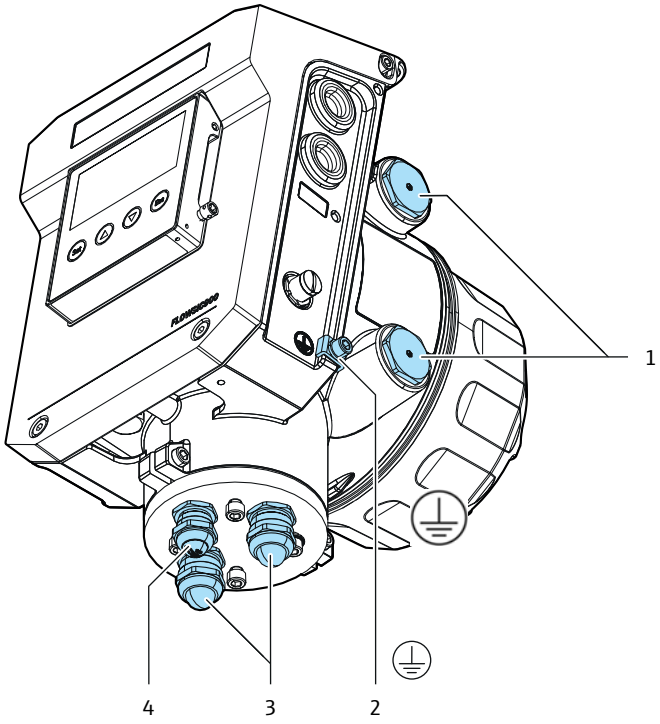
The meter body becomes part of the pipeline as soon as the FLOWSIC900 is installed in the pipeline. The wall of the pipeline and the meter body are then deemed a zone-separating barrier.

General information

- The documentation for zone classification according to EN 60079-10 must be available.
- The devices to be used must be checked for suitability for the application area.
- After installation, an initial test of the device and the plant according to EN/IEC 60079-17 must be performed.

7.5 Electrical connections

7.5.1 Overview



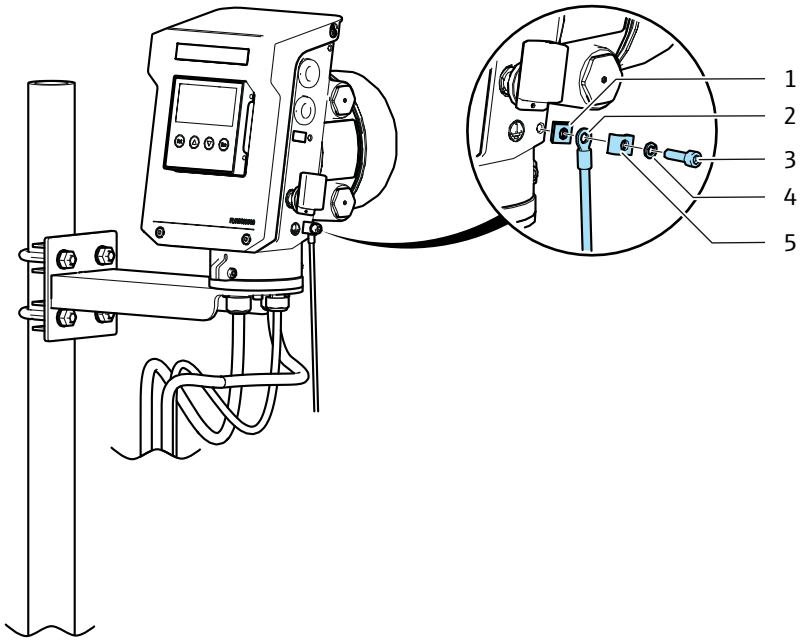
1 Cable entries
2 Exterior ground terminal
3 Two cable glands M20
4 Cable gland M16

Fig. 15: Electrical connections

7.5.2 Exterior ground terminal

NOTICE:
The cable for protective ground connection for the meter body must not be longer than 3 meters.

▶ Connect the protective ground connection.
Use a hex key, size 5. Tightening torque: 6 Nm

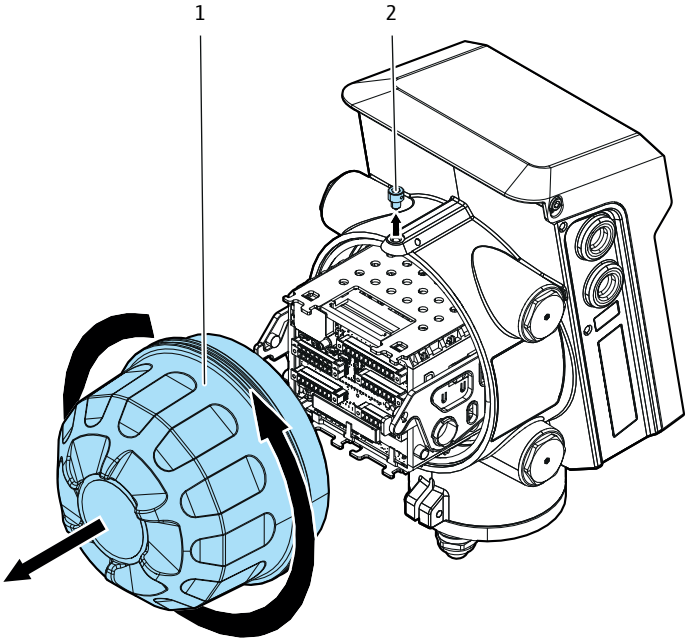


1 Square washer
2 Line
3 Screw M6
4 Washer
5 C-profile

Fig. 16: Protective ground connection

7.5.3 Ex-d terminal compartment

7.5.3.1 *Opening and closing the Ex-d terminal compartment*



1 Ex-d terminal compartment cover
2 Securing screw

Opening the Ex-d terminal compartment

1 Loosen the securing screw on the Ex-d terminal compartment cover with a hex key, size 5.
Ensure the tip of the screw no longer extends into the groove of the cover.
2 Unscrew the terminal compartment cover.
To loosen the cover, position a suitable tool (e. g. the shaft of a ring spanner) in the provided recesses in the cover.

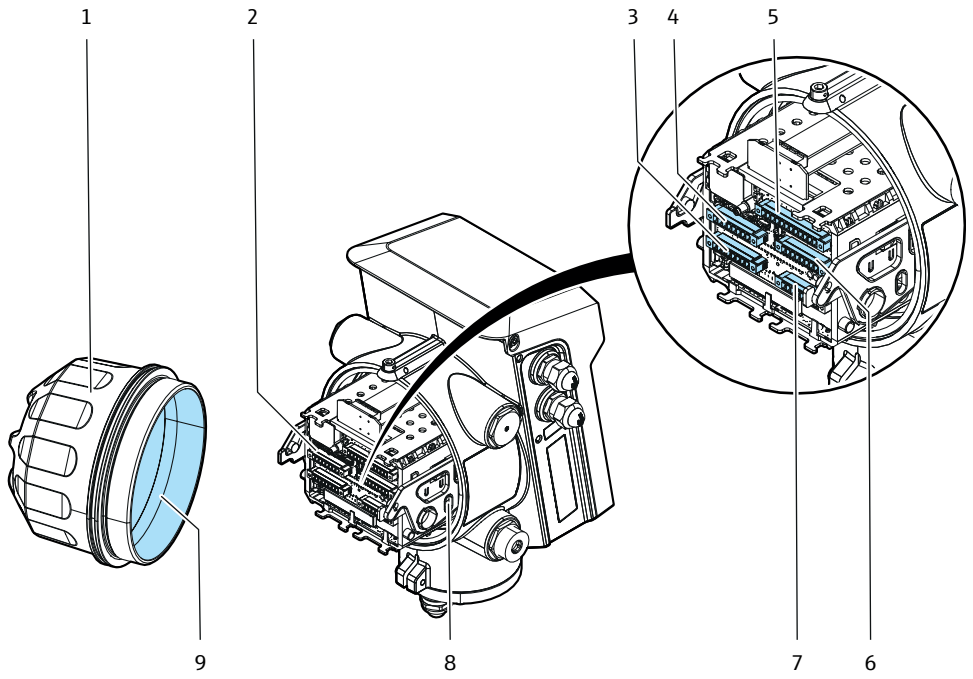
Closing the Ex-d terminal compartment

1 Make sure that the threads are clean.
Grease the threads with an assembly paste as required.
2 Screw the terminal compartment cover back on hand tight.
Do not use a tool for this work step.
3 Tighten the securing screw on the Ex-d terminal compartment cover with a hex key until the tip of the screw slightly enters the material of the cover.
Tightening torque: 2 Nm
Do not operate the device without the securing screw!

If the following parts are lost or damaged, they can be reordered using the part numbers provided:

Part no.	Description
2142865	Ex-d compartment Cover
2142894	O-Ring Ex-d compartment Cover

7.5.3.2 *Ex-d terminal assignment*



1 Ex-d terminal compartment cover
2 Ex-d terminal compartment
3 Plug P1
4 Plug P2
5 Plug P3
6 Plug P4
7 Plug P5
8 RS485 termination switches
9 Terminal labeling for plugs P1-P5

Fig. 17: Overview Ex-d terminal compartment

On delivery, the plugs are already plugged in and must be assigned by the user. Make sure that the pin assignment is correct see “Terminal numbering plugs P1-P5”, page 44 and see “Terminal assignment Ex-d terminal compartment for plugs P1-P5”, page 45.

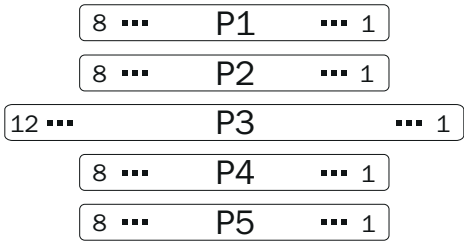


Fig. 18: Terminal numbering plugs P1-P5

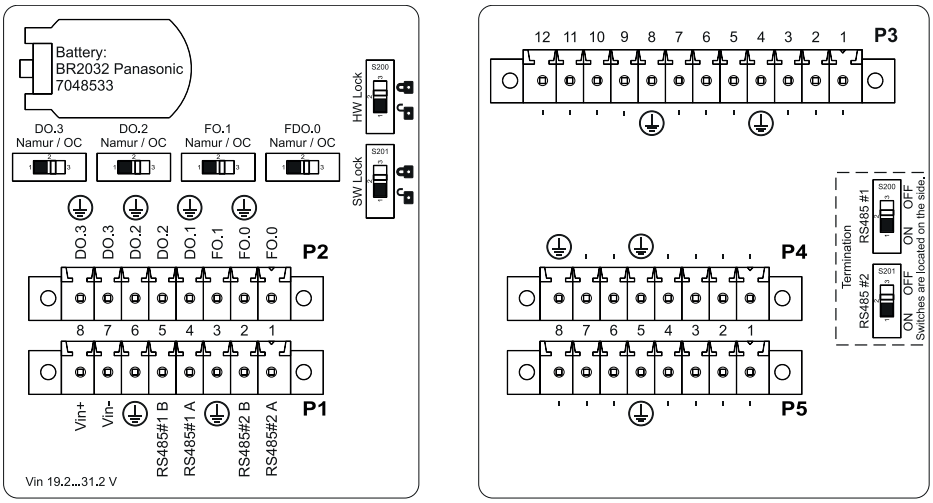


Fig. 19: Terminal assignment Ex-d terminal compartment for plugs P1-P5

Terminal assignment Ex-d terminal compartment

Plug designation	Pin No.	Signal name	Function	Comment	Conductor size
J100	1	RS485#2A	Serial RS485 [1]	RS485.2	0.5 … 1.5 mm²
	2	RS485#2B			
	3	GND			
	4	RS485#1A	Serial RS485 [1]	RS485.1	
	5	RS485#1B			
	6	GND			
	7	Vin-	Minus pole	Voltage supply, galvanically isolated from device grounding “GND”	
	8	Vin+	Positive pole		
J101	1 -8	Reserved for future extensions			0.5 … 1.5 mm²
J102	1-8	Reserved for future extensions			0.5 … 1.5 mm²
J103	1	FO.0	Frequency output	Pulse	0.5 … 1.5 mm²
	2	FO.0 GND			
	3	FO.1	Frequency output	Pulse	
	4	FO.1 GND			
	5	DO.2	Digital output	Status	
	6	DO.2 GND			
	7	DO.3	Digital output	Status, encoder	
	8	DO.3 GND			
J104	1-12	Reserved for future extensions			0.5 … 1.5 mm²

[1] Maximum cable length: 1000 m total length; cable: twisted pair, shielded

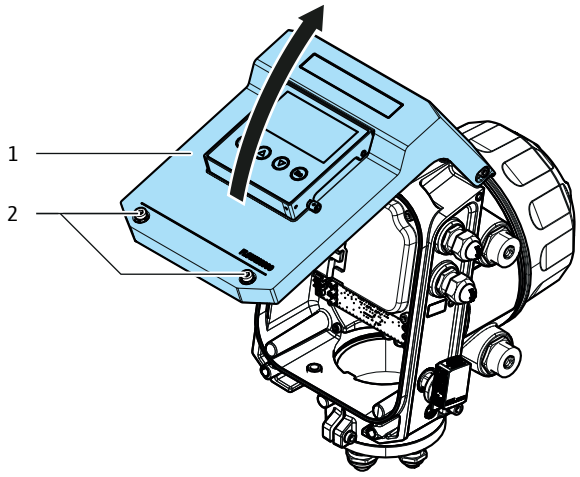
If the following parts are lost or damaged, they can be reordered using the part numbers provided:

Part no.	Description
2143051	Set of connection terminals

7.5.4 Ex-i terminal compartment

7.5.4.1 *Opening and closing the Ex-i terminal compartment*

Opening the Ex-i terminal compartment



1 Ex-i terminal compartment screws (captive)
2 Ex-i terminal compartment cover

1 Loosen the two screws (captive) of the Ex-i terminal compartment cover with a hex key, size 4.
2 Fold the terminal compartment cover upwards.

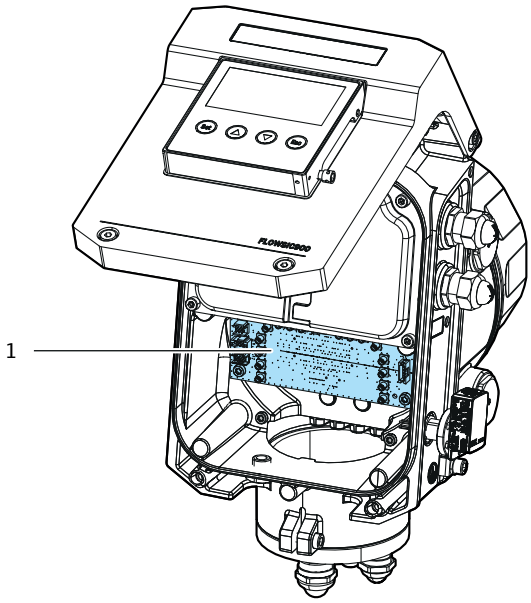
Closing the Ex-i terminal compartment

1 Ensure the sealing area is free from contamination.
2 Fold the terminal compartment cover downwards. Pull the terminal compartment cover forwards out of the catch when closing it.
3 Tighten the 2 screws (captive) of the Ex-i terminal compartment cover with a hex key, size 4. Tightening torque: 4 Nm

Intrinsically safe connections

U_o	I_o	P_o	C_o	C_i	L_o
Service interface (M12 socket on the side of the device)					
6.42 V	117 mA	410 mW	999.7 µF (IIA)	110 nF (IIA)	10.39 mH (IIA)
Display interface (M12 socket in front cover)					
6.42 V	117 mA	410 mW	999.7 µF (IIA)	12.2 nf (IIA)	10.39 mH (IIA)

7.5.4.2 *Ex-i terminal assignment*



1 *Ex-i terminal assignment*

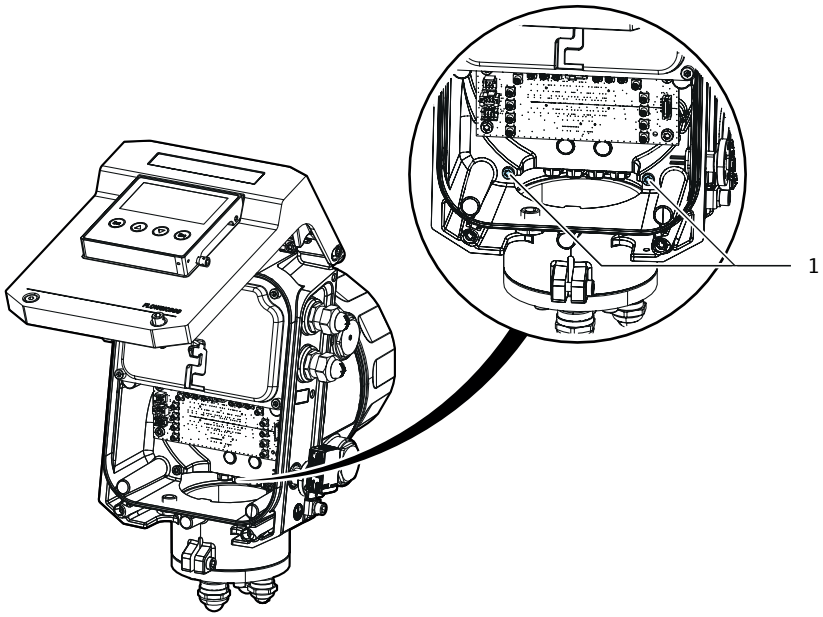
Fig. 20: Overview Ex-i terminal compartment

Connection of cables from the meter body

- Pass the connection cables for the transducers and the temperature sensor cable coming from the meter body through the cable glands and tighten with the defined torque.

Cable gland	Torque	Cable
M16	5 Nm	Internal Temperature sensor connection cable
M20	7 Nm	Transducer connection cables

- Both connection cables for the transducers have a shield connection cable.
- Connect the shield cables via the M4 tubular cable lug in the SPU housing on the left and right and tighten with 3 Nm.



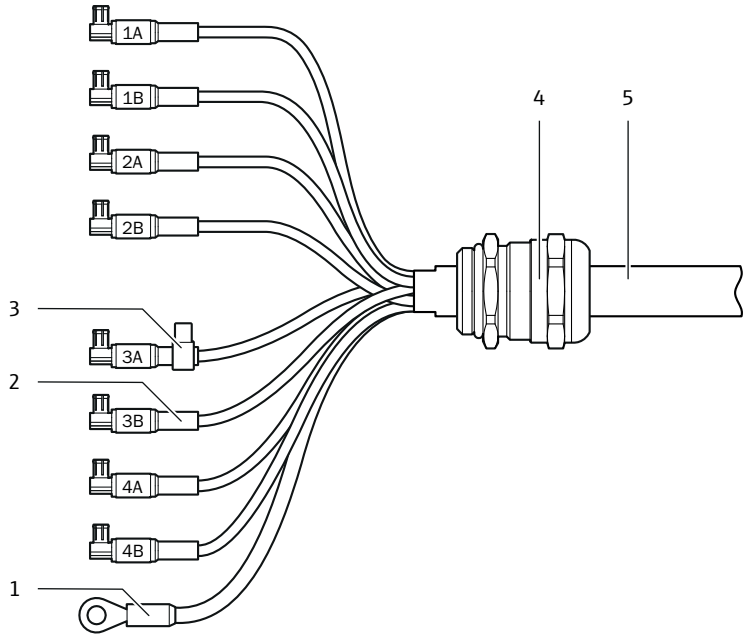
1 Screws for shield connection

Fig. 21: Shield connection

▶ Connect the cable plugs with the right socket on the Ex-i terminal board as assigned in Table 3.

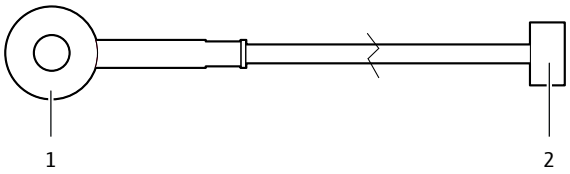
Table 3: Transducer connection

Cable plug		Terminal labeling
Labeling clip	**Yellow clip**	
1A	-	1-1A
2A	-	1-2A
3A	-	1-3A
4A	-	1-4A
1B	-	1-1B
2B	-	1-2B
3B	-	1-3B
4B	-	1-4B
1A	X	2-1A
2A	X	2-2A
3A	X	2-3A
4A	X	2-4A
1B	X	2-1B
2B	X	2-2B
3B	X	2-3B
4B	X	2-4B



1 Shield connection
2 Labeling clip
3 Additional yellow clip (only for path plane 2)
4 Cable gland (on SPU)
5 Multicoax cable (to meter body)

Fig. 22: Connection cables for the transducers



1 *Connection cable for the internal temperature sensor*
2 Plug (Terminal J206)

Fig. 23: Connection cable for the internal temperature sensor

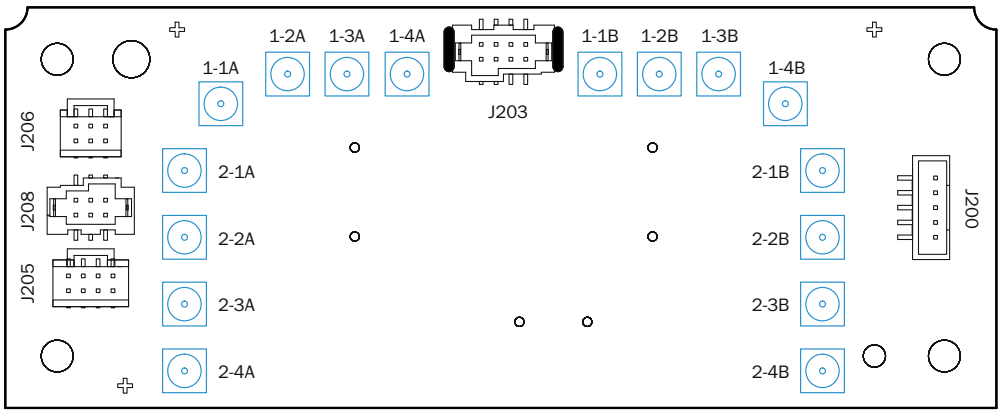


Fig. 24: Terminal assignment Ex-i terminal compartment

Terminal assignment Ex-i terminal compartment

Socket	Function
J200	Service connector, factory-wired
J203	Display connector, factory-wired
J206	6-pin connection cable for the internal temperature sensor from the meter body
J208	for future use
J205	for future use
MCX:	
1-1A ... 1-4A 1-1B ... 1-4B	For connection of ultrasonic transducers, path plane 1; first connection cable for the transducers from the meter body
2-1A ... 2-4A 2-1B ... 2-4B	For connection of ultrasonic transducers, path plane 2; second connection cable for the transducer cable from the meter body Path plane 2 exists only for Forte 8-path meter version.

7.5.5 Switching (Open Collector - Namur) on digital outputs

NOTICE:
Electrical parameters, see “Technical data”, page 84 “Digital outputs”.

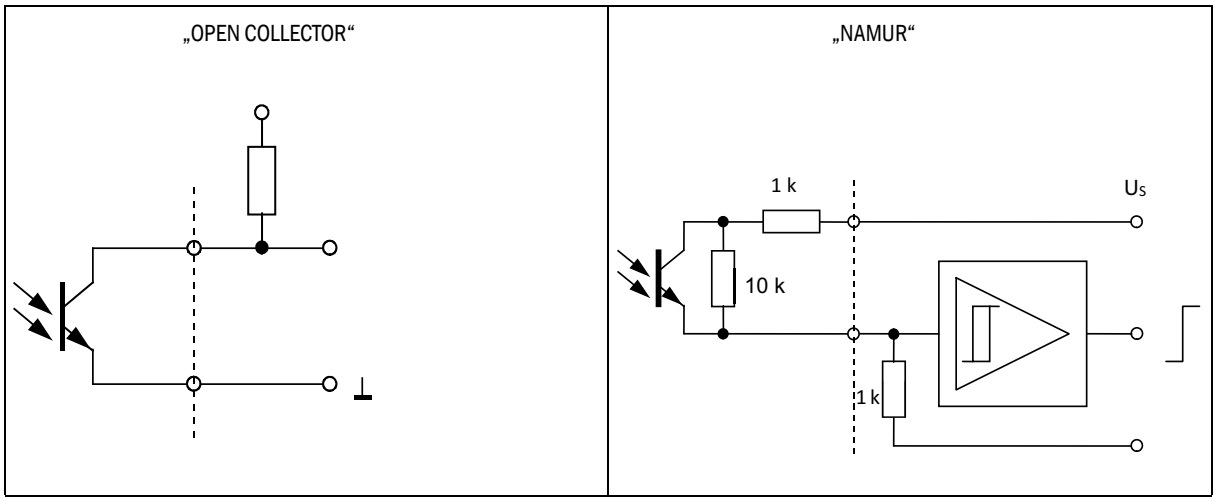


Fig. 25: DO circuitry (Open Collector - Namur)

7.5.6 Termination resistors of serial RS485 lines

For the serial RS485 lines, termination resistors can be optionally connected via switches (RS485#1 and RS485#2).

The termination network is structured as follows:

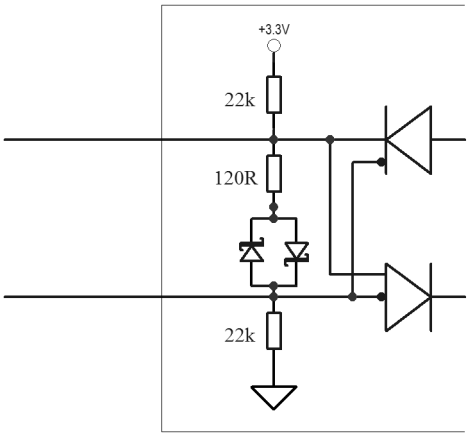


Fig. 26: Termination

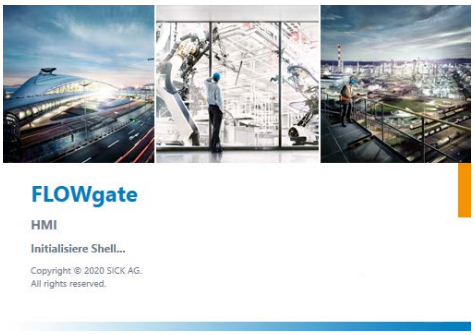
8 Commissioning

8.1 Important information

All activities described in „Mounting“ and „Electrical installation“ must be completed before commissioning.

8.2 Commissioning with the FLOWgate™ operating software

8.2.1 Auxiliary means and accessories required

FLOWgate™ is available on the Endress+Hauser website. 	The current FLOWgate™ version is available via www.endress.com
CDBT100 Connection device Bluetooth®	Available as an accessory
CDUSB100 Connection device USB	Available as an accessory

8.3 Connecting to the device via Bluetooth

1 Install the FLOWgate™ operating software.
2 For connection via Bluetooth®, connect the CDBT100 adapter.

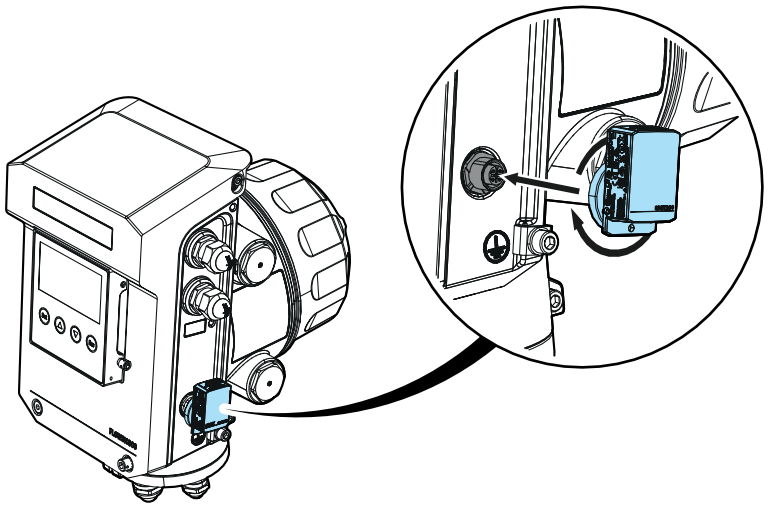
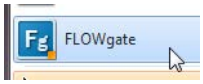


Fig. 27: Connecting the CDBT100 adapter

3 Click on the icon to start FLOWgate™: 

4 In FLOWgate™ click on icon “Scan” and scan for the device: 

5 When the device has been found, click on “Connect”.

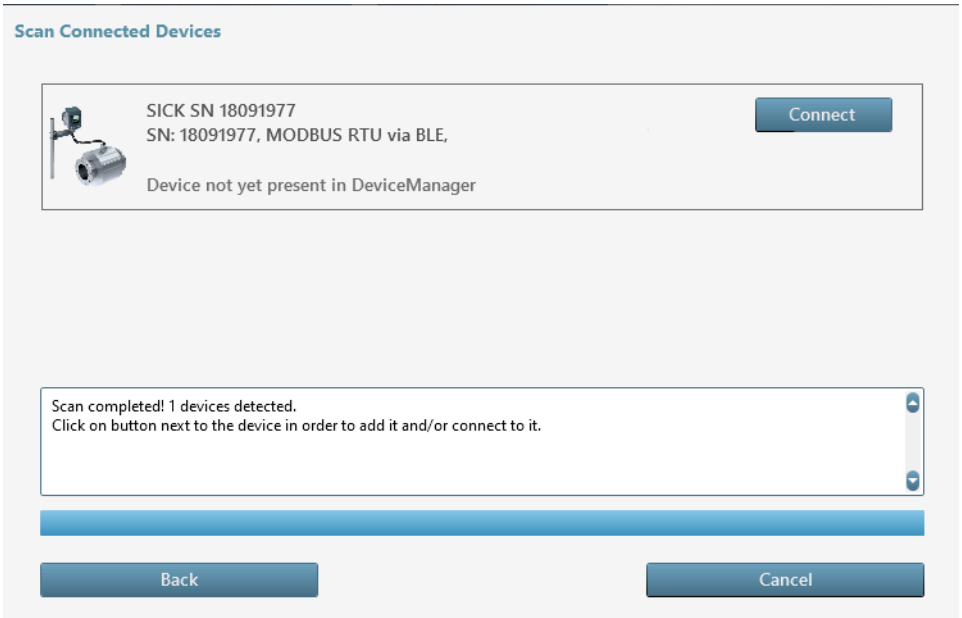


Fig. 28: Device found

6 Enter the Bluetooth® PIN (pairing key) and click “OK” to confirm.

Note:
The default Bluetooth® PIN is “0000“.
Your personal password for the “Admin” user can be found in the delivery documentation.

.

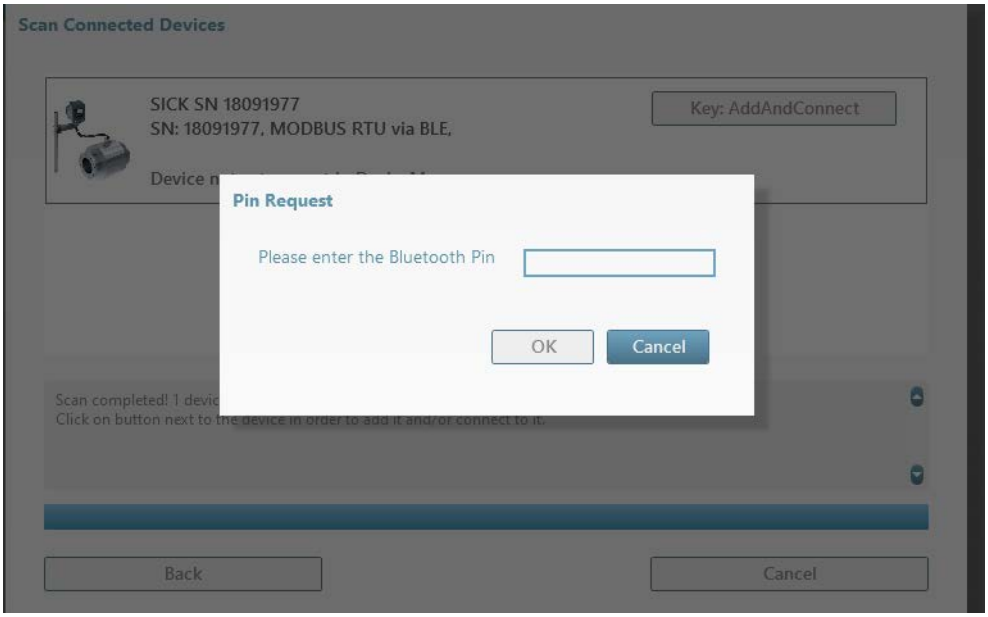


Fig. 29: Bluetooth® PIN

7 Login to the device as user “Admin”.
After successful login the Overview page is displayed.

8.4 Connecting to the device via USB

1 Install the FLOWgate™ operating software.
2 For connection via USB, connect the CDUSB100 adapter.

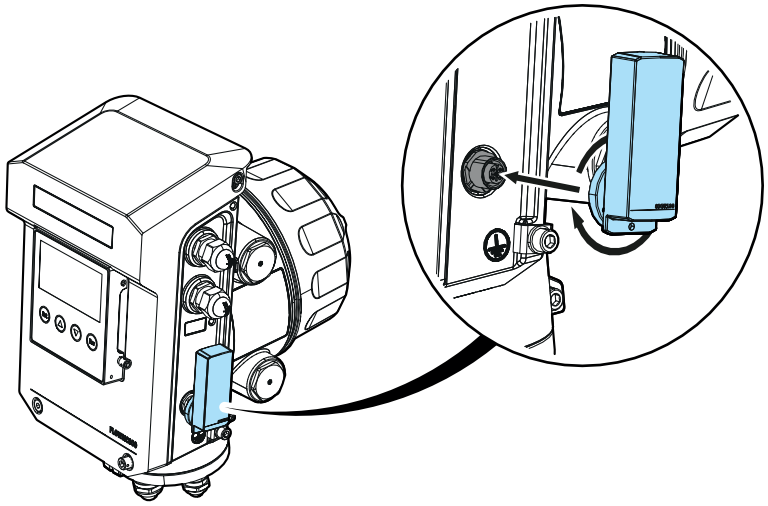
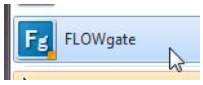


Fig. 30: Connecting the CDUSB100 adapter

3 Click on the icon to start FLOWgate™: 

4 In FLOWgate™ click on icon “Scan” and scan for the device: 

5 Select Serial port in the “Interface selection” window.

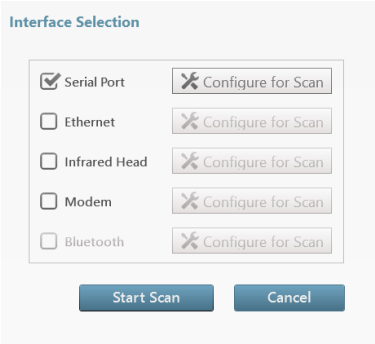


Fig. 31: Interface selection

6 Select the respective com port and the device-specific parameters.

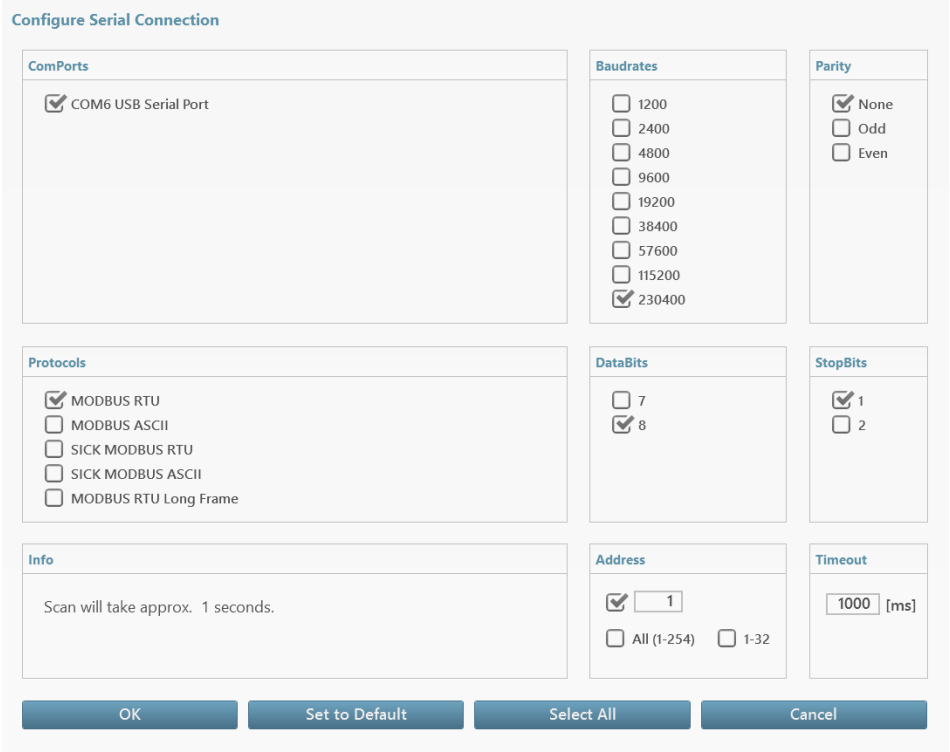


Fig. 32: Configure serial connection (examplary)

7 When the device has been found, click on “Connect”.

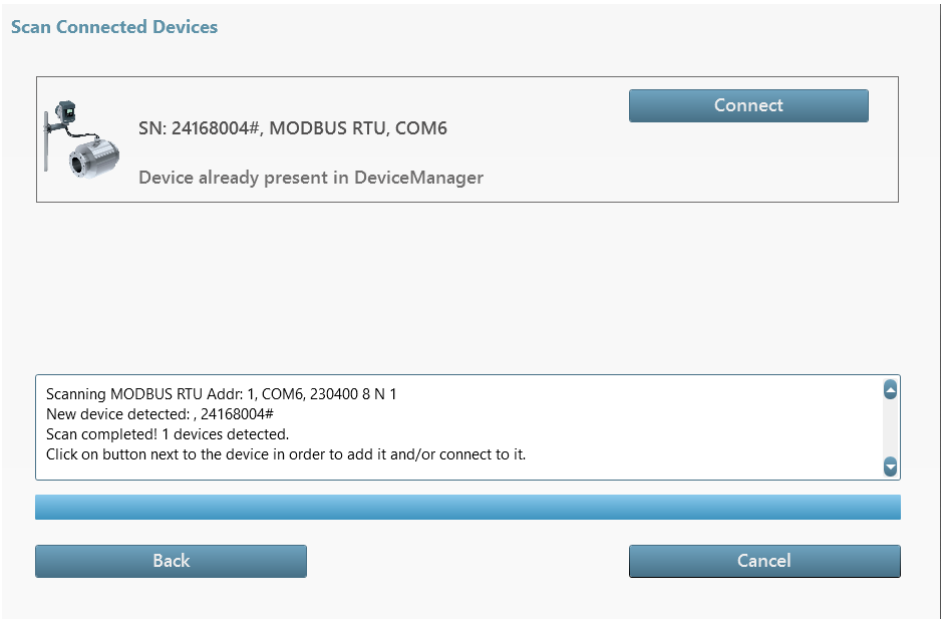


Fig. 33: Device found

8 Login to the device as user “Admin”.
After successful login the Overview page is displayed.

8.4.1 Commissioning wizard

8.4.1.1 *Overview*

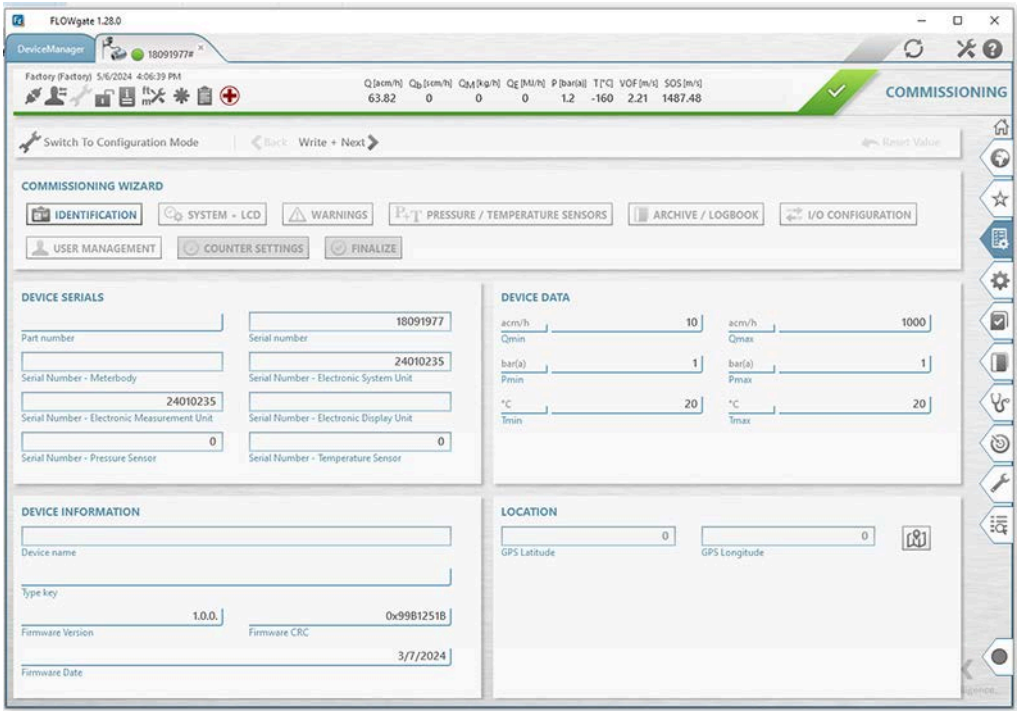


Fig. 34: Overview: Commissioning wizard

8.4.1.2 *Identification*

Device serials

▶ Check the device serial numbers: Compare the serial number against the main type plate.

Device data

▶ Check the device data: Compare the entries against the type plate.

Device information

▶ Enter a device name: The device name is freely selectable.

Location

The GPS coordinates of the flow meter can also be entered as an option.

This allows showing the location of the flow meter on Google maps.

8.4.1.3 *System + LCD*

Device date and time

Enter the date and time or synchronize with the PC.

Device units

The units are set at the factory as ordered.

Check the settings and adapt if necessary.

Device display

Configure the display language, units and time format as well as the measuring values to be shown on the display.

The display has two rolling display pages. Each display page can be parameterized with up to four display lines with measurement counters, measurement and diagnostic values and device information.

Via the button “Start testmode” a testmode for display function and brightness and contrast settings can be started optionally.

8.4.1.4 *Warnings*

Configure system and path warnings.

Warning limits

The standard limits for LNG applications are set at the factory.

Configure the warning limits as desired for you application.

User warnings activation

The warnings signaled by the device can be individually activated or deactivated. Activate single warnings as desired.

8.4.1.5 *Pressure/temperature sensors*

Select the source of pressure and temperature values and configure replacement values and the warning levels for pressure and temperature deviations.

8.4.1.6 *Archive/Logbooks*

Logbooks

- ▶ Select the totalizer which is used for entries in the custody logbook.
- ▶ Configure the custody logbook:
  - – Stopping: A warning is output when the logbook is full.
  - – Rolling: The oldest entries are overwritten when the logbook is full.

Data archive settings

- ▶ Configure the interval for the diagnostic archive. The default interval is set at the factory; default: 60 minutes.
- ▶ Configure the accounting hour: Totalizers and data are saved at the defined accounting hour time (standard = 6:00 AM).

8.4.1.7 *I/O Configuration*

In the I/O configuration step, the parameters can be set for the interfaces available in accordance with the ordered configuration.

8.4.1.8 *User management*

NOTICE:
Endress+Hauser recommends changing the initial password provided for the administrator for security reasons.

Up to 12 further users can be configured here:

- ▶ Enter a user name and specify a password.
- ▶ Select a user level.

- ▶ Select an expiration date for the account or activate the checkbox “Account never expires”.
- ▶ To create the new user, click on “Create account”.

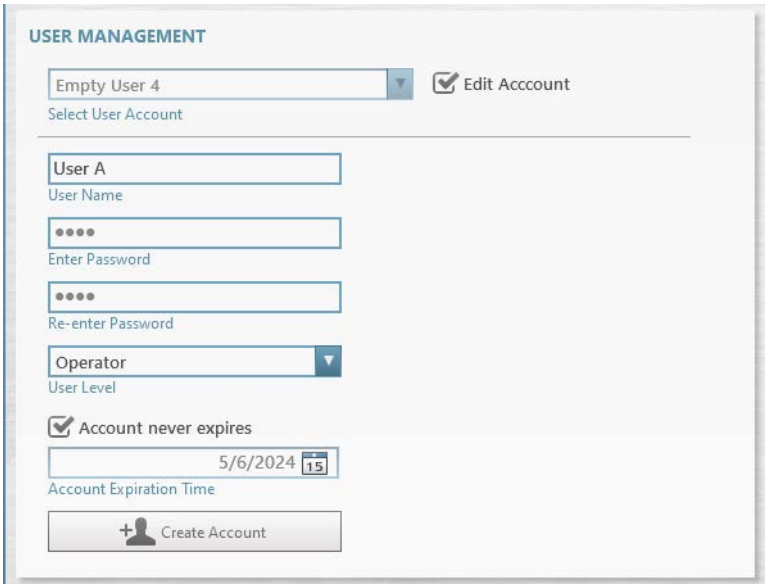


Fig. 35: User management

8.4.1.9 *Counter settings*

- ▶ Configure the resolution for the totalizers.

8.4.1.10 *Finalize*

Finalize

- ▶ If desired, reset the totalizers and clear the logbooks and the archive.

Generate reports

- ▶ Endress+Hauser recommends creating a parameter report and and a maintenance report and archiving the reports with the delivery documentation.

8.4.1.11 *Path failure compensation*

If Path compensation is activated:

The FLOWSIC900 can compensate one failed measuring path.

In a 4-path and 8-path system, the flow meter compensates for one failed measuring path and issues a warning in case of one failed measuring path. In that case, the measurement is still valid.

A path is considered failed when its acceptance rate is below the threshold.

Its path velocity is then not longer used to create measured values, but is substituted by a pre-configured path velocity value. Its path velocity is included in measurement when its acceptance rate is above the threshold again.

Multiple path failures result in “measurement invalid”. The meter issues an error and increments the disturbance volume.

If Path compensation is deactivated:

A single path failure or multiple path failures result in “measurement invalid”. The meter issues an error and increments the disturbance volume.

Path compensation is deactivated by default. If path compensation should be activated, it is recommended to set the parameters during commissioning / operation at typical process.

8.4.2 Function check after commissioning

Check the device status, see “Checking the meter state with FLOWgate™”, page 66.

The check for meter performance needs (flowing) LNG inside of the meter.

9 Operation

9.1 Operating using the display

The display is intended for reading measurement and diagnostic values, not for parameterizing the device.

NOTICE:
The display can be read down to a temperature of -20 °C. Below this temperature, the display may “freeze”. The display is not damaged below -20 °C to -40 °C. If the temperature rises to -20 °C or higher, the display can be read again.

Display in the symbol bar

Symbol	Significance	Description
✔	Device status: Ok	Measurement valid, no warning or error
	Device status: Malfunction	Error, the measured value is invalid
⚠	Device status: Warning	Warning, the measured value is still valid
	Registered events	Unacknowledged entries in logbook
	Parameter locking switch closed	Metrologically relevant parameters are protected against changing
	Parameter locking switch open	Metrologically relevant parameters can be changed
	Configuration mode	Configuration mode is active, parameters can be changed

9.1.1 FLOWSIC900 display menu

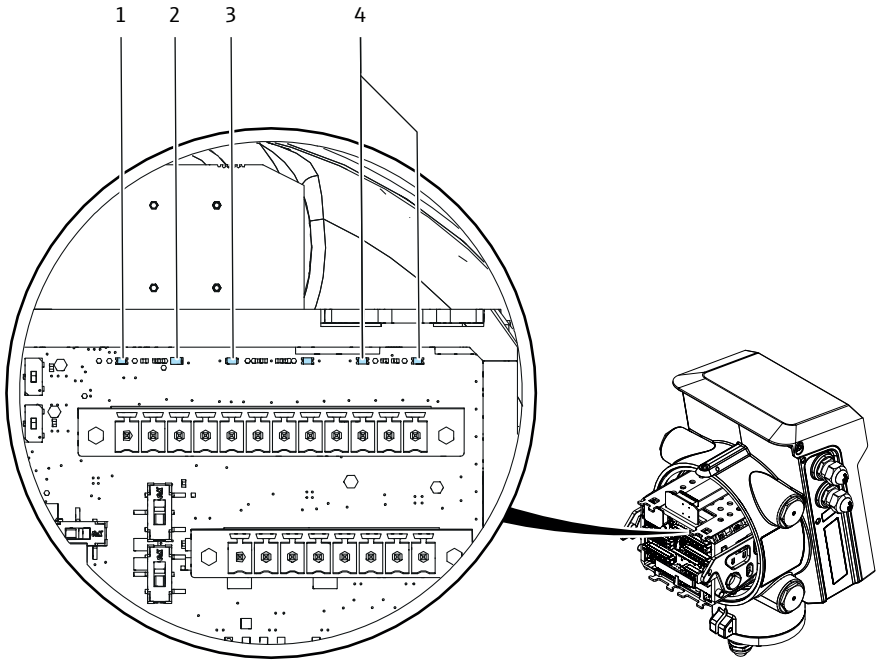
Table 4: Display menu

Menu level 0	Menu level 1	Menu level 2	Meaning
Main page 1			Major measuring values page 1 (adjustable)
Main page 2			Major measuring values page 2 (adjustable)
Device status			Device status menu
	Current events		Overview of current events
		Current event list	List of current events
	Event summary		Overview of history events
		Event summary list	List of historic events
	Last event reset		Time of last historic event reset
Totalizer values			Totalizer menu
	+V		Forward volume a. c. (undisturbed)
	-V		Reverse volume a. c. (undisturbed)
	+Ve		Forward volume a. c. (error)
	-Ve		Reverse volume a. c. (error)
	+Vt		Forward volume a. c. (total)
	-Vt		Reverse volume a. c. (total)
	+E		Forward energy (undisturbed)
	-E		Reverse energy (undisturbed)
	+Ee		Forward energy (error)
	-Ee		Reverse energy (error)
	+Et		Forward energy (total)
	-Et		Reverse energy (total)
	+M		Forward mass (undisturbed)
	-M		Reverse mass (undisturbed)
	+Me		Forward mass (error)
	-Me		Reverse mass (error)
	+Mt		+Mt Forward mass (total)
	-Mt		Reverse mass (total)
Measurement values			Measurement values menu
	Q		Volume flowrate a. c.
	Qe		Energyflow
	mf		Massflow
	P		Pressure
	T		Temperature
	VOF/VOG		Velocity of fluid/gas
	SOS		Speed of sound
	FO.1		Impulse frequency #1
	FO.2		Impulse frequency #2
	GCV		Gross calorific value a. c.
	Density		Density a. c.
Device information			
	Measuring point		Device TAG
	S/N device		Device serial number
	S/N electronics		Electronic board serial number
	S/N meter body		Meter body serial number
	Firmware version		Firmware version
	Metrol. fw version		Metrological firmware version
	Firmware CRC		Firmware checksum
	Metrol. fw CRC		Metrological firmware checksum
	Firmware date		Firmware release date
	Metrology CRC		Checksum of metrological parameters

Menu level 0	Menu level 1	Menu level 2	Meaning
	Min. oper. pressure		Minimum operating pressure
	Max. oper. pressure		Maximum operating pressure
	Impulse#1 factor		Impulse factor #1
	Impulse#2 factor		Impulse factor #2
	Date		Device date
	Time		Device time
	RTC battery level		Remaining RTC battery capacity
Display settings			Display settings menu
	Language	English	Set language to english
		German	Set language to german
		Chinese	Set language to chinese
		Russian	Set language to russian
		Spanish	Set language to spanish
		French	Set language to french
		Portugaise	Set language to portugaise
		Italian	Set language to italian
	Contrast		Contrast setting (not persistent)
		Up	Increase contrast
		Down	Decrease contrast
	Display test		Display test
		Perform test	Perform display test

9.2 Status LEDs on the Ex-d terminal board

The LEDs are located at the top edge of the terminal board in the Ex-d terminal compartment.



1 OK
2 Warn
3 Error
4 Power

Fig. 36: Status LEDs

Labeling on the circuit board	Description	LED Color
OK	Status OK	Green
Warn	Warning	Yellow
Error	Error	Red
Power	Internal power supply OK	Green

10 Maintenance

10.1 General information

The FLOWSIC900 does not include mechanically moving parts. The ultrasonic transducers are designed for the entire service life of the meter and are tested for cryogenic process conditions during the manufacturing process. If there are no country-specific legal requirements to the contrary, no recalibration is necessary under normal operating conditions.

User warning limits can be configured to provide early warnings. Maintenance is limited mainly to routine checks to determine the plausibility of the measured values and diagnostic results produced by the system.

Endress+Hauser recommends that Maintenance Reports be created and filed on a regular basis. Over a period of time, this provides a comparison data base useful when diagnosing problems.

The operating conditions (composition of measuring medium, pressure, temperature, flow velocity) of the individual status reports should be similar. When the individual reports are compared, it is recommended to evaluate and document deviations.

10.2 Routine checks

Proper device function can be determined directly on a mobile device or the display of FLOWSIC900. The FLOWgate™ operating software provides a user-friendly option for the performance of routine checks.

The FLOWSIC900 checks its own meter state with a system of user warnings and alarms. If the I/O interfaces are configured to indicate alarms and/or user warnings, it is not necessary to manually check the meter state.

The system status in the FLOWgate™ operating software provides a general overview when a visual feedback on the meter's state is desired.

10.2.1 Checking the meter state with FLOWgate™

▶ Check the device status.

Table 5: Signaling the device status in FLOWgate™

Status	Description
	Device status OK: Normal operation, neither warnings nor errors exist.
	Device status warning: At least one warning is pending in the device, the measured value is still valid.
	Device status error: At least one error is pending in the device, the measured value is invalid.

▶ Click on the symbol in the Status bar when warnings or errors exist. The current Status overview opens and shows details and information on how to proceed.

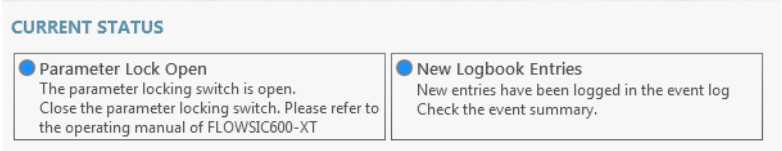


Fig. 37: Current status

The “Diagnostics” menu shows under “Meter values” in various profiles all diagnostics values providing information on the status of the device.

1 Diagnostic information
2 Measured SOS
3 System status
4 Status bar

Fig. 38: Meter values (example, freely configurable)

10.2.2 Comparing theoretical and measured speed of sound (SOS)

One of the main criteria for correct operation of an ultrasonic flow meter is conformity between the theoretical speed of sound calculated for the actual composition of the measuring medium, temperature and pressure, and the speed of sound measured by the flow meter.

The Speed of Sound Calculator (SOS Calculator) available in the FLOWgate™ operating software calculates a theoretical SOS for a specific composition of the measuring media at a specified temperature and pressure. The calculation of thermodynamic properties is based on the “GERG-2008” algorithm.

1 Establish a connection between FLOWSIC900 and FLOWgate™.
2 Open “SOS Calculator” in the “Diagnostics” menu.
3 Select the composition of the measuring medium and confirm with “Apply”. The composition can be entered manually or loaded as file.
4 Enter the current process conditions and select “Calculate SOS”.
5 Compare the theoretical speed of sound with the speed of sound measured with the FLOWSIC900.
The deviation of the measured SOS from the calculated SOS is shown for each path in the “Deviations per Path” area.
6 The deviation between the two speeds of sound should be less than ±0.2%.
If the deviation exceeds 0.4%:
Check the plausibility of the pressure, temperature and composition values.
The speed of sound should be measured and compared in the stationary system state (= continuous flow) and thermally stable state. The temperature entered must correspond as closely as possible to the temperature in the measuring section.
Example: 1 Kelvin of incorrect temperature measurement or input leads to an SOS deviation of approx. 0.7%

10.2.3 Checking the device status on the display

If there is a warning or malfunction on the device, the corresponding symbol is shown in the SPU display.

Table 6: Symbols

Symbol	Significance	Description
	Device status: Malfunction	The device has an error, the measured value is invalid.
	Device status: Warning	The device has a warning, the measured value is still valid.
	Registered events	Events have occurred since the last event summary reset.

▶ An active error or warning is shown flashing in the LC display.
▶ The status output can be configured to show whether the meter state “Measurement valid”, “Warning”, “Error”, “Maintenance necessary” becomes active.

10.3 Time synchronization

10.3.1 Time synchronization with the FLOWgate™ operating software

Date and time can be synchronized In the FLOWgate™ operating software with the connected PC during commissioning or in menu “Parameter Modification” and “System/ User”.

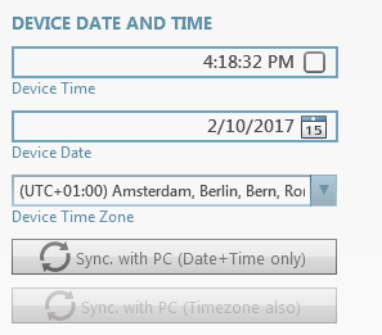


Fig. 39: Time synchronization

10.3.2 Service life/capacity of RTC battery

The real-time clock (RTC) of FLOWSIC900 is buffered by a battery. The device checks permanently whether the real-time clock is working and date and time have valid values. If this is not the case, a device error occurs and results in the respective entry in the event logbook. The error is eliminated only when a valid date is set.

The expected service life of the RTC battery is 10 years. After 90% of the expected service life, a warning is issued so that the battery can be replaced in time, see “Exchanging the RTC battery”, page 73.

10.4 Maintenance report

It is recommended to regularly create and archive a Maintenance report. This serves to create a comparison database and supports diagnostics.

The operating conditions (composition of measuring medium, pressure, temperature, flow velocity) of the individual Maintenance Reports should be similar. When the individual reports are compared, it is recommended to evaluate and document deviations.

1 Click in the status bar.
2 The “Maintenance Report” dialog opens.
It is recommended to set the duration of data collection to 5 minutes, but it can also be changed in the selection list.

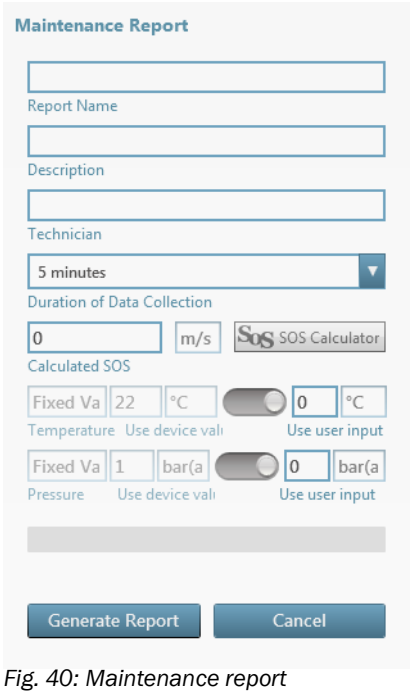


Fig. 40: Maintenance report

3 After the end of data collection, the report opens automatically and can be printed, saved as PDF document or sent via e-mail.
4 Finally close the report with the “Close” button.
5 It is recommended to file the printed report with the device delivery documentation.

10.5 Optional data backup

To prevent an overflow of the logbooks and possible data loss, logbook entries can be saved to the meter database with the FLOWgate™ operating software. The entries on the meter can then be deleted.

10.5.1 Logbook check and data backup

Page “Logbook Management” provides an overview and a general introduction to the logbooks.

The following functions are available here:

- “Load all logbooks from device”: Load the complete contents of all logbooks in the PC database.
- “Load all logbooks from database”: Add the overview data that are already on the PC to the logbook and make them available during the FLOWgate™ session.
- “Clear All Logbooks”: When the logbooks have been loaded from the device, they can be deleted in the device.
- When a logbook is selected, it is possible to only load/delete this logbook or to export it to CSV format or as PDF report.
- The PDF report is automatically opened and can be printed, saved or sent via e-mail.

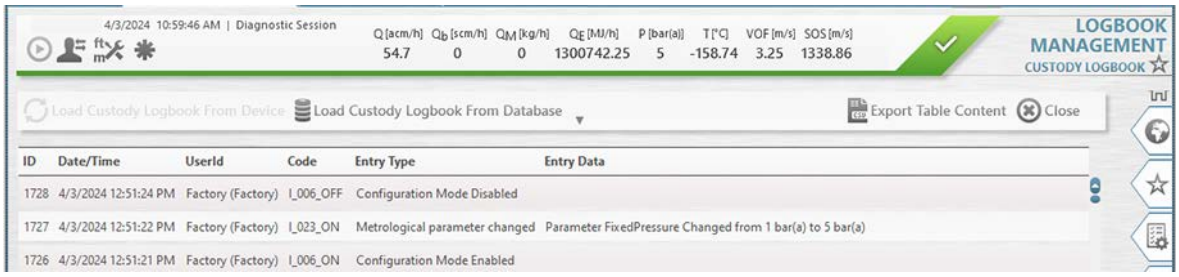


Fig. 41: Example: Custody logbook

Deleting logbook entries

Logbook entries can be deleted only via the FLOWgate™ operating software with button “Clear all Logbooks”. It is not possible to delete entries on FLOWSIC900.

10.5.2 Checking the data archives (data logs)

The FLOWSIC900 has a Diagnostic Archive.

The measured data are saved accordingly in the archives in the non-volatile memory of the device.

The Diagnostic Archive can be loaded and read in the “Archive Management” overview.

The archive data can be exported in CFX or CSV Format and then stored or sent as e-mail.

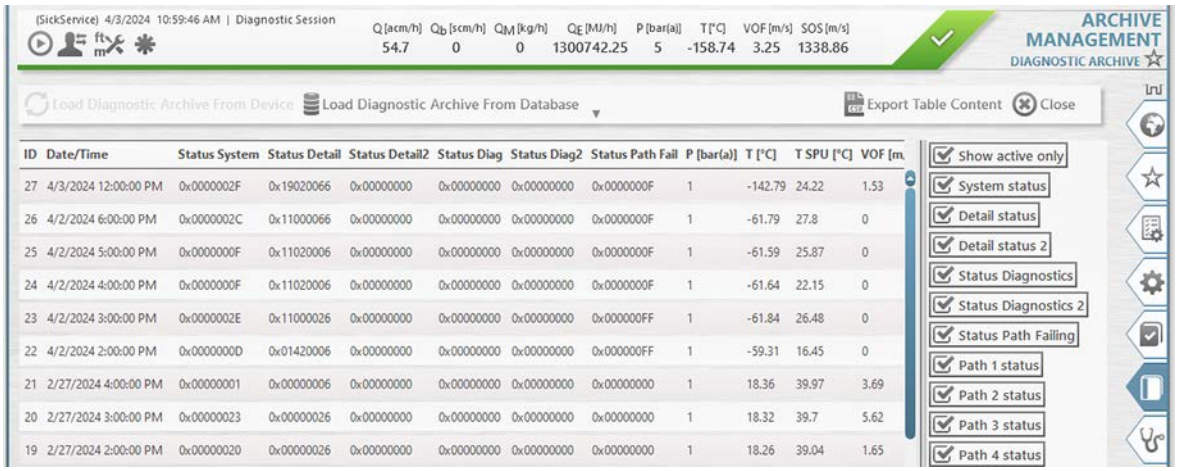


Fig. 42: Example: Diagnostic Archive

Deleting the archive

The archive can be deleted via the FLOWgate™ operating software archive data overview of the “Archive Management” or directly in the Diagnostic Archive.

10.6 Exchanging the RTC battery

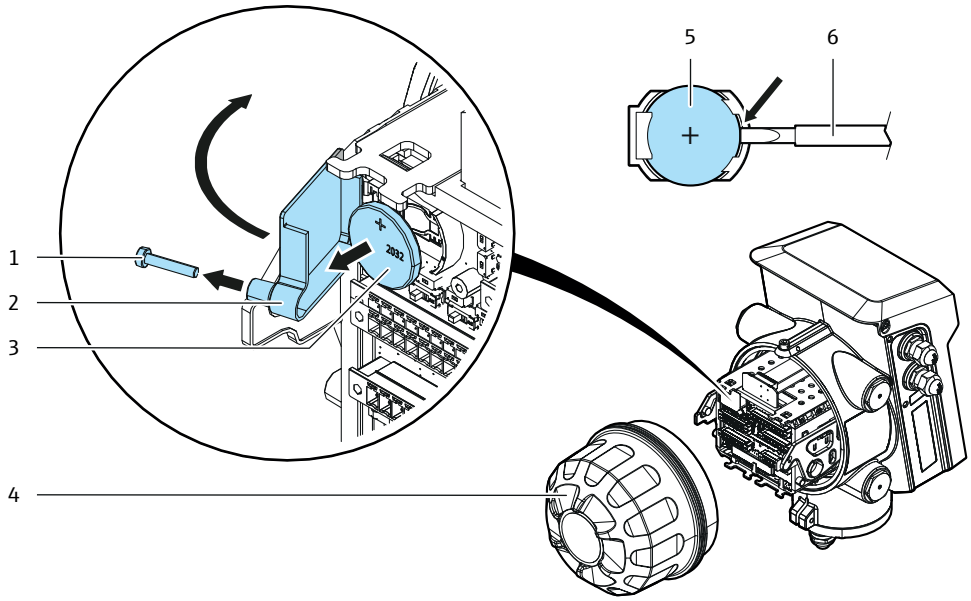
10.6.1 Battery type

Only PANASONIC battery type BR2032 is permitted as RTC battery, otherwise intrinsic safety is endangered. This specific battery type is available at Endress+Hauser (part no. 2085319).

10.6.2 Replacing the RTC battery

NOTICE: Measures in a metrologically secured area

- If stipulated by national regulations, measures on the device in the metrologically secured area after commissioning may be carried out only under official supervision.
- This must be coordinated with the authorities before carrying out the measures.
- All actions must be performed on the basis of this manual and, if necessary, the Service Manual for the product.



1 Retaining screw of the battery cover
2 Battery cover
3 RTC battery
4 Ex-d terminal compartment cover
5 RTC battery
6 Slotted screwdriver (max. size 0.3 mm)

Fig. 43: Battery replacement

1 Open the Ex-d terminal compartment cover, see “Ex-d terminal compartment”, page 43.
2 Remove RTC battery cover with a Torx screwdriver, size 10.
Keep the cover and the screw in a safe place.
3 Carefully remove the RTC battery from the holder.
- Insert the slotted screwdriver (max. thickness 0.3 mm), on the right-hand side, between the battery and the battery holder.
- Carefully lever the battery out of the holder.

NOTICE:
Ensure that the old battery is disposed of correctly, see “Disposal”, page 81.

4 Insert the new RTC battery.

5 Refit the battery cover.
6 Close the Ex-d cover terminal compartment, see “Ex-d terminal compartment”, page 43.
7 Connect with the device using the FLOWgate™ operating software, see “Connecting to the device via Bluetooth”, page 54.
8 Open the System + LCD tile in the Parameter Modification menu.
9 Set the date and time or synchronize with the PC.
10 Reset the battery lifetime counter.

10.7 Cleaning

NOTICE: Cleaning information

- Only clean the device with a damp cloth.
- Do not use solvents for cleaning.
- Only use materials for cleaning which do not damage the surface of the device.

11 Troubleshooting

11.1 Contacting customer service

- Contact Endress+Hauser Customer Service for any malfunctions you cannot clear yourself.
- To enable customer service to help you fast and efficient in such cases, please provide customer service a diagnostic session of the device showing malfunctions. The diagnostic session can be created with the FLOWgate™ operating software, see “Recording a diagnostic session”, page 77.

11.2 Status messages

- Current errors or warnings can be retrieved under “Device status” /“Current events” with error code.
- Detailed information on the status messages is available via the FLOWgate™ operating software in the Diagnostics menu via the “Status Diagnostics” tile.

Table 7: Status messages

Message	Description/clearance
New logbook entries	Check and reset event log book.
Metrology Hardware Lock open	Close metrology hardware lock in device.
Metrology Software Lock open	Remote Firmware Upload and installation possible.
Configuration mode	Change device mode.
System test mode	End test mode after testing is finished or restart device
Firmware checksum error	Contact customer service.
RTC hardware error	Contact customer service.
Date/Time invalid	Set date and time.
RTC battery 10%	Replace battery.
Totalizer checksum error	Reset totalizer.
Parameter invalid	Contact customer service.
Pressure sensor failure	Replace pressure sensor or contact customer service.
Pressure lower user limit exceeded	Check pressure alarm limits.
Pressure upper user limit exceeded	Check pressure alarm limits.
Temperature sensor failure	Replace temperature sensor or contact customer service.
Temperature lower user limit exceeded	Check temperature alarm limits. See user manual.
Temperature upper user limit exceeded	Check temperature alarm limits. See user manual.
Impulse #1 warning. Max Frequency exceeded.	Check flow rate and scaling (pulse factor).
Impulse #2 warning. Max Frequency exceeded.	Check flow rate and scaling (pulse factor).
Flow-hardware error	Contact customer service.

Message	Description/clearance
Path failure (error)	Check process conditions or contact customer service.
Path failure (warning)	Check process conditions or contact customer service.
Flow test active	End test mode after testing is finished or restart device
Flow adjust range exceeded	Save diagnostic session file and contact customer service.
Calculation error energy	Check process conditions or contact customer service.
Calibration mode	Change device mode.
Logbook failure	Check and Reset logbook or contact customer service.
Logbook warning	Check and Reset logbook or contact customer service.
Display module failure	Check Display incl. cabling or contact customer service.
Installed Firmware invalid.	Reinstall Firmware. Contact customer service.
User warning active	A user warning has been activated. Please check the meter diagnostic status in 'Parameter modification/ Warnings' or contact customer service.
Diagnostiv archive warning	Check and Reset diagnosis archive or contact customer service.

11.3 Recording a diagnostic session

1 Click the icon in the tool bar to start a diagnostic session.
2 Select the desired data collection time.
It is recommended to select a minimum data collection time of 5 minutes and to load the logbooks and data archives
3 Click “Start” to start recording.
The following message with the current storage location of the data collection is shown after successful creation of the diagnostic session.

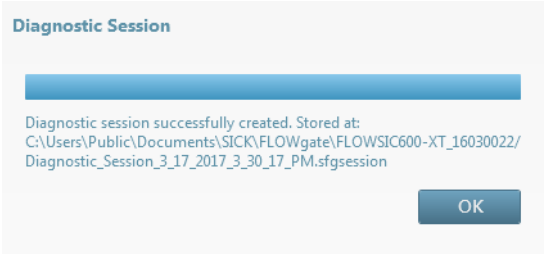


Fig. 44: Diagnostic recording completed

4 Click “OK” to confirm the message.
- Click “Save as” to select a storage location for the diagnostic recording.
- Click “E-mail” to send the file per e-mail. The file is appended to an e-mail when an e-mail client is available.
- Click “Close” to leave the file at the standard storage location.

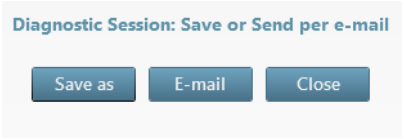


Fig. 45: Save the diagnostic session

The diagnostic sessions are saved as files with the ending .sfgsession. The files are saved by default under:
C:\Users\Public\Documents\SICK\FLOWgate
The name of the storage folder consists of device type and serial number of the device.

11.4 Password recovery

11.4.1 Procedure

In case you have lost access to the device due to missing user name or password information, please contact your “Admin” user.

If you no longer have the login information for the “Admin” account, a password recovery can be requested from your local Endress+Hauser representative.

The procedure uses device-specific keys, which are compared with the data stored in the factory to prevent unauthorized resetting of passwords. A password recovery can also be performed with the parameter locking switch closed, since user management is not one of the metrologically relevant settings.

11.4.2 Initializing a password recovery

1 Connect to the device with the FLOWgate™ operating software.
2 Connect with known user data or as a guest user.
No user name and password are required for the “guest” user level.
3 Open the “Parameter Modification” menu.
4 Open the “User Management” tile.
5 To start the password recovery process, click “Start password restore procedure”.

Fig. 46: Password management

6 Confirm the query to proceed.

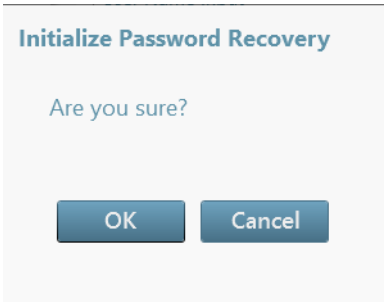


Fig. 47: Confirming password recovery

The password recovery process is initialized.

The password management status shows “Recovery pending” and the “Challenge code” is displayed.

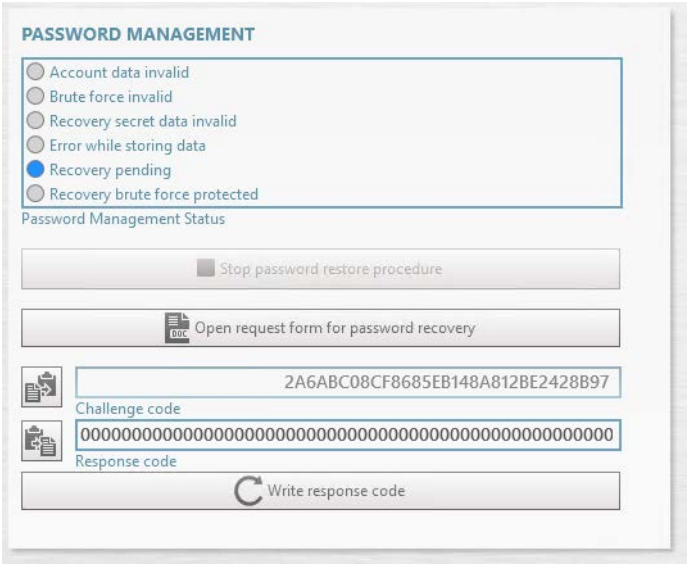
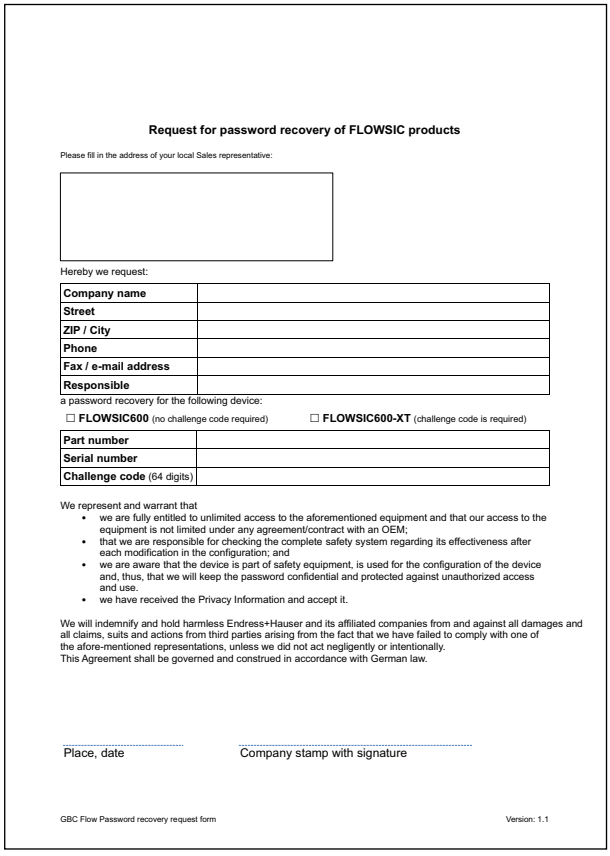


Fig. 48: Password recovery pending

NOTICE:
The “Challenge code” is a a one-time code and only valid as long as the password recovery process is active.

7 Open the password recovery request form.



Request for password recovery of FLOWSIC products

Please fill in the address of your local Sales representative:

Hereby we request:

Company name	
Street	
ZIP / City	
Phone	
Fax / e-mail address	
Responsible	

a password recovery for the following device:

☐ **FLOWSIC600** (no challenge code required) ☐ **FLOWSIC600-XT** (challenge code is required)

Part number	
Serial number	
Challenge code (64 digits)	

We represent and warrant that

- we are fully entitled to unlimited access to the aforementioned equipment and that our access to the equipment is not limited under any agreement/contract with an OEM;
- that we are responsible for checking the complete safety system regarding its effectiveness after each modification in the configuration; and
- we are aware that the device is part of safety equipment, is used for the configuration of the device and, thus, that we will keep the password confidential and protected against unauthorized access and use.
- we have received the Privacy Information and accept it.

We will indemnify and hold harmless Endress+Hauser and its affiliated companies from and against all damages and all claims, suits and actions from third parties arising from the fact that we have failed to comply with one of the afore-mentioned representations, unless we did not act negligently or intentionally.
This Agreement shall be governed and construed in accordance with German law.

Place, date

Company stamp with signature

GBC Flow Password recovery request form Version: 1.1

Fig. 49: PDF form for password recovery (example)

8 Enter the device and customer data.
9 Enter Challenge Code as displayed in FLOWgate™.
The challenge code can be copied from FLOWgate™ via button to the left of the code.

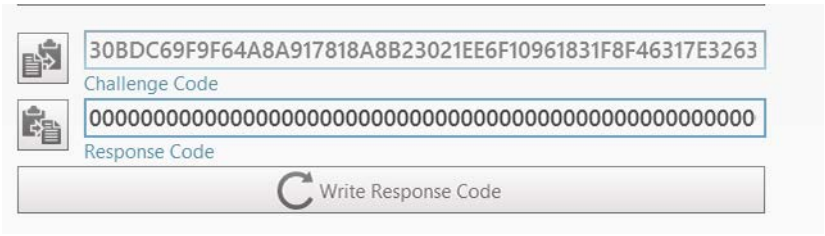


Fig. 50: Challenge code

10 Fill out request form completely, print and sign it.
11 Send the request form to your local Endress+Hauser representative.

NOTICE: Cancelling an ongoing password recovery process
The password recovery process can only be cancelled by the “Admin” user after successful login.

11.4.3 Resetting the passwords

1 After receiving the response from Endress+Hauser, log into the device again as e.g. guest.
2 Open the “Parameter Modification” menu .
3 Open the “System/User” tile.
4 Enter the response code into the corresponding field.
Click the button to the left of the field to paste from the clipboard.

Fig. 51: Response code

5 To write the response code to the device, click “Write Response Code”.

NOTICE:
The recovery process can only be canceled by the login described above. However, after three incorrect entries you have to wait two hours before the next attempt as brute force protection.

6 After sucessful password recovery, the following message is displayed.

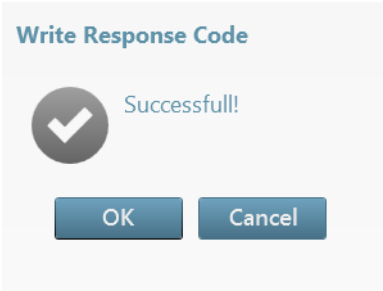


Fig. 52: Response code successfully written

When the response code has been written to the device successfully, the password recovery process is complete.

Note:
User name and password for the “Admin” account have been reset to the default settings with the recovery. The other accounts have been reset and need to be reconfigured.

Log in with the “Admin”account and reconfigure the user management.

12 Decommissioning

12.1 Safety information on decommissioning

Ensure that all safety instructions are observed:

- see “For your safety”, page 10
- see “Mounting”, page 29
- see “Electrical installation”, page 37

12.2 Return delivery

12.2.1 Contact

Contact your local Endress+Hauser representative for assistance.

12.2.2 Clearance certificate

A clearance certificate will be provided by your local Endress+Hauser representative, if necessary.

12.2.3 Packaging

Make sure the measuring device cannot be damaged during transport.

12.3 Permanent decommissioning of the device

If the device is permanently decommissioned, Endress+Hauser recommends deleting critical data before disposal.

12.4 Disposal

NOTICE: Disposal of batteries, electrical and electronic devices

- ▶ In accordance with international directives and regulations, batteries, accumulators, and electrical or electronic devices must not be disposed of with household waste.
- ▶ The owner is obligated to dispose of the devices at the end of their service life via the appropriate public disposal points.
- ▶ icon on the product, packaging, or in this document indicates that a product is covered by these provisions:

The applicable local and statutory environmental regulations and guidelines for the disposal of industrial and electrical waste must be observed.

NOTICE:

The applicable local and statutory environmental regulations and guidelines for the disposal of industrial and electrical waste must be observed.

The following assemblies may contain substances that need to be disposed of separately:

- Electronics: Capacitors, accumulators, batteries
- Displays: Liquid in the LC displays

13 Technical data

13.1 Dimensional drawings

Dimensions of the FLOWSIC900 - remote version

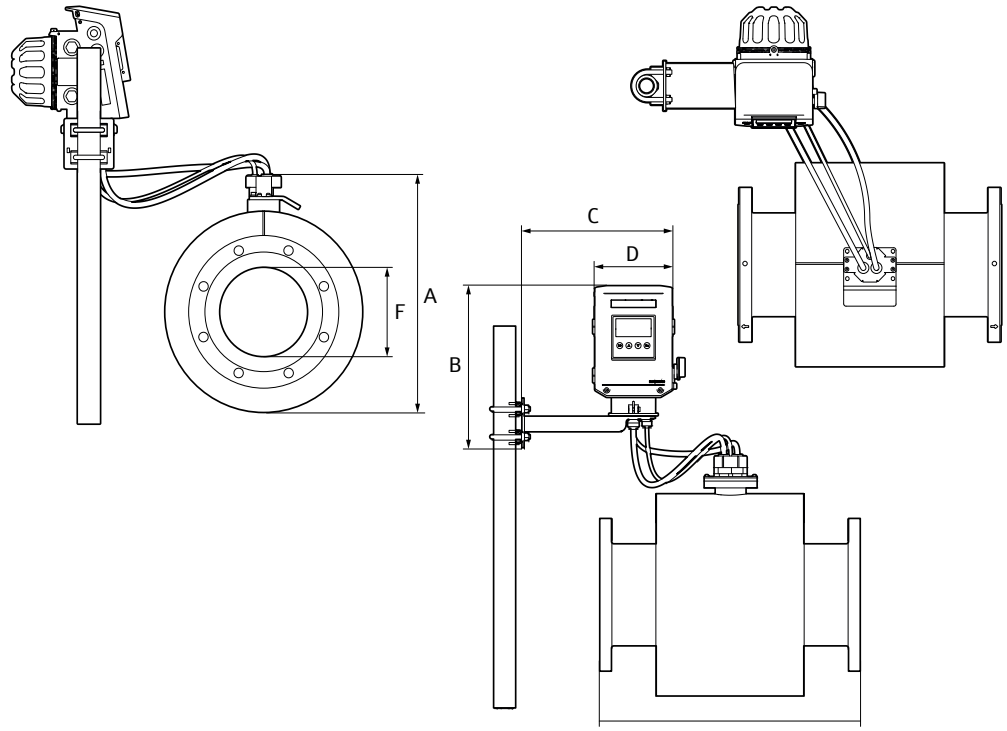


Table 8: Dimensions in mm, weight in kg

Nominal size	Weight [1]	A	B	C	D	E	F[2]
	[kg]	[mm]					
8" / DN200	145	550	364	369	228	600	202.74
10" / DN250	204	620				750	254.46
12" / DN300	395	620				900	304.74
14" / DN350	500	650				1050	336.54
16" / DN400	550	720				762	387.34
18" / DN450	585	752				820	437.94
20" / DN500	705	800				902	488.94
24" / DN600	1,000	910				991	590.94
26" / DN650	1,135	960				1,050	641.36
28" / DN700	1,250	1,010				1,100	691.94
30" / DN750	1,350	1,060				1,150	742.96
32" / DN800	1,460	1,100				1,200	793.94
34" / DN850	1,590	1,150				1,200	844.94
36"/ DN900	1,880	1,184				1,250	894.94

[1] Meter body only; SPU weight see “Technical data”, page 84
[2] Refers exemplary to wall schedule 40S/STD acc. ASME B36.19/B36.10. Other inner diameters available.

Table 9: Dimensions in inch, weight in lbs

Nominal size	Weight	A	B	C	D	E
	[lbs]	[in]				
8" / DN200	320	21.7	14.3	14.5	9.0	23.6
10" / DN250	450	24.4				29.5
12" / DN300	870	24.4				35.4
14" / DN350	1,100	25.6				41.3
16" / DN400	1,210	28.3				30.0
18" / DN450	1,290	29.6				32.3
20" / DN500	1,550	31.5				35.5
24" / DN600	2,200	35.8				39.0
26" / DN650	2,500	37.8				41.3
28" / DN700	2,760	39.8				43.3
30" / DN750	2,890	41.7				45.3
32" / DN800	3,220	43.3				47.2
34" / DN850	3,510	45.3				47.2
36"/ DN900	4,140	46.6				49.2

13.2 Technical data

Note:
The exact device specifications and performance data of the product may deviate and depend on the respective application and customer specification. A device-specific data sheet is supplied with the device on delivery.

Table 10: Technical data FLOWSIC900

Meter characteristics and measuring parameters	
Measured values	Volume a. c., volumetric flow a. c., velocity of fluid, speed of sound
Number of measuring paths	4 / 8 (Forte)
Measurement principle	Ultrasonic transit time difference measurement
Measuring medium	LNG (Liquefied natural gas)
Measuring ranges	0.5 m/s ... 13 m/s
Repeatability	≤ ±0.05% of the measured value[1]
Accuracy	Typical error limits Q_{min} ... Q_{max} 4-path and 8-path type: ≤ ±0.2% of the measured value After flow calibration and adjustment
Design pressure	0 bar(g) ... 19 bar(g) / 0 ... 275 psi(g)
Design temperature	-196 °C ... +60 °C / -328 °F ... +140 °F
Operating pressure	0 bar(g) ... 19 bar(g) / 0 ... 275 psi(g)
Operating temperature	-196°C ... +60 °C / -328 °F ... +140 °F
Nominal pipe size	DN200 ... DN900 / 8” ... 36” Schedule 40S/STD acc. ASME B36.19 / B36.10
Flange type	0 bar(g) ... 19 bar(g) / 0 ... 275 psi(g): Class 150/300 acc. to ASME B16.5/B16.47 PN40 acc. to EN 1092-1 0 bar(g) ... 16 bar(g) / 0 ... 232 psi(g) PN16 acc. to EN 1092-1
	Raised Face Stock Finish Others on request
Material	Meter body (wetted): Stainless steel (316/316L / 1.4401/1.4404) Ultrasonic transducers (wetted): Titanium Grade 5 SPU (electronics) housing: Aluminum (copper-free)[2]
Coating	SPU housing: Coating system: C3, option: C5-M-H[3] acc. to ISO 12944 Color: Company Standard Meter body: Uncoated Coating on request
Flow direction	Unidirectional, bidirectional

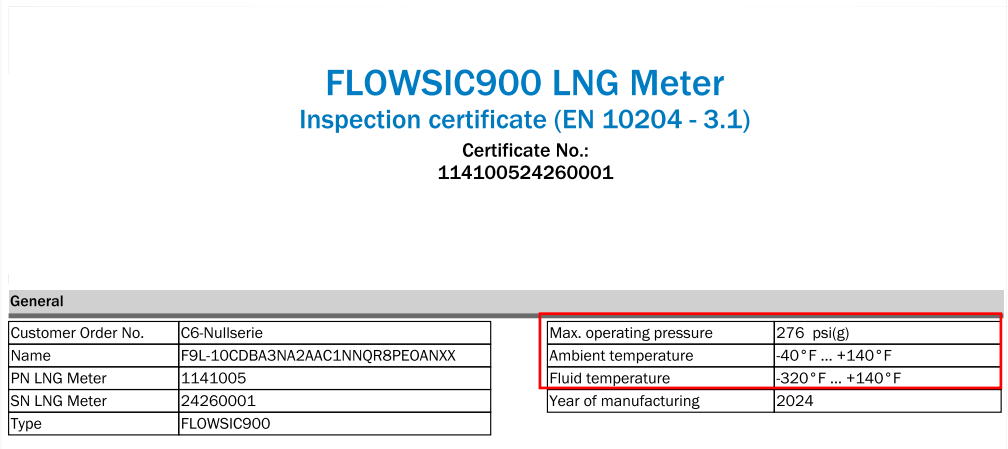
Mounting direction in pipeline	Horizontal, vertical[4]	
SPU mounting	Remotely mounted away from meter body (5 m cable length), vertical wall or pipe mounting	
Ambient conditions		
Ambient temperature [5]	IECEx/ATEX: -40 °C ... 60 °C / -40 °F ... 140 °F NEC/CEC: -30 °C ... 60 °C / -22 °F ... 140 °F	
Storage temperature	IECEx/ATEX: -40 °C ... 60 °C / -40 °F ... 140 °F NEC/CEC: -30 °C ... 60 °C / -22 °F ... 140 °F	
Ambient pressure	80 kPa (0.8 bar) ... 110 kPa (1.1 bar) / 12 psi ... 16 psi	
Oxygen content in the air	Air with normal oxygen content, normally 21 percent by volume	
Geographic altitude	Up to 2000 m / 6500 ft (above sea level)	
Ambient humidity	≤ 100% relative humidity, non-condensing	
Transient overvoltage	Overvoltage category I	
Environmental conditions	During use (enclosure closed): pollution degree 4	
	During installation/service (enclosure open): pollution degree ≤ 3	
Installation location	Indoor, outdoor	
Certifications		
Ex	ATEX	Ⓔx II 2(1) G Ex db ia [ia Ga] IIA T4 Gb
	IECEx	Ex db ia [ia Ga] IIA T4 Gb
	NEC/CEC (US/CA)	Ex db ia [ia Ga] IIA T4 Gb Class I, Zone 1, AEx db ia [ia Ga] IIA T4 Gb
	NEC (US)	Class I Division 1 Group D T4
Enclosure rating	IP66/IP67 acc. EN 60529, Type 4X acc, UL50E	
Dimensions and weight		
Dimensions	See dimensional drawings	
Weight	SPU: 8.7 kg Meter body: See dimensional drawings	
Electrical connections		
Voltage	U_{nom} = 24 V DC +30% /- 20% U_m = 60 V	
Power	I_{nom} = 250 mA A higher switch-on current must be expected; recommended power supply: 1 A	
Power consumption	Typically 5 W	
Cable entries	4x M25x1.5 or 4x NPT 3/4" [6]	
Outputs and interfaces		
Serial RS485	Quantity: 2 Electrically isolated, termination switchable Data protocol: Modbus RTU, Modbus ASCII Baud Rate: 2.400...230.400 U_m = 60 V	

Service interface	For connection of commissioning and service adapters: CDBT100 (Bluetooth® Low Energy, wireless) CDUSB100 (USB, wired)
Digital outputs	Digital output/frequency output: Quantity: 4 Passive Electrically isolated Reverse polarity protection Switchable Namur/Open Collector Switching frequency: 0 … 10 kHz Max. input voltage: 30 V DC U_m = 60 V In Open Collector configuration: Max. switching voltage (switch closed): 1.8 V DC Max. current: 50 mA In Namur configuration at 8.2 V Us supply voltage: Power switch state “On”: 3.7mA Power switch state “Off”: 0.7 mA
Display	Measured values, system information, warnings, maintenance requests, alarms
Operation	Commissioning and regular checks via FLOWgate™ Visualization of measured values via integrated display[7] on SPU front cover
Battery	
Battery type	Coin cell, type BR2032, manufacturer PANASONIC
Battery chemistry	Lithium poly carbon monofluoride Li-$(CF)_x$

[1] At reference conditions, fulfilling requirements of API MPMS Ch. 5.8, Table B.1 and OIML R 117-1 Cl. 0.3
[2] Aluminium EN AW-6082 or Aluminium EN AC-44300 with ≤ 0.1% copper content, copper-free acc. API definition (API Recommended Practice 14FZ)
[3] CX pending
[4] See mounting instructions
[5] Additional limitations apply for metrological use. Please refer to the specific type evaluation certificate. The certified max. ambient temperature for use acc. OIML or MID is +55 °C (131 °F)
[6] Depending on the device variant selected
[7] Depending on the device variant selected, this feature is available as an option.

13.3 Design pressure and design temperature

Please refer to the supplied acceptance test certificate (EN 10204 - 3.1) and the type plate on the meter body for the actual values for the design pressure and design temperature for your specific device.



FLOWSIC900 LNG Meter

Inspection certificate (EN 10204 - 3.1)

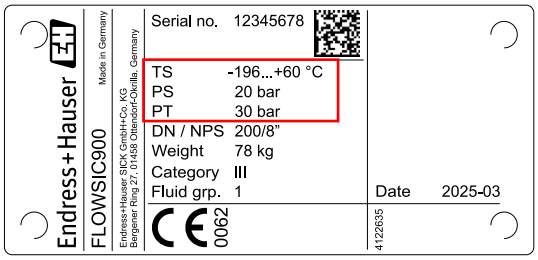
Certificate No.:
114100524260001

General

Customer Order No.	C6-Nullserie
Name	F9L-10CDBA3NA2AAC1NNQR8PE0ANXX
PN LNG Meter	1141005
SN LNG Meter	24260001
Type	FLOWSIC900

Max. operating pressure	276 psi(g)
Ambient temperature	-40 °F ... +140 °F
Fluid temperature	-320 °F ... +140 °F
Year of manufacturing	2024

Fig. 53: Example acceptance test certificate (EN10204 – 3.1)



TS Minimum/Maximum design temperature
PS Maximum design pressure
PT Test pressure

Fig. 54: Meter body type plate (example)

13.4 Flow rates

Table 11: Flow rates LNG meter FLOWSIC900,

Nominal diameter	Q_{min}	Q_{max}	Q_{min}	Q_{max}	Re_{min}
	m^3/h		ft^3/h		
8" / DN200	60	1,500	2,100	53,000	30,000
10" / DN250	90	2,300	3,200	81,000	40,000
12" / DN300	130	3,300	4,600	117,000	50,000
14" / DN350	160	4,100	5,700	145,000	55,000
16" / DN400	220	5,500	7,700	195,000	65,000
18" / DN450	280	7,000	9,900	247,000	75,000
20" / DN500	340	8,800	12,000	310,000	80,000
24" / DN600	500	12,800	17,700	452,000	100,000
26" / DN650	590	15,200	21,000	536,000	105,000
28" / DN700	680	17,600	24,000	621,000	110,000
30" / DN750	790	20,200	28,000	713,000	120,000
32" / DN800	900	23,000	32,000	812,000	130,000
34" / DN850	1,020	26,000	36,000	920,000	140,000
36" / DN900	1,140	29,000	40,000	1,020,000	150,000

14 Annex

14.1 Type plates

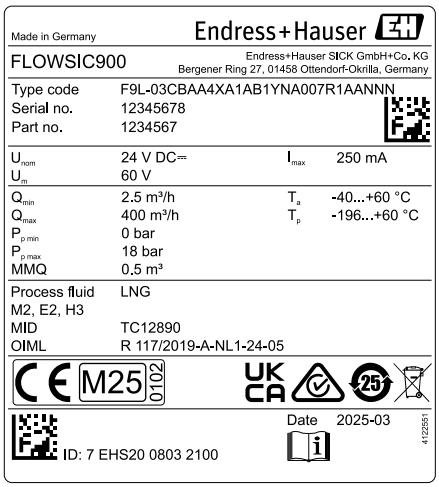


Fig. 55: Main type plate on SPU (example)

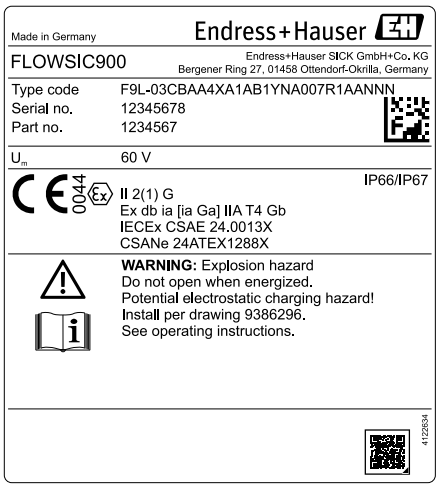


Fig. 56: Ex type plate on SPU ATEX/IECEx (example)

Fig. 57: Ex type type plate on SPU CSAus – USA only (example)

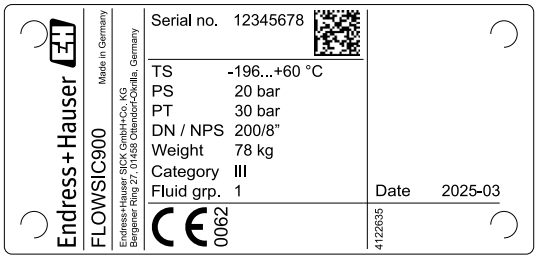


Fig. 58: Meter body type plate (example)

14.2 Conformities

The FLOWSIC900 conforms to the following standards or recommendations:

ATEX

- EN IEC 60079-0:2018 (Edition 7)
- EN 60079-1:2014 (Edition 7)
- EN 60079-11:2012 (Edition 6)

IECEx

- IEC 60079-0:2017 (Edition 7)
- IEC 60079-1:2014 (Edition 7)
- IEC 60079-11:2011 (Edition 6)
- EN 61326-1:2013

CSAus

- UL 60079-0 (Edition 7)
- UL 60079-1 (Edition 7)
- UL 60079-11 (Edition 6)
- UL 61010-1 (Edition 3)
- FM3600 (2022)
- FM3610 (2021)
- FM3615 (2022)

cCSA

- CSA C22.2 No. 60079-0:19
- CSA C22.2 No. 60079-1:16
- CSA C22.2 No. 60079-11:14
- CSA C22.2 No. 61010-1-12, UPD1:2015, UPD2:2016, AMD1:2018

PED

- 2014/68/EU

ASME

- ASME B31.3

Dimensions

- ASME B16.5
- ASME B16.47
- ASME B36.10
- ASME B36.19
- EN 1092-1

Metrological

- OIML R117-1:2019
- MID 2014/32/EU (as part of a MI-005 system)
- WELMEC 8.8:2017
- WELMEC 7.2:2023

14.3 Connection diagrams

Control drawings

Connection parameters for power supply of FLOWSIC900

Terminal	Function	Unom [V]	Um [V]	Inom [mA]	Pnom [W]
Ext. Power	external power supply via flameproof field wiring	24 +30 %/-20 %	60	250	5
All other Data IO	Data IO	max. 30	60	---	---

[Ex ia] Associated Equipment
Only for interconnection with an Exi equipment or an [Exi] associated equipment
Entity parameters of interconnected equipments must be complied as follows:
Uo < Ui, Io < Ii, Po< Pi, Co > Ci + Ccable, Lo > Li + Lcable

Entity parameters for connections on the Ex i terminal compartment

Terminal	Function	active					
		Uo [V]	Io [mA]	Po [mW]	Co [µF]	Ci [nF]	Lo [mH]
Interfaces for interconnection with Display Unit, e. g CID100							
M12 Connector	Front cover for display unit connection	6.42	117	410	999.7	13.2	10.39
Interface for interconnection with auxiliary service equipment							
M12 Connector	Service/Bluetooth Dongle	6.42	117	410	999.7	110	10.39

n/a: denotes not relevant and needed not to be applied

For further informationen see
Operating Instructions.

Transducer outputs and p/T sensor connections are internal interfaces.
They are during flow meter mounting relevant only. See operating instructions for mounting descriptions.

Class I, Division 1, Group D T4
Class I, Division 2, Group D T4
Ex db ia [ia Ga] IIA T4 Gb
Class I, Zone 1, AEx db ia [ia Ga] IIA T4 Gb
Ta -30...+60 °C
In the US install in accordance with the NEC (NFPA70, Article 504) and ANSI/ISA-RP12.06.01
In Canada install in accordance with CEC part 1

Exia Intrinsically Safe; Securite Intrinseque

WARNING: EXPLOSION HAZARD
Substitution of components may impair Intrinsic safety
AVERTISSEMENT: RISQUE D' EXPLOSION - La substitution de composants peut compromettre la securite intrinseque.

IND	REV	DATE	CREATOR	DATE	RELEASE
01	1L94	2024-02-18	paulst	2024-02-27	scheisv

	DATE	NAME
CREATOR	2024-10-16	scheisv
RELEASE	2024-12-02	paulst

Endress+Hauser SICK GmbH+Co. KG
Barenger Ring 27
01458 Ottendorf-Okrilla

SCALE UNIT
SCALE 1:1

TITLE: CONTROL DRAWING FLOWSIC900
CONTROL DRAWING FLOWSIC900

DRAWING NUMBER 9386296
TYPE/DIN FL900
MATERIAL —
ORIGIN 00
REPLACES
SHEET-NO. 1 of 2
SIZE A4

Fig. 59: Control drawings: 9386296 (Page 1 of 2)

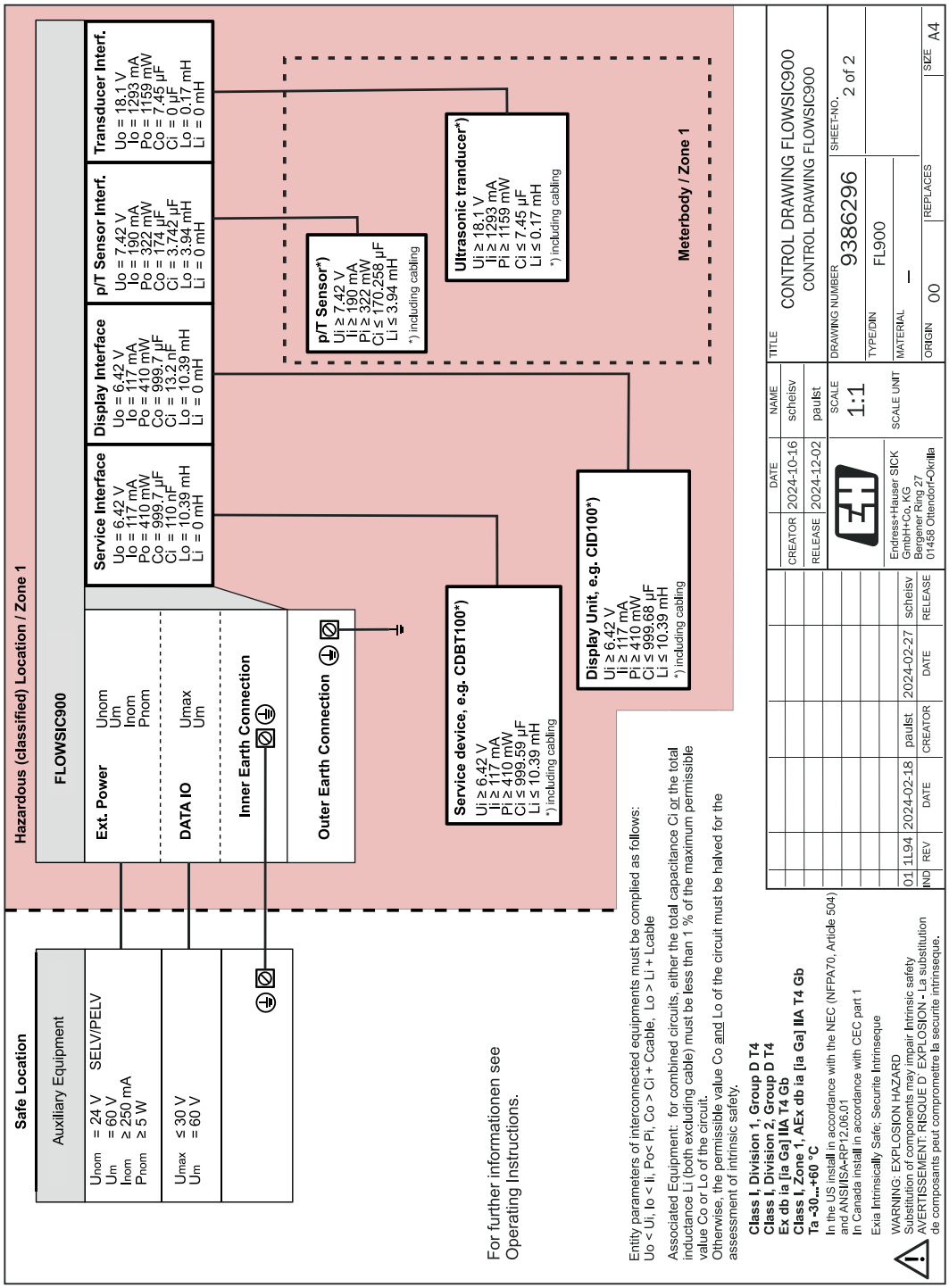


Fig. 60: Control drawings: 9386296 (Page 2 of 2)

14.4 Type code

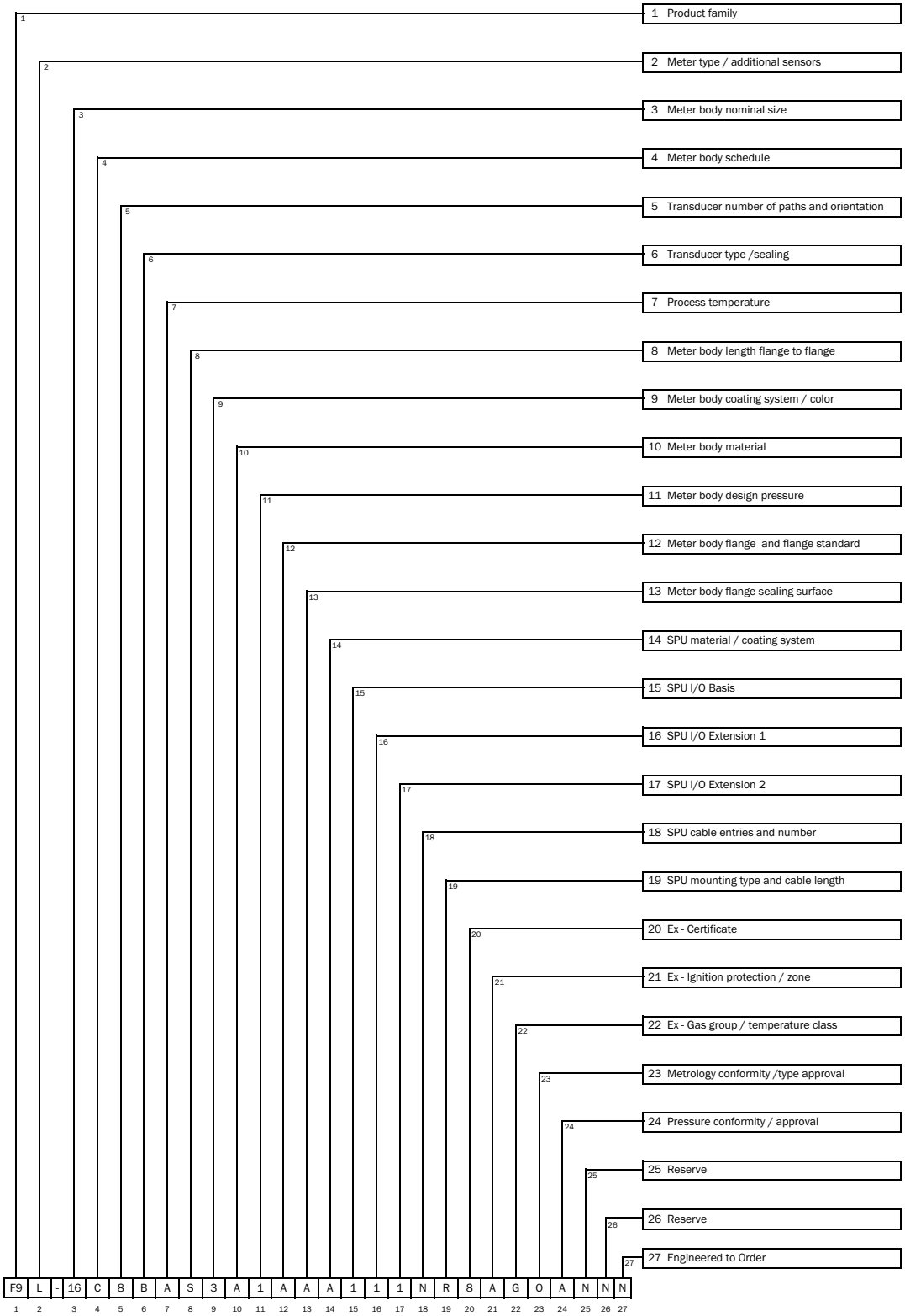


Fig. 61: Type code

1	**Product family**	
	F9	FLOWSIC900
2	**Meter type / additional sensors**	
	L	LNG Large Scale Meter
3	**Meter body nominal size**	
	08	08" / DN200
	10	10" / DN250
	12	12" / DN300
	14	14" / DN350
	16	16" / DN400
	18	18" / DN450
	20	20" / DN500
	22	22" / DN550
	24	24" / DN600
	26	26" / DN650
	28	28" / DN700
	30	30" / DN750
	32	32" / DN800
	34	34" / DN850
	36	36" / DN900
4	**Meter body schedule**	
	C	Schedule STD/40S ASME B 36.19
	E	EN 1092-1
	X	Individual EtO
5	**Transducer number of paths and orientation**	
	C	4 path, parallel
	D	8 path, 4X4 path crossed
6	**Transducer type / sealing**	
	B	T414C / PTFE
7	**Process temperature**	
	A	-196 ... +60°C
8	**Meter body length flange to flange**	
	3	3D
	4	4D
	5	5D
	S	SD
	X	Individual EtO
9	**Meter body coating system / color**	
	N	None / uncoated
	X	Individual EtO
10	**Meter body material**	
	A	Stainless Steel EN 1.4401/1.4404 ASTM A182 Gr. F316/316L
	X	Individual EtO
11	**Meter body design pressure**	
	1	16 bar(g)
	2	19 bar(g)
	X	Individual EtO
12	**Meter body flange / flange standard**	
	A	Class 150 ASME B16.5
	B	Class 150 ASME B16.47 Series A
	D	Class 300 ASME B16.5
	E	Class 300 ASME B16.47 Series A
	O	PN16 EN 1092-1
	P	PN40 EN 1092-1
	X	Individual EtO
13	**Meter body flange sealing surface**	
	A	ASME B16.5/16.47 raised face stock finish
	B	ASME B16.5/16.47 raised face smooth finish
	1	Form A EN 1092-1
	2	Form B1 EN 1092-1
	X	Individual EtO
14	**SPU material / coating system**	
	C	Aluminium EN copper-free / C3 ISO 12944
	D	Aluminium EN copper-free / C5 ISO 12944
15	**SPU I/O Basis**	
	1	2 x RS485, 2 x DO, 2 x FO, 1 x service interface, 1x display interface
16	**SPU I/O Extension 1**	
	N	None
17	**SPU I/O Extension 2**	
	N	None
18	**SPU Cable entries and number**	
	P	4 x M25x1.5
	Q	4 x 3/4" NPT
19	**SPU mounting type and cable length**	
	R	Remote with 5 m cable
20	**Ex - Certificate**	
	1	IECEx/ATEX
	U	CSAus (NEC)
21	**Ex - Ignition protection / zone**	
	A	Ex d / Zone 1
	O	Cl. I, Div. 1 / Cl. I Zone 1
22	**Ex - Gas group / temperature class**	
	A	IIA T4
	E	D T4
23	**Metrology conformity / type approval**	
	O	OIML R117 (Global)
	N	None
24	**Pressure conformity / approval**	
	A	ASME
	P	PED
25	**Reserve**	
	N	None
26	**Reserve**	
	N	None
27	**Engineered to order**	
	N	No
	X	Individual EtO

Fig. 62: Type code (example)

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