OPERATING INSTRUCTIONS

Flow-X
Gas flow computer

Description
Installation
Operation

SICK
Sensor Intelligence.

Document Information

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Warning Symbols


Hazard (general)


Voltage Hazard

Explosive or combustible gas hazard

Warning levels / Signal words

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

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

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

NOTICE
Hazard which could result in material damage.

Information Symbols


Information about use in potentially explosive atmospheres.


Important technical information for this product


Supplementary information


Link to information in another place

Glossary

ADC	Analog to Digital converter
AI	Analog Input
AO	Analog Output
API	Application Programming Interface An interface that allows an application to interact with another application or operating system, in our case, Flow-X. Most of the Flow-X API is implemented through Excel worksheet functions.
ASCII	American Standard Code for Information Interchange. A set of standard numerical values for printable, control, and special characters used by PCs and most other computers. Other commonly used codes for character sets are ANSI (used by Windows 3.1+), Unicode (used by Windows 95 and Windows NT), and EBCDIC (Extended Binary-Coded Decimal Interchange Code, used by IBM for mainframe computers).
Asynchronous	A type of message passing where the sending task does not wait for a reply before continuing processing. If the receiving task cannot take the message immediately, the message often waits on a queue until it can be received.
Client/server	A network architecture in which each computer or process on the network is either a client or a server. Clients rely on servers for resources, such as files, devices, and even processing power. Another type of network architecture is known as a peer-to-peer architecture. Both client/server and peer-to-peer architectures are widely used, and each has unique advantages and disadvantages. Client/server architectures are sometimes called two-tier architectures
CPU	Central Processing Unit
DAC	Digital to Analog Converter
DCS	Distributed Control System
DDE	Dynamic Data Exchange. A relatively old mechanism for exchanging simple data among processes in MS-Windows.
Device driver	A program that sends and receives data to and from the outside world. Typically a device driver will communicate with a hardware interface card that receives field device messages and maps their content into a region of memory on the card. The device driver then reads this memory and delivers the contents to the spreadsheet.
DI	Digital Input
DO	Digital Output
EGU	Engineering Units
EIA	Electrical Industries Association
Engineering units	Engineering units as used throughout this manual refers in general to the units of a tag, for example “bar”, or “ºC” and not to a type of unit, as with “metric” units, or “imperial” units.
Ethernet	A LAN protocol developed by Xerox in cooperation with DEC and Intel in 1976. Standard Ethernet supports data transfer rates of 10 Mbps. The Ethernet specification served as the basis for the IEEE 802.3 standard, which specifies physical and lower software layers. A newer version, called 100-Base-T or Fast Ethernet supports data transfer rates of 100 Mbps, while the newest version, Gigabit Ethernet supports rates of 1 gigabit (1000 megabits) per second.
Event	Anything that happens that is significant to a program, such as a mouse click, a change in a data point value, or a command from a user.
Exception	Any condition, such as a hardware interrupt or software error-handler, that changes a program's flow of control.
FET	Field Effect Transistor
Fieldbus	A set of communication protocols that various hardware manufacturers use to make their field devices talk to other field devices. Fieldbus protocols are often supported by manufacturers of sensor hardware. There are debates as to which of the different fieldbus protocols is the best. Popular types of fieldbus protocol include Modbus, Hart, Profibus, Devicenet, InterBus, and CANopen.
GC	Gas Chromatograph
GUI	Graphical User Interface
HART	Highway Addressable Remote Transducer. A protocol defined by the HART Communication Foundation to exchange information between process control devices such as transmitters and computers using a two-wire 4-20mA signal on which a digital signal is superimposed using Frequency Shift Keying at 1200 bps.
HMI	Human Machine Interface. Also referred to as a GUI or MMI. This is a process that displays graphics and allows people to interface with the control system in graphic form. It may contain trends, alarm summaries, pictures, and animations.
I/O	Input/Output
IEEE	Institute for Electrical and Electronics Engineers
ISO	International Standards Organization
Kernel	The core of Flow-X that handles basic functions, such as hardware and/or software interfaces, or resource allocation.
MIC	Machine Identification Code. License code of Flow-X which uniquely identifies you computer.
MMI	Man Machine Interface (see HMI)
OEM	Original Equipment Manufacturer
P&ID	Piping and Instrumentation Diagram
PC	Personal Computer
PCB	Printed Circuit Board
Peer-to-peer	A type of network in which each workstation has equivalent capabilities and responsibilities. This differs from client/server architectures, in which some computers are dedicated to serving the others. Peer-to-peer networks are generally simpler, but they usually do not offer the same performance under heavy loads. Peer-to-peer is sometimes shortened to the term P2P.
PLC	Programmable Logic Controller. A specialized device used to provide high-speed, low-level control of a process. It is programmed using Ladder Logic, or some form of structured language, so that engineers can program it. PLC hardware may have good redundancy and fail-over capabilities.
PLC	Programmable Logic Controller. A specialized device used to provide high-speed, low-level control of a process. It is programmed using Ladder Logic, or some form of structured language, so that engineers can program it. PLC hardware may have good redundancy and fail-over capabilities.

Polling	A method of updating data in a system, where one task sends a message to a second task on a regular basis, to check if a data point has changed. If so, the change in data is sent to the first task. This method is most effective when there are few data points in the system. Otherwise, exception handling is generally faster.
Process visualization software	A system for monitoring and controlling for production processes, and managing related data. Typically such a system is connected to external devices, which are in turn connected to sensors and production machinery. The term “process visualization software” in this document is generally used for software with which SCADA software, HMI software, or supervisory computer software applications can be built. In this document, although strictly not correct, the terms “SCADA”, “HMI”, “supervisory”, and “process visualization” are alternately used, and refer to the computer software applications that can be realized with “eXLerate” PC-based supervisory software.
Protocol	An agreed-up format for transmitting data between two devices. In this context, a protocol mostly references to the Data Link Layer in the OSI 7-Layer Communication Model.
Query	In SCADA/HMI terms a message from a computer to a client in a master/client configuration utilizing the message protocol with the purpose to request for information. Usually, more than 1 data-point is transmitted in a single query.
Real-time	The characteristic of determinism applied to computer hardware and/or software. A real-time process must perform a task in a determined length of time. The phrase “real-time” does not directly relate to how fast the program responds, even though many people believe that real-time means real-fast.
Resource	Any component of a computing machine that can be utilized by software. Examples include: RAM, disk space, CPU time, real-world time, serial devices, network devices, and other hardware, as well as O/S objects such as semaphores, timers, file descriptors, files, etc.
RS232	EIA standard for point to point serial communications in computer equipment
RS422	EIA standard for two- and four-wire differential unidirectional multi-drop serial
RS485	EIA standard for two-wire differential bidirectional multi-drop serial communications in computer equipment
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
SQL	Standard Query Language
SVC	Supervisory Computer
Synchronous	A type of message passing where the sending task waits for a reply before continuing processing.
Tag	A “tag” as used within this document refers to a data point existing in the tag database, with a number of properties, such as its assigned I/O address, current value, engineering units, description, alias name, and many others.
TCP/IP	Transmission Control Protocol/Internet Protocol. The control mechanism used by programs that want to speak over the Internet. It was established in 1968 to help remote tasks communicate over the original ARPANET.
TTL	Transistor-Transistor Logic
UART	Universal Asynchronous Receiver & Transmitter
URL	Uniform Resource Locator. The global address for documents and resources on the World Wide Web.
Web Server	A computer that has server software installed on it and is used to deliver web pages to an intranet/ Internet.
XML	Extensible Markup Language. A specification for Web documents that allows developers to create custom tags that enable the definition, transmission, validation, and interpretation of data contained therein.

Flow-X

1 Important Information

About this document
Main hazards
Intended use
Responsibility of user

1.1 About this document

These Operating Instructions describe the Flow-X flow computer.

They contain basic information about the product as well as installation, start-up, operation and maintenance.

These Operating Instructions only cover standard applications conforming to the specified technical data.

Additional information and assistance for special applications are available from your SICK representative. We certainly recommend consulting SICK's specialists for your special application.

1.2 Main hazards

Handling or using the device incorrectly can result in personal injury or material damage. Therefore, it is imperative that you observe the following points to prevent damage.

The legal stipulations and associated technical regulations relevant for the respective system must be observed when preparing and carrying out work.

- All work must be carried out in accordance with the local, system-specific conditions and with due consideration to operating hazards and specifications.
- The Operating Instructions belonging to the Flow-X flow computer as well as system documentation must be available on site.
- The instructions for preventing danger and damage contained in these documents must be observed at all times.

1.3 Intended use

1.3.1 Purpose of the device

The Flow-X flow computer measures and calculates the base volume flow rate and totals using standard algorithms and actual process data from connected devices like FLOWSIC gas meters and transmitters.

It may only used as specified by the manufacturer.

1.3.2 Correct use

The device may only be used as described in these Operating Instructions.

Pay special attention to the following information:

- The usage of the technical data corresponds to the specifications on allowable use as well as assembly, connection, ambient and operating conditions (see the order documents, device pass, type plates and documentation delivered with the device).
- All measures required to maintain the device, e.g. for maintenance and inspection, transport and storage are complied with.

1.4 Responsibility of user

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

Flow-X

2 Product Description

Modules
Enclosure
Modes
Security

2.1 Introduction

This chapter provides an overview of the SICK Flow-X flow computer.

2.2 Flow-X/P enclosure

This is a panel-mounted (“/P”) flow computer with up to four streams, and an additional station module with a 7" multi-lingual color touch-screen and additional serial (3x) and Ethernet interfaces (2x). This flow computer can be used in both horizontal and vertical position. Field connections are available in standard 37-pin and 9-pin D-Sub type connectors at the rear.

Figure 1 Flow-X/P enclosure

2.3 Flow-X/S

Figure 2 Flow-X/S enclosure

Single stream, DIN rail enclosure with direct screw terminals for field connections.

Interfaces include dual Ethernet with built-in web-server via RJ45 connectors.

Graphical LCD display with 4-8 lines for local multi-lingual display of measured & calculated data.

2.4 Flow-X/ST

Figure 3 Flow-X/ST enclosure

Single stream, DIN rail enclosure with direct screw terminals for field connections as Flow-X/S, plus an additional 7" inch color touch-screen based User Interface module which connects to either Ethernet interface.

The touch screen module can be mounted in a panel.

2.5 Flow X/M module

A Flow-X/M flow module usually represents on stream in your metering system.

The Flow-X/M module has its own 4-line display and 4 navigation buttons to allow inspection of values and changing of parameters if required.

Figure 4 Flow module

The Flow modules are always mounted in the following enclosure a panel-mounted flow computer (maximum 4 modules), Flow-X/P.

A single module has the following I/O capabilities:

Table 1 Summary of Flow-X/M inputs and outputs

Signal type	Nr	Description
Analog input	6 [1]	Analog transmitter input, high accuracy, 4 ... 20 mA, 0 ... 20 mA, 0 ... 5 V, 1 ... 5 V Inputs are fully floating (optically isolated).
HART input	4 [1]	Independent HART loop inputs, on top of the 4 ... 20 mA signals (analog inputs) Support includes multi-drop for each transmitter loop
4-wire PRT inputs	2	High accuracy Pt100 inputs, resolution 0.02 °C for 100 Ω input Error depending on range: 0 to 50 °C: Error < 0.05 °C or better –220 to +220 °C: Error <0.5 °C or better
Pulse inputs	1 [2]	High speed single or dual pulse input. Frequency range 0 ... 5 kHz (dual pulse) or 0 ... 10 kHz (single pulse)
Density	4 [2]	Periodic time input, 100 ... 5000 µs, resolution < 1ns
Digital Inputs	16 [2]	Digital status inputs, resolution 100 ns (10 MHz)
Digital Outputs	16 [2]	Digital output, open collector (0.5 A DC) Rating 100mA @24V.
Pulse Outputs	4 [2]	Open collector, max. 10 Hz
Sphere detector inputs	4 [2]	Supports 1, 2 and 4 detector configurations mode, resolution 100 ns (10 MHz)
Analog outputs	4	Analog output for flow control, pressure control 4 ... 20mA, outputs floating, resolution 14 bits, 0.075% FS
Prover Outputs	1 [2]	Pulse output for proving applications, the output represents the corrected pulse signal. Resolution 100 ns (1MHz)
Frequency outputs	4 [2]	Frequency outputs for emulation of flow meter signals. Maximum frequency 10KHz, accuracy 0.1%
Serial	2	RS485/RS232 serial input for ultrasonic meter, printer or generic, 115 kb
Ethernet	2	RJ45 Ethernet interface, TCP/IP
Power supply	2	External, 20 ... 32 V DC, nominal 24 V DC, with redundant connections

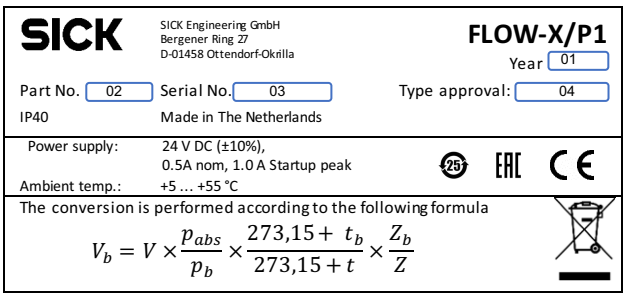
[1] The maximum number of analog inputs plus Hart inputs is 6.

[2] There are in total 16 in- and outputs available for these functions.

2.6 Type plate

The Flow-X type plate contains the following information: CE marking, MID approval number, notified body, serial number, year of build, operating temperature according to MID approval (actual operating temperature is 5 to 55 °C) and test certificate number.

Figure 5 Type plate



1 Year of production
2 7 digit SICK product part number
3 ABB Serial number
4 Dedicated MID Type Approval number

2.7 Multi-module mode

The Flow-X/P enclosures usually accommodate more than one module. These modules may be used in standalone mode, where each module is acting as an independent flow computer.

The other option is to use modules in Multi-Module mode, where they exchange data over the Ethernet. In this setup, the modules act together as one flow computer.

2.8 Security

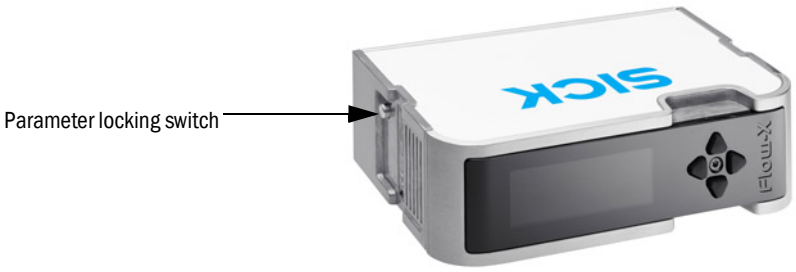
2.8.1 Metrological seal

All enclosures have the option of locking the flow computer with a lead seal by an authorized body, to prevent access to the tamper switch of the individual modules (see below). In a Flow-X/P (Panel) one bar is used to seal all installed modules with one lead seal.

2.8.2 Parameter locking switch

Each flow module has a mechanical switch to prevent changing of the application or vital parameters within that application. See §5.13.1 (→ page 87).

Figure 6 Parameter locking switch



2.8.3 Passwords

Access to the parameters and functions from the front panel or through a PC-connection is protected by passwords.

For a full description of password protection, user groups and access rights see → page 89, § 5.13.4.

2.9 Advantages

The SICK Flow-X flow computer provides a flexible, scalable platform to create your flow metering solutions. Where in other systems, flexibility also implies extensive configuration for even the simplest application, our “Flow-Xpress Basic” configuration software guarantees easy configuration, and the “Flow-Xpress Professional” configuration software allows detailed configuration with unparalleled freedom.

2.10 User interfaces

2.10.1 Flow-X/P touch screen

The Flow-X/P has an integral 7” touch screen graphical interface that provides access to and allows for entry of all data. The touch screen is an integral part of the Flow-X/P and can’t be detached or replaced. The interface provides access to the station module that is an integral part of the X/P itself and to the up to 4 installed flow modules.

Figure 7 Flow-X/P touch screen

2.10.2 Touch screen panel PC

All Flow-X flow computers can be operated with several type of touchscreen panel PCs that run the WinCE or Windows 32 operating system. For this purpose SICK provides the 'StandaloneGUI.exe' program that supports the following platforms:

- Windows 32 bit / x86
- WinCE5 / ARM
- WinCE6 / x86

A single touch panel can be used for multiple flow computers providing a cost-effective user interface.

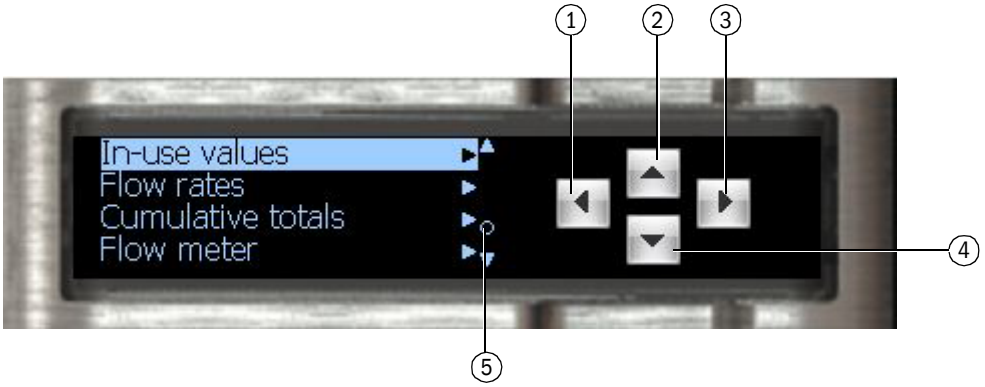
SICK supplies a 7" touch panel PC version for installation in a cabinet.

Figure 8 Touch Panel PC

2.10.3 Flow-X/M LCD display

A Flow-X/M flow module has its own local textual display that has the same capabilities as the main user interface except for the entry of alpha-numeric characters.

Figure 9 Flow-X/M LCD display



1 One menu level "up"
2 Up in the menu or changes a value
3 Selects a menu item
4 Down in the menu or changes a value
5 Alarm indicator

The display provides access to the data of the local module and when the module is installed in a Flow-X/P also to the station module and the other modules that are installed in the same Flow-X/P.

2.10.4 Flow-X web interface

All Flow-X flow computers have an embedded web server that allows for remote operation through the common web browser programs, such as Windows Internet Explorer, Mozilla Firefox, Google Chrome, Opera, etc.

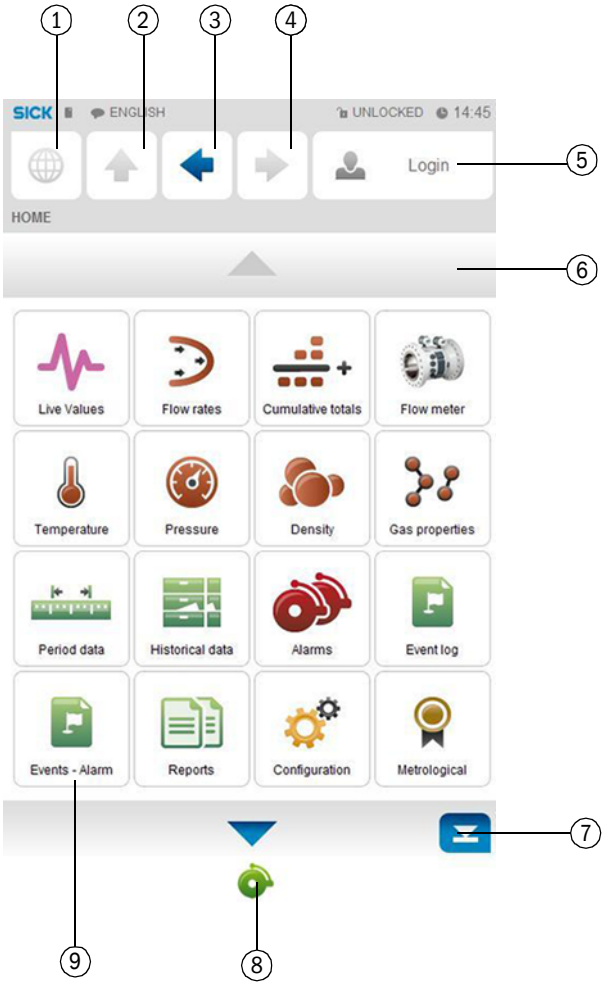
The web browser provides the same capabilities as the main user interface plus an explorer tree for easy navigation.

It also provides the option to download reports and historical data.

2.10.5 User interface layout

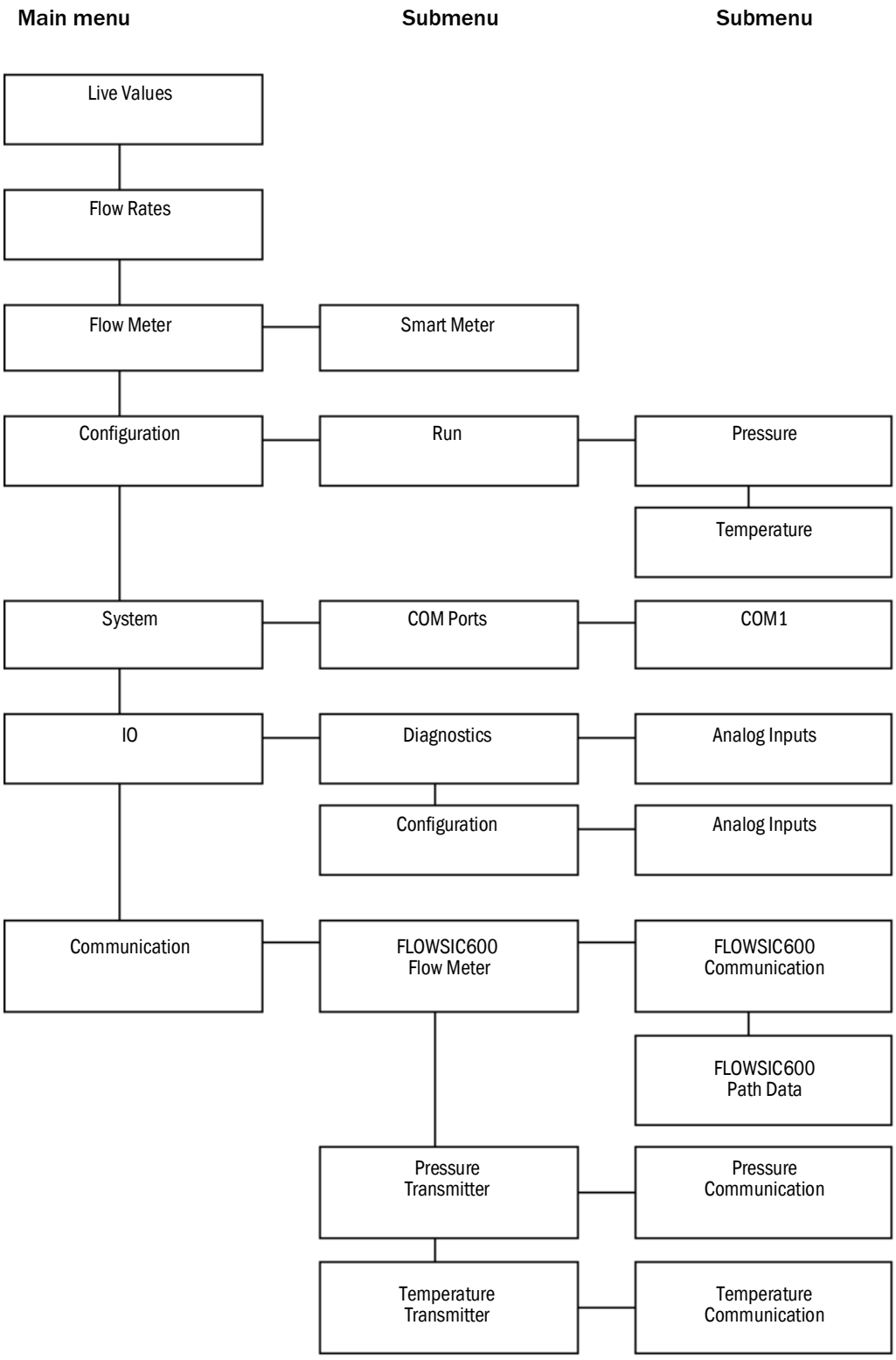
All the Flow-X Graphical User Interfaces have the following layout and buttons.

Fig. 10 Main menu of the Flow-X flow computer



1 To the "main menu"
2 One menu level "up"
3 One step backward
4 One step forward
5 To "Login" menu
6 One page up
7 To end of page
8 To "Alarms" menu
9 One page down

Fig. 11 Menu tree of relevant menu items of the Flow-X flow computer



2.11 XML interface

The Flow-X flow computer provides a secured XML interface in order to establish an automated interface with a host computer.

Web services are available for the following data and actions:

- Alarms state and acknowledgment
- General device information
- Display menu structure
- Text translations to foreign languages
- Event logs
- Historical data archives
- List of archived reports
- Read-out of individual reports
- Read and write data values
- Units and enumerations

A document that describes the Flow-X XML interface in detail can be requested at SICK.

Flow-X

3 Installation

Decisions to make
Mechanical Installation
Electrical Installation

3.1 Decisions to make

This chapter provides a short overview of considerations to be made in selecting the appropriate Flow-X products.

3.1.1 Location

The Flow-X modules are designed to operate in a temperature range of 5 ... 55 °C (41 ... 131 °F) humidity may be up to 90 %, non-condensating. In practice, the modules are usually mounted in racks in a controlled environment such as a control room, rack room or auxiliary room, or an analyzer house.

CAUTION:

The SICK Flow-X flow computer is neither intrinsically safe nor explosion-proof and can therefore only be used in a designated non-hazardous (safe) area.

For other devices always refer to documentation supplied by the manufacturer for details of installation in a hazardous area.

When connected to a device that resides in a hazardous area, it may be required to interpose safety barriers or galvanic isolators between the device and the SICK Flow-X flow computer. Refer to the device documentation for adequate information.

3.1.2 Capabilities

The SICK Flow-X flow computer supports an extensive list of International standard calculations for Natural gas and other applications.

For example:

- AGA8, AGA10
- API chapter 21.1
- ISO 6976 (all editions)
- NX19, SGERG, PTZ
- GPA 2172
- ASME 1967 (IFC-1967) steam tables, IAPWS-IF97 steam density

3.1.3 Number of modules

A module represents one stream. An overview of the available I/O per module may be found in §6.3 (→ page 53).

Station totals may be calculated in any module in the same enclosure, including the Flow-X/P Panel display module.

Special consideration applies to serial ports. Every module has 2 serial ports. If more ports are required, the Flow-X/P may be considered as it has 3 extra serial ports.

3.1.4 Redundancy

If, for increased availability, a redundant solution is required, 2 modules per stream may be used.

To obtain maximum availability, two identical SICK Flow-X/P enclosures can be used that operate in redundancy mode.

All modules have integrated support for dual 24 V power supply.

3.1.5 Fast Data exchange

Modules placed in a SICK Flow-X/P (Panel) enclosure are capable of fast data exchange with the modules next to it, over the Ethernet. This is the so-called Multi-Module Mode. Examples are one module communicating to a Gas Chromatograph and making this data available to 4 other modules, and additionally serving as a Modbus Slave to one central DCS connection.

Each Module is capable of using the data from other modules as if it exists in its own data space. For this purpose the SICK Flow-X/P includes two dedicated Ethernet switches. As an alternative it is possible to set up a Modbus TCP/IP link using Ethernet for data exchange between modules.

3.1.6 Display requirements

The SICK Flow-X/P touch screen has the largest display area available on the flow computer market and allows for effective and user-friendly data display and navigation through pages. Its multi-language-support is unique and includes non-western fonts.

This display feature is not always required. Each individual module is equipped with a local black and white graphical display, allowing for data display and parameter setting at the module itself. The display supports 4 to 8 lines for data and/or parameters.

Apart from these physical displays, each module incorporates a web server, allowing display pages to be accessed through a standard web browser over Ethernet.

3.1.7 Power supply

All models require 24 V DC and have integrated support for redundant power supply.

3.2 Mechanical Installation

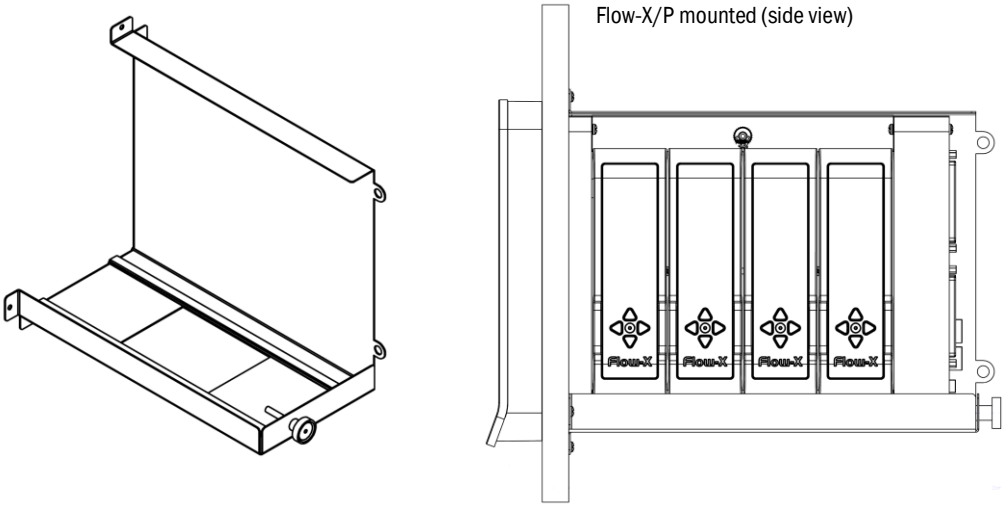
3.2.1 Introduction

This chapter describes the mechanical aspects of all enclosures. For full drawings with sizes see §6.6 (→ page 56).

3.2.2 Flow-X/P

The panel mounted Flow-X/P requires a mounting bracket, which is part of the delivery. The bracket is designed to allow full access to the mounted flow modules. This rack is fixed to the back of the panel in which the Flow-X/P is to be mounted. The flow computer slides in at the front of the panel, and the screw fixes the two together.

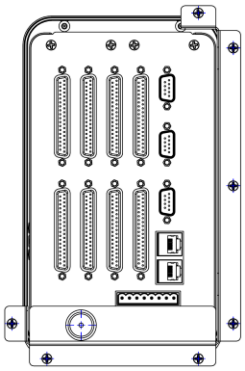
Figure 12 Flow-X/P mounting bracket



All connectors for power, field wiring and communication are located at the back of the Flow-X/P. For each module, 2 sub-D connectors (37-pin) contain all field signals. Additional connectors exist for 3 the serial ports of the display module, and 2 ethernet RJ45 connections. A 24 V DC Power connector completes the lot. See §3.3 (→ page 25) for connector details.

The modules that are inserted into the Flow-X/P are locked in place with a bar with the possibility to seal to prevent any unnoticed unauthorized access.

Figure 13 Flow-X/P rear view (mounted) .



- The 9-pin D-sub connectors are male.
- The 37-pin D-sub connectors are female.

3.3 Electrical Installation

3.3.1 Introduction

This chapter provides details on all aspects of the electrical installation, including field wiring, communication, power supply and earthing. Since all models use the same Flow-X/M module, the connection diagrams in this chapter apply to all models.

CAUTION:

The SICK Flow-X flow computer is neither intrinsically safe nor explosion-proof and can therefore only be used in a designated non-hazardous (safe) area.

For other devices always refer to documentation supplied by the manufacturer for details of installation in a hazardous area.

When connected to a device that resides in a hazardous area, it may be required to interpose safety barriers or galvanic isolators between the device and the SICK Flow-X flow computer. Refer to the device documentation for adequate information.

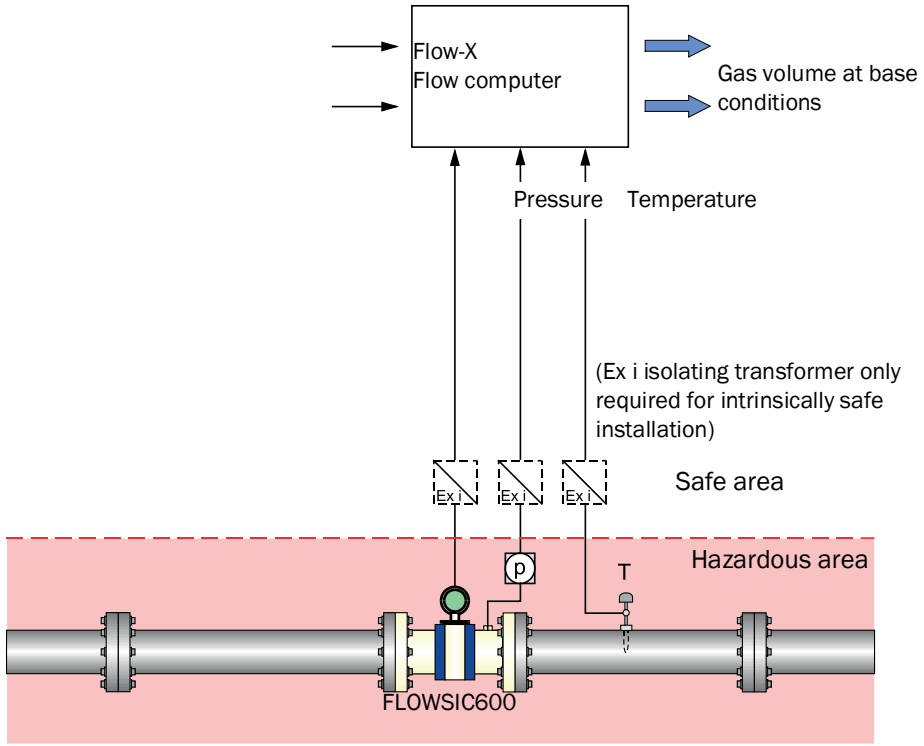
The Flow-X modules are fully configurable through software. No dipswitches or jumpers need to be set inside. There are no user-replaceable fuses or other components inside. Opening a module will void any warranty.

For easy reference, the connector details are presented first. Loop diagrams and additional connection drawings are to be found below.

3.3.2 General connection

The following chapter describes the connection to a single module of a Flow-X flow computer. Proceed accordingly if more modules are to be connected.

Figure 14 General connection



3.3.3 Cable specifications

Serial port (RS485)

	Specification	Notes
Type of cable	Twisted pair, shielded, Cable impedance approx. 100...150Ω Low cable capacitance: ≤ 100 pF/m	Connect shielding at other end to ground terminal
Min./ max. cross-section	2 x 0.5/1 mm² (2 x 20-18 AWG)	
Maximum cable length	300 m at 0.5 mm² (1600 ft for 20 AWG) 500 m at 0.75 mm² (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

For more details concerning the cable specifications, please see Section "Cable specifications" of Operating Instructions "FLOWSIC600".

3.3.4 Location of connectors

The Flow-X/P flow computer is the panel-mounted version that has a touch-screen and can contain up to 4 Flow-X/M flow modules.

Power, I/O, and communication terminals are on the back of the flow computer. The touch-screen module processes the two RJ45 connectors (for Ethernet) and three 9-pin D-sub male connectors (for serial communications). These connections are functional even with no flow module installed. The first serial communications port only supports RS232, the other both RS232 and RS485.

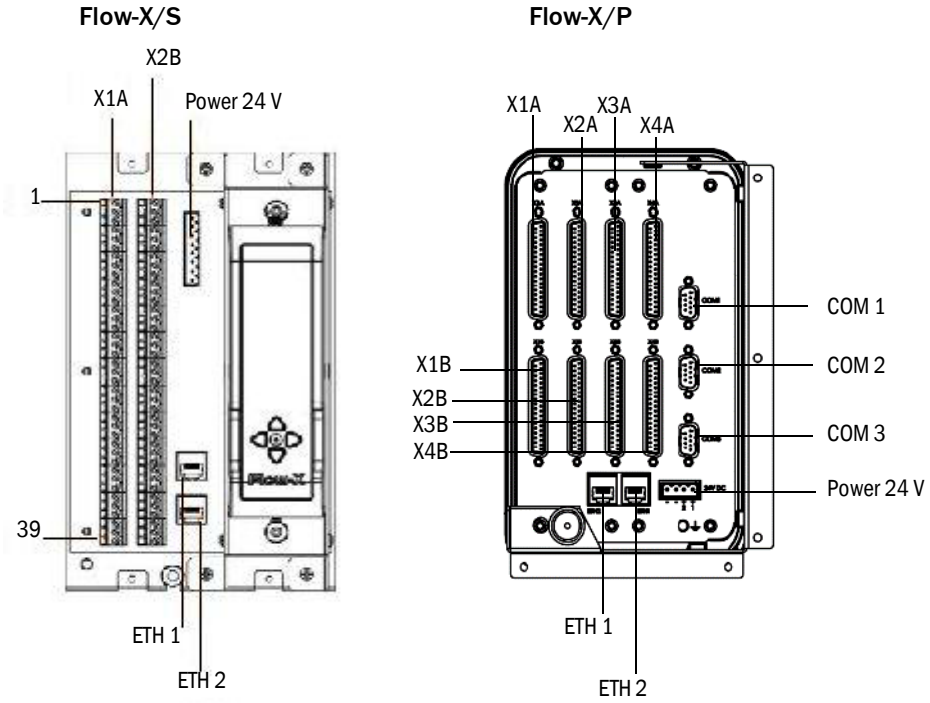
Furthermore there are eight 37-pin D-sub female connectors for the I/O and serial communication ports of the 4 flow modules. Only the connections for the actual installed flow modules can be used.

The three 9-pin D-sub connectors are the serial ports of the Display module. These ports may be used to communicate to devices such as a gas chromatograph, or a DCS. COM1 is RS232 only, COM2 and COM3 may be individually configured for RS232 or RS485.

LAN1 and LAN2 are Ethernet connectors, to connect your Flow-X/P to your network. The modules are used in Multi-module mode. The individual Ethernet connections of each module are not used in a Flow-X/P.

Power supply connector → page 27, § 3.3.5

Fig. 15 Location of connectors



For more details on the existing connections, see Section "Electrical installation" of the "Flow-X Flow Computer" Technical Information.

3.3.5 Power supply connector

The Flow-X flow computer provides redundant power connections that may be connected to two power supplies. The two power supplies may operate independently and there is no need for a redundant power supply. When the in-use power supply fails, the flow computer will automatically switch to the other power supply without any loss of power. The Flow-X flow computers use an 4-pin terminal block for connecting one or two external power supplies. The primary connection must always be used, the secondary is optional.

The primary power supply must be connected a (the) “24 V DC – Primary” terminal and one of the “0 – V DC” terminals. The optional secondary power supply must be connected to a (the) “24 V DC – Secondary” terminals and one of the “0 V” terminals.

Figure 16 Flow-X power terminal block

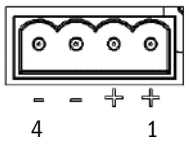


Table 2 Flow-X power terminal block

Pin	Description	Indication on Flow-X
1	24 V – Primary	+1
2	24 V – Secondary	+2
3	0 V	–
4	0 V	–

3.3.6 Field connections

The FLOWSIC600 gas flow meter is connected from terminal 81/82 to the serial COM port 1 of the used module of the flow computer. For connection with a 2-wire RS-485 connection, it is sufficient to use the Tx+ and Tx terminals.

The pressure transmitter is connected to the Analog 1/HART 1 connector whereas the temperature transmitter is connected to the Analog 2/HART 2 connector of the used module of the flow computer

Electrical installation

The location and type of the connections varies between the individual Flow-X flow computer models.

Fig. 17 Field connections

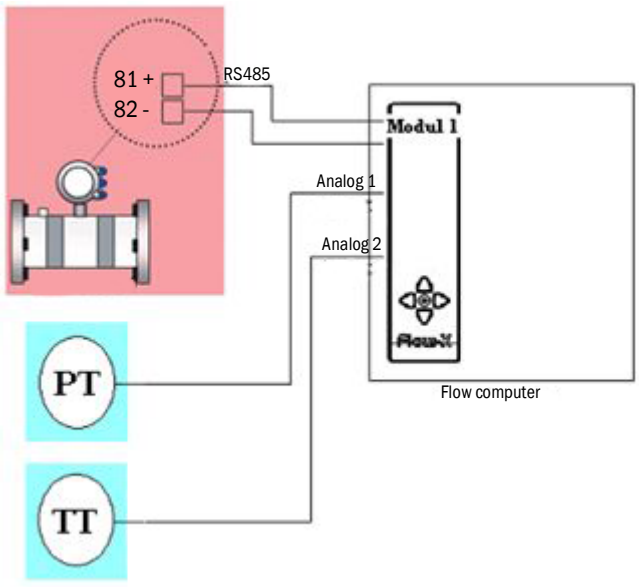
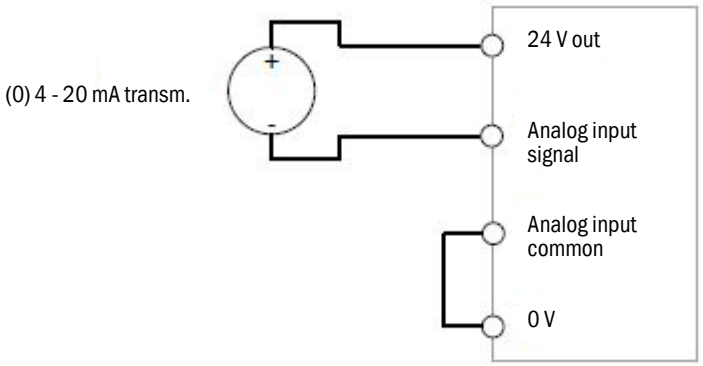


Fig. 18 General transmitter connection with internal supply 24 V



Both transmitters can obtain their 24 V supply voltage via internal supply from the Flow-X flow computer and can be connected accordingly. it is possible that additional cables are required for this purpose.

An external supply is possible; the correct connection is described on → p. 23, § 3.1.7.

See the following Tables and Figures for the exact location and type of the relevant connections.

> ***NOTICE:***
> This manual describes single stream installation.
> In case of a multi-stream installation, use the connectors of the corresponding stream according to Figure 19.

Figure 19 Multi-stream installation

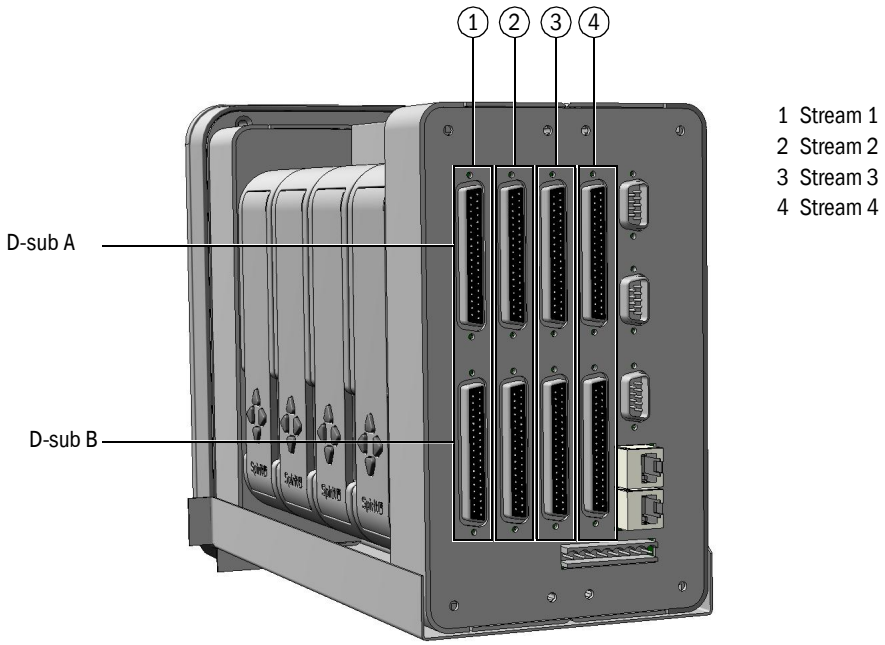


Table 3 37-pin connector (Flow-X/P)

	Connected device	Terminal ID	Flow-X/P connector	Flow-X/P pin
Serial Com Port 1	Gas flow meter	TRx+	X1A	1
		TRx-	X1A	2
Analog/HART Input 1	Pressure transmitter	+	X1A	32
		-	X1A	33
Analog/HART Input 2	Temperature transmitter	+	X1A	34
		-	X1A	35
24 V out	Pressure or temperature transmitter		X1A	5
0 V common			X1A	9
0 V common			X1A	11

Table 4 39-pin connector (Flow-X/S)

	Connected device	Terminal ID	Flow-X/S connector	Flow-X/S pin
Serial Com Port 1	Gas flow meter	TRx+	X1B	32
		TRx-	X1B	33
Analog/HART Input 1	Pressure transmitter	+	X1B	11
		-	X1B	12
Analog/HART Input 2	Temperature transmitter	+	X1B	13
		-	X1B	14
24 V out	Pressure or temperature transmitter		X1A	1
0 V common			X1A	2
0 V common			X1A	4

3.3.7 9-pin D-sub connectors (serial communication)

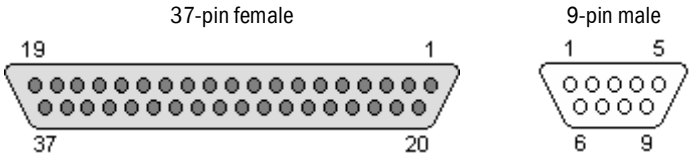
These connectors are only available on the Flow-X/P model. They connect to the three serial COM ports of the display module. The connectors on the Flow-X/P are male (→ Figure 20). A connecting cable must have a female connector.

The 9-pin D-sub male connectors have the following pin connections.

Table 5 9-pin D-sub connector pin connections for Flow-X/P

Pin	COM 1 RS232 only	COM 2 / COM 3 RS232 | RS485 (2-wire) | RS485 (4-wire)
1		– | – | Rx–
2	Rx	Rx | – | Rx+
3	Tx	Tx | Sig– | Tx–
4		– | Sig+ | Tx+
5	0 V	0 V
6		
7	RTS	
8	CTS	
9		

Figure 20 D-sub connectors



3.3.8 Ethernet

The Flow-X/P flow computers provide two standard RJ45 Ethernet connections.

Whether or not these Ethernet plugs can be used for communication depends on the software configuration. When the corresponding flow module operates autonomously, so not in a multi-module configuration, the two Ethernet connections can be used to communicate with the flow module. This is also true when the flow module is the “first” flow computer in a multi-module configuration. “First” means first in the software application, which does not necessarily correspond with the physical position within the rack.

Flow-X

4 Commissioning

Device settings
Connecting devices with HART protocol
Connecting analog devices
Configuration and connection check

4.1 Device settings

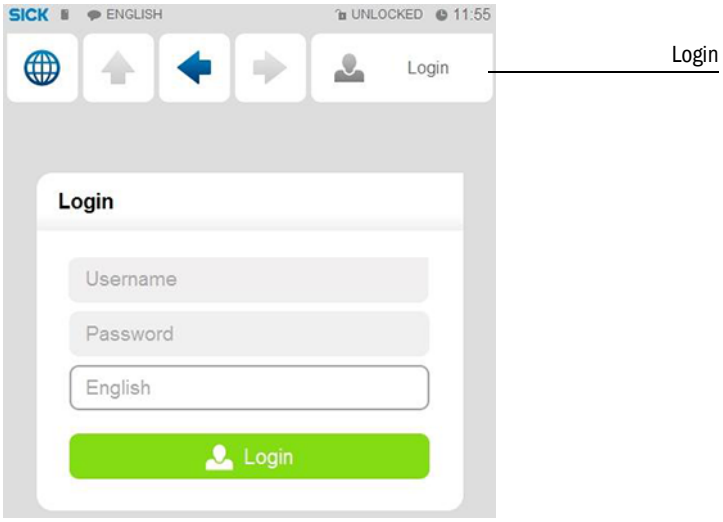
Device settings can be changed via the touchscreen of the Flow-X flow computer, the integrated web server of the Flow-X flow computer or the integrated screen of the module used.

Menu navigation is identical on all variants.

A login is required if settings are to be changed using the menu of the Flow-X flow computer or using the integrated web server.

1 Touch or click the "Login" button.

Fig. 21 "Login" menu of the Flow-X flow computer



2 Enter your username and the associated password.

User name	Password	Pin code	Security level
operator	sick	000123	500
tech	tech	000789	750

3 Confirm with "Login".

If changes are to be made using the module screen, login with your pin in the "Login" menu.

Fig. 22 "Login" menu of the module screen

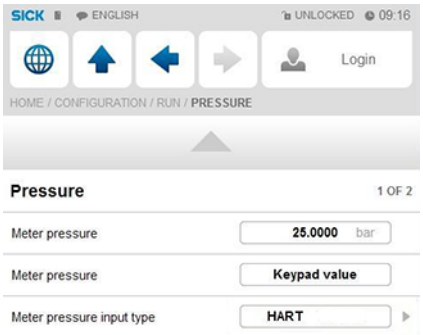
4.2 Connecting devices with HART protocol

► Connect the transmitters as described in chapter "Electrical Installation".

4.2.1 Pressure transmitter

1 Go to Configuration/Run/Pressure.
2 Set "Meter pressure input type" to "HART".

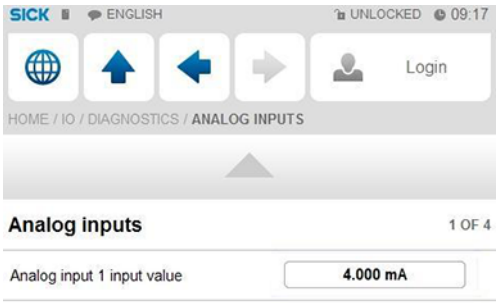
Fig. 23 Configuration/Run/Pressure



3 Go to IO/Diagnostics/Analog inputs.
4 The value of "Analog input 1 value" must be approx. 4 mA.

Please note: Minor deviations are possible.

Fig. 24 IO/Diagnostics/Analog inputs



4.2.2 Temperature transmitter

1 Go to Configuration/Run/Pressure.
2 Set "Meter Temperature input type" to "HART".
3 Go to IO/Diagnostics/Analog inputs.
The value of "Analog input 2 value" must be approx. 4 mA.

Please note: Minor deviations are possible.

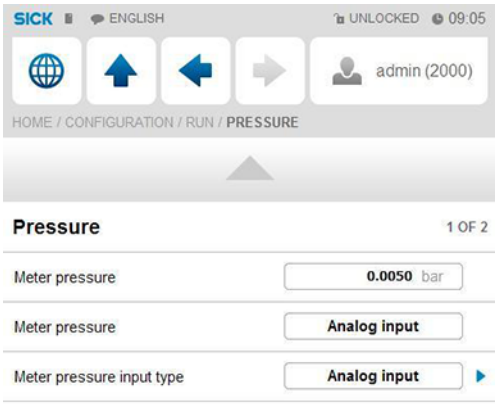
4.3 Connecting analog devices

4.3.1 Pressure transmitter

1 Go to Configuration/Run/Pressure.

2 Set "Meter pressure input type" to "Analog input".

Fig. 25 Configuration/Run/Pressure



3 Go to IO/Diagnostics/Analog inputs.

The value of "Analog input 1 value" must be between 4 mA and 20 mA.

Check whether these are error values defined by the device and check the function of the transmitter if this is not the case.

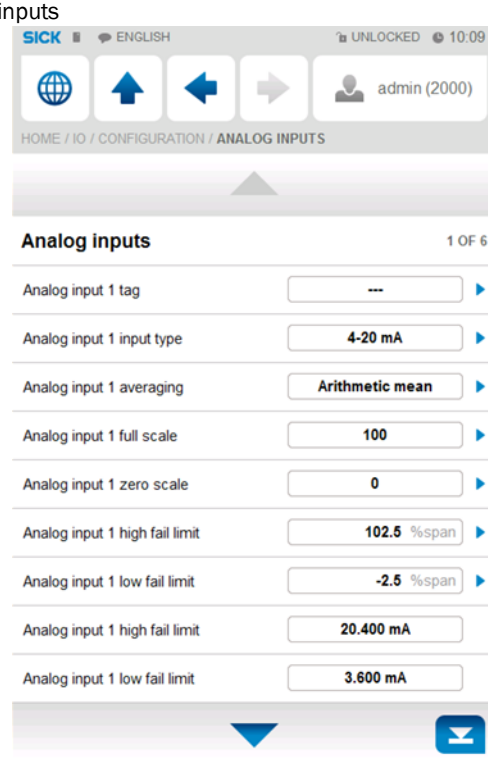
Adapting the scale in the flow computer to the working range of the transmitter

1 Go to IO/Configuration/Analog inputs.

2 Set "Analog input 1 full scale" to the maximum value of the measuring range of the pressure transmitter.

3 Set "Analog input 1 zero scale" to the minimum value of the measuring range of the pressure transmitter.

Fig. 26 IO/Configuration/Analog inputs



4.3.2 Temperature transmitter

1 Go to Configuration/Run/Pressure.
2 Set "Meter Temperature input type" to "Analog input".
3 Go to IO/Diagnostics/Analog inputs.
The value of "Analog input 2 value" must be between 4 mA and 20 mA.
Check whether these are error values defined by the device and check the function of the transmitter if this is not the case.

Adapting the scale in the flow computer to the working range of the transmitter

1 Go to IO/Configuration/Analog inputs.
2 Set "Analog input 2 full scale" to the maximum value of the measuring range of the temperature transmitter.
3 Set "Analog input 2 zero scale" to the minimum value of the measuring range of the temperature transmitter.

4.4 Device configuration and connection check

4.4.1 FLOWSIC600

Checking the communication status

1 Go to Communication/FLOWSIC600 Flow meter/FLOWSIC600 Communication.

2 Check the "Communication status“:

When the "Communication Status" is set to "OK", the correct device ID has already been set on the flow computer.

Fig. 27 Communication/Flowsic600 Flow Meter/FLOWSIC600 Communication

Changing the device ID

1 Go to Communication/FLOWSIC600 Flow meter/FLOWSIC600 Communication.

2 Change the "Modbus server/slave ID" to the device ID set in the device.

3 Check the communication status again.

4 If necessary, check the communication protocol used (SICK MODBUS ASCII for FLOW-SIC600 or ASCII for the Flow-X flow computer).

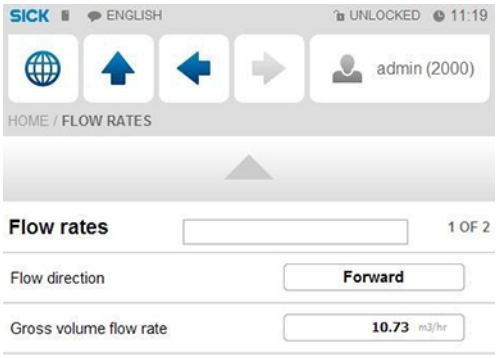
Changing the protocol type is possible only via the MEPAFLOW600 CBM software for FLOWSIC600 or via the Flow-Xpress software for the flow computer.

For more information, see Section "Configuration with MEPAFLOW600 CBM".

5 In menu item "Flow rates", check whether the flow computer receives data from the gas flow meter under "Gross volume flow rate".

These must match the flow rate indicated by the gas flow meter.

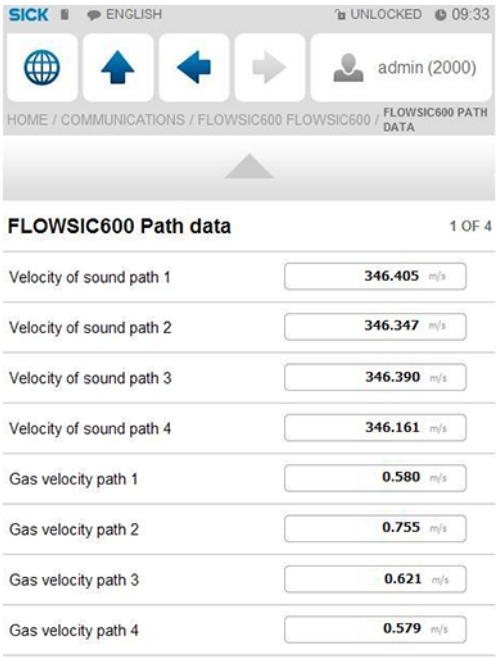
Fig. 28 Menu "Flow rates"



6 Go to Communication/Flowsic600 Flow Meter/Flowsic600 Path Data.

7 Check whether there are data on the individual paths.

Fig. 29 Communication/Flowsic600 Flow meter/FLOWSIC600 Path data



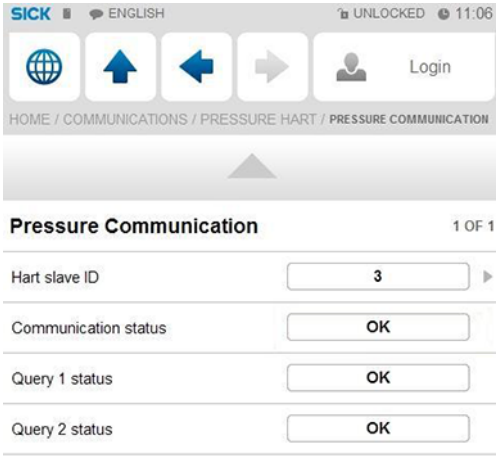
4.4.2 Pressure transmitter

4.4.3 Checking the communication status

1 Go to Communication/Pressure Hart/Pressure Communication.

2 Check the "Communication status“:
When the "Communication Status" is set to "OK", the correct device ID has already been set on the flow computer.

Fig. 30 Communication/Pressure Hart/ Pressure Communication



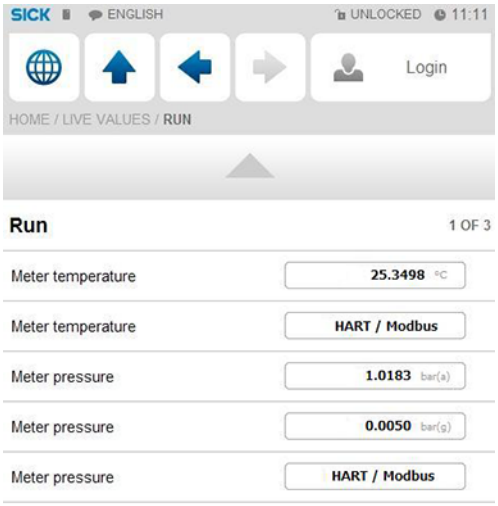
Changing the device ID

1 Go to Communication/Pressure Transmitter/Pressure Communication.

2 Change the "HART slave ID" to the device ID set in the device.

3 Check the communication status again.
4 Go to "Live Values/Run".
5 Check whether the flow computer receives data from the pressure transmitter under "Meter pressure".

Fig. 31 Menu "Live Values/Run"

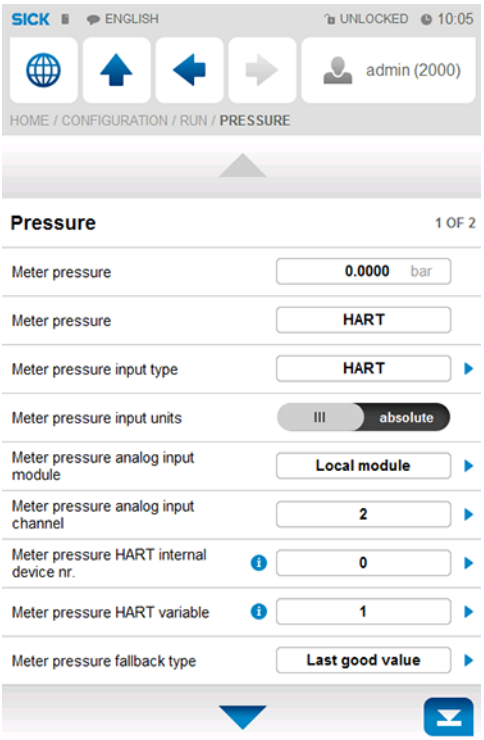


Changing the measuring mode

Depending on the measuring mode of the pressure transmitter, it is necessary to alternate between overpressure measurement and absolute pressure measurement in the Flow-X flow computer.

1 Go to Configuration/Run/Pressure.
2 Change the "meter pressure input units" to "absolute" or "gauge", depending on the transmitter configuration.
3 If anything is unclear, check the transmitter configuration.
Note: The reference value of the ambient pressure is 101.325 kPa.

Fig. 32 Configuration/Run/Pressure



4.4.4 Temperature transmitter

Checking the communication status

1 Go to Communication/Temperature Transmitter/Temperature Communication.
2 Check the "Communication Status“:
When the "Communication Status" is set to "OK", the correct device ID has already been set on the flow computer.

Changing the device ID

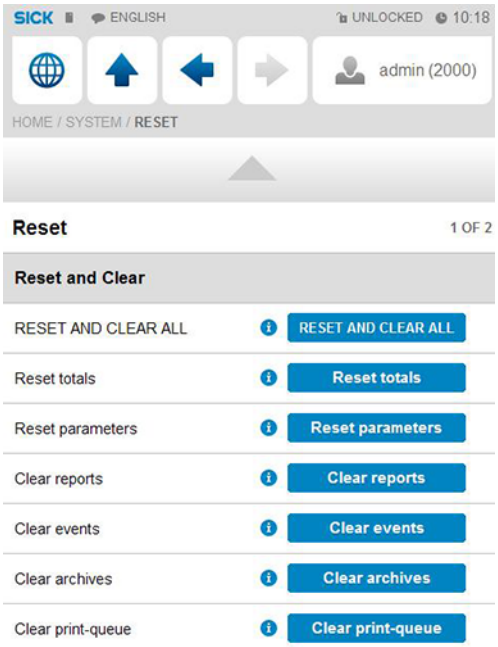
1 Go to Communication/Temperature Transmitter/Temperature Communication.
2 Change the "HART slave ID" to the device ID set in the device.
3 Check the communication status again.
4 Go to "Live Values/Run".
5 Check whether the flow computer receives data from the temperature transmitter under "Meter temperature".

4.4.5 Clearing log files and reports

After the start-up of all devices, it is recommended to clear the event logs and reports created during the commissioning in the Flow-X flow computer.

Select and confirm "Reset totals", "Clear reports", "Clear archives" and "Clear print-queue".

Fig. 33 System/Reset



4.5 Metrological Settings

This display is only visible if “MID compliance” (Configuration, Overall setup, Overall setup) is enabled.

The following settings are required by MID (Measuring Instrument Directive).

► Select: Display > Metrological, Accountable alarm

Table 6 Metrological settings

Setting	Security level	Description
Q_{min}	1000	Low range value (minimum allowable flow rate) of the flow meter. If the flow rate is below this value then the accountable alarm is raised
Q_{max}	1000	High range value (maximum allowable flow rate) of the flow meter. If the flow rate is above this value then the accountable alarm is raised

Flow-X

5 Troubleshooting

Testing gas flow meter communication
Interface configurations of gas meter connection

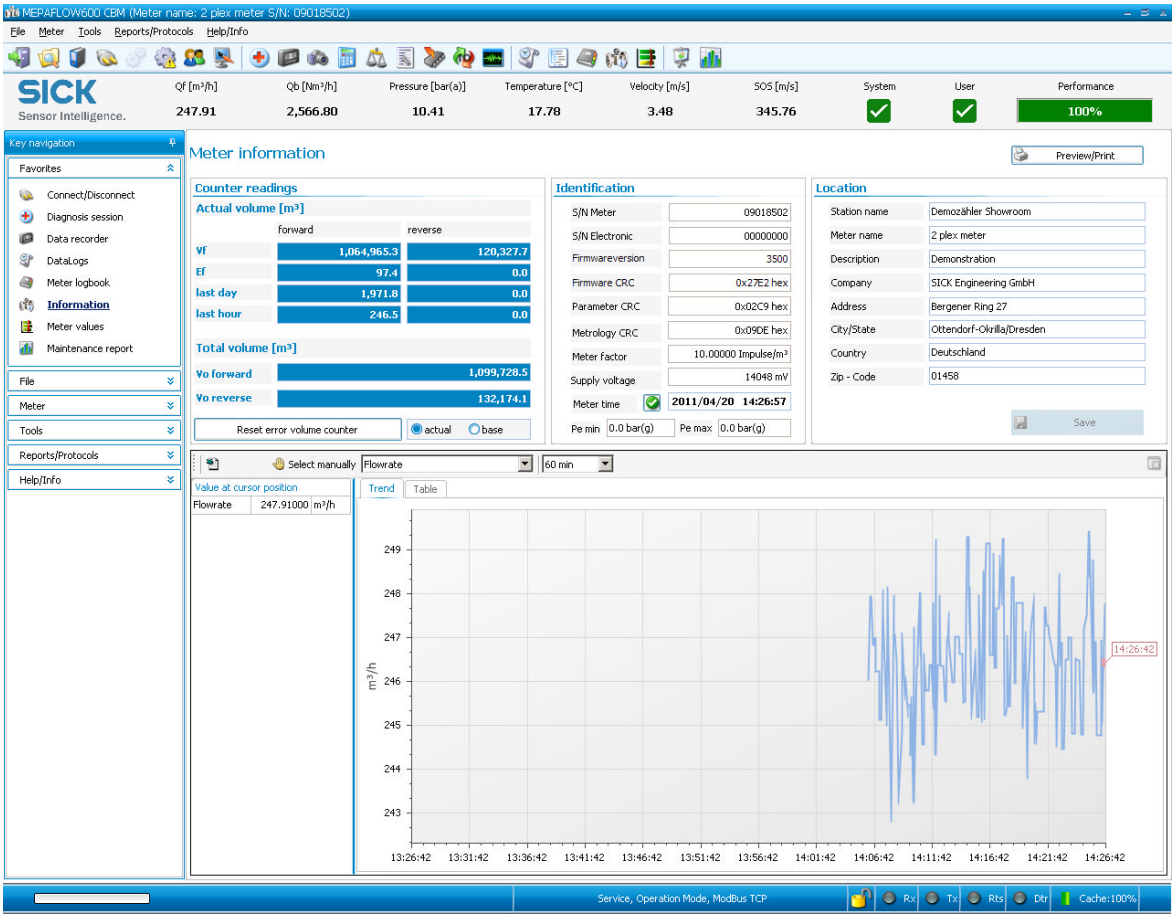
5.1 Testing gas flow meter communication

MEPAFLOW CBM

Software MEPAFLOW600 CBM is mainly used in the following for configuring the FLOW-SIC600 gas flow meter.

For more details concerning the software and its use, see Section "MEPAFLOW600 CBM" of the Operating Instructions FLOWSIC600.

Fig. 34 MEPAFLOW600 CBM graphical user interface

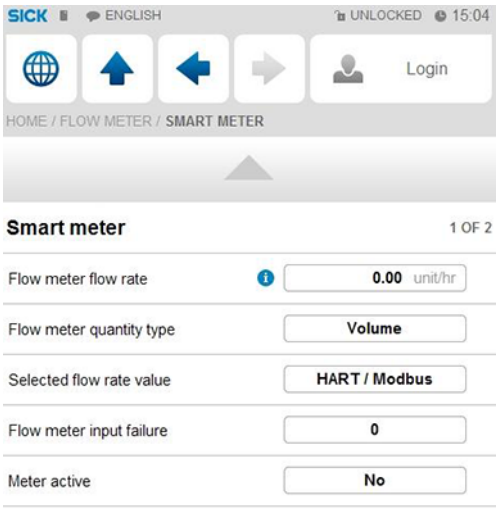


Connection check

If there is no flow on the gas flow meter itself, it is still possible to check the connection of the device.

1 Go to Flow Meter/Smart Meter in the menu of the Flow-X flow computer.
"Flow meter input failure" reads 0, since there is no error
As there is no gas flow, "Meter active" is set to "No".

Fig. 35 Flow Meter/Smart Meter

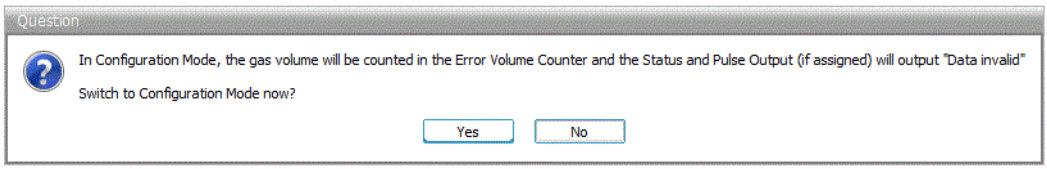


2 Open the MEPAFLOW600 CBM software on the computer connected to the gas flow meter.

For more details concerning the installation and use of MEPAFLOW600 CBM, see Section "Connecting to the FLOWSIC600 with MEPAFLOW600 CBM" of Operating Instructions "FLOWSIC600".

3 Change from File/Operation Mode to File/Configuration Mode.
4 Confirm the message with "Yes".

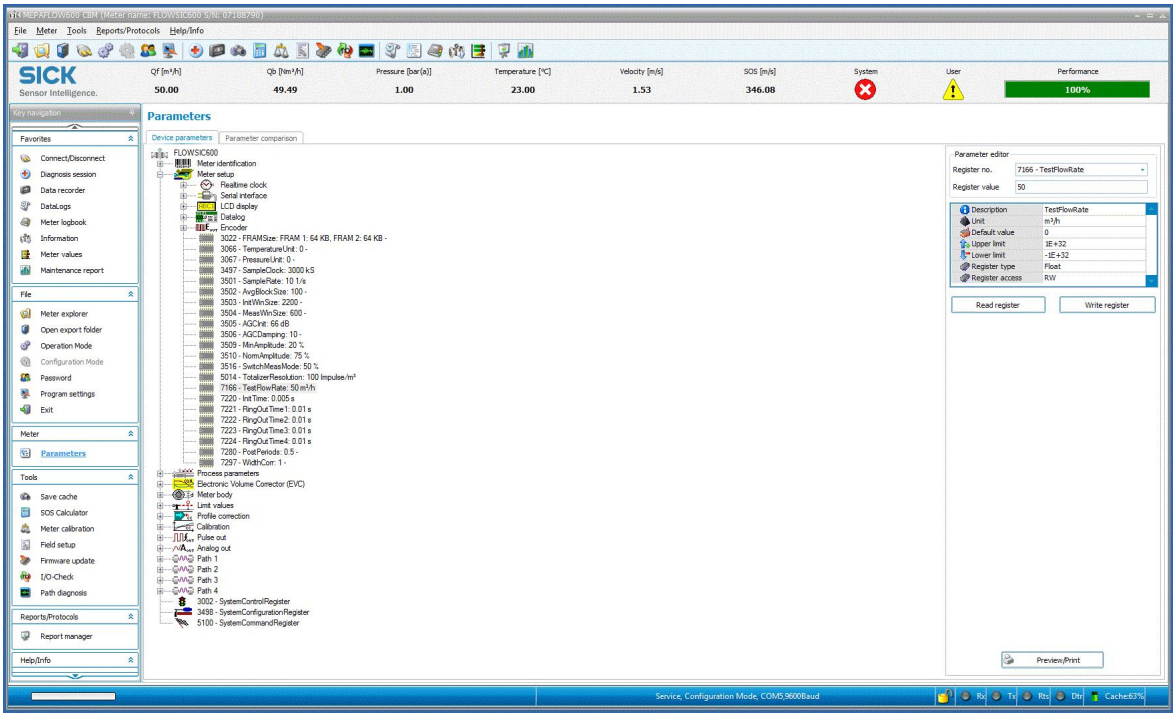
Fig. 36 Change to configuration mode



The flow computer shows the error message "Flow meter measurement fail" which can be ignored until returning to Operation Mode. The error message then disappears automatically.

5 Select the "Parameters" option under "Meter" in the menu bar.
6 Select "Meter setup" in the menu.
7 Select register #7166 "TestFlowRate".
8 Change the register value to any optional value.
9 Confirm the input with "Write register".

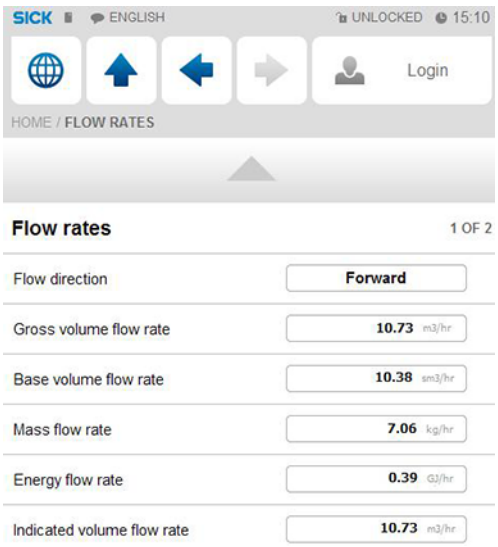
Fig. 37 Determining the flow rate



10 Go to "Flow rates" in the menu of the flow computer.

11 Check whether the value for "Gross volume flow rate" matches the set register value.

Fig. 38 Menu "Flow rates"



12 Then return to "Operation Mode" via MEPAFLOW600.

5.2 Interface configurations of gas meter connection

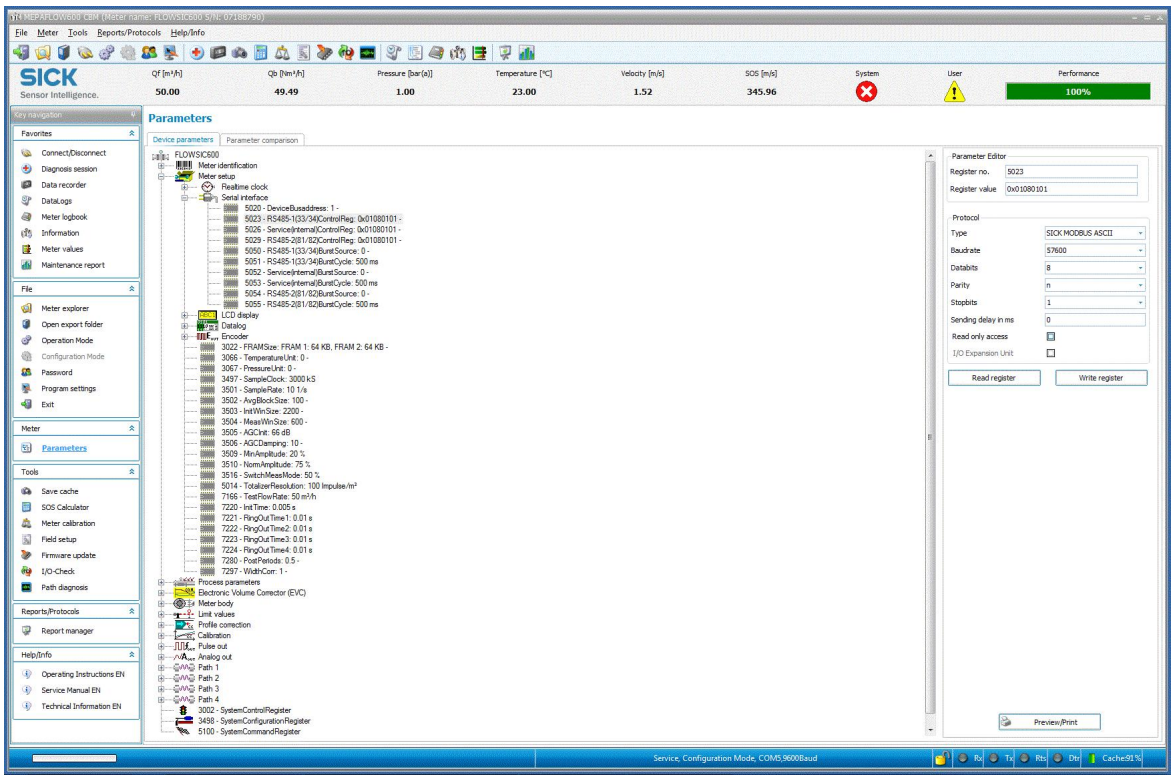
5.2.1 Configuration with MEPAFLOW600 CBM

1 Open the MEPAFLOW600 CBM software on the computer which is connected to the gas flow meter.

2 In the menu bar, change from "Operation Mode" to "Configuration Mode"under "File".

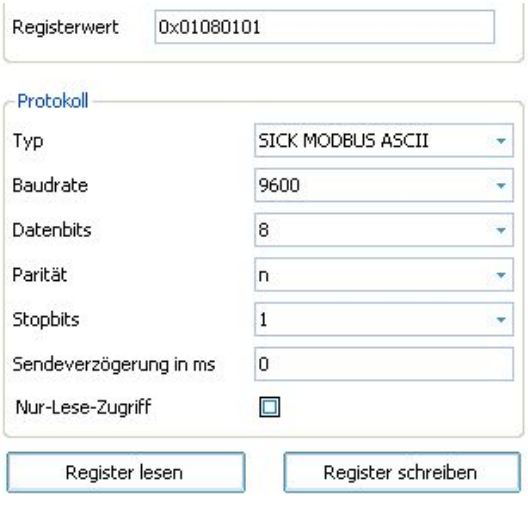
3 Confirm the message with "Yes".
4 Select the "Parameters" option under "Meter" in the menu bar.
5 Select "Meter setup" in the menu and then menu item "Serial interface".
6 Select register 5023 "RS485-1(33/34)ControlReg:".

Fig. 39 Change the interface



7 On the right side of the screen, under "Protocol", change the communication type, baud rate, data bits, parity and stop bits.

Fig. 40 Interface



The values specified here are the standard values defined in the Flow-X flow computer.

8 Confirm the input with "Write register".

Please note: Settings on the interface only become effective when returning to "Operation Mode".

Deviating configurations must be set in the Flow-X flow computer and in FLOWSIC600

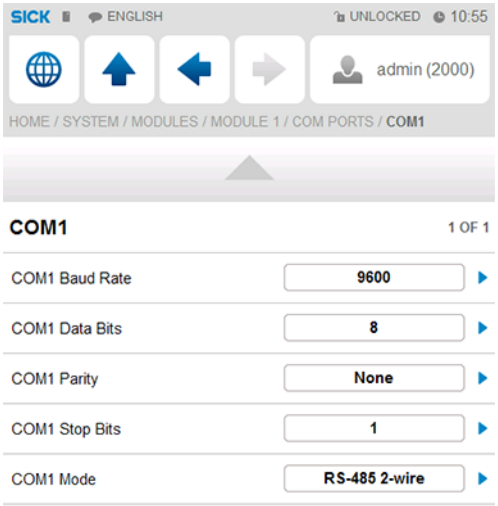
5.2.2 Configuration with the Flow-X flow computer, webserver or module screen

Login is required to change settings. Proceed as explained in chapter "Connection of Devices".

1 Go to System/Modules/Module 1/COM Ports/COM1.

2 Change baud rate, data bits, parity and stop bits to the values set in MEPAFLOW600 CBM.

Fig. 41 System/COM Ports/COM1 > Change screen RS485



5.3 Checking the measuring mode setting of the pressure transmitter

► Go to "Live Values".

The pressure transmitter does not yet measure the pressure

- The value of "Meter Pressure" for absolute pressure is "1".
- The value of "Meter Pressure" for overpressure is "0".

The set measuring mode of the transmitter has to be changed if this is not the case.

Please note: Minor deviations are possible.

Pressure transmitter already measuring

The set measuring mode of the transmitter has to be changed if both the values of "Meter pressure" for absolute pressure and for overpressure are negative and the error message "Compressibility calculation error" is shown.

Changing the transmitter measuring mode

1 Go to Configuration/Run/Pressure.

2 Change the "meter pressure input units" to "absolute" or "gauge", depending on transmitter configuration.

If anything is unclear, check the transmitter configuration.

Note: The reference value of the ambient pressure is 101.325 kPa.

5.4 Checking analog temperature transmitters

If incorrect temperature values or error messages are indicated by an analog temperature transmitter, check the scaling set for the transmitter.

Adapting the scale in the flow computer to the working range of the transmitter

1 Go to IO/Configuration/Analog inputs.

2 Set "Analog input 2 full scale" to the maximum value of the indicator value of the temperature transmitter.

3 Set "Analog input 2 zero scale" to the minimum value of the indicator value of the temperature transmitter.

Flow-X

6 Appendix

Conformities
General specifications
I/O specifications
Dimensions
Wiring examples

6.1 Conformities

6.1.1 CE certificate

The Flow-X flow computer has been developed, manufactured and tested in accordance with the following EC directives:

- EMC Directive 2004/108/EC (until 19 April 2016), 2014/30/EU (from 20 April 2016)
- MID Directive 2004/22/EC (until 19 April 2016), 2014/32/EU (from 20 April 2016)

Conformity with above directives has been verified. The equipment has been designated the CE label.

6.1.2 Standard compatibility and type approval

The Flow-X flow computer conforms to the following norms, standards or recommendations:

- EN 61000-6-4
- EN12405-1, A2
- AGA 10
- AGA 8

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

- MID Approval, NMI (Nederlands Meetinstituut): T10548

6.2 General specifications

Item	Type	Description	Quantity
Temperature	Operating	Operating range temperature	+5 ... +55 °C
Temperature	Storage	Storage range temperature	–20 ... +70 °C
Processor	Freescale	i.MX6 processor with math coprocessor, and FPGA	800 MHz
Memory	RAM	Program Memory	512 MB
Storage	SLC	Storage memory for data logging, OS and firmware	1024 MB
Clock	RTC	Real time clock with internal lithium cell Accuracy better than 1 s/day	

Other specifications

Item	Specification
MTBF	5 years minimum
EMC	EN 61326-1997 industrial locations EN 55011
Casing	EN 60950

6.3 Flow-X/M I/O specifications

6.3.1 I/O signal specifications

Table 7 Analog signals specifications

Signal	Nr	Type	Description
Analog input	6[1]	4 ... 20 mA, 0 ... 20 mA, 0 ... 5 V, or 1 ... 5 V	Analog transmitter input High accuracy (error <0.008 % FS, resolution 24 bits) For (for example) 3xdP, P, T. Inputs are fully floating (optically isolated).
Temperature input	2	PRT	Analog Pt100 input. –220 ... +220 °C for 100 Ω input. Resolution 0.02 °C Max. error: ● 0 ... +50 °C: 0.05 °C ● –220 ... +220 °C: 0.5 °C
Hart modems	4[1]	HART	Loop inputs for HART transmitters, on top of the first 4 analog input signals.
Analog output	4	4 ... 20 mA, 0 ... 20 mA, or 1 ... 5 V.	Analog output for PID, pressure control valve. 12 bits A DC, 0.075 % fs. Update rate 0.1 s.

[1] Total number of analog inputs + HART inputs = 6.

Table 8 Digital signals specifications

Signal	Nr	Type	Description
Dual pulse input	1[1]	High impedance	High speed USM meter input, pulse count. Trigger level 0.5 V. Max. level 30 V. Frequency range 0 ... 5 kHz (dual pulse), or 0 ... 10 kHz (single pulse). Compliant with ISO6551, IP252, and API 5.5. True Level A implementation.
Digital input	16[1]	High impedance	Digital status input, or prover inputs. 0.5 ms detect update rate for 2 inputs, others 250 ms max.
Digital output	16[1]	Open collector	Digital output for relays etc. (0.5 A DC). Rating 100 mA @24 V. Update rate at cycle time.
Prover output	1[1]	Open collector	Two related pulse outputs, for proving applications. One output is the highest value of the dual pulse inputs, and the other output the difference between the dual input pulses. The outputs are On-Off-HighZ.
Pulse output	4[1]	Open collector	Max. 100 Hz

[1] Total number of digital inputs + digital outputs + pulse outputs + density inputs + sphere detector inputs = 16.

Table 9 Communication specifications

Signal	Nr	Type	Description
Serial	2	RS485/422/232	Multi-purpose serial communication interface Minimum 110 baud, maximum 256000 baud
Ethernet	2	RJ45 100 Mbit/s	Ethernet interface - TCP/IP

6.3.2 Flow calculation specifications

Table 10 Certified flow calculations

Library of certified flow calculations
Supports AGA9
API chapter 21.1
ISO 6976 (all editions)
NX19 SGERG PTZ
GPA 2172
ASME 1967 (IFC-1967) steam tables, IAPWS-IF97 steam density

Table 11 Standard flow calculations

Standard flow calculations
Batch and period recalculation (meter factor, BS&W, density, etc.)
Unlimited number of period and batch totals and flow and time weighted averages. Periods can be of any type. Maintenance totalizers are supported
Calibration curve up to unlimited number of points (linear and polynomial).
Prover support: uni-directional, bi-directional (2 / 4 detector inputs), compact prover, master meter, dual chronometry, pulse interpolation.
Control: – PID control – valve control – prove control – batch control
All common spreadsheet functions to obtain maximum flexibility.

6.3.3 Supported devices

Table 12 Standard supported devices

Standard supported devices
Ultrasonic Flow Meters – SICK FLOWSIC product family
All major gas chromatographs – All major gas chromatographs – ABB – Daniel – Instromet – Siemens – Any Modbus-supporting Gas chromatograph

6.4 Power consumption

Table 13 Power consumption at 24 V DC [1]

Device	Nominal value	Peak value at startup
Flow X/P0	0.3 A	0.8 A
Flow X/M (flow module)	0.3 A	0.8 A

[1] Excluding supply of external transmitter loops.

The power supply input circuits of the Flow-X/P0 and the Flow-X/M flow modules are equipped with an auto-fuse, rated at 30 V DC and 1.1 A each.

E.g. a Flow-X/P4, which is a Flow-X/P with 4 Flow-X/M flow modules has a nominal power consumption of 1.5 A (0.3 A of Flow-X/P0 + 4 × 0.3 A for each flow module) and a peak consumption of 4.0 A at startup.

6.5 Weight

Table 14 Weight of single components

Component	Weight
Flow-X/M (single flow module)	0.8 kg (1.8 lbs)
Flow-X/P0 (without flow modules)	3.6 kg (8.0 lbs)

Table 15 Weight of combined products

Product	Weight
Flow X/P1	4.4 kg (9.8 lbs)
Flow X/P2	5.2 kg (11.6 lbs)
Flow X/P3	6.0 kg (13.4 lbs)
Flow X/P4	6.8 kg (15.2 lbs)

6.6 Dimensions

Figure 42 Flow-X/P dimensions

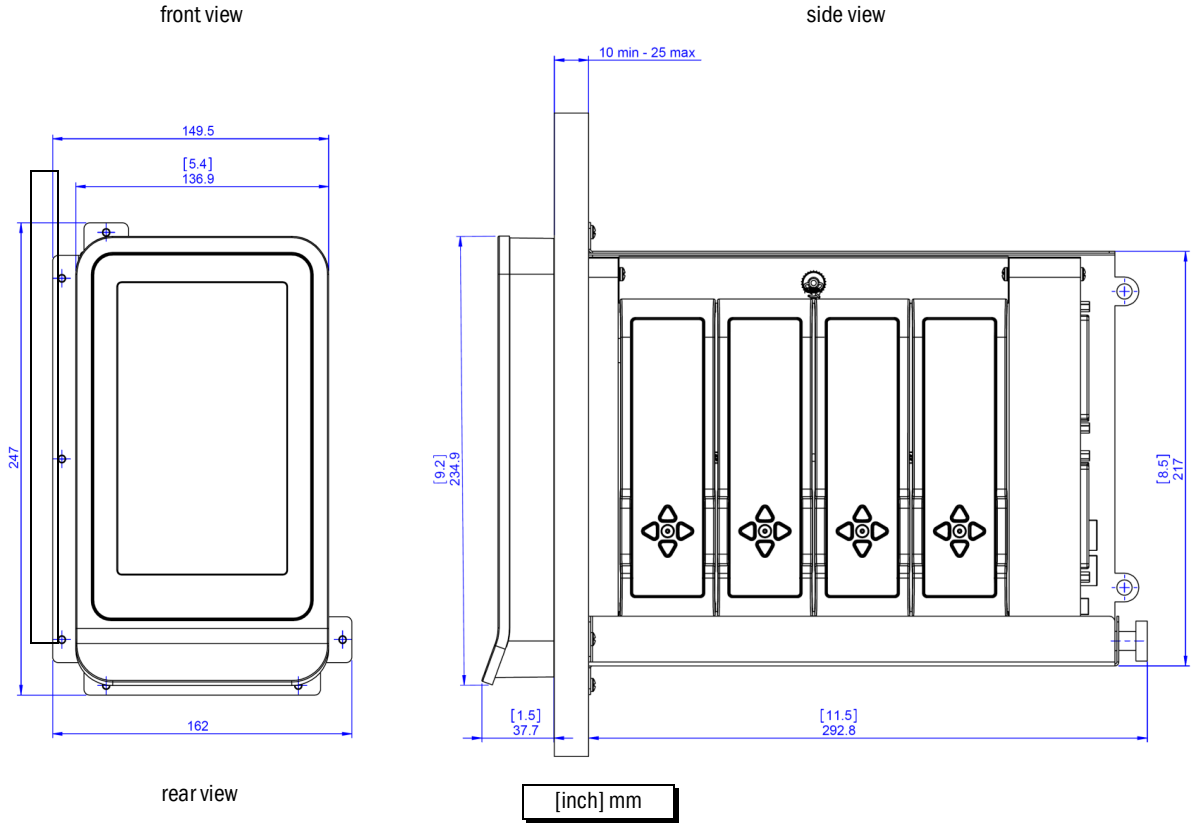


Figure 43 Flow-X/P bracket dimensions

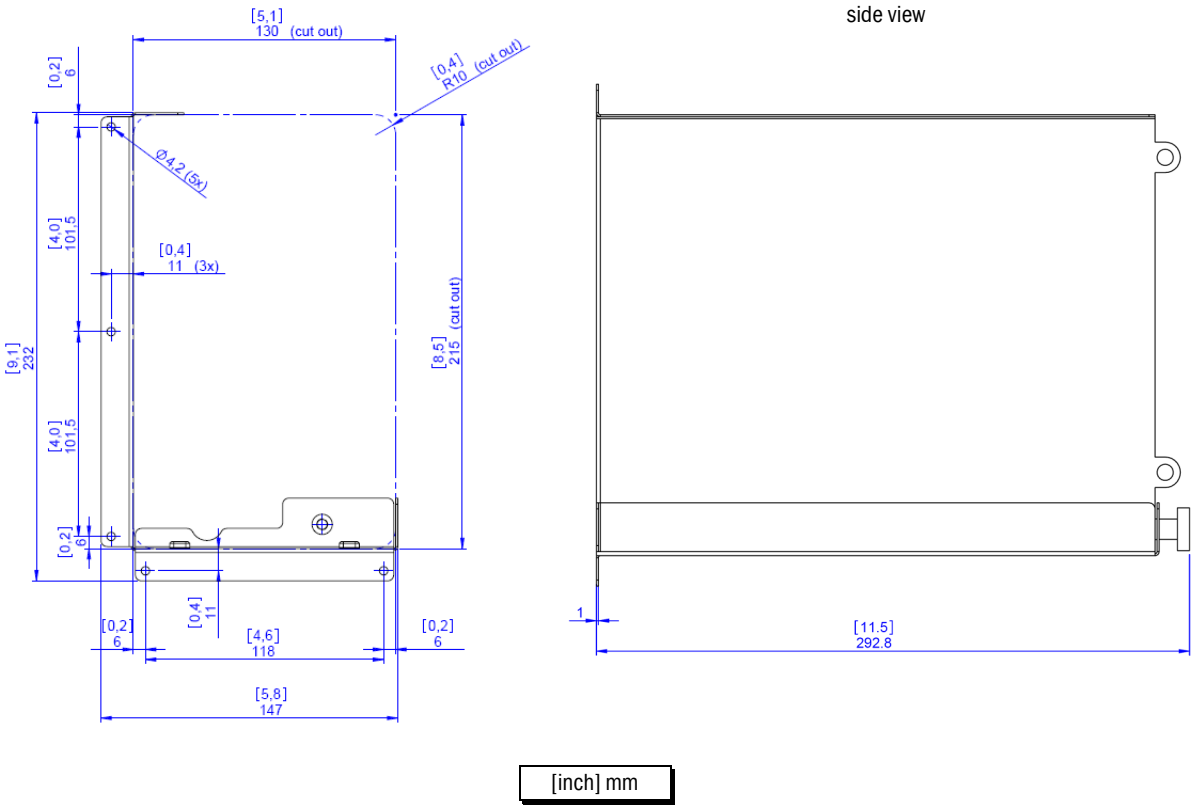


Figure 44 Flow-X/ST dimensions

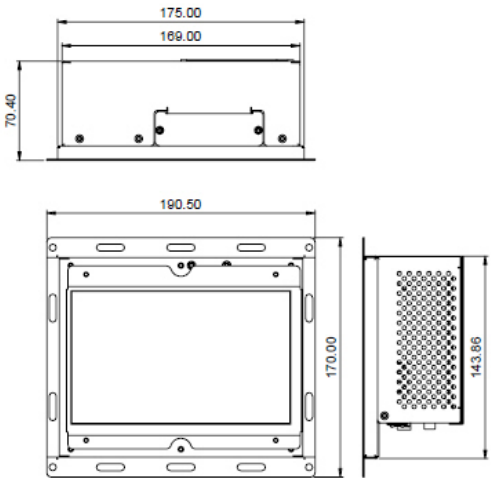


Figure 45 Flow-X/S horizontal dimensions

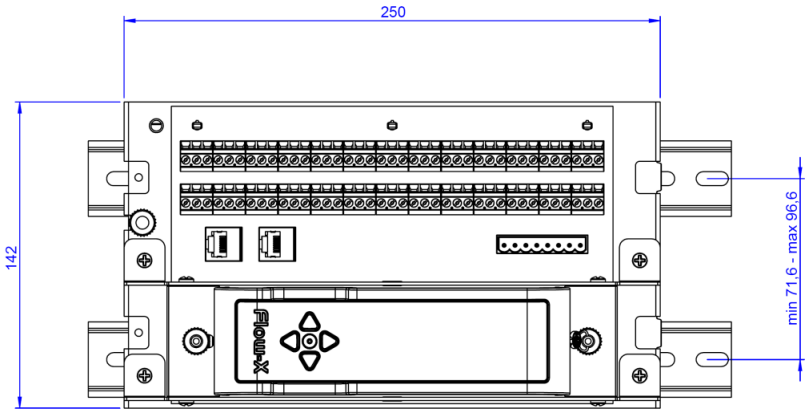


Figure 46 Flow-X/S vertical dimensions

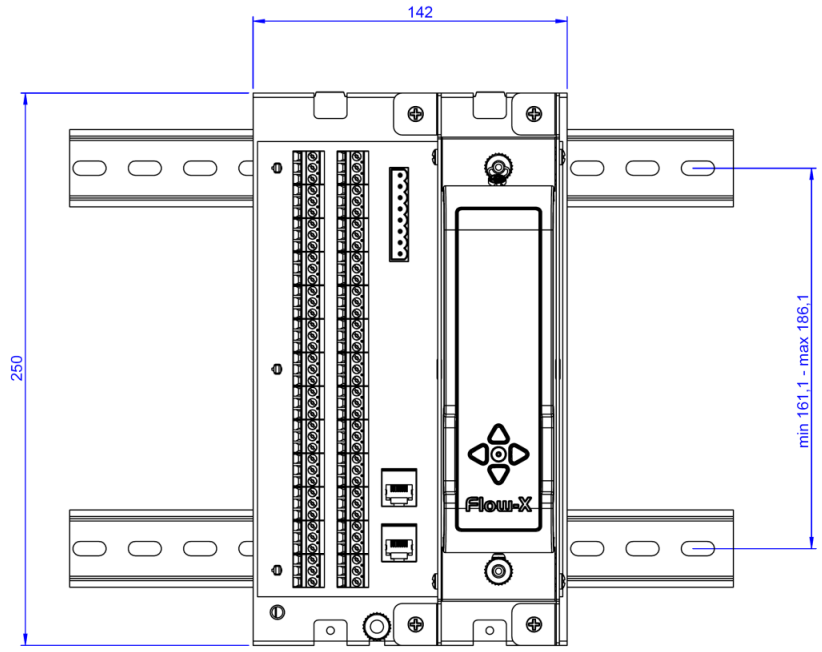


Figure 47 Flow-X/S wall mount dimensions

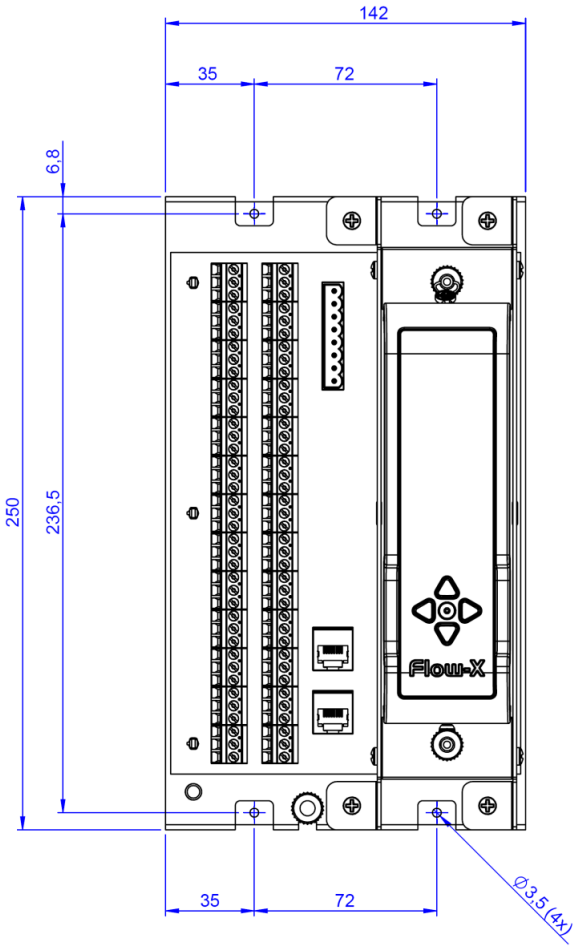
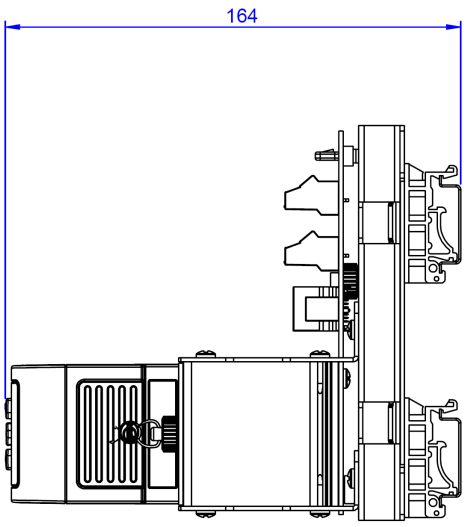


Figure 48 Flow-X/S wall mount side view dimensions



6.7 Wiring examples

Figure 49 Non-intrinsically safe installation

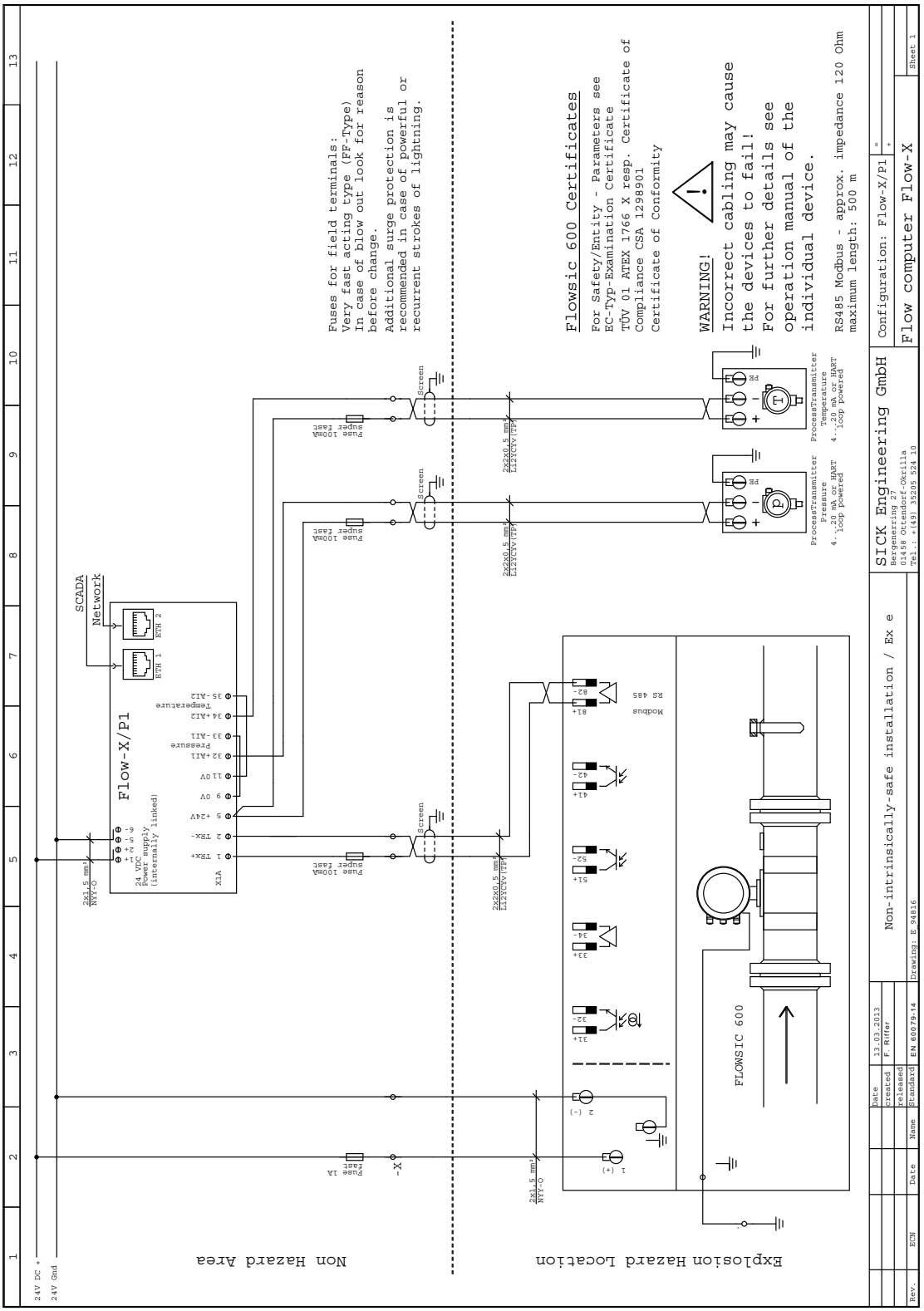
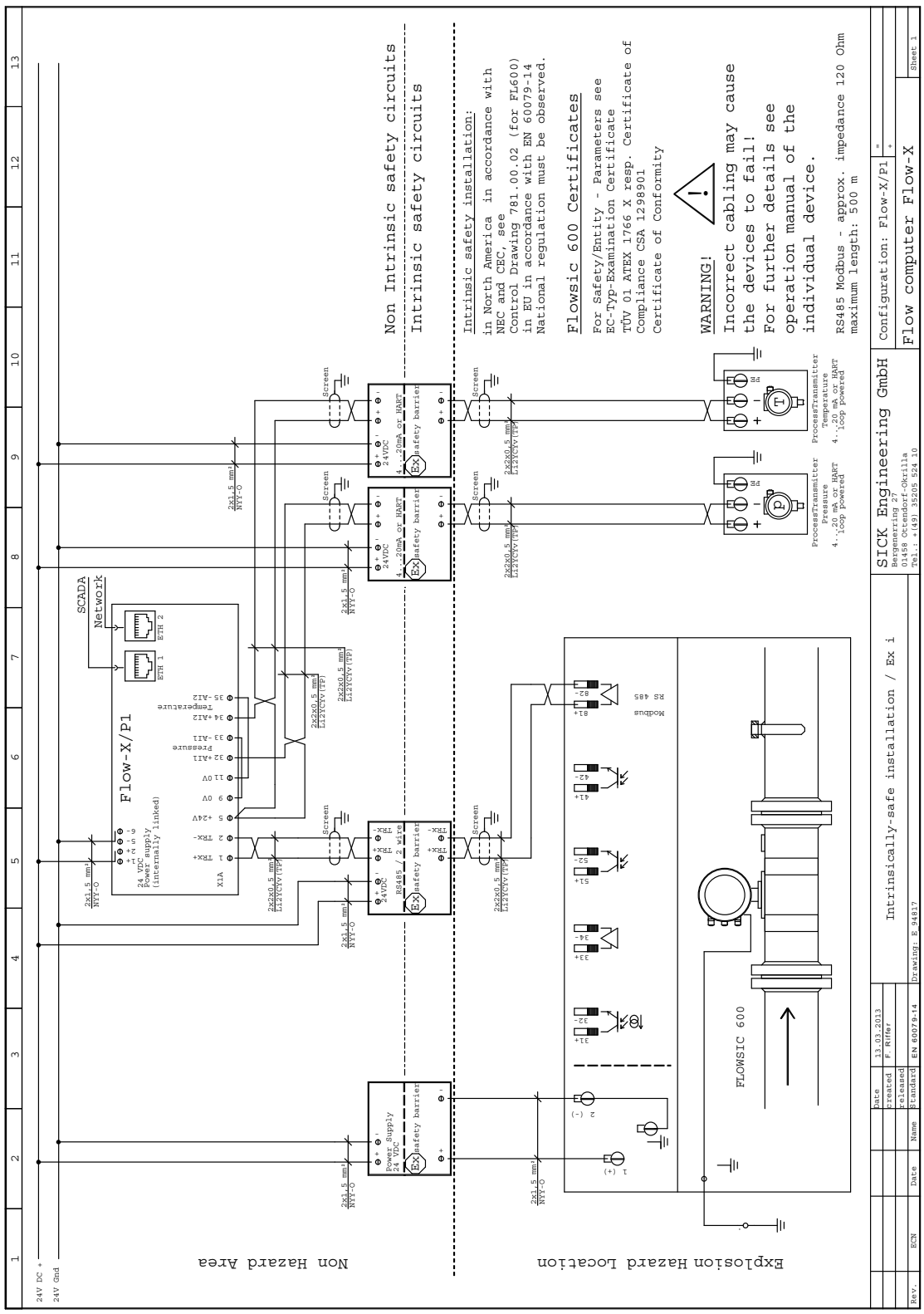


Figure 50 Intrinsically safe installation



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