

**FLAWSIC600**  
**Ultrasonic Gas Flow Meter**



**Ultrasonic Gas Flow Meter  
for Custody Transfer  
and Process Applications**

**MEPAFLOW600 CBM and Firmware V3.6.xx**



## Document Information

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## Glossary

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Abbreviations used in this manual

act.	actual (under operating/flowing conditions)
AGC	<b>A</b> utomatic <b>G</b> ain <b>C</b> ontrol
ANSI	<b>A</b> merican <b>N</b> ational <b>S</b> tandards <b>I</b> nstitute
ASCII	<b>A</b> merican <b>S</b> tandard <b>C</b> ode for <b>I</b> nformation <b>I</b> nterchange
ASME	<b>A</b> merican <b>S</b> ociety of <b>M</b> echanical <b>E</b> ngineers
ATEX	<b>A</b> tmosphères <b>E</b> xplosifs: Abbreviation for European standards that govern safety in potentially explosive atmospheres
AWG	<b>A</b> merican <b>W</b> ire <b>G</b> age
CBM	<b>C</b> ondition <b>B</b> ased <b>M</b> aintenance
CSA	<b>C</b> anadian <b>S</b> tandards <b>A</b> ssociation
DC	<b>D</b> irect <b>C</b> urrent
DIN	<b>D</b> eutsches <b>I</b> nstitut für <b>N</b> ormung
DN	<b>N</b> ominal <b>D</b> iameter (internal)
DSP	<b>D</b> igital <b>S</b> ignal <b>P</b> rocessor
EC	<b>E</b> uropean <b>C</b> ommunity
EMC	<b>E</b> lectro <b>M</b> agnetic <b>C</b> ompatibility
EN	<b>E</b> uro <b>N</b> orm (European Standard)
EVC	<b>E</b> lectronic <b>V</b> olume <b>C</b> orrector
Ex	Potentially <b>e</b> xplosive atmosphere
HART®	Communication interface
IEC	<b>I</b> nternational <b>E</b> lectrotechnical <b>C</b> ommission
IECEX	EC system for certification in accordance with standards for devices for use in potentially explosive atmospheres
LCD	<b>L</b> iquid <b>C</b> rystal <b>D</b> isplay
LED	<b>L</b> ight <b>E</b> mitting <b>D</b> iode
MDR	<b>M</b> anufacturer <b>D</b> ata <b>R</b> ecord
MEPAFLOW	<b>M</b> enu-assisted <b>P</b> arameterization and <b>D</b> iagnosis for <b>F</b> LOWSIC600
NAMUR	<b>N</b> ormenarbeitsgemeinschaft für <b>M</b> ess- und <b>R</b> egeltechnik in der chemischen Industrie (now "Interessengemeinschaft Prozessleittechnik der chemischen und pharmazeutischen Industrie"; ~ Association for Instrumentation and Control Standards in the Chemical Industry)
norm.	<b>n</b> ormalized/corrected (under standard conditions)
OI	<b>O</b> perating <b>I</b> nstructions
OIML	<b>O</b> rganisation <b>I</b> nternationale de <b>M</b> etrologie <b>L</b> egale
PC	<b>P</b> ersonal <b>C</b> omputer
PTB	<b>P</b> hysikalisch <b>T</b> echnisch <b>B</b> undesanstalt (~ Federal Metrology Office in Germany)
Reg. #	<b>R</b> egister number
RTU	<b>R</b> emote <b>T</b> erminal <b>U</b> nit
SNR	<b>S</b> ignal <b>N</b> oise <b>R</b> atio
SPU	<b>S</b> ignal <b>P</b> rocessing <b>U</b> nit
TI	<b>T</b> echnical <b>I</b> nformation
VDE	<b>V</b> erband <b>d</b> er <b>E</b> lektrotechnik <b>E</b> lektronik <b>I</b> nformationstechnik (~ Association of German Electrical Engineers)

## Warning Symbols

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Hazard (general)



Hazard in potentially explosive atmospheres



Hazard by voltage

## Warning Levels / Signal Words

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### **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**

Hazard which *could* result in property damage.

## Information Symbols

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Information about the use in potentially explosive atmospheres



Important technical information for this product



Important information on electric or electronic functions



Supplementary information



Link to information at another place

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# FLWSIC600

## 1 Important Information

About this document

Scope of document

Safety instructions

Authorised staff

General safety instructions and protective measures

Dangers due to hot, corrosive and explosive gases and high pressure

Dangers due to heavy loads

Environmental information and instructions for disposal

## 1.1 About this document

This manual describes the FLOWSIC600 measuring system, which is used to determine the volumetric flow rate, volume and speed of sound in gases transported in pipelines. It provides general information on the measuring method employed, design and function of the entire system and its components, on planning, assembly, installation, calibration commissioning, maintenance and troubleshooting. A detailed description of the various system capabilities, options and settings which will assist in optimizing the meter configuration for a specific application is also included.

This manual covers standard applications which conform with the technical data specified. Additional information and assistance for special applications are available from your SICK representative. However, it is generally recommended that advantage be taken of qualified consulting services provided by SICK experts for your specific application.

This manual is a part of the FLOWSIC600 device documentation.

**Documentation available via [www.FLOWSIC600.com](http://www.FLOWSIC600.com) or from your local representative:**

- FLOWSIC600 MODBUS specification document
- FLOWSIC600 HARTbus specification document
- FLOWSIC600 Technical Bulletin ENCODER Output

**Documentation available from your local representative after training:**

- FLOWSIC600 service manual
- FLOWSIC600 extraction tool operating instructions

## 1.2 Scope of document



This document applies to meters with firmware version 3.6.00 or higher and extended memory for the storage of e.g. hourly and daily mean values.

The software description in this document applies to MEPAFLOW600 CBM V1.3.00.

The following terms will be used for measurands:

Measurand	Basic abbreviations and units for FLOWSIC600			Abbreviations used for LCD-Display of SPU			MEPAFLOW600 CBM software		
Volume at flowing conditions	Vf	m <sup>3</sup>	acf	Vf	m <sup>3</sup>	cf	Vf	m <sup>3</sup>	acf
Volume at base conditions	Vb	Nm <sup>3</sup>	scf	Vb	m <sup>3</sup>	cf	Vb	Nm <sup>3</sup>	scf
Error volume at flowing conditions	Ef	m <sup>3</sup>	acf	Ef	m <sup>3</sup>	cf	Ef	m <sup>3</sup>	acf
Error volume at base conditions	Eb	Nm <sup>3</sup>	scf	Eb	m <sup>3</sup>	cf	Eb	Nm <sup>3</sup>	scf
Total volume at flowing conditions	Vo	m <sup>3</sup>	acf	Vo	m <sup>3</sup>	cf	Vo	m <sup>3</sup>	acf
Volume flow at flowing conditions	Qf	m <sup>3</sup> /h	acf/h	Qf	m <sup>3</sup> /h	cf/h	Qf	m <sup>3</sup> /h	acf/h
Volume flow at base conditions	Qb	Nm <sup>3</sup> /h	scf/h	Qb	m <sup>3</sup> /h	cf/h	Qb	Nm <sup>3</sup> /h	scf/h
Mass counter	M	t	lbs	M	t	lbs	M	t	lbs
Error Mass	Me	t	lbs	M	t	lbs	M	t	lbs
Mass flow at base conditions	Mf	t/h	lbs/h	M	t/h	lbs/h	M	t/h	lbs/h

## 1.3 Safety instructions

### 1.3.1 Intended use of the equipment

The FLOWSIC600 measuring system is used for measuring the actual volumetric flow rate of gases transported in pipelines. It can be used for measuring the actual corrected volume and the speed of sound in gases.

The measuring system shall only be used as specified by the manufacturer and as set forth below. Always observe the following information:

- Make sure the use of the equipment complies with the technical data, information about the permitted use, assembly and installation specifications and ambient as well as operating conditions. Relevant information is provided in the order documentation, type plate, certification documents and this manual.
- Any actions for the purpose of maintaining the value of the equipment, e.g. service and inspection, transport and storage etc., shall be performed as specified.
- Do not expose the equipment to mechanical stress, such as pigging.
- The flooding of the FLOWSIC600 with any liquid (e.g. for pressure or leakage tests) is deemed improper use. The consequences of such actions can not be foreseen or estimated. Improper use may result in failure of the ultrasonic transducers and consequently, failure of the entire flow meter.

Should it be necessary to flood the FLOWSIC600, please contact the manufacturer prior to doing so. In addition, the following instructions must be strictly adhered to:

**WARNING:**

- ▶ The pressure during flooding may not exceed more than 1,2 times the nominal pressure (when transducers are assembled).

### 1.4 Authorized staff

Persons responsible for safety shall ensure the following:

- Any work on the measuring system shall only be carried out by qualified staff and must be approved by skilled staff responsible for the plant.  
Due to their professional training, knowledge and vocational experience, as well as their knowledge of the relevant standards, regulations, health and safety regulations and equipment conditions, qualified persons shall be assigned by the person responsible for personal and plant safety to carry out such work. Qualified persons must be able to identify possible dangers and to take preventive action in due time. Skilled persons are defined in DIN VDE 0105 and IEC 364, or comparable standards.
- Skilled persons shall have precise knowledge of process-specific dangers, e.g. due to the effects of hot, toxic and pressurized gases, gas-liquid mixtures and other process media, and of the design and working principle of the measuring system and shall have received and be able to document appropriate training.
- In hazardous areas with potentially explosive atmospheres, wiring and installation shall only be carried out by staff trained according to EN /IEC 60079-14 and according to national regulations.

## 1.5 General safety instructions and protective measures

Using the equipment for any purpose other than that intended by the manufacturer, or improper operation may result in injuries and damage to the equipment. Read this section and the notes and warnings in the individual sections of this manual carefully and observe the instructions contained therein when carrying out any work on the FLOWSIC600 measuring system.

General instructions to be adhered to:

- Always comply with the statutory provisions and the associated technical rules and regulations relevant to the equipment when preparing for and carrying out any work on the measuring system. Pay particular attention to potentially hazardous aspects of the equipment, such as pressurized piping and explosion protection zones. Always observe the relevant regulations.
- Always consider local and equipment-specific conditions and process-specific dangers when carrying out any work on the equipment.
- Operating and service instructions and equipment documentation shall always be available on site. Always observe the safety instructions and notes on the prevention of injuries and damage given in these manuals.
- Ensure appropriate protective accessories are available in sufficient supply. Always use such protective accessories. Check that appropriate safety devices are fitted and working correctly.

## 1.6 Dangers due to hot, corrosive and explosive gases and high pressure

The FLOWSIC600 measuring system is directly integrated into gas-carrying pipelines.

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



### **WARNING:**

In plants with toxic and explosive gases, high pressure or high temperatures, the FLOWSIC600 measuring system shall only be installed or removed after the associated piping has been isolated and depressurized (i.e. vented to atmosphere).

The same applies to repair and service work which involves opening any pressurized component or the explosion-proof signal processing unit (SPU).



### **NOTICE:**

Design, manufacture and inspection of the FLOWSIC600 measuring system is performed in compliance with the safety requirements set forth in the European Pressure Equipment Directive 2014/68/EU.

1.7

### Dangers due to heavy loads

The FLOWSIC600 measuring system must be safely attached to the carrying structure when being transported and installed.



**WARNING:**

- Only use lifting gear and equipment (e.g. lifting straps) which is suitable for the weight to be lifted. Max. load information can be found on the type plate of the lifting gear.
- The eye bolts attached to the meter body are suitable for the transport of the measuring device. However, additional loads (e.g. blind covers, filling for pressure tests or associated piping) must not be lifted and transported together with the measuring system without the use of additional support from the lifting gear.
- Never attach lifting gear to the signal processing unit or its mounting bracket and avoid contact between these parts and the lifting gear.

1.8

### Environmental information and instructions for disposal

The FLOWSIC600 components are easily disassembled and do not contain toxic, radioactive or any other environmentally hazardous materials. The instrument consists primarily of steel, stainless steel, plastic and aluminium, and consequently there are few restrictions for disposal, except for the printed circuit boards, which must be disposed of as electronic scrap.



# FLWSIC600

## 2 Product Description

System components
Operating states, meter states and signal output
Self-Diagnosis with User Warnings
Data Handling in the FLWSIC600
MEPAFLOW600 CBM

## 2.1 System components

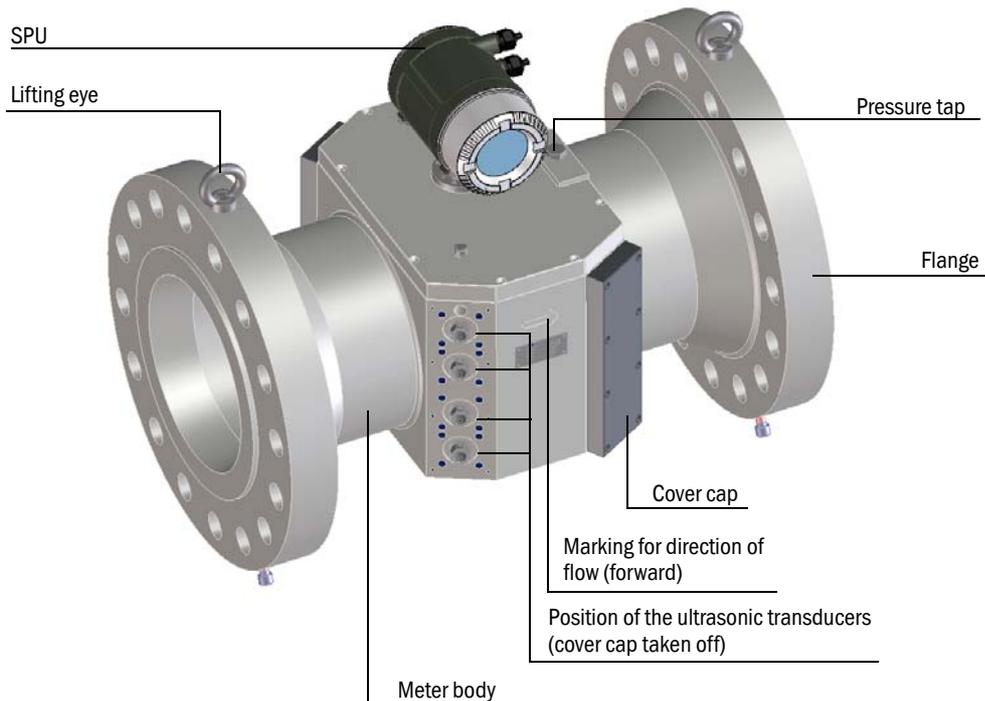
The FLOWSIC600 measuring system consists of the following hardware components:

- Meter body
- Ultrasonic transducers
- Signal processing unit (SCU)

The MEPAFLOW600 CBM software is the user interface used to facilitate configuration and diagnosis (→ pg. 25, 2.5).

Figure 1

FLOWSIC600



### 2.1.1 Meter body

The meter body consists of a mid section for mounting the ultrasonic transducers, with flanges on either end. The meter body is made of a single-piece casting or forging, which is machined on precision equipment to ensure high reproducibility of the geometric parameters.

The internal diameter, design of the sealing surface, and standard dimensions of the flanges are in accordance with the specifications in the key code. The meter body material is chosen to suit customer requirements. Standard meter bodies are available in carbon steel, low temperature carbon steel and stainless steel.

The meter bodies can be delivered in several nominal sizes (→ pg. 112, 7.1.4).

### 2.1.2 Ultrasonic transducers

The FLOWSIC600 ultrasonic transducers are optimized to suit your application requirements. The high quality of the transducer design provides the basis for accurate and highly stable propagation time measurements with nanosecond precision. These transducers are of an intrinsically safe design ("ia", with Equipment Protection Level Ga).

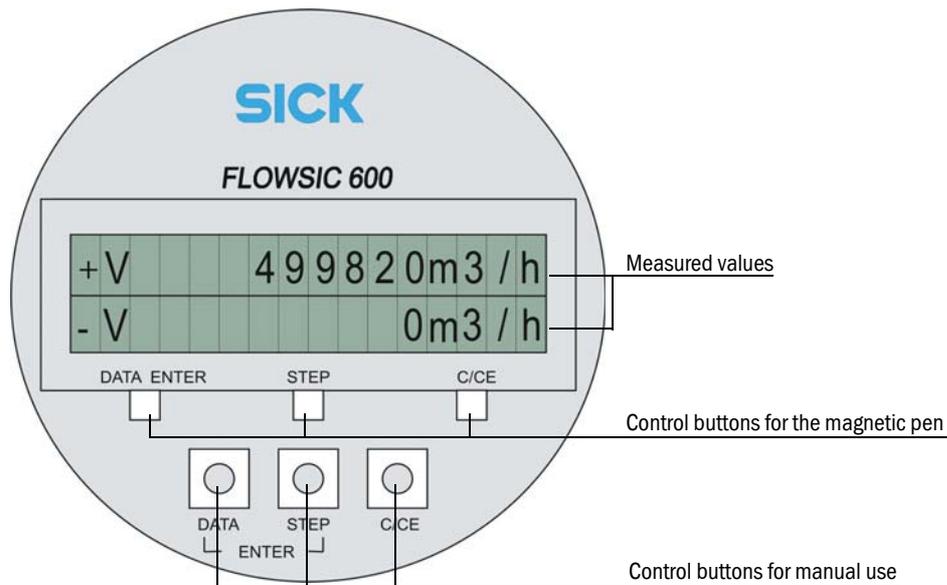
### 2.1.3 Signal processing unit

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

The volume counters, log books (errors, warnings, parameter changes) and datalogs are stored in non-volatile data memory (FRAM) together with a time stamp (Logbooks → pg. 118, 7.2.) On system restart, the counter readings that were last saved are restored as the start values for the volume counters. The FRAM backup provides an unlimited number of writing cycles and protects the saved data for a minimum of 10 years.

The SPU is equipped with a front panel containing a two-line LCD to display current measured values, diagnostics and logbook information (→ Figure 2). An LED display is optionally available. The values to be displayed can be selected using a magnetic pen without removal of the window cover .

Figure 2 FLOWSIC600 front panel LCD



The power supply and interface terminals are located on the back of the SPU in a separate terminal section of the enclosure (→ pg. 42, 3.4.4).

The electronics are mounted in the SPU enclosure certified to EN / IEC 60079-1 with protection type "d" (flameproof enclosure). The transducer circuits are of an intrinsically safe design ("ia", with Equipment Protection Level Ga).

## 2.2 **Operating modes, meter states and signal output**

The FLOWSIC600 has two operating modes (→ pg. 16, 2.2.1):

- Operation
- Configuration Mode

In Operation Mode, the meter can have the following meter states (→ pg. 17, 2.2.2):

- Measurement valid
- Chck request
- Data invalid

### 2.2.1 **Operation mode and configuration mode**

The meter can be operated by the user in two modes: Operation Mode or Configuration Mode.

#### **Operation Mode**

In Operation Mode, the meter runs in one of the three aforementioned meter states, depending on the measuring conditions.

#### **Configuration Mode**

The Configuration Mode is used to modify parameters that directly influence the measurement and to test the system and output signals. Configuration Mode forces the meter into the meter status "Data invalid" and the digital output "Measurement valid" is deactivated. Invalid measured values may be produced. The system continues operation using the current sample rate and executes all calculations as in the Operation Mode. Frequency output and analog output may represent test values and do thus not necessarily indicate measured values. Any parameter modifications are applied immediately to the running calculations with the following exception: changes of the sample rate or of the configuration of the serial interface are applied after the meter is switched to Operation Mode.



If the meter is in Configuration Mode and there have been no activities either on the LCD display or via MEPAFLOW600 CBM for more than 15 minutes, the meter automatically switches to Operation Mode.

## 2.2.2 Meter states

### 2.2.2.1 Status: Measurement valid

The meter status "Measurement" is the standard meter status of the FLOWSIC600. Frequency outputs and current output are updated cyclically and indicate the actual volume and volume flow rate. In addition, the analog signal can indicate the actual flow rate, corrected volumetric flow rate, SOS (speed of sound) or VOG (velocity of gas). The digital output "Direction of flow" is updated in accordance with the direction of the volumetric flow. The digital output "Measurement valid" (active) represents the status of the measurement. Positive (forward) and negative (reverse) volumetric flow rates are integrated and saved in separate internal memory sections.

The MODBUS interface allows the query of all parameters and signals at any time without interfering with the function of the system.

Each measurement initiated by the system controller includes one full transit time measurement with, and one against the direction of flow on each path. The result of each measurement is written to a mean value memory to be used in further calculations. The size of this memory block and thus the device response delay can be modified through the parameter in register #3502 "AvgBlockSize". If no result can be calculated due to poor signal quality, this measurement is registered as an invalid attempt in the mean value memory. The mean value is formed in a variable averaging process including all valid measured values in the memory.

If the number of invalid measurements on a path exceeds a predefined limit (Reg. #3514 „Performance“), the measuring system activates the meter status "Check request".

### 2.2.2.2 Status: Check request

This meter status becomes active if one measuring path has failed and the adaptive path failure compensation has been activated. The multi-path FLOWSIC600 system is able to compensate for this failure. Measurement is continued with reduced accuracy and the volume is still counted in the volume counters. If a path fails while the path failure compensation is not active, the measuring system will activate the "Data invalid" status.

Moreover the meter status "Check request" becomes active when the system alarms 2002 ("No HART communication to temperature transmitter"), 2003 ("No HART communication to pressure transmitter"), or 2004 ("Maximum pulse output frequency exceeded") become active (table → pg. 118, 7.2.1).

### 2.2.2.3 Status: Data invalid

If the quality of received signals is deficient in one or more measuring paths or the logbook is full or the measured value is out of the calibration range, the SPU must mark the measured value invalid and activate the meter status "Data invalid". The measured volume is counted in the error volume counter. However, the SPU will cyclically attempt to re-establish valid measurements. As soon as the signal quality and number of valid measurements meet the required criteria, the SPU will automatically change back to the "Measurement valid" or "Check request" status.

## 2.2.3 Output of pulse signals and status information

**NOTICE: TYPE APPROVAL**

Pulse output signals can be customized as shown in the following table.

Table 1 Pulse output

Output signal / LCD / port		Signal behavior			
		Measurement status	Check request status	Configuration Mode	Data invalid*
Pulse output signals	Inverted with error signal **				
	Phase shift 90° ***	Positive flow rate			
		Negative flow rate			
	Separate outputs for reach direction	Positive flow rate			
		Negative flow rate			
Single pulse output ***					

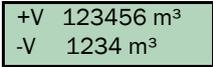
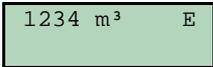
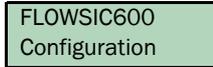
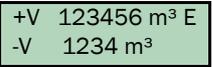
\* The meter can be configured to output a fixed frequency if the meter has the status "Data invalid". The frequency to be output in this case can be configured (0-6 kHz) in Reg. #3034 "ErrorFreq".

\*\* Default setting on delivery.

\*\*\* Optional setting on customer request.

The default setting for "Check request", "Configuration" and "Data invalid" is "normally closed".

Table 2 Status output

Output signal / LCD / port	Signal behavior			
	Measurement status	Check request status	Configuration Mode	Data invalid
"Check request" Status signal	Status "active / inactive" * Measurement valid	Status "active / inactive" * Compensation of path failure	"undefined"	"undefined"
"Direction of flow" Status signal	Status "active / inactive" * Positive or negative direction of flow	Status "active / inactive" * Positive or negative direction of flow	"undefined"	"undefined"
"Warning"	Status "active / inactive" *	Status "active / inactive" *	"undefined"	"undefined"
LCD display		 Display flashing		 Display flashing
Serial port RS485	<ul style="list-style-type: none"> <li>● Measured value, diagnosis information and parameters</li> <li>● Measuring data logging, diagnosis and configuration through the MEPAFLOW600 CBM software</li> <li>● Connection with external process control equipment through implemented MODBUS protocol (data polling)</li> </ul>			

\*The "active" or "inactive" state can be assigned to the electric switch status "normally open" or "normally closed" by configuration in the MEPAFLOW600 CBM software (adjust settings for Reg. #5101 on the "Parameters" page.).

The output signal designation is described in the Technical Information.

The LCD display can display measured values, parameters, messages and other information.

A flashing letter in the upper right corner of the LCD display indicates that a logbook contains unacknowledged logbook entries. Depending on the type of entry this will be:

- "I" for Information
- "W" for Warning
- "E" for Error

After acknowledging all new entries, the letter stops flashing. For details see → pg. 94, 5.4.1.

### 2.3 Self-diagnosis with User Warnings

During normal operation, the ratios of sound and path velocities, amplification values, performance, and signal-to-noise ratios are continuously monitored. If these values exceed set limits (customized User Warning limits), a warning signal will be generated. This allows immediate measures to be taken to address a problem which could potentially impact measurement quality. A message in the Warning Logbook documents the time of the event and the specific User Warning limit which was exceeded.

-  ● The "Warning" signal does not affect the functionality of the meter.
- All User Warning parameters - except for the parameter 'Min. VOG for warnings' - can be configured in the User Access Level "Operator" and without switching the meter to the Configuration Mode.

A User Warning becomes active only if a User Warning limit has been continuously exceeded for a certain time (specified in the parameter "Warning duration and averaging for warnings" in the Configuration tab of User Warnings).

During commissioning or operation, the User Warning limits can be adapted and activated or deactivated in the "User Warnings" window in MEPAFLOW600 CBM to suit individual application requirements (→ pg. 72, 4.7.1).

Figure 3 Button "User" in the MEPAFLOW600 CBM main system bar, "User Warnings" window

<b>SICK</b> Sensor Intelligence.	Qf [m³/h]	Qb [Nm³/h]	Pressure [bar(a)]	Temperature [°C]	Velocity [m/s]	SOS [m/s]	System	User	Performance
	20.20	301.68	14.48	19.44	1.30	346.93			100%

Opens the "User Warnings" window

System warnings  
see Technical Information

Path warnings  
see Technical Information

**User Warnings**

Status Configuration Diagnostic Comparison limits

**User warnings**

Meter S/N: 09018502  
Meter date/time: 4/20/2011 15:46:33

**System warnings**

Profile factor	
Symmetry	
Theoretical SOS deviation	
High Gas Velocity	
Low Input Voltage	
Logbook full of unack. entries	
Diagnostic difference	
Battery LifeSpan (change battery)	

**Path warnings**

	P1	P2	P3	P4
Path turbulence				
SNR limit				
AGC limit				
AGC deviation				
SOS deviation				
Performance limit				

Legend

- Warning not active
- Warning active
- Disabled

Window always on top

Subject to change without notice

## 2.4 Data handling in the FLOWSIC600

### 2.4.1 Integrated volume counters

The FLOWSIC600 is equipped with integrated volume counters which can be displayed both on the LCD display and in MEPAFLOW600 CBM.

#### Integrated volume counters

Volume counter	Abbreviation
Volume at flowing conditions (forward)	+ Vf
Volume at flowing conditions (reverse)	- Vf
Error volume at flowing conditions (forward) <sup>1</sup>	+ Ef
Error volume at flowing conditions (reverse) <sup>1</sup>	- Ef
Total volume at flowing conditions (forward)	+ Vo
Total volume at flowing conditions (reverse)	- Vo
Total volume at flowing conditions (all)	Vo

#### Last hour/day registers

Volume counter	Abbreviation
Forward volume of last hour	Last hour forw.
Reverse volume of last hour	Last hour rev.
Forward volume of last day	Last day forw.
Reverse volume of last day	Last day rev.

#### Additional counters in meters with integrated Electronic Volume Corrector (EVC)

Volume counter	Abbreviation
Volume at base conditions (forward)	+ Vb
Volume at base conditions (reverse)	- Vb
Error volume at base conditions (forward) <sup>1</sup>	+ Eb
Error volume at base conditions (reverse) <sup>1</sup>	- Eb

#### Mass counters

Mass counter	Abbreviation
Mass counter (forward)	+ M
Mass counter (reverse)	- M
Mass total (forward)	M+
Mass total (reverse)	M-
Error Mass (forward) <sup>1</sup>	Me+
Error mass (reverse) <sup>1</sup>	Me-

<sup>1</sup> see Technical Information

## 2.4.2

**Logbooks**

Important system events are stored in three logbooks in the SPU memory of the meter.

Each logbook entry consists of a running index number, the event, a time stamp and the acknowledgement status. Entries in Custody logbook [1] and Warning logbook [2] also include the volume counter readings valid at that time. The events are logged continuously in order of occurrence into one of the three logbooks:

- Logbook 1 (Custody logbook [1], max. 1000 entries)
- Logbook 2 (Warning logbook [2], max. 500 entries)
- Logbook 3 (Parameter logbook [3], max. 250 entries)

Every logbook has its own index counter. Logbook entries are classified on the LCD display according to the event type.

**Event types in logbooks**

Display	Event type
E	Error
W	Warning
I	Information

A list of possible logbook entries can be found in the table 'Overview of event entries' in the Appendix, see → pg. 118, 7.2.1.

**Logbook overflow****NOTICE: TYPE APPROVAL**

If a FLOWSIC600 is configured as a custody meter, the volume counters stop if Custody logbook [1] and/or Parameter Logbook [3] is full. The meter status "Data invalid" is activated. The measured values are now counted in the error volume counter.

If the FLOWSIC600 is not configured as a custody meter, all logbooks are per default configured to be overflowing. This means the index number continues increasing, and after the logbook has reached its maximum number of entries, each new entry overwrites the oldest entry.



If the logbook overflows, the oldest data will be lost. Regularly saving the logbook entries to the database via MEPAFLOW600 CBM (→ pg. 94, 5.4.1) and deletion of entries in the meter itself prevents data loss. If entries are deleted via MEPAFLOW600 CBM, the logbook index counter on the meter is reset.

**Index counter overflow**

The index number displayed in the LCD display runs up to 9999 and then overflows. In case of an index overflow, all logbook entries are deleted and all logbook index counters reset.

**Acknowledging entries**

Each entry can be acknowledged manually on the LCD display (see Technical Information) as well as in MEPAFLOW600 CBM (→ pg. 95, 5.4.1.2). It is possible to acknowledge individual entries or all entries at once.

### 2.4.3 DataLogs<sup>1</sup>

For firmware version 3.4.03 and higher, the FLOWSIC600 provides two DataLogs (Hourly Log and Daily Log). They save averaged measured values and are stored in the SPU's non-volatile memory (FRAM). All data can be downloaded and exported to Excel files with MEPAFLOW600 CBM (→ pg. 97, 5.4.2.1.).



The following sections describe the default configuration of the DataLogs. The DataLogs can be configured to best suit your application → pg. 75, 4.7.2.2.

#### 2.4.3.1 Hourly Log

The Hourly Log logs hourly diagnostic values by default (dataset type "Diagnostic Values", → pg. 50, Table 11) for the forward flow. As long as the flow is valid and the VOG is above Vmin all diagnostic and flow values are averaged over one hour and saved every full hour. The Hourly Log stores these values for more than a month (38 days) by default. They are then overwritten with new values.

#### 2.4.3.2 Daily Log

The Daily Log logs the daily volume counter values by default (dataset type "Volume Counters" → pg. 50, Table 12) for the forward flow. All flow values are averaged over one day and saved at the (configurable) Accounting Hour (→ 2.8.3.6). The Daily Log stores these values for approximately 2 years by default (1 year and 361 days). They are then overwritten with new values.

##### DataLog Storage Cycle

Hourly Log and Daily Log can be configured to save entries in a storage cycle of: 3 min, 5 min, 15 min, 30 min, 1 hour, 12 hours or 24 hours.

If a DataLog is set to a Storage cycle of 12 or 24 hours, the accounting hour takes effect.

#### 2.4.3.3 DataLog storage behavior

Hourly Log and Daily Log can be configured for the following storage behavior:

- Overflow (Default)
- Stopping



##### Storage Behavior "Stopping"

If a DataLog is configured with the storage behavior "Stopping", a warning will be shown in the Meter Status Table when the DataLog is full. See → pg. 90, 5.2.3.

#### 2.4.3.4 Types of datasets stored in the DataLogs

Hourly Log and Daily Log can be configured to store one of the following type of dataset:

- Diagnosewerte
- Volumenzähler
- Standardvolumenzähler
- Massenstromzähler

<sup>1</sup> This feature may be deactivated. Please contact your SICK representative.

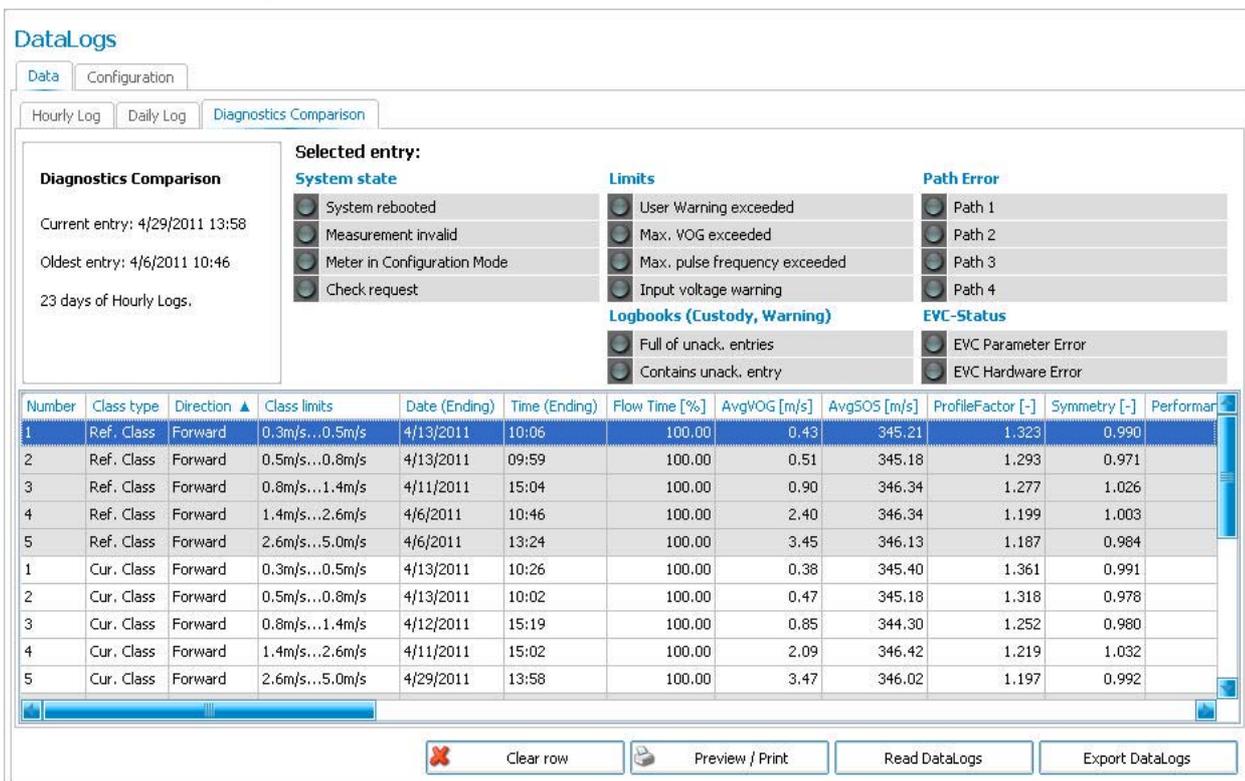
### 2.4.4 Diagnostics Comparison Log<sup>1</sup>

The Diagnostics Comparison Log provides a comparison between current diagnostic values (current fingerprint) and those of a reference time (reference fingerprint, for example, at time of commissioning). Since the diagnostic values (dataset type "Diagnostic Values", see Technical Information → Table 11) are velocity-dependent, it is necessary to use a velocity-adaptive comparison. Five gas velocity range classes are calculated from the velocity range of the meter. The current diagnosis values are stored in Current Classes 1 to 5, while the reference values are stored in Reference Classes 1 to 5.

Reference values are collected after the meter has been commissioned or after the classes have been cleared. Reference values are stored in the Reference Classes 1 to 5. If a Reference Class is filled with an entry, the next valid entry is stored into the same velocity range but in the corresponding Current Class (e.g. if Reference Class is filled, the next value from within this velocity range will be stored in Current Class 1). During operation, the Current Classes are continually overwritten with new entries. The Reference Classes stay unchanged until they are manually cleared.

Per default the Diagnostics Comparison Log operates bidirectional, saving separate data for both flow directions. The values are stored in the gas velocity classes 1 to 5, depending on the gas velocity.

Figure 4 Diagnostics Comparison Log



1 This feature may be deactivated. Please contact your SICK representative.

## 2.5 **MEPAFLOW600 CBM**

Most data provided by the FLOWSIC600 (like readings, logbook entries and parameters) can be accessed via the LCD display of the meter. However, the MEPAFLOW600 CBM software provides a more user friendly access to diagnostic, configuration and measurement data of the flow meter. Software installation

### 2.5.1 **System requirements**

- Microsoft Windows XP/Windows 7
- Min. 1 GHz CPU
- Min. 512 MB RAM
- USB- or serial interface
- Screen resolution min. 1024 x 768 pixel (optimal display resolution 1280 x 1024 pixel)

#### **Compatibility**

MEPAFLOW600 CBM can be used for all firmware and hardware versions of the FLOWSIC600. The availability of the software features depends on the firmware version of the connected FLOWSIC600.

#### **Installation**

A product CD containing the MEPAFLOW600 CBM software is included in delivery of the FLOWSIC600. Insert the product CD into your CD-ROM drive to install the software.

#### **Download from [www.flowsic600.com](http://www.flowsic600.com)**

MEPAFLOW600 CBM can be downloaded free of charge from [www.flowsic600.com](http://www.flowsic600.com) website. Select the Software tab and follow the download instructions.

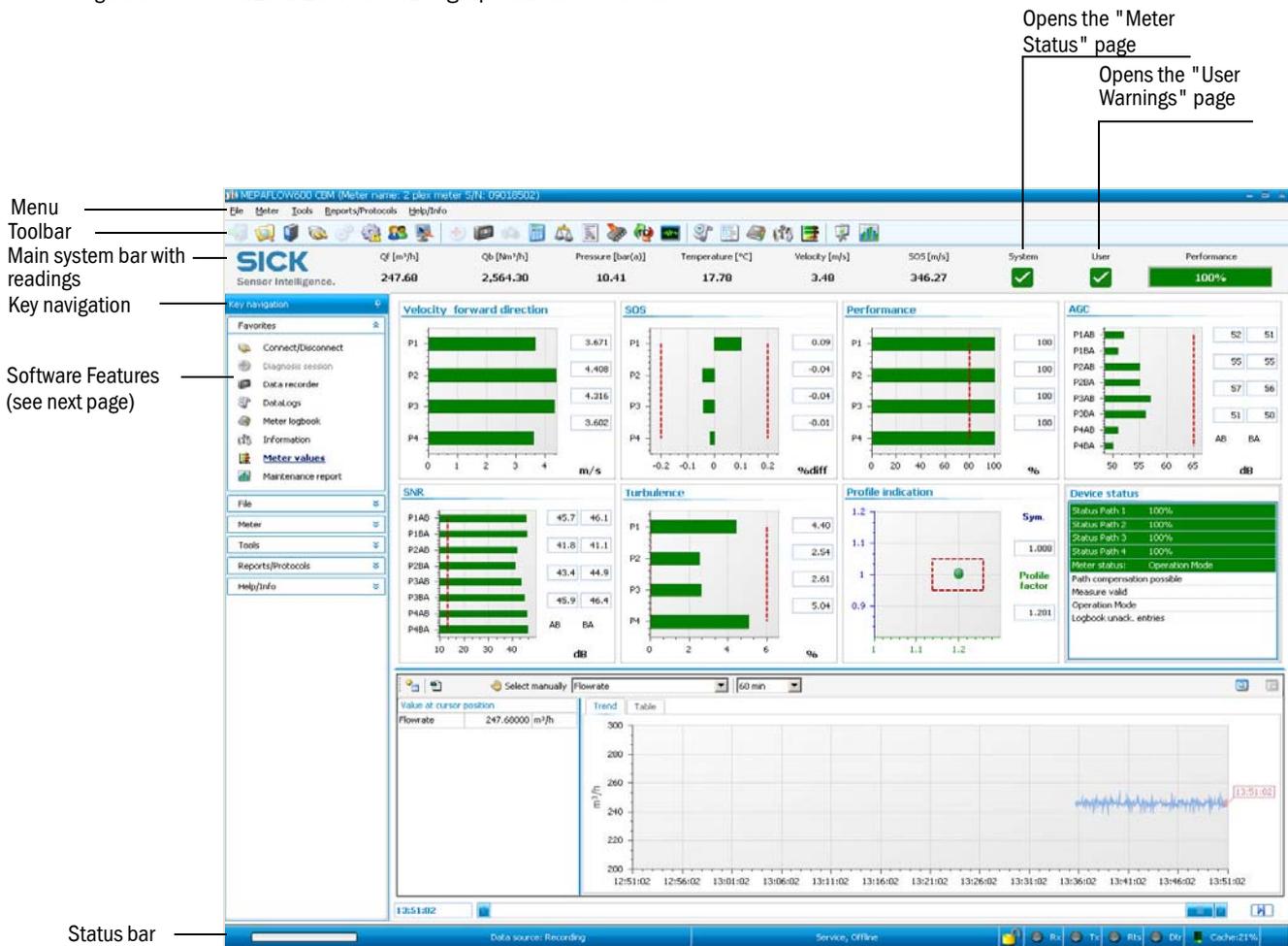


Administration rights are required for installing the MEPAFLOW600 CBM software. Ensure that the database path specified is one for which users of MEPAFLOW600 CBM have write access.

## 2.5.2 Overview

The MEPAFLOW600 CBM software supplies a menu-based user interface with many features for the diagnosis of the FLOWSIC600 system. It allows the access to all system parameters, displays diagnostic information in charts and graphs, generates reports (i.e. Maintenance reports) and data files (records, logs) which can be exported and can be used for data analysis. The MEPAFLOW600 CBM meter database allows online and offline management of parameters, reports, session files and logbooks.

Figure 5 MEPAFLOW600 CBM graphical user interface



## Software features

Main readings bar	Description
Meter Status	Window displaying the current Meter Status.
User Warnings	Window for the display of the User Warnings and for the configuration of the User Warning Limits and the Diagnostic Comparison Limits.
Key navigation	Description
Connect/Disconnect	Assistant for establishing online and offline connections between MEPAFLOW600 CBM meter database and FLOWSIC600.
Diagnosis Session	Quick creation of session files for diagnostic purposes.
Data recorder	Tool for the recording and playback of current, future or cached readings.
DataLogs	Access to Hourly Log, Daily Log and Diagnostics Comparison data saved in the meter. Data can be exported to Excel. The Diagnostics Comparison Report can be printed or exported as PDF.
Meter logbook	Access to meter logbook and logbook entries saved to meter database.
Information	Overview of higher level meter information: Counter readings, identification and location of meter and display of readings (e.g. flow rate) in graph.
Meter values	Detailed diagnostic page with graphs for velocity of gas, speed of sound (SOS), path performance, AGC, signal-to-noise-ratio (SNR), turbulence, profile symmetry and user selectable readings (e.g. flow rate). Summary of device status.
Maintenance report	Assistant for the creation of Maintenance reports.
Meter explorer	Overview, access and management of the meter database saved on the PC. Includes all meter data and sessions with entries for all changes of parameters, changes of the operating mode, measurement records (including diagnosis sessions) and maintenance reports. Functions for export, import, creation and deletion of meter data.
Go to Operation Mode / Go to Configuration Mode	Operation Mode switches: "Operation Mode" for normal operation or "Configuration Mode" for writing information (i.e. parameters) to the meter.
Program settings	Access to program settings for the individual adjustment of the program appearance and setup (e.g. settings for file path, memory, unit system and layout).
Parameters	Access to all meter parameters. Assistant for comparing current parameter settings with previous ones.
Save cache	Saves the historical data from the PCs memory (cache) to a record.
SOS Calculator	A theoretical SOS can be calculated for a specific gas composition.
Meter calibration	The calibration wizard guides the user through the calibration procedure with automated processes to write the information to the meter and generate reports.
Field setup	The field setup wizard guides the user through the commissioning procedure.
Firmware update	Assistant for installing firmware updates.
I/O check	The I/O check wizard guides the user through a test of all meter outputs.
Path diagnosis	Access to path diagnosis and graphs of received signals.
Report manager	Overview, access and management of all reports stored in the meter database. The report manager enables the creation of Trend reports from saved records and maintenance reports.



# FLWSIC600

## 3 Installation

General notes

Installation

Mechanical installation

Electrical installation

### 3.1 General notes

#### 3.1.1 Delivery

The FLOWSIC600 is delivered in a pre-assembled condition in a sturdy package. When unpacking the device, check for possible damage in transit. Pay particular attention to the interior of the meter body, any visible transducer components and the sealing surfaces on the flanges. Any damage must be documented and reported to the manufacturer immediately.

Also check the shipment to ensure all components are included. The standard meter shipment is comprised of:

- ▶ FLOWSIC600 measuring system (meter body with signal-processing unit and transducers)
- ▶ MEPAFLOW600 CBM operation, configuration and diagnosis software
- ▶ Operating Instructions,
- ▶ Manufacturer Data Report (MDR)

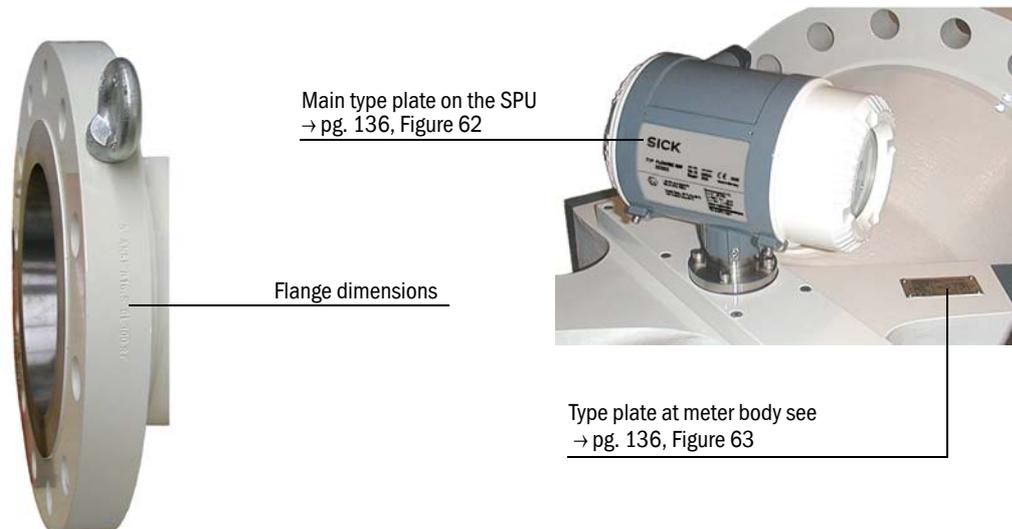


**NOTICE:**

To guarantee safe and reliable operation of the measuring equipment, make sure the actual site conditions match the information provided on the labels on the meter body and SPU (see Figure 6).

Figure 6

FLOWSIC600 labels and marks



## 3.1.2 Transport and storage

**WARNING:**

Only use lifting gear and equipment (e.g. lifting straps) which is suitable for the weight to be lifted. Max. load information can be found on the type plate of the lifting gear. It is strongly recommended to use only the eye bolts when lifting the meter by itself. To lift the FLOWSIC600 please pay attention to Figure 7.

During FLOWSIC600 transport and storage operations, make sure that:

- ▶ The meter is firmly secured at all times
- ▶ Measures are taken to avoid mechanical damage
- ▶ Humidity and ambient temperature are within specified limits (→ pg. 113, Table 9).

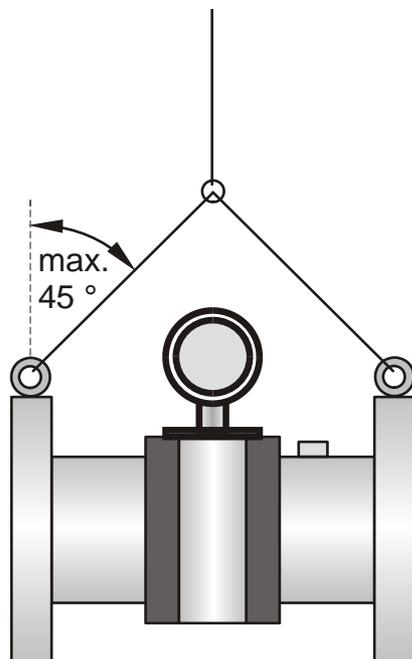
If the device is to be stored outside for more than one day, sealing surfaces of the flanges and the interior of the meter body must be protected from corrosion, e.g. with Anticorit spray (not required for stainless steel meter bodies). The same measure shall be taken if the meter is to be stored in dry condition, but for more than a week.

**NOTICE:**

Due to natural temperature fluctuation in the course of a day, or if the meter is transported to a place with different temperature and humidity conditions, moisture may condense on any material. Carbon steel surfaces may corrode if left unprotected.

Figure 7

Lifting requirements



## 3.2 Installation

Generally, the installation arrangement is specified during the project planning phase, before installation of the system. Nominal size, material and type of flange should therefore be in accordance with the design of the measurement facility. It is particularly important that the meter inlet and outlet is of the same internal diameter as the adjacent piping.

Fastening bolts, nuts and flange seals used must be suited to the operational conditions, and comply with legal regulations and relevant standards.



The installation requirements were evaluated according to the flow disturbance sensitivity tests according to

- OIML R 137-1&2, 2012 "Gas meters", Annex B and
- ISO 17089-1, 2010, "Measurement of fluid flow in closed conduits - ultrasonic meters for gas - Part 1: Meters for custody transfer and allocation measurement.", 5.9.3 Installation requirements and flow profile considerations.



Any deviation from the planned design of the FLOWSIC600 and installation arrangement shall be agreed upon with the supplier and documented prior to installing the meter.

### 3.2.1 Measuring location

General requirements:

- The FLOWSIC600 can be installed in customary straight inlet and outlet pipes. The adjacent pipes must have the same nominal size as the meter body. The internal diameter can be obtained from the table (see Technical Information) based on the flange rating and the Standard. The max. permitted difference of the internal diameter of the inlet pipe from that of the meter body is 3%. Any welding beads and burrs on the flanges of the inlet pipe shall be removed.
- The meter body may be installed in a horizontal or vertical position. In case of horizontal installation, the meter body shall be aligned so that the planes formed by the measuring paths are in a horizontal position. This minimizes dirt in the pipeline from entering the transducer ports. Vertical installation is only possible if the measuring system is used for dry, non-condensing gases. The gas flow must be free from any foreign material, dust and liquids. Otherwise, filters and traps shall be used.
- Do not mount equipment or fittings which may adversely affect the gas flow directly upstream the FLOWSIC600.
- Seals at the flange connections between meter body and pipeline must not protrude into the pipeline. Any protrusion into the flowing gas stream may change the flow profile and thus the measuring accuracy may be adversely affected.
- Pressure transmitter shall be connected to the pressure tap provided (→ pg. 14, Figure 1). The pressure tap can be a 1/8, 1/4 or 1/2 inch NPT (female) port, depending on meter size and customer requirements.
- For the leak-proof connection on the pressure line, a suitable thread sealing agent (e.g. PTFE tape) must be used when the pressure connection adapter is screwed in. After Installation and Commissioning the leak-tightness must be checked. All leaks must be repaired. Temperature probes shall be arranged as shown in → Figure 8 and → Figure 9.

### 3.2.2 Installation configurations

The choice of the installation configuration (see → Figure 8 and → Figure 9) depends on type and extent of the flow disturbance at the installation position.

Type of disturbance (distance upstream < 20 DN)	Possible installation configuration
None	Configuration 1 or 2
Elbow, reducer	
Double elbow out of plane, T piece	
Gas pressure controller with/ without noise abatement trim	Configuration 2
Diffuser	
Diffuser with swirling flow	

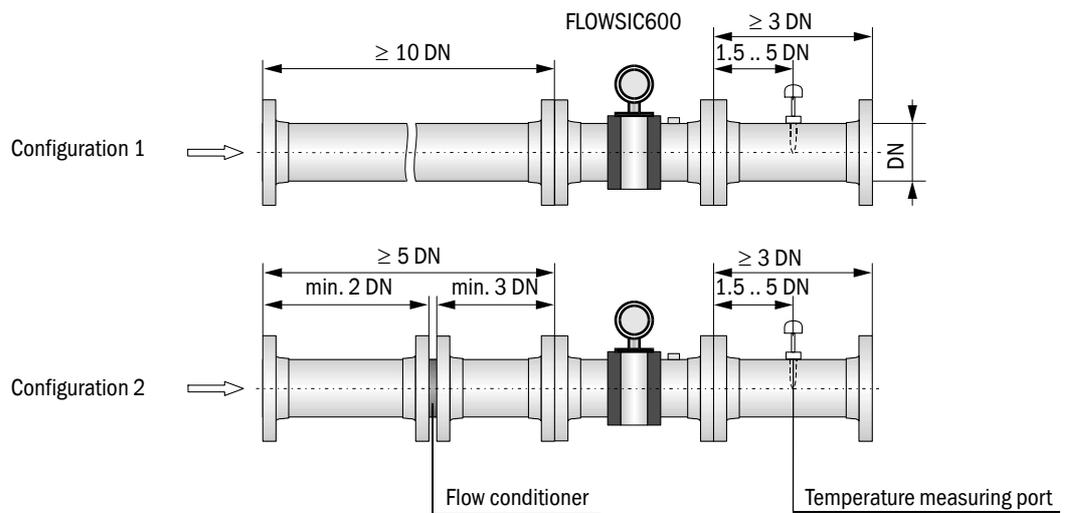


When configuration 2 (with flow conditioner) is used, the velocity of gas must not exceed 40 m/s (131 ft/s) in the pipe.

#### Unidirectional use

Figure 8

FLOWSIC600 installation in the pipeline for unidirectional use





## 3.3

**Mechanical installation**

Work on the pipelines to prepare for the installation of the gas flow meter is not included in the scope of delivery.

It is recommended to use the following tools, equipment and supplies for installation of the FLOWSIC600:

- Lifting gear or fork lift (with sufficient capacity to lift meter or meter-piping assembly)
- Box wrench with size suitable for flange installation
- Thread seal (e.g. PTFE tape) and flange gaskets
- Bolt lubricant,
- Leak detection spray

**WARNING: DANGER**

- Always observe the general safety regulations and safety instructions given in Section 1 when carrying out any installation work.
- The FLOWSIC600 must only be mounted on depressurized and vented pipelines.
- Take all necessary precautions to avoid local or plant-specific dangers.

## 3.3.1

**Choosing flanges, seals and other parts**

Use pipeline flanges, bolts, nuts, and seals that withstand the maximum operational pressure and temperature, as well as ambient and operational conditions (external and internal corrosion) for the flange connections. For installation lengths and flange dimensions, see MDR.

**WARNING: DANGER**

- Always strictly observe the safety instructions for the installation of pressure equipment including the connection of several pressure components set forth in the local or national relations and standards or Pressure Equipment Directive 2014/68/EU.
- Installation staff must be familiar with the directives and standards applicable for pipeline construction.

## 3.3.2

**Mounting the FLOWSIC600 in the piping**

An arrow on the meter body indicates the main direction of flow. It is recommended to install the FLOWSIC600 as indicated by this arrow if the meter is to be used for unidirectional flow applications. If the meter is to be used in the bidirectional mode, the arrow indicates the positive direction of flow.

**Installation work to be carried out****WARNING:**

- The lifting eyes are designed for transporting the meter only. Do not lift the FLOWSIC600 using these eyes when additional loads (such as blind covers, filling for pressure tests or piping) are attached (also see → pg. 31, 3.1.2)
- Never attach lifting gear to the signal processing unit or its mounting bracket and avoid contact between these parts and the lifting gear.
- The FLOWSIC600 must not turn over or start to swing while being transported. Flange sealing surfaces, SPU housing and transducer cover caps may be damaged when the lifting gear is not attached properly.
- Take suitable measures to prevent damage to the meter when carrying out any other work (welding, painting) near the FLOWSIC600.

- ▶ Position the FLOWSIC600 at the desired location of the pipeline using the lifting gear. Only use the lifting eyes provided to lift and transport the device. If lifting straps are used, wrap them around the meter body.
- ▶ Check for correct seating and alignment of the flange gasket after installing the flange bolts, but prior to tightening.
- ▶ Align the FLOWSIC600 such that the offsets between inlet pipe, meter body and outlet pipe are minimized.
- ▶ Insert the remaining fastening bolts and tighten the nuts cross-wise. The tightening torque applied must not be lower than specified in the project planning.
- ▶ Mount the pressure sensing line between pressure tap and pressure transmitter.
- ▶ Fill the pipeline and check the installed FLOWSIC600 and piping connections for leaks.

**NOTICE: Observe allowed pressure change**

- ▶ The pressure change within the measuring section must not exceed 0.5 MPa/min in order to protect transducers and seals.

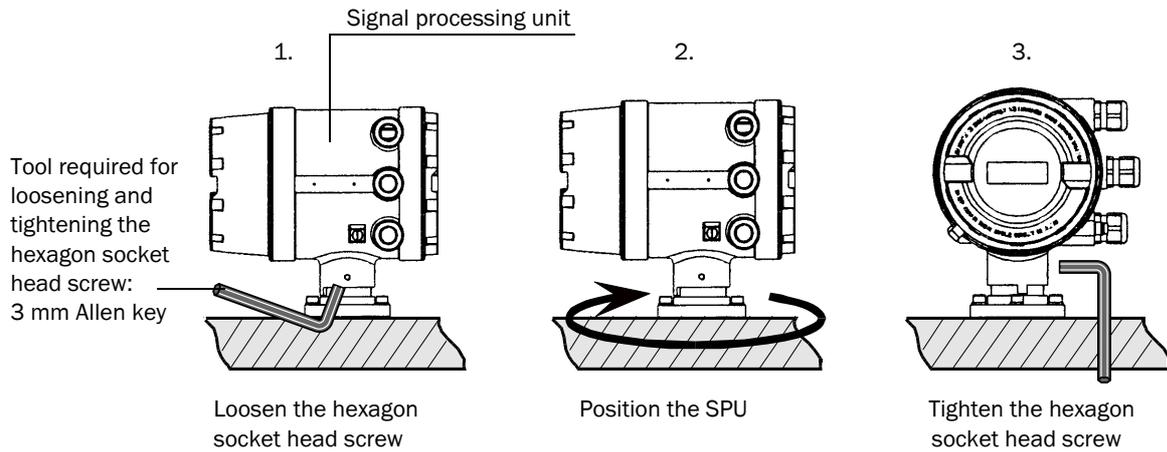


It is recommended to perform a leak test in accordance with the relevant regulations and standards after completion of the mechanical installation.

### 3.3.3 SPU alignment

The signal processing unit (SPU) can be turned so that the display can be easily read and that cable routing is facilitated (see → Figure 10). A stop on the housing prevents the SPU from being turned by more than 330° to prevent damage to the cables that come from the meter body.

Figure 10 Positioning the SPU.



**NOTICE:**

Do not forget to tighten the hexagon socket head screw after positioning the SPU.

## 3.4 Electrical installation

### 3.4.1 General information

#### Prerequisites

Wiring work (routing and connecting the power supply and signal cables), which is necessary when installing the FLOWSIC600, is not included in the scope of delivery. The mechanical installation described in Section →3.3 must be completed first. Comply with the minimum cable specification requirements set out in Section →3.4.2.

#### Cable routing

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



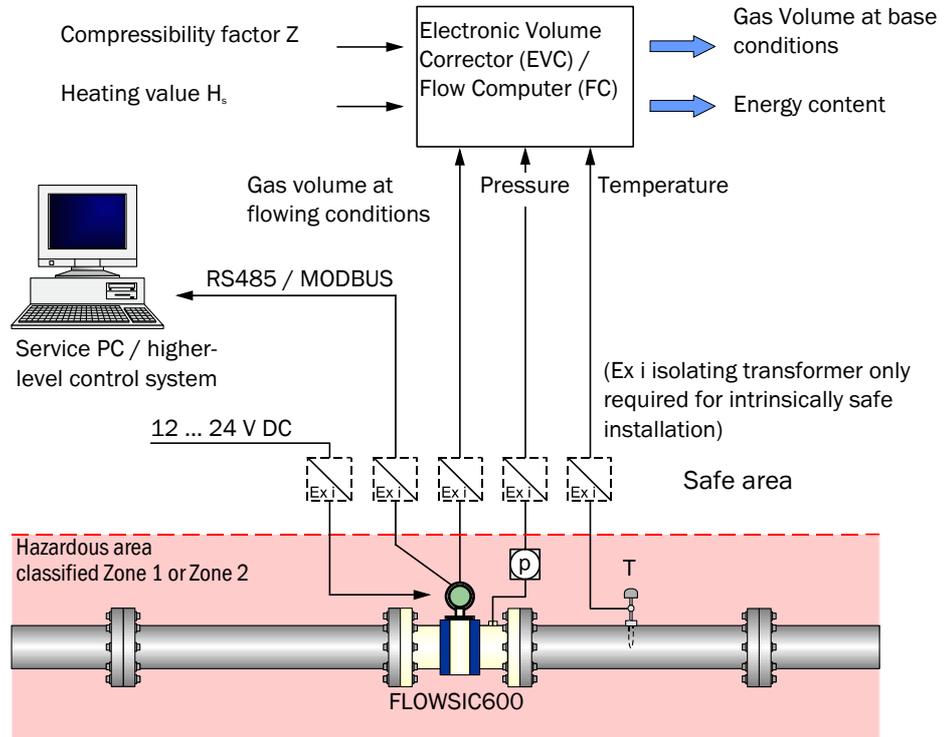
#### **WARNING: DANGER**

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

**General connection of the FLOWSIC600**

Figure 11

FLAWSIC600 connection diagram



## 3.4.2

**Cable specifications****WARNING:**

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

**Power supply 12 ... 28.8 V DC**

	Specification	Notes
Type of cable	Two conductors	Connect shielding (if present) to ground terminal
Min./ max. cross-sectional area	0.5 mm <sup>2</sup> / 2.5 mm <sup>2</sup> (20 - 12 AWG)	
Maximum cable length	Depending on loop resistance; Minimum input voltage on the FLOWSIC600 must be 12 V DC.	Peak current 150 mA
Cable diameter	6 ... 12 mm (1/4 to 1/2 inch)	Fixing range of the cable glands

**Digital output / current output**

	Specification	Notes
Type of cable	Twisted pair, shielded	Connect shielding at other end to ground terminal
Min./ max. cross-sectional area	2 x 0.5/1 mm <sup>2</sup> (2 x 20-18 AWG)	Do not connect unused conductor pairs and prevent them from accidental short-circuit
Maximum cable length	Loop resistance ≤ 250 Ω	
Cable diameter	6 ... 12 mm (1/4 to 1/2 inch)	Fixing range of the cable glands

**Serial port (RS485)**

	Specification	Notes
Type of cable	Twisted pair, shielded, impedance approx. 100...150Ω low cable capacitance: ≤ 100 pF/m	Connect shielding at other end to ground terminal
Min./ max. cross-sectional area	2 x 0.5/1 mm <sup>2</sup> (2 x 20-18 AWG)	
Maximum cable length	300 m at 0.5 mm <sup>2</sup> (1600 ft for 20 AWG) 500 m at 0,75 mm <sup>2</sup> (3300 ft for 20 AWG)	Do not connect unused conductor pairs and prevent them from accidental short-circuit
Cable diameter	6 ... 12 mm (1/4 to 1/2 inch)	Fixing range of the cable glands

**NOTICE:**

Only the lower fault current may be used with an internally fed analog output and use of HART communication.

## 3.4.3

**Checking the cable loops**

Check the cable loops to verify that the cables are connected correctly. Proceed as follows:

- ▶ Disconnect both ends of the cable of the loop to be tested. This is to prevent connected devices from interfering with the measurement.
- ▶ Test the entire cable loop between SPU and terminal device by measuring the loop resistance.
- ▶ If you want to test the insulation resistance as well, the cables must be disconnected from the electronic module before using the insulation resistance tester.

**WARNING:**

Applying test voltage to the cables before disconnecting them from the electronics module will seriously damage the electronics module.

- ▶ Reconnect all cables after the loop resistance test.

**WARNING: Explosion Hazard**

- In non-intrinsically safe installations, the terminal boxes may only be opened if the system is disconnected from the power supply.
- In non-intrinsically safe installations, the cables may only be disconnected if the system is disconnected from the power supply.
- The window cover must only be opened if the system is disconnected from the power supply and only 10 minutes or more after the system has been switched off, or the area is known to be non-hazardous.

**NOTICE:**

Incorrect cabling may cause failure of the FLOWSIC600. This will invalidate warranty claims. The manufacturer assumes no liability for consequential damage.

### 3.4.4 Terminal enclosure on the SPU

#### Opening the rear housing cover

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



**NOTICE: Lubricant**

Only use LOCTITE 8156 as lubricant for front and rear housing cover.

A schematic wiring diagram is provided on the inside of the rear housing cover.

Figure 12

SPU housing

Open the cover

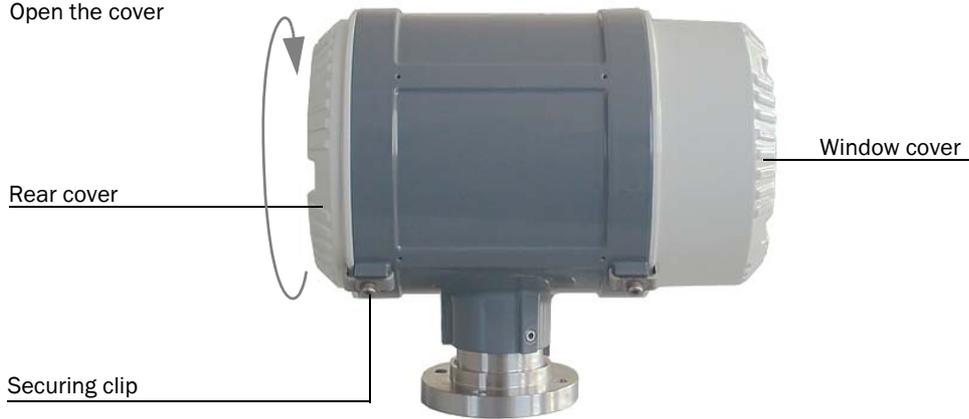
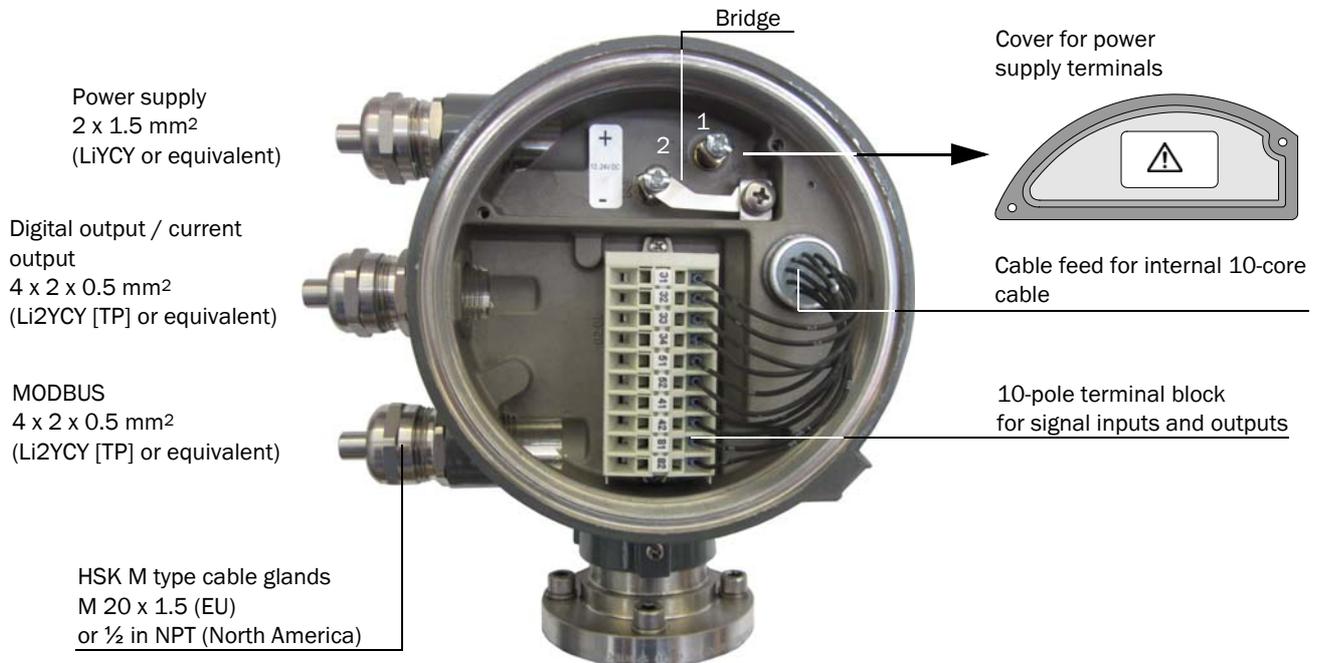


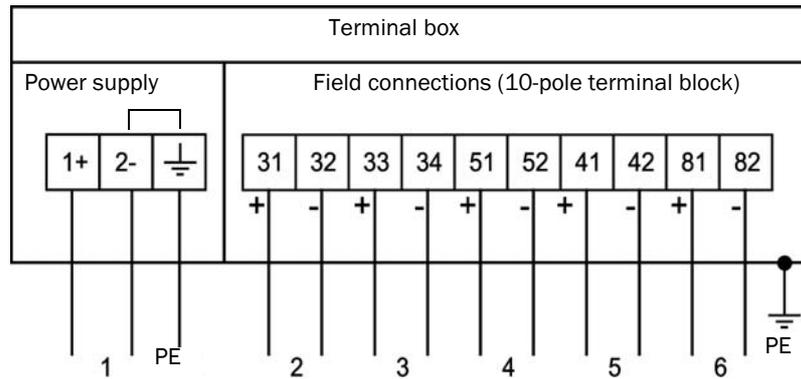
Figure 13

Terminal box on the rear of the SPU (see Section → 3.4.2 for North American wiring specification equivalents)



Subject to change without notice

Figure 14 Terminal assignment for use in safe areas

**NOTICE: Potential equalization**

PE: Potential Equalization terminal must be connected to earth ground.

**NOTICE: Device-internal bridge**

Terminals 2 and PE are bridged internally, i.e. there is no insulation between PE and negative potential (→ Figure 13).

- ▶ This bridge is a firm part of the device and mandatory. It must not be removed or altered.
- ▶ Altering the bridge voids the manufacturer's warranty.

**NOTICE: Termination of Modbus lines**

Begin and end of the Modbus lines must be terminated.

- Terminal 81/82: Always terminated
- Terminal 33/34: Switchable, terminated ex factory

For detailed information, see Service Manual FLOWSIC600, Section 4.4 "Serial interface RS485".

### 3.4.5 Operating the FLOWSIC600 in non-hazardous areas

Assign the terminals in the SPU terminal box (→ Figure 14) in accordance with the following table.

No.	Connection for	Function	Terminal	Value	Notes
1	Power supply		1+, 2-	12 ... 24 (+20%) V DC	
2	Digital output DO 0 (HF 2)	Passive	31, 32	$f_{\max} = 6 \text{ kHz}$ , configurable pulse duration 0.05 s - 1 s Range: Variable number of pulses per volume unit "closed": $0 \text{ V} \leq U_{\text{CE L}} \leq 2 \text{ V}$ , $2 \text{ mA} \leq I_{\text{CE L}} \leq 20 \text{ mA}$ (L=Low) "open": $16 \text{ V} \leq U_{\text{CE H}} \leq 30 \text{ V}$ , $0 \text{ mA} \leq I_{\text{CE H}} \leq 0.2 \text{ mA}$ (H=High)	With NAMUR contact for connection to switching amplifier (according to EN 60947-5-6:2000)
3	Serial port	MODBUS (RS485)	33, 34	9600 Baud, 8 data bits, no parity, 1 stop bit	Baud rate to be set through software
4	Digital output DO 1 (HF 1)	Passive	51, 52	$f_{\max} = 6 \text{ kHz}$ , configurable pulse duration 0.05 s - 1 s Range: Variable number of pulses per volume unit "closed": $0 \text{ V} \leq U_{\text{CE L}} \leq 2 \text{ V}$ , $2 \text{ mA} \leq I_{\text{CE L}} \leq 20 \text{ mA}$ (L=Low) "open": $16 \text{ V} \leq U_{\text{CE H}} \leq 30 \text{ V}$ , $0 \text{ mA} \leq I_{\text{CE H}} \leq 0.2 \text{ mA}$ (H=High)	With NAMUR contact for connection to switching amplifier (according to EN 60947-5-6:2000)
5	Digital output DO 2	Passive	41, 42	"closed": $0 \text{ V} \leq U_{\text{CE L}} \leq 2 \text{ V}$ , $2 \text{ mA} \leq I_{\text{CE L}} \leq 20 \text{ mA}$ (L=Low) "open": $16 \text{ V} \leq U_{\text{CE H}} \leq 30 \text{ V}$ , $0 \text{ mA} \leq I_{\text{CE H}} \leq 0.2 \text{ mA}$ (H=High) "Check request" (default)	
6	Digital output DO 3	Passive	81, 82	"closed": $0 \text{ V} \leq U_{\text{CE L}} \leq 2 \text{ V}$ , $2 \text{ mA} \leq I_{\text{CE L}} \leq 20 \text{ mA}$ (L=Low) "open": $16 \text{ V} \leq U_{\text{CE H}} \leq 30 \text{ V}$ , $0 \text{ mA} \leq I_{\text{CE H}} \leq 0.2 \text{ mA}$ (H=High) "Direction of flow" (default) (alternative "Warning")	
	Alternative assignment with second serial port (RS485)				9600 Baud, 8 data bits, no parity, 1 stop bit

3.4.6 **Requirements for use in hazardous areas with potentially explosive atmospheres<sup>1</sup>**

**Intended use**

The FLOWSIC600 is suitable for use in hazardous areas classified as Zone 1 and Zone 2.

**Certification in accordance with ATEX**

II 1/2 G Ex de ib [ia] IIC T4

II 1/2 G Ex de ib [ia] IIA T4

Permitted ambient temperature range -40°C to +60°C

EC TYPE Examination Certificate: TÜV 01 ATEX 1766, include 1. to 6. Supplement

**IECEX Certification**

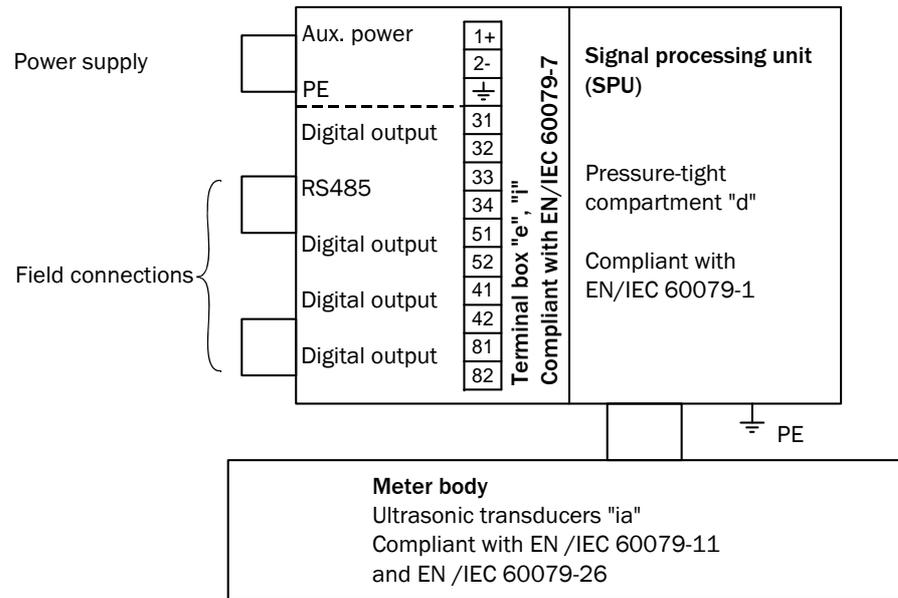
Gb/Ga Ex de ib [ia Ga] IIC T4

Gb/Ga Ex de ib [ia Ga] IIC T4

Permitted ambient temperature range -40°C to +60°C, optionally - -50°C to +70°C

IECEX Certificate of Conformity: IECEX TUN 11.0001 X

Figure 15 FLOWIC600 components and their type of protection



1 For use in USA and Kanada, see control drawings see Technical Information.

### Operating conditions for the ultrasonic transducers

The FLOWSIC600 is designed for use in hazardous areas with potentially explosive atmospheres only under normal atmospheric conditions. The atmospheric conditions must be within the following ranges:

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

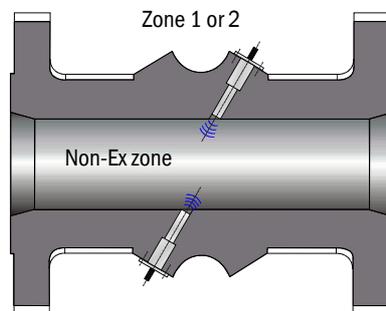
The ambient temperature must be within the range specified at the SPU type plate, e.g. -40 °C to +60 °C.

Once the FLOWSIC600 is installed in the pipeline, the meter body becomes a part of the pipeline. The wall of the pipeline and the meter body is then deemed a zone-separating barrier. The figure below helps in understanding the different situations for a possible application and shows what operating conditions apply.

Figure 16

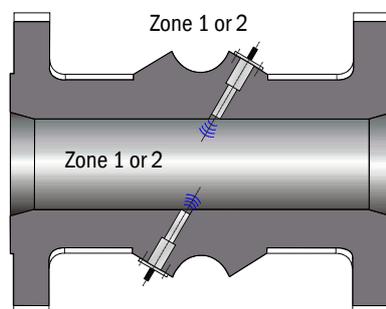
#### Ex-Zones

Case 1:



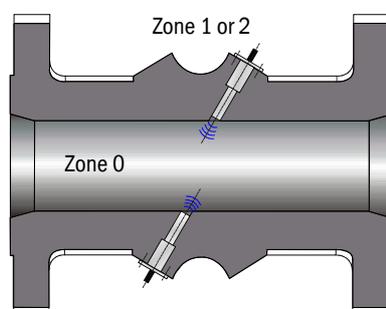
- The pipeline contains a non-explosive mixture. The gas mixture may be combustible.
- Gas pressure and gas temperature may be within the range specified by the tag on the meter body.

Case 2:



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

Case 3:



- The area inside the pipeline is classified as hazardous area Zone 0.
- Gas pressure must be in the range from 80 kPa to 110 kPa (normal atmospheric condition)
- Gas temperature must be in the range from -20 °C to 60 °C.

### Additional requirements for operation of ultrasonic transducer in Zone 0 classified areas

The FLOWSIC600 is marked with a minimum rating of II 1/2 G Ex [ia] or Gb/Ga Ex [ia Ga].

### Operation of ultrasonic sensors in Zone 0

The ultrasonic transducers are suitable for operation in Zone 0 at atmospheric conditions, i.e. ambient temperature -20 °C to 60 °C and ambient pressure 0.8 bar to 1.1 bar(a). If ultrasonic transducers with titanium housing are to be used in Zone 0, it must be assured that the medium does not transport solid parts (like dust or other particles) which could cause an ignition hazard. Otherwise, transducers made from stainless steel must be used. After installation and following every de-installation and reinstallation of the ultrasonic transducers, the seal effect must be appropriately checked. During operation, the leak-tightness must be periodically checked and the seals replaced if necessary. After de-installation and before every reinstallation the seals must be replaced according to the original assembly. Seals can be ordered from SICK (part number and serial number from type plate at SPU).

**NOTICE:**

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

The user must ensure that the ambient temperature around the electronics housing does not exceed the maximum permitted ambient temperature marked on the type plate of the FLOWSIC600.

**General requirements for installation**

- The documentation for hazardous area classification (zone classification) according to EN/IEC60079-10 must be available.
- The equipment must be verified as suitable for use in the classified area.
- Additional requirements must be observed for use of transducers in Zone 0 as described above.
- After installation an initial test run of the complete equipment and the plant according to EN/IEC60079-17 must be performed before regular operation is started.

**Requirements regarding cabling**

- Cables must fulfill the requirements set forth in EN/IEC60079-14.
- Cables that are subject to exceptional thermal, mechanical or chemical stress must be specially protected, e.g. by laying them in protective tubing.
- Cables that are not installed fire proof must be flame retardant according to IEC 60332-1.
- Cables for Ex e must comply with EN/IEC 60079-14 section 11.
- Observe the clamping range of the cable glands for cable selection.
- Use Ex e II respectively Ex i II certified cable glands with adequate ingress protection rating as alternate replacement only.
- For intrinsically safe wiring and an ambient temperature range between -20 °C to +60 °C, the existing metal cable glands may be replaced with light-blue plastic cable glands (available on request).
- Replace the existing cable glands with suitable cable glands if installation with armored cables is intended.
- When delivered, the cable glands are secured by default with a sealing plug. If the cable glands are not used, only sealing plugs with EX e II approval must be used.
- Conduit systems must comply with EN/IEC 60079-14, section 9.4 and 10.5. In addition, compliance with national and other relevant regulations is required
- "Conduits" according to IEC 60614-2-1 and IEC60614-2-5 are not suitable.
- Conduits must be protected against vibration.
- Use a suitable thread sealant, as detailed in EN/IEC60079-14, section 9.4.
- Protect stranded wires against fraying with ferrules.
- Keep clearance and creepage distances for the connected wires in accordance with EN/IEC60079 and EN/IEC 60079-11 respectively.
- Connect unused wires to ground or safeguard so that a short circuit with other conductive parts is excluded.
- Carry out potential equalization in accordance with EN/IEC6079-14
- The meter body and the electronic housing must be connected to the potential equalization.
- Where the FLOWSIC600 is installed in a grounded metal duct, no additional grounding is required for the meter body. The electronics housing must nevertheless be separately grounded.

### Connection of the FLOWSIC600 with associated equipment

The terminal compartment of the FLOWSIC600 complies with the requirements of EN/IEC60079-7 and EN/IEC 60079-11, respectively.

The FLOWSIC600 provides non-intrinsically safe wiring as well as intrinsically safe wiring with the interconnected associated equipment in the following manner:

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

A combination of intrinsically safe and non-intrinsically safe wiring for the field connections is not permitted.

Maximum voltage in the safe area must not exceed 253 V ( $U_m = 253V$ ).

For intrinsically safe wiring:

- The safety-relevant data in the EC Type Examination Certificate and the IECEx Certificate of Conformity must be observed.
- Intrinsic safety for each circuit must be assessed in accordance with EN/IEC60079-14 section 12.
- The safety-relevant parameters of interconnected equipment must comply with the following values:  $U_o < U_i$ ,  $I_o < I_i$ ,  $P_o < P_i$ ,  $C_i + C_{cable} < C_o$ ,  $L_i + L_{cable} < L_o$

The interconnection of two or more intrinsically safe outputs may require an additional assessment of intrinsic safety in accordance with EN /IEC60079-11.

Ensure that the cover on the power supply connection is properly sealed for regular operation.

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



#### **WARNING: Explosion Hazard**

- Do not open the enclosure while energized.
- Wait 10 minutes after power has been removed before opening the window cover.
- Do not open the cover of the terminal compartment while energized unless wiring is intrinsically safe.
- Do not remove the cover of the power supply while energized unless wiring is intrinsically safe.
- Do not connect or disconnect while circuits are live unless the area is known to be non-hazardous or wiring is intrinsically safe.
- Do not use the equipment if damaged (includes cables or terminals).

### Terminal assignment

The terminal assignment in the SPU terminal box (see → pg. 43, Figure 14) is the same as for the installation of the FLOWSIC600 in non-hazardous areas (see table → pg. 44, 3.4.5).



**NOTICE:**

For measurement reasons, the equipotential bonding must, as far as possible, be identical to the pipeline potential or protective ground/earth. Additional grounding with the protective conductor via the terminals is not permitted!

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



**NOTICE:**

Replace backup battery with PANASONIC type BR2032, Sick part no. 7048533. It may only be replaced by trained staff.

### Specific requirements for installation and use in North America

The FLOWSIC600 is intended for use in hazardous areas classified as Class I Division 1 and Class I Zone 1 as follows:

- Cl. I, Div. 1, Groups B, C and D, T4 resp. Cl. I, Zone 1, Group IIB + Hydrogene, T4
- Cl. I, Div. 1 Group D, T4 resp. Cl. I, Zone 1, Group IIA, T4

Further, the FLOWSIC600 is suitable for use in hazardous areas classified as Class I Division 2 and Class I Zone 2 as follows:

- Cl. I, Div. 2, Groups A, B, C and D, T4 resp. Cl. I, Zone 2, Group IIC, T4
- Cl. I, Div. 2 Group D, T4 resp. Cl. I, Zone 2, Group IIA, T4

### Installation

- Install in the US in accordance with the NEC.
- Install in Canada in accordance with CEC part 1.

For further details see drawing no. 781.00.02 (see Technical Information).

## Notes for safe operation in hazardous areas

**WARNING:**

Always observe the temperature specifications for use in hazardous areas.



Approval of the ultrasonic transducers in zone 0 is only valid for operation under atmospheric conditions.

- Explosion protection: II 1/2G Ex de ib [ia] IIC T4 or II 2G Ex de ib [ia] IIA T4
- Ambient temperature range is from -40 °C to +60 °C.
- If terminals are assigned with intrinsically safe circuits, it is recommended that the metal cable glands be replaced with the light-blue plastic ones
- The type of protection for the field connections and power supply connection is determined by the external circuits that are connected (for options see "Connection options" above).
- Safety-relevant data for intrinsically safe circuits is provided in the EC Type Examination Certificate and the IEC Certificate of Conformity.
- Ensure that the cover on the power supply connection is properly sealed. In intrinsically safe installations, the terminal box can be opened and cables connected and disconnected while the system is live. In this case the safe separation of the circuits from each other must be observed.
- If the meter body is insulated, the insulation thickness must not exceed 100 mm. The SPU housing must not be insulated.
- The standard paint of the FL600 meter body consists of a double layer: Epoxy and Acrylic RAL9002. This combination is the ideal protection of the meter body against corrosion. The layer thickness is less than 0.2 mm.

**WARNING: Explosion Hazard**

The ultrasonic probes are preferably made from titanium.

- ▶ Should zone 0 or zone 1 have been defined in the pipeline, operation is allowed only when ignition hazards caused by impact or friction can be excluded.

**WARNING: Ignition hazard through electrostatic discharges**

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

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



## Safety-relevant data of inputs and outputs for ATEX certified FLOWSIC600 only

Power circuit	Intrinsically safe Ex ia/ib IIA/IIB/ IIC								Non-intrinsically safe
Power supply	$U_i = 20 \text{ V}$ , $P_i = 2,6 \text{ W}$								12...24 V DC
Active current output Terminals 31/32	$U_o = 22.1 \text{ V}$								$U_B = 18 \text{ V}$ $U_B = 35 \text{ mA}$
	$I_o$ [mA]	$P_o$ [mW]	Ex ia/ib IIA $C_o$ [ $\mu\text{F}$ ] $L_o$ [mH]		Ex ia/ib IIB $C_o$ [ $\mu\text{F}$ ] $L_o$ [mH]		Ex ia/ib IIC $C_o$ [nF] $L_o$ [mH]		
Hardware variant 1-5,7/9, A	155	857	4.1	7			163	1	
Hardware variant 6, B	87	481	2	7	0.5	4	77	1	
	Characteristic curve: linear or for connection to certified intrinsically safe circuits with the following maximum values: $U_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 750 \text{ mW}$ Internal capacity: $C_i = 4 \text{ nF}$ Internal inductance: negligible								
Digital output Terminals 51/52 Terminals 41/42 Terminals 81/82	For connection to certified intrinsically safe circuits with the following maximum values: $U_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 750 \text{ mW}$ Internal capacity: $C_i = 4 \text{ nF}$ Internal inductance: negligible								$U_B = 30 \text{ V}$ $I_B = 100 \text{ mA}$
RS485 Terminals 33/34 Terminals 81/82	Characteristic curve: linear $U_o = 5.88 \text{ V}$ $I_o = 313 \text{ mA}$ $P_o = 460 \text{ mW}$ $C_o = 1000 \mu\text{F}$ for IIA resp. $43 \mu\text{F}$ for IIC $L_o = 1.5 \text{ mH}$ for IIA resp. $0.2 \text{ mH}$ for IIC or for connection to certified intrinsically safe circuits with the following maximum values: $U_i = 10 \text{ V}$ $I_i = 275 \text{ mA}$ $P_i = 1420 \text{ mW}$ Internal capacity: $C_i = 4 \text{ nF}$ Internal inductance: negligible								$U_B = 5 \text{ V}$ $I_B = 175 \text{ mA}$
Ultrasonic transducer connections (for connecting SICK ultra- sonic transducers only)	Ex ia/ib IIA		Ex ia/ib IIB			Ex ia/ib IIC			
	Characteristic curve: linear Max. transmission voltage: $U_o = \pm 60.8 \text{ V}$ Short-circuit current: $I_o = \pm 92 \text{ mA}$ $P_o = 1399 \text{ mW}$ Internal capacity $C_i = \text{negligible}$ Internal inductance: $L_i = 20.6 \text{ mH}$		$U_o = \pm 51.2 \text{ V}$ $I_o = \pm 77 \text{ mA}$ $P_o = 986 \text{ mW}$ negligible $L_i = 15.5 \text{ mH}$			$U_o = \pm 38.9 \text{ V}$ $I_o = \pm 59 \text{ mA}$ $P_o = 574 \text{ mW}$ negligible $L_i = 6.7 \text{ mH}$			

**WARNING:**

$U_m = 235 \text{ V}$ : For intrinsically safe installation, maximum voltage in the non-hazardous area must not exceed 253 V

Safety-relevant data of inputs and outputs for IECEx certified FLOWSIC600 only

Power circuit	Intrinsically safe Ex ia/ib IIA/IIB/ IIC							Non-intrinsically safe
Power supply	$U_i = 20 \text{ V}, P_i = 2,6 \text{ W}$							12 ... 24 V DC
Active current output Terminals 31/32	$U_o = 22.1 \text{ V}$							$U_B = 18 \text{ V}$ $U_B = 35 \text{ mA}$
	$I_o$ [mA]	$P_o$ [mW]	Ex ia/ib IIA $C_o$ [μF] $L_o$ [mH]		Ex ia/ib IIB $C_o$ [μF] $L_o$ [mH]		Ex ia/ib IIC $C_o$ [nF] $L_o$ [mH]	
All hardware variants	87	481	2	7	0.5	4	77    1	
	Characteristic curve: linear or for connection to certified intrinsically safe circuits with the following maximum values: $U_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 750 \text{ mW}$ Internal capacity: $C_i = 4 \text{ nF}$ Internal inductance: negligible							
Digital output Terminals 51/52 Terminals 41/42 Terminals 81/82	For connection to certified intrinsically safe circuits with the following maximum values: $U_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 750 \text{ mW}$ Internal capacity: $C_i = 4 \text{ nF}$ Internal inductance: negligible							$U_B = 30 \text{ V}$ $I_B = 100 \text{ mA}$
RS485 Terminals 33/34 Terminals 81/82	Characteristic curve: linear $U_o = 5.88 \text{ V}$ $I_o = 313 \text{ mA}$ $P_o = 460 \text{ mW}$ $C_o = 1000 \text{ μF}$ for IIA resp. $43 \text{ μF}$ for IIC $L_o = 1.5 \text{ mH}$ for IIA resp. $0.2 \text{ mH}$ for IIC or for connection to certified intrinsically safe circuits with the following maximum values: $U_i = 10 \text{ V}$ $I_i = 275 \text{ mA}$ $P_i = 1420 \text{ mW}$ Internal capacity: $C_i = 4 \text{ nF}$ Internal inductance: negligible							$U_B = 5 \text{ V}$ $I_B = 175 \text{ mA}$
Ultrasonic transducer connections (for connecting SICK ultrasonic transducers only)	Ex ia/ib IIA		Ex ia/ib IIB		Ex ia/ib IIC			
	Characteristic curve: linear Max. transmission voltage: $U_o = \pm 60.8 \text{ V}$ Short-circuit current: $I_o = \pm 92 \text{ mA}$ $P_o = 388 \text{ mW}$ Internal capacity $C_i =$ negligible Internal inductance: $L_i = 20.6 \text{ mH}$		$U_o = \pm 51.2 \text{ V}$ $I_o = \pm 77 \text{ mA}$ $P_o = 372 \text{ mW}$ negligible $L_i = 15.5 \text{ mH}$		$U_o = \pm 38.9 \text{ V}$ $I_o = \pm 59 \text{ mA}$ $P_o = 248 \text{ mW}$ negligible $L_i = 6.7 \text{ mH}$			



**WARNING:**

$U_m = 235 \text{ V}$ : For intrinsically safe installation, maximum voltage in the non-hazardous area must not exceed 253 V



# FLWSIC600

## 4 Commissioning

General notes

Connecting the FLOWIC600 to a PC or laptop

Connecting to the FLOWIC600 with MEPAFLOW600 CBM

Identification Field setup

Function test

Activation of path compensation

Sealing

Documentation

## 4.1

**General notes**

Before commissioning, all activities described in the chapter »Installation« must be completed. It is recommended to use a laptop/PC with MEPAFLOW600 CBM software installed for the commissioning (→ pg. 59, 4.3). The commissioning should be documented with a Commissioning Protocol. The document "FLAWSIC600 Commissioning Protocol" is content of the FLOWSIC600 shipping on paper and on the product CD.

The FLOWSIC600 is 'wet' or 'dry' calibrated when delivered to the end user. The 'dry' calibration consists of the 3-D measurement of the meter body, zero-flow and speed of sound test, and other system specific inspections/tests which belong to the manufacturing and quality assurance process. The 'wet' calibration is performed at a flow calibration test stand (calibration test facility).

All parameters, determined by the aforementioned tests, as well as design specific data are preset and stored in the FLOWSIC600 in a non-volatile memory before delivery. The design-specific data, which is known before manufacturing the device, will not be changed during commissioning. This is of special importance if the FLOWSIC600 is officially sealed after an authorized flow calibration. Generally, the parameters are protected by a password. Additionally a Parameter write lock in the SPU prevents custody relevant parameter changes.

**NOTICE: Type approval**

If the FLOWSIC600 is to be used for custody transfer applications, each change of parameters and of the Parameter write lock has to be agreed to by the applicable national authorities.

In all other cases the output parameters of the FLOWSIC600 can be adapted on site by trained staff.

Commissioning the FLOWSIC600 involves the following steps, regardless of whether the device is installed at a test facility or at the final measuring location:

- Connecting the FLOWSIC600 to a PC or Laptop (→ pg. 57, 4.2)
- Connecting to the FLOWSIC600 with MEPAFLOW600 CBM (→ pg. 59, 4.3)
- Identification (→ pg. 65, 4.4)
- Field setup (→ pg. 67, 4.5)
- Function test → pg. 69, 4.6,
- Optional additional setup (→ pg. 72, 4.7)
- Activation of path compensation (→ pg. 83, 4.8)
- Sealing (→ pg. 84, 4.9),
- Documentation (→ pg. 84, 4.10)

## 4.2 Connecting the FLOWSIC600 to a PC or laptop

### 4.2.1 Connecting the FLOWSIC600 via RS485 / RS232 cable

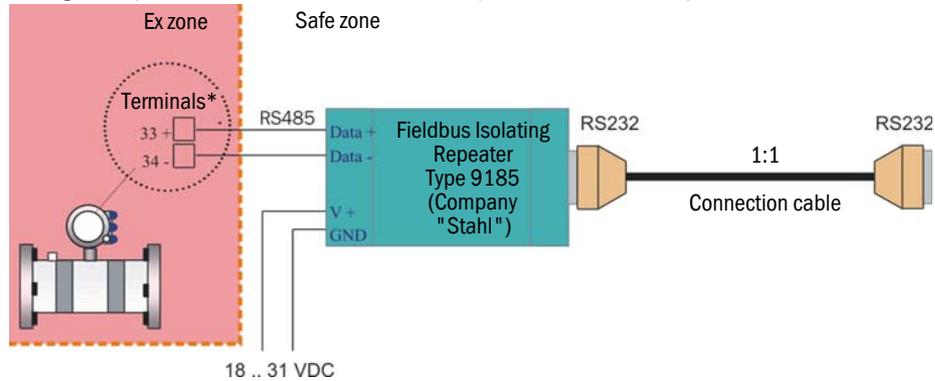


Interface sets for the connection of the FLOWSIC600 with a PC via serial or USB-interface can be ordered from SICK. See → pg. 58, Table 3.

The FLOWSIC600 serial interface conforms with the RS485 standard. An RS485 /RS232 cable and a 1:1 interface cable (pin 2 – pin 2 and pin 3 – pin 3) are required for data transfer to PC or laptop (see → Figure 17). Because MEPAFLOW600 CBM, the operation and diagnosis software for the FLOWSIC600, does not support RTS/CTS data transfer, the adapter must be able to distinguish between transmission and reception mode automatically. We, therefore, recommend the use of a serial interface set available from SICK.

Figure 17

Wiring example of "MEPA interface set RS485 / RS232" intrinsically safe for DIN rail mounting



\*Possible terminals for the RS485 connection are:

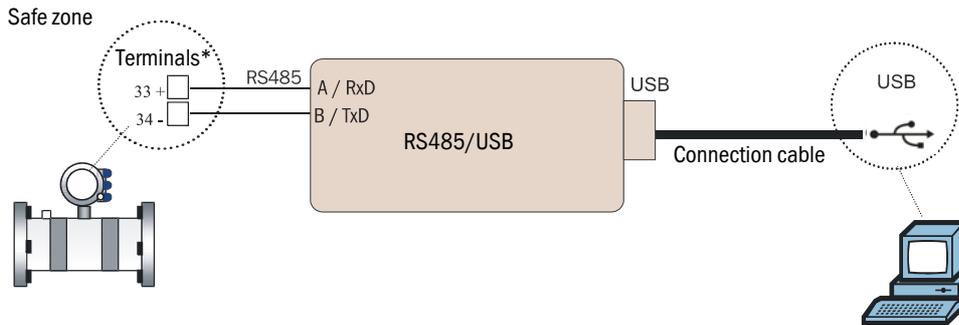
- 33 (+) and 34 (-)
- 81 (+) and 82 (-)

If necessary, the RS485 ports can be assigned to a specific bus address (Reg. #5020 "DeviceBusaddress"). The service port always has the bus address "1".

#### 4.2.2 Connecting the FLOWSIC600 via RS485/USB converter

If the PC/laptop does not offer a RS232 serial interface, a USB interface can be used. An appropriate USB converter is necessary to transform the signal for the RS485 device interface. The USB converter available through SICK contains a CD-ROM with a software driver which must be installed before an online connection between the FLOWSIC600 and the MEPAFLOW600 CBM software can be established.

Figure 18 Wiring example of "MEPA interface set RS485/USB" (Converter, Cable, Terminal plug, CD-ROM with software driver), non-intrinsically safe (see also Fig. 104)



\*Possible terminals for the RS485 connection are:

- 33 (+) and 34 (-)
- 81 (+) and 82 (-)

If necessary, the RS485 ports can be assigned to a specific bus address (Reg. #5020 "DeviceBusaddress"). The service port always has the bus address "1".

Table 3 Interface sets for the connection of the FLOWSIC600 to a network

Description	Part Number
"MEPA interface set RS485 / RS232" intrinsically safe for DIN rail mounting	2033410
"MEPA interface set RS485/USB" (Converter, cable, terminal plug, CD-ROM with software driver), non-intrinsically safe	6030669

## 4.3 Connecting to the FLOWSIC600 with MEPAFLOW600 CBM

### 4.3.1 Starting MEPAFLOW600 CBM

The MEPAFLOW600 CBM software is provided on the product CD shipped with the meter. It can also be downloaded from [www.flowsic600.com](http://www.flowsic600.com). See → pg. 25, for more details on the installation.

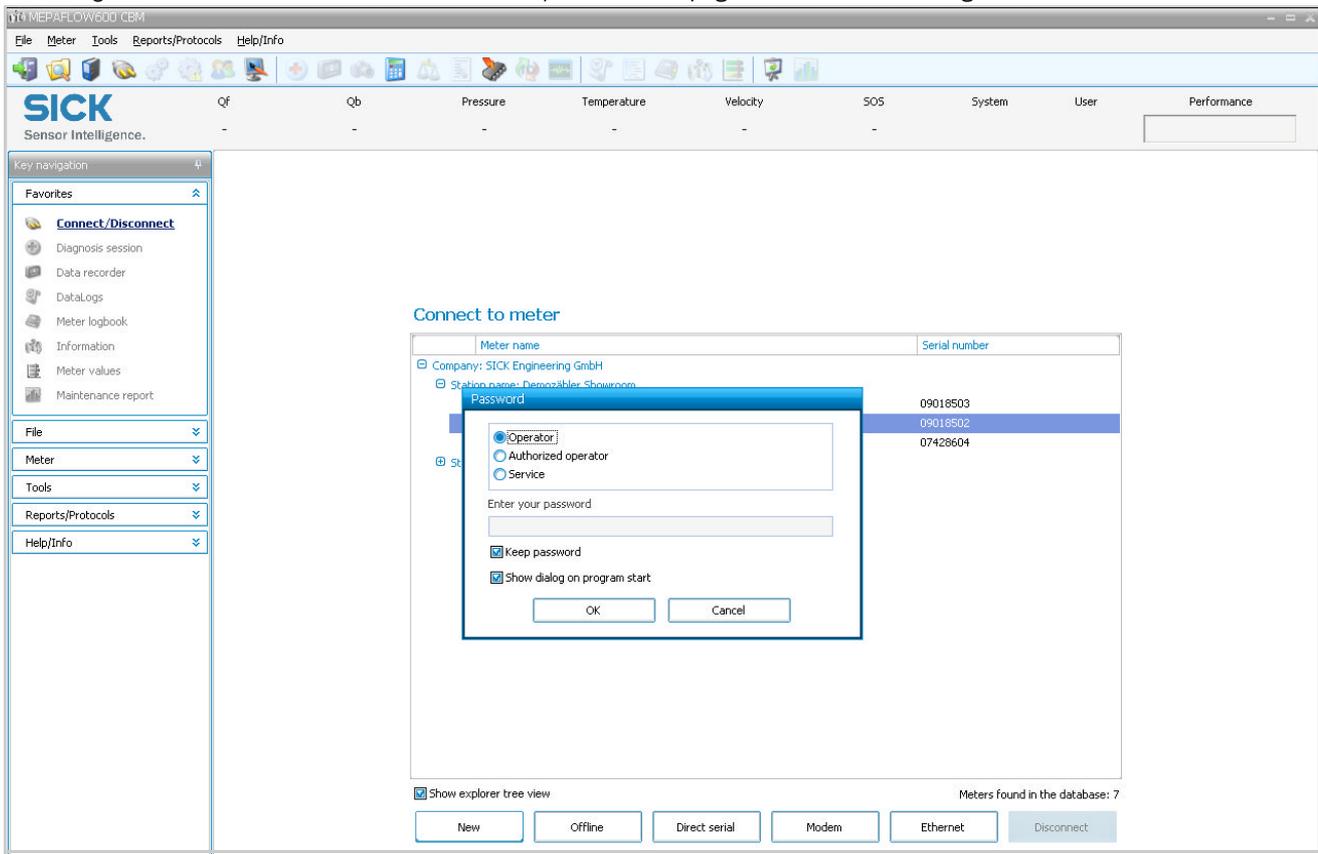
- ▶ After successful installation, start the MEPAFLOW600 CBM by selecting the "MEPAFLOW600 CBM" entry in the program group "SICK", created during installation, or by double-clicking on the desktop icon.

### 4.3.2 Choosing a User Access Level

- ▶ After starting MEPAFLOW600 CBM, the "Connect / Disconnect" page appears with the "Password" dialog window. (→ Figure 19)
- ▶ Choose a User access level, activate the corresponding radio button, enter the password and click the "OK" button.

User access level	Password
Operator	No password required
Authorized operator	"sickoptic"
Service	See Service Manual

Figure 19 MEPAFLOW600 CBM "Connect / Disconnect" page with "Password" dialog window



#### 4.3.3 Creating a new meter entry in the meter database



New meter entries can be created, whether the corresponding meter is connected to the PC or not. If the meter is connected, MEPAFLOW600 CBM loads all available parameters from the meter. If the meter is not connected, an initial master data set is created from the information the user enters (see Technical Data).

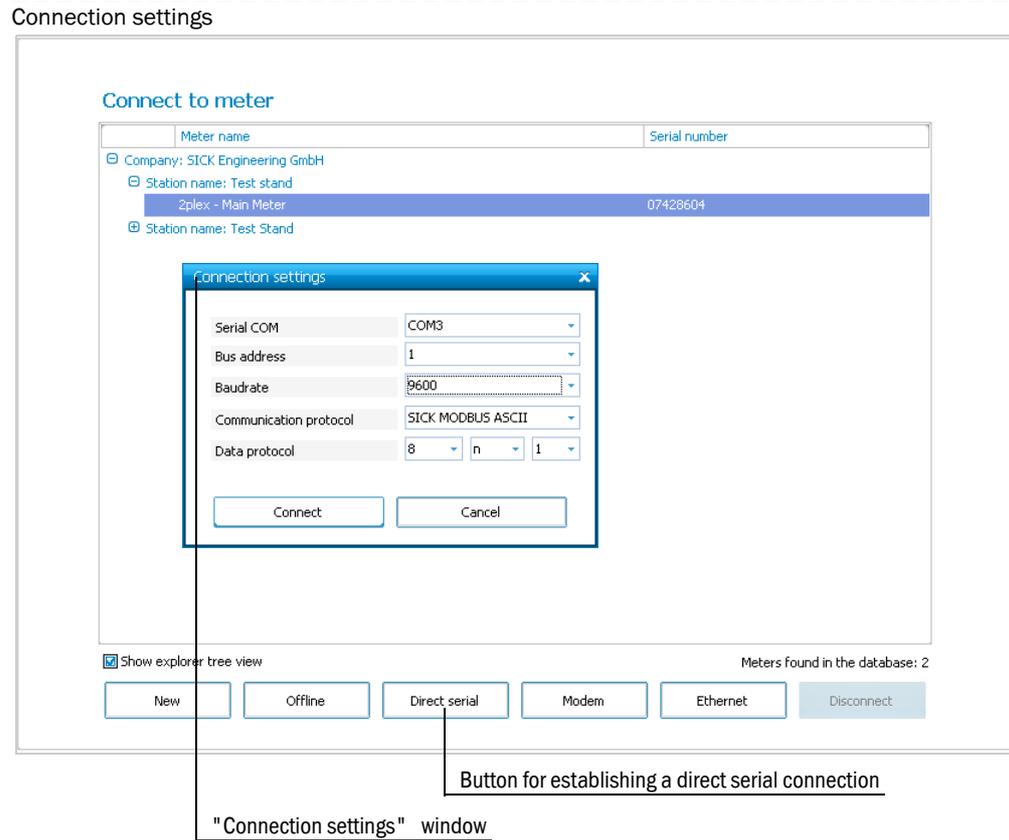
- ▶ Open the "Connect / Disconnect" page (Figure 19).
- ▶ Click "New". Then follow the instructions on screen.

## 4.3.4

**Online connection: Direct serial**

- ▶ Choose a meter and click the "Direct serial" button to establish a serial connection to a meter which is connected to the PC (→ Figure 20).
- ▶ Specify the appropriate connection settings in the "Connection settings" window (→ Figure 20) and click the "Connect" button to establish an online connection to the meter. If the connection fails, see → pg. 108, 6.4 for troubleshooting.

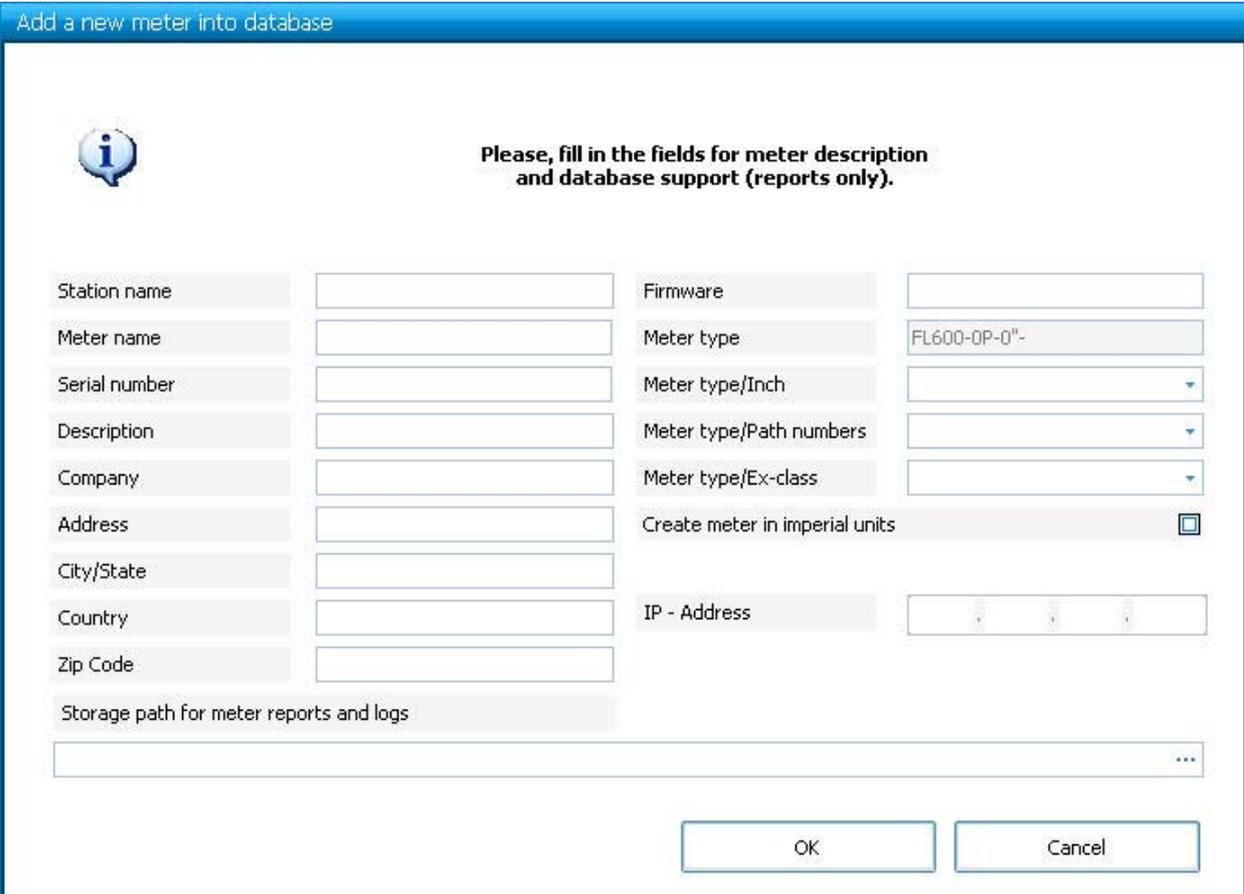
Figure 20



The parameters shown in the "Connection Settings" window in → Figure 20 are the default values with which the FLOWSIC600 RS485 interface is configured. The serial COM port must be individually selected.

- ▶ Edit the fields for the meter identification in the "Add new meter into database" dialog. The serial number, firmware version and meter type are automatically read from the meter → Figure 21.
- ▶ After the connection has been established, MEPAFLOW600 CBM displays the start page (can be specified in the Program settings) and the current readings from the meter.

Figure 21 Adding new meter to database



**Add a new meter into database**

**Please, fill in the fields for meter description and database support (reports only).**

Station name	<input type="text"/>	Firmware	<input type="text"/>
Meter name	<input type="text"/>	Meter type	FL600-0P-0"-
Serial number	<input type="text"/>	Meter type/Inch	<input type="text"/>
Description	<input type="text"/>	Meter type/Path numbers	<input type="text"/>
Company	<input type="text"/>	Meter type/Ex-class	<input type="text"/>
Address	<input type="text"/>	Create meter in imperial units	<input type="checkbox"/>
City/State	<input type="text"/>	IP - Address	<input type="text"/>
Country	<input type="text"/>		
Zip Code	<input type="text"/>		
Storage path for meter reports and logs			
<input type="text"/>			

OK Cancel

## 4.3.5

**Online connection: Ethernet**

The FLOWSIC600 can be connected to a network via Ethernet with an adapter. This adapter translates the meter MODBUS communication (ASCII or RTU) to MODBUS TCP. MEPAFLOW600 CBM supports the MODBUS TCP protocol.

**Requirements**

- The Ethernet connection requires firmware V3.3.05 or higher. It provides the required generic MODBUS protocol on the interface for the MODBUS TCP adapter.
- The FLOWSIC600 must be connected to a MODBUS ASCII/ MODBUS RTU to MODBUS TCP adapter, which is connected to a network via Ethernet and receives a - preferably permanent - IP address.
- The PC with MEPAFLOW600 CBM V1.0.47 or higher installed must be connected to the network and have uninhibited access to this IP address.

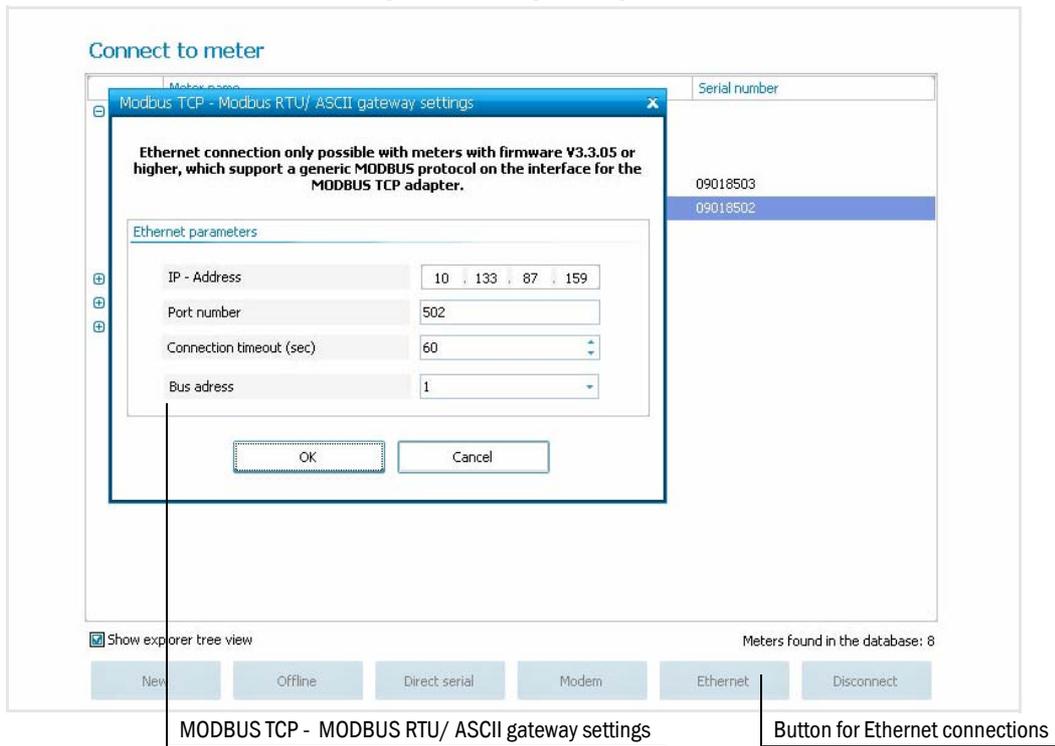
**Preparations for online connections via Ethernet**

- ▶ Make sure one of the serial ports (terminals 33/34 or 81/82) of the FLOWSIC600 is configured to use Generic MODBUS RTU or Generic MODBUS ASCII (NOT a SICK MODBUS protocol).
- ▶ Make sure the serial port is configured so that the highest baud rate is used (56000 baud).
- ▶ Connect a MODBUS RTU/MODBUS ASCII to MODBUS TCP adapter to the serial port according to the manual of the adapter.
- ▶ Connect the adapter cable to your network.
- ▶ Make sure the network assigns a permanent IP address to the adapter.
- ▶ Configure the adapter to the network settings (IP address / protocol / baudrate / gateway etc.) that you want to use (refer to adapter manual).
- ▶ Make sure the PC with MEPAFLOW600 CBM has access to the adapter's IP address.
- ▶ Make sure you know the MODBUS bus address of the meter.

In case of problems with the network setup, refer to your network administrator.

- ▶ Click the "Ethernet" button to establish a connection via Ethernet.
- ▶ Specify the IP address of the MODBUS TCP adapter and the bus address of the meter in the dialog "MODBUS TCP - MODBUS RTU/ASCII gateway settings" (→ Figure 22).
- ▶ Click "OK" to establish an online connection to the meter.

Figure 22 "MODBUS TCP - MODBUS RTU/ASCII gateway settings" dialog for online connections via Ethernet



**Tested MODBUS TCP to MODBUS ASCII/RTU adapter**

The connection between FLOWSIC600 and MEPAFLOW600 CBM has been tested with the "MODBUS TCP to MODBUS ASCII/RTU Converter", Model MES1b by B&B Electronics. This adapter is shipped with a software, which searches the network for connectable devices and supplies the user with the IP addresses found.

Table 4 Interface sets for the connection of the FLOWSIC600 to a network

Description	Part Number
MODBUS TCP to MODBUS ASCII/RTU Converter	6044004

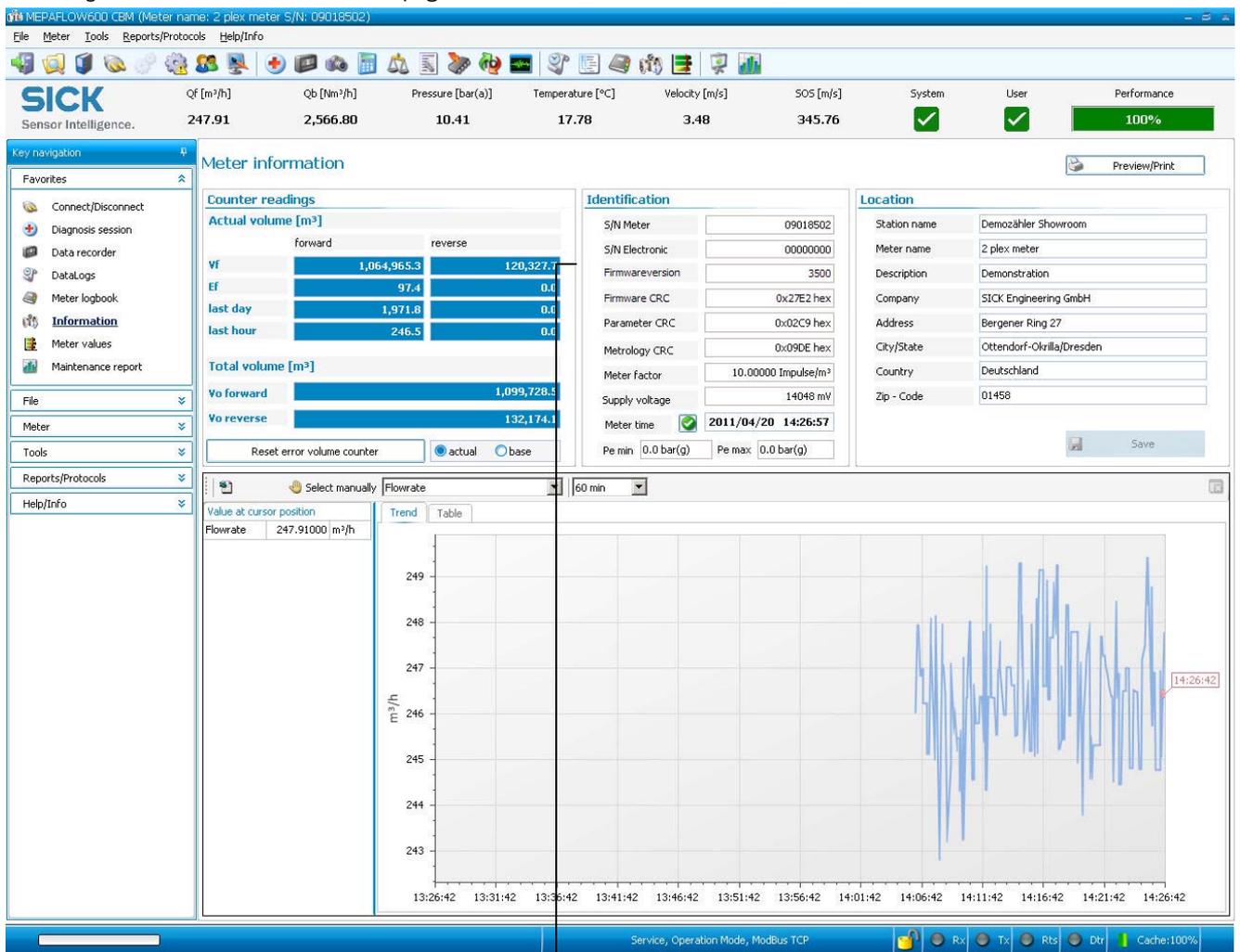
## 4.4 Identification

### 4.4.1 Checking identification, operation / design data and firmware version

Before commissioning, cross-check the data representing the flow meter with the data in the test protocols which are contained in the Manufacturer Data Report (MDR). This can be done on the LCD display (see Technical Information) or - much easier - with MEPAFLOW600 CBM software:

- Open the "Meter information" page and compare the data in the "Identification" section (→ Figure 23) with the data in the check reports of the MDR or, when the meter has been calibrated, with the calibration and parameter report.

Figure 23 "Meter Information" page



"Identification" section

## 4.4.1.1

**Firmware**

The FLOWSIC600 firmware is stored on a non-volatile memory (FLASH PROM). The program code for the signal processor and system micro-controller are identified by a version number (Reg. #5002 "FirmwareVersion") and a check sum (Reg. #5005 "ProgramCRC") and can be verified as mentioned above.

**NOTICE: Type approval**

If the FLOWSIC600 is used for fiscal metering, the approved firmware versions and the associated check sums are documented in the national pattern approval certificates.

4.5

**Field setup**

The MEPAFLOW600 CBM software "Field setup" wizard guides the user through the parameter configuration during the commissioning of the FLOWSIC600. The wizard consists of 8 pages. For checking the configuration of the SPU outputs refer to the "Instrument Data Sheet" of the FLOWSIC600, which is included in the Manufacturer Data Record (MDR) (example see → Figure 24).



The parameter changes performed in the Field setup wizard require the User Access Level "Authorized operator" (see → pg. 59, 4.3.2).

- ▶ To start the Field setup, choose "Tools / Field Setup" from the menu.
- ▶ Follow the instructions on screen step by step.

Figure 24 Example of an "Instrument Data Sheet" as contained in the MDR

1	<b>GENERAL</b>			54	<b>TRANSMITTER (Integral)</b>		
2	<b>Meter-No.: 3889</b>			56 *	Power supply / Power consumption	12 .. 28,8 V DC	< 1W
3	Type	FL600		57 *	Enclosure classification	IP 67	
4	Meter size	06" / DN150		58 *	Cable entry	M20 x 1,5 (3x)	
5 *	Article number			* 59	Hazardous Area Class.		
6 *	TAG number					II 1/2G Eex de ib [Ia] IIA T4	
7 *							
8 *	Order number	01/11-2		60	SPU housing material	Aluminium	
9	<b>METER BODY</b>			* 61	Ambient temperature (range)	°C	-40 ... 60
10	Inner pipe diameter	mm	147,00	62	Display	LCD	
11	Overall length (A)	mm	450,00	63	Display language	Russian	
12	Overall height (B)	mm	490,00	64	Engineering units	Metric	
13	Weight	kg	130	65	<b>Output and Signal Configuration - Signal processing unit</b>		
14	Flow range	m³/h	32 ... 2500	66	DO0/AO0 Terminals 31/32 (HF-Pulse)	Volume a.c., no pulses when data invalid	
15	Number of meas. paths	4		67	Signal configuration	NAMUR / normally open	
16	Linearity	±/ -0.5% of MV 0.1 ... 1 Qmax		68			
17 *	Repeatability	< 0,1%		69			
18	Flange design code	DIN/EN 1092-1		70			
19	Flange class	PN100		71			
20	Flange face	Form B2		72	MOD Terminals 33/34 (RS 485)	SICK Modbus ASCII	
21	Body material	1.0566 / ASTM A350 Gr. LF2		73	DO1 Terminals 51/52 (HF-Pulse)	Volume a.c.	
22	Transducers exchangeable under pressure	No		74	meter factor	1/m³	2.880
23 *	Transducer cover	Aluminium		75	Signal configuration	NAMUR / normally open	
* 24	Design temperature	°C	-46 ... 100	76	max. Output	8,2 V / 0,8...6,5 mA	
* 25	Design pressure	bar (g)	94	77	DO2 Terminals 41/42 (Status)	Status Warning	
26	Material certificate	3.1 EN 10204		78	Signal configuration	NAMUR / normally open	
27 *	Enclosure classification	IP 67		79	max. Output	8,2 V / 0,8...6,5 mA	
28 *	Surface coating / painting	two layers: Epoxy + Acrylic RAL9002		80	DO3 Terminals 81/82 (RS 485)	SICK Modbus ASCII	
29 *	Pressure tapping	1/4" NPT female		81			
30	<b>Sensors</b>			82			
31				83	<b>COMMUNICATION</b>		
32 *	Sensor material	Titan 3.7165		84	Interface	2x RS 485	

#### 4.5.1 **Disconnecting from the meter and closing the session**

When disconnecting from the meter, a session is stored in the MEPAFLOW600 CBM meter database. It contains the following data:

- a complete parameter set from the meter at disconnection
- all parameter changes made during Field setup (entries can be viewed in the Meter Explorer)
- all logbook data (if downloaded)
- the Maintenance Report created on page 8 of the Field setup

This data can be accessed later with the "Meter Explorer", even when you are not directly connected to the meter.

To disconnect from the meter and to close the session, proceed as follows:

- ▶ Go to "Connect / Disconnect" page (select "File / Connect/Disconnect" from menu).
- ▶ Click "Disconnect". The "Session description" window opens.
- ▶ Describe the activities carried out during the session (e.g. "Field Setup").
- ▶ Click OK.

## 4.6 Function test

The major system parameters are configured at the factory. The default settings should allow error free operation of the FLOWSIC600. Nevertheless, correct meter operation should be verified on site when the meter is installed and is subject to actual operating conditions.

### 4.6.1 Function test on FLOWSIC600 with LCD front panel

The FLOWSIC600 is functioning correctly, if the standard display shows two pages of measurands and current readings and the pages alternate every 5 seconds. (For operation and menu structure of the SPU with LCD see Technical Information )

If a current error or warning is active, the display will be interrupted by an error message every 2 seconds. As soon as the cause of the error/warning has been rectified, the FLOWSIC600 automatically returns to the standard display.

If the logbooks contain unacknowledged errors, warnings or information, the corresponding letter is displayed in the upper right hand corner and flashes. The letter stops flashing, once the message has been acknowledged in the logbook. It disappears when the entries have been cleared from the logbook.

Detailed information on errors is available in the logbook (see → pg. 94, 5.4.1 und see Technical Information ). See chapter → »Troubleshooting«.



You are advised to check the plausibility of the measured and diagnosis values, even if the device is functioning properly (see chapter → »Maintenance«).

### 4.6.2 Function test on FLOWSIC600 with LED front panel

The FLOWSIC600 is functioning correctly when the green status LEDs for each measuring path installed start flashing periodically approximately 30 seconds after the power supply is switched on.

If the yellow LED flashes, the FLOWSIC600 works in the operation state "Check request" with an insignificantly reduced accuracy (e.g. if one path fails).

If the yellow LED lights up permanently, the measurement is invalid. In this case, the error must be diagnosed (see Chapter 8 of this Manual).

### 4.6.3 Function test with MEPAFLOW600 CBM

#### Performance check

- ▶ Once the facility is flowing at the initial flow rate, go to the "Meter values" page to check the performance of the meter. The performance value should be at least 75% on all paths. If the velocity of gas is greater than 30 m/s (100 ft/s), the performance values may be significantly lower.
- ▶ Check the Main system bar for system alarms (the symbol on the button "System" should be green) and warnings (the symbol on the button "User" should be green) (→ Figure 25). If there is a yellow or a red symbol, proceed as described on → pg. 100, 6.1.

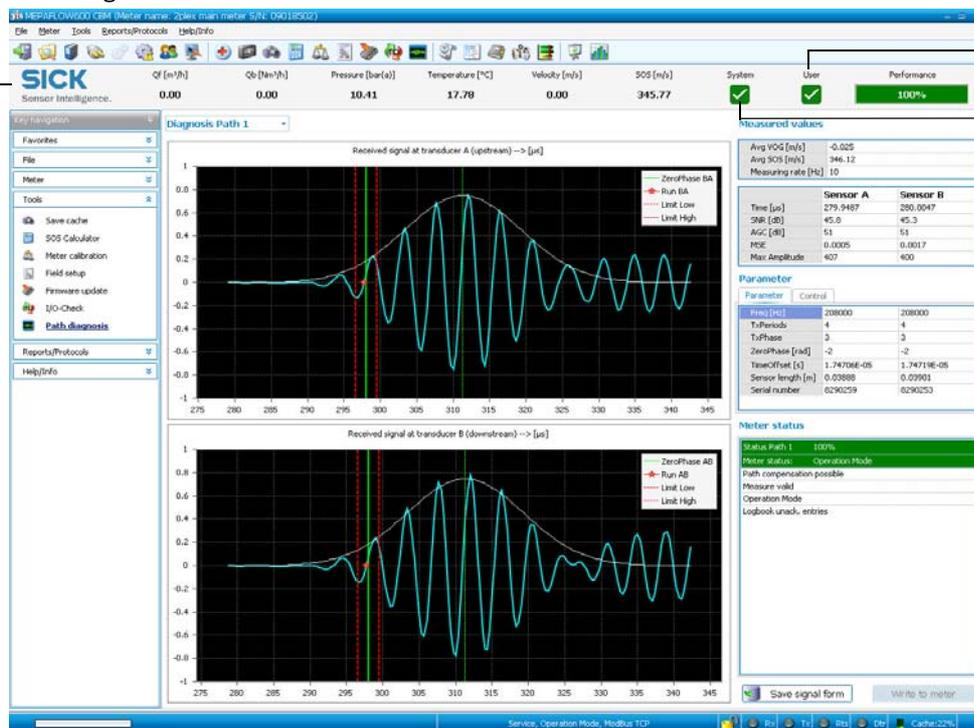
#### Zero phase check

- ▶ Use the "Path Diagnosis" wizard (→ Figure 25) to check the "Zero Phase" parameters of both transducers on each path (path 1, 2, 3, 4).

Properly adjusted zero phases of the individual paths are the basis for accurate transit time measurement of the ultrasonic signals. The "Zero Phase" parameter of a path is properly adjusted, when the green cursor in the signal window is symmetrically within the two dotted red limit lines and the red asterisk is positioned exactly on the second positive zero crossing of the received ultrasonic signal (→ Figure 26).

Figure 25 "Path Diagnosis" wizard in MEPAFLOW600 CBM

Main system bar



"User" Button

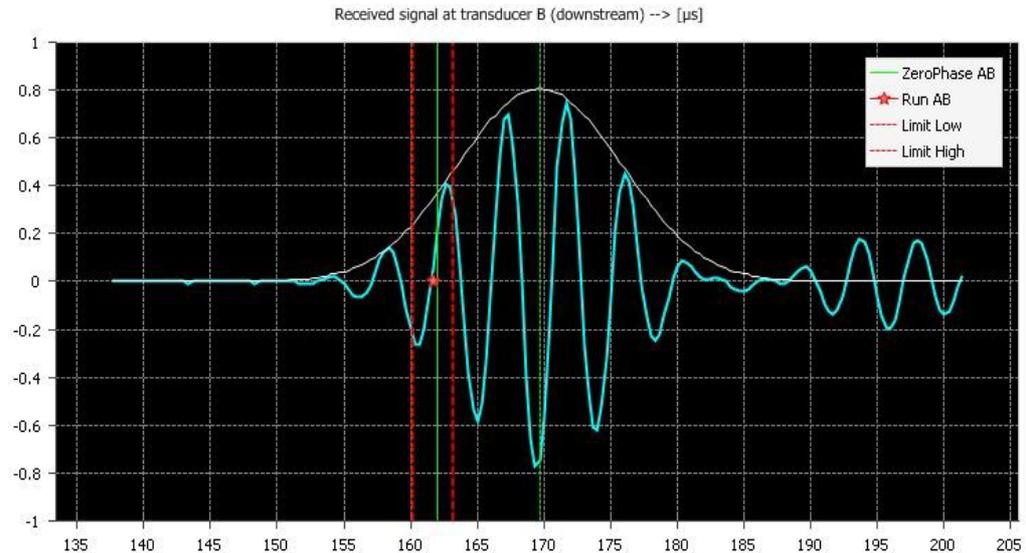
"System" Button

If the zero phase values do not meet the aforementioned criteria, the zero phase needs to be adjusted according to angepasst werden (see Technical Information).

In addition, the validity of the settings should be verified:

- Open the "Meter status" window and go to the tab "Advanced or Path Status" (→ pg. 83, Figure 30). If a lamp for "Time plausibility" is on, it indicates an incorrect zero phase.

Figure 26 Signal window displaying ultrasonic signal in the "Path Diagnosis" page



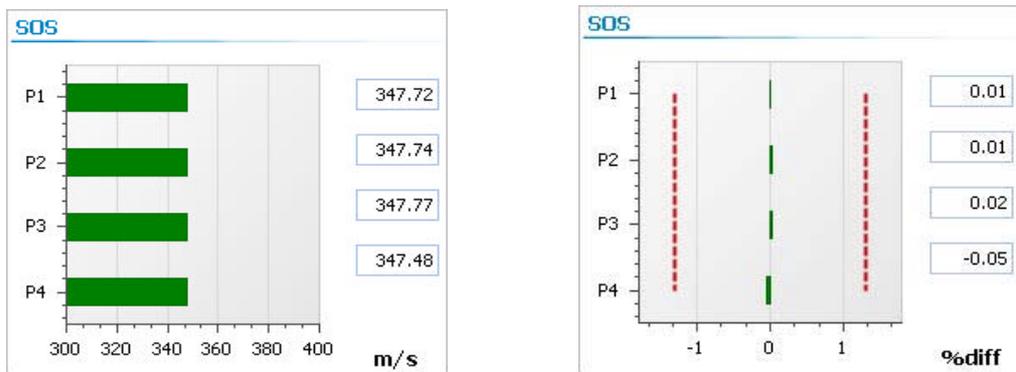
- Go to the "Meter values" page to check that the measured SOS values are almost the same at all paths of the FLOWSIC600, and that they differ by less than 0.1% (→ Figure 27).
- Switch between display of absolute and difference SOS by clicking the right mouse button on the SOS graph and using the context-menu.



In the case of very low gas velocities (< 1 m/s or 3 ft/s), there may be more significant differences between the paths due to thermal stratification. In this case, the SOS on the upper paths (1 and 2) will be higher than the lower paths.

- Check that the measured SOS deviates no more than 0,3% from a theoretical SOS, which is calculated from gas composition, pressure and temperature (→ pg. 87, 5.2.1).

Figure 27 SOS per path on the "Meter values" page (left: absolute SOS , right: difference to average)



## 4.7 Optional advanced setup

### 4.7.1 Configuration and activation of User Warnings

When normal operating conditions have been reached, the User Warnings can be configured to best suit the specific application.



- The User Warnings are preconfigured when the meter is shipped from the factory (see "Default activation state" and "Default value" see Technical Information in the following tables → pg. 151, Table 20).
- If there is no need to change the User Warnings, or if you are not sure about consequences of changes, keep the values as they are or discuss with a SICK representative.

To configure the User Warning limits, proceed as follows:

- ▶ Use MEPAFLOW600 CBM to connect to the meter (→ pg. 59, 4.3).
- ▶ Open the "User Warnings" assistant from the main system bar by clicking the "User" button (→).
- ▶ Go to the "Configuration" tab (→, right side).
- ▶ Use Dokument Technical Information to plan the configuration of User Warnings to best suit the specific application.
- ▶ Activate or deactivate User Warnings with the check box on the right.
- ▶ Edit parameter values in the fields.
- ▶ Click the "Write to meter" button.



All User Warning parameters - except for the parameter 'Min. VOG for warnings' - can be configured in the User Access Level "Operator" and without switching the meter to the Configuration Mode.

Button "User" in the main system bar, "User Warnings" assistant with "Status" and "Configuration" tab

<b>SICK</b> Sensor Intelligence.	Qf [m³/h] <b>20.20</b>	Qb [Nm³/h] <b>301.68</b>	Pressure [bar(a)] <b>14.48</b>	Temperature [°C] <b>19.44</b>	Velocity [m/s] <b>1.30</b>	SOS [m/s] <b>346.93</b>	System <input checked="" type="checkbox"/>	User <input checked="" type="checkbox"/>	Performance <b>100%</b>
-------------------------------------	---------------------------	-----------------------------	-----------------------------------	----------------------------------	-------------------------------	----------------------------	---	---	----------------------------

"User" Button

"Status" tab

"Configuration" tab

## 4.7.2 Configuration of DataLogs

### 4.7.2.1 Using the DataLogs

Starting with firmware version 3.4.00, the FLOWSIC600 provides two DataLogs (Hourly Log and Daily Log). They save averaged measured values and are stored in the SPU's non-volatile memory (FRAM). All data can be downloaded and exported to Excel files with MEPAFLOW600 CBM (→ pg. 24, 2.4.4.).



#### Valid flow for DataLog logging

Gas flow values are averaged for the DataLog entry only if VOG is above the "Min. VOG for warnings" (→ pg. 72, 4.7.1) and the flow is in the direction for which the DataLog was configured. The Flow Time saved for every entry indicates about how long the gas flow was valid for DataLog Logging during the storage cycle. For example:

- If the flow was above "Min. VOG for warnings" and in the forward direction (for a forward configured Hourly Log) for half an hour, the corresponding Hourly Log data will show a Flow Time of 50%.
- If the flow was above "Min. VOG for warnings" but in the reverse direction (for a forward configured Hourly Log) for an hour, the corresponding Hourly Log data will show a Flow Time of 0%.
- If the Flow Time is 0%, all diagnosis related values are shown as 0 (Temperature is 0 Kelvin). Meter Status and Volume Counter values are shown as usual.

#### 4.7.2.2 Configuration of DataLogs

The following parameters can be configured on the Configuration tab of the DataLogs page (→ Figure 28) to best suit the specific application (for more details see → pg. 23, 2.4.3.4 and following):

- Type of dataset,
- Storage cycle,
- Storage behavior,
- Active flow direction,
- Accounting hour
- Distribution of FRAM capacity.



Changes to the parameters "Type of dataset", "Storage behavior" or "Direction" will erase all entries from the DataLog which is changed.

- ▶ If configuring these parameters after commissioning, first download and export all entries according to → 2.4.4, to prevent loss of data.

When the meter is shipped, the DataLogs are preconfigured.

Table 5 Standard DataLogs configuration when meter is shipped \*

Configuration parameter	Hourly log	Daily log	Diagnostics comparison log
Type of Dataset	Diagnostic values	Volume counters	Diagnostic values
Storage cycle	1 hour	1 day	5 min
Storage behavior	Overflow	Overflow	not applicable
Active flow direction	Forward	Forward	Bidirectional
Accounting hour	not applicable	0 (midnight)	not applicable
Max. number of entries	Entries for approx. 38 days	Entries for approx. 2 years	20 entries



\* Depending on location, the DataLogs for the specific FLOWSIC600 may be preconfigured to fit the requirements e.g. of API, MID or PTB. These settings may differ from the defaults described here.

Complete the following steps to configure the DataLogs:

- ▶ Go to the DataLogs page (select Meter / DataLogs from menu).
- ▶ Choose the Configuration tab (see → Figure 28).
- ▶ Switch the meter into Configuration Mode (choose "File / Configuration Mode" from the menu).
- ▶ Use the drop down lists to select the parameter settings.
- ▶ Click the "Write to meter" button.

Figure 28 DataLogs Configuration tab

"Configuration" tab

**DataLogs**

Data Configuration

**Diagnostics Comparison (DataLog 1)**

Vmin / Vmax	1.0m/s...13.7m/s
Storage cycle	5minute(s)

Clear Diagnostics Comparison

**Hourly Log (DataLog 2)**

Type of dataset	Diagnostic Values	Currently Logs for 38days (912 datasets)
Storage cycle	1hour(s)	Rolling entries
Storage behavior	Overflow	
Direction	Forward	

Clear Hourly Log

**Daily Log (DataLog 3)**

Type of dataset	VolumeCounters	Currently Logs for 1year, 360days (725 datasets)
Storage cycle	1day(s)	Rolling entries
Storage behavior	Overflow	
Direction	Forward	
Accounting hour	00:00	

Clear Daily Log

Distribution of FRAM capacity for Hourly Log and Daily Log

Hourly Log	71%
Daily Log	29%
Unused	0%

Reset defaults Write to meter

#### 4.7.2.3 Disabling DataLogs

To disable a DataLog complete the following steps:

- ▶ Go to the DataLogs page (select Meter / DataLogs from menu).
- ▶ Choose the Configuration tab (see → Figure 28).
- ▶ Switch the meter into Configuration Mode (choose "File / Configuration Mode" from the menu).
- ▶ Set the parameter "Storage cycle" to "disabled" for any DataLog that should be disabled.
- ▶ Click the "Write to meter" button.

#### 4.7.2.4 **Enabling (starting) DataLogs**

To enable (start) a disabled DataLog, complete the steps described under → pg. 77, 4.7.2.5 (Resetting DataLog Parameters to Defaults).

#### 4.7.2.5 **Resetting DataLog parameters to defaults**



##### **Before resetting DataLog Parameters to Defaults**

In MEPAFLOW600 CBM from V1.1.00, DataLog entries are not saved in the meter database. Before clearing entries from DataLogs, download and export the entries into Excel (→ pg. 96, 5.4.2).

Complete the following steps to reset the DataLog parameters to the defaults:

- ▶ Go to the DataLogs page (select Meter / DataLogs from menu).
- ▶ Choose the "Configuration" tab (see → Figure 28).
- ▶ Switch the meter into Configuration Mode (choose "File / Configuration Mode" from the menu).
- ▶ Click "Reset defaults".



##### **Defaults**

The default settings are described in → 2.4.3.1 and → 2.4.3.2.

### 4.7.3 Configuring and using the Diagnostics Comparison Log

The Diagnostics Comparison Log can be used to get information on changes in the meter's health (more information → pg. 24, 2.4.4): The Diagnostic Comparison Report, created from the data of the Diagnostics Comparison Log, facilitates an easy and quick information about changes in the meter health between two different points of time (e.g. commissioning and now) (see Technical Information Diagnostic Comparison Report Check).

#### 4.7.3.1 Using the Diagnostics Comparison Log

The Diagnostics Comparison Log provides a comparison between current diagnostic values (dataset type "Diagnostic Values", see Technical Information) and those of a reference time (e.g. at time of commissioning). The current diagnosis values are stored in Current Classes 1 to 5, while the reference values are stored in Reference Classes 1 to 5.

To prepare the Diagnostics Comparison Log for the future use, complete the following steps when the FLOWSIC600 is running under normal operating conditions:

- ▶ Go to the "DataLogs" page (choose "Meter / DataLogs" from the menu) → pg. 76, Figure 28.
- ▶ In the "DataLog" selection dialog, activate the check box for "Diagnostics Comparison" [DataLog1], to download the Diagnostics Comparison data from the meter.
- ▶ Click "Export Datalogs" and export the Diagnostics Comparison Data to an Excel File for future reference.
- ▶ Clear all Diagnostics Comparison Log data that may have been collected from the meter during calibration:
  - ▶ Choose the "Configuration" tab (see → Figure 28).
  - ▶ Switch the meter into Configuration Mode (select File/Configuration Mode from menu).
  - ▶ Click the "Clear Diagnostics Comparison" button and confirm the confirmation dialog with "Yes".
  - ▶ Switch the meter into Operation Mode.
- ▶ If possible, operate the meter in the Velocity Range Classes 1 to 5 (also see → pg. 79, 4.7.3.2) to fill the Reference Classes with data representing the correct operation of your installation.



#### Filling the velocity range classes with valid flow data

- Only stable gas flow conditions will be used to calculate the averaged data in the Diagnostics Comparison Log. Therefore the set gas velocities should be well within the class limits and should stay relatively stable for the time set as storage cycle (default is 5 minutes).
- The parameter DataLogClassStdev (Reg. #3050) sets the allowed standard deviation for the definition of the gas flow conditions as stable → 2.4.3.4.

When the reference classes are filled with data representing the usual operation of the installation, the current classes will be continuously updated, showing the current state of the meter. Use the Diagnostics Comparison Report (see Technical Information) → pg. 181, 6.4.3, to detect changes in the meter between the diagnostic values in the reference classes and those in the current classes.

#### 4.7.3.2 **Configuring the general conditions for the Diagnostics Comparison Log**

The gas velocity class ranges are calculated to optimally cover the operation range of the meter. The lower limit of the gas velocity range classes is defined by the parameter "Min. VOG for warnings". The upper limit is defined by "VOG limit".

- ▶ View the Diagnostics Comparison data tab, to find the velocity class limits calculated for the meter. → Figure 4, S. 24 shows an example of a Diagnostics Comparison Log filled with entries.
- ▶ If necessary, configure "Min. VOG for warnings" and "VOG limit" to fit the application range of your specific FLOWSIC600 on the configuration tab of the User Warnings window (→ pg. 72, 4.7.1).



- Changes to the parameters "Min. VOG for warnings" or "VOG limit" will clear all data from the Diagnostics Comparison Log!
- Note that the parameter "Min. VOG for warnings", Reg. #7208 "PathCompClassLow", plays an important role in path compensation (see Technical Information).
- Note that the parameter "VOG limit" also defines the limit for User Warnings.

#### 4.7.3.3 **Configuring the Diagnostics Comparison Log**

Complete the following steps to configure the Diagnostics Comparison Log:

- ▶ Go to the DataLogs page (choose "Meter / DataLogs" from the menu).
- ▶ Choose the Configuration tab (see → Figure 28).
- ▶ Switch the meter into Configuration Mode (select File/Configuration Mode from menu).
- ▶ Use the drop down lists behind the arrows to select the parameter settings.
- ▶ Click the "Write to meter" button.

## 4.7.3.4

**Configuration of the Diagnostics Comparison limits**

The Diagnostics Comparison limits can be activated to make the meter generate a warning when the difference between the diagnostic values in the reference classes and those in the current classes exceed the Diagnostics Comparison limit values.

These limits can be activated and configured in the User Warnings window:

- ▶ Use MEPAFLOW600 CBM to connect to the meter (→ pg. 59, 4.3).
- ▶ Open the "User Warnings" window from the main system bar by clicking the "User" button (→ Figure 29).
- ▶ Go to the "Diagnostic Comparison limits" tab (→ Figure 29).
- ▶ Use Tabelle 24 in der Technical Information to plan the optimum configuration of the Diagnostics Comparison limits to best suit your application.
- ▶ Activate or deactivate the Diagnostic Comparison limits with the check box on the right.
- ▶ Edit parameter values in the fields.
- ▶ Click the "Write to meter" button.



All Diagnostics Comparison limit parameters can be configured in the User Access Level "Authorized Operator" and without switching the meter to the Configuration Mode.

Table 6 Diagnostics Comparison limits

Monitored difference between reference values and current values	Configurable difference limit	Default value	Notes	Default activation state <sup>1</sup>
Profile factor	Profile Factor change	10%	A change of the profile factor value may be caused by contamination, blockage or deposits in the line that change the symmetry of the flow profile. ► We recommend to use the default value.	Off
Symmetry	Symmetry change	10%	A change of the symmetry value may be caused by contamination, blockage or deposits in the line that change the symmetry of the flow profile. ► We recommend to use the default value.	
SOS differences between paths	SOS difference change	1%	The SOS deviation indicates whether or not a path is measuring the correct transit time. ► We recommend to use the default value.	
Turbulence	Turbulence change	50%	A change of the turbulence value may be caused by contamination, blockage or deposits in the line that change the symmetry of the flow profile. ► We recommend to use the default value.	
SNR (Signal-to-noise ratio)	SNR change	20dB	Interfering noise caused by fittings in the pipeline, valves that are not fully open, sources of noise near the measuring location, or defective ultrasonic transducers may affect the signal-to-noise-ratio. ► We recommend to use the default value.	
AGC (Signal amplification)	AGC change	10dB	If the AGCs of a path deviate more than allowed, this can indicate a malfunction in the ultrasonic transducers, electronic modules, transducer cables or parameter settings (signal models, control limits). ► We recommend to use the default value.	

<sup>1</sup> User Warnings must be activated to become effective on the warning output.

Figure 29

"User Warnings" window with "Diagnostics Comparison limit" tab

<b>SICK</b> Sensor Intelligence.	Qf [m³/h]	Qb [Nm³/h]	Pressure [bar(a)]	Temperature [°C]	Velocity [m/s]	SOS [m/s]	System	User	Performance
	20.20	301.68	14.48	19.44	1.30	346.93	✓	✓	100%

"User" Button

**User Warnings**

Status Configuration **Diagnostic Comparison limits**

**Meter S/N: 09018502** **Meter date/time: 4/20/2011 15:53:04**

Difference limits	User limit	Unit	Maximum value	Unit	Activation
Profile Factor change	5.0	%	0.8	%	<input checked="" type="checkbox"/>
Symmetry change	5.0	%	-0.3	%	
SOS difference change	0.30	%	0.01	%	
Turbulence change	6.0	%	0.4	%	
SNR change	6.0	dB	1.0	dB	
AGC change	6.0	dB	0.0	dB	

Window always on top

### 4.8 Activation of path compensation

If the status bit "Path compensation valid" is "active", then the FLOWSIC600 is able to compensate a path failure.

The meter automatically sets this bit to "active" after operating for about 20 minutes with error free measurement at all paths at a gas velocity between 1 to 8m/s (3.3 to 26.2 ft/s) and also about 20 minutes at a gas velocity higher than 8m/s (26.2 ft/s).

The status bit "Path compensation valid" is displayed on the "Meter status" page (→ pg. 83, Figure 30).

**+i Determination of path relationships during commissioning**

Due to the unique path relationships of each individual installation, every meter must determine the path relationships during the commissioning procedure.

In order to ensure that the system is able to compensate for path failure at both high and low flow velocities, it is recommended that the FLOWSIC600 meter be run for 20 minutes at low gas velocities (< 8 m/s or < 26.2 ft/s) first and then for 20 minutes at high gas velocities (> 8 m/s or > 26.2 ft/s) during commissioning.

Figure 30 "Meter status" page with active "Path compensation valid" status bit

The screenshot shows the SICK Meter Status interface. At the top, there are several data points: Qf [m³/h] (20.20), Qb [Nm³/h] (301.68), Pressure [bar(a)] (14.48), Temperature [°C] (19.44), Velocity [m/s] (1.30), and SOS [m/s] (346.93). Below this, there are three status indicators: System (checked), User (checked), and Performance (100%).

The main content area is divided into several sections:

- Meter 5/N: 09018502** and **Meter date/time: 5/5/2011 16:04:36**
- Operating Mode**: Operation Mode (green), Configuration Mode (grey), Air test active (grey).
- Meter Status**: Measurement valid (green), Check request (grey), User Warning Limit exceeded (grey), Path failure (see advanced) (grey).
- System**: Volume counter CRC error (a.c.) (grey), Volume counter CRC error (s.c.) (grey), I/O Impulse out of range (grey), System time invalid (RTC error) (grey), Firmware CRC error (grey), Logbook(s) contains unack. entries (grey), Battery LifeSpan (change battery) (grey), Signature error (grey).
- Parameters**: Parameter CRC error (grey), Parameter invalid (grey), Parameter defaults loaded (grey), Path Comp. Param. error (grey), DSP Parameter error (grey).
- Measurement**: EVC hardware error (grey), EVC parameter invalid (grey), HART com. p error (grey), HART com. T error (grey), DSP error (grey), DSP boot error (grey), DSP measure invalid (grey), Adjust range error (grey), Path compensation valid (green), Continuous measure mode (checked), Filter Mode active (checked).
- Logbooks**: Custody Logbook [1] (grey), Warning Logbook [2] (grey), Parameter Logbook [3] (grey).
- DataLogs**: Diagnostic Comparison (DataLog 1) (grey), Hourly Log (DataLog 2) (grey), Daily Log (DataLog 3) (grey).
- Other**: Parameter write lock: UNLOCKED, Unit system in meter: METRIC.

A callout box points to the "Path compensation valid" indicator, stating "Opens the 'Meter Status' screen".

Subject to change without notice

#### 4.9 **Sealing**

After having completed the commissioning, seal the signal processing unit (if required) in accordance with the sealing plan (→ pg. 132, 7.6).

#### 4.10 **Documentation**

The commissioning should be documented with a Commissioning Protocol. The document "FLOWSIC600 Commissioning Protocol" is content of the FLOWSIC600 shipping on paper and on the product CD.

- ▶ File the completed Commissioning Protocol with the Manufacturer Data Record (MDR)

# FLWSIC600

## 5 Maintenance

General  
Routine checks  
Maintenance report  
Optional data download

## 5.1 General

The FLOWSIC600 does not contain mechanically moving parts. The meter body and ultrasonic transducers are the only components that come into contact with the gaseous media. Titanium and high-quality stainless steel ensure that these components are resistant to corrosion, provided that the meter is installed and operated in accordance with the relevant specifications. This means that the FLOWSIC600 is a low-maintenance system. User Warning Limits can be configured to provide early warnings for possible issues with contamination or blockage. Maintenance is limited mainly to routine checks to determine the plausibility of the measured values and diagnostic results produced by the system.

It is recommended that Maintenance Reports be created and filed on a regular basis (→ pg. 92, 5.3). This creates a basis of comparable data over time and helps when a problem requires diagnosis.



The operating conditions (gas composition, pressure, temperature, flow velocity) of the individual Maintenance Reports should be comparable or documented separately and taken into account when the data is analyzed.

### Routine checks:

- »Comparing theoretical and measured Speed of Sound (SOS)« (pg. 87)
- »Checking the meter health« (pg. 89)
- »Time synchronization« (pg. 90)
- »Battery lifespan / capacity« (pg. 91)

### Documentation:

- »Maintenance report« (pg. 92)

### Optional data download:

- »Logbook check« (pg. 94)
- »DataLogs check« (pg. 96)
- »Prüfen des Diagnostics Comparison Reports« (see Technical Information)
- »Trendreport« (see Technical Information)
- »Sicherung der MEPAFLOW600 CBM Zählerdatenbank« (see Technical Information)

### Optional advanced configurations:

- »Optionale Anpassung der Nutzerwarnungen« (see Technical Information)

## 5.2 Routine checks

The information displayed on the front panel LCD display of the FLOWSIC600 meter can be checked to ensure that the system is functioning properly. The MEPAFLOW600 CBM software provides a more user friendly way for doing routine checks.

### 5.2.1 Comparing theoretical and measured Speed of Sound (SOS)

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

The Speed of Sound Calculator (SOS Calculator) available in MEPAFLOW600 CBM calculates a theoretical SOS for a specific gas composition at a specified temperature and pressure (→ Figure 31). The calculation of thermodynamic properties is based on the "GERG-2004 XT08 Wide-Range Equation of State for Natural Gases and other Mixtures". The algorithms that are implemented in the SOS calculator were developed by the Ruhr-University Bochum (Germany).

Figure 31 Speed of Sound Calculator with loaded gas composition file

Name	Formula	Value
Methane	CH4	0
Nitrogen	N2	78.1106
Carbon dioxide	CO2	0.04
Ethane	C2H6	0
Propane	C3H8	0
N-Butane	N-C4H10	0
I-Butane	I-C4H10	0
N-Pentane	N-C5H12	0
I-Pentane	I-C5H12	0
N-Hexane	N-C6H14	0
N-Heptane	N-C7H16	0
N-Octane	N-C8H18	0
N-Nonane	N-C9H20	0
N-Decane	N-C10H22	0
Hydrogen	H2	0
Oxygen	O2	20.9491
Carbon monoxide	CO	0
Water	H2O	0
Hydrogen sulphide	H2S	0
Helium	HE	0
Argon	AR	0.9003

Sum [%] 100.0000

Clear Gas composition

Temperature 17.78 °C  
Pressure (Absolute) 10.4111 bar(a)

This calculation of SOS is based on the GERG-2004 XT08 Wide-Range Equation of State for Natural Gases and Other Mixtures.

Speed of Sound (calc) 343.15 m/s  
Speed of Sound (measured) 345.830 m/s  
Difference 0.78 [%]

Re-read SOS Calculate

OK

- ▶ Use MEPAFLOW600 CBM to connect to the meter (→ pg. 59, 4.3).
- ▶ Start the SOS calculator from the Maintenance Report or choose "Tools / SOS Calculator" from the menu (→ pg. 92, Figure 35).

- ▶ Enter the gas composition and specify temperature and pressure for your specific application.
- ▶ Click the "Calculate" button.
- ▶ If the SOS calculator was started from the Maintenance Report, the calculated value is automatically copied to the corresponding field in the wizard and to the report.
- ▶ Compare the theoretical SOS with the SOS measured by the FLOWSIC600 (see Figure 32, main system bar).

The deviation between both should be less than 0.1%. If the deviation exceeds 0.3%, check the plausibility of temperature, pressure and gas composition. Otherwise proceed according to → pg. 87, 5.2.1.

It is possible to set up a user warning to continuously monitor for a deviation between a theoretical SOS (written to the meter e.g. by a flow computer) and the current measured SOS. See -> Section Commissioning, Optional setup of user warnings.

### 5.2.2 Checking the meter health

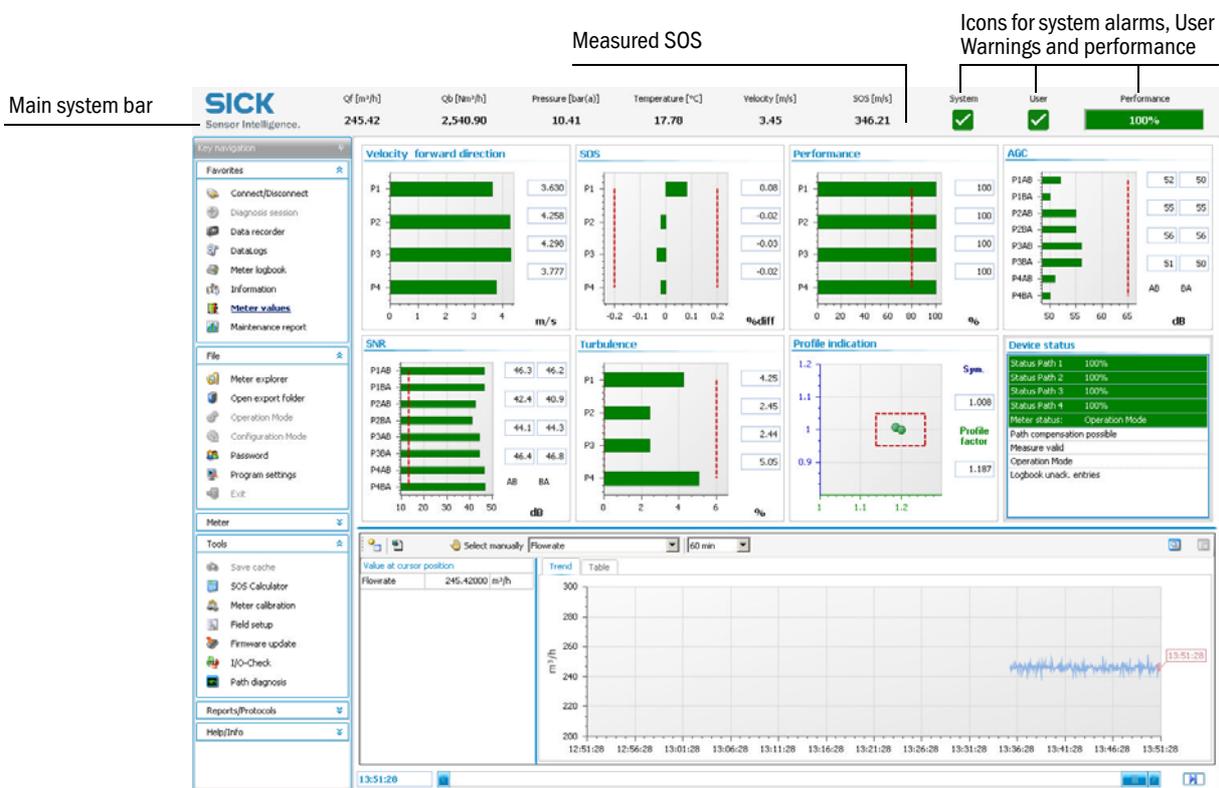
The FLOWSIC600 monitors its own meter health with User Warnings and system alarms. If the outputs are configured to indicate alarms and / or User Warnings, it is not necessary to manually check the meter health.

To get visual feedback about the meter's health, the "Main system bar" in MEPAFLOW600 CBM provides a compact overview:

- ▶ Use MEPAFLOW600 CBM to connect to the meter (→ pg. 59, 4.3).
- ▶ Check the main system bar for any yellow or red icon (→ Figure 32). A red or yellow icon indicates a potential problem with the meter.

If any of the icons in the main system bar are yellow or red, proceed with checking the "Meter Status" (→ pg. 101, 6.2.1) and the "User Warnings" (→ pg. 103, 6.2.2).

Figure 32 Main system bar



### 5.2.3 Time synchronization

All entries in logbooks or datalogs saved in the meter's memory (FRAM) are written with a time stamp containing the meter time. The meter time can be synchronized with a master clock (e.g. PC clock) via MODBUS or with MEPAFLOW600 CBM.



A synchronization causes a logbook entry in the Custody logbook [1] only if the time change is greater than 3% of the time elapsed since the last synchronization.

#### Synchronization via MODBUS

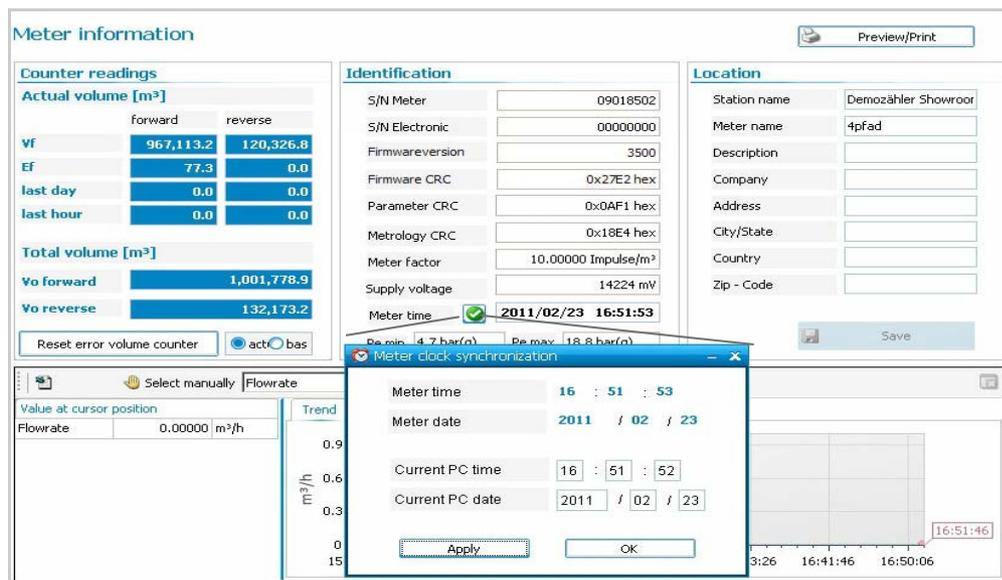
The date and the time of the FLOWSIC600 can be set separately by an external write. Each operation for date and time causes a separate entry in the Custody logbook [1].

Alternatively the synchronization function can be used. To use this method, the date (Reg. #5007 "Date") and the time register (Reg. #5008 "Time") must be written sequentially within 2 seconds. The date register must be written first. The write operation can be accomplished by the MODBUS without setting the FLOWSIC600 into Configuration Mode.

#### Time synchronization via MEPAFLOW600 CBM

MEPAFLOW600 CBM offers a synchronization function via a button in the "Meter Information" screen (→ Figure 33). The button is marked with a yellow sign calling attention to the synchronization if the time difference between the meter clock and the PC clock is greater than 30 seconds.

Figure 33 Synchronization button and meter clock synchronization window



#### 5.2.4 Battery lifespan / capacity

The Real Time Clock (RTC) of the FLOWSIC600 is buffered by a battery. The manufacturer states that the battery life span is at least ten years. The remaining battery capacity can be viewed on the LCD in the first menu level (see Technical Information).

Figure 34 Display of remaining battery capacity on the LCD display



Because the FLOWSIC600 has no regular maintenance cycle, the system alarm "Battery lifetime" is generated when the remaining battery life is less than 15%. This alarm forces the operator to change the battery (→ pg. 101, 6.2.1). A logbook entry is also generated. Optionally, the user can choose an additional user warning for the battery lifespan (see Technical Information).



**NOTICE:**

The battery may only be changed by trained staff. See → pg. 106, 6.2.4 for troubleshooting.

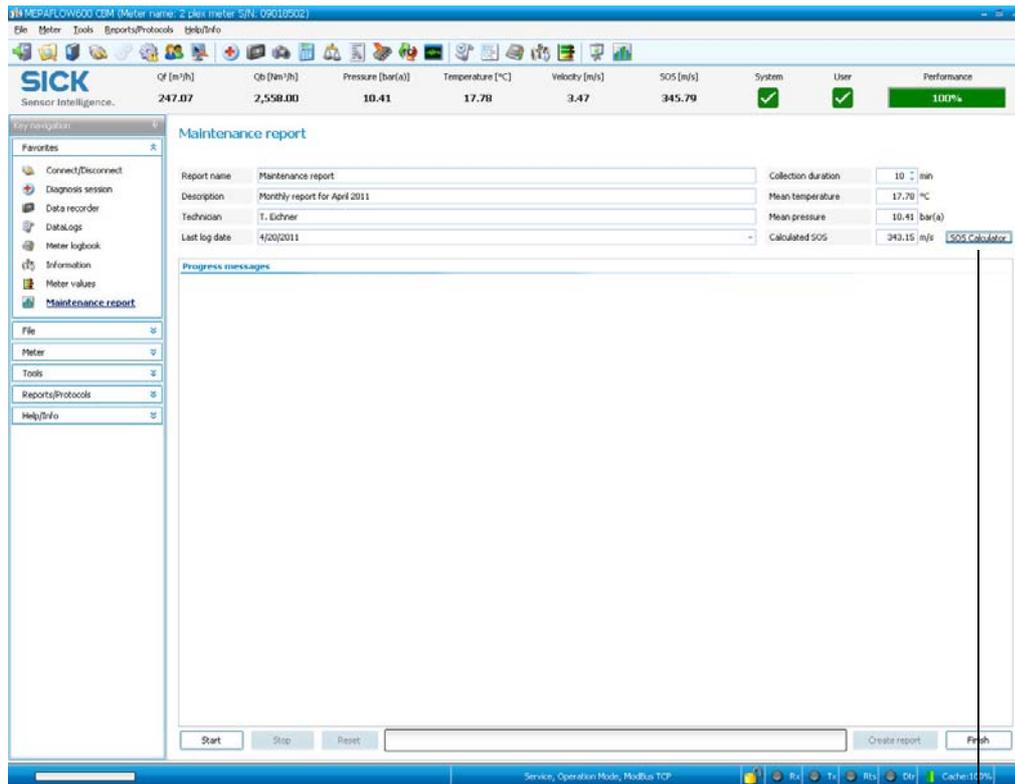
### 5.3 Maintenance report

It is recommended that Maintenance Reports be generated and filed on a regular basis. This creates a basis of comparable data over time and helps when a problem has to be diagnosed.



The operating conditions (gas composition, pressure, temperature, flow velocity) of the individual Maintenance Reports should be similar or documented separately and taken into account when the data is analyzed.

Figure 35 "Maintenance report" wizard



Click to open the  
"SOS Calculator"

To create a maintenance report, follow the described procedure:

- ▶ Choose "Favorites / Maintenance report" from the menu to open the Maintenance report wizard (→ Figure 35).
- ▶ Enter the information (Description, Technician) in the fields provided.

- ▶ Specify the "Collection duration", a timespan, over which live meter data is to be collected to document the meter's state (default: 1 minute).
- ▶ Enter the current pressure, temperature and SOS. Use the SOS Calculator to calculate the SOS for the gas composition (→ pg. 87, 5.2.1). The gas composition must be current and representative.
- ▶ Click the "Start" button to start live data collection. Diagnosis data, measured values and status information will be collected over the specified time span and will be saved in the meter database.
- ▶ Click the "Create report" button. The Maintenance report will be generated and displayed.
- ▶ Print it and file the copy in the Manufacturer Data Report (MDR) shipped with the meter.



The Maintenance report and the record are stored in the MEPAFLOW600 CBM meter database and accessible via the "Meter explorer" and the "Report Manager". Maintenance reports can be exported to an Excel file. If Maintenance reports have been regularly collected, a Trend report can be created (see Technical Information).

## 5.4 Optional data download

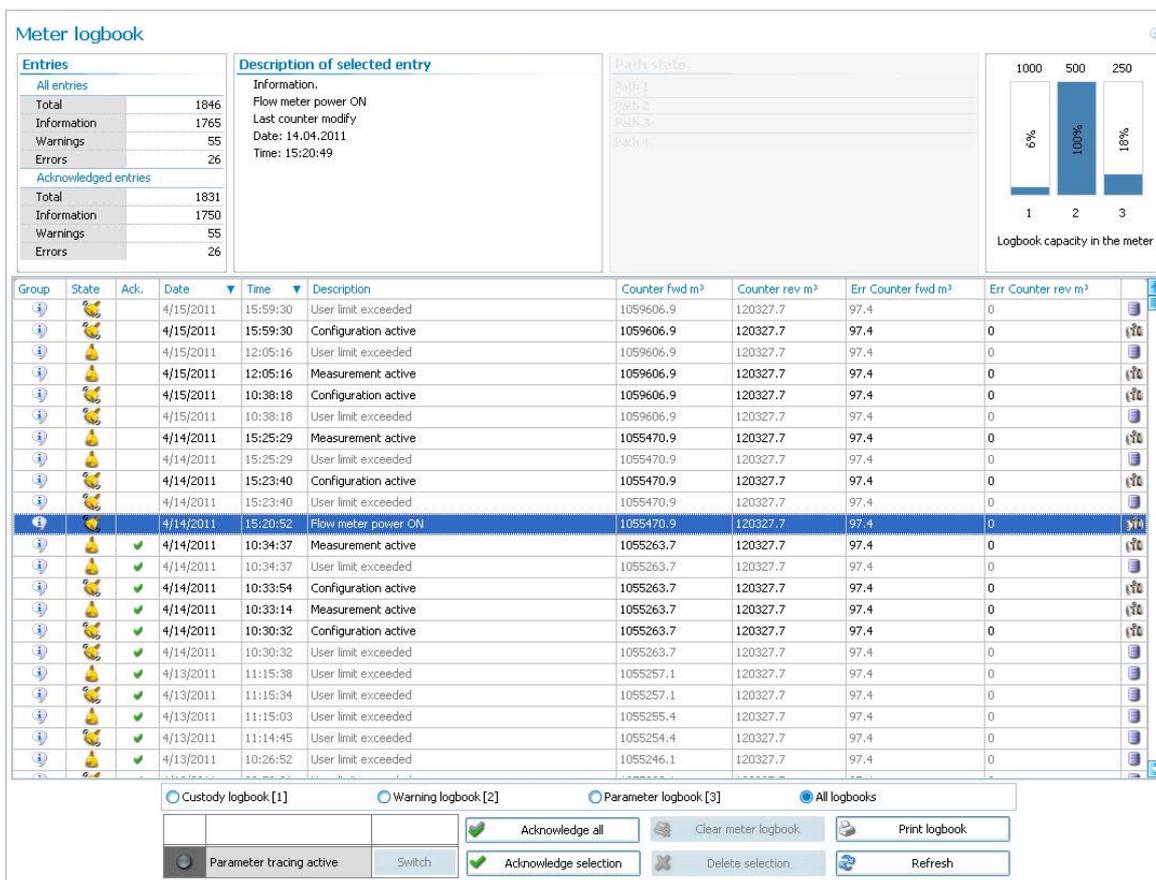
### 5.4.1 Logbook check



To prevent an overflow of the logbooks and possible data loss, logbook entries can be saved to the meter database with the MEPAFLOW600 CMB software. The entries on the meter can then be deleted.

The "Meter logbook" page shows all logbook entries on the meter and in the MEPAFLOW600 CBM database. It provides details on each entry and information on the number of registered events and the remaining memory space.

Figure 36 "Meter logbook" page in MEPAFLOW600 CBM



#### 5.4.1.1 Downloading and saving logbook entries to the MEPAFLOW600 CBM meter database

To download and save logbook entries to the MEPAFLOW600 CBM meter database, proceed as follows:

- ▶ Use MEPAFLOW600 CBM to connect to the meter (→ pg. 59, 4.3).
- ▶ Choose "Meter / Meter Logbook" from the menu to open the Logbook page.
- ▶ In the dialog "Logbook selection", select the desired logbooks and click "OK".

The logbook entries are now downloaded to the MEPAFLOW600 CBM database. They can be viewed offline without connection to the meter or share them with others (export the device or the session).

#### 5.4.1.2 Acknowledging logbook entries on the meter

To acknowledge logbook entries on the meter, proceed as follows:

- ▶ Download and save the logbook entries from the meter according to → 5.4.1.1.
- ▶ Select the logbook in which entries are to be acknowledged or select "All logbooks" to acknowledge entries in all logbooks at once.
- ▶ Mark the entries to be acknowledged.
- ▶ Click the "Acknowledge selection" button to acknowledge the selected entries only or click the "Acknowledge all" button in order to acknowledge all entries in the selected logbook(s).

#### 5.4.1.3 Clearing logbooks on the meter

If the logbooks are configured with the storage behavior "rolling", it is not necessary to clear the logbooks on the meter. When the logbook is full, new entries will overwrite the oldest entries.

If a logbook is configured with the storage behavior "blocking" (e.g. with custody configuration), a full Custody logbook [1] will activate the meter status "Data invalid". In this case it is recommended to clear the logbooks.

**NOTICE:**

The following preconditions must be met to clear logbooks on the meter:

- The Parameter write lock must be in the "UNLOCKED" position (see Technical Information)
- The user must be in the User Access Level "Service" (password see Service Manual).
- The meter must be in Configuration Mode.

To clear the logbooks on the meter, proceed as follows:

- ▶ Choose the User Access Level "Service" (→ pg. 59, 4.3.2).
- ▶ Download and save the logbook entries from the meter according to → 5.4.1.1.
- ▶ Select the logbook to be cleared or select "All logbooks" to clear all.
- ▶ Switch the meter to Configuration Mode (choose "File / Configuration Mode" from the menu).
- ▶ Click the "Clear meter logbook" button and confirm the warning with "OK".
- ▶ Switch the meter to Operation Mode.
- ▶ If the Parameter write lock was unlocked prior to clearing the meter logbook, follow all necessary procedures to bring the meter to back to its original state.

### 5.4.2 DataLogs check

Starting with firmware version 3.4.00, the FLOWSIC600 provides two DataLogs (Hourly Log and Daily Log). They save averaged measured values and are stored in the SPU's non-volatile memory (FRAM). All data can be downloaded and exported to Excel files with MEPAFLOW600 CBM (→ pg. 73, on configuring the DataLogs.).

**+** Full support for the DataLogs is provided by MEPAFLOW600 CBM V1.1.00 or higher.

Figure 37 DataLogs page with opened tab for Hourly Logs

The screenshot shows the MEPAFLOW600 CBM software interface. At the top, there is a status bar with various sensor readings: Qf [m³/h] (245.87), Qb [Nm³/h] (2,545.60), Pressure [Bar(a)] (10.41), Temperature [°C] (17.78), Velocity [m/s] (3.45), SOS [m/s] (345.76), System (checked), User (checked), and Performance (100%).

The main interface is divided into several sections:

- Key navigation:** A sidebar on the left with options like Connect/Disconnect, Diagnosis session, Data recorder, DataLogs (selected), Meter logbook, Information, Meter values, and Maintenance report.
- DataLogs:** A central panel with tabs for Data, Configuration, Hourly Log (selected), Daily Log, and Diagnostics Comparison. It shows a selected entry for 4/20/2011 16:55 and a list of system states, limits, path errors, and EVC status.
- Table:** A large table displaying hourly log data with columns: Date (Ending), Time (Ending), Flow Time [%], Vo forward [m³], Vo reverse [m³], Vf forward [m³], Vf reverse [m³], Eb forward [Nm³], Eb reverse [Nm³], Vb forward [Nm³], Vb reverse [Nm³], and AvgPerform. The table contains 24 rows of data for the date 4/19/2011.
- Meter Status section:** A box on the right side of the interface, highlighted with a bracket, containing the text "Meter Status" section.
- Buttons:** At the bottom right, there are buttons for "Read DataLogs" and "Export DataLogs".

for update

for export

#### 5.4.2.1 Downloading and exporting of DataLog data

To download and export the data from your FLOWSIC600, complete the following steps:

- ▶ Use MEPAFLOW600 CBM to connect to the meter (→ pg. 59, 4.3).
- ▶ Go to the DataLogs page (choose "Meter / DataLogs" from the menu).
- ▶ In the dialog "DataLog selection", select those DataLogs that you want to view and/or export and click "OK".
- ▶ Now the DataLogs page is displayed with the data from the meter (see Technical Information).
- ▶ If you select a DataLog entry, its time stamp and the meter status (see below) is shown in the middle section.
- ▶ To update the data from the meter, use the button "Read DataLogs".
- ▶ To export DataLog data to an Excel file (.xls), use the button "Export DataLogs".

For more options and configuration, see Technical Information.



##### Meter status

In every DataLog entry, a condensed meter status information is saved. It shows all meter status information that became active during the storage cycle - even if it was for the shortest period of time.

If a meter status information bit is shown active in a DataLog entry, the logbooks will contain a corresponding entry with more information.

- ▶ Always check the logbooks, if you require more information about the meter status information in the DataLogs.

##### Flow weighted diagnostic information in DataLog data

The datasets do not contain any diagnostic information for gas velocities below the value for the parameter  $V_{min}$  (Reg. #7036 "LowFlowCutOff"). The "Flow time" value shows, for what percentage of the duration of the storage cycle the flow was above  $V_{min}$  and in the flow direction specified for the DataLog.

All diagnostic information is flow-weighted.

#### 5.4.2.2 Clearing entries from DataLogs

If the DataLogs are configured with the storage behavior "rolling", it is not necessary to clear the entries from the DataLogs on the meter. When the DataLog is full, new entries will overwrite the oldest entries.

If a DataLog is configured with the storage behavior "blocking", the DataLog will stop saving new entries when it is full and a yellow light will indicate the full DataLog on the meter status table (→ pg. 101, 6.2.1). In this case it is recommended to clear the entries from the DataLogs.

To clear all entries from a DataLog, complete the following steps:

- ▶ Go to the DataLogs page (select Meter / DataLogs from menu).
- ▶ Choose the Configuration tab.
- ▶ Switch the meter into Configuration Mode (choose "File / Configuration Mode" from the menu).
- ▶ Click the "Clear" button for the DataLogs from which you want to clear entries.
- ▶ Switch the meter into Operation Mode.

# FLWSIC600

## 6 Troubleshooting

- General troubleshooting
- Indication of meter states, system alarms and warnings
- Generation of diagnosis session
- Meter connection troubleshooting

This chapter provides solutions for problems highlighted by routine tests during maintenance (→ pg. 87, 5.2) or the function tests after commissioning (→ pg. 69, 4.6).

If the cause of the problem cannot be localized, it is recommended to use the MEPAFLOW600 CBM software to record the current parameter set and diagnosis values in a diagnosis session file (→ pg. 107, 6.3) and send this to a local SICK representative.

### 6.1 General troubleshooting

Problem	Possible causes	Actions
<ul style="list-style-type: none"> <li>● No display</li> <li>● No pulse frequency</li> <li>● No active status signal</li> </ul>	Faulty power supply	<ul style="list-style-type: none"> <li>▶ Check the input voltage at terminals 1 and 2.</li> <li>▶ Check cables and terminal connections.</li> </ul> <p><b>Caution</b> Take the relevant safety precautions!</p>
	Defective device	<ul style="list-style-type: none"> <li>▶ Create a diagnosis session according to → pg. 107, 6.3 and contact your local SICK representative.</li> </ul>

### 6.2 Indication of meter states, system alarms and warnings

The FLOWSIC600 gives information about alarms and warnings in the following ways:

- The LCD display indicates active system alarms or warnings. If a current error or warning is active, the display will flash and a message will be displayed with a message number in the upper right corner (→ pg. 118, 7.2.1 for more details on LCD error messages).
- A status output can be configured to indicate if the meter status "Data invalid", the meter status "Check request" or the "Warning" status become active.
- The pulse output can be configured to indicate if the meter is in Configuration Mode or if the meter status "Data invalid" becomes active.
- The meter status registers can be read via MODBUS (see document "FLOWSIC600 Modbus Specification").
- The MEPAFLOW600 CBM software can be used to check the meter health. System alarms and User Warnings are indicated in the Main system bar.

It is recommended to use MEPAFLOW600 CBM to get further information on the meter's health:

- ▶ If the meter indicates "Data invalid" or "Check request" follow → pg. 101, 6.2.1.
- ▶ If the meter indicates "Warning", follow → pg. 103, 6.2.2.
- ▶ To do a more detailed check of the meter health (see „Technical Information“

### 6.2.1 Checking the "Meter Status" window

The "Meter status" window in MEPAFLOW600 CBM displays an overview about the meter's status and operation.

- ▶ Use MEPAFLOW600 CBM to connect to the meter (→ pg. 59, 4.3).
- ▶ Click on the "System" button in the main system bar to open the "Meter status" window (→ Figure 38).
- ▶ Check the general "Meter Status" section (marked in Figure 38) for yellow or red lights.

Meter status light	Causes	Actions
Green light "Measurement valid"		Measurement is valid, meter is operating correctly.
Red light "Measurement valid"	Measurement is invalid and / or the meter is in Configuration Mode. The measured volume is counted in the error volume counter. <sup>1</sup>	<ul style="list-style-type: none"> <li>▶ If the meter is in Configuration Mode, choose "File / Operation Mode" from the menu to switch it to Operation Mode.</li> <li>▶ Otherwise proceed according to → pg. 107, 6.3.</li> </ul>
Yellow light "Check request"	One or more paths have failed or another problem affects the measurement accuracy. <sup>1</sup>	▶ Proceed according to → pg. 107, 6.3.
Yellow light "User Warning Limit exceeded".	A User Warning Limit was exceeded. <sup>2</sup>	▶ Check the User Warnings according to → pg. 103, 6.2.2.
Red light "Path failure"	One or more paths have failed.	▶ Proceed according to → pg. 107, 6.3.

<sup>1</sup> See → pg. 17, 2.2.2 for more details on meter states.

<sup>2</sup> See → pg. 20, 2.3 for more details on User Warnings.

- ▶ If there are no yellow or red lights in the general "Meter Status" section you can check the following other sections (also marked in Figure 38) for yellow or red lights.

Meter status light	Causes	Actions
Yellow light "Logbook contains unack. entries"	Logbook contains unacknowledged entries.	▶ Download and check all logbook entries according to → pg. 94, 5.4.1.1.
Red light for any Logbook "full"	The logbook in question is configured to "blocking" and is full of entries.	<ul style="list-style-type: none"> <li>▶ Download and check all logbook entries according to → pg. 94, 5.4.1.1.</li> <li>▶ Clear the meter logbook according to → pg. 95, 5.4.1.3.</li> <li>▶ Consider reconfiguring the logbook to "rolling" (Parameter Page). If your meter is configured according to PTB requirements a full Custody Logbook [1] will activate the meter status "Data invalid".</li> <li>▶ Download and check all logbook entries according to → pg. 94, 5.4.1.1.</li> <li>▶ Clear the meter logbook according to → pg. 95, 5.4.1.3.</li> </ul>
Yellow light for any DataLog "full"	The DataLog in question is configured to "blocking" and is full of entries.	<ul style="list-style-type: none"> <li>▶ Check the DataLog <sup>1</sup> leeren</li> <li>▶ whether the DataLog is to be configured as "rolling" <sup>1</sup>.</li> </ul>
Yellow light "Battery Lifespan (change battery)"	After 8.5 years this warning is activated to force the user to change the battery.	<ul style="list-style-type: none"> <li>▶ See → pg. 106, 6.2.4 for more details.</li> <li>▶ Contact trained staff or your SICK representative.</li> <li>▶ Trained staff: Change the battery according to the procedure described in the Service Manual</li> </ul>

Figure 38 Main system bar with "System" button and opened "Meter Status" window

Opens the "Meter Status" window

Main system bar

<b>SICK</b> Sensor Intelligence.	Qf [m³/h] 20.20	Qb [Nm³/h] 301.68	Pressure [bar(a)] 14.48	Temperature [°C] 19.44	Velocity [m/s] 1.30	SOS [m/s] 346.93	System ✓	User ✓	Performance 100%
-------------------------------------	--------------------	----------------------	----------------------------	---------------------------	------------------------	---------------------	-------------	-----------	---------------------

General "Meter Status" section

Indication if logbook(s) contain(s) unacknowledged entries

Battery change

"Logbooks" section

"DataLogs" section

**Meter Status**  
Advanced or Path Status

**Meter 5/N: 09018502**      **Meter date/time: 5/5/2011 16:04:36**

**Operating Mode**

Operation Mode	●
Configuration Mode	●
Air test active	●

**Electronic Volume Corrector (EVC)**

EVC hardware error	●
EVC parameter invalid	●
HART com. p error	●
HART com. T error	●

**Meter Status**

Measurement valid	●
Check request	●
User Warning Limit exceeded	●
Path Failure (see advanced)	●

**Measurement**

DSP error	●
DSP boot error	●
DSP measure invalid	●
Adjust range error	●
Path compensation valid	●
Continuous measure mode	✓
Filter Mode active	✓

**System**

Volume counter CRC error (a.c.)	●
Volume counter CRC error (s.c.)	●
I/O Impulse out of range	●
System time invalid (RTC error)	●
Firmware CRC error	●
Logbook(s) contains unack. entries	●
Battery LifeSpan (change battery)	●
Signature error	●

**Logbooks**

	CRC Error	Full
Custody Logbook [1]	●	●
Warning Logbook [2]	●	●
Parameter Logbook [3]	●	●

**DataLogs**

	CRC Error	Full
Diagnostic Comparison (DataLog 1)	●	●
Hourly Log (DataLog 2)	●	●
Daily Log (DataLog 3)	●	●

Parameter write lock: **UNLOCKED**  
Unit system in meter: **METRIC**

**Parameters**

Parameter CRC error	●
Parameter invalid	●
Parameter defaults loaded	●
Path Comp. Param. error	●
DSP Parameter error	●

**Legend**

- OK, no alarm or warning active
- Warning active
- Alarm active
- Disabled
- ✓ On (enabled/active)
- Off (disabled/inactive)

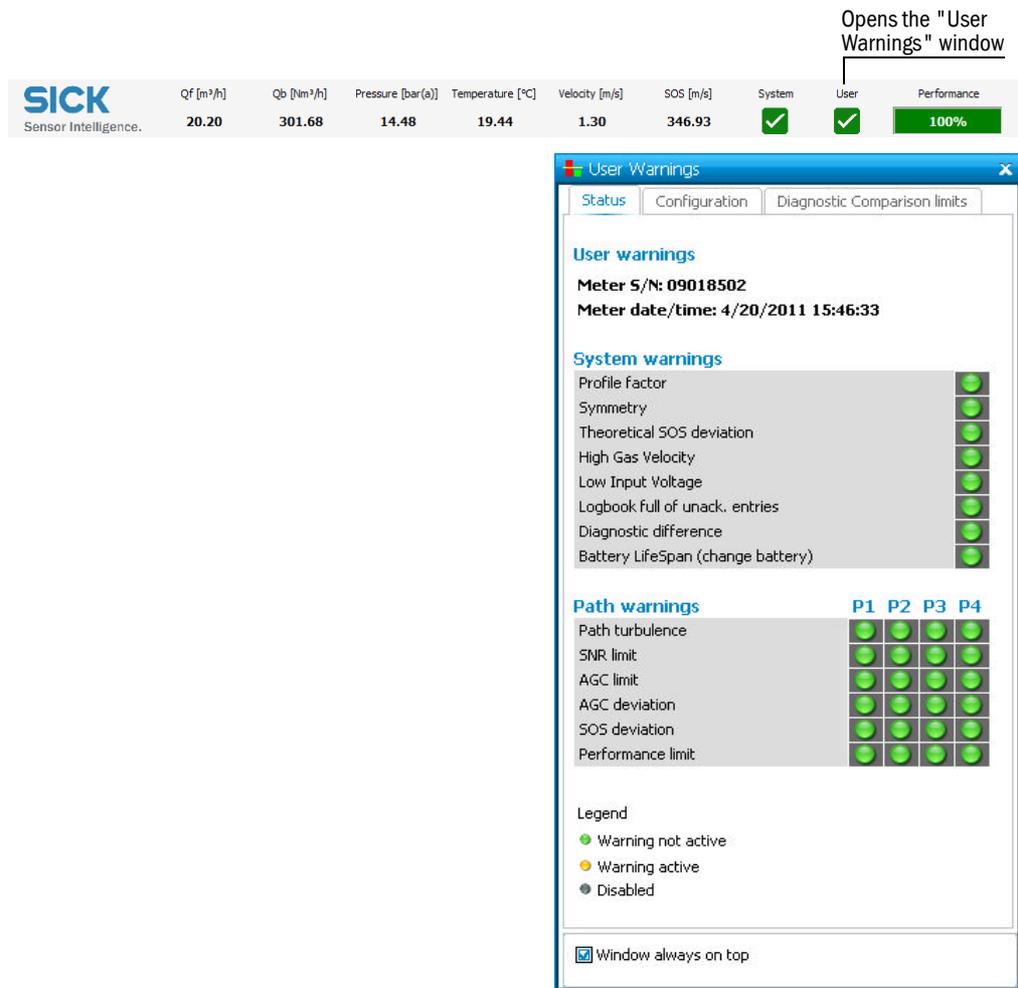
Window always on top

### 6.2.2 Checking the "User Warnings" window

The "User Warnings" window displays an overview about the User Warning status.

- ▶ Use MEPAFLOW600 CBM to connect to the meter (→ pg. 59, 4.3).
- ▶ Click on the "User" button in the main system bar of the MEPAFLOW600 CBM screen to open the "User Warnings" window (→ Figure 39).
- ▶ Check the window for yellow lights and proceed according to Technical Information.

Figure 39 Main system bar with button "User" and opened "User Warnings" window



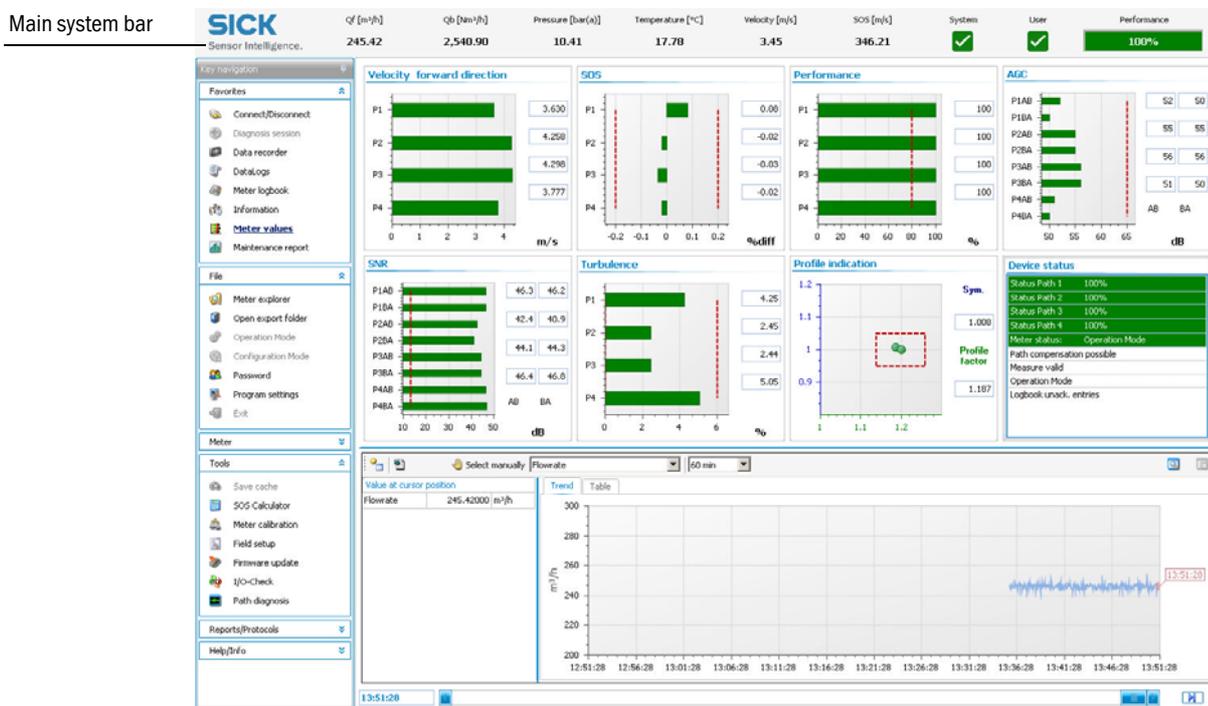
### 6.2.3 Checking the diagnostic meter values

The "Meter values" page displays detailed diagnostic information:

- ▶ Use MEPAFLOW600 CBM to connect to the meter (→ pg. 59, 4.3).
- ▶ Choose "Meter / Meter values" from the menu to call up the "Meter values" page (→ Figure 40).
- ▶ Check the "Meter values" page for any yellow or red graphs or yellow or red indicators in the Main system bar. Yellow or red indicates a potential problem.

If any of the graphs or any of the icons in the main system bar are yellow or red, proceed with checking the "Meter Status" (→ pg. 101, 6.2.1) and the "User Warnings" (→ pg. 103, 6.2.2).

Figure 40 "Meter values" page



Problem	Possible causes	Actions
Implausible speed of sound	Gas composition, pressure or temperature measurement is incorrect	Check gas composition, pressure and temperature. Create a Diagnosis Session according to → pg. 107, 6.3 and contact your trained staff or your local SICK representative.
Different speed of sound in the individual paths	Faulty transducer or electronic module	Create a Diagnosis Session according to → pg. 107, 6.3 and contact your trained staff or your local SICK representative. Trained staff: Replace the transducer(s) (see Service Manual, Chapter 7). Note: Temperature-induced stratification can result in differences between the individual paths, especially with very low flow (higher temperatures generate higher speeds of sound). Even if the plant is being filled or if it is shut down, different speeds of sound may occur in the individual paths as a result of stratification.
Lower signal-to-noise ratio and reception sensitivity	Damaged transducer	Create a Diagnosis Session according to → pg. 107, 6.3 and contact your trained staff or your local SICK representative. Trained staff: Replace the transducer(s) (see Service Manual, Chapter 7).
Increased number of rejected measurements in individual paths	Additional sources of noise due to a valve that is not fully open, fittings, noise sources near the device	Check the measurement plausibility and number of rejected measurements and, if necessary, eliminate noise sources. Create a Diagnosis Session according to → pg. 107, 6.3 and contact your trained staff or your local SICK representative.
Increased receiver sensitivity (AGC)	Different gas composition or process pressure	No action required on the device
	Transducer(s) are dirty	Create a Diagnosis Session according to → pg. 107, 6.3 and contact your trained staff or your local SICK representative. Trained staff: Clean the transducer(s) (see Service Manual, Chapter 7)
Increased number of rejected measurements in all paths	Additional noise sources	Eliminate noise sources
	Gas velocity outside the measuring range	

### 6.2.4 Battery lifespan / capacity

Because the FLOWSIC600 has no regular maintenance cycle, a user warning will be automatically generated if the remaining battery life is less than 15%. After 8.5 years, a warning is generated which forces the operator to change the battery. The battery may only be changed by trained staff. The procedure for changing the battery is described in the Service Manual. For further information on warning settings see Technical Information.

Figure 41 Flashing message on the LCD display, prompts to change the battery

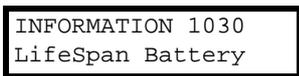


Figure 42 "Battery Lifespan" status bit in "Meter Status" window

"Battery Lifespan" status bit

The screenshot shows a software window titled "Meter Status" with a blue header. It contains several sections of status indicators:

- Meter S/N: 06528707** and **Meter date/time: 1/1/1970 00:00:57**
- Operating Mode:** Operation Mode (green), Configuration Mode (grey), Air test active (grey).
- Meter Status:** Measurement valid (red), Check request (grey), User Warning Limit exceeded (grey), Path failure (see advanced) (grey).
- System:** Volume counter CRC error (a.c.) (grey), Volume counter CRC error (s.c.) (grey), I/O Impulse out of range (grey), System time invalid (RTC error) (red), Firmware CRC error (grey), Logbook(s) contains unack. entries (yellow), **Battery LifeSpan (change battery) (yellow)**, Signature error (grey).
- Parameters:** Parameter CRC error (grey), Parameter invalid (grey), Parameter defaults loaded (grey), Path Comp. Param. error (grey), DSP Parameter error (grey).
- Electronic Volume Corrector (EVC):** EVC hardware error (grey), EVC parameter invalid (grey), HART com. p error (grey), HART com. T error (grey).
- Measurement:** DSP error (grey), DSP boot error (grey), DSP measure invalid (grey), Adjust range error (grey), Path compensation valid (green), Continuous measure mode (green with checkmark), Filter Mode active (grey).
- Logbooks:** Custody Logbook [1] (grey), Warning Logbook [2] (grey), Parameter Logbook [3] (grey). Columns for CRC Error and Full.
- DataLogs:** Diagnostic Comparison (DataLog 1) (grey), Hourly Log (DataLog 2) (grey), Daily Log (DataLog 3) (grey). Columns for CRC Error and Full.
- Parameter write lock:** UNLOCKED
- Unit system in meter:** METRIC

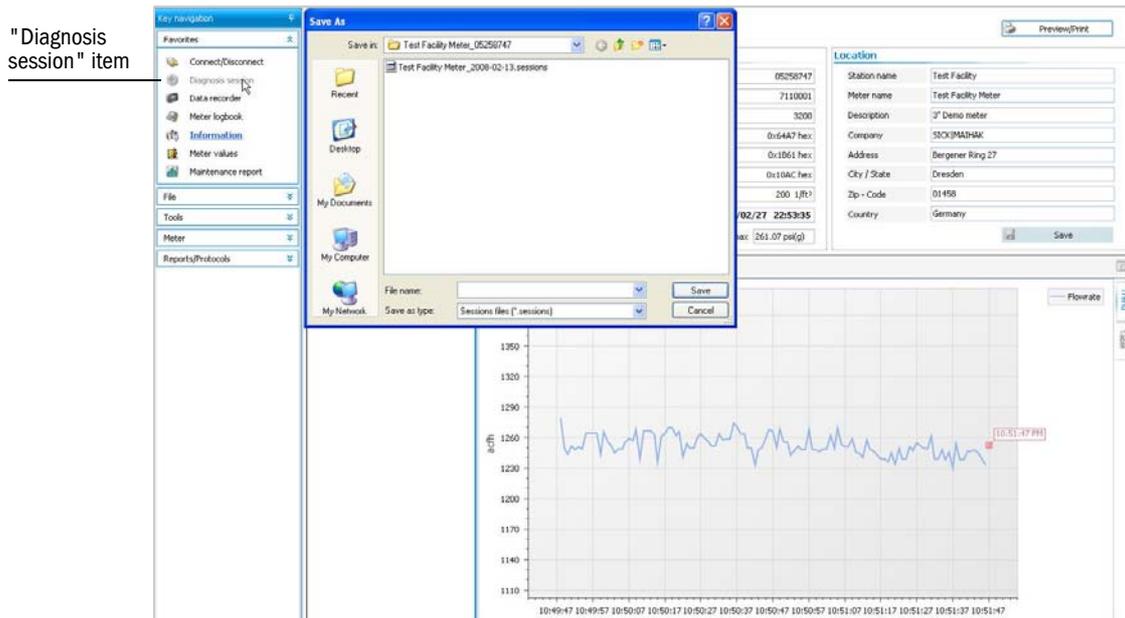
A legend at the bottom left explains the colors: green for OK, yellow for Warning, red for Alarm, grey for Disabled, green checkmark for On, and grey dash for Off.

### 6.3 Generation of a Diagnosis session

If it becomes necessary to generate a Diagnosis session for remote support, follow the procedure described below:

- ▶ Start the MEPAFLOW600 CBM software and establish an online connection to the meter (see → pg. 59, 4.3 for all necessary preparations).
- ▶ Choose "Tools / Diagnosis session" from the menu or click the "Diagnosis session" item in the Key navigation (→ Figure 43)

Figure 43 "Diagnosis session" generation



- ▶ Specify a file name. (The file path is set according to the program settings. If necessary, specify a different path.)
- ▶ Click the "Save" button.
- ▶ MEPAFLOW600 CBM will now download the logbooks from the meter and generate a Diagnosis session with all relevant data. The entire process usually takes about three minutes. If the logbooks contain a lot of entries, the process may take longer.
- ▶ Email the Diagnosis session file to your SICK representative for support.

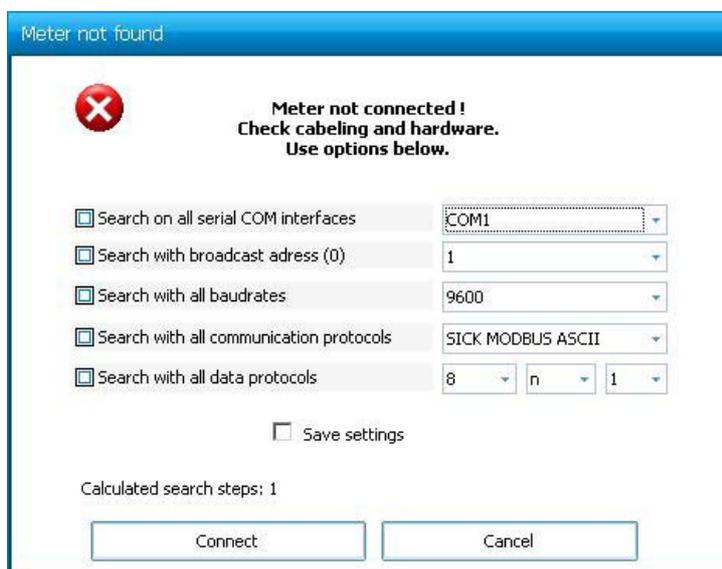
## 6.4 Meter connection troubleshooting

### Meter not found at initial connection/connection lost during session

- ▶ Check all cables and the hardware. Check also the correct installation of the adapters (see → pg. 57, 4.2.1 and → pg. 58, 4.2.2).
- ▶ Attempt to re-establish connection via "Connect to Meter" window.
- ▶ Use the options in the window displayed to make MEPAFLOW600 CBM search with wider options ( → Figure 44), especially if parameters (e.g. the baud rate) may have been changed.

 If necessary, the RS485 ports can be assigned to a specific bus address (Reg. #5020 "DeviceBusaddress"). The service port always has the bus address "1".

Figure 44 "Meter not found" dialog for the specification of wider search options.



# FLWSIC600

## 7 Appendix

Conformities and technical data

Logbooks

Connection diagrams for operating the FLOWIC600 in hazardous areas in accordance with North American Guidelines (NEC, CEC)

Wiring examples

Sealing plan

## 7.1 Conformities and technical data

### 7.1.1 CE certificate

The FLOWSIC600 has been developed, manufactured and tested in accordance with the following EU directives:

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

Conformity with above directives has been verified and the device has been marked with the CE label. The specific designation of the pressure equipment demanded according to the Pressure Equipment Directive 2014/68/EU under part 3.3 and 3.4 can be found in the MDR of the FLOWSIC600.

### 7.1.2 Standard compatibility and type approval

The FLOWSIC600 conforms to the following norms, standards or recommendations:

- EN 60079-0, EN 60079-1, EN 60079-7, EN 60079-11, EN 60079-26
- OIML R 137-1, 2006, "Gas meters, Part 1: Requirements"
- OIML D 11, 2004, "General requirements for electronic measuring instruments"
- A.G.A Report No. 9, 2007, "Measurement of Gas by Multipath Ultrasonic Meters"
- API 21.1 "Flow Measurement Using Electronic Metering Systems"
- ISO 17089-1, 2010, "Measurement of fluid flow in closed conduits - ultrasonic meters for gas - Part 1: Meters for custody transfer and allocation measurement."
- BS 7965, 2009, "Guide to the selection, installation, operation and calibration of diagonal path transit time ultrasonic flow meters for industrial gas applications."

2" Type approval for commercial or custody transfer has been granted by the relevant authorities, e.g.:

- Germany: PTB (Physikalisch-Technical Bundesanstalt), code number 7.421 / 03.05
- Netherlands: NMI (Netherlands Meetinstituut), code number B35
- Canada: Measurement Canada, Approval No. AG-0521
- Switzerland: Metrologie und Akkreditierung Switzerland, Appr. No. CH-G4-04404-00
- Europe: MID Approval, DE-08-MI002-PTB005
- GOST

### 7.1.3 WELMEC compliance

The interfaces and the software of the FLOWSIC600 have been designed non-reactive in terms of the Eichordnung, Anlage 7 "Messgeräte für Gas" (calibration regulations, Annex 7 "Gas Meters") and the requirements of the WELMEC regulation 7.2, and documented completely in document "Interface description".

The test results were archived in a traceable manner and can be provided on request.

Figure 45 Common key code (for short description of meter design, indicated on Type Plate\* and Instrument Data Sheet\*\*)

# Type Code FLOWSIC600

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<b>Key code</b> FL600-															
<b>METER BODY</b>															
<b>Path configuration</b>															
1-Path	1	P													
2-Path	2	P													
4-Path	4	P													
1+1-Path redundant	1	R													
2+2-Path redundant	2	R													
4+4-Path (Quatro)	4	R													
4+1-Path (2plex)	5	C													
2-Path crossed	2	X													
4-Path crossed	4	X													
2-Path Special	2	S													
<b>Overall length</b>															
2D			2	D											
3D			3	D											
4D			4	D											
5D			5	D											
6D			6	D											
Shortened Meter body			S	D											
Other size			X	D											
<b>Nominal size</b>															
2" / DN 50			0	2											
3" / DN 80			0	3											
4" / DN 100			0	4											
6" / DN 150			0	6											
8" / DN 200			0	8											
10" / DN 250			1	0											
12" / DN 300			1	2											
16" / DN 400			1	6											
Other size			#	#											
<b>Connection flange type</b>															
ASME B16.5 / ASME B16.47 (>24")			C	L	#	#	#	#							
DIN EN 1092-1			P	N	#	#	#	#							
GOST 12815-80 / 12821-80 / GOST-R 54432-2011			P	N	#	#	#	#							
NORSOK L 005			N	K	#	#	#	#							
TECHLOK			I	N	X	X	#	#							
Grayloc			G	R	X	X	#	#							
EN 1759-1			C	L	#	#	#	#							
Other type			X	X	X	X	X	X							
<b>Connection diameter</b>															
Schedule ###					S	C	#	#	#	#					
Specified in [mm] (DIN)					#	#	#	#	.	#					
<b>Flange type / sealing face</b>															
Raised Face (ASME B16.5 / B16.47)									R	F					
Ring Type Joint (ASME B16.5 / B16.47)									R	J					
Form B1 (EN 1092-1 / 1759-1)									B	1					
Form B2 (EN 1092-1 / 1759-1)									B	2					
Form # Inlet / Form # Outlet (EN 1092-1 / 1759-1)									#	#					
Version V# (GOST 12815-80 / 12821-80)									V	#					
Type T# (GOST-R 54432-2011)									T	#					
Special design									X	X					
<b>Material</b>															
Carbon Steel										0					
Stainless steel										1					
LT-CS										2					
Duplex										3					
Superduplex										4					
Superaustenit										5					
Aluminium										6					
Other material										X					
<b>Connection for Extraction Tool</b>															
Yes														Y	
No														N	
<b>ULTRASONIC TRANSDUCER</b> (Will be selected by SICK on the basis of the technical data)															
<b>SIGNAL PROCESSING UNIT</b>															
<b>Ex-proof-design</b>															
None															0
CSA Group D T4															1
CSA Group B, C, D T4															2
ATEX IIA T4, M20x1.5															3
ATEX IIC T4, M20x1.5															4
ATEX IIA T4, 1/2 NPT															5
ATEX IIC T4, 1/2 NPT															6
IECEX IIA T4, M20x1.5															7
IECEX IIC T4, M20x1.5															8
IECEX IIA T4, 1/2 NPT															9
IECEX IIC T4, 1/2 NPT															A
<b>Power supply</b>															
12...24V DC															D
<b>Data outputs</b>															
Hardware variant 1 (4 digital outputs)															1
Hardware variant 2 (1 analog current output and 3 digital outputs)															2
Hardware variant 4 (1 analog current output and 2 RS485)															4
Hardware variant 5 (with integrated EVC, p- and T-transmitters externally power supplied, I/O board with DSP)															5
Hardware variant 6 (with integrated EVC, p- and T-transmitters internally power supplied, I/O board with DSP)															6
Hardware variant 7 (same as hardware variant 1, but with LowPressureAnalogBoard)															7
Hardware variant 8 (same as hardware variant 2, but with LowPressureAnalogBoard)															8
Hardware variant 9 (same as hardware variant 4, but with LowPressureAnalogBoard)															9
Hardware variant A (same as hardware variant 5, but with LowPressureAnalogBoard)															A
Hardware variant B (same as hardware variant 6, but with LowPressureAnalogBoard)															B
<b>HART-Protocol</b> (By selection of hardware variant 2 and 8 only)															
Yes															Y
No															N
<b>Front panel</b>															
LED SICK															0
LCD SICK															1
<b>Custody transfer design meter</b>															
Yes															Y
No															N

Rev. 1.12

2013/05



# ... to be specified by SICK

\* ... only design of USM, no restriction to type approval (4P; 5C; 4R -> Y / other path configurations -> N)

E\_69423

Subject to change without notice

\* See → pg. 136, Figure 63

\*\* The Instrument Data Sheet is included in the Manufacturer Data Report (MDR).

## 7.1.4 Technical data

**Type approval**

The information in this section may differ from the type approval which is valid for the FLOWSIC600 in your country.

Please use your national type approval for the FLOWSIC600.

Table 8 Common meter sizes and flow rates

	Nominal Size		Actual flow rate [m <sup>3</sup> /h]			Actual flow rate [ft <sup>3</sup> /h]		Max. Velocity*	
			Q <sub>min</sub>	Q <sub>t</sub>	Q <sub>max</sub> <sup>1</sup>	Q <sub>min</sub>	Q <sub>max</sub> <sup>1</sup>	[m/sec]	[ft/sec]
TYPE APPROVAL	DN 50	(NPS 2)	4	13	400	140	14,000	65	213
	DN 80	(NPS 3)	8	32	1000	280	35,000	65	213
	DN 100	(NPS 4)	13	50	1,600	460	56,000	60	197
	DN 150	(NPS 6)	20	80	3000	710	106,000	50	164
	DN 200	(NPS 8)	32	130	4500	1,130	159,000	45	148
	DN 250	(NPS 10)	50	240	7000	1,770	247,000	40	131
	DN 300	(NPS 12)	65	375	8000	2,300	282,000	33	108
	DN 350	(NPS 14)	80	375	10000	2,830	353,000	33	108
	DN 400	(NPS 16)	120	600	14000	4,240	494,000	33	108
	DN 450	(NPS 18)	130	650	17000	4,600	600,000	33	108
	DN 500	(NPS 20)	200	975	20000	7,070	707,000	33	108
	DN 600	(NPS 24)	320	1500	32000	11,300	1,131,000	33	108
	DN 700	(NPS 28)	400	2000	40000	14,100	1,414,000	30	98
	DN 750	(NPS 30)	400	2000	45000	14,100	1,590,000	30	98
	DN 800	(NPS 32)	400	2400	50000	14,100	1,767,000	30	98
	DN 900	(NPS 36)	650	3750	66000	23,000	2,333,000	30	98
	DN 1000	(NPS 40)	650	5000	80000	23,000	2,828,000	30	98
DN 1050	(NPS 42)	1300	6000	85,000	46,000	3,004,000	30	98	
DN 1100	(NPS 44)	1400	6500	90000	49,500	3,181,000	28	92	
DN 1200	(NPS 48)	1600	7000	100000	56,600	3,535,000	27	89	

<sup>1</sup> Q<sub>max</sub> can be limited by the working pressure and attenuation of the gas medium



\*When a configuration with flow conditioner is used, the velocity of gas must not exceed 40 m/s (131 ft/s) in the pipe.

Table 9 Technical data

Meter characteristics and measuring parameters		
Measured variables	Flow rate, volume at flowing and base conditions, gas velocity, speed of sound	
Number of measuring paths	2, 4, 4+1, 4+4	
Measuring Principle	Ultrasonic transit time difference measurement	
Measured medium	Natural gas, N <sub>2</sub> , O <sub>2</sub> , air, C <sub>2</sub> H <sub>4</sub> , vapor, process gases	
Measuring ranges	Actual flow rate.	4 ... 400 m <sup>3</sup> /h / 1,600 ... 100,000 m <sup>3</sup> /h
	Measuring ranges depending on nominal pipe size	
Repeatability	< 0.1 % of reading	
Accuracy		Error limits
	2-path version <sup>1</sup>	≤ ± 1 %
	4-path version <sup>2</sup>	≤ ± 0.5% Dry calibrated
	4-path version <sup>2</sup>	≤ ± 0.2% After flow calibration and adjustment with constant factor
	4-path version <sup>2</sup>	≤ ± 0.1% After flow calibration and adjustment with polynomial or piece-wise correction
<sup>1</sup> Within range Q <sub>t</sub> ... Q <sub>max</sub> with straight inlet/outlet section of 20D/3D or with flow straightener 10D/3D		
<sup>2</sup> Within range Q <sub>t</sub> ... Q <sub>max</sub> with uninterrupted inlet/outlet section 10D/3D or with flow straightener 5D/3D		
Diagnostics functions	Integrated device diagnosis and extended diagnosis use software MEPAFLO600 CBM	
Gas temperature	-40 °C ... +180 °C On request: -194 °C ... +280 °C	
Operating pressure	0 bar (g) ... 250 bar (g) On request: Up to 450 bar (g)	
Nominal pipe size	2" ... 48" (DN 50 ... DN 1200)	
Ambient conditions		
Ambient temperature	ATEX, CSA	-40 °C ... +60 °C
	IECEX	-40 °C ... +70 °C
	Optional IECEX	-50 °C ... +70 °C
Storage temperature	-40 °C ... +70 °C	
Ambient humidity	≤ 95% relative humidity	
Approvals		
Conformities	AGA Report No. 9 API 21.1 OIML D11 OIML R137-1 ISO 17089-1 BS 7965 Type approvals: MID, Measurement Canada, GOST ...	
Ex approvals	IECEX	Gb/Ga Ex d e ib [ia Ga] IIA T4 Gb/Ga Ex d e ib [ia Ga] IIC T4 Ultrasonic transducer, intrinsically safe
	ATEX	II 1/2G Ex de ib [ia] IIA T4 II 1/2G Ex de ib [ia] IIC T4 Ultrasonic transducer, intrinsically safe
	NEC/CEC (US/CA)	Class I, Division 1, Groups B, C, D T4 Class I, Division 2, Groups A, B, C, D T4 Class I, Division 1, Group D T4 Class I, Division 2, Group D T4 Ultrasonic transducer, intrinsically safe
Electrical safety	CE	
IP classification	IP 65 / IP 66 / IP 67	

<b>Outputs and interfaces</b>	
Analog output	1 output (optional): 4 ... 20 mA, 200 $\Omega$ Active/passive, electrically isolated
Digital outputs	Up to 3 outputs: 30 V, 10 mA Passive, electrically isolated, open collector or acc. to NAMUR (EN 50227), $f_{\max} = 6$ kHz (scalable)
Interfaces	RS-485 (2x, for configuration, measured value output and diagnosis)
Bus protocol	MODBUS ASCII MODBUS RTU HART
Operation	Via meter display and software MEPAFLOW600 CBM
<b>Installation</b>	
Dimensions (W x H x D)	See dimension drawings
Weight	Depending on device version
Material in contact with media	Low-temperature carbon steel, stainless steel, Duplex steel
<b>Electrical connection</b>	
Voltage	12 ... 28.8 V DDC For active current output: 15 ... 28.8 V DDC
Power input	$\leq 1$ W
<b>General</b>	
Scope of delivery	The scope of delivery is dependent on the application and the customer specifications.

## Criteria applicable to meter when used in accordance with metrological type approval

Table 10 Meter sizes according to metrological type approval

Meter size	Meter size	Measuring range (Qmin [m <sup>3</sup> /h])					Max. flow rate Qmax [m <sup>3</sup> /h]	Meter factor [pulses/m <sup>3</sup> ]
		≥1:100	1:80	1:50	1:30	1:20		
DN 80 (3")	G100					8	160	45000
	G160				8	13	250	28800
	G250			8	13	20	400	18000
	G400*		8	13	20	32	650	11100
DN 100 (4")	G160					13	250	28800
	G250				13	20	400	18000
	G400			13	20	32	650	11100
	G650*		13	20	32	50	1000	7200
DN 150 (6")	G250					20	400	18000
	G400				20	32	650	11100
	G650			20	32	50	1000	7200
	G1000		20	32	50	80	1600	4500
	G1000E		32				2200	3272
	G1600*	20	32	50	80	130	2500	2880
DN 200 (8")	G400					32	650	11100
	G650				32	50	1000	7200
	G1000			32	50	80	1600	4500
	G1600		32	50	80	130	2500	2880
	G1600E	32	40				3600	2000
	G2500*	32		80	130	200	4000	1800
DN 250 (10")	G1000				50	80	1600	4500
	G1600			50	80	130	2500	2880
	G2500		50	80	130	200	4000	1800
	G2500E	50					5000	1285
	G4000*	50	80	130	200	320	6500	1110
DN 300 (12")	G1600				80	130	2500	2880
	G2500			80	130	200	4000	1800
	G4000	65	80	130	200	320	6500	1110
	G4000 E	65					7800	920
DN 350 (14")	G1600				80		2500	2880
	G2500			80	130	200	4000	1800
	G4000		80	130	200	320	6500	1110
	G4000 E	80					7800	920

Meter size	Meter size	Measuring range (Qmin [m <sup>3</sup> /h])					Max. flow rate Qmax [m <sup>3</sup> /h]	Meter factor [pulses/m <sup>3</sup> ]
		≥1:100	1:80	1:50	1:30	1:20		
DN 400 (16")	G2500				130	200	4000	1800
	G4000			130	200	320	6500	1110
	G6500		120	200	320	500	10000	720
	G6500 E	120					12000	600
DN 450 (18")	G4000			130	200	320	6500	1110
	G6500		130	200	320	500	10000	720
	G10000	130					16000	450
DN 500 (20")	G4000				200	320	6500	1110
	G6500			200	320	500	10000	720
	G10000		200	320	500	800	16000	450
	G10000 E	200					20000	360
DN 550 (22")	G6500			200	320	500	10000	720
	G10000		200	320	500	800	16000	450
	G16000	200					25000	288
DN 600 (24")	G6500				320	500	10000	720
	G10000			320	500	800	16000	450
	G16000		320	500	800	1300	25000	288
	G16000 E	320					32000	225
DN 650 (26")	G6500				320	500	10000	720
	G10000			320	500	800	16000	450
	G16000		320	500	800	1300	25000	288
	G16000E	320					32000	225
DN 700 (28")	G6500					500	10000	720
	G10000				500		16000	450
	G16000			500			25000	288
	G25000	400	500				40000	180
DN 750 (30")	G6500					500	10000	720
	G10000				500		16000	450
	G16000			500			25000	288
	G25000	400	500				40000	180
DN 800 (32")	G10000				500	800	16000	450
	G16000			500			25000	288
	G25000	400	500				40000	180
DN 850 (34")	G16000				800		25000	288
	G25000			800			40000	180
	G40000	650	800				65000	111
DN 900 (36")	G16000				800		25000	288
	G25000			800			40000	180
	G40000	650	800				65000	111

Meter size	Meter size	Measuring range (Qmin [m <sup>3</sup> /h])					Max. flow rate Qmax [m <sup>3</sup> /h]	Meter factor [pulses/m <sup>3</sup> ]
		≥1:100	1:80	1:50	1:30	1:20		
DN950 (38")	G16000					1300	25000	288
	G25000				1300		40000	180
	G40000		800	1300			65000	111
DN 1000 (40")	G16000					1300	25000	288
	G25000				1300		40000	180
	G40000	650	800	1300			65000	111

- Any flow rates given above are also valid in the bidirectional mode.
- G-classes marked with an asterisk (\*) must only be used in configuration No. 2 (see → pg. 33, 3.2.2).
- G-classes marked with an (E) have an extended max. flow rate (max. flow velocity  $v_{\max} = 36$  m/s) related to commonly established turbine meter G-classes.
- The transition flow  $Q_t$  is based on the flow range the meter is designed for according to the main plate. It is:
  - for a flow range of 1:20  $Q_t = 0.20 Q_{\max}$  and
  - for a flow range of 1:30  $Q_t = 0.15 Q_{\max}$  and
  - for a flow range of  $\geq 1:50$   $Q_t = 0.10 Q_{\max}$
- Higher values for  $Q_{\min}$  and lower values for  $Q_{\max}$  are admissible provided that  $Q_{\min} \geq 0.05 Q_{\max}$ .
- Another meter factor is admissible if the frequency at the pulse output is selected  $< 6$  kHz for  $1.2 Q_{\max}$ .



**WARNING: Explosion Hazard**

Do not open the window cover unless the area is known to be non-hazardous.

## 7.2 Logbooks

### 1 Classification of logbook entries

The entries are distinguished into three classes and identified by the initial character in the first line.

- "I"information
- "W"warning
- "E"error/ malfunction

### 2 Type of occurrence

- "+"point of time identifying the beginning of a status
- "-"point of time identifying the end of a status

### 7.2.1 Overview of event entries in meter logbooks

Message No. on LCD	Details	Logbook	LCD Text
<b>Custody logbook [1]</b>			
3002	NO DSP communication	1	E+System 0001 NO DSP-Communic.
			E-System 0001 NO DSP-Communic.
3003	Measurement invalid	1	E+DSP 0001 Reading invalid
			E-DSP 0001 Reading invalid
3004	Firmware CRC invalid	1	E+Firmware 0001 CRC invalid
			E-Firmware 0001 CRC invalid
3005	Parameter CRC invalid	1	E+Parameter 0001 CRC invalid
			E-Parameter 0001 CRC invalid
3006	Parameter out of range	1	E+Parameter 0001 #XXXX range error
			E-Parameter 0001 #XXXX range error
3007	Failure during storage of path compensation parameter	1	E+PathComp. 0001 Storage error
			E+PathComp. 0001 Storage error
3008	Meter clock time invalid	1	E+System 0001 ClockTime inval.
			E-System 0001 ClockTime inval.

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Message No. on LCD	Details	Logbook	LCD Text
3009	Custody logbook [1] overflow	1	E+Logbook 1 0001 Overflow
			E-Logbook 1 0001 Overflow
3011	CRC volume counter (a.c) invalid	1	E+Count.ac 0001 CRC invalid
			E-Count.ac 0001 CRC invalid
3012	CRC volume counter (n.c) invalid	1	E+Count.sc 0001 CRC invalid
			E-Count.sc 0001 CRC invalid
3013	Transit time mode activated	1	E+System 0001 TransitTimeMode
			E-System 0001 TransitTimeMode
3014	No signature key	1	E+System 0001 No signature key
			E-System 0001 No signature key
2001	Path failure	1	W+PathError 0001 Path 1 2 3 4
			W-PathError 0001 All paths OK
2002	No HART communication to temperature transmitter	1	W+HART T 0001 No communication
			W-HART T 0001 No communication
2003	No HART communication to pressure transmitter	1	W+HART P 0001 No communication
			W-HART P 0001 No communication
2004	Maximum pulse output frequency exceeded (6kHz)	1	W+PulseOut 0001 6000 Hz exceeded
			W-PulseOut 0001 6000 Hz exceeded
2005	EVC parameter invalid	1	W+EVC 0001 EVC para.invalid
			W+EVC 0001 EVC para.invalid
2006	EVC hardware error	1	W+EVC 0001 EVC module error
			W+EVC 0001 EVC module error
1001	Flow meter power ON	1	I Power ON 0001 dd/mm/yy mm:ss
1002	Meter clock adjusted	1	I Set Time 0001 dd/mm/yy mm:ss

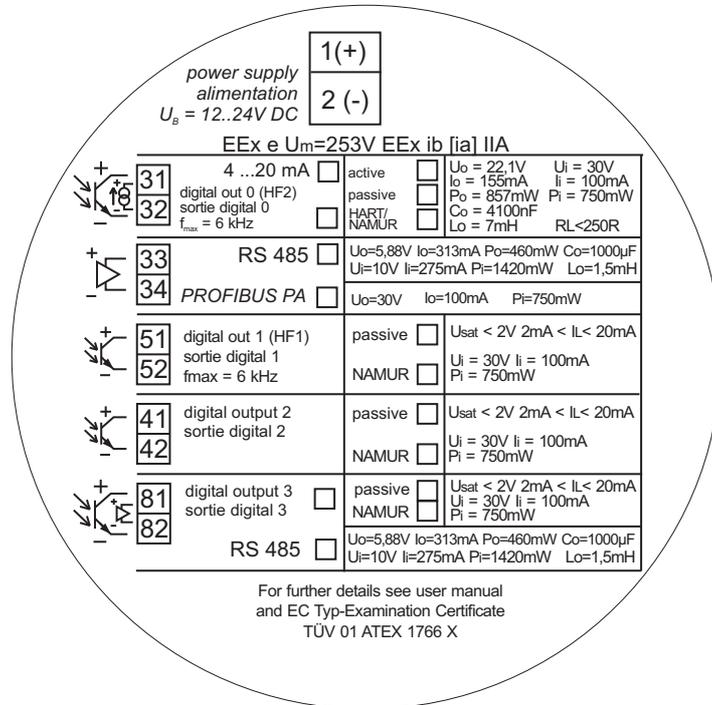
Message No. on LCD	Details	Logbook	LCD Text
1003	Configuration Mode active	1	I+Meas.Mode 0001 Configurat. ON 1
			I-Meas.Mode 0001 Measurement ON 1
1004	Firmware changed	1	I Update FW 0001 3104 -> 3200
1007	Custody logbook [1] erased and initialized	1	I Logbook 1 0001 Reset and Init
1014	Overflow volume counter (a.c.)	1	I Count.ac 0001 Overflow
1015	Overflow volume counter (s.c.)	1	I Count.sc 0001 Overflow
1016	Error volume counter cleared	1	I Reset E 0001 01/01/07 10:47
1017	All volume counters cleared	1	I Reset V 0001 01/01/07 10:47
1027	Initialization error → Default parameter loaded	1	I+InitError 0001 DefaultParaLoad
			I-InitError 0001 DefaultParaLoad
1029	Air test mode activated	1	I+Airtest 0001 Active
			I-Airtest 0001 Not active
<b>Warning logbook [2]</b>			
1008	Warning logbook [2] erased and initialized	2	I Logbook 2 0001 Reset and Init
1010	Warning logbook [2] overflow	2	I+Logbook 2 0001 Overflow
			I-Logbook 2 0001 Overflow
1018	DataLog 1 cleared	2	I DataLog 1 0001 Reset
1019	DataLog 2 cleared	2	I DataLog 2 0001 Reset
1020	DataLog 3 cleared	2	I DataLog 3 0001 Reset
1021	DataLog 1 overflow	2	I+DataLog 1 0001 Overflow
			I-DataLog 1 0001 Overflow
1022	DataLog 2 overflow	2	I+DataLog 2 0001 Overflow
			I-DataLog 2 0001 Overflow

Message No. on LCD	Details	Logbook	LCD Text
1023	DataLog 3 overflow	2	I+DataLog 3 0001 Overflow
			I-DataLog 3 0001 Overflow
1024	DatenLog 1 CRC error	2	I+DataLog 1 0001 CRC invalid
			I-DataLog 1 0001 CRC invalid
1025	DatenLog 2 CRC error	2	I+DataLog 2 0001 CRC invalid
			I-DataLog 2 0001 CRC invalid
1026	DataLog 3 CRC error	2	I+DataLog 3 0001 CRC invalid
			I-DataLog 3 0001 CRC invalid
1028	Customer limit exceeded	2	I+Userlimit 0001 Limit XXXXXXXXXXX
			I-Userlimit 0001 Limits OK
<b>Parameter logbook [3]</b>			
1005	Parameter changed	3	I Parameter 0001 Change Reg3001
1006	All parameters to default (Reset)	3	I Parameter 0001 Reset all
1009	Parameter logbook [3] erased and initialized	3	I Logbook 3 0001 Reset and Init
1011	Parameter logbook [3] overflow	3	I+Logbook 3 0001 Overflow
			I Logbook 3 0001 Overflow

7.3 **SPU terminal assignment**

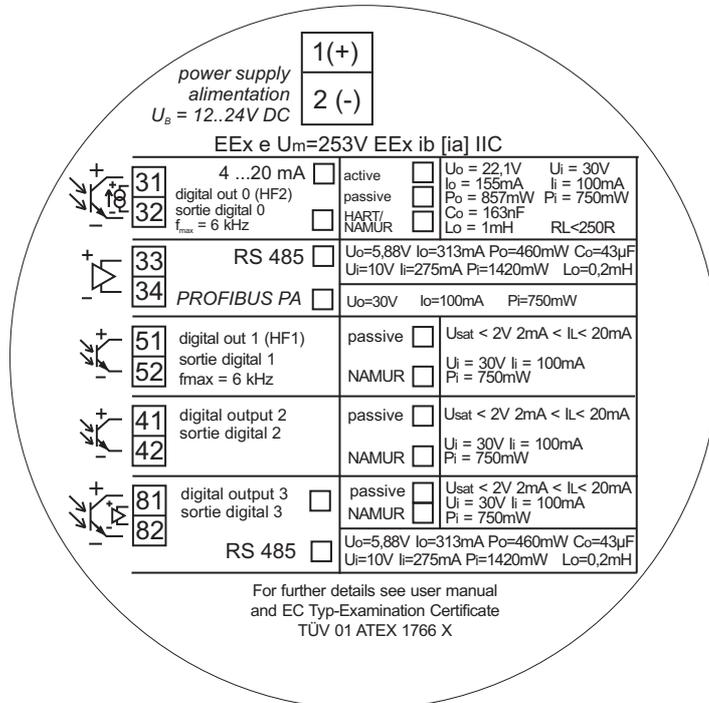
**Connection in accordance with ATEX IIA**

Figure 46 Terminal assignment in accordance with ATEX IIA



**Connection in accordance with ATEX IIC**

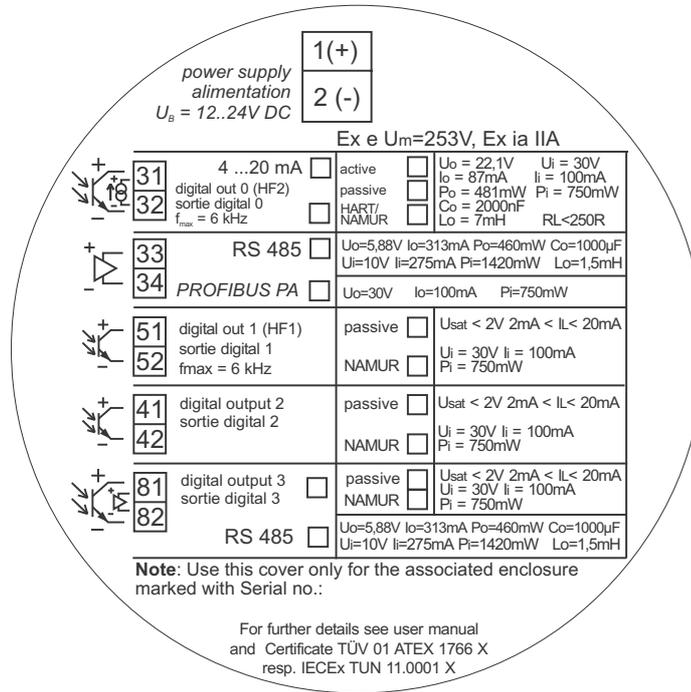
Figure 47 Terminal assignment in accordance with ATEX IIC



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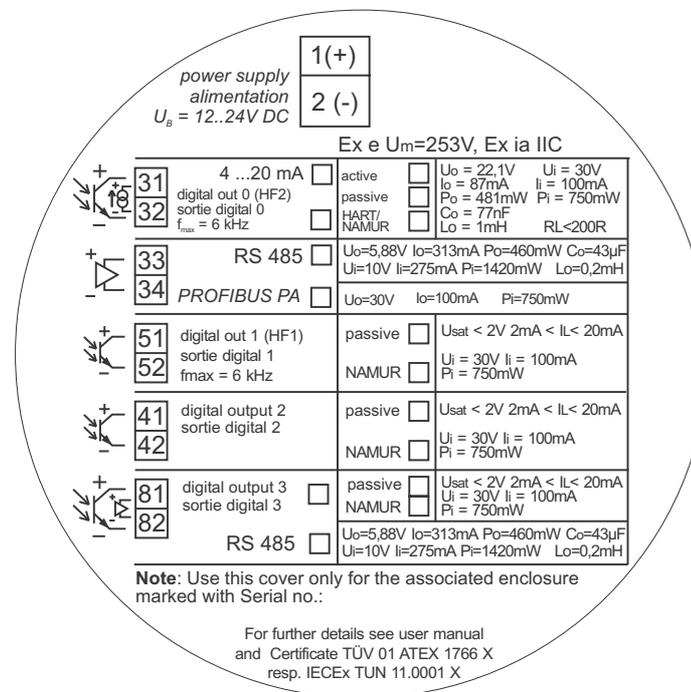
Connection in accordance with ATEX /IECEX IIA

Figure 48 Terminal assignment in accordance with ATEX IIA



Connection in accordance with ATEX /IECEX IIC

Figure 49 Terminal assignment in accordance with ATEX IIC



For CSA SPU Assignment → S. 127, »Control drawing 781.00.02 (page 4)« and following.

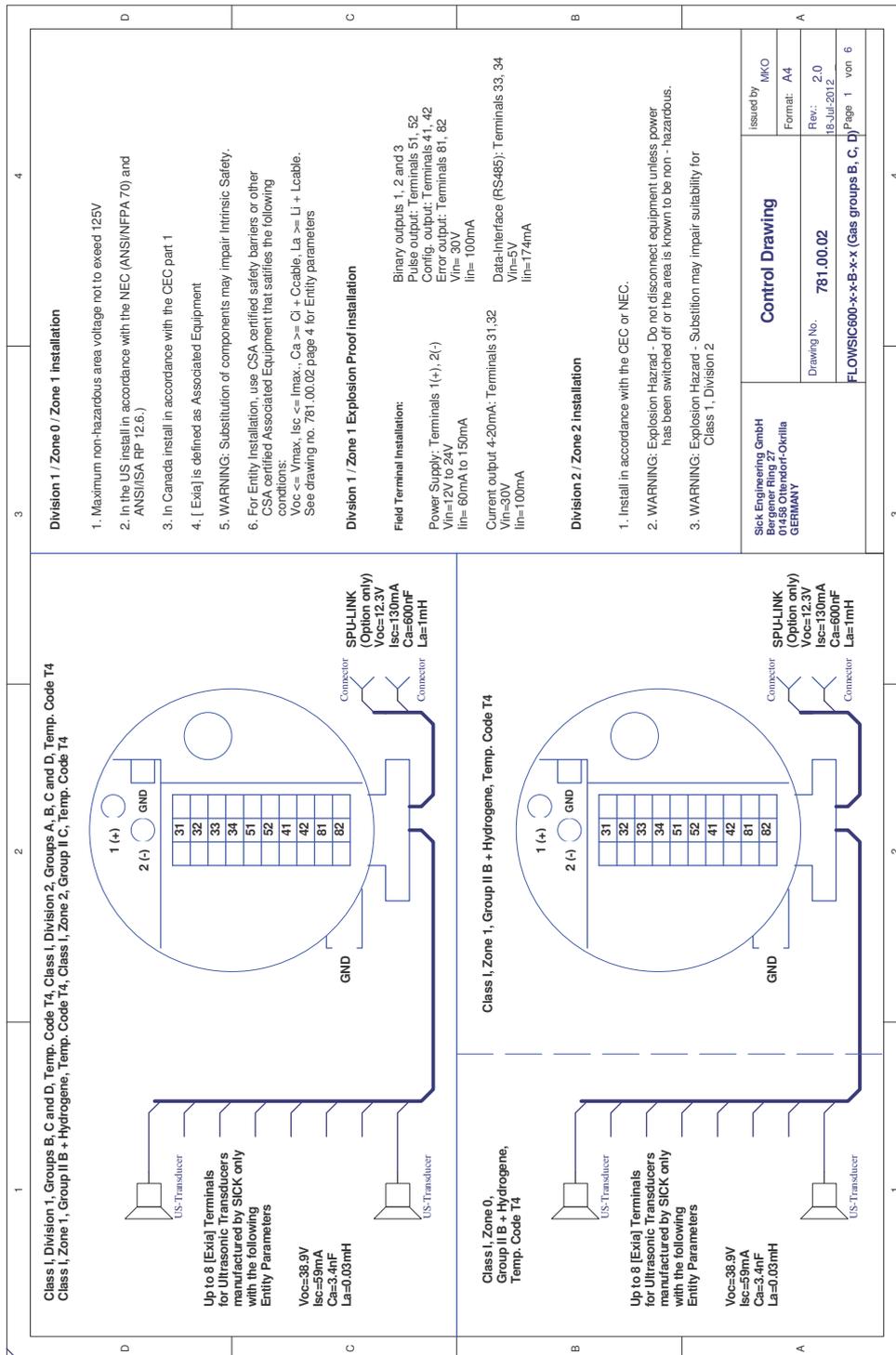
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7.4

## Connection diagrams for operating the FLOWSIC600 in hazardous areas in accordance with North American Requirements (NEC, CEC)

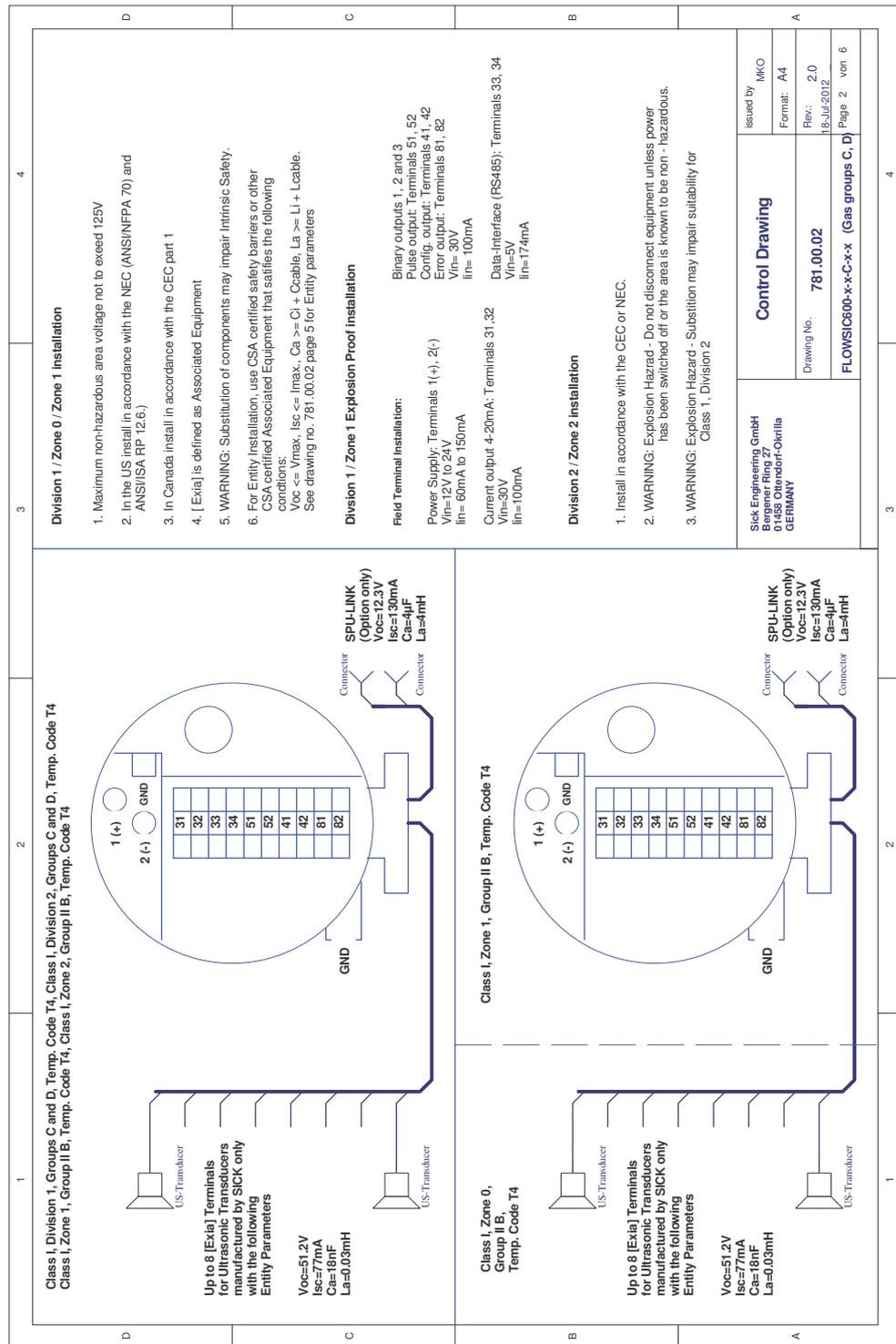
Figure 50

Control drawing 781.00.02 (page 1)



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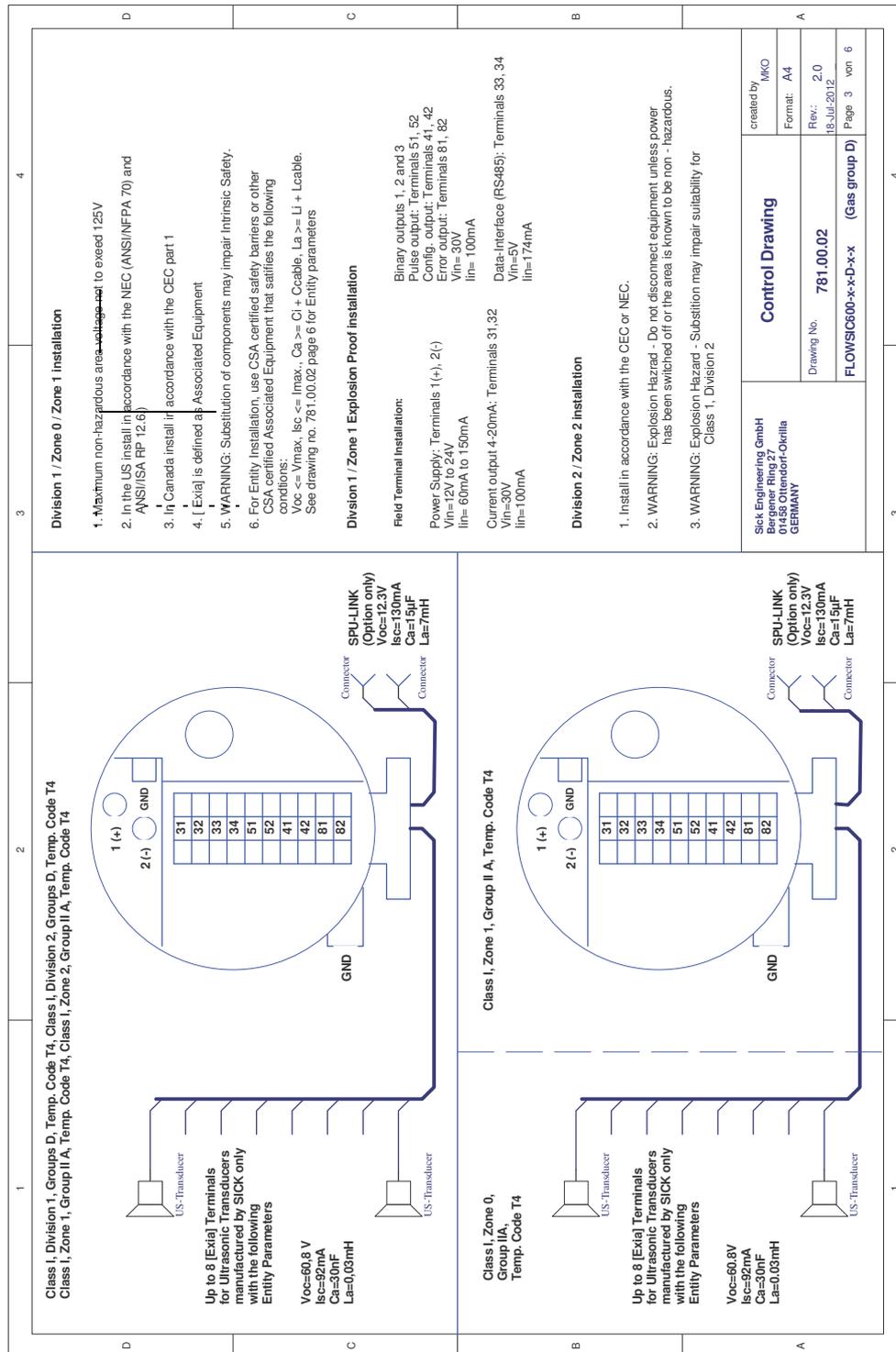
Figure 51 Control drawing 781.00.02 (page 2)



SICK Engineering GmbH Rue Paroissien 10 01458 Otfendörf-Okulla GERMANY		Control Drawing		issued by MKO
Drawing No. 781.00.02		Format: A4		Rev.: 2.0
FLOWSiC600-x-x-c-x-x (Gas groups C, D)		Page 2		von 6

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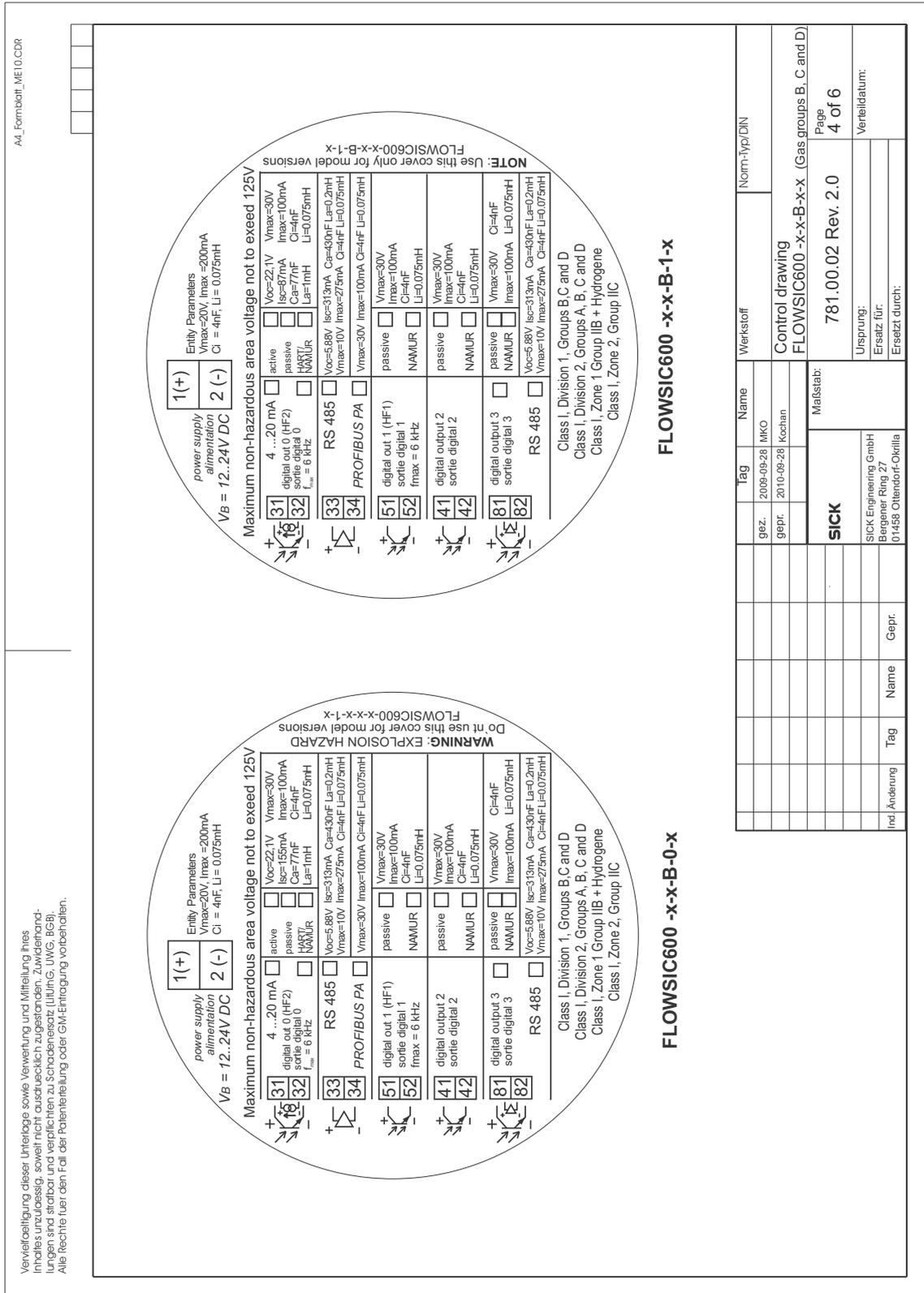
Figure 52 Control drawing 781.00.02 (page 3)



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Figure 53 Control drawing 781.00.02 (page 4)

Subject to change without notice



AL\_Formblatt\_ME10.CDR

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Figure 54 Control drawing 781.00.02 (page 5)

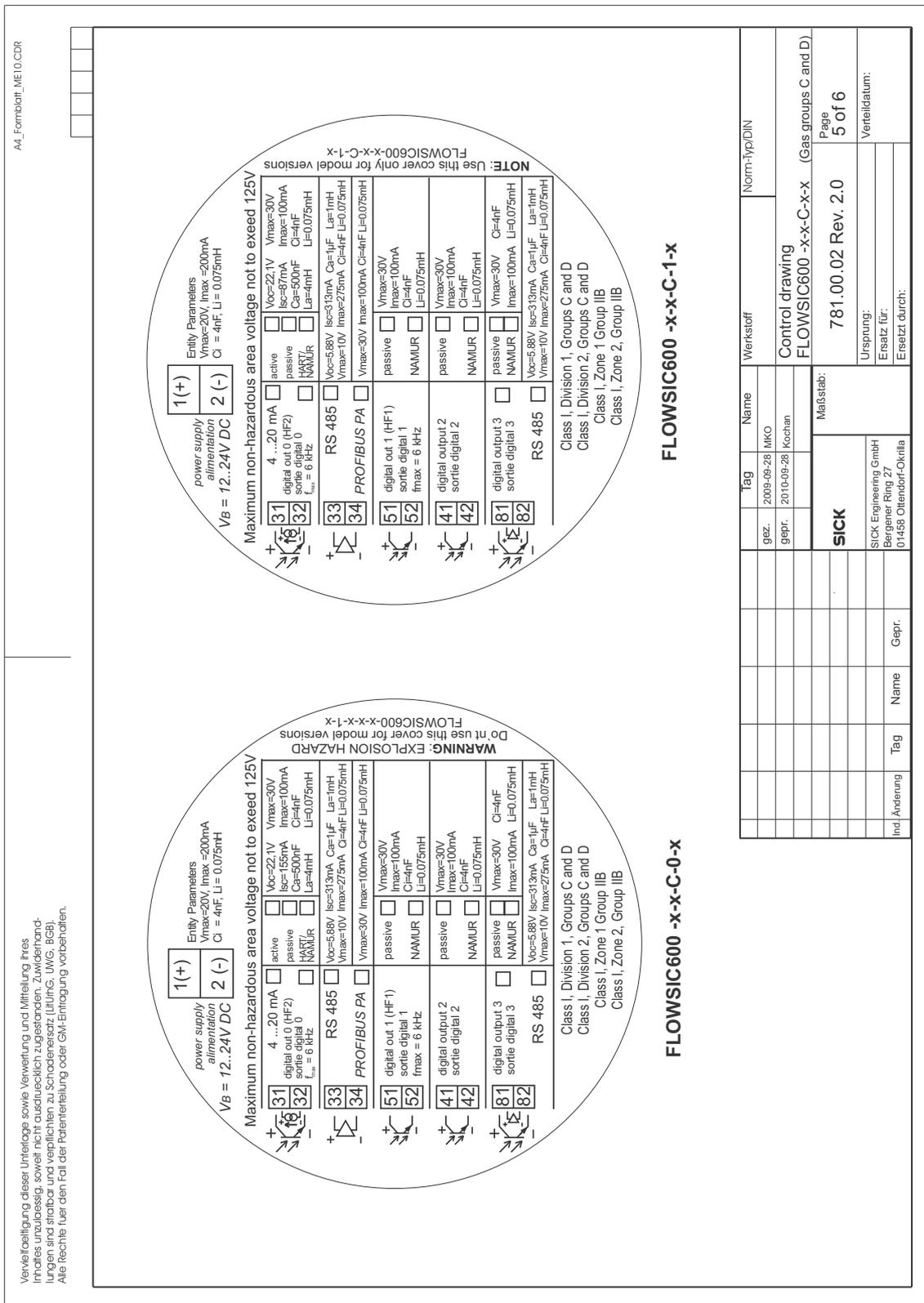
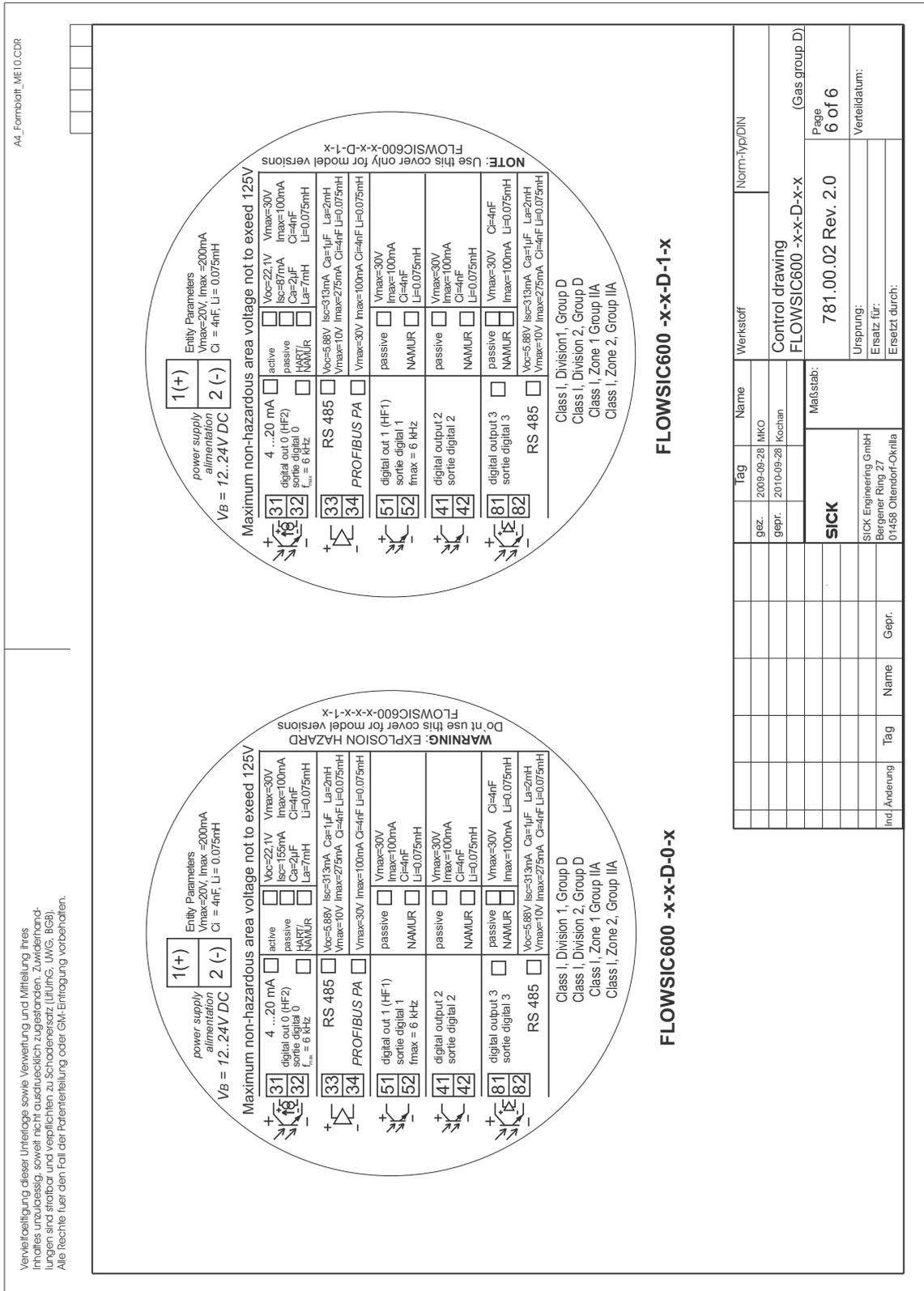


Figure 55 Control drawing 781.00.02 (page 6)

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A4\_Fornblatt\_ME10.CDR

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7.6

**Sealing plan**

Figure 58 Sealing plan, part 1 (cast version)

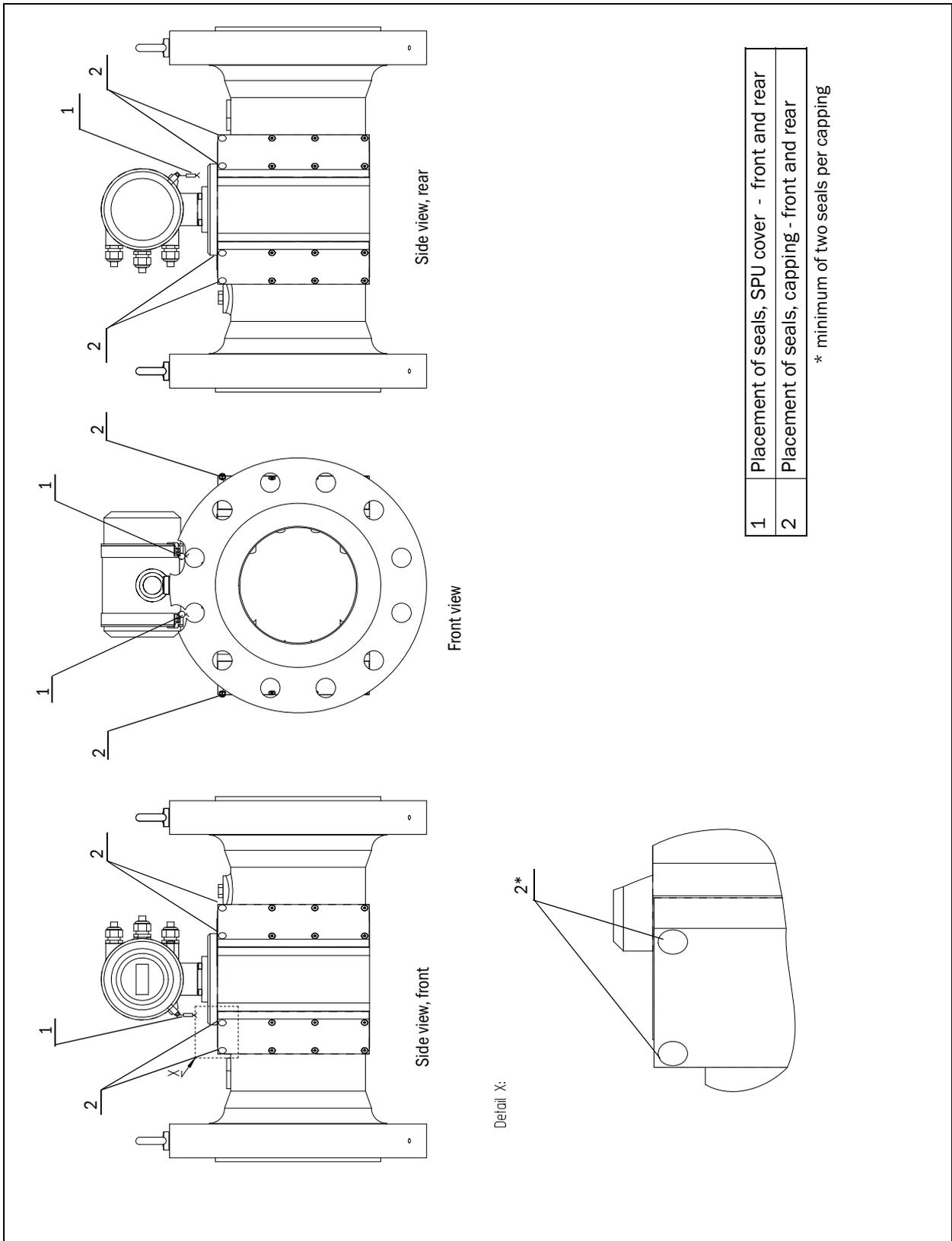
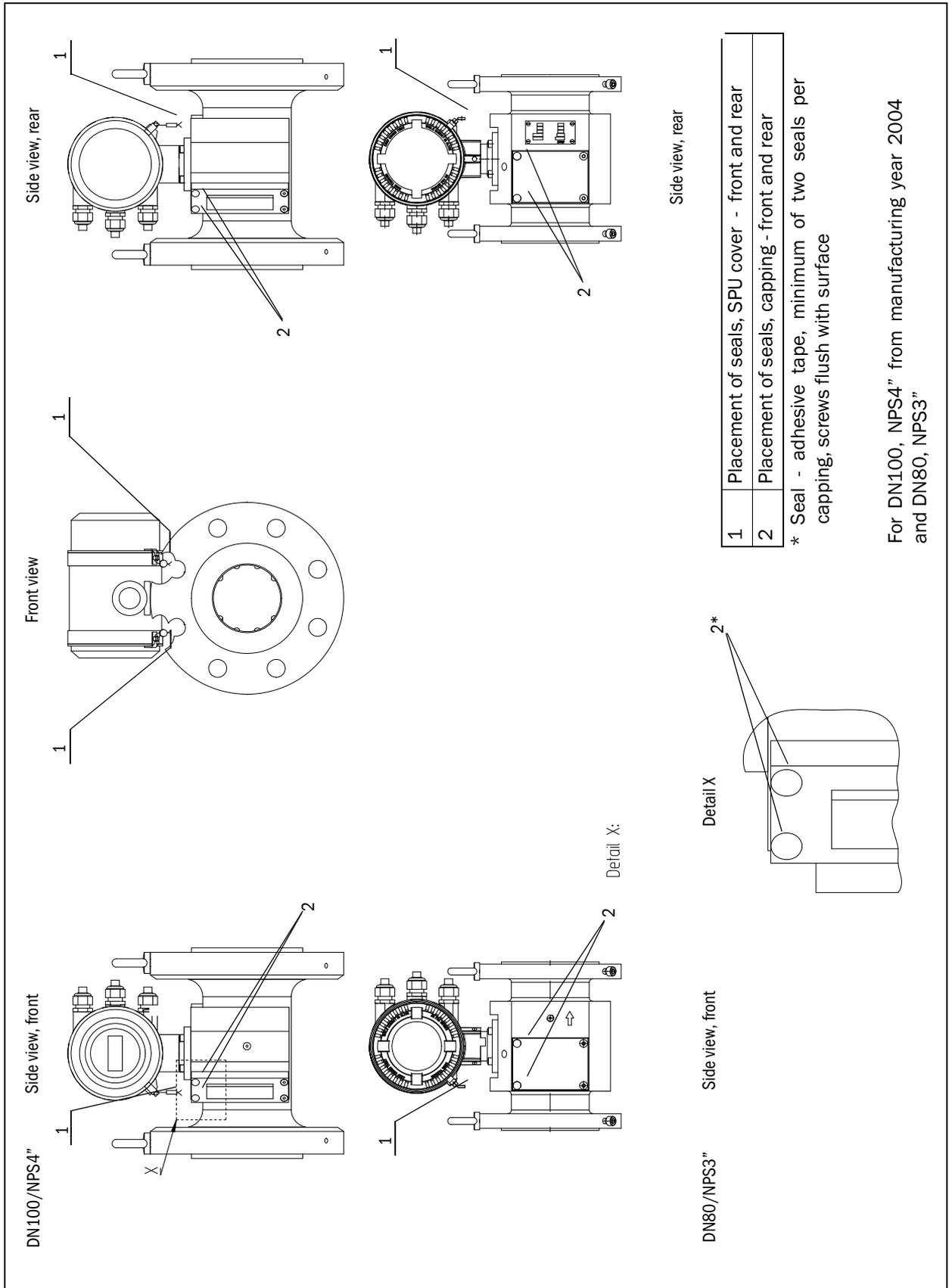


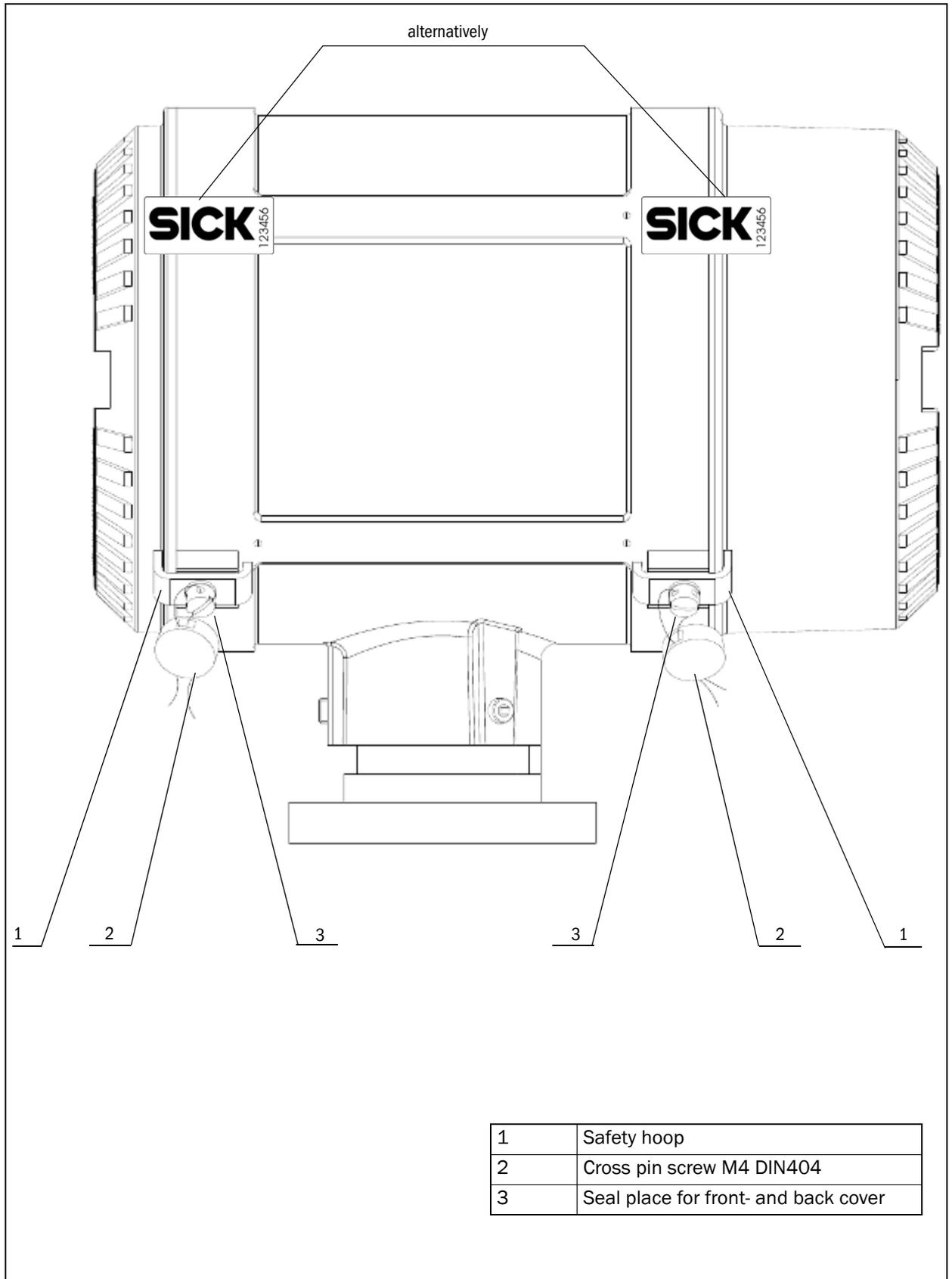
Figure 59 Sealing plan, part 2 (cast version)



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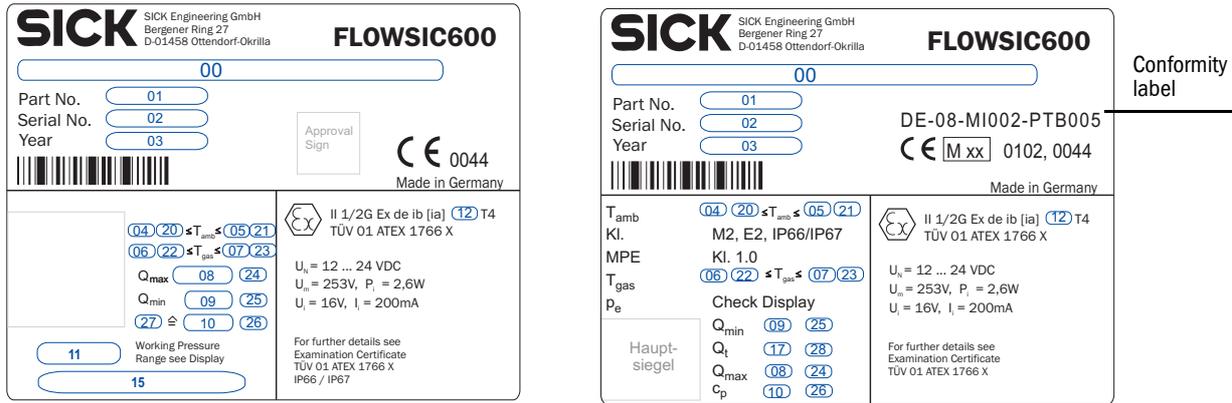


Figure 61 Sealing plan, part 4



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Figure 62 Examples: Main type plates on the signal processing unit (right: including conformity label)



Variable	Bezeichnung	Bezeichnung
00	Typschlüssel	Device type
01	Artikelnummer	Part Number
02	Seriennummer	Serial Number
03	Baujahr	Year
04	Min. Umgebungstemperatur	Min. Ambient Temperature
05	Max Umgebungstemperatur	Max Ambient Temperature
06	Min. Mediumstemperatur	Min. Gas Temperature
07	Max. Mediumstemperatur	Max. Gas Temperature
08	Max. Durchfluss	Max. Flow rate
09	Min. Durchfluss	Min. Flow rate
10	Impulswertigkeit	K-Factor
11	Baugröße	Size
12	Gasgruppe Ex	Gas group Ex
13	Modellnummer	Model Number
14	-	Type approval
15	Verwendung	use
16	-	Year short (YY)
17	Trenndurchfluss	transition flow rate
18	-	-
19	-	-
20	Einheit zu 04	unit to 04
21	Einheit zu 05	unit to 05
22	Einheit zu 06	unit to 06
23	Einheit zu 07	unit to 07
24	Einheit zu 08	unit to 08
25	Einheit zu 09	unit to 09
26	Einheit zu 10	unit to 10
27	unit Vol	unit Vol
28	Einheit zu 17	unit to 17

Figure 63 Example: Type plate on the meter body

Variable	Bezeichnung	Description
1	Messaufnehmer Identifikation	Meter Body Identifikation
2	Datum	Date
3	Nominale Nennweite mm/inch	Nominal Pipe Size mm/inch
4	Gewicht	Weight
5	Einsatztemperaturbereich min/max	Temperature Range min/max
6	Max. Betriebsüberdruck	Max. Operating Overpressure
7	Prüfüberdruck	Test Overpressure

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