FLOWSIC500
Ultrasonic Gas Flow Meter with Optional Volume Conversion

Installation
Operation
Maintenance

SICK
Sensor Intelligence.

Document information

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Manufacturer
SICK Engineering GmbH
Bergener Ring 27 · D-01458 Ottendorf-Okrilla · Germany
Phone: +49 35205 52410
Fax: +49 35205 52450
E-mail: info.pa@sick.de

Original documents
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Glossary

AC	Alternating Current
Al	Aluminium
ATEX	ATEX: Atmosphères Explosifs: Abbreviation for European standards that govern safety in potentially explosive atmospheres
CSA	Canadian Standards Association (www.csa.ca)
DC	Direct Current
HF	High frequency, e. g. HF pulses
IEC	International Electrotechnical Commission
IECEx	IEC system for certification in accordance with standards for devices for use in potentially explosive atmospheres
IPxy	Ingress Protection: Degree of protection of a device in accordance with IEC/DIN EN 60529; x specifies the protection against contact and impurities, y protection against moisture.
LF	Low frequency, e. g. LF pulses
NAMUR	Abbreviation for "Normen-Arbeitsgemeinschaft für Mess- und Regeltechnik in der chemischen Industrie", now "Interessengemeinschaft Automatisierungstechnik der Prozessindustrie" (www.namur.de)
pTZ	Volume conversion as a function of the pressure, the temperature and with consideration of the compression factor
TZ	Volume conversion as function of the temperature and a fixed pressure value and with consideration of the compression factor

Warning symbols

⚠	IMMEDIATE HAZARD of severe injuries or death
⚠	Hazard (general)
⚡	Hazard by electrical voltage
EX	Hazard in potentially explosive atmospheres
💥	Hazard by explosive substances/mixtures
✕	Hazard by unhealthy substances
☠	Hazard by toxic substances

Warning levels / signal words

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

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

CAUTION
Hazard or unsafe practice which *could* result in less severe or minor injuries.

NOTICE
Hazards which *could* result in property damage

Information symbols

EX	Information on product characteristics related to protection against explosions (general)
⟨Ex⟩	Information on product characteristics related to Explosion Protection Regulation (ATEX)
Ex	Information on product characteristics related to explosion protection in accordance with the IECEx scheme.
!	Important technical information for this product
⚡	Important information on electric or electronic functions
💡	Nice to know
+i	Supplementary information
+i↪	Link referring to information at another place

FLOWSIC500

1 Important information

Main hazards
About this document
Intended use
Responsibility of user
Additional documentation/information
Information on cybersecruity threats

1.1 Main hazards

⚠ **DANGER: Risk of explosion when the gas flow meter is damaged**
Natural gas flows with line pressure through the gas flow meter. Natural gas can escape when the gas flow meter is damaged which creates a risk of explosion.
▶ Prevent any possible damage to the gas flow meter. When necessary, fit protection devices.
▶ If the gas flow meter is damaged: Stop natural gas feed immediately and purge the FLOWSIC500 with inert gas.

⚠ **WARNING: Hazards through leaks**
Operation in leaky condition is not allowed and potentially dangerous.
▶ Regularly check leak tightness of equipment.

1.2 About this document

This Manual describes:
– Device components
– Installation
– Operation of the FLOWSIC500.

It contains the main safety information for safe operation of the FLOWSIC500.

Application area of the document
This document is valid for FLOWSIC500 with firmware version 2.15.00 and higher.

FLOWSIC500 with Ex approval acc. CSA

! *NOTICE:*
For a French translation of this document, please refer to document 8025734 "Manuel d'utilisation FLOWSIC500".

1.3 Intended use

1.3.1 Purpose of the device

The FLOWSIC500 serves for measuring the gas volume, volume flow rate and gas velocity of natural gas in pipelines.

The FLOWSIC500 with optional volume conversion serves for measuring the gas volume and converting the gas volume measured to base conditions as well as registering data on totalizer levels, maximums and other data.

1.3.2 Product identification

Product name:	FLOWSIC500
Manufacturer:	SICK Engineering GmbH Bergener Ring 27 01458 Ottendorf-Okrilla Germany

The type plates for metrological and electrical parameters are located on the gas flow meter. The type plate for the Pressure Equipment Directive is located on the adapter.

Type plate examples, see → p. 152, § 9.5.

Fig. 1   Location of type plates

Marking according to ATEX/IECEx
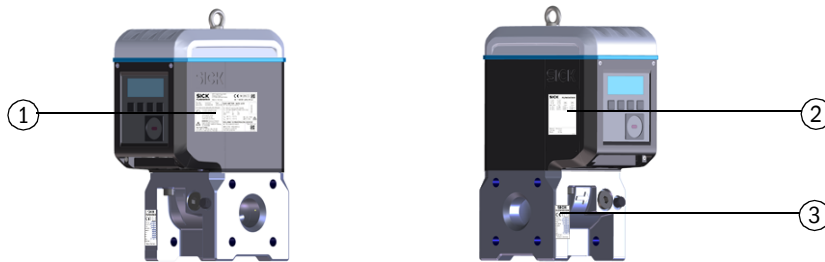
Marking according to CSA
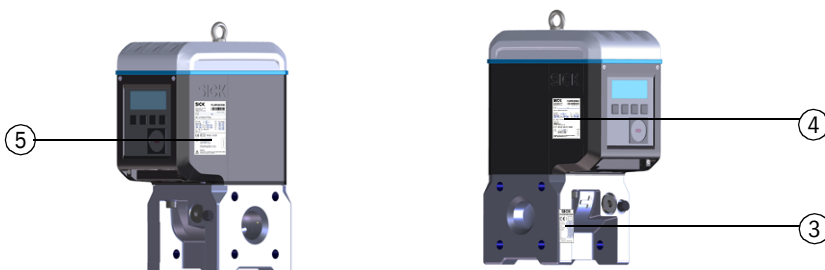
1 Type plate, metrological and electrical parameters (metrology and electronics)

2 Pin assignment of plug-in connectors

3 Type plate, Pressure Equipment Directive

4 Type plate, electrical parameters (electronics)

5 Type plate, metrological parameters (metrology)

4

1.3.3 Operation in potentially explosive atmospheres

EX	The FLOWSIC500 is suitable for use in potentially explosive atmospheres: ATEX: II 2G Ex ia [ia] IIB T4 Gb, II 2G Ex ia [ia] IIC T4 Gb, II 2G Ex op is IIC T4 Gb IECEx: Ex ia [ia] IIB T4 Gb, Ex ia [ia] IIC T4 Gb, Ex op is IIC T4 Gb US/C: Class I Division 1, Groups C, D T4, Ex/AEx ia IIB T4 Ga

+i↪ Further information on potentially explosive atmospheres → p. 46, §3.4.1.

1.3.4 Combustible gas

► The FLOWSIC500 is suitable for measuring combustible and occasionally ignitable gases corresponding to zones 1 and 2.

1.3.5 Restrictions of use

► Refer to the type plate for the configuration of your FLOWSIC500.
► Check the FLOWSIC500 is suitably equipped for your application (e.g., gas conditions).

⚠	**WARNING:** Hazard through material fatigue The FLOWSIC500 has been designed for use under mainly static loads. ► Maximum allowed gradient of static pressure: 3 bar/s (45 psi/sec) The number of complete pressure application and release processes should be kept low during operation. ► Replace the device when 500 cycles have been reached.

!	*NOTICE:* The FLOWSIC500 is designed for measuring clean and dry natural gas. ► The operating company should install a suitable filter or cone screen ahead of the gas flow meter when the gas is contaminated.

!	*NOTICE:* ● The FLOWSIC500 is suitable for use in pressurized lines within the parameters specified in the device. The device conforms to Pressure Device Equipment 2014/68/EC. ● It is the user's responsibility to ensure the maximum values specified for pressure and temperature on the type plate are not exceeded during operation.

Subject to change without notice

1.3.6 Cleaning

> ⚠️ **WARNING: Ignition hazard through electrostatic charges**
> In certain extreme conditions in gas group IIC, unprotected plastic parts and non-grounded enclosure metal parts can reach an ignitable measure of electrostatic charges.
> ► Take precautionary measures to prevent electrostatic charges, localize, e.g. the components where a charge generating mechanism could occur (e.g. due to dust deposits caused by wind) and clean these with a damp cloth.

> **!** *NOTICE:* **Cleaning information**
> ► Only clean the FLOWSIC500 with a damp cloth.
> ► Do not use solvents for cleaning.
> ► Only use materials for cleaning which do not damage the surface of the FLOWSIC500.

1.4 Responsibility of user

► Only put the FLOWSIC500 into operation after reading the Operating Instructions.

► Observe all safety information.

► If anything is not clear: Please contact the SICK Customer Service.

Designated users

The FLOWSIC500 may only be operated by skilled technicians who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

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

Correct use

► Only use the FLOWSIC500 as described in these Operating Instructions (→ p. 11, § 1.3.1). The manufacturer bears no responsibility for any other use.

► Do not carry out any work or repairs on the FLOWSIC500 not described in this manual.

► Do not remove, add or change any components in or on the FLOWSIC500 unless such changes are officially allowed and specified by the manufacturer.

Otherwise

– Any warranty by the manufacturer becomes void

– The FLOWSIC500 can become dangerous

– The approval for use in potentially explosive atmospheres is no longer valid

– The approval fur use in lines pressurized above 0.5 bar (7.25 psi) bar is no longer valid.

Danger identification 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.

Special local conditions

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

Retention of documents

These Operating Instructions must be

► Kept available for reference

► Passed on to new owners.

1.5 Additional documentation/information

Some parameter settings, device components and characteristics depend on the individual device configuration. This individual device configuration is described in the device documentation delivered with the device:

- Conformity Declaration
- Material certificate
- Inspection certificate
  - Device configuration sheet
  - Encoder test protocol (optional)
  - Low pressure calibration test protocol (optional)
  - Labels according to Pressure Equipment Directive 2014/68/EC, Annex 1 Part 3.3
- Printed Parameter report
- Product CD:
  - Operating Instructions
  - FLOWgate^{TM} operating software
  - FLOWgate^{TM} Software Manual
  - Certificates
  - Instructions/information for accessories
  - Calibration instructions
  - Modbus specification

1.6 Information on cybersecruity threats

Protection against cybersecurity threats requires a comprehensive cybersecurity concept that must be continuously reviewed and maintained. A suitable concept consists of organizational, technical, procedural, electronic and physical levels of defense 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 if the product is used as part of such a concept.

Visit www.sick.com/psirt for more information, such as:
● General information on cybersecurity
● Contact option for reporting vulnerabilities
● Information on known vulnerabilities (Security Advisories)

FLOWSIC500

2 Product description

Measuring principle
System components
FLOWgate^{TM} operating software
Interfaces
Totalizers
Data processing in
Device option
Parameter protection
Sealing
PowerIn Technology^{TM}

2.1 Measuring principle

2.1.1 Gas flow meter

The FLOWSIC500 works according to the principle of ultrasonic transit time difference measurement.

Fig. 2   Functional principle

v = Gas velocity
L = Measuring path
α = Angle of inclination in °
t_{AB} = Sound transit time in flow direction
t_{BA} = Sound transit time against flow direction
D_I = Pipe inner diameter
Q = Volume flow
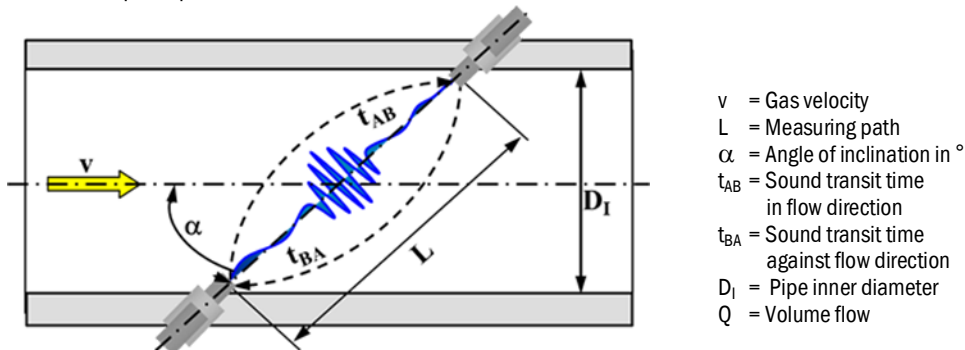
Measured signal transit times t_{AB} and t_{BA} are defined by the current sound and gas velocity.

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

The FLOWSIC500 calculates the volume flow rate internally from the gas velocity and the diameter of the measuring section of the gas flow meter.

$$ Q = \frac{\pi}{4} D_I^2 \cdot \frac{L}{2\cos\alpha} \cdot \frac{t_{BA} - t_{AB}}{t_{AB} \cdot t_{BA}} $$

2.1.2 Volume conversion (optional)

The integrated volume conversion converts the measured gas volume from measurement conditions to base conditions.

Calculation according to EN 12405:

$$ V_b = C \cdot V_m $$

V_b = Volume at base conditions
C = Conversion factor
V_m = Volume at measurement conditions

$$ C = \frac{p}{p_b} \cdot \frac{T_b}{T} \cdot \frac{Z_b}{Z} $$

p = Gas pressure at measurement conditions
p_b = Pressure at base conditions
T = Gas temperature at measurement conditions
T_b = Temperature at base conditions
Z_b = Compression factor at base conditions
Z = Compression factor at measurement conditions

The measurement conditions are either determined with pressure and temperature sensors or entered as fixed value.

> **+i** The following short forms are used in this document for better readability:
> - Volume at base conditions = base volume
> - Volume at flowing conditions = measurement volume

2.2 System components

The FLOWSIC500 measuring system comprises:
- FLOWSIC500 gas flow meter,
- Adapter for installation in pipeline and
- Optional p&t sensors for the volume conversion device option.

Fig. 3   FLOWSIC500 components

Gas flow meter
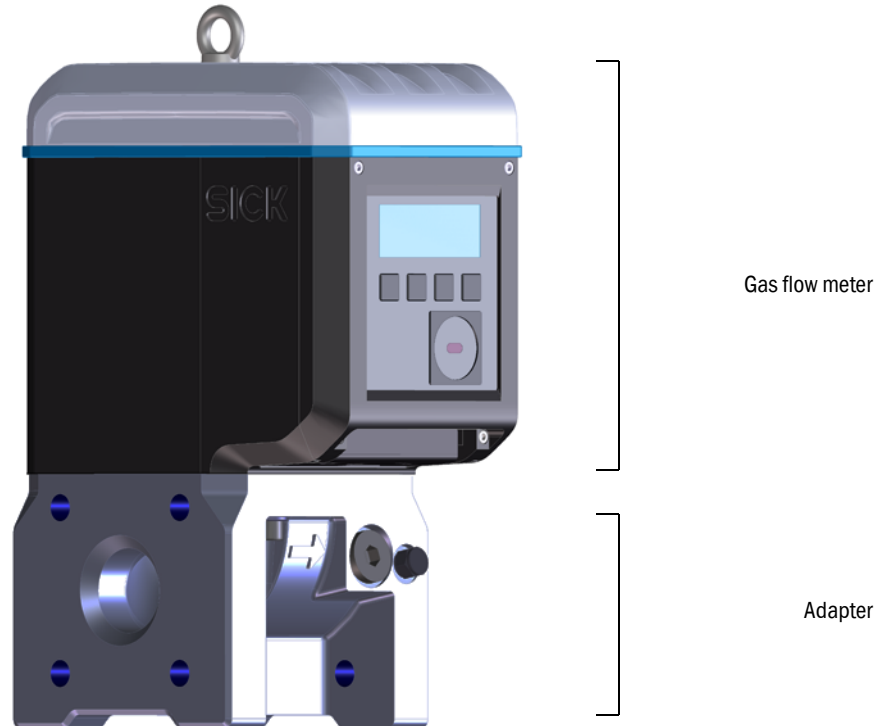
Adapter

2.2.1 Adapter

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

Depending on the version, the adapter is designed for assembly on line flanges PN16 in accordance with DIN EN1092-1, CL150 in accordance with ASME B16.5, or 1.6MPa in accordance with GOST 12815-80.

+i   Fitting lengths available: → p. 155, §9.6.

2.2.2   **Gas flow meter**

An internal flow conditioner rectifies the gas flow in the gas flow meter so that flow profile disturbances caused by pipe bends in the inlet or outlet sections or components projecting into the pipe (e.g., a thermowell) have no influence on measuring results.

The gas flow meter can be exchanged without taking the adapter out of the pipeline.

The gas flow meter is fitted with:

● Control unit
● Optical and electrical interfaces
● Measuring cell with ultrasonic transducers
● Electronics.

The product variant with volume conversion and integrated pressure and temperature sensors also has the calibrated pressure sensor and calibrated temperature sensor fitted in the gas flow meter.

2.2.3   **Meter sizes**

Available meter sizes

2.3 FLOWgate^TM operating software

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

> **+i↵** For FLOWgate^TM operating software, see "Software Manual FLOWgate^TM".
> The Software Manual is on the delivered Product CD.
> The Software Manual is also available using the Help function of the FLOWgate^TM operating software.

2.3.1 Overview

Software functions

- Measured values overview
- Field setup wizard
- Parameter modification
- Logbook and archive management
- Calibration
- Diagnostics data
- Service actions
- Session browser

Fig. 4 Software platform FLOWgate^TM – FLOWSIC500 "Overview"
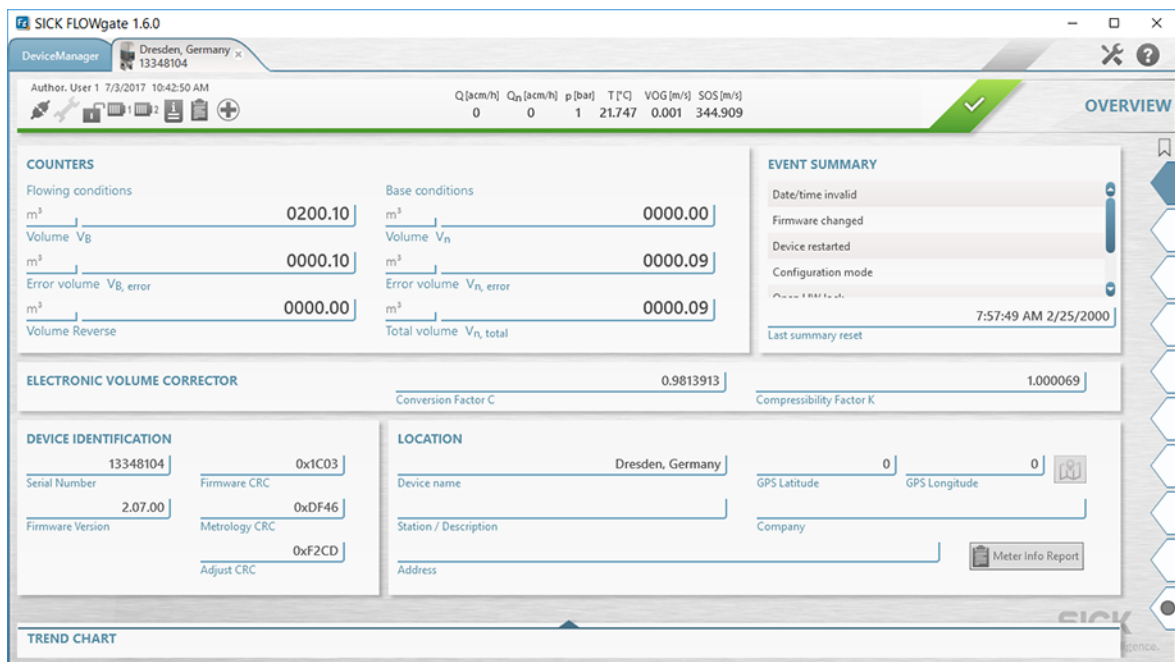
2.3.2 System requirements

- Microsoft Windows 7/8/10
- Min. 1.8 GHz CPU
- Min. 1 GB RAM
- Approx. 100 MB free memory (without .NET framework)
- USB or serial interface
- Recommended minimum screen resolution: 1024 x 768 pixels, optimum screen resolution 1368 x 768 pixels
- Microsoft .NET framework 4.6 or higher

> **+i↺** If the user is not an administrator, the following entries in the registry must exist or be configured for installation of the system:
> - AlwaysInstallElevated = 1
> - EnableUserControl = 1
>
> Support: http://msdn.microsoft.com/en-us/library/aa367561(v=vs.85).aspx

2.3.3 Access rights

Device function	Guest	User 3	User 2	User 1	Auth. user 3	Auth. user 2	Auth. user 1
Standard password	-	1111	1111	1111	2222	2222	2222
User can be deactivated	-	x	x	-	x	x	-
Read parameters and measured values	x	x	x	x	x	x	x
Read data archive	-	x	x	x	x	x	x
Change parameters not custody relevant	-	x	x	x	x	x	x
Change custody relevant parameters	-	-	-	-	x	x	x
User management	-	-	-	-	-	-	x
Calibration mode	-	-	-	-	x	x	x
Configuration mode	-	-	-	-	x	x	x
Test digital outputs	-	-	-	-	x	x	x

2.4 Interfaces

The FLOWSIC500 supports various digital and serial interfaces.

The configuration of the interfaces as delivered is described in the delivery documents provided with the respective device.

Table 1   Interface configurations

Type code	I/O: F	I/O: G	I/O: H	I/O: I or J	I/O: K	I/O: L	I/O: M	I/O: N
	LF	HF	Encoder + LF	RS485	Encoder + HF	2 x LF	RS485 + HF	RS485 + NF
DO_0	-	HF pulses	Encoder	-	Encoder	-	HF pulses	-
DO_1	Normal operation: Diagnosis warning, test mode: Test pulses				HF pulses	As for config. F, G, H, I, J	-	-
DO_2	LF pulses	-	-	-	-	LF pulses	-	NF pulses
DO_3	Malfunction	Malfunction	LF pulses	-	Malfunction	LF pulses	-	-
Serial	-	-	-	RS485	-	-	RS485	RS485

> **+i↵**
> - Information on explosion-technical characteristics and rated voltage → p. 46, §3.4.
> - Details on standard interface configurations available → p. 51, §3.4.6.

2.4.1 Pulse and status outputs

FLOWSIC500 has 4 digital switching outputs. Digital switching outputs DO_0, DO_2 and DO_3 are electrically isolated according to EN 60947-5-6.

Alternatively, digital switching outputs DO_2 and DO_3 can also be configured as Open Collector.

When used as pulse output, maximum 2 kHz can be output on digital switching output DO_0 and maximum 100 Hz on digital switching outputs DO_2 and DO_3. When used as status output, status information "Validity of measurement" or the result of the self-diagnosis can be represented.

Digital switching output DO_1 is not electrically isolated. In normal mode, the diagnosis warning is output on DO_1, test pulses are output in test mode.

The digital switching outputs are updated synchronously once per second.

2.4.2 Encoder totalizer

Alternatively, NAMUR switching output DO_0 can be configured so that the totalizer level of the totalizer Vm, the meter state and a meter identification are output via asynchronous serial communication. This allows the connection of volume converters with a suitable input for encoder totalizers.

> **!** **NOTICE:**
> With encoder communication, it must be ensured that the transmitted digit count or totalizer resolution can be processed by the connected volume converter.
>
> A parameter modification can be carried out on the FLOWSIC500 with the FLOWgate^{TM} operating software when the parameter locking switch is open.

2.4.3 Serial data interface

The serial interface is designed as externally powered RS485 and requires an external intrinsically safe power supply for operation.

Maximum cable length for the RS485 interface: 300 m

2.4.4 Optical data interface

An optical interface according to IEC 62056-21 with serial bit, asynchronous data transmission is located on the front of the FLOWSIC500.

The interface can be used to read out data and parameter settings and to configure the FLOWSIC500.

2.5 Totalizers

2.5.1 Device status and totalizers used

Various volume totalizers are fitted on the FLOWSIC500 depending on the configuration.

Meter V is used in the configuration as gas flow meter. If the gas flow meter has a malfunction, the measured volume is also recorded in the error volume counter errV.

Table 2   Device status and totalizers used

Status	Totalizer	
	V	errV
Operation	●	
Malfunction	●	●

A gas flow meter Vm, a base volume meter Vb and a total volume meter Vbtot are used in the configuration as gas flow meter with integrated volume conversion (device option). If malfunctions occur, the measured values are not recorded in the base volume meter Vb, but the converted volume is recorded in the malfunction volume encoder totalizer errVb.

Table 3   Device status and totalizers used (with device option volume conversion)

Status	Totalizer				
	Vb	errVb	Vbtot	Vm	errVm
Operation	●		●	●	
Malfunction		●	●	●	●

Authorized users (user level "Authorized user") can reset the error volume counters → p. 98, §5.2.11.

2.5.2 Reverse flow

The FLOWSIC500 is designed as unidirectional and has a configurable zero-flow cutoff which is factory set to a value of 1 m^3 (35 ft^3) as default.

The totalizers are stopped during reverse flow and this volume is counted in a separate buffer totalizer. When normal operation resumes, the buffer totalizer is first computed with the flow rate.

The totalizers are first incremented again after the reverse flow volume has passed through.

During reverse flow, the meter first switches to malfunction when the preconfigured buffer volume has been exceeded. An error message is output on the device.

The zero-flow cutoff (measuring threshold for low flow rate) and the buffer volume (limit value for reverse flow volume) can be adjusted with the FLOWgate^{TM} operating software during commissioning (→ p. 73, §4.3.2.3) or, after commissioning, in the "Warning" area in the "Parameter Modification" menu.

2.6 Data processing in

2.6.1 Logbooks

The FLOWSIC500 stores events and parameter changes in the following logbooks:

- Event logbook

  All events with timestamp, user logged on and totalizer level, max. number of entries: 1000

  When the Event logbook is 90% full, the FLOWSIC500 changes to device status "Warning", warning W-2001 is shown on the display.

  When the Event logbook is full, the FLOWSIC500 changes to device status "Malfunction", error E-3001 is shown on the display (→ p. 102, §6.2, "Status messages").

> **!** **NOTICE:**
> If the optional feature "Load recording device with maximum load display" feature is activated and the event logbook is full, the device time can be corrected even if the operation is not logged. That the time has been set is evident from the status of the measuring period entry. Updating is the responsibility of the plant operator.

- Parameter logbook

  All parameter changes with timestamp, user logged on, totalizer level, old and new parameter value and register number, maximum number of entries: 250

  The oldest entries are overwritten when the Parameter logbook is full.

- Metrology logbook

  All changes to selected custody-relevant parameters (→ p. 31, §2.8.2), with parameter locking switch activated with timestamp, user logged on, totalizer level, old and new parameter value and register number, maximum number of entries: 100

  When the Metrology logbook is full, custody relevant parameters can be modified only after the parameter locking switch has been opened. The FLOWSIC500 changes to device status "Warning", warning W-2002 is shown on the display (→ p. 102, §6.2, "Status messages").

- Gas composition logbook

  All parameter changes of the gas composition for the volume conversion with timestamp, user logged on, totalizer level, old and new parameter values and register number, maximum number of entries: 150

  The oldest entries are overwritten when the Gas composition logbook is full.

The data are stored in non-volatile memory. All logbooks can be viewed, stored and reset with the FLOWgate^{TM} operating software. The Event logbook can be viewed after logon as "User" or "Authorized user" on the device.

The following parameters are displayed:

- Event type
- Number of events
- Short description
- Timestamp

2.6.2 Archives

The integrated data registration stores totalizer levels, maximums and other data in the following archives:

- Measuring period archive

  Totalizers and data saved after the measuring period elapses (standard = 60 min). The measuring period can be adjusted → p. 93, §5.2.6.9.
- Daily archive

  Totalizers and data saved at the defined gas hour time (standard = 06:00)
- Monthly archive

  Totalizers and data saved at the defined gas day time (standard = 1st day of month)

> +1↩ Explanations on data structure and storage depth are available in Technical Bulletin "Data Registration").
> You will find the document on the delivered product CD.

2.7 Device option

2.7.1 Volume conversion

The FLOWSIC500 gas flow meter with volume conversion captures the gas volume under measurement conditions and converts it to a volume under base conditions.

Gas volume conversion can run selectively (set at the factory) as PTZ or TZ volume conversion. The configuration as temperature volume conversion uses the default value for measurement pressure for calculations.

Measurement conditions are recorded with the pressure and temperature sensors or entered as fixed values.

By default, measured values recording and subsequent calculation of the conversion factor are performed every 30 seconds. The update interval can be adjusted → p. 91, §5.2.6.5, "Calculation".

Depending on the configuration, the compressibility factor (K-factor) is determined with one of the following calculation methods or can be entered as a fixed value.

- Fixed value
- SGERG88
- AGA 8 Gross method 1
- AGA 8 Gross method 2
- AGA NX-19
- AGA NX-19 mod.
- AGA NX-19 mod. GOST
- GERG91 mod.
- AGA8-92DC (AGA-8 Detail)

The FLOWSIC500 checks the permissible entry limits of the parameters for the selected calculation method. If one of the entry values is outside the limit values, the FLOWSIC500 switches to malfunction state and uses the fixed value of the compressibility factor for calculation of the basis volume.

An absolute pressure sensor (optional: relative pressure sensor) EDT23 or the functionally compatible successor model EDT96 and a temperature sensor EDT34 or the functionally compatible successor model EDT87 measure current measurement conditions and transfer the sensor type, measured value as well as the sensor status via a digital interface.

The FLOWSIC500 reads the valid measuring range automatically and, periodically, the current status and measured value.

A sensor is only activated for measurement when the configured serial number matches the serial number transferred for the sensor.

If no sensor is detected or a sensor is not functioning correctly, the FLOWSIC500 automatically uses the stored default value (= fixed value) of the state variable.

In this case, the FLOWSIC500 switches to malfunction state and, using the default value, stores the volume under base conditions calculated for pressure or temperature in the error volume counter.

If not specified otherwise, the FLOWSIC500 is supplied with the following standard settings:

Table 4   Standard settings

Unit system	SI	Imperial
T unit	°C	°F
P unit	bar	psi
Symbols according to	EN 12405	API
Calculation method	SGERG88	AGA 8 Gross method 1
Reference conditions for density and heating value	(T1/T2/p2) 25 °C/0 °C/1.01325 bar (a)	(T1/T2/p2) 60 °F/60 °F/14.7300 psi (a)
Basic pressure	1.01325 bar (a)	14.7300 psi (a)
Basic temperature	0 °C	60 °F

2.7.1.1 Integrated pressure and temperature sensors

The FLOWSIC500 with volume conversion and integrated pressure and temperature sensors does not have any external components. The internal pressure and temperature sensors are already fitted and calibrated at the factory. The measuring ports are located in the gas flow meter.

This means the FLOWSIC500 does not require any additional installation of sensors to determine the measurement conditions and is immediately ready for operation after volume conversion has been configured.

2.7.1.2 External pressure and temperature sensors

The FLOWSIC500 with volume conversion and external sensors is used at measuring ports where a test/calibration of the pressure or temperature sensor in the system may be required.

It is recommended to install a three-way test valve that separates the pressure sensor from the measurement pressure and provides a test connection to test the pressure sensor.

→ Fig. 5 shows a FLOWSIC500 with external sensors and test valve BDA04 for gas temperatures to -25 °C.

Fig. 5   FLOWSIC500 with external sensors and test valve BDA04
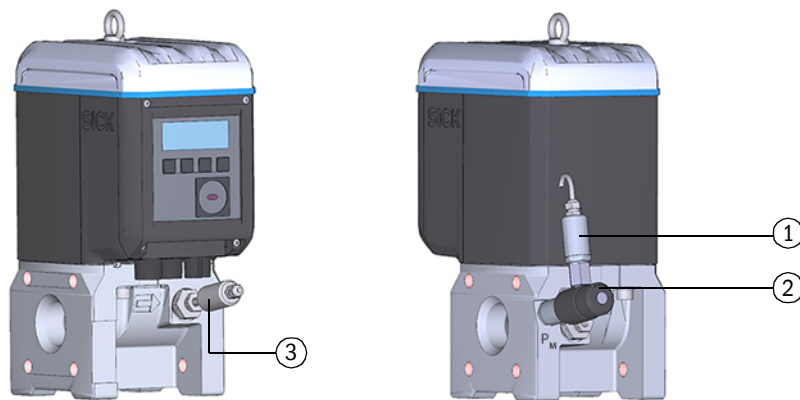
1 Pressure sensor
2 Test valve BDA04
3 Temperature sensor

A three-way test valve (→ Fig. 6) that is fitted next to the FLOWSIC500 is used for gas temperatures to -40 °C.

Fig. 6   Three-way test valve with p-sensor and Minimess coupling
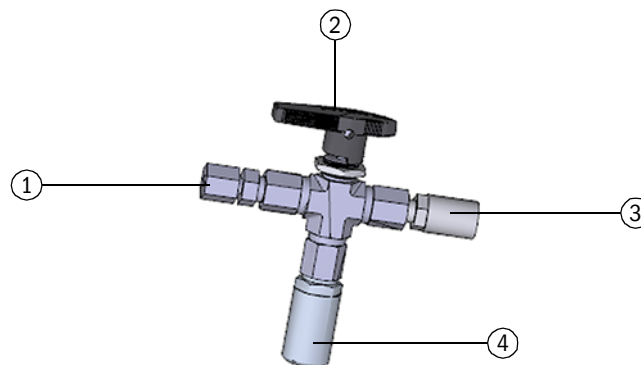
1 Pipe screw fitting 1/4" NPT on pipe D06
   or pipe screw fitting 1/4" NPT on pipe 1/4"
2 Hand lever
3 Test connection (Minimess coupling)
4 Pressure sensor, connection thread G 1/4"

2.7.2 Load recording device with maximum load display

The optional feature "Load recording device with maximum load display" is available for FLOWSIC500 with integrated volume conversion. The feature is optionally activated at the factory and extends the archive entries of the measuring period archive, daily archive and monthly archive by additional details, e. g. time stamps of measurement and process variables, T_{min}, T_{max} and flowtime.

> **+i↪** Explanations on data structure and storage depth are available in Technical Bulletin "Data Registration").
> You will find the document on the delivered product CD.

The archive contents can be shown on the display. A search function is also available, see →p. 99, §5.2.16. Querying the measurement data and external time synchronization are also possible via the RS485 interface.

When the current measuring period elapses, the consumption and process values of this period are used for updating the daily and monthly extreme values related to the measuring period.

When the current day is ended, the consumption and process values of this day are used for updating the daily related monthly extreme values.

If the feature "Load recording device with maximum load display" is activated, the FLOWSIC500 checks if the measuring period or the daily period is still valid when ending the measuring period or the daily period. If the period is valid, the consumption of this period is used for updating the daily and monthly extreme values.

A period entry is marked as invalid when the following events occur:

- when there is a device malfunction,
- when the target recording duration has not been observed,
- when the time has been set beyond the synchronization limit,
- if the difference between the start and end time stamps does not match the target period duration.

For the maximum load function, the stored measured values for the currently running and the previous, i.e. last completed, periods can be shown on the display, see →p. 96, §5.2.6.10.

The maxima (↑) of the last 24 months in each case are stored in the monthly archive and can also be viewed on the display.

2.7.3 Extension measurement capability up to 30% hydrogen

By default, the FLOWSIC500 has the ability to measure a hydrogen content of up to 10% in natural gas. Starting with firmware version 2.17.00, this range can be extended up to 30% with an additional license. Accuracy class 1.0 is always maintained.

The license can be activated ex works when ordering the device or can be obtained from SICK at a later date. When activating the license for gas flow meters in the field, the national regulations must be taken into account.

2.7.4 Gas Quality Indicator (GQI)

When commissioning the FLOWSIC500 (from FW2.15), the current gas composition and a permissible deviation can be parameterized via the Gas Quality Indicator (GQI) in FLOW-gate™. The gas quality is continuously monitored. If the gas composition is changed by admixing other gas types, e.g. biogas, the operator receives status information as soon as the Gas Quality Indicator (GQI) of the FLOWSIC500 exceeds the parameterized permissible deviation. Changes in the gas quality can thus be detected.

As of firmware 2.17, the hydrogen content in the natural gas can be monitored via an option/license with the gas quality indicator. As a basis for monitoring, the gas composition of the natural gas in the meter must be parameterized with FLOWgate™. If the set limit value is exceeded with fluctuating hydrogen feed-in, the FLOWSIC500 reports this back to the operator via the status. In this way, changes in the hydrogen content and thus also the heating values can be detected in real time. The Gas Quality Indicator based on i-diagnostics™ forms the basis for ensuring contractually agreed gas qualities where no gas quality measurement by means of a gas chromatograph or no measurement of the hydrogen content is available.

For a meter in the field, activation of the feature via a SICK license is only possible in compliance with national regulations.

2.8 Parameter protection

2.8.1 Parameter locking switch

A parameter locking switch is located on the circuit board to secure the custody relevant parameters. This covers all values that influence volume metering and volume conversion.

Fig. 7   Parameter locking switch on the circuit board
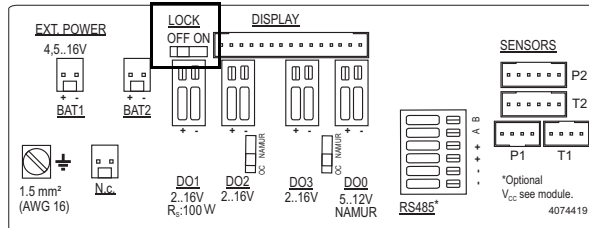
The parameter locking switch is secured by the terminal compartment cover and a seal.

2.8.2 Metrology logbook

Selected custody relevant parameters can be modified when the parameter locking switch is closed and after logging in as authorized user.

An entry in the metrology logbook is generated to ensure the traceability of these parameter changes. The entry contains the timestamp, old and new value, totalizer level V (for gas flow meters) or Vb (for gas flow meters with device option volume conversion) and the logged on user.

The Metrology logbook can have a maximum of 100 entries. The FLOWSIC500 switches to status "Warning" when the Metrology logbook is full.

The Metrology logbook can be cleared when the parameter locking switch is open. Parameter changes to the following parameters are entered in the Metrology logbook as long as entries are possible.

Table 5   Custody relevant parameters - gas flow meter

Parameter	Description
Max. reverse flow volume	Buffer volume for reverse flow
Symbols for measured value displays	Symbols used on the display (formula symbols)

Table 6   Custody relevant parameters - gas flow meter with volume conversion

Parameter	Description
Max. reverse flow volume	Buffer volume for reverse flow
Symbols for measured value displays	Symbols used on the display (formula symbols)
Calculation interval	Cycle time for updating measured values (pressure, temperature) and calculation of the compressibility factor
Calculation method	Calculation method for the compressibility factor
Value range check	Checking the input parameters for the conversion algorithms
Reference conditions	Reference conditions for density and heating value
Heating value unit	Heating value unit
Density value selection	Selection of relative density or standard density
Basic pressure	Pressure standard conditions
Basic temperature	Temperature standard conditions
K-factor (fixed)	Figure for method "Fixed value" when the calculation of the K-factor is incorrect
Default value for Molar mass	Default value, when the calculation of the molar mass is disturbed
p Lower alarm limit	Lower warning limit for the pressure which can be set by the customer
p Upper alarm limit	Upper warning limit for the pressure which can be set by the customer
p Default value	Fixed value of measurement pressure
p Unit	Unit for pressure values
Atmospheric pressure	Ambient pressure
p Serial number	Serial number of pressure sensor
p Offset	Offset for pressure sensor adjustment
p Adjust factor	Factor for pressure sensor adjustment
T Lower alarm limit	Lower warning limit for the temperature which can be set by the customer
T Upper alarm limit	Upper warning limit for the temperature which can be set by the customer
T Default value	Fixed value of measurement temperature
T Unit	Unit for temperature values, used for entry and display
T Serial number	Serial number of temperature sensor
T Offset	Offset for temperature sensor adjustment
T Adjust factor	Factor for temperature sensor adjustment
Measuring period	Period for billing archive
Gas hour	Billing hour for the day archive
Gas day	Billing day for month archive

2.8.3 Gas composition logbook

All changes of gas composition parameters for volume conversion are saved in the Gas composition logbook.

The entry contains timestamp, old and new value of the changed parameter, totalizer level Vb, logged on user and the register number. The Gas composition logbook can have a maximum of 150 entries. The oldest entries are overwritten when the Gas composition logbook is full.

The Gas composition logbook can only be cleared when the parameter locking switch is open.

Table 7   Gas composition parameters for volume conversion

Parameter	Description
Relative density	Relation between gas density and air density under reference conditions
Reference density	Gas reference density under reference conditions
Heating value	Gas heating (under reference conditions)
Carbon dioxide (CO_2)	CO_2 proportion in gas
Hydrogen H_2	H_2 proportion in gas
Nitrogen N_2	N_2 proportion in gas
Methane CH_4	Methane proportion in gas
Ethane C_2H_6	Ethane proportion in gas
Propane	Propane proportion in gas
Water H_2O	Water vapor proportion in gas
Hydrogen sulfide H_2S	Hydrogen sulfide proportion in gas
Carbon monoxide CO	Carbon monoxide proportion in gas
Oxygen O_2	Oxygen proportion in gas
i-butane	i-butane proportion in gas
n-butane	n-butane proportion in gas
i-pentane	i-pentane proportion in gas
n-pentane	n-pentane proportion in gas
n-hexane	Hexane proportion in gas
n-heptane	Heptane proportion in gas
n-octane	Octane proportion in gas
n-nonane	Nonane proportion in gas
n-decane	Decane proportion in gas
Helium	Helium proportion in gas
Argon	Argon proportion in gas

2.9 Sealing

The FLOWSIC500 is secured at the factory with a seal on the cover.

Gas flow meter and adapter can be secured at the joint by a user seal (adhesive label) glued with approximately equal spread on gas flow meter and adapter.

Optionally, the electronics cover can also be protected by the customer after the end of the installation against unauthorized opening.

Fig. 8   Factory seal of the cover on the gas flow meter
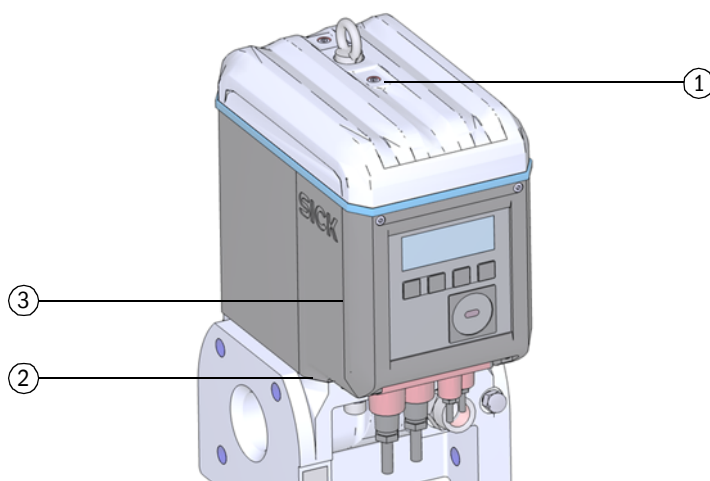
1 Seal position
2 Possible position of the adapter seal
3 Possible position of the electronic cover seal

In addition, the FLOWSIC500 has seal positions on the terminal compartment cover and the plug-in connector cover.

An adhesive label secures the interfaces and the parameter lock by the terminal cover compartment.

During commissioning, the plug-in connector cover must be secured according to national regulations. This can be performed with an adhesive label which is glued with approximately equal spread on the cover and the enclosure or alternatively by using capstan screws and a tensioned sealing wire and a wire seal.

Fig. 9   Seals on the terminal compartment and plug-in connector cover
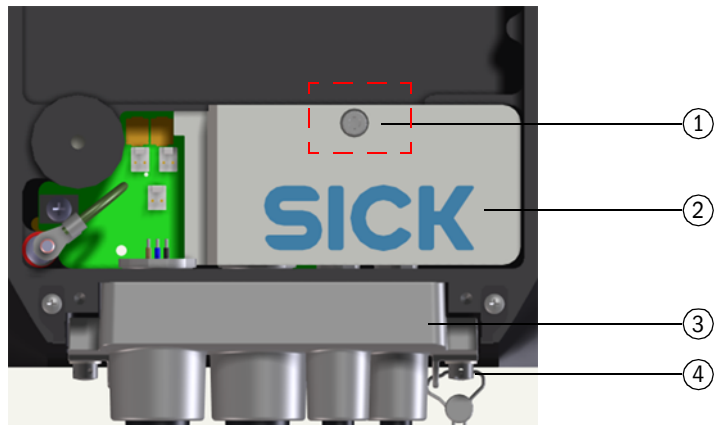
1 Seal position
2 Terminal compartment cover (securing the terminal compartment)
3 Plug-in connector cover
4 Capstan screw, wire and wire seal (securing of plug-in connector cover)

> **NOTICE:**
> ► Secure the terminal compartment cover and the plug-in connector cover with at least one verification seal against unauthorized removal of the cover!

Fig. 10   Seal on the temperature sensor (example)
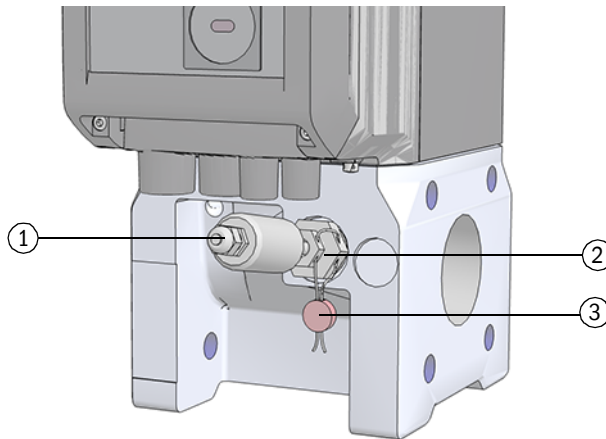
1 Temperature sensor
2 Locknut
3 Wire seal

Fig. 11   Seal on the pressure sensor (example)
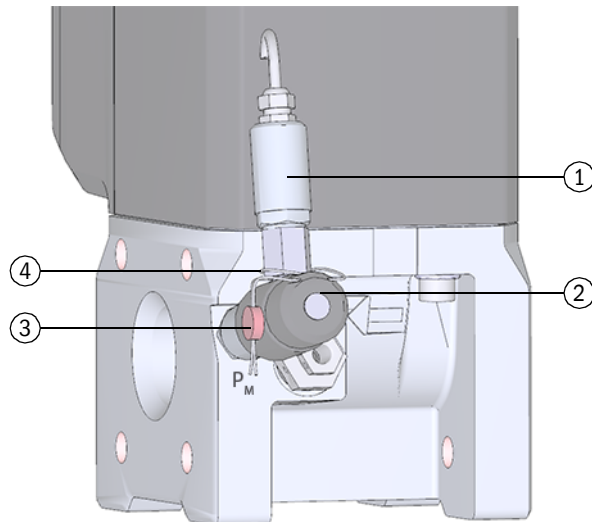
1 Pressure sensor
2 Test valve BDA04
3 Wire seal
4 Wire loop

> **!** **NOTICE:**
> Make sure that the wire loop is placed tight around the pressure sensor.

2.10 PowerIn Technology™

The FLOWSIC500 is available with two configurations:

- For operation with external intrinsically safe power supply with backup battery (backup duration: Approx. 3 months).
- Self-sufficient power configuration: 2 internal longlife battery packs (typical service life: At least 5 years).

  The second battery pack is activated automatically when the first pack is empty and a message displayed (→ p. 80, § 5.2).

FLOWSIC500

3   Installation

Hazards during installation
General information
Mechanical installation
Electrical installation
Installing the external pressure and temperature sensors
Fitting a display protector (option)

3.1 Hazards during installation

> **CAUTION: General risks during installation**
> ► Observe applicable valid regulations, general standards and guidelines.
> ► Observe local safety regulations, operating instructions and special regulations.
> ► Observe the safety information in → p. 10, §1.1.
> ► Comply with the safety requirements of Pressure Equipment Directive 2014/68/EC or ASME B31.3 when installing pressure devices including connection of various pressure devices.
> ► Persons carrying out installation work must be familiar with the directives and standards applicable for pipeline construction and have the corresponding qualifications, e.g. in accordance with DIN EN 1591-4.

> **WARNING: Hazards through the gas in the system**
> The following conditions can increase the risk:
> • Toxic gas or gas dangerous to health
> • Explosive gas
> • High gas pressure
>
> ► Only carry out installation, maintenance and repair work when the system is non-pressurized.

> **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.

3.2 General information

3.2.1 Delivery

The FLOWSIC500 is delivered preassembled 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 FLOWSIC500 into operation if you notice any damage!

► Check the scope of delivery for completeness.

The standard scope of delivery comprises:
● FLOWSIC500 (gas flow meter and adapter, already fitted),
● Backup battery (if device is configured for external power supply), or
● 2 battery packs (if device is configured for battery operation).

3.2.2 Transport

► During all transport and storage work, ensure:
  – The FLOWSIC500 is always well secured
  – Measures to prevent mechanical damage have been taken
  – Ambient conditions are within specified limits.

3.3 Mechanical installation

	CAUTION: General risks during installation
⚠	► Observe applicable valid regulations, general standards and guidelines.
	► Observe local safety regulations, operating instructions and special regulations.
	► Observe the safety information in → p. 10, §1.1.
	► Comply with the safety requirements of Pressure Equipment Directive 2014/68/EC or ASME B31.3 when installing pressure devices including connection of various pressure devices.
	► Persons carrying out installation work must be familiar with the directives and standards applicable for pipeline construction and have the corresponding qualifications, e.g. in accordance with DIN EN 1591-4.

The FLOWSIC500 normally does not need straight inlet and outlet sections and can be fitted directly after bends in the pipe.

	NOTICE: **Installation requirements**
!	► The following elements must not be present within a distance of 5 DN to the adapter in upstream direction:
	– A valve not always operated fully open,
	– a pressure regulator.
	► The pressure sensor must be maximum 5 DN behind the gas flow meter. Alternatively, the temperature sensor in the optional immersion sleeves can be used in the adapter.
	► In concrete application, observe limitations resulting from type approval!

3.3.1 Preparations

► Select a suitable installation location. Ensure adequate assembly clearances (→ Table 12).
► The following tools and materials are required to install the FLOWSIC500:
  – Hoisting equipment (lifting capacity according to the weight specifications → p. 155, §9.6)
  – Box wrench with size suitable for flange installation
  – Torque wrench
  – Flange gaskets
  – Lubricant, metal-free or suitable for aluminum, e.g. OKS 235, to prevent thread mountings seizing up.

	NOTICE:
!	Do not use copper paste!

  – SW3 Allen key
  – Leak detection.

3.3.2 Choosing flanges, gaskets and other components

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

→ Table 8 contains a list of recommended bolts and → Table 9 contains a list of recommended gaskets.

For devices with approval according to GOST, → Table 10 contains a list of recommended bolts and → Table 11 contains a list of recommended gaskets.

Fig. 12   Dimensions of gaskets
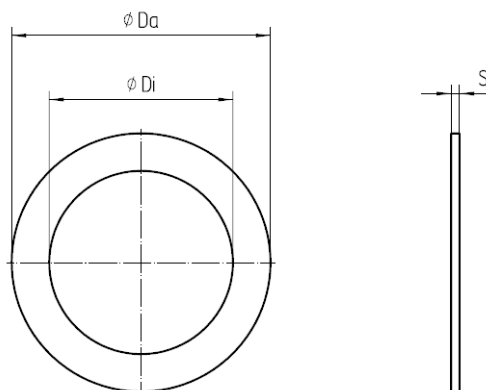
Table 8   Bolts and tightening torques

Device/flange type	Bolts	Washers	Nuts	Tightening torque	
PN16 / EN1092-1					
DN50/ PN16	4 pc. DIN835-M16x45-A2-70	4 pc. DIN125-A17-A4	4 pc. ISO4032-M16-A4-70	130 Nm	96 lbf ft
DN80/ PN16	8 pc. DIN835-M16x45-A2-70	8 pc. DIN125-A17-A4	8 pc. ISO4032-M16-A4-70	130 Nm	96 lbf ft
DN100/ PN16					
DN150/ PN16	8 pc. DIN835-M16x45-A2-70	8 pc. DIN125-A21-A2	8 pc. ISO4032-M20-A2-70	250 Nm	184 lbf ft
Class 150 / ASME B16.5					
2"/ Cl150	4 pc. Double end threaded stud Ø 5/8", length 3.5" - ASME B18.31.2, ASTM A193 Grade B8M	4 pc. Type A plain washer (narrow series) Ø 5/8" - ANSI B18.22.1, grade 8 stainless steel	4 pc. Hex flat nut (UNC series) Ø 5/8" - ANSI B18.2.2, ASTM A194 Grade 8MA	140 Nm	103 lbf ft
3"/ Cl150					
4"/ Cl150	8 pc. Double end threaded stud Ø 5/8", length 3.5" - ASME B18.31.2, ASTM A193 Grade B8M	8 pc. Type A plain washer (narrow series) Ø 5/8" - ANSI B18.22.1, grade 8 stainless steel	8 pc. Hex flat nut (UNC series) Ø 5/8" - ANSI B18.2.2, ASTM A194 Grade 8MA	140 Nm	103 lbf ft
6"/ Cl150	8 pc. Double end threaded stud Ø 3/4", length 4.0" - ASME B18.31.2, ASTM A193 Grade B8M	8 pc. Type A plain washer (narrow series) Ø 3/4" - ANSI B18.22.1, grade 8 stainless steel	8 pc. Hex flat nut (UNC series) Ø 3/4" - ANSI B18.2.2, ASTM A194 Grade 8MA	240 Nm	177 lbf ft

Table 9   Gaskets

Device/flange type	Da[1] [mm]	Di [mm]	S [mm]	Material
PN16 / EN1092-1				
DN50/ PN16	107	61		
DN80/ PN16	142	90	2	novapress® FLEXIBLE/815
DN100/ PN16	162	115		
DN150/ PN16	218	169		
Class 150 / ASME B16.5				
2"/ Cl150	105	60		
3"/ Cl150	137	89	2	novapress® FLEXIBLE/815
4"/ Cl150	175	114		
6"/ Cl150	222	168		

[1]   Da = outer diameter, Di = inner diameter, S = thickness, → Fig. 12

Recommended bolts and gaskets according to GOST

Table 10   Bolts and tightening torques

Device/flange type	Bolts	Washers	Nuts	Tightening torque
PN16 / GOST 12815-80				
DN50/ PN16 Series 1+2	4 pc. DIN835-M16x45-A2-70	4 pc. DIN125-A17-A4	4 pc. ISO4032-M16-A4-70	130 Nm
DN80/ PN16 Series 1	8 pc. DIN835-M16x45-A2-70	8 pc. DIN125-A17-A4	8 pc. ISO4032-M16-A4-70	130 Nm
DN80/ PN16 Series 2	4 pc. DIN835-M16x45-A2-70	4 pc. DIN125-A17-A4	4 pc. ISO4032-M16-A4-70	130 Nm
DN100/ PN16 Series 1+2	8 pc. DIN835-M16x45-A2-70	8 pc. DIN125-A17-A4	8 pc. ISO4032-M16-A4-70	130 Nm
DN150/ PN16	8 pc. DIN835-M20x55-A2-70	8 pc. DIN125-A21-A2	8 pc. ISO4032-M20-A2-70	250 Nm
PN16 / EN1092-1				
DN50/ PN16	4 Stck DIN835-M16x45-A2-70	4pc. DIN125-A17-A4	4 pc. ISO4032-M16-A4-70	130 Nm
DN80/ PN16	8 pc. DIN835-M16x45-A2-70	8pc. DIN125-A17-A4	8 pc. ISO4032-M16-A4-70	130 Nm
DN100/ PN16	8 pc. DIN835-M16x45-A2-70	8 pc. DIN125-A17-A4	8 pc. ISO4032-M16-A4-70	130 Nm
DN150/ PN16	8 pc. DIN835-M20x55-A2-70	8 pc. DIN125-A21-A2	8 pc. ISO4032-M20-A2-70	250 Nm

Table 11   Gaskets

Device/flange type	Da[1] [mm]	Di [mm]	S [mm]	Material
PN16 / GOST 12815-80				
DN50/ PN16 Series 1+2	107	61		
DN80/ PN16 Series 1	142	90		
DN80/ PN16 Series 2	142	90	2	novapress® FLEXIBLE/815
DN100/ PN16 Series 1+2	162	115		
DN150/ PN16 Series 1+2	218	169		
PN16 / EN1092-1				
DN50/ PN16	107	61		
DN80/ PN16	142	90	2	novapress® FLEXIBLE/815
DN100/ PN16	162	115		
DN150/ PN16	218	169		

[1] Da = outer diameter, Di = inner diameter, S = thickness, → Fig. 12

3.3.3 **Fitting in the pipeline**

> | ! | *NOTICE:*
> | | The lifting lug is designed for transporting the measuring device only.
> | | Do not lift or transport the FLOWSIC500 with additional loads using this lug.
> | | ► The FLOWSIC500 must not swing or tilt on the hoisting equipment during transport.
> | | ► The FLOWSIC500 must not turn during transport otherwise the lifting lug could be screwed out.

> | ! | *NOTICE:* **Observe the gas flow direction**
> | | The prescribed flow direction is marked on the adapter with an arrow.
> | | Arrow direction and gas flow direction must match.
> | | ► Install the FLOWSIC500 in flow direction.
> | | The device signals a malfunction when the FLOWSIC500 is installed against the prescribed flow direction.

The FLOWSIC500 can be installed horizontal or vertical.

The control unit can be rotated ± 90° (→ p. 49, §3.4.4).

Fig. 13   Installation examples

Direction of gas flow

Marking for flow direction
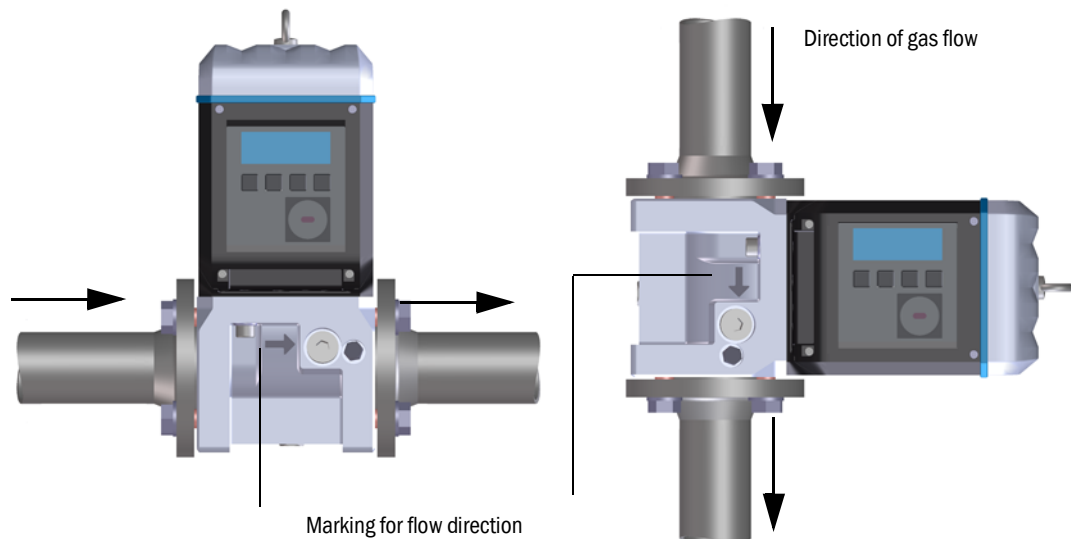
3.3.3.1 **Assembly clearances**

Maintain adequate assembly clearances to ensure there is enough room to exchange the gas flow meter. The upward clearance is needed to remove the gas flow meter from the adapter and to put it back on again. The downward clearance is needed to loosen the screws, take these out or insert these again and to fit the tool correctly.

> **!** *NOTICE:*
> Depending on the tool used and the installation location, adequate clearances to the sides are also required.

Fig. 14   Assembly clearances
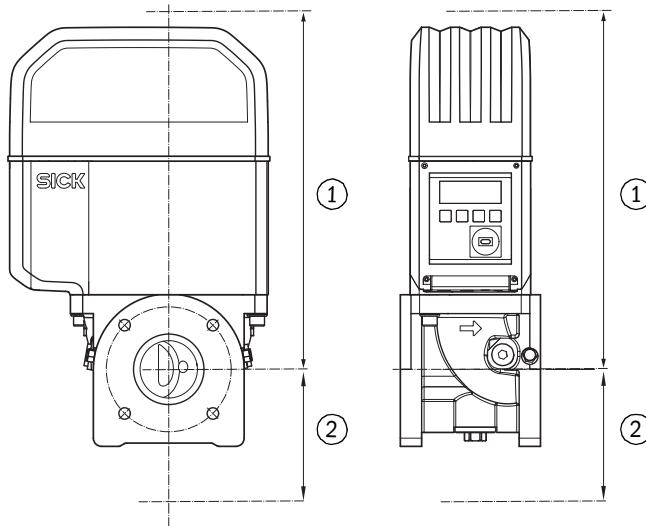
1 Upward clearance
2 Downward clearance

Table 12   Minimum clearance required starting from the pipe axis

Meter size	Upward clearance, without lifting lug		Upward clearance, with lifting lug		Downward clearance	
	[mm]	[in]	[mm]	[in]	[mm]	[in]
DN50/2"	300	11,81	340	13,39	200	7,87
DN80/3"	460	18,11	510	20,08	250	9,84
DN100/4"	520	20,47	570	22,44	320	12,6
DN150/6"	520	20,47	570	22,44	320	12,6

3.3.3.2   **Pipeline torque**

> ⚠ *NOTICE:*
> If the FLOWSIC500 is installed so that the gas flow meter projects sideways from the pipeline, the gas flow meter weight creates a torque on the pipeline.
> ► Make sure the pipeline is capable of holding the gas flow meter → p. 45, Table 13.

Table 13   Pipeline torque

Meter size	Torque	
	[Nm]	[lbf ft]
DN50/2"	6	5
DN80/3"	16	12
DN100/4"	31	23
DN150/6"	31	23

3.3.3.3   **Installation in pipeline**

1   Select suitable bolts.

    Recommended bolts →Table 8.

2   Use the hoisting equipment to position the FLOWSIC500 in the desired location in the pipeline.

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

3   Insert and align the gaskets.

4   Apply lubricant to the bolts.

5   First screw the bolts by hand into the adapter to the stop.
    –   Screw in the bolts according to DIN835 with the shorter thread end.
    –   The bolts according to ASME B18.31.2 can be screwed in with any end.

6   Check the thread length in the adapter is fully utilized.

7   Then install the washers and nuts, and tighten them by hand.

8   Check whether the thread length of the nut is fully utilized.

    If necessary, use a different bolt length.

9   Check correct positioning of flange gaskets.

10   Tighten nuts evenly and crosswise in small steps until the specified tightening torque is reached (→Table 8).

    Make sure the flange sits free of tension.

11   Slowly increase the pressure in the pipeline.

    Gradient: Max. 3 bar/min (45 psi/min)

12   Carry out a leak tightness check on the pipeline (in accordance with the pipeline operating company's specifications).

3.4 Electrical installation

3.4.1 Requirements for use in potentially explosive atmospheres

EX	The FLOWSIC500 is suitable for use in potentially explosive atmospheres: ATEX: II 2G Ex ia [ia] IIB T4 Gb, II 2G Ex ia [ia] IIC T4 Gb, II 2G Ex op is IIC T4 Gb IECEx: Ex ia [ia] IIB T4 Gb, Ex ia [ia] IIC T4 Gb, Ex op is IIC T4 Gb US/C: Class I Division 1, Groups C, D T4, Ex/AEx ia IIB T4 Ga

EX	For a FLOWSIC500 used in potentially explosive atmospheres: ► Installation, commissioning, maintenance and inspection may only be carried out by skilled persons having knowledge of the relevant rules and regulations for potentially explosive atmospheres, especially: – Ignition protection types – Installation regulations – Category classification ► Comply with all valid IEC standards.

The FLOWSIC500 is suitable for measuring combustible and occasionally ignitable gases corresponding to zones 1 and 2.

Basic requirements

► The documentation for zone categorization in accordance with IEC60079-10 must be available

► The FLOWSIC500 must have been checked for suitability for the actual installation location and the Ex marking on the device must match the requirements.

► After installation and before initial commissioning, the complete equipment and the system must be inspected in compliance with IEC 60079-17.

⚠	**WARNING: Risk of explosion** All electrical connections of the FLOWSIC500 are approved for connection to the certified intrinsically safe power circuits only. ► Proof of the intrinsic safety in compliance with IEC 60079-14 must be presented for interconnection with the associated intrinsically safe equipment. Otherwise the intrinsic safety of the FLOWSIC500 can be endangered, i.e. the ignition protection for the FLOWSIC500 can no longer be ensured.

Operating conditions for the ultrasonic sensors

The FLOWSIC500 is designed for use in potentially explosive atmospheres solely under normal atmospheric conditions within the following limits.

– Ambient pressure range 0.8 bar (11.6 psi) to 1.1 bar (15.95 psi)

– Air with normal oxygen content, normally 21 percent by volume

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

The gas flow meter becomes part of the pipeline as soon as the FLOWSIC500 is installed in the pipeline.

The walls of the pipeline and the gas flow meter then serve as zone-separating barrier. The following Figure shows the different situations for a possible application and the operating conditions that apply.

Fig. 15   Ex zones

Case 1:

Zone 1 or 2

Non-explosive gas mixture

- The pipeline contains a non-explosive mixture. The gas mixture can be combustible.
- Gas pressure and gas temperature can be within the range specified on the type plate of the gas flow meter.

Case 2:

Zone 1 or 2

Zone 1 or 2

- The area inside the pipeline is classified as potentially explosive atmosphere Zone 1 or 2.
- The gas pressure must be within the range 0.8 (11.6 psi) to 1.1 bar (15.95 psi) (normal atmospheric conditions).
- Gas temperature must be within the permitted ambient temperature range specified by the type plate on the gas flow meter

> ⚠ **WARNING: Risk of ignition through impacts or friction**
> The ultrasonic transducers of the FLOWSIC500 are made of titanium. The pipe adapter and part of the electronic enclosure may be made of aluminum.
> In rare cases, ignition sources due to impact and friction sparks could occur. The maximum piezoelectric energy that can be released through impacts on the ultrasonic transducers exceeds the limit for Gas group IIC specified in §10.7 of EN60079-11:2012.
> ► For this reason, the ultrasonic transducers may only be used in zone 1 when risks of ignition arising from impacts or friction on the sensor housing can be ruled out within the application.
> ► Only ultrasonic transducers provided by SICK may be used!

3.4.2   **Criteria for electrical connection**

Installation work → p. 39, §3.3 must be completed.

⚠	**WARNING: Risk of explosion - hazard for intrinsic safety** ► The following work may only be carried out by skilled technicians familiar with the special characteristics of the intrinsic safety of the ignition protection type and who have knowledge of the relevant standards and regulations for interconnection of intrinsically safe power circuits.

3.4.3   **Opening and closing the electronics cover**

EX	The Ex i terminal compartment of the FLOWSIC500 can be accessed after the electronics cover has been opened. The cover may also be opened in the hazardous area when under voltage. However, safe separation between the various intrinsically safe power circuits must not be breached.

Opening the electronics cover

1   Loosen the 4 screws (captive) on the electronics cover using an SW3 Allen key.

Fig. 16   Position of electronics cover screws

4 screws
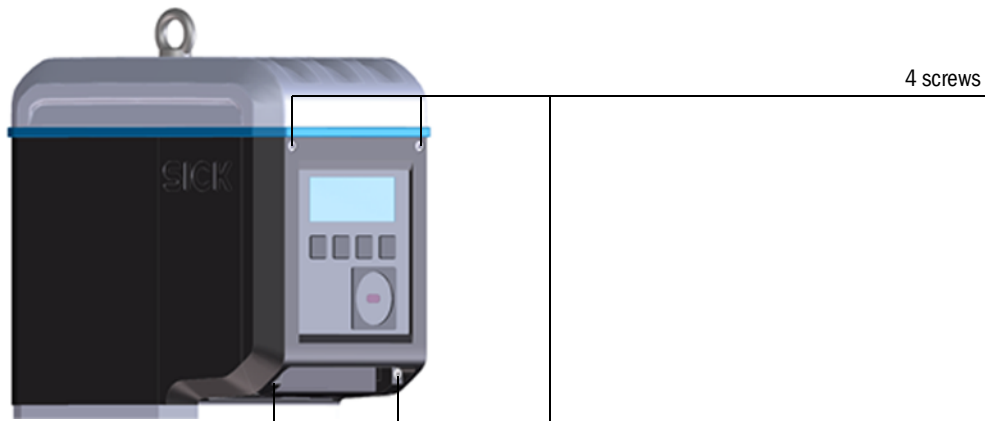
2   Open the electronics cover.

Closing the electronic cover

1   Close the electronics cover.

❗	► Make sure no battery and display cables are pinched.

2   Screw the electronics cover tight again.
     Tightening torque: 2.0 Nm (18 lbf in)

3.4.4 Rotating the control unit

1 Open the electronics cover (→ p. 46, §3.4)

2 Loosen the 4 display screws with an SW3 Allen key, → Fig. 17.

Fig. 17   Position of display screws
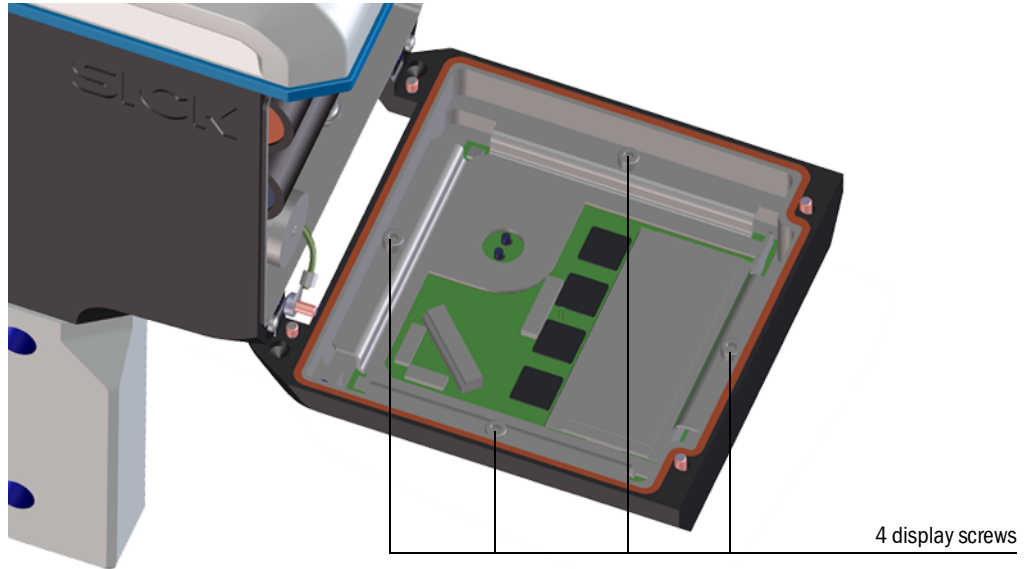
4 display screws

3 Check the display seal for intactness and correct fitting.

4 A new seal is available as spare part when the display seal is damaged (Part No. 2095177).

5 Rotate the display in the desired direction and reposition.

6 Tighten the display screws evenly.
   Tightening torque: 1.0 Nm (9 lbf in)

7 Close the electronics cover again.

3.4.5 Electrical connections

The FLOWSIC500 interfaces are accessible from the outside via external plug-in connectors.

Fig. 18   Connections

1   Plug-in connector 1 (B-coded): External power supply and signal output
2   Plug-in connector 2 (A-coded): Signal output
3   Ground screw
4   Connections for pressure/temperature sensors (optional)

Fig. 19   M12 plug-in connector coding
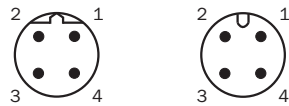
Plug-in connector 1   Plug-in connector 2
(B-coded)   (A-coded)

> **NOTICE:**
> Safety relevant parameters are valid for connecting all pins of a plug-in connector.

> **+i** Plug-in connector 2 (A-coded) can be configured when ordered, configuration options → p. 51, §3.4.6.
> The respective configuration is printed on the type plate (→ p. 54).

> **+i** The external power supply need not be connected when the FLOWSIC500 is operated with internal batteries.

3.4.6 Pin assignment of plug-in connectors

3.4.6.1 Plug-in connector 1: External power supply and signal output

Pin assignment for configuration F, G, H, I, J, K, L

Table 14   Pin assignment for M12 plug-in connector 1 (male/B-coded, 4-poles)

M12 pin	Input/output	Function/signal	Operating parameters	Safety relevant parameters
1	PWR-	Voltage supply	Rated input voltage 4.5 … 16 V	U_i = 20 V I_i = 667 mA P_i = 753 mW U_o = 8.2 V I_0 = 0.83 mA P_0 = 1.7 mW C_0 = 7.6 µF L_0 = 100 mH
2	PWR+			
3	DO_1-	Diagnosis warning, Pulse output in test mode (→ Table 1) and for configuration K, f_{max} = 2 kHz at 120% Q_{max}	OC (Open Collector) Passive, not electrically isolated Max. 16 V Max. 100 mA R_{on} < 110 Ω R_{off} > 1 MΩ	
4	DO_1+			

Pin assignment for configuration M

Table 15   Pin assignment for M12 plug-in connector 1 (male/B-coded, 4-poles)

M12 pin	Input/output	Function/signal	Operating parameters	Safety relevant parameters
1	PWR-	Voltage supply	Rated input voltage 4.5 … 16 V	U_i = 20 V I_i = 667 mA P_i = 753 mW
2	PWR+			
3	DO_0-	HF pulses f_{max} configurable to 2 kHz at 120% Q_{max}	NAMUR, electrically isolated, optically isolated Rated input voltage 8.2 V I_{on} = 3.4 mA I_{off} = 0.7 mA	
4	DO_0+			

Pin assignment for configuration N

Table 16   Pin assignment for M12 plug-in connector 1 (male/B-coded, 4-poles)

M12 pin	Input/output	Function/signal	Operating parameters	Safety relevant parameters
1	PWR-	Voltage supply	Rated input voltage 4.5 … 16 V	U_i = 20 V I_i = 667 mA P_i = 753 mW
2	PWR+			
3	DO_2-	LF pulses f_{max} configurable to 100 Hz at 120% Q_{max}	Passive, electrically isolated, configurable as: OC (Open Collector)*: Max. 16 V Rated current 20 mA or NAMUR: Rated input voltage 8.2 V I_{on} = 3.4 mA I_{off} = 0.7 mA	
4	DO_2+			

3.4.6.2 Plug-in connector 2: Signal output

Table 17   Pin assignment for M12 plug-in connector 2 (male/A-coded, 4-poles)

M12 pin	Input/output	Function/signal	Operating parameters	Safety relevant parameters
Pin assignment configuration 1: LF pulses and malfunction (electrically isolated), type code I/O: F				
1	DO_2+	LF pulses	Passive, electrically isolated, configurable as:	U_i = 20 V
2	DO_2-	f_{max} configurable to 100 Hz at 120% Q_{max}	OC (Open Collector)*: Max. 16 V Rated current 20 mA	P_i = 753 mW
3	DO_3-	Malfunction	or NAMUR: Rated input voltage 8.2 V I_{on} = 3.4 mA I_{off} = 0.7 mA	
4	DO_3+			
Pin assignment configuration 2: HF pulses and malfunction (electrically isolated), type code I/O: G				
1	DO_0+	HF pulses	NAMUR, electrically isolated, optically isolated	U_i = 20 V
2	DO_0-	f_{max} configurable to 2 kHz at 120% Q_{max}	Rated input voltage 8.2 V I_{on} = 3.4 mA I_{off} = 0.7 mA	P_i = 753 mW
3	DO_3-	Malfunction	Passive, electrically isolated, configurable as OC (Open Collector)* or NAMUR, see Configuration 1 for operating parameters	
4	DO_3+			
Pin assignment configuration 3: Encoder and LF pulses (electrically isolated), type code I/O: H				
1	DO_0+	Encoder log	NAMUR, electrically isolated, optically isolated	U_i = 20 V
2	DO_0-		Rated input voltage 8.2 V I_{on} = 3.4 mA I_{off} = 0.7 mA	P_i = 753 mW
3	DO_3-	LF pulses	Passive, electrically isolated, configurable as OC (Open Collector)* or NAMUR, see Configuration 1 for operating parameters	
4	DO_3+			
* Standard configuration				
Pin assignment configuration 4: RS485 module (external feed), standard version: Type code I/O: J, low voltage version: Type code I/O: I				
1	PWR+	RS485 module (externally powered)	Electrically isolated	U_i = 20 V P_i = 1.1 W
2	Data A		Standard version: Rated input voltage U_b = 4 ... 16 V	IIC: C_i = 0.22 µF IIB: C_i = 1.35 µF
3	PWR-		Low voltage version: Rated input voltage U_b = 2.7 ... 5 V	L_i = 0.03 mH
4	Data B			

Table 17   Pin assignment for M12 plug-in connector 2 (male/A-coded, 4-poles)

M12 pin	Input/output	Function/signal	Operating parameters	Safety relevant parameters
Pin assignment configuration 5: Encoder and HF pulses (not electrically isolated), type code I/O: K				
The HF pulses are output via plug-in connector 1 (DO_1), → Table 14.				
1	DO_0+	Encoder log	NAMUR, electrically isolated, optically isolated	U_i = 20 V P_i = 753 mW
2	DO_0-		Rated input voltage 8.2 V I_{on} = 3.4 mA I_{off} = 0.7 mA	
3	DO_3-	Malfunction	Passive, electrically isolated, configurable as OC (Open Collector)* or NAMUR, see Configuration 1 for operating parameters	
4	DO_3+			
* Standard configuration				
Pin assignment configuration 6: LF pulses and malfunction (electrically isolated), type code I/O: L				
1	DO_2+	LF pulses	Passive, electrically isolated, configurable as:	U_i = 20 V P_i = 753 mW
2	DO_2-	f_{max} configurable to 100 Hz at 120% Q_{max}	OC (Open Collector)*: Max. 16 V Rated current 20 mA	
3	DO_3-	LF pulses		
4	DO_3+	f_{max} configurable to 100 Hz at 120% Q_{max}	or NAMUR: Rated input voltage 8.2 V I_{on} = 3.4 mA I_{off} = 0.7 mA	
Pin assignment configuration 7: RS485 module + HF pulses, type code I/O: M				
The HF pulses are output via plug-in connector 1 (DO_0), → Table 15.				
1	PWR+	RS485 module (externally powered)	Electrically isolated	U_i = 20 V P_i = 1.1 W IIC: C_i = 0.22 µF IIB: C_i = 1.35 µF L_i = 0.03 mH
2	Data A		Standard version: Rated input voltage U_b = 4 ... 16 V	
3	PWR-			
4	Data B			
Pin assignment configuration 8: RS485 module + LF pulses, type code I/O: N				
The LF pulses are output via plug-in connector 1 (DO_2), → Table 16.				
1	PWR+	RS485 module (externally powered)	Electrically isolated	U_i = 20 V P_i = 1.1 W IIC: C_i = 0.22 µF IIB: C_i = 1.35 µF L_i = 0.03 mH
2	Data A		Standard version: Rated input voltage U_b = 4 ... 16 V	
3	PWR-			
4	Data B			

Fig. 20   Marking on the type plate (example)
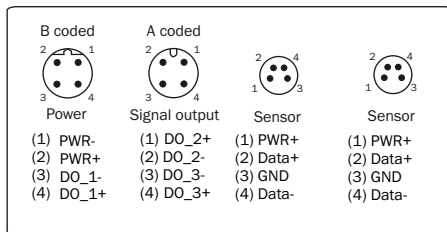
+i→   Internal terminal assignment→ p. 156, §9.7

3.4.7   DO configuration switch (Open Collector - Namur)

Fig. 21   Open Collector - Namur
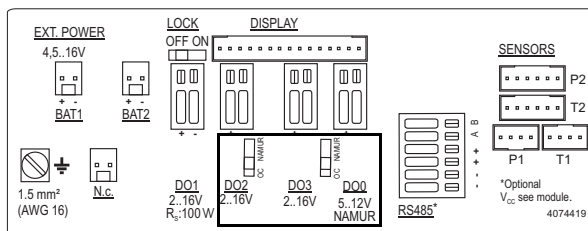
Figure 22   DO switching (Open Collector - Namur)

"OPEN COLLECTOR"	"NAMUR"
Max. configurable impulse duration: 0.05s ... 1 s	Impulse duration: n/a
External supply: $U_S \leq 12$ V	External supply: U_S= 8.2V
Switching states	Switching states
"ON": $0 \leq U_{CE} \leq 2$V; 2mA $\leq I_{CE} \leq 20$mA	"On": $I_O = 3.4$ mA
"OFF": $I_{CE} \leq 0.2$ mA (leakage flow)	"OFF": $I_O = 0.7$ mA
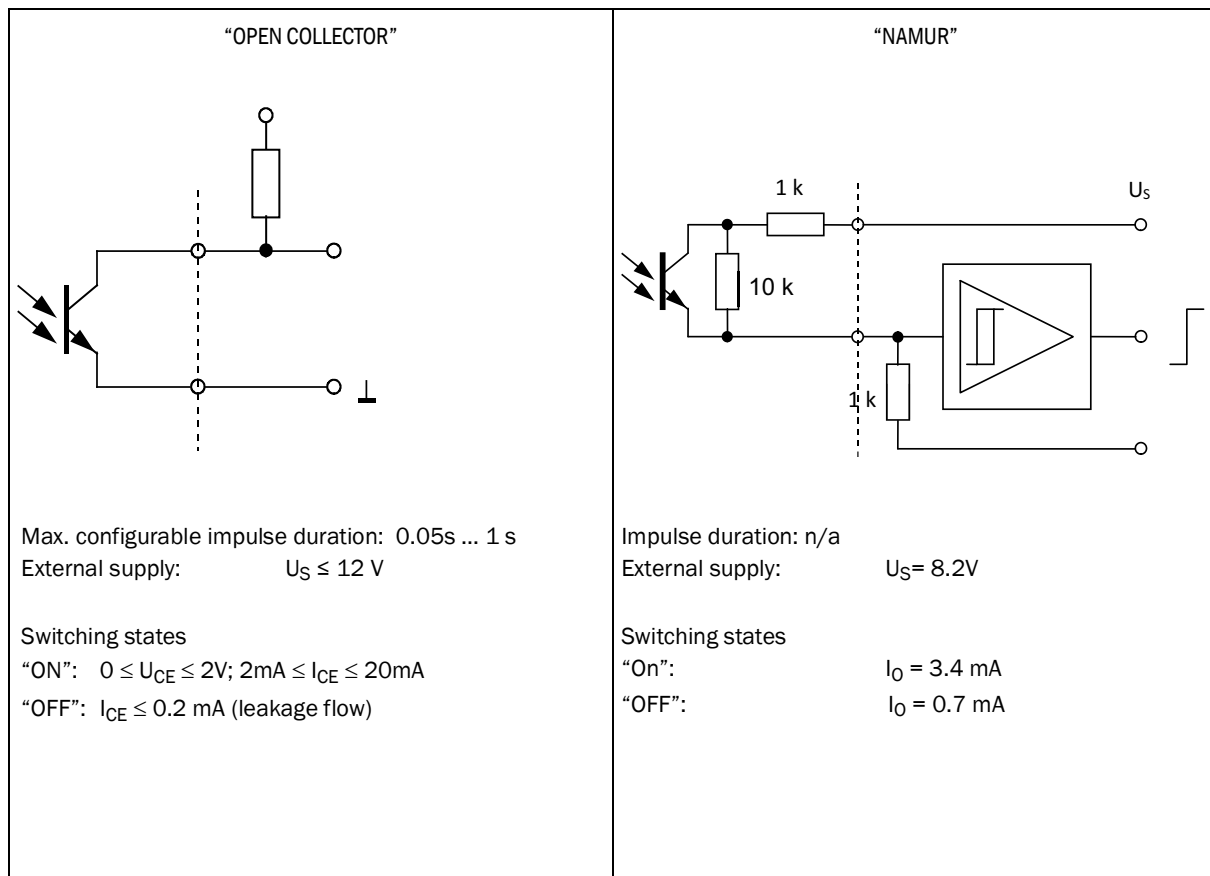
3.4.8 Cable specifications

When the plugs available from SICK are used, a shielded control cable with 4x0.25 mm^2 cross-section, with PVC insulation and approx. 5 mm outer diameter is required.

> ⚠️ **WARNING: 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.

SICK recommends the ready-made cables available as accessories (→ p. 136, §8.1).

Wire colors of the cable available as spare part

Table 18   Power supply cable; for connection to plug-in connector 1, B-coded
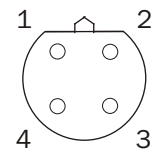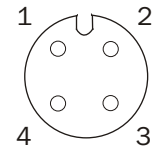
Part No.	Pin	Wire color	Plug
2067424, 2067425	1	Brown	
	2	White	
	3	Blue	
	4	Black (or yellow/green)	
2067632, 2067633	1	White	
	2	Brown	
	3	Green	
	4	Yellow	

Table 19   Data cable for connection to plug-in connector 2, A-coded

Part No.	Pin	Wire color	Plug
2067422, 2067423	1	Brown	
	2	White	
	3	Blue	
	4	Black (or yellow/green)	
2067630, 2067631	1	White	
	2	Brown	
	3	Green	
	4	Yellow	

3.4.9 Operation with external power supply

EX	The FLOWSIC500 is designed electrically intrinsically safe.
	► After correct installation has been checked, the plug connections in the hazardous area can be connected and disconnected under voltage as well.

3.4.9.1 Connecting the external power supply

1 Connect the external intrinsically safe power supply to the M12 plug-in connector of the FLOWSIC500.

Safety-relevant parameters → p. 51, §3.4.6.

Fig. 23   Connection for external power supply underneath the gas flow meter

1 External power supply and signal output

2 Switch the power supply on.
The FLOWSIC500 is initialized.

3 Measurement starts and the current measured value for the gas volume appears.

4 Set the date and time (→ p. 68, §4.2).

3.4.9.2 Connecting the backup battery

1 Open the electronics cover (→ p. 48, 3.4.3).

2 Connect the backup battery (Part No. 2065928) to connection BAT2 in the terminal compartment (→ Fig. 24).

3 Close the electronics cover again.

Fig. 24   Connected backup batteries
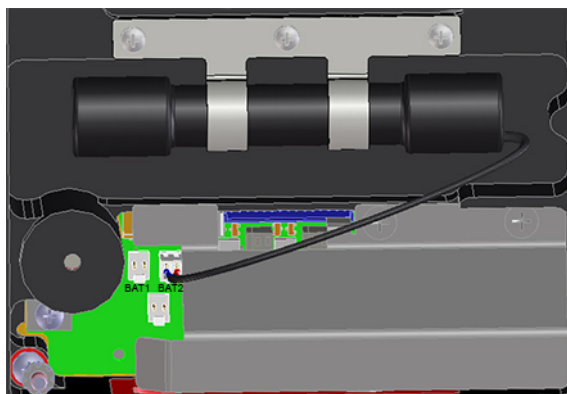
3.4.10	**Battery operation**

> **WARNING: Ignition hazard through electrostatic charges**
> Make sure the electrostatic risks when handling the transportable plastic battery packs are minimized.
> ► Take suitable precautionary measures, e.g wear antistatic shoes, when a charge generating mechanism has been identified, e.g. repeated rubbing of battery packs against clothing.
> ► Putting the battery packs in the bag or carrying them on a belt, using a keyboard or cleaning with a damp cloth do not cause a significant electrostatic risk.

> **WARNING: Hazard through wrong spare parts**
> The FLOWSIC500 and the delivered battery packs are designed intrinsically safe.
> ► Only the exchangeable battery packs from SICK with Part No. 2064018 and the backup battery with Part No. 2065928 may be used for the power supply of the device
> ► The battery packs can be connected and disconnected in the hazardous area as well.
> ► Only connect the battery packs to the connections marked for this purpose in the terminal compartment of the FLOWSIC500.
> ► Modifying the electrical connection parts is not allowed.

3.4.10.1   **Connecting the batteries to supply the FLOWSIC500**

1   Open the electronics cover (→ p. 48, §3.4.3).

2   Insert the battery packs (Part. No. 2064018) as shown and connect to connections
BAT1 and BAT2 in the terminal compartment.
The FLOWSIC500 is initialized.

Fig. 25   Connected battery packs
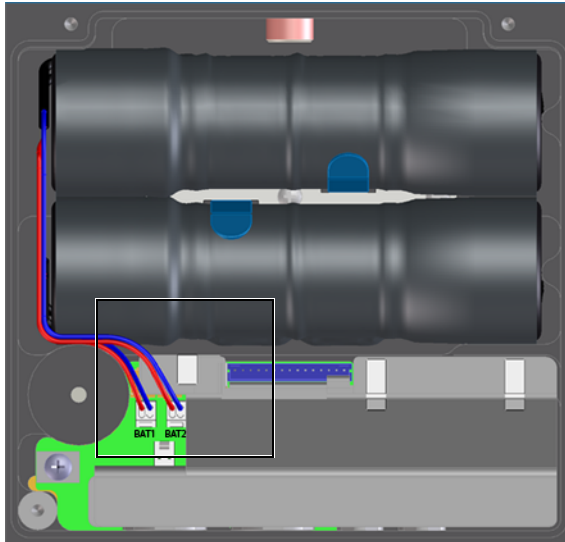
3   Close the electronics cover again.

4   Set the date and time (→ p. 68, §4.2).

3.5 Installing the external pressure and temperature sensors

The adapter of FLOWSIC500 has measuring ports for pressure and temperature.

> **!** *NOTICE:*
> ► The pressure measuring port to be used for measurement is marked "P_M". On meters with flow direction "left-right" (→), the marked pressure measuring port is on the rear of the adapter, on meters with flow direction "right-left" (←), it is on the front.
> ► The pressure and temperature sensors can only be replaced when the parameter locking switch is open..

Fig. 26   Pressure and temperature measuring ports (front and rear side)
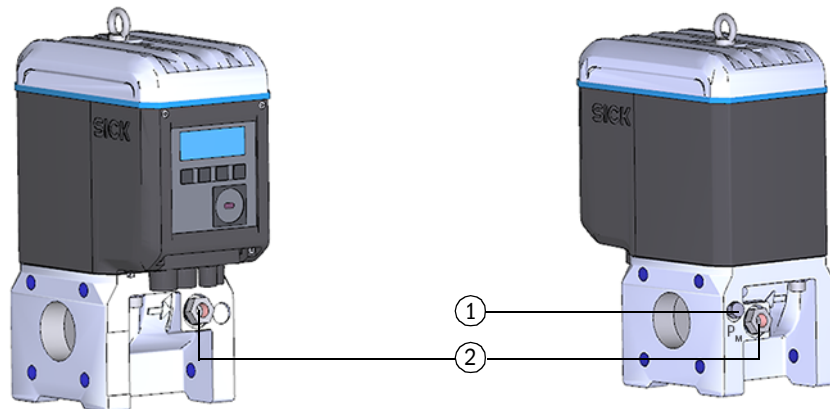
1 Pressure measuring port
2 Alternative temperature measuring ports

> **!** *NOTICE:* **Ensure sufficient assembly clearance!**
> Ensure sufficient clearance to the wall or other components at the rear measuring ports when installing the sensors.
> The recommended minimum clearance to the wall is 0.3 m.

3.5.1 Fitting the plug-in connector cover

Fit the plug-in connector cover before installing the sensors.

1 Guide the sensor plugs through the openings in the plug-in connector cover.

Fig. 27   Plug-in connector cover
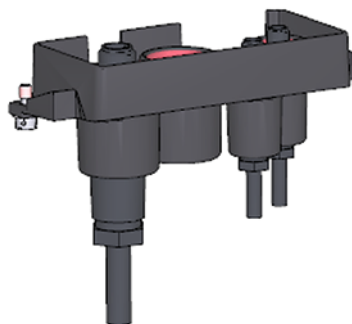
2 Connect the plugs to the planned connections.

> ℹ️ For meter sizes DN50 and DN80, it is recommended to connect the pressure sensor to the right M8 connection and the temperature sensor to the left M8 connection.
> The FLOWSIC500 automatically detects whether a pressure or temperature sensor has been connected to a connection.

Fig. 28   Connections for pressure and temperature sensors

1 Connections for pressure and temperature sensors

3 Push the plug-in connector cover over the plugs and fasten with both capstan screws.

Fig. 29   Fastening the plug-in connector cover
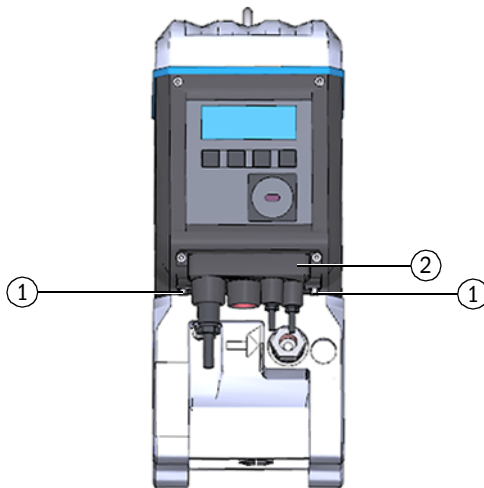
1 Capstan screw
2 Plug-in connector cover

3.5.2 **Installing the pressure sensor**

A three-way test valve is normally fitted to be able to test the pressure sensor also when installed.

> **!** *NOTICE:* **Fitting information**
> It is recommended to connect the pressure sensor with the three-way test valve or with the FLOWSIC500 so that there is a downward slope from the pressure sensor to the connection point and from the three-way test valve to the FLOWSIC500.

► Before installing a pressure sensor, check if there is a G 1/4" or NPT 1/4" thread on the meter body.

► The thread type is marked on the meter body:

Fig. 30   Marking on meter body
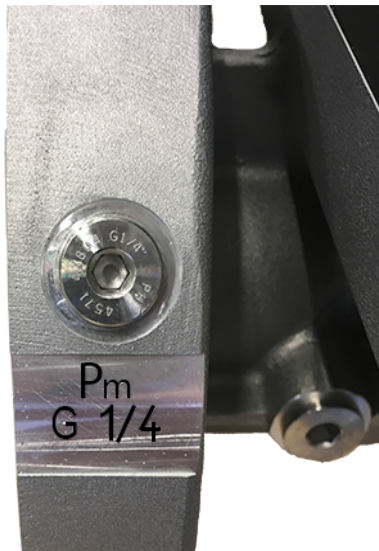
Thread G 1/4"   Thread 1/4" NPT

► When the meter body has an NPT 1/4" thread, screw in the adapter from NPT 1/4" to G 1/4" (Part No. 2075562) before using the accessory parts available from SICK.

> **!** *NOTICE:*
> The thread on the meter body is damaged when a wrong thread type is screwed in.
> Observe the marking on the meter body!

Variant 1: Installation with test valve BDA04 (up to -20 °C dynamic, up to -30 °C static)

> **+i→** For details on installation with test valve BDA04, see manufacturer Operating Instructions.
> You will find the document on the delivered product CD.

1 Remove the dummy plug on the pressure measuring port marked "P_m".

2 When the meter body has an NPT 1/4" thread, first screw in the adapter from NPT 1/4" to G 1/4" (Part No. 2075562).

3 Fit the test valve BDA04.
    Pay attention to the alignment of the connection for the pressure sensor.

4 Fit the pressure sensor on the test valve BDA04 (→ Fig. 31).

Fig. 31   Test valve BDA04 with pressure sensor fitted
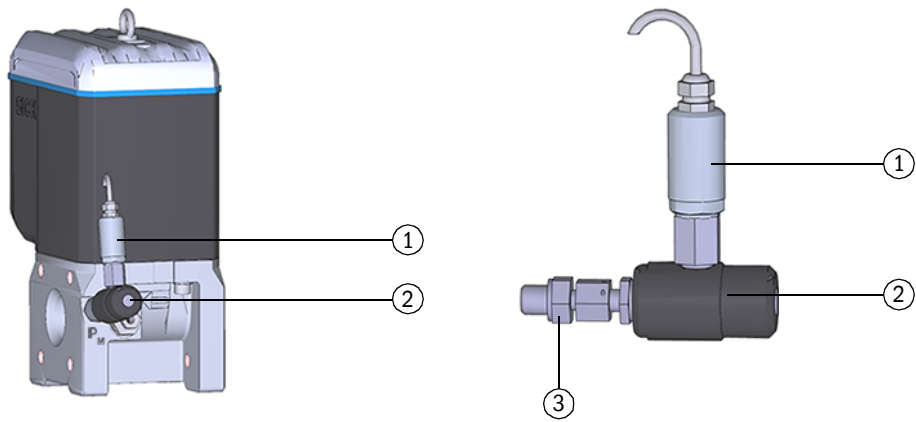
1 Pressure sensor, connection thread G 1/4"
2 Test valve BDA04
3 FLOWSIC500 connection (G 1/4" male thread)

Table 20   Test valve BDA04 positions

Measuring position	
Test position	

Variant 2: Installation with three-way test valve (to -40 °C)

Here, a conventional three-way test valve is used.

Install the three-way test valve with pressure sensor fitted at a suitable location next to the FLOWSIC500. A pressure line serves to connect the pressure measuring connection of the FLOWSIC500 to the three-way test valve.

Two variants of the pressure connection set with three-way test valve are available. The type code indicates which variant must be selected.

▶ Check type code, position 6 "p-sensor connection", on the type plate (→ Fig. 1) of your FLOWSIC500.

▶ Select the connection set suitable for the pressure connection on the FLOWSIC500, → p. 136, §8.1.

"Connection p-sensor" in type code	Pressure connection
3	Pipe screw fitting pipe 1/4"
4	Pipe screw fitting pipe D6

▶ For the complete type code description, see → p. 150, §9.4.

Fig. 32   Pressure connection on FLOWSIC500
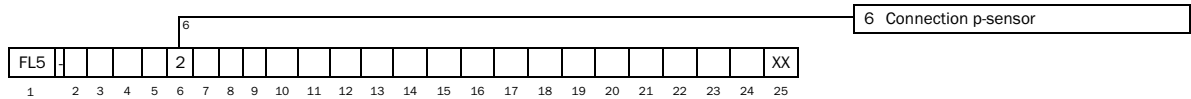
1   Fasten the three-way test valve at a suitable location.

1   Remove the dummy plug on the pressure measuring port marked "P$_m$".

2   When the meter body has an NPT 1/4" thread, first screw in the adapter from NPT 1/4" to G 1/4" (Part No. 2075562).

3   Screw in the pipe screw fitting for pipe 1/4" or pipe D6.

4   Install the pressure line between the FLOWSIC500 and the three-way test valve.

5   Fit the pressure sensor to the three-way test valve.

Fig. 33   Pressure sensor installation on the three-way test valve (-40 °C)
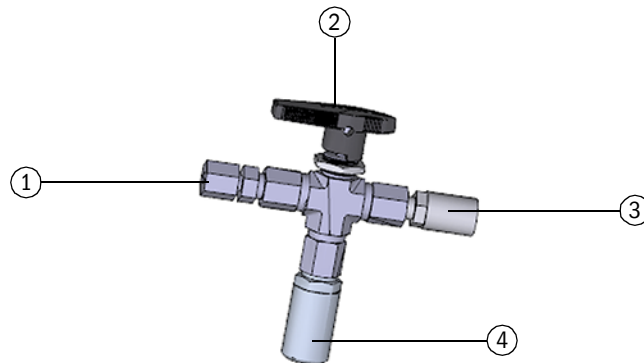
1   Pipe screw fitting 1/4" NPT on pipe D06
    or pipe screw fitting 1/4" NPT on pipe 1/4"
2   Hand lever
3   Test connection (Minimess coupling)
4   Pressure sensor, connection thread G 1/4"

Table 21   Three-way test valve positions

Measuring position	FLOWSIC500 → ⬤ ← Test pressure
Test position	FLOWSIC500 → ⬤ ← Test pressure
Closed position	FLOWSIC500 → ⬤ ← Test pressure

Variant 3: Installation without a three-way test valve

Here, the pressure sensor is connected directly to the FLOWSIC500.

1   Remove the dummy plug on the pressure measuring port marked "P_m".
2   When the meter body has an NPT 1/4" thread, first screw in the adapter (Part No. 2075562).
3   Fit the pressure sensor.

Fig. 34   Installation without three-way test valve
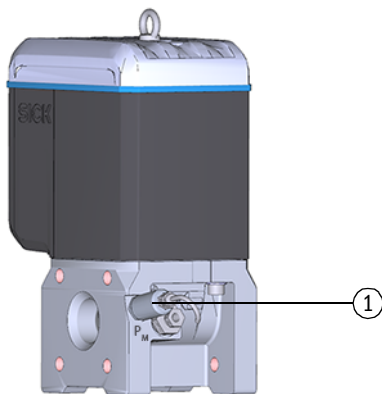
1 Pressure sensor, connection thread G 1/4"

3.5.3 Installing the temperature sensor

> ⚠ *NOTICE:*
> SICK recommends to install the temperature sensor on the temperature measuring port which is on the same side as the display.

> +**i** The temperature sensor can be greased with heat-conductive oil or paste to improve its performance.

1 Insert the temperature sensor into the immersion sleeve to the stop.
2 Tighten the locknut.
3 Have the wire seal attached by a calibration inspector (→ Fig. 10).

Fig. 35   Installing the temperature sensor
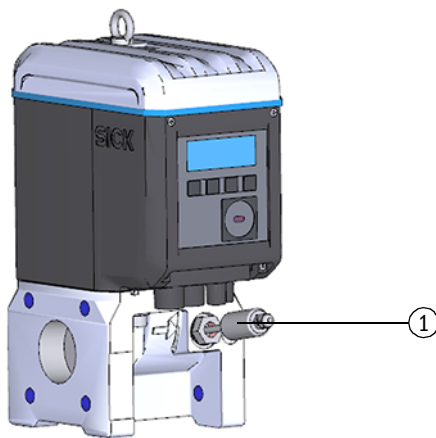
1 Temperature sensor

3.6 Fitting a display protector (option)

Display protector (Part No. 2085547) is available as an option for protection of the display from UV light.

Fig. 36   Display protection

Tools required

- Allen keys SW 3 and 2.5
- Jaw wrench SW 6

EX	The Ex i terminal compartment of the FLOWSIC500 can be accessed after the electronics cover has been opened. The cover may also be opened in the hazardous area when under voltage. However, safe separation between the various intrinsically safe power circuits must not be breached.

1	Loosen and unscrew the two upper screws of the electronics cover with an Allen key SW 3.	
2	Instead, mount the delivered screws with a SW 6 jaw wrench.	
3	Mount the display cover with the pre-mounted screws (captive) using an Allen key SW 2.5.	

FLOWSIC500

4 Commissioning

General information

Commissioning on the display

Commissioning with the FLOWgate™ operating software

4.1 General information

- All activities described in § 3 "Installation" must be completed before commissioning.
- Commissioning can be carried out directly on the device via the display, → p. 68, §4.2.
- The field setup wizard in the FLOWgate™ operating software supports an advanced commissioning, → p. 71, §4.3.

> **!** *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 measures must be carried out based on this Manual.

4.2 Commissioning on the display

4.2.1 Commissioning sequence

4.2.1.1 Gas flow meter commissioning

FLOWSIC500 commissioning is normally performed in the following sequence:

► Log on as "Authorized user" (→ p. 97, §5.2.7).
► Set the date and time (→ p. 69, §4.2.2).
► Check the device status (→ p. 70, §4.2.4).

4.2.1.2 Gas flow meter commissioning with device option volume conversion

► Log on as "Authorized user" (→ p. 97, §5.2.7).
► Set the date and time (→ p. 69, §4.2.2).
► Activate the configuration mode (→ p. 97, §5.2.9).
► Set fixed values for pressure and temperature (→ p. 69, §4.2.3.1).
► Set reference values (already configured: → Table 4).
► Select the calculation method (already configured: → p. 91, §5.2.6.5)
► Set the fixed value of the compressibility factor (→ p. 91, §5.2.6.5).
► Check the configuration (→ p. 70, §4.2.3.3).
► Configure the gas composition (→ p. 70, §4.2.3.3).
► Adapt alarm limits for pressure and temperature (→ p. 92, §5.2.6.6 and → p. 92, §5.2.6.7).

> **+i** The alarm limits are set in the factory to the measuring range of the selected sensor

► Terminate configuration mode (→ p. 97, §5.2.9).
► Check the device status (→ p. 70, §4.2.4).

4.2.2 **Setting the date and time**

Date and time must be set after the power supply has been connected. The FLOWSIC500 displays error E-3007 ("Time invalid") until the time has been set.

> **+i↵** Detailed information on operating using the display and on menu navigation → p. 80, § 5.2.

> **+i** ● The time zone function adapts the time to the new time zone.
> If you want to change date and time as well as the time zone, change the time zone first.
> ● Date and time can be changed without starting configuration mode.

1 Log on as "Authorized user" (→ p. 97, § 5.2.7).
2 Switch to the "System settings" submenu in the FLOWSIC500 menu.
3 Call up "Date".
4 Press ENTER to start the edit mode.
The cursor now blinks under the first position of the date.
5 Use the arrow buttons to increment or decrement the selected position by 1 until the correct digit is shown.
6 Confirm with ENTER.
The cursor now blinks under the second position of the date.
7 Repeat for the remaining positions of the date.
The date is saved when you confirm the last position with ENTER.
8 Switch to "Time".
9 Use the arrow buttons to increment or decrement the first position of the time by 1 until the correct digit is shown.
10 Confirm with ENTER.
11 Repeat for the remaining positions of the time.
The time is saved when you confirm the last position with ENTER.

4.2.3 **Configuring volume conversion (device option)**

4.2.3.1 **Setting fixed values**

The fixed values must be set to the average measurement conditions of pressure and temperature:
1 Log on as "Authorized user" (→ p. 97, § 5.2.7).
2 Start the configuration mode (→ p. 97).
3 In the FLOWSIC500 menu, switch to submenu "Pressure parameters" or "Temperature parameters"
4 Select the view "p Fixed value" or "T Fixed value".
5 Press ENTER to start the edit mode.
The cursor now blinks under the first position of the parameter.
6 Use the arrow buttons to increment or decrement the selected position by 1 until the correct digit is shown.
7 Confirm with ENTER.
The cursor now blinks under the second position of the parameter.
8 Repeat for all remaining positions of the parameter.
The fixed value is saved when you confirm the last position with ENTER.

4.2.3.2 Checking the configuration

The FLOWSIC500 is delivered already configured according to customer specifications.

It is recommended to check the custody-relevant parameters and settings. The custody relevant parameters are shown in the delivered Parameter report and can be compared against the current configuration on the display.

A new Parameter report can be created using the FLOWgate™ operating softwarte:

► Open the menu "Parameter change" in the FLOWgate™ operating software.

► Click "Create Parameter report". The report is generated.

► File the report with the device documentation.

4.2.3.3 Configuring the gas composition

1 Log on as "Authorized user" (→ p. 97, §5.2.7).

2 Start the configuration mode (→ p. 97).

3 Switch to submenu "Conversion/Gas composition" in the FLOWSIC500 menu.

4 Set the parameters to characterize the gas to be measured according to the selected K-number calculation method.

> **! NOTICE:**
> Configuration of gas composition may only be changed once a day.
> More frequent changes may damage the internal parameter memory (EEPROM) and thus shorten the service life of the FLOWSIC500.

> **+i** Parameter changes of the gas composition are stored in the Gas composition logbook.
> The Gas composition logbook can be viewed using the FLOWgate™ operating software (menu "Logbook management" > "Gas composition logbook").

4.2.4 Checking the device status

Make sure the FLOWSIC500 is in error-free operating status:

1 Log on as "Authorized user" (→ p. 97, §5.2.7).

2 Check whether warnings or errors are shown in the symbol bar on the display.

⚠	The device has a warning. The FLOWSIC500 is in "Warning" status.
((👤))	The device has an error. The FLOWSIC500 is in "Malfunction" status.

3 If warnings or malfunctions exist, change to view "Current events" on the main display:

– Clear existing malfunctions (→ p. 102, §6.2, "Status messages").

– Contact SICK Customer Service for any malfunctions you cannot clear yourself (→ p. 102, §6.1, "Contacting Customer Service").

4 The event overview can be reset when all warnings and errors have been cleared (→ p. 98, §5.2.12).

4.3 **Commissioning with the FLOWgate™ operating software**

4.3.1 **Connect to the device**

A data connection can be established with the device using the optical data interface and the infrared/USB adapter HIE-04 (Part No. 6050502).

This interface serves to configure the FLOWSIC500. The infrared/USB adapter has a USB 2.0 interface. This interface provides the connection to the PC and transfers the FLOWSIC500 data.

> **+i** A device driver software must first be installed to operate the adapter on a PC. The device driver software is on the delivered Product CD.

1 Install the device driver software before connecting the USB plug to the PC.
2 Connect the USB plug to the PC.
3 Fit the infrared/USB adapter to the infrared interface as shown (→ Fig. 37), a magnet integrated in the reading head retains the adapter.

Fig. 37   Alignment of the infrared adapter

Correct alignment   Wrong alignment

4 Install the FLOWgate™ operating software.

   The FLOWgate™ operating software and the associated Manual can be found on the Product CD delivered with the FLOWSIC500 and are also available under www.sick.com.

5 Press any button on the display to activate the optical data interface on the FLOW-SIC500.

   When a connection has been established with the infrared/USB adapter, the optical data interface on the FLOWSIC500 remains active until the infrared/USB adapter is removed.

6 The display and the optical interface remain active during the connection.

7 Click on the FLOWgate™ icon to start FLOWgate™:
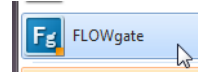
8 Add the FLOWSIC500 to the Device Manager of the FLOWgate™ operating software and create a connection to the device.

9 Login as "Authorized User" on the device.

> **+i** Standard password for "Authorized User": 2222

10 Start the field setup wizard and follow the step-by-step instructions.

4.3.2 Field setup wizard

> ! **NOTICE:**
> Configuration mode must be active to change parameters.
> ► Click on the symbol in the toolbar to activate configuration mode.

4.3.2.1 Device identification

► Check the device serial number and type code: Compare the entries against the type plate.

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

4.3.2.2 System/User

Date and time

► Enter the date and time or synchronize with the PC.

After completing commissioning, the daylight saving time settings can be activated and configured, see → p. 76, § 4.3.3.

User management

> ! **NOTICE:**
> SICK recommends changing the initial password provided for the "Authorized User" for security reasons.

Further users can be activated here when desired.

► Activate the associated checkbox of the desired user.

► Specify a password. The password must comprise 4 digits.

Up to three users and three authorized users can be activated. "Authorized User 1" and "User 1" are always activated,

For access rights for single user levels, see → p. 22, § 2.3.3.

Fig. 38   Example

4.3.2.3 Warnings

The "Warnings" area serves to set the limit values outside of which the FLOWSIC500 is to output warnings (flow rate) or errors (pressure and temperature).

Limit values can be set for:

- Flow rate
- Pressure
- Temperature
- Reverse flow volume (buffer volume)
- Limit value for low flow rate (zero-flow cutoff)

In addition, the warnings signalled by the device can be individually activated or deactivated in the "User warnings activation" area.

The Gas Quality Indicator allows the gas quality to be monitored in real time. By clicking on "Set reference point" the reference point is set automatically based on the current measured values. The permissible deviation in percent can be configured. If the limit value is exceeded or fallen below, the FLOWSIC500 generates a warning. Setting the reference point requires that gas of typical quality flows through the FLOWSIC500. If this is not given during commissioning, the reference point can be set afterwards in the menu "Parameter modification/Warnings".

Bild 39   Gas Quality Indicator
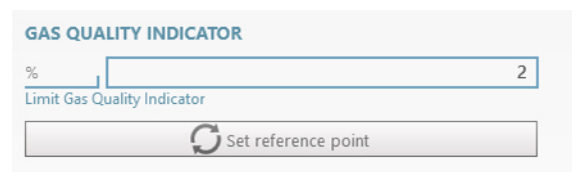
4.3.2.4 Communication

► The configuration of the single plug-in connectors is preset according to the configuration ordered. Check the configuration and adapt when necessary.
► For pulse outputs, the maximum frequency and the minimum pulse width must be set during commissioning.
► The status outputs are configured as standard so that status "Measurement invalid" is output. Selecting status "Measurement valid" shortens the battery service life considerably because the output is then permanently activated.

Plug 1: B-coded

► Configuration as status or pulse output possible: Select the desired configuration.
► Enter the maximum frequency and minimum pulse width in the "Pulse 1" area when configuring as a pulse output.

When configured as a pulse output, make sure the overload frequency of 120% Q_{max} is covered and the connected device understands the frequency.

The following conditions must be satisfied:

- The "Maximum frequency" must be set to a value higher or equal to the "Frequency at Qr".
- The "Minimum pulse width" must be set to a value lower or equal to 1/(2 x "Frequency at Qr").

Example

Frequency at Qr = 382 Hz

Maximum frequency:

Set "Maximum frequency" to a value ≥ 382 Hz.

Recommendation. Round up to 400 Hz.

Minimum pulse width:

1 Hz corresponds to 1000 ms

382 Hz corresponds to 2.6 ms

1/(2 x "Frequency at Qr") = 1.3 ms

Set "Minimum pulse width" to an integer value < 1.3 ms.

Recommendation: set 1 ms.

Fig. 40   Pulse settings example

Plug 2: A-coded

► Configuration as status or pulse output possible: Select the desired configuration.

► Enter the maximum frequency and minimum pulse width in the "Pulse 2" area when configuring as a pulse output.

For configuration, see Section "Plug 1: B-coded".

Communication tests

● Pulse output:
  – Enter the desired test frequency.
  – Push the slider to "On" to start the test. The test frequency is output on all pulse outputs.

Fig. 41   Pulse output test

● Flow rate
  – Enter the desired test flow rate and start the test.
● Digital output
  – Select the desired digital output.
  – Push the slider to "On".

4.3.2.5 **Volume conversion (only for device option volume conversion)**

For a detailed description of the single parameters, see the FLOWSIC500 menu description, p. 91, § 5.2.6.5.

▶ Determine the reference values.

▶ Enter the specifications for gas characteristics.

▶ Select the algorithm and parameters for calculating the compressibility factor.

▶ Enter fixed values.

4.3.2.6 **Totalizers**

Totalizers

▶ Setting or resetting the totalizer levels.

▶ Determine the limits for the reverse flow volume.

Meter settings

▶ Configure the significant digits for the meters:

All meters have up to 9 significant digits, without sign. The number of significant digits can be varied between 5 to 9.

▶ Determine the resolution for the meters:

The totalizer resolution can be set in the range 0.001 to 100 in increments of factor 10 for the volume at flowing conditions and the volume at base conditions of the meter. It is therefore necessary to multiply the totalizer level with the corresponding totalizer resolution to interpret the totalizer level.

> **!** *NOTICE:*
> The totalizer levels are stored in the unit system set in the device. The unit and resolution are stored in the data records so that the logbooks remain constant when these settings are changed and need not be reset.
> All totalizer levels are deleted when the unit or totalizer resolution are changed.

4.3.2.7 **Completion**

▶ If desired, empty the logbooks and archive:

– Activate the checkbox of the logbooks or archive to be emptied.

– Click "Clear selected".

▶ Check the collection status. If desired, reset the Event overview.

▶ Create a Parameter report:

– Click "Create Parameter report". The report is generated.

– File the report with the device documentation.

4.3.3 Activate and configure the daylight saving time

> ⚠ **NOTICE:**
> If the optional feature "Load recording device with maximum load display" feature is activated, the periods for daylight saving time are preset at the factory for 10 years.
>
> The periods for daylight saving time must be updated before the preset times expire. This is the responsibility of the plant operator.
>
> To ensure that the archive entries are displayed correctly, the last two years must be retained when updating.

1. Open the tile "System/User" in the "Parameter Modification" area.
2. Activate Configuration mode.
3. Activate the daylight saving time.

Fig. 42   Activating the daylight saving time settings
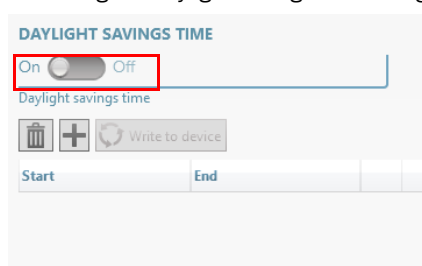
4. Click "+" to enter a new time period for daylight saving time.
5. Use the arrow buttons to set the start of the daylight saving time.

    The FLOWgate™ operating software always increases or reduces the position you clicked beforehand; e.g. the month is increased when the month is clicked. The year is increased when the year is clicked. The FLOWgate™ operating software increases the day by 1 when the text box is not clicked.

    The date can also be entered using the keyboard.

Fig. 43   Setting the time period for the daylight saving time
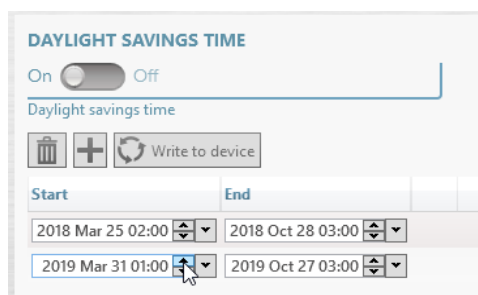
6. Then set the end of the daylight saving time.
7. Click "Write to device" to write the daylight saving time to the FLOWSIC500.
8. Enter further time periods when desired. Daylight saving time start and end can be configured for up to 10 years in advance.

4.3.4 Configure the power management

Select the type of power supply corresponding to the configuration of the FLOWSIC500:

- Dynamic Mode (External + Backup):

  Measuring rate: 4 Hz
- Battery Mode (2 x Battery):

  Measuring rate: 1 Hz, to maximize the battery service life
- Eco Mode (External + Backup):

  Standard setting: Measuring rate is 4 Hz when the external voltage supply is available. The measuring rate is set automatically to 1 Hz if the external voltage supply fails in order to maximize the backup battery service life.

Fig. 44 Power management

4.3.5   Function check after commissioning

▶ Check the device status.

Table 22   Signaling the device status in FLOWgate™

Status	Description
	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.

FLOWSIC500

5 Operation

Control unit
Operating using the display

5.1 Control unit

Fig. 45   Operating and display elements
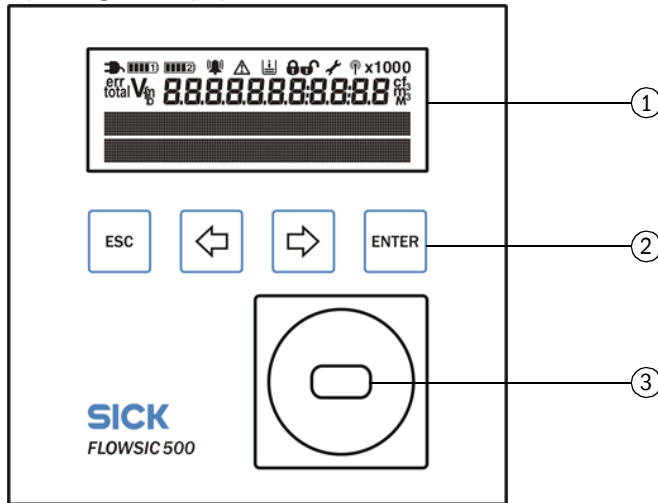
1 Display
2 Buttons
3 Optical data interface

5.2 Operating using the display

► Press any button to switch the display on.

> In battery operation, the display and the optical data interface have a timeout and switch off after approx. 60 seconds (default setting) when not button has been pressed and no data transmission takes place.
> The display and the optical interface are permanently active when an external power supply is connected.

Table 23   Buttons

	In menu	In Edit mode
Esc	Returns to next higher level of the operator menu	Aborts input of new value and returns to the next higher level of the operator menu.
⇦ ⇨	Toggles between single menu entries on one level	Increments or decrements a parameter by 1, toggles between several selection options.
ENTER	Calls a submenu, starts edit mode.	Confirms an input.

5.2.1 Display in the symbol bar

Table 24   Symbols

Symbol	Significance	Description
🔌	External power supply	Only displayed when the device is configured with external power supply.
🔋1	Battery fill level, battery 1	Displayed when the FLOWSIC500 is configured for battery operation: Status of the first battery pack Details on the battery fill level → p. 81, § 5.2.2.
🔋2	Battery fill level, battery 2	With external power supply: Backup battery status. With battery operation: Second battery pack status. Details on the battery fill level → p. 81, § 5.2.2.
📢	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.
🔒	Parameter locking switch closed	Metrologically relevant parameters are protected against changing; modifications are registered in the Metrology logbook → p. 31, § 2.8.2.
🔓	Parameter locking switch open	Metrologically relevant parameters can be changed; the modifications are not saved in the Metrology logbook.
🔧	Configuration mode	Device parameters can be changed.

> **!**   *NOTICE:*
> In device status "Malfunction" or "Warning", the respective symbols are shown blinking on the display.

5.2.2 Battery fill level display

The battery symbol changes as the battery is discharged.

Table 25   Battery fill level display

🔋	Battery fill level > 75%
🔋	Battery fill level > 50%
🔋	Battery fill level > 25%
🔋	Battery fill level > 25%
🔋	Battery almost empty but still in use

- The last segment of the battery symbol starts to blink when the battery fill level drops below 10%.
- When the battery is completely empty, the empty battery symbol blinks and the FLOWSIC500 has switched to the second battery.

5.2.3 Main screen (without device option volume conversion)

▶ Use buttons ⇐ and ⇒ to toggle between the menu entries on a level.

▶ Press ENTER to go down one menu level.

Main display

The following information is displayed on the top display menu level:

Main display	Description

`V              000000000 m³`
 	
`20.08.2021        10:30:52`
	V = Volume absolute, cannot be reset

↳ Pressing ENTER opens the FLOWSIC500 menu.	

`errV           000000000 m³`
 	
`20.08.2021        10:30:52`
	errV = Error volume: Volume counted during a malfunction, can be reset

↳ Pressing ENTER opens the action "Reset error volume". → "Resetting the error volume" (p. 98).	
`Q               0.000 m3/h` `VOG             0.000 m/s`	Q = Volume flow VOG = Gas velocity
`Current events` `1 Event`	Current events (1 event is reported)
↳ Pressing ENTER opens a list of current reported events. Use the arrow buttons to toggle through the reported events.	
`Event Summary` `2 Events`	Stored status messages: Events since the last time the event summary was reset (2 events have occurred).
↳ Pressing ENTER opens a list of stored events. Use the arrow buttons to toggle through the stored events.	
`Last Event Reset` `20.08.2021        10:30:52`	Last reset of event summary
↳ Pressing ENTER opens the action "Reset Event Summary". → "Resetting the event summary" (p. 98).	

> **! NOTICE:**
> A parameter with Malfunction status is shown on the display by a blinking exclamation mark after the parameter (e. g. Q!).

Menu navigation (without device option volume conversion)

Some menu functions are only available when you are logged in with user level "User" or "Authorized User":

User level:	G	Guest (standard)	U	User (1) User (2) User (3)	A1 A2 A3	Authorized user (1) Authorized user (2) Authorized user (3)
Access rights:	-	Hidden	○	View	●	Start/edit

Path	G	U	A2+3	A1	Explanation
Main display: Volume under measurement conditions V	○	○	○	○	
FLOWSIC500 menu: User	○	○	○	○	
Logged in user level	●	●	●	●	→ p. 88, §5.2.6.1
Login	●	●	●	●	
Logout	-	●	●	●	
FLOWSIC500 menu: Device mode	○	○	○	○	→ p. 89, §5.2.6.2
Calibration mode	○	○	●	●	
Configuration mode	○	○	●	●	
FLOWSIC500 menu: Device information	○	○	○	○	→ p. 89, §5.2.6.3
Measuring port	○	○	○	○	
Serial number	○	○	○	○	
Firmware Version	○	○	○	○	
Firmware Date	○	○	○	○	
Firmware CRC	○	○	○	○	
Metrology CRC	○	○	○	○	
Min. oper. pressure	○	○	○	○	
Max. oper. pressure	○	○	○	○	
Meter factor	○	○	○	○	
Frequency at Qr [Hz]	○	○	○	○	
Meter factor 2	○	○	○	○	
FLOWSIC500 menu: System settings	○	○	○	○	→ p. 89, §5.2.6.4
Power supply (1) [%]	○	○	●	●	
Power supply (2) [%]	○	○	●	●	
Date	○	○	●	●	
Time	○	○	●	●	
Timezone	○	○	●	●	
Language	○	●	●	●	
Symbols	○	○	○	○	
LCD test	○	●	●	●	
FLOWSIC500 menu: Logbooks	○	○	○	○	
Event logbook	○	○	○	○	
List of stored events	-	○	○	○	
Parameter logbook	○	○	○	○	
Metrology logbook	○	○	○	○	
Main display: Error volumes errV	○	○	●	●	
Main display: Volume flow under measurement conditions/ gas velocity	○	○	○	○	
Main display: Current Events	○	○	○	○	
List of current events	○	○	○	○	
Main display: Event Summary	○	○	○	○	
List of stored events	○	○	○	○	
Main display: Last Event Reset	○	○	●	●	→ p. 98, §5.2.12

5.2.4 **Main display (with device option volume conversion)**

► Use buttons ⇐ and ⇒ to toggle between the menu entries on a level.

Press ENTER to go down one menu level.

> +**i** The symbols on the display are shown as standard in accordance with EN12405.
> Symbols with regional deviations can be configured.
> These Operating Instructions use symbols in accordance with EN12405.

Main display (with device option volume conversion)

The following information is displayed on the top display menu level:

Main display	Description

`Vb`　　　　　`000000000 m³`
 	
`20.08.2021`　　　`10:30:52`
	V_b= Volume at base conditions, uninterrupted

↳ Pressing ENTER opens the FLOWSIC500 menu.	

`errVb`　　　　`000000000 m³`
 	
`20.08.2021`　　　`10:30:52`
	$^{err}V_b$ = Error volume at base conditions

↳ Pressing ENTER opens the action "Reset error volume". → "Resetting the error volume" (p. 98).	

`totalVb`　　　`000000000 m³`
 	
`20.08.2021`　　　`10:30:52`
	$_{total}V_b$ = Total volume at base conditions = V_b + $^{err}V_b$

`Vm`　　　　　`000000000 m³`
 	
`20.08.2021`　　　`10:30:52`
	V_m = Total volume at measurement conditions

`errVm`　　　　`000000000 m³`
 	
`20.08.2021`　　　`10:30:52`
	$^{err}V_m$ = Error volume
	Volume counted at measurement conditions, during a malfunction, can be reset

`Q`　　　　　　`0.000 m3/h` `Qb`　　　　　`0.000 m3/h`	Q = Volume flow at measurement conditions Qb = Volume flow at base conditions
`SOS`　　　　　`430.00 m/s` `VOG`　　　　　`0.000 m/s`	SOS = Sound velocity currently measured VOG = Gas velocity currently measured

Main display	Description

<pre>p   3.532 bar
T   25.42 °C</pre>
	p = Pressure currently used for volume conversion
	T = Temperature currently used for volume conversion

<pre>C   25.7368
K   0.9541</pre>
	C = Conversion factor
	K = Compressibility factor

<pre>Z   0.99830
Zb   0.99812</pre>
	Z = Compression factor at measurement conditions currently used for volume conversion
	Zb = Compression factor at base conditions currently used for volume conversion

<pre>Current events
1 Event</pre>
	Current events (1 event is reported)

↳ Pressing ENTER opens a list of current reported events. Use the arrow buttons to toggle through the reported events.	

<pre>Event Summary
2 Events</pre>
	Stored status messages: Events since the last time the event summary was reset (2 events have occurred).

↳ Pressing ENTER opens a list of stored events. Use the arrow buttons to toggle through the stored events.	

<pre>Last Event Reset
20.08.2021   10:30:52</pre>
	Last reset of event summary

↳ Pressing ENTER opens the action "Reset Event Summary". → "Resetting the event summary" (p. 98).	

> **!** *NOTICE:*
> A parameter with Malfunction status is shown on the display by a blinking exclamation mark after the parameter (e. g. Q!).

Menu navigation (with device option volume conversion)

Some menu functions are only available when you are logged in with user level "User" or "Authorized User":

User level:	G	Guest (standard)	U	User (1) User (2) User (3)	A1 A2 A3	Authorized user (1) Authorized user (2) Authorized user (3)
Access rights:	-	Hidden	○	View	●	Start/edit

Path	G	U	A2+3	A1	Explanation
Main display: Base volume Vb	○	○	○	○	
FLOWSIC500 menu: User	○	○	○	○	→ p. 88, §5.2.6.1
Logged in user level	●	●	●	●	
Login	●	●	●	●	
Logout	-	●	●	●	
FLOWSIC500 menu: Device mode	○	○	○	○	→ p. 89, §5.2.6.2
Calibration mode	○	○	●	●	
Configuration mode	○	○	●	●	
FLOWSIC500 menu: Device information	○	○	○	○	p. 89, §5.2.6.3
Measuring port	○	○	○	○	
Serial number	○	○	○	○	
Firmware version	○	○	○	○	
Firmware date	○	○	○	○	
Firmware CRC	○	○	○	○	
Metrology CRC	○	○	○	○	
Min. oper. pressure	○	○	○	○	
Max. oper. pressure	○	○	○	○	
Meter factor	○	○	○	○	
Frequency at Qr	○	○	○	○	
Meter factor 2	○	○	○	○	
FLOWSIC500 menu: System settings	○	○	○	○	→ p. 89, §5.2.6.4
Power supply (1)	○	○	●	●	
Power supply (2)	○	○	●	●	
Date	○	○	●	●	
Time	○	○	●	●	
Timezone	○	○	●	●	
Language	○	●	●	●	
Symbols	○	○	○	○	
LCD test	○	●	●	●	
FLOWSIC500 menu: Conversion	○	○	○	○	→ p. 91, §5.2.6.5
Conversion: References	○	○	○	○	
Basic pressure	○	○	●	●	
Basic temperature	○	○	●	●	
Ref. conditions	○	○	●	●	
Atmospheric pressure	○	○	●	●	
Conversion: Calculation	○	○	○	○	
Calc. methods	○	○	●	●	
Calc. interval	○	○	●	●	
K-factor (fixed)	○	○	●	●	
Conversion: Gas composition	○	○	○	○	
Density entry type	○	○	●	●	
Reference density	○	○	●	●	
Relative density	○	○	●	●	
CO2 [mol%]	○	○	●	●	
N2 [mol%]	○	○	●	●	
H2 [mol%]	○	○	●	●	
Heating value	○	○	●	●	
Heating value unit	○	○	●	●	
FLOWSIC500 menu: Pressure parameters	○	○	○	○	→ p. 92, §5.2.6.6

Subject to change without notice

Path	G	U	A2+3	A1	Explanation
p Sensor type	○	○	○	○	
p Sensor serial number	○	○	○	○	
p Lower alarm limit	○	○	●	●	
p Upper alarm limit	○	○	●	●	
p Default value	○	○	●	●	
p Unit	○	○	●	●	
p Adjust offset	○	○	●	●	
p Adjust factor	○	○	●	●	
FLOWSIC500 menu: Temperature parameters	○	○	○	○	→ p. 92, § 5.2.6.7
T Sensor type	○	○	○	○	
T Sensor serial number	○	○	○	○	
T Lower alarm limit	○	○	●	●	
T Upper alarm limit	○	○	●	●	
T Default value	○	○	●	●	
T Unit	○	○	●	●	
T Adjust offset	○	○	●	●	
T Adjust factor	○	○	●	●	
FLOWSIC500 menu: Logbooks	○	○	○	○	
Event logbook	○	○	○	○	
List of stored events	-	○	○	○	
Parameter logbook	○	○	○	○	
Metrology logbook	○	○	○	○	
Gas composition logbook	○	○	○	○	
FLOWSIC500 menu: Archives	○	○	○	○	→ p. 93, § 5.2.6.9
Configuration	○	○	○	○	
Gas hour	○	○	●	●	
Gas day	○	○	●	●	
Measuring period	○	○	●	●	
Measuring period archive	○	○	○	○	
List of stored entries	○	○	○	○	
Daily archive	○	○	○	○	
List of stored entries	○	○	○	○	
Monthly archive	○	○	○	○	
List of stored entries	○	○	○	○	
FLOWSIC500 menu: Maximum load	○	○	○	○	→ p. 96, § 5.2.6.10
Current periods	○	○	○	○	
List of detailed data	○	○	○	○	
Previous periods	○	○	○	○	
List of detailed data	○	○	○	○	
Main display: errVb	○	○	●	●	→ p. 98, § 5.2.11
Main display: totalVb	○	○	○	○	
Main display: Vm	○	○	○	○	
Main display: errVm	○	○	○	○	
Main display: Q/Qb	○	○	○	○	
Main display: SOS/VOG	○	○	○	○	
Main display: p/T	○	○	○	○	
Main display: C-factor	○	○	○	○	
Main display: Z/Zb	○	○	○	○	
Main display: Current Events	○	○	○	○	
List of current events	○	○	○	○	
Main display: Event Summary	○	○	○	○	
List of stored events	○	○	○	○	
Main display: Last Event Reset	○	○	●	●	→ p. 98, § 5.2.12

5.2.5 Configuration of main display

The configuration of the main display can be performed using the FLOWgate™ operating software.

The following contents are available:

- Empty (line 1 - set at the factory)
- Date, time (line 2 - set at the factory)
- Pressure p
- Temperature T
- Conversion factor C
- Compressibility factor K
- Operational flow rate Q
- Flow rate Qb relative to the base conditions
- VOG
- SOS

Configuring

1 Connect to device, → p. 71, § 4.3.1.
2 Open the tile "System/User" in the "Parameter Modification" area.
3 Start the configuration mode.
4 Select the desired parameters in the selection boxes "Contents display line" and "Contents bottom display line".
5 Click "Write to device".
  The parameters are written to the device and the display contents adjusted to match the selection.
6 Return to the operating mode.

5.2.6 FLOWSIC500 menu

5.2.6.1 User

User	Logged in user level, without login: Guest → "Changing the user level" (p. 97) Logged in as: ● User (1) ● User (2)* ● User (3)* ● Authorized user (1) ● Authorized user (2)* ● Authorized user (3)* * when activated

5.2.6.2 Device mode

Calibration mode	Display whether calibration mode for the flow rate check is switched on or off, start and end calibration mode In calibration mode, message "CALIBRATION MODE" blinks on the main display with the meter factor now effective for the calibration (set at the factory). The FLOWSIC500 outputs test pulses with a maximum possible frequency of 2 kHz at 120% $Q_{max.}$ on digital switching output DO_1 (→ p. 51, §3.4.6.1). For flow rate check and calibration, see document "9193003: Calibration Instructions for the Ultrasonic Gas Flow Meter FLOWSIC500"
Configuration mode	Display whether configuration mode is switched on or off, Starting and terminating configuration mode → "Start configuration mode" (p. 97)

5.2.6.3 Device information

Measuring port	Measuring port identifier
Serial number	Device serial number
Firmware Version	Firmware version installed on the device
Firmware Date	Firmware release date
Firmware CRC	Firmware check sum
Metrology CRC	Check sum of metrologically relevant parameters
Min. oper. pressure	Minimum operating overpressure
Max. oper. pressure	Maximum operating overpressure
Meter factor	Pulse valency, relation between frequency and flow rate [Imp/m^3]
Frequency at Qr	Frequency for overload flow rate $Q_r = 1,2\ Q_{max}$
Meter factor 2	Pulse valency, relation between frequency and flow rate [Imp/m^3], for second pulse output (for interface configuration L, 2 x NF pulse)

5.2.6.4 System settings

Power supply (1)	● For battery operation: – Fill level for battery pack 1 [%], – Confirm battery exchange for battery pack 1. → "Confirming battery replacement" (p. 99) ● With external power supply: – Display: 100% → "Checking the external power supply" (p. 99)
Power supply (2)	● For battery operation: – Fill level for battery pack 2 [%], – Confirm battery exchange for battery pack 2. ● With external power supply: – Fill level for backup battery – Confirm battery exchange for backup battery. → "Confirming battery replacement" (p. 99)
Date	Device date → "Commissioning on the display" (p. 68)
Time	Device time → "Commissioning on the display" (p. 68)
Timezone	Time zone set on device
Language	Language for displays Available: English, German, Russian → "Setting the language" (p. 97)

Symbols according to	Symbols for the Measuring screens, the setting can be changed with the FLOWgate™ operating software.
	Gas flow meter:
	LCD test

Symbols for the Measuring screens, the setting can be changed with the FLOWgate™ operating software.

Gas flow meter:

	EN12405	PTB	GOST	API
Volume total	V	V	V	Vf
Error volume	$_{err}V$	$_{err}V$	$_{err}V$	$_{err}Vf$
Flow rate	Q	Q	Q	Qf
Velocity of gas	VOG	VOG	VOG	VOG
Speed of sound	SOS	SOS	SOS	SOS

Gas flow meter with volume conversion::

	EN12405	PTB	GOST	API
Volume (measurement) total	Vm	Vb	V	Vf
Error volume (measurement)	$_{err}Vm$	$_{err}Vb$	$_{err}V$	$_{err}Vf$
Volume (base) without interruption	Vb	Vn	Vc	Vb
Error volume (base)	$_{err}Vb$	$_{err}Vn$	$_{err}Vc$	$_{err}Vb$
Volume (base) total	$_{total}Vb$	$_{total}V$	$_{total}Vc$	$_{total}Vb$
Flow rate (measurement)	Q	Q	Q	Qf
Flow rate (base)	Qb	Qn	Qc	Qb
Pressure (measurement)	p	p	P	Pf
Pressure (base)	Pb	Pn	Pc	Pb
Temperature (measurement)	T	T	T	Tf
Temperature (base)	Tb	Tn	Tc	Tb
Velocity of gas	VOG	VOG	VOG	VOG
Speed of sound	SOS	SOS	SOS	SOS
Compressibility	K	K	K	s
Conversion factor	C	C	C	C
Compression factor (measurement)	Z	z	Z	Zf
Compression factor (base)	Zb	zn	Zc	Zb

LCD test	Display test → "Testing the display" (p. 99)

5.2.6.5   **Conversion (only for device types with volume conversion)**

References

Basic pressure	Basic pressure [unit acc. to display]
Basic temperature	Basic temperature [unit acc. to display]
Ref. conditions	Reference conditions for density and heating value Display: T1/T2/p2 T1 = Reference temperature, heating value T2 = Reference temperature, rel. density/reference density p2 = Reference pressure, rel. density/reference density
Atmospheric pressure	Ambient pressure [unit acc. to display] Input required for version with relative pressure sensor

	T1	T2	p2
Set 1	25 °C	0 °C	1.01325 bar (a)
Set 2	0 °C	0°C	1.01325 bar (a)
Set 3	15 °C	15 °C	1.01325 bar (a)
Set 4	60 °F	60 °F	14,7347 psi (a)
Set 5	60 °F	60 °F	14.7300 psi (a)
Set 6	25 °C	20°C	1.01325 bar (a)

Calculation

Calculation method	Calculation method for the compressibility factor Select from: ● SGERG88, ● AGA 8 Gross method 1 ● AGA 8 Gross method 2 ● AGA NX-19 ● AGA NX-19 mod. ● AGA NX-19 mod. GOST ● GERG91 mod. ● AGA8-92DC ● Fixed value
Calculation interval	Cycle time for updating measured values (pressure, temperature), calculation of the compressibility factor Select from: 3 s, 10 s, 20 s, 30 s, 60 s
K-factor (fixed)	Entry of K factor for method "Fixed value" when the calculation of the K-factor is incorrect.

Gas composition (only for device option volume conversion)

Density entry type	Select from: Reference density, relative density Either menu item "Reference density" or menu item "Relative density" is displayed depending on the selection.
Reference density	Gas reference density under reference conditions
Relative density	Relative density, relation between gas density and air density under reference conditions
CO2	CO_2 - proportion in gas [mol%]
N2	N_2 - proportion in gas [mol%]
H2	H_2 - proportion in gas [mol%]

Heating value	Gas heating (under reference conditions)
Heating value unit	Heating value unit Select from: Default, MJ/m^3, kWh/m^3, BTU/ft^3 Default = Standard setting according to selected unit system (SI or US), configured in accordance with the order

> The calculation method selected determines the permissible entry limits for gas proportions as well as pressure and temperature.

5.2.6.6 Pressure parameters (only for device option volume conversion)

p Sensor type	Display of configured pressure sensor
p Sensor serial number	Pressure sensor serial number expected by the device, preset
p Lower alarm limit	Lower alarm limit for pressure sensor
p Upper alarm limit	Upper alarm limit for pressure sensor
p Default value	Fixed value for measurement pressure [unit acc. to display] The entry value is used as fixed value for configuration as TZ conversion and for pressure measurement malfunctions.
p Unit	Unit for pressure values, used for entry and display Select from: Default, bar, psia, kPa, MPa, kg/cm^2, psig Default = Standard setting according to selected unit system (SI or Imperial), configured in accordance with the order
p Adjust offset	Calibration offset for pressure sensor [unit acc. to display]
p Adjust factor	Calibration factor for pressure sensor

5.2.6.7 Temperature parameters (only for device option volume conversion)

T Sensor type	Display of configured temperature sensor
T Sensor serial number	Temperature sensor serial number expected by the device, preset
T Lower alarm limit	Lower alarm limit for temperature sensor
T Upper alarm limit	Upper alarm limit for temperature sensor
T Default value	Fixed value for measurement temperature [unit acc. to display] The entry value is used as fixed value for malfunctions of temperature measurement.
T Unit	Unit for temperature values, used for entry and display Select from: Default, ° C, ° F, K, °R Default = Standard setting according to selected unit system (SI or Imperial), configured in accordance with the order
T Adjust offset	Calibration offset for temperature sensor [unit acc. to display]
T Adjust factor	Calibration factor for temperature sensor

5.2.6.8 Logbooks

Event logbook	Number of entries currently stored/max. number Pressing ENTER opens the detailed view. The detailed view shows the event type, a short text and the timestamp.
Parameter logbook	Number of entries currently stored/max. number
Metrology logbook	Number of entries currently stored/max. number
Gas composition logbook	Number of entries currently stored/max. number

5.2.6.9 Archives (only for device option volume conversion)

Configuration

Gas hour	Billing hour for the day archive Entry range: 00:00 ... 23:59 Default: 06:00
Gas day	Billing day for month archive Measuring range: 1 ... 28 Default: 1
Measuring period	Defines the period for the billing archive Select from: 3 min, 5 min,15 min, 30 min, 60 min Default: 60 min

Measuring period archive

List of entries (0 .. 6000)		Entry x: Entry index, timestamp, Checksum status OK or Invalid
	Date/Time	Entry timestamp To start the editor of the search function, press ENTER.
	Entry ID	Entry ID, identical to the ID in FLOWgate archive To start the editor of the search function, press ENTER.
	Entry status	Status as a hex value and verbal "valid/invalid".
	Device status	Cumulative system status at the time of the end of the measuring period
	VbMP	Volume at base conditions V_b counter reading To start the editor of the search function, press ENTER.
	VbMPΔ	V_b counter progress of the measuring period
	VbErrMP	Error volume at base conditions $^{err}V_b$
	VbErrMPΔ	$^{err}V_b$ counter progress of the measuring period
	VmMP	Volume at measurement conditions V_m counter reading
	VmMPΔ	V_m counter progress of the measuring period
	VmErrMP	Error volume at measurement conditions $^{err}V_m$ counter reading
	VmErrMPΔ	$^{err}V_m$ counter progress of the measuring period
	QbMP↑	Maximum flow rate at base conditions during measuring period
	QMP↑	Maximum flow rate at measurement conditions during measuring period
	pMP↑ pMP↓	Maximum and minimum pressure during measuring period
	pMPØ TMPØ	Average pressure and temperature (flow-weighted)
	KMPØ CMPØ	Average compressibility and conversion factor (flow-weighted)
	SOSMPØ Flowtime	Average speed of sound, Flowtime (time with Q > LowFlowCutOff)

Daily archive

List of entries (0 .. 600)		Entry y: Entry index, timestamp, Checksum status OK or Invalid
	Date/Time	Entry timestamp To start the editor of the search function, press ENTER.
	Entry ID	Entry ID, identical to the ID in FLOWgate Archive To start the editor of the search function, press ENTER.
	Entry status	Status as a hex value and verbal "valid/invalid".
	Device status	Cumulative system status at the time of the end of the day
	VbDy	Volume at base conditions V_b counter reading To start the editor of the search function, press ENTER.
	VbDyΔ	V_b counter progress of the day (Dy)
	VbErrDy	Error volume at base conditions $^{err}V_b$
	VbErrDyΔ	$^{err}V_b$ counter progress of the day
	VmDy	Volume at measurement conditions V_m counter reading
	VmDyΔ	V_m counter progress of the day
	VmErrDy	Error volume at measurement conditions $^{err}V_m$ counter reading
	VmErrDyΔ	$^{err}V_m$ counter progress of the day
	QbDy$\uparrow$	Maximum flow rate at base conditions during day
	QbDy$\uparrow$ Date/Time	Timestamp of maximum flow rate at base conditions during day
	QbDy$\downarrow$	Minimum flow rate at base conditions during day
	QbDy$\downarrow$ Date/Time	Timestamp of minimum flow rate at base conditions during day
	QDy$\uparrow$	Maximum flow rate at measurement conditions during day
	QDy$\uparrow$ Date/Time	Timestamp of maximum flow rate at measurement conditions during day
	QDy$\downarrow$	Minimum flow rate at measurement conditions during day
	QDy$\downarrow$ Date/Time	Timestamp of minimum flow rate at measurement conditions during day
	pDy$\uparrow$	Maximum pressure during day
	pDy$\uparrow$ Date/Time	Timestamp of maximum pressure during day
	pDy$\downarrow$	Minimum pressure during day
	pDy$\downarrow$ Date/Time	Timestamp of minimum pressure during day
	pDy$\emptyset$	Average pressure during day (flow-weighted)
	TDy$\emptyset$	Average temperature during day
	TDy$\uparrow$	Maximum temperature during day
	TDy$\uparrow$ Date/Time	Timestamp of maximum temperature during day
	TDy$\downarrow$	Minimum temperature during day
	TDy$\downarrow$ Date/Time	Timestamp of minimum temperature during day
	KDy$\emptyset$ CDy$\emptyset$	Average compressibility and conversion factor (flow-weighted) during day
	SOSDy$\emptyset$	Average speed of sound during day

Monthly archive

List of entries (0 .. 25)			Entry z: Entry index, timestamp, Checksum status OK or Invalid
	Date/Time		Entry timestamp To start the editor of the search function, press ENTER.
	Entry ID		Entry ID, identical to the ID in FLOWgate Archive To start the editor of the search function, press ENTER.
	Entry status		Status as a hex value and verbal "valid/invalid".
	Device status		Cumulative system status at the time of the end of the month
	VbMo		Volume at base conditions V_b counter reading To start the editor of the search function, press ENTER.
	VbMoΔ		V_b counter progress per month (Mo)
	VbMP↑		Maximum progress of V_b per measuring period
		VbMP↑ Date/Time	Timestamp of maximum progress of V_b per measuring period during month
	VbDy↑		Maximum progress of V_b per day during month
		VbDy↑ Date/Time	Timestamp of maximum progress of V_b per day during month
	VbErrMo		Error volume at base conditions $^{err}V_b$
	VbErrMoΔ		$^{err}V_b$ counter progress of the month
	VmMo		Volume at measurement conditions V_m counter reading
	VmMoΔ		V_m counter progress of the month
	VmMP↑		Maximum progress of V_m in a measuring period of the month
		VmMP↑ Date/Time	Timestamp of maximum progress of V_m in a measuring period of the month
	VmDy↑		Maximum progress of V_m in a day of the month
		VmDy↑ Date/Time	Timestamp of maximum progress of V_m in a day of the month
	VmErrMo		Betriebsvolumen gestört $^{err}V_m$ Zählerstand
	VmErrMoΔ		$^{err}V_m$ counter progress of the month
	QbMo↑		Maximum flow rate at base conditions during month
		QbMo↑ Date/Time	Timestamp of maximum flow rate at base conditions during month
	QbMo↓		Minimum flow rate at base conditions during month
		QbMo↓ Date/Time	Timestamp of minimum flow rate at base conditions during month
	QMo↑		Maximum flow rate at measurement conditions during month
		QMo↑ Date/Time	Timestamp of maximum flow rate at measurement conditions during month
	QMo↓		Minimum flow rate at measurement conditions during month
		QMo↓ Date/Time	Timestamp of minimum flow rate at measurement conditions during month
	pMo↑		Maximum pressure occurred during month
		pMo↑ Date/Time	Timestamp of maximum pressure occurred during month
	pMo↓		Minumum pressure occurred during month
		pMo↓ Date/Time	Timestamp of minimum pressure occurred during month
	pMoØ		Average pressure during month (flow-weighted)
	TMoØ		Average temperature during month
	TMo↑		Maximum temperature occurred during month
		TMo↑ Date/Time	Timestamp of maximum temperature occurred during month
	TMo↓		Minimum temperature occurred during month
		TMo↓ Date/Time	Timestamp of minimum temperature occurred during month
	KMoØ CMoØ		Average compressibility and conversion factor (flow-weighted) during month

5.2.6.10 Maximum load (only for device option volume conversion)

Current periods

VbMPaΔ		V_b counter progress of the current measuring period
	MP remaining time	Remaining time of the current measuring period
VbDyaΔ		V_b counter progress of the current day
VbMoaΔ		V_b counter progress of the current month
VbMPa↑		Maximum progress of V_b in a measuring period of the current month
	VbMPa↑ Date/Time	Timestamp of maximum progress of V_b in a measuring period of the current month
VbDya↑		Maximum progress of V_b in a day of the current month
	VbDya↑ Date/Time	Timestamp of maximum progress of V_b in a day of the current month
VmMPaΔ		V_m counter progress of the current measuring period
VmDyaΔ		Measurement volume V_m counter progress of the current day
VmMoaΔ		V_m counter progress of the current month
VmMPa↑		Maximum progress of V_m in a measuring period of the current month
	VmMPa↑ Date/Time	Timestamp of maximum progress of V_m in a measuring period of the current month
VmDya↑		Maximum progress of V_m in a day of the current month
	VmDya↑ Date/Time	Timestamp of maximum progress of V_m in a day of the current month

Previous periods

> +ℹ Maximum values from days and months further in the past are available in the corresponding daily and monthly archives, → p. 93, § 5.2.6.9.

VbMPΔ		V_b counter progress of the previous measuring period
	VbMPΔ Date/Time	Timestamp of maximum progress of V_b in the previous measuring period
VbDyΔ		V_b counter progress of the previous day
	VbDyΔ Date/Time	Timestamp of V_b counter progress of the previous day
VbMoΔ		V_b counter progress of the previous month
	VbMoΔ Date/Time	Timestamp of V_b counter progress of the previous month
VbMP↑		Maximum progress of V_b in a measuring period of the previous month
	VbMP↑ Date/Time	Timestamp of maximum progress of V_b in a measuring period of the previous month
VbDy↑		Maximum progress of V_b in a day of the previous month
	VbDy↑ Date/Time	Timestamp of maximum progress of V_b in a day of the previous month
VmMPΔ		V_m counter progress of the previous measuring period
	VmMPΔ Date/Time	Timestamp of V_m counter progress of the previous measuring period
VmDyΔ		V_m counter progress of the previous day
	VmDyΔ Date/Time	Timestamp of V_m counter progress of the previous day
VmMoΔ		V_m counter progress of the previous month
	VmMoΔ Date/Time	Timestamp of V_m counter progress of the previous month
VmMP↑		Maximum progress of V_m in a measuring period of the previous month
	VmMP↑ Date/Time	Timestamp of maximum progress of V_m in a measuring period of the previous month
VmDy↑		Maximum progress of V_m in a day of the previous month
	VmDy↑ Date/Time	Timestamp of maximum progress of V_m in a day of the previous month

5.2.7 **Changing the user level**

1 Call up menu function "User".

2 Press ENTER to start the edit mode.

3 Use the arrow buttons to select the desired user level.

4 Confirm with ENTER.

The cursor now blinks under the first position of the password.

5 To enter the password:
– Use the arrow buttons to increment or decrement the first position of the password by 1 until the correct digit is shown.
– Confirm with ENTER.
The cursor now blinks under the second position of the password.
– Repeat for the remaining positions of the password.
– You are logged in with the selected user level after the last position of the password is confirmed.

> **+i** The following users are set at the factory:
> ● User (1), password: 1111
> ● Authorized user (1), password: 2222
>
> ► Change the password after the first logon using the FLOWgate^{TM} operating software.

5.2.8 **Setting the language**

1 Switch to the "System settings" submenu in the FLOWSIC500 menu.

2 Call up "Language".

3 Press ENTER to start the edit mode.

4 Use the arrow buttons to select the desired language.

5 Confirm with ENTER.

The display texts are now shown in the selected language.

5.2.9 **Changing the device mode**

On the FLOWSIC500, the device modes Configuration and Calibration can be activated independently from each other.

5.2.9.1 **Starting and terminating configuration mode**

Start configuration mode

1 Switch to the "Device mode" submenu in the FLOWSIC500 menu.

2 Call up "Configuration mode".

3 Press ENTER to start the edit mode.

4 Use the arrow buttons to select ON.

5 Confirm with ENTER.

The configuration mode is started.
Symbol ⚒ is displayed in the symbol bar.

Terminate configuration mode

1 Call up "Configuration mode".

2 Use the arrow buttons to select OFF.

3 Confirm with ENTER.

The configuration mode is terminated.

5.2.9.2 **Starting and terminating calibration mode**

Calibration mode can be started and terminated in the same manner as the configuration mode (→ p. 98, § 5.2.9.2).

In calibration mode, message "CALIBRATION MODE" blinks on the main display with the meter factor now effective for the calibration (set at the factory).

The FLOWSIC500 outputs test pulses with a maximum possible frequency of 2 kHz at 120% Q_{max}.on digital switching output DO_1 (→ p. 34, § 3.4.6.1).

5.2.10 **Changing parameters**

Numerical values

1 Start the configuration mode (→ p. 97).

2 Select the desired parameter in the menu.

3 Press ENTER to start the edit mode.
The cursor now blinks under the first position of the parameter.

4 Use the arrow buttons to increment or decrement the selected position by 1 until the correct digit is shown.

5 Confirm with ENTER.
The cursor now blinks under the second position of the parameter.

6 Repeat for all remaining positions of the parameter.

Selection lists

1 Start the configuration mode (→ p. 97).

2 Select the desired parameter in the menu.

3 Press ENTER to start the edit mode.

4 use the arrow buttons to switch to the desired selection.

5 Confirm with ENTER.

5.2.11 **Resetting the error volume**

1 Switch to the error volume display on the main screen.

2 Press ENTER to start the edit mode.

3 Use the arrow buttons to select OK.

4 Confirm with ENTER.
The error volume is reset.

5.2.12 **Resetting the event summary**

1 Switch to the "Event Summary" display on the main display.

2 Press ENTER to open a list of the stored events.

3 Press ENTER to start the edit mode.

4 Use the arrow buttons to select OK.

5 Confirm with ENTER.
The event summary is reset.

5.2.13 Confirming battery replacement

Confirm battery replacement on the display after you have changed a battery.

1 Switch to the "System settings" submenu in the FLOWSIC500 menu.

2 Switch to the status indicator of the replaced batteries, e.g. "Power Supply (1)".

3 Press ENTER to start the edit mode.

4 Use the arrow buttons to select OK.

5 Confirm with ENTER.

5.2.14 Checking the external power supply

An external power supply connected to the meter can be checked as follows:

1 Switch to the "System settings" submenu in the FLOWSIC500 menu.

2 Select "Power supply (1)" with the arrow buttons and confirm with ENTER.

3 Select "Check ext.power supply" and confirm with ENTER.

5.2.15 Testing the display

1 Switch to the "System settings" submenu in the FLOWSIC500 menu.

2 Call up "LCD Test".

3 Press ENTER to start the display test.

All display segments on the display are activated and deactivated three times. Defective display segments can thus be detected.

5.2.16 Searching archive entries

The archive entries in the measuring period archive, daily archive and monthly archives can be searched using the following values:

● Timestamp (input format: YY/MM/DD*hh:mm)

● Entry ID (input format: XXXXXXXX)

● Counter readings base volume (input format: NNNNNNN.XXX)

The search function is only available if the displayed archive contains at least two entries.

The search masks (editors) used are designed the same for all archives and are operated identically:

1 To start the editor, press ENTER at the desired entry type in the menu to be searched.

Press ENTER for the desired entry type.

In the bottom line, the value from the current archive entry is preset as the start value for the change.

2 In the bottom line of the display, from left to right, use the arrow buttons to set the desired value.

Press ENTER after each digit to confirm the entry.

3 To start the search, confirm the last digit with ENTER.

As long as the search is running, the display shows "Search... NNNN" (NNNN = number of entries already searched).

To cancel editing or a running search, press ESC. The display then returns to the last archive entry displayed.

The first exact match is displayed as the search result.

If there is no exact match, the archive entry will be determined for which the difference to the searched value is the smallest. If there is no matching entry, the system returns to the last archive entry displayed.

FLOWSIC500

6   Clearing malfunctions

Contacting Customer Service
Status messages
Additional messages in the Event logbook
Starting a diagnostic session

6.1 Contacting Customer Service

+i Contact SICK Customer Service for any malfunctions you cannot clear yourself.

+i→ To help Customer Service understand malfunctions that have occurred, the FLOWgate™ operating software provides the option to create a diagnostics session, → p. 105, §6.4.

6.2 Status messages

● Active errors or warnings are shown flashing in the LC display. 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 26 Information messages

Status message	Description/clearance
I-1017	The device firmware has been changed.
I-1018	The device has been started.
I-1019	Configuration mode is active.→ p. 97, §5.2.9.1"Starting and terminating configuration mode"
I-1020	The parameter locking switch is open.→ p. 31, §2.8.1 "Parameter locking switch"

Table 27 Warning messages

Status message	Description/clearance
W-2001	The Event logbook is up to 90% full. The Event logbook can be viewed, stored and reset with the FLOWgate™ operating software.
W-2002	The Metrology logbook is full. Custody relevant parameters can only be modified after the parameter locking switch has been opened. The Metrology logbook can be reset with the FLOWgate™ operating software. → p. 101, §6 "Clearing malfunctions"
W-2003	More pulses than permissible should be output on the pulse output. Check whether the current flow rate is higher than the maximum flow rate. If the flow rate is within the permissible range, check whether the selected output scaling (= Meter factor) is correct. → p. 102, §6.1 "Contacting Customer Service"
W-2008	Flow rate measurement is in status "Warning". Have the device checked by Customer Service. → p. 102, §6.1 "Contacting Customer Service"
W-2009	The measured flow rate is outside the set warning limits. Check the current measuring conditions or adjust the limits. The warning limits can be set with the FLOWgate™ operating software.
W-2010	W-2009 = flow rate below warning limit, W-2010 = flow rate above warning limit.
W-2016	Battery 1 failure. → p. 111, §7.3.2 "Changing the battery packs"
W-2017	Battery 2 failure. ● With external power supply: → p. 110, §7.2.2 "Changing the backup battery" ● For battery operation: → p. 111, §7.3.2 "Changing the battery packs"
W-2018	External power supply failure. Check the connection and function of the external power supply. → p. 56, §3.4.9 "Operation with external power supply".

Table 28   Error messages

Status message	Description/clearance
E-3001	The Event logbook is full. Check the Event logbook. The Event logbook can be reset with the FLOWgate™ operating software.
E-3006	Checksum error → p. 102, §6.1 "Contacting Customer Service".
E-3007	Time invalid → p. 68, §4.2 "Commissioning on the display".
E-3009	The FLOWSIC500 is in calibration mode. → p. 98, §5.2.9.2, "Starting and terminating calibration mode".
E-3010	Temperature sensor failure. The FLOWSIC500 uses the default value specified. → p. 132, §7.6 "Exchanging an external pressure or temperature sensor" → p. 102, §6.1 "Contacting Customer Service".
E-3012	Pressure sensor failure. The FLOWSIC500 uses the default value specified. → p. 132, §7.6 "Exchanging an external pressure or temperature sensor" → p. 102, §6.1 "Contacting Customer Service".
E-3013	Device is outside the permissible measurement pressure range. Check Pmin/Pmax vs. pressure.
E-3014	Flow rate measurement is in status "Malfunction", → p. 102, §6.1 "Contacting Customer Service".
E-3017	The K-factor cannot be calculated. Check the values entered for gas composition against the reference conditions and the base conditions. → p. 84, §5.2.4 "Main display (with device option volume conversion)".
E-3018	Reverse flow The measured creep volume (reverse flow) is larger than the preconfigured buffer volume.→ p. 23 If larger reverse flows occur regularly, contact Customer Service to have the preconfigured volume adapted. → p. 102, §6.1 "Contacting Customer Service".
E-3019	The measured gas temperature/gas pressure is outside the permissible limits. E-3019 = Gas temperature is below the alarm limit
E-3020	E-3020 = Gas temperature is above the alarm limit E-3021 = Gas pressure is below the alarm limit
E-3021	E-3022 = Gas pressure is above the alarm limit
E-3022	Check the set alarm limit values. → p. 92, §5.2.6.7 "Temperature parameters"
E-3023	Time is inaccurate. Check time synchronisation.

6.3 Additional messages in the Event logbook

The FLOWSIC500 saves all status messages ($\rightarrow$ p. 102, §6.2) as well as further supplementary messages concerning events and status changes in the Event logbook.

Each message code is supplemented with a (+) or (-) to identify an incoming message = (+) or an outgoing message = (-).

Table 29   Information messages in the Event logbook

Status message	Description/clearance
I-1001	Event logbook has been reset
I-1002	Parameter logbook has been reset.
I-1003	Metrology logbook has been reset.
I-1004	Measuring period archive has been reset.
I-1005	Daily archive has been reset.
I-1006	Monthly archive has been reset.
I-1010	Event overview has been reset.*)
I-1011	Time has been reset.*)
I-1012	Totalizers have been reset.
I-1013	Error volume totalizers have been reset.*)
I-1014	All parameters have been reset or a group of parameters have been reset.*)
I-1021	Battery (1) has been replaced.
I-1022	Battery (2) has been replaced.
I-1023	Totalizers have been preset.*)
I-1025	Gas composition logbook reset
I-1026	Gas parameters changed

Table 30   Warning messages in the Event logbook

Status message	Description/clearance
W-2011	The number of valid measurements (performance of flow rate measurement) is significantly lower than normal.*)
W-2012	Flow rate measurement is performed with reduced precision.*)
W-2013	Flow rate higher than 120% Q_{max}.
W-2021	Entry with invalid CRC in the measuring period archive.
W-2022	Entry with invalid CRC in the daily archive.
W-2023	Entry with invalid CRC in the monthly archive.

Table 31   Error messages in Event logbook

Status message	Description/clearance
E-3002	Check sum of totalizers is invalid.
E-3003	Check sum of firmware is invalid.
E-3004	Parameter is invalid.*)
E-3005	Check sum of logbooks/archives is invalid.*)
E-3015	Hardware error in flow rate measurement.*)
E-3016	Number of valid measurements (performance of flow rate measurement) is not sufficient.*)

In the Event logbook, additional data, e.g. status, totalizer levels, measured values and parameters at the time of certain events are saved.

These events or messages are identified with *). The data can be viewed and saved with the FLOWgate™ operating software ($\rightarrow$ p. 78, §4.3.5).

6.4 **Starting a diagnostic session**

1 Click the ⊕ icon in the tool bar to start a diagnostic session.

2 Select the desired data collection duration and enter a description.

It is recommended to select a data collection duration of at least 5 minutes.

Fig. 46   Data collection duration for the diagnostic session

Diagnostic Session

| 5 minutes | ▼ |

Duration of Data Collection

| Test session |

Description

[Start]   [Cancel]
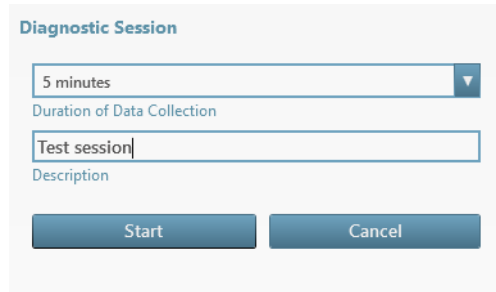
3 Click "Start" to start recording.

The following message with the current storage location of the data collection is shown after successful creation of the diagnostic session.

Fig. 47   Diagnostic recording completed

Diagnostic Session

Diagnostic session successfully created. Stored at:
C:\Users\Public\Documents\SICK\FLOWgate\FLOWSIC500_13348104/
FLOWSIC500_13348104_Diagnostic_Session_7_3_2017_1_20_35_PM.sfgsession

[OK]
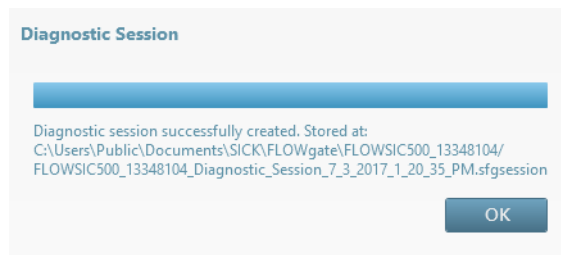
4 Click "OK" to confirm the message.

5 Store the diagnostic session or send per e-mail.

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

Fig. 48   Store the diagnostic session or send per e-mail

Diagnostic Session: Save or Send per e-mail

[Save .zip as]   [E-mail .zip]

[Save as]   [E-mail]   [Close]
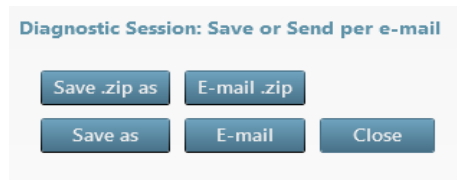
6 Click "Close" to leave the file at the standard storage location.

– Click "Save as" to select a different storage location for the diagnostic recording. Selecting the option "Save .zip as" stores the parameter recordings and logbook files as single files in a zip archive.

– 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 "Save as" to select a storage location for the diagnostic recording. Selecting the option "Save .zip as" stores the parameter recordings and logbook files as single files in a zip archive.

FLOWSIC500

7 Maintenance and meter exchange

Information on handling lithium batteries
Maintenance when using external power supply
Maintenance when using battery power supply
Meter exchange
Function check of a pressure or temperature sensor
Exchanging an external pressure or temperature sensor

7.1 Information on handling lithium batteries

> ⚠ **WARNING: Ignition hazard through electrostatic charges**
> Make sure the electrostatic risks when handling the transportable plastic battery packs are minimized.
> ► Take suitable precautionary measures, e.g wear antistatic shoes, when a charge generating mechanism has been identified, e.g. repeated rubbing of battery packs against clothing.
> ► Putting the battery packs in the bag or carrying them on a belt, using a keyboard or cleaning with a damp cloth do not cause a significant electrostatic risk.

> ⚠ **WARNING: Risk of explosion - hazard for intrinsic safety**
> ► Only the exchangeable battery packs from SICK with Part No. 2064018 and the backup battery with Part No. 2065928 may be used for the power supply of the device.
> ► Do not use damaged batteries; they must be disposed of correctly!

> ⚠ **WARNING:**
> ► Comply with the national regulations when transporting used battery packs by air freight!

The battery packs are marked with important information concerning storage and disposal.

Table 32   Marking

Symbol	Significance
🗑	Do not dispose with household trash.
♻	Recycling

Fig. 49   Identification of battery packs

Variable	Description
00	Serial No.
01	Date
02	QR-Code → Order No. + 00

7.1.1 Information on storage and transport

► Prevent a short circuit of the battery terminals:
  – Store and transport the batteries in their original packaging
  – or tape the battery terminals.
► Store cool (under 21 °C (70 °F)), dry and without major temperature fluctuations.
► Protect against permanent sunlight.
► Do not store near the heating.

7.1.2 Disposal information

In the EU

► Dispose of lithium batteries in accordance with the Battery Directive 2006/66/EU.
► In Germany, you can hand in the batteries at your local recycling center.
  Alternatively, the battery manufacturer Tadiran Germany offers a return service on request.
  Contact data:
  Phone: +49 (0)6042/954-122
  Fax: +49 (0)6042/954-190
  www.tadiranbatteries.de

In the USA

► Batteries have to be disposed of by an authorized waste disposal company.
  Identification of lithium batteries:
  – Proper shipping name: Waste lithium batteries
  – UN number: 3090
  – Label requirements: MISCELLANEOUS, HAZARDOUS WASTE
  – Disposal code: D003
► If anything is unclear, contact the local office of the Environmental Protection Agency (EPA).

In other countries:

Please observe national regulations for the disposal of lithium batteries.

7.2 Maintenance when using external power supply

7.2.1 Service life of backup battery

When new, the capacity of the backup battery has been calculated for bridging up to 3 months failure of the supply voltage. When voltage supply is not interrupted, the service life is at least 10 years when stored at approx. 25 °C (77 °F).

Repeated, even short-time voltage failure reduces the remaining buffer capacity of the battery so that exchange is recommended.

> **+i** If both the supply voltage and the backup battery fail, the clock setting is lost and the FLOWSIC500 does not measure anymore. Totalizer levels determined until then and parameter settings remain permanently stored.

7.2.2 Changing the backup battery

> ⚠ **WARNING: Risk of explosion - hazard for intrinsic safety**
> ► Only the exchangeable battery packs from SICK with Part No. 2064018 and the backup battery with Part No. 2065928 may be used.

1. Ensure external voltage supply.
2. Open the electronics cover (→ p. 48, §3.4.3)
3. Loosen the connection of the backup battery.
4. Remove the backup battery.
5. Insert a new backup battery and connect the battery to connection BAT2.
6. Close the electronics cover (→ p. 48, §3.4.3)
7. Confirm battery replacement on the display (→ p. 99, §5.2.13).
8. Alternatively, confirm battery replacement with the FLOWgate™ operating software:
   – Connect to device, → p. 71, §4.3.1.
   – Open the tile "System/User" in the "Parameter Modification" area.
   – Start the configuration mode.
   – Click "Battery exchange source 2" in the area "Power supply".
   – Return to the operating mode.

> **!** *NOTICE:*
> The battery symbol on the display shows full straight away after the battery change.
> The check whether the battery is really operational then takes 20 minutes.

7.3 Maintenance when using battery power supply

7.3.1 Service life of battery packs

Under typical operating conditions, the expected total service life of both battery packs is 5 years.

> **+i** The complete failure of both battery packs results in the loss of the clock settings and the FLOWSIC500 does not measure anymore.
> Totalizer levels determined until then as well as the parameter settings remain permanently stored.

The FLOWSIC500 needs more power

- when the display is used frequently,
- when the infrared interface is used,
- when the encoder output is frequently used (scanning cycles < 15 min).

When the electrically isolated NAMUR output (DO_0) is used, an external voltage supply is recommended due to the significantly higher power requirement.

The capacity of the batteries is reduced in unfavorable climatic conditions, for example when the temperatures are significantly higher or lower than 25 °C (77 ° F).

7.3.2 Changing the battery packs

> ⚠ **WARNING: Risk of explosion – hazard for intrinsic safety**
> ► Only the exchangeable battery packs from SICK with Part No. 2064018 and the backup battery with Part No. 2065928 may be used for the power supply of the device.
> ► Do not use damaged batteries; they must be disposed of correctly!

The charge level of the battery packs is shown as a symbol on the display.

Table 33   Battery fill level

Symbol	Significance	Description
▉▉▉▏	Battery pack 1 fill level (connection BAT1)	Details on the battery fill level → p. 81, §5.2.2.
▉▉▉▏₂	Battery pack 2 fill level (connection BAT2)	

The second battery pack is activated automatically when the first pack is completely empty.

When one battery pack is empty, at least this battery pack should be changed. Both battery packs must be changed at the latest when the second battery pack is running low.

1 Check on the display which battery pack is empty.
2 Open the electronics cover (→ p. 48, §3.4.3)
3 Loosen *only* the respective terminal connection of the empty battery pack.

> **!** *NOTICE:*
> Only loosen one connection at a time to ensure continuous voltage supply!
> If both battery packs are to be exchanged at the same time, first replace the empty battery pack and then the still used battery pack.

Fig. 50   Battery connections on the circuit board
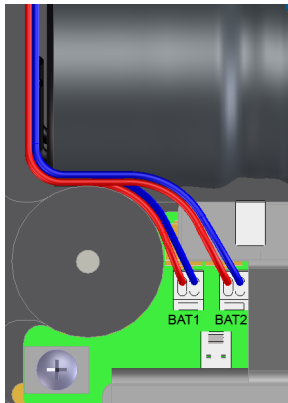
4   Remove the battery pack and replace by the new one.

5   Reconnect the electrical system.

The FLOWSIC500 now continues to use the second battery pack and then switches back to the new battery pack.

6   Close the electronics cover (→ p. 48, §3.4.3)

7   Confirm battery replacement on the display (→ p. 99, §5.2.13).

8   Alternatively, confirm battery replacement with the FLOWgate™ operating software:
    –   Connect to device, → p. 71, §4.3.1.
    –   Login as "Authorized User" on the device.
    –   Open the tile "System/User" in the "Parameter Modification" area.
    –   Start the configuration mode.
    –   When the battery pack on "BAT2" has been exchanged, click "Battery change Source 2" in area "Power supply".
    –   When the battery pack on "BAT1" has been exchanged, click "Battery change Source 1" in area "Power supply".

9   Return to the operating mode.

!	*NOTICE:* The battery symbol on the display shows full straight away after the battery change. The check whether the battery is really operational then takes 20 minutes.

7.4   **Meter exchange**

7.4.1   **Prerequisites for meter exchange**

> [!] *NOTICE:*
> Ensure that the meter exchange is carried out according to the national regulations for Ex and pressure applications of your country.

7.4.2   **Hazards during meter exchange**

> ⚠ **WARNING: Hazards due to combustible gases or high pressure**
> Natural gas under line pressure flows through the gas flow meter during running operation. The gas flow meter may only be exchanged when the equipment is at a standstill.
> *Before commencing installation work:*
> ► Ensure the pipeline is free from pressure and free from combustible gases.
> ► Purge the pipeline with inert gas if necessary.
> ► Observe the safety information in §1.1 (→ p. 10) and §3.1 (→ p. 38).

> [!] *NOTICE:*
> The gas flow meter may only be exchanged by skilled persons who, based on their technical training and knowledge in pipeline construction as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.
> ► Observe the information in §1.4 (→ p. 13).
> ► In case of doubt, please contact the local SICK Customer Service.

7.4.3   **Sequence of meter exchange**

To exchange the gas flow meter, proceed as follows:

1   Download the user-specific configuration of the installed gas flow meter (→ p. 116, §7.4.6).
2   Disconnecting electrical connections (→ p. 117, §7.4.7).
3   Removing the installed gas flow meter (→ p. 118, §7.4.8).
4   Installing the replacement gas flow meter (→ p. 122, §7.4.9).
5   Perform a leak tightness check (→ p. 124, §7.4.10).
6   Connect the new gas flow meter to the electric system (→ p. 46, §3.4).
7   Upload the user-specific configuration of the previously installed gas flow meter to the new gas flow meter (→ p. 127, §7.4.11).
8   Check the function of the gas flow meter (→ p. 131, §7.4.12).
9   If necessary, secure metrologically (→ p. 131, §7.4.13).

7.4.4 **Required tools and auxiliary material**

● Meter exchange set (item numbers → p. 138, §8.2.1) with:
  – Test cap for the respective meter size (→ Fig. 51, component no. 9)
  – Socket wrench
  – Allen key

Table 34 Openings

Meter size	Socket wrench	Allen key
DN50/2"	19	8
DN80/3"	24	10
DN100/4"	30	14
DN150/6"		

● Torque wrench
● Transport protection for the gas flow meter with a safety strap (item numbers → p. 137, §8.1.3)
● Silicone grease
● Leak detection spray
● Lubricant, metal-free or suitable for aluminum, e.g. OKS 235, to prevent thread mountings seizing up.

> **!** *NOTICE:*
> Do not use copper paste!

7.4.5 Overview

Fig. 51 Components for meter exchange using DN50/2" as example

1 Securing screws
2 Ripplock washers
3 Center bolt
4 Ripplock washer
5 Gas flow meter
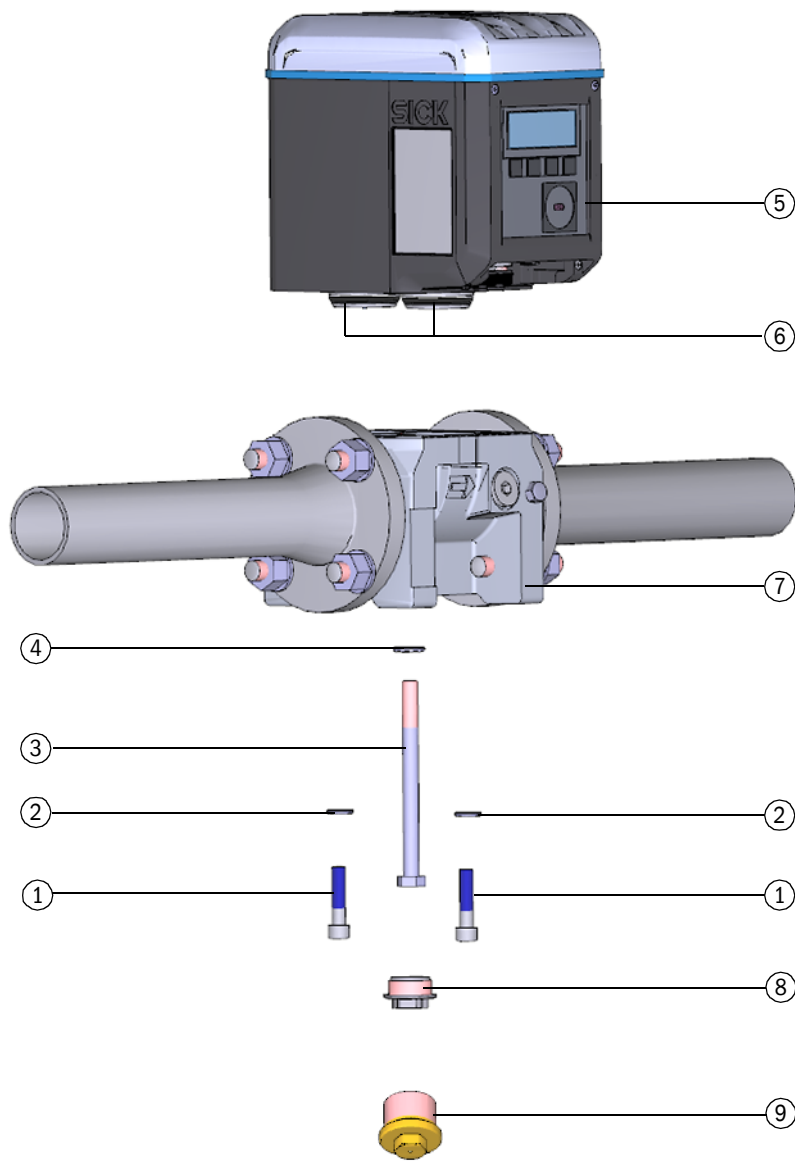
6 Connecting pieces with seals
7 Adapter
8 Locking cap
9 Test cap

7.4.6 Backup of user-specific configuration of installed gas flow meter

1 Connect to device, → p. 71, § 4.3.1.

2 Open the "Meter Replacement" tile in the "Service" menu.

3 Click "Backup Parameter" to backup the parameters of the currently installed gas flow meter.

Fig. 52   Parameter backup
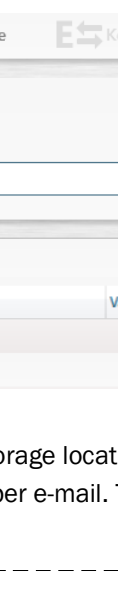
4 Save the parameter file:
   – Click "Save as" to choose a storage location for the parameter file.
   – Click "E-mail" to send the file per e-mail. The file is appended to an e-mail when an e-mail client is available.

Fig. 53   Save the parameter file

5 Click "Close" after storing the csv file.

> **NOTICE:**
> The parameter set is required after exchanging the gas flow meter to transfer the customer-specific or device-specific parameters to the new gas flow meter.

7.4.7 Disconnecting electrical connections

Observe the safety information in §3.4 (→ p. 46)!

Depending on the configuration of your FLOWSIC500, proceed as follows:

1 Disconnect the potential equalization line at the outer ground terminal (on the right of the M12 plug-in connections) of the electronic housing (→ Fig. 18, p. 50).

2 If installed, remove the plug-in connector cover. To do so, loosen the capstan screws (→ Fig. 29, p. 60).

3 If installed, manually loosen and remove the M12 plug-in connectors for external power supply and the signal output (→ Fig. 18, p. 50).

4 If installed, manually loosen and remove the plug-in connectors of the pressure and temperature sensors (→ Fig. 18, p. 50).

5 Open the electronics cover (→ p. 48, §3.4.3).

► Configuration with external power supply and backup battery:
Switch the backup battery to "N.c.".

Fig. 54 Switching the backup battery
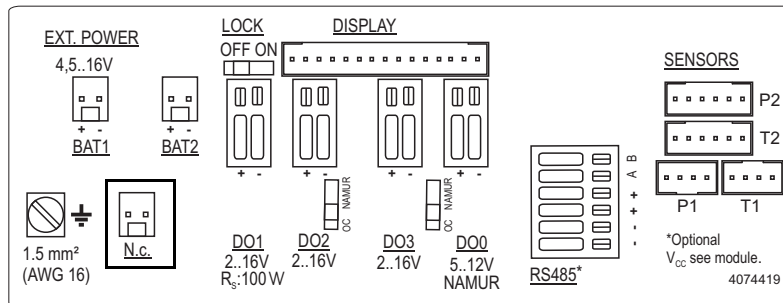
► Self-sufficient power configuration with battery packs:
Remove the battery packs and dispose of or store properly according to → p. 108, §7.1.

> [!] SICK recommends inserting new batteries during every meter exchange.

6 Close the electronics cover again (→ p. 48, §3.4.3).

7.4.8   **Removing the installed gas flow meter**

1	Ensure safe conditions.

⚠	**WARNING: Hazards due to combustible gases or high pressure** Natural gas under line pressure flows through the gas flow meter during running operation. The gas flow meter may only be exchanged when the equipment is at a standstill. *Before commencing installation work:* ► Ensure the pipeline is free from pressure and free from combustible gases. ► Purge the pipeline with inert gas if necessary. ► Observe the safety information in §1.1 and §3.1.
⚠	**WARNING: Hazard due to the gas flow meter falling down** ► Secure the gas flow meter before loosening the screw fitting, e.g. by supporting the gas flow meter or with the help of another person holding the gas flow meter.

2	Unscrew the closure cap.
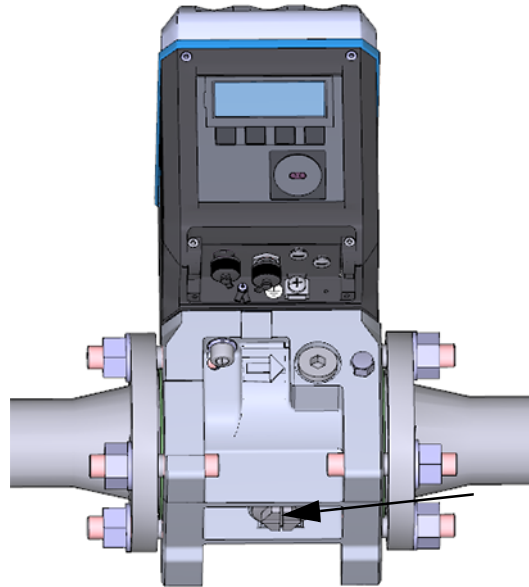
| 3 | Remove securing screws (1) with the Allen key |

Meter size	Number of securing screws
DN50/2"	2
DN80/3"	3
DN100/4"	4
DN150/6"	4

4 Loosen center bolt (2) five to six turns.
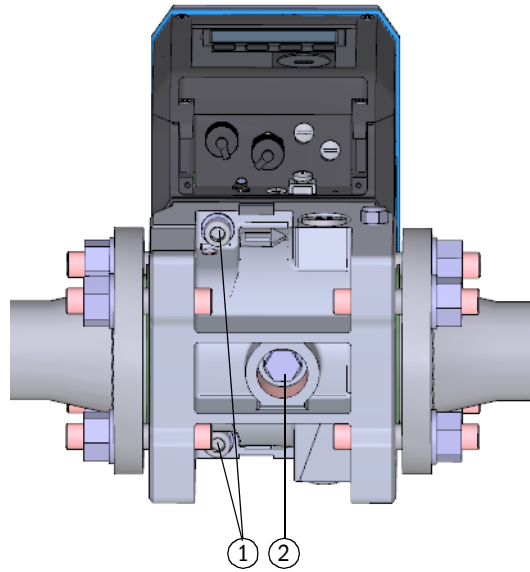
5 Instead of the closure cap, at first manually screw the test cap for the respective meter size in until the test cap touches the center bolt.
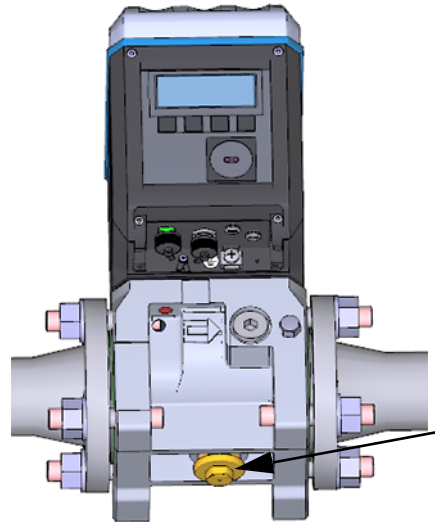
6 Keep on screwing the test cap in with the socket wrench against the resistance of the center bolt until the test cap is completely screwed in.

The center bolt pushes the seals upwards and lifts the gas flow meter up.

approx. 5 mm
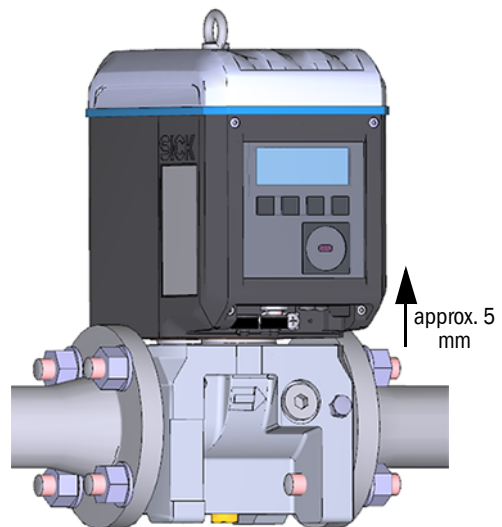
7 Unscrew the test cap and the center bolt completely with the socket wrench.	
8 Pull the gas flow meter straight upwards and remove it. **9** Ensure that the connecting pieces with the O-rings are still on the gas flow meter.	
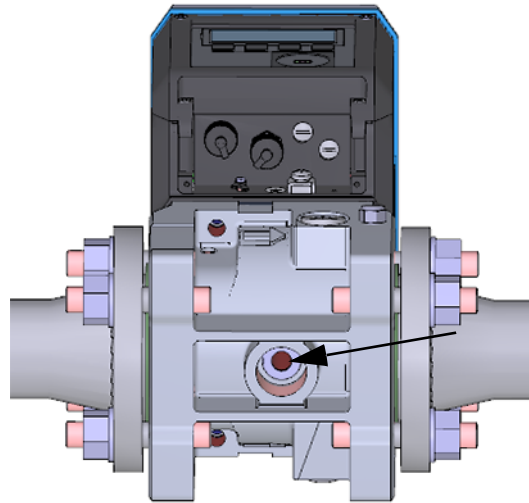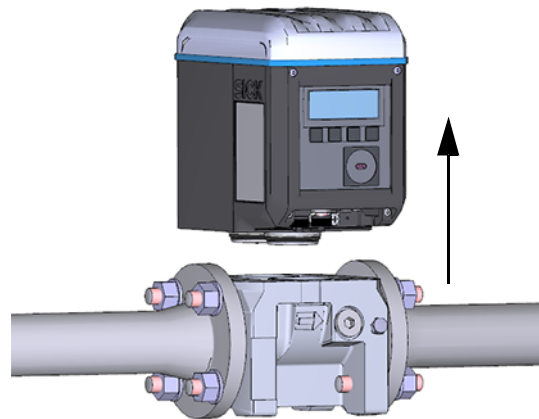
10 Ensure that the gas flow meter can not be contaminated or damaged at any time.
11 Secure the removed gas flow meter with the transport protection before shipping:
    – Fit the gas flow meter on the transport protection.
    – Secure the gas flow meter with the strap provided.	
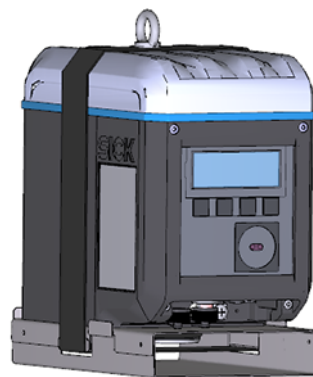
12 Check the sealing surfaces on the adapter (marked green):
  – When the sealing surfaces are contaminated, clean carefully.
  – Ensure that the sealing surfaces are undamaged. They have to be free of scratches or grooves.
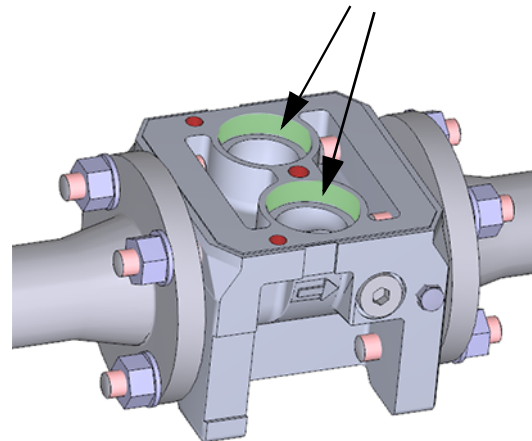
⚠ **WARNING: Hazard of leaks**

There is a risk of the installation becoming leaky when the sealing surfaces of the adapter are damaged. Operation in leaky condition is not allowed and potentially dangerous.

► In this case, the adapter has to be exchanged.
► Please contact your local SICK Customer Service.

7.4.9 **Installing the replacement gas flow meter**

!	*NOTICE:* When the sealing surfaces of the adapter have been cleaned with a detergent, let it evaporate completely.

1	Carefully remove the transport protection of the new gas flow meter. Pay attention to the arrangement of O-ring seals (1) and support plates (2).	
2	Check the outside of the replacement gas flow meter for transport damage. Only undamaged gas flow meters may be installed.	
3	Ensure that flat sealing (1) and the O-rings on connection pieces (2) are not damaged.	
4	Check all threads on the components for damage.	
5	Apply silicone grease to the sealing surfaces of the adapter.	
6	Apply silicone grease to the O-rings on the connection pieces.	
7	Carefully fit the gas flow meter on the adapter. Pay attention to the correct orientation of the gas flow meter. The position of the center bolt allows only one fitting direction.	
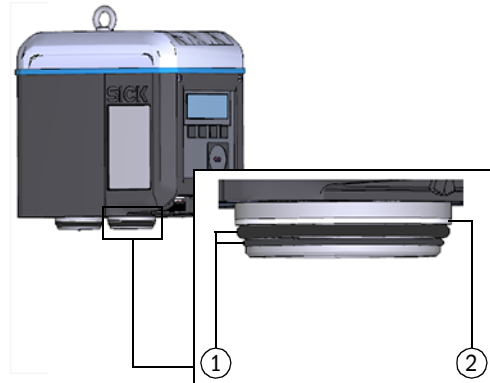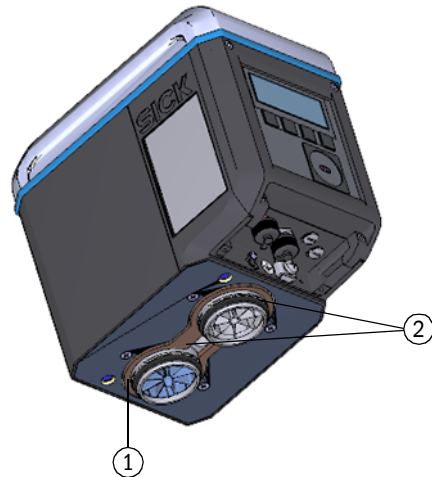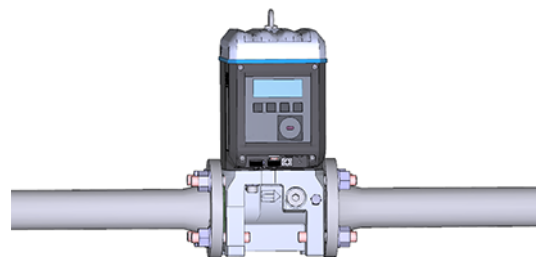
8 Carefully plug the connection pieces with the O-rings into the openings of the adapter.
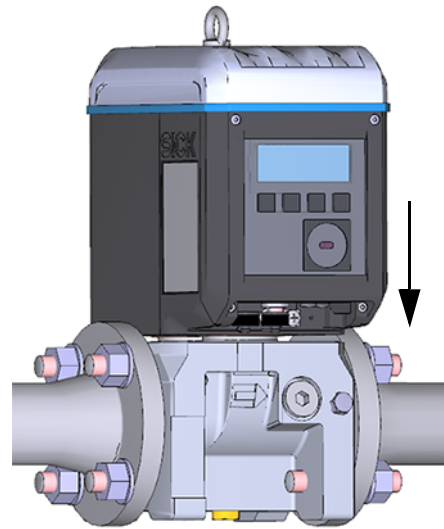
9 First screw the provided new center bolt with Ripplock washer in manually.
SICK recommends using lubricant.

10 Then tighten the center bolt with the socket wrench to the specified tightening torque.

Meter size	Tightening torque	
DN50/2"	45 Nm	34 lbf ft
DN80/3"	100 Nm	74 lbf ft
DN100/4"	145 Nm	107 lbf ft
DN150/6"		
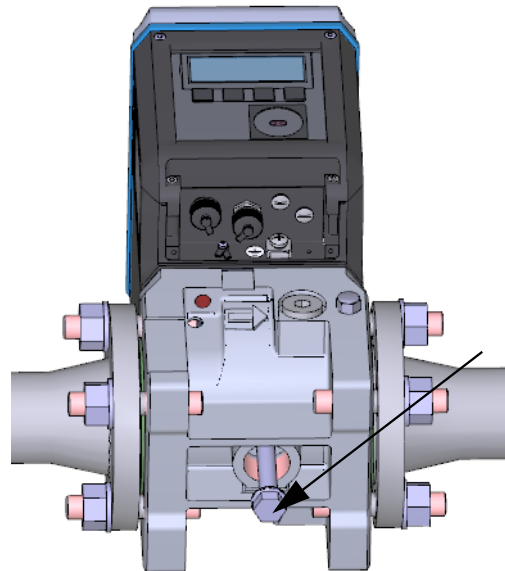
11 First screw the provided securing screws with Ripplock washers in manually.

12 Then tighten the securing screws with the Allen key to the specified tightening torque.

Meter size	Tightening torque	
DN50/2"	20 Nm	15 lbf ft
DN80/3"	45 Nm	34 lbf ft
DN100/4"	100 Nm	74 lbf ft
DN150/6"		

13 Check the leak tightness, → p. 124, §7.4.10.
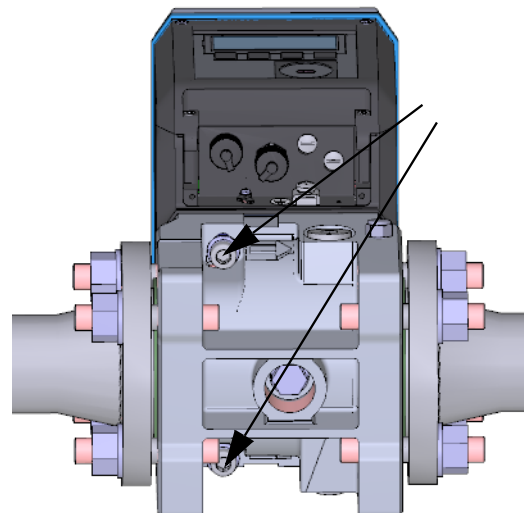
14	After a successful leak tightness check, connect the replacement gas flow meter to the electric system, see §3. 4 "Electrical installation".
15	If desired, upload the configuration of the previously installed gas flow meter to the replacement gas flow meter (→ p. 116, §7.4.6).
16	Checking the function of the new gas flow meter, → p. 131, §7.4.12.
17	If necessary, secure metrologically (→ p. 131, §7.4.13).

7.4.10   **Perform a leak tightness check**

After each exchange of the gas flow meter, the correct installation of the gas flow meter and the leak tightness of the measuring device has to be checked.

To check the leak tightness, the corresponding test cap for the respective meter size is needed (→ p. 114, §7.4.4).

1 First screw the test cap for the respective meter size in manually. **2** Then tighten the test cap with the socket wrench until the test cap is completely screwed in.	
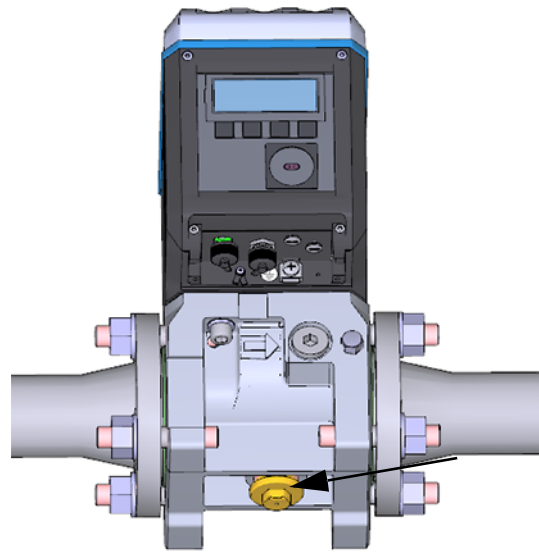
3	Slowly increase the pressure in the device (max. gradient 3 bar/min or 45 psi/min) up to the line pressure.
4	Apply leak detection spray to the opening of the test cap.
5	Check over at least 15 min whether gas escapes at the opening of the test cap – When no gas escapes from the opening of the test cap, see → p. 125, §7.4.10.1. – When gas escapes from the opening of the test cap, see → p. 125, §7.4.10.2.

7.4.10.1   **Leak tightness check successful**

1   Remove the test cap with the socket wrench.
2   Screw in the closure cap.
3   Then connect the replacement gas flow meter to the electric system, see §3. 4 "Electrical installation".
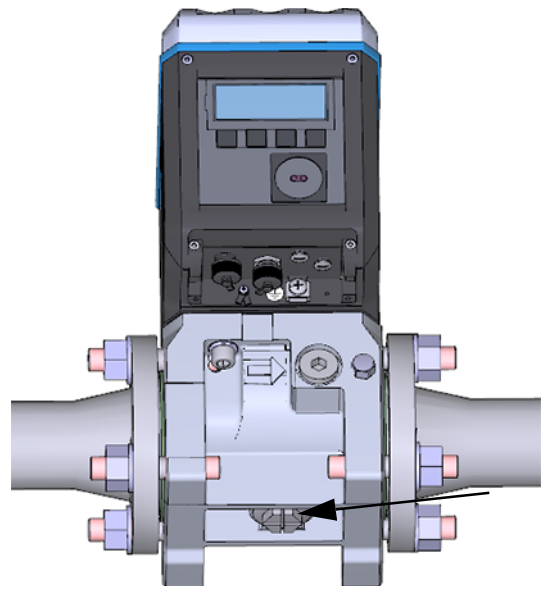
7.4.10.2   **Leak tightness check not successful**

1   Close the line and depressurize the device.
2   Vent the environment.
3   Remove the gas flow meter from the adapter as described, see → p. 118, §7.4.8.

4   Check flat seal (1) and the O-rings on connections pieces (2) for completeness, intactness and correct installation. When the sealing elements are damaged, a new seal set is available as spare part.

Meter size	Item number
DN50	2067394
DN80	2067395
DN100	2067396
DN150	

Subject to change without notice
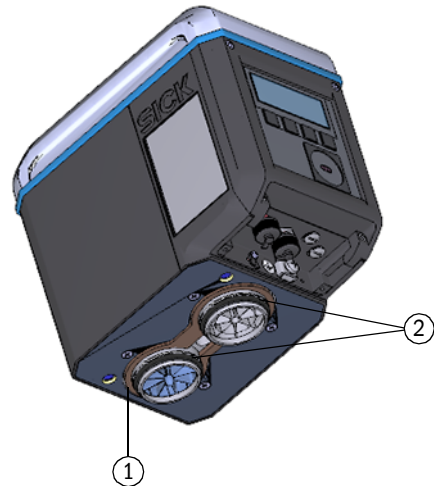
5	Check the sealing surfaces on the adapter (marked green) for contamination and damage.
6	When the sealing surfaces are damaged, e.g. due to corrosion or external force, the adapter has to be exchanged.
7	When the adapter is damaged, it has to be removed and a new adapter installed → p. 39, §3.3. Then install the gas flow meter anew, → p. 122, §7.4.9.
8	When the components do not seem to be damaged but leak tightness can not be established, please contact SICK Customer Service (→ p. 102, §6.1).
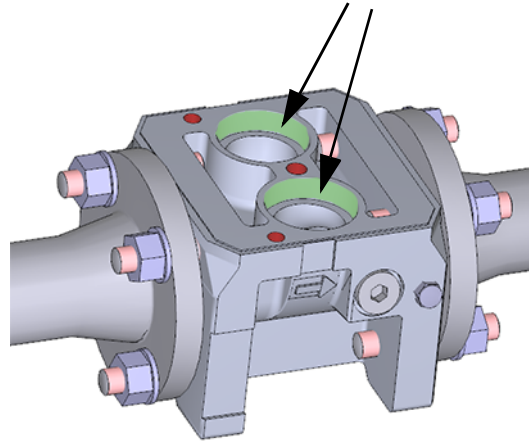
7.4.11 **Loading the parameter backup**

> ⚠ *NOTICE:* **Parameter protection**
> ► Check the position of the parameter locking switch, see → p. 81, §5.2.1.
> ► When open, proceed with step 1.
> ► When closed, the counter values and the configuration of the digital outputs cannot be written to the meter.
>   An information message is output when the parameters are being written. If the further parameters are however to be written, click "OK" to confirm the information message

1 Connect to device, → p. 71, §4.3.1.
2 Open the "Meter Replacement" tile in the "Service" menu.
3 Set the source for the parameter exchange to "Parameter file".
4 Select the parameter file stored before exchanging the meter, → p. 116, §7.4.6.

Fig. 55   Parameter file
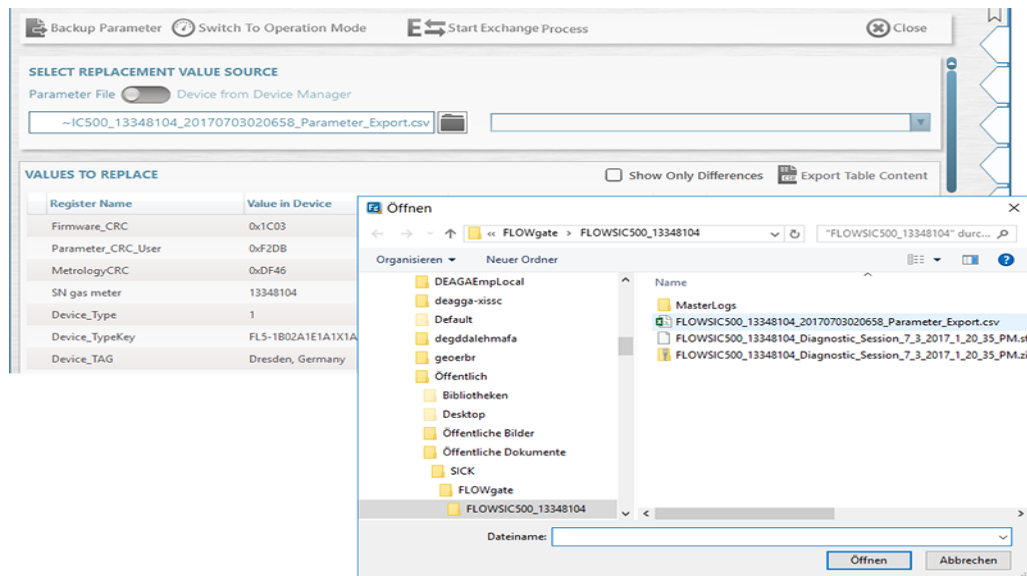
5 An overview of the old and new values is shown under "Values to replace". Activate the "Show only differences" checkbox to show only the differences.
6 Activate Configuration mode.
7 Click "Start Value Exchange" to load the parameter backup.

Fig. 56   Starting the exchange

8 In the dialog that opens, select whether the totalizer levels are to be used from the saved parameter set or should be reset. The operating company is responsible for deciding whether to accept or reset the volume counters.

Fig. 57   Counter values

9 Confirm with "OK".

10 The serial numbers of the pressure and temperature sensor are queried for gas flow meters with external pressure and temperature technology.

Fig. 58   Serial numbers for pressure and temperature sensors

11 Check the serial numbers.

12 Enter the new serial numbers when the numbers do not match the serial numbers of the installed pressure and temperature sensors.

13 Confirm with "OK".

14 Check the serial number of the adapter; enter the serial number when different from the one stored.

Fig. 59   Adapter serial number

15 During transfer of the parameter values, the sequence is shown in a progress bar.

16 Confirm the upload with "OK" after completion of the upload.
    The "Meter exchange report" is created.

17 Save the report as pdf file or csv file or send by e-mail.

Fig. 60   Saving the meter exchange report
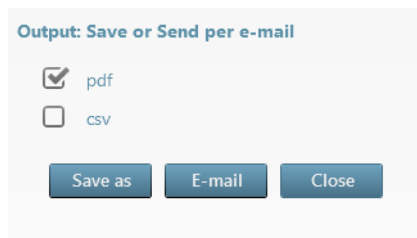
Fig. 61   Meter exchange report (example)

FLOWSIC500	Meter Replacement Report		
	ID 10101000000		SICK Sensor Intelligence.

Device name	Dresden, Germany	Device Type		Ultrasonic gas meter
Station / Description		Manufacturer		SICK
SN gas meter	13348104	Nominal Diameter		DN50 | 2"
Device Type Key	FL5-1B02A1E1A1X1A1C2D3B1C1L2XX	Firmware Version		2.07.00
Company		Firmware CRC		0x1C03
Address		Metrology CRC		0xDF46
ZIP Code, City		Adjust Parameter CRC		0xF2CD
Country		Created with		FLOWgate 1.6.0.4604
GPS	Lat: 0.00000 | Lon: 0.00000			

	Replaced meter	New meter
SN gas meter	13348104	13348104
Device Type Key	FL5-1B02A1E1A1X1A1C2D3B1C1L2XX	FL5-1B02A1E1A1X1A1C2D3B1C1L2XX
Parameter CRC User	0xF2DB	0xF2DB
Metrology CRC	0xDF46	0xDF46
Firmware CRC	0x1C03	0x1C03

Register	Initial value in device	New value	Unit	Transfer state	Remark
Device_TAG	Dresden, Germany	Dresden, Germany		no Transfer	kept (no differences)
Serial number adapter	00003320	123		**Success**	
Service_TimeOut	15	15	min	no Transfer	kept (no differences)
UserEnable	7	7		no Transfer	kept (no differences)
Pwd_User_1	****	****		no Transfer	kept (no differences)
Pwd_User_2	****	****		no Transfer	kept (no differences)
Pwd_User_3	****	****		no Transfer	kept (no differences)
Pwd_AuthorizedUser_1	****	****		no Transfer	kept (no differences)
Pwd_AuthorizedUser_2	****	****		no Transfer	kept (no differences)
Pwd_AuthorizedUser_3	****	****		no Transfer	kept (no differences)
DO.0_Configuration	0	0		no Transfer	kept (no differences)
DO.1_Configuration	2	2		no Transfer	kept (no differences)
DO.2_Configuration	5	5		no Transfer	kept (no differences)
DO.3_Configuration	8	8		no Transfer	kept (no differences)
PulseSource	1	1		no Transfer	kept (no differences)
PulseSource2	0	0		no Transfer	kept (no differences)
PulseFrequencyLimit	400	400	Hz	no Transfer	kept (no differences)
PulseFrequencyLimit2	10	10	Hz	no Transfer	kept (no differences)

Data date: 7/3/2017 2:38:02 PM   Print date: 7/3/2017 2:38:02 PM   Page 1 of 4

7.4.12 Checking the function of the new gas flow meter

► Check on the display if there are any malfunctions or warnings:

	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.

► When malfunctions or warnings exist, clear the cause (→ p. 101, §6).
► Alternatively, check the device status with the FLOWgate^{TM} operating software, → p. 78, §4.3.5.
► Create a diagnostics session and file with the device documentation, → p. 105, §6.4 .

7.4.13 Securing metrologically

► Gas flow meter and adapter can be secured at the joint by a user seal (adhesive label) (→ p. 34, §2.9).
► When the parameter locking switch has been opened during the meter exchange, secure the parameter locking switch anew metrologically (→ Fig. 9, p. 35).

7.5 Function check of a pressure or temperature sensor

The error status of a sensor is displayed on the device as an event.

1 Switch to main display "Current events".

2 Check the list for a current event with type 'E-3010' (temperature sensor failure) or 'E-3012' (pressure sensor failure).

Exchange the sensor involved when one of these errors is displayed → p. 132, §7.6.

> **+i** Replace the gas flow meter in the device configuration with internal pressure and temperature sensors.

If an error is not displayed, the sensor function can be checked by comparing the measured value on the FLOWSIC500 with the measured value of a reference sensor.

7.6 Exchanging an external pressure or temperature sensor

> **EX** **WARNING: Hazard through wrong spare parts**
> The FLOWSIC500 and the delivered pressure and temperature sensors are designed intrinsically safe.
> ► Only pressure and temperature sensors from SICK may be used → p. 138, §8.2.2.
> ► The pressure and temperature sensors can be connected and disconnected in the hazardous area as well.
> ► The pressure and temperature sensors may only be connected using the M8 plug-in connectors marked accordingly on the FLOWSIC500.
> ► Modifying the electrical connection parts is not allowed.

> **!** *NOTICE:*
> The pressure and temperature sensors can only be replaced when the parameter locking switch is open.

7.6.1 Exchanging the pressure sensor

1 Three-way test valve: Move the lever to the test position (→ Table 21).

Test valve: Fit the adapter on the test connection (Part No. 2071841).

2 Unscrew the sensor from the three-way test valve.

Here, loosen the screw fitting slowly so that any overpressure can escape under control.

3 Loosen the plug-in connector cover.

4 Disconnect the plug.

5 Connect the plug to the M8 connection on the FLOWSIC500.

6 Screw the plug-in connector cover tight.

7 Install a new pressure sensor on the pressure measuring port marked "P_m" → p. 61, §3.5.2.

8 Enter the serial number of the new sensor in the FLOWSIC500 with the FLOWgate™ operating software.

 – Connect to device, → p. 71, §4.3.1.

 – Open the "Device Identification" tile in the "Parameter Modification" menu.

 – Start the configuration mode.

 – Enter the new serial number in the field "Pressure sensor serial number".

 – Return to the operating mode. The new serial number is written to the device.

9 Check the function by comparing the operating point or checking the display value (remove adapter on test connection) against a reference measurement.

> **[!]** *NOTICE:* Leak tightness check
> SICK recommends a leak tightness check after sensor replacement.

7.6.2 Exchanging the temperature sensor

> **+i** The temperature sensor can be greased with heat-conductive oil or paste to improve its performance.

1 Loosen the locknut and pull the temperature sensor out of the protective tube.

2 Loosen the plug-in connector cover.

3 Disconnect the plug.

4 Guide the plug of the new sensor through the plug-in connector cover.

5 Connect the plug to the M8 connection on the FLOWSIC500.

6 Screw the plug-in connector cover tight.

7 Fit the new temperature sensor in the protective tube → p. 65, §3.5.3.

8 Enter the serial number of the new sensor in the FLOWSIC500 with the FLOWgate™ operating software:
  - Connect to device, → p. 71, §4.3.1.
  - Open the "Device Identification" tile in the "Parameter Modification" menu.
  - Start the configuration mode.
  - Enter the new serial number in the field "Temperature sensor serial number".
  - Return to the operating mode. The new serial number is written to the device.

9 Check the function by comparing the operating point or checking the display value (remove adapter on test connection) against a reference measurement.

FLOWSIC500

8   Accessories and spare parts

Accessories
Spare parts

8.1 Accessories

8.1.1 Gas flow meter accessories

Description	Part No.
Mounting set for meter installation 2"/DN50 with flange type ANSI150 (ASME B16.5)	2067402
Mounting set for meter installation 3"/DN80 with flange type ANSI150 (ASME B16.5)	2067403
Mounting set for meter installation 4"/DN100 with flange type ANSI150 (ASME B16.5)	2067404
Mounting set for meter installation 6"/DN150 with flange type ANSI150 (ASME B16.5)	2067405
Mounting set for meter installation 2"/DN50 with flange type PN16 (EN1092-1)	2067406
Mounting set for meter installation 3"/DN80 with flange type PN16 (EN1092-1)	2067407
Mounting set for meter installation 4"/DN100 with flange type PN16 (EN1092-1)	2067408
Mounting set for meter installation 6"/DN150 with flange type PN16 (EN1092-1)	2067409
Mounting set for meter installation 2" | DN50 with flange type PN16 (GOST 12815-80 and GOST 33259–2015); flange face V1 series 1/2	2067411
Mounting set for meter installation 3" | DN80 with flange type PN16 (GOST 12815-80) for flange face V1 series 1; or with flange type PN16 (GOST 33259–2015) for flange face Version B series 2	2067412
Mounting set for meter installation 3" | DN80 with flange type PN16 (GOST 12815-80) for flange face V1 series 2; or with flange type PN16 (GOST 33259–2015) for flange face Version B series 2	2067413
Mounting set for meter installation 4" | DN100 with flange type PN16 (GOST 12815-80 and GOST 33259–2015); flange face V1 series 1/2	2067414
Mounting set for meter installation 6" | DN150 with flange type PN16 (GOST 12815-80 and GOST 33259–2015); flange face V1 series 1/2	2067416
Dummy plug for pressure connection NPT 1/4"	2067398
Dummy plug for temperature connection G1/2"	2067401
M12 plug (A-coded) for data transfer	2067419
M12 connector (B-coded) for power supply	2067420
2 m connection cable for data transfer; -25 °C ... +60 °C / -13 °F ... +140 °F; with connector (A-coded) and ferrules	2067422
5 m connection cable for data transfer; -25 °C ... +60 °C / -13 °F ... +140 °F; with connector (A-coded) and ferrules	2067423
2 m connection cable for data transfer; -40 °C ... +70 °C / -40 °F ... +158 °F; with connector (A-coded) and ferrules	2067630
5 m connection cable for data transfer; -40 °C ... +70 °C / -40 °F ... +158 °F; with connector (A-coded) and ferrules	2067631
10 m connection cable for power supply; -25 °C ... +60 °C/ -13 °F ... +140 °F; with connector (B-coded) and ferrules	2067424
20 m connection cable for power supply; -25 °C ... +60 °C/ -13 °F ... +140 °F; with connector (B-coded) and ferrules	2067425
10 m connection cable for power supply; -40 °C ... +70 °C/ -40 °F ... +158 °F; with connector (B-coded) and ferrules	2067632
20 m connection cable for electrical supply; -40 °C ... +70 °C/ -40 °F ... +158 °F; with plug (B-coded) and connector sleeves	2067633
Zener Barrier Z715; working voltage 13 V at 10 µA; ATEX II (1) GD [Ex ia Ga] IIC; DIN rail mounting; Protection class IP20; Operating temperature -20 to +60 °C | -4 to +140 °F	6079581
Single-channel safety barrier series 9001; operating voltage 12 V DC; ATEX II 3 (1) G Ex nA [ia Ga] IIC/IIB T4 Gc; CSA Class I, Division 2, Groups A, B, C, D; degree of protection IP20/40; operating temperature -20 °C ... +60 °C	6050603

Description	Part No.
Power supply unit 253 V AC / 12 V DC; operating voltage 12 V DC/1 A; 1-phase; screw connection; DIN rail mounting NS 35, EN 60715; CUL listed; degree of protection IP20; operating temperature: -25 °C ... 70 °C	6050642
Infrared/USB adapter HIE-04; data transfer up to 38400 baud; USB 2.0; cable length 2.25 m; ATEX II 2G Ex mb IIC T4; operating temperature -25 °C ... +60 °C; degree of protection IP30	6050602
Tamper-proof protection of connectors	2067397
Display protector for FLOWSIC500, retrofittable	2085547

8.1.2 Volume conversion (device option) accessories

Description	Part No.
Pressure connection set, -40 °C to 70 °C: Three-way cock, fitting with ferrule 6 mm, test connection (Minimess coupling)	2066281
Pressure connection set, -40°C to 70°C: Three-way cock, fitting with ferrule 1/4", test connection (Minimess coupling)	2071770
Pressure connection set, -25°C to 60°C: Test valve BDA04 (G1/4"), fitting with ferrule	2071098
Hose connection set DN4 RP1/4	2071841
Thermowell for nominal widths DN50 to DN100 | 2" to 4" Seal for use in -40°C to 70°C	2068309
Thermowell for nominal width DN150 | 6" Seal for use in -40°C to 70°C	2093697
Thermowell for nominal widths DN50 to DN100 | 2" to 4" Seal for use in -40°C to 70°C Incl. leak tightness/strength test according to DIN 30690-1	2095155
Thermowell for nominal width DN150 | 6" Seal for use in -40°C to 70°C Incl. leak tightness/strength test according to DIN 30690-1	2095156

8.1.3 Transport accessories

Description	Part No.
Transport protection for gas flow meter, rated width DN50/2"	2079021
Transport protection for gas flow meter, rated width DN80/3"	2079001
Transport protection for gas flow meter, rated width DN100/4"	2079022
Transport protection for gas flow meter, rated width DN150/6"	

8.2 Spare parts

8.2.1 Gas flow meter spare parts

Description	Part No.
Battery (7.2 V; 19 Ah) for self-sufficient meter operation (Battery pack 2R20 → 6050492 Tadiran SL-2880)	2064018
Backup battery (7.2 V; 2.7 Ah) for intrinsically safe main power supply (Battery pack 2R6 → 6049966 Tadiran SL-860)	2065928
Display module for FLOWSIC500; for output configuration "A-E" (type code)	2066077
Display module for FLOWSIC500; for output configuration "F-L" (type code)	2092947
Display seal	2095177
RS485 module; rated input voltage 4 - 16 V; for output configuration "J" (type code)	2087946
RS485 module; rated input voltage 2.7 - 5 V; for output configuration "I" (type code)	2087945
Tool set for gas flow meter exchange 2"/DN50	2067510
Tool set for gas flow meter exchange 3"/DN80	2067511
Tool set for gas flow meter exchange 4"/DN100 and 6"/DN150	2067512
Gasket set for gas flow meter exchange 2"/DN50	2067394
Gasket set for gas flow meter exchange 3"/DN80	2067395
Gasket set for gas flow meter exchange 4"/DN100 and 6"/DN150	2067396

8.2.2 Volume conversion (device option) spare parts

Description	Part No.
EDT23 - digital pressure sensor; overpressure 0 to 4 bar; G1/4" male thread	2071175
EDT23 - digital pressure sensor; overpressure 0 to 10 bar; G1/4" male thread	2071174
EDT23 - digital pressure sensor; overpressure 0 to 20 bar; G1/4" male thread	2071176
EDT23 - digital pressure sensor; absolute pressure 0,8 to 5,2 bar; G1/4" male thread	2071178
EDT23 - digital pressure sensor; absolute pressure 2 to 10 bar; G1/4" male thread	2071179
EDT23 - digital pressure sensor; absolute pressure 4 to 20 bar; G1/4" male thread	2071180
EDT96 - digital pressure sensor; absolute pressure 0,8 to 20 bar; G1/4" male thread	2115920
EDT34 - digital temperature sensor, -25 °C to +60 °C	2071181
EDT34 - digital temperature sensor, -40 °C to +70 °C	2071777
Sealing plug NPT 1/4"	2067398
Sealing plug G1/4"	2067400
Pipe screw fitting for pipe diameter 6 mm	2071771
Pipe screw fitting for pipe diameter 1/4"	2069071
Adapter from NPT 1/4" male thread to G1/4" female thread	2075562

FLOWSIC500

9   Annex

Conformities and Technical Data

Application ranges

Volume conversion: input variables and limit values of the algorithms

Type code

Type plates

Dimensional drawings

Internal terminal assignment

Installation examples

Connection diagrams for operation of the FLOWSIC500 in accordance with CSA

Connection diagrams for operation of the FLOWSIC500 in accordance with ATEX/
IECEx

9.1 **Conformities and Technical Data**

9.1.1 **CE certificate**

The FLOWSIC500 has been developed, manufactured and tested in accordance with the following EU Directives:

- Pressure Equipment Directive 2014/68/EU
- ATEX Directive 2014/34/EU
- EMC Directive 2014/30/EU
- Measuring Instrument Directive 2014/32/EU

Conformity with the above Directives has been determined and the CE label attached to the device.

9.1.2 **Standards compatibility**

The FLOWSIC500 conforms to the following standards or recommendations:

- OIML R137-1&2, 2012
  Gas Meters - Part 1: Metrological And Technical Requirements; Part 2: Metrological Controls And Performance Tests
- EN 60079-0:2012/A11:2013, EN 60079-11:2012, EN 60079-28:2007
  Explosive atmospheres - Part 0: Equipment - General requirements; Part 11: Equipment protection by intrinsic safety "i"; Part 28: Protection of equipment and transmission systems using optical radiation
- IEC 60079-0: 2011, IEC 60079-28: 2011 (6th Edition)
  Explosive atmospheres - Part 0: Equipment - General requirements; Part 28: Protection of equipment and transmission systems using optical radiation
- IEC 60079-11: 2011+Cor.: 2012 (6th Edition)
  Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
- EN 61326-1:2006
  Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements (IEC 61326-1:2005)
- IEC 61326:2005
  Electrical equipment for measurement, control and laboratory use – EMC requirements
- EN 61010-1:2010
  Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements (IEC 61010-1:2010)
- IEC 61010-1:2010 + Cor.: 2011
  Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements
- EN 12405-1+A2:2010-10
  Gas meters - Conversion devices - Part 1: Volume conversion

9.1.3 Technical Data

Meter characteristics and measuring parameters		
Measured variable	Volume a.c., volume flow a.c.	
Measuring principle	Ultrasonic transit time difference measurement	
Measured medium	Natural gas (dry, odorized), nitrogen, air, up to 30 % hydrogen in natural gas	
Measuring ranges[1]	Volume flow a.c., DN50/2"	$1.0 \ldots 160 \ m^3/h \ (35 \ldots 5{,}650 \ cfh)$
	Volume flow a.c., DN80/3"	$2.5 \ldots 400 \ m^3/h \ (88 \ldots 14{,}125 \ cfh)$
	Volume flow a.c., DN100/4"	$4.0 \ldots 650 \ m^3/h \ (141 \ldots 22{,}955 \ cfh)$
	Volume flow a.c., DN150/6"	$4.0 \ldots 1{,}000 \ m^3/h \ (141 \ldots 35{,}314 \ cfh)$
Repeatability	$\leq 0.1\%$	
Accuracy	Accuracy class 1, typical error limits Q_{min} up to $0.1 \ Q_{max}$: $\leq \pm 1.0 \ \%$ $0.1 \ Q_{max}$ up to Q_{max}: $\leq \pm 0.5 \ \%$	
	Accuracy class 1, maximum allowed error limits: Q_{min} up to $0.1 \ Q_{max}$: $\leq \pm 2\%$ $0.1 \ Q_{max}$ up to Q_{max}: $\leq \pm 1\%$ After HP flow rate calibration: $\pm 0.2\%$ with test pressure, otherwise $\pm 0.5\%$	
Diagnostics functions	Permanent monitoring of measured values	
Gas temperature	-25 °C ... +60 °C (-13 °F ... 140 °F); optional: -40 °C ... +70 °C (-40 °F ... 158 °F)	
Operating pressure	PN16 (EN 1092-1, GOST 12815-80): 0 bar (g) ... 16 bar (g) Class 150 (ASME B16.5): 0 bar (g) ... 20 bar (g)	
Ambient conditions		
Ambient temperature	-25 °C ... +60 °C (-13 °F ... 140 °F); optional: -40 °C ... +70 °C (-40 °F ... 158 °F)	
Storage temperature	-40 °C ... +80 °C (-40 °F ... 176 °F)	
Electromagnetic Conditions (EMC)	E2 in accordance with OIML R137-1&2, 2012	
Mechanical conditions	M2 in accordance with OIML R137-1&2, 2012	
Approvals		
Conformities	→ p. 140, §9.1	
Ex approvals	IECEx	Ex ia [ia] IIB T4 Gb, Ex ia [ia] IIC T4 Gb, Ex op is IIC T4 Gb
	ATEX	II 2G Ex ia [ia] IIB T4 Gb, II 2G Ex ia [ia] IIC T4 Gb, II 2G Ex op is IIC T4 Gb
	NEC/CEC (US/CA)	CSA: I. S. for Class I, Division 1 Groups C,D T4, Ex/AEx ia IIB T4 Ga
IP classification	IP 66	
Outputs and interfaces		
Digital outputs and Interfaces	Configurations: ● LF pulses + malfunction, electrically isolated (f_{max} = 100 Hz), ● HF pulses + malfunction, electrically isolated (f_{max} = 2 kHz), ● Encoder + LF pulses, electrically isolated (f_{max} = 100 Hz), ● Encoder, electrically isolated + HF pulses, not electrically isolated (f_{max} = 2 kHz) ● 2 x LF pulses, electrically isolated (f_{max} = 100 Hz)	

	● RS485 module, externally powered, *alternative* to digital outputs
	   Protocol Modbus RTU
	   Register allocations: Modbus ENRON, DSfG-Instance-F
	● RS485 module, externally powered + HF pulses, electrically isolated
	   (f_{max} = 2 kHz)
	● RS485 module, externally powered + LF pulses, electrically isolated
	   (f_{max} = 100 Hz)
	● Optical interface (according to EN62056-21 (Section 4.3))
	● Device option: RS485 module, internally powered	

Installation	
Dimensions (W x H x D)	See dimensional drawings (→ p. 155, § 9.6)
Weight	See dimensional drawings (→ p. 155, § 9.6)
Material in contact with media	Aluminium AC-42100-S-T6
Mounting	Horizontal or vertical installation with 0 D straight inlet/outlet piping
Electrical connection	
Voltage	Intrinsically safe supply: 4.5 ... 16 V DC
	Including 3-months backup battery
Power input	≤ 100 mW
General	
Options	Self-sufficient meter design (typical battery service life: More than 5 years)
Scope of delivery	The scope of delivery is dependent on the application and the customer specification.
General	
Battery type	Battery pack 2R6 → 6049966 Tadiran SL-860
	Battery pack 2R20 → 6050492 Tadiran SL-2880
Battery chemistry	Lithium thionyl chloride cell → Li/SOCl2

[1] Volume flow a.c. according to AGA 9
DN50/2": 1.6 ... 160 m^3/h (57 ... 5,650 cfh)
DN80/3": 4.0 ... 400 m^3/h (141 ... 14,125 cfh)
DN100/4": 6.5 ... 650 m^3/h (230 ... 22,955 cfh)
DN150/6": 6.5 ... 1.000 m^3/h (230 ... 35,314 cfh)

Table 35   Technical Data (additional for device option volume conversion)

Volume conversion		
Accuracy	Accuracy class 0.5 Maximum allowed error limit of conversion factor C: ≤ ± 0.5% (at reference conditions)	
Conversion method	PTZ or TZ	
Calculation methods	● Fixed value ● SGERG88, ● AGA 8 Gross method 1 ● AGA 8 Gross method 2 ● AGA NX-19	● AGA NX-19 mod. ● AGA NX-19 mod. GOST ● GERG91 mod. ● AGA8-92DC (AGA-8 detail)
Logbooks and Archives		
Logbooks	● Event logbook (1000 entries) ● Parameter logbook (250 entries) ● Metrology logbook (100 entries) ● Gas composition logbook (150 entries)	
Archives	● Billing archive (6000 entries) ● Day archive (600 entries) ● Month archive (25 entries)	
Pressure sensor (only for device option volume conversion)		
Measuring ranges	Absolute pressure sensors	Relative pressure sensors
	0.8 ... 5.2 bar (a)	0 ... 4 bar (g)
	2.0 ... 10.0 bar (a)	0 ... 10 bar (g)
	4.0 ... 20.0 bar (a)	0 ... 20 bar (g)
	0.8 ... 20.0 bar (a)	
Temperature sensor (only for device option volume conversion)		
Measuring ranges	-25 ... +60 ° C	
	-40 ... +70 ° C (optional)	

9.1.4 **Flow rates**

Table 36 Flow rates

Meter size	G class	Measuring range [m³/h]	Measuring range [cfh]	Turndown ratio
DN50 / 2"	G 40	1.3 - 65	45.9 - 2,295.5	1 : 50
	G 65	2.0 - 100	70.6 - 3,530.5	1 : 50
	G 100	3.2 - 160	113.0 - 5,650.3	1 : 50
	G 100	1.6 - 160	56.5 - 5,650.3	1 : 100
	G 100	1.0 - 160	35.3 - 5,650.0	1 : 160
DN80 / 3"	G 100	3.2 - 160	113.0 - 5,650.0	1 : 50
	G 160	5.0 - 250	176.6 - 8,828.7	1 : 50
	G 160	2.5 - 250	88.3 - 8,828.7	1 : 100
	G 250	8.0 - 400	282.5 - 14,125.9	1 : 50
	G 250	4.0 - 400	141.3 - 14,125.9	1 : 100
	G 250	2.5 - 400	88.3 - 14,125.9	1 : 160
DN100 / 4"	G 160	5.0 - 250	176.6 - 8,828.7	1 : 50
	G 250	8.0 - 400	282.5 - 14,125.9	1 : 50
	G 250	4.0 - 400	141.3 - 14,125.9	1 : 100
	G 400	13.0 - 650	459.1 - 22,954.5	1 : 50
	G 400	6.5 - 650	229.5 - 22,954.5	1 : 100
	G 400	4.0 - 650	141.3 - 22,954.5	1 : 160
DN150 / 6"	G 250	8.0 - 400	282.5 - 14,125.9	1 : 50
	G 250	4.0 - 400	141.3 - 14,125.9	1 : 100
	G 400	13.0 - 650	459.1 - 22,954.5	1 : 50
	G 400	6.5 - 650	229.5 - 22,954.5	1 : 100
	G 400	4.0 - 650	141.3 - 22,954.5	1 : 160
	G 650	20.0 - 1,000	706.3 - 35,314.7	1 : 50
	G 650	10.0 - 1,000	353.1 - 35,314.7	1 : 100
	G 650	6.2 - 1,000	219.0 - 35,314.7	1 : 160
	G 650	5.0 - 1,000	176.6 - 35,314.7	1 : 200
	G650	4.0 - 1,000	141.3 35,314.7	1 : 250

9.1.5 **Overload protection**

Table 37 Overload protection

Meter size	Q_{max}		Overload protection		
	[m³/h]	[cfh]		[m³/h]	[cfh]
DN50 / 2"	160	5,650	150% Q_{max}	240	8,475
DN80 / 3"	400	14,125	150% Q_{max}	600	21,187.5
DN100 / 4"	650	22,955	150% Q_{max}	975	34,432.5
DN150 / 6"	1,000	35,314	120% Q_{max}	1.200	42,376.8

9.2 Application ranges

9.2.1 Pressure loss

Fig. 62 Typical pressure loss FLOWSIC500

$\Delta p_{natural\ gas}$ [mBar]

Nominal size

DN50

DN80

DN100

DN150

Reference density natural gas: ρ = 0.83 kg/m³
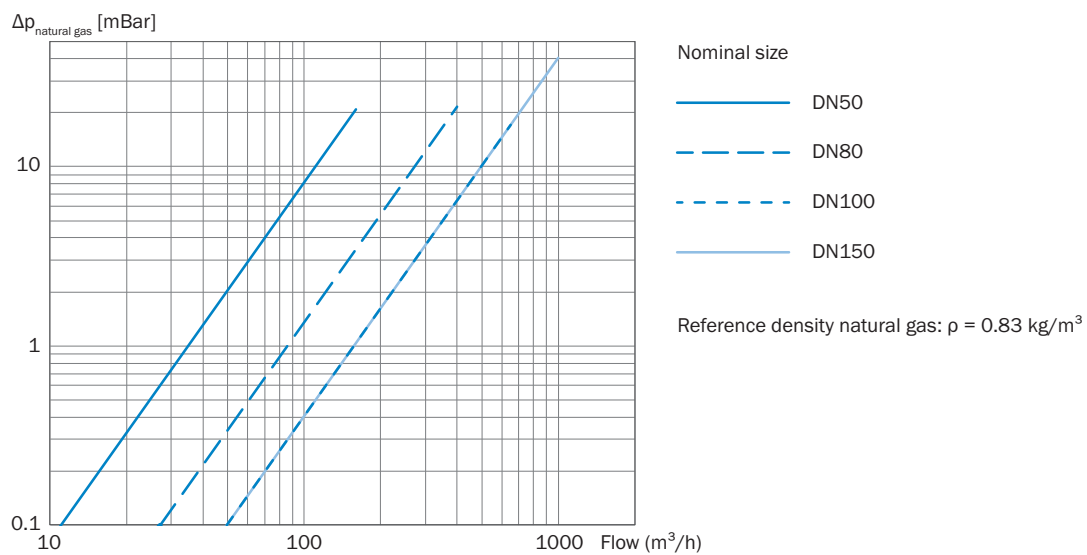
9.2.2 Methane concentration (CH$_4$) in natural gas

At very high methane concentrations, the FLOWSIC500 requires a minimum operating pressure for meter size DN80 up to DN150. Methane has a damping effect on the signal transmission.

Meter size DN50

Fig. 63   Minimum operating pressure DN50
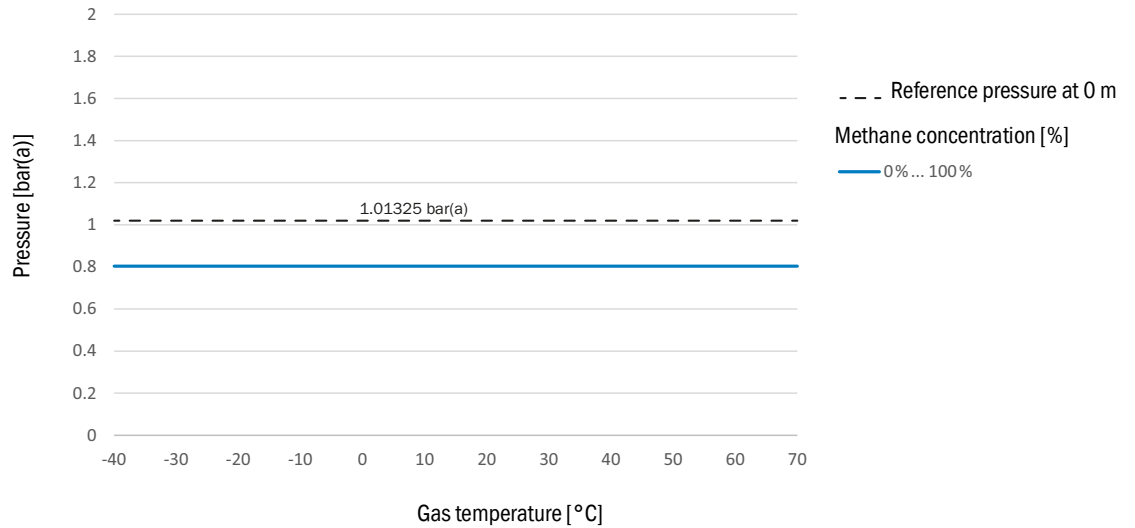
Meter size DN80/DN100/DN150

Fig. 64   Minimum operating pressure DN80/DN100/DN150
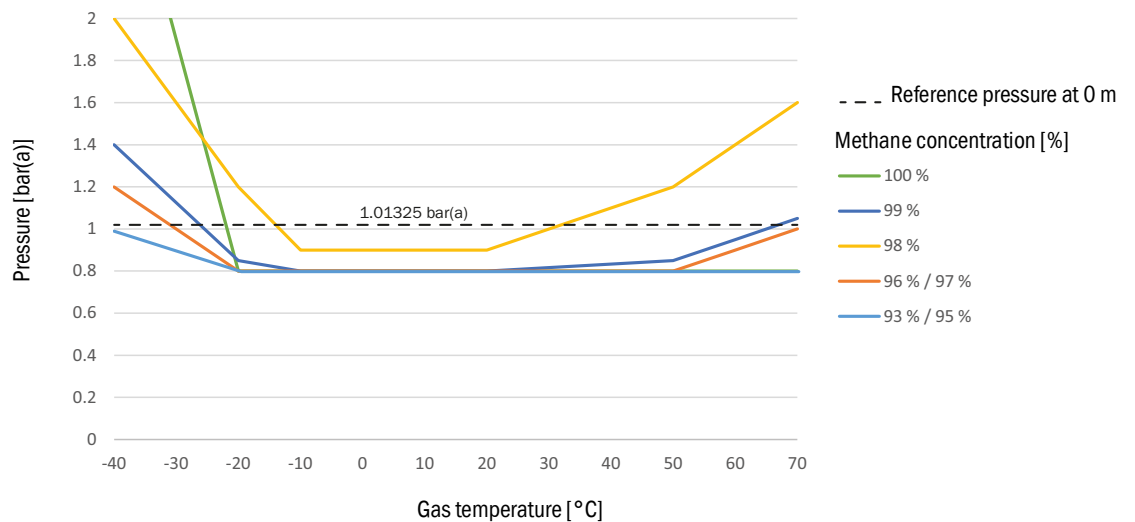
9.2.3 Carbon dioxide concentration (CO_2) in natural gas

The measuring capability of the FLOWSIC500 is limited by a maximum carbon dioxide concentration.

Meter size DN50

Fig. 65   Maximum carbon dioxide concentration DN50
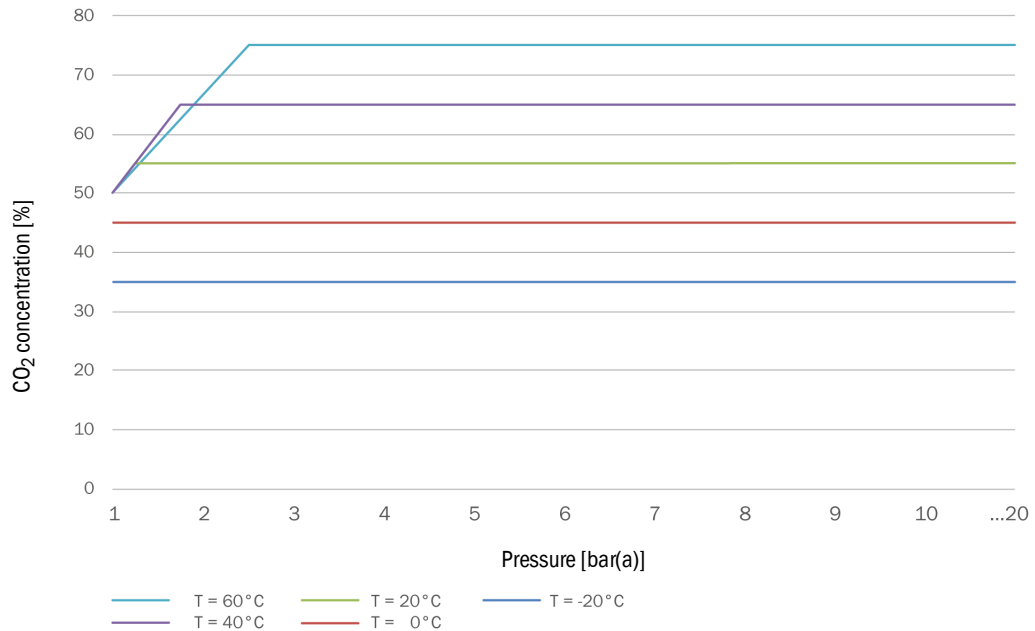
Meter size DN80 / DN100 / DN150

Bild 66   Maximum carbon dioxide concentration DN80 / DN100 / DN150
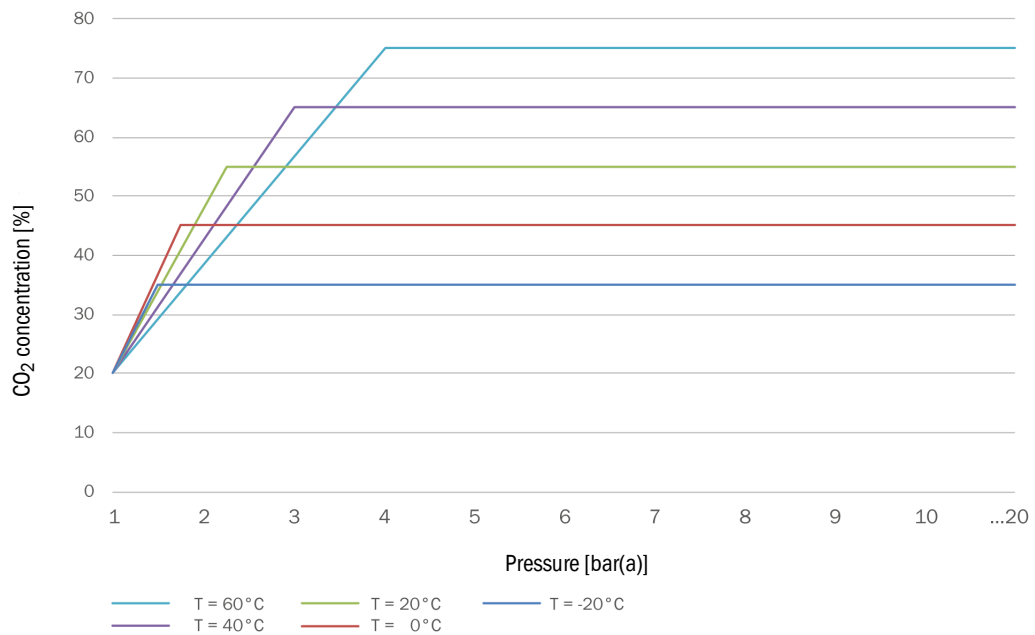
9.2.4 **Speed of sound**

The speed of sound of the measured gas needs to be in a range of 300 m/s to 600 m/s.

9.3 Volume conversion: input variables and limit values of the algorithms

9.3.1 SGERG88

Parameter	Normal range	Expanded range	Unit
Heating value	30..45	20..48	MJ/m^3
Relative density	0.55..0.8	0.55..0.9	-
Mole fraction CO2	0..0.2	0..0.3	mol/mol
Mole fraction H2	0..0.1	0..0.1	mol/mol
Pressure	0..120	0..120	bar(a)
Temperature	-10..65	-10..65	°C

9.3.2 AGA 8 Gross method 1 und 2

Parameter	AGA Gross 1	AGA Gross 2	Unit
Heating value	18.7..45.1	-	MJ/m^3
Relative density	0.554..0.87	0.554..0.87	-
Mole fraction CO2	0..0.3	0..0.3	mol/mol
Mole fraction N2	-	0..0.5	mol/mol
Mole fraction H2	0..0.1	0..0.1	mol/mol
Pressure	0..120	0..120	bar(a)
Temperature	-8..62	-8..62	°C

9.3.3 AGA NX-19 und NX-19 mod.

Parameter	NX19	NX19mod	NX19mod.BR.korr.3H	Unit
Heating value	-	31.8..39.8	39.8..46.2	MJ/m^3
Relative density	0.554..1.0	0.554..0.75	0.554..0.691	-
Mole fraction CO2	0..0.15	0..0.15	0.025	mol/mol
Mole fraction N2	0..0.15	0..0.15	0.07	mol/mol
Pressure	0..344.74	0..137.9	0..80	bar(a)
Temperature	-40..115.56	-40..115.6	0..30	°C

9.3.4 AGA NX-19 mod. GOST

Parameter	NX19mod-GOST	Unit
Reference density	0.66..1.0	kg/m^3
Mole fraction CO2	0..0.15	mol/mol
Mole fraction N2	0..0.2	mol/mol
Pressure	0..120	bar(a)
Temperature	-23.15..66.85	°C

9.3.5 GERG91 mod.

Parameter	Normal range	Expanded range	Unit
Reference density	0.66..1.05	0.66..1.05	kg/m^3
Mole fraction CO2	0..0.2	0..0.2	mol/mol
Mole fraction N2	0..0.2	0..0.2	mol/mol
Pressure	0..75	0..120	bar(a)
Temperature	-23.15..76.85	-23.15..76.85	°C

9.3.6 **AGA8-92DC (AGA-8 Detail)**

Parameter	Normal range	Expanded range	Unit
Mole fraction Methane	0.45 - 1.0	0 - 1	mol/mol
Mole fraction N2	0 - 0.5	0 - 1	mol/mol
Mole fraction CO2	0 - 0.3	0 - 1	mol/mol
Mole fraction Ethane	0 - 0.1	0 - 1	mol/mol
Mole fraction Propane	0 - 0.04	0 - 0.12	mol/mol
Mole fraction Water	0 - 0.0005	0 - dew point[4]	mol/mol
Mole fraction HydrogenSulphide	0 - 0.0002	0 - 1	mol/mol
Mole fraction H2	0 - 0.1	0 - 1	mol/mol
Mole fraction CarbonMonoxide	0 - 0.03	0 - 0.03	mol/mol
Mole fraction Oxygen	-	0 - 0.21	mol/mol
Mole fraction i-Butane	0 - 0.01[1]	0 - 0.06[1]	mol/mol
Mole fraction n-Butane	0 - 0.01[1]	0 - 0.06[1]	mol/mol
Mole fraction i-Pentane	0 - 0.003[2]	0 - 0.04[2]	mol/mol
Mole fraction n-Pentane	0 - 0.003[2]	0 - 0.04[2]	mol/mol
Mole fraction n-Hexane	0 - 0.002[3]	0 - dew point[3][4]	mol/mol
Mole fraction n-Heptane	0 - 0.002[3]	0 - dew point[3][4]	mol/mol
Mole fraction n-Octane	0 - 0.002[3]	0 - dew point[3][4]	mol/mol
Mole fraction n-Nonane	0 - 0.002[3]	0 - dew point[3][4]	mol/mol
Mole fraction n-Decane	0 - 0.002[3]	0 - dew point[3][4]	mol/mol
Mole fraction Helium	0 - 0.002	0 - 0.03	mol/mol
Mole fraction Argon	-	0 - 0.01	mol/mol
Pressure	0 - 1379	0 - 1379	bar(a)
Temperature	-129 - 204	-129 - 204	°C

[1] The sum of all butane fractions must not exceed the specified limit.
[2] The sum of all pentane fractions must not exceed the specified limit.
[3] The sum of all hydrocarbon fractions ≥ Hexane must not exceed the specified limit.
[4] The algorithm is only valid up to the dew point. Before applying the algorithm,make sure that the gas is completely in the gas phase (below dew point).

9.4 Type code

Fig. 67 Type code FLOWSIC500 (overview)

1	Device type
2	Nominal size adapter
3	Flange-flange dimension adapter
4	Pressure rating / flange standard
5	Mating surface
6	Connection p-sensor
7	Connection T-sensor
8	Material adapter/gas meter
9	Material certification adapter/gas meter
10	Surface adapter / gas meter
11	(Reserve)
12	Nominal size gas meter
13	Flow direction
14	Transducer
15	Maximum flow rate
16	Measuring span
17	Sensoric for volume correction
18	Gas temperature / ambient temperature
19	Pressure range p-sensor
20	Cable connection
21	Power supply
22	EX certification
23	I/O (Interface configurations)
24	Conformity
25	Customized solution

FL5	2	A	01	A	2	A	1	A	1	X	1	A	1	A	1	A	1	A	3	B	1	F	3	XX
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Fig. 68   Type code FLOWSIC500 (explanation)

1	Device type	
	FL5	FLOWSIC500
2	Nominal size adapter	
	X	Replacement meter only
	1	DN 50 / 2"
	2	DN 80 / 3"
	3	DN100 / 4"
	D	DN150 / 6", adapter 4"
3	Flange-flange dimension adapter	
	X	Replacement meter only
	A	50 mm
	B	171 mm
	E	241 mm
	G	300 mm
	L	450 mm
4	Pressure rating / flange standard	
	1	PN16 / EN1092-1
	2	Class 150 / ASME B16.5
	3	PN16 / GOST 12815-80
	4	PN16 / GOST 33259-2015
5	Mating surface	
	X	Replacement meter only
	A	Flat face, smooth finish
	B	Raised face, smooth finish
	C	Form A / DIN EN 1092-1
	D	Form B1 / DIN EN 1092-1
	E	GOST V1 Series 2
	F	GOST V1 Series 1
	G	GOST VB Series 1
	H	GOST VB Series 2
6	Connection p-sensor	
	X	Replacement meter only
	1	Plug NPT 1/4"
	2	Plug G1/4"
	3	Compression fitting 1/4"
	4	Compression fitting D6
7	Connection T-sensor	
	X	Replacement meter only
	A	without
	B	2xG1/2" 1x temperature pocket (left-right), 1x blind plug
	C	2xG1/2" 1x temperature pocket (right-left), 1x blind plug
	D	2xG1/2" 2x temperature pocket
	E	2x G 1/2" plug
8	Material adapter/gas meter	
	1	Aluminum / aluminum
9	Material certification adapter/gas meter	
	A	3.1 / 3.1
10	Surface adapter/gas meter	
	1	Shot-peened / SICK standard
11	Reserve	
	X	-
12	Nominal size gas meter	
	1	DN 50 / 2"
	2	DN 80 / 3"
	3	DN100 / 4"
	C	DN150 / 6"
13	Flow direction	
	A	Left - right
	B	Right - left
14	Transducer	
	1	Type 1: 300 kHz
15	Maximum flow rate	
	A	Qmax 65 m³/h
	B	Qmax 100 m³/h
	C	Qmax 160 m³/h
	D	Qmax 250 m³/h
	E	Qmax 400 m³/h
	F	Qmax 650 m³/h
	G	Qmax 1000 m³/h

16	Measuring span	
	1	1:50
	2	1:100
	3	1:160
	4	1:200
	5	1:320
	6	1:400
	7	1:406
	8	1:625
	9	1:250
17	Sensoric for volume correction	
	A	-
	B	T-Sensor external
	C	T-Sensor internal
	D	p/T-Sensoren external
	E	p/T-Sensoren internal
18	Gas temperature/ambient temperature	
	1	-25°C ... +60°C / -25°C ... +60°C
	3	-40°C ... +70°C / -40°C ... +70°C
19	Pressure range p-Sensor	
	A	-
	B	absolute 0.8 ... 5,2 bar
	C	absolute 2.0 ... 10,0 bar
	D	absolute 4.0 ... 20,0 bar
	E	absolute 0.8 ... 20,0 bar
	F	relative 0 ... 4.0 bar / 0 ... 58,0 PSI
	G	relative 0 ... 10.0 bar / 0 ... 145.0 PSI
	H	relative 0 ... 25.0 bar / 0 ... 362.6 PSI
20	Cable connection	
	1	2x M12 , 2x M8
	3	2x M12
21	Power supply	
	B	External with backup battery
	C	Autarkic with battery pack (5 years)
22	EX certification	
	1	ATEX Zone 1 / IEC-Ex Zone 1, Group IIB
	2	ATEX Zone 1 / IEC-Ex Zone 1, Group IIC
	3	CSA Class 1 Div 1, Group CD
23	I/O (Interface configurations)	
	F	Impulse LF + Status (galvanically isolated)
	G	Impulse HF + Status (galvanically isolated)
	H	Encoder + Impulse LF (galvanically isolated)
	I	RS485 Module - battery powered (external)
	J	RS485 Module - line powered (external)
	K	Encoder + Impulse HF (not galvanically isolated)
	L	2 x LF-Impulses (galvanically isolated)
	M	RS485 Module - line powered (external) + Impulse HF
	N	RS485 Module - line powered (external) + Impulse LF
24	Conformity	
	2	PED
	3	MID, PED
	4	PED, CIS
	6	PED, China
	7	PED, Ukraine
	8	PED, India
	9	PED, TR CU
	A	Customized
	B	Customized
	C	Customized
25	Customized solution	
	XX	-

9.5 Type plates

9.5.1 Metrology and electronics type plates

Fig. 69 Legend for type plates

Variable	Bezeichnung	Description
00	Typschlüssel	Type code
01	Artikelnummer Gaszähler (Materialnr.)	Part number gas meter (material number)
02	Seriennummer	Serial number
02.1	Seriennummer (XXXX XXXX)	Serial number (XXXX XXXX)
03	Datum (MM/JJJJ)	date (MM/YYYY)
04	Min. Umgebungstemperatur	Min. ambient temperature
05	Max Umgebungstemperatur	Max. ambient temperature
06	Min. Mediumstemperatur	Min. gas temperature
07	Max. Mediumstemperatur	Max. gas temperature
08	Max. Durchfluss	Max. flow rate
09	Min. Durchfluss	Min. flow rate
10	Trenndurchfluss	Transition flow rate
11	Nennweite	Size
12	Jahr (metrologisch) (JJ)	Year (metrological) (YY)
13	Datamatrix-Code 01(M)+02(S) Format: MMMMMMMSSSSSSSS	Datamatrix-Code 01(M)+02(S) Format: MMMMMMMSSSSSSSS
13.1	Datamatrix-Code 01(M)+7SIC00+02(S) Format: MMMMMMM7SIC00SSSSSSSS	Datamatrix-Code 01(M)+7SIC00+02(S) Format: MMMMMMM7SIC00SSSSSSSS
16	Belegung PIN 1_1	PIN assignment 1_1
17	Belegung PIN 1_2	PIN assignment 1_2
18	Belegung PIN 2_1	PIN assignment 2_1
19	Belegung PIN 2_2	PIN assignment 2_2
20	Belegung PIN 2_3	PIN assignment 2_3
21	Belegung PIN 2_4	PIN assignment 2_4
22	Platzhalter Angaben EVCD	Placeholder label EVCD
23	Platzhalter Angaben CE	Placeholder label CE
24	Platzhalter variable Kennzeichnung	Placeholder variable sign
25	Durchmesser - 7/8*DNXX	diameter - 7/8*DNXX
26	Gewicht Gaszähler, inkl. Adapter	Weight gas meter, including adapter
30	Einheit der Temperatur 04/05/06/07	unit of temperature 04/05/06/07
31	Einheit des Volumenstroms 08/09/10	unit of volume flow 08/09/10
32	Einheit der Länge 25	unit of lenght 25
33	Einheit des Gewichts 26	unit of weight 26

9.5.1.1 Identification according to ATEX/IECEx

Fig. 70 Metrology and electronics type plate (example)

Subject to change without notice

Fig. 71   Pin assignment of plug-in connectors (example)
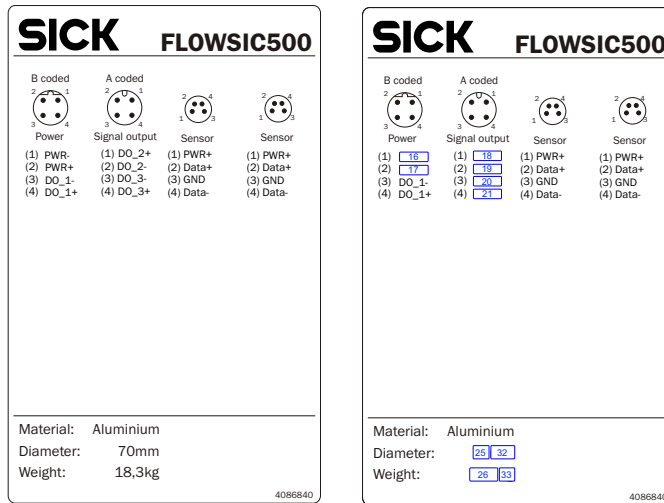
9.5.1.2   **Identification according to CSA**

Fig. 72   Metrology type plate (example)

Fig. 73   Electronics type plate (example)

9.5.2   Type plate, Pressure Equipment Directive

Fig. 74   Type plate, Pressure Equipment Directive (example)

Variable	Bezeichnung	Description
01	Artikelnummer (Adapter)	Part number (Adapter)
02	Seriennummer (SSSSSSSS) (Adapter)	Serial number (SSSSSSSS) (Adapter)
03	Datum (MM/YYYY)	Date (MM/YYYY)
04	Nennweite Adapter	Adapter size
05	Druckstufe	Pressure rating
06	Nennlänge	Flange to flange dimension
07	Einsatztemperaturbereich (Format: -min/+max)	Temperature range (format: -min/+max)
08	Max. Betriebsüberdruck	Max. operating overpressure
09	Prüfüberdruck	Pressure
10	Datamatrix-Code 01(M) + 02(S	Datamatrix-Code 01(M) + 02(S)
	Format: MMMMMMMSSSSSSSS	Format: MMMMMMMSSSSSSSS
11	Jahr (metrologisch) (YY)	Year (Metrological) (YY)
12	Label Gerätetyp (FLOWSIC500 oder FLOWSIC500 CIS)	Label device type (FLOWSIC500 or FLOWSIC500 CIS)
13	Nennweite	Size
20	Einheit zur Nennlänge 08	Unit of nominal length 08
21	Einheit zur Temperatur 09	Unit of temperature 09
22	Einheit zum Druck 10 & 11	Unit of pressure 10 & 11

9.6 Dimensional drawings

Fig. 75 Dimensions
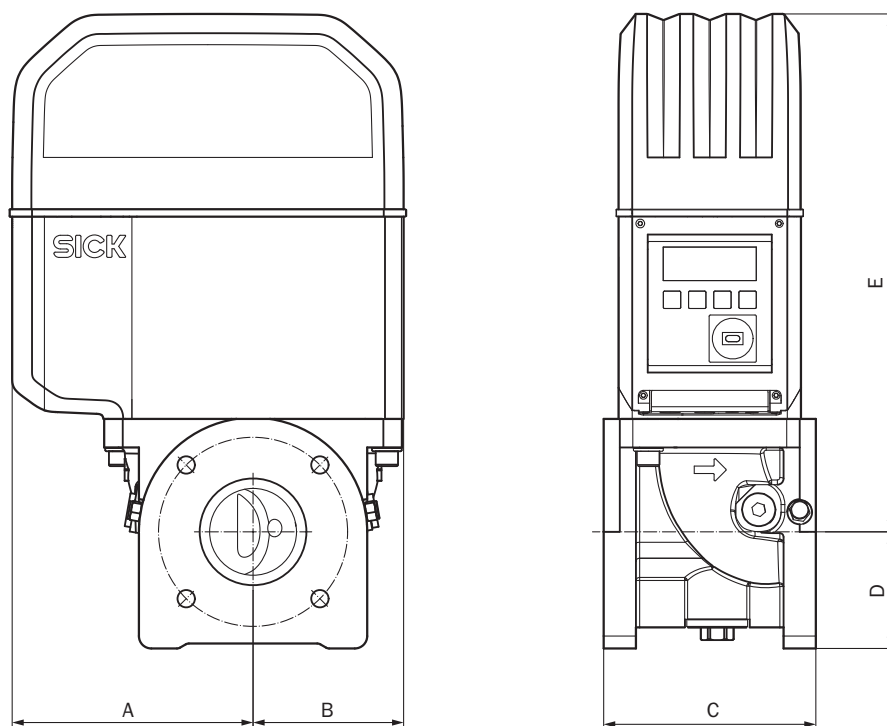
Table 38 Dimensions metrical (imperial)[1]

	DN50 (2")		DN80 (3")		DN100 (4")		DN150 (6")
A	153 (6.02)		194 (7.64)		231 (9.09)		232 (9.13)
B	78 (3.07)		121 (4.76)		159 (6.26)		158 (6.22)
C[2]	150 (5.91)	171 (6.73)	171 (6.73)	241 (9.49)	241 (9.49)	300 (11.81)	450 (17.72)
D	71 (2.80)		94 3.70)		108 (4.25)		143 (5.63)
E	272 (10.71)		417 (16.42)		476 (18.74)		476 (18.74)
Weight	11 (24.25)	11 (24.25)	19 (42)	21 (46.3)	28 (61.7)	30 (66.1)	35 (77.1)

[1] All dimensions in mm (inch), weights in kg (lb)
[2] C = fitting length, two fitting lengths are available for meter sizes DN50 (2") to DN100 (4").

9.7   Internal terminal assignment

Fig. 76   Terminal assignment

WARNING: Use only battery type:
Battery pack order no.:   2064018
Manufacturer: SICK
Backup battery order no.: 2065928
Manufacturer: SICK

For safety parameters see operating instructions!

Wire size for all terminals: 0,14..0,5 mm² (AWG 24 ... 20)

EXT. POWER
4,5..16V

LOCK
OFF ON

DISPLAY

SENSORS
P2
T2
P1   T1

BAT1   BAT2

1.5 mm²
(AWG 16)   N.c.

DO1   DO2   DO3   DO0
2..16V   2..16V   2..16V   5..12V
R_s:100 W   NAMUR

RS485*

A B

*Optional
V_{CC} see module.
4074419

Subject to change without notice

9.8 **Installation examples**

Fig. 77 Battery operation

FLOWSIC500 with LF output connected to electronic volume corrector
(both battery powered and intrinsically safe)

Hazardous area
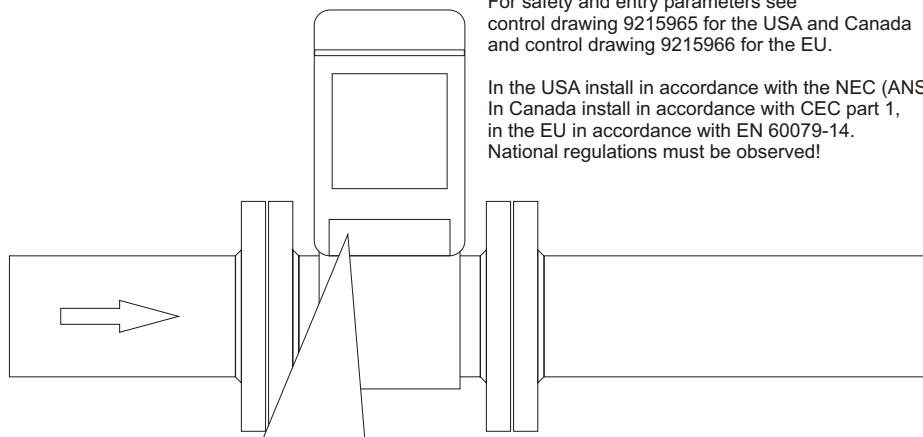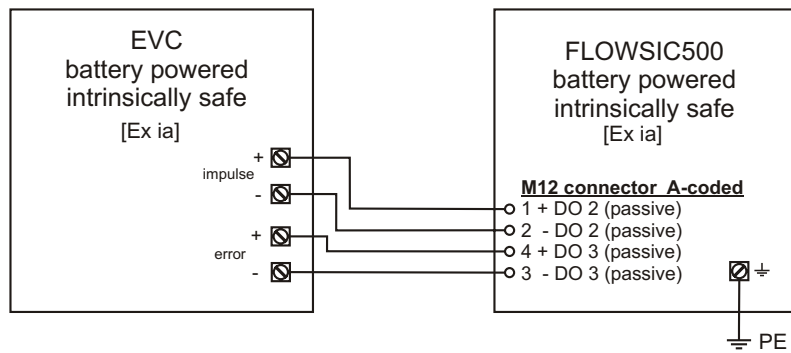
EVC
battery powered
intrinsically safe
[Ex ia]

impulse + -

error + -

FLOWSIC500
battery powered
intrinsically safe
[Ex ia]

M12 connector A-coded
1 + DO 2 (passive)
2 - DO 2 (passive)
4 + DO 3 (passive)
3 - DO 3 (passive)

PE

For safety and entry parameters see
control drawing 9215965 for the USA and Canada
and control drawing 9215966 for the EU.

In the USA install in accordance with the NEC (ANSI/NFPA70)
In Canada install in accordance with CEC part 1,
in the EU in accordance with EN 60079-14.
National regulations must be observed!
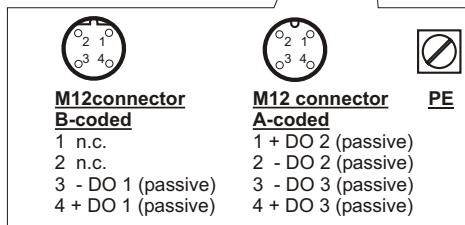
**M12connector
B-coded**
1 n.c.
2 n.c.
3 - DO 1 (passive)
4 + DO 1 (passive)

**M12 connector
A-coded**
1 + DO 2 (passive)
2 - DO 2 (passive)
3 - DO 3 (passive)
4 + DO 3 (passive)

PE

WARNING!
Incorrect cabling can cause the FLOWSIC500 to fail!
See Operating Instructions for further details!

Subject to change without notice

Fig. 78   Operation with safety barrier and external power supply

FLOWSIC500 with HF output powered with safety barrier and external power supply, connected to electronic volume corrector
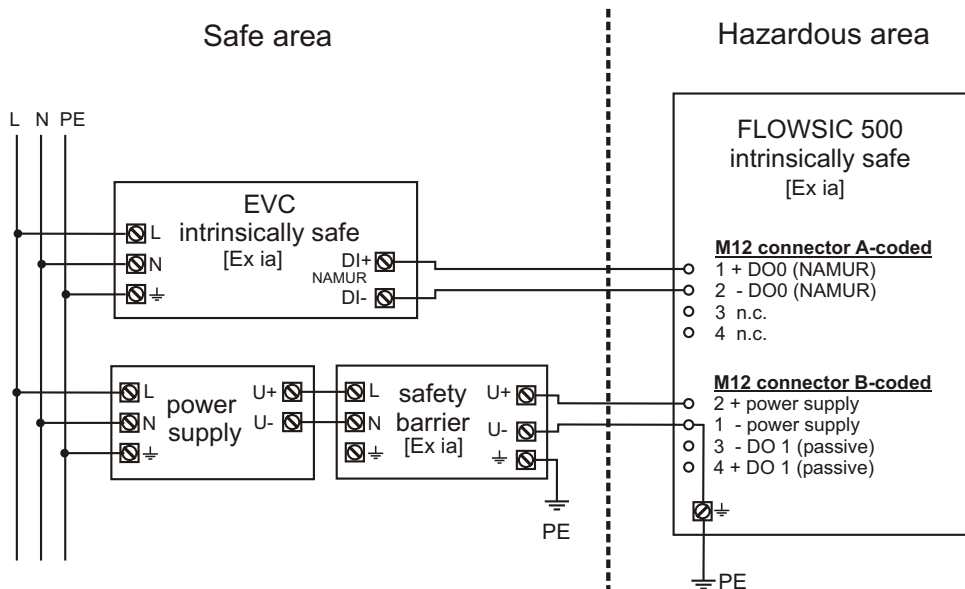
For safety and entry parameters see
control drawing 9215965 for the USA and Canada
and control drawing 9215966 for the EU.

In the USA install in accordance with the NEC (ANSI/NFPA70),
in Canada install in accordance with CEC part 1,
in the EU install in accordance with EN 60079-14.
Further national regulations must be observed!
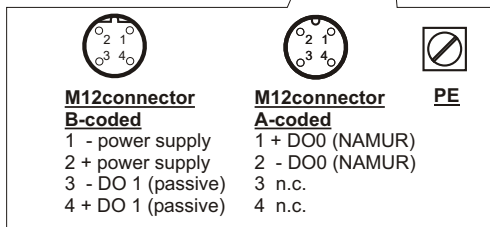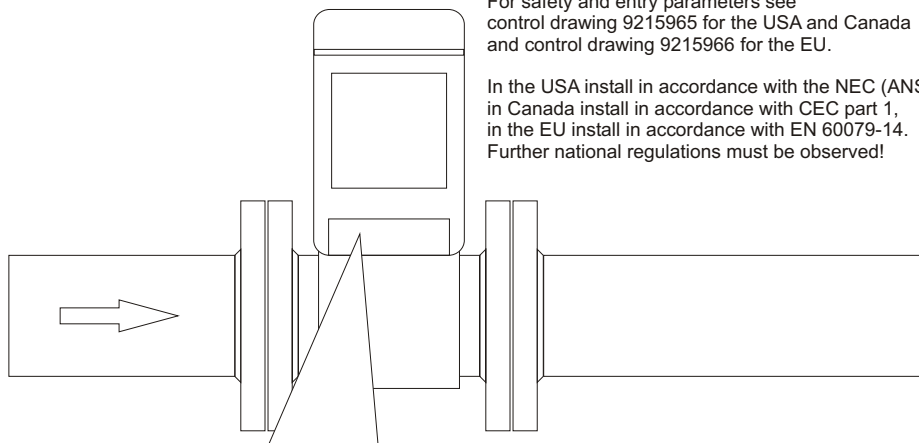
WARNING!
Incorrect cabling can cause the FLOWSIC500 to fail!
See Operating Instructions for further details!

Attention!
DO0 is optically insulated.
Do not use as HF output in battery powered mode!
Frequent activity results in a reduced battery life time.

Subject to change without notice

Fig. 79   Operation with external power supply (intrinsically safe)

FLOWSIC500 externally powered (IS) and connected to electronic volume corrector, RS485 externally powered

For safety and entry parameters see
control drawing 9215965 for the USA and Canada
and control drawing 9215966 for the EU.

In the USA install in accordance with the NEC (ANSI/NFPA70),
in Canada install in accordance with CEC part 1,
in the EU install in accordance with EN 60079-14.
National regulations must be observed!

WARNING!
Incorrect cabling can cause the FLOWSIC500 to fail!
See Operating Instructions for further details!

Attention!
RS485 must be powered externally!
For enviroments with relevant eletromagnetic disturbance
and long cables, shielded cables are recommend.

**M12connector
B-coded**
1 - power supply
2 + power supply
3 - DO 1 (passive)
4 + DO 1 (passive)

**M12 connector
A-coded**
1 + power supply
2 + data (RS485 A)
3 - power supply
4 - data (RS485 B)

9.9 Connection diagrams for operation of the FLOWSIC500 in accordance with CSA

Fig. 80 Control diagram 9215965 (page 1)

Fig. 81   Control diagram 9215965 (page 2)

A4_Formblatt_ME10.CDR

[Ex ia] Associated Equipment
Only for interconnection with an Exi equipment or an [Exi] associated equipment
Entity parameters of interconnected equipments must be compiled as follows:
Vo < Vi, Io < Ii, Po< Pi, Co > Ci + Ccable, Lo > Li + Lcable or
Voc < Vmax, Isc < Imax, Ca > Ci + Ccable, La > Li + Lcable
Interconnection with intenal p & T sensors approved

Entity paramaters for external connections in the Exi terminal compartment

Terminal/ Connector*)	Function	active Uo Voc (V)	Io Isc (mA)	Po (mW)	Co Ca (µF)	Lo La (mH)	passive Ui Vmax (V)	Ii Imax (mA)	Pi (mW)	Ci (µF)	Li (mH)
BAT1 +/- Terminal / connector	Battery pack 1 or external power supply	--	--	--	--	--	20	667	772	n.s.	n.s
BAT2 +/- connector	Battery pack 2 resp. backup barrery	--	--	--	--	--	20	667	320	n.s	n.s
DO0 +/- terminal	Digital output 0 optical isolated	--	--	--	--	--	20	--	1100	n.s.	n.s
DO1 +/- terminal	Digital output 1	8.2	0.83	1.7	7.6	100	20	--	1100	n.s	n.s
DO2 +/- terminal	Digital output 2 optical isolated	--	--	--	--	--	20	--	1100	n.s	n.s
DO3 +/- terminal	Digital output 3 optical isolated	--	--	--	--	--	20	--	1100	n.s	n.s
RS485 -/-/+/+/A/B	RS485 Data interface (option) optical isolated	--	--	--	--	--	20	--	1100	1.35	0.03
P1/T1 sensor	RS 485 included power supply for p & T sensors	8.2	396	716	6.4	0.2	--	--	--	--	--
P2/T2 sensor	SPI included power supply for p & T sensors	8.2	407	739	7.6	0.2	--	--	--	--	--

*) connectors for internal connection only

n.s.: denotes negligible small

SENSORS
P2   T2
T1
P1
RS485 (option, see user manual)

Wire size for all terminals: 0.14...0.5 mm² (AWG 24 ... 20)

DISPLAY
LOCK
OFF ON
DO1 2...16V Rₛᵣᵤₙ 100 Ω
DO2 2...16V
DO3 2...16V
DO0 5..12V NAMUR
DC NAMUR
A B
4 mm² (AWG 12)

Optionally Exia Temperature Sensor

Temperature range and pressure range see Marking plate

Optionally Exia pressure sensor

Ultrasonic Transducers

EXT. POWER
4.5..16V
BAT1
BAT2
n.c.
1.5 mm² (AWG 16)

Class I, Division 1, Groups C and D, Temp. Code T4
Ex ia IIB T4 Ga
Class I, Zone 0 AEx ia IIB T4 Ga

-25°C < Tamb < 60°C, for extended range see Marking plate

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.

Subject to change without notice

Vervielfaeltigung dieser Unterlage sowie Verwertung und Mitteilung Ihres Inhaltes unzulaessig, soweit nicht ausdruecklich zugestanden. Zuwiderhand-lungen sind strafbar und verpflichten zu Schadenersatz (§I1UhG, UWG, BGB). Alle Rechte fuer den Fall der Patenterteilung oder GM-Eintragung vorbehalten.

Werkstoff	Norm-Typ/DIN
Control drawing FLOWSIC500 isolated I/O	
9215965	Page 2 of 7
Ursprung:	Verteildatum:
Ersatz für:	
Ersetzt durch:	

		Tag	Name
gez.	2014-07-16	MKO	
gepr.	2014-08-27	kochami	

SICK
SICK Engineering GmbH
Bergener Ring 27
01458 Ottendorf-Okrilla

Maß/stab:

Ind.	Änderung	Tag	Name	Gepr.
03	ZY57	2018-05-02	kochami	
02	Ed.6	2015-09-24	kochami	
01	draft	2014-08-27	kochami	

Fig. 82 Control diagram 9215965 (page 3)

A4_Formblatt_ME10.CDR

Preselected Configuration for circular connectors M12, male
Configuration "2 Digital outputs LF"

Connector.	Function / signal	Internal connection	Operating parameters	Safety parameters*)
M12, male, B-coded				
Pin 1	ext. power supply "–" (GND)	"BAT1 –" terminal	nominal input voltage 4.5...16 V	Ui = 20 V Ii = 667 mA Pi = 772 mW
Pin 2	ext. power supply "+"	"BAT1 +" terminal		
Pin 3	Digital output DO1 "–" (GND)	"DO1 –" terminal	passive, non-isolated, Low side switch max.16 V nom. 20 mA Ron < 110 Ohm Roff >1 MOhm	Ui = 20 V Pi = 1.1 W Uo = 8.2 V Io = 0.83 mA Po = 1.7 mW Co = 7.6 µF Lo = 100 mH
Pin 4	Digital output DO1 "+"	"DO1 +" terminal		
M12, male, A-coded	Configuration "2 Digital outputs LF"		passive, optically isolated	
Pin 1	Digital output DO2 "+"	"DO2 +" terminal	max.16 V nom. 20 mA switchable as NAMUR nominal 8.2 V Ion = 3.4 mA Ioff = 0.7 mA	Ui = 20 V Pi = 1.1 W
Pin 2	Digital output DO2 "–"	"DO2 –" terminal		
Pin 3	Digital output DO3 "–"	"DO3 –" terminal		
Pin 4	Digital output DO3 "+"	"DO3 +" terminal		

*) values apply for the interconnection of all circuits within each connector

		Name	Tag			Norm-Typ/DIN	
	gez.	MKO	2014-07-16				
	gepr.	kochami	2014-08-27	**Control drawing FLOWSIC500 isolated I/O**			

SICK

SICK Engineering GmbH
Bergener Ring 27
01458 Ottendorf-Okrilla

Werkstoff			
Maßstab:	**9215965**		
Ursprung:	Ersatz für:	Page	
	Ersetzt durch:	3 of 7	Verteildatum:

03	ZY57	2018-05-02	kochami			
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01	draft	2014-08-27	kochami			
Ind.	Änderung	Tag	Name		Gepr.	

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Optionally Exia Temperature Sensor

Temperature range and pressure range see Marking plate

Optionally Exia pressure sensor

Ultrasonic Transducers

SENSORS

P1 P2
T1 T2

Wire size for all terminals: 0.14...0.5 mm² (AWG 24 ... 20)

DISPLAY

LOCK
OFF ON

DO1 DO2 DO3 DO0
2...16V 2...16V 2...16V 5..12V
Rs=100Ω NAMUR NAMUR NAMUR

4 mm²
(AWG 12)

EXT.POWER
4.5..16V

BAT1 BAT2
N.C.

M12
ext. Power + DO1

M12
DO2 + DO3

1.5 mm²
(AWG 16)

Class I, Division 1, Groups C and D, Temp. Code T4
Ex ia IIB T4 Ga
Class I, Zone 0 AEx ia IIB T4 Ga

-25°C < Tamb < 60°C, for extended range see Marking plate
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.

Subject to change without notice

Fig. 83   Control diagram 9215965 (page 4)

Pre-selected Configuration for circular connectors M12, male
Configuration " 2 Digital outputs HF (Encoder) + LF"

Connector.	Function / signal	Internal connection	Operating parameters	Safety parameters*)
M12, male, B-coded				
Pin 1	ext. power supply "–" (GND)	"BAT1 –" terminal	nominal input voltage 4.5...16 V	Ui = 20 V Ii = 667 mA Pi = 772 mW
Pin 2	ext. power supply "+"	"BAT1 +" terminal		
Pin 3	Digital output DO1 "–" (GND)	"DO1 –" terminal	passive, non-isolated, Low side switch max.16 V nom. 20 mA Ron < 110 Ohm Roff >1 MOhm	Ui = 20 V Pi = 1.1 W Uo = 8.2 V Io = 0.83 mA Po = 1.7 mW Co = 7.6 µF Lo = 100 mH
Pin 4	Digital output DO1 "+"	"DO1 +" terminal		
M12, male, A-coded				
Pin 1	Configuration "Digital outputs HF + LF" Digital output DO0 "+"	"DO0 +" terminal	NAMUR / OC optically isolated nominal 8.2 V Ion = 3.4 mA Ioff = 0.7 mA	Ui = 20 V Pi = 1.1 W
Pin 2	Digital output DO0 "–"	"DO0 –" terminal		
Pin 3	Digital output DO2 or DO3 "+"	"DOx +" terminal	max.16 V nom. 20 mA switchable as NAMUR nominal 8.2 V Ion = 3.4 mA Ioff = 0.7 mA	
Pin 4	Digital output DO2 or DO3 "–"	"DOx –" terminal		

*) values apply for the interconnection of all circuits within each connector

A4_Formblatt_ME10.CDR

Werkstoff — Norm-Typ/DIN

Control drawing FLOWSIC500 isolated I/O

9215965

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		Tag	Name	
gez.		2014-07-16	MKO	
gepr.		2014-08-27	kochami	

SICK — SICK Engineering GmbH, Bergener Ring 27, 01458 Ottendorf-Okrilla

Maß/stab:

Ursprung:
Ersatz für:
Ersetzt durch:

03	ZY57	2018-05-02	kochami	
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01	draft	2014-08-27	kochami	
Ind.	Änderung	Tag	Name	Gepr.

Class I, Division 1, Groups C and D, Temp. Code T4
Ex ia IIB T4 Ga
Class I, Zone 0 AEx ia IIB T4 Ga

-25°C < Tamb < 60°C, for extended range see Marking plate

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.

Wire size for all terminals: 0,14...0,5 mm² (AWG 24 ... 20)

EXT. POWER 4,5...16V — BAT1 — ext. Power + DO1 — M12

M12 — DO0 + DOx

DISPLAY — LOCK OFF ON

DO1 2...16V R<100Ω — DO2 2...16V — DO3 2...16V — DO0 5...12V NAMUR

1,5 mm² (AWG 16) — 4 mm² (AWG 12)

SENSORS — P1 P2 T1 T2

Ultrasonic Transducers

Optionally Exia pressure sensor

Optionally Exia Temperature Sensor

Temperature range and pressure range see Marking plate

Fig. 84 Control diagram 9215965 (page 5)

A4_Formblatt_ME10.CDR

Preselected Configuration for circular connectors M12, male
Configuration "Digital output HF (Encoder)"

Connector.	Function / signal	Internal connection	Operating parameters	Safety parameters*)
M12, male, B-coded				
Pin 1	ext. power supply "–" (GND)	"BAT1 –" terminal	nominal input voltage 4.5...16 V	Ui = 20 V, Ii = 667 mA, Pi = 772 mW
Pin 2	ext. power supply "+"	"BAT1 +" terminal		
Pin 3	Digital output DO1 "–" (GND)	"DO1 –" terminal	passive, non-isolated, Low side switch max. 16 V, nom. 20 mA, Ron < 110 Ohm, Roff >1 MOhm	Ui = 20 V, Pi = 1.1 W, Uo = 8.2 V, Io = 0.83 mA, Po = 1.7 mW, Co = 7.6 µF, Lo = 100 mH
Pin 4	Digital output DO1 "+"	"DO1 +" terminal		
M12, male, A-coded	Configuration "Digital output HF"		NAMUR optically isolated nominal 8.2 V, Ion = 3.4 mA, Ioff = 0.7 mA	
Pin 1	Digital output DO0 "+"	"DO0 +" terminal		Ui = 20 V, Pi = 1.1 W
Pin 2	Digital output DO0 "–"	"DO0 –" terminal		
Pin 3	n.c.			
Pin 4	n.c.			

*) values apply for the interconnection of all circuits within each connector

Vervielfaeltigung dieser Unterlage sowie Verwertung und Mitteilung ihres Inhaltes unzulaessig, soweit nicht ausdruecklich zugestanden. Zuwiderhandlungen sind strafbar und verpflichten zu Schadenersatz (LitUrhG, UWG, BGB). Alle Rechte fuer den Fall der Patenterteilung oder GM-Eintragung vorbehalten.

Optionally Exia Temperature Sensor

Temperature range and pressure range see Marking plate

Optionally Exia pressure sensor

Ultrasonic Transducers

SENSORS

P2 T2
P1 T1

Wire size for all terminals: 0.14...0.5 mm² (AWG 24 ... 20)

DISPLAY
LOCK OFF ON
DO1 DO2 DO3 DO0
2...16V 2...16V 2...16V 5...12V
Rs 100 Ω NAMUR NAMUR NAMUR

4 mm² (AWG 12)

EXT. POWER
4.5...16V

BAT1 n.c. BAT2

M12
ext. Power + DO1

M12
DO0

1.5 mm² (AWG 16)

Class I, Division 1, Groups C and D, Temp. Code T4
Ex ia IIB T4 Ga
Class I, Zone 0 AEx ia IIB T4 Ga
-25°C < Tamb < 60°C, for extended range see Marking plate
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.	Änderung	Tag	Name				
03	ZY57	2018-05-02	kochami				
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01	draft	2014-08-27	kochami				
Ind.	Änderung	Tag	Name	Gepr.			

	Tag	Name	Norm-Typ/DIN
gez.	2014-07-16	MKO	
gepr.	2014-08-27	kochami	

SICK
SICK Engineering GmbH
Bergener Ring 27
01458 Ottendorf-Okrilla

Werkstoff

Control drawing FLOWSIC500 isolated I/O

Maßstab:

9215965

Ursprung:
Ersatz für:
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Page 5 of 7

Verteildatum:

Subject to change without notice

Fig. 85 Control diagram 9215965 (page 6)

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A4_Formblatt_ME10.CDR

Preselected Configuration for circular connectors M12, male
Configuration "RS485 external powered"

Connector.	Function / signal	Internal connection	Operating parameters	Safety parameters*)
M12, male, B-coded				
Pin 1	ext. power supply "−" (GND)	"BAT1 −" terminal	nominal input voltage 4.5…16 V	Ui = 20 V Ii = 667 mA Pi = 772 mW
Pin 2	ext. power supply "+"	"BAT1 +" terminal		
Pin 3	Digital output DO1 "−" (GND)	"DO1 −" terminal	passive, non-isolated, Low side switch max. 16 V nom. 20 mA Ron < 110 Ohm Roff > 1 MOhm	Ui = 20 V Pi = 1.1 W Uo = 8.2 V Io = 0.83 mA Po = 1.7 mW Co = 7.6 µF Lo = 100 mH
Pin 4	Digital output DO1 "+"	"DO1 +" terminal		
M12, male, A-coded	Configuration "RS485 external powered"		optically isolated	
Pin 1	Auxiliary power supply input "+"	"RS485 +" terminal	nominal input voltage 2.7… 5 V (LV) 4 …16 V	Ui = 20 V Pi = 1.1 W Ci = 1.35 µF Li = 0.03 mH
Pin 2	"RS485 Data Interface "A"	"RS485 A" terminal		
Pin 3	Auxiliary power supply input "−"	"RS485 −" terminal		
Pin 4	RS485 Data Interface "B"	"RS485 B" terminal		

*) values apply for the interconnection of all circuits within each connector

SENSORS P2 T2 T1 P1

Optionally Exia Temperature Sensor

Temperature range and pressure range see Marking plate

Optionally Exia pressure sensor

Ultrasonic Transducers

Wire size for all terminals: 0.14...0.5 mm² (AWG 24 ... 20)

DISPLAY

LOCK OFF ON

DO1 2...16V R₃=100 Ω
DO2 2...16V NAMUR
DO3 2...16V NAMUR
DO0 5..12V NAMUR

RS485 A B − + + −

EXT. POWER 4.5...16V
BAT1

M12 ext. Power + DO1
BAT2
n.c.

M12 RS485

1.5 mm² (AWG 16)
4 mm² (AWG 12)

Class I, Division 1, Groups C and D, Temp. Code T4
Ex ia IIB T4 Ga
Class I, Zone 0 AEx ia IIB T4 Ga

-25°C < Tamb < 60°C, for extended range see Marking plate

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.	Änderung	Tag	Name				
03	ZY57	2018-05-02	kochami				
02	Ed.6	2015-09-24	kochami				
01	draft	2014-08-27	kochami				
Ind.	Änderung	Tag	Name	Gepr.			

	Tag	Name			
gez.	2014-07-16	MKO			
gepr.	2014-08-27	kochami			

SICK
SICK Engineering GmbH
Bergener Ring 27
01458 Ottendorf-Okrilla

Maß/stab:

Control drawing FLOWSIC500 isolated I/O

Werkstoff

Norm-Typ/DIN

9215965

Ursprung:
Ersatz für:
Ersetzt durch:

Verteildatum:

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Fig. 86   Control diagram 9215965 (page 7)

Circular connectors M8, female for interconnection with external p & T sensors

Connector.	Function / signal	internal Connection	Operating parameters	Safety parameters*)
M8 (M12) female	p or T sensor			
Pin 1	PWR (power supply out "+")	"p & T sensor" 4-pole connector, coded	nominal output voltage 3.3 V	Uo = 8.2 V Io = 396 mA Po = 716 mW Co = 6.4 µF Lo = 0.2 mH
Pin 2	DATA + (A)			
Pin 3	GND (power supply out "−")			
Pin 4	DATA − (B)			
M8 (M12) female	T or p sensor			
Pin 1	PWR (power supply +)	"p & T sensor" 4-pole connector, coded	nominal output voltage 3.3 V	Uo = 8.2 V Io = 396 mA Po = 716 mW Co = 6.4 µF Lo = 0.2 mH
Pin 2	DATA + (A)			
Pin 3	GND (powersupply −)			
Pin 4	DATA − (B)			

*) values apply for the interconnection of all circuits within each connector

Class I, Division 1, Groups C and D, Temp. Code T4
Ex ia IIB T4 Ga
Class I, Zone 0 AEx ia IIB T4 Ga

-25°C < Tamb < 60°C, for extended range see Marking plate

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.

Temperature range and pressure range see Marking plate

Ultrasonic Transducers

SENSORS

Wire size for all terminals: 0,14..0,5 mm² (AWG 24 ... 20)

DISPLAY

LOCK
OFF ON

EXT.POWER 4,5..16V

M12   M12
ext. Power + DO1   e.g. DO0

BAT1   BAT2

1,5 mm² (AWG 16)

M8 p & T   M8 p & T

DO1 2..16V   DO2 2..16V   DO3 2..16V   DO0 5,12V NAMUR
Rg 100 Ω

4 mm² (AWG 12)

A4_Formblatt_ME10.CDR

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	gepr.	kochami	2014-08-27		

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SICK Engineering GmbH
Bergener Ring 27
01458 Ottendorf-Okrilla

Maßstab:

Werkstoff   Control drawing FLOWSIC500 isolated I/O

9215965

Ursprung:
Ersatz für:
Ersetzt durch: Verteildatum:

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02	Ed.6	2015-09-24	kochami		
01	draft	2014-08-27	kochami		
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9.10 Connection diagrams for operation of the FLOWSIC500 in accordance with ATEX/IECEx

Fig. 87 Control diagram 9215966 (page 1)

Fig. 88   Control diagram 9215966 (page 2)

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

Safety parameters for external connections in the Exi terminal compartment

Terminal/ Connector*)	Function	active Uo (V)	Io (mA)	Po (mW)	Co (µF)	Lo (mH)	passive Ui (V)	Ii (mA)	Pi (mW)	Ci (µF)	Li (mH)
BAT1 +/- Terminal / connector	Battery pack 1 or external power supply	—	—	—	—	—	20	667	753	n.s.	n.s
BAT2 +/- connector	Battery pack 2 resp. backup barrery	—	—	—	—	—	20	667	320	n.s	n.s
DO0 +/- terminal	Digital output 0 optical isolated	—	—	—	—	—	20	N/A	1100	n.s.	n.s
DO1 +/- terminal	Digital output 1 non-isolated	8.2	0.83	1.7	7.6	100	20	N/A	753	n.s	n.s
DO2 +/- terminal	Digital output 2 optical isolated	—	—	—	—	—	20	N/A	753	n.s	n.s
DO3 +/- terminal	Digital output 3 optical isolated	—	—	—	—	—	20	N/A	753	n.s	n.s
RS485 -/-/+/+/A/B	RS485 Data interface (option) optical isolated	8.2	396	673	6.4	0.2	20	N/A	1100	IIB:1.35 IIC:0.22	0.03
P1/T1 sensor	RS 485 included power supply for p & T sensors	8.2	407	683	7.6	0.2	—	—	—	—	—
P2/T2 sensor	SPI included power supply for p & T sensors	8.2	407	683	7.6	0.2	—	—	—	—	—

n.s.: denotes negligible small
N/A denotes: not relevant and need not to be applied

*) connectors for internal connection only

Optionally Exia Temperature Sensor

Optionally Exia pressure sensor

Ultrasonic Transducers

Temperature range and pressure range see Marking plate

SENSORS — P1 P2 T1 T2

DISPLAY

LOCK OFF ON

RS485 (option, see user manual)

Wire size for all terminals: 0,14...0,5 mm² (AWG 24...20)

EXT.POWER 4,5..16V — BAT1 — BAT2 — n.c.

1,5 mm² (AWG 16)

4 mm² (AWG 12)

DO1 2..16V Rs<100Ω NAMUR

DO2 2..16V

DO3 2..16V OC NAMUR

DO0 5..12V OC

II 2 G Ex ia [ia] IIB T4 Gb,
II 2 G Ex ia [ia] IIC T4 Gb
II 2 G Ex op is IIC T4 Gb

Ex ia [ia] IIB T4 Gb
Ex ia [ia] IIC T4 Gb
Ex op is IIC T4 Gb

Comply with European directive
2014/34/EU (ATEX) and
EN 60079-0, EN 60079-11, EN60079-28
IEC 60079-0, IEC60079-11, IEC60079-28

-25°C < Tamb <60°C; for extended range see Marking plate.

⚠ **WARNING: EXPLOSION HAZARD**
Read operation instructions before install.
Install in accordance with IEC60079-14.

	Tag	Name
gez.	2014-07-16	MKO
gepr.	2015-01-29	kochami

SICK

SICK Engineering GmbH
Bergener Ring 27
01458 Ottendorf-Okrilla

Werkstoff — Norm-Typ/DIN

Instructions FLOWSIC500 isolated I/O

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9215966

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Ind. Änderung		Tag	Name	Gepr.	

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Fig. 89   Control diagram 9215966 (page 3)

A4_Formblatt_ME10.CDR

Pre-selected Configuration for circular connectors M12, male
Configuration "2 Digital outputs LF"

Connector.	Function / signal	Internal connection	Operating parameters	Safety parameters*)
M12, male, B-coded				
Pin 1	ext. power supply "–" (GND)	"BAT1 –" terminal	nominal input voltage 4.5...16 V	U_i = 20 V I_i = 667 mA P_i = 753 mW
Pin 2	ext. power supply "+"	"BAT1 +" terminal		
Pin 3	Digital output DO1 "–" (GND)	"DO1 –" terminal	passive, non-isolated, Low side switch max.16 V max.100 mA Ron < 110 Ohm Roff >1 MOhm	U_o = 8.2 V I_o = 0.83 mA P_o = 1.7 mW C_o = 7.6 µF L_o = 100mH
Pin 4	Digital output DO1 "+"	"DO1 +" terminal		
M12, male, A-coded	Configuration "2 Digital outputs LF"		passive, optically isolated	
Pin 1	Digital output DO2 "+"	"DO2 +" terminal	max.16 V	U_i = 20 V P_i = 753mW
Pin 2	Digital output DO2 "–"	"DO2 –" terminal	nom. 20 mA switchable as NAMUR nominal 8.2 V I_{on} = 3.4 mA I_{off} = 0.7 mA	
Pin 3	Digital output DO3 "–"	"DO3 –" terminal		
Pin 4	Digital output DO3 "+"	"DO3 +" terminal		

*) values apply for the interconnection of all circuits within each connector

Optionally Exia Temperature Sensor

Optionally Exia pressure sensor

Ultrasonic Transducers

SENSORS

P2 T2
P1 T1

Temperature range and pressure range see Marking plate

Wire size for all terminals: 0.14...0.5 mm² (AWG 24 ... 20)

DISPLAY

LOCK OFF ON

DO1 2..16V Rs 100 Ω
DO2 2..16V NAMUR
DO3 2..16V NAMUR
DO0 5..12V NAMUR

4 mm² (AWG 12)

EXT. POWER 4.5...16V
BAT1
BAT2
n.c.
1.5 mm² (AWG 16)

M12 ext. Power + DO1
M12 DO2 + DO3

Ex ia [ia] IIB T4 Gb
Ex ia [ia] IIC T4 Gb
Ex op is IIC T4 Gb

II 2 G Ex ia [ia] IIB T4 Gb,
II 2 G Ex ia [ia] IIC T4 Gb
II 2 G Ex op is IIC T4 Gb

Comply with European directive 2014/34/EU (ATEX) and
EN 60079-0, EN 60079-11, EN60079-28
IEC 60079-0, IEC60079-11, IEC60079-28

-25°C < Tamb <60°C, for extended range see Marking plate.

⚠ **WARNING:** EXPLOSION HAZARD
Read operation instructions before install.
Install in accordance with IEC60079-14.

Subject to change without notice

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Fig. 90 Control diagram 9215966 (page 4)

A4_Formblatt_ME10.CDR

Pre-selected Configuration for circular connectors M12, male
Configuration " 2 Digital outputs HF (Encoder) + LF"

Connector.	Function / signal	Internal connection	Operating parameters	Safety parameters*)
M12 , male, B-coded				
Pin 1	ext. power supply "–" (GND)	"BAT1 –" terminal	nominal input voltage 4.5…16 V	Ui = 20 V Ii = 667 mA Pi = 753 mW
Pin 2	ext. power supply "+"	"BAT1 +" terminal		
Pin 3	Digital output DO1 "–" (GND)	"DO1 –" terminal	passive, non-isolated, Low side switch max.16 V max.100 mA Ron < 110 Ohm Roff >1 MOhm	Uo = 8.2 V Io = 0.83 mA Po = 1.7 mW Co = 7.6 µF Lo = 100 mH
Pin 4	Digital output DO1 "+"	"DO1 +" terminal		
M12, male, A-coded	Configuration "Digital outputs HF + LF"		NAMUR optical isolated	
Pin 1	Digital output DO0 "+"	"DO0 +" terminal	nominal 8.2 V Ion = 3.4 mA Ioff = 0.7 mA	Ui = 20 V Pi = 753mW
Pin 2	Digital output DO0 "–"	"DO0 –" terminal		
Pin 3	Digital output DO2 or DO3 "+"	"DOx +" terminal		
Pin 4	Digital output DO2 or DO3 "–"	"DOx –" terminal		

*) values apply for the interconnection of all circuits within each connector

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Optionally Exia Temperature Sensor

Optionally Exia pressure sensor

Temperature range and pressure range see Marking plate

Ultrasonic Transducers

SENSORS

P2 T2 P1 T1

Wire size for all terminals: 0.14...0.5 mm² (AWG 24 ...20)

DISPLAY
LOCK OFF ON
DO1 2..16V Rₛ 100 Ω
DO2 2..16V
DO3 2..16V
OC NAMUR
DO0 5..12V NAMUR
4 mm² (AWG 12)

M12 DO0 + DOx

EXT. POWER 4.5..16V
BAT1 n.c. BAT2

M12 ext. Power + DO1

1.5 mm² (AWG 16)

II 2 G Ex ia [ia] IIB T4 Gb,
II 2 G Ex ia [ia] IIC T4 Gb
II 2 G Ex op is IIC T4 Gb

Ex ia [ia] IIB T4 Gb,
Ex ia [ia] IIC T4 Gb
Ex op is IIC T4 Gb

–25°C < Tamb <60°C;

WARNING: EXPLOSION HAZARD
Read operation instructions before install.
Install in accordance with IEC60079-14.

Comply with European directive
2014/34/EU (ATEX) and
EN 60079-0, EN 60079-11, EN60079-28
IEC 60079-0, IEC60079-11, IEC60079-28
for extended range see Marking plate.

			Name		Tag	Name	Werkstoff		**Instructions FLOWSIC500 isolated I/O**
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01	draft	2015-03-20	kochami		Gepr.
Ind.	Änderung	Tag	Name	Tag	Name

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Fig. 91   Control diagram 9215966 (page 5)

Pre-selected Configuration for circular connectors M12, male
Configuration "Digital output HF" (Encoder)

Connector.	Function / signal	Internal connection	Operating parameters	Safety parameters*)
M12, male, B-coded				
Pin 1	ext. power supply "−" (GND)	"BAT1 −" terminal	nominal input voltage 4.5…16 V	Ui = 20 V
Pin 2	ext. power supply "+"	"BAT1 +" terminal		Ii = 667 mA, Pi = 753 mW
Pin 3	Digital output DO1 "−" (GND)	"DO1 −" terminal	passive, non-isolated, Low side switch max.16 V max.100 mA Ron < 110 Ohm Roff >1 MOhm	Uo = 8.2 V, Io = 0.83 mA, Po = 1.7 mW, Co = 7.6 µF, Lo = 100 mH
Pin 4	Digital output DO1 "+"	"DO1 +" terminal		
M12, male, A-coded	Configuration "Digital output HF"	Configuration "Digital output HF"		
Pin 1	Digital output DO0 "+"	"DO0 +" terminal	NAMUR optical isolated nominal 8.2 V Ion = 3.4 mA Ioff = 0.7 mA	Ui = 20 V
Pin 2	Digital output DO0 "−"	"DO0 −" terminal		Pi = 1.1 W
Pin 3	n.c.	--		
Pin 4	n.c.	--		

*) values apply for the interconnection of all circuits within each connector

Instructions FLOWSIC500 isolated I/O
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Ex ia [ia] IIB T4 Gb,
Ex ia [ia] IIC T4 Gb
Ex op is IIC T4 Gb

II 2 G Ex ia [ia] IIB T4 Gb,
II 2 G Ex ia [ia] IIC T4 Gb
II 2 G Ex op is IIC T4 Gb

Comply with European directive 2014/34/EU (ATEX) and
EN 60079-0, EN 60079-11, EN60079-28
IEC 60079-0, IEC60079-11, IEC60079-28

-25°C < Tamb <60°C, for extended range see Marking plate.

WARNING: EXPLOSION HAZARD
Read operation instructions before install.
Install in accordance with IEC60079-14.

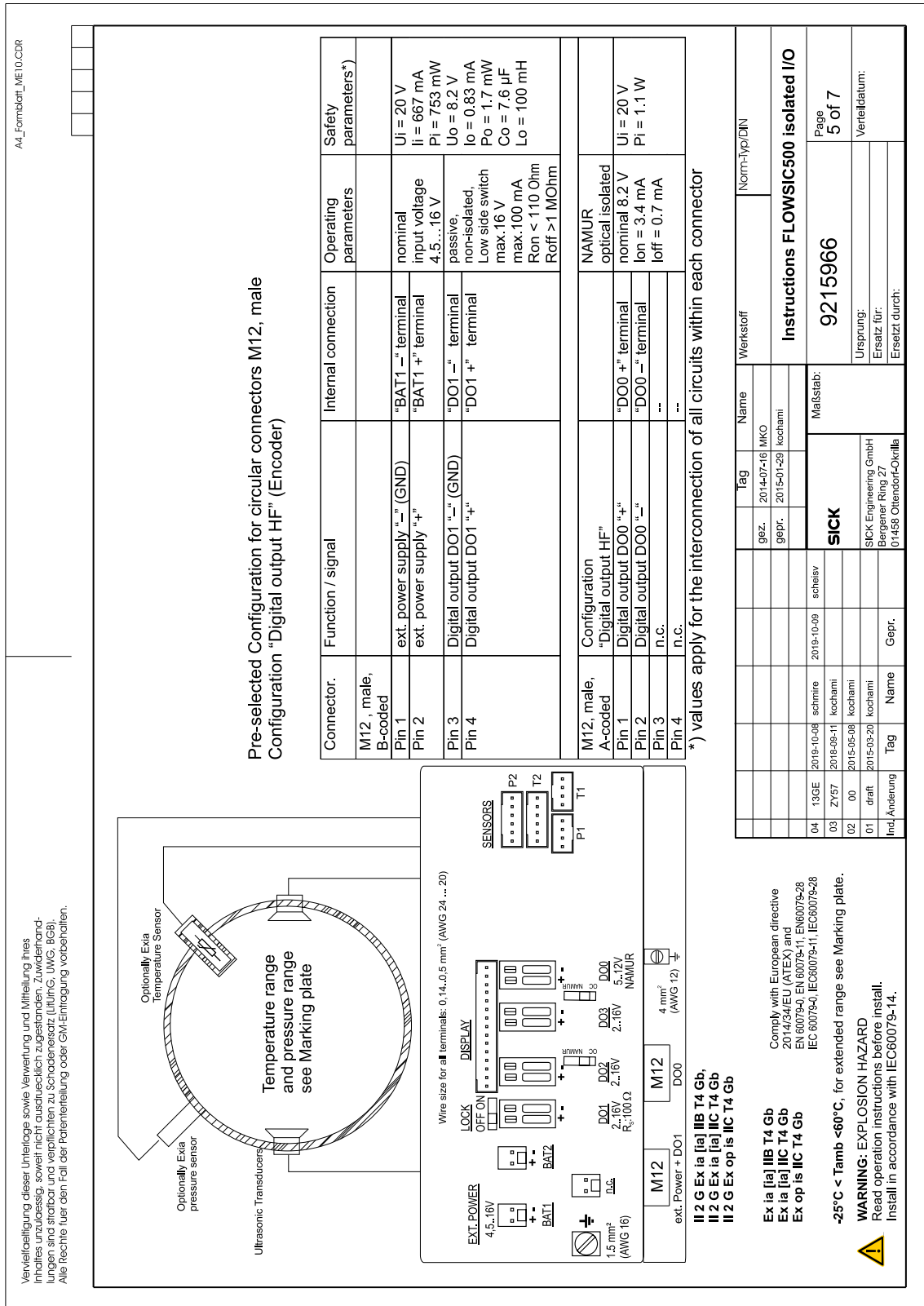**Fig. 92** Control diagram 9215966 (page 6)

Pre-selected Configuration for circular connectors M12, male
Configuration "RS485 external powered"

Connector.	Function / signal	Internal connection	Operating parameters	Safety parameters*)
M12 , male, B-coded				
Pin 1	ext. power supply "–" (GND)	"BAT1 –" terminal	nominal input voltage 4.5…16 V	Ui = 20 V Ii = 667 mA Pi = 753 mW
Pin 2	ext. power supply "+"	"BAT1 +" terminal		
Pin 3	Digital output DO1 "–" (GND)	"DO1 –" terminal	passive, non-isolated, Low side switch max.16 V max.100 mA Ron < 110 Ohm Roff >1 MOhm	Uo = 8.2 V Io = 0.83 mA Po = 1.7 mW Co = 7.6 μF Lo = 100 mH
Pin 4	Digital output DO1 "+"	"DO1 +" terminal		
M12, male, A-coded	Configuration "RS485 external powered"		isolated	
Pin 1	Auxiliary power supply input "+"	"RS485 +" terminal	nominal input voltage 2.7…5 V (LV) 4 …16V	Ui = 20V Pi = 1.1 W IIB: Ci = 1.35 μF IIC: Ci = 0.22 μF Li = 0.03 mH
Pin 2	"RS485_ Data Interface "A"	"RS485 A" terminal		
Pin 3	Auxiliary power supply input "–"	"RS485 B" terminal		
Pin 4	RS485_ Data Interface "B"	"RS485 –" terminal		

*) values apply for the interconnection of all circuits within each connector

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Norm-Typ/DIN

Instructions FLOWSIC500 isolated I/O

Werkstoff

Name

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Bergener Ring 27
01458 Ottendorf-Okrilla

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Gepr.

SENSORS
P2 T2
P1 T1

Optionally Exia Temperature Sensor

Optionally Exia pressure sensor

Ultrasonic Transducers

Temperature range and pressure range see Marking plate

Wire size for all terminals: 0,14...0,5 mm² (AWG 24 …20)

DISPLAY
LOCK OFF ON

A B
RS485

DO0
5.12V
NAMUR
DO3
2..16V
OC NAMUR
DO2
2..16V
OC NAMUR
DO1
2..16V
R₅=100 Ω

4 mm²
(AWG 12)

1,5 mm²
(AWG 16)

EXT.POWER
4,5..16V

BAT1

n.c.

BAT2

M12
ext. Power + DO1

M12
RS485

II 2 G Ex ia [ia] IIB T4 Gb,
II 2 G Ex ia [ia] IIC T4 Gb
II 2 G Ex op is IIC T4 Gb

Ex ia [ia] IIB T4 Gb
Ex ia [ia] IIC T4 Gb
Ex op is IIC T4 Gb

-25°C < Tamb <60°C;

Comply with European directive 2014/34/EU (ATEX) and
EN 60079-0, EN 60079-11, EN60079-28
IEC 60079-0, IEC60079-11, IEC60079-28

-25°C < Tamb <60°C; for extended range see Marking plate.

WARNING: EXPLOSION HAZARD
Read operation instructions before install.
Install in accordance with IEC60079-14.

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Fig. 93   Control diagram 9215966 (page 7)

Australia
Phone +61 (3) 9457 0600
        1800 33 48 02 – tollfree
E-Mail sales@sick.com.au

Austria
Phone +43 (0) 2236 62288-0
E-Mail office@sick.at

Belgium/Luxembourg
Phone +32 (0) 2 466 55 66
E-Mail info@sick.be

Brazil
Phone +55 11 3215-4900
E-Mail comercial@sick.com.br

Canada
Phone +1 905.771.1444
E-Mail cs.canada@sick.com

Czech Republic
Phone +420 234 719 500
E-Mail sick@sick.cz

Chile
Phone +56 (2) 2274 7430
E-Mail chile@sick.com

China
Phone +86 20 2882 3600
E-Mail info.china@sick.net.cn

Denmark
Phone +45 45 82 64 00
E-Mail sick@sick.dk

Finland
Phone +358-9-25 15 800
E-Mail sick@sick.fi

France
Phone +33 1 64 62 35 00
E-Mail info@sick.fr

Germany
Phone +49 (0) 2 11 53 010
E-Mail info@sick.de

Greece
Phone +30 210 6825100
E-Mail office@sick.com.gr

Hong Kong
Phone +852 2153 6300
E-Mail ghk@sick.com.hk

Hungary
Phone +36 1 371 2680
E-Mail ertekesites@sick.hu

India
Phone +91-22-6119 8900
E-Mail info@sick-india.com

Israel
Phone +972 97110 11
E-Mail info@sick-sensors.com

Italy
Phone +39 02 27 43 41
E-Mail info@sick.it

Japan
Phone +81 3 5309 2112
E-Mail support@sick.jp

Malaysia
Phone +603-8080 7425
E-Mail enquiry.my@sick.com

Mexico
Phone +52 (472) 748 9451
E-Mail mexico@sick.com

Netherlands
Phone +31 (0) 30 229 25 44
E-Mail info@sick.nl

New Zealand
Phone +64 9 415 0459
        0800 222 278 – tollfree
E-Mail sales@sick.co.nz

Norway
Phone +47 67 81 50 00
E-Mail sick@sick.no

Poland
Phone +48 22 539 41 00
E-Mail info@sick.pl

Romania
Phone +40 356-17 11 20
E-Mail office@sick.ro

Russia
Phone +7 495 283 09 90
E-Mail info@sick.ru

Singapore
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Slovakia
Phone +421 482 901 201
E-Mail mail@sick-sk.sk

Slovenia
Phone +386 591 78849
E-Mail office@sick.si

South Africa
Phone +27 10 060 0550
E-Mail info@sickautomation.co.za

South Korea
Phone +82 2 786 6321/4
E-Mail infokorea@sick.com

Spain
Phone +34 93 480 31 00
E-Mail info@sick.es

Sweden
Phone +46 10 110 10 00
E-Mail info@sick.se

Switzerland
Phone +41 41 619 29 39
E-Mail contact@sick.ch

Taiwan
Phone +886-2-2375-6288
E-Mail sales@sick.com.tw

Thailand
Phone +66 2 645 0009
E-Mail marcom.th@sick.com

Turkey
Phone +90 (216) 528 50 00
E-Mail info@sick.com.tr

United Arab Emirates
Phone +971 (0) 4 88 65 878
E-Mail contact@sick.ae

United Kingdom
Phone +44 (0)17278 31121
E-Mail info@sick.co.uk

USA
Phone +1 800.325.7425
E-Mail info@sick.com

Vietnam
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Detailed addresses and further locations at **www.sick.com**

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