TECHNICAL INFORMATION

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

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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.

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Flow-X

2 Product Description

Modules

Enclosure

Modes

Security

Subject to change without notice

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

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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.

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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.

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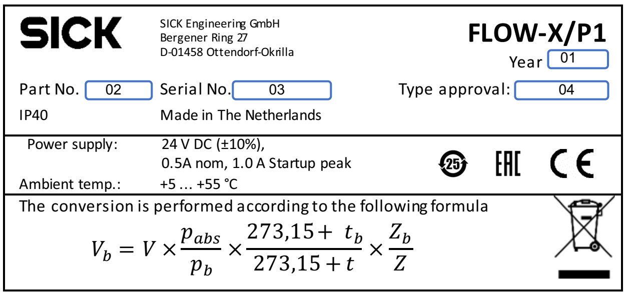
2.6 ## Type plate

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

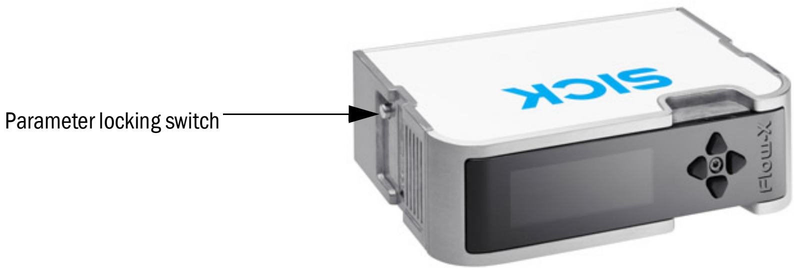
2.8.1 ### Metrological seal

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



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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

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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 'Stand-aloneGUI.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

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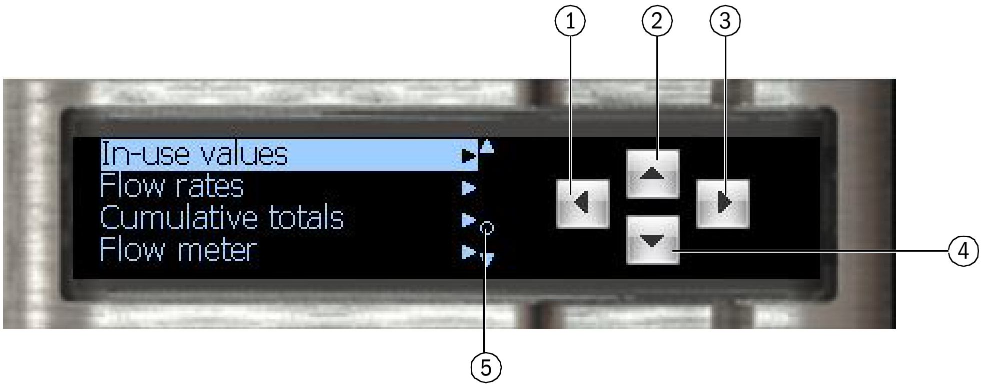
2.10.3 Flow-X/M LCD display

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.

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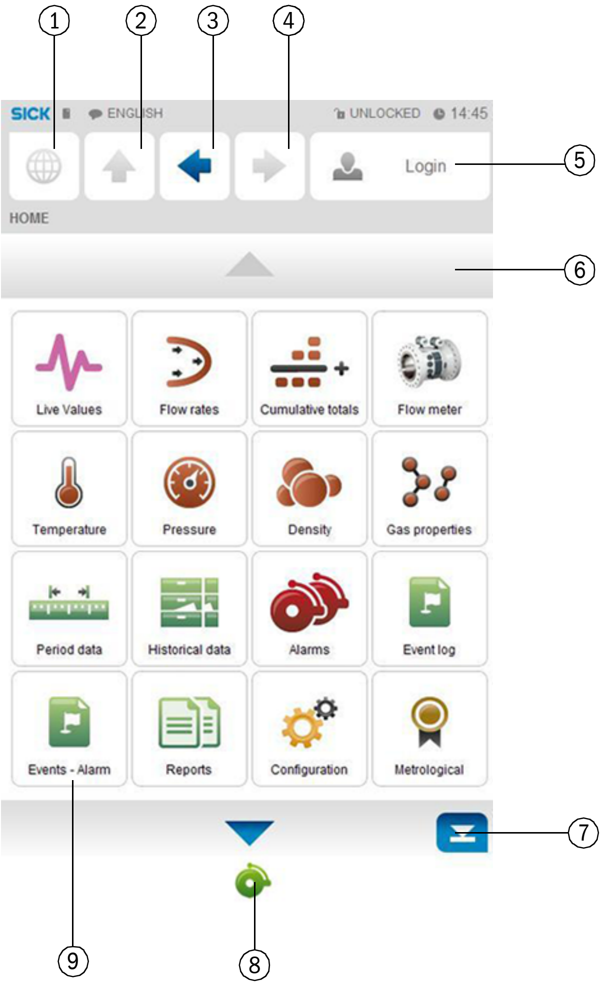
2.10.5

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

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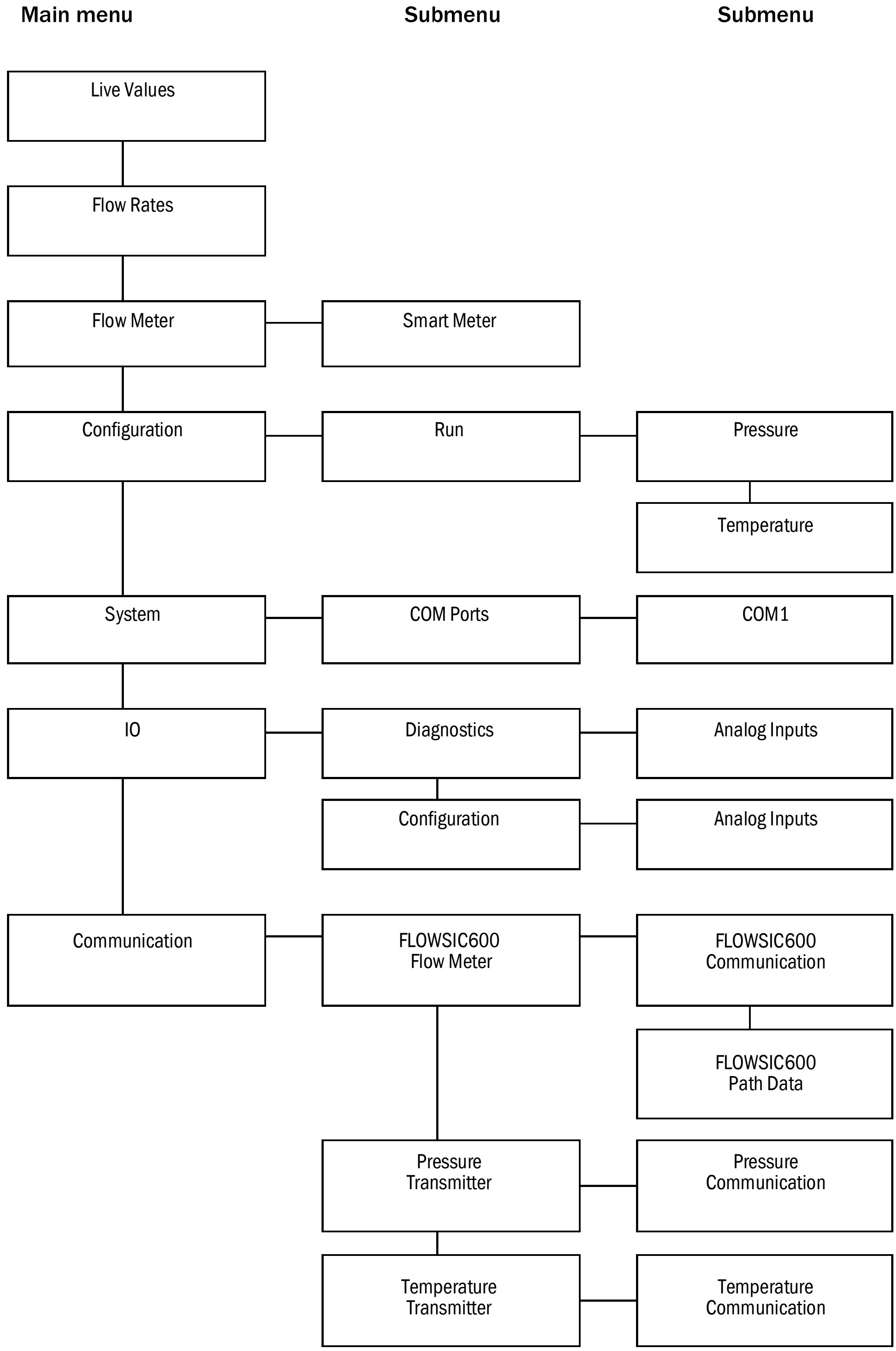
Fig. 11 Menu tree of relevant menu items of the Flow-X flow computer



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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.

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Flow-X

3 Installation

Decisions to make
Mechanical Installation
Electrical Installation

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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 §8.3 (→ page 165).

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.

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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.

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3.2 Mechanical Installation

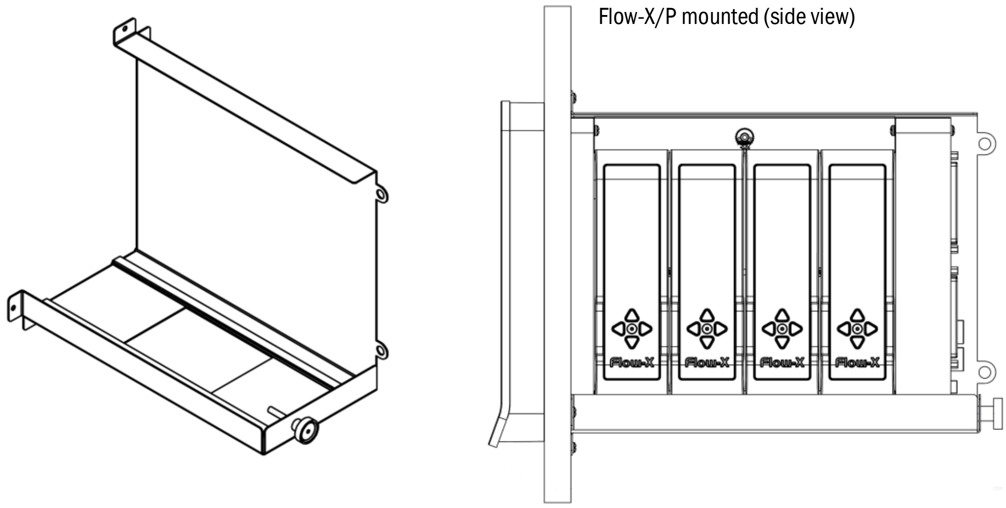
3.2.1 Introduction

This chapter describes the mechanical aspects of all enclosures. For full drawings with sizes see §8.6 (→ page 168).

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.

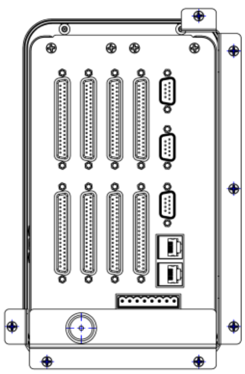
Figure 12 Flow-X/P mounting bracket



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 29) 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.

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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.

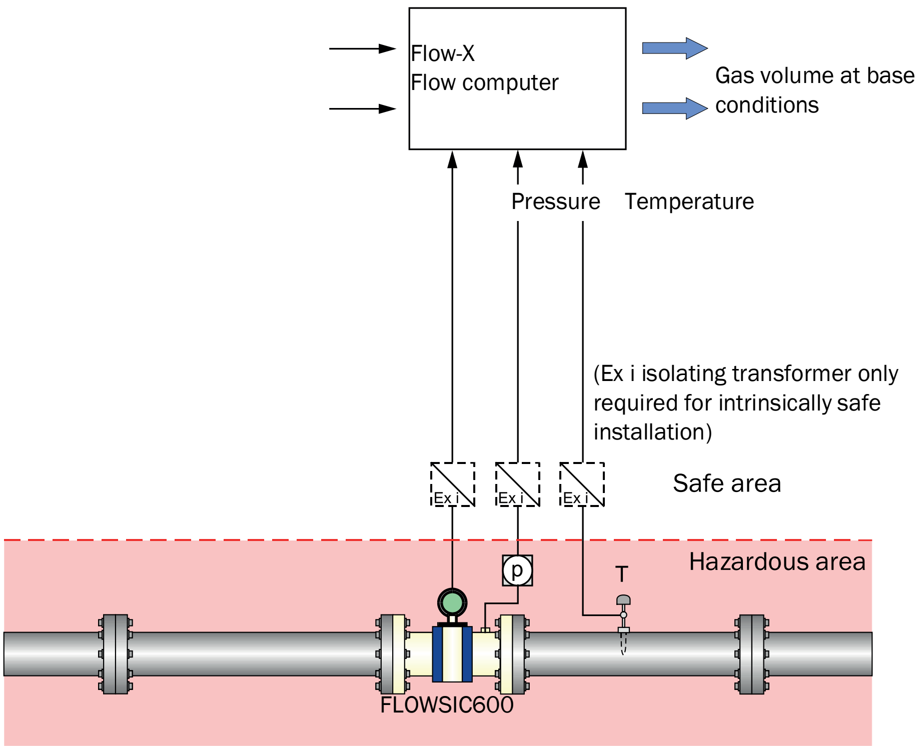
The Flow-X modules are fully configurable through software. No dipswitches or jumpers need to be set inside. There are no user-replaceable fuses or other components inside. Opening a module will void any warranty.

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



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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 mm^2 (2 x 20-18 AWG)	
Maximum cable length	300 m at 0.5 mm^2 (1600 ft for 20 AWG) 500 m at 0.75 mm^2 (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.

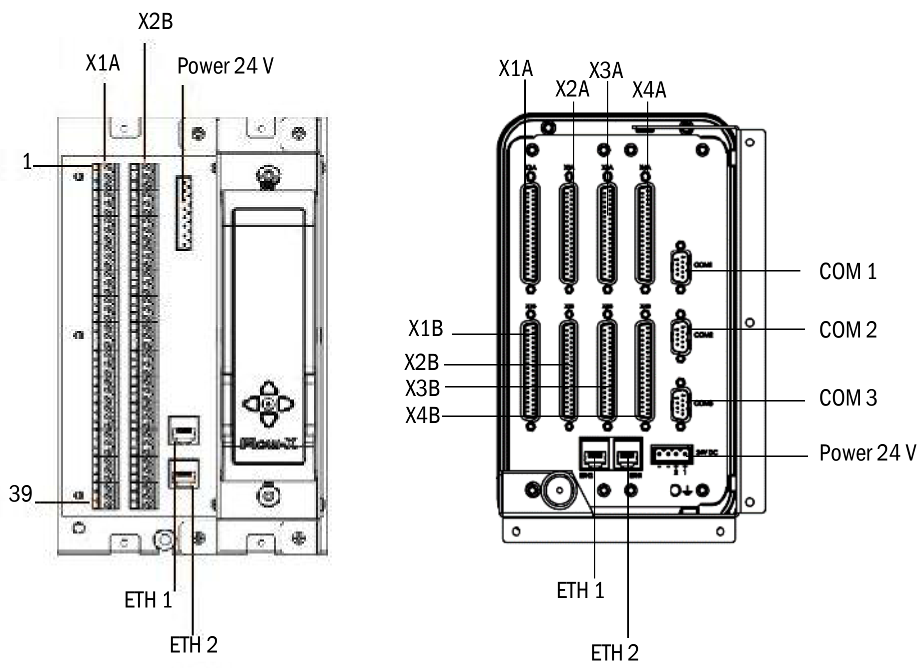
The three 9-pin D-sub connectors are the serial ports of the Display module. These ports may be used to communicate to devices such as a gas chromatograph, or a DCS. COM1 is RS232 only, COM2 and COM3 may be individually configured for RS232 or RS485.

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 31, §3.3.5
- I/O connector details → page 35, §3.3.7
- COM connector details → page 36, §3.3.8

Subject to change without notice

Fig. 15 Location of connectors



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

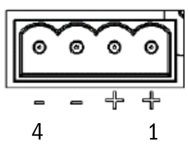


Table 2 Flow-X power terminal block

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

Subject to change without notice

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

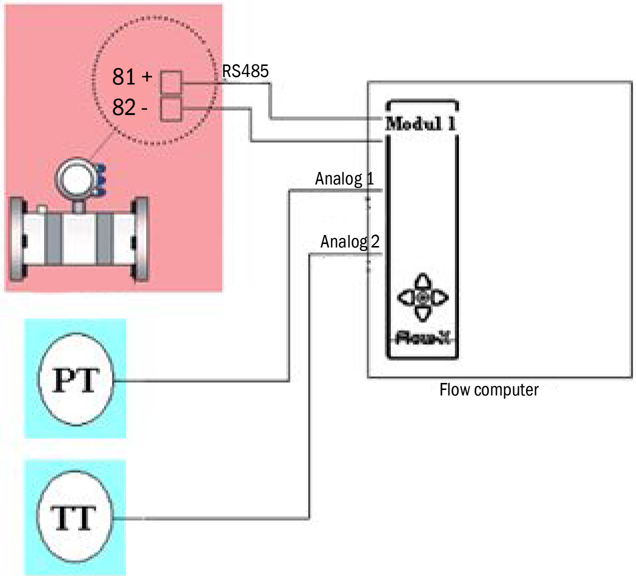
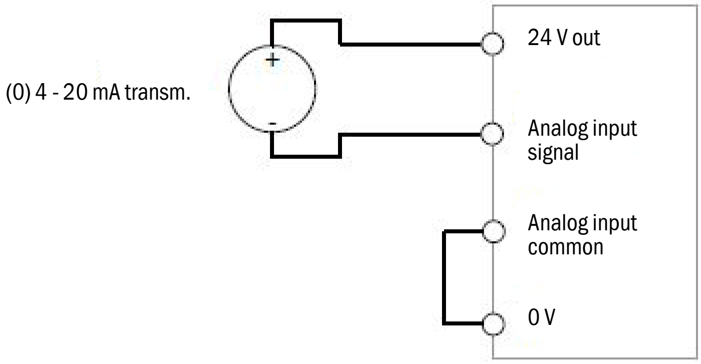


Fig. 18 General transmitter connection with internal supply 24 V



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. 27, §3.1.7.

Subject to change without notice

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

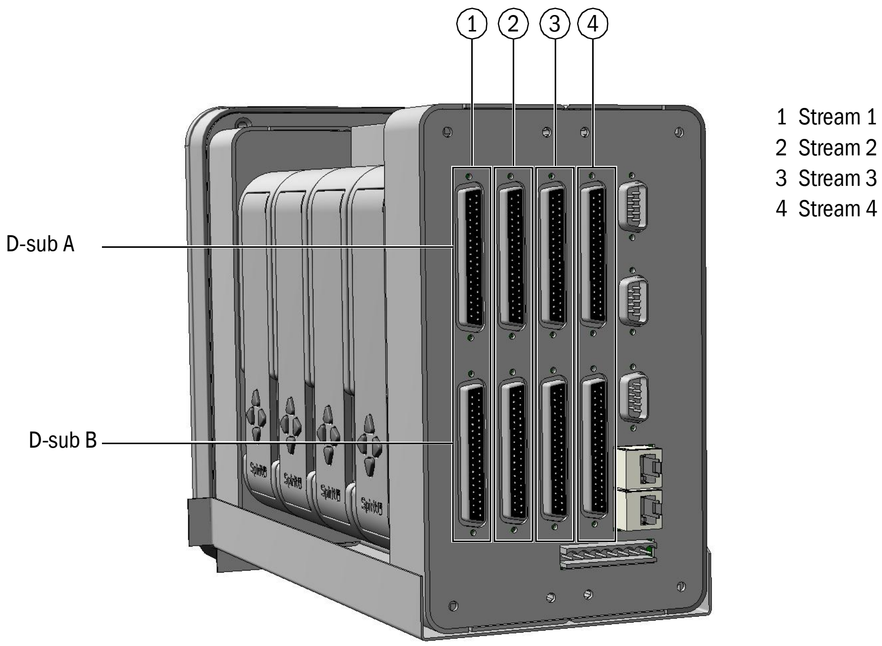


Table 3 37-pin connector (Flow-X/P)

	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

Subject to change without notice

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 trans-mitter	+	X1B	13
		-	X1B	14
24 V out	Pressure or tempera-ture transmitter		X1A	1
0 V common			X1A	2
0 V common			X1A	4

Subject to change without notice

3.3.7 37-pin D-sub connectors

The mounted connectors are female (pin schedule →page 37, Figure 20), so a connecting cable must have male connectors.

Table 5 37-pin D-sub connector A pin-out Flow-X/P

A-connector			
Pin	Function	Pin	Function
1	COM1 – | Sig+ | Tx+ [1]		
2	COM1 Tx | Sig– | Tx– [1]	20	Digital 4
3	COM1 – | – | Rx– [1]	21	0 V (Common)
4	COM1 Rx | – | Rx+ [1]	22	Digital 5
5	24 V out	23	0 V (Common)
6	Digital 1	24	Digital 6
7	0 V (Common)	25	0 V (Common)
8	Digital 2	26	Digital 7
9	0 V (Common)	27	0 V (Common)
10	Digital 3	28	Digital 8
11	0 V (Common)	29	0 V (Common)
12	Analog output 1	30	Analog output 2
13	Analog output common	31	Analog output common
14	Analog input common	32	Analog input 1
15	PRT 1 power +	33	Analog input common
16	PRT 1 signal +	34	Analog input 2
17	PRT 1 signal –	35	Analog input common
18	PRT 1 power –	36	Analog input 3
19	Analog input common	37	Analog input common

[1] RS232 | RS485 2 wire | RS485 4 wire.

Table 6 37-pin D-sub connector B pin-out Flow-X/P

B-connector			
Pin	Function	Pin	Function
1	COM2 – | Sig+ | Tx+ [1]		
2	COM2 Tx | Sig– | Tx– [1]	20	Digital 12
3	COM2 – | – | Rx– [1]	21	0 V (Common)
4	COM2 Rx | – | Rx+ [1]	22	Digital 13
5	24 V out	23	0 V (Common)
6	Digital 9	24	Digital 14
7	0 V (Common)	25	0 V (Common)
8	Digital 10	26	Digital 15
9	0 V (Common)	27	0 V (Common)
10	Digital 11	28	Digital 16
11	0 V (Common)	29	0 V (Common)
12	Analog output 3	30	Analog output 4
13	Analog output common	31	Analog output common
14	Analog output incommon	32	Analog input 4
15	PRT 2 power +	33	Analog input common
16	PRT 2 signal +	34	Analog input 5
17	PRT 2 signal -	35	Analog input common
18	PRT 2 power -	36	Analog input 6
19	Analog input common	37	Analog input common

[1] RS232 | RS485 2 wire | RS485 4 wire.

Subject to change without notice

3.3.8 Screw terminals

These connectors are used with the Flow-X/S (Single) model.

Table 7 Screw terminal A pin-out for Flow-X/S

X1A / X2A terminal strip			
Pin	Function	Pin	Function
1	24VDC out	21	Digital 9
2	0 V (Common)	22	0 V (Common)
3	Digital 1	23	Digital 10
4	0 V (Common)	24	0 V (Common)
5	Digital 2	25	Digital 11
6	0 V (Common)	26	0 V (Common)
7	Digital 3	27	Digital 12
8	0 V (Common)	28	0 V (Common)
9	Digital 4	29	Digital 13
10	0 V (Common)	30	0 V (Common)
11	Digital 5	31	Digital 14
12	0 V (Common)	32	0 V (Common)
13	Digital 6	33	Digital 15
14	0 V (Common)	34	0 V (Common)
15	Digital 7	35	Digital 16
16	0 V (Common)	36	0 V (Common)
17	Digital 8	37	24VDC out
18	0 V (Common)	38	0 V (Common)
19	24VDC out	39	24VDC out
20	0 V (Common)		

Table 8 Screw terminal B pin-out for Flow-X/S

X1B / X2B terminal strip			
PIn	Function	Pin	Function
1	PRT 1 power +	21	Analog input 6
2	PRT 1 signal +	22	Analog input common
3	PRT 1 signal -	23	Analog output 1
4	PRT 1 power -	24	Analog output common
5	Analog input common	25	Analog output 2
6	PRT 2 power +	26	Analog output common
7	PRT 2 signal +	27	Analog output 3
8	PRT 2 signal -	28	Analog output common
9	PRT 2 power -	29	Analog output 4
10	Analog input common	30	Analog output common
11	Analog input 1	31	0 V (Common)
12	Analog input common	32	COM 1 - | Sig+ | Tx+ [1]
13	Analog input 2	33	COM 1 Tx | Sig- | Tx- [1]
14	Analog input common	34	COM 1 - | - | Rx- [1]
15	Analog input 3	35	COM 1 Rx | - | Rx+ [1]
16	Analog input common	36	COM 2 - | Sig+ | Tx+ [1]
17	Analog input 4	37	COM 2 Tx | Sig- | Tx- [1]
18	Analog input common	38	COM 2 - | - | Rx- [1]
19	Analog input 5	39	COM 2 Rx | - | Rx+ [1]
20	Analog input common		

[1] RS-232 | RS-485 2 wire | RS-485 4 wire

Subject to change without notice

3.3.9 9-pin D-sub connectors (serial communication)

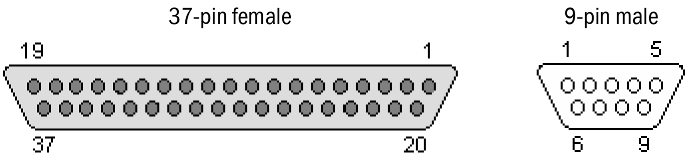
These connectors are only available on the Flow-X/P model. They connect to the three serial COM ports of the display module. The connectors on the Flow-X/P are male (→ Figure 20). A connecting cable must have a female connector.

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

Table 9 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



3.3.10 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.

Subject to change without notice

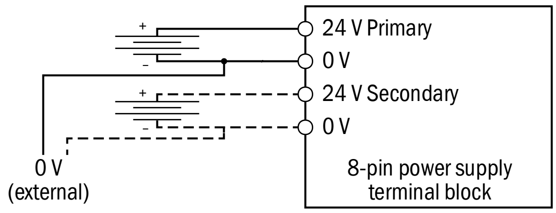
3.4 Connection diagrams

3.4.1 Ground wiring

The SICK Flow-X flow computer uses the following separate ground connections:

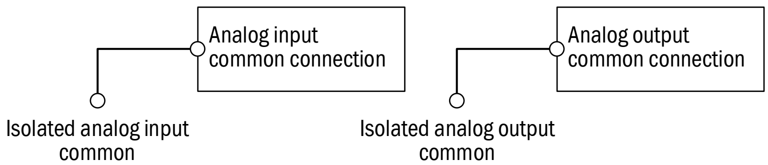
- one common ground for the power supply and the digital signals ("0 V")
- one isolated common ground for the analog inputs ("Analog input common")
- one isolated common ground for the analog outputs ("Analog output common")
- chassis ground (through the chassis grounding screw)

Figure 21 Flow-X power supply ground wiring



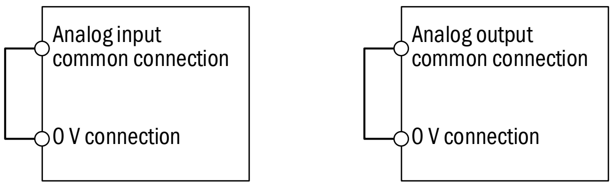
The separate common ground for analog inputs and analog outputs accommodate for applications with isolated (floating) analog signals.

Figure 22 Isolated analog signal ground



If no isolated analog signal ground is available, then the analog input and/or output common ground must be connected to the common ground (0 V).

Figure 23 Common analog signal ground



3.4.2 Fuses

Each analog and digital I/O channel is protected for over-voltage and over-current by a polyfuse that resets automatically a few seconds after the fault situation has cleared.

The 24 V DC power supply is protected by a polyfuse as well, which is rated I_{max} 2.2 A and V_{max} 30 V DC.

Subject to change without notice

3.4.3 Digital signals

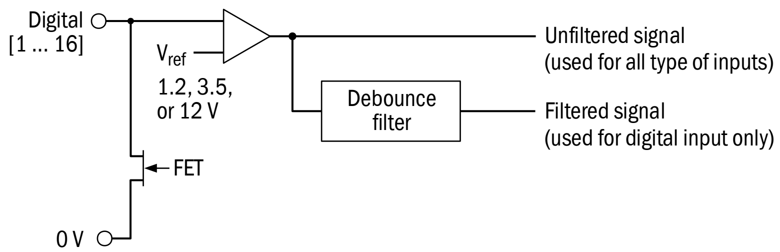
Each Flow-X/M module provides 16 general-purpose digital channels that are all sampled and processed at 10 MHz.

Each channel can be individually and independently configured as one of the following type of digital I/O:

- Digital input
- Digital output
- Pulse input
- Time period input (typically used for densitometers)
- Pulse output (for driving electro-mechanical counters)
- Detector input (for meter proving)
- Prover bus output (to support separate prover flow computers)

The following schematic illustrates the electrical circuit as used for each digital signal:

Figure 24 Digital channel circuit



Each digital channel has two field terminals, one terminal for the signal itself and one ground terminal. The ground terminal is only to be used when required by the application. All ground terminals are internally connected to the main power return terminal.

Each digital input channel supports two threshold levels for signal activation.

For digital channels 1 through 8 the threshold level is selectable between 1.25 V and 12 V and for channels 9 through 16 between 3.75 V and 12 V. The default is 12 V for all 16 channels.

An 8 ms debounce filter is used to filter on digital status input signals, such as valve positions. Both the unfiltered and filtered signals are available in the software.

The FET is used for output signals and connects the input signal to the common ground. When the channel is configured as an input, the FET will be left in the open state permanently.

Subject to change without notice

3.4.4 **Digital inputs**

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

Each of the 16 digital channels of a Flow-X/M flow module can be configured to operate as a digital input.

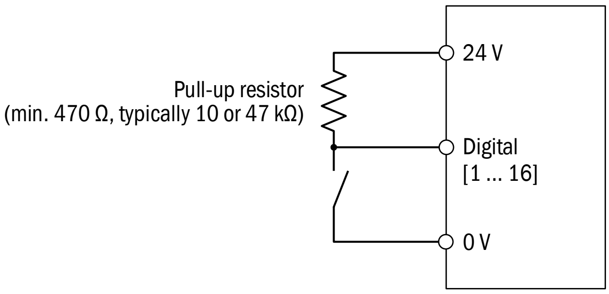
Digital inputs are sampled at 20 MHz, so all 16 channels can be used for fast signals such as prover detector switches.

The digital input signal is sampled both unfiltered and with an 8 ms debounce period, which effectively ignores any state changes shorter than 8 ms.

The digital input circuit can be either externally or internally powered.

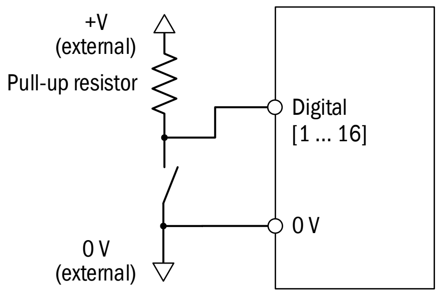
Because the digital inputs are floating, an external pull-up resistor is required if the loop is internally powered.

Figure 25 Internally powered digital input



When externally powered, the external source should have a connection to the common ground of the SICK Flow-X flow computer (“0 V”). Only when this is not already arranged externally, an additional connection is required as shown in the following figure. Also a pull-up resistor may be required depending on the application.

Figure 26 Externally powered digital input



Subject to change without notice

3.4.5 Pulse inputs

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

Each digital channel can be configured as a pulse input. Depending on the type of pulse signal a single- or dual pulse input will be allowed for each flow module. Each flow module supports one pulse input.(single or dual).

To accommodate for different type of pre-amplifiers each pulse input channel supports two threshold levels for signal activation. For channels 1 ... 8 the threshold level is selectable between 1.25 V and 12 V and for channels 9 ... 16 between 3.75 V and 12 V. The default is 12 V for all 16 channels.

Both single and dual pulse inputs are supported. In dual pulse mode, ISO 6651 pulse integrity checking at level B is always enabled. Level A support (correction) may optionally also be enabled.

It is common practice to use pre-amplifiers to condition signal level from the meter pickup-coils. The following figures illustrate typical wiring when using pre-amplifiers.

Figure 27 Pre-amplifier with open-collector output

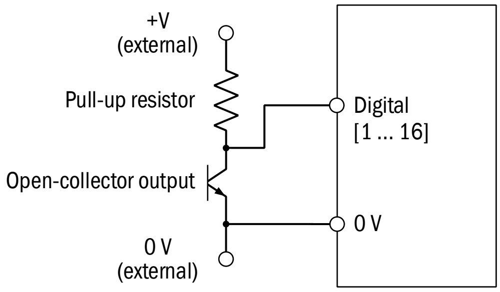
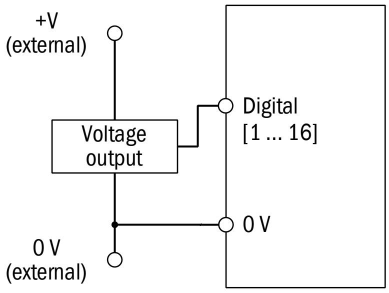


Figure 28 Pre-amplifier with voltage output



Subject to change without notice

3.4.6 **Digital outputs**

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

Each digital channel can be configured to operate as a digital output in which case it acts as an open collector. When the digital output is activated, the digital signal is connected to the flow computer common ground.

Figure 29 Internally powered digital output

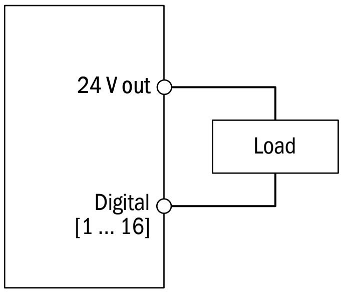
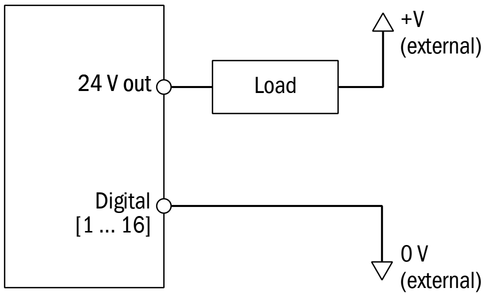
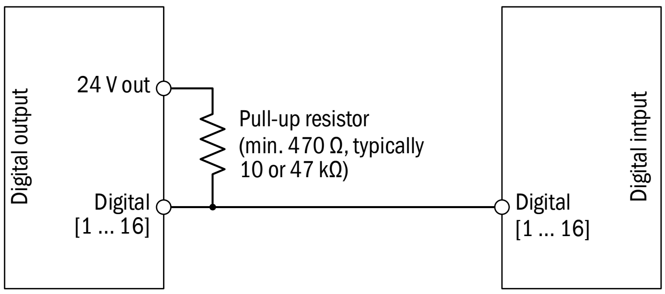


Figure 30 Externally powered digital output



To connect a digital output of one SICK Flow-X flow computer to a digital input of another SICK Flow-X flow computer an external resistor is required.

Figure 31 Connecting a digital output to a digital input



Subject to change without notice

3.4.7 Pulse outputs

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

Each flow module has pulse outputs available. These outputs can be used to increase external flow counters. The complete definition can be done by the Flow-Xpress configuration software.

3.4.8 Prover bus outputs

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

Each flow module has a prover bus output. The prover bus output can be configured using the Flow-Xpress configuration software.

3.4.9 Analog signals

3.4.10 Analog inputs

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

Each flow module provides 6 analog inputs. Each analog input is software configurable as 4 ... 20 mA, 0 ... 20 mA, 1 ... 5 Volt, or 0 ... 5 Volt input.

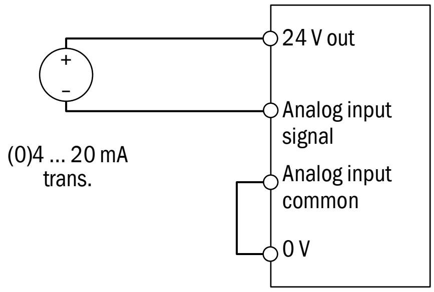
For each flow module the first 4 analog inputs can also be used as HART inputs.

The analog input circuits are floating in relation to the other type of I/O, with a single common ground shared between the analog inputs of the same flow module.

When the analog input channel is used as a mA input, the internal resistor of 250 Ω is activated.

When the loop is internally powered through one of the several “24 V DC out” terminals of the Flow-X flow computer, the common analog input ground must be referenced to the same reference ground as the power supply as shown below.

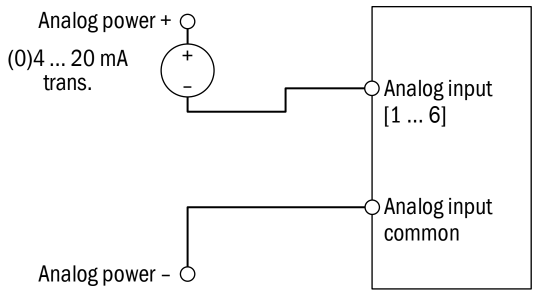
Figure 32 Internally powered mA input



Subject to change without notice

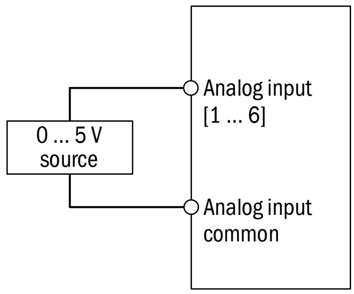
When the mA loop is externally powered then the grounding method depends on whether the application uses an isolated power supply and isolated grounding for analog inputs, refer to section “Ground wiring”.

Figure 33 Externally powered mA input



When the analog input is configured for measuring 0 to 5 V DC or 1 to 5 V DC the internal resistor is disconnected and the voltage differential between the analog input terminal and common analog input ground is measured.

Figure 34 V DC input

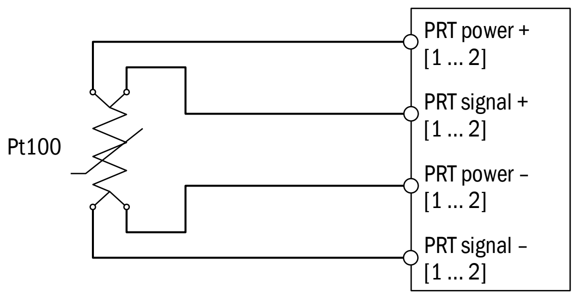


3.4.11 Pt100 input

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

Each Flow-X/M flow module provides two Pt100 inputs.

Figure 35 Pt100 input



Subject to change without notice

3.4.12 HART inputs

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

The first 4 analog input circuits of each Flow-X/M flow module have an on-board HART modem to facilitate HART communication.

The Flow-X flow computer uses an internal 250 Ω resistor for its analog inputs, which is adequate for HART communication.

The flow computer supports both a single HART transmitter and multiple HART transmitter per loop.

If of a single HART device in the loop, the 4 ... 20 mA signal is measured in parallel and available in the software.

Figure 36 HART loop (single transmitter)

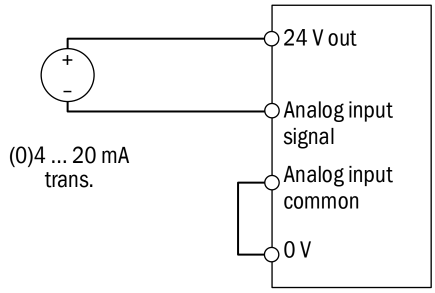
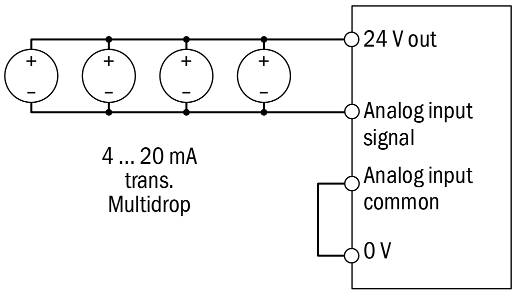


Figure 37 HART loop (multi-drop)



> In systems with HART inputs where a separate external analog input common is used, it is required to connect the analog input common and the 0 V with a 50 µF capacitor in-between.

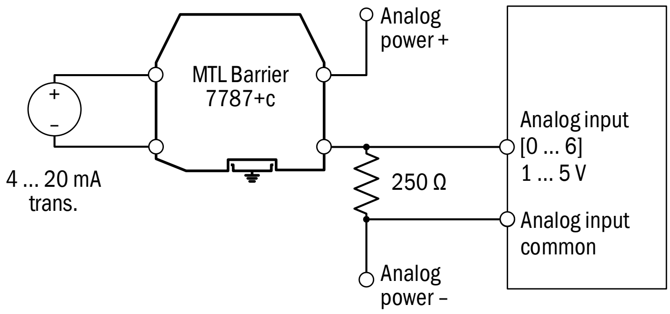
Subject to change without notice

3.4.13 Barriers

When devices are located in a hazardous area, safety barriers are required. For analog inputs, selected MTL Barriers have been tested with Flow-X/M. Other brands may work as well, but a test is recommended. Below schematics provide application examples that have been proved to function.

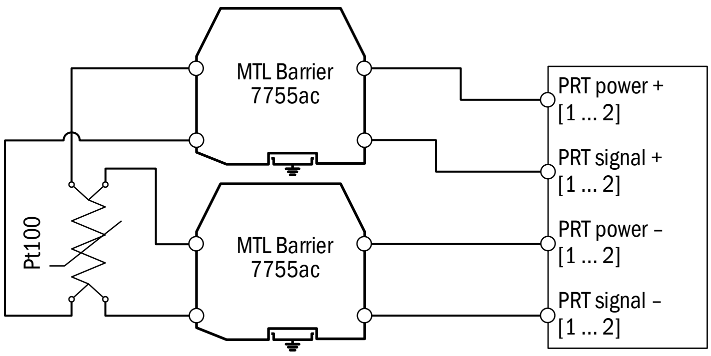
In all cases, refer to the barrier and device documentation to ensure proper application of barrier and field wiring.

Figure 38 Analog 4 ... 20 mA transmitter with barrier



Above figure shows a 4 ... 20 mA transmitter, externally powered. The barrier is MTL, type 7787+. The Flow-X/M is configured as 1 ... 5 V input, requiring an external precision resistor of 250 Ω to convert the 4 ... 20 mA into 1 ... 5 V. If the flow computer is configured as 4 ... 20 mA, the resistor must be omitted.

Figure 39 Pt100 with barrier



The above figure shows a 4-wire PRT-application with 2 MTL 7755ac barriers.

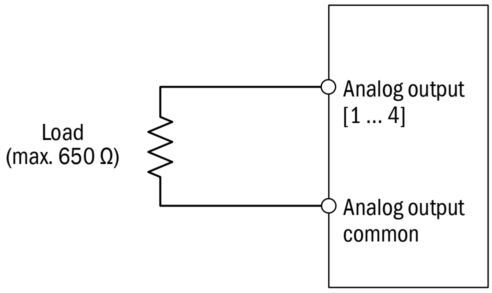
Subject to change without notice

3.4.14 Analog outputs

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

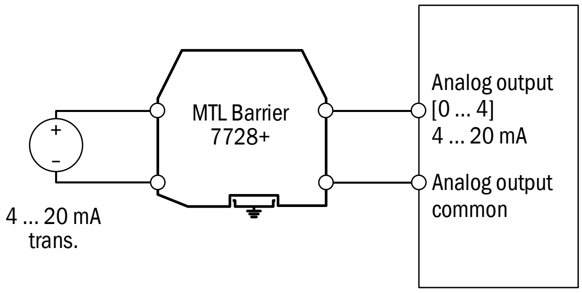
The 4 ... 20 mA analog output circuits are floating in relation to the other type of I/O, with a single common ground shared between the analog outputs of the same flow module.

Figure 40 Analog output



Below figure shows a 4 ... 20 mA control in a hazardous area, separated from the safe area by an MTL barrier type 7728+.

Figure 41 Analog 4 ... 20 mA control with barrier



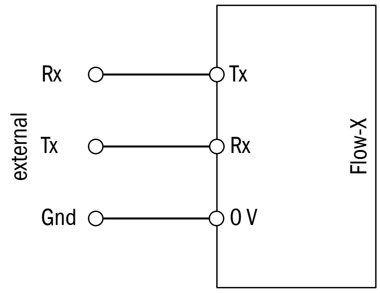
Subject to change without notice

3.5 Serial interfaces

Each Flow-X/M flow module provides 2 serial ports. Furthermore the Flow-X/P provides an additional 3 serial ports. Each serial port is capable of either RS232 or RS485 communications, with the exception of COM1 of the Flow-X/P display module which is RS232RS232 only.

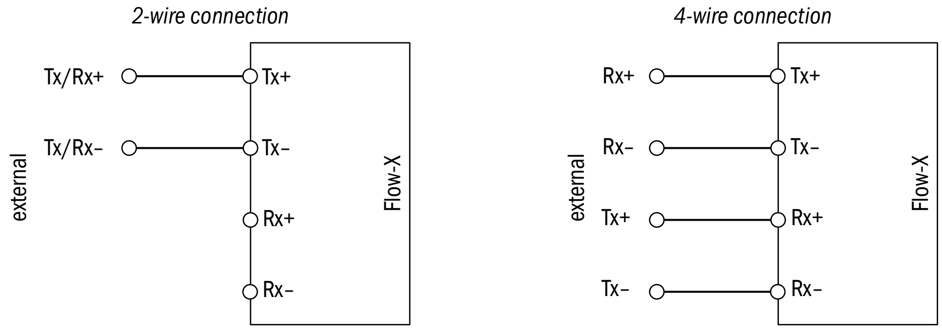
For RS232 communications 3 terminals are used: Tx, Rx and 0 V. Hardware Flow control is not supported (except for COM1 of the Flow-X/P display module which does support flow control).

Figure 42 RS232 connection



For RS485 communications both half-duplex (2-wire) and full-duplex (4-wire) modes are supported.

Figure 43 RS485 connections



For a *2-wire* RS485 connection, the Tx+ and Tx– terminals must be connected, while the Rx+ and Rx– terminals may remain unconnected (no need for jumpers).

RS485 connections need terminating resistors to reduce voltage reflections that can cause the receiver to misread the logic level.

Subject to change without notice

Flow-X

4 Commissioning

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

Subject to change without notice

4.1 Device settings

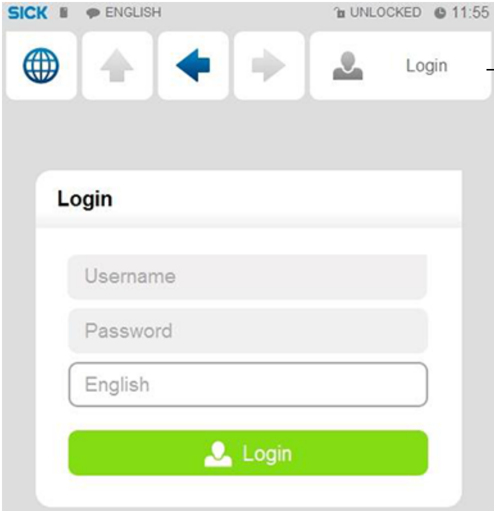
Device settings can be changed via the touchscreen of the Flow-X flow computer, the integrated web server of the Flow-X flow computer or the integrated screen of the module used.

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. 44 "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. 45 "Login" menu of the module screen

Subject to change without notice

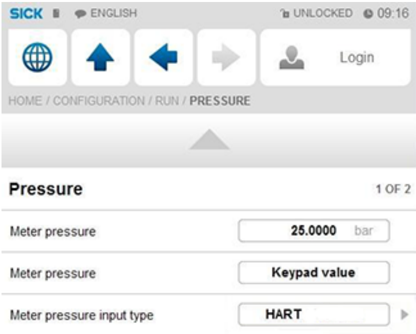
4.2 Connecting devices with HART protocol

► 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".

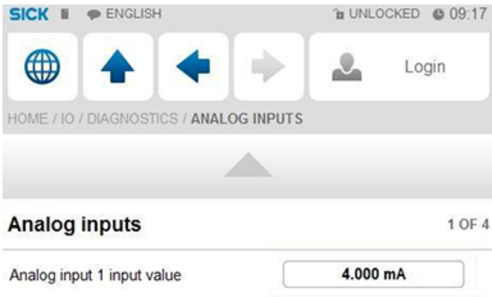
Fig. 46 Configuration/Run/Pressure



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

> +i Please note: Minor deviations are possible.

Fig. 47 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.

> +i Please note: Minor deviations are possible.

Subject to change without notice

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".

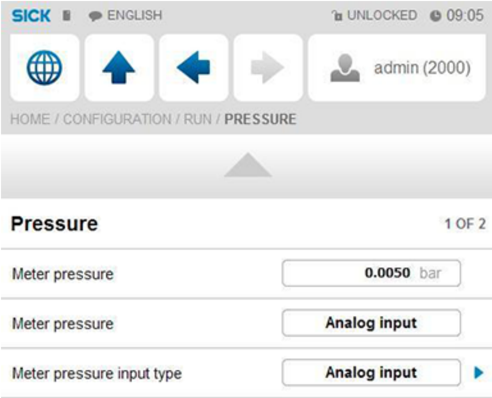


Fig. 48 Configuration/Run/Pressure

3 Go to IO/Diagnostics/Analog inputs.

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

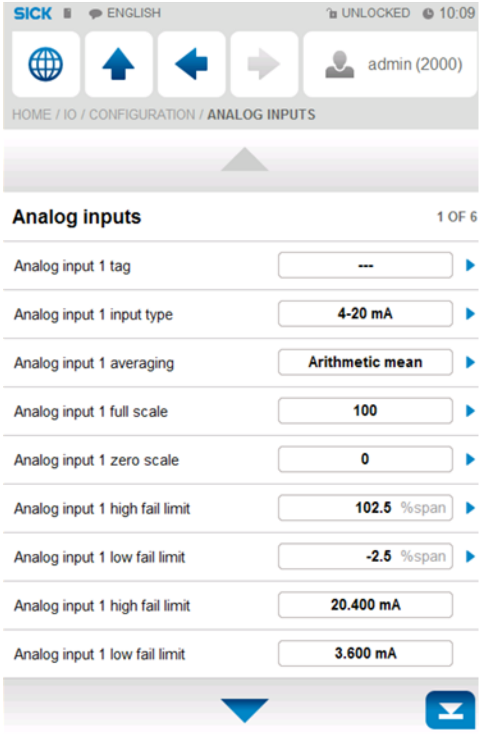
Check whether these are error values defined by the device and check the function of the transmitter if this is not the case.

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.

Subject to change without notice

Fig. 49 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.

Subject to change without notice

4.4 Device configuration and connection check

4.4.1 FLOWSIC600

Checking the communication status

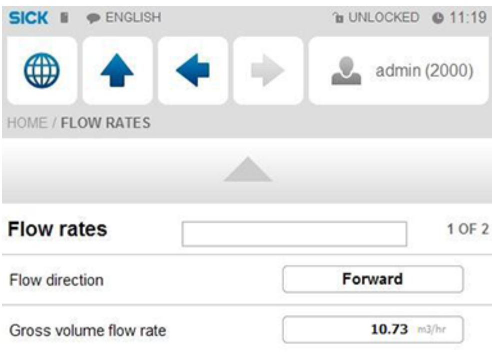
1. Go to Communication/FLOWSIC600 Flow meter/FLOWSIC600 Communication.
2. Check the "Communication status“:
   When the "Communication Status" is set to "OK", the correct device ID has already been set on the flow computer.

Fig. 50 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.

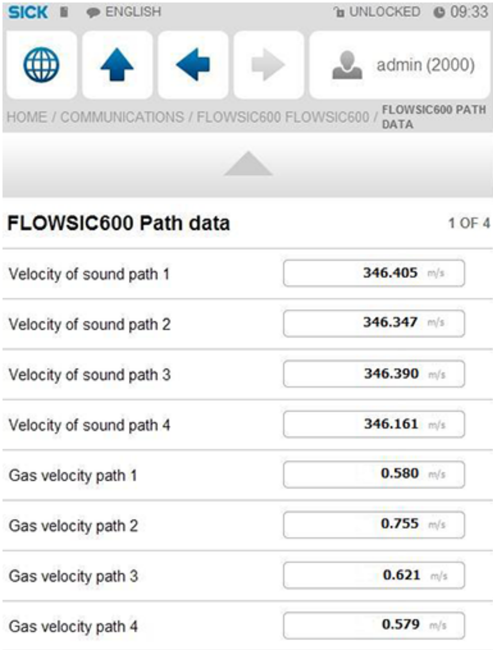
Fig. 51 Menu "Flow rates"



Subject to change without notice

6 Go to Communication/Flowsic600 Flow Meter/Flowsic600 Path Data.
7 Check whether there are data on the individual paths.

Fig. 52 Communication/Flowsic600 Flow meter/FLOWSIC600 Path data

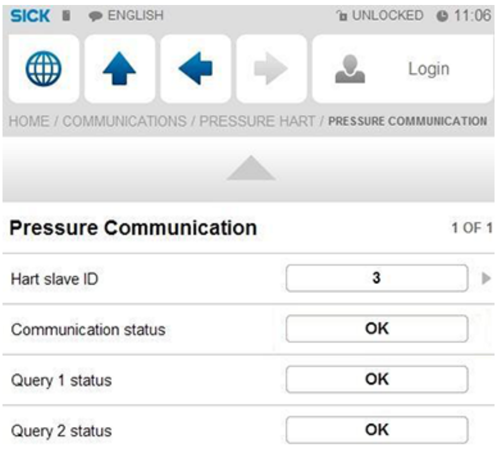


4.4.2 Pressure transmitter

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. 53 Communication/Pressure Hart/ Pressure Communication



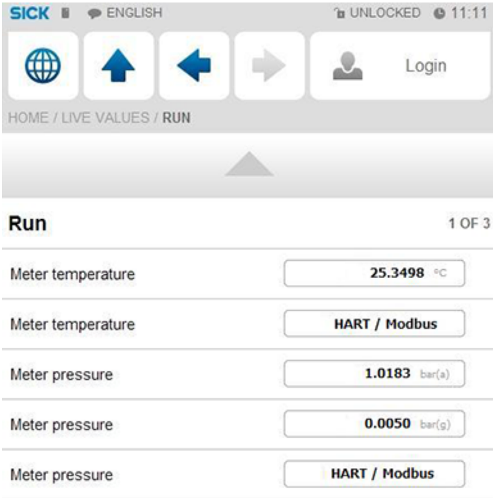
Changing the device ID

1 Go to Communication/Pressure Transmitter/Pressure Communication.
2 Change the "HART slave ID" to the device ID set in the device.

Subject to change without notice

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. 54 Menu "Live Values/Run"



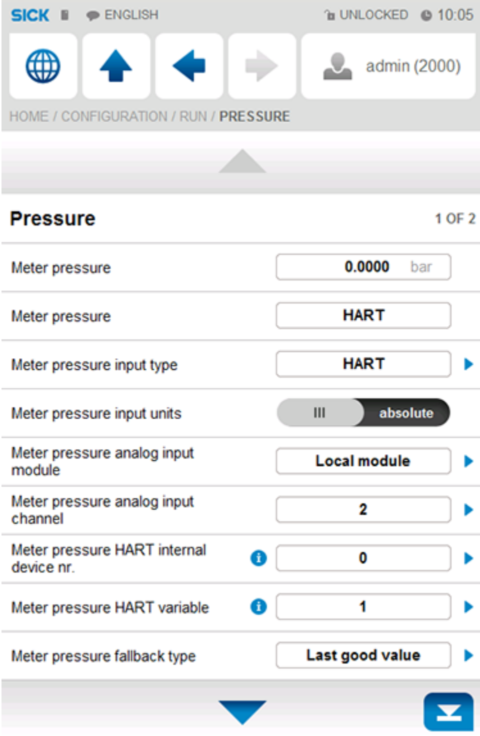
Changing the measuring mode

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.

Subject to change without notice

Fig. 55 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".

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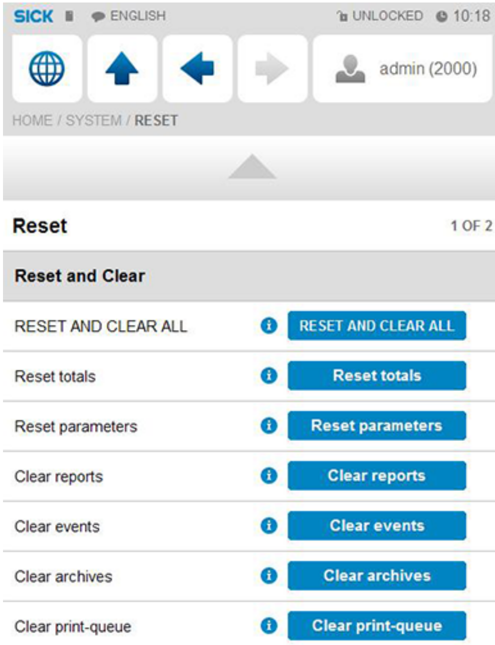
4.4.5 **Clearing log files and reports**

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. 56 System/Reset



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Flow-X

5 Advanced Commissioning

Subject to change without notice

5.1 Flow-Xpress software

5.1.1 Flow-Xpress scope and versions

Flow-Xpress is the software package to configure and engineer SICK Flow-X software applications. There are two editions of Flow-Xpress:

- *Standard edition:* for flow computer configuration and engineering.
- *Professional Edition:* with which template applications can be fully developed using our advanced spreadsheet environment.

Figure 57 FlowXpress configuration software

A Flow-X module or set of modules are configured from a laptop or computer simply via the Ethernet interface. Configurations can be uploaded or downloaded to or from the flow computer.

Flow-Xpress offers software configuration where step-by-step a flow computer configuration is made using an Explorer-like tree. At this user level simple check-boxes and straight-forward data entry fields are offered to the user.

After all applicable choices/selections have been made the flow computer configuration can be written to the connected flow computer with a single mouse-click.

With each flow computer we ship a DVD with various, ready-to-run & metrology approved templates for oil and gas applications, thus, a user is able to select the required application for his or her needs.

In addition to this standard level of configuration software operation we offer additionally a Professional Edition, containing its spreadsheet environment in which maximum flexibility is offered for demanding end-users or System Integrators.

The configuration of the flow computer can be directly edited in the spreadsheet environment of the Professional Edition so that fully-user definable applications can be developed.

A flow computer application can be checked and tested in a spreadsheet, compared directly with alternative flow calculation programs, tested off-line and, most importantly, even on-line.

A further advantage of the Professional Edition is that - even without a connected flow computer - the software offers a powerful and rich environment for flow calculations in a spreadsheet with more functionality than many commercially available flow calculation software packages.

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Our standard edition is shipped with each flow computer; the Professional Edition is only available for end-users and System Integrators who have successfully followed our dedicated training program.

Note: The spreadsheet based “templates” can be seen as the firmware of our flow computer. “Firmware” is the term used for the software at traditional flow computers. Since the user can freely modify these Flow-X templates for a fit-for-purpose approach, tailor-made firmware can be created

5.2 Software installation

This chapter describes how to install the FlowX-press configuration software to your computer.

> You will need administrator rights in order to install. Refer to your system administrator if you are not sure you have these rights on the account you use.

5.2.1 System requirements

- Microsoft Windows 7 or higher
- Microsoft Excel Excel 2007 SP2 or higher

5.2.2 Installation procedure

A product CD containing the software is included with the SICK Flow-X flow computer when it is delivered.

1. Insert the product CD into your CD-ROM drive to install the software.
2. Start the file “Flow-Xpress_Setup.exe” to install the software
3. Follow the instructions from there.

   If autostart is disabled on your system, use Explorer to navigate to your CD-drive and start setup.exe.

After installation, you will need to get a license from SICK based on the unique Machine ID that your computer will provide, in order to use the configuration software. Depending on your license you may be able to run Flow-Xpress in Basic mode or also in “Professional” mode.

5.2.3 Software de-installation

Software de-installation is through the Windows Add/remove programs option.

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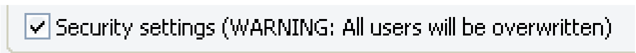
5.2.4 Flow-Xpress Basic mode

After an application file has been opened or read from a device the following options appear:

Device Setup	Defines the type of flow computer and the number of modules. For custom-made applications, which contain more than one template, also the actual application running in each module can be defined.
Ports & Devices	Defines the communication devices and printers that are connected to the flow computer.
Settings	Overall date/time, display and security settings.
Displays	Shows all the operating displays including the menu structure. Existing displays may be modified and new displays may be added.
Languages	Defines the actual translation tables. The native language of the standard applications is English. Additional languages may be added and can then be selected on the local flow computer and on the web display.
Parameters	Shows all the parameters (i.e. configuration settings or constants) that are part of the loaded application and that will be modifiable on the local flow computer display and web display. The actual values as stored in the loaded application are shown. These may be different from the actual values as used by each flow computer. To change a parameter value in the flow computer you can do any of the following: **1** Modify the parameter value directly on the flow computer display **2** Enter the Flow-Xpress Online mode and change the parameter accordingly **3** Change the value in the loaded application and write the application to the flow computer with the option to overwrite the parameters enabled. Note that this will *overwrite all parameter values* in the flow computer. 
Reports	Shows the actual reports part of the loaded application. Modifications to existing and addition of new reports as well as assignment of printers and definition of report retention (archiving) periods.
Security	Shows the users part of the loaded application. Users may be added and deleted, provided that you have appropriate log-on level. The actual users as stored in the loaded application are shown. These may be different from the actual as known by each flow computer. To change security settings you can do any of the following: **1** Enter the Flow-Xpress Online mode and make the changes accordingly. **2** Change the user in the loaded application and write the application to the flow computer with the option to overwrite the security settings enabled. Note that this will *overwrite all security settings* in the flow computer. 
Calculations	Contains the user-defined calculations.
Alarming	Defines overall alarm settings including the colors used on the displays for the different alarm states.
Versions	Allows for version control of the applications and shows the revision history of the loaded application.

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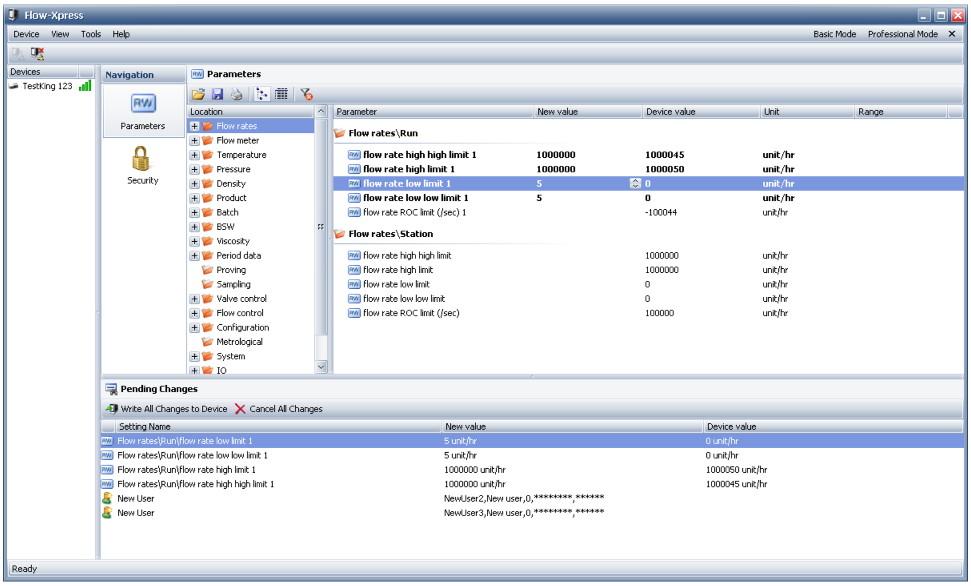
5.2.5 Flow-Xpress Online mode

The Flow-Xpress Online mode allows for modification to the flow computer parameter values and security settings on-the-fly, so without the necessity to write an application or reboot the flow computer.

The Online mode also allows modification of the security settings for multiple devices simultaneously. To do this, select multiple flow computers in the “Read configuration from Flow Computer” screen.

Figure 58 Flow-Xpress Online mode



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5.2.6 Flow-Xpress “Professional” mode

Flow-Xpress “Professional” mode provides full access to all the functions and features.

> +i Flow-Xpress “Professional” mode requires the “Flow-Xpress Professional” license.

Flow-Xpress “Professional” mode provides additional capabilities and functions such as:

- define new applications consisting of one or more templates
- access to the worksheets that contain all the application-specific functionality
- modify, add and delete worksheets
- debug flow computers on-line, i.e. looking into all the details inside the flow computer
- define units en enumerations
- define historical data archives

The following functions are additional to the Flow-Xpress Basic mode

Sheets & Templates	Structures the worksheets in templates.
Historical Data	Defines the historical data archives.
Units	Defines the units that can be used for the displays and reports and the conversions between units.
Enumerations	Defines the enumerations. E.g. .consider the enumeration for the failure status: 0: OK 1: Fail for a tag that uses this enumeration and that has the value 1, the text “Fail” will appear on the display and report. Enumeration texts are also translated when defined in section “Languages”.

5.2.7 Setup

The flow modules are configured through the Flow-Xpress software. This software may be run in “Basic” mode, or, depending on your license, in “Professional” mode.

Table 10 Requirements for the use of Flow-Xpress

Aspect	Requirement
Operating system	Windows 7 or higher
Additional software	Excel 2010 or higher, language version English
Connection	Standard Ethernet connection with RJ45 connector, capable of 100baseT (100Mbit)
Hardware	CD-player for software installation only (local or shared from another computer)

If you want to connect a laptop or desktop PC directly to your Flow-X model (→ Figure 59), you will need an ethernet cross cable (CAT 5), available from any computer store. If you use a network hub or switch (→ Figure 60), you may use standard Ethernet cables (CAT 5).

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Figure 59 Direct Ethernet connection without switch

Figure 60 Ethernet connection with switch

RJ45 cables

If you want to fabricate your cables yourself, please use the following information:

Table 11 Ethernet RJ45 straight cable pin-out

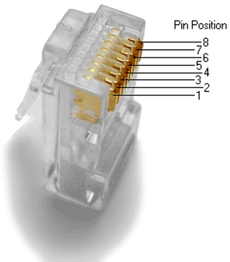
Ethernet Standard Cable (EIQ/TIA-568B)			
Connector A		Connector B	
Pin	Colour	Pin	Colour
1	White/Orange	1	White/Orange
2	Orange	2	Orange
3	White/Green	3	White/Green
4	Blue	4	Blue
5	White/Blue	5	White/Blue
6	Green	6	Green
7	White/Brown	7	White/Brown
8	Brown	8	Brown

Table 12 Ethernet RJ45 cross cable pin-out

Ethernet Cross Cable (EIQ/TIA-568A and B)			
Connector A		Connector B	
Pin	Colour	Pin	Colour
1	White/Orange	1	White/Green
2	Orange	2	Green
3	White/Green	3	White/Orange
4	Blue	4	Blue
5	White/Blue	5	White/Blue
6	Green	6	Orange
7	White/Brown	7	White/Brown
8	Brown	8	Brown

Subject to change without notice

Figure 61 Pin Position



5.2.8 Configuration Sheet

The SICK Flow-X has the following capabilities:

- Supports both single meter runs and meter stations consisting of several meter runs.
- Support of SICK ultrasonic gas flow meters
- Supports output of flow rate / total through analog, HART or Modbus signal
- Analog, HART and Modbus options for live inputs
- Last good, keypad and fallback options for failing input signals
- Automatic switching from HART to analog signal in case of HART failure
- Automatic use of backup signal for installations with an additional pulse output
- Data valid input (in combination with a pulse input)
- One or two gas chromatographs both on stream and station level
- Meter body correction for pressure and temperature
- Remote gas composition through Modbus both on stream and station level
- Process inputs for density, base density and specific gravity
- Selectable meter factor and meter K-factor interpolation curves (12 points)
- Hourly and daily totals and averages of in-use as well as input data
- Additional 2 freely definable periods for totals and averages
- Several compressibility algorithms for line and base conditions: AGA-8, ISO-6976, SGERG, NX-19 and GPA-2172
- Built-in support for SICK ultrasonic flow meters and turbine meters
- Built-in support for ABB, Siemens, Yamatake and Daniel gas chromatographs
- User-definable HART and Modbus interface to any other type of flow meter and gas chromatograph
- AGA-10 for velocity of sound verification
- Cross-module I/O sharing
- Indication of total rollover on reports
- Indication of input override / failure on reports
- Diagnostic display for SICK ultrasonic gas flow meters
- Station functionality
- Forward and reverse totalizers and averages
- Maintenance totalizers
- Accountable/non-accountable totalizers
- Remote station functionality

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5.3 Flow-X applications

A SICK Flow-X flow computer is loaded with a SICK software application that is loaded by all the flow modules and also by the panel module. The software application consists of 1 or more application templates and optionally 1 or more communication drivers.

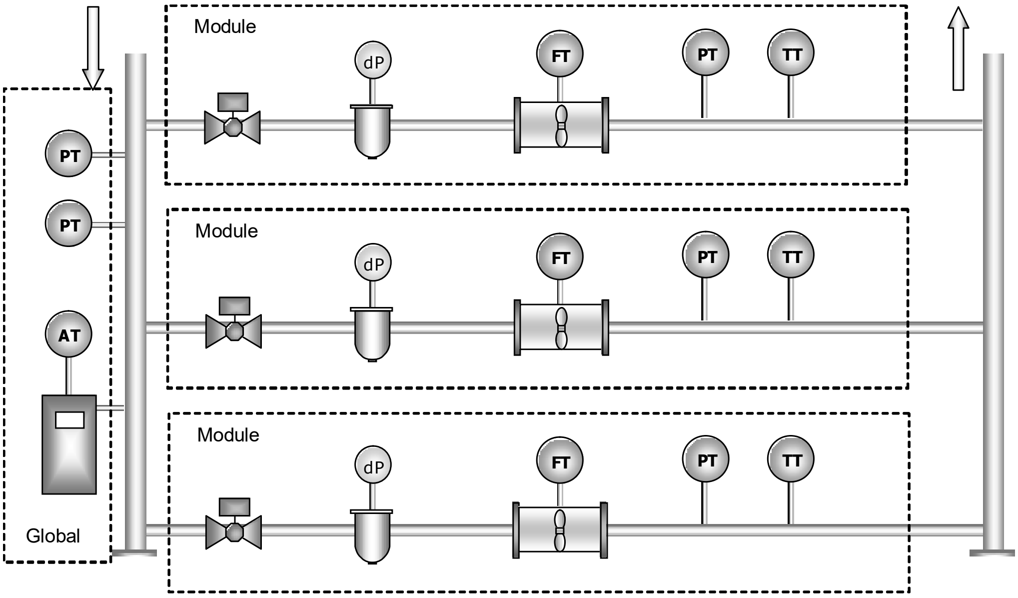
- An *application template* contains all the calculations, logic, display and reports for a typical application, e.g. a gas metering system.
- A *communication device* defines the communication interface for one particular communication device, e.g. an ultrasonic flow meter or a gas chromatograph. Both application and communication templates may have their own displays.

5.3.1 Application templates

Each Flow-X/M flow module processes one application template, where each template covers one meter run. Modules part of the same flow computer may process the same application template or different templates.

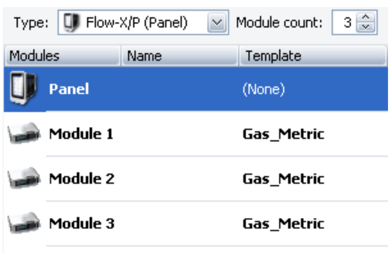
Consider the following example: a flow metering skid consisting of 3 meter runs and an inlet header with common process equipment (e.g. a densitometer or a gas chromatograph).

Figure 62 Typical gas metering station



The assignment the application template ("Gas_Metric" in this example) would be as follows in case of a Flow-X/P3.

Figure 63 Flow-X/P template assignment



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5.3.2 Communication devices

Communication templates are used to setup communication between the flow computer and external devices.

The Flow computer is able to communicate with any device that supports the HART and/or the Modbus protocol.

For each type of communication device (HART, Modbus and others) a separate communication template is used. A communication template contains the actual communication details such as data addresses, data block and register sizes etc. for the particular device.

A communication template may also contain additional calculations and logic. Furthermore communication templates may provide additional displays and reports to the flow computer configuration that show any data of the device.

Using separate communication templates has the advantage that new communication devices can be added to the configuration without having to modify the application template itself.

For HART devices a generic communication template is provided that can be used for all HART devices.

Data hand-off

To provide flow computer data to external systems, e.g. a central SCADA system, a DCS or a supervisory computer, communication templates of type Modbus Slave and Server can be used.

The standard applications provide a Modbus communication sheet named “Tag list” that contains all relevant data. It can be used both for Modbus Ethernet (TCP/IP) and serial communication.

5.3.3 Standard applications

SICK provides application and communication templates for the Flow-X flow computer that are under revision and quality control of SICK. These templates provide most if not all functionality required in the majority of all the flow computer applications. One application template can be loaded in each Flow-X/M flow module.

The SICK application templates provide extensive functionality of which only a part will be applicable to actual situation. For this purpose the SICK application templates provide a display called Main Setup that controls which parts of the application are actually used and which are not. The displays for the non-active application parts are automatically hidden.

For a detailed description of the standard application templates, refer to the corresponding section of the Flow-X Application Manual.

> Besides of the templates provided by SICK, you can also set up and use your own application and communication templates, provided that you are authorized to use “FlowXpress Professional”.

Subject to change without notice

5.4 Writing an application to a device

This chapter describes how to write an application to a Flow-X device.

The procedure is as follows:

1 Connect an Ethernet cable between your computer and the Flow-X

2 Set up your computer’s Ethernet port.

Make sure the IP-address of your computer’s Ethernet card is in the same range (but not equal to) the IP-address of the corresponding Ethernet port of the Flow-X

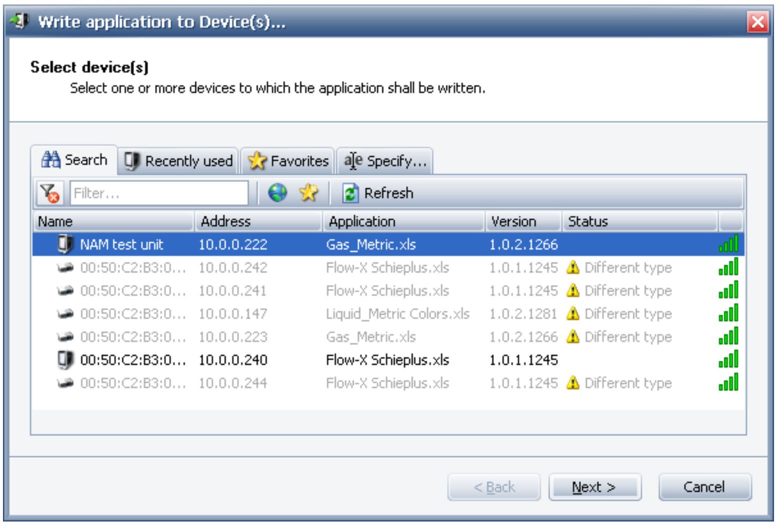
3 Open the application file in Flow-Xpress (Flow-Xpress → Open File…).

4 Load parameter file (if available) in Flow-Xpress (Flow-Xpress → Parameters, Load).

If no parameter file is loaded the default parameter set will be used.

5 Write the application to the device (Flow-Xpress → File, Write to device…).

››› Flow-Xpress starts compiling the application. When this has been finished, Flow-Xpress shows a list of all available Flow-X devices on the network.

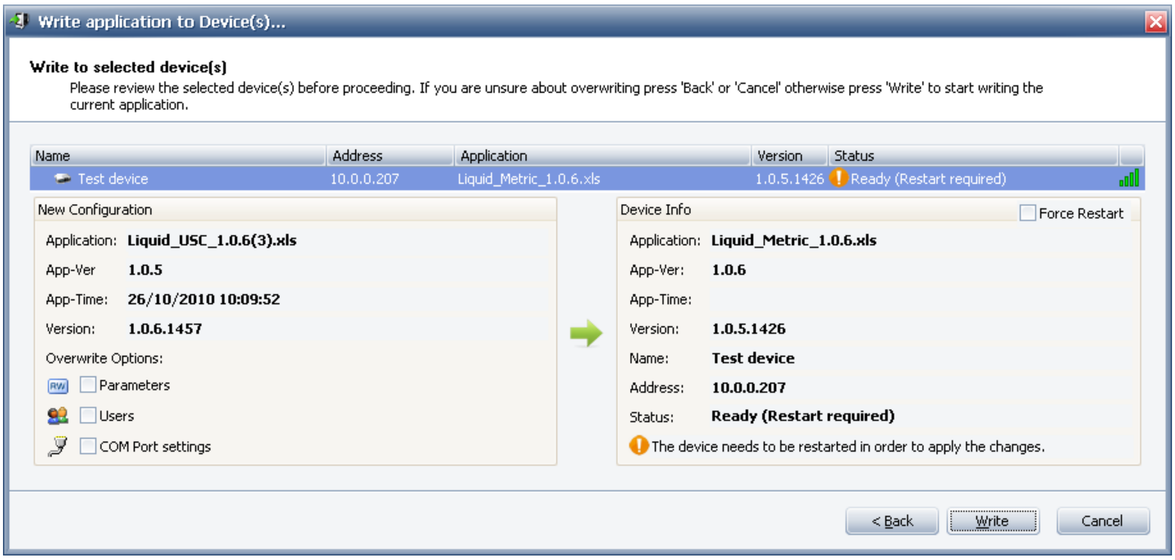


6 Select the device you want write the application to and click “Next >”.

> **!**
>
> ► Be sure the application has been configured for the right device setup (Flow-X → Device Setup).
>
> An application can only be written to a device with the same device setup.
>
> In case of a Flow-X/P the application should be written to the panel (X/P) itself, not to the individual modules. The panel will distribute the application to the modules.

Subject to change without notice

7 Select write options and click “Write”.



Parameters	If selected, the configuration parameters from Flow-Xpress are written to the Flow-X as well, overwriting the parameters in the Flow-X.
Users	If selected, the security settings (user names, passwords, etc.) from Flow-Xpress are written to the Flow-X as well, overwriting the settings in the Flow-X.
COM port settings	If selected, the COM port settings (baudrate, databits, etc.) from Flow-Xpress are written to the Flow-X as well, overwriting the settings in the Flow-X.

NOTICE:

If you select one of these options (Parameters / COM-port settings / Users), the existing configuration parameters and settings in the Flow-X are overwritten with the parameters and settings of the application.

► Only use these options if you are sure you want to use the parameters and settings from the application instead of the existing parameters and settings in the Flow-X.

8 Enter administrator user name and password.

> The administrator user name and password of the current application in the Flow-X must be entered, in order to allow the existing application to be overwritten by the new one.

››› Now the application is written to the Flow-X.

››› Depending on the type of modifications that have been made relative to the existing application and settings, the Flow-X reboots and starts the new application.

Subject to change without notice

5.5 Reading an application from a device

This chapter describes how to read an application from a Flow-X device

The procedure is as follows:

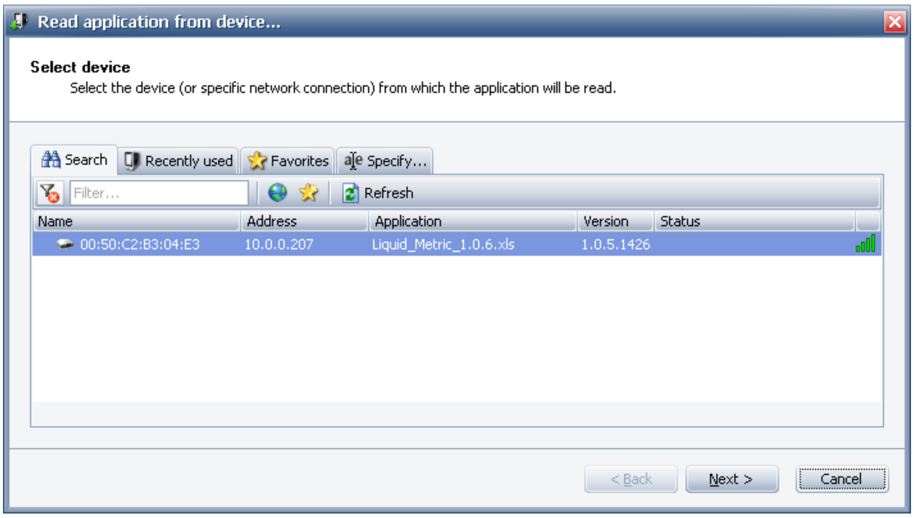
1 Connect an Ethernet cable between your computer and the Flow-X

2 Set up your computer's Ethernet port.

Make sure the IP-address of your computer's Ethernet card is in the same range (but not equal to) the IP-address of the corresponding Ethernet port of the Flow-X.

3 Start Flow-Xpress and select "Read from device..." (Flow-Xpress → File, Read from device…).

››› Flow-Xpress shows a list of all available Flow-X devices on the network.



4 Select the device you want to read the application from and click "Next >".

››› Flow-Xpress reads the application from the selected device. It creates a folder in \My Documents\Flow-X\Received and saves a copy of the application and associated parameter and security files into that folder.

5 Load the application.

››› By clicking the "Continue" button, the application is loaded into Flow-Xpress. The parameter and security files are loaded as well. After this you might save the application to a different location, or with a different file name. By doing this, the parameter and security files are included as default settings in the application file.

Subject to change without notice

5.6 Setting up the device

This chapter describes how to set up a new flow computer configuration based on the SICK Gas metric application templates

5.6.1 Overall setup procedure

The overall setup procedure for a Flow-X flow computer consists of the following steps:

1	Setting up Ethernet	The Flow-Xpress configuration software uses Ethernet to communicate with the flow computer.
2	Setting up the display	The brightness of the LCD display of each flow module can be changed if required. Also the Flow-X/P touch screen can be re-calibrated if required.
3	Setting up the communication bus	For the Flow-X/P the internal communication bus needs to be set up manually
4	Setting up the flow computer application	By means of the Flow-Xpress software the actual application is written to the flow computer. This may be one of the standard applications, e.g. Gas_Metric or a custom-made application. Application files can be read from disc or from a flow computer.
5	Setting up the flow computer device	Once the actual application is loaded the actual Flow-X flow computer device needs to be defined in Flow-Xpress, e.g. a Flow-X/P3 will be of type Flow-X/P with 3 modules.
6	Setting up HART devices	Each flow module provides 4 HART inputs.
7	Setting up communication devices	Communication with host devices and field and control equipment need to be set up in Flow-Xpress. The available communication drivers may differ for each application.
8	Setting the application parameters	Each application will have its own set of parameters (also called “configuration settings” or “constants”). For the standard applications all parameters are described in the corresponding manual.
9	Setting up security	By default the flow computer uses 3 generic users called “Operator, “Engineer” and Administrator”. Other users may be added.
10	Setting up printers and reports	The flow computer stores all its reports internally also when no printer has been defined.
11	Add user-defined displays	The flow computer provides an extensive set of displays. You can add any number of displays to the set of standard displays.
12	Add user-defined calculations	Additional data points, alarms and logic can be added through so-called “Calculations”.
13	Writing the application to the flow computer	After the initial setup has been completed in Flow-Xpress the application can be stored and written to the flow computer.

Subject to change without notice

5.6.2 Setting up Ethernet

Flow-Xpress software uses Ethernet to communicate with the flow computer. Additionally Ethernet can be used for communication with a host computer and other field and control equipment. It may also be used for network printing and remote web access.

> The flow computer has 2 independent Ethernet ports. The flow computer is only able to access or communicate with devices that are in the same IP range / subnet mask of the applicable Ethernet port.

The following Ethernet settings need to be defined for both Ethernet port 1 and 2:

IP address	Unique IP address
Subnet Mask	The subnet mask is applied to the destination IP address when matching it to the value in the network destination. When written in binary, a “1” must match and a “0” need not match. For example, a default route uses a 0.0.0.0 net mask that translates to the binary value 0.0.0.0, so bits need not match. A host route--a route that matches an IP address--uses a 255.255.255.255 net mask that translates to the binary value 11111111.11111111.11111111.11111111, so all of the bits must match Usually set to 255.255.255.0, causing the flow computer to be able to reach all IP addresses “on the same subnet”.
Default Gate-way	The gateway address is the IP address that the local host uses to forward IP messages to other IP networks. This is either the IP address of a local network adapter or the IP address of an IP router (such as a default gateway router) on the local network segment Usually not defined (“0.0.0.0”), typically required for VPN connections.

5.6.3 Setting up Ethernet on a Flow-X/M flow module

For each flow module the Ethernet settings are accessible through the local LCD display:

Figure 64 Ethernet settings on the LCD display

► Display → System, Network

5.6.4 Setting up Ethernet on a Flow-X/P

Ethernet setting are available on the local touch screen.

► Display → System, Network

Subject to change without notice

5.6.5 Setting up the displays

5.6.6 Setting up the display of the Flow-X/M

For each flow module the following settings are available for the local LCD display.

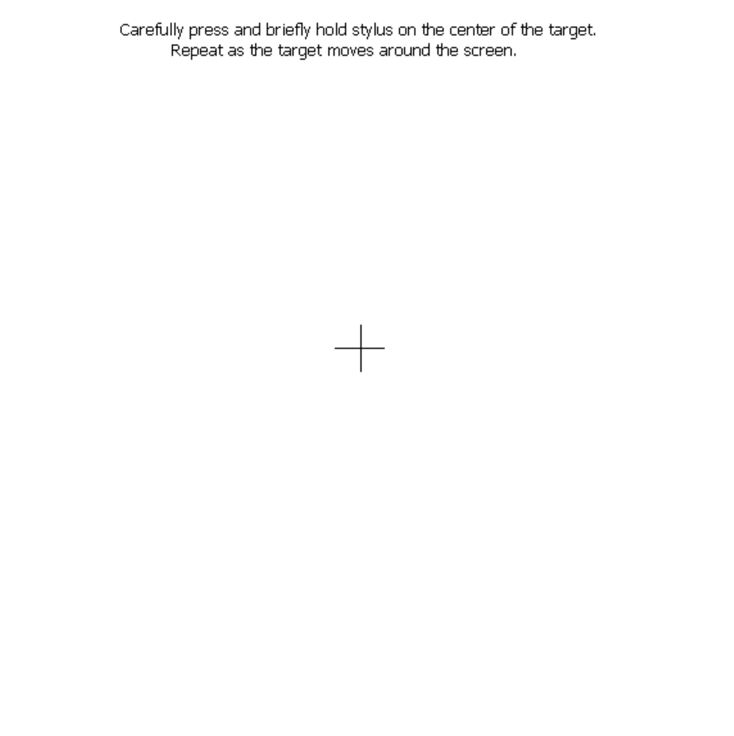
Number of lines on LCD	Sets the number of lines displayed on the LCD. Minimum number of lines is 4, maximum is 8.
LCD backlight intensity	Sets the brightness of the local LCD display between 30 (lowest brightness) and 100 (highest brightness). 100 is the default value.
Caption on LCD	Enables or disables the caption (the title of the display) on top of each page
Test LCD flash	Allows for a visual test of all display pixels. Alternates between black and white for 5 seconds
Test LCD black	Shows all display pixels in black color
Test LCD white	Shows all display pixels in white color

Figure 65 Ethernet settings on the LCD display

► Display → System, Display

5.6.7 Setting up the display on a Flow-X/P

The following settings are available for the touch screen of a Flow-X/P:

Orientation	Sets the display orientation to either “Vertical” (the default) or “Horizontal”.
Re-calibrate	Enables a 5-point recalibration of the Flow-X/P touch screen the next time the device is powered up. 

► Display → System, Display

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5.7 Communication bus setup

This section describes the procedure to setup the internal communications bus for a Flow-X/P.

> **_NOTICE:_**
> The internal communication bus needs to be setup as outlined in these procedures otherwise the flow computer will not operate correctly.

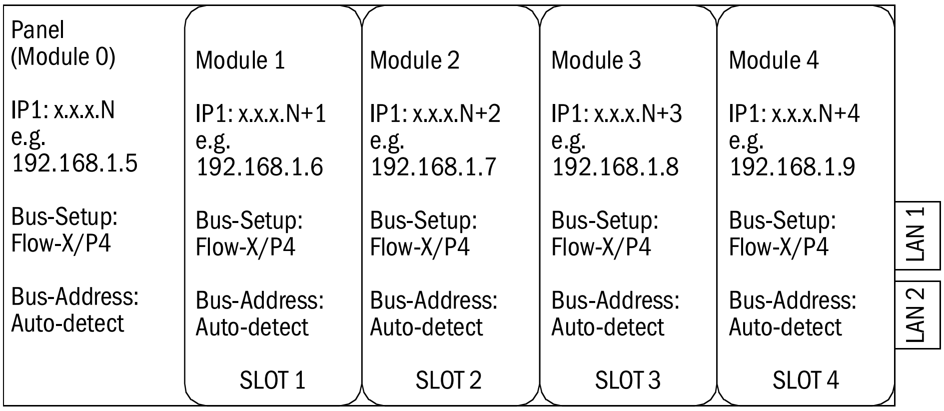
The procedure to setup a Flow-X/P that contains with one or more flow modules is as follows:

1 Step 1: Install the flow modules in the Flow-X/P chassis.

Module 1 shall be inserted in slot 1 (slot closest to front panel), module 2 in slot, etc. as indicated in the picture below.

2 Step 2: Assign consecutive IP addresses.

Assign *consecutive* IP addresses to *Network 1* of the Flow-X/P and to all the flow modules as shown in the picture below. The Flow-X/P should have the lowest IP address (e.g. 192.168.1.5), module 1 (the one closest to the front panel) should have the same IP address *plus 1* (e.g. 192.168.1.6) etc.



The network address can be set on display "System, Network" (or System, Modules, <Panel/Module 1, ..>, Network).

> - If you change If the network address through a web browser you will loose the connection to the flow computer.
> - Make sure that the last part of the subnet mask, which is typically set to "xxx.xx.xxx.0", allows the modules to connect to each other.

3 Set the "Bus setup" setting on the Flow-X/P

Set the "Bus setup" setting to the applicable value on the front module (Flow-X/P):

1 module:	Flow-X/P1
2 modules:	Flow-X/P2
3 modules:	Flow-X/P3
4 modules:	Flow-X/P4

The network address can be set on display "System, Bus" (or System, Modules, <Panel/ Module 1, ..>, Bus).

Bus	
Bus Setup	Flow-X/P1
Network 1 IP Address	10.0.0.20
Bus Address	Auto-detect
Bus Status	Not Connected

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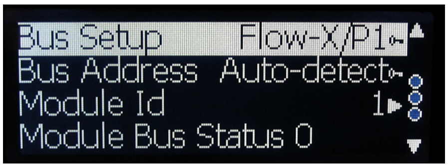
4 Set the “Bus setup” setting on all modules.

Perform the previous step on *all* the flow modules (through the LCD, touchscreen or web display). Use the *same bus setting* as on the Flow-X/P.



5 Power the flow computer off and on again.

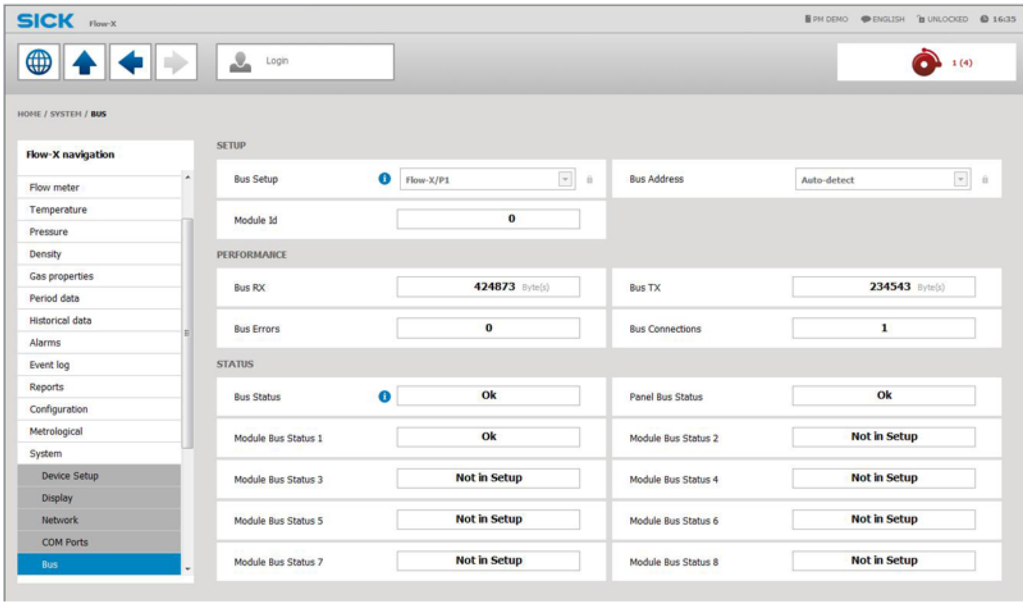
6 Write the application.

Write the required application to the flow computer. Make sure that the application is set up properly (refer to section Device setup in Flow-Xpress)

7 Final check.

Check that the communications bus is working properly on display “System, Bus”.

Figure 66 Checking the communication bus status



This picture is applicable for a Flow-X/P1 (= Flow-X/P with 1 flow module).

Subject to change without notice

5.8 Setting up the application

Before the flow computer can be put in operation the required application file has to be written to it from Flow-Xpress. SICK provides standard applications that cover most of the gas flow metering installations.

1 Start Flow-Xpress

Figure 67 Flow-Xpress startup display

2 Select “Open file” under “Start Here” to open an application file from a local or network drive.

Or alternatively:

Select “Read from Device” under Start Here to read an application file from a flow computer and use that as a string point for your new configuration.

Figure 68 Flow-Xpress Basic mode main display

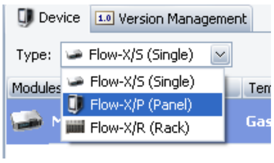
The next step is to the setup the flow computer device.

Subject to change without notice

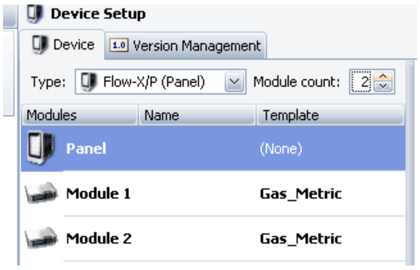
5.9 Device setup

1 In Flow-Xpress select Device Setup.

2 Select the Type of device.



3 For the Flow-X/P (Panel): Define the actual installed flow modules.



4 *For applications with multiple templates:* Select the applicable template for each module.

> This step is not required for standard applications because these contain one template only.

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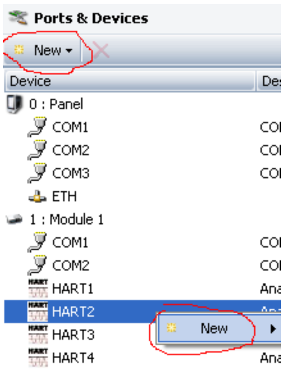
5.10 Setting up HART communication

The following setup procedure applies when HART devices are connected to the flow computer.

> Each flow module provides 4 HART inputs on analog inputs 1, 2 3 and 4.

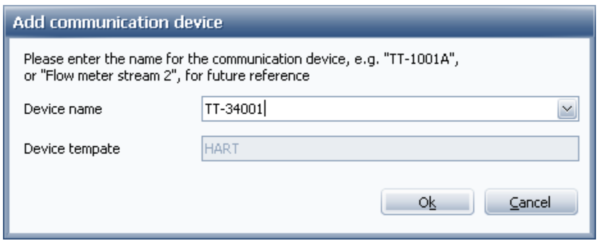
1. In Flow-Xpress select Ports & Devices.
2. Select the Flow-X/M flow module to which the HART loop is / will be connected.
3. Select the HART / analog input channel to which the HART device is / will be connected.
4. Either select New or right-click the port and select New.



5. Select the HART device from the pop-up list.

> Select HART for generic HART communication with any HART device. This will have the flow computer read the primary variable only.

6. Define a unique name for device. This name will be shown on the flow computer display.



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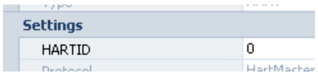
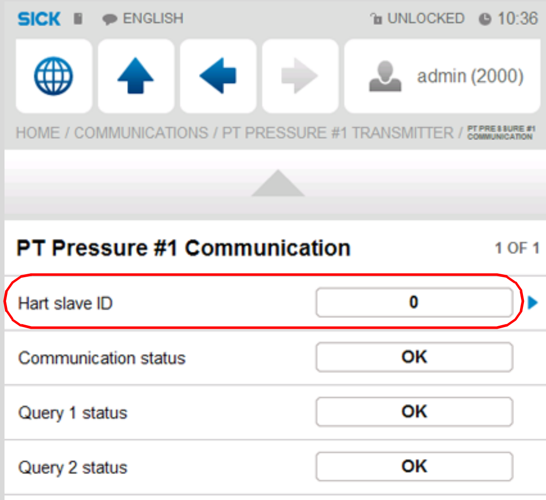
7 Define the HART slave ID of the HART device (default 0) .



After having written the application to the flow computer, the HART slave ID can be changed on the flow computer display “Communications\<HART device>\Communication”.

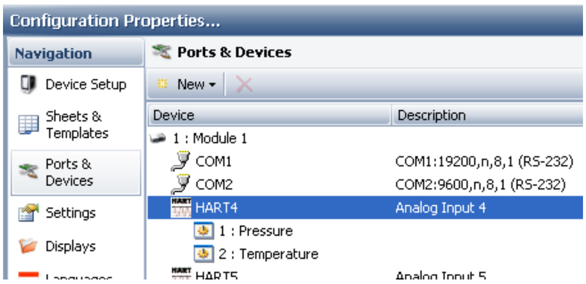


Multi-drop HART

Multiple transmitters can be connected to the same HART loop (i.e. analog input channel). For this purpose the HART transmitters need to have a unique poll address that is in the range 1..15 (so >0).

In multi-drop mode the HART transmitter sets its output at a constant 4 mA and only communicates digitally.

► To enable multi-drop mode assign multiple HART transmitters to the same HART port.



► Write the application to the Flow-X device.

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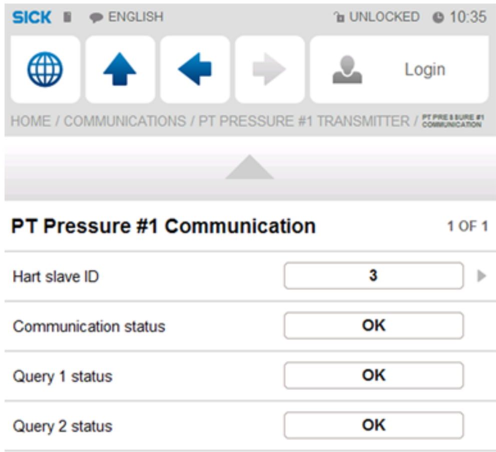
► For each transmitter set the HART slave ID (poll address) on the flow computer display "Communications\<HART device>\ Communication".



In multi-drop mode the slave ID must be unique for transmitter connected to the same HART port. The ID must be a number between 1 and 15 (so > 0).

Subject to change without notice

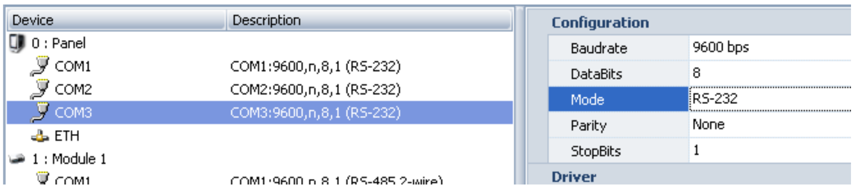
5.11 Setting up communication devices

The chapter applies when the flow computer has to communicate with one or more host computers and/or devices over one of its serial COM ports or via Ethernet.

5.11.1 Setting up a COM port

1 In Flow-Xpress select Ports & Devices.

2 Select the COM port and make sure all settings match with the connected device.



Baudrate	Baud rate ranging from 110 to 256000
DataBits	Number of data bits 5, 6, 7 or 8.
Mode	Type of electrical connection: RS232, RS485 (2-wire) or RS485 (4-wire). RS 485 2-wire is also known as half-duplex and RS-485 4-wire is also known as full duplex and as RS-422. Note that COM1 of the touch screen panel (0: Panel) is a RS232 port only. Refer to Flow-X Volume Installation manual for electrical connection details.
Parity	Type of data parity bit: None, Odd, Even, Mark or Space. If the parity bit is present but not used, it may be referred to as mark parity (when the parity bit is always 1) or space parity (the bit is always 0).

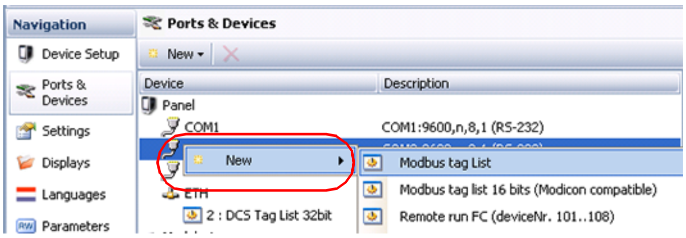
5.11.2 Setting up communication with a host computer

1 *If the host device is connected to one of the COM-ports:* First set up the COM port as described in section “Setting up a COM port”).

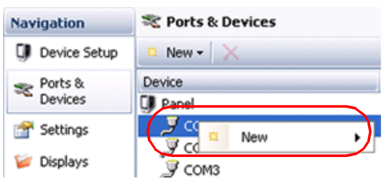
2 *If the host device is connected to Ethernet:* Make sure that the IP address and subnet mask of the external device correspond with the flow computer settings (→ page 73, §5.6.2).

3 Select the COM port to which the device is / will be connected, then

– either select New

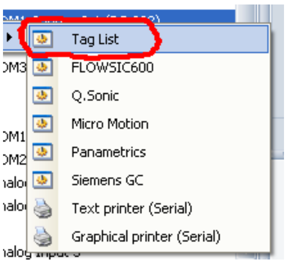


– or right-click the port and select New.



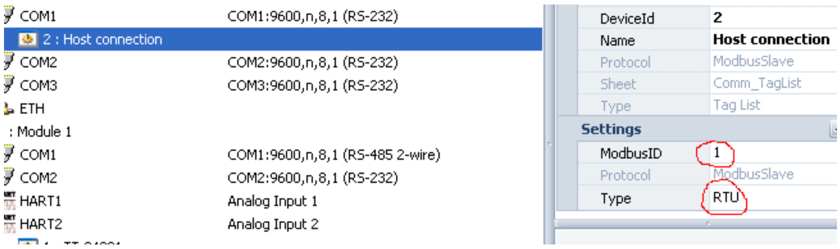
Subject to change without notice

4 *To set up Modbus communication with a host device:* Select “Tag List”.



5 Define a name for this connection (e.g. “Host connection” or “DCS”).

6 Select the new connection underneath the COM port or Ethernet and define the Modbus ID.
The Modbus ID is the Modbus Slave address for serial ports and the Modbus Server address in case of Ethernet.



7 Define the Modbus type.

RTU	Modbus RTU, non-Modicon compatible. Uses the addresses and register sizes as defined on the communication sheet in the application file. Refer to section “Modbus/Modicon compatibility compatibility “ for further details.
RTU16	Modbus RTU, Modicon compatible (16-bit register based) To be used when the host device only supports 16-bits registers. See more details below
ASCII	Modbus ASCII (uses the same type of register addressing as Modbus RTU)

The actual Modbus addresses can be inspected by opening the application file in Excel.

NOTICE:
Any change to the application file in Excel may corrupt the application.

Subject to change without notice

5.11.3 Modbus/Modicon compatibility

Depending on the selected Modbus type (RTU or RTU16) the flow computer will use either Modicon-compatible addressing or addressing based on variable register lengths.

Option “RTU16” uses Modicon-compatible addressing based on 16-bit register size for all data types, where option “RTU” uses the addresses as defined on the communication sheet as part of the application file.

For example: The figure below shows query (data block) 11 starting at address 2300 of one of the standard Modbus tag lists.

11	2300	mod1_GM_Run!TT_CUR	Run 1 - Meter temperature	degC	float
11	2301	mod1_GM_Run!PT_CUR	Run 1 - Meter pressure	bar	float
11	2302	mod1_GM_Run!PT_CUR_ABS	Run 1 - Meter pressure - atmospheric	bar_a	float
11	2303	mod1_GM_Run!PT_CUR_GAUGE	Run 1 - Meter pressure - gauge	bar_g	float

The data type is “float” meaning that 1 value occupies 32-bits. Suppose that the host device wants to read out the absolute pressure value only, then the following start address and register length apply depending on Modicon compatibility.

Modbus type	Start address	Number of registers
RTU (non-Modicon compatible):	2302	1
RTU16 (Modicon compatible):	2304	2

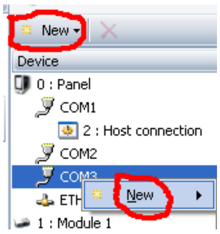
For “RTU16”, the 1st float value is on 16-bit registers 2300 and 2301, the 2nd value on 2302 and 2303, etc.

- The Flow-X does not implicitly *subtract* any value (like 1 or 40001) from the start address for Modbus requests as some Modbus devices do. It uses the addresses as defined on the communication sheet.
- If the host device implicitly subtracts a value from the start address when sending out a Modbus request, then you need to add the same amount to start address that is entered in the configuration software of the host device.

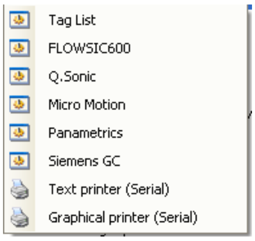
Subject to change without notice

5.11.4 Setting up communication with external devices

1 Select the COM or Ethernet port to which the device is/will be connected, then either select New or right-click the port or select New.

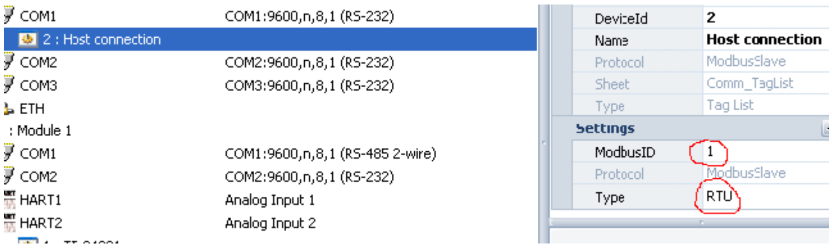


2 Select the device from the list of the available devices.



3 Define a name for the device. This name will be used on the displays.

4 Select the new connection underneath the COM port or Ethernet and define the Modbus ID.
The Modbus ID is the Modbus Slave address for serial ports and the Modbus Server address in case of Ethernet.



5 Define the Modbus type.

RTU	Modbus RTU, non-Modicon compatible. Uses the addresses and register sizes as defined on the communication sheet in the application file. Refer to section “Modbus/Modicon compatibility compatibility “ for further details.
RTU16	Modbus RTU, Modicon compatible (16-bit register based) To be used when the host device only supports 16-bits registers. See more details below.
ASCII	Modbus ASCII (uses the same type of register addressing as Modbus RTU)

The actual Modbus addresses can be inspected by opening the application file in Excel.

NOTICE:
Any change to the application file in Excel may corrupt the application.

Subject to change without notice

5.12 Modifying the application parameters

In the previous sections it has been explained how a new application is created and how the flow computer device itself and the external HART and communication devices are set up.

Most other functionality is set up by application parameters, including but not limited to:

- flow meter inputs
- transmitters and PT100 elements
- factors and constants
- totalizers and averaging
- density and compressibility calculations
- etc.

The actual parameters that are available in your application depend on which application templates have been selected (refer to section Device setup). The actual parameters with their menu structure are explained in the related “Gas Metric Application’ manual.

All parameters can be accessed in several ways, both on-line (directly on the flow computer) and off-line on your computer.

- *In Flow-Xpress:* Through the list of parameters (section Parameters)
  - ››› This will set the parameter values offline, in the loaded application.
- through the Flow-Xpress Online mode
  - ››› This will set the values directly in the flow computer.
- On the LCD display of each flow module
- *In case of Flow-X/P:* through the touchscreen display
- *For any Flow-X flow computer:* through a web browser

All methods give full control to all parameters. The only restriction is that through the LCD display only allows for numbers to be entered but no alphanumeric characters.

Subject to change without notice

5.13 Security and Data protection

5.13.1 Parameter locking switch

Each flow module has a mechanical switch (parameter locking switch) that ensures that the metrological software cannot be modified in any way through either the user interface or the communication interfaces (serial and Ethernet).

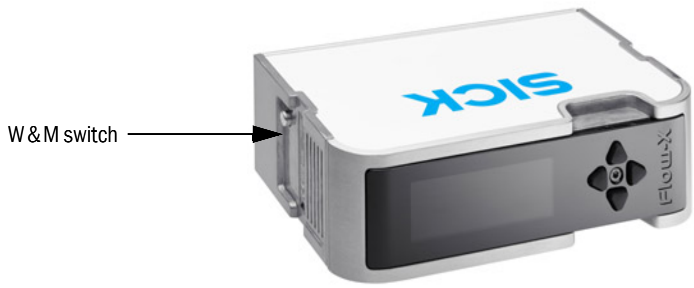
When the parameter locking switch is enabled, it will not be possible to overwrite the application, firmware and FPGA software in the flow computer. It will however still be possible to read all software and data from the flow computer.

When the parameter locking switch is enabled, it will not be possible to change any configuration setting or to give any control commands with security level 1000 and higher.

When the parameter locking switch is activated only configuration settings with security level less than 1000 can be modified, provided that an authorized user has logged in. All configuration settings that are legally relevant have a security level of 1000 or higher.

Normal operation functions such as display selection, alarm acknowledgment and report printing are not disabled by the parameter locking switch.

Figure 69 Parameter switch



5.13.2 Metrological seal

The flow computer provides a bracket that can be closed and sealed. When the bracket is closed, the parameter locking switch can no longer be accessed.

Therefore the parameter locking switch on all the flow modules needs to be enabled before the bracket is closed and sealed.

It is not possible to dismount a flow module from the flow computer without breaking the seal and opening the bracket.

5.13.3 Data protection

All software is stored on the internal storage medium. External access is only possible through the flow computer configuration software (called Flow-Xpress). However when the W&M switch is enabled it will not be possible to change the software in the flow module.

As an additional safety measure the flow computer applies a CRC32 checksum on the complete set of software files. When any file has been changed, removed or added the software will be rejected and the last known valid software, which is automatically backed up internally after every successful start-up, is used instead.

All parameters are stored on the internal storage medium. Direct access to this internal storage is not possible. Instead external access is only possible through the flow computer configuration software (called Flow-Xpress), through the LCD and web display and through the communication interfaces.

All metrological parameters have a security level of 1000 or higher. When the parameter locking switch is enabled, it will not be possible to edit any metrological parameter through any interface (Flow-Xpress, user interface and communication interface), even when a user with security level of 1000 or higher has logged in.

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Also every parameter change will be logged as an event.

All retentive and historical measurement data are stored on the internal storage medium. Direct access to this internal storage is not possible.

It is not possible to delete measurement data manually. Instead measurement data is deleted automatically when it has become out of date, i.e. when it is older than a configurable period.

Report and event files are stored in an encrypted format and with a checksum. Historical report and events can be previewed and reprinted through the Flow-X flow computer user interface (LCD and web).

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5.13.4 Users, passwords and security levels

The following users and passwords are used by the standard SICK applications:

User name	Password	Pin code	Security level
operator	sick	000123	500
tech	tech	000789	750
engineer	FL600	011001	1000
admin	SICKFLOWx	123321	2000

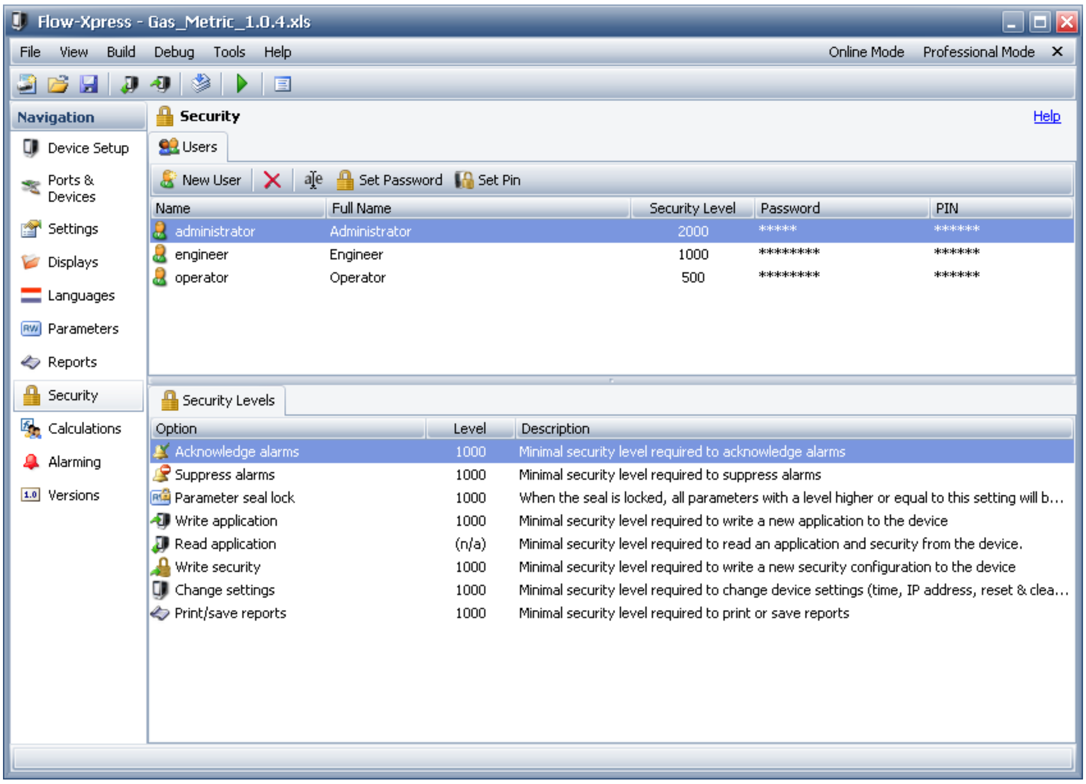
> **NOTICE:**
> Please change the default passwords.

In Flow-Xpress users and passwords can be modified and added to the flow computer both in online (directly in the flow computer, also for multiple flow computers at once) and offline mode (in the loaded application file).

Each user has a specific security level. The security level determines what the user can and cannot do with the flow computer. Each parameter has a specific security level. Only users with at least the required level will be able to change the parameter.

Furthermore there are number of overall settings for which the security level can be set as shown in the following figure.

Figure 70 Security settings



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5.14 Reports & printers

> +i Flow-X supports both text and graphical printers both on serial and Ethernet ports.

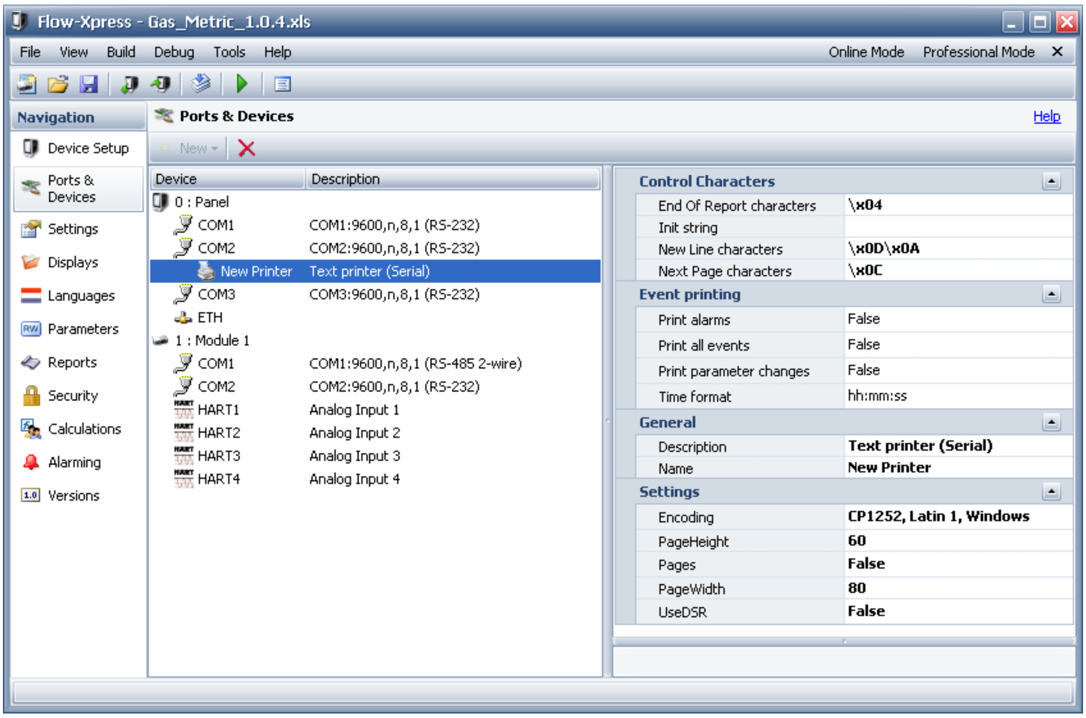
5.14.1 Defining a serial text printer

1 In Flow-Xpress select Ports & Devices.

2 Select the applicable COM port and define port settings (baud rate, parity data bits, stop bits → page 82, §5.11.1).

3 First select the COM port, then select “New” (or right-click and select “New”), and then select either “Text printer (serial)”.

Figure 71 Serial printer settings



4 *If required:* Change the settings for the printer.

End Of Report characters	Hexadecimal sequence code at the end of the report
Init string	Hexadecimal sequence code to initialize the printout
New line characters	Hexadecimal sequence code for a new line
Next page characters	Hexadecimal sequence code at the end of the page
Print alarms	Automatically prints alarms to the printer
Print all events	Automatically prints events to the printer
Print parameter changes	Automatically print parameter changes to the printer
Time format	Time format used for printer alarms, events and parameter changes.
Description	Description of the printer
Name	Name of the printer as it appears in Flow-Xpress when selecting the printer or referring to the printer from the application.
Encoding	Sets the Code Page. The default code page is Cp1252 US English. Set a different code page when non-English characters need to be printed.
PageHeight	The number of lines per page. The flow computer will automatically add blank lines at the end of each report such that ach printout takes a whole number of pages, provided that option “Pages” is enabled.

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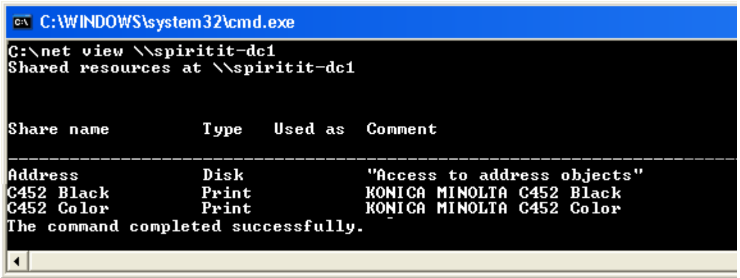
Pages	In case “Pages” is enabled, the flow computer will automatically add blank lines at the end of each report such that ach printout takes a whole number of pages (based on setting “PageHeight”).
PageWidth	Page width in number of characters. For each line the flow computer will skip characters that go beyond this number.
UseDSR	Uses the printer handshake signal, which may be a legal requirement. When the signal is off (indicating that printer is offline, has run out of paper or has an internal error) the flow computer will queue reports. When enabled the actual DSR signal will be as follows : ● Flow-X/P: COM1 – pin 8 (CTS) ● Flow-X/M : Digital channel 16 of the same module

Subject to change without notice

5.14.2 Defining an Ethernet graphical printer

The flow computer supports the PCL printer protocol to print graphical reports over TCP/IP Ethernet.

1. In Flow-Xpress select Ports & Devices.
2. Select “Ethernet”, “New” (or right-click and select “New”) and then select “Graphical printer (Ethernet)”.
3. Define the printer settings.

Description	Description of the printer
Name	Name of the printer as it appears in Flow-Xpress when selecting the printer or referring to the printer from the application.
Network share	Name of the printer port as it defined on the Ethernet network, defined as: \\server name\printer share (e.g. “\host-computer\C452 Black”)  ► Make sure that the flow computer is allowed to access the printer share (also see note below). ► Please contact your IT department for further information required in the setup of a network printer.
User name	(Domain) user to connect to the printer. Required when accessing the printer over a network with restricted security <domain name\>user name
User password	Password to connect to the printer

- Please make sure that the user defined for the printer has the proper security rights to access the printer.
- Also make sure that the flow computer which is a WINCE device is allowed to access the printer server and to access the network shares. Consult your IT department in case the printer is attached to a Local Area Network with restricted security.

Subject to change without notice

5.14.3 Defining an Ethernet text printer

The flow computer supports the LPD/LPR printer protocol to print text reports over TCP/IP Ethernet. The LPD/LPR protocol was developed originally for UNIX and has since become the de facto cross-platform printing protocol. It has the advantage that the flow computer can directly access the printer independent of any Windows security settings.

1 In Flow-Xpress select Ports & Devices.
2 Select “Ethernet”, “New” (or right-click and select “New”) and then select “Text printer (Ethernet)”.
3 Define the printer settings.

Queue	Name of the LPD print queue as defined in the printer. Depending on your printer this setting needs to be defined or not.
Server	IP address of the printer server
User	Identity of the flow computer on the printer (max. 30 characters)
Description	Description of the printer
Name	Name of the printer as it appears in Flow-Xpress when selecting the printer or referring to the printer from the application.
Encoding	Sets the Code Page. The default code page is UTF-8 (Unicode).
PageWidth	Page width in number of characters. For each line the flow computer will skip characters that go beyond this number.

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5.14.4 Reports

Depending on the application the flow computer provides a number of reports. Modifications to existing and addition of new reports can be performed through Flow-Xpress “Basic” and “Professional” mode.

Standard reports

The Gas Metric Application provides the following standard reports:

- Run Daily report

  This is the standard daily production report for one run that is printed automatically every “fiscal” day.
- Station Daily report

  This is the standard daily production report for the station that is printed automatically every “fiscal” day.
- Run Hourly report

  This is the standard hourly production report for one run that is printed automatically at the end of every hour.
- Station Hourly report

  This is the standard hourly production report for the station that is printed automatically every at the end of every hour.
- Run Period A report

  This is the standard period A production report for one run that is printed automatically at the end of every period A.
- Station Period A report

  This is the standard period A production report for the station that is printed automatically every at the end of every period A.
- Run Period B report

  This is the standard period B production report for one run that is printed automatically at the end of every period B.
- Station Period B report

  This is the standard period B production report for the station that is printed automatically every at the end of every period B.
- Run Current Conditions report

  Shows a consistent snapshot of the actual input and calculated values of one run. All values are of the same calculation cycle.
- Station Current Conditions report

  Shows a consistent snapshot of the actual input and calculated values of the station. All values are of the same calculation cycle.

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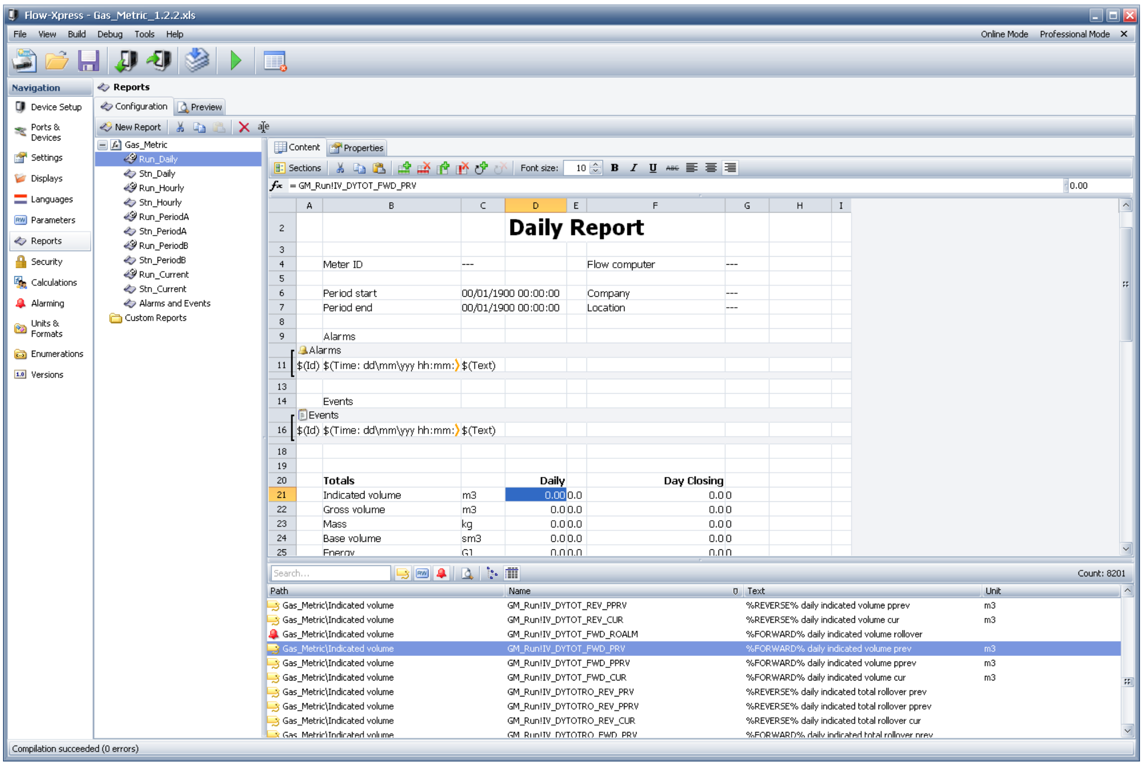
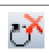
Report content

Figure 72   Report Content



The report content can be modified using the spreadsheet based report editor. Cells can contain static text, tag values or formula results. The number of decimal places used to display formula results can be edited in the right-most field of the formula bar. Tag values and Formulas should start with ‘=’ to display their value. If the = character is omitted, the cell content is displayed as static text.

The report content editor has some special toolbar buttons:

Sections	Change the visibility of Page Header, page body and Page Footer areas.
	Insert an Alarm or Event section at the current selected row. A section can contain records of the specified Section type.
	Remove the selected Alarm or Event section

Report cells can contain special fields. The fields are filled with values when a report is generated. The supported special fields are:

$(PageNum)	Current report page number
$(NumPages)	Total number of report pages
$(PrintTime)	Date and time the report is printed. Use $(PrintTime: <formatString>) to specify the display format of the print time. The formatstring can contain (parts of) string “dd/mm/yyy hh:mm:ss”

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Report sections

Reports can contain sections. A section is a report area that contains records for the specified section type. A section can be created in the body of a report using the ‘Create section’ button in the Report editor toolbar. If a section cell is selected, the section properties and supported section fields are displayed. The name and type of the section as well as filters for the records shown in the section can be changed in Section properties.

The supported section fields vary by section type. The supported section fields are:

Section Field	Events section	Alarms section
Count	●	●
Id	●	●
Text	●	●
Time	●	●
Severity	●	–
Location	●	–

The number of records present in a section can be shown in every cell of the report with the formula: “=<SectionName>.$(Count)”. *Example:* =Alarms.$(Count) to display the number of records present in the Alarms section of the report.

Report properties

The Properties tab allows modification of the report properties. The following settings are available for reports

Trigger	Determines if the report is generated automatically or not. The drop-down list shows the available events that can trigger the automatic generation. Depending on the application there are the following type of events:	
	Manual	Select “Manual” if the report does not require automatic generation based on period, batches or operator commands. – Note: the report may still be automatically generated by application logic.
	Period	Periodical events, e.g. hourly and daily period roll-overs
	Batch	Generates the report at the corresponding batch end.
	Command Tag	Each operator command that can be issued from the display can also be used as a trigger to generate a report.
Printer	Printer to be used for report printouts:	
	(Select Printer)	Indicates the report is only stored in file and does create a print-out.
	(No Printers configured)	Indicates that no printers are configured in “Ports and Devices”. The report will only be stored in file and no print-out is created.
Storage	Determines limit method of stored reports (time, storage space or number of reports).	
Name suffix	Identification method of each new report:	
	Timestamp	Adds a timestamp to each new report file.
	Count	Adds a sequence number to each new report file.

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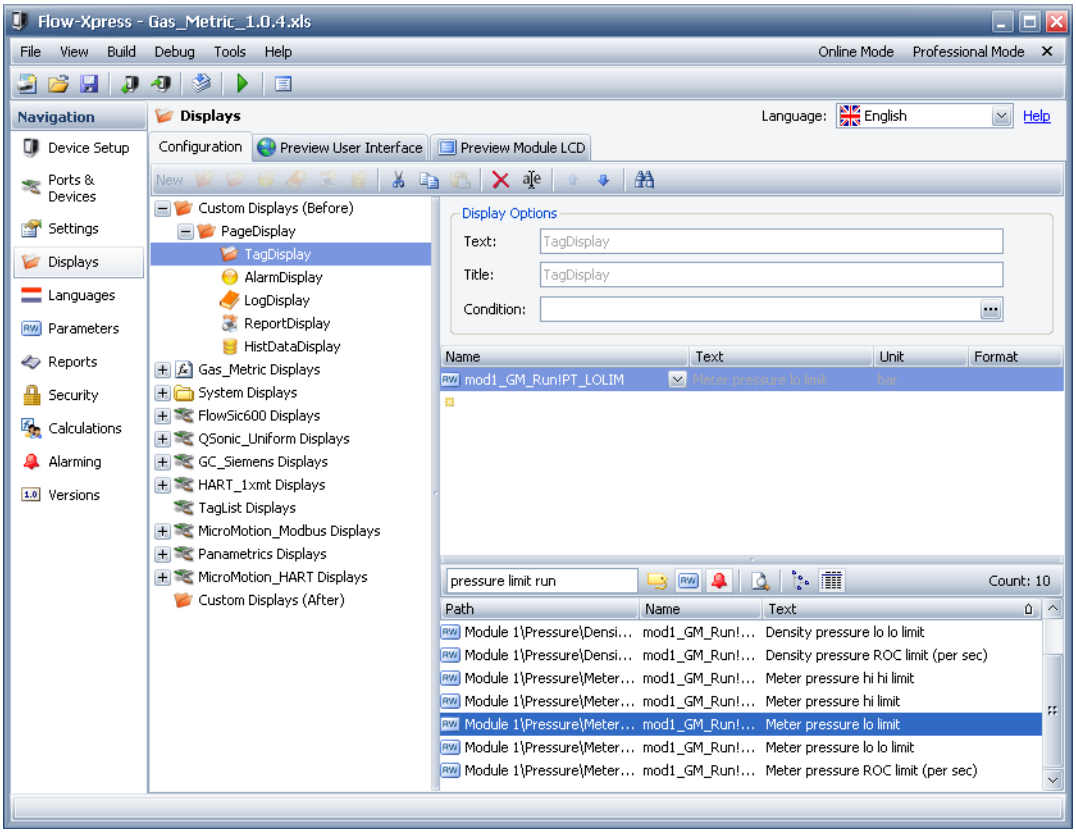
5.15 Displays

You can add user-defined displays to the standard applications, if required.

User-defined displays will appear before the standard displays in the menu when defined under section Custom Displays (Before) and after the standard displays when defined in section Custom Displays (After).

Figure 73 User-defined displays



The following display types can be defined:

Page display	Container for other displays. Multiple levels of page displays may be defined.
Tag display	Contains tag values and parameters (i.e. configuration settings or constants).
Alarm display	Contains the actual alarms. This may be all alarms of the flow computer or alarms filtered on their state (active / not active, enabled / disabled, suppressed / not suppressed, acknowledged / not acknowledged).
Log display	Contains historical alarms and event logs.
Report display	Shows historical (archived) reports. These may be all reports or reports of a specific type and meter run (or station).
Historical Data display	Shows historical data of either all the archives of a specific archive.

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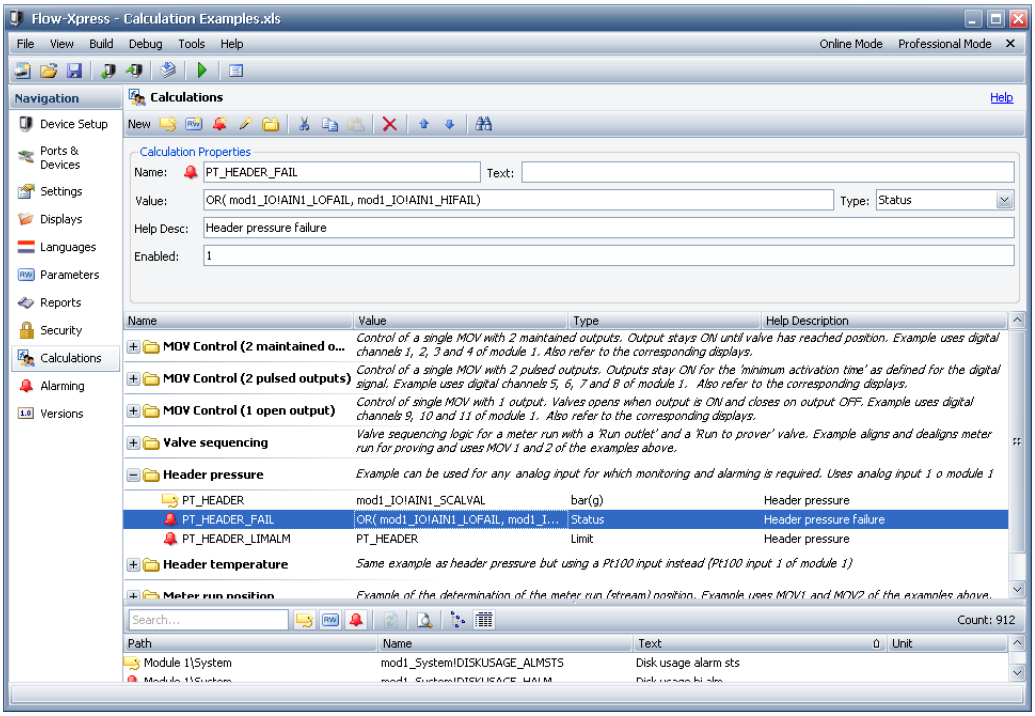
5.16 Calculations

You can add user-defined calculations and logic to the standard applications, if required.

Numerous examples are provided in application file “Calculation examples.xls”. You can copy and paste these examples into your Flow-X application file and modify these calculations to suit your specific installation.

Figure 74 User-defined Calculations



With Calculations you can define additional data values, analog and digital inputs and outputs, alarms and logic

The following type of entries can be defined in section “Calculations”:

	Defines a new tag, e.g. the “Header pressure”. The tag value can be a constant or any expression. In case of a constant, the value can be set through additional calculations	
	Defines a new parameter (i.e. a configuration setting or a constant) that can be modified by the operator / engineer on the local flow computer display or remote web display.	
	Defines a new alarm. The following type of alarms are available:	
	Status alarm	Any boolean expression may be defined for this purpose
	Limit alarm	Applies 4 limits on any variable: low low, low, high and high high
	Rate of Change alarm	Generate an alarm when the value changes more rapidly than the ROC limit (value per second)
	Deviation alarm	Monitors the deviation between two values and generates an alarm when the deviation is more than the limit.
	Write a value to a tag whenever a particular event occurs or as long as a condition is true. Can be used for any purpose, e.g. for control logic or to write a value to a writeable tag (e.g. a parameter or a control command).	
	Groups a number of calculations together. Multiple group levels may be defined.	

Refer to application file “Calculation Examples” for examples.

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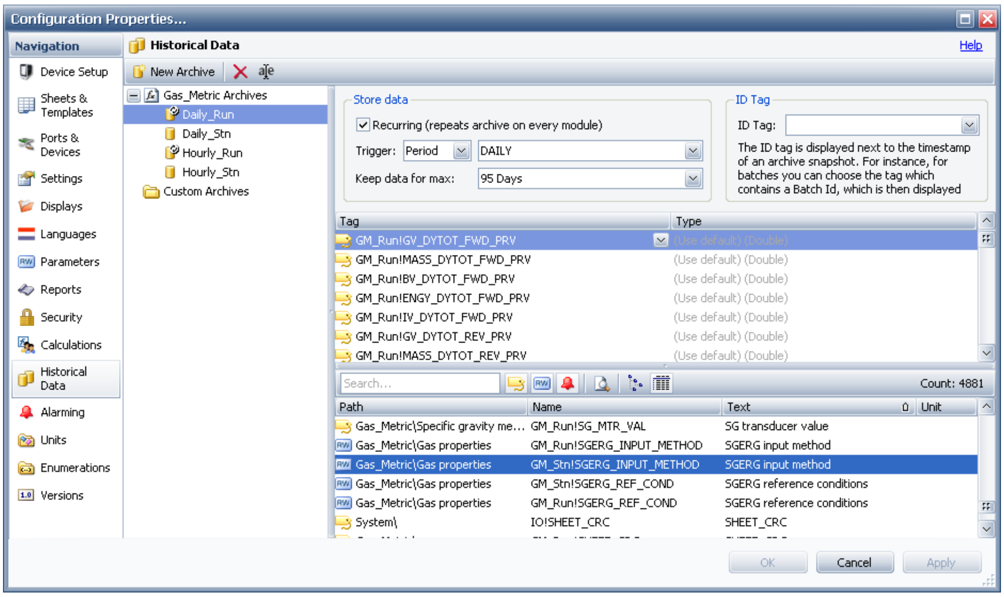
5.17 Data Archives

The flow computer is able to store any number of data points to a Historical Data archive based on period intervals and batch ends. Any number of archives may be defined.

Data archives are configured through Flow-Xpress as shown in the figure below. Each data archive has its own retention period (expressed in number of days) or size in Mb.

Any data point may be added to an archive, not only data that corresponds with the selected period (e.g. a daily period) but also running data of other periods (e.g. monthly data), instantaneous data and actual parameter values.

Figure 75 Data archives



The standard applications typically contain archives that store all period and batch totals and averages. Additional archives may be defined.

Archived data can be shown and retrieved in several ways:

Shown on a	● Historical Data display
Retrieved through the	● XML interface
Retrieved by	● Modbus communication

For retrieval over Modbus Flow-X emulates the Raw Data Archive feature of Omni flow computers. This allows legacy systems that have an automatic connection to Omni flow computers to directly interface with the Flow-X flow computer without the need to invest in a new software interface.

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5.18 Redundancy

For critical applications two Flow-X flow computers can be set up in a duty / standby (also called master / slave) mode of operation. Both flow computers interface to the same input and output signals, perform the same flow computations and have equal communication links to external devices.

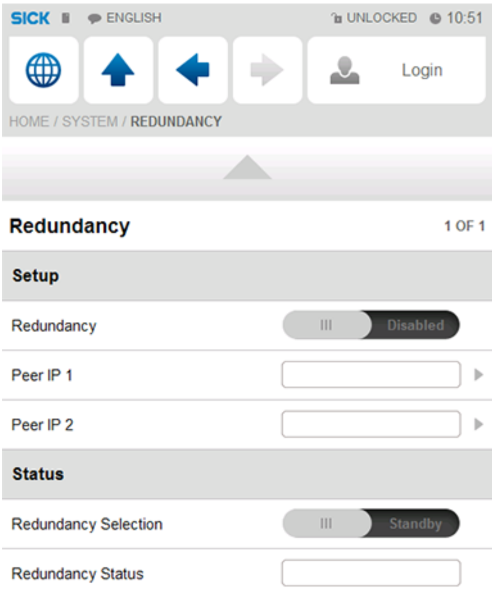
Data points configured for synchronization are sent from duty to standby flow computer either continuously or once at startup to ensure that no critical data is lost and to allow for bump less switchovers without any hiccups of control signals.

Typical data that are configured for continuous synchronization are PID control parameters and historical meter factors resulting. Data that are synchronized at flow computer startup typically include cumulative (non-resettable) totalizers, and period and batch totals and averages.

The flow computers exchange IP messages on both Ethernet ports to monitor each other's mode of operation (Duty / Standby) and to exchange a watchdog signal. Data synchronization will be operational provided that at least one Ethernet connection is up and running.

To enable redundancy go to display "System\Redundancy" and enable option "Redundancy" and define both IP addresses of the other flow computer.

Figure 76 Redundancy



The list of tags that need to be synchronized is set up in the Flow-Xpress configuration software in section "Settings".

> **NOTICE:**
> For the purpose of redundancy it is strongly advised that *both* Ethernet ports ETH1 *and* ETH2 are either connected to an external hub or switch or inter-connected via a direct cross cable, in order to have a redundant communication link between the two flow computers.

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5.19 Maintenance mode

5.19.1 General

Maintenance mode is a special mode of operation intended for testing the flow computer functionality, typically its calculations.

Maintenance mode can be enabled and disabled for each meter run separately.

Maintenance mode is the same as normal operation mode except that in Maintenance Mode all the custody transfer totals (normal totals) are inhibited. Instead flow is accumulated in separate Maintenance totals.

Furthermore analog outputs are forced to 4 mA and pulse outputs are inhibited in maintenance mode.

5.19.2 Starting maintenance mode

A permissive flag is used to enter and exit maintenance mode. By default the flag is always 1, i.e. it is always permitted to enter/exit maintenance mode. However the permissive flag may be controlled by custom-made logic through “Calculations”. E.g. entering/exiting maintenance mode to is only permitted when the meter is inactive.

► To enable maintenance mode go to the following display:
  Display > Configuration, Run <x>, Maintenance mode. with <x> the relative number of the flow module that controls the flow meter

Table 13 Maintenance mode settings

Setting	Secutity level	Description
Maintenance mode enabled	1000	Enables maintenance mode provided that switch permissive flag is set.

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Flow-X

6 Advanced configuration

Subject to change without notice

6.1 General information

This chapter lists the features of the Flow-X Gas Metric Application and shows some typicalmeter run configurations that are covered by it.

6.2 Inputs

The SICK Flow-X can process one or more gas meter runs. For each meter run the following type of I/O can be configured:

- Flow meter input
- Process inputs
- Status inputs
- Gas Chromatographs

6.2.1 Flow meter input

The following types of flow meter input are supported:

Table 14 Flow meter input

Input type	Meant for
Pulse input	Any flow meter that provides a single or dual pulse output that represents the volumetric or mass quantity.
Smart input	Any flow meter that provides a serial, HART or analog output that represents the volumetric or mass quantity (only Modbus and HART) or rate. Typically used for: Ultrasonic flow meters
Smart & pulse input	Typically used for ultrasonic flow meters that provide both a “smart” output and a pulse output. Either output signal may be selected as the primary. The secondary signal will be used in case the primary should fail.

6.2.2 Process input

A process input is a live signal that is a qualitative measurement of the fluid.

A process input can be any of the following types:

- Analog input (0 ... 20 mA, 4 ... 20 mA, 0 ... 5 V DC)
- Pt100 inputs (only for temperature measurement)
- HART input
- Modbus input
- Fixed value

Table 15 Process input

Process Input	Meant for
Meter temperature	Temperature at the flow meter. Temperature at the downstream location or in case of bi-directional flow at the up- or downstream location may be used.
Meter pressure	Pressure at the flow meter.
Base density	Also called standard density
CO_2	Carbon dioxide content ● Only used when the SGERG or NX19 calculation is enabled.
N_2	Nitrogen content ● Only used when the SGERG or NX19 calculation is enabled.
H_2	Hydrogen content ● Only used when the SGERG or NX19 calculation is enabled
Heating Value	The gross heating value, also called the superior calorific value. ● Used for energy calculations and for SGERG or NX19 calculations.

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6.2.3 Status inputs

The application optionally uses a status input that represents the validity of the flow meter signal and is typically provided by ultrasonic flow meters in combination with a pulse signal. The input is only used for alarming purposes and to control the accountable totals required for MID approval.

6.2.4 Gas Chromatographs

The application supports one or two gas chromatographs. In case of two gas chromatographs the application uses the gas composition of the primary gas chromatograph (GC) and switches to the backup GC in case the primary GC should fail.

Besides of the gas composition being provided by a gas chromatograph there is the option for a gas composition that is communicated by an external device (e.g. a supervisory computer) to the flow computer.

Also a fixed gas composition can be applied.

6.3 Outputs

The application supports the following outputs

- PID control output
- Analog outputs
- Pulse outputs
- Status outputs

6.3.1 PID control output

One analog output for PID control is supported, which is typically used for controlling a flow control valve.

6.3.2 Analog outputs

Each flow module provides 4 analog outputs. Each output may be configured to output any process variable (e.g. the volume flow rate or the meter temperature)

6.3.3 Pulse outputs

The application supports the configuration of up to 4 pulse outputs per flow module to drive electro-mechanical counters. The pulse outputs can also be used for sampling control.

6.3.4 Status outputs

By adding user-defined functionality to the standard application, status outputs can be used for controlling devices such as motor-operated valves

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6.4 Typical meter run configurations

The application can be used for single meter runs and for metering stations consisting of multiple meter runs.

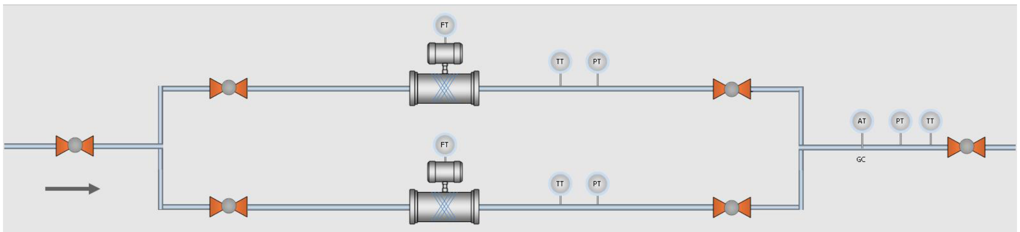
For meter stations the meter runs may run independently or with a common density input and/or product definition.

- Single meter run
- Meter station with independent meter runs
- Meter station with common on-line analyzers

Metering stations of maximum 4 meter runs can be controlled by a SICK Flow-XP. For each meter run the Flow-XP should be equipped with a Flow-XM module. All station functionality is executed by the Flow-XP panel. In this case the application has to be configured as a multi-stream application, which is sent to the Flow-XP as a whole.

It is also possible to control a meter station using a number of separate Flow-X/M modules in Flow-XS and/or Flow-XR enclosures. In this case each Flow-XM is running its own single stream application. For station functionality an extra Flow-XM is used, which communicates to each run Flow-XM. In this configuration a meter station of maximum 8 meter runs can be controlled.

Figure 77 Meter station with 2 meter runs and common on-line analyzers



In order to enable the configurations above, the Gas Metric Application can be configured either as:

- Independent single stream application
- Multiple stream Flow-XP application (max. 4 streams)
- Single stream application that communicates to a station flow computer
- Station application that communicates to a number of (max. 8) single stream flow computers

6.5 Application overview

6.5.1 Flow rates

This display shows the actual flow rates.

► Select: Display > Flow rates

The following operational settings are available for the flow rates.

Table 16 Operational settings for flow rates

Setting	Security level	Description
Hi hi limit	500	Limit for the flow rate high high alarm [unit/hr]*
Hi limit	500	Limit for the flow rate high alarm [unit/hr]*
Lo limit	500	Limit for the flow rate low alarm [unit/hr]*
Lo lo limit	500	Limit for the flow rate low low alarm [unit/hr]*
Rate of change limit	500	Limit for the flow rate of change alarm [unit/hr/sec]*

*Limits are based on the primary flow rate from the flow meter. Therefore, units are either [m3/hr] or [kg/hr], depending on the meter type.

Subject to change without notice

6.5.2 Temperature

Two temperature inputs are used at meter run level: the meter temperature and, in case of a live density measurement at meter run level, the density temperature (i.e. the temperature at the point where the density is measured).

► Select: Display > Temperature

In case of a live density measurement at station level, the density temperature is available Depending on the actual configuration settings are available for the following temperature inputs:

- <Run>, Meter temperature
- <Run>, Density temperature
- Station, Density temperature

► Select: Display > Flow rates

The following operational settings are available for each applicable temperature variable at station level:

Table 17 Operational settings for temperature

Setting	Security level	Description
Keypad	500	Temperature keypad selection *0: Disabled* The live input value is used for the calculations. *1: Enabled* The keypad value is used for the calculations
Keypad		Temperature keypad value [°C]
Hi hi limit	500	Limit for the temperature high high alarm [°C]
Hi limit	500	Limit for the temperature high alarm [°C]
Lo limit	500	Limit for the temperature low alarm [°C]
Lo lo limit	500	Limit for the temperature low low alarm [°C]
Rate of change limit	500	Limit for the temperature rate of change alarm [°C/sec]

6.5.3 Pressure

Two pressure inputs are used at meter run level: the meter pressure and, in case of a live density measurement at meter run level, the density pressure (i.e. the pressure at the point where the density is measured).

► Select: Display > Flow rates

In case of a live density measurement at station level, the density pressure is available at station level.

Depending on the actual configuration settings are available for the following pressure inputs:

- <Run>, Meter pressure
- <Run>, Density pressure
- Station, Density pressure

The following operational settings are available for each applicable pressure variable.

Table 18 Operational settings for pressure

Setting	Security level	Description
Input units	1000	Pressure units *1: Absolute* The input value is an absolute pressure [bar(a)]. *2: Gauge* The input value is a gauge pressure [bar(g)] (i.e. relative to the atmospheric pressure)

Subject to change without notice

Table 18 Operational settings for pressure

Setting	Security level	Description
Keypad	500	Pressure keypad selection *0: Disabled* The live input value is used for the calculations. *1: Enabled* The keypad value is used for the calculations
Keypad	500	Pressure keypad selection [bar][1]
Hi hi limit	500	Limit for the pressure high high alarm [bar][1]
Hi limit	500	Limit for the pressure high alarm [bar][1]
Lo limit	500	Limit for the pressure low alarm [bar][1]
Lo lo limit	500	Limit for the pressure low low alarm [bar][1]
Rate of change limit	500	Limit for the pressure rate of change alarm [bar/sec]

[1] Either [bar(a)] or [bar(g)], depending on the selected input units.

Gas properties

Depending on the configuration density settings are either on meter run or station level.

► Select: Display > Gas properties

Heating value

For the Gross Heating Value (GHV) the following operational settings are available:

Table 19 Operational settings for GHV

Setting	Security level	Description
GHV keypad	1000	GHV keypad selection *0: Disabled* The live/calculated value is used for the calculations. *1: Enabled* The keypad value is used for the calculations
GHV keypad	1000	GHV keypad value [MJ/sm3]
GHV hi hi limit	1000	Limit for the GHV high high alarm [MJ/sm3]
GHV hi limit	1000	Limit for the GHV high alarm [MJ/sm3]
GHV lo limit	1000	Limit for the GHV low alarm [MJ/sm3]
GHV lo lo limit	1000	Limit for the GHV low low alarm [MJ/sm3]
GHV rate of change limit	1000	Limit for the GHV rate of change alarm [MJ/sm3/sec]

Gas composition

For the gas composition the following operational settings are available:

Table 20 Operational settings for GHV

Setting	Security level	Description
Composition keypad	1000	GHV keypad selection *0: Disabled* The live composition is used for the calculations. *1: Enabled* The keypad composition is used for the calculations

Subject to change without notice

Table 20 Operational settings for GHV

Setting	Security level	Description
Component keypad	1000	Keypad values for the following components: – Methane (C_1) – Nitrogen (N_2) – Carbon Dioxide (CO_2) – Ethane (C_2) – Propane (C_3) – Water ($H2_0$) – Hydrogen Sulfide (H_2S) – Hydrogen (H_2) – Carbon Monoxide (CO) – Oxygen (O_2) – i-Butane (iC_4) – n-Butane (nC_4) – i-Pentane (iC_5) – n-Pentane (nC_5) – neo-Pentane ($neoC_5$) – Hexane (C_6)* – Heptane (C_7)* – Octane (C_8)* – Nonane (C_9)* – Decane (C_{10}) – Helium (He) – Argon (Ar)

*If split coefficients are used for C6+, C7+, C8+ or C9+, then these components represent the corresponding Cx+ value. F.e. if a C6+ split is used, which means that the C6 – C10 components are calculated from the C6+ fraction and the C6+ split coefficients, then the C6 value represents the C6+ fraction and the C7 ... C10 values are not used.

The Cx+ split coefficients can be entered in the configuration menu: Configuration, Run <x> or Station, Gas properties, Composition

For each of the 22 components, the Cx+ fractions and the unnormalized sum of components the following limits are available:.

Table 21 Limits for gas components

Limit	Security level	Description
Component high limit	1000	Limit for the component high alarm [%mole]]
Component low limit	1000	Limit for the component low alarm [%mole]

Depending on the configuration, a composition limit alarm optionally triggers a switch-over to the keypad composition or to the last received good composition.

Co_2, H_2 and N_2

These displays are only available if SGERG or NX-19 is selected to calculate the compressibility and/or molar mass (refer to paragraph Calculations)

Table 22 Operational settings for CO_2, H_2 and N_2

Setting	Security level	Description
Keypad	500	Component keypad selection *0: Disabled* The live value is used for the calculations. *1: Enabled* The keypad value is used for the calculations.
Keypad	500	Component keypad value (*)
Hi hi limit	500	Limit for the component high high alarm (*)
Hi limit	500	Limit for the component high alarm (*)
Lo limit	500	Limit for the component low alarm (*)

Subject to change without notice

Table 22 Operational settings for CO_2, H_2 and N_2

Setting	Security level	Description
Lo lo limit	500	Limit for the component low low alarm (*)
Rate of change limit	500	Limit for the component rate of change alarm [(*)/sec]

6.5.4 Meter K-factor

Only available when Meter device type is “Pulse” or “Smart/pulse”.

To convert meter pulses into metered volume a nominal K-factor can be defined or a calibration curve as a function of the actual pulse frequency can be applied.

► Select: Display > Flow meter, Run <x>, Meter K-factor
With <x> the module number of the meter run

6.5.5 Meter K-factor settings

Table 23 Settings for meter K-factor

Setting	Security level	Description
Nominal K-factor (forward/reverse)	1000	The number of pulses per unit, with the unit being cubic meters for volumetric flow meters and kilogram for mass flow meters. Separate nominal K-factors for forward and reverse flow. ● Nominal K-factors are only used if K-factor curve interpolation is disabled. ● The reverse nominal K-factor is only used if reverse totalizers are enabled.
K-factor curve interpolation enabled	1000	Controls whether the nominal K-factor or the calibration curve is used. *0: No* Nominal K-factor is used. *1: Yes* *Calibration curve is used.*
Curve extrapolation allowed	1000	Controls if extrapolation is allowed when the pulse frequency is outside the calibration curve *0: No* When the pulse frequency is below the first calibration point or above the last calibration point, then respectively the first or the last calibration K-factor will remain in-use. *1: Yes* The interpolation is extrapolated when the pulse frequency is outside the calibrated range

K-factor curve (forward/reverse)

► Select: Display > Flow meter, Run <x>, Meter K-factor, K-factor curve (forward/reverse)
With <x> the module number of the meter run

K-factor curves are only visible if K-factor curve interpolation is enabled. The reverse K-factor curve is only visible if reverse totalizers are enabled.

Table 24 Settings for K-factor curve

Setting	Security level	Description
Point x –Frequency	1000	Pulse frequency [Hz] of the calibration point.
Point x – K-factor	1000	Meter K-factor [pulses/unit] of the calibration point.

- Pulse frequency must be in ascending order
- Up to 12 points can be defined. For unused points, leave the pulse frequency at 0. E.g. when the curve has 6 points, the pulse frequency of points 7 through 12 should be set to 0.

Under normal circumstances you should not enable both K-factor curve interpolation and meter factor/error curve interpolation at the same time

Subject to change without notice

6.5.6 Meter factor/error

Only available when Meter device type is “Pulse” or “Smart/pulse”.

To correct for a meter error that was determined at a meter calibration, the volume or mass as indicated by the meter can be corrected with either one nominal value or a calibration curve.

Because meter calibration reports specify either the meter factor or the meter error as a function of the flow rate, the flow computer accommodates the entry of either value. The relationship between the meter error and the meter factor as follows:

Meter factor = (100-Meter error)/100 (with the meter error specified as a percentage).

► Select: Display > Flow meter, Run <x>, Meter factor error

With <x> the module number of the meter run

Meter factor/error settings

Table 25 Settings for meter factor/error

Setting	Security level	Description
Type of input value	1000	Defines what the entered values mean. Applies for both the nominal value and the calibration curve values. *1: Meter factor [-]* *2: Meter error [%]*
Nominal meter factor/error (forward or reverse)	1000	The nominal meter factor or error used for the entire flow range. ● The nominal meter factor/error is only used if meter factor/error curve interpolation is disabled. Separate meter factors/errors for forward and reverse flow. ● The reverse nominal meter factor/error is only used if reverse totalizers are enabled.
Meter factor/error curve interpolation enabled	1000	Controls whether the nominal meter error or the calibration curve is used. *0: Disabled* Nominal value is used. *1: Enabled* Calibration curve is used.
Extrapolation allowed	1000	Controls if extrapolation is allowed when the flow rate is outside the calibration curve *0: No* When the flow rate is below the first calibration point or above the last calibration point, then respectively the first or the last calibration error will remain in-use. *1: Yes* The interpolation is extrapolated when the pulse frequency is outside the calibrated range.

Meter factor/error curve (forward/reverse)

► Select: Display > Flow meter, Run <x>, Meter factor error, Meter factor curve (forward/reverse)

With <x> the module number of the meter run

Subject to change without notice

Meter factor/error curves are only visible if meter factor/error curve interpolation is enabled. The reverse meter factor/error curve is only visible if reverse totalizers are enabled.

Table 26 Settings for meter factor/error curve

Setting	Security level	Description
Point x – Flow rate	1000	Flow rate [unit/h] of the calibration point.
Point x – Meter factor error	1000	Meter factor/Meter error [%] of the calibration point.

- Flow rate must be in ascending order
- Up to 12 points can be defined. For unused points, leave the flow rate at 0. E.g. when the curve has 6 points, the pulse frequency of points 7 through 12 should be set to 0.
- Under normal circumstances you should not enable both K-factor curve interpolation and meter factor/error curve interpolation at the same time.

Subject to change without notice

6.6 Setting up the I/O

A logical first step in the configuration process is to define the physical I/O points that involve all the transmitters, controllers and devices that are or will be physically wired to the I/O terminals of the flow computer.

Each flow module has the following amount of I/O.

- 6 analog inputs
- 2 Pt100 inputs
- 4 analog outputs
- 16 digital I/O

> The total number of pulse inputs, time period inputs, status inputs, pulse outputs and status outputs is 16.

The I/O points can later on be assigned to the related station and meter run variables.

6.6.1 Analog inputs

► Select: Display > Configuration, <Module IO <x.>, Analog inputs, Analog input <y>
with <x> the number of the module to which the input is physically connected and <y> the relative input number

Each flow module has 6 analog inputs. For each analog input the following settings are available:

Table 27 Settings for analog inputs

Setting	Security level	Description
Tag	900	Alphanumeric string representing the tag name of the transmitter, e.g. “PT-1001A”. ● Only used for display and reporting purposes.
Input type	1000	Type of input signal *1: 4 ... 20 mA* *2: 0 ... 20 mA* *3: 1 ... 5 Vdc* *4: 0 ... 5 Vdc*
Averaging	1000	The method to average the individual samples within every calculation cycle. 15 samples per second are taken, so with a cycle time of 500 ms 7 to 8 samples are available per cycle. *1: Arithmetic mean* Enter “1: Arithmetic Mean” for transmitters
Full scale	1000	The value in engineering units that corresponds with the full scale value. E.g. for a 4 ... 20 mA temperature transmitter with a range of –30 ... 80 °C the value 80 should be entered
Zero scale	1000	The value in engineering units that corresponds with the zero scale value. E.g. for a 4 ... 20 mA temperature transmitter with a range of –30 ... +80 °C the value –30 should be entered
High fail limit	1000	The value as percentage of the total span, at which a high fail alarm is given. Should be between 100 and 112.5 % span. For a 4 ... 20 mA transmitter this corresponds to 20 to 22 mA.
Low fail limit	1000	The value as percentage of the total span, at which a low fail alarm is given. Should be between –25 and 0 % span. For a 4 ... 20 mA transmitter this corresponds to 0 to 4 mA.

Subject to change without notice

6.6.2 Pt100 inputs

► Select: Display > Configuration, <Module IO <x.>, Pt100 inputs, Pt100 input <y>
with <x> the number of the module to which the input is physically connected and <y> the relative input number

Each flow module has 2 PRT inputs that can be connected to a Pt100 element. For each PRT input the following settings are available.:

Table 28 Settings for Pt100 inputs

Setting	Security level	Description
Tag	900	Alphanumeric string representing the tag name of the transmitter, e.g. “PT-1001A”. ● Only used for display and reporting purposes.
Input type	1000	Type of Pt100 element *1: European (most commonly used)* Alpha coefficient 0.00385 Ω/ Ω / °C As per DIN 43760, BS1905, IEC751 Range –200 ... +850 °C *2: American* Alpha coefficient 0.00392 Ω/ Ω / °C Range –100 ... +457 °C
High fail limit	1000	The temperature in °C at which a high fail alarm is given.
Low fail limit	1000	The temperature in °C at which a low fail alarm is given.

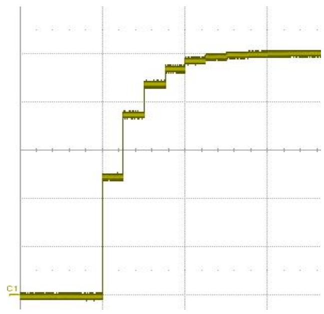
Subject to change without notice

6.6.3 Analog outputs

► Select: Display > Configuration, <Module IO <x.>, Analog outputs, Analog output <y> with <x> the number of the module to which the output is physically connected and <y> the relative output number

Each flow module has 4 analog outputs. For each analog output the following settings are available:

Table 29 Settings for analog outputs

Setting	Security level	Description
Tag	900	Alphanumeric string representing the tag name of the output signal, e.g. “AO-045”. Only used for display and reporting purposes.
Full scale	1000	The value in engineering units that corresponds with the full scale (20 mA) value. E.g. for a temperature with a range of ... 30 ... +80 °C the value 80 should be entered.
Zero scale	1000	The value in engineering units that corresponds with the zero scale (4mA) value. E.g. for a temperature with a range of –30 ... +80 °C the value –30 should be entered.
Dampening factor	900	Dampening factor [0 ... 8]. Can be used to obtain a smooth output signal. The value represents the number of calculation cycles * 8 that are required to get to the new setpoint. *0: No filtering* *1: It takes 8 cycles to get to the new setpoint* *2: It takes 16 cycles to get to the new setpoint* etc. For example: following filtering is used when setpoint is set to 1: 

Subject to change without notice

6.6.4 Digital IO assignments

Each flow module provides 16 multi-purpose digital channels that can be assigned to any type of input or output.

Table 30 Digital IO assignments

Setting	Security level	Description
Tag	900	Alphanumeric string representing the tag name of the output transmitter, e.g. "AO-045". Only used for display and reporting purposes.
Signal type	1000	Assigns the digital signal to a specific purpose. *0: Not used* *1: Digital input (e.g. status input)* *2: Digital output (e.g. status output, control output)* *3: Pulse input A (single pulse/channel A of dual pulse)* *4: Pulse input B (channel B of dual pulse)* *9: Pulse output 1 (to drive an E/M counter or a sampler)* *10: Pulse output 2* *11: Pulse output 3* *12: Pulse output 4*

6.6.5 Digital IO settings

Additional settings for the 16 digital channels.

Table 31 Digital IO settings

Setting	Security level	Description
Polarity	900	*1: Positive* *2: Negative* Refer to setting "Input latch mode" for more details.
Threshold level	900	Each digital channel has 2 threshold levels, which are as follows (all relative to signal ground):
		Channels 1 through 8: *1: + 3.75 Volts* *2: + 12 Volts*
		Channels 9 through 16: *1: + 1.25 Volts* *2: + 12 Volts*
Input latch mode	900	● Only applies when signal type is "Digital input" *1: Actual* *2: Latched*
		Polarity = Positive & Input latch mode = Actual then digital input is *0: OFF when signal is currently below threshold* *1: ON when signal is currently above threshold* Polarity = Positive & Input latch mode = Latched then digital input is *0: OFF when signal has not been above threshold* *1: ON when signal is or has been above threshold in the last calculation cycle*
Output min. activation time	900	● Only applies when signal type is "Digital output". Minimum period of time that the signal will remain activated. After the minimum activation time has elapsed the output signal will remain activated until the control value becomes 0.
Output delay time	900	● Only applies when signal type is "Digital output". Period of time that the control signal must be high (> 0) without interruption before the output will be activated. If the control signal becomes 0 before the time has elapsed, then the output signal will not be activated. The value 0 disables the delay function.

Subject to change without notice

6.6.6 Pulse input

> As for any digital signal a pulse input has a threshold level (Volts) that determines whether the actual signal is considered on or off.
> The actual threshold level is defined on display “Digital IO settings”.

Meant for a flow meter that provides a single or dual pulse output signal. Each flow module supports either 1 single or 1 dual pulse input.

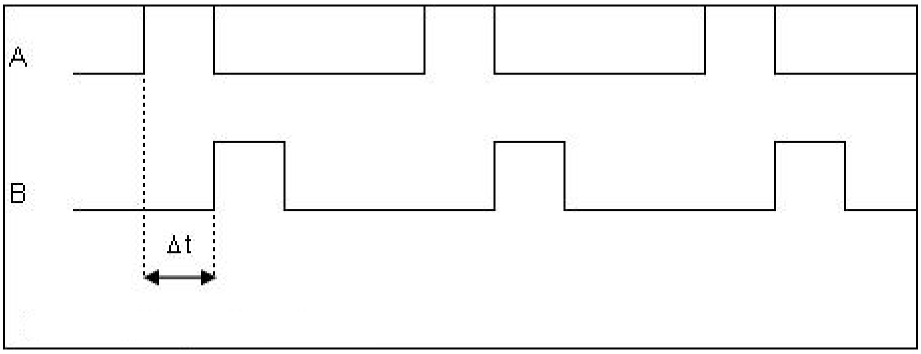
A dual pulse signal is a set of two pulse signals (“pulse trains”) A and B that originate from the same flow meter. The two pulse trains are similar but shifted in phase (typically 90°).

The primary purpose of the dual signal is to allow for pulse integrity checking. Added or missing pulses on either pulse train can be detected and corrected for and simultaneous noise pulses can be rejected.

Detailed information is provided on the raw, corrected and error pulses for both channels.

The phase shifted pulse train signal also allows for automatic detection of flow direction. Each A pulse is followed by a B pulse within a time period (Δt) in case the flow runs in the forward direction. In case the flow runs in the reverse direction, the opposite is the case, i.e. each B pulse is followed by an A pulse within the same time period Δt.

Figure 78 Channel B lags Channel A



There is also the option to conditionally output the raw pulse signal, which is useful in case a separate flow computer is used for proving purposes. The proving flow computer takes the pulse output from the flow computer that processes the meter on prove to perform prove measurements including double chronometry if required. The prover output signal is generated at 10 MHz, the same frequency at which the raw pulse input signals are sampled.

The SICK Flow-X series of flow computers provides Level A and Level B pulse security as defined in ISO 6551. Level B means that bad pulses are detected but not corrected for. At Level A bad pulses are detected and corrected.

► Select: Display > Configuration, <Module IO <x.>, Pulse input
 with <x> the number of the module to which the input is physically connected

Subject to change without notice

Each flow module has 1 pulse input, which may be either a single or a dual type of signal. The following settings are available for the pulse input of each flow module.

Table 32 Pulse input settings

Setting	Security level	Description
Error pulses limit	1000	When the number of error pulses reaches this limit, then a corresponding alarm will be raised. The value 0 disables this limit check. Not used for a single pulse input (channel B = not assigned).
Good pulses reset limit	1000	When the number of consecutive good pulses (so without any error pulse) exceeds this limit then the number of error pulses will automatically be reset to 0. The value 0 disables this reset function. Not used for a single pulse input (channel B = not assigned).
Error rate limit	1000	When the absolute difference in the pulse frequency between channel A and B exceeds this limit, then a corresponding alarm will be raised. The value 0 disables this limit check. Not used for a single pulse input (channel B = not assigned).
Pulse fidelity level	1000	Pulse fidelity levels according to ISO6551 None: No pulse fidelity checking or correction Level A: Pulse verification, alarming and correction Level B: Pulse verification and alarming; no correction If pulse fidelity level A is enabled, then the corrected pulses are used for flow totalization. If pulse fidelity level B is enabled or if pulse fidelity checking is disabled, then the uncorrected pulses of channel A are used or, in case channel A does not provide any pulses, the uncorrected pulses of channel B are used.
Pulse fidelity threshold	1000	Pulse fidelity checking is only enabled when the actual pulse frequency is above this threshold limit [Hz].

Subject to change without notice

6.6.7

Pulse outputs

Pulse outputs can be used to feed pulses to an electro-mechanical (E/M) counter.

A reservoir is used to accumulate the pulses. Pulses are taken from the reservoir and fed to the output at a rate that will not exceed the specified output rate.

► Select: Display > Configuration, <Module IO <x.>, Pulse outputs, Pulse output <y>
with <x> the number of the module to which the output is physically connected and <y> the relative output number

Each flow module has 4 pulse outputs.

For each pulse output the following settings are available.

Table 33 Pulse output settings

Setting	Security level	Description
Significance	900	Factor that specifies the relation between the input value and the number of output pulses. E.g. a value of 100 means that 1 pulse is generated whenever 100 input units (e.g. m3) have been accumulated.
Max frequency	900	Maximum pulse frequency. When output pulses are generated at a frequency higher than the maximum output rate, the superfluous pulses will be accumulated in the pulse reservoir. The maximum output rate is not a restriction of the Flow-X flow computer, but may be a restriction of the connected device. E.g. a electro-mechanical counter may be able to generate pulses up to 10 Hz.
Pulse duration	900	The flow computer uses a fixed pulse duration to output the pulses. The “Pulse duration” is the time that an output pulse remains active (high) in millisecond. The actual pulse duration that will be used is the minimum of this setting and the time corresponding to 50% duty cycle at maximum frequency. E.g. if the setting = 0.25 s and the maximum frequency = 5 Hz, then the actual pulse duration equals 0.5 * 1/5 = 0.1 s.
Reservoir limit	900	Alarm limit for the number of pulses in the reservoir buffer. When the number of pulses in the reservoir exceeds the limit, then an alarm will be raised and no further pulses will be accumulated.

Subject to change without notice

6.7 Overall setup

The application can be used for the following situations:

1 Single run application
  – Flow-X/P1 or X/M
2 Multiple runs without station functionality (X/P only)
  – 2-4 runs (X/P2, X/P3, or X/P4)
  – One application file for all runs
3 Multiple runs with station functionality (X/P only)
  – 2-4 runs (X/P2, X/P3, or X/P4)
  – One application file for all runs including station
4 Run FC of a (multiple run FCs <> station FC) configuration
  – The run FC communicates to the station FC via Modbus
  – Separate applications files for each run FC
5 Station FC of a (multiple run FCs <> station FC) configuration
  – The station FC communicates to the run FCs via Modbus
  – Separate application file for the station FC

Setting up an application for these situations is done by a combination settings in Flow-Xpress and settings on the “Overall setup” display.The following overview shows how to set up the SICK Flow-X for any of these situations:

6.7.1 Setting up a single run application

A single run application is set up as follows:

Table 34 Single run application

Flow-Xpress		
	Device Setup:	X/S single or X/P with 1 module
Overall setup		
	Meter run functionality:	Enabled
	Station totals and rates:	Disabled
	Station product:	Disabled

6.7.2 Setting up a multiple run application without station functionality

A multiple run application without station functionality is set up as follows:

Table 35 Multiple run application without station functionality

Flow-Xpress		
	Device Setup:	X/P with 2, 3 or 4 modules
Overall setup		
	Meter run functionality:	Enabled
	Station totals and rates:	Disabled
	Station product:	Disabled

Subject to change without notice

6.7.3 Setting up a multiple run application with station functionality

A multiple run application with station functionality is set up as follows:

Table 36 Multiple run application with station functionality

Flow-Xpress		
	Device Setup:	X/P with 2, 3 or 4 modules
Overall setup		
	Meter run functionality:	Enabled
	Station totals and rates:	Enabled*
	Station product:	Panel (X/P only)*
	*Depending on the required station functionality, at least one of these settings must be enabled	

6.7.4 Setting up a run FC of a (multiple run FCs <> station FC) configuration

A run FC of a (multiple run FCs <> station FC) configuration is set up as follows:

Table 37 Run FC of a configuration

Flow-Xpress		
	Device Setup:	X/S single or X/P with 1 module
	Ports & Devices	Enable the “Remote station FC” modbus list (either on a COM port or on the Ethernet port) and give it device number 100.
Overall setup		
	Meter run functionality:	Enabled
	Station totals and rates:	Enabled or Disabled*
	Station product:	Remote station FC
	*This setting is not applicable for this configuration.	

6.7.5 Setting up the station FC of a (multiple run FCs <> station FC) configuration

The station FC of a (multiple run FCs <> station FC) configuration is set up as follows:

Table 38 Station FC of a configuration

Flow-Xpress		
	Device Setup:	X/S single or X/P with 1 module
	Ports & Devices	Enable a “Remote run FC” modbus list (either on a COM port or on the Ethernet port) for each run and give it a device number between 101 and 108. The run with device nr. 101 will be read as run 1, 102 as run 2, etc.
Overall setup		
	Meter run functionality:	Disabled
	Station totals and rates:	Enabled or Disabled*
	Station product:	Remote station FC
	*Depending on the required station functionality, station totals and rates can be enabled or disabled.	

Subject to change without notice

6.8 Settings

6.8.1 Overall setup settings

► Select: Display > Configuration, Overall setup, Overall setup

The overall setup display contains the following settings:

Table 39 Overall setup settings

Setting	Security level	Description
Meter run functionality	1000	Enables or disables all meter run functionality. If the flow computer should act as a remote station flow computer, then the meter run functionality should be disabled. In all other cases meter run functionality must be enabled. *0: Disabled* *1: Enabled*
Station totals and rates	900	Determines whether or not the flow computer maintains station totals, station flow rates and station averages. *0: Disabled* No station totals, rates and averages are maintained *1: Enabled* Station totals, rates and averages are maintained
Station product	900	Defines if a common product setup is used for all meter runs or if each meter run uses its own product setup. If enabled, one common density/gas composition is used for all runs. If disabled, each run uses its own density/gas composition. *0: Disabled* *1: Panel (XP only)* A common product setup is used for all mete runs of a Flow-XP. This option is only available on a SICK Flow-X/P. *2: Remote station FC* A common product setup is used for all mete runs, while station functionality is conducted b a remote station flow computer. Option 2: “Remote station FC” activates communication between a run flow computer and a remote station flow computer. In case of a *remote station flow computer* the Station product must be set to “Remote station FC” AND meter run functionality must be disabled. On a *run flow computer* that has to communicate to a remote station flow computer, the Station product must also be set to “Remote station FC”, but meter run functionality should be enabled
Flow weighted averaging method	1000	Determines whether flow weighted averages are weighted on volume flow or mass flow. *1: Volume* *2: Mass*
Date format	1000	Date format used on the flow computer screens and reports *1: dd/mm/yy* *2: mm/dd/yy*
Atmospheric pressure	1000	The local atmospheric pressure [bar(a)] is used to convert gauge pressure to absolute pressure and vice versa.
Molar mass of air	1000	The molar mass of air [kg/kmol] is used to calculate the specific gravity. If the specific gravity is a live input (via a SG transducer or as a process input) then this parameter is used to calculate the observed and base density and corresponding volumes. 28.9626 [kg/mol] according to ISO-6976:1995
Base density of air	1000	The base density of air [kg/m3] is used to calculate the relative density. Typical values are 1.292923 [kg/kmol] at 0 [°C], 1.224510 [kg/kmol] at 15 [°C] and 1.204449 [kg/kmol] at 20 [°C] (from ISO-6976:1995)

Subject to change without notice

Table 39 Overall setup settings

Setting	Security level	Description
Reference pressure	1000	The reference pressure [bar(a)] for the base density and base volume
Reference temperature	1000	The reference temperature [°C] for the base density and base volume
Universal gas constant	1000	Universal gas constant R [J/K/mol]. 8.314510 [J/K/mol] according to IS6976:1995 Refer to section calculations to check when and how this parameter is used.
Use net HV for energy	900	Controls whether the net heating value is used for energy totals instead of the gross heating value. *0: No* *1: Yes*
Disable totals if meter is inactive	1000	Controls if totals should be disabled when the meter is inactive. The meter is inactive if the flow rate or pulse frequency is below the threshold level. *0: No* *1: Yes*
Set flow rate to 0 if meter is inactive	900	Controls if the flow rates should be set to 0 when the meter is inactive. The meter is inactive if the flow rate or pulse frequency is below the threshold level. *0: No* *1: Yes*
MID compliance	1000	Compliance with the Measuring Instrument Directive (MID). *0: Disabled* *1: Enabled* Refer to chapter "MID Compliance" for more information.
Reverse totals	1000	Enables or disabled the reverse totals. If reverse totals are disabled, only forward totals are shown. *0: Disabled* *1: Enabled* See paragraph "Flow direction input" for an explanation how to configure the flow direction.

Subject to change without notice

6.8.2

System data settings

► Select: Display > Configuration, Overall setup, System data:

Table 40 System data settings

Setting	Security level	Description
System tag	900	Tag number for the meter station or in case of a single stream flow computer, the meter run, e.g. "YY-100"
System location	900	Name of the location of the meter station or in case of a single stream flow computer, the meter run, e.g. "Green field,South section"
System description	900	Description of the meter station or in case of a single stream flow computer, the meter run, e.g. "Export stream 2"
System company	900	Name of the company that owns the meter station or in case of a single stream flow computer, the meter run, e.g. "GasTransco"
Flow computer tag	900	Tag number of the flow computer, e.g. "FY-1001A"

6.8.3

Period settings

The start of the daily period is configurable. Furthermore there are 2 user-definable periods that can be used for any period type and any period start, e.g. a 2 weekly period starting at Tuesday 06:00 or a 2nd fiscal day starting at 08:00. The flow computer maintains the same set of totals and averages for the user-definable periods as for the hourly and daily periods.

► Select: Display > Configuration, Overall setup, Periods

Table 41 Period settings

Setting	Security level	Description
Day start hour	900	Start of the daily period as offset in hours from midnight. E.g. for a day start at 6:00 AM this parameter should be set to 6.
Period <X> type	900	Type of period *1: Second* *2: Minute* *3: Hour* *4: Day* *5: week* *6: Month* *7: Quarter* *8: Year*
Period <X> duration	900	Period duration, i.e. number of period types. E.g. for a 2 weekly period, enter a 2 (and set the period type at 5: week).
Period <X> start day	900	Offset in days
Period <X> start hour	900	Offset in hours
Period <X> start minute	900	Offset in minutes E.g. to define a monthly event at the 5th on 06:30, enter 4 for Period start day, 6 for Period start hour and 30 for Period start minute
Period <X> label	900	Text to be shown on period displays and reports E.g. "Weekly" or "Two monthly"

Subject to change without notice

6.8.4 Totalizer settings

► Select: Display > Configuration, Overall setup, Totals

Table 42 Totalizer settings

Setting	Security level	Description
Gross volume total decimal places	900	The number of decimal places for the indicated and gross volume cumulative totals
Base volume total decimal places	900	The number of decimal places for the base (standard) volume cumulative totals.
Mass total decimal places	900	The number of decimal places for the mass cumulative totals.
Energy total decimal places	900	The number of decimal places for the energy cumulative totals.
Gross volume total rollover val	900	The rollover value for the indicated and gross volume cumulative totals.
Base volume total rollover val	900	The rollover value for the base (standard) volume cumulative totals.
Mass total rollover val	900	The rollover value for the mass cumulative totals.
Energy total rollover val	900	The rollover value for the energy cumulative totals.

Subject to change without notice

6.9 Meter run setup

+i These displays are only available if “Meter run functionality” is enabled.

6.9.1 Run setup

The overall meter run settings are accessible through the following display:

► Select: Display > Configuration, Run <x.>, Run setup
with <x> the relative number of the flow module that controls the flow meter

+i If “Station product” is enabled, then the settings marked with (*) are not available on the “Run setup” display, but on the “Station setup” display instead.

Table 43 Meter run settings

Setting	Security level	Description
Meter device type	1000	The following meter device types are supported: *1: Pulse* Any SICK flow meter that provides a single or dual pulse signal representing the volumetric or mass flow. *2: Smart* Any SICK flow meter that provides its flow rate and/or total value through an analog or HART signal or via a Modbus communications link. Typically used for ultrasonic flow meters. For a HART signal and a Modbus communications link the corresponding communications device (refer to paragraph “Smart meter setup”) needs to be defined as well. *3: Smart/pulse* Any SICK flow meter that provides its flow rate and/or total value through an analog or HART signal or via a Modbus communications link and also through a single or dual pulse signal. Either the smart or the pulse signal may be defined as the primary signal for totalization. Also a deviation check between the two signals is performed. Typically used for ultrasonic flow meters that provide both a communications link and a pulse signal.
Base density input type (*)		Defines how the base density (density at reference conditions) is determined. *1: Always use keypad* Use this option when a fixed value is used for the base density *5: Custom input* The value [kg/sm3] that is written to tag “Base density custom value” will be used as the base density. Use this option when the base density value is sent to the flow computer over a Modbus communications link or when you want to apply user-defined calculations for the base density value. *6: Calculated from gas composition* The base density is calculated from the gas composition. Refer to chapter Calculations for more information about the actual calculations *12: Gas chromatograph value* Uses the base density that is read from the gas chromatograph.
Meter density calculation method		Defines how the meter density (density at line conditions) is calculated *1: Calculated from base density* Defines how the specific gravity (SG) is determined

Subject to change without notice

Table 43 Meter run settings

Setting	Security level	Description
Specific gravity input type (*)		Defines how the specific gravity (SG) is determined. *0: None (calculated from base density)* There is no specific gravity input. Specific gravity is calculated from base density. *1: Always use keypad* Use this option when a fixed value is used for the specific gravity. *5: Custom* The value [-] that is written to tag “Specific gravity custom value” will be used as the specific gravity. Use this option when the specific gravity value is sent to the flow computer over a Modbus communications link or when you want to apply user-defined calculations for the specific gravity value.
Gas composition input type (*)		Defines how the gas composition is provided to the flow computer *0: None* No gas composition is being used. *1: Always use keypad* Always uses the keypad gas composition, which is manually entered through the operator display *2: One gas chromatograph* The gas composition is provided by a single gas chromatograph (GC). The composition may be overruled by the keypad composition *3: Two gas chromatographs* The gas composition is provided by two (redundant) gas chromatographs. The composition of the selected GC will be used for the calculations. The composition may be overruled by the keypad composition *4: Custom* The component values that are written to the custom composition tags will be used. Use this option when the composition is sent to the flow computer over a Modbus communications link by an external system or when you want to apply user-defined calculations to set the component values.

Subject to change without notice

6.9.2
Flow meter setup

The type of flow meter is set up under Configuration, Run <x>, Run Setup.

► Select: Display > Configuration, Run <x.>, Flow meter, Meter data
with <x> the relative number of the flow module that controls the flow meter

Table 44 Flow meter setup

Setting	Security level	Description
Meter tag	900	Flow meter tag, e.g. “FT-1023AA”
Meter ID	900	Flow meter ID, e.g. “Check meter gas export 2”
Meter serial number	900	Flow meter serial number, e.g. “H1009245”
Meter manufacturer	900	Flow meter serial number, e.g. “H1009245”
Meter model	900	Flow meter model, e.g. “Promass 83”
Meter size	900	Flow meter size, e.g. “120 mm” or “ 11" “

6.9.3
Pulse input

This display is only available if “Meter device type” is either “Pulse” or “Smart/Pulse”.

► Select: Display > Configuration, Run <x.>, Flow meter, Pulse input
with <x> the relative number of the flow module that controls the flow meter

Table 45 Pulse input settings

Setting	Security level	Description
Pulse input quantity type	1000	Either “Volumetric” for a volumetric flow meter (e.g. turbine, PD, ultrasonic) or “Mass” for a mass flow meter (e.g. coriolis) *1: Volume* *2: Mass*
HF/LF pulses	1000	Enables or disables high frequency/low frequency pulses. *0: Disabled* Pulse A and B are both high frequency pulses. *1: Enabled* Pulse B is a low frequency pulse. The low frequency pulse is only used to check the high frequency pulse. The high frequency pulse (pulse A) is used for the flow calculations.
HF/LF pulses blade ratio	1000	Defines the ratio between the high frequency pulses and low frequency pulses E.g. a blade ratio of 4 means that there will be one LF pulse for every 4 HF pulses.
Meter active threshold frequency	1000	When the actual frequency (Hz) is below this threshold value, the meter is considered to be inactive. Depending on the settings “Disable totals when meter inactive” and “Set flow rate to 0 when meter inactive” the totals are stopped and/or the flow rate is set to zero (refer to paragraph “Overall setup”).

Subject to change without notice

6.9.4 Smart meter

> This display is only available if “Meter device type” is either “Smart” or “Smart/ Pulse”.

► Select: Display > Configuration, Run <x.>, Flow meter, Smart meter
with <x> the relative number of the flow module that controls the flow meter

Table 46 Smart meter settings

Setting	Security level	Description
Smart meter input type	1000	Type of input used for the “smart” flow meter *1: HART / Modbus* *2: Analog input*
Use flow rate or total	1000	● Only applies when smart meter input type = “HART / Modbus”. Determines whether the flow rate or the flow total value as provided by the flow meter is used for flow totalization. *1: Flow rate* *2: Flow total* In case of an analog input the input always represents a flow rate.
Analog input quantity type	1000	● Only applies when smart meter input type = “2: Analog input” or when input type is “1: HART / Modbus” and option “HART to analog fallback” is enabled *1: Volumetric* *2: Mass* For HART or Modbus inputs this is determined automatically from the communication tag list of the assigned communication device.
Analog input module	1000	● Only applies when smart meter input type = “2: Analog input” or when input type is “1: HART / Modbus” and option “HART to analog fallback” is enabled. Number of the flow module to which the analog signal is physically connected. *-1: Local module means the module of the meter run itself.*
Analog input channel	1000	● Only applies when smart meter input type = “2: Analog input” or when input type is “1: HART / Modbus” and option “HART to analog fallback” is enabled. Number of the analog input channel on the selected module to which the analog signal is physically connected.
HART/Modbus internal device nr	1000	● Only applies when smart meter input type = “HART / Modbus”. Device nr. of the communication device as assigned in the configuration software (Flow-Xpress, section “Ports & Devices”)
HART to analog fallback	1000	● Only applies for a single HART transmitter in a loop, where the 4 ... 20 mA signal is provided together with the HART signal. *0: Disabled* The 4 ... 20 mA signal will not be used when the HART signal fails. Instead value corresponding with the “Fallback type” will be used. *1: Enabled* The 4 ... 20 mA signal will be used when the HART signal fails. When both the HART and the mA signal fail the value corresponding with the “Fallback type” will be used.
Meter active threshold flow rate	1000	The meter will be considered inactive when the flow rate is below this limit value. The value should have the same units as used by the flow rate that is indicated by flow meter (m3/hr in case of a volume flow meter, kg/hr in case of a mass flow meter). Depending on the settings “Disable totals when meter inactive” and “Set flow rate to 0 when meter inactive” the totals are stopped and/or the flow rate is set to zero (refer to paragraph “Overall setup”).
Pulse is primary	1000	● Only applies when meter type is “Smart/pulse”. Controls whether the pulse input or the smart input is used as the primary source for flow totalization. *1: No* Smart input is primary *2: Yes* Pulse input is primary When the primary input fails, while the secondary input is healthy, then the secondary input will be used for totalization. Note that a single pulse input is always considered to be healthy.

Subject to change without notice

Table 46 Smart meter settings

Setting	Security level	Description
Flow deviation limit smart/pulses	900	● Only applies when meter type is “Smart/pulse”. The flow rate as indicated by the smart and pulse inputs are compared and an alarm is raised when the relative deviation between the two is larger than the “Flow deviation limit” [%].
Pulse K-factor selection	900	● Only applies when meter type is “Smart/pulse”. *1: Use parameter value* Uses the K-factor that is configured in the flow computer *2: Read from flow meter* Uses the K-factor that is read from the smart meter
		Note that communication of the K-factor via Modbus is not supported by all smart meters.
Flow meter total roll-over	900	Roll-over value for the flow meter total. The total is reset to zero if this limit is reached.
Flow meter max. change in total	900	Total increments beyond this limit will be ignored. This may f.e. happen in case the totalizer in the meter is reset or when the meter is replaced.
AGA10 velocity of sound check	900	Enables or disables a check between the velocity of sound (VOS) from the meter and the velocity of sound calculated by the flow computer based on AGA10. *0: Disabled* *1: Enabled* ● Only applies to ultrasonic flow meters.
Velocity of sound deviation limit	900	Deviation limit [m/s] for the velocity of sound check. If the velocity of sound check is enabled and the deviation between the VOS from the meter and the VOS calculated by the flow computer exceeds this limit, then an alarm is generated.

6.9.5 Data valid input

The Data valid input is an optional input that can be used to control the accountable totals (for MID compliance). It is usually only applicable for smart flow meters (e.g. ultrasonic or coriolis) that provide a pulse output signal.

► Select: Display > Configuration, Run <x.>, Flow meter, Data valid input
with <x> the relative number of the flow module that controls the flow meter

Table 47 Data valid input settings

Setting	Security level	Description
Data valid input type	900	Selects the data valid input type *0: None* Data valid check is disabled *1: Digital input* Reads the data valid status from a digital input. *2: Smart meter input* Uses the data valid status from the flow meter Modbus communication. *3: Custom* The value that is written to tag “Data valid custom condition” will be used. Use this option when the data valid condition is sent to the flow computer over a Modbus communications link or when you want to apply user-defined calculations for the data valid condition.
Data valid digital input module	900	Number of the flow module to which the signal is physically connected. *-1: Local module means the module of the meter run itself.*
Data valid digital input channel	900	Number of the digital channel on the selected module to which the signal is physically connected.

Subject to change without notice

6.9.6 Flow direction input

> Only available if “Reverse totals” are enabled (Display > Configuration, Overall setup, Overall setup).

The Flow direction input is used to control the flow direction.

- Select: Display > Configuration, Run <x.>, Flow meter, Flow direction input
  with <x> the relative number of the flow module that controls the flow meter

Table 48 Flow direction input settings

Setting	Security level	Description
Data valid input type	900	Selects the low direction input type. *1: Meter pulse phase* ● Only applies to dual pulse meters. The flow direction is derived from the sequence of the dual pulses. See paragraph“Pulse input” for more details. *1: Digital input* Reads the flow direction status from a digital input (0: Forward, 1: Reverse) *2: Smart meter input* Uses the flow direction from the flow meter Modbus communication *3: Custom* The value that is written to tag “Flow direction custom value” will be used. Use this option when the flow direction value is sent to the flow computer over a Modbus communications link or when you want to apply user-defined calculations for the flow direction.
Data valid digital input module	900	Number of the flow module to which the signal is physically connected. *-1: Local module means the module of the meter run itself*
Data valid digital input channel	900	Number of the digital channel on the selected module to which the signal is physically connected.

Subject to change without notice

6.9.7 Meter body correction

Only available when “Meter device type” is “Pulse”, “Smart” or “Smart/Pulse”.

The meter body correction facility is mainly meant for ultrasonic flow meters for which a correction of the expansion of the meter body may be required.

► Select: Display > Configuration, Run <x.>, Flow meter, Meter body correction
with <x> the relative number of the flow module that controls the flow meter

Table 49 Meter body correction settings

Setting	Security level	Description
Meter body correction	900	Controls if the correction is enabled or not *0: Disabled* *1: Enabled*
Meter body coefficient selection	900	*1: Use parameter value* Uses the body expansion coefficients that are configured in the flow computer *2: Read from flow meter* Uses the body expansion coefficients that are read from the smart meter Note that communication of the body expansion coefficients via Modbus is not supported by all smart meters.
Cubical temperature expansion coefficient	900	Cubical temperature expansion coefficient [1/K] (same as 1/°C) Equals linear temperature expansion coefficient multiplied by 3. Typical values are 4.12 E-5 for carbon steel and 5.23 E-5 for stainless steel.
Body correction reference temperature	900	Reference temperature for body correction [°C]
Cubical pressure expansion coefficient	900	Cubical pressure expansion coefficient [1/bar] Equals linear pressure expansion coefficient multiplied by 3. Typical value is 6 E-6 both for carbon steel and stainless steel.
Body correction reference pressure	900	Reference pressure for body correction [bar(a)].

Subject to change without notice

6.10 Station setup

6.10.1 Station setup

Only available when “Meter device type” is “Pulse”, “Smart” or “Smart/Pulse”

► Select: Display > Configuration, Station, Station setup.

The following settings are available on the “Station setup” display:

Table 50 Station setup settings

Setting	Security level	Description
Observed density input type		See the description in paragraph “Run setup”
Base density input type		xxx
Specific gravity input type		xxx
Gas composition input type		xxx

6.10.2 Station data

Only available on a SICK Flow-X/P with “Station product”, or “Station totals and rates” enabled and on a Remote station FC.

► Select: Display > Configuration, Station, Station data

Table 51 Station data settings

Setting	Security level	Description
Station ID		Station ID (text)
Station tag		Station tag (text)

6.10.3 Meter runs

Only available on a SICK Flow-X/P with “Station product”, or “Station totals and rates” enabled and on a Remote station FC.

► Select: Display > Configuration, Station, Station data

This display page gives an overview of the meter runs that make up the station.

Table 52 Meter runs

Setting	Security level	Description
Meter run <x> totalizer type		Defines how the station totals and rates are calculated. *1: Positive* The flow of this run is added to the station totals and rates. This is the default setting. *0: None* The flow of this run is not taken into account in the station totals and rates. *-1: Negative* The flow of this run is subtracted from the station totals and rates. This option should be used for return flows

Subject to change without notice

6.11 Setting up the temperature

► Select: Display > Configuration, Run <x.>, Temperature (, Meter temperature) with <x> the relative number of the flow module that controls the flow meter.

Table 53 Temperature settings

Setting	Security level	Description
Input type	1000	Type of input *1: Always use keypad* *2: Analog input* *3: Pt100 input* *4: HART* *5: Custom input* When option 5: Custom is selected then the value [°C] that is written to tag “Meter temperature custom value” will be used. Use this option when the temperature value is sent to the flow computer over a Modbus communications link or when you want to apply user-defined calculations for the temperature.
Analog / Pt100 input module	1000	● Only applies when input type is “2: Analog input” or “3: Pt100 input” or when input type is “4: HART” and option “HART to analog fallback” is enabled. Number of flow module to which the signal is physically connected to. *-1: Local module means the module of the meter run itself*
Analog / Pt100 input channel	1000	● Only applies when input type is “2: Analog input” or “3: Pt100 input” or when input type is “4: HART” and option “HART to analog fallback” is enabled. Number of the analog input channel on the selected module to which the signal is physically connected.
HART internal device nr.	1000	● Only applies when input type is “4: HART”. Internal device nr. of the HART transmitter as assigned in the configuration software (Flow-Xpress: “Ports & Devices”)
HART variable	1000	● Only applies when input type is “4: HART” Determines which of the 4 HART variables provided by the HART transmitter is used. Select the variable that represents the temperature. Usually this is the 1st (primary) variable.
Fallback type	1000	Determines what to do in case the input fails. *1: Last good value* Keep on using the last value that was obtained when the input was still healthy. *2: Fallback value* Use the value as specified by parameter “Fallback value” The fallback value is usually a fixed value and will generally never be changed during the lifetime of the flow computer. *3: Keypad value* Use the value as specified by parameter “Keypad value”
Fallback value	1000	● Only used when Fallback type is “2: Fallback value”. Represents the temperature [°C] that should be used when the input fails.
HART to analog fallback	1000	● Only applies for a single HART transmitter, where the 4 ... 20 mA signal is provided together with the HART signal. *0: Disabled* The 4 ... 20 mA signal will not be used when the HART signal fails. Instead the value corresponding with the “Fallback type” will be used. *1: Enabled* The 4 ... 20 mA signal will be used when the HART signal fails. When both the HART and the mA signal fail the value corresponding with the “Fallback type” will be used.

Subject to change without notice

6.12 Setting up the pressure

► Select: Display > Configuration, Run <x.>, Temperature (, Meter temperature) with <x> the relative number of the flow module that controls the flow meter

Table 54 Pressure settings

Setting	Security level	Description
Input type	1000	Type of input *1: Always use keypad* *2: Analog input* *4: HART* *5: Custom input* When option 5: Custom is selected then the value ([bar(a)] or [bar(g)]) that is written to tag “Meter pressure custom value” will be used. Use this option when the pressure value is sent to the flow computer over a Modbus communications link or when you want to apply user-defined calculations for the pressure.
Input units	1000	*1: Absolute* The input value is an absolute pressure [bar(a)] *2: Gauge* The input value is a gauge pressure [bar(g)] (i.e. relative to the atmospheric pressure)
Analog input module	1000	● Only applies when input type is “2: Analog input” or when input type is “4: HART” and option “HART to analog fallback” is enabled Number of flow module to which the signal is physically connected to. *-1: Local module means the module of the meter run itself*
Analog input channel	1000	● Only applies when input type is “2: Analog input” or when input type is “4: HART” and option “HART to analog fallback” is enabled Number of the analog input channel on the selected module to which the signal is physically connected.
HART internal device nr	1000	● Only applies when input type is “4: HART”. Internal device nr. of the HART transmitter as assigned in the configuration software (Flow-Xpress: “Ports & Devices”)
Hart variable	1000	● Only applies when input type is “4: HART” Determines which of the 4 HART variables provided by the HART transmitter is used. Select the variable that represents the pressure. Usually this is the 1st (primary) variable.
Fallback type	1000	Determines what to do in case the input fails. *1: Last good value* Keep on using the last value that was obtained when the input was still healthy. *2: Fallback value* Use the value as specified by parameter “Fallback value” The fallback value is usually a fixed value and will generally never be changed during the lifetime of the flow computer. *3: Keypad value* Use the value as specified by parameter “Keypad value”
Fallback value	1000	● Only used when Fallback type is “2: Fallback value”. Represents the pressure ([bar(a)] or [bar(g)], depending on the selected pressure input units) that should be used when the input fails.
HART to analog fallback	1000	● Only applies for a single HART transmitter, where the 4 ... 20 mA signal is provided together with the HART signal. *0: Disabled* The 4 ... 20 mA signal will not be used when the HART signal fails. Instead the value corresponding with the “Fallback type” will be used. *1: Enabled* The 4 ... 20 mA signal will be used when the HART signal fails. When both the HART and the mA signal fail the value corresponding with the “Fallback type” will be used.

Subject to change without notice

6.13 Configuring gas chromatographs

> Whether the gas chromatograph configuration is on station or meter run level is controlled by parameter “Station product”, which is accessible through Display Configuration, Overall setup, Overall setup.

The gas composition may be obtained from 1 or 2 gas chromatographs. The gas chromatograph(s) must be defined as a communications device in Flow-Xpress, section “Ports & Devices”.

The following display is only available when “Gas composition input type” is set to “One gas chromatograph” or “Two gas chromatographs”:

► Select: Display > Configuration, Run <x.>, Single / Dual chromatograph(s)
Display > Configuration, Station, Single / Dual chromatograph(s)
with <x> the relative number of the flow module that controls the flow meter

Table 55 Gas chromatograph settings

Setting	Security level	Description
GC A/B internal device nr.	1000	Internal device nr. of the gas chromatograph as assigned in the configuration software (Flow-Xpress: “Ports & Devices”)
GC selection mode	1000	● Only applies when “Gas composition input type” is set to “Two Gas Chromatographs”. Controls the selection between the 2 GCs. The gas composition of the selected GC is used for the calculations. The selection is based on a GC failure, which occurs when: the GC does not communicate (properly) to the flow computer the GC indicates a measurement problem. the GC is not in normal operation, but e.g. in maintenance or in calibration Note: The actual logic to determine a measurement problem or the operational mode of a GC may be different for each type of GC. *1: Auto-A* GC B is only selected when it has no failure, while GC A has a failure. GC A is selected in all other cases. *2: Auto-B* GC A is only selected when it has no failure, while GC B has a failure. GC B is selected in all other cases. *3: Manual-A* GC A is always selected, independent of any failure *4: Manual-B* GC B is always selected, independent of any failure

Subject to change without notice

6.14 Configuring gas properties

+i Whether the gas properties configuration is on station or meter run level is controlled by parameter Station product, which is accessible through display Configuration, Overall setup, Overall setup.

► Select: Display >< Configuration, Run <x.>, Gas properties, Composition
Display > Configuration, Station, Gas properties, Composition
with <x> the relative number of the flow module that controls the flow meter

6.14.1 Composition

Table 56 Gas composition settings

Setting	Security level	Description
Composition fall-back type	900	Determines what to do when the (communication with the) GC is in failure (in case of one GC) or when the (communication with) both GCs are in failure (in case of two GCs) *1: Use last received* Keep using the last received composition before the failure *3: Use keypad composition* Use the keypad composition
Composition fail on limit alarm	900	Determines what to do when one or more components, or the sum of components, are out of limits. *0: Disabled* The live gas composition is used, even in case of a composition limit alarm. *1: Enabled e live gas composition is not used in case of a composition limit alarm. Instead the last received good composition, or the keypad composition is used (depending on the fallback type).*
Live composition Cx+ split mode	1000	● Applies to the live gas composition received from the *gas chromatograph* or the *custom* composition and *not* to the keypad composition! Controls the split up of the C6+, C7+, C8+ or C9+ component of the live composition! *1: Not used* The values for C6, C7, C8, C9 and C10 will be used as received from the GC *2: C6+ split* The C6+ component is split into C6, C7, C8, C9 and C10 according to the defined split percentages. The values of C6, C7, C8, C9 and C10 as received from the GC are neglected. *2: C7+ split* The C7+ component is split into C7, C8, C9 and C10 according to the defined split percentages. The value of C6 is used as received from the GC. The values of C7, C8, C9 and C10 as received from the GC are neglected. *2: C8+ split* The C8+ component is split into C8, C9 and C10 according to the defined split percentages. The values of C6 and C7 are used as received from the GC. The values of C8, C9 and C10 as received from the GC are neglected. *2: C9+ split* The C9+ component is split into C9 and C10 according to the defined split percentages. The values of C6, C7 and C8 are used as received from the GC. The values of C9 and C10 as received from the GC are neglected.
Live composition C6 split %	1000	The C6 split percentage [%] for the live composition
Live composition C7 split %	1000	The C7 split percentage [%] for the live composition
Live composition C8 split %	1000	The C8 split percentage [%] for the live composition
Live composition C9 split %	1000	The C9 split percentage [%] for the live composition
Live composition C10 split %	1000	The C10 split percentage [%] for the live composition

Subject to change without notice

Table 56 Gas composition settings

Setting	Security level	Description
Keypad composition Cx+ split mode	1000	● Applies to the *keypad* composition, not to the composition received from the gas chromatograph or the custom composition! Controls the split up of the C6+, C7+, C8+ or C9+ component from the keypad composition. *1: Not used* The values for C6, C7, C8, C9 and C10 will be used as specified by the keypad composition *2: C6+ split* The C6(+) component from the keypad composition is split into C6, C7, C8, C9 and C10 according to the defined split percentages. The values of C7, C8, C9 and C10 from the keypad composition are neglected. *2: C7+ split* The C7(+) component from the keypad composition is split into C7, C8, C9 and C10 according to the defined split percentages. The value of C6 is used as specified in the keypad composition. The values of C8, C9 and C10 from the keypad composition are neglected. *2: C8+ split* The C8(+) component is split into C8, C9 and C10 according to the defined split percentages. The values of C6 and C7 are used as specified in the keypad composition. The values of C9 and C10 from the keypad composition are neglected. *2: C9+ split* The C9(+) component is split into C9 and C10 according to the defined split percentages. The values of C6, C7 and C8 are used as specified in the keypad composition. The value of C10 from the keypad composition is neglected.
Keypad composition C6 split %	1000	The C6 split percentage [%] for the keypad composition
Keypad composition C7 split %	1000	The C7 split percentage [%] for the keypad composition
Keypad composition C8 split %	1000	The C8 split percentage [%] for the keypad composition
Keypad composition C9 split %	1000	The C9 split percentage [%] for the keypad composition
Keypad composition C10 split %	1000	The C10 split percentage [%] for the keypad composition
neo-Pentane mode	1000	Defines what has to happen to the neo-Pentane component. neo-C5 is not supported by AGA8 and GPA-2172, therefore it has to be added to i-C5 or n-C5, or it can be neglected. *1: Add to i-C5* The neo-Pentane component is added to i-Pentane *2: Add to n-C5* The neo-Pentane component is added to n-Pentane *3: Neglect* The neo-Pentane component is not taken into account

The split percentages should add up to 100%.
If the gas composition doesn't count up to 100%, it is normalized by the flow computer, which means that all component values are raised or lowered proportionally, so that the sum of components counts up to 100%.

Subject to change without notice

6.14.2 Calculation setup

► Select: Display > Configuration, Run <x.>, Gas properties, Calculation setup
Display > Configuration, Station, Gas properties, Calculation setup
with <x> the relative number of the flow module that controls the flow meter r

Table 57 Calculation setup settings

Setting	Security level	Description
Compressibility calculation method	1000	Method to calculate the compressibility factor Z at the meter temperature and pressure and, in case of a live density measurement, also at the density temperature and pressure (Z_{dens}). *1: Keypad* Uses the meter compressibility and density compressibility keypad values *2: AGA8 (detailed)* Requires the gas composition *3: SGERG (AGA8 gross)* Requires additional process inputs for nitrogen, carbon dioxide, specific gravity and gross heating value. One of these 4 inputs may be calculated instead (refer to parameter SGERG input method) *4: NX19* Requires additional process inputs for nitrogen, carbon dioxide, specific gravity and gross heating value. *5: Custom* The values that are written to the tags “Meter compressibility custom value” and “Density compressibility custom value” will be used. Use this option when the compressibility value is sent to the flow computer over a Modbus communications link or when you want to apply user-defined calculations for the compressibility.
Meter compressibility keypad value	1000	Meter compressibility keypad value that is used when the compressibility calculation method is set to “Keypad”
Density compressibility keypad value	1000	Density compressibility keypad value that is used when the compressibility calculation method is set to “Keypad”
Base compressibility calculation method	1000	Method to calculate the compressibility factor at the reference conditions (Z_{base}). *1: Keypad* Uses the base compressibility keypad value *2: AGA8 (detailed)* Requires the gas composition *3: SGERG (AGA8 gross)* Requires additional process inputs for nitrogen, carbon dioxide, specific gravity and gross heating value. One of these 4 inputs may be calculated instead (refer to parameter SGERG input method) *4: NX19* Requires additional process inputs for nitrogen, carbon dioxide, specific gravity and gross heating value. *5: ISO6976-1983* Requires the gas composition *6: ISO6976-1995* Requires the gas composition *7: GPA2172* Requires the gas composition *8: Custom* The value that is written to the tag “Base compressibility custom value” will be used. Use this option when the base compressibility value is sent to the flow computer over a Modbus communications link or when you want to apply user-defined calculations for the base compressibility.
Base compressibility keypad value	1000	Base compressibility keypad value that is used if the compressibility calculation method is set to “Keypad”

Subject to change without notice

Table 57 Calculation setup settings

Setting	Security level	Description
Molar mass calculation method	1000	Method to calculate the molar mass *1: Keypad* Uses the molar mass keypad value *2: AGA8 (detailed)* Requires the gas composition *3: SGERG (AGA-8 gross)* Requires additional process inputs for nitrogen, carbon dioxide, specific gravity and gross heating value. One of these 4 inputs may be calculated instead (refer to parameter SGERG input method) *4: ISO6976-1983* Requires the gas composition *5: ISO6976-1995* Requires the gas composition *6: GPA2172* Requires the gas composition *8: Custom* The value [kg/kmol] that is written to the tag “Molar mass custom value” will be used. Use this option when the molar mass value is sent to the flow computer over a Modbus communications link or when you want to apply user-defined calculations for the molar mass.
Molar mass keypad value	1000	Molar mass keypad value that is used when the molar mass calculation method is set to “Keypad”
Heating value calculation method	1000	Controls how the heating value is determined *1: HV process input* The heating value is provided as a process input (keypad value, analog input, HART input, GC value, custom value). See paragraph “Gross Heating value input” *2: ISO6976-1995* Requires the gas composition *3: ISO6976-1983* Requires the gas composition *4: GPA-2172* Requires the gas composition
SGERG input method	1000	• Only applies if SGERG is selected to calculate the compressibility and/or the base compressibility SGERG calculation method as specified in the standard: *1: All inputs known* *2: Unknown N2* *3: Unknown CO2* *4: Unknown GHV* *5: Unknown RD (relative density)*
SGERG reference conditions	1000	• Only applies if SGERG is selected to calculate the compressibility and/or the base compressibility Reference conditions for the gross heating value and relative density values. *1: GHV/RD 25/0 °C* *2: GHV/RD 0/0 °C* *3: GHV/RD 15/15 °C*
NX19 G9 correction method	1000	• Only applies if NX-19 is selected to calculate the compressibility and/or the base compressibility Controls whether the AGA-NX-19-mod/AGA-NX-19-mod.BR.KORR.3H is used instead of the AGA-NX-19-1962 standard calculation. *0: Disabled* *1: Enabled*
ISO-6976-1995 reference conditions	1000	• Only applies if ISO6976:1995 is selected to calculate the base compressibility, molar mass and/or gross heating value. The reference temperatures for combustion/metering: *1: 15°C / 15°C* *2: 0°C / 0°C* *3: 15°C / 0°C* *4: 25°C / 0°C* *5: 20°C / 20°C* *6: 25°C / 20°C*

Subject to change without notice

Table 57 Calculation setup settings

Setting	Security level	Description
ISO-6976-1995 molar mass calculation method	1000	● Only applies if ISO6976:1995 is selected to calculate the base compressibility, molar mass and/or gross heating value. Defines how the molar mass is calculated from the gas composition. *1: From atomic masses* Calculates the molar mass from the atomic masses as defined in the note of Table 1 of the standard *2: Use table values* Uses the values from Table 1 of the standard
ISO-6976-1995 heating value calculation method	1000	● Only applies if ISO6976:1995 is selected to calculate the base compressibility, molar mass and/or gross heating value. Defines how the calorific value is calculated from the gas composition *1: Definitive method* Calculates the mass based calorific value from the molar based calorific values from table 3 and from the calculated molar mass values. Calculates the volume based calorific value by multiplying the molar based calorific values from table 3 by p2/R.T2 *2: Alternative method* Uses the values from tables 3, 4 and 5 as specified in the standard. Refer to paragraph 6.1 and 7.1 of the ISO-6976:1995 standard for more information.
IS06976-1983 metering reference temp.	1000	● Only applies if IS06976:1993 is selected to calculate the base compressibility, molar mass and/or gross heating value. The temperature used for calculating the compressibility, the density and the real relative density values *1: 0 °C* *2: 15 °C*
IS06976-1983 combustion ref. temp.	1000	● Only applies if IS06976:1983 is selected to calculate the base compressibility, molar mass and/or gross heating value. Temperatures used for calculating the calorific values. 1st value represents the combustion reference temperature and the 2nd value the Gas volume reference temperature *1: 25 °C / 0 °C* *2: 0 °C / 0 °C* *3: 15 °C / 0 °C* *4: 15 °C / 15 °C*
GPA2172 edition	900	● Only applies if GPA2172 is selected to calculate the base compressibility, molar mass and/or gross heating value. The GPA2172-96 standard uses the gas properties that are defined in the GPA-2145 standard. The latter standard is updated periodically. SICK Flow-X supports the following editions of the GPA-2145 standard: *1: GPA2145-00: 2000 edition* *2: GPA2145-03: 2003 edition* Earlier versions of the GPA-2145 standard did not contain metric values.

Subject to change without notice

6.14.3 Gross Heating Value input

The gross heating value [MJ/sm3] is used to calculate the energy flow rates and totalizers. Optionally the GHV is also used in the SGERG and NX-19 calculations to calculate the compressibility and/or molar mass (see paragraph “Calculation Setup”).

► Select: Display > Configuration, Run <x.>, Gas properties, GHV input
Display > Configuration, Station, Gas properties, GHV input
with <x> the relative number of the flow module that controls the flow meter

Table 58 Gross Heating Value Settings

Setting	Security Level	Description
Input type	1000	Type of input *0: None (calculated)* Uses the heating value calculated according to ISO-6976:83, ISO-6976:95 or GPA2172 (see paragraph “Calculation Setup”) *1: Always use keypad* *2: Analog input* *4: HART* *5: Custom input* The value [MJ/sm3] that is written to the tag “GHV custom value” will be used. Use this option when the GHV value is sent to the flow computer over a Modbus communications link or when you want to apply user-defined calculations for the GHV. *7: Gas chromatograph value* Uses the GHV value read from a gas chromatograph
Analog input module	1000	● Only applies when input type is “2: Analog input” or when input type is “4: HART” and option “HART to analog fallback” is enabled Number of flow module to which the signal is physically connected to. *-1: Local module means the module of the meter run itself*
Analog input channel	1000	● Only applies when input type is “2: Analog input” or when input type is “4: HART” and option “HART to analog fallback” is enabled Number of the analog input channel on the selected module to which the signal is physically connected.
HART internal device nr.	1000	● Only applies when input type is “4: HART” Internal device nr. of the HART transmitter as assigned in the configuration software (Flow-Xpress: “Ports & Devices”)
HART variable	1000	● Only applies when input type is “4: HART” Determines which of the 4 HART variables provided by the HART transmitter is used. Select the variable that represents the “Gross Heating Value”. Usually this is the 1st (primary) variable.
Fallback type	1000	Determines what to do in case the input fails. *1: Last good value* Keep on using the last value that was obtained when the input was still healthy. *2: Fallback value* Use the value as specified by parameter “Fallback value” The fallback value is usually a fixed value and will generally never be changed during the lifetime of the flow computer. *3: Keypad value* Use the value as specified by parameter “Keypad value”
Fallback value	1000	● Only used when Fallback type is “2: Fallback value”. Represents the GHV [MJ/sm3] that should be used when the input fails.
HART to analog fallback	1000	● Only applies for a single HART transmitter, where the 4 ... 20 mA signal is provided together with the HART signal. *0: Disabled* The 4 ... 20 mA signal will not be used when the HART signal fails. Instead the value corresponding with the “Fallback type” will be used. *1: Enabled* The 4 ... 20 mA signal will be used when the HART signal fails. When both the HART and the mA signal fail the value corresponding with the “Fallback type” will be used.

Subject to change without notice

6.14.4 CO_2, H_2, and N_2 inputs

Only available when SGERG or NX-19 is selected to calculate the compressibility and/or molar mass (see paragraph “Calculation Setup”).

► Select: Display > Configuration, Run <x.>, Gas properties, ... input
Display > Configuration, Station, Gas properties, ... input
with <x> the relative number of the flow module that controls the flow meter
with either CO_2, H_2, or N_2

Table 59 CO2, H2 and N2 input settings

Setting	Security Level	Description
Input type	1000	Type of input *0: None* The input is not used *1: Always use keypad* *2: Analog input* *4: HART* *5: Custom input* The value [% mol/mol] that is written to the $CO_2/H_2/N_2$ “custom value” will be used. Use this option when the value is sent to the flow computer over a Modbus communications link or when you want to apply user-defined calculations for the $CO_2/H_2/N_2$ content. *7: Gas chromatograph value* Uses the $CO_2/H_2/N_2$ value read from a gas chromatograph
Analog input module	1000	● Only applies when input type is “2: Analog input” or when input type is “4: HART” and option “HART to analog fallback” is enabled Number of flow module to which the signal is physically connected to. *-1: Local module means the module of the meter run itself*
Analog input channel	1000	● Only applies when input type is “2: Analog input” or when input type is “4: HART” and option “HART to analog fallback” is enabled Number of the analog input channel on the selected module to which the signal is physically connected.
HART internal device nr.	1000	● Only applies when input type is “4: HART” Internal device nr. of the HART transmitter as assigned in the configuration software (Flow-Xpress: “Ports & Devices”)
HART variable	1000	● Only applies when input type is “4: HART” Determines which of the 4 HART variables provided by the HART transmitter is used. Select the variable that represents the $CO_2/H_2/N_2$ value. Usually this is the 1st (primary) variable.
Fallback type	1000	Determines what to do in case the input fails. *1: Last good value* Keep on using the last value that was obtained when the input was still healthy. *2: Fallback value* Use the value as specified by parameter “Fallback value” The fallback value is usually a fixed value and will generally never be changed during the lifetime of the flow computer. *3: Keypad value* Use the value as specified by parameter “Keypad value”
Fallback value	1000	● Only used when Fallback type is “2: Fallback value”. Represents the value [%mol/mol] that should be used when the input fails.
HART to analog fallback	1000	● Only applies for a single HART transmitter, where the 4 ... 20 mA signal is provided together with the HART signal. *0: Disabled* The 4 ... 20 mA signal will not be used when the HART signal fails. Instead the value corresponding with the “Fallback type” will be used. *1: Enabled* The 4 ... 20 mA signal will be used when the HART signal fails. When both the HART and the mA signal fail the value corresponding with the “Fallback type” will be used.

Subject to change without notice

6.15 Pulse outputs

Each flow module provides a maximum of 4 pulse outputs.

Pulse outputs can be set up both at meter run level for *run totals* and at station level for *station totals*.

> The station pulse outputs are only available when the following parameter has been set:
> ► Display:Configuration, Overall setup, Overall setup
> Parameter: Station totals and rates
> Value: Enabled

► Select: Display > Configuration, Run <x.>, Pulse outputs
Display > Configuration, Station, Pulse outputs
with <x> the relative number of the flow module that controls the flow meter

Table 60 Pulse output settings

Setting	Security level	Description
Pulse output <x> totalizer	900	The totalizer that is used for the pulse output. When the configuration is at meter run level the run total will be used, while at station level the station total will be used. *-1: Custom* *0: None* *1: Indicated volume [m3] (forward)* *2: Gross volume [m3] (forward)* *3: Base volume [sm3] (forward)* *4: Mass [kg] (forward)* *5: Energy [GJ] (forward)* *6: Good pulses (forward)** *7: Error pulses (forward)** *8: Indicated volume [m3] (reverse)* *9: Gross volume [m3] (reverse)* *10: Base volume [sm3] (reverse)* *11: Mass [kg] (reverse)* *12: Energy [GJ] (reverse)* *13: Good pulses (reverse)** *14: Error pulses (reverse)** *Only available at meter run level If –1: Custom is selected, then the value that is written to the tag “pulse output <x> custom increment” will be used. Use this option if you want to apply user-defined calculations to the totalizers, f.e. converting them into different units.
Pulse output <x> module	900	Number of flow module to which the signal is physically connected to. *-1: Local module means the module of the meter run itself*
Pulse output <x> index	900	Pulse output number of the specified module to which the signal is physically connected.

Subject to change without notice

6.16 Analog outputs

Each flow module provides 4 analog outputs, which can be set up at meter run level and at station level.

The station analog outputs are only available when the following parameter has been set:

- Display:Configuration, Overall setup, Overall setup
  Parameter: Station totals and rates
  Value: Enabled

OR

- Display:Configuration, Overall setup, Overall setup
  Parameter: Station product
  Value: Enabled

- Select: Display > Configuration, Run <x.>, Analog outputs
  Display >Configuration, Station, Analog outputs
  with <x> the relative number of the flow module that controls the flow meter

Table 61 Analog output settings

Setting	Security level	Description
Analog output <x> variable	900	The variable that is used for the analog output. When the configuration is at meter run level the run total will be used, while at station level the station total will be used. *-1: Custom* *0: Not assigned* *1: Gross volume flow rate [m3/h]* *2: Base volume flow rate [sm3/h]* *3: Mass flow rate [kg/h]* *4: Energy flow rate [GJ/h]* *5: Specific gravity [-]* *6: Base density [kg/sm3]* *7: Relative density [-]* *8: Gross heating value [MJ/sm3]* *9: Net heating value [MJ/sm3]* *10: Meter temperature [°C]** *11: Meter pressure [bara]** *12: Meter pressure [barg]** *Only available at meter run level
Analog output <x> module	900	Number of the flow module that is used for this output. *-1: Local module means the module of the meter run itself*
Analog output <x> channel	900	Analog output channel on the specified module that is used for this output.

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The following settings apply for each individual valve:

Table 62 Valve control settings

Setting	Security level	Description
Control signals	1000	*0: No control* Valve control is disabled *1: Two pulsed outputs* Two separate outputs for open and close commands. The outputs stay ON during the “Minimum activation time” as defined in display IO, Configuration, Digital IO settings *2: Two maintained outputs* Two separate outputs for open and close commands. The outputs remain ON until the valve has reached its position *3: One output – ON is open* One output to open the valve. At the valve open command the output stays ON for the “Minimum activation time” as defined in display IO, Configuration, Digital IO settings *4: One output – ON is close* One output to close the valve. At the valve close command the output stays ON for the “Minimum activation time” as defined in display IO, Configuration, Digital IO settings
Position signals	1000	*0: No inputs* No inputs for open and close positions. Valve position is derived from the latest valve command. *1: Two inputs* Two separate inputs for open and close position. *2: One input (open position)* One input that is ON when the valve is in the open or forward position, else OFF. *3: One input (closed position)* One input that is ON when the valve is in the closed or reverse position, else OFF.
Travel timeout period	1000	Maximum allowed time [s] for the valve to move to the required position. The valve timeout alarm is raised when the valve does not reach the required position within this time.
Open position DI module	1000	Module to which the open position signal is physically connected *-1: Local module means the module of the meter run itself*
Open position DI channel	1000	Digital channel on the selected module to which the open position signal is physically connected
Closed position DI module	1000	Module to which the closed position signal is physically connected. *-1: Local module means the module of the meter run itself*
Closed position DI channel	1000	Digital channel on the selected module to which the closed position signal is physically connected
Open control DO module	1000	Module to which the open control output signal is physically connected *-1: Local module means the module of the meter run itself*
Open control DO channel	1000	Digital channel on the selected module to which the open control output signal is physically connected
Close control DO module	1000	Module to which the close control output signal is physically connected *-1: Local module means the module of the meter run itself*
Close control DO channel	1000	Digital channel on the selected module to which the close control output signal is physically connected

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6.17 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 63 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

6.18 Calculations

6.18.1 General

This chapter specifies the main calculations performed by the Gas Metric Application. The different parameters are accessible through the display menu.

> ***NOTICE:***
> Calculations in compliance with a measurement standard, such as AGA-8, are not specified in this manual. Please refer to the standards for more details on these calculations.

6.18.2 Flow rates for volumetric flow meters

The following equations apply for SICK ultrasonic flow meters that provides a volumetric quantity as a pulse signal or as a smart signal (Modbus, HART or analog input)

Indicated volume flow rate

For a flow meter that provides a pulse signal the meter K-factor is applied to obtain the flow rate from the pulse frequency.

$Q_i = f / MKF * 3600$

where:

Q_i	Indicated volume flow rate	[m^3/hr]
MKF	Meter K-factor	[pulses/m3]
f	Pulse frequency	[Hz]

For smart flow meters the indicated volume flow rate is obtained directly from the flow meter.

Gross volume flow rate (volumetric flow meters)

The gross volume flow rate (also called corrected flow rate) is derived from the indicated flow rate (or uncorrected flow rate) as following:

$Q_v = Q_i * (1 - ME / (100 + ME)) * MBF$

where:

Q_v	Gross volume flow rate	[m^3/hr]
Q_i	Indicated volume flow rate	[m^3/hr]
ME	Meter error	[%]
MBF	Meter body correction factor	[-]

$ME = 100 * (1 - MF)$

with:

MF	Meter factor	[-]

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However, when parameter “MID compliance” is enabled, no correction is applied when either the pulse frequency is below 10 Hz or the volume flow rate is below parameter “Q_{min}” (in accordance with the EN-12405 standard part of MID).

$Q_v = Q_i$

Mass volume flow rate (volumetric flow meters).

$Q_m = Q_v * \rho$

where:

Q_m	Mass flow rate	[kg/hr]
Q_v	Gross volume flow rate	[m^3/hr]
ρ	Density at the flow meter conditions	[kg/m^3]

6.18.3 Base volume flow rate.

$Q_b = Q_v * \rho / \rho b$

where:

Q_b	Base volume flow rate	[m^3/hr]
Q_v	Gross volume flow rate	[m^3/hr]
ρ	Density at the flow meter conditions	[kg/m^3]
ρb	Density at the reference (base) conditions	[kg/m^3]

6.18.4 Energy flow rate

$Q_e = Q_b * HV / 1000$

where:

Q_e	Energy flow rate	[GJ/hr]
Q_b	Base volume flow rate	[m^3/hr]
HV	Heating value at reference (base conditions)	[MJ/m3]

Depending on parameter “Use Net HV for energy” HV is either the gross or the net heating value (calorific value).

6.18.5 Meter body correction factor

For ultrasonic flow meters a correction may be applied to compensate for the effect of the meter body expansion as a function of temperature and pressure of the fluid.

$MBF = 1 + 3 * \varepsilon t * (t - tr) + 3 * \varepsilon p * (p - pr)$

where:

MBF	Meter body correction factor	[–]
εt	Linear temperature expansion coefficient	[mm/mm/°C]
t	Temperature at the flow meter	[°C]
tr	Reference temperature for the expansion	[°C]
εp	Linear pressure expansion coefficient	[mm/mm/bar]
p	Pressure at the flow meter	[bar(a)]
pr	Reference pressure for the expansion	[bar(a)]

Note the factor 3 in the equation, because of a cubic expansion based on linear coefficients.

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6.19 Communication

6.19.1 General

Communication with the SICK Flow-X flow computer is freely configurable. Communication lists for Modbus and HART may be modified and added, refer to chapter “Communication” for all details.

6.19.2 Standard Modbus communication lists

Modbus Tag List

The SICK Flow-X provides an overall Modbus communication list that contains all variables and parameters of up to four meter runs and the station. This communication list can be used for serial and Ethernet communication.

This Modbus tag list uses a register size of 2 bytes (16 bits) for integer data, a register size of 4 bytes (32 bits) for single precision floating point data (f.e. process values and averages) and a register size of 8 bytes (64 bits) for double precision floating point data (totalizers).

This overall communication list can be used “as is” or it can be modified if required.

Please open the application in Flow-Xpress Professional to review and modify the standard Modbus communication list.

Modbus Tag List 16 bits (Modicon compatible)

This is an abbreviated Modbus tag list, which only includes the most important data, like process values and totalizers. It is mainly meant for communication to older (DCS) systems or PLC's that don't support data addresses larger than 16 bits (Modicon compatible).

This Modbus tag list uses a register size of 2 bytes (16 bits) for integer data, single precision floating point data (process values) and long integer data (totalizers).

Because the totalizers are communicated as long integers, the totalizer rollover values should not be set higher than 1.E+09.

Except for the FC time, which can be written for time synchronization, this tag list only contains read data.

This communication list can be used “as is” or it can be modified if required.

Please open the application in Flow-Xpress Professional to review and modify the standard Modbus communication list.

Remote station FC

Generic modbus list for communication to a remote station FC. Select this modbus list on run flow computers that have to communicate to a remote station flow computer.

> **!** ***NOTICE:***
> Make sure the device nr. is set to 100 (Flow-Xpress: ”Ports & Devices”).

Remote run FC

Generic modbus list for communication by a remote station FC to its assigned run flow computers. Select this modbus list on a remote station FC that has to communicate to a number of run flow computers.

For each run flow computer to which the station flow computer has to communicate, a separate “Remote run FC” modbus list has to be selected on the remote station FC. Make sure the device nr. is set to 101 for the first run, 102 for the second run, etc. The remote station FC can communicate to up to 8 run flow computers.

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Modbus devices

The application by default supports the following Modbus devices:

- Flow meters
  - FLOWSIC600 gas flow meter
  - FLOWSIC600-XT gas flow meter
- Gas chromatographs
  - Siemens Maxum
  - Siemens Sitrans
  - Yamatake HGC
  - ABB NGC 8206

Additional Modbus devices can be configured using Flow-Xpress Professional. More devices will be added to the standard application in the nearby future.

HART devices

The application by default supports the following HART devices:

- HART transmitter (generic HART communication list for temperature, pressure, etc. transmitters that support HART).

Additional HART devices can be configured using Flow-Xpress Professional. More devices will be added to the standard application in the nearby future.

To use any of these communication lists, you have to select them in Flow-Xpress “Ports & Devices” and assign them to the appropriate communication port.

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Flow-X

7 Troubleshooting

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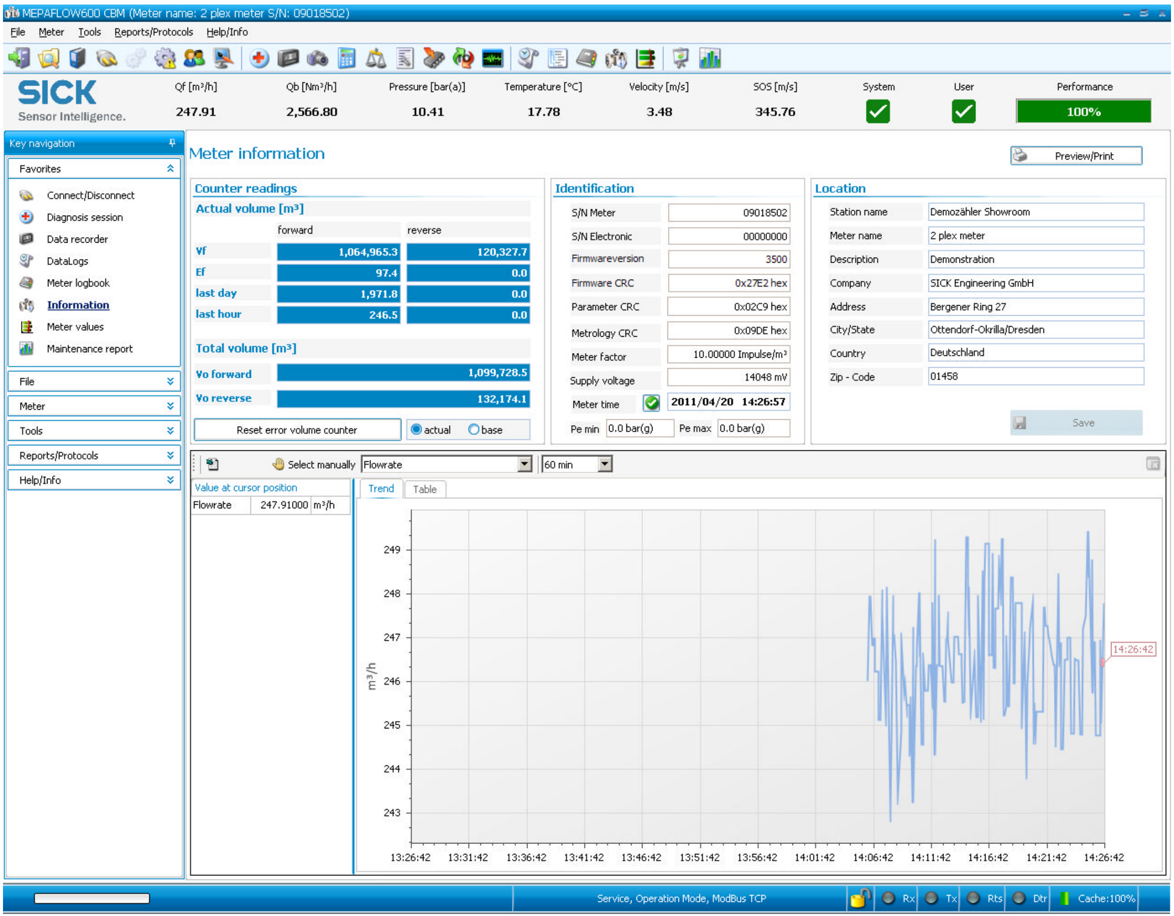
7.1 Testing gas flow meter communication

MEPAFLOW CBM

Software MEPAFLOW600 CBM is mainly used in the following for configuring the FLOWSIC600 gas flow meter.

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

Fig. 79 MEPAFLOW600 CBM graphical user interface



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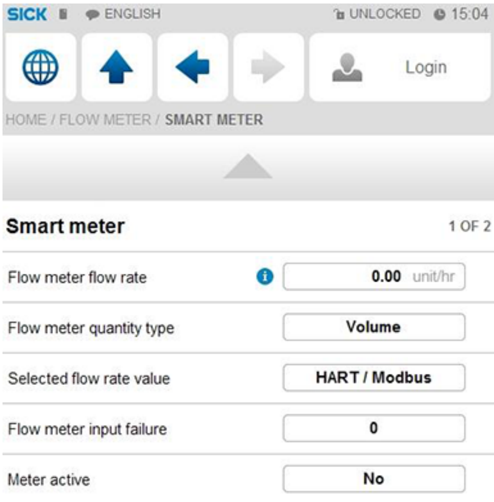
Connection check

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. 80 Flow Meter/Smart Meter

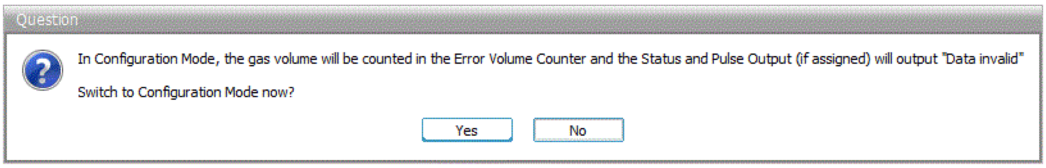


2 Open the MEPAFLOW600 CBM software on the computer connected to the gas flow meter.

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. 81 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".

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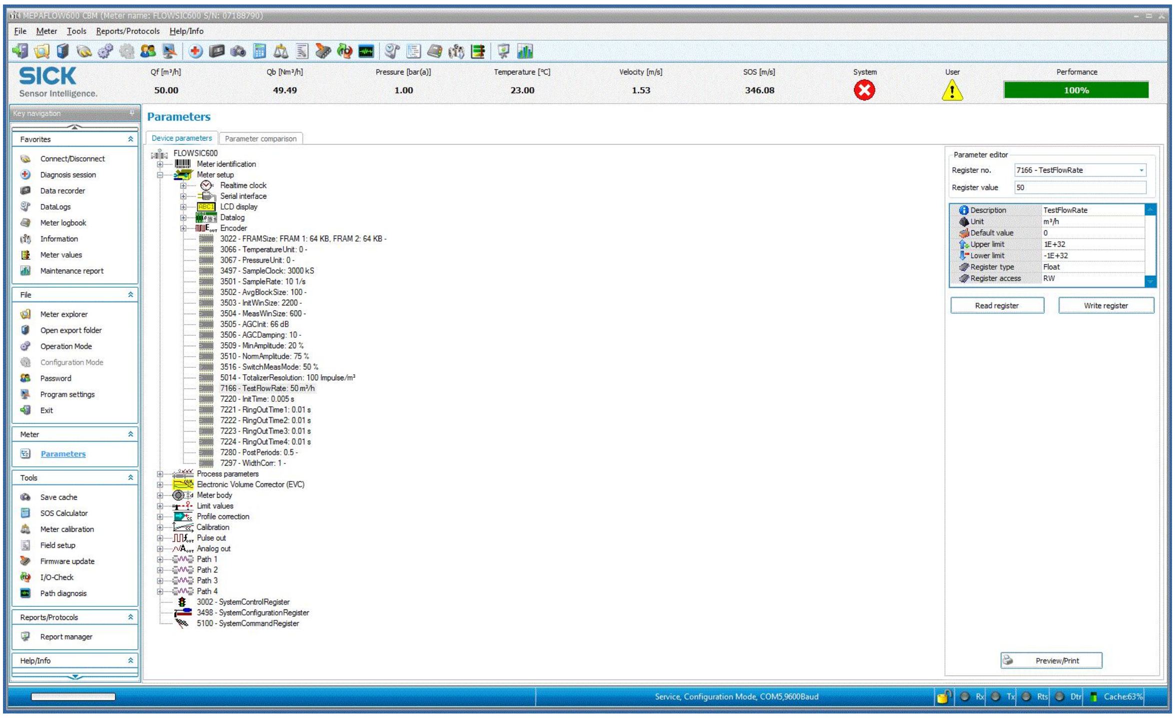
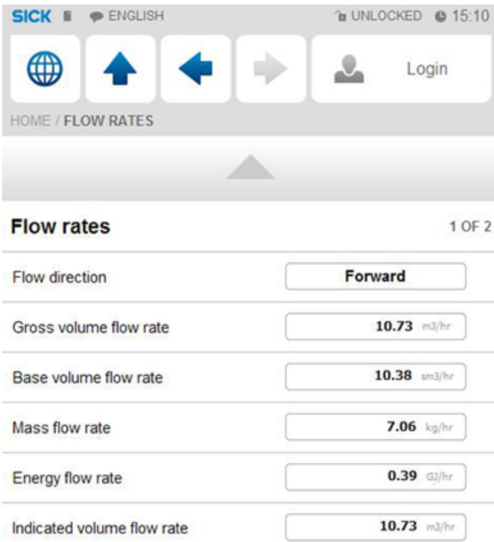
Fig. 82 Determining the flow rate



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. 83 Menu "Flow rates"



12 Then return to "Operation Mode" via MEPAFLOW600.

7.2 Interface configurations of gas meter connection

7.2.1 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".

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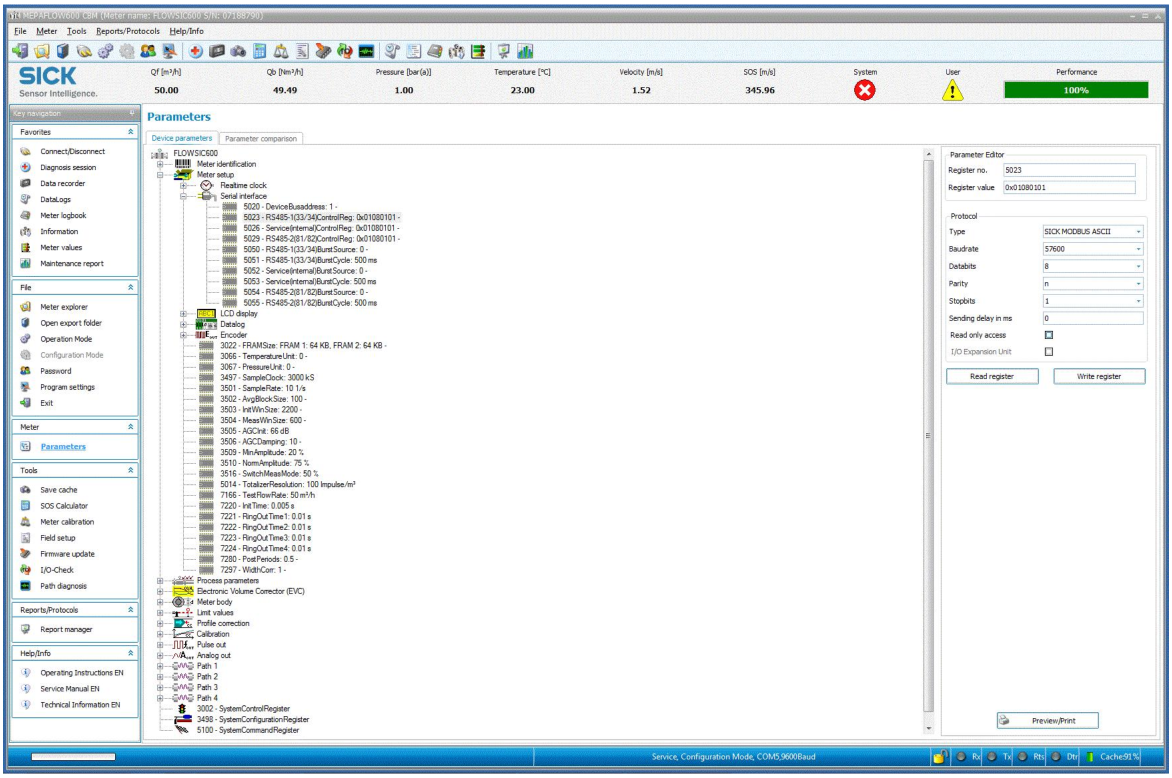
3 Confirm the message with "Yes".
4 Select the "Parameters" option under "Meter" in the menu bar.
5 Select "Meter setup" in the menu and then menu item "Serial interface".
6 Select register 5023 "RS485-1(33/34)ControlReg:".

Fig. 84 Change the interface



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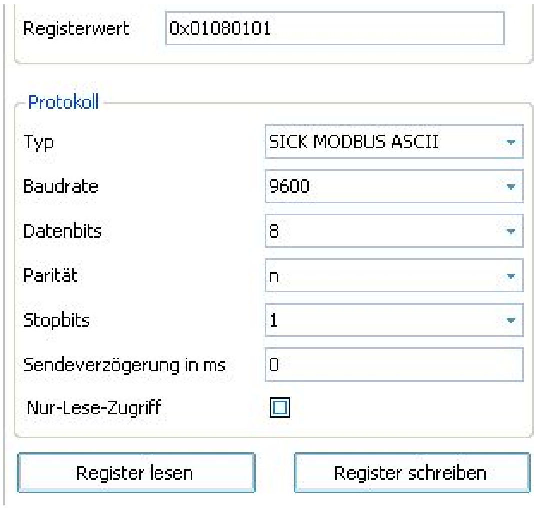
7 On the right side of the screen, under "Protocol", change the communication type, baud rate, data bits, parity and stop bits.

Fig. 85 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

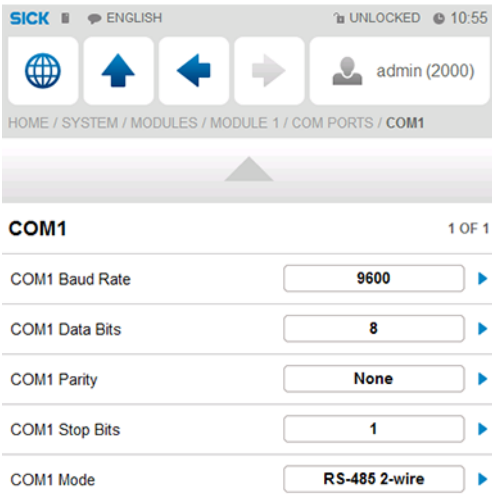
7.2.2 Configuration with the Flow-X flow computer, webserver or module screen

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. 86 System/COM Ports/COM1 > Change screen RS485



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7.3 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.

7.4 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.

7.5 I/O diagnostics

A Flow-X flow computer with a standard SICK application provides a set of displays with diagnostic information on the digital and analog I/O of the flow modules that are part of the Flow-X flow computer

To access the diagnostics displays:

1 On the LCD or web display select Diagnostics, IO from the main menu.
2 Select the applicable flow module (only in case of a flow computer with more than one flow module).
3 Select the type of I/O.

7.6 I/O calibration

The analog inputs, PRT inputs and analog outputs can be calibrated at up to 5 calibration points.

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7.6.1 Calibration points

For each type of I/O the 5 calibration points can be defined. For analog inputs and analog outputs the calibration points are defined as percentage of span, while for Pt100 inputs the calibration points are defined in Ω (Ohm).

The number of calibration points may range from 1 through 5. The actual number of calibration points is determined by 5 reference values which are expressed as percentage of span.

The calibration points should be defined in ascending order, e.g. 0, 50, 100 %. Non-used reference values shall be set to 0. If a calibration point is smaller than or equal to the previous point, then it is not taken into account and also the following points will not be taken into account.

Typical calibration points for analog inputs and outputs are:

Table 64 Calibration points for analog inputs

Calibration points	Description
0, 0, 0, 0, 0	A single offset value is applied over the entire range
0, 100, 0, 0, 0	Calibration at 2 points, low and high range
0, 50, 100, 0, 0	Calibration at 3 points, low, mid and high range
0, 25, 50, 75, 100	Calibration at 5 points, low and high range and 3 mid ranges

For PRT inputs typical calibration points are:

Table 65 Calibration points for PRT inputs

Calibration points	Description
0, 0, 0, 0, 0	A single offset value is applied over the entire range
50, 150, 0, 0, 0	Calibration at 2 points, low and high range
50, 100, 150, 0, 0	Calibration at 3 points, low, mid and high range
50, 75, 100, 125,150	Calibration at 5 points, low and high range and 3 mid ranges

► Select: Display > Diagnostics, IO, Calibration:

Table 66 Calibration settings

Setting	Security level	Description
Analog input cal. point 1 ... 5	1500	The calibration points for the calibration of the 6 analog inputs
PRT calibration point 1 ... 5	1500	The calibration points for the calibration of the 2 PRT inputs
Analog output cal. point 1 ... 5	1500	The calibration points for the calibration of the 4 analog outputs

7.6.2 Analog input calibration

The procedure to calibrate an analog input is based on a loop calibrator that, depending on the type of input, can provide a 4 ... 20 mA, 0 ... 20 mA, 1 ... 5 V DC, or 0 ... 5 V DC signal.

During calibration the process input (e.g. pressure, temperature) that uses the analog input will fall back to the keypad, last good or fallback value, depending on setting “Fallback type” that has been defined for this process input.

1 Go to the analog input calibration display.
2 Select: Display > Diagnostics, IO, <Module x>, Calibration, Analog inputs
3 With x the applicable module number, i.e. the flow module to which the signal is physically connected.
4 Select the analog input to be calibrated.

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5 The process value used for the flow calculations will now fall back to the last good, keypad or fallback value (depending on the fall back type). The calibration display shows the required reference value for the 1st calibration point and the actual corrected value based on the current calibration values.
6 Disconnect the transmitter signal and connect the loop calibrator.
7 Wait for the signal to stabilize and issue the “Recalibrate this point”.

> **NOTICE:**
> Recalibration is optional at every calibration point. When the corrected signal is close enough to the reference value you may decide to skip re-calibration.

8 Check that the corrected value corresponds with the reference value and issue the “Go to next calibration point” command on the display.
9 Repeat steps 4 through 7 for the remaining calibration points.
10 Disconnect the current loop calibrator and reconnect the transmitter.
11 Set the “Selected analog input” to “None” or alternatively select the next analog input to be calibrated. The live input signal will now be used again

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7.6.3 PRT input calibration

1 Go to the PRT input calibration display.
2 Select: Display > Diagnostics, IO, <Module x>, Calibration, PRT inputs
With x the applicable module number, i.e. the flow module to which the signal is physically connected.
3 Select the channel number of the PRT input to be calibrated on the display.
The process value used for the flow calculations will now fall back to the last good, keypad or fallback value (depending on the fall back type). The calibration display shows the required reference value for the 1st calibration point and the actual corrected value based on the current calibration values.
4 Disconnect the Pt100 element and connect decade box.
5 Adjust the decade box such that it outputs the required reference value as indicated on the calibration display)
6 Wait for the signal to stabilize and issue the “Recalibrate this point”.

> **!** ***NOTICE:***
> Recalibration is optional at every calibration point. When the corrected signal is close enough to the reference value you may decide to skip re-calibration.

7 Check that the corrected value corresponds with the reference value and issue the “Go to next calibration point” command on the display.
8 Repeat steps 4 through 6 for the remaining calibration points.
9 Disconnect the decade box and reconnect the Pt100 element.
10 Set the “Selected PRT input” to “None” or alternatively select the next analog input to be calibrated. The live input signal will now be used again.

7.6.4 Analog output calibration

The procedure to calibrate an analog output is based on a 4 ... 20 mA meter.

1 Connect the mA meter in series with the load.
2 Go to the analog output calibration display.
3 Select: Display > Diagnostics, IO, <Module x>, Calibration, Analog outputs
4 With x the applicable module number, i.e. the flow module to which the signal is physically connected.
5 Select the channel number of the analog output to be calibrated on the display. This will adjust the analog output to the 1st calibration point.
6 Increase or decrease the output until it the indication on the mA meter matches the reference value.
7 Issue the “Recalibrate this point” command.

> **!** ***NOTICE:***
> Recalibration is optional at every calibration point. When the corrected signal is close enough to the reference value you may decide to skip re-calibration.

8 Check on the current meter that the output signal corresponds with the reference value and issue the “Go to next calibration point” command on the display.
9 Repeat steps 4 through 6 for the remaining calibration points
10 Set the “Selected analog output” to “None” or alternatively select the next analog output to be calibrated. The analog output will now be controlled by the application software again.
11 Disconnect the mA meter.

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7.7 Reading debugging information from a device

This chapter describes how to download information from a Flow-X device to send to SICK for debugging purposes

The procedure is as follows:

1 Connect an Ethernet cable between your computer and the Flow-X .

2 Set up your computer's Ethernet port.

Make sure the IP-address of your computer's Ethernet card is in the same range (but not equal to) the IP-address of the corresponding Ethernet port of the Flow-X.

3 In Flow-Xpress basic and online mode, select "Read debug info from device" from the "Tools" menu. Click on the "Read debug info from device" button in the "Tools" section on the ribbon in professional mode.

4 Flow-Xpress will show a window with all the devices that are reachable on the local network. Select the device from which you want to read debugging information and click "Next >".

5 Flow-Xpress will ask you to enter the username and password for the user with the highest security rights.

6 Flow-Xpress will download the information from the device. Press the "Details" button to see a description of what Flow-Xpress is currently doing. After the download process is complete, the "Save As" button will become available. Clicking this button will allow you to select a folder and file name to which the debugging information will be saved.

7 Send the debugging information to SICK to help you solve your problem with the device.

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Flow-X

8 Appendix

Conformities
General specifications
I/O specifications
Dimensions
Wiring examples

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8.1 Conformities

8.1.1 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.

8.1.2 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

8.2 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

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8.3 Flow-X/M I/O specifications

8.3.1 I/O signal specifications

Table 67 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 68 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 69 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

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8.3.2 Flow calculation specifications

Table 70 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 71 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.

8.3.3 Supported devices

Table 72 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

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8.4 Power consumption

Table 73 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.

8.5 Weight

Table 74 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 75 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)

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8.6 Dimensions

Figure 87 Flow-X/P dimensions

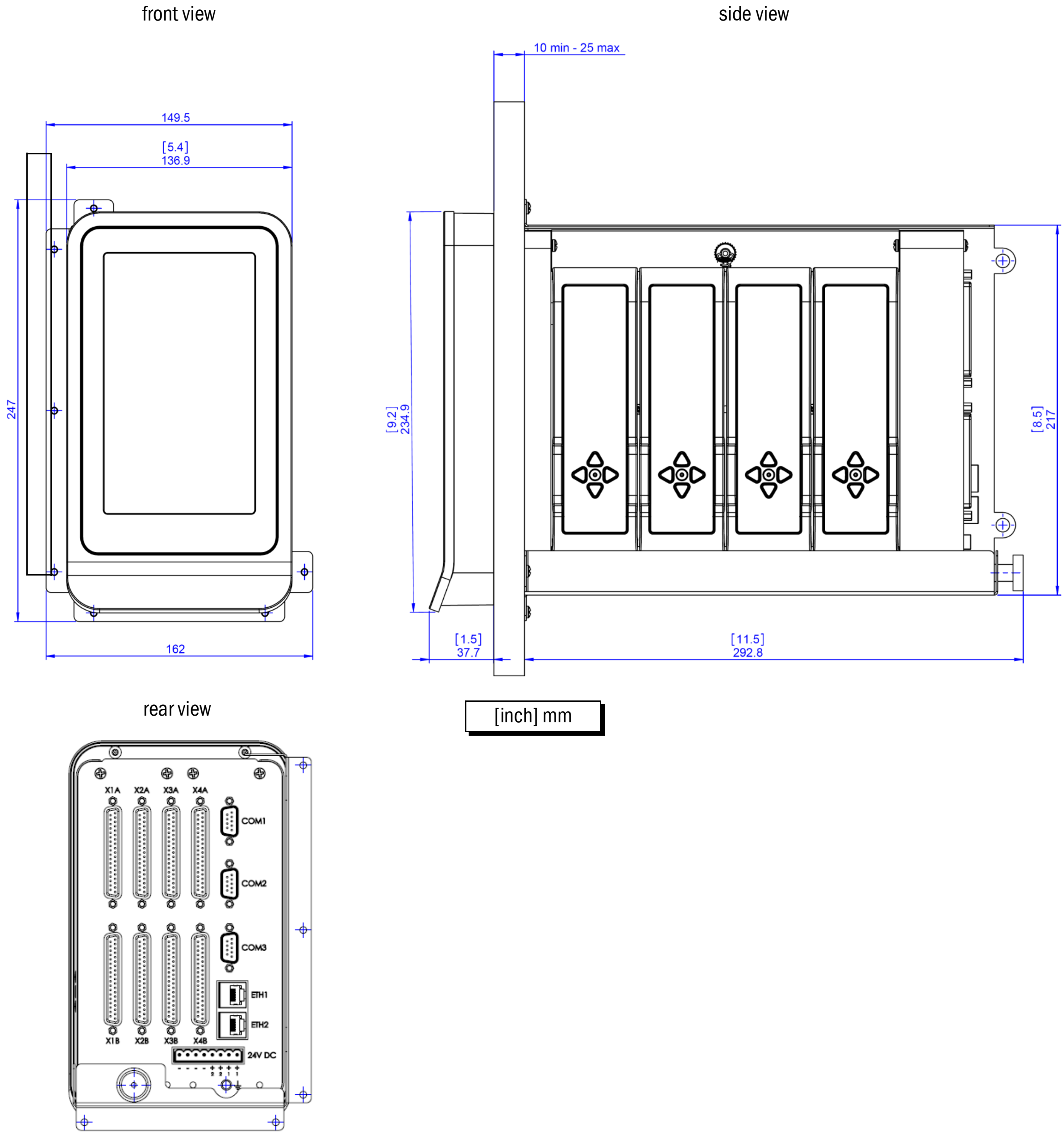

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Figure 88 Flow-X/P bracket dimensions

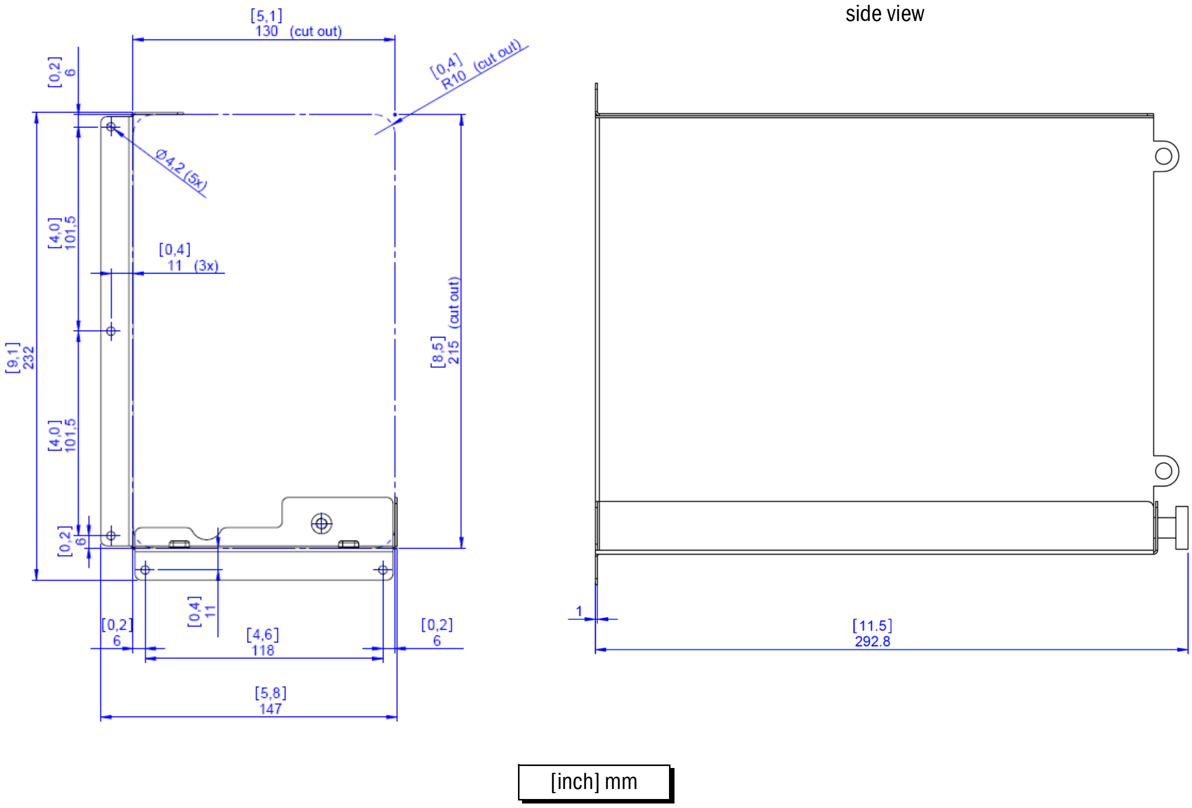

Figure 89 Flow-X/ST dimensions

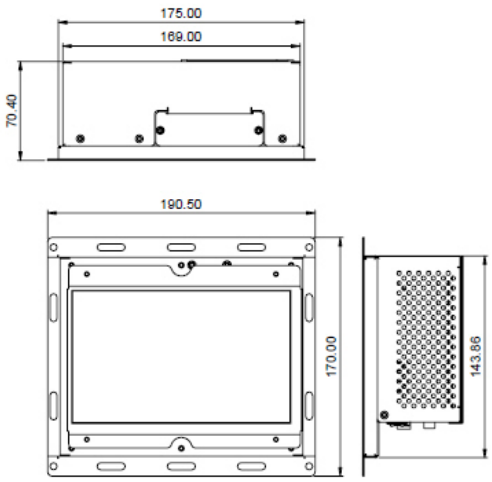

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Figure 90 Flow-X/S horizontal dimensions

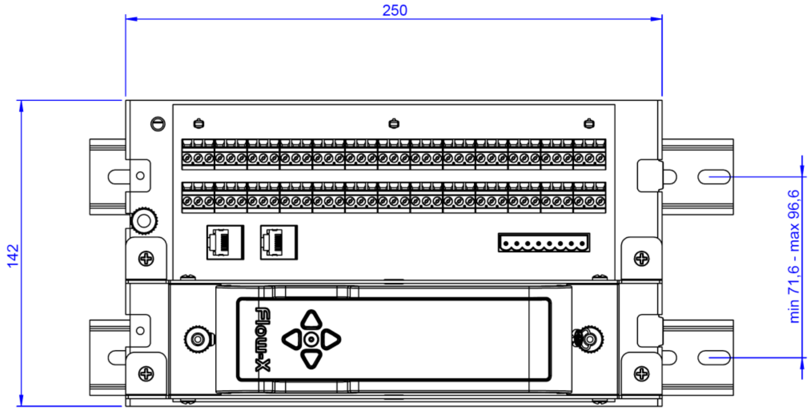

Figure 91 Flow-X/S vertical dimensions

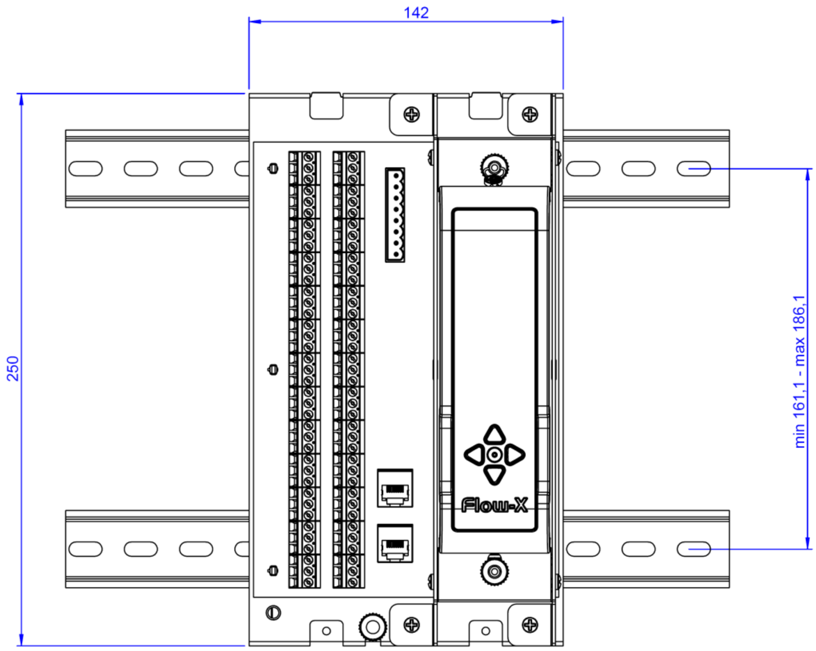

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Figure 92 Flow-X/S wall mount dimensions

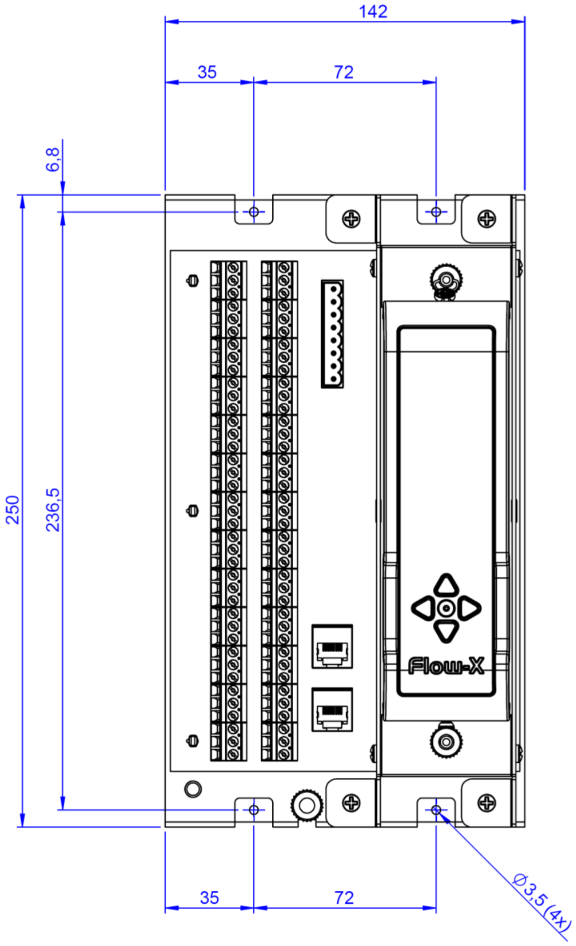
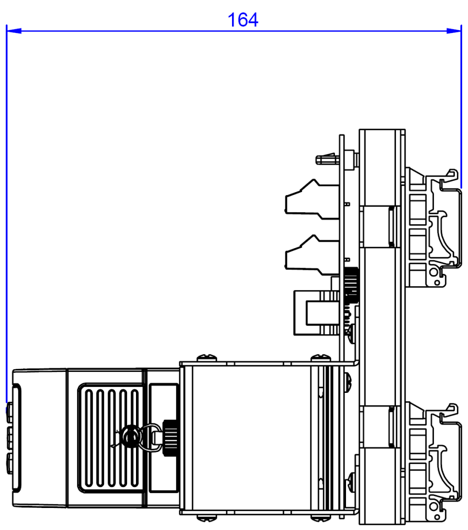


Figure 93 Flow-X/S wall mount side view dimensions



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8.7 Wiring examples

Figure 94 Non-intrinsically safe installation

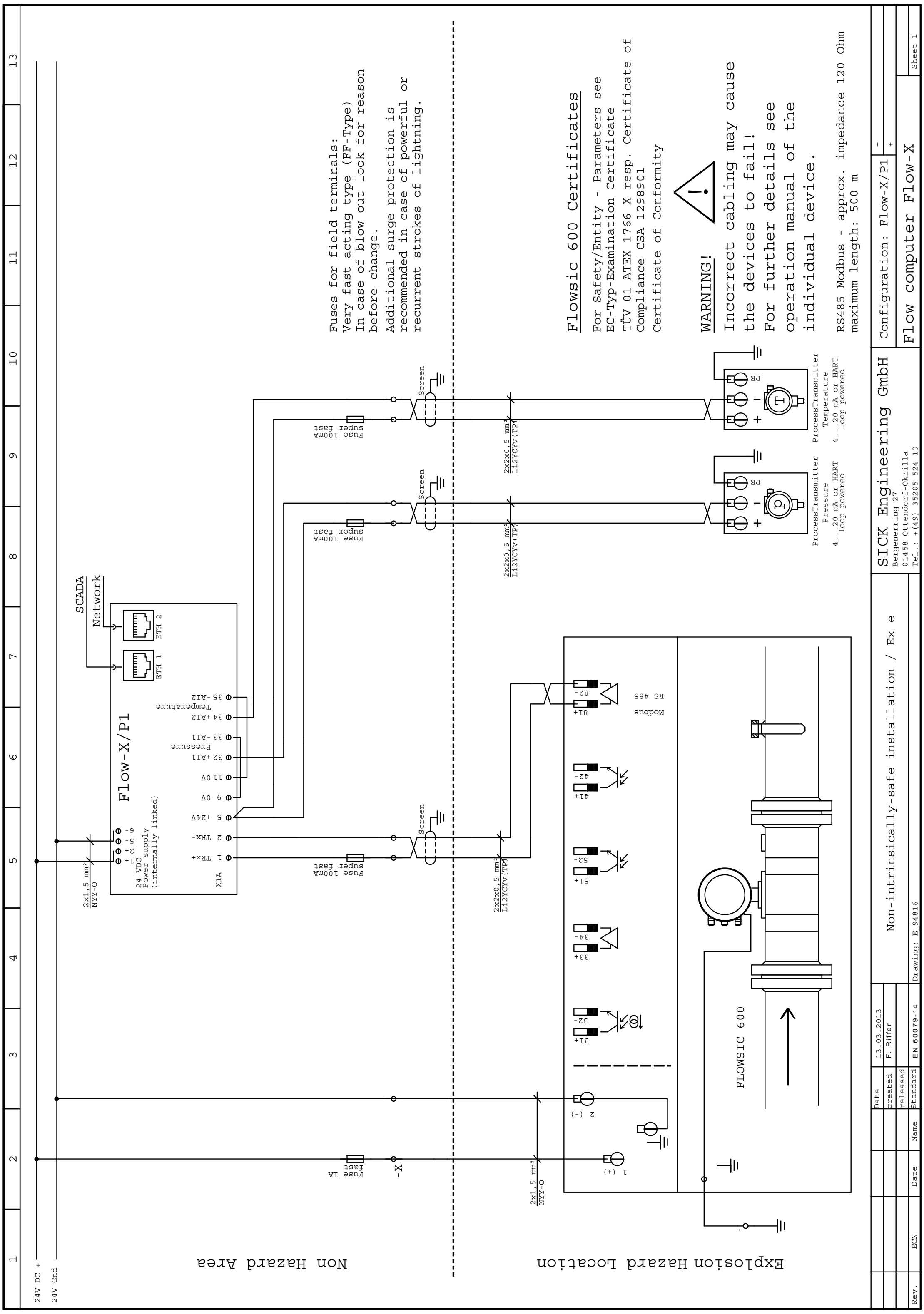

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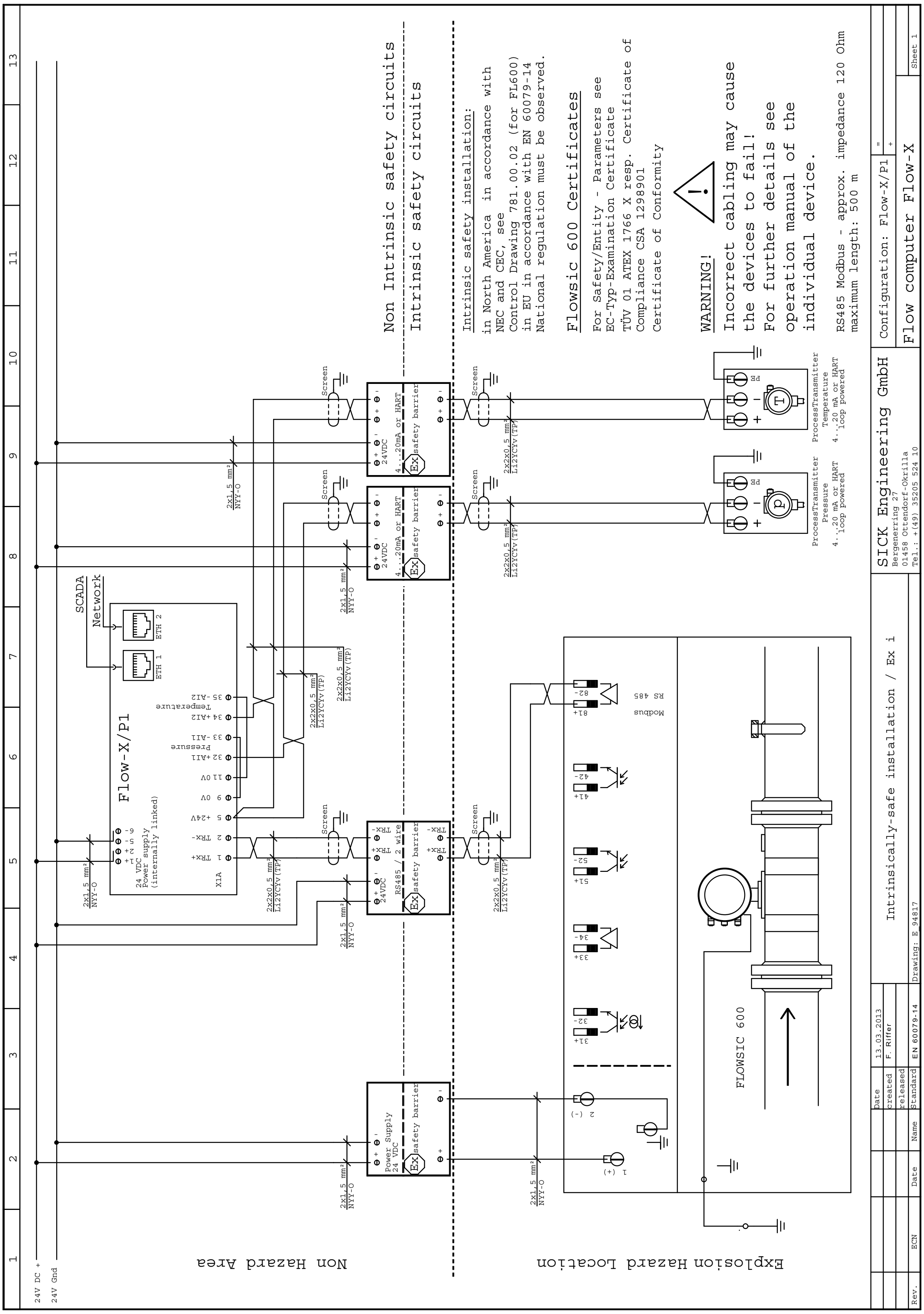
Figure 95 Intrinsically safe installation



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