OPERATING INSTRUCTIONS

FLOWSIC500
Ultrasonic Gas Flow Meter with Optional Volume Conversion

Installation
Operation
Maintenance

SICK
Sensor Intelligence.

Document Information

Described Product
Product name: FLOWSIC500

Document ID
Title: Operating Instructions FLOWSIC500
Part No.: 8015391
Version: 2.0
Release: 2013-08

Manufacturer
SICK AG
Erwin-Sick-Str. 1 · D-79183 Waldkirch · Germany
Phone: +49 7641 469-0
Fax: +49 7641 469-1149
E-mail: info.pa@sick.de

Place of Manufacture
SICK Engineering GmbH
Bergener Ring 27 · D-01458 Ottendorf-Okrilla · Germany

Original Documents
The English version 8015391 of this document is an original document of SICK AG.
SICK AG assumes no liability for the correctness of an unauthorized translation.
Please contact SICK AG or your local representative in case of doubt.

Legal Information
Subject to change without notice.

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 (high frequency pulses)
IEC	International Electronical Commission
IECEx	IEC system for certification in accordance with standards for devices for use in potentially explosive atmospheres
IP*xy*	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 (low-frequency pulses)
MDR	Manufacturer Data Record
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

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 personal injury or property damage.

NOTICE
Hazards which *could* result in property damage

Information Symbols

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


Information on product characteristics related to European Directive 94/9/EC (ATEX)

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


Important technical information for this product


Important information on electric or electronic functions


Nice to know


Supplementary information


Link referring to information at another place

FLOWSIC500

1 Important Information

Main hazards
About this document
Intended use
Responsibility of user

1.1 Main hazards

DANGER: Risk of explosion when the cartridge is damaged

Natural gas flows through the upper part ("meter cartridge") of the FLOWSIC500 with line pressure. Natural gas can escape when the cartridge is damaged which creates a risk of explosion.

- ► Prevent any possible damage to the meter cartridge. When necessary, fit protection devices.
- ► If the meter cartridge 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.

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 meter readings, maximums and other data.

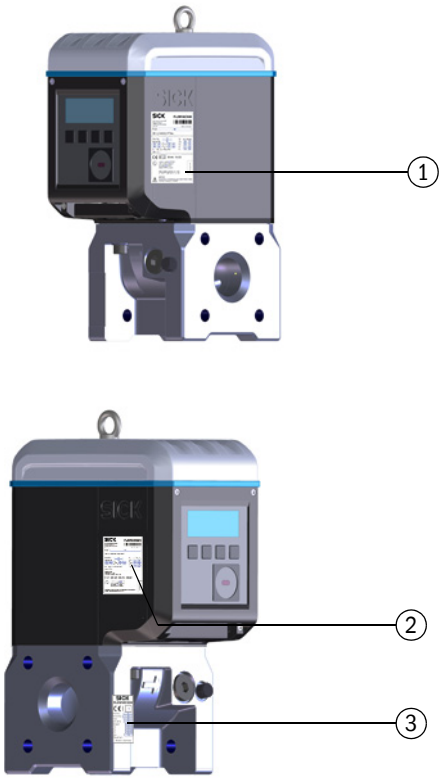
1.3.2 Product identification

Product name:	FLOWSIC500
Manufacturer:	SICK AG Erwin-Sick-Str. 1 79183 Waldkirch Germany
Place of manufacture:	SICK Engineering GmbH Bergener Ring 27 01458 Ottendorf-Okrilla Germany

The type plates for metrological and electrical parameters are located on the meter cartridge.

The type plate for the Pressure Equipment Directive is located on the meter body.

Fig. 1 Location of type plates



1 Type plate, metrological parameters (metrology)
2 Type plate, electrical parameters (electronics)
3 Type plate, meter body

- Example for metrology type plate → p. 92, § 9.2.1.1.
- Example for electronics type plate → p. 93, § 9.2.1.2
- Example for meter body type plate → p. 93, § 9.2.2.

1.3.3 Operation in potentially explosive atmospheres

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

Further information on potentially explosive atmospheres → p. 33, §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 (45psi/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 operator 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 complies with Pressure Equipment Directive 97/23/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.

1.3.6 Cleaning

***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. 8, § 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.

> **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, components and characteristics depend on the individual device configuration. This individual device configuration is described in the device documentation delivered with the device.

- Certificate of conformity/EX certificates (depending on configuration)
- Material certificate
- Inspection certificate
  - Device configuration sheet
  - Encoder test protocol (if configured)
  - Low-pressure calibration test protocol (if ordered)
  - Labels according to Pressure Equipment Directive 97/23/EC, Annex 1 Part 3.3
- Printout of the Data Book
- Product CD with:
  - Operating Instructions
  - Operating program FLOWgate500
  - FLOWgate500 Software Manual
  - Key code
  - Instructions for Kamstrup test valve BDA04

FLOWSIC500

2 Product Description

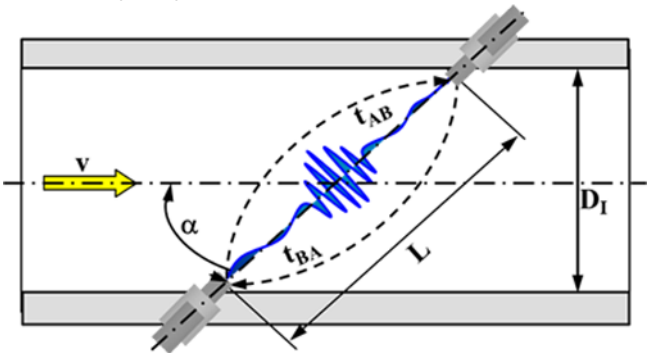
Operating principle
Device components
Meter sizes
Power supply
Interfaces
Device option: Volume conversion
Totalizers
Logbooks and Archives
Parameter protection
Sealing

2.1 Operating 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 in ft/s
L = Measuring path in ft
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 pipeline diameter.

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

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 transmitters or entered as fixed value.

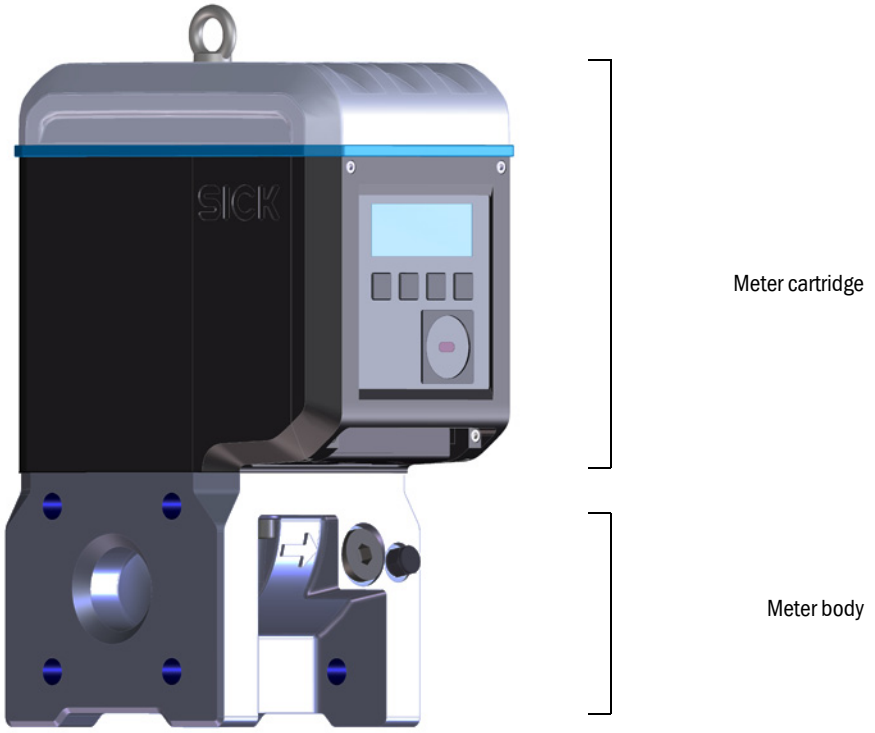
The following short forms are used in this document for better readability:
- Volume at base conditions = base volume
- Volume at measurement conditions = measurement volume

2.2 Device components

The FLOWSIC500 comprises:

- Meter body
- Meter cartridge.

Fig. 3 FLOWSIC500 components



2.2.1 Meter body

A meter body serves to install the FLOWSIC500 in the pipeline. The meter body is available in various flange standards and fitting lengths to connect the meter cartridge to the system pipeline.

Depending on the version, the meter body 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.

Fitting lengths available: → p. 94, § 9.3.

2.2.2 Meter cartridge

The meter cartridge is fitted on the meter body.

The complete gas flow is channeled through the cartridge for measurement.

An internal flow conditioner rectifies the gas flow 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 meter cartridge can be exchanged without taking the meter body out of the pipeline.

The meter cartridge contains:

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

The product variant with volume conversion and integrated pressure and temperature transmitters also has the calibrated pressure transmitter and calibrated temperature transmitter fitted in the meter cartridge.

2.3 Meter sizes

Available meter sizes → p. 94, § 9.3.

2.4 Power supply

The FLOWSIC500 is available with two configurations:

- For operation with external intrinsically safe power supply with backup battery in the meter cartridge (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. 56, § 5.2).

2.5 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

	Config. 1 (LF)	Config. 2 (HF)	Config 3 (Encoder)	Config. 4 (RS485)
DO_0	-	HF pulses	Encoder	RS485
DO_1	Diagnosis warning	Measured value validity	Measured value validity	Measured value validity
DO_2	LF pulses	-	-	-
DO_3	Measured value validity	-	-	-

- Information on explosion-technical characteristics and rated voltage → p. 33, § 3.4.
- Details on standard interface configurations available → p. 38, § 3.4.6.

2.5.1 Pulse and status outputs

FLOWSIC500 has 4 digital switching outputs. Digital switching output DO_0 is designed electrically isolated according to EN 60947-5-6. Pulses (NAMUR) or a status can be output via this digital switching output.

An external voltage supply is recommended when DO_0 is used as NAMUR pulse output.

Digital switching outputs DO_1 - DO_3 are transistor outputs not electrically isolated (emulation of a Reed contact). They can be configured as status or pulse outputs.

The digital switching outputs are updated synchronously once per second. They provide information on the current volume flow under measurement conditions with flow proportional pulses.

The maximum pulse frequency can be set to 10 Hz or 2 kHz at 120% Q_{max}. Measurement validity and the result of the self-diagnosis function of the device are output via the status outputs.

2.5.2 Encoder totalizer

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

2.5.3 Serial data interface

The serial interface is designed as externally powered RS485 and requires an external intrinsically safe power supply for operation. The RS485 interface has no internal line termination.

2.5.4 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.

2.6 Device option: Volume conversion

2.6.1 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 transmitters or entered as fixed values.

By default, measured values recording and subsequent conversion to the volume under base conditions are performed every 30 seconds. The update interval can be adjusted → p. 66, "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.

- SGERG88,
- AGA 8 Gross method 1
- AGA 8 Gross method 2
- AGA NX-19
- AGA NX-19 mod.
- Fixed value

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 transmitter EDT 23 (optional: relative pressure transmitter EDT 23) and a temperature transmitter EDT 34 measure current measurement conditions and transfer the transmitter type, measured value as well as the transmitter status via a digital interface.

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

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

If no transmitter is detected or a transmitter 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 2 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)
Standard pressure	1.01325 bar (a)	14.7300 psi (a)
Standard temperature	0 °C	60 °F

2.6.2 Integrated pressure and temperature transmitters

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

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

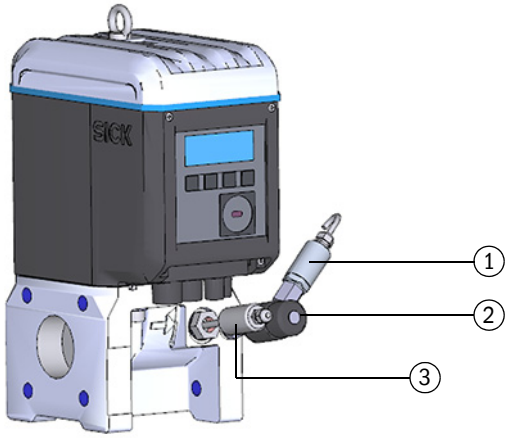
2.6.3 External pressure and temperature transmitters

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

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

→ Fig. 4 shows a FLOWSIC500 with external transmitters and Kamstrup test valve BDA04 for gas temperatures to -25 °C.

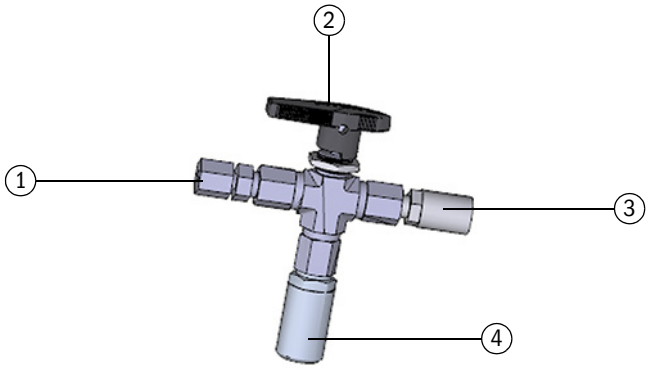
Fig. 4 FLOWSIC500 with external transmitters and Kamstrup test valve BDA04



1 Pressure transmitter
2 Kamstrup test valve BDA04
3 Temperature transmitter

A three-way test valve (→ Fig. 5) that is fitted next to the FLOWSIC500 is used for gas temperatures to -40 °C.

Fig. 5 Three-way test valve with p transmitter and Minimess coupling



1 FLOWSIC500 connection
2 Three-way test valve
3 Test connection (Minimess coupling)
4 Pressure transmitter

2.7 Totalizers

2.7.1 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 3 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 error volume meter errVb.

Table 4 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. 70, § 5.2.10.

2.7.2 Reverse flow

The FLOWSIC500 is designed as unidirectional type and has a configurable zero-flow cutoff which is factory set to a value of 1 m^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.

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.

2.8 Logbooks and Archives

The integrated data registration stores meter readings, 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 → S. 64, § 5.2.5.9.
- 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)

Explanations on data structure and storage depth are available in Technical Bulletin "Data Registration").

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

- Event logbook

  All events with timestamp, user logged on and totalizer reading, 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. 74, § 6.2, "Status messages")..
- Parameter logbook

  All parameter changes with timestamp, user logged on, totalizer reading and old and new parameter value, max. number of entries: 250

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

  All changes to calibration-relevant parameters (→ p. 22, § 2.9.2), with parameter locking switch activated with timestamp, user logged on, totalizer reading and old and new parameter value, max. number of entries: 100

  When the Metrology logbook is full, calibration-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. 74, § 6.2, "Status messages").

The data are stored in non-volatile memory. All logbooks can be viewed, stored and reset with operating software FLOWgate500. The Event logbook can be viewed after logon as "User" or "Authorized user" on the device.

The following parameters are displayed:

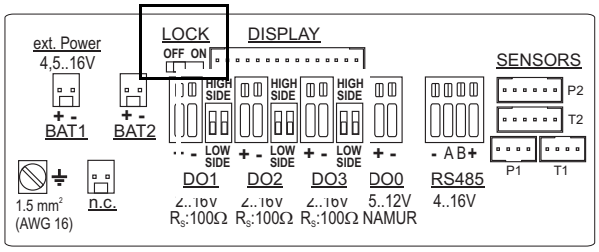
- Event type
- Number of events
- Short description
- Timestamp

2.9 Parameter protection

2.9.1 Parameter locking switch

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

Fig. 6 Parameter locking switch on the circuit board



The parameter locking switch is secured by the terminal compartment cover and a seal.

2.9.2 Metrology logbook

Calibration-relevant parameters can be modified when the parameter locking switch is closed and after logging in as authorized user. If these parameters are modified, an entry is created in the Metrology logbook containing the timestamp, old and new value, meter reading 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 Calibration-relevant parameters - gas flow meter

Max. zero-flow cutoff volume	Buffer volume for reverse flow
Symbols for measured value displays	Symbols used on the display (formula symbols)

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

Max. zero-flow cutoff volume	Buffer volume for reverse flwo
Symbols for mesured value displays	Symbols used on the dispaly (formula symbols)
Flow - lower warning limit	Lower warning limit for the flow which can be set by the customer
Flow - upper warning limit	Upper warning limit for the flow which can be set by the customer
Calculation method	Calculation method for the compressibility factor
Calculation interval	Cycle time for updating measured values (pressure, temperature) and calculation of the compressibility factor
Standard pressure	Standard pressure
Standard temperature	Standard temperature
Reference conditions	Reference conditions for density and heating value
Atmospheric pressure	Ambient pressure
K-factor (fixed)	Figure for method "Fixed value" when the calculation of the K-factor is incorrect.
CO2	CO_2 proportion in gas
H2	H_2 proportion in gas
N2	N_2 proportion in gas

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

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)
Heating value unit	Heating value unit
p Fixed value	Fixed value of measurement pressure
p Unit	Unit for pressure values, used for entry and display
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 Sensor serial number	Pressure transmitter serial number expected by the device
p Adjust offset	Calibration offset for pressure transmitter
p Adjust factor	Calibration factor for pressure transmitter
p Unit	Unit for pressure values
T Default value	Fixed value of measurement temperature
T Unit	Unit for temperature values, used for entry and display
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 Sensor serial number	Temperature transmitter serial number expected by the device
T Adjust offset	Calibration offset for temperature transmitter
T Adjust factor	Calibration factor for temperature transmitter
T Unit	Unit for temperature values, used for entry and display
Gas hour	Billing hour for the day archive
Gas day	Billing day for month archive
Measuring period	Period for billing archive

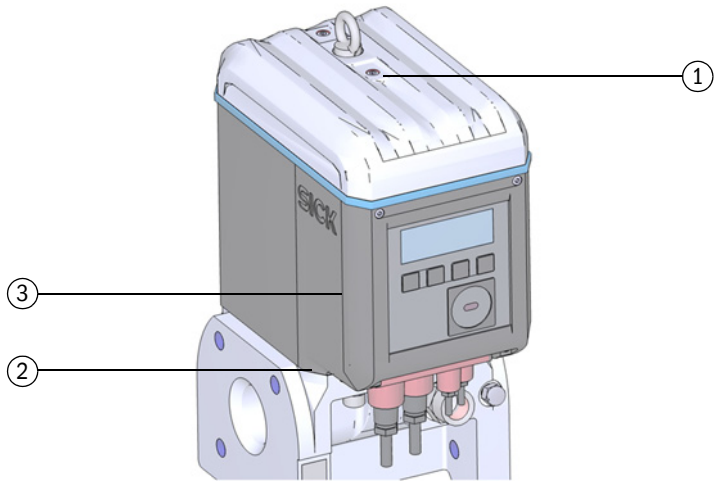
2.10 Sealing

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

Meter cartridge and meter body must be secured after completion of installation on the joint circumference with an adhesive label glued with approximately equal spread on meter cartridge and meter body.

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

Fig. 7 Factory seal of the cover on the meter cartridge



1 Seal position
2 Possible position of the meter body 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 locking switch by the terminal cover compartment.

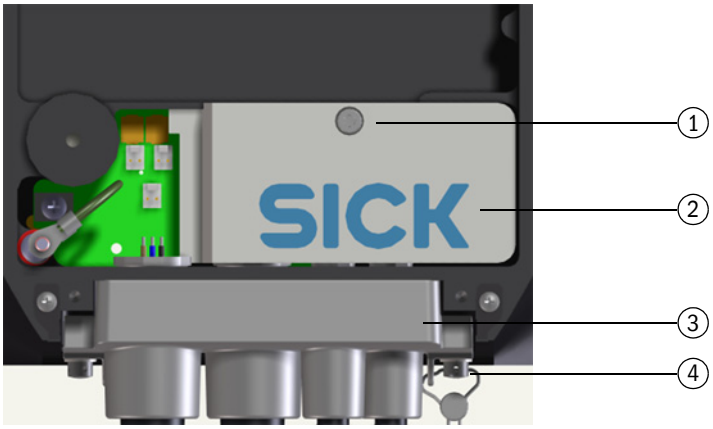
During the start-up, the plug-in connector cover must be secured according to national regulations. This can be performed with an adhesive label which is glued with approximately equal spread on the cover and the enclosure or alternatively by using capstan screws and a tensioned sealing wire and a wire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

Calibrated devices must be sealed by a calibration inspector after completion of the installation.

Measurements subject to calibration are not valid when the verification seals are damaged.

If required, the FLOWSIC500 must be recalibrated and resealed.

Fig. 8 Seals on the terminal compartment and plug-in connector cover

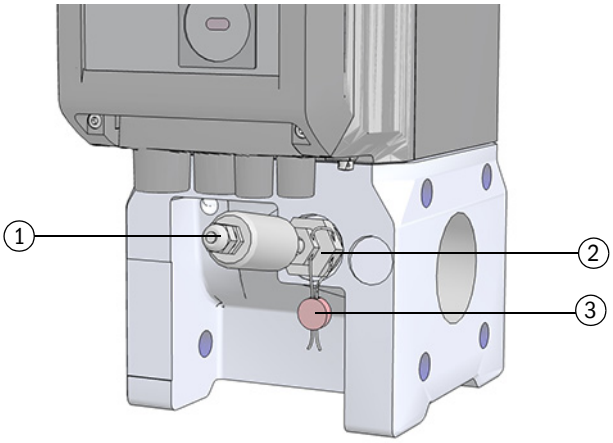


1 Seal position
2 Terminal compartment cover (securing the terminal compartment)
3 Plug-in connector cover
4 Capstan screw, wire and wire seal (securing of plug-in connector cover)

NOTICE:

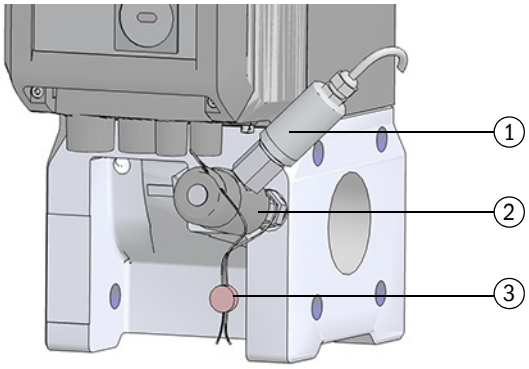
► Secure the terminal compartment cover and the plug-in connector cover with at least one verification seal against unauthorized removal of the cover!

Fig. 9 Seal on the temperature transmitter (example)



1 Temperature transmitter
2 Locknut
3 Wire seal

Fig. 10 Seal on the pressure transmitter (example)



1 Pressure transmitter
2 Kamstrup test valve BDA04
3 Wire seal

FLOWSIC500

3 Installation

Hazards during installation
General information
Mechanical installation
Electrical installation
External pressure and temperature transmitters installation

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. 8, § 1.1.
- ► Comply with the safety requirements of Pressure Equipment Directive 97/23/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 (meter body and meter cartridge, 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. 8, § 1.1.
► Comply with the safety requirements of Pressure Equipment Directive 97/23/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:

► In concrete application, observe limitations resulting from type approval!

3.3.1 Preparations

The following tools and materials are required to install the FLOWSIC500:

- Hoisting equipment (lifting capacity according to the weight specifications → p. 94, § 9.3)
- Box wrench with size suitable for flange installation
- Torque wrench
- Flange gaskets
- Anti-seize paste, metal-free or suitable for aluminium, e.g. OKS 235, to prevent thread mountings seizing up

  NOTICE:
  Do not use copper paste!

- 3 mm 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 7 contains a list of recommended bolts and → Table 8 contains a list of recommended gaskets.

Table 7 Bolts and tightening torques

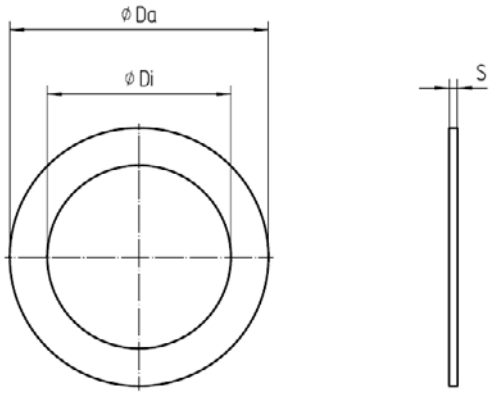
Device/flange type	Bolts	Washers	Nuts	Tightening torque	
DN50/ PN16	4 pc. DIN835-M16x45-A2-70	4 pc. DIN125-A17-A2	4 pc. ISO4032-M16-A2-70	130 Nm	96 lbf ft
DN80/ PN16	8 pc. DIN835-M16x45-A2-70	8 pc. DIN125-A17-A2	8 pc. ISO4032-M16-A2-70	130 Nm	96 lbf ft
DN100/ PN16					
DN150/ PN16	8 pc. DIN835-M16x45-A2-70	8 pc. DIN125-A21-A2	4 pc. ISO4032-M20-A2-70	250 Nm	184 lbf ft
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- 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 8 Gaskets

Device/flange type	Da[1] [mm]	Di [mm]	S [mm]	Material
DN50/ PN16	102	61	2	novapress® FLEXIBLE/815
DN80/ PN16	138	89		
DN100/ PN16	158	115		
DN150/ PN16	212	169		
2"/ Cl150	92	60	2	novapress® FLEXIBLE/815
3"/ Cl150	127	89		
4"/ Cl150	157	114		
6"/ Cl150	216	168		

[1] Da = outer diameter, Di = inner diameter, S = thickness, → Fig. 11

Fig. 11 Dimensions of gaskets



3.3.3 Fitting the FLOWSIC500 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.

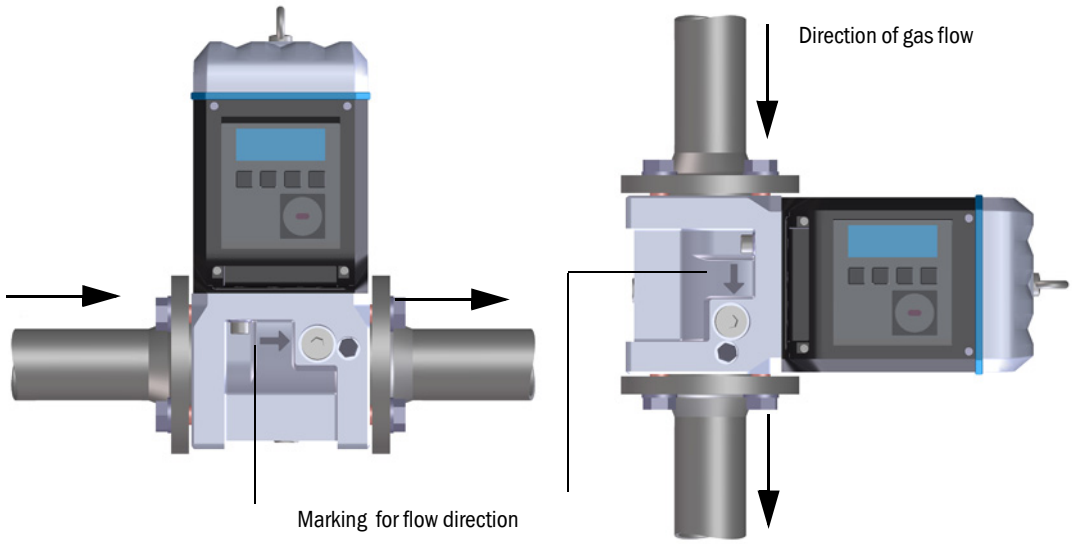
- ► The FLOWSIC500 must not swing or tilt on the hoisting equipment during transport.
- ► The FLOWSIC500 must not turn during transport otherwise the lifting lug could be screwed out.

NOTICE: **Observe the gas flow direction**
An arrow on the FLOWSIC500 marks the prescribed flow direction.
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. 33, § 3.4).

Fig. 12 Installation examples



NOTICE:
If the FLOWSIC500 is installed so that the cartridge projects sideways from the pipeline, the cartridge weight creates a torque on the pipeline.

- ► Make sure the pipeline is capable of holding the cartridge → p. 32, Table 9.

Table 9 Pipeline torque

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

Installation in pipeline

1 Select suitable bolts.

Recommended bolts →Table 7.

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 First screw the bolts by hand into the meter body 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.

5 Check the thread length in the meter body is fully utilized.

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

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

If necessary, use a different bolt length.

8 Check correct positioning of flange gaskets.

9 Tighten nuts evenly and crosswise in small steps until the specified tightening torque is reached (→Table 7).

Make sure the flange sits free of tension.

10 Slowly increase the pressure in the pipeline.

Gradient: Max. 3bar/s (45psi/sec)

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

3.4 Electrical installation

3.4.1 Requirements for use in potentially explosive atmospheres

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

For a FLOWSIC500 used in potentially explosive atmospheres:

- ► Installation, start-up, 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 start-up, 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

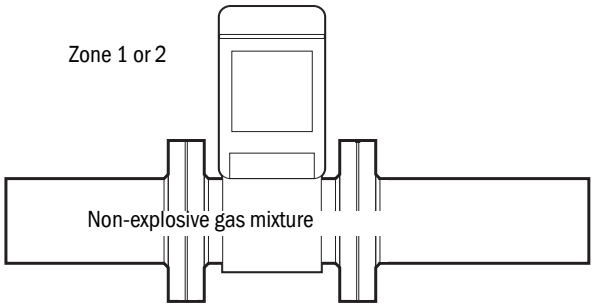
The ambient temperature must be within the range specified on the type plate.

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

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

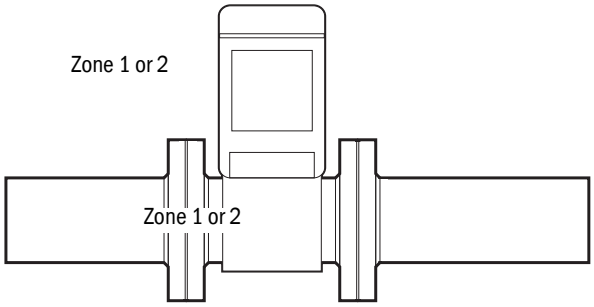
Fig. 13 Ex zones

Case 1:



- 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 meter cartridge.

Case 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).
- The gas temperature must be within the approved ambient temperature range specified on the type plate of the meter cartridge.

WARNING: Risk of explosion

The FLOWSIC500 ultrasonic transducers contain piezoelectric components and are made of a high strength titanium alloy.

For this reason, they 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. 29, §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.

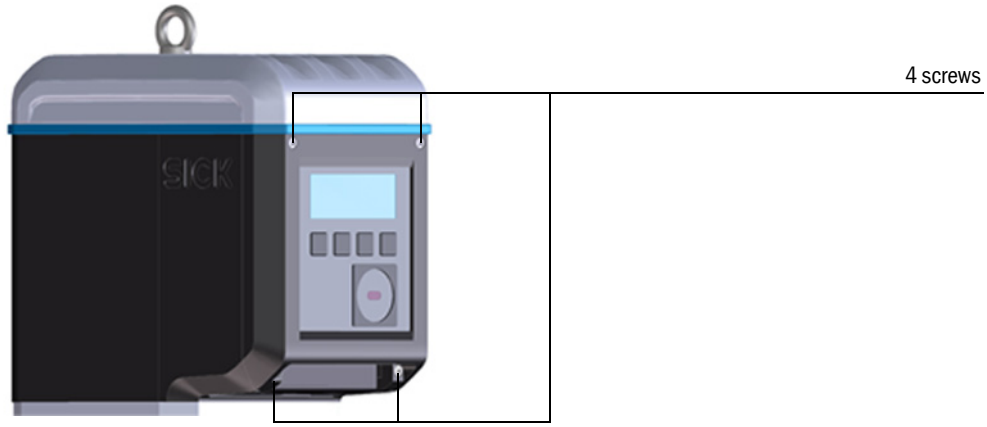
3.4.3 Opening and closing the electronics cover

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 a 3 mm Allen key.

Fig. 14 Position of electronics cover screws



2 Open the electronics cover.

Closing the electronic cover

1 Close the electronics cover.

► Make sure no battery and display cables are pinched.

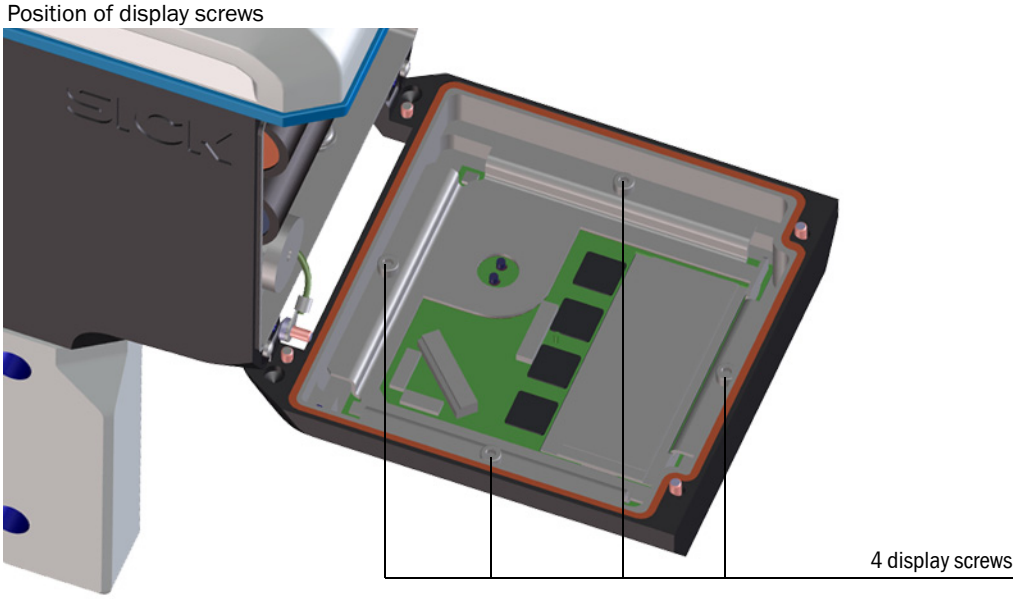
2 Screw the electronics cover tight again.
Tightening torque: 2.0 Nm (18 lbf in)

3.4.4 Rotating the control unit

1 Open the electronics cover (→ p. 33, § 3.4)

2 Loosen the 4 display screws with a 3 mm Allen key, → Fig. 15.

Fig. 15 Position of display screws



3 Rotate the display in the desired direction.

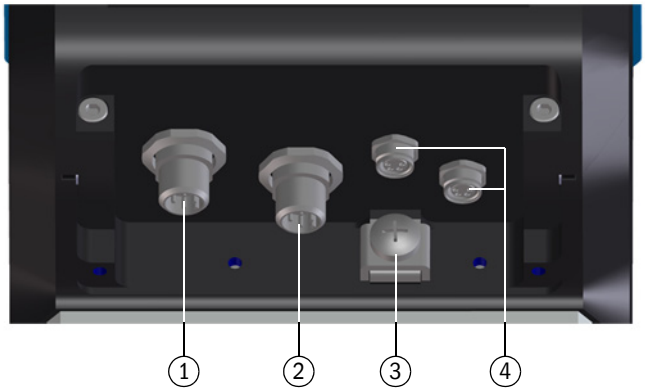
4 Tighten the display screws evenly.
Tightening torque: 1.0 Nm (9 lbf in)

5 Close the electronics cover again.

3.4.5 Electrical connections

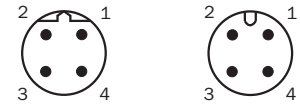
The FLOWSIC500 interfaces are accessible from the outside via external plug-in connectors.

Fig. 16 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 transmitters (optional)

Fig. 17 M12 plug-in connector coding



Plug-in connector 1 (B-coded) Plug-in connector 2 (A-coded)

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

Plug-in connector 2 (A-coded) can be configured when ordered, configuration options → p. 38, §3.4.6.
The respective configuration is printed on the type plate (→ p. 39).

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

Table 10 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 P_i = 725 mW I_i = 667 mA U_o = 8.2 V I_o = 0.83 mA C_o = 7.6 µF L_o = 100 mH
2	PWR+			
3	DO_1-	Depending on the configuration (→ Table 1): Diangosis warning, measured value validity, HF pulse output in calibration mode	Passive, not electrically isolated Reference potential, configurable → p. 51, § 4 Max. 16 V Max. 100 mA R_{on} < 100 Ω R_{off} > 1 MΩ	
4	DO_1+			

3.4.6.2 Plug-in connector 2: Signal output

Table 11 Pin assignment for M12 plug-in connector 2 (male/A-coded, 4-poles)

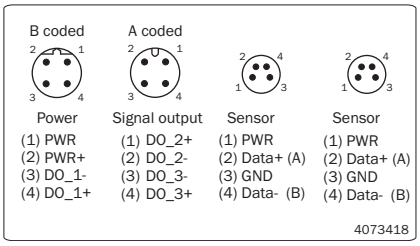
M12 pin	Input/output	Function/signal	Operating parameters	Safety relevant parameters
Pin assignment configuration 1: Two digital outputs LF				
1	Digital output DO_2+	LF pulses	Passive, not electrically isolated Reference potential, configurable → p. 51, § 4 Max. 16 V Max. 100 mA R_{on} < 100 Ω R_{off} > 1 MΩ	U_i = 20 V P_i = 1.1 W U_o = 8.2 V $\sum I_o$ = 1.7 mA C_o = 7.6 µF L_o = 100 mH
2	Digital output DO_2- (GND)			
3	Digital output DO_3- (GND)	Measured value validity		
4	Digital output DO_3+			
Pin assignment configuration 2: Digital output HF				
1	Digital output DO_0+	HF pulse	Electrically isolated, optically isolated Rated input voltage 8.2 V I_{on} = 3.4 mA I_{off} = 0.7 mA	U_i = 20 V P_i = 1.1 W
2	Digital output DO_0- (GND)			
3	Not used			
4	Not used			
Pin assignment configuration 3: Digital output encoder				
1	Digital output DO_0+	Encoder log	Electrically isolated, optically isolated Rated input voltage 8.2 V I_{on} = 3.4 mA I_{off} = 0.7 mA	U_i = 20 V P_i = 1.1 W
2	Digital output DO_0- (GND)			
3	Not used			
4	Not used			

Table 11 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 4: RS485 (externally powered)				
1	PWR+	RS485- communication interface (externally powered)	Not electrically isolated Rated input voltage 4...16 V	U_0 = 8.2 V I_0 = 2.5 mA P_0 = 5.1 mW C_0 = 5.8 µF L_0 = 100 mH U_i = 20 V P_i = 1.1 W C_i = 1.8 µF
2	Data A			
3	PWR-			
4	Data B			

NOTICE:
Depending on the operating mode, battery service life can shorten considerably when the electrically isolated switching output is used (configuration 2).

Fig. 18 Identification on the electronics type plate (example)



Internal terminal assignment→ p. 95, §9.4

3.4.7 Cable specifications

When the plugs available from SICK are used, a shielded control cable with 4x0.25 mm² 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. 84, §8.1).

3.4.8 Operation with external power supply

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.

3.4.8.1 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. 38, §3.4.6.

Fig. 19 Connection for external power supply underneath the meter cartridge

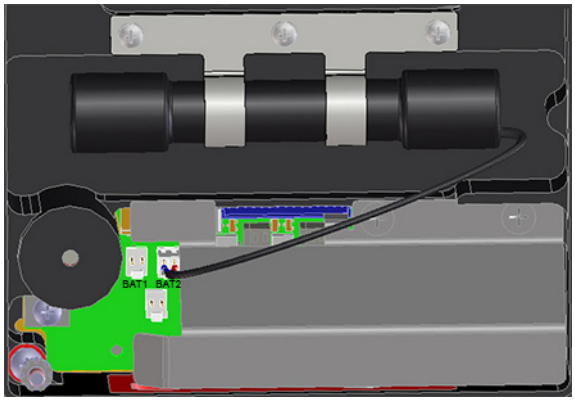
1 External power supply and signal output

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. 52, § 4.1).

3.4.8.2 Connecting the backup battery

1 Open the electronics cover (→ p. 35, 3.4.3).
2 Connect the back-up battery (Part No. 2065928) to connection BAT2 in the terminal compartment (→ Fig. 20).
3 Close the electronics cover again.

Fig. 20 Connected back-up batteries



3.4.9 Operation with batteries

The FLOWSIC500 and the delivered battery packs are designed intrinsically safe.

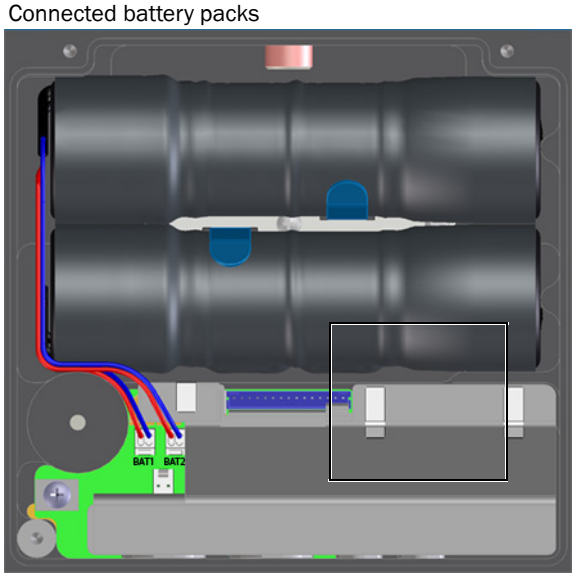
- Only the exchangeable battery packs from SICK with Part Nos. 2064018 and 2065928 may be used.
- The battery packs can be connected and disconnected in the hazardous area as well.
- Only connect the battery packs to the connections marked for this purpose in the terminal compartment of the FLOWSIC500.
- Modifying the electrical connection parts is not allowed.

1 Open the electronics cover (→ p. 33, 3.4)

2 Insert the battery packs as shown and connect to connections BAT1 and BAT2 in the terminal compartment.

The FLOWSIC500 is initialized.

Fig. 21 Connected battery packs



3 Close the electronics cover again.

4 Set the date and time (→ p. 52, § 4.1).

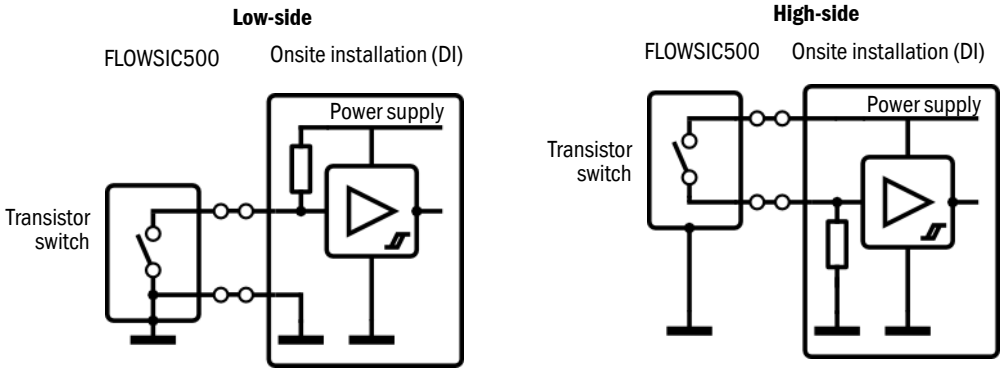
3.4.10 Defining the reference potential of the digital switching outputs

Digital switching outputs DO_1, DO_2 and DO_3 are designed so that they allow the connection of recording devices which require switching through the switching output against reference potential (low-side) or against operating voltage (high-side).

The switching outputs are configured by default for switching against reference potential.

If required by the local electrical installation, the digital switching outputs can be reconfigured on the circuit board.

Fig. 22 Installation example



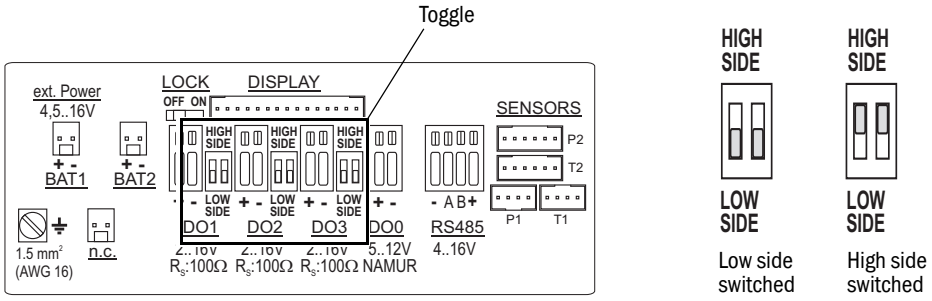
1 Open the electronics cover (→ p. 35, §3.4.3).

2 Remove the terminal compartment cover.

> ***NOTICE:***
> For calibrated devices: Remove the verification seals only when a calibration inspector is present, because the FLOWSIC500 must be sealed after completion of the installation (→ p. 39, §3.4.8)
> When the verification seals are damaged, the calibration validity of the measurement becomes void.

3 Toggle the DIL switches on the circuit board to high-side.

Fig. 23 DIL switches



4 Reinstall the terminal compartment cover.

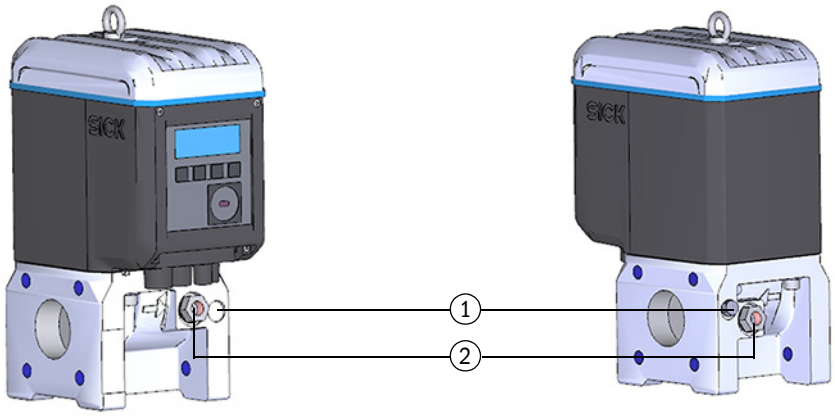
5 Have the FLOWSIC500 resealed.

6 Close the electronics cover again (→ p. 35, §3.4.3).

3.5 Installing the external pressure and temperature transmitters

The FLOWSIC500 has one pressure and temperature measuring port each on the front side and rear side of the meter body.

Fig. 24 Pressure and temperature measuring ports (front and rear side)



1 Pressure measuring port
2 Temperature measuring port

***NOTICE:* Ensure sufficient assembly clearance!**

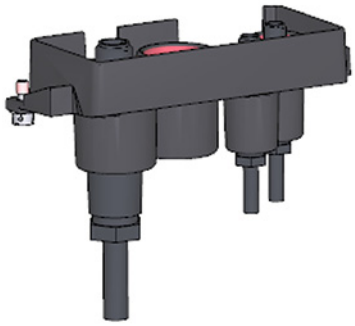
► Ensure sufficient clearance to the wall or other components at the rear measuring ports when installing the transmitters.
The recommended minimum clearance to the wall is 0.3 m.

3.5.1 Fitting the plug-in connector cover

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

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

Fig. 25 Plug-in connector cover



2 Connect the plugs to the planned connections.

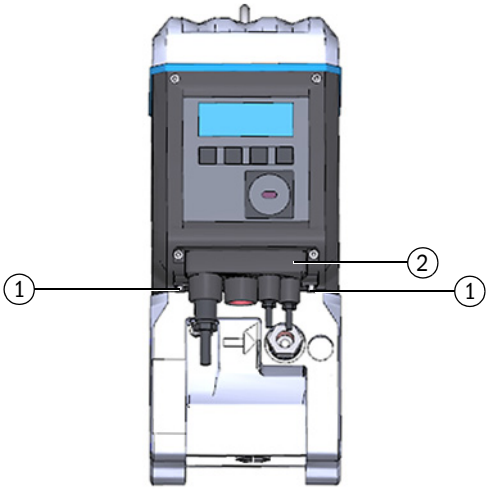
For meter sizes DN50 and DN80, it is recommended to connect the pressure transmitter to the right M8 connection and the temperature transmitter to the left M8 connection.
The FLOWSIC500 automatically detects whether a pressure or temperature transmitter has been connected to a connection.

Fig. 26 Connections for pressure and temperature transmitters

1 Connections for pressure and temperature transmitters

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

Fig. 27 Fastening the plug-in connector cover



1 Capstan screw
2 Plug-in connector cover

3.5.2 Installing the pressure transmitter

A three-way test valve is normally fitted to be able to test the pressure transmitter.

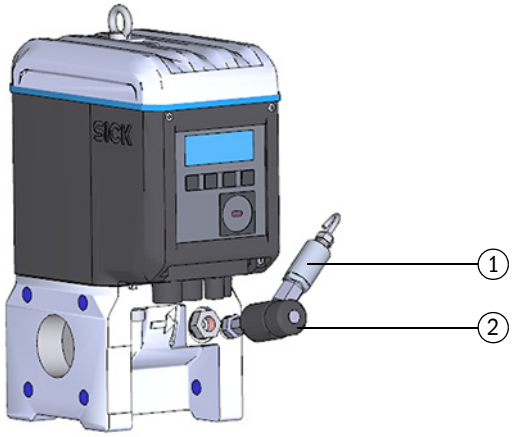
> ***NOTICE:* Fitting information**
> It is recommended to connect the pressure transmitter with the three-way test valve or with the FLOWSIC500 so that there is a downward slope from the pressure transmitter to the connection point and from the three-way test valve to the FLOWSIC500.

Variant 1: Installation with Kamstrup test valve BDA04 (up to -25 °C)

For details on installation with Kamstrup test valve BDA04, see Kamstrup Operating Instructions.
You will find the document on the delivered product CD.

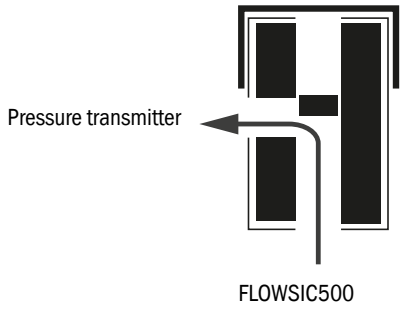
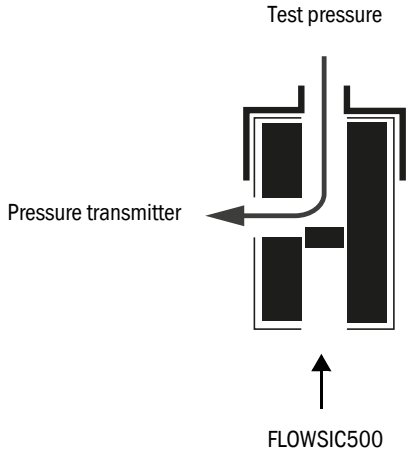
1 Remove the dummy plug at the pressure measuring port.
2 Fit the Kamstrup test valve BDA04.
Pay attention to the alignment of the connection for the pressure transmitter.
3 Fit the pressure transmitter on the Kamstrup test valve BDA04 (→ Fig. 28).

Fig. 28 Kamstrup test valve BDA04 with pressure transmitter fitted



1 Pressure transmitter
2 Kamstrup test valve BDA04

Table 12 Kamstrup test valve BDA04 positions

Measuring position	
Test position	

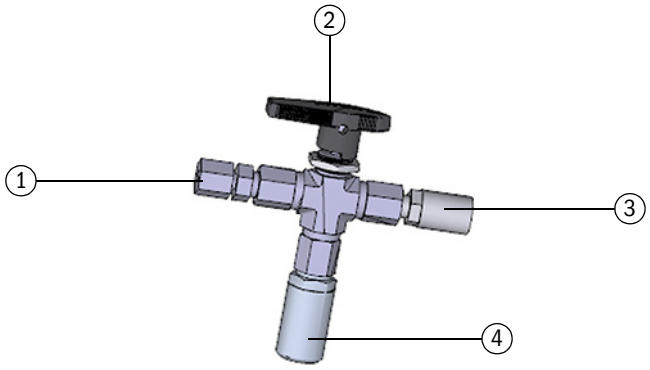
Variant 2: Installation with three-way test valve (to -40 °C)

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

Install the three-way test valve with pressure transmitter 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.

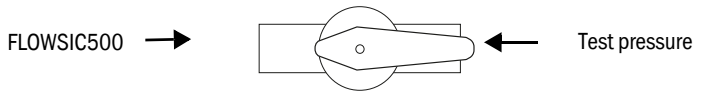
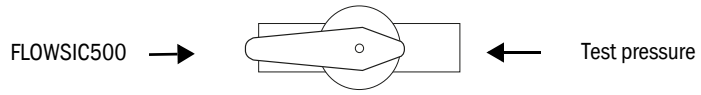
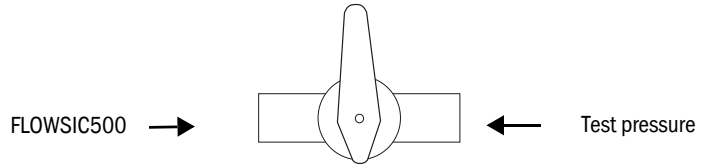
1 Fasten the three-way test valve at a suitable location.
2 Remove the dummy plug at the pressure measuring port.
3 Fit the supplied screw fitting.
4 Install the pressure line between the FLOWSIC500 and the three-way test valve.
5 Fit the pressure transmitter to the three-way test valve.

Fig. 29 Pressure transmitter installation on the three-way test valve (-40 °C)



1 FLOWSIC500 connection
2 Three-way test valve
3 Test connection (Minimess coupling)
4 Pressure transmitter

Table 13 Three-way test valve positions

Measuring position	
Test position	
Closed position	

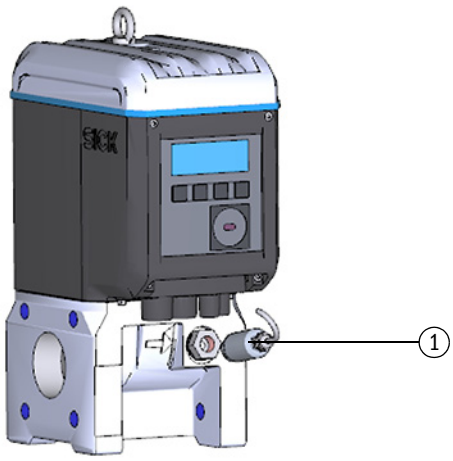
Variant 3: Installation without a three-way test valve

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

1 Remove the dummy plug at the pressure measuring port.

2 Fit the pressure transmitter.

Fig. 30 Installation without three-way test valve



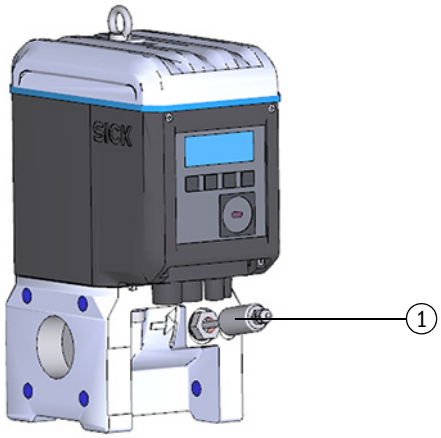
1 Pressure transmitter

3.5.3 Installing the temperature transmitter

The temperature transmitter can be greased with heat-conductive oil or paste to improve its performance.

1 Insert the temperature transmitter into the immersion sleeve to the stop.
2 Tighten the locknut.
3 Have the wire seal attached by a calibration inspector (→ Fig. 4).

Fig. 31 Installing the temperature transmitter



1 Temperature transmitter

FLOWSIC500

4 Start-up

Sequence of start-up
Setting the date and time
Configuring volume conversion (device option)
Checking the device status

4.1 Sequence of start-up

4.1.1 Start-up of gas flow meter

FLOWSIC500 start-up is normally performed in the following sequence:

- ► Log on as "Authorized user" (→ p. 69, § 5.2.6).
- ► Set the date and time (→ p. 52, § 4.2).
- ► Check the device status (→ p. 54, § 4.4).

4.1.2 Start-up of gas flow meter with device option volume conversion

- ► Log on as "Authorized user" (→ p. 69, § 5.2.6).
- ► Set the date and time (→ p. 52, § 4.2).
- ► Activate the configuration mode (→ p. 69, § 5.2.8).
- ► Set fixed values for pressure and temperature (→ p. 53, § 4.3.1).
- ► Set reference values (already configured: → Table 2).
- ► Select the calculation method (already configured: → p. 66, § 5.2.5.5)
- ► Set the fixed value of the compressibility factor (→ p. 66, § 5.2.5.5).
- ► Check the configuration (→ p. 54, § 4.3.3).
- ► Configure the gas composition (→ p. 54, § 4.3.3).
- ► Adapt alarm limits for pressure and temperature (→ p. 67, § 5.2.5.6 and → p. 67, § 5.2.5.7).

> The alarm limits are set in the factory to the measuring range of the selected transmitter

- ► Terminate configuration mode (→ p. 69, § 5.2.8).
- ► Check the device status (→ p. 54, § 4.4).

4.2 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.

> Detailed information on operating using the display and on menu navigation → p. 56, § 5.2.

> - 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. 69, § 5.2.6).
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.

4.3 Configuring volume conversion (device option)

4.3.1 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. 69, § 5.2.6).
2 Start the configuration mode → p. 69, §.
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.

4.3.2 Checking the configuration

The FLOWSIC500 is delivered already configured according to customer specifications.

It is recommended to check the calibration-relevant parameters and settings. The calibration-relevant parameters are shown in the Data Book printout and can be compared against the current configuration on the display.

A new printout of the Data Book can be created using the FLOWgate500 operating software.

4.3.3 Configuring the gas composition

1 Log on as "Authorized user" (→ p. 69, § 5.2.6).
2 Start the configuration mode → p. 69, §.
3 Switch to submenu "Conversion/Gas composition" in the FLOWSIC500 menu.
4 Enter the following parameters according to the gas used and for the calculation method selected:
   – Rel. density or reference density
   – H2 [mol%]
   – CO2 [mol%]
   – N2 [mol%]
   – Heating value

Parameter changes are saved in the Metrology logbook when the parameter locking switch is closed.
The Metrology logbook can be viewed using the FLOWgate500 operating software.

4.4 Checking the device status

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

1 Log on as "Authorized user" (→ p. 69, § 5.2.6).
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. 74, § 6.2, "Status messages").
   – Contact SICK Customer Service for any malfunctions you cannot clear yourself (→ p. 74, § 6.1, "Contacting Customer Service").
4 The event overview can be reset when all warnings and errors have been cleared (→ p. 70, § 5.2.11).

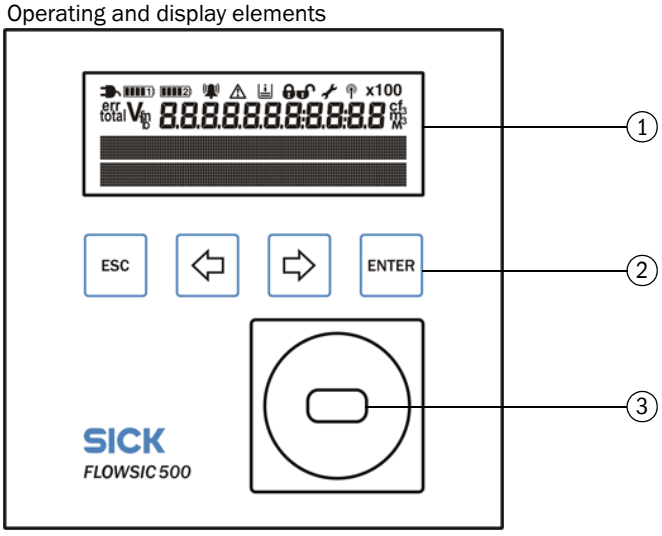
FLOWSIC500

5 Operation

Control unit
Operating using the display
Operating using the optical data interface
FLOWgate500 operating software
Parameter protection

5.1 Control unit

Fig. 32 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 14 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 15 Symbols

Symbol	Significance	Description
	External power supply	Only displayed when the device is configured with external power supply. Blinks: Fault in external power supply
	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. 57, § 5.2.2.
	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. 57, § 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. 22, § 2.9.2.
	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.

5.2.2 Battery fill level display

The battery symbol changes as the battery is discharged.

Table 16 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` `20.08.2012 10:30:52`	V = Volume absolute, cannot be reset
↳ Pressing ENTER opens the FLOWSIC500 menu.	
`errV 000000000 m³` `20.08.2012 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. 70).	
`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` `20.08.2012 10:30:52`	Last reset of event summary
↳ Pressing ENTER opens the action "Reset Event Summary". → "Resetting the event summary" (p. 70).	

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. 64, § 5.2.5.1
Login	●	●	●	●	
Logout	-	●	●	●	
FLOWSIC500 menu: Device mode	○	○	○	○	→ p. 64, § 5.2.5.2
Calibration mode	○	○	●	●	
Configuration mode	○	○	●	●	
FLOWSIC500 menu: Device information	○	○	○	○	→ p. 64, § 5.2.5.3
Measuring port	○	○	○	○	
Serial number	○	○	○	○	
Firmware Version	○	○	○	○	
Firmware Date	○	○	○	○	
Firmware CRC	○	○	○	○	
Metrology CRC	○	○	○	○	
Min. oper. pressure	○	○	○	○	
Max. oper. pressure	○	○	○	○	
Meter factor	○	○	○	○	
Frequency at Qr [Hz]	○	○	○	○	
FLOWSIC500 menu: System settings	○	○	○	○	→ p. 65, § 5.2.5.4
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	○	○	○	○	
FLOWSIC500 menu: Archives	○	○	○	○	→ p. 68, § 5.2.5.9
Gas hours	○	○	●	●	
Gas day	○	○	●	●	
Measuring period	○	○	●	●	
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. 70, § 5.2.11

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.

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 20.08.2012 10:30:52	V_b= Volume at base conditions, uninterrupted
↳ Pressing ENTER opens the FLOWSIC500 menu.	
errVb 000000000 m³ 20.08.2012 10:30:52	$^{err}V_b$ = Error volume at base conditions
↳ Pressing ENTER opens the action "Reset error volume". → "Resetting the error volume" (p. 70).	
totalVb 000000000 m³ 20.08.2012 10:30:52	$^{total}V_b$ = Total volume at base conditions = V_b + $^{err}V_b$
V_m 000000000 m³ 20.08.2012 10:30:52	V_m = Total volume at measurement conditions
$^{err}V_m$ 000000000 m³ 20.08.2012 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
p 3.532 bar T 25.42 °C	p = Pressure currently used for volume conversion T = Temperature currently used for volume conversion
C 25.7368 K 0.9541	C = Conversion factor K = Compressibility factor
Z 0.99830 Zb 0.99812	Z = Compression factor at measurement conditions currently used for volume conversion Z = Compression factor at base conditions currently used for volume conversion
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 20.08.2012 10:30:52	Last reset of event summary
↳ Pressing ENTER opens the action "Reset Event Summary". → "Resetting the event summary" (p. 70).	

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 Authorized user (1) A2 Authorized user (2) A3 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. 64, § 5.2.5.1
Logged in user level	●	●	●	●	
Login	●	●	●	●	
Logout	-	●	●	●	
FLOWSIC500 menu: Device mode	○	○	○	○	→ p. 64, § 5.2.5.2
Calibration mode	○	○	●	●	
Configuration mode	○	○	●	●	
FLOWSIC500 menu: Device information	○	○	○	○	p. 64, § 5.2.5.3
Measuring port	○	○	○	○	
Serial number	○	○	○	○	
Firmware version	○	○	○	○	
Firmware date	○	○	○	○	
Firmware CRC	○	○	○	○	
Metrology CRC	○	○	○	○	
Min. oper. pressure	○	○	○	○	
Max. oper. pressure	○	○	○	○	
Meter factor	○	○	○	○	
Frequency at Qr	○	○	○	○	
FLOWSIC500 menu: System settings	○	○	○	○	→ p. 65, § 5.2.5.4
Power supply (1)	○	○	●	●	
Power supply (2)	○	○	●	●	
Date	○	○	●	●	
Time	○	○	●	●	
Timezone	○	○	●	●	
Language	○	●	●	●	
Symbols	○	○	○	○	
LCD test	○	●	●	●	
FLOWSIC500 menu: Conversion	○	○	○	○	→ p. 66, § 5.2.5.5
Conversion: References	○	○	○	○	
Standard pressure	○	○	●	●	
Standard 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. 67, § 5.2.5.6
p Sensor type	○	○	○	○	

Path	G	U	A2+3	A1	Explanation
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. 67, § 5.2.5.7
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	○	○	○	○	
FLOWSIC500 menu: Archives	○	○	○	○	→ p. 68, § 5.2.5.9
Gas hour	○	○	●	●	
Gas day	○	○	●	●	
Measuring period	○	○	●	●	
Main display: errVb	○	○	●	●	→ p. 70, § 5.2.10
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. 70, § 5.2.11

5.2.5 FLOWSIC500 menu

5.2.5.1 User

User	Logged in user level, without login: Guest → "Changing the user level" (p. 69) Logged in as: ● User (1) ● User (2)* ● User (3)* ● Authorized user (1) ● Authorized user (2)* ● Authorized user (3)* * when activated

5.2.5.2 Device mode

Calibration mode	Display whether calibration mode for the flow 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. 38, §3.4.6.1). For flow check and calibration, see document "E_86770: 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. 69)

5.2.5.3 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 [Imp/m^3]
Frequency at Qr	Frequency for overload flow Qr=1.2 Qmax

5.2.5.4 System settings

<table>
<tr><td>Power supply (1)</td><td>● For battery operation:
– Fill level for battery pack 1 [%],
– Confirm battery exchange for battery pack 1.
→ "Confirming battery replacement" (p. 71)

● With external power supply:
– Display: 100%</td></tr>
<tr><td>Power supply (2)</td><td>● 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. 71)</td></tr>
<tr><td>Date</td><td>Device date → "Sequence of start-up" (p. 52)</td></tr>
<tr><td>Time</td><td>Device time → "Sequence of start-up" (p. 52)</td></tr>
<tr><td>Timezone</td><td>Time zone set on device</td></tr>
<tr><td>Language</td><td>Language for displays
Available: English, German, Russian

→ "Setting the language" (p. 69)</td></tr>
<tr><td>Symbols</td><td>Symbols for mesured value displays
The setting can be changed with the FLOWgate operating software.
Gas flow meter:
<table><tr><td></td><td>EN12405</td><td>PTB</td><td>GOST</td><td>API</td></tr><tr><td>Volume (measurement)</td><td>V</td><td>V</td><td>V</td><td>Vf</td></tr><tr><td>Flow (measurement)</td><td>Q</td><td>Q</td><td>Q</td><td>Qb</td></tr><tr><td>Velocity of Gas</td><td>VOG</td><td>VOG</td><td>VOG</td><td>VOG</td></tr><tr><td>Speed of Sound</td><td>SOS</td><td>SOS</td><td>SOS</td><td>SOS</td></tr></table>
Gas flow meter with volume conversion:
<table><tr><td></td><td>EN12405</td><td>PTB</td><td>GOST</td><td>API</td></tr><tr><td>Volume (measurement)</td><td>Vm</td><td>Vb</td><td>V</td><td>Vf</td></tr><tr><td>Volume (base)</td><td>Vb</td><td>Vb</td><td>Vc</td><td>Vb</td></tr><tr><td>Flow (measurement)</td><td>Q</td><td>Q</td><td>Q</td><td>Qb</td></tr><tr><td>Flow rate (base)</td><td>Qf</td><td>Qn</td><td>Qc</td><td>Qf</td></tr><tr><td>Pressure (measurement)</td><td>p</td><td>p</td><td>P</td><td>Pf</td></tr><tr><td>Pressure (base)</td><td>Pb</td><td>pn</td><td>Pc</td><td>Pb</td></tr><tr><td>Temperature (measurement)</td><td>T</td><td>T</td><td>T</td><td>Tf</td></tr><tr><td>Temperature (base)</td><td>Tb</td><td>Tn</td><td>TC</td><td>Tb</td></tr><tr><td>Velocity of Gas</td><td>VOG</td><td>VOG</td><td>VOG</td><td>VOG</td></tr><tr><td>Speed of Sound</td><td>SOS</td><td>SOS</td><td>SOS</td><td>SOS</td></tr><tr><td>K-factor (fixed)</td><td>K</td><td>K</td><td>K</td><td>s</td></tr><tr><td>Conversion factor</td><td>C</td><td>C</td><td>C</td><td>C</td></tr><tr><td>Z (measurement)</td><td>Z</td><td>Z</td><td>Z</td><td>Zf</td></tr><tr><td>Z (base)</td><td>Zb</td><td>Zn</td><td>Zc</td><td>Zb</td></tr></table></td></tr>
<tr><td>LCD test</td><td>Display test → "Testing the display" (p. 71)</td></tr>
</table>

5.2.5.5 Conversion (only for device types with volume conversion)

References

Standard pressure	Standard pressure [unit acc. to display]
Standard temperature	Standard 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

	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)

Atmospheric pressure	Ambient pressure [unit acc. to display] Input requried for version with relative pressure transmitter

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. ● 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/m³, kWh/m³, BTU/ft³ 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.

5.2.5.6 Pressure parameters (only for device option volume conversion)

NOTICE:
All entry values of the pressure parameters are relative to absolute pressure.

p Sensor type	Display of configured pressure transmitter
p Sensor serial number	Pressure transmitter serial number expected by the device, preset
p Lower alarm limit	Lower alarm limit for pressure transmitter
p Upper alarm limit	Upper alarm limit for pressure transmitter
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, psi, kPa, MPa, kg/cm2 Default = Standard setting according to selected unit system (SI or Imperial), configured in accordance with the order
p Adjust offset	Calibration offset for pressure transmitter [unit acc. to display]
p Adjust factor	Calibration factor for pressure transmitter

5.2.5.7 Temperature parameters (only for device option volume conversion)

T Sensor type	Display of configured temperature transmitter
T Sensor serial number	Temperature transmitter serial number expected by the device, preset
T Lower alarm limit	Lower alarm limit for temperature transmitter
T Upper alarm limit	Upper alarm limit for temperature transmitter
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 transmitter [unit acc. to display]
T Adjust factor	Calibration factor for temperature transmitter

5.2.5.8 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

5.2.5.9 Archives

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

5.2.6 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.

The following users are set at the factory:
- User (1), password: 1111
- Authorized user (1), password: 2222

► Change the password after the first logon via the FLOWgate operating software.

5.2.7 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.

5.2.8 Changing the device mode

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

5.2.8.1 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.

5.2.8.2 Starting and terminating calibration mode

Calibration mode can be started and terminated in the same manner as the configuration mode (→ p. 70, §5.2.8.2).

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 (→ S. 34, § 3.4.6.1).

5.2.9 Changing parameters

Numerical values

1 Start the configuration mode → p. 69, §.
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. 69, §.
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.

5.2.10 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.

5.2.11 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.

5.2.12 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.

5.2.13 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.

5.3 Operating using the optical data interface

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 adapter has a USB 2.0 interface. This interface provides the connection to the PC and transfers the FLOWSIC500 data.

A driver must first be installed to operate the adapter on a PC.
You will find the driver on the delivered product CD.

1 Do not connect the USB connector yet. First install the driver.
2 Connect the USB connector to the PC.
3 Fit the infrared adapter to the infrared interface as shown (→ Fig. 33); a magnet integrated in the reading head retains the adapter.

Fig. 33 Alignment of the infrared adapter

4 Press any button on the display to activate the optical data interface on the FLOWSIC500.
5 Start the connection on the PC.
When a connection has been established, the optical data interface on the FLOWSIC500 remains active until the adapter is removed.
The display and the optical interface remain active during the connection.

5.4 FLOWgate500 operating software

For information concerning the FLOWgate500 operating software, see "Software Manual FLOWgate500".
The Software Manual is on the delivered Product CD.
The Software Manual is also available using the Help function of the FLOWgate500 operating software.

FLOWSIC500

6 Clearing Malfunctions

Contacting Customer Service
Status messages
Additional messages in the Event logbook

6.1 Contacting Customer Service

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

- In Germany:
  E-mail: pa-support@sick.de
  Phone: +49 (0) 211 – 5301 – 401
- In other countries:
  Contact your local SICK subsidiary or technical support:
  E-mail: helpdesk.pa@sick.de
  Phone: +49 (0)7641 469 1277

6.2 Status messages

Table 17 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. 69, § 5.2.8, "Changing the device mode"
I-1020	The parameter locking switch is open.→ p. 22, § 2.9.1, "Parameter locking switch"

Table 18 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 operating software FLOWgate500.
W-2002	The Metrology logbook is full. Calibration-relevant parameters can only be modified after the parameter locking switch has been opened. The Metrology logbook can be reset using the operating software FLOWgate500. → p. 73, § 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 max. flow. If the flow is within the permissible range, check whether the selected output scaling (= pulse factor) is correct. → p. 74, § 6.1 "Contacting Customer Service"
W-2008	Flow measurement is in status "Warning". Have the device checked by Customer Service. → p. 74, § 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 using the operating software FLOWgate500. W-2009 = flow rate below warning limit, W-2010 = flow rate above warning limit.
W-2010	
W-2016	Battery 1 failure. → p. 80, § 7.3.2 "Changing the battery packs"
W-2017	Battery 2 failure. ● With external power supply: → p. 79, § 7.2.2 "Changing the backup battery" ● For battery operation: → p. 80, § 7.3.2 "Changing the battery packs"
W-2018	External power supply failure. Check the connection and function of the external power supply. → p. 39, § 3.4.8 "Operation with external power supply".

Table 19 Error messages

Status message	Description/clearance
E-3001	The Event logbook is full. Check the Event logbook. The Event logbook can be reset using the operating software FLOWgate500.
E-3006	Checksum error → p. 74, § 6.1 "Contacting Customer Service".
E-3007	Time invalid → p. 52, § 4.1 "Sequence of start-up".
E-3009	The FLOWSIC500 is in calibration mode. → p. 70, § 5.2.8.2, "Starting and terminating calibration mode".
E-3010	Temperature transmitter failure. The FLOWSIC500 uses the default value specified. → p. 82, § 7.5 "Exchanging an external pressure or temperature transmitter" → p. 74, § 6.1 "Contacting Customer Service".
E-3012	Pressure transmitter failure. The FLOWSIC500 uses the default value specified. → p. 82, § 7.5 "Exchanging an external pressure or temperature transmitter" → p. 74, § 6.1 "Contacting Customer Service".
E-3013	Device is outside the permissible measurement pressure range. Check Pmin/Pmax vs. pressure.
E-3014	Flow measurement is in status "Malfunction", → p. 74, § 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. 60, § 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. 17, § If larger reverse flows occur regularly, contact Customer Service to have the preconfigured volume adapted. → p. 74, § 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 = Gas temperature is above the alarm limit E-3021 = Gas pressure is below the alarm limit E-3022 = Gas pressure is above the alarm limit Check the set alarm limit values. → p. 67, § 5.2.5.7 "Temperature parameters"
E-3020	
E-3021	
E-3022	

6.3 Additional messages in the Event logbook

The FLOWSIC500 saves all status messages (→ p. 74, § 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 20 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.*)

Table 21 Warning messages in the Event logbook

Status message	Description/clearance
W-2011	The number of valid measurements (performance of flow measurement) is significantly lower than normal.*)
W-2012	Flow measurement is performed at reduced speed.*)
W-2013	Flow rate higher than 120% Q_{max}.

Table 22 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 measurement.*)
E-3016	Number of valid measurements (performance of flow measurement) is not sufficient.*)

In the Event logbook, additional data, e.g. status, meter 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 operating software FLOWgate500 (→ p. 72, § 5.4).

FLOWSIC500

7 Maintenance

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

7.1 Information on handling lithium batteries

WARNING: Risk of explosion - hazard for intrinsic safety

- ► Only the exchangeable battery packs from SICK with Part Nos. 2064018 and 2065928 may be used.
- ► Do not use damaged batteries; they must be disposed of correctly!

WARNING:

Do not transport used battery packs by air freight!

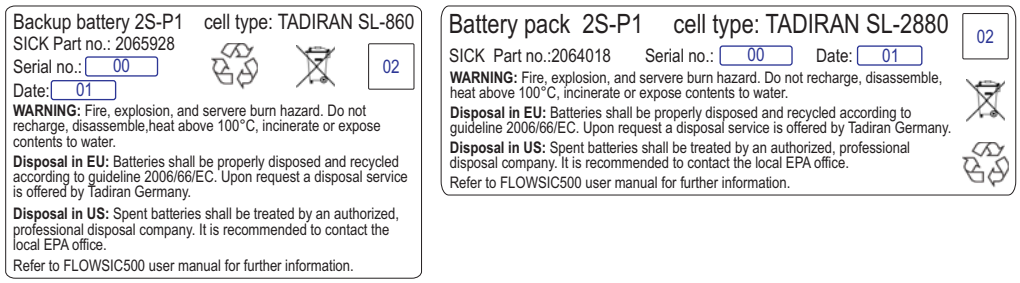
- ► Always remove used battery packs before shipment of the complete FLOWSIC500 or the meter cartridge.
- ► For weight reasons, the battery packs should always be removed before transport by air.

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

Table 23 Marking

Symbol	Significance
	Do not dispose with household trash.
	Recycling

Fig. 34 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.

If both the supply voltage and the backup battery fail, the clock setting is lost and the FLOWSIC500 does not measure anymore. Meter readings 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 Nos. 2064018 and 2065928 may be used.

1 Ensure external voltage supply.
2 Open the electronics cover (→ p. 35, § 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. 35, § 3.4.3)
7 Confirm battery replacement on the display (→ p. 71, § 5.2.12).

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.

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).

The complete failure of both battery packs results in the loss of the clock settings and the FLOWSIC500 does not measure anymore.
Meter readings determined until then as well as the parameter settings remain permanently stored.

7.3.2 Changing the battery packs

WARNING: Risk of explosion - hazard for intrinsic safety
► Only the exchangeable battery packs from SICK with Part Nos. 2064018 and 2065928 may be used.

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

Table 24 Battery fill level

Symbol	Significance	Description
	Battery pack 1 fill level (connection BAT1)	Details on the battery fill level → p. 57, § 5.2.2.
	Battery pack 2 fill level (connection BAT2)	

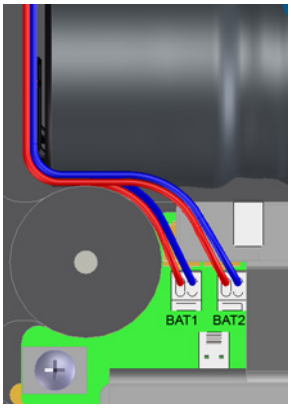
The second battery pack is activated automatically when the first pack is completely empty.

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. 35, § 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. 35 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. 35, § 3.4.3)

7 Confirm battery replacement on the display (→ p. 71, § 5.2.12).

7.4 Function check of a pressure or temperature transmitter

The error status of a transmitter 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 transmitter failure) or 'E-3012' (pressure transmitter failure).

Exchange the transmitter involved when one of these errors is displayed → p. 82, § 7.5.

Replace the gas flow meter or meter cartridge in the device configuration with internal pressure and temperature transmitters.

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

7.5 Exchanging an external pressure or temperature transmitter

WARNING: Hazard through wrong spare parts

The FLOWSIC500 and the delivered pressure and temperature transmitters are designed intrinsically safe.

- ► Only pressure and temperature transmitters from SICK may be used → p. 85, § 8.2.2.
- ► The pressure and temperature transmitters can be connected and disconnected in the hazardous area as well.
- ► The pressure and temperature transmitters may only be connected using the M8 plug-in connectors marked accordingly on the FLOWSIC500.
- ► Modifying the electrical connection parts is not allowed.

7.5.1 Exchanging the pressure transmitter

1 Three-way test valve: Move the knob to the test position (→ Table 13).
Kamstrup test valve: Fit the adapter on the test connection (Part No. 2071841).
2 Unscrew the transmitter 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 Fit the pressure transmitter → p. 45, § 3.5.2.
8 Enter the serial number of the new transmitter in the FLOWSIC500 with the operating software FLOWgate500.
9 Check the function by comparing the operating point or checking the display value (remove adapter on test connection) against a reference measurement.

7.5.2 Exchanging the temperature transmitter

1 Loosen the locknut and pull the temperature transmitter out of the protective tube.
2 Loosen the plug-in connector cover.
3 Disconnect the plug.
4 Guide the plug of the new transmitter 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 transmitter in the protective tube → p. 49, § 3.5.3.
8 Enter the serial number of the new transmitter in the FLOWSIC500 with the operating software FLOWgate500.
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"/DN50 with flange type ANSI150 (ASME B16.5)	2067403
Mounting set for meter installation 4"/DN50 with flange type ANSI150 (ASME B16.5)	2067404
Mounting set for meter installation 6"/DN50 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"/DN50 with flange type PN16 (EN1092-1)	2067407
Mounting set for meter installation 4"/DN50 with flange type PN16 (EN1092-1)	2067408
Mounting set for meter installation 6"/DN50 with flange type PN16 (EN1092-1)	2067409
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
Intrinsically safe power supply JBZ-02; input voltage 10.5... 15V, nominal 12V; ATEX II(2)G [EX ib] IIC; DIN rail mounting; degree of protection IP20; operating temperature: -25°C... +60°C	6050601
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
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
Screw-in protective tube set, G1/2 082 -40°C	2068735
Tamper-proof protection of connectors	2067397

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: Kamstrup test valve BDA04 (G1/4"), fitting with ferrule	2071098
Hose connection set DN4 RP1/4	2071841
Thermowell, gasket for use in -25°C to 60°C	2068309
Thermowell, gasket for use in -40°C to 70°C	2071768

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	2064018
Backup battery (7.2 V; 2.7 Ah) for intrinsically safe main power supply	2065928
Kit for 2"/DN50 cartridge exchange	2067510
Kit for 3"/DN80 cartridge exchange	2067511
Kit for 4"/DN100 and 6"/DN150 cartridge exchange	2067512
Gasket set for cartridge exchange 2"/DN50	2067394
Gasket set for cartridge exchange 3"/DN80	2067395
Gasket set for cartridge exchange 4"/DN100 + 6"/DN150	2067396

8.2.2 Volume conversion (device option) spare parts

Description	Part No.
EDT23 - digital pressure transmitter; overpressure 0 to 4 bar	2071175
EDT23 - digital pressure transmitter; overpressure 0 to 10 bar	2071174
EDT23 - digital pressure transmitter; overpressure 0 to 20 bar	2071176
EDT23 - digital pressure transmitter; absolute pressure 0.8 to 5.2 bar	2071178
EDT23 - digital pressure transmitter; absolute pressure 2 to 10 bar	2071179
EDT23 - digital pressure transmitter; absolute pressure 4 to 20 bar	2071180
EDT34 - digital temperature transmitter, -25 °C to +60 °C	2071181
EDT34 - digital temperature transmitter, -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 G1/4" to NPT 1/4"	2072456

FLOWSIC500

9 Annex

Conformities and Technical Data
Dimensional drawings
Type plates
Internal terminal assignment
Installation examples

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 97/23/EC
- Directive 94/9/EC (ATEX)
- EMC Directive 2004/108/EC
- Measuring Instruments Directive 2004/22/EC

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
- OIML D11
  General requirements for electronic measuring instruments
- EN 60079-0:2012, EN 60079-11:2012
  Explosive atmospheres - Part 0: Equipment - General requirements; Part 11: Equipment protection by intrinsic safety "i"
- IEC 60079-0: 2011 (6th Edition)
  Explosive atmospheres - Part 0: Equipment - General requirements
- 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	
Measuring ranges	Volume flow a.c., DN 50	1.0 ... 160 m^3/h (46 ... 5,650 cfh)
	Volume flow a.c., DN 80	2.5 ... 400 m^3/h (88 ... 14,125 cfh)
	Volume flow a.c., DN 100	4 ... 650 m^3/h (141 ... 22,955 cfh)
	Volume flow a.c., DN 150	4 ... 1,000 m^3/h (141 ... 35,314 cfh)
Repeatability	≤ 0.1%	
Accuracy	Accuracy class 1, typical error limits: Q_{min} up to 0.1 Q_{max}: ≤ ± 1.0 % 0.1 Q_{max} up to Q_{max}: ≤ ± 0.5 %	
	Accuracy class 1, maximum allowed error limits: Q_{min} up to 0.1 Q_{max}: ≤ ± 2 % 0.1 Q_{max} up to Q_{max}: ≤ ± 1 % After high-pressure flow calibration: ± 0.2% at test pressure, otherwise ± 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. 88, §9.1	
Ex approvals	IECEx	Ex ia [ia] IIB T4 Gb
	ATEX	II 2G Ex ia [ia] IIB T4 Gb
	NEC/CEC (US/CA)	CSA: I. S. for Class 1 Division 1 Groups C&D T4, Ex/AEx ia IIB T4 Ga
IP classification	IP 66	
Outputs and interfaces		
Digital outputs	3 open-collector outputs: Not electrically isolated, f_{max} = 10 Hz *or* 1 output: According to EN 60947-5-6 (NAMUR), f_{max} = 2 kHz, optically isolated	Output of: ● LF pulses ● HF pulses ● Status ● Encoder
Interfaces	RS-485 *alternative* to digital outputs (external feed), Optical interface (according to EN62056-21 (Section 4.3)	
Installation		
Dimensions (W x H x D)	See dimensional drawings (→ p. 94, §9.3)	
Weight	See dimensional drawings (→ p. 94, §9.3)	
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.

Table 25 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	● 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. ● Fixed value
Logbooks and Archives		
Logbooks	● Event logbook (1000 entries) ● Parameter logbook (250 entries) ● Metrology logbook (100 entries)	
Archives	● Billing archive (6000 entries) ● Day archive (600 entries) ● Month archive (25 entries)	
Pressure transmitter (only for device option volume conversion)		
Measuring ranges	Absolute pressure transmitters	Relative pressure transmitters
	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)
Temperature transmitter (only for device option volume conversion)		
Measuring ranges	-25 ... +60 ° C	
	-40 ... +70 ° C (optional)	

9.1.4 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 - 1000	706.3 - 35,314.7	1 : 50
	G 650	10.0 - 1000	353.1 - 35,314.7	1 : 100
	G 650	6.2 - 1000	219.0 - 35,314.7	1 : 160
	G 650	5.0 - 1000	176.6 - 35,314.7	1 : 200

9.2 Type plates

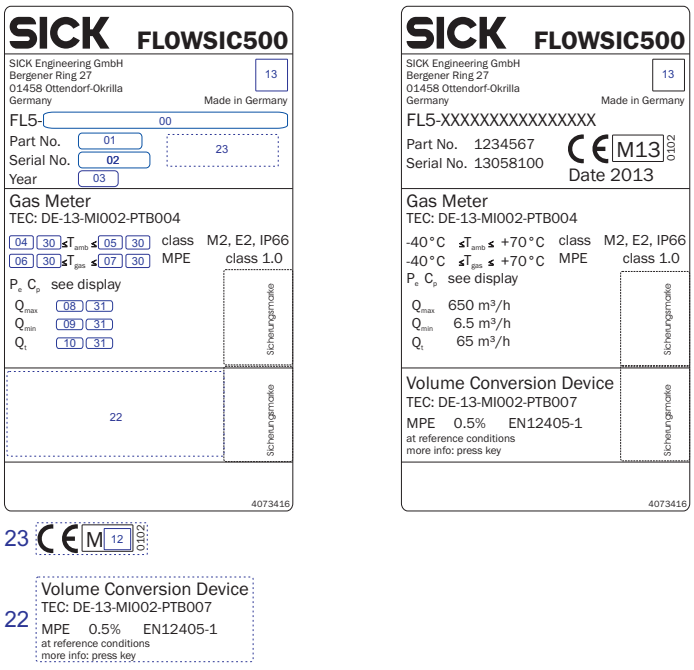
9.2.1 Metrology and electronics type plates

Fig. 36 Legend for type plates

Variable	Bezeichnung	Description
00	Typschlüssel	Devicetyp
01	Artikelnummer	Part Number
02	Seriennummer	Serial Number
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. Flowrate
09	Min. Durchfluss	Min. Flowrate
10	Trenndurchfluss	transition flowrate
12	Jahr (metrologisch) (JJ)	Year (metrologisch) (YY)
13	Datamatrix-Code 01(M)+02(S)	Datamatrix-Code 01(M)+02(S)
	Format: MMMMMMMSSSSSSSS	format: MMMMMMMSSSSSSSS
14	Gasgruppe Ex [IIB, optional IIC]	Gasgroup Ex [IIB, optional IIC]
15	PTB Zulassung	PTB certification
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	Angaben EVCD (nur bei FLOWSIC500 mit Geräteoption Mengenumwertung)	Label EVCD (only for FLOWSIC500 with device option volume conversion)
23	Angaben CE/MID	Label CE/MID
30	Einheit zur Temperatur (04)/(05)/(06)/(07)	Unit of temperature (04)/(05)/(06)/(07)
31	Einheit zum Volumenstrom (08)/(09)/(10)	Unit of volume flow (08)/(09)/(10)

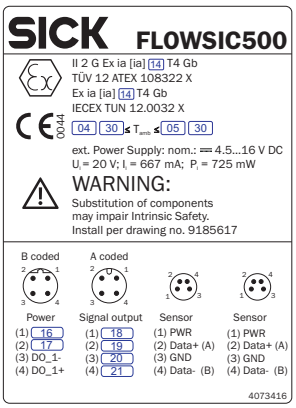
9.2.1.1 Metrology type plate

Fig. 37 Metrology type plate (example)



9.2.1.2 Electronics type plate

Fig. 38 Electronics type plate according to ATEX/IECEx (example)



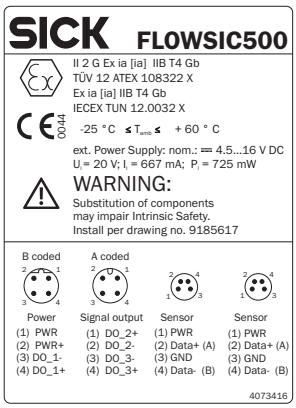
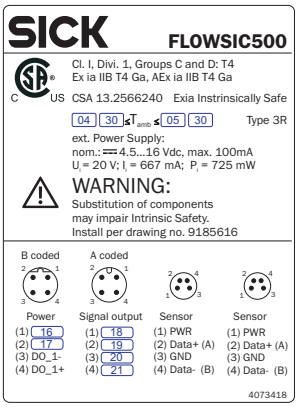
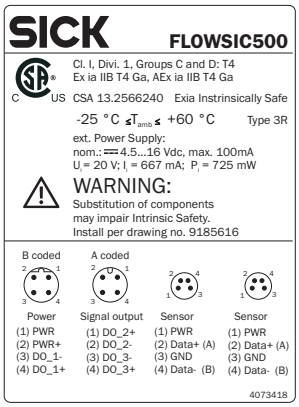


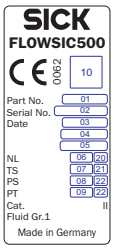
Fig. 39 Electronics type plate according to CSA (example)





9.2.2 Meter body type plate (example)

Fig. 40 Type plate, meter body



Variable	Bezeichnung	Description
01	Artikelnummer	Part number
02	Seriennummer (SSSSSSSS)	Serial number (SSSSSSSS)
03	Datum (MM/JJJJ)	Date (MM/YYYY)
04	Nennweite	Meter 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) Format: MMMMMMMSSSSSSSS	Datamatrix-Code → 01(M) + 02(S) format: MMMMMMMSSSSSSSS
20	Einheit zur Nennlänge 06	Unit of nominal length 06
21	Einheit zur Temperatur 07	Unit of temperature 07
22	Einheit zum Druck 08 & 09	Unit of pressure 08 & 09

9.3 Dimensional drawings

Fig. 41 Dimensions

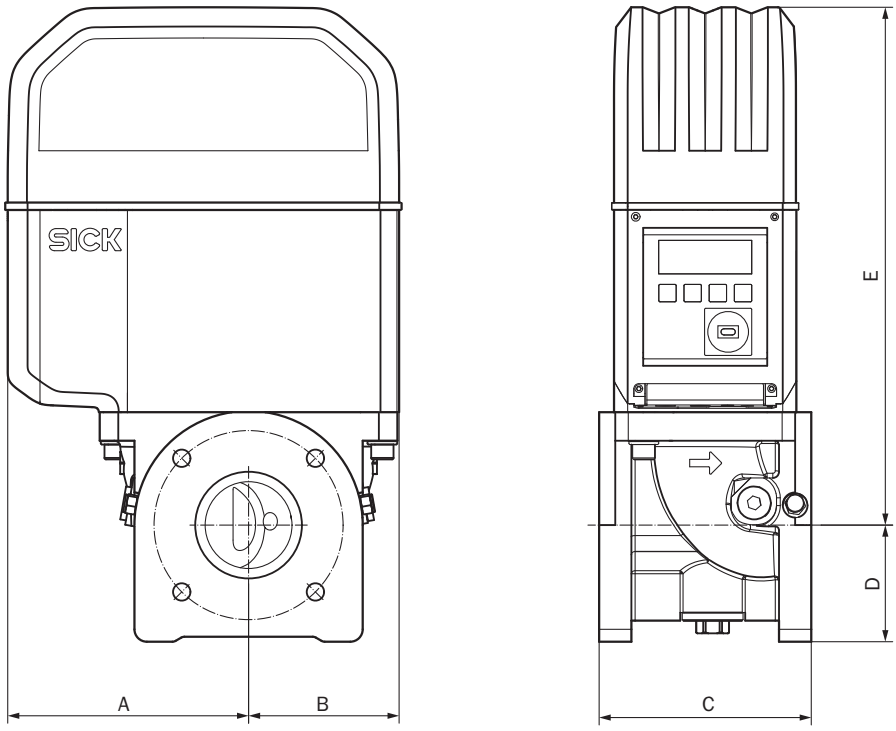


Table 26 Dimensions metrical (imperial)[1]

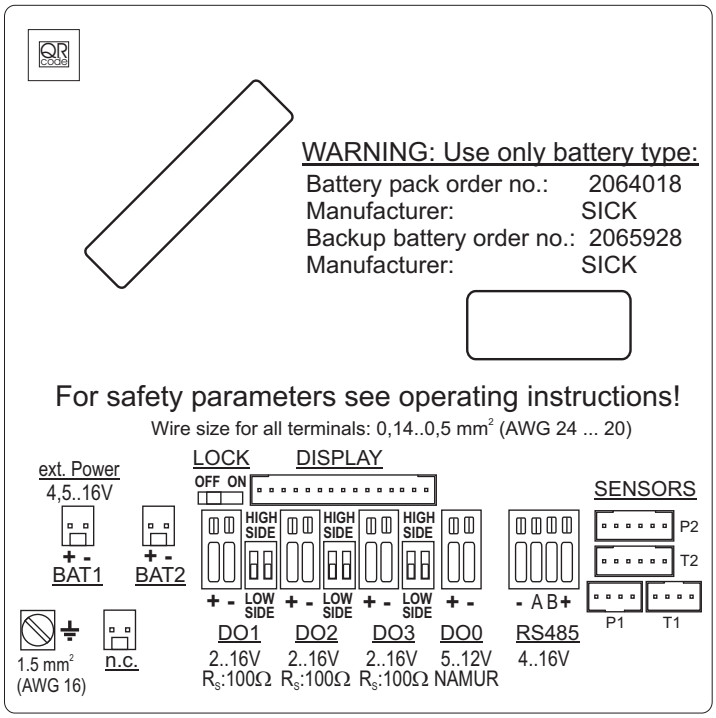
	DN50 (2")		DN80 (3")		DN100 (4")		DN150 (6")
A	153 (6.02)		194 (7.64)		231 (9.09)		232 (9.13)
B	78 (3.07)		121 (4.76)		159 (6.26)		158 (6.22)
C[2]	150 (5.91)	171 (6.73)	171 (6.73)	241 (9.49)	241 (9.49)	300 (11.81)	450 (17.72)
D	71 (2.80)		94 3.70)		108 (4.25)		143 (5.63)
E	272 (10.71)		417 (16.42)		476 (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").

9.4 Internal terminal assignment

Fig. 42 Terminal assignment



9.5 Installation examples

Fig. 43 Battery operation

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

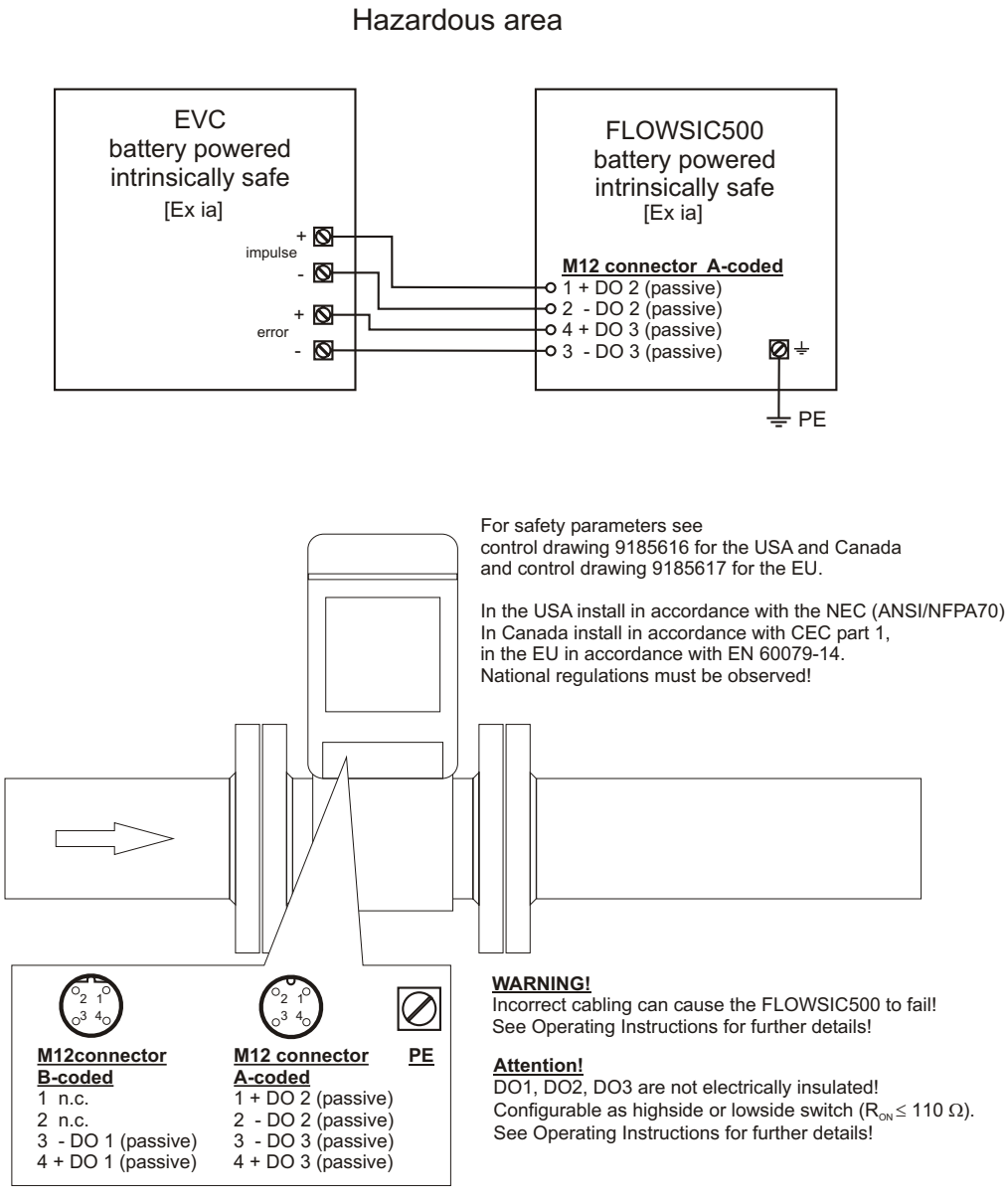
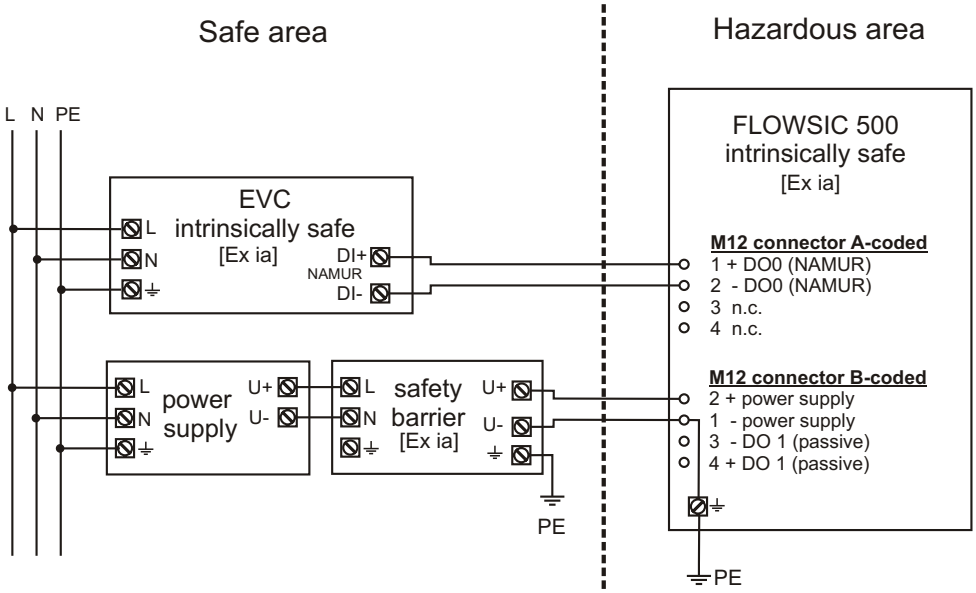
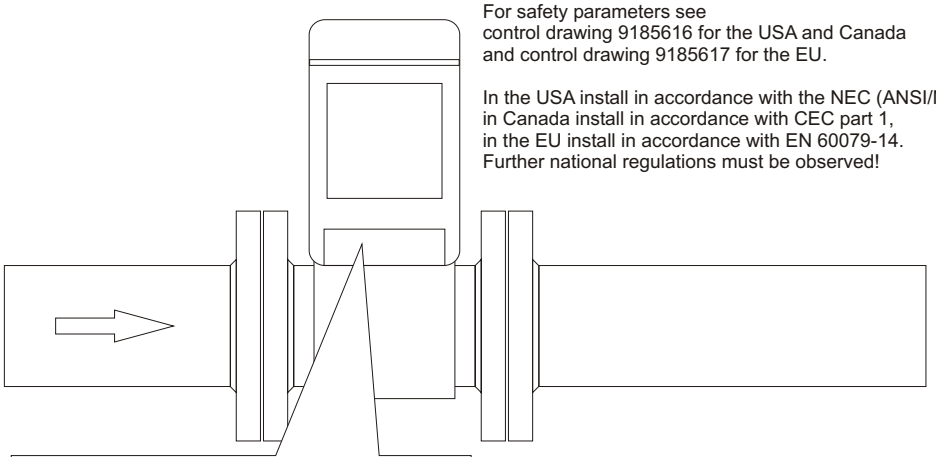


Fig. 44 Operation with safety barrier and external power supply

FLOWSIC500 with HF output powered with safety barrier and external power supply, connected to electronic volume corrector





For safety parameters see
control drawing 9185616 for the USA and Canada
and control drawing 9185617 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!

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

M12connector A-coded
1 + DO0 (NAMUR)
2 - DO0 (NAMUR)
3 n.c.
4 n.c.

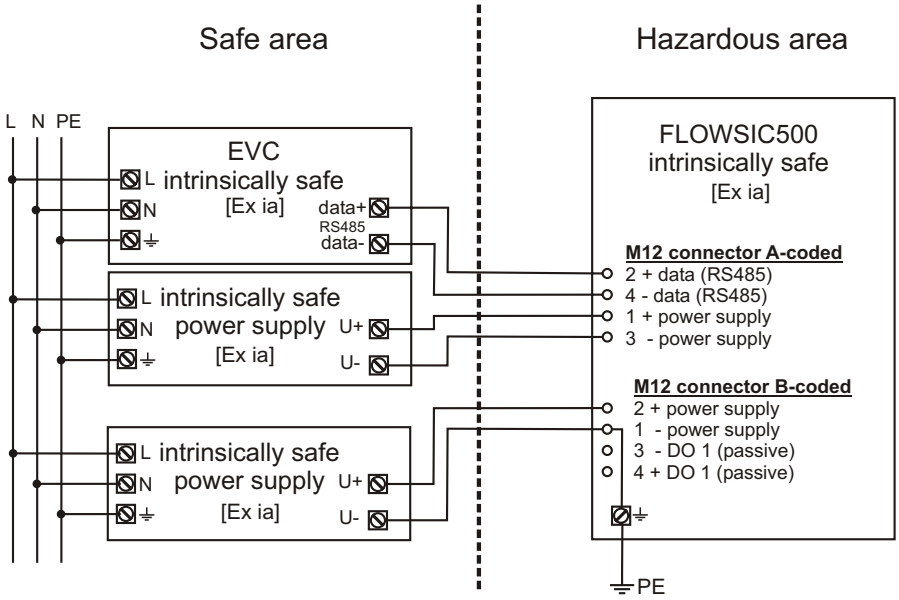
PE

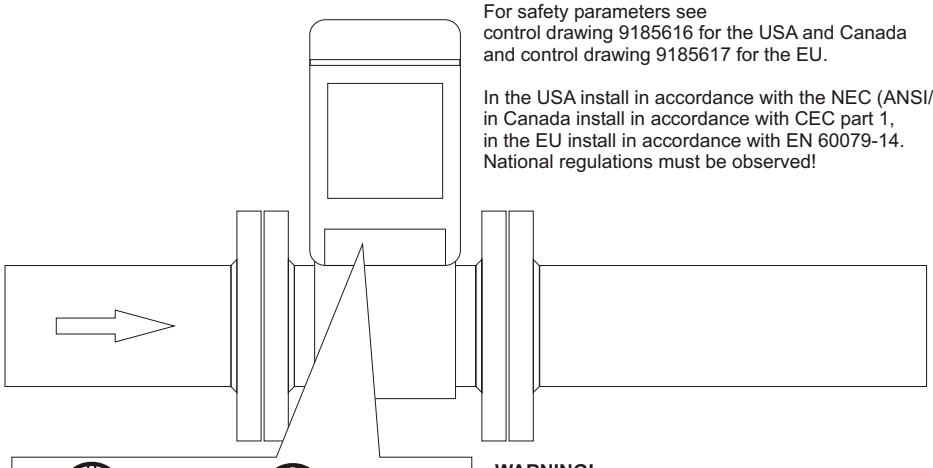
WARNING!
Incorrect cabling can cause the FLOWSIC500 to fail!
See Operating Instructions for further details!

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

Fig. 45 Operation with external power supply (intrinsically safe)

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





For safety parameters see
control drawing 9185616 for the USA and Canada
and control drawing 9185617 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!

M12connector B-coded	M12 connector A-coded	PE
1 - power supply	1 + power supply	
2 + power supply	2 + data (RS485 A)	
3 - DO 1 (passive)	3 - power supply	
4 + DO 1 (passive)	4 - data (RS485 B)	

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

Attention!
RS485 is not electrically insulated, must be powered externally and has no internal termination!
For enviroments with relevant eletromagnetic disturbance and long cables, shielded cables are recommend.

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

Fig. 46 Control diagram 9185616 (page 1)

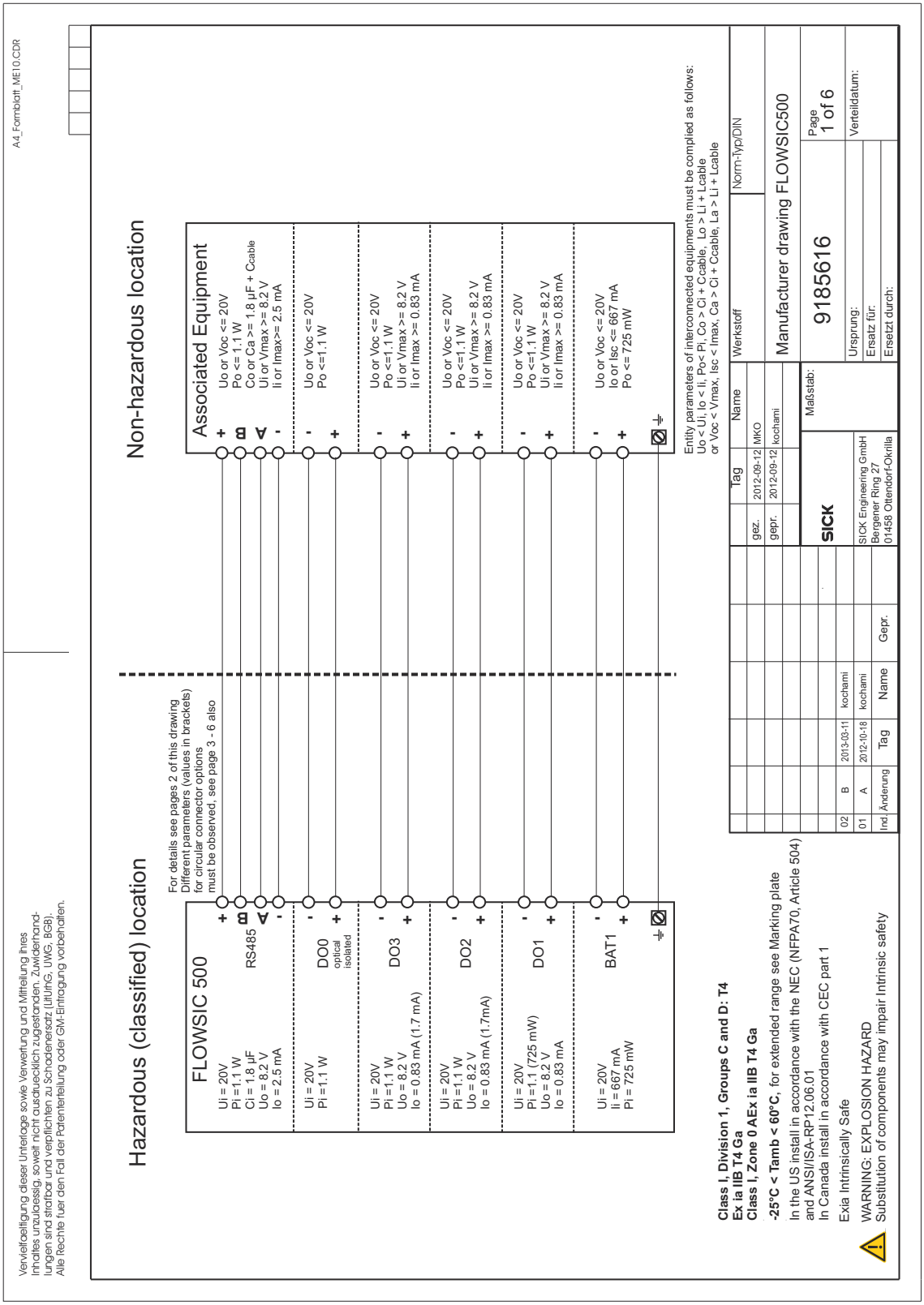


Fig. 47 Control diagram 9185616 (page 2)

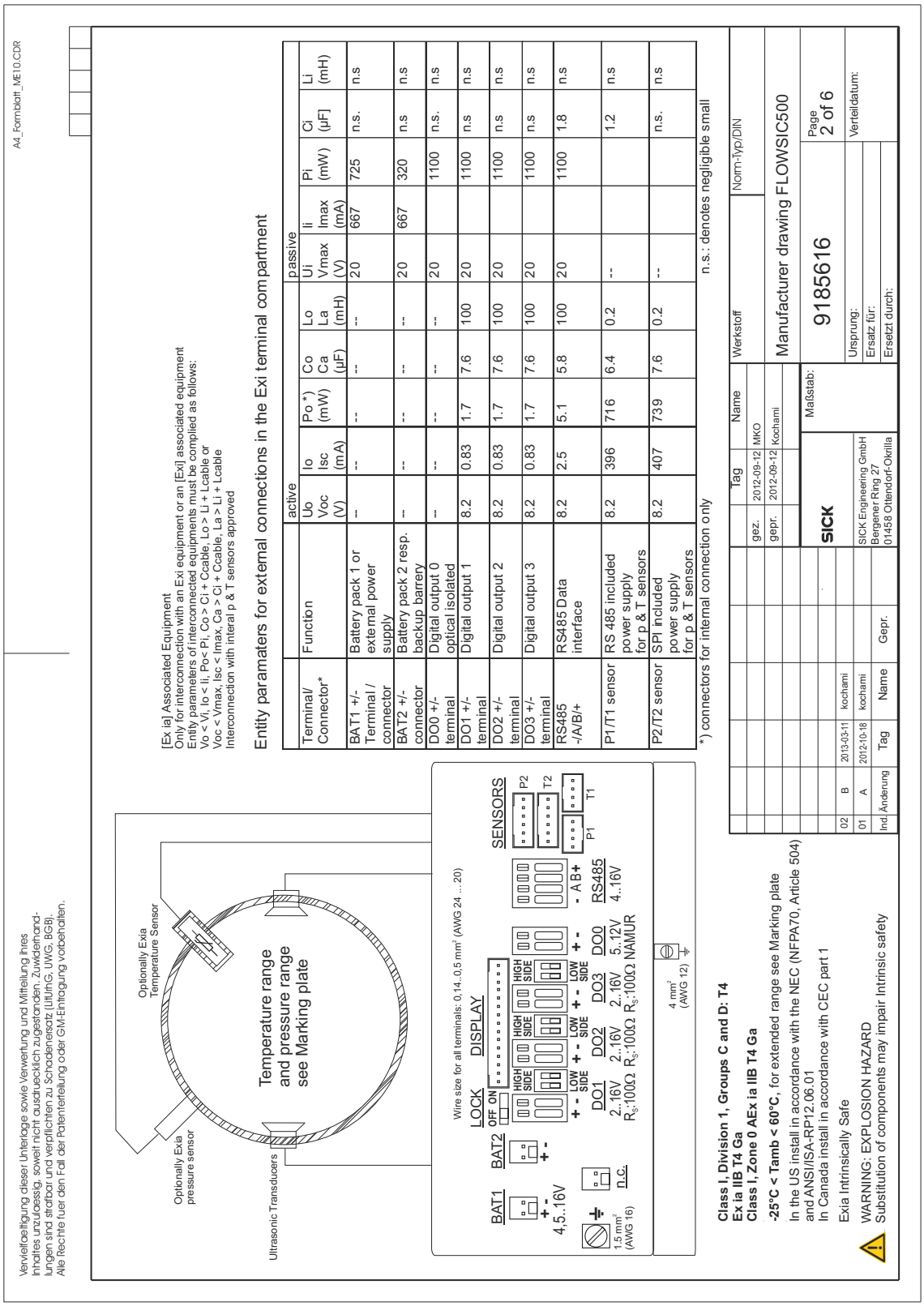


Fig. 48 Control diagram 9185616 (page 3)

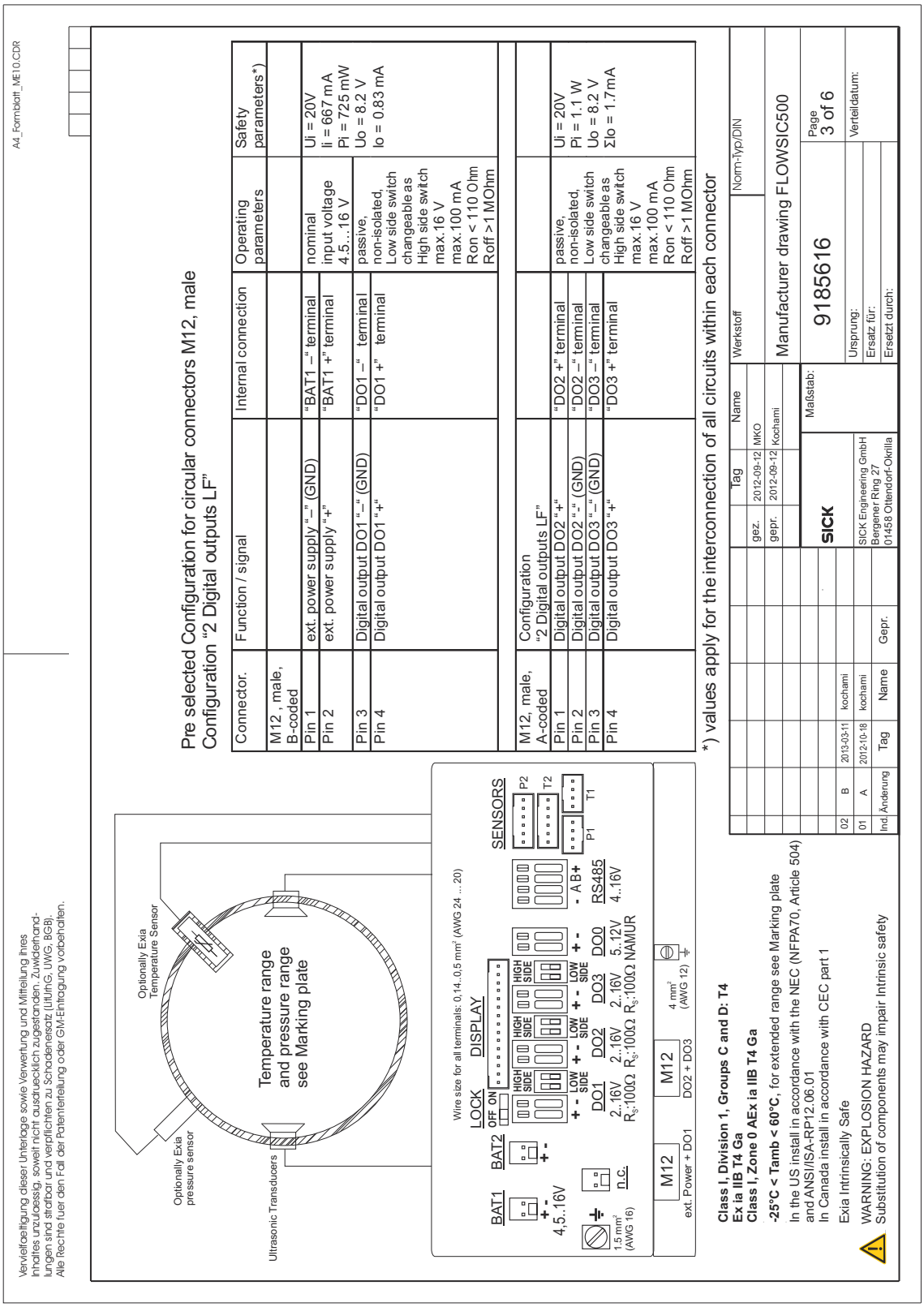


Fig. 49 Control diagram 9185616 (page 4)

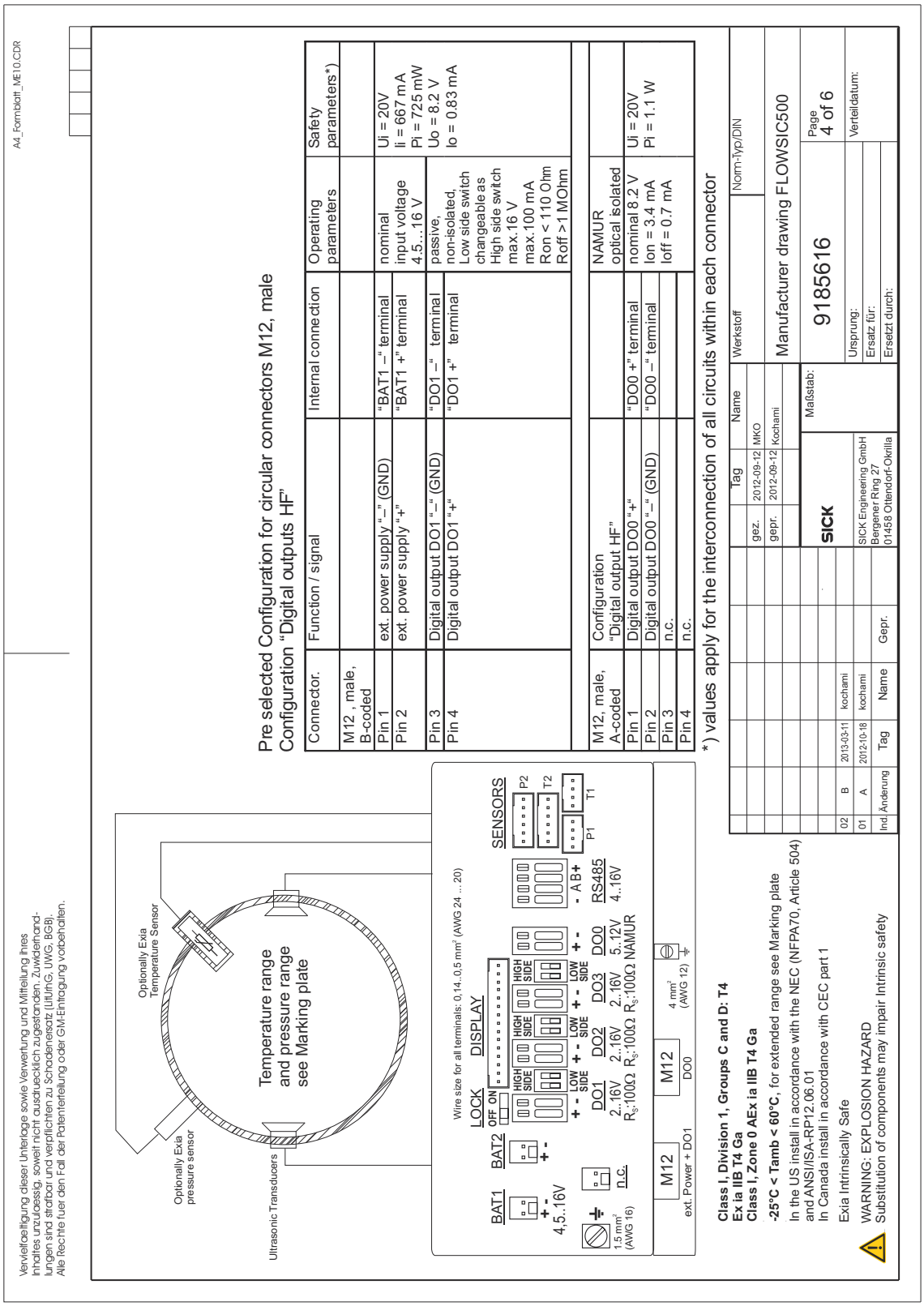


Fig. 50 Control diagram 9185616 (page 5)

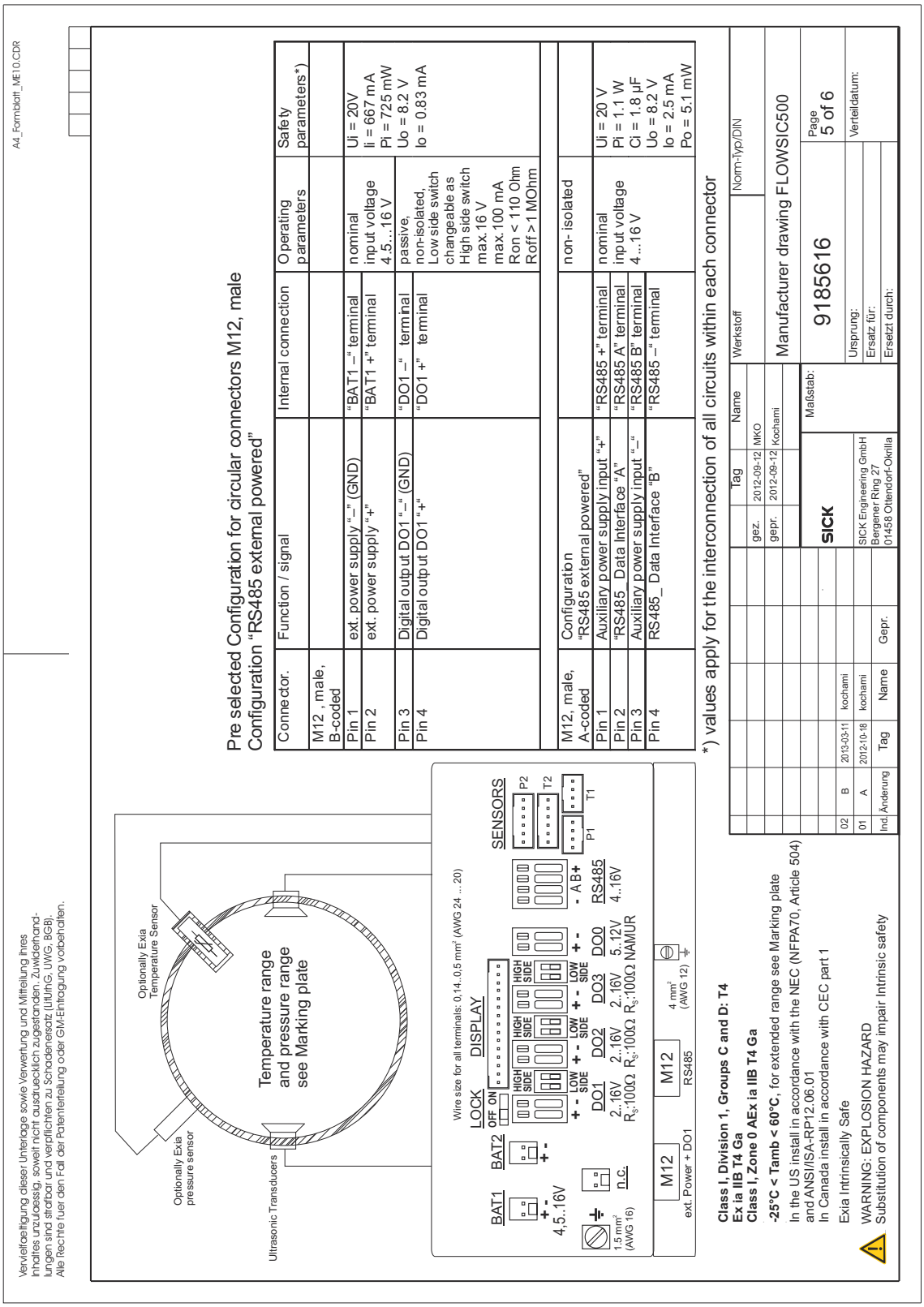
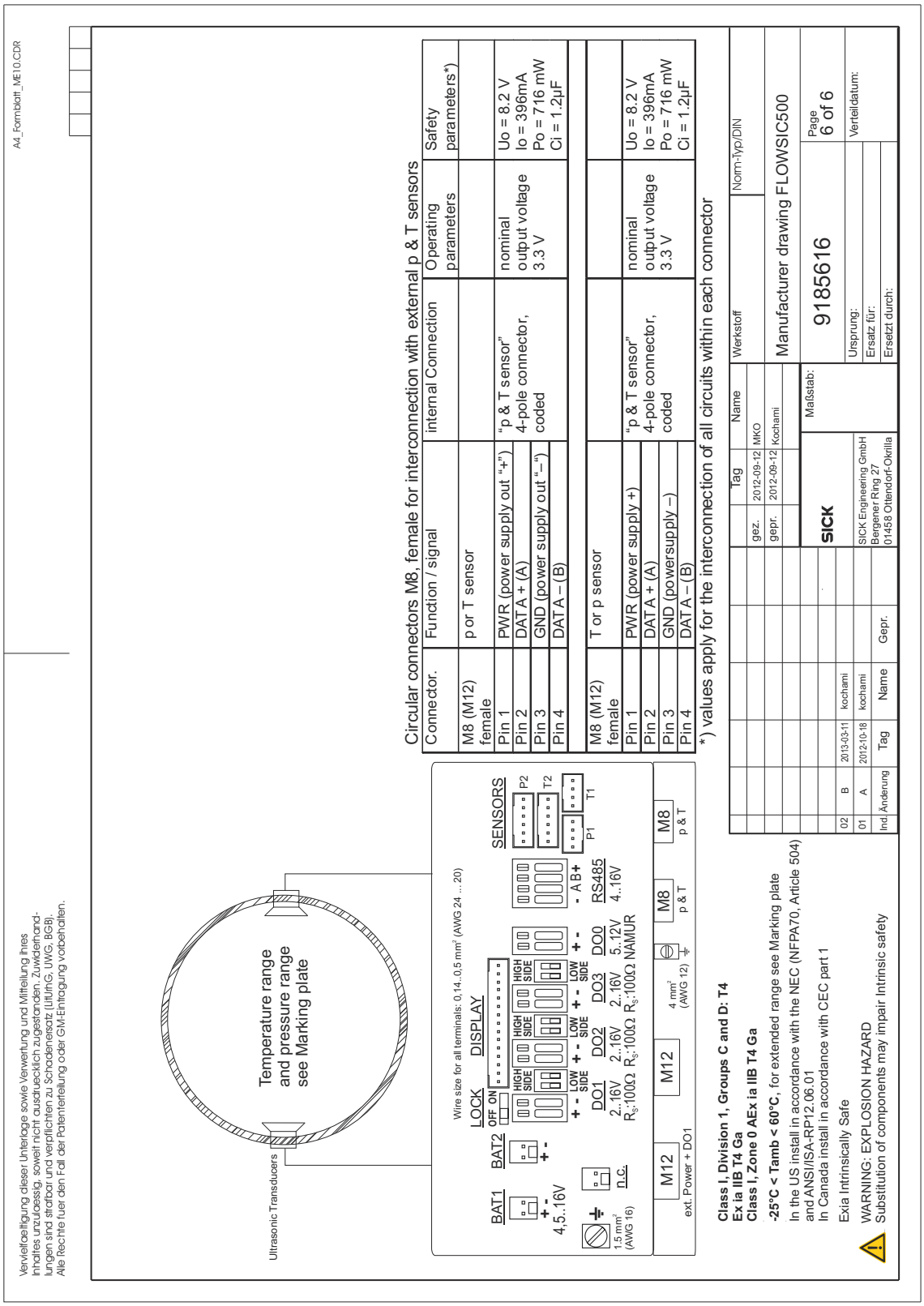


Fig. 51 Control diagram 9185616 (page 6)



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

Fig. 52 Control diagram 9185617 (page 1)

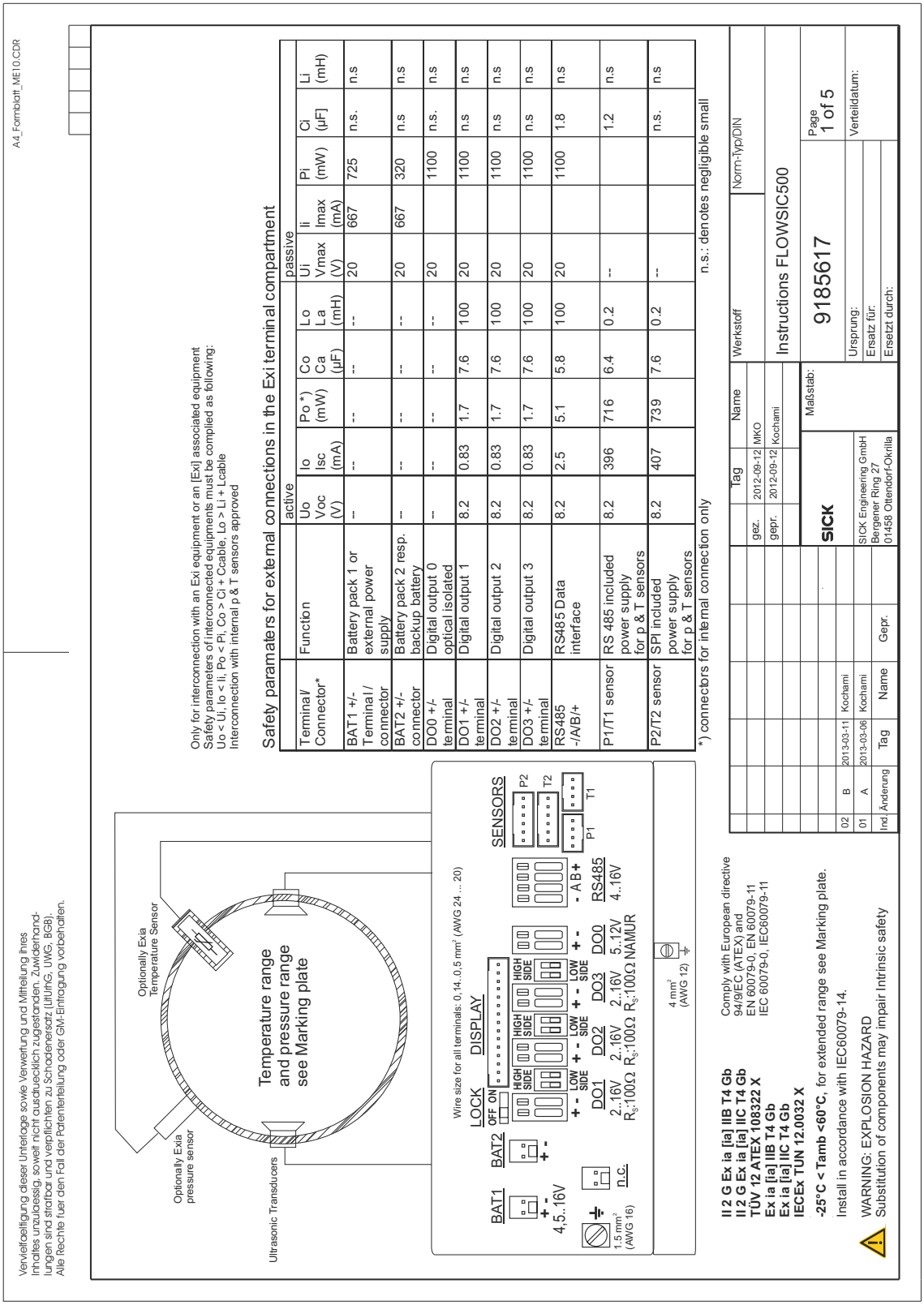


Fig. 53 Control diagram 9185617 (page 2)

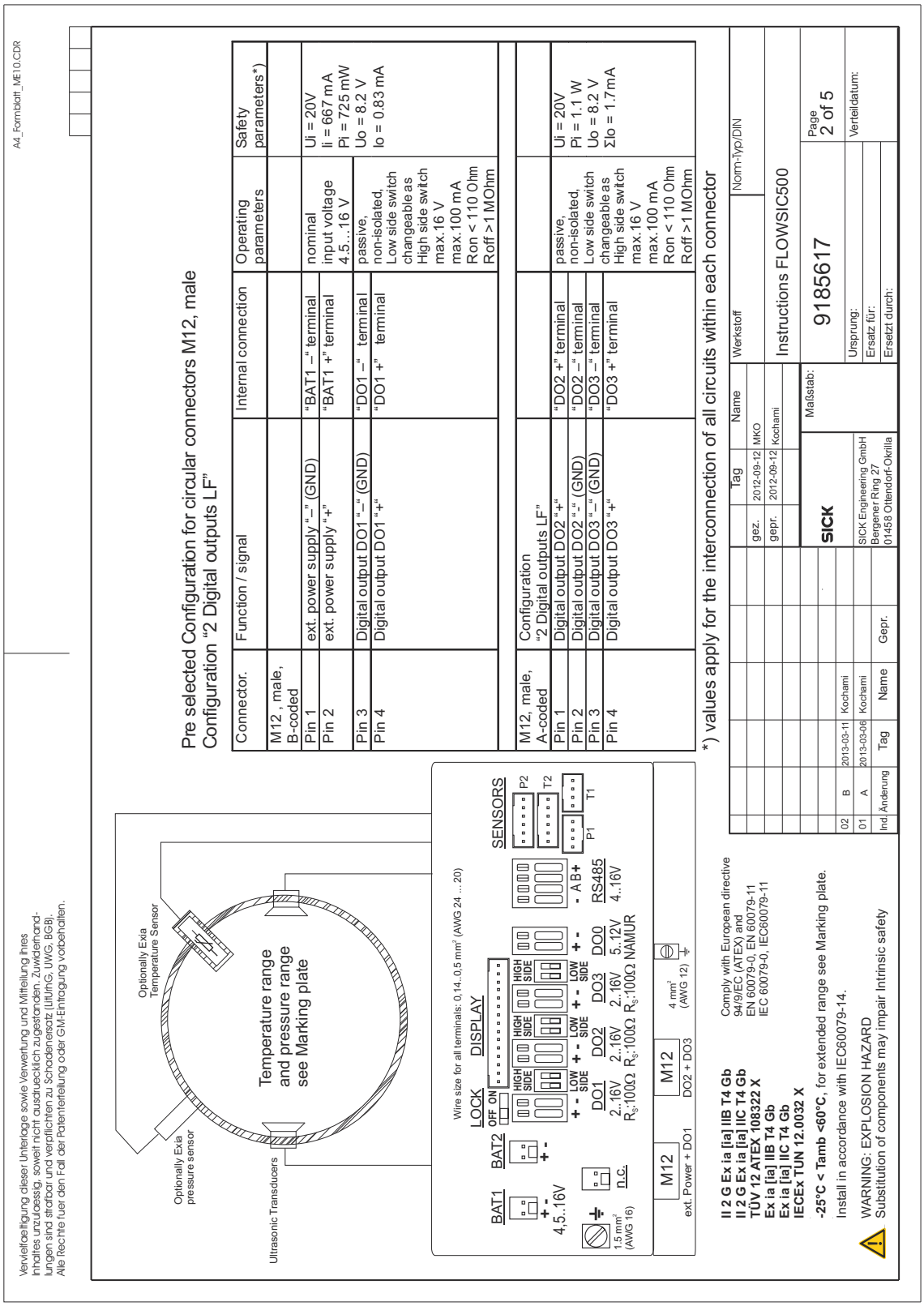


Fig. 54 Control diagram 9185617 (page 3)

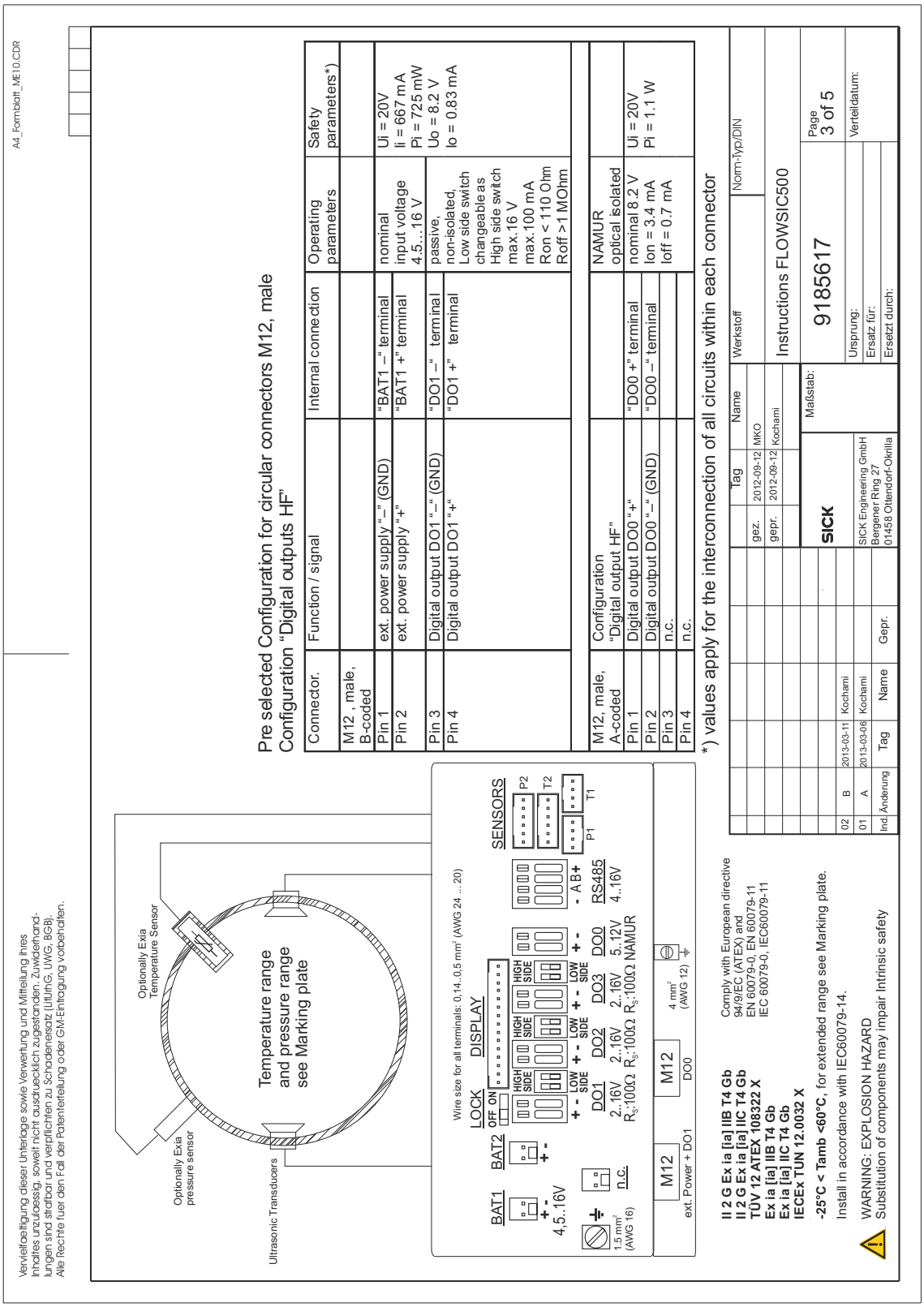


Fig. 55 Control diagram 9185617 (page 4)

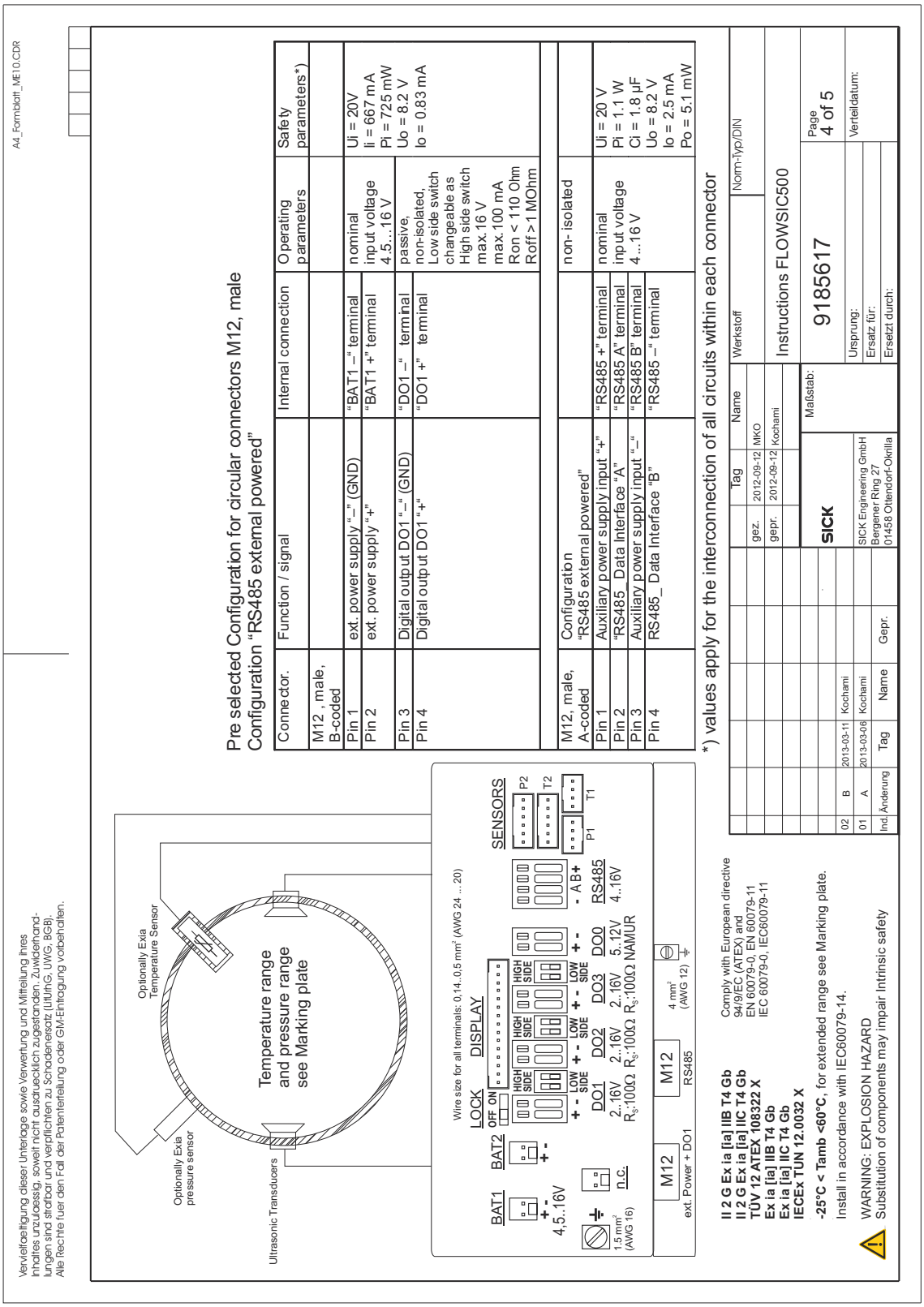
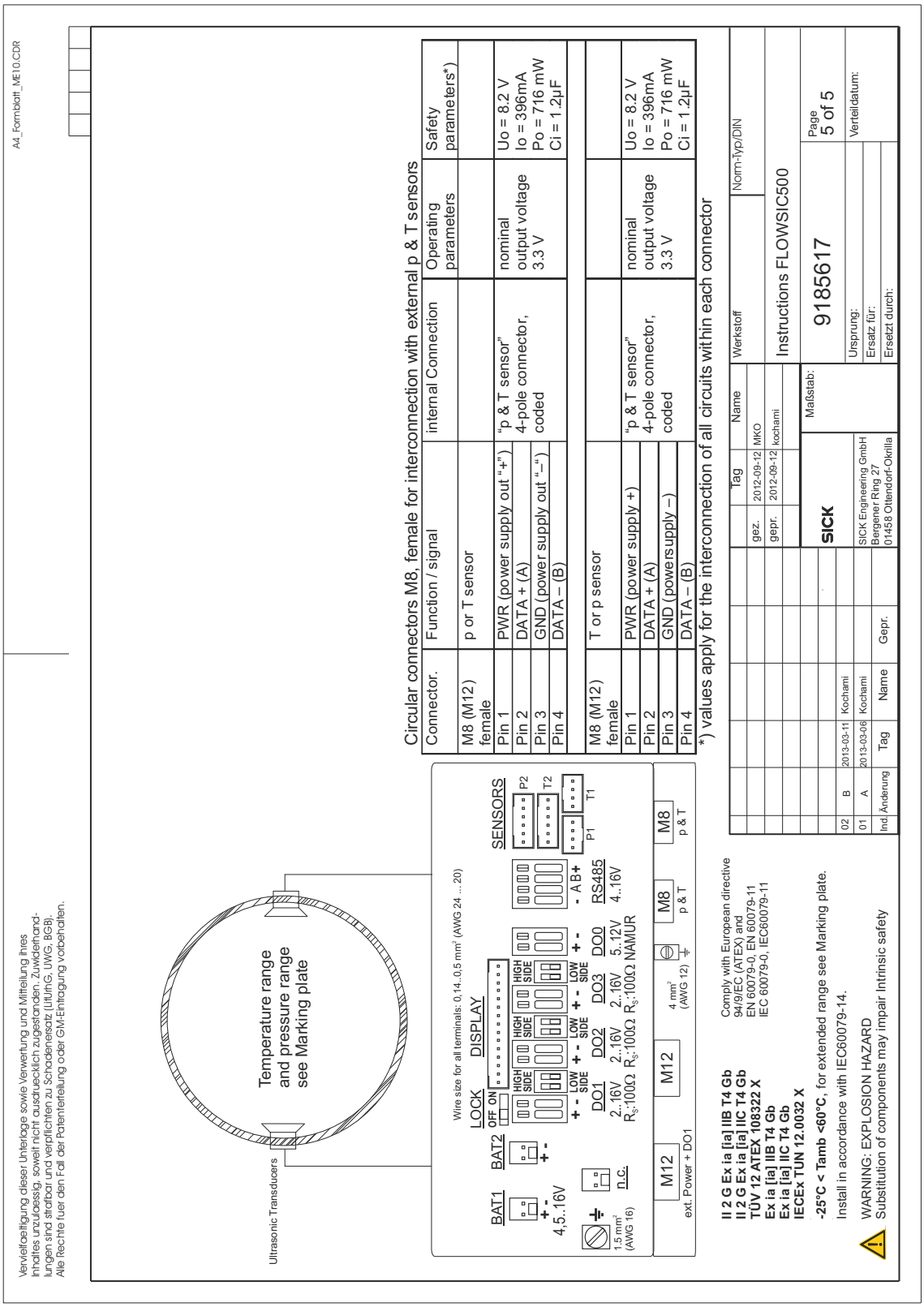


Fig. 56 Control diagram 9185617 (page 5)



8015391/2013-08/2.0/ISubject to change without notice

Australia
Phone +61 3 9457 0600
1800 334 802 – tollfree
E-Mail sales@sick.com.au
Belgium/Luxembourg
Phone +32 (0)2 466 55 66
E-Mail info@sick.be
Brasil
Phone +55 11 3215-4900
E-Mail sac@sick.com.br
Canada
Phone +1 905 771 14 44
E-Mail information@sick.com
Ceská Republika
Phone +420 2 57 91 18 50
E-Mail sick@sick.cz
China
Phone +86 4000 121 000
E-Mail info.china@sick.net.cn
Phone +852-2153 6300
E-Mail ghk@sick.com.hk
Danmark
Phone +45 45 82 64 00
E-Mail sick@sick.dk
Deutschland
Phone +49 211 5301-301
E-Mail kundenservice@sick.de
España
Phone +34 93 480 31 00
E-Mail info@sick.es
France
Phone +33 1 64 62 35 00
E-Mail info@sick.fr
Great Britain
Phone +44 (0)1727 831121
E-Mail info@sick.co.uk
India
Phone +91–22–4033 8333
E-Mail info@sick-india.com
Israel
Phone +972-4-6881000
E-Mail info@sick-sensors.com
Italia
Phone +39 02 27 43 41
E-Mail info@sick.it
Japan
Phone +81 (0)3 3358 1341
E-Mail support@sick.jp
Magyarország
Phone +36 1 371 2680
E-Mail office@sick.hu
Nederlands
Phone +31 (0)30 229 25 44
E-Mail info@sick.nl
Norge
Phone +47 67 81 50 00
E-Mail austefjord@sick.no
Österreich
Phone +43 (0)22 36 62 28 8-0
E-Mail office@sick.at
Polska
Phone +48 22 837 40 50
E-Mail info@sick.pl
România
Phone +40 356 171 120
E-Mail office@sick.ro
Russia
Phone +7-495-775-05-30
E-Mail info@sick.ru
Schweiz
Phone +41 41 619 29 39
E-Mail contact@sick.ch
Singapore
Phone +65 6744 3732
E-Mail admin@sicksgp.com.sg
Slovenija
Phone +386 (0)1-47 69 990
E-Mail office@sick.si
South Africa
Phone +27 11 472 3733
E-Mail info@sickautomation.co.za
South Korea
Phone +82 2 786 6321/4
E-Mail info@sickkorea.net
Suomi
Phone +358-9-25 15 800
E-Mail sick@sick.fi
Sverige
Phone +46 10 110 10 00
E-Mail info@sick.se
Taiwan
Phone +886 2 2375-6288
E-Mail sales@sick.com.tw
Türkiye
Phone +90 (216) 528 50 00
E-Mail info@sick.com.tr
United Arab Emirates
Phone +971 (0) 4 88 65 878
E-Mail info@sick.ae
USA/México
Phone +1(952) 941-6780
1 (800) 325-7425 – tollfree
E-Mail info@sickusa.com

More representatives and agencies
at **www.sick.com**

SICK
Sensor Intelligence.