Operating Instructions
Flow-X

Gas Flow Computer

Endress+Hauser
People for Process Automation

Described product
Product name: Flow-X

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

Legal information

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

CE

Contents

1 About this document

1.1 Function of this document

These Operating Instructions describe:

- Device components
- Installation
- Commissioning
- Operation
- Maintenance work required for reliable operation

These Operating Instructions only cover standard applications which conform with the technical data specified.

Additional information and assistance for special applications are available from your Endress+Hauser representative. It is generally recommended to take advantage of qualified consulting services provided by Endress+Hauser experts for your specific application.

1.2 Scope of application

- These Operating Instructions are only applicable for the measuring device described in the product identification.
- They are not applicable for other Endress+Hauser measuring devices.
- The standards referred to in these Operating Instructions are to be observed in the respective valid version.

1.3 Target groups

This Manual is intended for persons who install, operate and maintain the device.

1.4 Symbols and document conventions

1.4.1 Warning symbols

Symbol	Significance
	Hazard (general)
	Hazard in potentially explosive atmospheres

1.4.2 Warning levels and signal words

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

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

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

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

Note:
Tips

1.4.3 Information symbols

Symbol	Significance
	Information on product characteristics with regard to protection against explosions (general)
	Information on product characteristics with regard to European Directive ATEX 2014/34/EU
	Important technical information for this product
	Important information concerning electrical or electronic functions

1.5 Data integrity

Endress+Hauser uses standardized data interfaces, such as standard IP technology, in its products. The focus here is on the availability of the products and their properties.

Endress+Hauser always assumes that the customer is responsible for the integrity and confidentiality of data and rights involved in connection with using the products.

In all cases, the customer is responsible for the implementation of safety measures suitable for the respective situation, e.g., network separation, firewalls, virus protection and patch management.

2 For your safety

2.1 Basic safety information

WARNING:
The Flow-X flow computer is neither intrinsically safe nor explosion proof and can therefore only be used in a non-hazardous area (safe area).
For details on the installation of other devices in a hazardous area, always refer to the documentation supplied by the manufacturer.
When connecting to a device located in a hazardous area, it may be necessary to use safety barriers or galvanic isolation between the device and the Flow-X flow computer. Corresponding information can be found in the device documentation.

Improper use or handling can cause health or material damage. Therefore, it is imperative that the following points are observed 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 of operating hazards and specifications.
- The Operating Instructions belonging to the Flow-X flow computer as well as plant documentations must be available on site.
- Always observe the information on the prevention of danger and damage given therein.

2.2 Intended use

2.2.1 Purpose of the device

The Flow-X flow computer measures and calculates, using standard algorithms and process data, standardized volume flow based on the connected devices, such as FLOWSIC gas flow meters and process transmitters.

It may only be used as specified by the manufacturer.

2.2.2 Correct use

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

Pay special attention that:

- 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.

2.3 Responsibility of user

- ▶ Read the Operating Instructions before putting the Flow-X flow computer into operation.
- ▶ Observe all safety information.
- ▶ If anything is not clear: Please contact Endress+Hauser Customer Service.

3 Product description

3.1 Flow-X flow computer

The Flow-X flow computer consists of 1 to 4 Flow-X modules (Flow-X) and an enclosure (Flow-X/S, Flow-X/P or Flow-X/C). For a Flow-X/S or Flow-X/P enclosure, the Flow-X modules are exchangeable whereas for a Flow-X/C, the Flow-X module is permanently installed inside and therefore cannot be exchanged.

3.2 Flow-X Module

The Flow-X module is the core element and represents the complete gas flow computer. It represents a measuring section in a gas measuring system. The Flow-X module is operated in a Flow-X/S, Flow-X/P or Flow-X/C enclosure. It has its own 4-inch display and four navigation keys which serve to check values and change parameters.

Fig. 1: Flow-X module

Signal type	Qty.	Specification
Analog inputs	6 [1]	Analog transmitter input, high accuracy Input types: 4 ... 20 mA, 0 ... 20 mA, 0 ... 5 V, 1 ... 5 V Accuracy mA inputs; 0.002% FS at 21 °C, 0.008% at full ambient range of 0 ... 60°C, long-term stability 0.01%/year, resolution 24 bit. Analog inputs share a common, floating ground in relation to all other electronics.
4-wire PRT inputs	2	Resolution 0.02 °C for 100 Ohm input. Error depending on range 0 ... 50 °C: Error <0.05 °C or better -220 ... +220 °C: Error <0.5 °C or better
HART input	4 [1]	Independent HART current loop inputs, in addition to the 4 ... 20 mA signals (analog inputs) Support includes multi-drop for each measuring section and support for redundant flow computer operation
Analog outputs	4	Analog output for process outputs and flow/pressure control, resolution 14 bit, 0.075% FS. Analog inputs share a common, floating ground in relation to all other electronics.
Pulse inputs	4 [2]	Single or double pulse input. Adjustable trigger level at different voltages. Frequency range up to 10 kHz for single and double pulse. Compliant with ISO6551, IP252 and API 5.5. True Level A and Level B implementation.

Table 1: Flow-X/M inputs and outputs

Signal type	Qty.	Specification
Density/viscosity	4[2]	Periodic time input, 100 µs to 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) Rated value 100 V, 24 mA
Pulse outputs	4[2]	Open collector, 0.01 to 500 Hz
Inputs of the sphere detector	4[2]	Supports 1, 2 and 4 detector configuration mode Resolution 100 ns (10 MHz)
Prover bus outputs	1[2]	Meter pulse output for remote flow computers. Resolution 100 ns (1 MHz)
Frequency outputs	4[2]	Frequency outputs for emulation of flow meter signals. Maximum frequency 10 KHz, accuracy 0.1%
Serial	2	RS485 / RS-232 serial input for ultrasonic counter, printer or generic, 115kb
Ethernet	2	RJ45 Ethernet Interface, TCP/IP

[1] There are 6 analog inputs per module. Analog inputs 1 to 4 support HART.
[2] Total number of pulse inputs + digital inputs + digital outputs + pulse outputs + density inputs + sphere detector inputs + prover bus outputs + frequency outputs = 16

Table 1: Flow-X/M inputs and outputs

3.3 Flow-X enclosure

3.3.1 Flow-X/P

The Flow-X/P enclosure is a multi-stream flow computer with integrated station module and 7-inch touchscreen and can accommodate up to 4 Flow-X modules.

Fig. 2: Flow-X/P enclosure incl. four Flow-X modules

3.3.2 Flow-X/C

The Flow-X/C is the compact version of the Flow-X/P with a Flow-X module integrated in the enclosure. It has three serial and two Ethernet interfaces.

Fig. 3: Flow-X/C enclosure with internally installed Flow-X module

3.3.3 Flow-X/S

The Flow-X/S enclosure is a single module enclosure with DIN rail enclosure with direct screw terminals for the field connections and is used as single measuring section.

Fig. 4: Flow-X/S enclosure with a Flow-X module

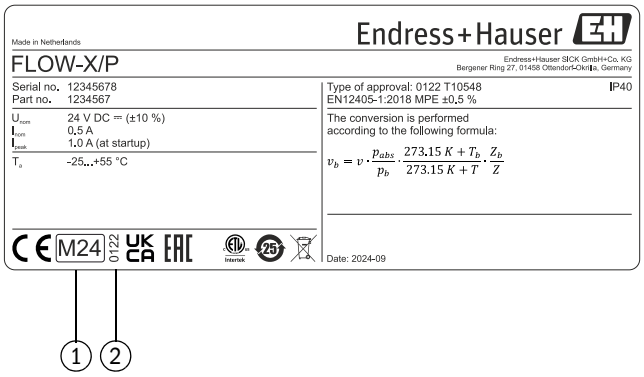
3.4 Flow-X

The Flow-X/T is a 7-inch color touchscreen that can be installed in an instrument panel. It serves as operator interface for Flow-X/S.

Fig. 5: Flow-X

3.5 Type plate

The Flow-X flow computer type plate contains the following information: CE code, MID approval number, notified body, serial number, year of manufacture, operating temperature according to MID approval and Test Certificate number.



1 MID code with the year of conformity
2 Number of the Notified Body under whose responsibility conformity has been confirmed.

Fig. 6: Type plate (example)

3.6 Multi-module operation

The Flow-X/P flow computers normally have more than one Flow-X module. These modules can be used in single or multi-module operation. In single module operation, each module acts as an independent flow computer. In multi-module operation, all modules work together as one flow computer, with data exchange via the Ethernet interface.

3.7 Configuration protection

3.7.1 Parameter locking switch

Each individual Flow-X module has a mechanical parameter locking switch, which prevents the change of crucial parameters within the program.

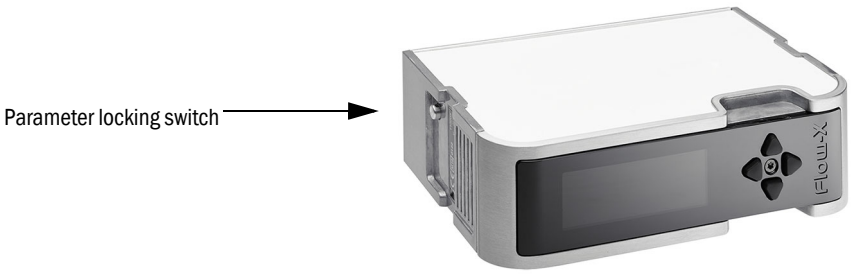


Fig. 7: Parameter locking switch

3.7.2 Metrological seal

All Flow-X enclosures have the option of sealing the parameter locking switch of the individual Flow-X modules with a seal. On a Flow-X/P enclosure, one bar is used to seal all installed Flow-X modules with one lead seal.

3.7.3 Passwords

Access to the parameters and functions of the Flow-X computer via the touchscreen or a connected computer is password protected.

3.8 User interfaces

3.8.1 Flow-X/P and Flow-X/C touchscreen

The Flow-X/P and Flow-X/C have an integrated 7-inch touchscreen with which to access and enter the data. The touchscreen is an integral part and cannot be removed or replaced.

3.8.2 Touchscreen for the Flow-X

All Flow-X flow computers can be operated with differing touchscreens. For this purpose, Endress+Hauser provides the program 'StandaloneGUI.exe' which supports the following platforms:

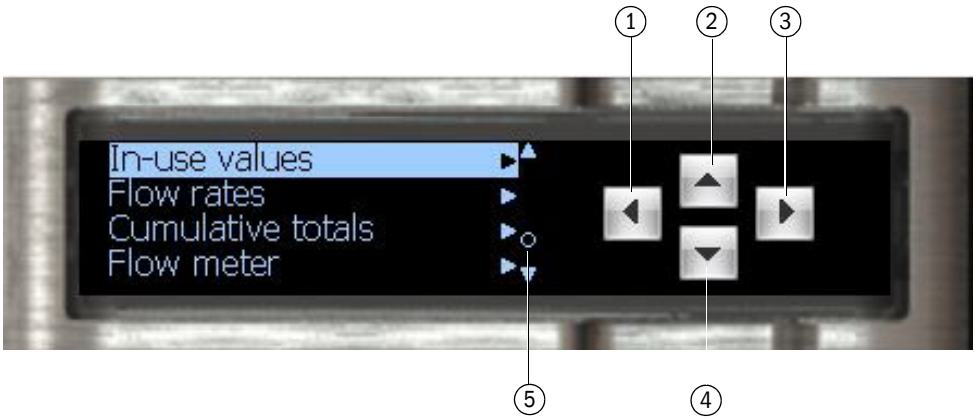
- Windows 32 bit / x86
- WinCE5 / ARM
- WinCE6 / x86

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

Endress+Hauser offers a 7-inch touch panel PC version designed for cabinet installation.

3.8.3 Flow-X module LCD display

Each Flow-X module has an LCD display. The display provides access to local Flow-X module data and, when the module is installed in a Flow-X/P enclosure, access to the Station module and external modules installed in the same Flow-X/P. It has the same range of functions as the main user interface , except for entering alphanumeric characters.



1 Up one menu level
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

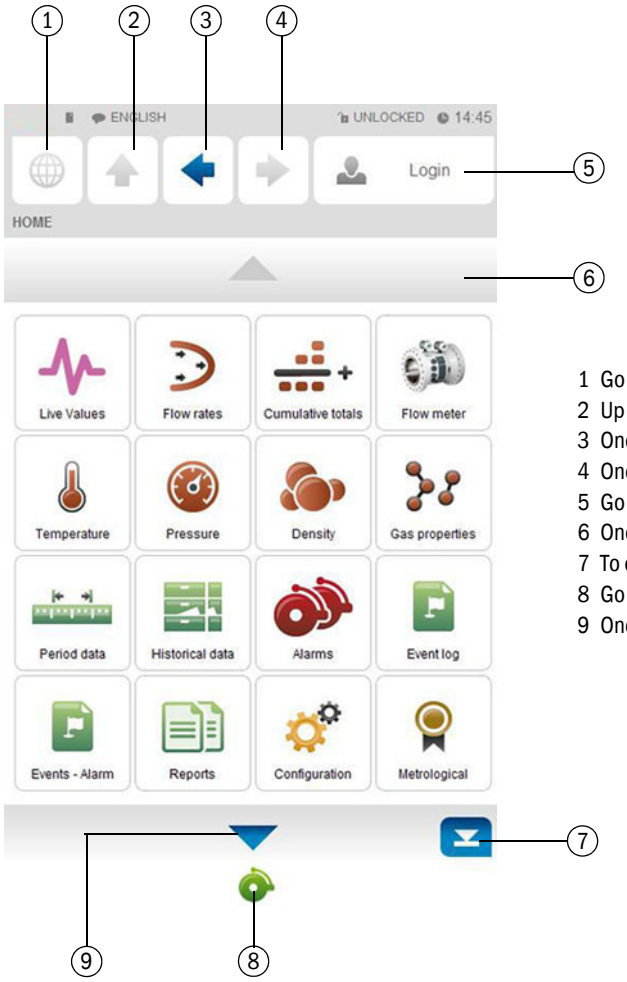
Fig. 8: Flow-X LC display

3.8.4 Flow-X web interface

All Flow-X flow computers have an integrated web server that allows external operation via common web browsers (Windows Internet Explorer, Mozilla Firefox, Google Chrome, Opera, etc.). The web browser offers the same features as the main user interface, plus an Explorer Tree for easy navigation. It also serves to download reports and historical data.

3.8.5 Touchscreen user interface layout

Flow-X flow computer user interfaces have the following layout and buttons:



1 Go to “Main menu”
2 Up one menu level
3 One step backward
4 One step forward
5 Go to “Login” menu
6 One page up
7 To end of page
8 Go to “Alarms” menu
9 One page down

Fig. 9: Main menu of the Flow-X flow computers

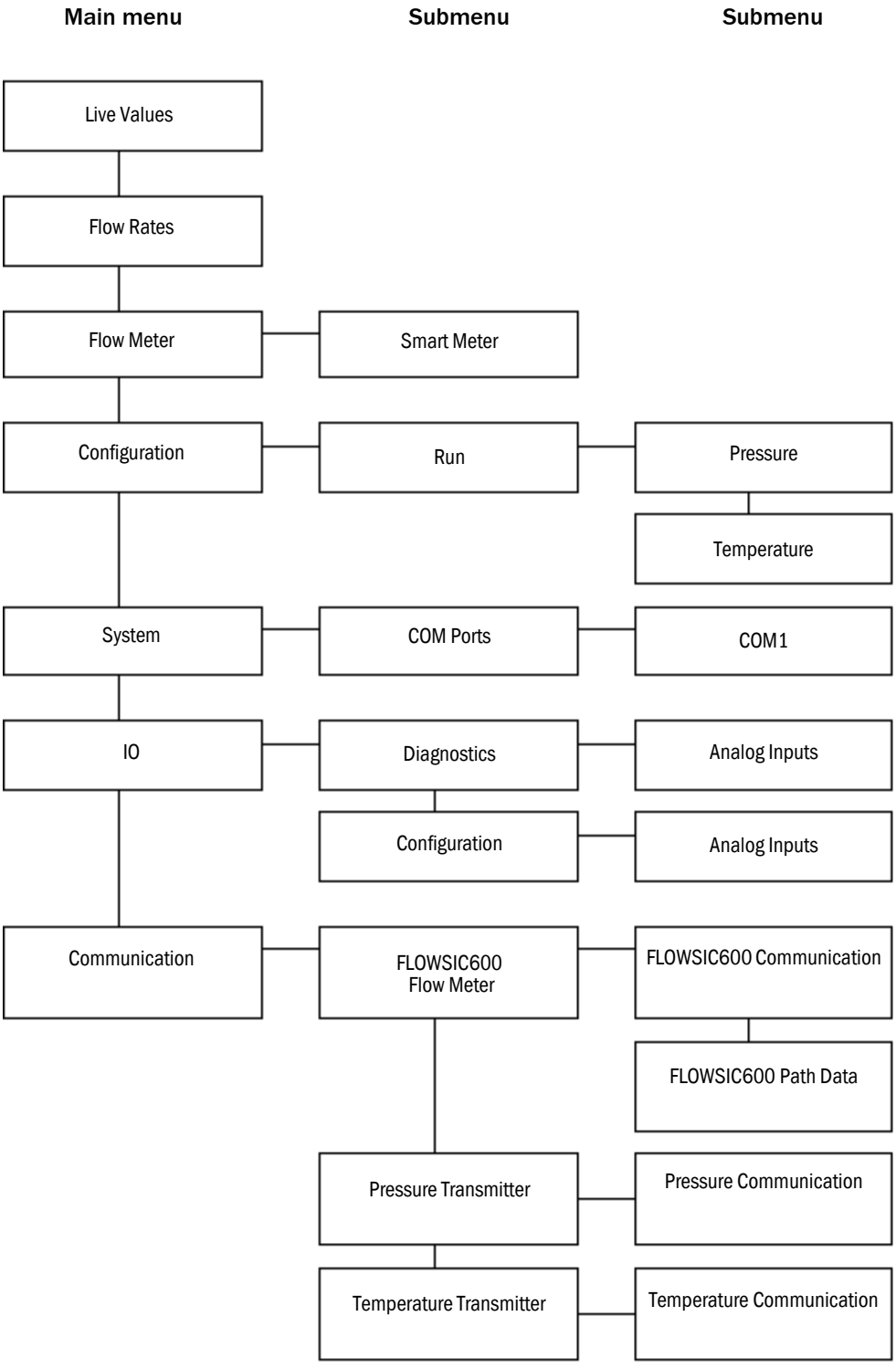


Fig. 10: Menu tree of relevant menu items of the Flow-X flow computer

3.9 XML interface

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

Web services are available for the following data and actions:

- Alarm states and acknowledgment
- General device information
- Menu structure of the display
- Text translations to foreign languages
- Event logs
- Historical data archives
- List of archived reports
- Reading out individual reports
- Reading and writing data values
- Units and item lists

A detailed description of the Flow-X XML interface can be requested from Endress+Hauser.

4 Installation

4.1 Necessary decisions

This Section contains a brief overview to help select the appropriate Flow-X products.

4.1.1 Installation location

The Flow-X flow computer is designed to operate in the following temperature ranges:

Flow-X flow computer	Temperature	Humidity
Flow-X/S	5 … 55 °C (41 … 131 °F)	5 … 95%, non-condensing
Flow-X/P	-25 … 55 °C (-13 … 131 °F)	5 … 90%, non-condensing
Flow-X/C	-25 … 55 °C (-13 … 131 °F)	5 … 90%, non-condensing

Table 2: Permissible temperature and humidity of the Flow-X flow computer

In practice, the modules are usually mounted on racks in a controlled environment, such as a control room, rack room, analyzer house or similar.
The Flow-X modules should not be exposed to direct sunlight during operation and storage.

4.1.2 Internationale Standards

The Flow-X flow computer supports an extensive list of international standard calculations for natural gas and other applications:

- Gas:
  - AGA5, AGA8 Parts 1 and 2, AGA10
  - AGA-NX19
  - SGERG-88
  - GERG-2008
  - GOST 30319-2
  - GPA 2172
  - ISO 6976 (all editions)
  - GSSSD MR113
  - Wet gas (De Leeuw, Reader Harris)

- Flow:
  - ISO 5167-1, 2, 3 and 4 (all editions)
  - ISO/TR15377
  - AGA3, AGA7, AGA9, AGA11
  - V-cone

4.1.3 Number of modules

One module typically represents a metering run.
Station totals can be calculated in any module in the same enclosure, including the Flow-X/P panel display module.
The serial ports require special attention. Each module has 2 serial ports. If more ports are needed, an Flow-X/P can be considered because it has 3 additional serial ports.
The Flow-X/C, Flow-X/P1 and Flow-X/S support the connection of up to 3 metering run per device with the special application “3runs”.

4.1.4 Redundancy

If a redundant solution is required for increased availability, two Flow-X modules can be used per metering run. Two identical Flow-X/P enclosures working in redundant mode can be used to attain maximum availability.
All modules have an integrated dual 24 V power supply.

4.1.5 Fast data exchange

Flow-X modules located in a Flow-X/P enclosure can exchange the data quickly with the neighboring Flow-X modules via Ethernet. This is the so-called multi-module operation.

As an example, a module is used that communicates with a gas chromatograph and makes this data available to four other modules and also serves as a Modbus slave to a central DCS connection.

Each Flow-X module can use the data from other modules as if it exists in its own data space. Flow-X/P has two dedicated Ethernet switches for this purpose. Alternatively, it is possible to set up a Modbus TCP/IP link using Ethernet to exchange data between the modules.

4.1.6 Display requirements

The Flow-X/P and Flow-X/C touchscreen supports effective and user-friendly data display and navigation through the menu structure. Multiple languages are supported.

This display function is not always required. Each individual module is equipped with a local black and white graphic display, which enables data display and parameter setting in the module itself. The display supports 4 to 8 lines for data and/or parameters.

Apart from these physical displays, each module contains a web server that makes it possible to display pages that can be accessed with a standard web browser via Ethernet.

4.1.7 Power supply

All Flow-X modules require 24 V DC and have integrated support for redundant power supply.

4.2 Mechanical installation

4.2.1 Flow-X/P and Flow-X/C

The Flow-X/P and Flow-X/C flow computers require a mounting bracket for installation in an instrument panel. For Flow-X/P, the mounting bracket is designed to allow unobstructed access to the installed Flow-X modules. The mounting bracket is attached to the back of the instrument panel in which the Flow-X/P or Flow-X/C flow computer is to be installed. The respective flow computer is inserted at the front of the instrument panel and connected to the mounting bracket with a screw.

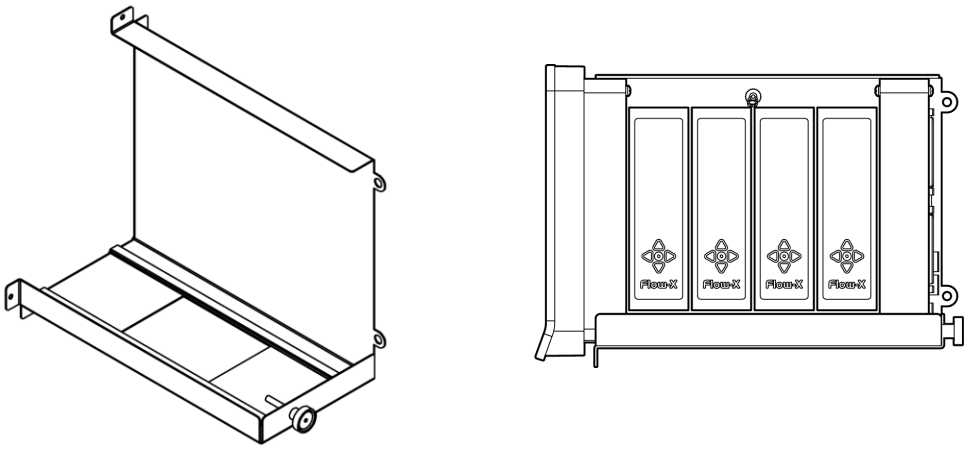


Fig. 11: Flow-X/P mounting bracket and side view Flow-X/P installed

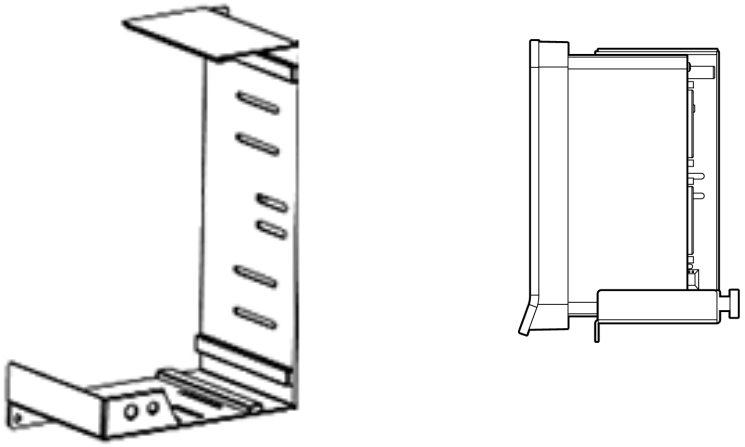


Fig. 12: Flow-X/C mounting bracket and side view Flow-X/C installed

All plug connectors for power, field wiring and communication are located on the rear of the Flow-X/P or Flow-X/C.

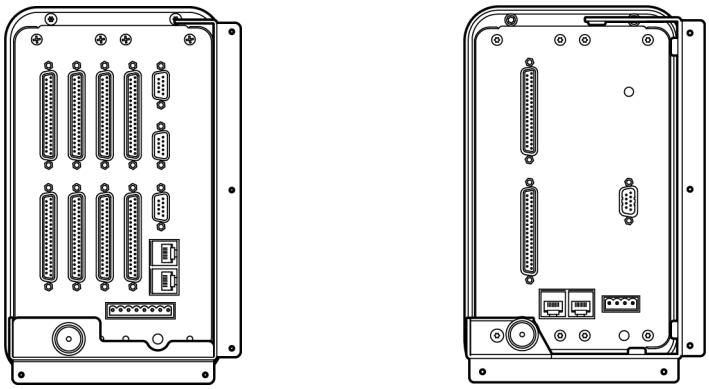


Fig. 13: Flow-X/P (left) and Flow-X/C (right) , rear view (installed)

4.3 Electrical installation

WARNING:
The device may only then be connected to the power supply when ALL of the other desired lines and plugs are connected to the device.
A plug or cable may only be disconnected from the device when the voltage supply to the device has been disconnected beforehand.
Connecting plugs or cables while the device is in operation can cause irreparable damage to the electronics. Corresponding defects are excluded from a warranty claim.

4.3.1 Introduction

This Section contains information for electrical installation, including field wiring, communications, power supply and grounding. Since all models use the same Flow-X module, the connection diagrams in this Section apply to all models.

The Flow-X modules are fully configurable using the software. No DIP switches or jumpers need to be set inside. Furthermore, there are no user-replaceable fuses or other components inside. Opening a module voids all warranty claims.

For the sake of simplicity, the details of the plug-in connections are described first. The loop diagrams and additional connection drawings then follow.

4.3.2 General connection

The following Section only describes the connection to a single Flow-X module of a Flow-X flow computer. Proceed accordingly when further Flow-X modules are to be connected.

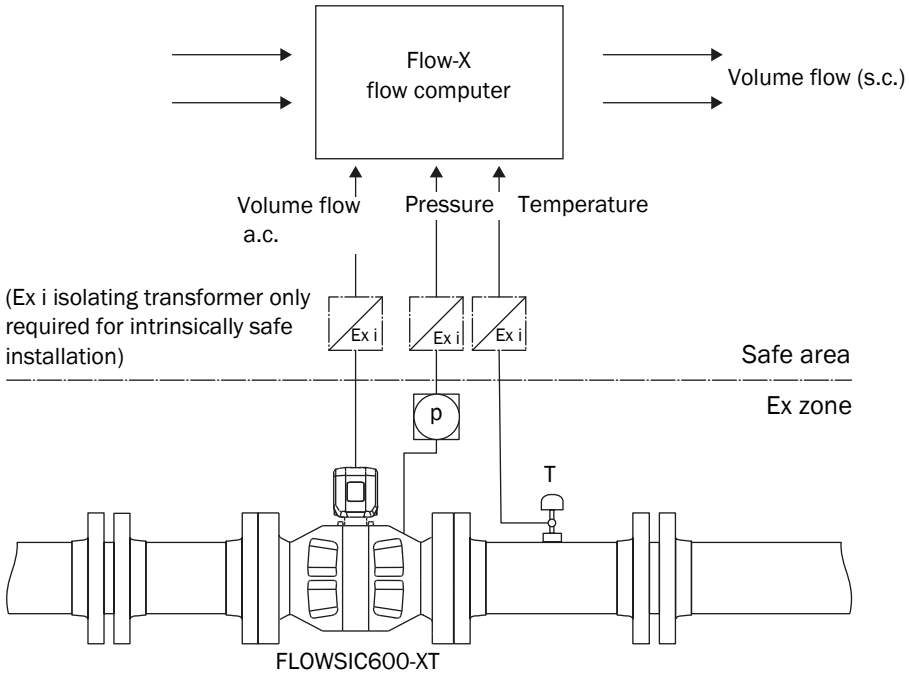


Fig. 14: General connection

4.3.3 Cable specification

	Specification	Remark
Cable type	Twisted pair, shielded, Cable impedance approx. 100...150 W 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 500 m at 0.75 mm²	Do not connect unused conductor pairs and prevent them from accidental short-circuit
Cable diameter	6 ... 12 mm	Clamping range of the cable glands

Table 3: Serial interface (RS485)

For more detailed information on cable specifications, refer to the “Cable specification” Section of the “FLOWSIC600-XT” or “FLOWSIC600” Operating Instructions.

4.3.4 Electrical connections

Connection type	Flow-X/S	Flow-X/P	Flow-X/C
RJ45 plug	2x (LAN1 and LAN2)	2x (LAN1 and LAN2)	2x (LAN1 and LAN2)
9-Pin D-sub connector (serial interface)	-	1x RS-232 COM1(x) 2x RS-232 or RS485 (COM2 and COM3)	1RS-232 COM3 (x) or 1RS-485 COM3
37-Pin D-sub sockets (I/O and serial ports)	-	8x (X1A - X4A and X1B to X4B)	2x (X1A and X1B)
Screw terminals	2x (X1A and X1B)	-	-

Table 4: Electrical connections

Only the 37-pin D-sub sockets can be used on which a Flow-X module is actually installed.

The three 9-pin D-sub connectors are the serial ports of the display module. These ports can be used to communicate with devices such as a gas chromatograph or a DCS. COM1 supports RS-232 only at Flow-X/P. COM2 and COM3 can be configured individually for RS-232 or RS485.

LAN1 and LAN2 are Ethernet connectors for connecting your Flow-X/P or Flow-X/C to your network. The Flow-XP modules are used in multi-module operation.

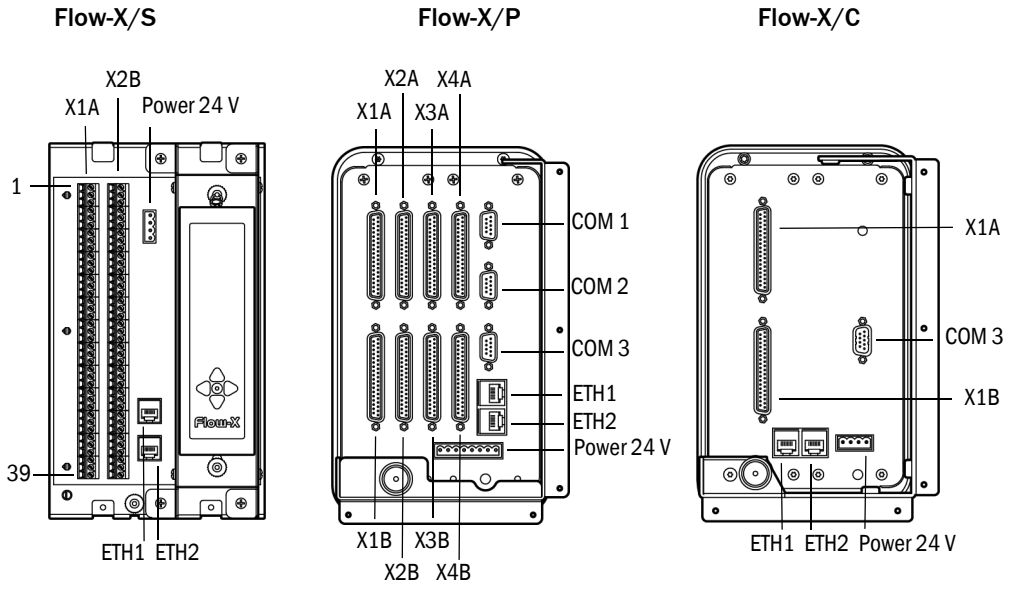


Fig. 15: Connection links position

For more detailed information on the available connections, refer to the Section “Electrical installation - Connector details” of the Technical Information “Flow-X flow computer”.

4.3.5 Power supply plug

WARNING:
The device may only then be connected to the power supply when ALL of the other desired lines and plugs are connected to the device.
A plug or cable may only be disconnected from the device when the voltage supply to the device has been disconnected beforehand.
Connecting plugs or cables while the device is in operation can cause irreparable damage to the electronics. Corresponding defects are excluded from a warranty claim.

The Flow-X flow computers have redundant power supply connections that can be connected to two independent power supplies. However, a redundant power supply is not required for operation of the Flow-X flow computer. The Flow-X flow computer switches automatically to the other power supply without power failure when the power supply used fails. The Flow-X flow computers use an 8-pin terminal block to connect one or two external power supplies. The primary connection must always be used, the secondary connection is optional.

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

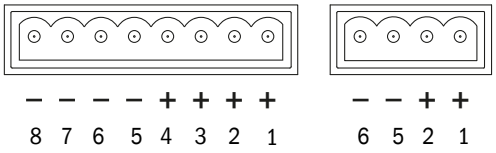


Fig. 16: Flow-X power terminal block Flow-X/P (left) and Flow-X/S or Flow-X/C (right)

Pin	Description	Indication on Flow-X
1	24 V - primary	+1
2	24 V - primary	+1
3	24 V - secondary	+2
4	24 V - secondary	+2
5	0 V	
6	0 V	
7	0 V	
8	0 V	

Table 5: Flow-X power terminal block

4.3.6 Field connections

WARNING:
Before connecting the analog signals to the flow computer, make sure the analog input values (voltage/current) and ranges are configured correctly. Incorrect configuration can cause damage to the inputs.

The FLOWSIC600-XT is connected to the serial COM Port 1 of the module used via the corresponding RS485 interface. Terminal 81/82 is used for this purpose on the FLOWSIC600. For connection with a 2-wire RS-485 connection, it is sufficient to use the Tx+ and Tx terminals. Alternatively, an Ethernet connection can be used to connect the FLOWSIC600-XT and flow computer.

The pressure transmitter is connected to the Analog 1/HART 1 port, while the temperature transmitter is connected to the Analog 2/HART 2 port of the Flow-X flow computer module used.

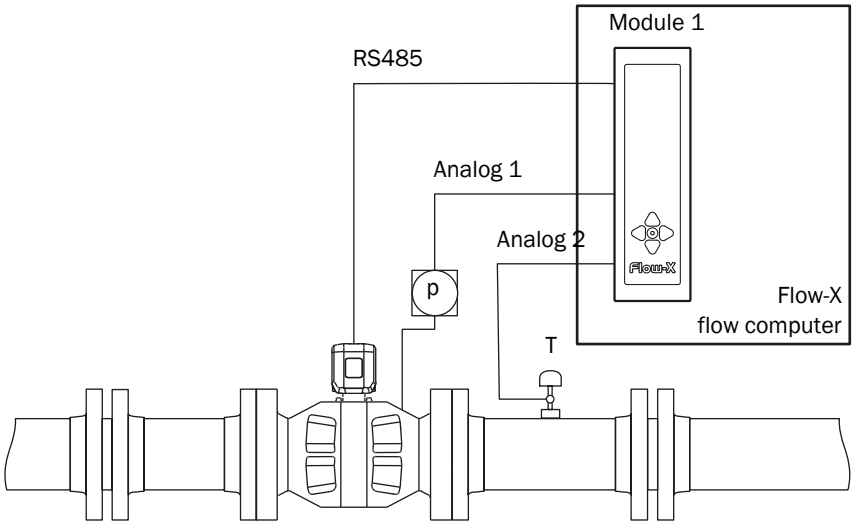


Fig. 17: Field connection using the FLOWSIC600-XT as example

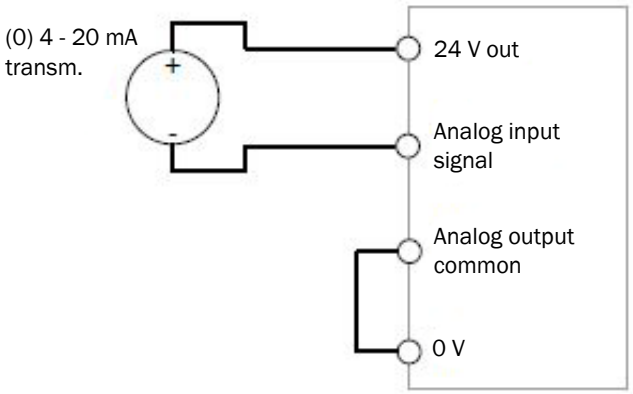
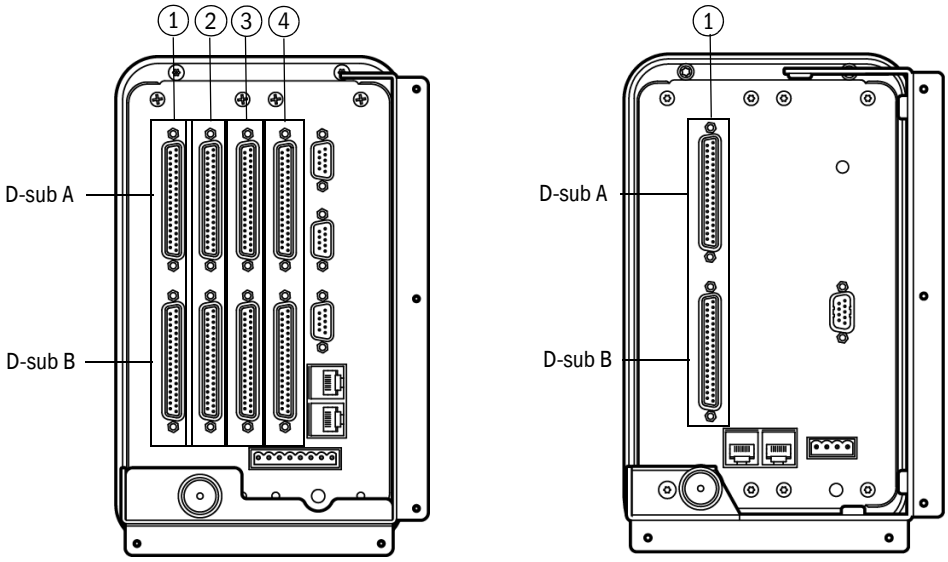


Fig. 18: General transmitter connection with internal 24 V supply

Both transmitters can receive their 24 V supply voltage via internal supply from the Flow-X flow computer and can be connected accordingly. This may require additional cables.
An external supply is also possible, the correct connection is described in →Technical Information §3.4.10.

The exact position and type of the relevant connections can be found in the following Tables and Figures.

Note:
These Operating Instructions describe the installation of a single measuring section. Use the connectors of the corresponding measuring section according to the following Figures when several measuring sections are installed.



1 Measuring section 1
2 Measuring section 2
3 Measuring section 3
4 Measuring section 4

Fig. 19: Connection ports Flow-X/P (left) and Flow-X/C (right)

	Connected device	Terminal ID	Plug connection	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

Table 6: 37-pin connection port (Flow-X/P and Flow-X/C)

	Connected device	Terminal ID	Plug connection	Pin
24 V out	Pressure or temperature transmitter		X1A	1
0 V common			X1A	2
			X1A	4

Table 6: 37-pin connection port (Flow-X/P and Flow-X/C)

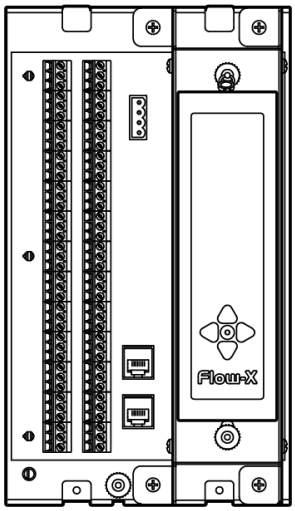


Fig. 20: Connection ports (Flow-X/S)

	Connected device	Terminal ID	Plug connection	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
			X1A	4

Table 7: 37-pin connection port (Flow-X/S)

4.3.7 9-pin D-sub connection port (serial communication)

These connection ports are only available on the Flow-X/P (Com 1 to 3) and Flow-X/C (Com 3) flow computers. These serve to connect to the serial COM ports of the display module. The connection ports of the Flow-X/P or Flow-X/C are plugs. The connecting line must have a socket. COM3 is implemented as RS485 on Flow-X/C.

Pin	**COM1** RS-232 only	**COM2** / **COM3** RS-232 / RS485 (2-wire) / RS485 (4-wire)	**COM3 Flow-X/C** RS-232/RS-485
1		RX	
2	RX	Rx+	
3	Tx	TX / Sig- / Tx-	TX/ Sig- /Tx-
4		- / Sig+ / Tx+	
5	0 V		
6			
7	RTS		-/Sig+ / Tx+
8	CTS		
9			

Table 8: 9-pin D-sub connector pin connections for Flow-X/P

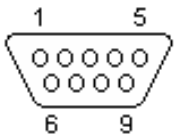


Fig. 21: 9-pin D-sub connection ports

4.3.8 Ethernet

WARNING:
The device may only then be connected to the power supply when ALL of the other desired cables and plugs are connected to the device.
A plug or cable may only be disconnected from the device when the voltage supply to the device has been disconnected beforehand.
Connecting plugs or cables while the device is in operation can cause irreparable damage to the electronics. Corresponding defects are excluded from a warranty claim.

The Flow-X/P and Flow-X/C flow computers have two standard RJ45 Ethernet connections.

Whether these Ethernet connectors can be used for communication or not depends on the software configuration. If the corresponding flow module operates autonomously, i.e. not in a multi-module configuration, the Ethernet ports can be used to communicate with the flow module. This also applies when the flow module is the “first” flow computer in a multi-module configuration. “First” means the first in the software program, this does not necessarily correspond to the physical position within the rack.

5 Commissioning

5.1 Device settings

The device settings are modified using the Flow-X flow computer touchscreen, the integrated Webserver or the **Flow-X module LCD display**.

The menu navigation is the same for all variants.

A login is required for the Flow-X flow computer touchscreen or integrated Web server settings.

1 Touch or click “Login”.

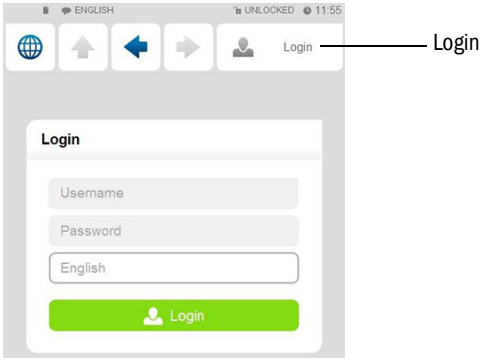


Fig. 22: “Login” menu

2 Enter the user name and corresponding password.

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

Table 9: Password overview

3 Confirm “Login”.
When making changes using the module screen, it is necessary to log in with your pin in the “Login” menu.

Fig. 23: Menu “Login” Flow-X module LCD display

5.2 Connecting devices with HART protocol

▶ Connect the transmitters as described in Section “Electrical installation”.

5.2.1 Pressure sensor

1 Go to menu item “Configuration/Run/Pressure”.
2 Set the “Meter pressure input type” to “HART”.

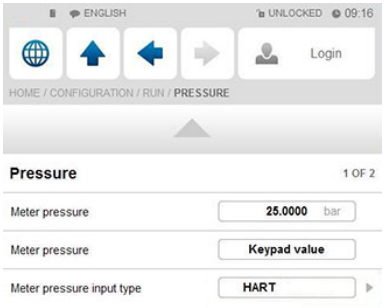


Fig. 24: Configuration/Run/Pressure

3 Go to menu item “IO/Diagnostics/Analog inputs”.
The value of “Analog input 1 input value” must be 4 mA.

Observe the following: Minor deviations are possible (typically <= +/-0.01mA).

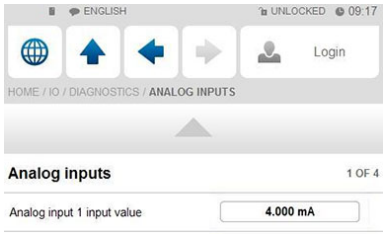


Fig. 25: IO/Diagnostics/Analog inputs (pressure sensor)

5.2.2 Temperature transmitter

1 Go to menu item “Configuration/Run/Pressure”.
2 Set the “Meter pressure input type” to “HART”.
3 Go to menu item “IO/Diagnostics/Analog inputs”.
The value of “Analog input 2 input value” must be 4 mA.

Observe the following: Minor deviations are possible (typically <= +/-0.01mA).

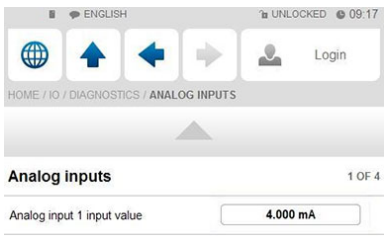


Fig. 26: IO/Diagnostics/Analog inputs (temperature sensor)

5.3 Connecting analog devices

5.3.1 Pressure transmitter

1 Go to menu item “Configuration/Run/Pressure”.
2 Set the “Meter pressure input type” to “Analog input”.

Fig. 27: Configuration/Run/Pressure

3 Go to menu item “IO/Diagnostics/Analog inputs”.
“Analog input 1 input value” must be between 4 mA and 20 mA. If this is not the case, the function of the transmitter must be checked and whether there are any error values defined by the device.

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

1 Go to menu item “IO/Diagnostics/Analog inputs”.
2 Set the value for “Analog input 1 full scale” to the maximum value of the measuring range of the pressure transmitter.
3 Set the value for “Analog input 1 zero scale” to the minimum value of the measuring range of the pressure transmitter.

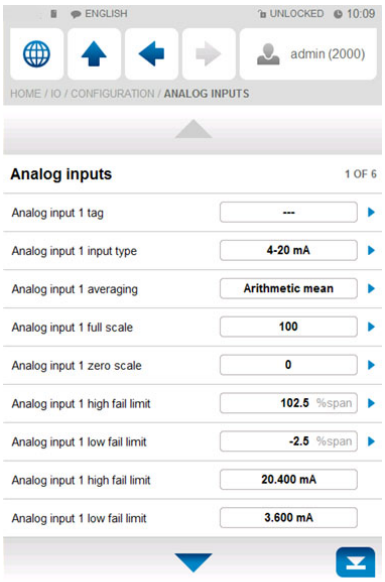


Fig. 28: IO/Diagnostics/Analog inputs

5.3.2 Temperature transmitter

1 Go to menu item “Configuration/Run/Temperature”.
2 Set the “Temperature pressure input type” to “Analog input”.
3 Go to menu item “IO/Diagnostics/Analog inputs”.
“Analog input 2 input value” must be between 4 mA and 20 mA.
If this is not the case, the function of the transmitter must be checked and whether there are any error values defined by the device.

Adjusting the scale in the flow computer to the working range of the transmitter:

1 Go to menu item “IO/Diagnostics/Analog inputs“.
2 Set the value for “Analog input 2 full scale” to the maximum value of the measuring range of the temperature transmitter.
3 Set the value for “Analog input 2 zero scale” to the minimum value of the measuring range of the temperature transmitter.

5.4 Device configuration and connection check

5.4.1 FLOWSIC600-XT

Checking the communication status

1 Go to menu item “Communication/Flowsic600-XT Flow meter/Flowsic600-XT Communication”
2 Check the “Communication status”.
When the “Communication Status” is set to “OK”, the correct device ID is already set in the flow computer.

Fig. 29: Menu item “Communication/Flowsic600-XT Flow Meter/FLOWSIC600-XT Communication”

Changing the device ID

1 Go to menu item “Communication/Flowsic600-XT Flow meter/Flowsic600-XT Communication”
2 Change the value “Modbus server/slave ID” to the device ID set in the device.
3 Check the communication status again.
4 Check the communication protocol used. Modbus® RTU for FLOWSIC600-XT or RTU for Flow-X flow computer.
Changing the protocol type is only possible via the FLOWgate™ software for the FLOWSIC600-XT, or via the Flow-Xpress software for the flow computer.
See Section “Configuration with FLOWgate™” for further information
5 In menu item “Flow rates”, check that the Flow-X flow computer receives data from the gas flow meter used under “Gross volume flow rate”. The data must match the flow rate displayed by the gas meter.

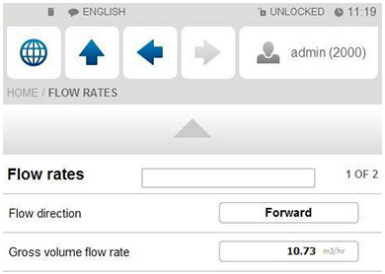


Fig. 30: Menu item “Flow rates”

6 Go to menu item “Communication/Flowsic600-XT Flow meter/Flowsic600-XT Path Data”.
7 Check that values are displayed for the individual paths.

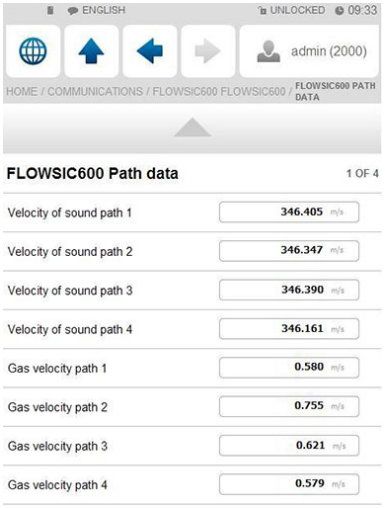


Fig. 31: Menu item “Communication/Flowsic600-XT Flow Meter/Flowsic600-XT Path Data”

5.4.2 Pressure transmitter

Checking the communication status

1 Go to menu item “Communication/Pressure Hart/Pressure Communication”.
2 Check the “Communication status”.
When the “Communication Status” is set to “OK”, the correct device ID is already set in the flow computer.

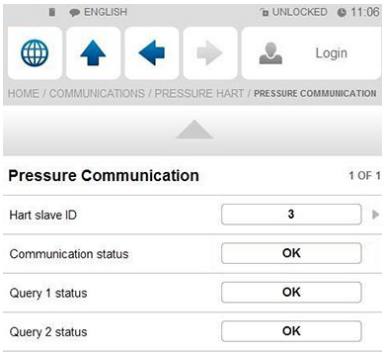


Fig. 32: Menu item “Communication/Pressure Hart/Pressure Communication”

Changing the device ID

1 Go to menu item “Communication/Pressure Hart/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 menu item “Live Values/Run”.
5 Check that the flow computer receives data from the pressure transmitter under “Meter pressure”.

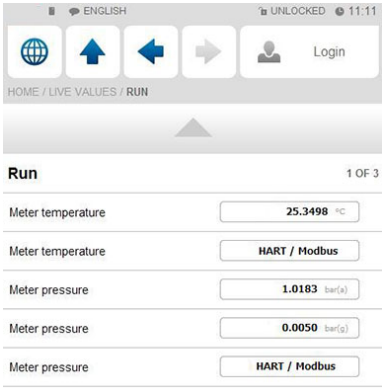


Fig. 33: Menu item “Live Values/Run”

Changing the measuring mode

Depending on the measurement type of the pressure transmitter, it is necessary to switch between gauge pressure measurement and absolute pressure measurement in the Flow-X flow computer.

1 Go to menu item “Configuration/Run/Pressure”.
2 Change the value for “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 1.01325 bar (a).

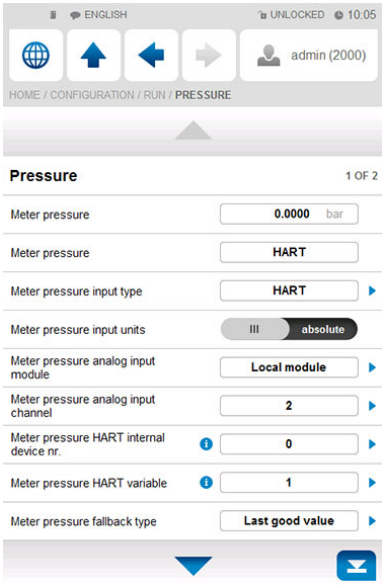


Fig. 34: Menu item “Configuration/Run/Pressure

5.4.3 Temperature transmitter

Checking the communication status

1 Go to menu item “Communication/Temperature Transmitter/Temperature Communication”.
2 Check the “Communication status”.
When the “Communication Status” is set to “OK”, the correct device ID is already set in the flow computer.

Changing the device ID

1 Go to menu item “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 menu item “Live Values/Run”.
5 Check that the Flow-X flow computer receives data from the temperature transmitter under “Meter temperature”.

5.4.4 Deleting log files and reports

After commissioning all devices, it is recommended to delete the event logs and reports generated in the Flow-X flow computer during commissioning.

6 To do this, select each of “Reset totals”, “Clear reports”, “Clear archives” and “Clear print-queue” and confirm.

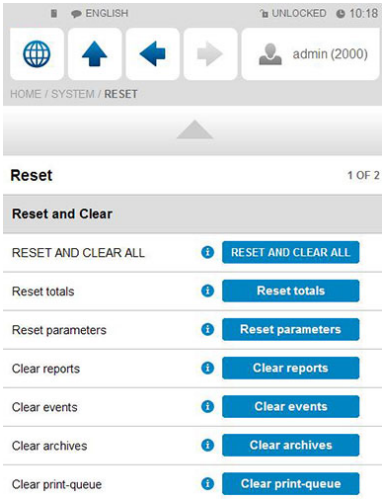


Fig. 35: Menu item “System/Reset”

5.5 Metrological settings

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

The following settings are required by the MID (Measuring Instruments Directive)!
Go to menu item “Display/Metrological, Accountable alarm”.

Setting	Security level	Description
Q_{min}	1000	Low range value (lowest permissible flow rate) of the gas flow meter. The corresponding alarm is triggered when the gas flow meter is below this value.
Q_{max}	1000	High range value (highest permissible flow rate) of the gas flow meter. The corresponding alarm is triggered when the gas flow meter is above this value.

Table 10: Metrological settings

6 Troubleshooting

6.1 Testing gas flow meter communication

FLOWgate™

In the following, the FLOWgate™ software is mainly used to configure the FLOWSIC600-XT gas flow meter.

Note:
For more detailed information on the software and its use, refer to the “FLOWgate™” Section of the FLOWSIC600-XT Operating Instructions.

FLOWgate™ graphical user interface

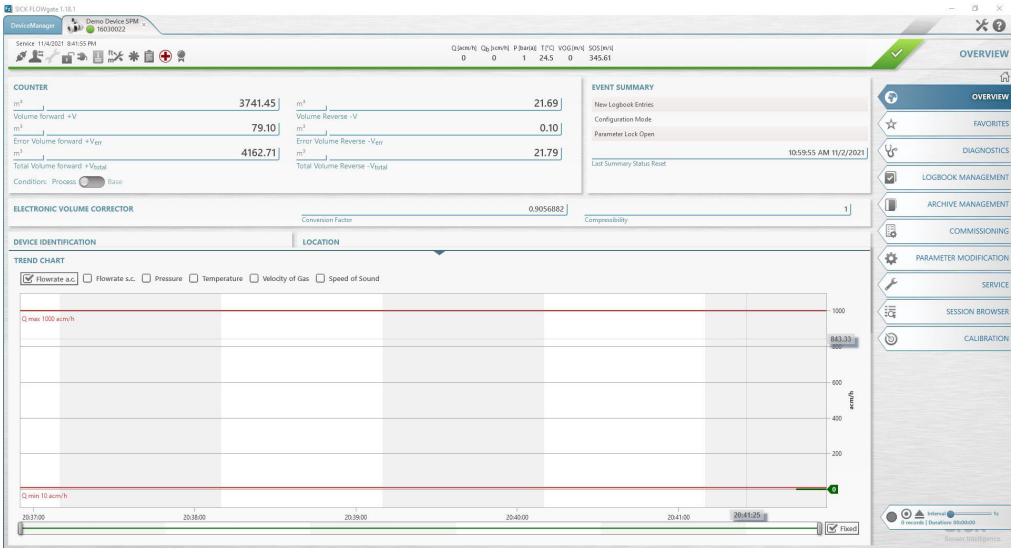


Fig. 36: FLOWgate™ graphical user interface

Connection test

The device connection can still be checked even when no gas is flowing through the gas flow meter.

1 On the Flow-X flow computer, go to menu item “Flow Meter/Smart meter”.
“Flow meter input failure” is set to 0 because no errors exist.
“Meter active” is set to “No” because there is no gas flow.

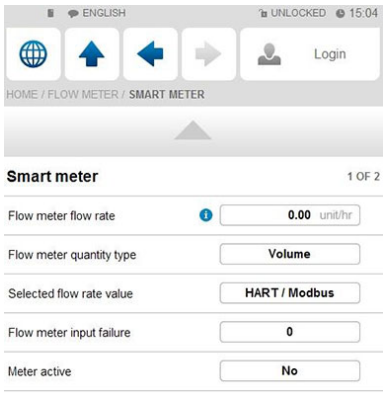


Fig. 37: Menu item “Flow Meter /Smart meter”

2 Start the FLOWgate™ software on the computer connected to the gas flow meter and connect to the connected gas flow meter.
3 Select “SERVICE” and “I/O CHECK” in the menu tree on the right side.
4 Select pulse outputs FO.0/FO.1 and switch to Configuration mode.

> The Flow-X flow computer shows error message “Flow meter measurement fail”, which can be ignored until the change back to Measurement mode. The error message then disappears automatically.

5 Enter any value for “Test frequency” or “Test flow rate” and move the slide switch to “Run”.

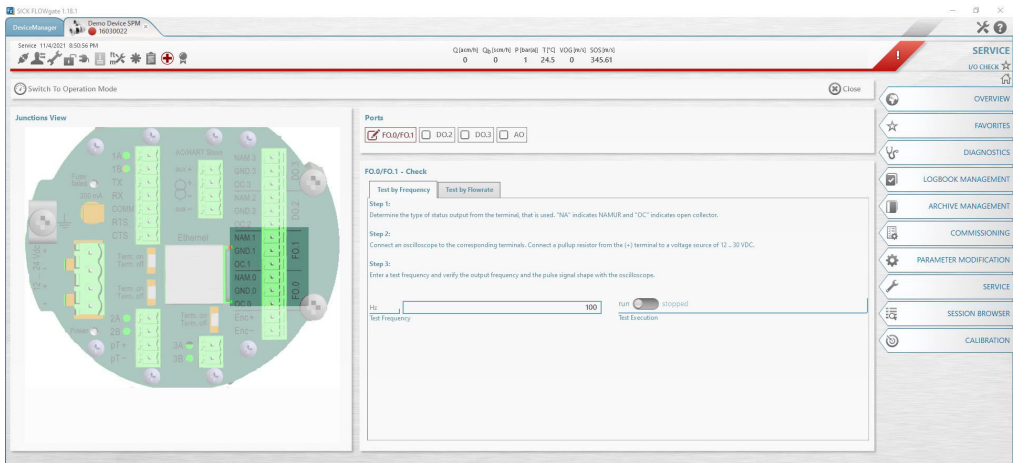


Fig. 38: Determining the flow rate

6 Go to the “Flow rates” menu of the Flow-X flow computer.
7 Check the value for “Gross volume flow rate” matches the set register value.

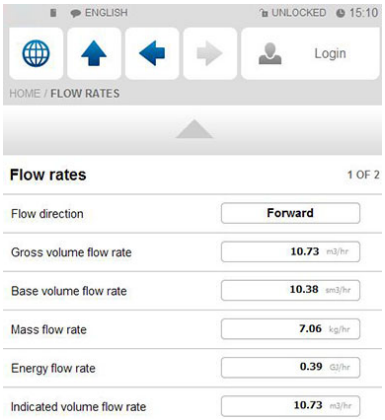


Fig. 39: Menu item “Flow rates”

8 Then return to “Operation mode” at FLOWgate™.

6.2 Interface configurations of gas meter connection

6.2.1 Configuration with FLOWgate™

1 Start the FLOWgate™ software on the computer connected to the gas flow meter.
2 In the menu tree on the right side, select “PARAMETER MODIFICATION” and “I/O CONFIGURATION”.
3 Select the desired interface.
4 Now select Protocol, Baudrate, Protocol Bits etc.

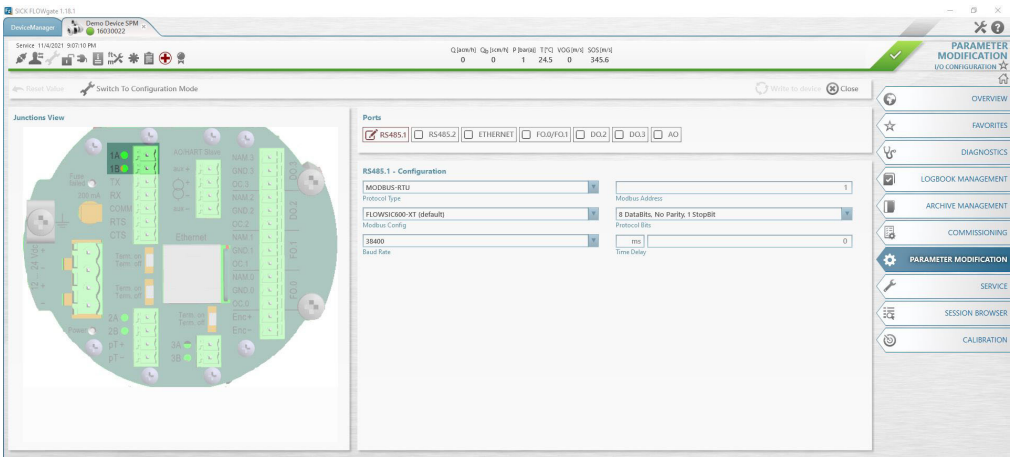


Fig. 40: Changing the interface

5 Configuration mode must be activated to make changes. Finally, the changes must be confirmed with the “Write to device” button.

The settings at the interface only become effective when switching back to “Operation mode”.
Deviating configurations must be set in Flow-X flow computer and in FLOWSIC600-XT.

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

Login is required to change settings. To do this, proceed as explained in the “Device settings” Section.

1 Go to menu item “System/Modules/Module 1/COM Ports/COM1”.
2 Change the baud rate, data bits, parity and stop bits to the values set in FLOWgate™.

Fig. 41: Menu item “System/Modules/Module 1/COM Ports/COM1”

6.3 Checking the measuring mode setting of the pressure transmitter

▶ Go to menu item “Live Values/run”.

The pressure transmitter does not yet measure the pressure

- The “Meter Pressure” value for the absolute pressure is “1”.
- The “Meter Pressure” value for the over pressure is “0”.

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

Observe the following: Minor deviations are possible.

Pressure transmitter already measuring

If the values of “Meter pressure” for absolute pressure as well as for overpressure are negative and the error message “Compressibility calculation error” is displayed, the set measuring mode of the transmitter must be changed.

Changing the transmitter measuring mode

1 Go to menu item “Configuration/Run/Pressure”.
2 Change the value for “Meter pressure input units” to “absolute” or “gauge”, depending on the transmitter configuration. If anything is unclear, check the transmitter configuration.
Note: The reference value of ambient pressure is 1.01325 bar (a).

6.4 Verifying the analog temperature transmitter

If the analog temperature transmitter sends incorrect temperature values or error messages, check the scaling set on the transmitter.

Adjusting the scale on the Flow-X flow computer to the transmitter working range:

1 Go to menu item “IO/Configuration/Analog inputs”.
2 Set the value for “Analog input 2 full scale” to the maximum display value of the temperature transmitter.
3 Set the value for “Analog input 2 zero scale” to the minimum display value of the temperature transmitter.

7 Appendix

7.1 Conformities

7.1.1 CE certificate

The Flow-X flow computer has been developed, manufactured and tested according to the following EU Directives:

- EMC Directive 2004/108/EG (until 19 April 2016), 2014/30/EU (as from 20 April 2016)
- Measuring Instrument Directive 2004/22/EG (until 19 April2016), 2014/32/EU (as from 20 April 2016)

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

7.1.2 Standards compatibility and type approvals

The Flow-X flow computer conforms to the following 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 (Flow-X/P, X/M, X/S, X/R)
  T11449 (Flow-X/C)

7.2 General specifications

Item	Type	Description	Quantity
Temperature	Operating hours	Operating temperature range	Flow-X/S: 5 ... 55 °C (41 ... 131 °F) Flow-X/P: -25 ... 55 °C (-13 ... 131 °F) Flow-X/C: -25 ... 55 °C (-13 ... 131 °F)
Temperature	Storage	Storage temperature range	Flow-X/S: -40 ... 75 °C (-40 ... 167 °F) Flow-X/P: -25 ... 70 °C (-13 ... 158 °F) Flow-X/C: -25 ... 70 °C (-13 ... 158 °F)
Processor	Freescale	i.MX processor with math coprocessor and FPGA	400 MHz
Memory	RAM	Program memory	2 GB
Flash	FRAM	Permanent storage / data recording storage	1 GB
Data memory	MMC	Memory for data recording	1024 MB
Clock	RTC	Real time clock with internal lithium cell, accuracy better than 1 s/ day	

Table 11: General specifications

Further specifications

Item	Specification
MTBF	At least 10 years
EMC	EN 61326-1997 Industrial location EN 55011
Enclosure	EN 60950

Table 12: Further specifications

7.3 Flow-X/M I/O specifications

7.3.1 I/O signal specifications

Signal	Number	Type	Description
Analog input	6[1]	4 ... 20 mA, 0 ... 20 mA, 0 ... 5 V, or 1 ... 5 V	Analog transmitter input High precision (error <0.008 % FS, resolution 24 bit) For (for example) 3xdP, P, T. The inputs are potential-free (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, in addition to 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 cycle 0.1 s.
[1] Total number of analog inputs + HART inputs = 6.			

Table 13: Analog signal specifications

Signal	Number	Type	Description
Dual pulse input	1[1]	High impedance	High speed USM counter input, pulse counting. Trigger level 0.5 V. Max. level 30 V. Frequency range 0 ... 5 kHz (4 x dual pulse) or 0 ... 10 kHz (4 x single pulse). Compliant with ISO6551, IP252 and API 5.5. True Level A implementation.
Digital input	16[1]	High impedance	Digital status input, or test inputs. Update cycle 0.5 ms for 2 inputs, for others 250 ms max.
Digital output	16[1]	Open Collector	Update cycle for relays etc. (0.5 A DC). Rated output 100 V, @24 V. Update rate at cycle time.
Test output	1[1]	Open Collector	Two contiguous pulse outputs, for test applications. One output corresponds to the highest value of the dual pulse inputs and the other output corresponds to the difference between the dual input pulses. The outputs are On-Off-HighZ.
Pulse output	4[1]	Open Collector	Max. 500 Hz
[1] Total number of digital inputs + digital outputs + pulse inputs + density inputs+ measured value inputs = 16.			

Table 14: Digital specifications

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

Table 15: Communication specifications

7.3.2 Specifications for flow calculation

List of certified flow calculations
Gas
AGA-NX19
AGA 5, AGA 8 Part 1 (AGA8:1994), AGA 8 Part 2 (GERG2008), AGA 10
SGERG-88
GERG-2008
GOST 30319-2
GPA 2172
ISO 6976 (all editions)
GSSSD MR113
Wet gas (De Leeuw, Reader Harris)
Flow
ISO 5167-1, 2, 3 and 4 (all editions)
ISO/TR15377
AGA3, AGA7, AGA9, AGA11
V-cone

Table 16: Certified flow calculations

Standard flow calculations
Recalculation of batch and period (counter factor, BS&W, density, etc.)
Unlimited number of period and batch totals and weighted averages of flow and time. Any type of period is possible. Maintenance counters are supported.
Calibration curve up to an unlimited number of points (linear and polynomial).
Support for test system: Unidirectional, bidirectional (2 / 4 encoder inputs), compact test system, master counter, double timing, pulse interpolation.
Control: • PID control • Valve control • Test control • Batch control
All the usual spreadsheet functions to achieve maximum flexibility.

Table 17: Standard flow calculations

7.3.3 Supported devices

Standard supported devices
Ultrasonic flow meters Product family FLOWSIC
All major gas chromatographs • All major gas chromatographs • ABB • Daniel • Instromet • Siemens • All gas chromatographs that support Modbus

Table 18: Standard supported devices

7.4 Power consumption

Device	Nominal value	Peak value at power on
Flow-X/C	0.6 A	1.0 A
Flow-X/P	0.4 A	0.8 A
Flow-X	0.4 A	0.8 A

Table 19: Power consumption at 24 V DC (exclusive supply of external transmitter loops.)

The power supply input circuits of the Flow-X/P0 and Flow-X/M Flow modules are equipped with automatic fuses, each rated 30 V DC and 1.1 A.

For example, a Flow-X/P4, which is a Flow-X/P with 4 Flow-X/M Flow modules, a nominal current 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 at switch-on.

7.5 Weight

Products	Weight
Flow-X/C	2.7 kg (6.0 lbs)
Flow-X/S	2.5 kg (5.5 lbs)
Flow-X (single Flow-X module)	0.8 kg (1.8 lbs)
Flow-X/P0 (without Flow-X module)	3.7 kg (8.2 lbs)

Table 20: Weight of individual components

Products	Weight
Flow-X/P1	4.5 kg (9.9 lbs)
Flow-X/P2	5.4 kg (11.9 lbs)
Flow-X/P3	6.3 kg (13.9 lbs)
Flow-X/P4	7.2 kg (15.9 lbs)

Table 21: Weight of combined products

7.6 Dimensions

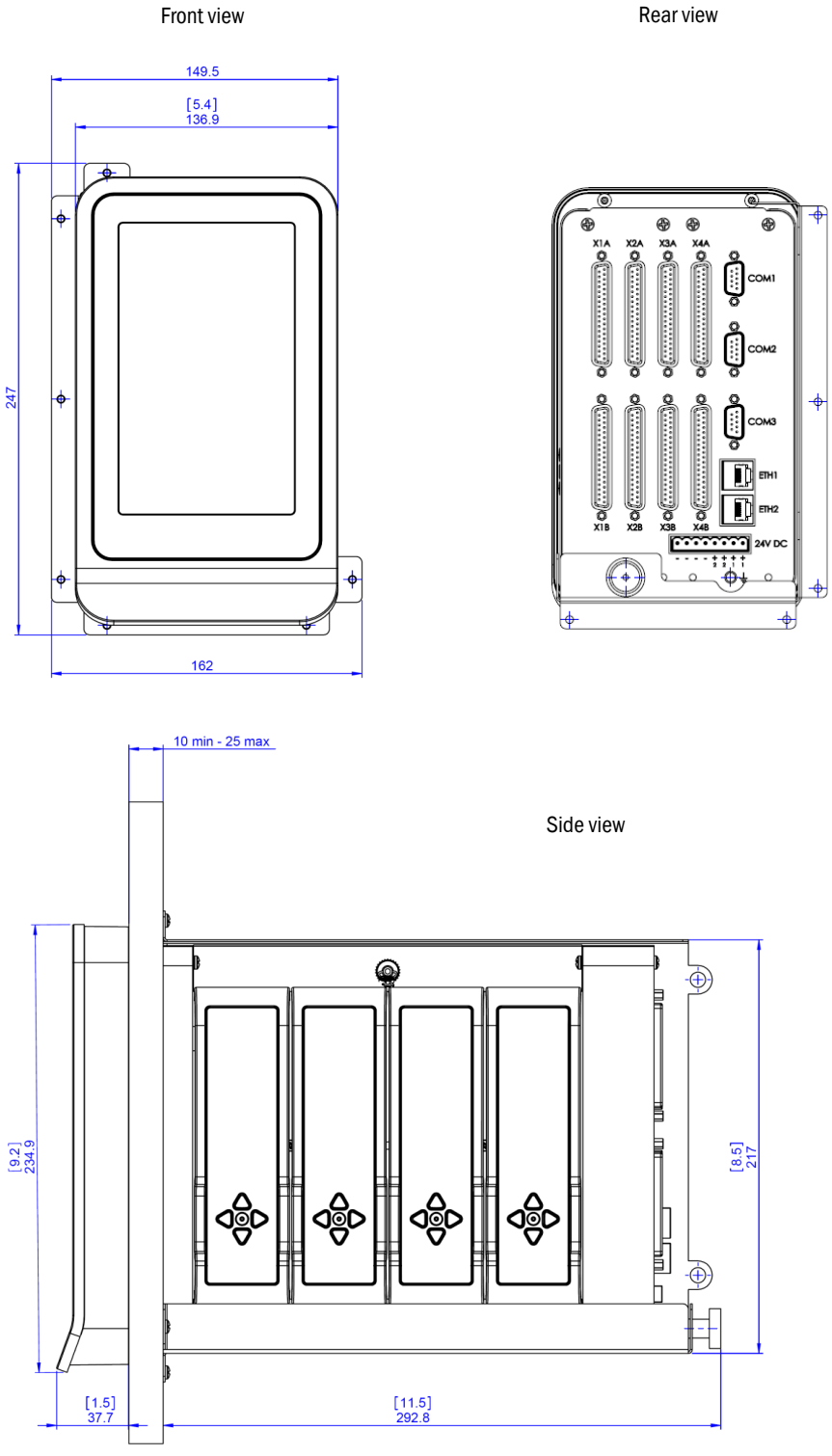
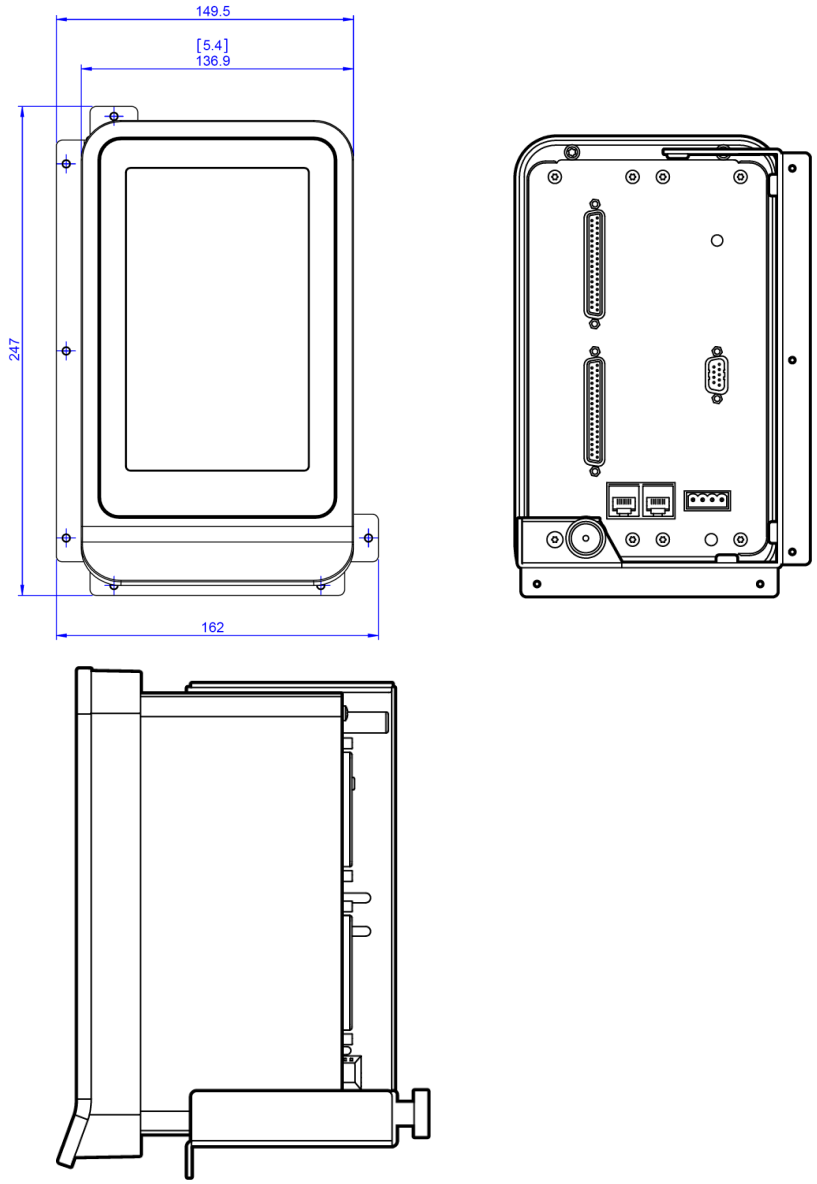


Fig. 42: Flow-X/P dimensions

Front view

Rear view



Dimension Flow-X/C

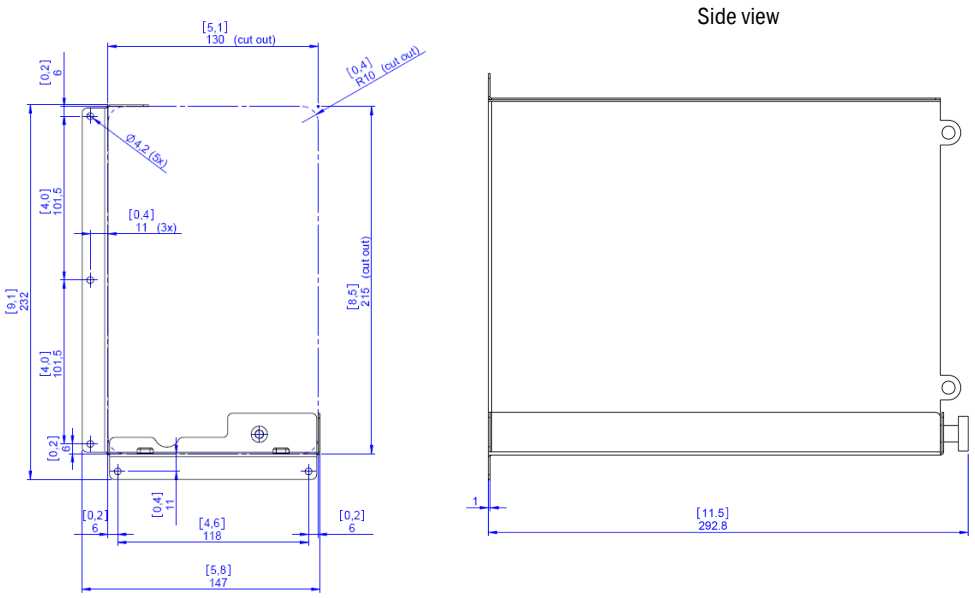


Fig. 43: Flow-X/P *wall bracket dimensions*

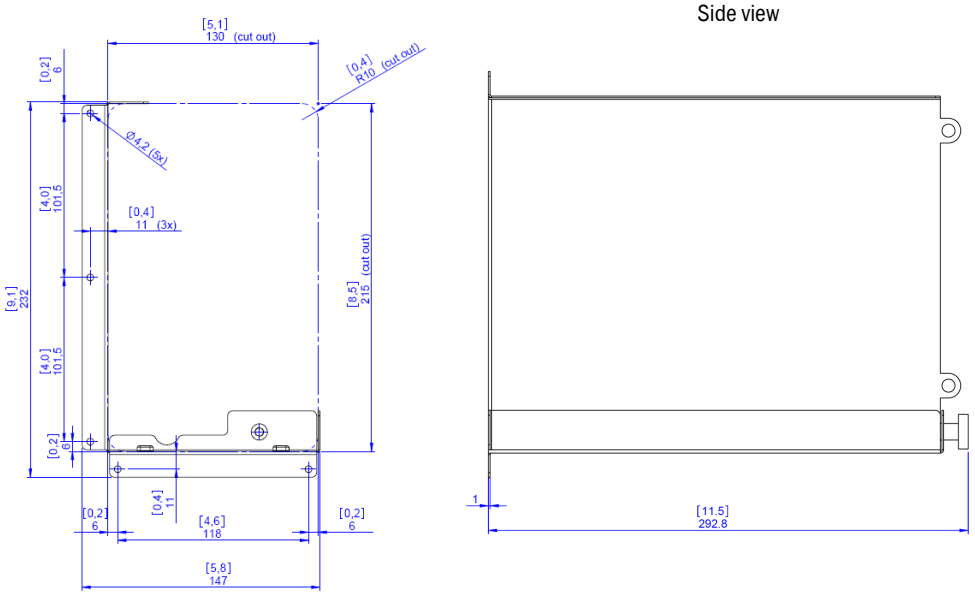


Fig. 44: Flow-X/C *wall bracket dimensions*

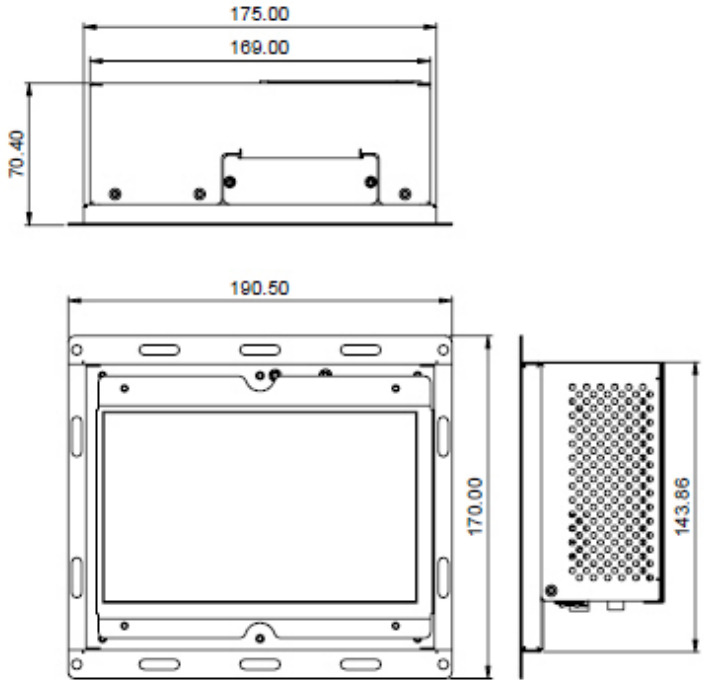


Fig. 45: Flow-X/T dimensions

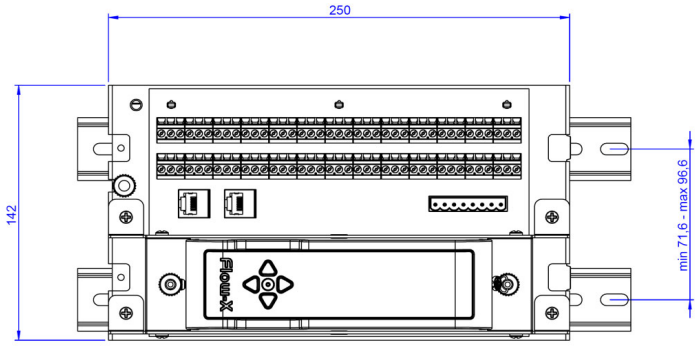


Fig. 46: Flow-X/S horizontal dimensions

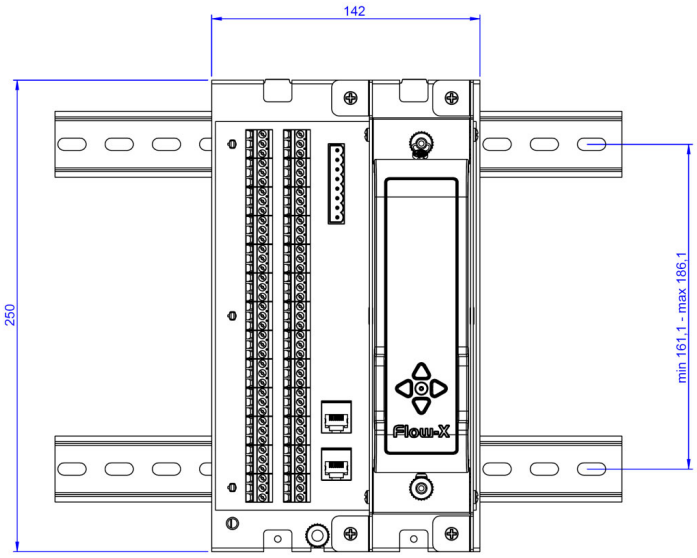


Fig. 47: Flow-X/S *vertical dimensions*

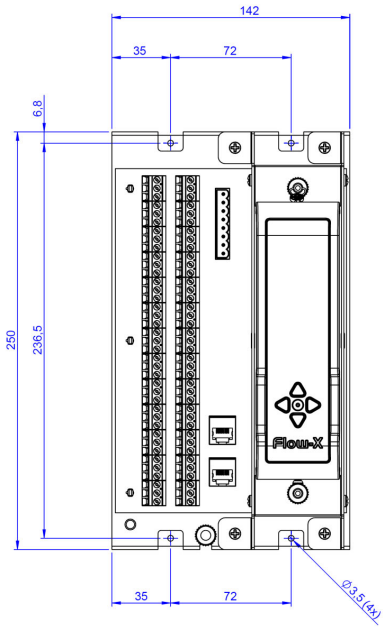


Fig. 48: Flow-X/S *wall mounted dimensions*

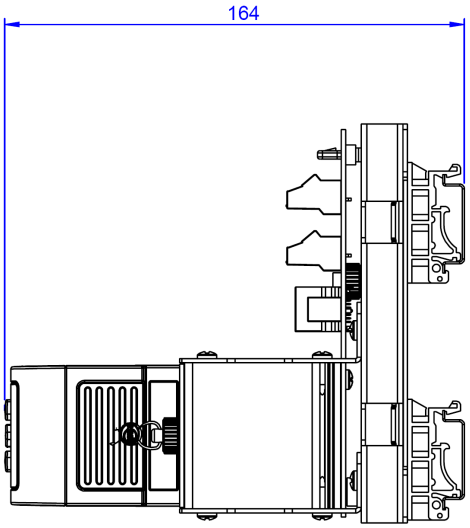
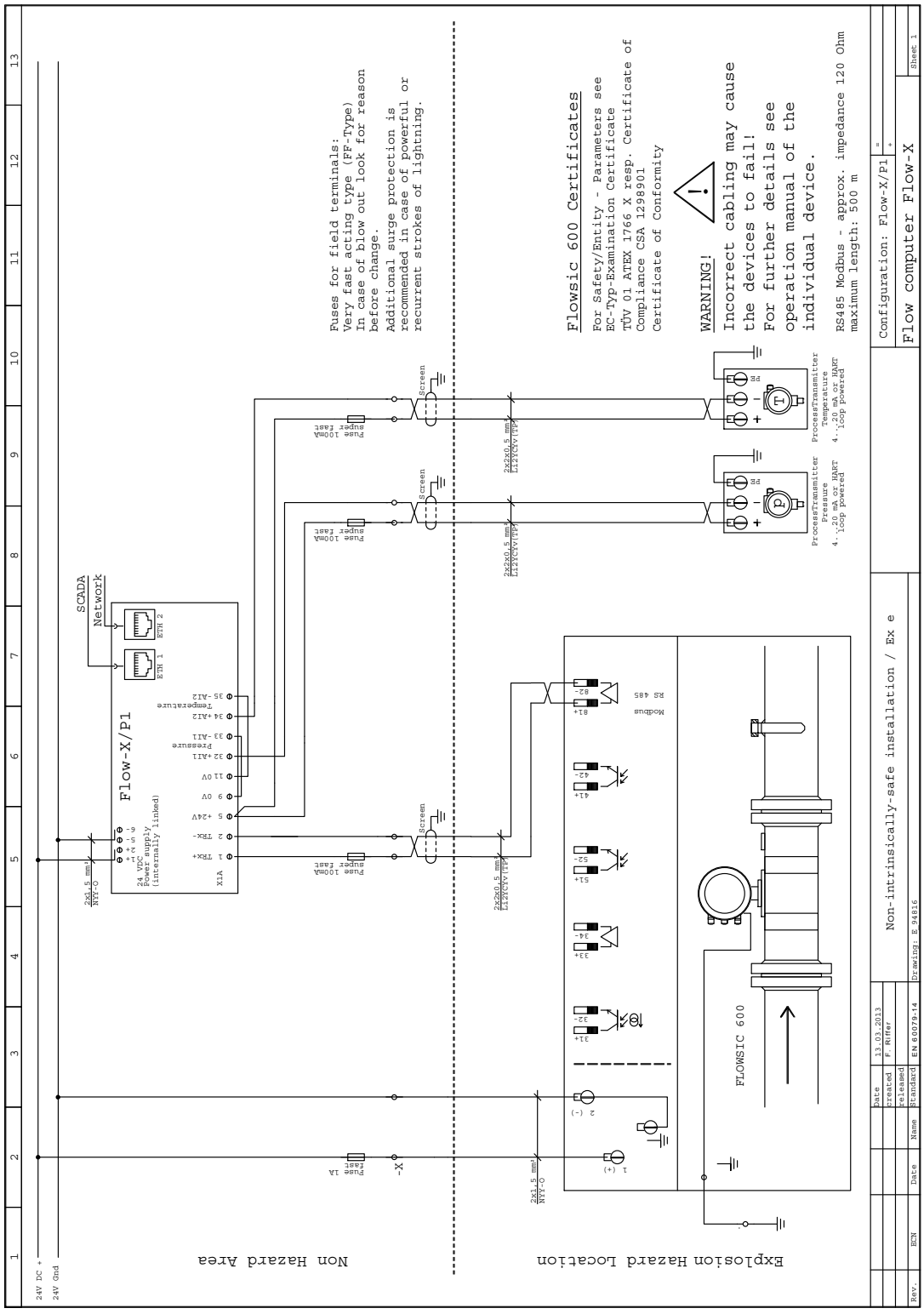
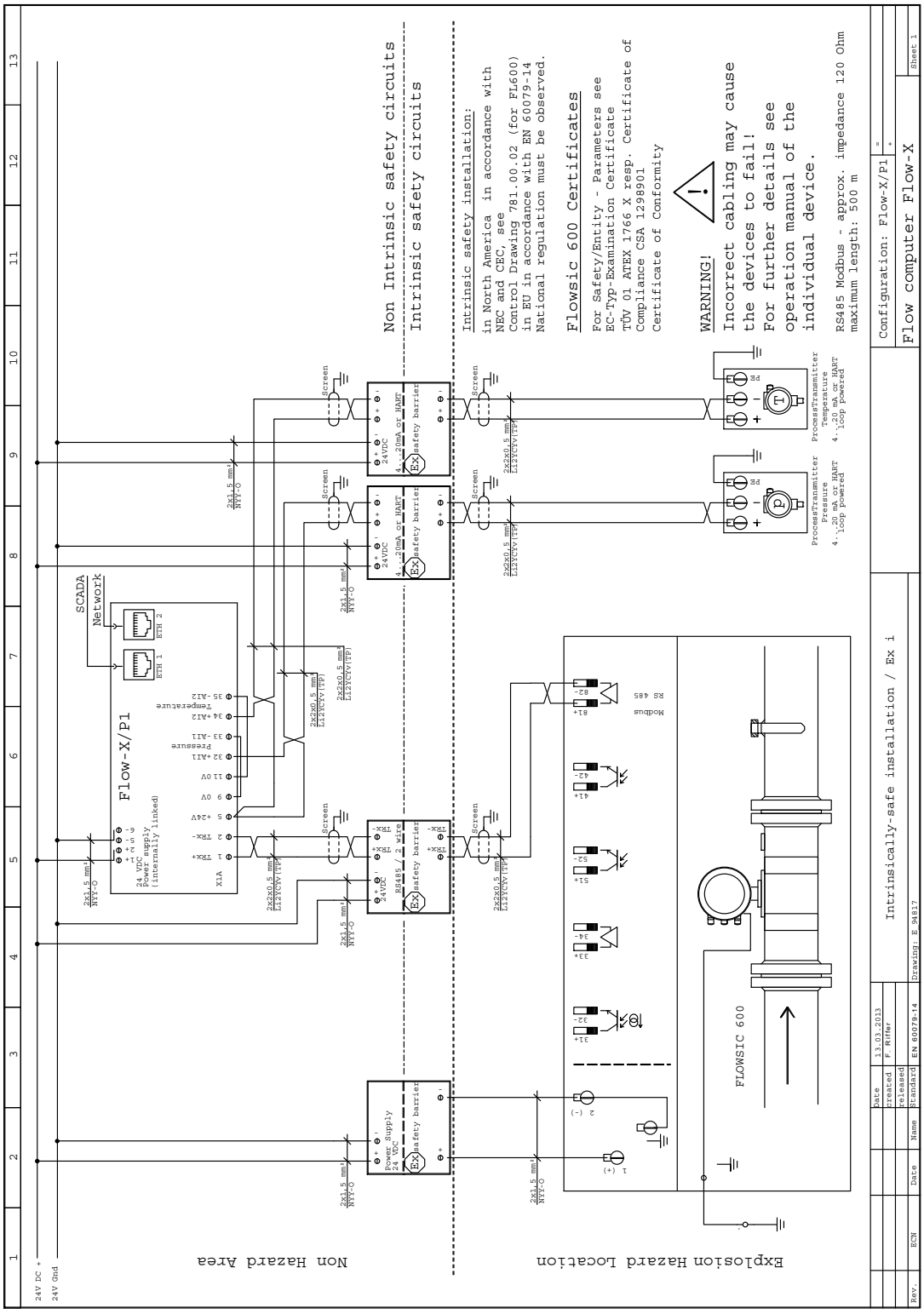


Fig. 49: Flow-X/S wall mounted dimensions, side view

7.7 Wiring example




Non Intrinsic safety circuits
Intrinsic safety circuits
Intrinsic safety installation:
in North America in accordance with NEC and CEC, see Control Drawing 781.00.02 (for FL600) in EU in accordance with EN 60079-14 National regulation must be observed.
Flowsic 600 Certificates
For Safety/Entity - Parameters see
EC-Typ-Examination Certificate TÜV 01 ATEX 1766 X resp. Certificate of Compliance CSA 1298901
Certificate of Conformity
WARNING!
Incorrect cabling may cause the devices to fail!
For further details see operation manual of the individual device.
RS485 Modbus - approx. impedance 120 Ohm
maximum length: 500 m
Flow computer Flow-X
Configuration: Flow-X/P1
Intrinsically-safe installation / Ex i
Flow-X/P1
SCADA Network
ETH 1
ETH 2
24 VDC Power supply (internally linked)
X1A
1 TRX+
2 TRX-
5 +24V
9 0V
11 0V
32 +A11 Pressure
33 -A11
34 +A12 Temperature
35 -A12
Power Supply 24 VDC
24VDC
4...20mA or HART
Ex safety barrier
RS485 / 2 wire
Modbus RS 485
ProcessTransmitter Temperature 4...20mA or HART loop powered
ProcessTransmitter Pressure 4...20mA or HART loop powered
FLOWSIC 600
Non Hazard Area
Explosion Hazard Location
24V DC +
24V Gnd
Screen
2x1.5 mm² NYY-O
2x220.5 mm² LiYCYv (TP)
Drawing: E 94817
EN 60079-14
Standard
Name
Date
ECN
Rev.
Sheet 1

8029781/1EEU/V2-0/2021-12

www.addresses.endress.com

Endress+Hauser

People for Process Automation