

SITRANS F

Ultrasonic flowmeters SITRANS FST030 (Modbus)

Operating Instructions

7ME372 (Modbus)

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction

1.1 Purpose of this documentation

These instructions contain all information required to commission and use the device. Read the instructions carefully prior to installation and commissioning. In order to use the device correctly, first review its principle of operation.

The instructions are aimed at persons mechanically installing the device, connecting it electronically, configuring the parameters and commissioning it, as well as service and maintenance engineers.

1.2 Document history

The following table shows major changes in the documentation compared to the previous edition.

The most important changes in the documentation when compared with the respective previous edition are given in the following table.

Edition	Note
12/2019	Support for external DSL functionality: path 3 and path 4, CH5 analog input. Support for gas installations. Support for FSS100 - SONOKIT.
08/2018	New functionalities: Scraper Pig detection, Rate of Change and Multipoint calibration
08/2017	Chapter: Safety notes. Use in hazardous areas. Special conditions for safe use. Added: Must be installed in accordance with Siemens control drawing A5E32778336A.
02/2017	First edition

Note

This manual applies to the SITRANS FST030 transmitter Modbus version only. Modbus® is a registered trademark of MODICON, Inc.

NOTICE

Use in a domestic environment

This Class A Group 1 equipment is intended for use in industrial areas.

In a domestic environment this device may cause radio interference.

In order to operate an ultrasonic flow meter, you need both the transmitter Operating Instructions and the sensor Installation Manual, see Flow documentation (<https://support.industry.siemens.com/cs/products?pnid=17317&lc=en-WW>).

1.3 Product compatibility

Manual edition	Remarks	Device revision	Compatible version of device integration package	
12/2019	Gas installations support	Modbus FW: 1.04.00 for gas FW: 1.03.00 for liquid (clamp-on and inline) HW: 002 and 003 Device revision 5 or later	SIMATIC PDM V8.2 or later	EDD: 1.04.00
			AMS Device Manager 12.0 or later	EDD: 1.04.00
			SITRANS DTM V4.1	EDD: 1.04.00
			Field communicator V3.8	EDD: 1.04.00
08/2018	Defect solved	Modbus FW: 1.00.01 HW: 002 Device revision 4 or later	SIMATIC PDM V8.2 or later	EDD: 1.02.00
			AMS Device Manager 12.0 or later	EDD: 1.02.00
			SITRANS DTM V4.1	EDD: 1.02.00
			Field communicator V3.8	EDD: 1.02.00
08/2017	Updated manuals	Modbus FW: 1.00.00 HW: 002 Device revision 3 or later	SIMATIC PDM V8.2 or later	EDD: 1.00.00 or 1.01.00
			AMS Device Manager 12.0 or later	EDD: 1.00.00 or 1.01.00
			SITRANS DTM V4.1	EDD: 1.00.00 or 1.01.00
			Field communicator V3.8	EDD: 1.00.00 or 1.01.00
02/2017	First edition Liquid installations support	Modbus FW: 1.00.00 HW: 002 Device revision 3 or later	SIMATIC PDM V8.2 or later	EDD: 1.00.00 or 1.01.00
			AMS Device Manager 12.0 or later	EDD: 1.00.00 or 1.01.00
			SITRANS DTM V4.1	EDD: 1.00.00 or 1.01.00
			Field communicator V3.8	EDD: 1.00.00 or 1.01.00

1.4 Device documentation package

The user documentation package for this product includes the following documents

Document	Purpose	Intended users	Availability
Operating Instructions	Contains all information needed to • check and identify the delivered package • install and electrically connect the product • commission the product, (setting parameters via HMI menu) • operate and maintain the device on a daily basis • troubleshoot and remedy minor operation interruptions	Instrument technicians, plant operators	• Available for download from homepage • Hardcopy can be purchased via PIA Life Cycle Portal (English and German languages)
Compact Operating Instructions - Ex	Contains all information needed to • satisfy the Special conditions for installation of Ex-certified products	Instrument technicians, plant operators with special training in systems for hazardous areas.	• On documentation disk • Available for download from homepage • Hardcopy can be ordered via PIA Life Cycle Portal
Function Manual	Contains • descriptions of all functions that can be accessed via the local display (HMI) • guide to setting parameters to obtain optimum operation of the device	Instrument technicians, plant operators	• Available for download from homepage

1.5 Items supplied

The device is delivered as:

Wall mount enclosure

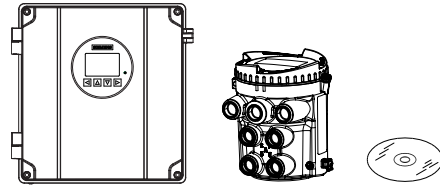
With internal DSL (Digital Sensor Link)

- SITRANS FST030 wall mount enclosure transmitter with internal DSL
- Siemens Process Instrumentation documentation disk containing certificates, and manuals



With external DSL (Digital Sensor Link)

- SITRANS FST030 wall mount enclosure transmitter without internal DSL
- External DSL (no separate power supply needed)
- Siemens Process Instrumentation documentation disk containing certificates, and manuals



Note

Supplementary information

Supplementary product and production specific certificates are included on the SensorFlash® SD card in the transmitter socket.

Note

Scope of delivery may vary, depending on version and add-ons. Make sure the scope of delivery and the information on the nameplate correspond to your order and the delivery note.

Note

The SD-Card Mass Storage functionality has been disabled by SIEMENS on all products sold or imported in the United States. Products having enabled SD-Card Mass storage functionality are intended to be used solely outside the United States and should not be imported into the United States by the user. SIEMENS expressly prohibits customers from using, importing, or buying products with the SD-Card Mass Storage functionality in the United States or performing any acts to enable the SD-Card Mass Storage functionality on products sold by SIEMENS with this feature disabled.

1.6 Checking the consignment

1. Check the packaging and the delivered items for visible damage.
2. Report any claims for damages immediately to the shipping company.
3. Retain damaged parts for clarification.
4. Check the scope of delivery by comparing your order to the shipping documents for correctness and completeness.



WARNING

Using a damaged or incomplete device

Risk of explosion in hazardous areas. May cause death or serious injury.

- Do not use damaged or incomplete devices.

1.7 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit

<https://www.siemens.com/industrialsecurity>.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under

<https://www.siemens.com/industrialsecurity>.

1.8 Transportation and storage

To guarantee sufficient protection during transport and storage, observe the following:

- Keep the original packaging for subsequent transportation.
- Devices/replacement parts should be returned in their original packaging.
- If the original packaging is no longer available, ensure that all shipments are properly packaged to provide sufficient protection during transport. Siemens cannot assume liability for any costs associated with transportation damages.

NOTICE
Insufficient protection during storage
The packaging only provides limited protection against moisture and infiltration.
• Provide additional packaging as necessary.

Special conditions for storage and transportation of the device are listed in Technical data (Page 143).



CAUTION

Protection of transmitter parts

The polypropylene foam parts in the transmitter are NOT packaging material.

- Do not remove polypropylene foam parts.

1.9

Notes on warranty

The contents of this manual shall not become part of or modify any prior or existing agreement, commitment or legal relationship. The sales contract contains all obligations on the part of Siemens as well as the complete and solely applicable warranty conditions. Any statements regarding device versions described in the manual do not create new warranties or modify the existing warranty.

The content reflects the technical status at the time of publishing. Siemens reserves the right to make technical changes in the course of further development.

Safety notes

2.1 Preconditions for safe use

This device left the factory in good working condition. In order to maintain this status and to ensure safe operation of the device, observe these instructions and all the specifications relevant to safety.

Observe the information and symbols on the device. Do not remove any information or symbols from the device. Always keep the information and symbols in a completely legible state.

2.1.1 Warning symbols on the device

Symbol	Explanation
	Consult operating instructions

2.1.2 Improper device modifications

 WARNING
Improper device modifications Risk of explosion in hazardous areas. May cause death or serious injury. Risk to personnel, system and environment can result from modifications to the device, particularly in hazardous areas. • Only carry out modifications that are described in the instructions for the device. Failure to observe this requirement cancels the manufacturer's warranty and the product approvals.

2.2 Laws and directives

Observe the safety rules, provisions and laws applicable in your country during connection, assembly and operation. These include, for example:

- National Electrical Code (NEC - NFPA 70) (USA)
- Canadian Electrical Code (CEC) (Canada)

Further provisions for hazardous area applications are for example:

- IEC 60079-14 (international)
- EN 60079-14 (EU)

2.2.1 FCC Conformity

US Installations only: Federal Communications Commission (FCC) rules

Note

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the operating instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference to radio communications, in which case the user will be required to correct the interference at his own expense.

2.2.2 Conformity with European directives

The CE marking on the device symbolizes the conformity with the following European directives:

Electromagnetic compatibility EMC 2014/30/EU	Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to electromagnetic compatibility
Atmosphère explosive ATEX 2014/34/EU	Directive of the European Parliament and the Council on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres
RoHS directive 2011/65/EU	Directive of the European Parliament and the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The applicable directives can be found in the EU declaration of conformity of the specific device.

Note

CE declaration

The CE declaration certificate is available on the SensorFlash SD card delivered with the device.

2.3 Requirements for special applications

Due to the large number of possible applications, each detail of the described device versions for each possible scenario during commissioning, operation, maintenance or operation in systems cannot be considered in the instructions. If you need additional information not covered by these instructions, contact your local Siemens office or company representative.

Note

Operation under special ambient conditions

We highly recommend that you contact your Siemens representative or our application department before you operate the device under special ambient conditions as can be encountered in nuclear power plants or when the device is used for research and development purposes.

2.4 Use in hazardous areas

Qualified personnel for hazardous area applications

Persons who install, connect, commission, operate, and service the device in a hazardous area must have the following specific qualifications:

- They are authorized, trained or instructed in operating and maintaining devices and systems according to the safety regulations for electrical circuits, high pressures, aggressive, and hazardous media.
- They are authorized, trained, or instructed in carrying out work on electrical circuits for hazardous systems.
- They are trained or instructed in maintenance and use of appropriate safety equipment according to the pertinent safety regulations.

WARNING
Use in hazardous area Risk of explosion. • Only use equipment that is approved for use in the intended hazardous area and labeled accordingly. • Do not use devices that have been operated outside the conditions specified for hazardous areas. If you have used the device outside the conditions for hazardous areas, make all Ex markings unrecognizable on the nameplate.

 WARNING

Loss of safety of device with type of protection "Intrinsic safety Ex i"

If the device or its components have already been operated in non-intrinsically safe circuits or the electrical specifications have not been observed, the safety of the device is no longer ensured for use in hazardous areas. There is a risk of explosion.

- Connect the device with type of protection "Intrinsic safety" solely to an intrinsically safe circuit.
- Observe the specifications for the electrical data on the certificate and/or in Technical data (Page 143).

 WARNING

Dust layers above 5 mm

Risk of explosion in hazardous areas.

Device may overheat due to dust build up.

- Remove dust layers in excess of 5 mm.

Description

SITRANS F US ultrasonic flow meter systems consist of a transmitter and a sensor. The following table lists the available combinations of transmitters and sensors.

Transmitter	Sensor type
FST030	FSS200 Clamp-on sensors for retrofitting on pipes DN 15 to DN 9000 (0.5" to 360") See FSS200 clamp-on sensors Installation Manual (https://support.industry.siemens.com/cs/products?dtp=Manual&mfn=ps&pnid=24498&lc=en-WW)
FST030	FSS100 - SONOKIT Inline sensor for retrofitting on pipes DN 100 to DN 4000 (4" to 160") See FSS100 - SONOKIT manuals (https://support.industry.siemens.com/cs/products?dtp=Manual&mfn=ps&pnid=17373&lc=en-US)

3.1 Design

3.1.1 Transmitter

The FST030 transmitter is available in different variants; Wallbox with internal DSL, and wallbox with external DSL.

The transmitter reads the measured process values from the sensor and calculates derived values. It provides up to four configurable I/Os, resistive RTD inputs, fieldbus communication Modbus, USB service channel, and a local display. It also adds functionalities such as totalizers, access control, diagnostics, and configuration. The local user interface consists of a display and four buttons for user interaction.

The transmitter has a modular design with discrete, replaceable electronic modules and connection boards to maintain separation between functions and facilitate field service. All modules are fully traceable and their provenance is included in the transmitter setup.

3.1.2 Digital Sensor Link (DSL)

The Digital Sensor Link (DSL) performs the signal processing of all measured signals in the sensor. Each flow technology (Ultrasonic, Magnetic, Coriolis,...) has its own specific Digital Sensor Link (DSL) to operate with the transmitter and technology specific sensors.

FST030 can be ordered with either internal or external DSL. The internal DSL comes preinstalled inside the transmitter enclosure. The external DSL comes in a separate enclosure.

Characteristics of internal DSL

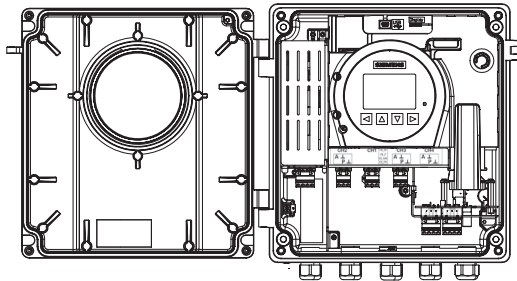


Figure 3-1 Wall mount enclosure with internal DSL

- Direct connection from transmitter to sensor, up to 20 m
- Easier to install
- Transmitter in Zone 2/Div 2 areas
- Up to 2 measurement paths
- Channel 5 and 6 on transmitter for RTD input

Characteristics of external DSL

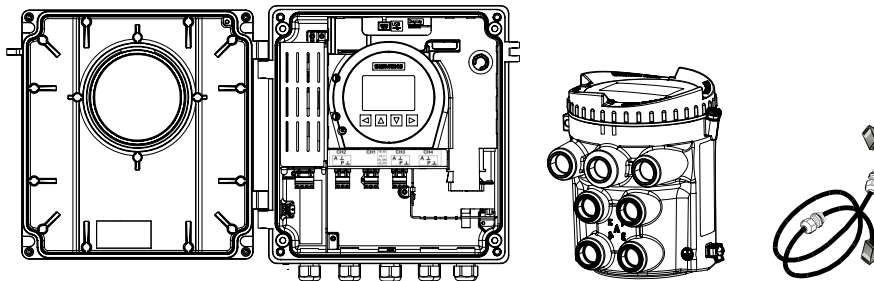


Figure 3-2 Wall mount enclosure without internal DSL, external DSL, and Siemens Sensor Link (SSL) cable

- Connection from transmitter to external DSL, up to 20 m
- Siemens Sensor Link ¹⁾ (SSL) cable from external DSL to sensor, up to 150 m
- External DSL installed in Zone 1/Div 1, with transmitter in Zone 2/Div 2
- Up to 4 measurement paths
- Channel 5 and 6 on external DSL for RTD input, or 4-20 mA input for temperature, pressure, density or viscosity

¹⁾ Siemens Sensor Link (SSL) cable provides both power to the external DSL, and communication between the external DSL and transmitter.

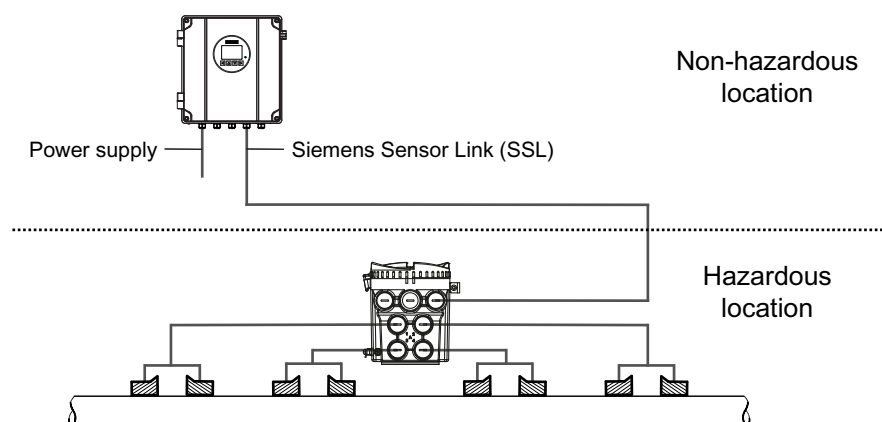
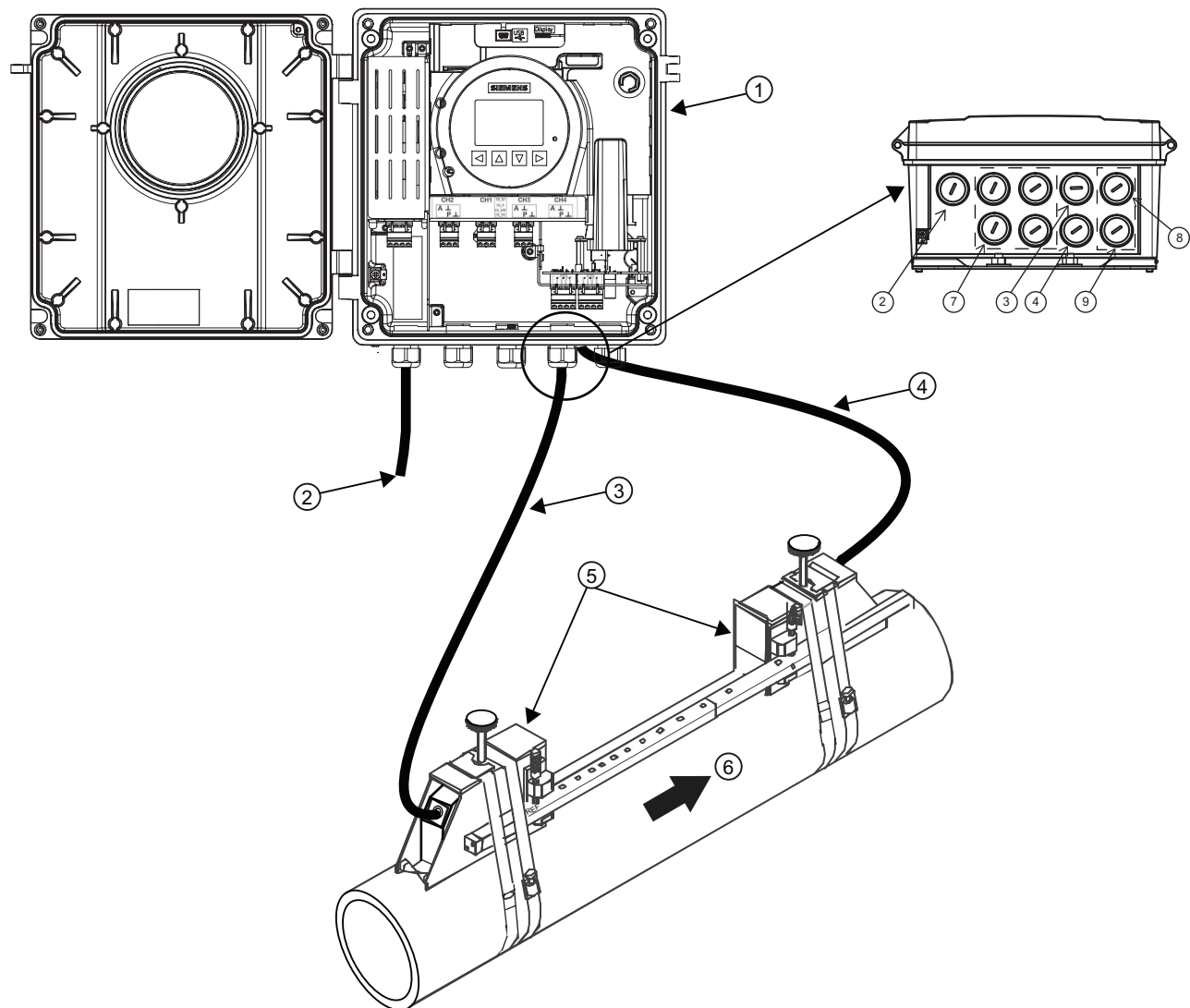


Figure 3-3 External DSL in hazardous location

3.2 System overview with internal DSL

System overview with internal DSL

The illustration below shows a typical transmitter and clamp-on sensor flowmeter configuration. You can also connect the transmitter to other flow ultrasonic sensors.



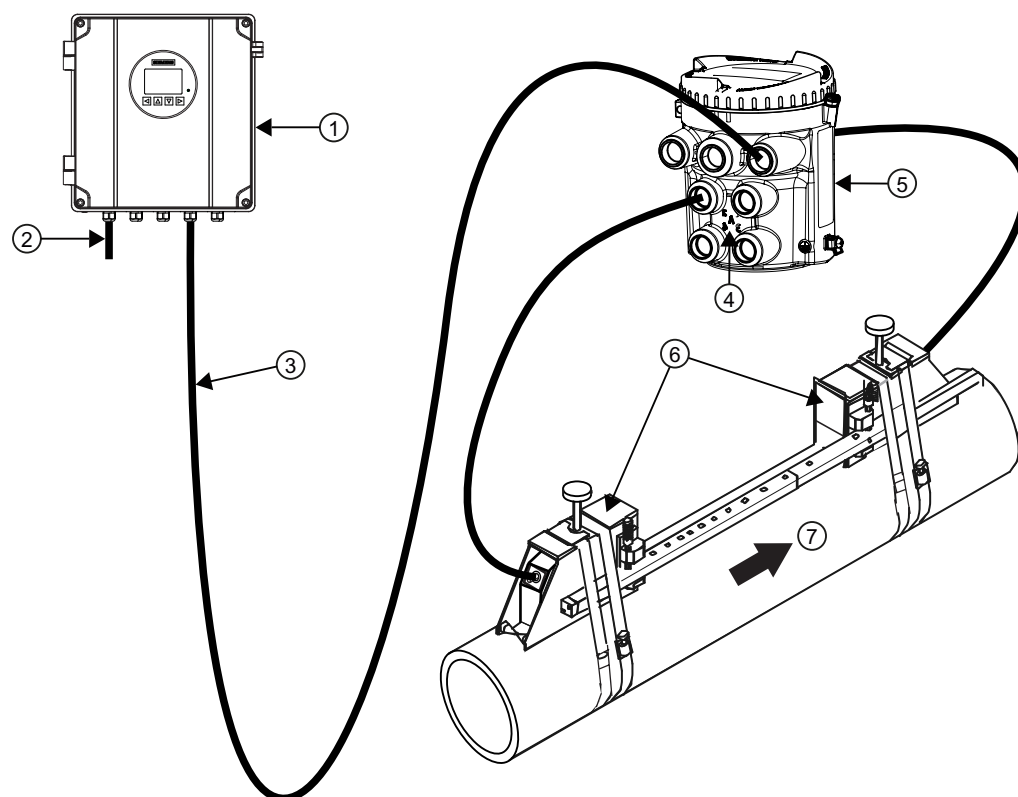
- | | |
|---|---------------------------------------|
| ① FST030 wall mounted transmitter | ⑤ Sensors |
| ② Power cable | ⑥ Flow direction |
| ③ Path 1 - Upstream sensor cable (1A) | ⑦ Ports for I/O, Communications, RTDs |
| ④ Path 1 - Downstream sensor cable (1B) | ⑧ Path 2 - Upstream (2A) |
| | ⑨ Path 2 - Downstream (2B) |

Figure 3-4 Wall mount transmitter overview (Reflect mount)

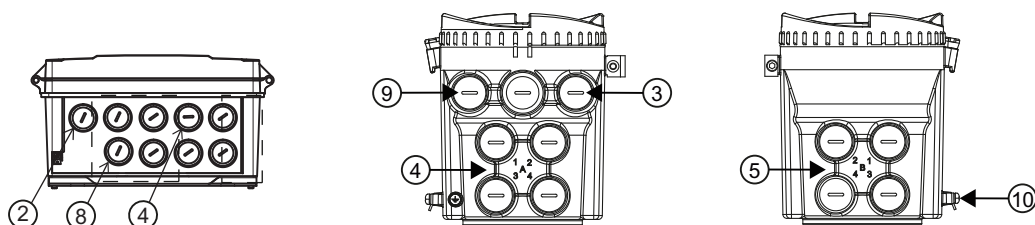
3.3 System overview with external DSL

System overview with external DSL

The illustration below shows a typical transmitter and clamp-on sensor flowmeter configuration with external DSL. You can also connect the transmitter to other flow ultrasonic sensors.



Wall mount transmitter overview with external DSL, example for FSS200



Transmitter bottom view

External DSL side view A

External DSL side view B

- | | | | |
|---|---|---|--------------------------------|
| ① | FST030 wall mounted transmitter | ⑥ | Sensors |
| ② | Power cable | ⑦ | Flow direction |
| ③ | Cable connection between FST030 and external DSL, up to 150 m | ⑧ | Ports for I/O, Communications |
| ④ | Path 1-4 Upstream (A) | ⑨ | Ports for Analog input or RTDs |
| ⑤ | Path 1-4 Downstream (B) | ⑩ | Protective earth |

3.4 System overview with FSS100 - SONOKIT

System overview with FSS100 - SONOKIT

The illustration below shows a typical transmitter and FSS100 - SONOKIT flowmeter configuration. You can also connect the transmitter to other flow ultrasonic sensors.

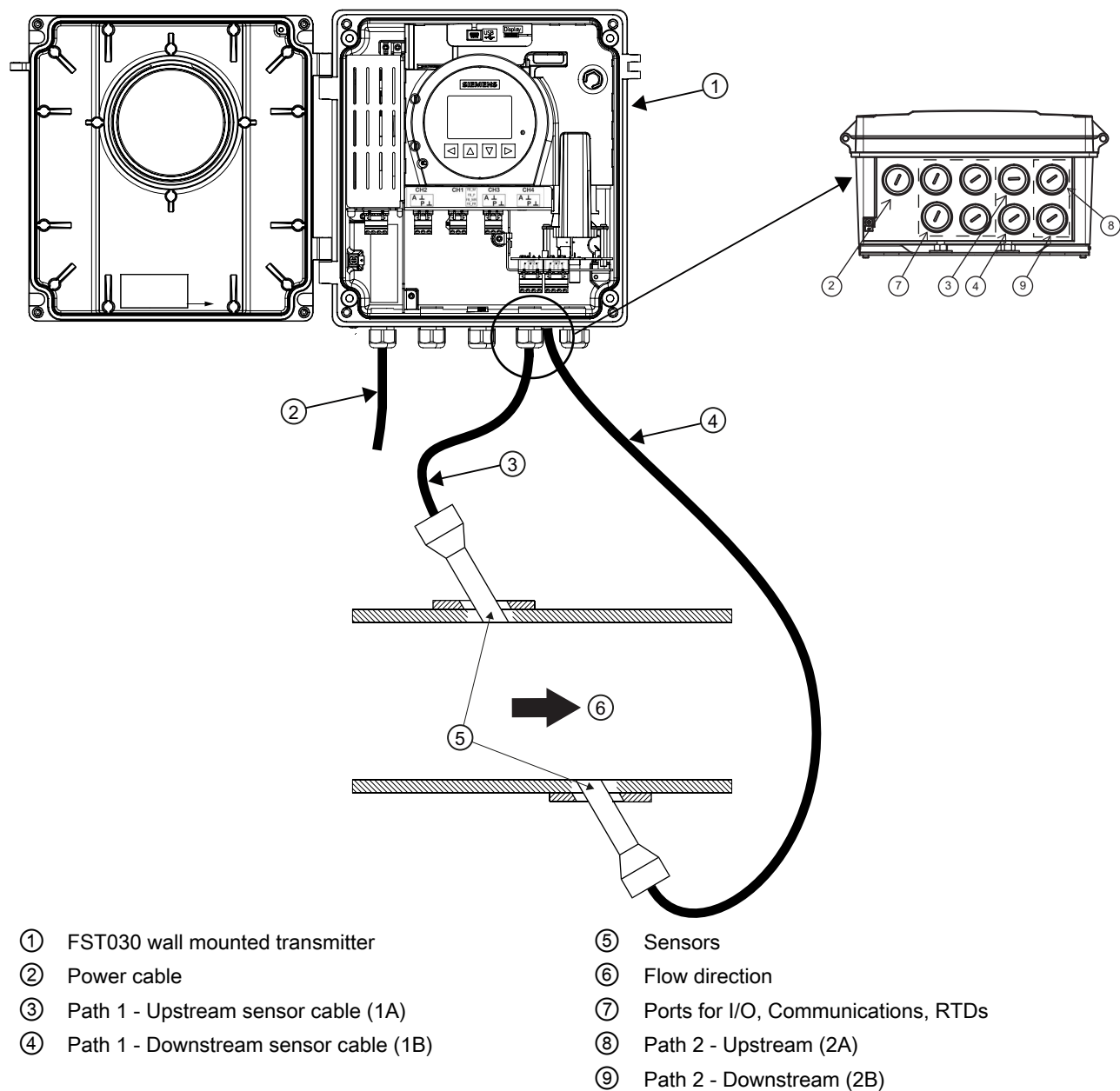


Figure 3-5 Wall mount transmitter overview with FSS100 - SONOKIT

3.5 Features

- The transmitter output can be connected via channel 1 to a Modbus fieldbus of a Process Control System (for example SIEMENS SIMATIC S7/PCS7).
- Available as wall mount enclosure with optional mount for 2" pipe
- Full graphical local display
- SensorFlash (SD card) for memory backup and documentation storage (certificates etc.)
- USB service interface
- Up to six input/output channels:
 - Channel 1: Current output for Modbus communication
 - Channel 2: Signal output; can be parameterized for:
 - Current output (0/4 to 20 mA)
 - Pulse output
 - Frequency output
 - Alarm, status
 - Channels 3 and 4: Signal output
 - Current output (0/4 to 20 mA)
 - Pulse output
 - Frequency output
 - Alarm, status
 - Pulse or frequency redundancy mode (only channel 3)
 - Channels 3 and 4: Relay output
 - Alarm, status
 - Channels 3 and 4: Signal input; can be parameterized as:
 - Current input (4 to 20 mA)
 - Totalizer control (resetting of totalizers)
 - Zero adjustment
 - Freezing of process values
 - Forcing of outputs
 - Channels 5 and 6:
 - Internal DSL: RTD resistive inputs
 - External DSL: RTD resistive input or current input (4 to 20 mA)
- Current, frequency, and pulse outputs with configurable fail safe mode
- High immunity against process noise
- Fast response to step changes in flow
- High update rate (100 Hz) on process values

- Measurement of:
 - Volume flow
 - Standard volume flow (hydrocarbon and gas variants only)
 - Mass flow
 - Flow velocity
 - Sound velocity
 - Liquident (hydrocarbon variant only)
 - Liquid identifier (hydrocarbon variant only)
 - Liquident Rate of Change (ROC): For interface detection (hydrocarbon variant only)
 - Medium temperature
 - Standard density (hydrocarbon and gas variants only)
 - Standard kinematic viscosity
 - Standardizing factor (hydrocarbon and gas variants only)
 - API gravity (hydrocarbon variant only)
 - Standard API gravity (hydrocarbon variant only)
 - Specific gravity (hydrocarbon variant only)
 - Standard specific gravity (hydrocarbon variant only)
 - Pipeline pig detection (hydrocarbon variant only)
- Measurement with external equipment connected to the transmitter via input channels 3 and 4
 - Medium temperature
 - Pressure
 - Kinematic viscosity
 - Density
- Configurable upper and lower alarm and warning limits for nearly all process values
- Independent low flow cut-off settings for volume flow and mass flow
- Zero-point adjustment (initiated by host system)
- Process noise damping using digital signal processing (DSP)
- Three totalizers for summation of flow process values
- Simulation of process values
- Simulation of all outputs
- Simulation of alarms
- Enabling alarms for visibility on all outputs (HMI, status and communication)
- Comprehensive diagnostics (NAMUR or Siemens standard) for troubleshooting and sensor checking
- Firmware update

- Use in hazardous areas according to specification
- USB mass storage* (not available in the USA)
- Data logging in SensorFlash
- Peak indicators
- Alarm delay

* The SD-Card Mass storage function is not available for use in the USA. This option is not available for ordering or shall not be ordered where end user may be located within USA.

3.6 Applications

- Water industry
- Wastewater industry
- HVAC industry
- Petrochemical industry
- Irrigation systems
- Plants transporting non-conductive liquids
- Power industry
- Process industry
- Gas industry

3.7 Approvals

Note

For further details see Approvals (Page 154).

The device is available with approvals for general purpose and for hazardous areas. In all cases, check the nameplate on your device, and confirm the approval rating.

3.8 Modbus communication

This device supports Modbus communication protocol. For further information on the Modbus communication, see Integrating the FST030 with Modbus system (Page 159) and Modbus holding registers tables (Page 171).

Installing/Mounting

4.1 Basic safety notes

4.1.1 Wallbox specific conditions of use

1. WARNING – Risk of electrostatic sparking. Clean only with a damp cloth.
2. 7ME372, 7ME382 and 7ME383 Wallbox transmitter threaded entries require a seal or gasket.
3. Temperature code T6 applies for ambient temperatures up to 45 °C; Temperature code T5 applies for ambient temperatures between 45 °C and 60 °C. The dust temperature class T85°C applies for ambient temperatures to 60 °C.
4. The equipment shall only be used in an area of at least pollution degree 2, as defined by IEC 60664-1.
5. Using the box provided on the nameplate, the user shall permanently mark the type of protection chosen for the specific installation. Once the type of protection has been marked, it shall not be changed.

Note**Pollution degree 2**

Pollution degree 2 can be achieved by controlling the micro environment within the equipment by maintaining IP65.

4.1.2 DSL11 specific conditions of use

1. ATEX/IECEx: Potential risk of sparking from aluminium alloy enclosure. In Zone 0 installations, equipment shall be installed in such manner as to prevent the possibility of sparks resulting from friction or impact against the enclosure.
2. US/Canada: Potential risk of sparking from aluminium alloy enclosure. In Division 1 or Zone 0 installations, equipment shall be installed in such manner as to prevent the possibility of sparks resulting from friction or impact against the enclosure.
3. WARNING – Risk of electrostatic sparking. Clean only with a damp cloth.
4. Group IIIC dust rating is only valid for a maximum dust layer of 5 mm.
5. Temperature code T6 and dust temperature class T₅ 64 °C applies for ambient temperatures up to 50 °C; Temperature code T5 and dust temperature class T₅ 74 °C applies for ambient temperatures between 50 °C and 60 °C.

4.2 Chapter overview (transmitter)

This chapter describes how to install the wall mount enclosure transmitter. For configurations with external DSL the chapter also describes how to install the external DSL.

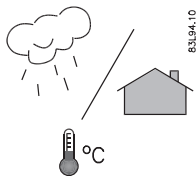
Wall mount enclosure

The wall mount enclosure version can be mounted either on a wall, on a pipe, or in panels, see Wall mount enclosure transmitter (Page 31).

External DSL

The external DSL can be mounted on a wall or on a pipe, see Mounting the external DSL (Page 33)

4.3 Installation location requirements



SITRANS F flowmeters with minimum IP67/NEMA 4X enclosure rating are suitable for indoor and outdoor installations.

Process pressure and medium temperature

If applicable, make sure that specifications for rated process pressure (PS) and medium temperature (TS) plus ambient temperature that are indicated on the device nameplate / label will not be exceeded.

Aggressive atmospheres

Ensure that the device is suitable for the application and that it is installed where there is no risk of penetration of aggressive vapors.

Direct sunlight

Prevent the device from overheating or materials becoming brittle due to UV exposure by protecting it from direct sunlight. Make sure that the maximum permissible ambient temperature is not exceeded. Refer to the information in Technical data (Page 143).

WARNING

Equipment used in hazardous areas

Risk of explosion. May cause death or serious injury.

Special requirements apply to the location and installation of the device. See Installation in hazardous areas.

WARNING

Fire Hazard

All user supplied cables connected to the transmitter must be suitable for 5°C above surrounding ambient temperature.

NOTICE
Strong vibrations Damage to device. • In plants with strong vibrations, mount the transmitter in a low vibration environment.

4.4 Installation instructions

4.4.1 Wall mount enclosure transmitter

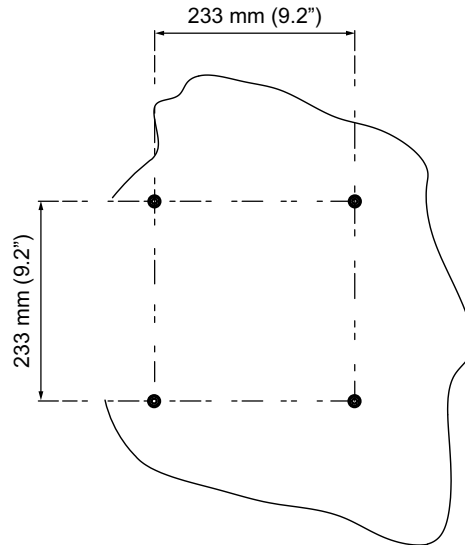
CAUTION
Opening lid Care must be taken when opening the lid to avoid the lid falling.

Note**Mounting screws are not included**

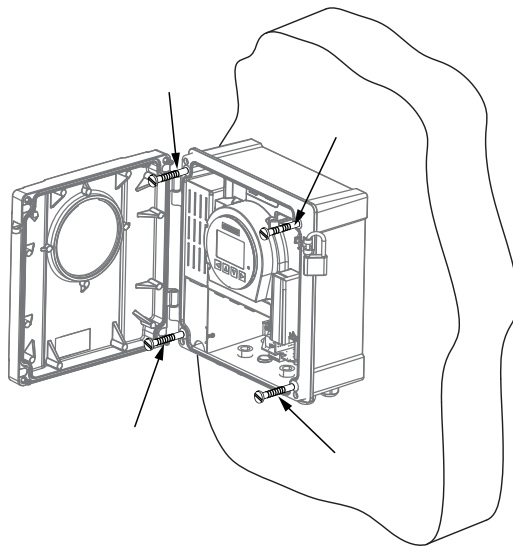
You will need four screws, able to support at least 55 lbs (25 kg). Siemens recommends M6x100 screws with appropriate anchors for the wall material.

4.4 Installation instructions

1. Prepare holes for the four screws (M6x100 or equivalent). Screw head diameter: max. 13.5 mm; screw shaft diameter: max. 6 mm.



2. Mount transmitter and tighten screws.



Note

Mounting on pipe or in panel

For mounting on pipe or in panel see the installation instructions given in A5E45462317 Instructions "Pipe/panel mount kit" which is provided with the optional pipe/panel mount kit.

4.4.2 Mounting the external DSL

Wall mounting

1. Remove mounting bracket from DSL.
2. Mount bracket on a wall using four screws.

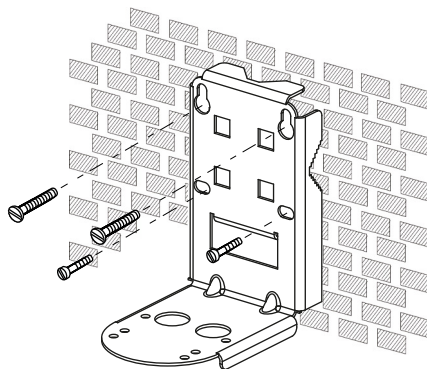


Figure 4-1 Mounting bracket on wall

3. Mount DSL on mounting bracket using four screws.

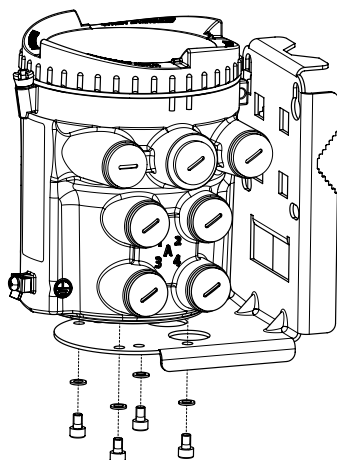


Figure 4-2 Mounting DSL to mounting bracket

Pipe mounting

1. Remove mounting bracket from DSL.
2. Mount bracket on a horizontal or a vertical pipe using ordinary hose clips or duct straps.

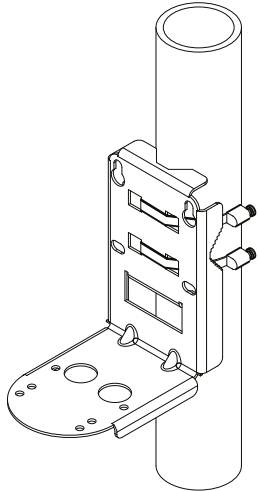


Figure 4-3 Mounting bracket on vertical pipe

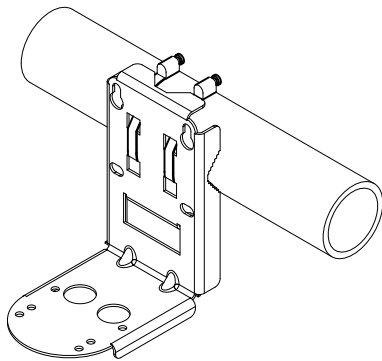


Figure 4-4 Mounting bracket on horizontal pipe

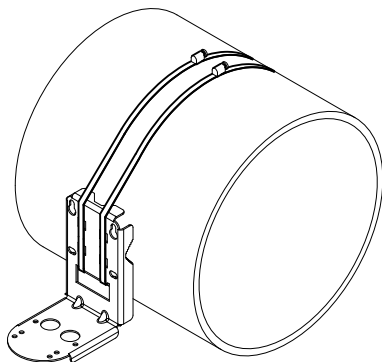


Figure 4-5 Mounting bracket on big horizontal pipe

3. Mount DSL on mounting bracket using four screws.

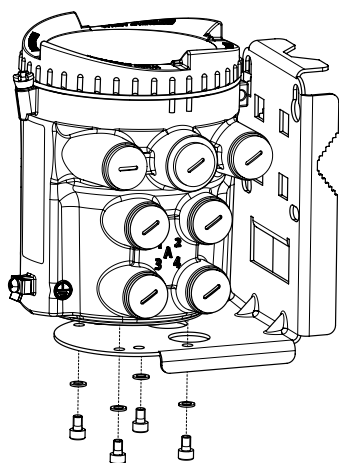


Figure 4-6 Mounting DSL to mount bracket

Connecting

This chapter describes how to wire up the transmitter. How to wire up the sensor is described in the sensor installation manual. The configuration steps depend on your configuration (with or without external DSL).

In standard configuration the transmitter and external DSL come with M20 cable entry threads. If ordered as NPT thread, NPT adapters are supplied for each cable entry. Sensor cables are equipped with cable glands as ordered.

Only for configurations with external DSL:

1. Connecting the external DSL (Page 45)

For all configurations:

1. Preparing for the connections (Page 55)
2. Connecting Modbus (Page 57)
3. Connecting channels 2 to 4 (Page 58)
4. Connecting channels 5 and 6 on internal DSL (Page 61)
5. Connecting the power supply (Page 62)
6. Finishing the transmitter connection (Page 64)

5.1 Basic safety notes

 WARNING
Missing PE/ground connection Risk of electric shock. Depending on the device version, connect the power supply as follows: • Power plug: Ensure that the used socket has a PE/ground conductor connection. Check that the PE/ground conductor connection of the socket and power plug match each other. • Connecting terminals: Connect the terminals according to the terminal connection diagram. First connect the PE/ground conductor.

**WARNING****Unsuitable cables, cable glands and/or plugs**

Risk of explosion in hazardous areas.

- Use only cable glands/plugs that comply with the requirements for the relevant type of protection.
- Tighten the cable glands in accordance with the torques specified in Technical data (Page 143).
- Close unused cable inlets for the electrical connections.
- When replacing cable glands, only use cable glands of the same type.
- After installation, check that the cables are seated firmly.

**WARNING****Lack of equipotential bonding**

Risk of explosion through compensating currents or ignition currents through lack of equipotential bonding.

- Ensure that the device is potentially equalized.

Exception: It may be permissible to omit connection of the equipotential bonding for devices with type of protection "Intrinsic safety Ex i".

**WARNING****Unprotected cable ends**

Risk of explosion through unprotected cable ends in hazardous areas.

- Protect unused cable ends in accordance with IEC/EN 60079-14.

**WARNING****Improper laying of shielded cables**

Risk of explosion through compensating currents between hazardous area and the non-hazardous area.

- Shielded cables that cross into hazardous areas should be grounded only at one end.
- If grounding is required at both ends, use an equipotential bonding conductor.

** WARNING****Insufficient isolation of intrinsically safe and non-intrinsically safe circuits**

Risk of explosion in hazardous areas.

- When connecting intrinsically safe and non-intrinsically safe circuits ensure that isolation is carried out properly in accordance with local regulations for example IEC 60079-14.
- Ensure that you observe the device approvals applicable in your country.

** WARNING****Incorrect conduit system**

Risk of explosion in hazardous areas as result of open cable inlet or incorrect conduit system.

- In the case of a conduit system, mount a spark barrier at a defined distance from the device input. Observe national regulations and the requirements stated in the relevant approvals.

** WARNING****Energized devices**

Risk of electric shock or explosion.

When energized the device may be opened by qualified personnel only.

** WARNING****Mains supply from building installation overvoltage category 2**

A switch or circuit breaker (max. 15 A) must be installed in close proximity to the equipment and within easy reach of the operator. It must be marked as the disconnecting device for the equipment.

5.2 Disconnecting device

Overvoltage Category II

Connect mains supply through a switch or circuit breaker (max. 15 A) in close proximity to the transmitter and within easy reach of the operator. Mark it as the disconnecting device for the transmitter.

5.3 Device nameplates

Each part of the system has three nameplate types showing the following information:

- product identification
- product specifications
- certificates and approvals

The transmitter is identified as 'Ultrasonic Transmitter SITRANS FST030'. The sensor is identified as 'Ultrasonic Sensor SITRANS FSS200' for clamp-on, or 'Ultrasonic Sensor SITRANS FSS100' for SONOKIT.

Nameplate of transmitter

SIEMENS	
①	Ultrasonic Transmitter SITRANS FST030
②	System order no.: XXXX.....
③	Transmitter no.: XXXX.....
④	Serial no.: XXXX.....
⑤	System revisions: XXXX.....
⑥	Power supply: 100-240 VAC, 47 to 63 Hz 20-27 VDC 22 VA
⑦	Material/Version: Aluminium
⑧	Cable entries: M20x1,5
⑨	Enclosure: IP66/IP67 Type 4X
⑩	Ambient temp.: -40 to 60 °C (-40°F to 140°F)
⑪	Year of manufacture: 2015
⑫	   0518  II 3(1) G II 3(1) D
⑬	SW function: Standard Um = 250 Vrms
⑭	Ch1: 4-20 mA, Act. HART FM 17ATEX0055X
⑮	Ch2: Signal output act. IECEx FMG 17.0023X
⑯	Ch3: Signal output pas. ☐ Ex ec ia [ia Ga] IIC T6...T5 Gc
⑰	Ch4: Signal output pas. ☐ Ex tc [ia Da] IIIC T85°C Dc
	Ch5: RTD  FM 17US0219X
	Ch6: RTD FM 17CA0110X
	☐ CL I, DV 2 GP ABCD ☐ CL II/III, DV 2 GP EFG ☐ CL I Zone 2: AEx ia nA [ia Ga] IIC T6...T5 Gc ☐ CL I Zone 2: AEx/Ex ec ia [ia Ga] IIC T6...T5 Gc ☐ Zone 22: AEx/Ex tc [ia Da] IIIC T85°C Dc
	Installations in Division 2, Zone 2 and Zone 22 shall be in accordance with drawing A5E32778336A
	☐ Associated apparatus for / Matériel associé pour CL I, II, III, DIV 1, GP ABCDEFG install per A5E32778336A
	Temperature code: T6 for Ta = -40°C to 45°C T5 for Ta = -40°C to 60°C
⑰	 
Siemens AG DE-76181 Karlsruhe, Germany	
Made in France	

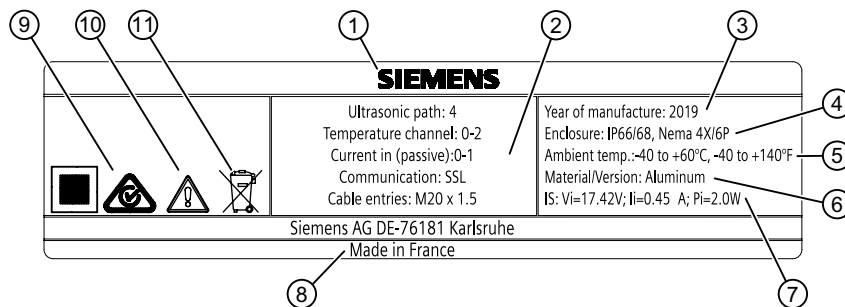
- ① Transmitter product name
- ② Device-specific system order number (transmitter and sensor)
- ③ Transmitter replacement order number
- ④ Transmitter serial number

- ⑤ System revision numbers; firmware (FW) and hardware (HW)
- ⑥ Power supply
- ⑦ Transmitter enclosure material and version (compact / remote)
- ⑧ Type of conduit / cable entries
- ⑨ Degree of protection IP
- ⑩ Ambient temperature
- ⑪ Year when device was manufactured
- ⑫  WEEE symbol, see Disposal (Page 104)
- ⑬  Consult the Operating Instructions
- ⑭ Software function
- ⑮ Communication interface on channel 1 (Ch1)
- ⑯ Input/output setup of channels 2 to 6, if ordered
- ⑰  / QR-code: C-tick logo and product-specific QR-code

Figure 5-1 Transmitter nameplate, example

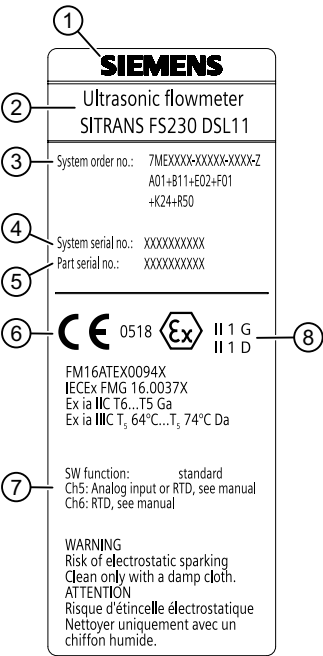
5.3.1 External DSL nameplates

Nameplates of External DSL



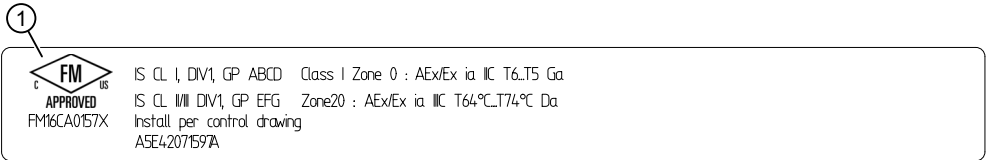
- ① Manufacturer
- ② I/O connections
- ③ Year of manufacture
- ④ Degree of protection
- ⑤ Ambient temperature range
- ⑥ Material
- ⑦ Intrinsic Safety (IS) parameters
- ⑧ Place of manufacture
- ⑨ Conformity with country-specific directive
- ⑩ Consult operating instructions, certificates and approvals under Instructions and manuals (<https://www.siemens.com/processinstrumentation/documentation>)
- ⑪ WEEE symbol, see Disposal (Page 104)

Figure 5-2 External DSL - product nameplate layout, example



- ① Manufacturer
- ② Product name
- ③ System order number
- ④ System serial number
- ⑤ Part serial number
- ⑥ Conformity with country-specific directive
- ⑦ Configurations
- ⑧ ATEX/IECEx marking for hazardous area

Figure 5-3 External DSL - specification nameplate layout, example



- ① FM marking for hazardous area

Figure 5-4 External DSL - Ex nameplate layout, example

5.4 Connecting the sensor cables to the wall mount transmitter with internal DSL

Preparing for the connection

1. Loosen the four lid screws.
2. Open the lid.
3. Remove F-connector tool from wall mount enclosure.

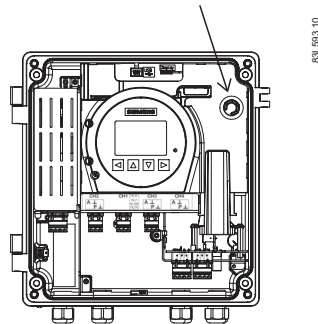
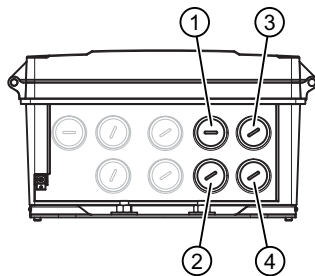


Figure 5-5 F-connector tool location

Connecting the flow sensor cables

When connecting the sensors it is required for the system to function that the sensor cables are connected correctly. Both sensor cables for each path must be connected to the same port numbers (1A and 1B or 2A and 2B) on the transmitter.

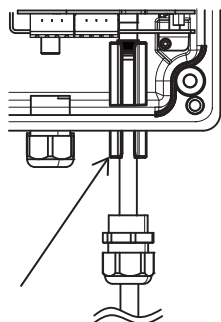


- | | |
|---|----------------------------|
| ① Path 1 - Upstream sensor cable (1A) | ③ Path 2 - Upstream (2A) |
| ② Path 1 - Downstream sensor cable (1B) | ④ Path 2 - Downstream (2B) |

The sensor cables are delivered with a premounted F-connector at transmitter end.

1. Remove blind plug from wall mount enclosure.
2. Slide the cable gland back onto the cable and allow access for the F-connector tool.
3. Place F-connector tool around cable and slide up to engage F-connector nut.
4. Push cable through gland opening. Ensure that center lead is aligned with connector port in transmitter.

5. Tighten F-connector using tool until you meet mechanical stop.



6. Remove F-connector tool.
 7. Mount and tighten cable gland.
- Repeat these steps for each sensor cable.

5.5 Connecting the external DSL

For configurations with external DSL first prepare the connections in the external DSL enclosure. Afterwards proceed with the connections in the FST030 transmitter enclosure.

In the external DSL it is possible to connect sensor cables from up to four measurement paths.

Furthermore, external measurements from up to two optional devices can be connected: 4 to 20 mA current input (passive) and/or resistive temperature device (RTD)

The DSL wiring comprises the following steps:

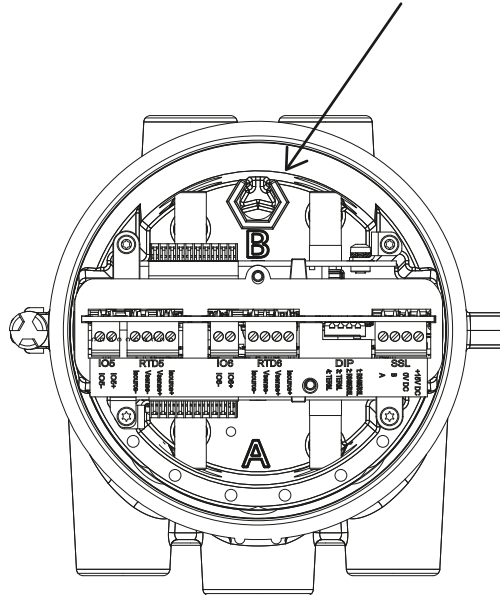
1. Preparing for the DSL connections (Page 46)
2. Connecting the sensor cables (Page 46)
3. Connecting optional devices (Page 49)
4. Connecting the SSL cable (Page 51)
5. Finishing the DSL connection (Page 54)

See also

Transmitter power supply, communications and I/Os connection (Page 54)

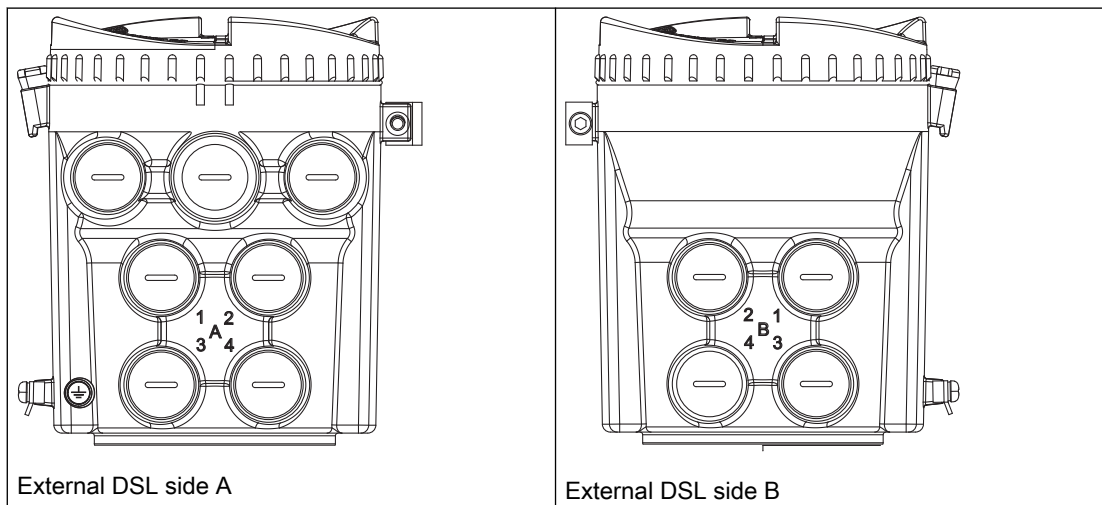
5.5.1 Preparing for the DSL connections

1. Remove lid from DSL
2. Remove F connector tool from DSL and use it to connect the sensor cables.



5.5.2 Connecting the sensor cables

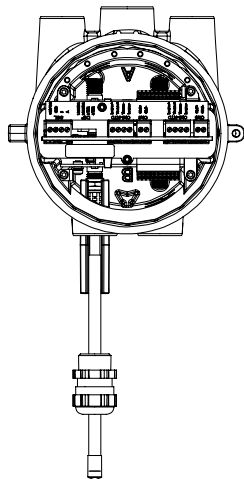
When connecting the sensor to the DSL make sure that you connect the sensor cables for each path to the corresponding numbers on the DSL (A and B).



The sensor cables are delivered with a pre-mounted F-connector at transmitter end.

1. Remove blind plug from external DSL enclosure.
2. Slide the cable gland back onto the cable and allow access for the F-connector tool.
3. Place F-connector tool around cable and slide up to engage F-connector nut.

4. Push cable through gland opening. Ensure that center lead is aligned with connector port in external DSL.
5. Tighten F-connector using tool until you meet mechanical stop.



6. Remove F-connector tool.
 7. Mount and tighten cable gland.
- Repeat these steps for each sensor cable.

5.5.3 Channel 5 and 6 input configuration

Note**Connection of optional devices**

The external DSL provides the option of connecting two additional devices to channels 5 and 6. Do not connect two devices to one channel.

Note**Analog input on channel 6**

Hardware version 2 and below does not support analog input on channel 6.

Input configuration

Connect the two, three or four wires to the terminal block as shown below. Short-circuit terminals as required.

Note

The terminal connector is detachable

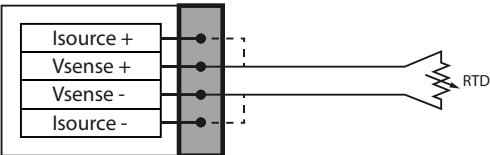
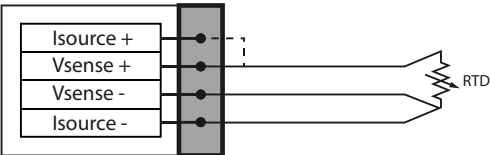
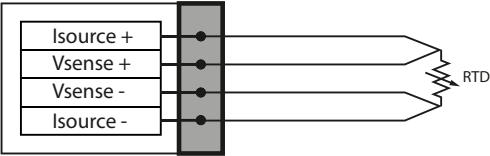
For easier access unplug the terminal connector. After connecting the wires, plug the terminal connector back in.

Note

RTD shield grounding

Make sure that the RTD cable shield is properly grounded. Consult the FSS200 Installation Manual on how to ground the RTD cable shield.

Table 5-1 Channels 5 and 6 configuration

Configuration	Software configuration	Connection diagram
Input Passive	Current input	
RTD input	Pt100 Pt500 Pt1000	---- Short 
		2-wire RTD configuration ---- Short 
		3-wire RTD configuration 
		4-wire RTD configuration

5.5.4 Connecting optional devices

Connecting 4 to 20 mA current input cable (passive)

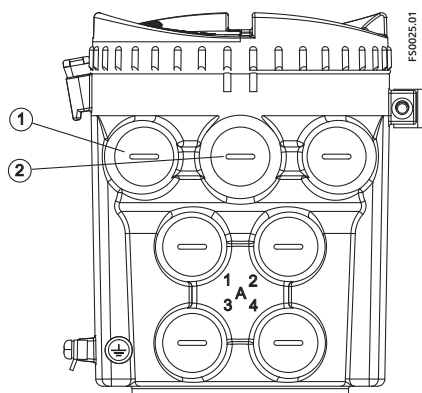
Note

Connection of optional devices

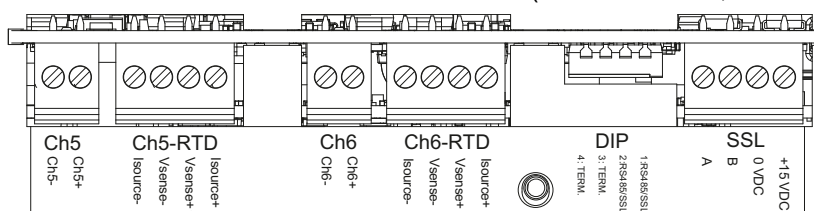
The DSL provides the option of connecting two additional devices to channels 5 and 6. Do not connect two devices to one channel.

Perform the following steps for each current input cable.

1. Remove cap and ferrule from cable gland and slide onto cable.
2. Remove one of the blind plugs (① or ②) and fit cable gland.



3. Push cable through gland opening.
4. Ground current input cable shield using the ground clamp inside the external DSL.
5. Connect the two wires to two-terminal block (Ch5+ and Ch5-, or Ch6+ and Ch6-).

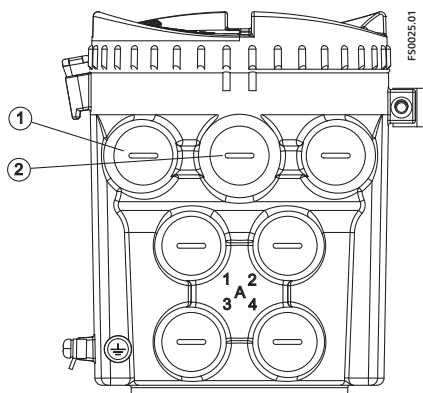


6. Assemble and tighten cable gland.

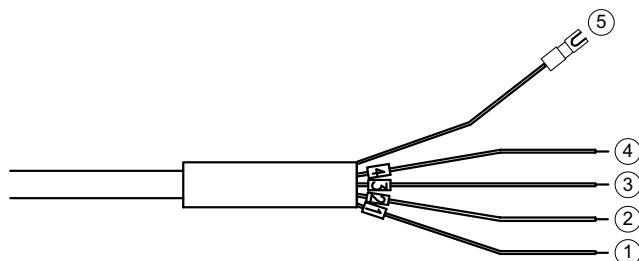
Connecting RTD cable

Perform the following steps for each RTD cable.

1. Remove cap and ferrule from cable gland and slide onto cable.
2. Remove one of the blind plugs (① or ②) and fit cable gland.



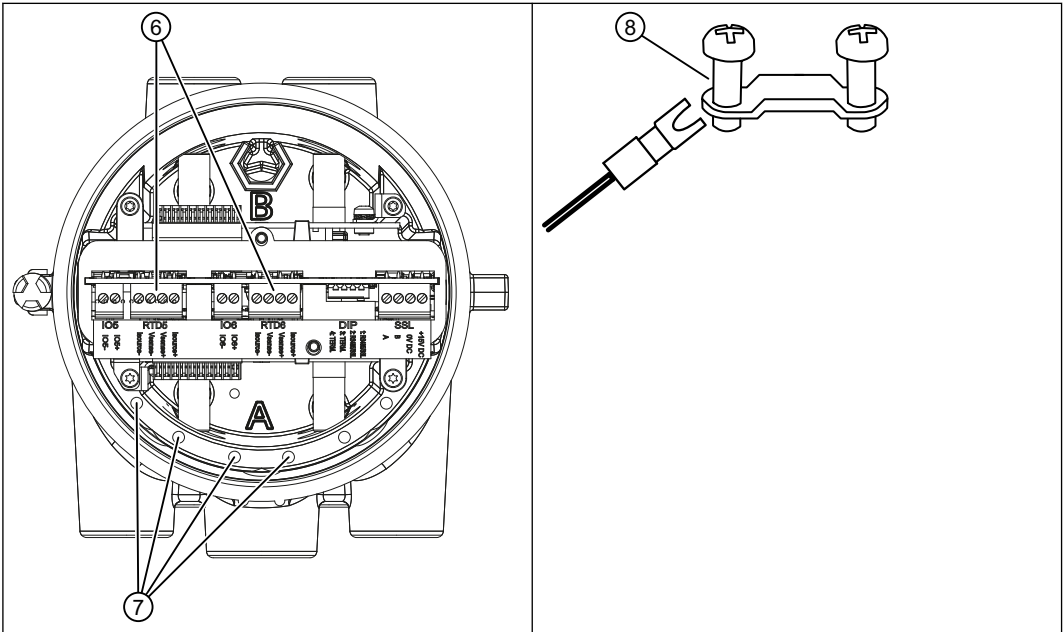
3. Push cable through gland opening.
4. Attach an RTD cable crimp lug on the blue wire ⑤ of the cable by using a crimp tool or equivalent.



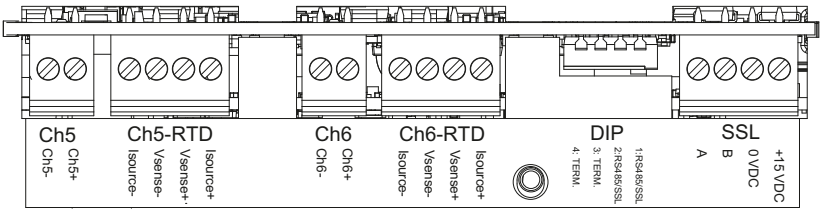
- ① Wire to Isource + (black)
- ② Wire to Vsense + (white)
- ③ Wire to Isource - (green)

- ④ Wire to Vsense - (red)
- ⑤ Wire to ground (blue)

5. Ground the RTD cable shield in the external DSL ⑦, by sliding the crimp lug on wire ⑤ onto one of the installed strain reliefs screws ⑧.



6. Connect the two, three or four wires to four-terminal block (Ch5-RTD or Ch6-RTD) ⑥. Short-circuit terminals as required.



2-wire device	3-wire device	4-wire device
--- Short	--- Short	

7. Assemble and tighten cable gland.

5.5.5 Connecting the SSL cable

M12 connector version

The SSL cable is provided with M12 style stainless steel plugs.

The cable shield is physically and electrically terminated within the body of the plug.

Note

Never pull the cable by the plug - only by the cable itself.

1. Connect DSL using the supplied 4-wire cable with M12 connectors to both the external DSL and the transmitter.

Note
Grounding

The DSL cable shield is only mechanically connected to the grounding terminal (PE), when the M12 plug is correctly tightened.

M20 connector version

1. Prepare SSL cable by stripping it at both ends.

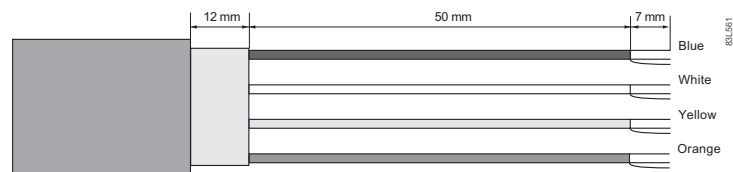
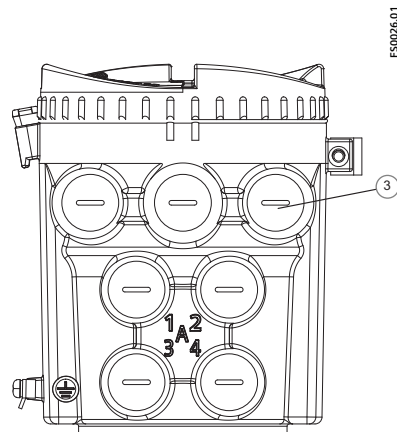


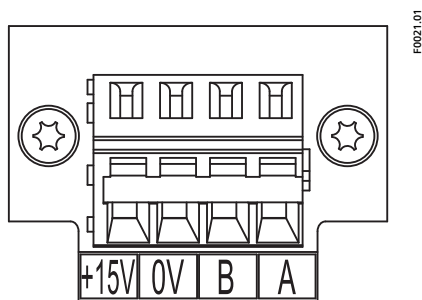
Figure 5-6 Cable end

2. Remove cap and ferrule from cable gland and slide onto cable.
3. Remove blind plug (③) and fit cable gland.



4. Push cable through gland opening.

5. Connect the four wires according to list below.

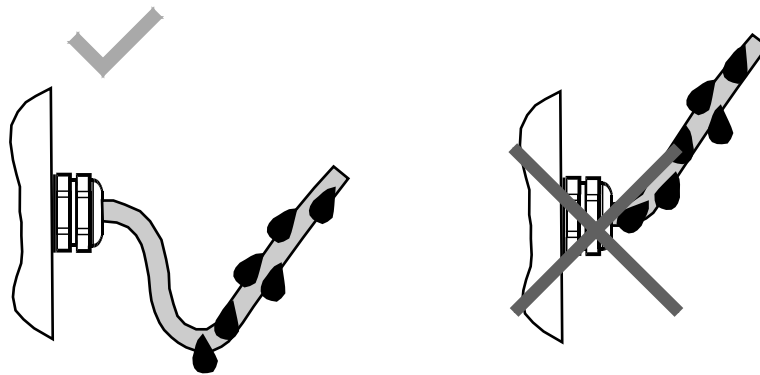


Terminal number	Description	Wire color
1	+15 V DC	Orange
2	0 V DC	Yellow
3	B	White
4	A	Blue

6. Assemble and tighten cable gland.

5.5.6 Finishing the DSL connection

1. Place F connector tool in DSL.
2. Check individual wire installation by tugging firmly.
3. Firmly tighten cable glands and insert blanking plugs in unused cable entries.
4. Remove O-ring from lid.
5. Reinstall lid and screw in until mechanical stop. Wind back lid by one turn.
6. Mount O-ring by pulling it over the lid and tighten lid cover until you feel friction from the O-ring on both sides. Wind lid further by one quarter of a turn to seal on the O-ring.
7. Ensure that moisture does not penetrate to inside of DSL enclosure by creating a drip loop (bend cables downward) immediately before cable glands.



Note

Protection class

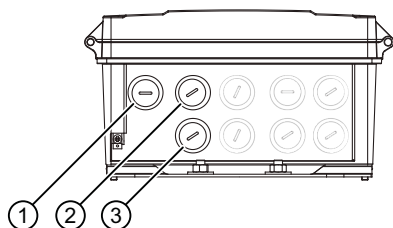
The DSL is IP68 only if the lid is properly mounted and all M20 holes are closed with appropriate blind plugs or cable glands.

5.6 Transmitter power supply, communications and I/Os connection

For sensor connection, see relevant sensor installation manual.

5.6.1 Preparing for the connections

1. Remove blind plugs where required.



- ① Power supply connection
- ② Input/output connection (channels 2 to 4)
- ③ Modbus connection

2. Loosen spring screws on enclosure lid.

3. Open enclosure lid. A nameplate showing the configuration is placed on the outside of the transmitter enclosure.

SIEMENS

Serial no.: FDKB8310000101

Power supply:
L/+ Terminal 1
N/- Terminal 2

A: Active
P: Passive
NO: Normally open contact
NC: Normally closed contact

Channel	Function	Parameters	Terminals
1	Modbus	RL < 500 Ohm A: Vo = 28V Io = 87mA P: Vi = 30V li = 100mA	Al+1 -2) Al+1 -2) Pt+3 -4)
2	Current, freq. pulse, status output	RL < 500 Ohm A: Vo = 28V Io = 87mA P: Vi = 30V li = 100 mA	Al+3 -2) Al+3 -2) Pt+2 -1) Pt+2 -1)
3	Current in/out Freq., pulse out status out,dig.in	RL < 500 Ohm A: Vo = 28V Io = 87mA P: Vi = 30V li = 100 mA	Al+3 -2) Al+3 -2) Pt+2 -1) Pt+2 -1)

Channel	Function	Parameters	Terminals
4	Relay	Vi=30 VDC, li=100 mA	NO (3 2) NC (2 1)
5	RTD	RTD: See manual	
6	RTD	RTD: See manual	

See Operating Instructions

Siemens AG DE-76181 Karlsruhe
Made in France

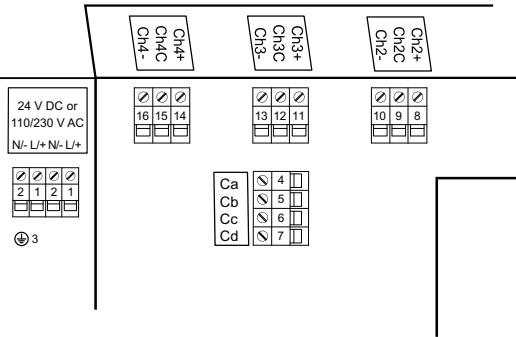
- ① Power supply connections
 - L/+ Terminal 1
 - N/- Terminal 2
 - ⊕ Terminal 3
- ② Serial no.
- ③ Key to symbols
 - A Configured as active input/output
 - P Configured as passive input/output
 - NO Connected as normally open contact
 - NC Connected as normally closed contact
- ④ Initial firmware and hardware revisions
- ⑤ Device configuration date
- ⑥ Updates (to be filled in on firmware and hardware updates)
- ⑦ Configuration of channels 1 to 6

Figure 5-7 Example configuration label

See also

Input/output configuration (Page 60)

5.6.2 Terminal layout



For configuration of the software parameters, see Input/output configuration (Page 60). More information can be found in the Function Manual.

The following table shows:

- Which cable with which terminal
- Hardware and software configuration of the channels

HW configuration	SW configuration	Terminals																	
		Power supply			Ch1				Ch2			Ch3			Ch4				
Power supply		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
Channel 1 HART	Current output HART	L/+	N/-	Ⓢ	Active/+	Active/-	Passive/+	Passive/-											
	In				Passive/+	Passive/-													
Channel 1 MODBUS					+ (B)	- (A)												Out	- (A)
Channel 1 PROFIBUS					In	- (A)												Out	- (A)
					+ (B)	- (A)												Out	- (A)
Channel 2 output	Current, Frequency, Pulse and Status								Active/+	Active/-	Passive/+	Passive/-							
Channel 3 & 4 Input and output	Outputs: Current, Frequency, Pulse and Status Inputs: Digital											Active/+	Active/-		Active/+	Active/-			
Channel 3 & 4 Relay	Status output												Passive/+	Passive/-		Passive/+	Passive/-		
												NO	NO		NO	NO			
												NC	NC	NC		NC	NC		

Figure 5-8 Terminals/configuration overview

Ex and non-Ex versions

- For Ex versions active or passive current output is preselected at ordering and cannot be changed.
- Non-Ex versions can be connected as either active or passive.

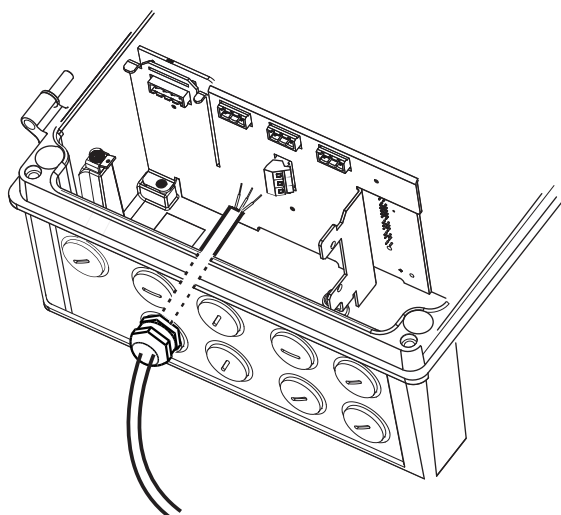
5.6.3 Connecting Modbus

Current output Modbus

Note**Integrating the FST030 with Modbus system**

Further information on how to integrate the FST030 in a point-to-point or multidrop Modbus RTU network in non-hazardous or hazardous areas can be found in the appendix under Integrating the FST030 with Modbus system (Page 159).

1. Open enclosure lid.
2. Remove blind plug and fit cable gland.
3. Push cable through open gland and cable path.



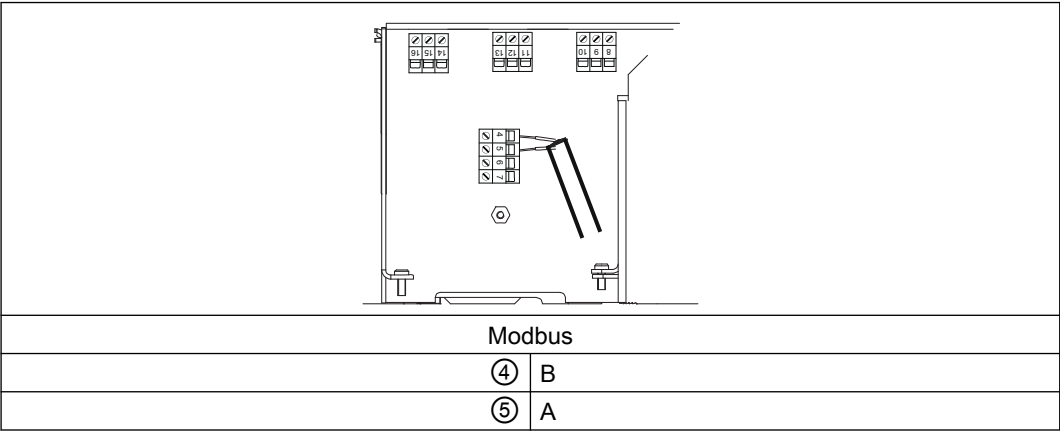
4. Restore ferrule and tighten cap to lightly hold cable in place.

5. Connect wires to terminals using a screwdriver.

Note

The terminal connector is detachable

For easier access unplug the terminal connector. After connecting the wires, plug the terminal connector back in.



Termination of channel 1. The numbers refer to the terminal layout, see Preparing for the connections (Page 55).

6. Tighten cable gland.

5.6.4 Connecting channels 2 to 4

Channel 2 is for output only, channels 3 to 4 can be ordered as either inputs/outputs or relays, see Preparing for the connections (Page 55)

Connect wires

Note

Additional load resistor

Depending on the internal load of an externally connected device, an additional load resistor might be required, for the pulse, status and frequency functions to work properly,

1. Remove cap and ferrule from cable gland and slide onto cable.
Wall mount enclosure: Remove blind plug and fit cable gland.
2. Push cable through open gland and cable path.
3. Restore ferrule and tighten cap to lightly hold cable in place.
4. Fold signal cable screen back over outer sheath and ground beneath cable clamp.
In case of shielded cables, use metal cable glands for proper connection.

5. Connect wires to terminals using a screwdriver.

Note

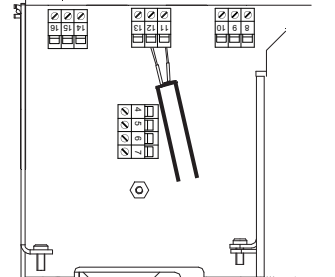
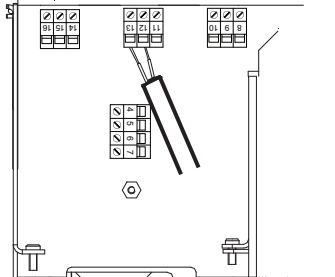
The terminal connector is detachable

For easier access unplug the terminal connector. After connecting the wires, plug the terminal connector back in.

6. Tighten cable gland.

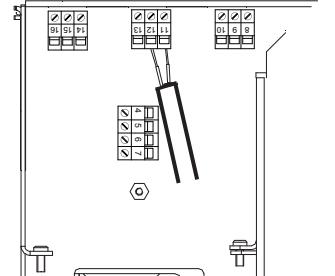
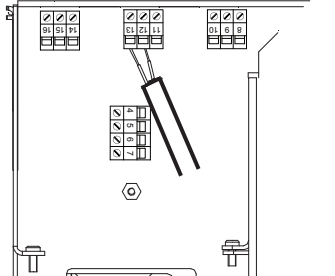
The numbers in the graphics below refer to table Preparing for the connections (Page 55)

If connected as input or output (channels 2 to 4)

	
Active configuration	Passive configuration
⑫ -	⑬ -
⑪ +	⑫ +

Termination example for channel 3

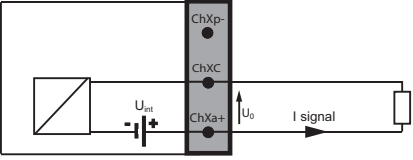
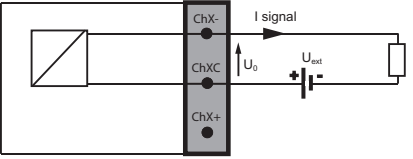
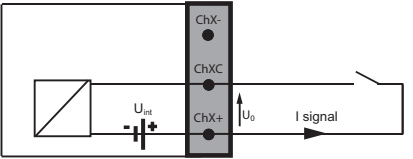
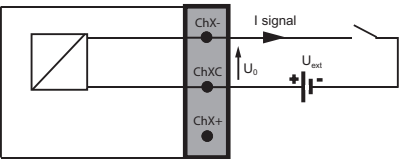
If connected as relay (channels 3 and 4 only)

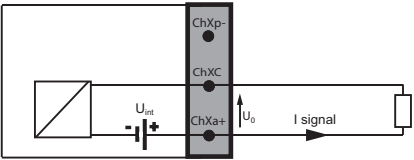
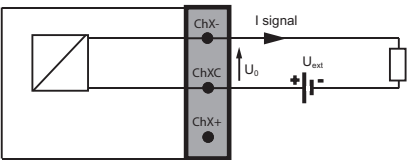
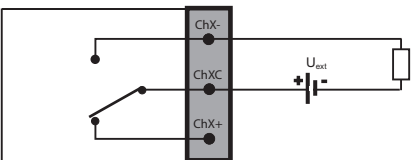
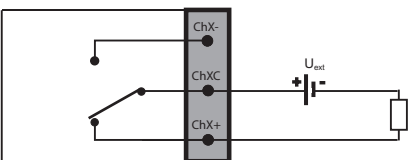
	
Normally open contact (NO)	Normally closed contact (NC)
⑫ NO	⑬ NC
⑪ NO	⑫ NC

Termination example for channel 3 - relay connection

5.6.4.1 Input/output configuration

All pressure values are handled as absolute pressure. If connected pressure transmitters measure the pressure in gauge pressure, then please convert to absolute pressure by using the scaling functionality of the flow transmitters current input channel.

Configura- tion	Software configuration	Channel			
		2	3	4	
Output Active	Current output Frequency output Pulse output Status output - Alarm class - Alarm item - NAMUR status signals	X	X	X	 Active
Output Passive	Current output Frequency output Pulse output Status output - Alarm class - Alarm item - NAMUR status signals	X	X	X	 Passive
Input Active	Digital input - Reset totalizer 1 - Reset totalizer 2 - Reset totalizer 3 - Reset all totalizers - Force outputs - Freeze process values - Zero adjust		X	X	 Active
Input Passive	Digital input - Reset totalizer 1 - Reset totalizer 2 - Reset totalizer 3 - Reset all totalizers - Force outputs - Freeze process values - Zero adjust		X	X	 Passive

Configura- tion	Software configuration	Channel			
		2	3	4	
Current input Active	Process values - Pressure - Medium temperature - Viscosity - Density		X	X	 Active
Current input Passive	Process values - Pressure - Medium temperature - Viscosity - Density		X	X	 Passive
Relay output Normally open	Alarm class Alarm item NAMUR status signals		X	X	 Normally open
Relay output Normally closed	Alarm class Alarm item NAMUR status signals		X	X	 Normally closed

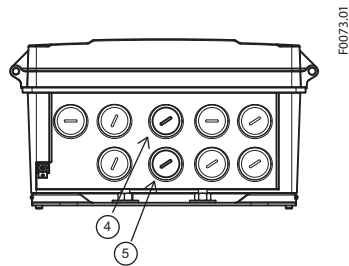
5.6.5 Connecting channels 5 and 6 on internal DSL

Connecting RTD (Resistance Temperature Detector) cable

Perform the following steps for each RTD cable.

1. Loosen the four lid screws and open lid.
2. Remove cap and ferrule from cable gland and slide onto cable.

3. Remove one of the blind plugs (④ or ⑤) and fit cable gland.



4. Push cable through gland opening.
5. Connect the two, three or four wires to the terminal block as shown below. Short-circuit terminals as required.

Note

The terminal connector is detachable

For easier access unplug the terminal connector. After connecting the wires, plug the terminal connector back in.

Note

RTD shield grounding

Make sure that the RTD cable shield is properly grounded. Consult the FSS200 Installation Manual on how to ground the RTD cable shield.

2-wire device	3-wire device	4-wire device

6. Assemble and tighten cable gland.

5.6.6 Connecting the power supply

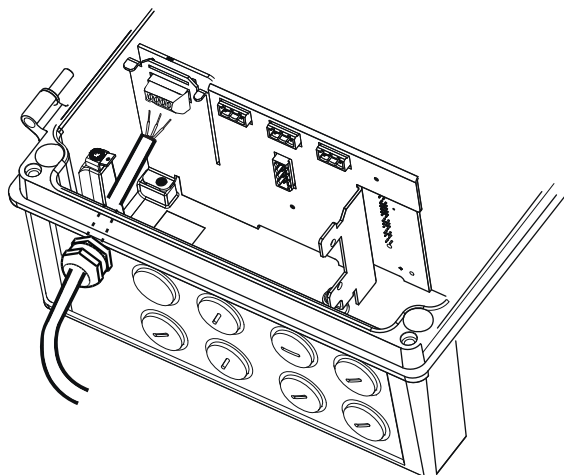
Note

Power supply wiring

- 0.2 to 2.5 mm (24 AWG to 12 AWG) solid or stranded
- torque between 0.5 to 0.6 Nm
- One wire per terminal connection

1. Open enclosure lid, unscrew power supply terminal protection cover screw, and remove protection cover.
2. Remove blind plug and fit cable gland.

3. Push cable through open gland and cable path



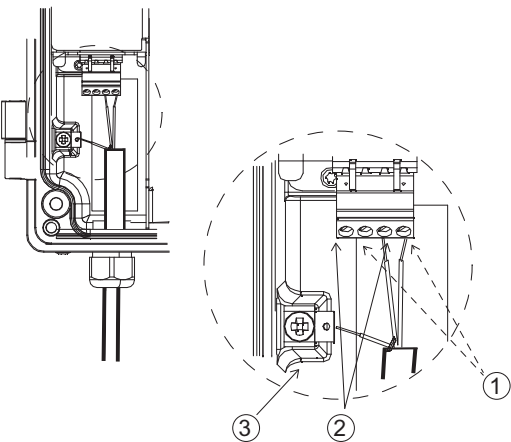
4. Restore ferrule and tighten cap to lightly hold cable in place.

5.7 Finishing the transmitter connection

- 5. Connect ground to terminal $\oplus$ and power to terminals L/+ and N/- in the manner shown below at right using a screwdriver.

Note
The terminal connector is detachable

For easier access unplug the terminal connector. After connecting the wires, plug the terminal connector back in.



- ① L/+
- ② N/-
- ③ $\oplus$ Protective Earth (PE)

AC connection	DC connection
L/+ N/- $\oplus$ ← L ← N $\oplus$ Power: 85 to 264 V AC, 47 to 63 Hz	L/+ N/- $\oplus$ ← + ← - $\oplus$ Power: 19.2 to 28.8 V DC

- 6. Tighten cable gland.
- 7. Mount power supply protection cover and fasten protection cover screw.

5.7 Finishing the transmitter connection

Connection check-up

- 1. Check individual wire installation by tugging firmly.
- 2. Firmly tighten cable glands and insert blanking plugs in unused cable entries.
- 3. Close lid.

4. Tighten the four spring screws.
5. Ensure that moisture does not penetrate to inside of electronics enclosure.

Commissioning

This chapter gives instructions to commissioning your device, see Commissioning via local display (Page 71).

Furthermore, the device can be commissioned using SIMATIC PDM, see Commissioning with SIMATIC PDM (Page 371).

6.1 Basic safety notes

WARNING

Loss of explosion protection

Risk of explosion in hazardous areas if the device is open or not properly closed.

- Close the device as described in Installing/Mounting (Page 29).

WARNING

Opening device in energized state

Risk of explosion in hazardous areas

- Only open the device in a de-energized state.
- Check prior to commissioning that the cover, cover locks, and cable inlets are assembled in accordance with the directives.

Exception: Devices having the type of protection "Intrinsic safety Ex i" may also be opened in energized state in hazardous areas.

Note

Verify proper operation and configuration of all analog inputs

Incorrect configuration can have a negative impact on flow compensation and produce errors in flow rate.

6.2 General requirements

Before commissioning it must be checked that:

- The device has been installed and connected in accordance with the guidelines provided in Installing/Mounting (Page 29) and Connecting (Page 37).
- Device installed in hazardous areas meets the requirements described in Approvals (Page 154).

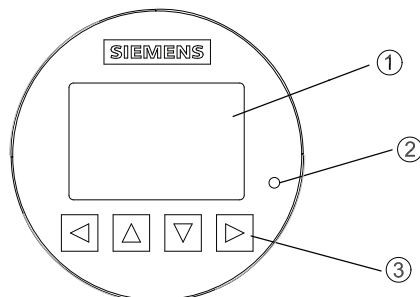
6.3 Power up

Power up the device. Devices with local display show a screen for initial startup (Page 70).

6.4 Local display

The device is commissioned/operated with the touch keypad on the local display.

The elements are actuated by touching the glass panel on the appropriate button. The text display above the operating elements gives a menu-guided operation of the individual device function/parameters. Successful operation of the button is confirmed by a small green LED next to the display.



- ① Full graphical display
- ② LED (for indication of button operation)
- ③ Touch keypad

Figure 6-1 Local display

Note

Calibration of the keypad

When the lid is closed, all buttons are calibrated. During calibration the LED is on and the buttons cannot be operated.

If one of the buttons is pressed for more than 10 seconds, the calibration of this button begins which has a duration of less than 10 seconds. Release the button for further operation.

Note**Local display timeout**

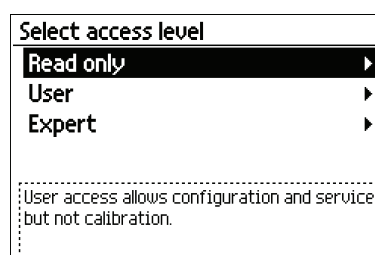
If no button is pressed for 10 minutes, the display switches to show operation view. If Backlight is set to Automatic, display backlight goes off automatically 30 seconds after the last button press.

Note

Operation does not require opening of the device. This means that the high degree of protection of IP67 and safety in hazardous areas are guaranteed at all times.

6.5 Access control

You can view all items in the HMI menu but the parameters are protected against changes through access level control. To gain access, select one of the following access levels:



- **Read only**
Allows no configuration. The user is only able to view the parameter values. No PIN code required.
- **User**
Allows configuration and service of all parameters except calibration parameters. Default PIN code is 2457.
- **Expert**
Allows configuration and service of all parameters including flow and density calibration parameters. Default PIN code is 2834.

PIN codes can be changed in **Security (5)**.

Note**Lost PIN code**

If the PIN code is lost, provide Siemens customer support with the transmitter serial number (see nameplate). Siemens customer support will provide a code to be entered in **PIN recovery (5.4)**.

Disable access level control

If logged in as Expert you can **Deactivate user PIN** meaning that you will always be logged in as User and will not be prompted to enter the password. Enabling the access level control can be done in **Activate user PIN** and requires entering the Expert password.

Auto logout function

You will **not** be prompted for password for 10 minutes after the last key press.

NOTICE
Device restart
Whenever the device is restarted, the access level is reset to Read only.

6.6

Initial startup

The first time the device is powered up, you will be prompted to set the language. The device always starts up showing "Language" in English. When the language has been set, you will be prompted to set the date and time.

You will be asked if you want to start the "Quick commissioning" wizard. If you choose "Yes" (recommended), the "Quick commissioning" wizard will start. If you choose "No", you accept the default values of the device, and the next HMI view will be the operation view 1.

Start

Language



Welcome



Set date and time



Quick commissioning



Yes



Continue with Quick commissioning wizard

No



First startup wizard is now finished

6.7 Commissioning via local display

In this chapter it is described how to commission the device via the local display using the Quick commissioning wizard.

6.7.1 Wizards

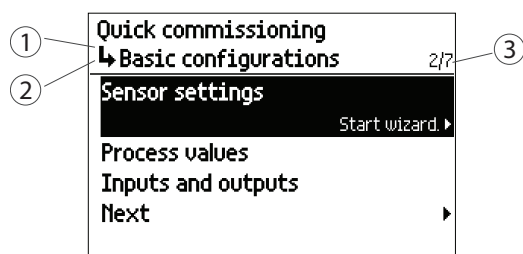
In this chapter it is described how to commission the device via the local display using the wizards.

The first view in each wizard (About - view 1) is a description of what settings/actions can be performed using the specific wizard.

The last view in each wizard (Finished) shows that the last step of the wizard was completed.

Any parameter changes confirmed with  are saved immediately.

At any time in any wizard selecting **Exit** will bring you back to the main wizard menu without discarding changes.



- ① Wizard name
- ② Step name / Parameter name
- ③ View number / Total views in wizard

The purpose of the wizards is to guide you through a quick set-up of various parameters.

The following wizards are available:

- Quick commissioning
- Sensor settings
- Process values
- Inputs and outputs
- Copy configuration
- Communication

Use the  and  keys to highlight the desired HMI wizard and press right key to enter the wizard.

Table 6-1 Key functions - wizards

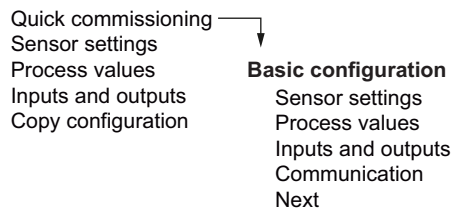
Key	Function
	Leave menu without saving changes
	Scroll up in list of options/change parameter value
	Scroll down in list of options/change parameter value
	On first button press: Select option. On second button press: Confirm selection and save setting. When you reach the end of the wizard, e.g. "The Process values wizard is now finished.": return to wizard list

6.7.1.1 Quick commissioning wizard

The Quick commissioning wizard will guide you through configuration of parameters essential for your application. You configure parameters essential for your application by selecting the configuration path and sub-wizards appropriate for your application.

Start

Quick start



Text

Select a basic configuration wizard
Set the identification parameters

Options/Description

Sensor settings, Process values, Inputs and outputs, Copy configuration, Communication
Long tag, Location, Installation date

The Quick commissioning wizard comprises the following subwizards:

- Sensor settings wizard (Page 73)
- Process values wizard (Page 77)

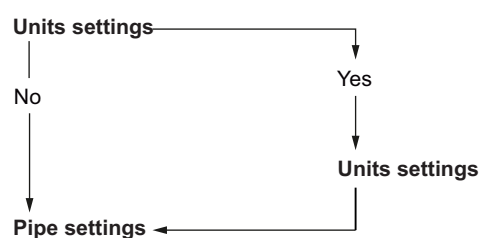
- Inputs and outputs wizard (Page 80)
- Communication wizard (wizard) (Page 85)

Each sub-wizard has its own view numbering. The sub-wizard name and the parameter name are shown in the upper left corner of the display. The view number and the total views in the sub-wizard are shown in the upper right corner of the display.

6.7.1.2 Sensor settings wizard

The Sensor settings wizard will guide you through configuration of essential parameters.

Sensor settings (1)

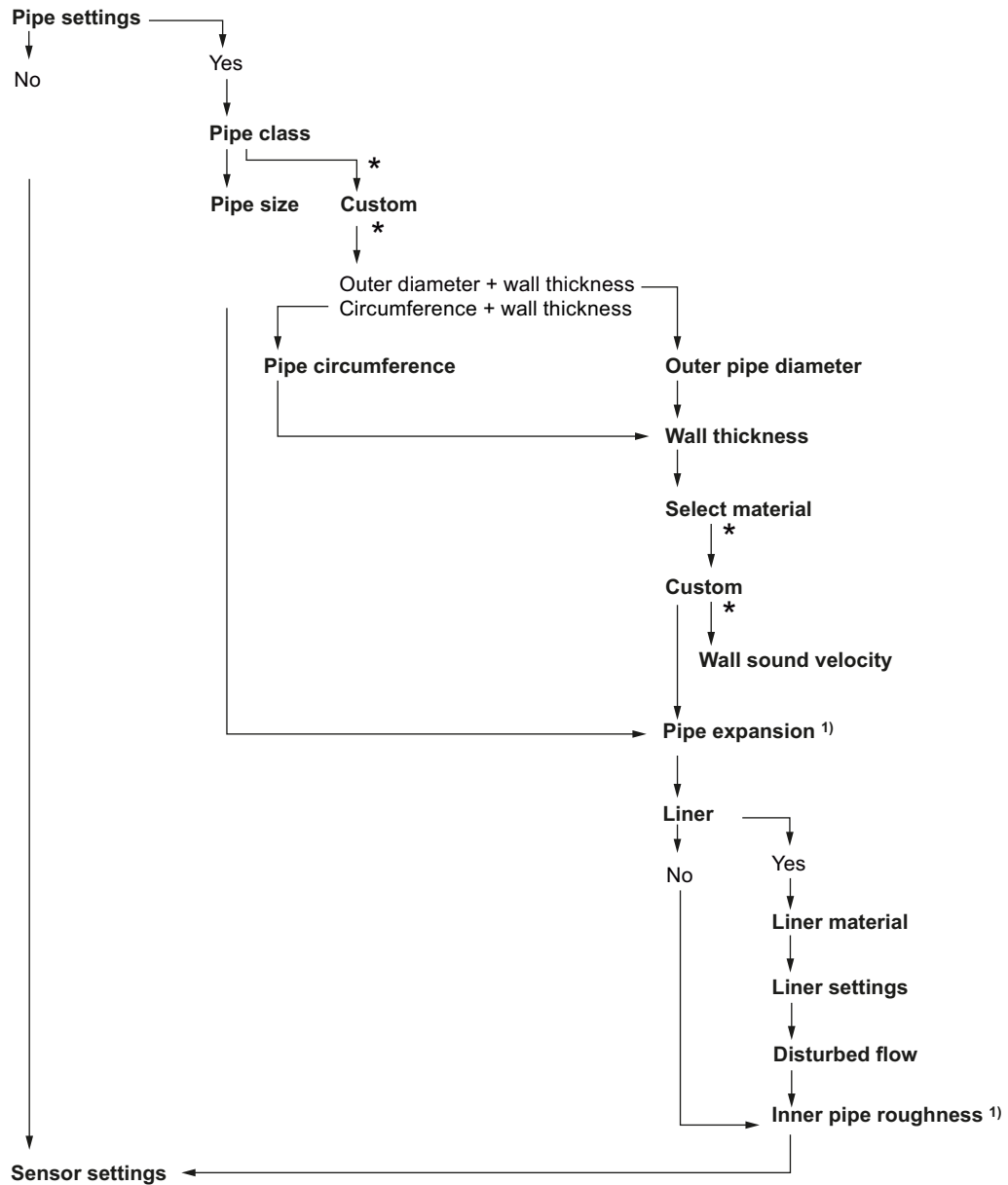


Text

Unit settings
Unit settings

Options/Description

Select "Yes" to configure the display units.
Set the display units of length, temperature, pressure, kinematic viscosity, and density.

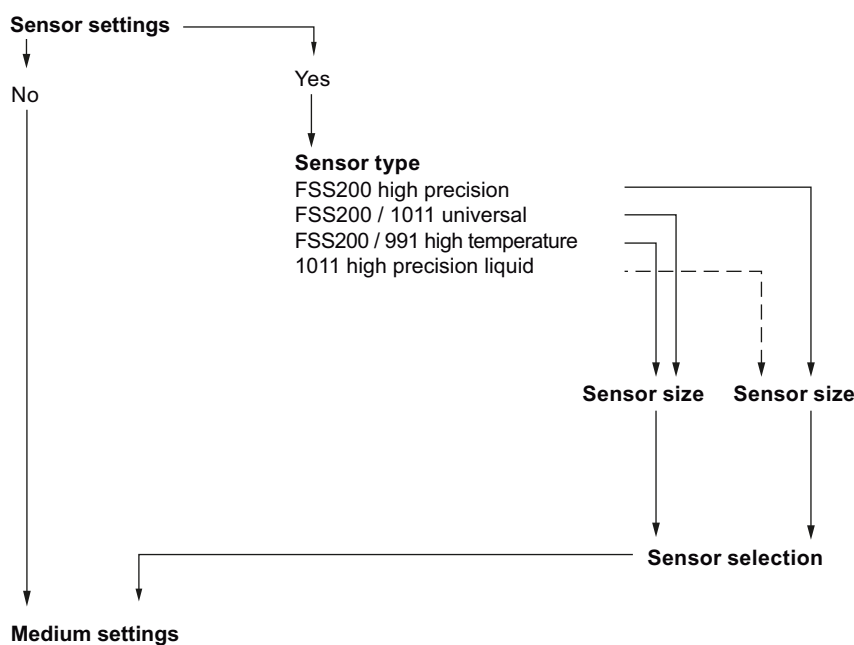
Sensor settings (2)**Text**

Pipe settings
 Pipe class
 Pipe size
 Pipe circumference
 Outer pipe diameter
 Wall thickness
 Select material
 Wall sound velocity

Options/Description

Select "Yes" to configure the pipe.
 Select the pipe class.
 Select the pipe size from the options available for the selected pipe class.
 Enter pipe circumference. Only available if custom pipe class is selected.
 Enter outer pipe diameter. Only available if custom pipe class is selected.
 Enter wall thickness. Only available if custom pipe class is selected.
 Select the pipe material.
 Enter the wall sound velocity of the material. Only available if custom material is selected.

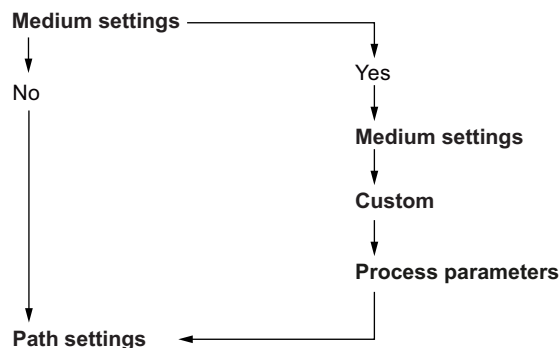
Pipe expansion	Define the pipe expansion coefficients for pressure and temperature induced pipe expansion
Liner	Select "Yes" to configure the liner material. Select "No" to only configure the Inner pipe roughness.
Liner material	Select the liner material.
Liner settings	Set the liner sound velocity and thickness.
Disturbed flow	Define the type of pipe configuration and the distance to the sensor.
Inner pipe roughness	Set the inner pipe roughness.
*	Select "Custom" to enter non-standard values.

Figure 6-2 ¹⁾ Only for Expert**Sensor setting (3)****Text**

Sensor settings
 Sensor settings
 Sensor size
 Sensor selection

Options/Description

Select "Yes" to configure the sensors.
 Select the sensor type installed (found on sensor label).
 Select the sensor size from the options list (found on sensor label).
 Define the temperature compensation mode, the temperature class, the spacing offset and the cable length

Sensor settings (4)**Text**

Medium settings

Medium settings

Process parameters

Options/Description

Select "Yes" to configure the medium.

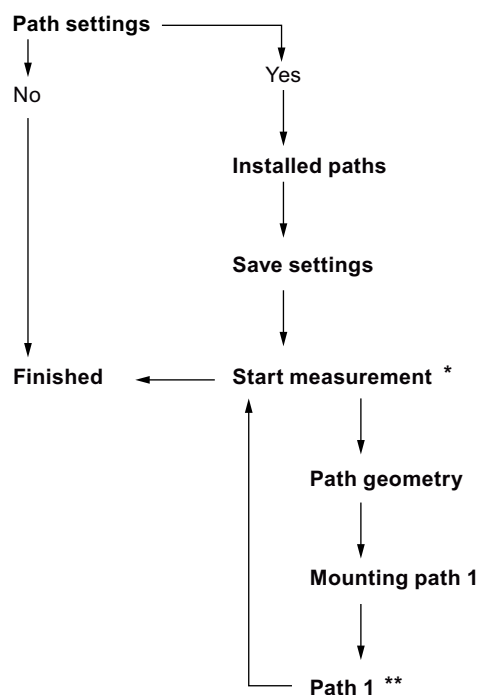
Select the process medium.

Set the expected sound velocity (only available if custom process medium is selected) and the process temperature, pressure, kinetic viscosity, and density.

Note**Important!**

The entry of fixed process kinematic viscosity and/or fixed process density in this menu will be ignored for the following cases:

1. One or more analog inputs are enabled and assigned to either "density" and/or "kinematic viscosity". This overrides the corresponding fixed process values.
 2. The Hydrocarbon table calculation for density and/or viscosity are enabled (applies only to the Hydrocarbon meter variant). This overrides the corresponding fixed process values.
-

Sensor settings (5)**Text**

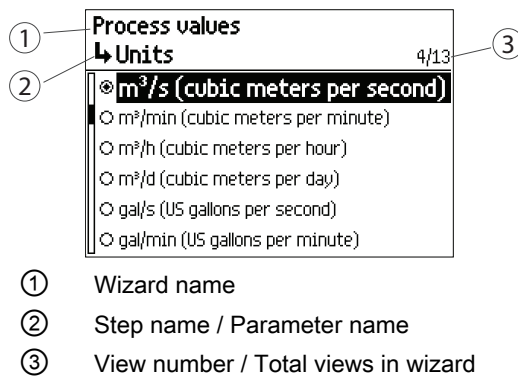
Path settings
 Installed paths
 Save settings
 Start measurement
 Path geometry
 Mounting path 1
 Path 1

Options/Description

Select "YES" to configure the path(s).
 Select the paths installed.
 Moves to the next menu item.
 * for each installed path. Select the path to configure.
 Define the geometry of the path (direct or reflect mode)
 Displays the recommended sensor mounting method, spacing index and spacing distance.
 Select "Receiver signal" to view graphical display of the receiver signal.
 ** Select "Next" to configure next path or to select "Next" to finish the wizard.

6.7.1.3**Process values wizard**

The Process values wizard will guide you through setup of process values for your application. The prioritizing of the process values automatically configures the measurement views on the display. The process value configured as first process value is set as first display view.



Start**Quick start**

*only supported in hydrocarbon or gas meter variants

6.7.1.4 Inputs and outputs wizard

The first screen in the Inputs and outputs wizard informs about the active/passive operation availability. It shows the application possibilities of your hardware. The kind of operation depends on the wiring.

Inputs/Outputs wizard

The Inputs and outputs wizard will guide you through setup of inputs and outputs on the available channels. The availability of channels 3 and 4 depends on the product configuration.

Inputs/Outputs wizard

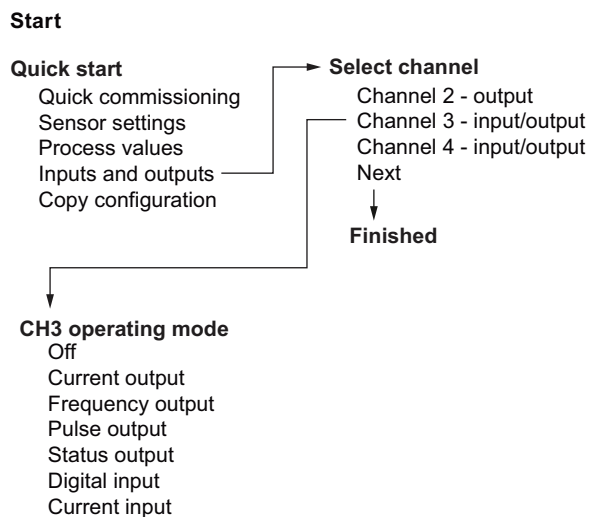
First you must set the output functionality you want the channel to operate. Choose between Off, Current output, Frequency output, Pulse output, or Status output, Digital input or Current input.

Channel 2 provides output functionality only.

Channel 3 and 4 provide input or output functionality.

If one of the channels 3 or 4 is configured to relay the functionality of this channel is reduced to Status output.

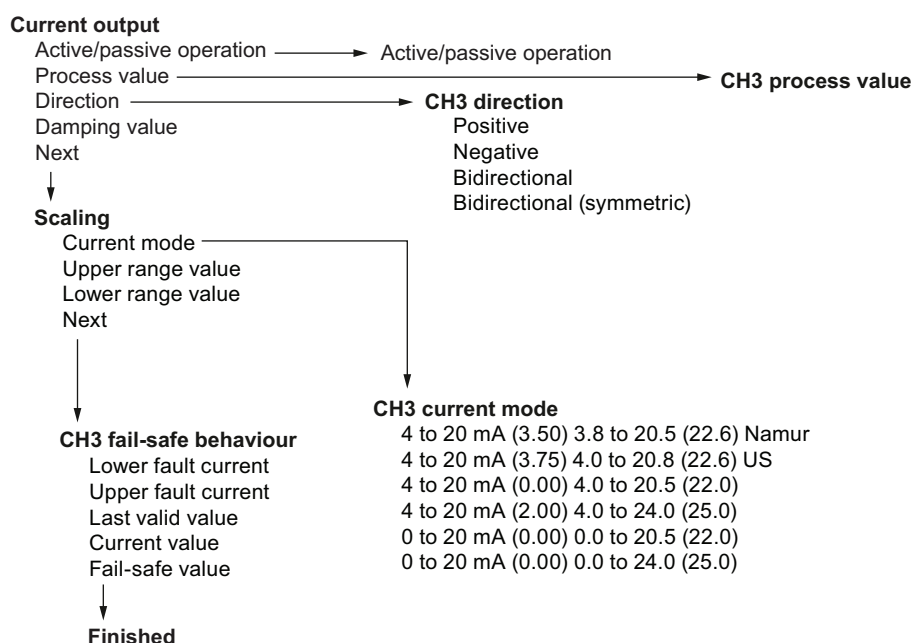
Inputs/Outputs



Current output - channels 2 to 4

Current output - channels 2 to 4

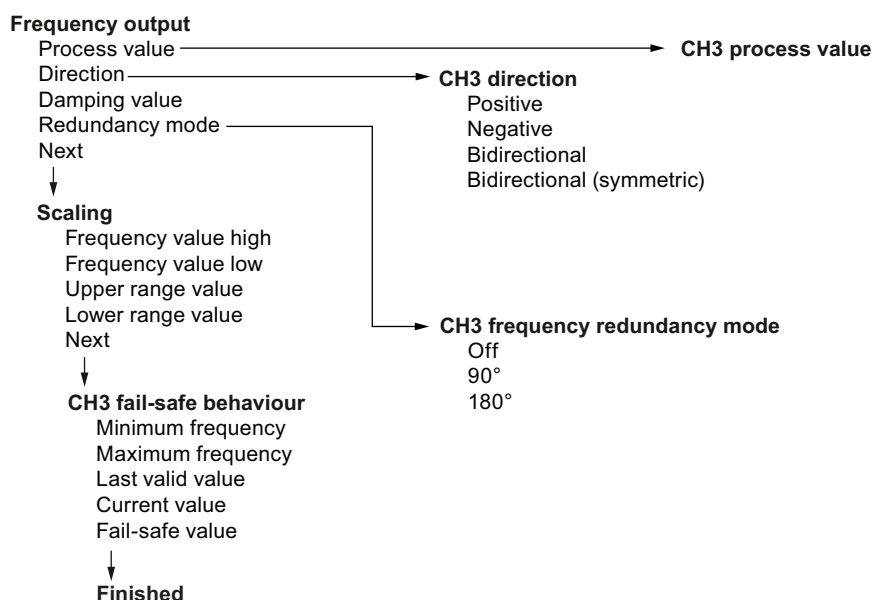
The Current output can be configured to 0...20 mA or 4...20 mA. You can assign a process value to the current, set the direction, the damping value, the lower range value, the upper range value, and the fail-safe behavior.



Frequency output - channels 2 to 4

Frequency output – channels 2 to 4

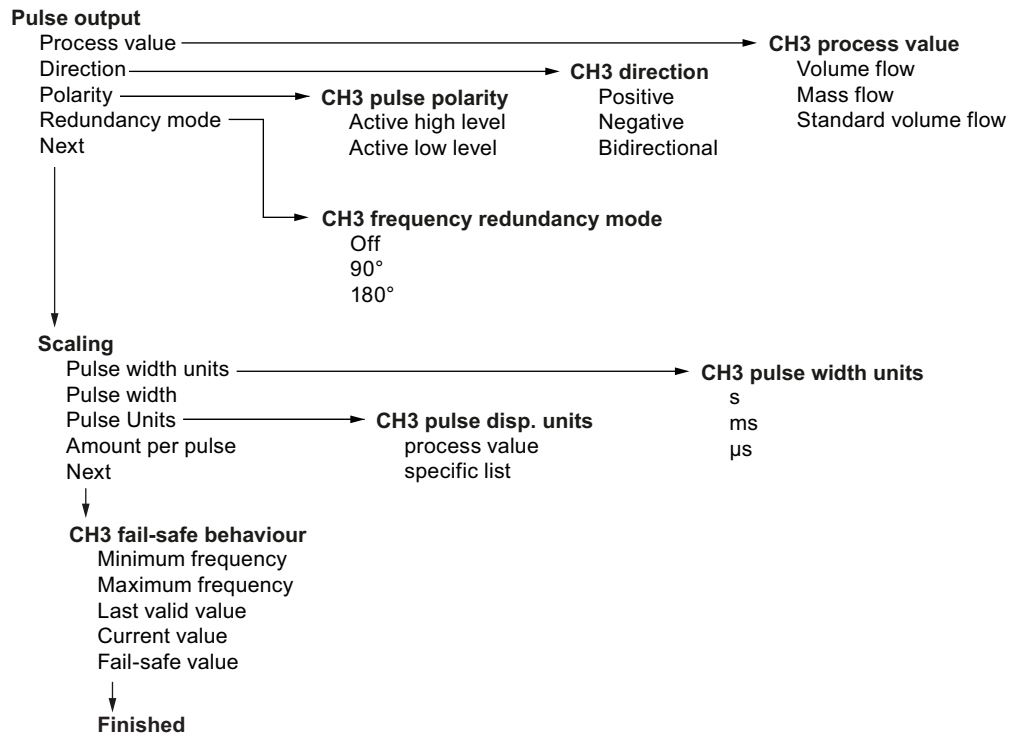
You can assign the process value, and you can set the direction, the damping value, the lower range value, the upper range value, and the fail-safe behavior.



Pulse output - channels 2 to 4

Pulse output – channels 2 to 4

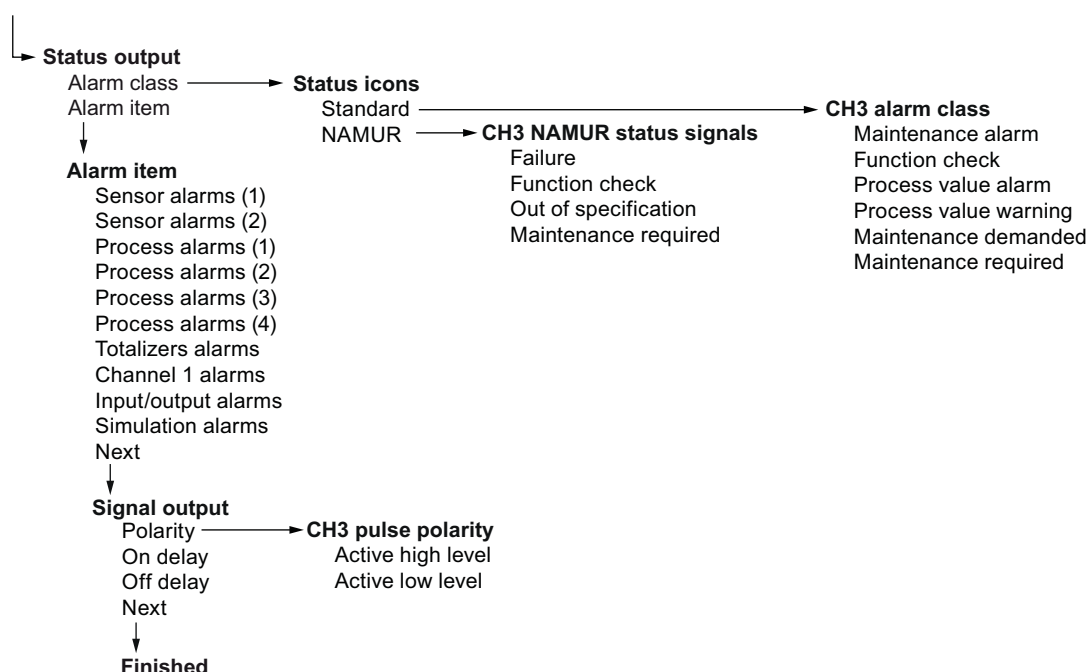
You can assign the process value, and you can set the direction, the polarity, the redundancy mode, the pulse width, pulse width units, pulse units amount per pulse, and the fail-safe behavior.



Status output - channels 2 to 4

Status output – channels 3 to 4

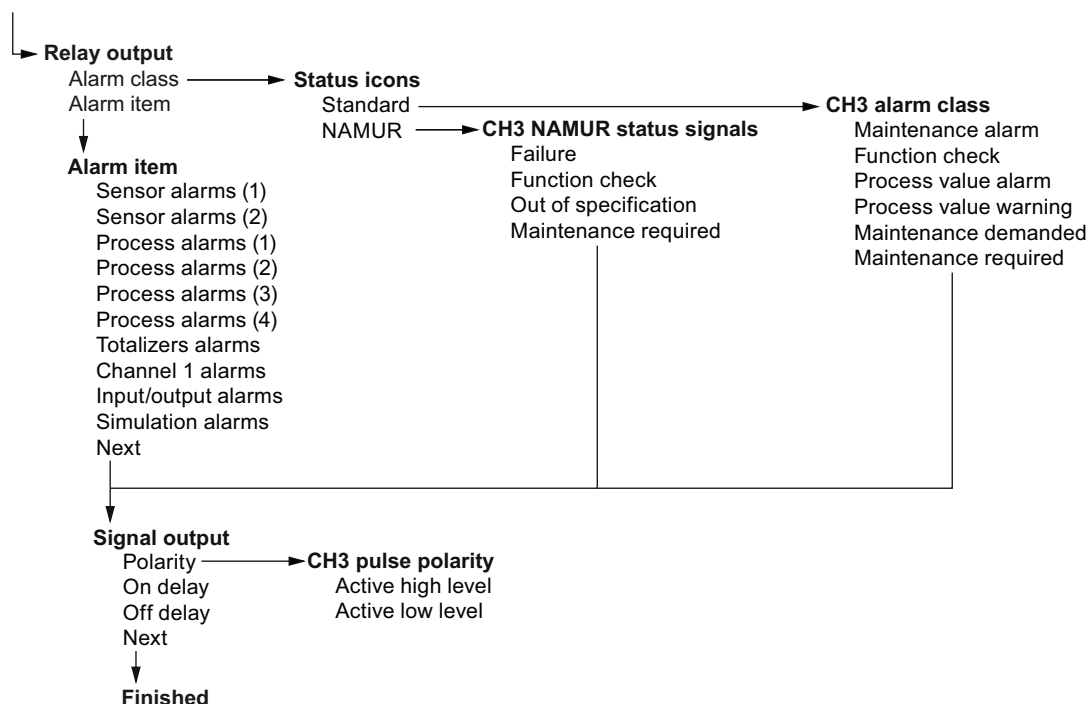
You can configure the status mode, the polarity, on delay and off delay.



Relay output - channels 3 and 4

Relay output - channels 3 and 4

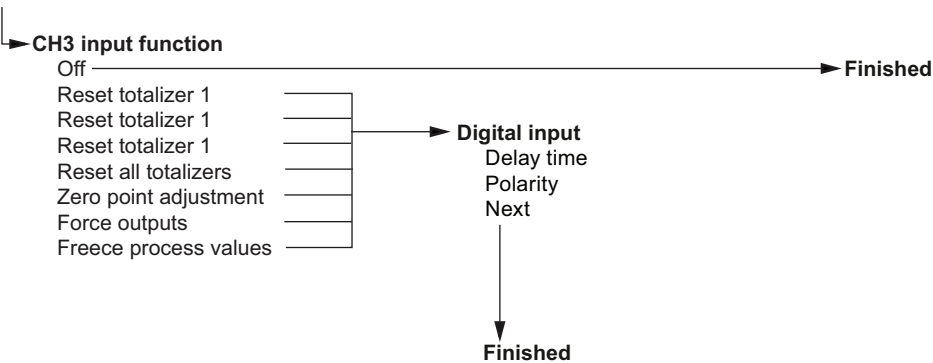
You can configure the functionality of the Relay output, the polarity, on delay and off delay.



Digital input - channels 3 to 4

Digital input - channels 3 to 4

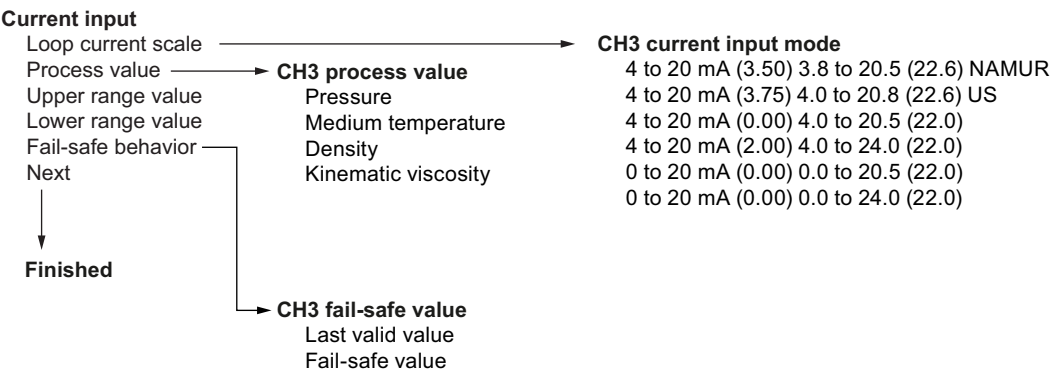
The Digital input can be used to control device functions such as reset of totalizers, zero point adjustment, force outputs, or freeze process values. You can set the delay time and the polarity.



Analog input - channels 3 to 4

Analog input - channels 3 to 4

The analog input can be configured to either Pressure, Medium temperature, Density, or Kinematic viscosity.



6.7.1.5 Communication wizard

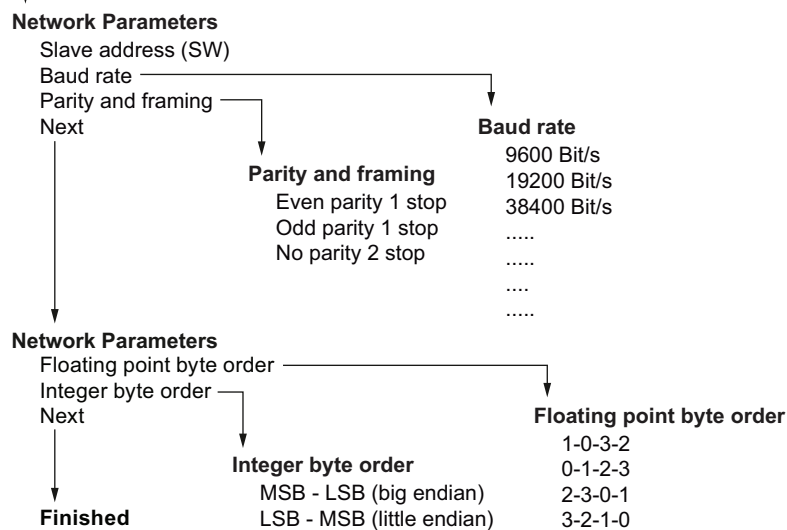
This wizard will guide you through the configuration of the communication interface.

6.7.1.6 Communication wizard (wizard)

Start

Quick start

Quick commissioning
 Sensor settings
 Process values
 Inputs and outputs
 Copy configuration
 Communication



6.8 Commissioning FSS100 - SONOKIT

Condition

- You have installed and connected the FST030 transmitter and FSS100 - SONOKIT sensor
- You know the following parameters for your installation:
 - Inner pipe diameter D_i
 - Beam angle θ
 - Path length L
 - Chord height ratio h (0 for 1-path)
 - Expected sound velocity
 - Kinematic viscosity

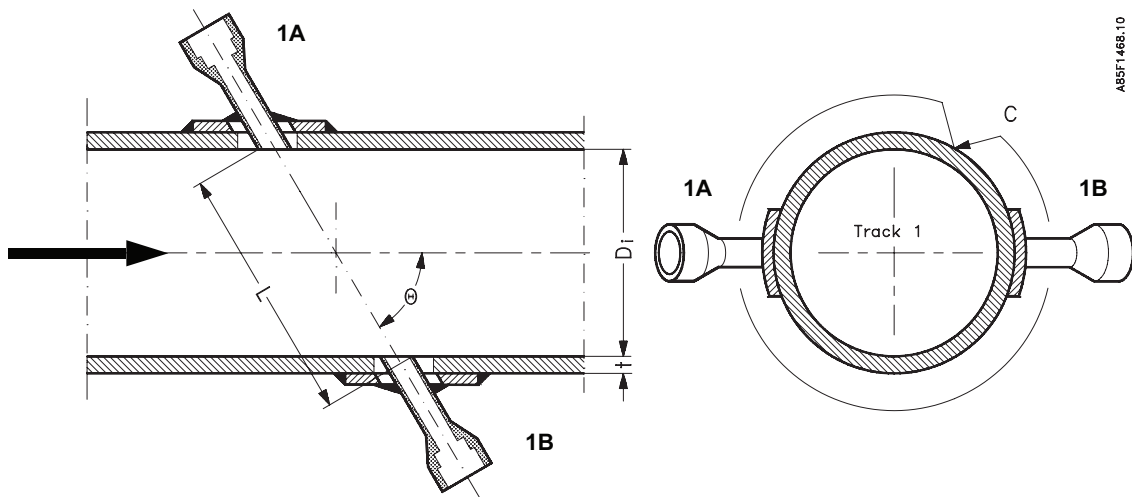


Figure 6-3 FSS100 - SONOKIT 1-path

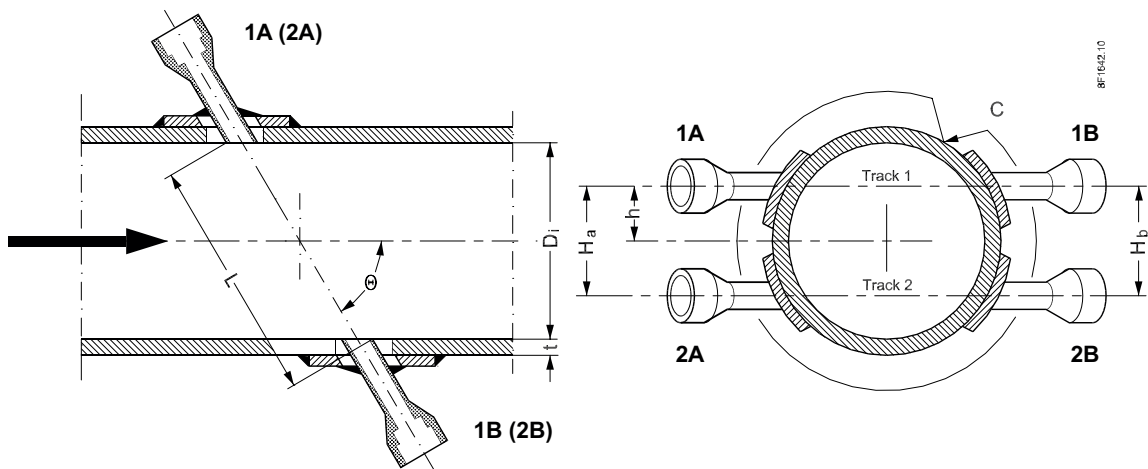


Figure 6-4 FSS100 - SONOKIT 2-path

Procedure

Note

FSS100 - SONOKIT 1-path

For a 1-path installation only enter the parameters for either Path 1 or Path 2 (depending on your cable connection).

1. Enter "Inner pipe diameter" in menu 2.1.2.9
2. Enter "Expected sound velocity" in menu 2.1.4.2
3. Enter "Kinematic viscosity" in m^2/s in menu 2.1.4.5
The Kinematic viscosity is required for the reynolds compensation.
For example: Water 20 °C $\rightarrow$ 1 cSt or $1 \text{ mm}^2/\text{s} = 0.000001 \text{ m}^2/\text{s}$
4. Enter "Beam angle" in radians in menu 2.1.6.2
For example: $45^\circ \rightarrow 0.7854 \text{ rad}$

5. For a 1-path installation select "Path 1" or "Path 2" (depending on your cable connection) in menu 2.1.6.1 "Supported paths for inline systems" and save settings.
For a 2-path installation select "Path 1" and "Path 2" in menu 2.1.6.1 "Supported paths for inline systems" and save settings.
6. Enter "Path length" for Path 1 in menu 2.1.6.3.3
7. Enter "Chord height ratio" for Path 1 in menu 2.1.6.3.4
For a 1-path installation the "Chord height ratio" is 0.
8. Enter "Path weight" for Path 1 in menu 2.1.6.3.5
Fixed weighting factor. For Inline the sum of the weight for the installed paths should be 1.
For 1-path enter 1 on the single path.
For 2-path enter 0.5 for each path.
9. Enter "Path length" for Path 2 in menu 2.1.6.4.3
10. Enter "Chord height ratio" for Path 2 in menu 2.1.6.4.4
For a 1-path installation the "Chord height ratio" is 0.
11. Enter "Path weight" for Path 2 in menu 2.1.6.4.5
Fixed weighting factor. For Inline the sum of the weight for the installed paths should be 1.
For 2 paths enter 0.5 for each path. For 1 path enter 1.
12. Enter "Preamplifier" in menu 2.1.13.1
The pre-amplifier has to be set according to the sensor size:
DN 150 to DN 1000 = off
> DN 1000 = on
DN 50 to DN 150 = Half of TX signal amplitude

Operating

7.1 Operating the device with display

7.1.1 Display views

There are six display views, all fully configurable. Use the  and the  keys to switch between the display views.

Multiple types of views are available:

- Display of measured process values, see Reading the process values (Page 92).
- Display for totalizer operation, see Operating the totalizers (Page 94).
- Display of a list of active alarms, see Handling alarms (Page 94).
- Display of six configurable diagnostic values, see Reading the diagnostic values (Page 96).

7.2 Operating the FST030

7.2.1 Navigating the menu structure

7.2.1.1 Parameter view

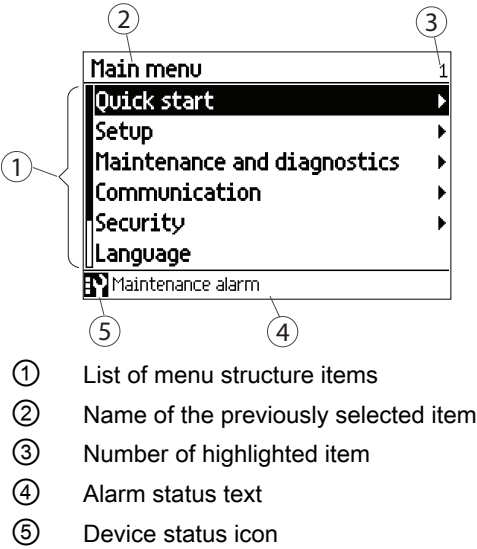
The exact structure of the operating menu is explained in the Function Manual.

All items of the menu structure of the device are identified with a unique number.

Level 1 of the menu structure is standardized for all Siemens Process Instrumentation devices and covers the following groups:

1. Quick start: Lists the most important parameters for quick configuration of the device. All parameters in this view can be found elsewhere in the menu.
2. Setup: Contains all parameters which are needed to configure the device.
3. Maintenance and diagnostics: Contains parameters which affect the product behavior regarding maintenance, diagnostics and service.
4. Communication: Contains parameters which describe the communication settings of the device.

- 5. Security: Contains parameters which describe all security settings of the device.
- 6. Language: Parameter for changing the language of the local display. Regardless of the language setting, the term for this parameter is always the English term (Language).



- ① List of menu structure items
- ② Name of the previously selected item
- ③ Number of highlighted item
- ④ Alarm status text
- ⑤ Device status icon

Figure 7-1 Level 1 of the menu structure

You can navigate through the menu structure items in the device using the four buttons on the display as described below.

Table 7-1 Key functions - menu structure navigation

Key	Function
	Return to previous item.
	Select the item above.
	Select the item below.
	Enter the selected item.

7.2.2 Fixed display texts

Some displayed texts are fixed, which means they will not change regardless of changed display language.

The following tables list the fixed display texts and their corresponding process value, diagnostic value, and compensation value names. Some are available for both water and oil variants, some only for hydrocarbon or gas variants (marked *).

Table 7-2 Process values

Fixed display text	Process value name
VOL.FLOW	Volume flow
MASS FLOW	Mass flow

Fixed display text	Process value name
FLOW VEL	Flow velocity
SOUND VEL	Sound velocity
S.VOL FLOW *	Standard volume flow (standard flow rate)
DENSITY	Density
KIN. VISCOSITY	Kinematic viscosity
PRESSURE	Pressure
MEDIUM TEMP.	Medium temperature
SPEC.GRAVITY *	Specific gravity
TOT1	Totalizer 1
TOT2	Totalizer 2
TOT3	Totalizer 3
S.DENSITY *	Standard density
S.SPEC.GRAVITY *	Standard specific gravity
STAND.FACTOR *	Standardizing factor
LIQUIDENT *	This variable represents the measured liquid sonic velocity
API GRAVITY *	API gravity
S.API GRAVITY *	Standard API gravity
S.KIN.VISCOS. *	Standard kinematic viscosity
LIQUID IDENTIFIER *	Liquid identifier
ROC *	Liquid rate of change
AUX TEMP.	Auxiliary temperature

Table 7-3 Diagnostic values

Fixed display text	Diagnostic value name (#=channel number)
TRN TEMP.	Transmitter internal temperature
SEN.TEMP.1	RTD temperature 1
SEN.TEMP.2	RTD temperature 2
CURR. OUT CH#	Current output value
CURR. IN CH#	Current input value
PULSE OUT CH#	Pulse output amount
FREQ. OUT CH#	Frequency output
DIG. IN CH#	Digital input value
STAT. OUT CH#	Status output value
DSL TEMP.	Sensor internal temperature
REYNOLDS NO.	Reynolds number
P#.SNR UP	SNR up path #
P#.SNR DOWN	SNR down path #
P#.SOUND VEL	Sound velocity path #
P#.DELTA TIME	Delta time path #
P#.ACC.BURST	Percentage of bursts accepted oath #
P#.PEAK AMP.DN	Peak amplitude down path #

Fixed display text	Diagnostic value name (#=channel number)
P#.PEAK AMP.UP	Peak amplitude up path #
P#.TTIME MAX	Maximum acceptable travel time for path #
P#.TTIME MIN	Minimum acceptable travel time for path #
P#.CORR.FACT	Signal correlation factor path #
P#.FLOWVEL	Flow velocity path #
P#.RXGAIN UP	Upstream signal amplifier gain path #
P#.RXGAIN DN	Downstream signal amplifier gain path #

7.2.3 Reading the process values

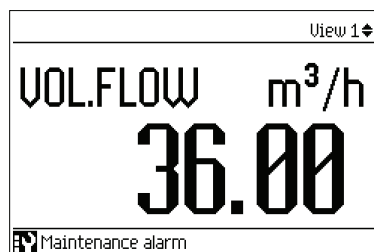
The current value of the process values can be displayed either as one or more numeric values or as numeric value(s) in combination with a graph/bargraph. The following view types are available:

- Single value
- Three values
- Totalizer
- 1 value and graph
- 1 value and bargraph
- Six values

Table 7-4 Key functions - measurement view

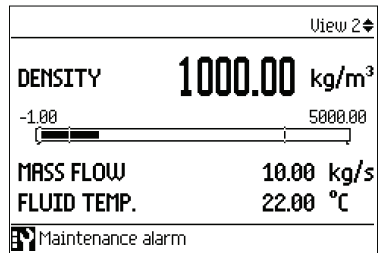
Key	Function
	No functionality
	Go to the previous measurement view
	Go to the next measurement view
	Enter the parameter view

Single value



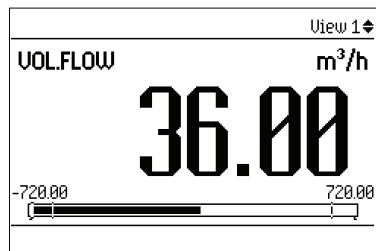
FS003SS.01.02

Three values



FS0034SS.01.02

1 value and bargraph



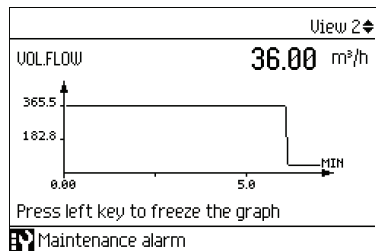
FS0035SS.01.02

Note

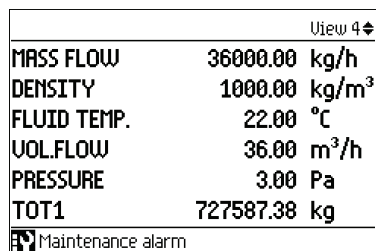
Bargraphs

The bargraph limit values indicate the set lower and upper alarm limits, and the vertical lines in the bargraph indicate the set lower and upper warning limits.

1 value and graph



Six values



7.2.4 Operating the totalizers

When totalizer is displayed in the main view, press  to access the totalizer operation.

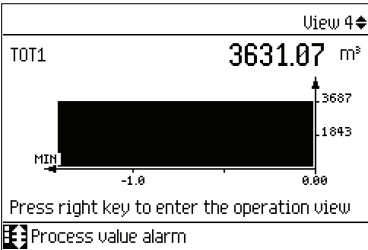
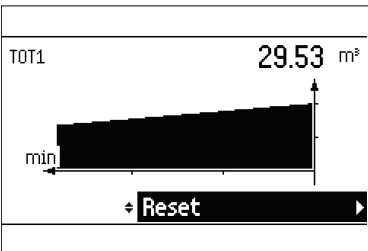


Table 7-5 Key functions - totalizer operation

Key	Function
	Exit totalizer operation
	Select action to perform
	Select action to perform
	Perform selected action



7.2.5 Handling alarms

When the alarm list is displayed in the main view, press  to get more detailed information about the active alarms.

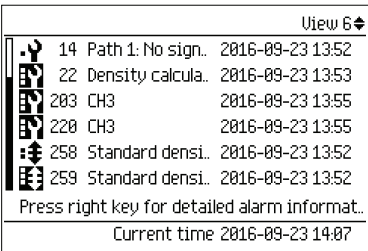


Table 7-6 Key functions - alarms list view

Key	Function
	Exit alarm list view
	Select the item above in the list; keep pressing the key to accelerate scrolling up the selection list
	Select the item below in the list; keep pressing the key to accelerate scrolling down the selection list
	View more information on the selected alarm

Active diagnostic events		
	5 DSL voltages	2016-09-23 13:52 ▶
	7 Flow measurem.	2016-09-23 13:52 ▶
	14 Path 1: No sign.	2016-09-23 13:52 ▶
	22 Density calcula.	2016-09-23 13:53 ▶
	203 CH3	2016-09-23 13:55 ▶
	220 CH3	2016-09-23 13:55 ▶
	258 Standard densi.	2016-09-23 13:52 ▶
Current time 2016-09-23 14:11		

203 CH3
Coming 2016-09-23 13:55
Cable break. Check channel current output cable connection.

Press to exit the detailed alarm information.

Alarm acknowledgement

There are two ways to have the alarms removed from the alarm list.

- **Manual:** The alarm remains in the alarm list until the alarm is manually acknowledged (ack.). Before the alarm can be acknowledged, the cause must be eliminated. Press to go to the detailed alarm information. Press again to acknowledge the alarm. The time of the acknowledgement is shown in the history log.

19 Electronics temp.
Coming 2016-07-29 16:06
Acknowledge ▶
Int. DSL temp. is outside the specified operating temp. range. Verify that the ambient temp. is within specified limits. Working outside temp. limits can damage electronics and reduce product lifetime.

- **Auto:** The alarm is removed from the alarm list when the cause is removed (going)

7.2.6 Reading the diagnostic values

One of the main views can be configured to show six diagnostic values.

View 5 ↕	
TRN TEMP.	30.46 °C
CURR. OUT. CH2	4.00 mA
FREQ. OUT. CH3	10040.16 Hz
PULSE OUT. CH4	0.00 kg
AUX TEMP.	50.549995 °C
REYNOLDS NO.	0.0

7.3 Reading / changing parameters

Depending on your access level, you can read the current value or edit the value of the selected parameter.

7.3.1 Alphanumeric parameters

Read only

The view shows the set value. Press  to exit the view.

Wall thickness	21.3.2
◀ ESC	0.001 m

Edit

Editable alphanumeric parameters are displayed as shown here.

Wall thickness	21.3.2
Max 0.5	
◀ ESC	-----0.001 m OK ▶
Min 0.000001	

Table 7-7 Key functions - editing alphanumeric values

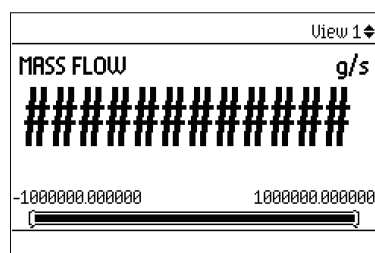
Key	Function
	Select the next left position. If the most left position is selected: exit the parameter edit view without confirming the changes. Keep pressing the key to jump to the most left position.
	Change the selected number/character. Numeric characters: increase the number by one (for example from 7 to 8) ASCII characters: select the previous character in the alphabet.
	Change the selected number/character. Numeric characters: decrease the number by one (for example. from 8 to 7) ASCII characters: select the next character in the alphabet.
	Select the next right position. If most right position is selected: confirm the change and exit the parameter edit view. Keep pressing the key to jump to the most right position.

Note

Ensure that the new value is within the minimum/maximum range when changing numeric values.

Note**##### signs in display**

The display is unable to show the measured value. Change the measurement units or the resolution.



7.3.1.1 Changing the resolution

In order to change the resolution of the process value shown in the operation view (for example mass flow), set the decimal places as defined in **Decimal places** (for example mass flow menu number 2.2.2.4).

The resolution can also be changed by changing the resolution of one configuration parameter for this process value (for example **Low flow cut-off** menu number 2.2.2.5). Any changes in resolution will change the resolution of all other configuration parameters for this process value as well.

7.3.2 Parameter lists

Parameter list - read only

Table 7-8 Key functions - read only

Key	Function
	Exit parameter list
	No functionality
	No functionality
	No functionality

Flow direction211

☐ Negative

☒ Positive

Parameter list - editable

The help texts describe the possible adjustments of the respective parameters.

Table 7-9 Key functions - edit

Key	Function
	Escape the view without changing the value.
	Select the option above.
	Select the option below.
	Confirm selected option.

Flow direction211

☐ Negative

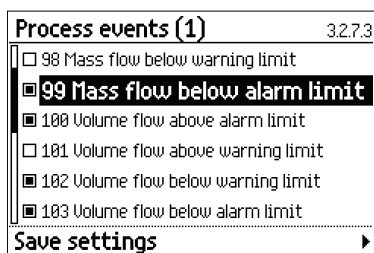
☒ Positive

Select pos/neg flow. Default pos flow is indicated by arrow on sensor.

Multiselection

Table 7-10 Key functions - multiselection of options

Key	Function
	Escape the view without changing the value.
	Scroll up in the list. If the uppermost position is selected: highlight Save settings.
	Scroll down in the list. If the lowermost position is selected: highlight Save settings.
	Select / deselect option.



It is possible to select/deselect multiple alarms to be suppressed. The marked alarms will **NOT** be suppressed.

Service and maintenance

8.1 Basic safety notes

WARNING
Impermissible repair of the device • Repair must be carried out by Siemens authorized personnel only.

WARNING
Impermissible repair of explosion protected devices Risk of explosion in hazardous areas • Repair must be carried out by Siemens authorized personnel only.

8.2 Cleaning

Cleaning the enclosure

- Clean the outside of the enclosure with the inscriptions and the display window using a cloth moistened with water or a mild detergent.
- Do not use any aggressive cleansing agents or solvents, e.g. acetone. Plastic parts or the painted surface could be damaged. The inscriptions could become unreadable.

8.3 Electrostatic charge

WARNING
Electrostatic charge May cause death or serious injury. Risk of explosion in hazardous areas if electrostatic charges develop, for example, when cleaning plastic surfaces with a dry cloth • Prevent electrostatic charging in hazardous areas. • Clean only with a damp cloth.

- Prevent electrostatic charging in hazardous areas.
- Clean only with a damp cloth.

8.4 Maintenance and repair work

The device is maintenance-free. However, a periodic inspection according to pertinent directives and regulations must be carried out.

An inspection can include, for example, check of:

- Ambient conditions
- Seal integrity of the process connections, cable entries, and cover
- Reliability of power supply, lightning protection, and grounds

8.4.1 Service and maintenance information

Service and maintenance information is information about the condition of the device used for diagnostics and service purposes.

Maintenance information parameters

The basic maintenance information parameters are:

- Identification
 - Order number
 - Long tag
 - Descriptor
 - Location
 - Installation date
 - Product name
 - Serial number
 - Hardware and firmware versions
- Condition and setup
 - Peak values
 - Signal monitoring
 - Temperature monitoring
 - Monitoring of inputs and outputs
 - Operating time
 - Parameter change log
 - FW update log
 - Diagnostic log

Service information parameters

- Operating time total
- Operating time
- Transmitter hardware version
- Display module hardware version
- DSL hardware version

8.4.2 On-board battery replacement

Note

The on-board battery is used to maintain real time clock and should only be replaced with Panasonic BR1225A/BN.
Siemens spare part number: A5E41372210

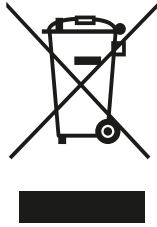
8.5 Return procedure

Enclose the bill of lading, return document and decontamination certificate in a clear plastic pouch and attach it firmly to the outside of the packaging.

Required forms

- Delivery note
- Return goods delivery note (<https://www.siemens.com/processinstrumentation/returngoodsnote>)
with the following information:
 - Product (item description)
 - Number of returned devices/replacement parts
 - Reason for returning the item(s)
- Decontamination declaration (<https://www.siemens.com/sc/declarationofdecontamination>)
With this declaration you warrant "that the device/replacement part has been carefully cleaned and is free of residues. The device/replacement part does not pose a hazard for humans and the environment."
If the returned device/replacement part has come into contact with poisonous, corrosive, flammable or water-contaminating substances, you must thoroughly clean and decontaminate the device/replacement part before returning it in order to ensure that all hollow areas are free from hazardous substances. Check the item after it has been cleaned. Any devices/replacement parts returned without a decontamination declaration will be cleaned at your expense before further processing.

8.6 Disposal



Devices described in this manual should be recycled. They may not be disposed of in the municipal waste disposal services according to the Directive 2012/19/EC on waste electronic and electrical equipment (WEEE).

Devices can be returned to the supplier within the EC, or to a locally approved disposal service for eco-friendly recycling. Observe the specific regulations valid in your country.

Further information about devices containing batteries can be found at: Information about battery / product return (WEEE) (<https://support.industry.siemens.com/cs/document/109479891/>)

Diagnostics and troubleshooting

9.1 Basic troubleshooting

Initial checking of the application

The first step in determining the health of the installation and/or application is to observe the lower line of the HMI display, which indicates when an active alarm is present (as shown in the example below).

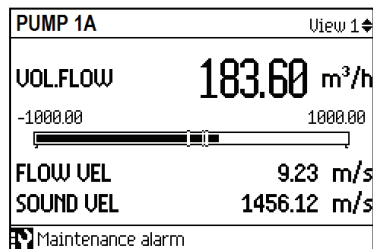


Figure 9-1 HMI display with alarm indication

Scrolling up or down to display View 6 will show all active alarms. See Device status symbols (Page 119) for details regarding the specific status icons and alarm codes. A more detailed explanation and suggested action for the individual alarm code can be seen by pressing the right arrow while in display view 6.

Note

In cases where the end user has "disabled" view 6, the active alarms can be viewed in the **Diagnostic events** **Active diagnostic events** menu.

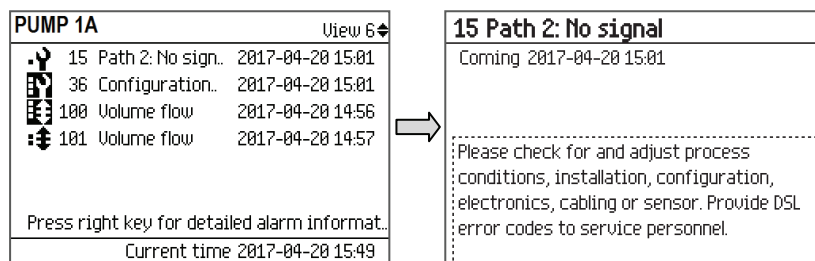


Figure 9-2 Display view 6 with all alarm and error codes shown

Note that the alarms will persist even after the problem is resolved, unless the **Diagnostic events** **Acknowledge mode** is set to **Auto**, or the alarm is manually acknowledged.

Maintenance alarms:

Depending on the type and severity of a **maintenance alarm**, the flow measurement may be either completely stopped or the accuracy of the flow measurement degraded. Maintenance alarms are also triggered by system related diagnostics, such as system monitoring, PCB temperature, memory, communication problems, etc.

Process alarms:

Process alarms are generally related to a process value, such as volume flow rate, exceeding the specified output span limits. For example; the current or frequency output may be out of range, or the user defined process value alarm / warning limit may be exceeded.

There are many installation errors which can lead to poor flow measurement accuracy, even in the absence of a maintenance or process alarm. For this reason it is important to also evaluate the sensor diagnostics to verify that the flowmeter is operating within an acceptable range for optimal performance.

If a persistent or intermittent alarm occurs, or the flow measurement accuracy is suspect, first check that the installation and commissioning are performed as described in the Operating Instructions.

If the alarm is still not resolved, then go through the steps of the Troubleshooting Guide shown below. The troubleshooting guide, and the referenced subsections, will enable you to trace the reason for the alarms as well as offer potential solutions for resolving the problem.

9.2 Troubleshooting Guide (example for 2 path installation)

Troubleshooting guide

The tables below provide an overview of potential symptoms with associated alarm codes and diagnostics (if applicable). The possible cause and remedy are shown in the right two columns. Additional troubleshooting steps are noted with gray highlighted references marked **A1**, **A2**, etc.

This troubleshooting guide assumes basic knowledge of the sensor diagnostics, especially with regard to:

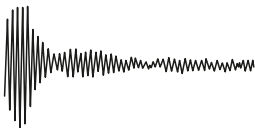
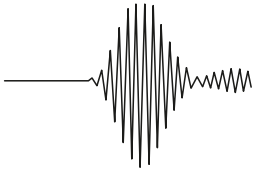
- The path specific liquid sound velocity,
- Rx signal (receive signal),
- SNR (signal to noise ratio),
- RxGain (receive amplifier gain),
- CorrFact (Correlation factor).

For more information, see Check sensor specific data (Page 115).

Troubleshooting Symptom: (Zero flow and zero sound velocity)

Symptoms / Alarms	Diagnostics	Cause	Remedy
Display shows no flow and measured sound velocity is 0 m/s. <i>No Alarm codes</i>	- Path 1 state: 0-0 - Path 2 state: 0-0	No paths installed.	- At least 1 path must be installed for flow measurement to start. - Follow instructions in sensor setup wizard while ensuring that at least 1 path is selected from the installed paths multi-selection menu.
(Gas meters only) Display shows unstable flow or stable flow with large error. <i>No Alarm codes</i>	- Measured flow rate unexpectedly jumps between two very different discrete values. - Measured flow rate indicates a large error greater than +/-5% of expected for velocities over 10 m/s. - Poor receive signal SNR (< 20 dB)	Poor SNR due to improperly applied pipe damping material.	- Check adhesion of damping material to pipe wall/paint. - Roll out any trapped bubbles under damping material. - Reinstall new damping material after ensuring proper cleaning / degreasing of pipe surface.
		High flow compensation factor requires update	Refer to Function Manual for details on how to adjust the High flow compensation factor.

Symptoms / Alarms	Diagnostics	Cause	Remedy
Display shows no flow and measured sound velocity is 0 m/s. <i>With Alarm codes:</i>  14: Path1 No Signal <i>and / or</i>  15: Path2 No Signal <i>and</i>  34: Invalid flow meas.	- RxGain > 60 - No Rx signal present on any path	Pipe not completely filled with liquid.	- Make sure that the pipe is completely filled with liquid, or relocate sensors to a section of pipe that is expected to be normally full (see A2 (Page 114)). - Avoid installation of sensors on top or bottom of horizontal pipe.
		Pipe is not pressurized or pressure is too low.	- Ensure pipeline is at the expected operating pressure. - Typical minimum operating pressure is 1 bara for plastic pipe and 8 bara for steel pipe.
		- Cable broken, detached or attached to the wrong F-connector channels. - Broken or miswired cables.	- Ensure that the sensor cables are properly connected and routed between the sensors and transmitter. - Verify continuity by evaluating the DC resistance between the cable center conductor and shield with the sensors connected.
		Incorrectly installed sensors or incorrect setup parameterization.	- Verify pipe dimensions - Verify sensor selection, mounting configuration and spacing. - Ensure that ultrasonic couplant is applied (grease or dry couplant) (see A4 (Page 117)).
		Damaged / defective sensors or frontend hardware.	Verify operation of sensor and frontend hardware using a pipe simulator "Test block" (see A1 (Page 112))
Display shows no flow and measured sound velocity is 0 m/s. <i>With Alarm code:</i>  36: Configuration 2	No Rx signal present on any path	The pipe dimensions are too small for the selected sensor size or frequency.	- Verify pipe dimensions, fluid selection, and sensor selection. - Application may not be suitable for the purchased sensor size.

Symptoms / Alarms	Diagnostics	Cause	Remedy
Display shows no flow and measured sound velocity is 0 m/s. <i>With Alarm code:</i>  34: Invalid flow meas.	Rx signal is intermittently present but does not show a proper leading baseline:  For comparison Rx signal with proper leading baseline: 	Incorrectly installed sensors or incorrect setup parameterization.	• Verify actual pipe dimensions against entered values. • Verify sensor selection, mounting configuration and spacing (see A4 (Page 117)).
		Incorrect Expected fluid sound velocity.	• A very large error in the expected fluid sound velocity (or sound speed) can result in a large sensor spacing error and cause the meter to search for the signal in the wrong transit-time range. • Verify that the entered expected sound velocity is correct for the application.
		Pipe is mostly empty causing meter to operate on pipe noise.	• Make sure that the pipe is completely filled with liquid, or relocate sensors to a section of pipe that is expected to be normally full. • Avoid installation of sensors on top or bottom of horizontal pipe (see A4 (Page 117)).
		High synchronous pipe noise present in gas measurement signal	• Ensure pipeline is at the expected operating pressure. • Verify that pipe damping material is applied correctly. • Consider installing sensors in the reflect 4-traverse for small diameter pipes or direct 1-traverse configuration for larger pipes.

Troubleshooting Symptoms: (Active flow with measurement errors or alarms)

Symptoms / Alarms	Diagnostics	Cause	Remedy
Display shows active flow with large sound velocity error. <i>No Alarm codes</i>	- High positive or negative sound velocity error. - Measured flow not the expected value.	Incorrectly installed sensors or incorrect setup parameterization. The entered Expected sound velocity is far from the actual fluid sound velocity.	Verify pipe dimensions, sensor selection, mounting configuration and spacing. Optimal performance is achieved when the sensors are spaced correctly based on the actual fluid sound velocity. If possible, perform the sensor setup wizard again using the initially measured sound velocity for the expected sound velocity.
Display shows active flow. <i>With Alarm code:</i>  28: Configuration 1		Duplicate assignment of pressure, density, viscosity or temperature. Same process value assigned to more than 1 analog input (including RTD inputs). RTD input conversion indicates an out-of-range temperature (limited between -50 to 250 °C).	Check "inputs and outputs" channels assignment. Reassign inputs or disable unused inputs. - Check the RTD connections to CH5 and/or CH6. - Ensure that the selected RTD type (100, 500 or 1000 ohm) matches the resistance of the installed RTD. - Ensure that the user RTD calibration parameters (offset and slope) are set correctly in the RTD setup menu.
Display shows active flow. <i>With Alarm code:</i>  7: Flow measurement		Measured transit-time (sound velocity) is outside the allowed range for the entered sensor spacing.	Applications involving multiple fluid compositions may experience a significant variation in sound velocity. If this is expected then ensure that the sensor setup wizard is performed using the nominal fluid sound velocity. Optimal performance is achieved when the sensors are spaced correctly based on the actual fluid sound velocity. If possible, perform the sensor setup wizard again using the initially measured sound velocity as the expected sound velocity.

9.2 Troubleshooting Guide (example for 2 path installation)

Symptoms / Alarms	Diagnostics	Cause	Remedy
Flow rate appears to be correct, but sign (flow direction) is wrong <i>No Alarm codes</i>	Nothing unusual	Upstream / downstream sensor cables reversed at front-end or sensors.	Verify that the upstream sensor is connected to the upstream F-connector on the frontend (labeled A).
		<i>Flow direction</i> parameter is set to "negative" flow.	Change selection in Setup > Sensor > Flow direction .
Zero point adjustment fails		Delta-time is too high due to flow in the pipe.	Verify that flow is completely stopped before performing the Zero point adjustment.
		Path being zeroed is not in measurement state.	Confirm that the path(s) are installed properly and providing stable flow measurement.
		Defective sensors (excessive zero offset)	Check sensors (e.g. using a "Test block" see A1 (Page 112)).

Troubleshooting Symptoms: (Hardware issues)

Symptoms / Alarms	Alarm codes	Cause	Remedy
Display is completely blank, but communications is still possible on the service channel.		Display cable disconnected from Transmitter module or cable is broken.	1. Check cable connections between display and Transmitter module.
		HMI module defective	Contact Technical Support
Display is completely blank and communication with service channel is not possible		No power to unit / defective or disconnected PSU or Transmitter module	1. Check mains power connection. 2. Verify that PSU and transmitter modules are fully plugged into backplane.
Keypad is not responsive		Enclosure lid is not completely closed or display is not tight against glass window.	Check tightness of lid screws. Cycle power and allow several seconds for auto recalibration of keypad.
Datalogger and backup not working	 181: SensorFlash	Error indicates failed chkdisk. Possible failed SD card.	1. Remove and try to repair the SD card in a PC. 2. Replace SD card if repair unsuccessful.
		SD card not installed	1. Insert SD card 2. Verify the SensorFlash is recognized as being installed: menu 3.7.2
		Connected to the SD card as mass storage device (MSD)	Detach the USB cable
SensorFlash does not work as MSD (Mass Storage Device).		MSD not enabled for US market	

Symptoms / Alarms	Alarm codes	Cause	Remedy
Displayed flow rate appears to be frozen, or display continuously reads "wait for the sensor connect" after power cycle.	 150: Sensor signal disrupted	Broken or disconnected internal SSL cable between barrier module and DSL frontend module.	1. Check SSL cable connections. 2. Verify that barrier module is fully plugged into back-plane.
		Barrier module may be defective	Contact Technical Support
		DSL frontend module may be defective	

9.3 Using a pipe simulator test block (A1)

Introduction

In cases where users desire or require the need to verify proper operation of the flow system, Siemens offers test blocks to allow bench testing the transmitter, sensors and cables. If the system operates properly using the test block, then focus on application conditions as the source of the problem. Size A and B universal sensors use the 7ME39600TB10 Test Block and Size C and D universal sensors use the 7ME39600TB20 Test Block.

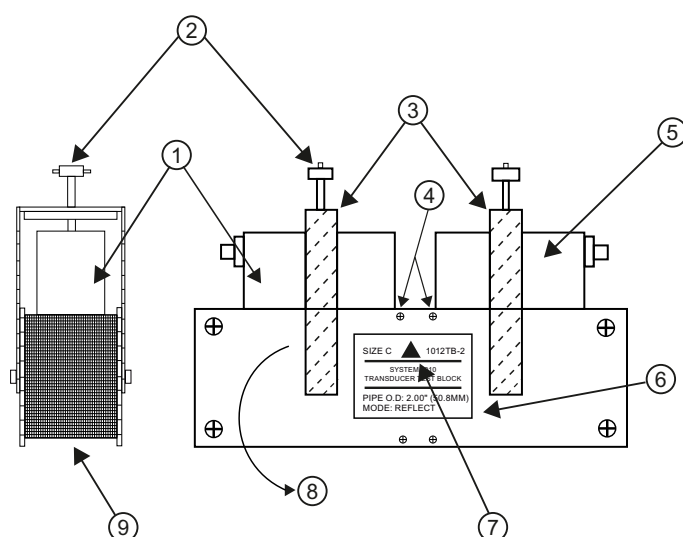
Note

Test blocks do not support the FSS200 High Precision sensors and FSS100 - SONOKIT

Installation on test blocks

The test blocks provide two test surfaces. Each surface supports a specific sensor size. For example, one surface of the 7ME39600TB10 Test Block supports Size "A" Sensors and the other supports Size "B" Sensors.

The Test Blocks include two labels, one on each side-plate. The labels identify the sensor size, data to be entered, and the surface to be used with the specific sensor size. See illustration below.



- | | |
|--|---|
| ① Sensor under test | ⑤ Sensor under test |
| ② Sensor clamping screw | ⑥ Label shows data entry parameters for size C. Size D sensor parameters appear on a label on the other side plate. |
| ③ Sensor clamping brackets | ⑦ This arrow points to the surface associated with the sensor size identified on the label. |
| ④ Slide sensors firmly against sensor pin-stops. | ⑧ This example shows testing for size C. Rotate brackets 180° to mount size D sensors. |
| | ⑨ Sensor testing surface for C size sensor. |

1. Identify the side of the simulator that applies to the sensor size under test. Rotate the clamping bracket as required to mount sensors on the test surface.
2. Using a coupling compound, preferably CC102 (7ME39600UC10) or CC128 (7ME39600UC20), mount the sensors on the pipe simulator as shown above. Slide each sensor until it presses against the pin-stop. Use the clamping screws to hold the sensors in place.
3. Connect sensor cables between each Sensor and the meter connectors for the path under test. The Up and Down cable orientation is not important.

Note

The next step in this procedure will automatically overwrite any existing sensor setup parameters.

4. Sign in as Expert (default password 2834).
5. Access the test block setup wizard, **Setup** ☒ **Sensor** ☒ **Configuration** of test blocks, then select the corresponding FS200 Universal sensor size from the dropdown list. The device will automatically configure the parameter required for operation on the selected sensor and test block.

Upon the completion of the test block setup wizard, the flowmeter should report a sound velocity within the range of approximately 1350 to 1700 m/s with an Rx gain value of no more than 45 dB. The Rx signal can also be evaluated for proper signal characteristics.

If it is not possible to successfully install the sensors on the test block, then there may be a problem with either the sensors, cabling or internal DSL cassette.

9.4 Inspect the application (A2)

Inspect the application (A2)

If the flowmeter is unable to measure flow, or gives intermittent / unstable measurement with persistent maintenance alarm(s), then go through the following inspection steps or see if you can find help in the examples shown in the table. First of all ensure that:

1. The sensors are installed as described in the Operating Instructions.
2. The pipe is guaranteed to be completely full, with no trapped gas (relocate installation if possible).
3. All cable connections are secure.
4. The installation pipe is in good condition.

Depending on application, you should furthermore ensure the following:

For gas applications:

1. Verify that the pipe is pressurized at the expected operating pressure.
2. Ensure that the gas composition does not include a high CO₂ mole fraction (>10%), which can significantly attenuate the receive signal.

Note

The liquid must be homogeneous in order to measure with high accuracy. If the liquid contains solid particles of greater density than the liquid, then these solids can settle, especially at low flow rates. This will cause instability in the sensor and lead to measurement errors. For gas applications, a high liquid fraction will also impact measurement accuracy, resulting in a higher than expected flow reading.

Application inspection examples

The following examples, possible causes and suggestions for corrective action may give the answer to why the flow measurement is inaccurate, unstable or not possible.

Table 9-1 All sensor types

Installation problem	Possible impact	Remedy
Ungrounded transmitter enclosure	Increased susceptibility to external electronic EMC noise may result in unstable flow measurement.	• Ensure that the transmitter enclosure is properly grounded using the earthing clamp.

Table 9-2 Only FSS200

Installation problem	Possible impact	Remedy
Sensors installed too close to a pipe elbow, Tee fitting, expansion, throttling valve or partially open ball or butterfly valve.	There will likely be a significant impact on the measurement accuracy. In extreme cases, flow measurement will not be possible due to the extreme turbulence. Flow instability is likely to occur with poor upstream pipe conditions.	- Install the sensors in a different location with sufficient straight run conditions, especially upstream. - Install sensors in the preferred reflect "V" configuration, if at all possible. - Install 2 paths to minimize the impact on accuracy.
Excessive use of ultrasonic couplant on small pipes.	Poor SNR (signal to noise ratio) may result to excessive use of couplant, especially on small pipes with relatively thick walls.	- For pipes <DN50, use only a thin layer of couplant (< 1mm), especially when the pipe surface is very smooth. - Evaluate the Rx signal and SNR first with a moderate layer of couplant. Remove couplant to see if the signal improves.

9.5 Check sensor specific data

9.5.1 Verify sensor diagnostic parameters (A3)

Verify sensor diagnostic parameters (A3)

The diagnostic values of the sensor are shown in the default HMI diagnostic view. The HMI provides six configurable measurement/diagnostic values that are updated dynamically.

PUMP 1A	View 2	PUMP 1A	View 4
P1.RXGAIN UP	5.0 dB	DSL TEMP.	31.3 °C
P1.SNR UP	5.0 dB	REYNOLDS NO.	21390
P1.DELTA TIME	234.1 ns	P1.SOUND UEL	1432.9 m/s
P1.TTIME UP	152.23 µs	P2.SOUND UEL	1431.3 m/s
P1.ACC.BURST	100 %	P1.PEAK AMP.UP	5645.2
P1.CORR.FACT	0.98	P2.PEAK AMP.UP	5632.7
Maintenance alarm		Maintenance alarm	

Figure 9-3 6 value diagnostic screen views

Additional diagnostics can be found in the sensor diagnostics menu: **Maintenance and Diagnostic**  **Diagnostics**  **Sensor**. Here the Path states and Receiver signals (with user login) can also be viewed to provide greater insight into application and/or setup issues.

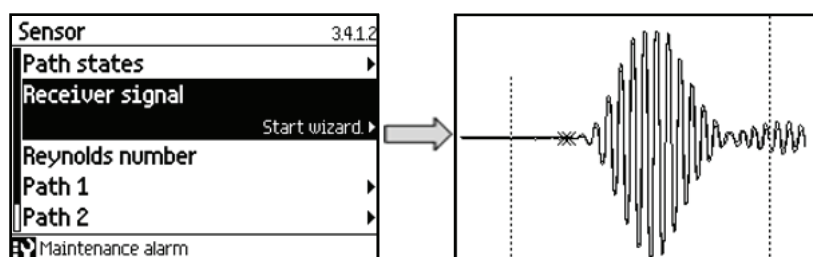


Figure 9-4 Sensor diagnostic screen with ideal Receiver signal shown

A more comprehensive list of DSL error codes is available when it becomes necessary to call a Siemens service personnel for low level troubleshooting.

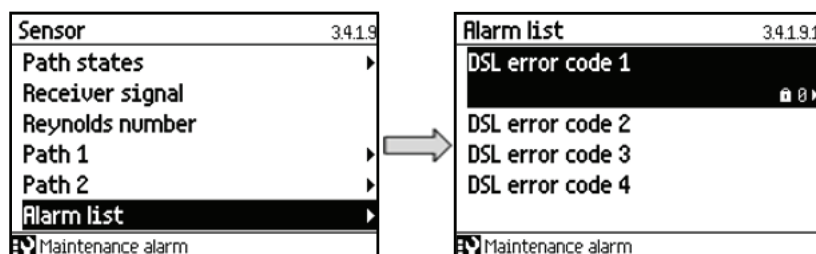


Figure 9-5 Detailed DSL error codes for advanced troubleshooting with Siemens service

Note

Diagnostic and process values may also be checked using PDM.

A brief description of each sensor diagnostic parameter is given in the table below, along with the typical range of values for pipe sizes 12 – 1200 mm. Note that separate parameters are available for each installed path.

Diagnostic parameter	Description	Typical values
RXGain up	Receive amplifier gain value for the upstream receive signal. Lower gain values indicate a stronger receive signal.	0 to 50 dB
RxGain down	Receive amplifier gain value for the downstream receive signal. Lower gain values indicate a stronger receive signal.	0 to 50 dB
SNR up	Signal to Noise Ratio of upstream signal. A high SNR indicates less baseline noise on the receive signal.	25 to 80 dB
SNR down	Signal to Noise Ratio of downstream signal. A high SNR indicates less baseline noise on the receive signal.	25 to 80 dB
Sound velocity	Fluid sound velocity	600 to 2000 m/s
Flow velocity	Flow velocity. Represents the measured path flow velocity before flow profile compensation.	0 to ± 15 m/s
Delta time	The precisely measured time difference between the upstream and downstream receive signals.	0 to 10000 ns
Travel time up	Measured transit-time from transmission to reception of the upstream receive signal.	15 to 3000 μ s
Travel time down	Measured transit-time from transmission to reception of the downstream receive signal.	15 to 3000 μ s

Diagnostic parameter	Description	Typical values
Correlation factor	A dimensionless indication of how strongly correlated the upstream and downstream signal are to each other. A value of 1 represents the best correlation, 0 the worst.	0.9 to 1
%-rate of accepted bursts	% of bursts accepted Based on various diagnostic input (i.e. correlation strength, gain level, SNR, etc.) the meter may reject specific up/down receive sets or bursts. The percentage of accepted bursts is one measure of the application's health. Less than 100% generally indicates a disruption in the fluid, such as from suspended solids or bubbles in the liquid.	99 to 100%
Actual sensor frequency	The actual transmit frequency for the specific path. Determined after performing a "frequency sweep" to determine the best frequency match to the pipe wall.	130000 to 4000000 Hz (0.13 to 4.0 MHz)
Peak amplitude up	Downstream signal peak amplitude at the transducer connection.	-10 to 80 dBmV
Peak amplitude down	Upstream signal peak amplitude at the transducer connection.	-10 to 80 dBmV
Min acc travel time	The minimum acceptable transit-time for reliable flow measurement. Signals arriving before this time will cause the flowmeter to generate a configuration alarm or prevent proper signal detection.	15 to 4000 μ s
Max acc travel time	The maximum acceptable transit-time for reliable flow measurement. Signals arriving after this time will cause the flowmeter to generate a configuration alarm or prevent proper signal detection.	15 to 4000 μ s
Lower sound velocity limit	The minimum allowed fluid sound velocity for reliable flow measurement. Operation below this limit may impact measurement accuracy or prevent proper signal detection. A configuration alarm will also be generated.	150 to 2100 m/s
Upper sound velocity limit	The maximum allowed fluid sound velocity for reliable flow measurement. Operation above this limit may impact measurement accuracy or prevent proper signal detection. A configuration alarm will also be generated.	150 to 2100 m/s

9.6 Improve the application (A4)

If the application still gives unstable or incorrect measurements, a number of measures can be taken to improve the installation. In the following it is described how to find the causes of a high measurement error or unstable flow measurement and other measures that will improve the installation.

Checking the zero point offset

In order to observe if the zero point (or zero flow offset) exceeds the reasonable limit for the application, it will be necessary to first set the Low flow cut-off to 0.0 m³/s. Any zero point offset will then be visible on the flow display.

If necessary, perform the Zero point adjustment again.

Incorrect installation of the FSS200 sensors

- Are the sensors properly aligned and spaced along the pipe axis?
- Sensors should not be installed on the very top or bottom of a horizontal pipe, where gas or solids can interfere with the acoustic signal.
- Are the sensors properly coupled (with supplied grease couplant) to the pipe wall?
- Is the pipe surface free of any loose or bubbling paint? If necessary, sand or condition the pipe surface to ensure reliable sensor coupling.
- Is there heavy pitting on the surface? Pipe surface should be clean and smooth.

Air in the liquid

- When significant air is present in the liquid, the flow measurement may become unstable, which leads to a poor measurement accuracy.

Checking for air:

- Look for unstable path gain and SNR diagnostics.
- Observe the path receive signals and look for rapidly varying waveform characteristics that would result from scattering of the acoustic beam by air bubbles.

Typical causes of air in the liquid

- The pump cavitates, the rotary speed of the pump is too high in relation to the supply of liquid to the pump.
- The flow rate in the pipe is too high, so components installed upstream of the flowmeter can cause cavitation.
- If there is a filter installed upstream of the flowmeter, it may be close to blocking, which also can cause cavitation.
- Liquid flashes to vapor bubbles while passing through partially open valves or orifices.

Scraper pig detection on FSS200 sensors

Note

Not for critical operations

The "Scraper pig detection" function is not infallible. There are occasions where the system may not detect the scraper pig. This function should be used for reference only and not relied upon for critical operations.

- The scraper pig detection is derived by the loss of signal caused by the passing of scraper pigs. Certain scraper pig designs may not have sufficient mass, or center core, to block the signal resulting in a missed detection. Typically this can happen with inspection pigs.
- The maximum length in the scraper pig detection settings has to consider the total length of the scraper pig, plus the expected waste buildup moving in front of the scraper pig.

9.7 Device status symbols

Device status is shown using symbols and text on the local display. Additionally, the symbol and respective text message for each device status can be seen in remote engineering, asset management or process control systems.

Messages are shown on the display.

- In the operation view, alarms are shown as a combination of symbol and text in the lower line of the display. If several diagnostic messages are active at the same time, the most critical is shown.
- In the alarm list view all active alarms are shown as a list. The alarm list combines a symbol, text and an alarm ID number. The alarms are arranged according to the alarm ID numbers. The alarm list view can also be accessed via parameter "Active diagnostic events".
- In the alarm history view the most recent alarms (up to 100) are listed. The alarm history log can be viewed in parameter "Diagnostic log". The alarm history log can be reset in parameter "Reset log".

Device status characteristics

The following table provides possible cause of device status, and actions for the user or service.

The device provides two types of alarm formats; symbols used on the local display are based on NAMUR status signals or Siemens standard alarm classes, selected in parameter "Status icons".

In SIMATIC PDM, symbols are based on Siemens standard alarm classes.

The sequence of symbols in the table corresponds to the priority of the device status, beginning with the most critical.

Device status symbols

Local display - NAMUR NE 107			NAMUR - HCF	Local display - Siemens standard			SIMATIC PDM/PLC		
Symbol	Device status	Priority *	Priority *	Symbol	Device status	Priority **	Symbol	Device status	Priority **
	Failure	1	1		Maintenance alarm	1	 	Maintenance alarm	1
Cause: Output signal invalid due to fault in the field device or in the peripherals. Action: Maintenance is required immediately.									
	Maintenance required	3	4		Maintenance demanded	2	 	Maintenance demanded	2
Cause: Output signal is still valid, but wear reserve is almost exhausted and/or a function will be limited soon. Action: Maintenance is strongly recommended as soon as possible.									
	Maintenance required	3	4		Maintenance required	3	 	Maintenance required	3

9.7 Device status symbols

Local display - NAMUR NE 107			NAMUR - HCF	Local display - Siemens standard			SIMATIC PDM/PLC		
Symbol	Device status	Priority *	Priority *	Symbol	Device status	Priority **	Symbol	Device status	Priority **
Cause: Output signal is still valid. No functional restriction detected but end of wear reserve expected in next weeks. Action: Maintenance of device should be planned.									
	Function check	2	2		Manual operation	4		Manual operation	4
Cause: Output signal temporarily invalid (e.g. frozen) due to work being performed on the device. Action: Disable manual mode via HMI or engineering system.									
	Function check	2	2		Simula- tion or substitute value	5		Simula- tion or substitute value	5
Cause: Output signal temporarily does not represent the process because output based on a simulation value. Action: Disable simulation mode via HMI or engineering system or restart device.									
	Failure	1	1		Out of service	6		Out of service	6
Cause: Output signal does not represent process value. Device mode is set to "Out of service". Action: Disable "Out of service" and enable normal operation.									
	Out of specifi- cation	4	3		Process value alarm	8		Process value alarm	8
Cause: Deviations from permissible ambient or process conditions detected by the device (through self-monitoring, or warnings / faults in the device) indicate that the measured value is unreliable or deviations from the set value in the actuators is most likely greater than anticipated under normal operating conditions. Process or ambient conditions will damage the device or result in unreliable output. Action: Check ambient temperature or process conditions. If possible, install device at different location.									
	Out of specifi- cation	4	3		Process value warning	10		Process value warning	10
Cause: Deviations from permissible ambient or process conditions detected by the device (through self-monitoring, or warnings / faults in the device) indicate that the measured value is unreliable or deviations from the set value in the actuators is most likely greater than anticipated under normal operating conditions. Process or ambient conditions can damage the device or result in unreliable output. Action: Check ambient temperature or process conditions. If possible, install device at different location.									
no sym- bol shown					Process value tol- erance	11		Process value tol- erance	11

Local display - NAMUR NE 107			NAMUR - HCF	Local display - Siemens standard			SIMATIC PDM/PLC			
Symbol	Device status	Priority *	Priority *	Symbol	Device status	Priority **	Symbol	Device status	Priority **	
Cause: At least one process value has exceeded or fallen below a process tolerance limit parameter set in device. Action: Check that limit parameter settings are suitable for application.										
no sym- bol shown				no sym- bol shown	Configura- tion changed	12		no sym- bol shown	Configura- tion changed	12
Cause: The device configuration has changed due to a work process. Action: Reset configuration flag to clear diagnostic message.										
no sym- bol shown	Good - OK			no sym- bol shown	no assign- ment	13		no sym- bol shown	no assign- ment	13
Cause: Device status ok. No active diagnostic errors. Action: No action required.										

* Lowest priority number equals highest fault severity.

** Both the Siemens standard symbol and its corresponding Namur symbol (from device display) will be shown in SIMATIC PDM.

Information symbols

The following information symbols are used on the local display.

Local display	
Symbol	Description
	Data exchanged
	No data exchanged
	Write access enabled
	Device hardware lock enabled
	Device button lock enabled
	Custody transfer enabled

9.8 Fault codes and corrective actions

Alarms and system messages support both Siemens standard alarm classes and NAMUR status signals.

In the following tables the alarm IDs (identification numbers) are listed along with possible causes and directions for corrective action.

Sensor diagnostic events

ID/ Sym- bols	Diagnostic	Action	Comments
5  	DSL voltages	DSL-internal voltage limits exceeded. Please check the power connection and repower the device. If the alarm still exists, call service personnel. Electronics may be damaged and it may be necessary to replace DSL electronics.	
6  	DSL Storage	A malfunction in the DSL-internal memory was detected. Parameters are either not initialized correctly or stored correctly. Repower the device and check parameter values. If alarm still exists, call service personnel. Internal data storage may be damaged and it may be necessary to replace DSL electronics.	
7  	Flow measurement	An error in the flow measurement system detected and the measurement accuracy can be affected. Try to repower the device. If alarm still exists, call service personnel. It may be necessary to replace the DSL electronics or firmware.	
8  	DSL internal	Try to repower the device. If alarm still exists, call service personnel. It may be necessary to replace the DSL electronics or firmware.	
9  	Oil: Density	An error in the oil density calculation was detected and the measurement accuracy can be affected. Check if device is configured properly, investigate DSL error codes to determine precise root cause.	Only hydrocarbon
10  	Oil: Viscosity	An error in the oil viscosity calculation was detected and the measurement accuracy can be affected. Check if device is configured properly, investigate DSL error codes to determine precise root cause.	Only hydrocarbon
11  	Oil : Spec. gravity	An error in the oil gravity calculation was detected and the measurement accuracy can be affected. Check if device is configured properly, investigate DSL error codes to determine precise root cause.	Only hydrocarbon
14  	Path 1: No signal	Potential reasons: Process conditions, wrong installation, defect in electronics, cabling or sensor. It may be necessary to adjust either installation or configuration or to replace components. Provide DSL error codes to service personnel for further information.	

ID/ Sym- bols	Diagnostic	Action	Comments
15  	Path 2: No signal	Potential reasons: Process conditions, wrong installation, defect in electronics, cabling or sensor. It may be necessary to adjust either installation or configuration or to replace components. Provide DSL error codes to service personnel for further information.	
19  	Electronics temp.	The internal DSL temperature is outside the specified operating temperature range. Verify that the ambient temperature is within specified limits. Working outside temperature limits can damage electronics and reduce product lifetime.	
22  	Density calculation	Measurement of Process Density has failed. This could be due to errors in attached cabling or measurement equipment, defect sensor frontend electronics or configuration errors on channels 3, 4, 5 or 6. Investigate DSL error codes to determine precise root cause and required actions. For processes with a constant density, the density can alternatively be based on a fixed user specified value.	
23  	Medium temp. calc.	The measurement of Process Temperature has failed. This could be due to errors in attached cabling or measurement equipment, defect sensor frontend electronics or configuration errors on channels 3, 4, 5 or 6. Investigate DSL error codes to determine precise root cause and required actions. For processes with a constant temperature, the process temperature can alternatively be based on a fixed user specified value.	
24  	Pressure calculation	Measurement of Process Pressure has failed. This could be due to errors in attached cabling or measurement equipment, defect sensor frontend electronics or configuration errors on channels 3, 4, 5 or 6. Investigate DSL error codes to determine precise root cause and required actions. For processes with a constant pressure, the pressure can alternatively be based on a fixed user specified value.	
25  	Viscosity calculation	Measurement of Process Viscosity has failed. This could be due to errors in attached cabling or measurement equipment, defect sensor frontend electronics or configuration errors on channels 3, 4, 5 or 6. Investigate DSL error codes to determine precise root cause and required actions. For processes with a constant viscosity, the viscosity can alternatively be based on a fixed user specified value.	

ID/ Sym- bols	Diagnostic	Action	Comments
26  	Sensor temp. comp.	The clamp-on sensor temperature compensation has failed, because measurement of temperature failed. This could be due to errors in attached cabling or measurement equipment, defect sensor frontend electronics or configuration errors on channels 3, 4, 5 or 6. Investigate DSL error codes to determine precise root cause and required actions. For processes with a constant temperature, the sensor temperature compensation can alternatively be based on a fixed user specified process temperature.	
27  	Scraper pig detected	Scraper pig detected. The ultrasonic signal was temporarily interrupted when the scraper pig passed through the sensor measurement section.	Only hydrocarbon
28  	Configuration 1	An invalid configuration was detected. Investigate detailed diagnostics to determine precise root cause. Investigate DSL error codes to determine which settings are invalid. The setup parameters must be changed via the local display menu or via an external configuration tool.	
32  	Auxiliary input	The auxiliary measurement on CH5 or CH6 has failed. This could be due to errors in attached cabling or measurement equipment, defect sensor frontend electronics or configuration errors on channels 3, 4, 5 or 6. Investigate DSL error codes to determine which settings are invalid.	
34  	Invalid flow meas.	Signal was lost on 1 or more paths causing the measurement to stop or become untrustworthy. Check if device is configured properly, Investigate DSL error codes to determine precise root cause.	
35  	Failure on CH5 or CH6	Configuration of channel 5 or 6 failed. The electronics may be defect or the sensors connected to channel 5 or 6 are defect or installed incorrectly. If alarm still exists, call service personnel. It may be necessary to replace the DSL electronics.	
36  	Configuration 2	An invalid configuration was detected with impact on the measurement accuracy. Investigate DSL error codes to determine which settings are invalid. The setup parameters must be changed via the local display menu or via an external configuration tool.	

ID/ Sym- bols	Diagnostic	Action	Comments
37  	DSL system monitor	A malfunction in the DSL-internal system monitor was detected. While alarm is active, PCB temperatures and internal voltage measurements are not updated. If alarm persists, call service personnel.	
38  	Path diagnostics	A diagnostic alarm limit on a measurement path was exceeded. Please check and adjust process conditions or investigate detailed diagnostics to determine precise root cause. Provide DSL error codes to service personnel if necessary.	

Transmitter diagnostic events

ID/ Sym- bols	Diagnostic	Action	Comment
96  	Mass flow	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper alarm limit'.	
97  	Mass flow	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	
98  	Mass flow	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	
99  	Mass flow	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower alarm limit'	
100  	Volume flow	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper alarm limit'	
101  	Volume flow	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	

ID/ Sym- bols	Diagnostic	Action	Comment
102  	Volume flow	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	
103  	Volume flow	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower alarm limit'	
104  	Density	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper alarm limit'	
105  	Density	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	
106  	Density	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	
107  	Density	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower alarm limit'	
108  	Medium temperature	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper alarm limit'	
109  	Medium temperature	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	
110  	Medium temperature	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	

ID/ Sym- bols	Diagnostic	Action	Comment
111  	Medium temperature	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower alarm limit'	
132  	Standard volume flow	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper alarm limit'	Only hydrocarbon
133  	Standard volume flow	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	Only hydrocarbon
134  	Standard volume flow	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	Only hydrocarbon
135  	Standard volume flow	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower alarm limit'	Only hydrocarbon
136  	Totalizer 1	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper alarm limit'	
137  	Totalizer 1	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	
138  	Totalizer 1	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	
139  	Totalizer 1	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower alarm limit'	

ID/ Sym- bols	Diagnostic	Action	Comment
140  	Totalizer 2	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper alarm limit'	
141  	Totalizer 2	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	
142  	Totalizer 2	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	
143  	Totalizer 2	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower alarm limit'	
144  	Totalizer 3	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper alarm limit'	
145  	Totalizer 3	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	
146  	Totalizer 3	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	
147  	Totalizer 3	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower alarm limit'	
148  	Transmitter temperature	Transmitter temperature above alarm limit. Relocate the device if possible or lower the ambient temperature enough to cool the device. Inspect the device for heat-related damage.	

ID/ Sym- bols	Diagnostic	Action	Comment
149  	Transmitter temperature	Transmitter temperature below alarm limit. Re-locate the device if possible or raise the ambient temperature enough to heat the device. Inspect the device for cold-related damage.	
150 	Sensor signal disrupted	Turn off the power. Unplug and reconnect the sensor cable. Restore power. If the error still exists, contact your local Siemens representative.	
151  	SensorFlash	Backup disabled. Another SensorFlash was inserted. To acknowledge please copy the configuration from the SensorFlash to the device, remove this Sensorflash and insert the original SensorFlash.	
152  	SensorFlash	Backup disabled. Another SensorFlash was inserted. To acknowledge please copy the configuration from the SensorFlash to the device, remove this Sensorflash and insert the original SensorFlash.	
159  	Internal error	Internal error in transmitter. Turn off the power, wait 5 seconds and turn on the power again. If the error still exists, contact your local Siemens representative.	
160  	Mass flow	Value simulated. Disable 'Simulation' before returning to normal operation	
161  	Volume flow	Value simulated. Disable 'Simulation' before returning to normal operation	
162  	Density	Value simulated. Disable 'Simulation' before returning to normal operation	
163  	Medium temperature	Value simulated. Disable 'Simulation' before returning to normal operation	

ID/ Sym- bols	Diagnostic	Action	Comment
166  	Standard volume flow	Value simulated. Disable 'Simulation' before re- turning to normal operation	Only hydrocarbon
167  	Totalizer 1	Value simulated. Disable 'Simulation' before re- turning to normal operation	
168  	Totalizer 2	Value simulated. Disable 'Simulation' before re- turning to normal operation	
169  	Totalizer 3	Value simulated. Disable 'Simulation' before re- turning to normal operation	
170  	Loop current	Loop current simulated. Disable 'Simulation' be- fore returning to normal operation	Only HART devices
172  	Transmitter	FW invalid. A component does not have the ex- pected FW version. Start a product firmware update to update the component version or re- place the component.	
173  	Sensor	FW invalid. A component does not have the ex- pected FW version. Start a product firmware update to update the component version or re- place the component.	
174  	Display	FW invalid. A component does not have the ex- pected FW version. Start a product firmware update to update the component version or re- place the component.	
175  	IO	FW invalid. A component does not have the ex- pected FW version. Start a product firmware update to update the component version or re- place the component.	

ID/ Sym- bols	Diagnostic	Action	Comment
176  	Sensor	Sensor type incompatible. Please replace sensor.	
177  	Device is starting	Please wait until startup is finished. Startup time see manual.	
178  	Transmitter	FW invalid. A component does not have the expected FW version. Start a product firmware update to update the component version.	
179  	Alarm class	Alarm class simulated. Disable Simulation before returning to normal operation.	No detailed information available in view Active diagnostic events. Icon depends on simulated alarm class resp. NAMUR status signal and the priority in case of multiple alarm classes simulated.
181  	SensorFlash	SensorFlash Chkdsk failed. Start Chkdsk again. If error still exists replace SensorFlash.	
183  	CH2	Input current too low. Check wiring and signal of connected sensor or output source to input channel.	If Operation mode is configured to Current input.
184  	CH2	Input current too high. Check wiring and signal of connected sensor or output source to input channel.	If Operation mode is configured to Current input
185  	CH2	External failure. Connected sensor or output to input channel is out of operation range. Please check connected sensor or output source.	If Operation mode is configured to Current input
186  	CH3	Input current too low. Check wiring and signal of connected sensor or output source to input channel	If Operation mode is configured to Current input

ID/ Sym- bols	Diagnostic	Action	Comment
187  	CH3	Input current too high. Check wiring and signal of connected sensor or output source to input channel	If Operation mode is configured to Current input
188  	CH3	External failure. Connected sensor or output to input channel is out of operation range. Please check connected sensor or output source.	If Operation mode is configured to Current input
189  	CH4	Input current too low. Check wiring and signal of connected sensor or output source to input channel	If Operation mode is configured to Current input
190  	CH4	Input current too high. Check wiring and signal of connected sensor or output source to input channel	If Operation mode is configured to Current input
191  	CH4	External failure. Connected sensor or output to input channel is out of operation range. Please check connected sensor or output source.	If Operation mode is configured to Current input
195  	CH2	Loop current in lower saturation. Check process conditions or align limit to normal operation. Adjust channel 2 parameter 'Lower range value'	If Operation mode is configured to Current output
196  	CH2	Loop current in upper saturation. Check process conditions or align limit to normal operation. Adjust channel 2 parameter 'Upper range value'	If Operation mode is configured to Current output
197  	CH2	Cable break. Check channel 2 current output cable connection.	If Operation mode is configured to Current output
198  	CH2	Frequency too low. Check process conditions or align limit to normal operation. Adjust channel 2 parameter 'Lower range value'	If Operation mode is configured to Frequency output

ID/ Sym- bols	Diagnostic	Action	Comment
199  	CH2	Frequency too high. Check process conditions or align limit to normal operation. Adjust channel 2 parameter 'Upper range value'	If Operation mode is configured to Frequency output
200  	CH2	Pulse overflow. Pulse output insufficient pulse separation. Reduce pulses per amount, or reduce pulse width, or increase amount	If Operation mode is configured to Pulse output
201  	CH3	Loop current in lower saturation. Check process conditions or align limit to normal operation. Adjust channel 3 parameter 'Lower range value'	If Operation mode is configured to Current output
202  	CH3	Loop current in upper saturation. Check process conditions or align limit to normal operation. Adjust channel 3 parameter 'Upper range value'	If Operation mode is configured to Current output
203  	CH3	Cable break. Check channel 3 current output cable connection	If Operation mode is configured to Current output
204  	CH3	Frequency too low. Check process conditions or align limit to normal operation. Adjust channel 3 parameter 'Lower range value'	If Operation mode is configured to Frequency output
205  	CH3	Frequency too high. Check process conditions or align limit to normal operation. Adjust channel 3 parameter 'Upper range value'	If Operation mode is configured to Frequency output
206  	CH3	Pulse overflow. Pulse output insufficient pulse separation. Reduce pulses per amount, or reduce pulse width, or increase amount	If Operation mode is configured to Pulse output
207  	CH4	Loop current in lower saturation. Check process conditions or align limit to normal operation. Adjust channel 4 parameter 'Lower range value'	If Operation mode is configured to Current output

ID/ Sym- bols	Diagnostic	Action	Comment
208  	CH4	Loop current in upper saturation. Check process conditions or align limit to normal operation. Adjust channel 4 parameter 'Upper range value'	If Operation mode is configured to Current output
209  	CH4	Cable break. Check channel 4 current output cable connection	If Operation mode is configured to Current output
210  	CH4	Frequency too low. Check process conditions or align limit to normal operation. Adjust channel 4 parameter 'Lower range value'	If Operation mode is configured to Frequency output
211  	CH4	Frequency too high. Check process conditions or align limit to normal operation. Adjust channel 4 parameter 'Upper range value'	If Operation mode is configured to Frequency output
212  	CH4	Pulse overflow. Pulse output insufficient pulse separation. Reduce pulses per amount, or reduce pulse width, or increase amount	If Operation mode is configured to Pulse output
214  	CH2	Channel simulated. Disable 'Simulation' before returning to normal operation	
215  	CH3	Channel simulated. Disable 'Simulation' before returning to normal operation	
216  	CH4	Channel simulated. Disable 'Simulation' before returning to normal operation	
217  	Process values frozen	All process values and totalizers are frozen. To return to normal operation the related input signal has to switch.	

ID/ Sym- bols	Diagnostic	Action	Comment
218  	Outputs forced	Outputs are forced. To return to normal operation the related input signal has to switch	
219  	CH2	Loop current deviation. Check current output cable connection. In passive mode check power supply.	If Operation mode is configured to Current output
220  	CH3	Loop current deviation. Check current output cable connection. In passive mode check power supply.	If Operation mode is configured to Current output
221  	CH4	Loop current deviation. Check current output cable connection. In passive mode check power supply.	If Operation mode is configured to Current output
222  	Modbus	Invalid register mapping. Source register allocated in duplicate. Check register mapping.	
223  	Modbus	Invalid coil configuration. Modbus coils are not configured correctly. Check coil allocation.	
228  	Sound velocity	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	
229  	Sound velocity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	
230  	Sound velocity	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	

ID/ Sym- bols	Diagnostic	Action	Comment
231  	Sound velocity	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	
232  	Flow velocity	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	
233  	Flow velocity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	
234  	Flow velocity	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	
235  	Flow velocity	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	
236  	Pressure	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	
237  	Pressure	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	
238  	Pressure	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	
239  	Pressure	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	

ID/ Sym- bols	Diagnostic	Action	Comment
244  	Kinematic viscosity	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	
245  	Kinematic viscosity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	
246  	Kinematic viscosity	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	
247  	Kinematic viscosity	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	
248  	Rate of change	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	Only hydrocarbon
249  	Rate of change	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
252  	Standard kinematic viscosity	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	Only hydrocarbon
253  	Standard kinematic viscosity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
254  	Standard kinematic viscosity	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	Only hydrocarbon

ID/ Sym- bols	Diagnostic	Action	Comment
255  	Standard kinematic viscosity	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	Only hydrocarbon
256  	Standard density	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	Only hydrocarbon
257  	Standard density	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
258  	Standard density	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	Only hydrocarbon
259  	Standard density	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	Only hydrocarbon
260  	API gravity	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	Only hydrocarbon
261  	API gravity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
262  	API gravity	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	Only hydrocarbon
263  	API gravity	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	Only hydrocarbon

ID/ Sym- bols	Diagnostic	Action	Comment
264  	Standard API gravity	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	Only hydrocarbon
265  	Standard API gravity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
266  	Standard API gravity	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	Only hydrocarbon
267  	Standard API gravity	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	Only hydrocarbon
268  	Specific gravity	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	Only hydrocarbon
269  	Specific gravity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
270  	Specific gravity	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	Only hydrocarbon
271  	Specific gravity	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	Only hydrocarbon
272  	Standard specific gravity	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	Only hydrocarbon

ID/ Sym- bols	Diagnostic	Action	Comment
273  	Standard specific gravity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
274  	Standard specific gravity	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	Only hydrocarbon
275  	Standard specific gravity	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	Only hydrocarbon
276  	Liquident	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	Only hydrocarbon
277  	Liquident	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
278  	Liquident	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	Only hydrocarbon
279  	Liquident	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	Only hydrocarbon
289  	Sound velocity	Value simulated. Disable 'Simulation' to return to normal operation.	
290  	Flow velocity	Value simulated. Disable 'Simulation' to return to normal operation.	

ID/ Sym- bols	Diagnostic	Action	Comment
291  	Pressure	Value simulated. Disable 'Simulation' to return to normal operation.	
292  	Kinematic viscosity	Value simulated. Disable 'Simulation' to return to normal operation.	
293  	Sensor temperature	Value simulated. Disable 'Simulation' to return to normal operation.	
294  	Auxiliary temperature	Value simulated. Disable 'Simulation' to return to normal operation.	
296  	CH5	Channel simulated. Disable 'Simulation' to return to normal operation.	
297  	CH6	Channel simulated. Disable 'Simulation' to return to normal operation.	
298  	Standard volume flow	Value simulated. Disable 'Simulation' to return to normal operation.	Only hydrocarbon
299  	Standardizing factor	Value simulated. Disable 'Simulation' to return to normal operation.	Only hydrocarbon
300  	Standard kinematic viscosity	Value simulated. Disable 'Simulation' to return to normal operation.	Only hydrocarbon

ID/ Sym- bols	Diagnostic	Action	Comment
301  	Standard density	Value simulated. Disable 'Simulation' to return to normal operation.	Only hydrocarbon
302  	Liquident	Value simulated. Disable 'Simulation' to return to normal operation.	Only hydrocarbon
303  	API gravity	Value simulated. Disable 'Simulation' to return to normal operation.	Only hydrocarbon
304  	Standard API gravity	Value simulated. Disable 'Simulation' to return to normal operation.	Only hydrocarbon
305  	Specific gravity	Value simulated. Disable 'Simulation' to return to normal operation.	Only hydrocarbon
306  	Standard specific gravity	Value simulated. Disable 'Simulation' to return to normal operation.	Only hydrocarbon
307  	Rate of change	Value simulated. Disable 'Simulation' to return to normal operation.	Only hydrocarbon

Technical data

Note

Device specifications

Siemens makes every attempt to ensure the accuracy of these specifications but reserves the right to change them at any time.

10.1 Power

Table 10-1 Power supply

Description	Specification
Supply voltage	100 to 240 V AC, 47 to 63 Hz 20 to 27 V DC
Power consumption	20W / 22VA
Environmental conditions:	- Transient over voltages up to the levels of overvoltage category II - Temporary over voltages occurring on mains supply only - MAINS supply voltage fluctuations up to $\pm 10\%$ of the nominal voltage.
Reverse polarity protection (y / n)	Y
Galvanic isolation	2500 V AC

10.2 Modbus interface

Table 10-2 Modbus communication

Description	Specification
Protocol version	Modbus RTU
Default transmission rate	19 200 bit/s
Default parity	Even
Default device address	1

10.3 Inputs

Table 10-3 Digital input (Channels 3 and 4)

Description	Channels 3 and 4
Load	15 to 30 V DC, R_{in} 7 kOhm
Functionality	- Reset totalizer 1, 2 or 3 - Reset all totalizers - Freeze process values - Force outputs

Table 10-4 Current input (Channels 3 and 4)

Description	Channels 3 and 4	
Signal range	0 to 20 mA (EX-version) 0 to 25 mA (non-EX-version)	
Resolution	0.5 μ A	
Load	<470 Ohm (EX-version) <770 Ohm (non-EX-version)	
Time constant (adjustable)	0,0 to 100 s	
Fault current	US:	NAMUR:
Measurement range (mA)	4 to 20.8	3.8 to 20.5
Minimum alarm (mA)	3.75	3.5
Maximum alarm (mA)	22.6	22.6
Customized fail-safe mode	- Last valid value - Lower fault current - Upper fault current - Fail-safe value - Current value	
Galvanic isolation	All inputs and outputs are galvanically isolated PELV circuits with 60 V DC isolation from each other and ground. Maximum test voltage: 500 V AC	
Cable ¹⁾	Standard industrial signal cable with up to 3 twisted pairs with overall screen can be connected between the transmitter and the control system. Individual pair or overall screen is optional depending on user requirements.	
Voltage range	Max. 24 V DC (active) 14 to 30 V DC (passive)	

¹⁾ User supplied cables must be suitable for 5°C above surrounding ambient temperature.

Table 10-5 Channels 5 and 6 input (RTD)

Description	Channels 5 and 6
Temperature range	-50 to 250°C (-58 to 482°F)
Resolution	<0.1 mK
Accuracy	+/- 0.25 K (calibrated 4 wire)
Input protection	25 VDC overvoltage
Cabling ¹⁾	2, 3 or 4 wire

¹⁾ User supplied cables must be suitable for 5°C above surrounding ambient temperature.

10.4 Outputs

Table 10-6 Current output (Channel 1)

Description	Channel 1	
Signal range	4 to 20 mA	
Resolution	0.4 µA	
Load	- Ex i: <470 Ω (HART ≥ 230 Ω) - Non-Ex: <770 Ω (HART ≥ 230 Ω)	
Time constant (adjustable)	0.0 to 100 s	
Fault current	4 - 20 NAMUR	4 - 20 US
Measurement range (mA)	3.8 - 20.5	4.0 - 20.8
Lower fault current (mA)	3.5	3.75
Upper fault current (mA)	22.6	22.6
Customized fail-safe mode	- Last valid value - Lower fault current - Upper fault current - Fail-safe value - Current value	
Galvanic isolation	All inputs and outputs are galvanically isolated PELV circuits with 60 V DC isolation from each other and ground. Maximum test voltage: 500 V AC	
Cable ¹⁾	Standard industrial signal cable with up to 3 twisted pairs with overall screen can be connected between the transmitter and the control system. Individual pair or overall screen is optional depending on user requirements.	
Voltage range	Max. 24 V DC (active) 14 to 30 V DC (passive)	

¹⁾ User supplied cables must be suitable for 5°C above surrounding ambient temperature.

Table 10-7 Current output (Channels 2 to 4)

Description	Channels 2 to 4
Signal range	0/4 to 20 mA
Resolution	0.4 µA

10.4 Outputs

Description	Channels 2 to 4					
Load	- Ex i: <470 Ω - Non-Ex: <770 Ω					
Time constant (adjustable)	0.0 to 100 s					
Fault current	4-20 NAMUR	4-20 US	4-20 NAMUR	4-20 US	0-20 NAMUR	0-20 US
Measurement range (mA)	3.8 - 20.5	4.0 - 20.8	4.0 - 20.5	4.0 - 24.0	0.0 - 20.5	0.0 - 24.0
Lower fault current (mA)	3.5	3.75	2.0	2.0	0.0	0.0
Upper fault current (mA)	22.6	22.6	22.0	25.0	22.0	25.0
Customized fail-safe mode	- Last valid value - Lower fault current - Upper fault current - Fail-safe value - Current value					
Galvanic isolation	All inputs and outputs are galvanically isolated PELV circuits with 60 V DC isolation from each other and ground. Maximum test voltage: 500 V AC					
Cable ¹⁾	Standard industrial signal cable with up to 3 twisted pairs with overall screen can be connected between the transmitter and the control system. Individual pair or overall screen is optional depending on user requirements.					
Voltage range	Max. 24 V DC (active) 14 to 30 V DC (passive)					

¹⁾ User supplied cables must be suitable for 5°C above surrounding ambient temperature.

Table 10-8 Digital output

Description	Channels 2 to 4
Pulse	41.6 μ s to 5 s pulse duration
Resolution	1 μ s
Frequency	0 to 10 kHz, 50 % duty cycle, 120 % overscale provision
Resolution	0.2 Hz
Load	< 750 Ω
Time constant (adjustable)	0 to 100 s
Active	0 to 24 V DC, 87 mA, short-circuit-protected
Passive	3 to 30 V DC, 100 mA, short-circuit-protected
Functions	- Pulse - Frequency - Alarm class / NAMUR status - Alarm item

Table 10-9 Relay output

Description	Channels 3 to 4
Type	Change-over voltage-free relay contact
Load	30 V DC (30 V AC peak), 100 mA
Functions	- Alarm class / NAMUR status - Alarm item

10.5 Energy limitation parameters FST030

Table 10-10 Output parameters

	External DSL connections	Sensor connections	RTD connections
U_o	17.42 V DC	17.43 V DC	4.52 V DC
I_o	459 mA	452 mA	13.8 mA
P_o	2000 mW	991 mW	26.6 mW
C_o - Group IIC - Groups IIB, III - Group IIA	338 nF 1969 nF 8199 nF	169.5 nF 985 nF 1000 nF	4.28 μF 139 μF 994 μF
L_o - Group IIC - Groups IIB, III - Group IIA	134 μH 675 μH 1.35 μH	67 μH 348 μH 697 μH	1.87 mH 7.47 mH 14.9 mH
L_o/R_o - Group IIC - Groups IIB, III - Group IIA	17.8 μH/Ω 71.2 μH/Ω 142 μH/Ω	18.0 μH/Ω 72.2 μH/Ω 144 μH/Ω	- NA - NA - NA

Table 10-11 I/O connections active

	HART active	Modbus	I/O 2 active	I/O 3 active	I/O 4 active
Terminals	4, 5	4, 5, 6, 7	8, 9	11, 12	14, 15
U_o	28 V DC	4.2 V DC	28 V DC	28 V DC	28 V DC
I_o	85 mA	118 mA	87 mA	87 mA	87 mA
P_o	584.5 mW	124 mW	601 mW	601 mW	601 mW

10.6 Energy limitation parameters for external DSL

	HART active	Modbus	I/O 2 active	I/O 3 active	I/O 4 active
Terminals	4, 5	4, 5, 6, 7	8, 9	11, 12	14, 15
C_o					
• Group IIC	• 72 nF	• 4200 nF	• 78 nF	• 78 nF	• 78 nF
• Groups IIB, III	• 639 nF	• 10000 nF	• 645 nF	• 645 nF	• 645 nF
• Group IIA	• 2139 nF	• 10000 nF	• 2145 nF	• 2145 nF	• 2145 nF
L_o					
• Group IIC	• 1.64 mH	• 2.56 mH	• 1.46 mH	• 1.46 mH	• 1.46 mH
• Groups IIB, III	• 16.4 mH	• 10.2 mH	• 15.7 mH	• 15.7 mH	• 15.7 mH
• Group IIA	• 36.0 mH	• 20.5 mH	• 34.7 mH	• 34.7 mH	• 34.7 mH

Table 10-12 I/O connections passive

	HART pas- sive	I/O 2 pas- sive	I/O 3 pas- sive	I/O 3 relay	I/O 4 pas- sive	I/O 4 relay
Terminals	5, 6	9, 10	12, 13	11, 12, 13	15, 16	14, 15, 16
U_i	30 V DC	30 V DC	30 V DC	30 V DC	30 V DC	30 V DC
I_i	100 mA	100 mA	100 mA	100 mA	100 mA	100 mA
P_i	1000 mW	1000 mW	1000 mW	1000 mW	1000 mW	1000 mW
C_i	15.8 nF	7.3 nF	7.3 nF	7.3 nF	7.3 nF	7.3 nF
L_i	36 μ H	36 μ H	36 μ H	36 μ H	36 μ H	36 μ H

Note

External capacitance and inductance

The C_o and L_o values already take into consideration the combined effects of external capacitance and inductance. No further reduction of external capacitance and inductance is required.

10.6 Energy limitation parameters for external DSL

Table 10-13 Input parameters

	SSL (power & signal)	Analog input IO5 Analog input IO6
U_i	17.42 V DC	30 V DC
I_i	459 mA	100 mA
P_i	2.0 W	0.75 W
C_i	2.52 nF	0 nF
L_i	315 nH	105 nH

Table 10-14 Output parameters

	RTD 5, RTD 6 (any combination of connections)	Sensor outputs, each (up to 8)
U_o	4.52 V DC	17.43 V DC
I_o	13.8 mA	452 mA
P_o	26.6 mW	991 mW
C_o - Group IIC - Groups IIB, III - Group IIA	4.28 μF 139.5 μF 994 μF	169.5 nF 985 nF 1000 nF
L_o - Group IIC - Groups IIB, III - Group IIA	1.87 mH 7.47 mH 14.9 mH	67 μH 348 μH 697 μH
L_o/R_o - Group IIC - Groups IIB, III - Group IIA	- NA - NA - NA	18.0 μH/Ω 72.2 μH/Ω 144 μH/Ω

Note

External capacitance and inductance

The C_o and L_o values already take into consideration the combined effects of external capacitance and inductance. No further reduction of external capacitance and inductance is required.

10.7 Construction

Table 10-15 Designated use

Description	Specification
Measurement of process medium	- Fluid Group 1 (suitable for dangerous fluids) - Aggregate state: Paste/light slurry, liquid and gas

Table 10-16 System design

Description	Specification
Measuring principle	Ultrasonic
System architecture	Wall mount enclosure with internal DSL Wall mount enclosure with external DSL

Transmitter design

Table 10-17 Wall mount enclosure transmitter design

Description	Specification
Dimensions	See Transmitter (Page 157)
Weight	Transmitter (with internal DSL): 5.6 kg (12.3 lbs) Transmitter (without internal DSL): 4.9 kg (10.8 lbs) Display module: 0.095 kg (0.2 lbs) Input/output module: 0.090 kg (0.2 lbs)
Design	Wall mount enclosure with or without internal DSL
Material	Aluminum with corrosion-resistant coating
Ingress protection	IP66/67/NEMA 4X to EN/IEC 60529 (1 meter for 30 min)
Mechanical load	18 to 1000 Hz random, 3.17 g RMS, in all directions, to EN/IEC 68-2-36

Table 10-18 External DSL design

Description	Specification
Dimensions	See External DSL dimensions (Page 157)
Weight	External DSL: 2.5 kg (5.5 lbs)
Design	External DSL for pipe or wall mounting
Material	Aluminum with corrosion-resistant coating
Ingress protection	IP66/67/NEMA 4X to EN/IEC 60529 (1 meter for 30 min)
Mechanical load	18 to 1000 Hz random, 3.17 g RMS, in all directions, to EN/IEC 68-2-36

Torques

Table 10-19 Installation torques

Description	Torque (Nm)
Cable gland to enclosure (Siemens supplied, metric)	10

Note

NPT glands

When using NPT glands, the user must take care to use the supplied NPT thread adaptors.

10.8 Operating conditions

Table 10-20 Basic conditions

Description		Specification
Ambient temperature (Humidity max. 90 %)	Operation: Transmitter without display Display	-40 to +60 °C (-40 to +140 °F) -20 to +60 °C (-4 to +140 °F)
Ambient temperature (Humidity max. 90 %)	Storage:	-40 to +70 °C (-40 to +158 °F)
Climate class		DIN 60721-3-4
Altitude		Up to 2000 m (6560 ft)
Pollution		Degree 2
Relative humidity		95 %
Bump resistance		On request
Shock resistance		On request
Thermal shock		On request
Vibration resistance		On request
EMC performance	- Emission - Immunity	- EN 55011 / CISPR-11 - EN/IEC 61326-1 (Industry) NAMUR

Table 10-21 Process medium conditions

Description	Specification
Process medium temperature within the acceptable temperature range for the sensors	(-40 to 230 °C for High Temperature 991 sensors)
Fluid must be sonically conductive	-
Operation outside the Reynolds transition region for best accuracy	-

Table 10-22 Performance section

Description	Specification
Pending approvals	- ATEX Zone 2 - IECEX Zone 2 - FM Class I Div. 2 - FMc Class I Div. 2
Accuracy	± 0.5 ... 1 % for velocities above 0.3 m/s and >10 diameters straight run
Repeatability	± 0.25 % (based on ISO 11631)
Pipe size range	12.7 ... 10 m (0.5 ... 394")

Description	Specification
Wall Thickness Range	0.64 ... 76.2 mm (0.025 ... 3.0")
Pipe material	Any sonically conductive material (steel, plastic, aluminum, glass, cement, ductile iron, copper)

10.9 Cables and cable entries

Table 10-23 SSL cable, basic data

Description	Specification
Number of conductors	4
Square area [mm ²]	0.326 (AWG 22/7)
Screen	Yes
Outside color	- Standard version: gray (RAL 7001) - Ex version: light-blue (RAL 5015)
External diameter [mm]	6.5 (standard); 12 (armored)
Maximum length [m (ft.)]	150 (492)
Installation environment	Industrial including chemical processing plants
Insulation material	Special polyolefin
Halogen-free	Yes
RoHS compliant	Yes
Torsional strength	>3 million cycles at ± 180° on 200 mm - Not adapted for garland mounting (festoon)
Permissible temperature range [°C (°F)]	-40 to +80 (-40 to +176)
Min. bending radius allowed	Single 5 X ø

Table 10-24 Signal cable recommendations

Description	Specification
Square area [mm ²]	0.5 (AWG 20)
Linear resistance [Ohm/km]	≤ 120
Max. length [Ohm] (depends on total linear resistance)	< 500
Signal run time [ns/m]	≤ 5.3
Insulation resistance [MOhm*km]	≥ 200
Characteristic impedance 1 – 100 MHz [Ohm]	100 (±5)
Attenuation @ 1 Mhz	< 2.9 dB/100 m
Operating voltage (peak) [V]	≤ 300
Test voltage (wire/wire/screen rms 50 Hz 1 min) [V]	= 700

Electrical data at reference temperature (20 °C)

Table 10-25 Power supply cable recommendations

Description	Specification
Square area [mm ²]	1.3 (AWG 16)
Max. length [m]	300 (AWG 16)

Note

Size the cable length and diameter to provide 19.2 V DC at power terminals at load current of 0.75 A

Table 10-26 Transmitter cable glands and entries

Description	Specification
Glands	- Material - Nylon¹⁾ - Brass/Ni plated - Stainless steel AISI 316/1.4404 - Cable cross section - Ø 8 to 17 mm (0.31" to 0.67") - Ø 5 to 13 mm (0.20" to 0.51")
Entries	9 x M20

¹⁾: If operating temperature is below -20 °C (-4 °F), use Brass/Ni plated or stainless steel cable glands.

Cable glands and fittings for use in Explosive Atmospheres

1. M20 to ½ NPT adaptors, M12 connector and plugs supplied by Siemens have been approved as part of the certification.
2. Cable glands shall be rated for a minimum ingress protection rating of IP54 and have an ambient temperature rating suitable for the installation with a safety factor of 5 °K above the maximum ambient.
3. The threads shall be M20 x 1.5. A sealing ring or gasket shall be used. Cable sizes of 5 to 14.3 mm may be used unless otherwise restricted by the manufacturer.
4. Cable glands for use in Zone 2 explosive atmospheres shall be rated Ex e as follows:
 - For use in US Zone 2 explosive atmospheres they shall be rated AEx ex or AEx eb. They shall also be rated for Enclosure Type 4.
 - For Canadian, IECEx or ATEX Zone 2 explosive atmospheres they shall be rated Ex ec or Ex eb.

10.10 Approvals

Note

Device-specific approvals

Always refer to nameplates on the device for device-specific approvals.

Table 10-27 Ratings FST030 Wallbox

Description	Specification
Hazardous locations (United States & Canada)	Class I, Division 2, Groups A, B, C, D Class II, Division 2, Groups E, F, G Class III, Division 2 Class I, Zone 2, AEx ia nA [ia Ga] IIC T6...T5 Gc Class I, Zone 2; AEx/Ex ec ia [ia Ga] IIC T6...T5 Gc Class II, Zone 22; AEx/Ex tc [ia Da] IIIC T85°C Dc Um = 250 Vrms
Explosive Atmospheres (ATEX & IECEx)	Ⓔ II 3(1) D Ex tc [ia Da] IIIC T85°C Dc Ⓔ II 3(1) G Ex ec ia [ia Ga] IIC T6...T5 Gc
Ambient Temperature range	-40 °C ≤ Ta ≤ 60 °C
Enclosure Rating	Enclosure Type 4X IP66/IP67
Temperature code	T6 for -40 °C ≤ Ta ≤ 45 °C, T5 for -40 °C ≤ Ta ≤ 60 °C, T5 85 °C for -40 °C ≤ Ta ≤ 60 °C

Table 10-28 Ratings FS230 DSL11

Description	Specification
Hazardous locations (United States & Canada)	IS Class I, Division 1, Groups A, B, C, D IS Class II, Division 1, Groups E, F, G IS Class III, Division 1 Class I, Zone 0; AEx/Ex ia IIC T6...T5 Ga Class II, Zone 20; AEx/Ex ia IIIC T64°C...T74°C Da
Explosive Atmospheres (ATEX & IECEx)	Ⓔ II 1 D Ex ia IIIC T ₅ 64°C...T ₅ 74°C Da Ⓔ II 1 G Ex ia IIC T6...T5 Ga
Ambient Temperature range	-40 °C ≤ Ta ≤ 60 °C
Enclosure Rating	Enclosure Type 4X/6P IP66/IP68 (3 meters for 21 days)
Temperature code	T6 for -40 °C ≤ Ta ≤ 50 °C, T5 for -40 °C ≤ Ta ≤ 60 °C, T ₅ 64 °C for -40 °C ≤ Ta ≤ 50 °C, T ₅ 74 °C for -40 °C ≤ Ta ≤ 60 °C

Division 2, Zone 2, Zone 22 Installations

1. I/O shall be installed as intrinsically safe circuits.
2. Active circuits are associated apparatus to external intrinsically safe apparatus where $U_i (V_{max}) \geq U_o (V_{oc} \text{ or } V_t)$; $I_i (I_{max}) \geq I_o (I_{sc} \text{ or } I_t)$; $P_i (P_{max}) \geq P_o$; $C_o (C_a) \geq C_i + C_{cable}$; $L_o (L_a) \geq L_i + L_{cable}$
3. Passive circuits and relays shall be connected to external associated apparatus where $U_i (V_{max}) \geq U_o (V_{oc} \text{ or } V_t)$; $I_i (I_{max}) \geq I_o (I_{sc} \text{ or } I_t)$; $P_i (P_{max}) \geq P_o$; $C_o (C_a) \geq C_i + C_{cable}$; $L_o (L_a) \geq L_i + L_{cable}$

10.11 SensorFlash

Table 10-29 SensorFlash

Description	Specification
	SD card (S-300u)
Capacity	4 GB
File system support	FAT32 / 8.3
Temperature range	
Operation:	-40 to +85 °C (-40 to 185 °F)
Storage:	-40 to +100 °C (-40 to 212 °F)

Note**SensorFlash functions support**

Only the supplied 4 GB SD cards are supported for backup, restore, logging, and firmware update.

Dimension drawings

11.1 Transmitter

Wall mount enclosure

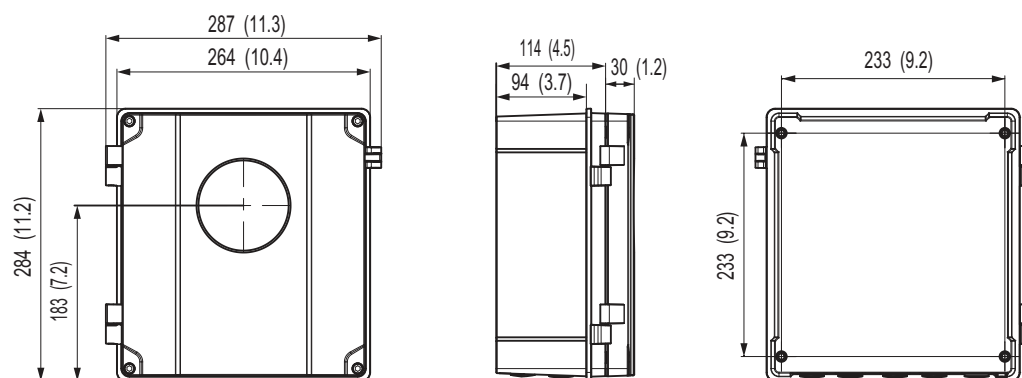


Figure 11-1 Transmitter dimensions in mm (")

11.1.1 External DSL dimensions

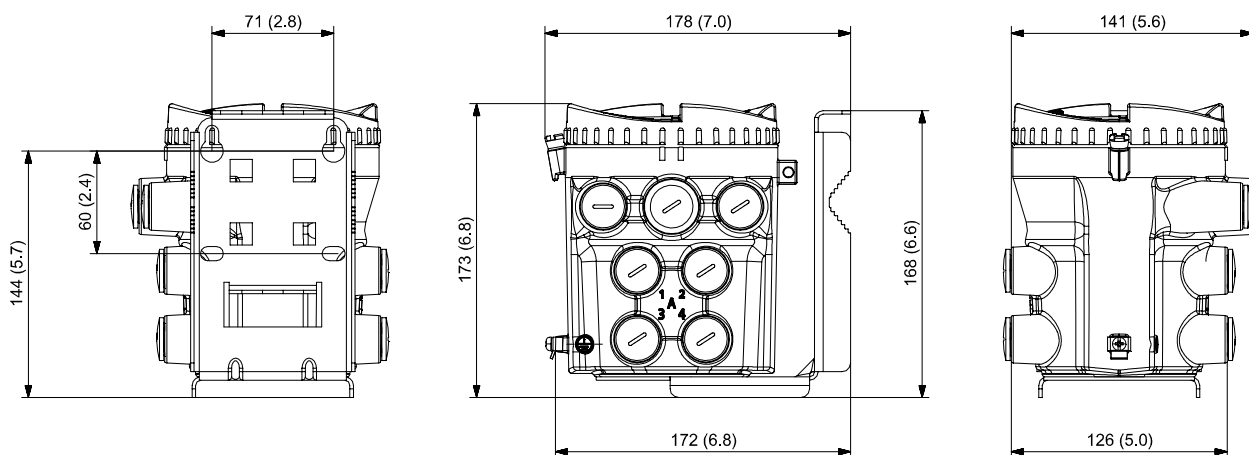


Figure 11-2 DSL dimensions in mm (")

Modbus communication

A.1 Integrating the FST030 with Modbus system

This chapter provides information on how to integrate the device in a point-to-point or multidrop Modbus RTU network in non-hazardous or hazardous areas. Many details of network design are beyond the scope of these operating instructions. The points below provide an overview of the major design criteria. For further details contact Siemens.

If the device is integrated in a hazardous area, two flameproof conduit seals per device must be installed; one at the device in the hazardous area and one in the non-hazardous area, see System configuration (Page 159).

A.1.1 System configuration

Non-hazardous areas

The following figures show examples of installations in point-to-point and multidrop configurations in non-hazardous areas.

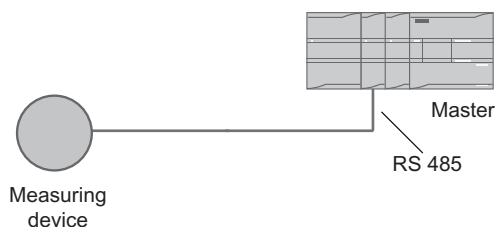


Figure A-1 Point to point configuration in non-hazardous locations

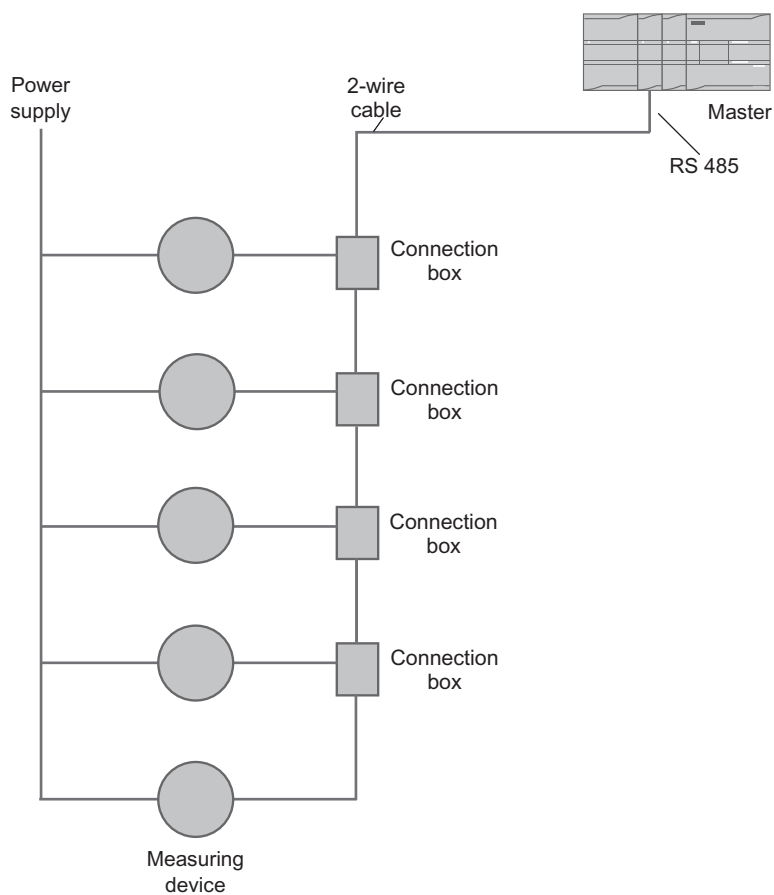


Figure A-2 Multidrop configuration (branch) in non-hazardous area

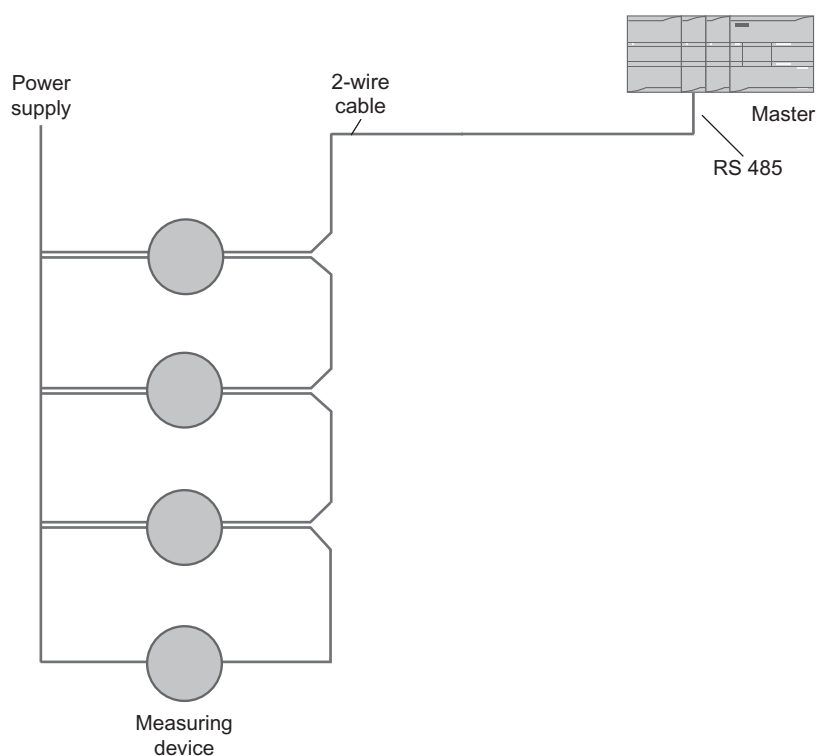


Figure A-3 Multidrop configuration (Daisy chain) in non-hazardous area

Hazardous areas

The following figures show examples of installations in point-to-point and multidrop configurations in hazardous areas.

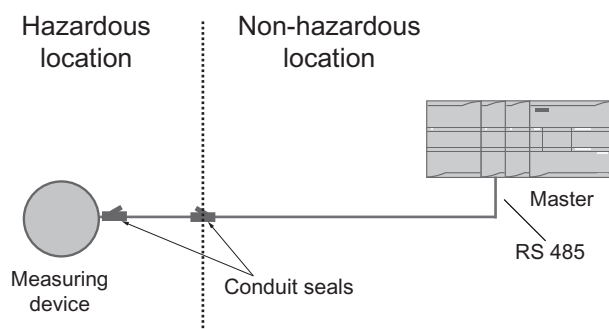


Figure A-4 Point-to-point configuration in hazardous area

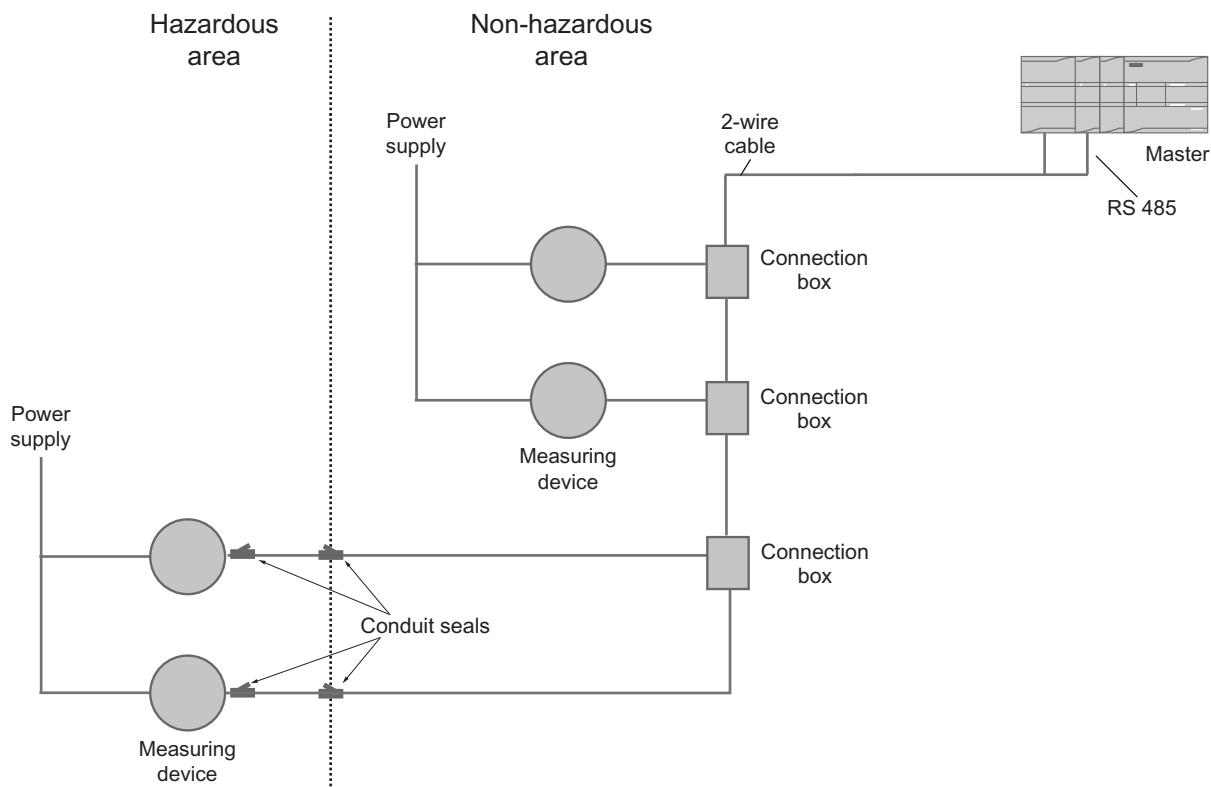


Figure A-5 Multidrop configuration in hazardous area

NOTICE

Flameproof conduit seals

Two flameproof conduit seals are required for each device in hazardous area installations.

NOTICE

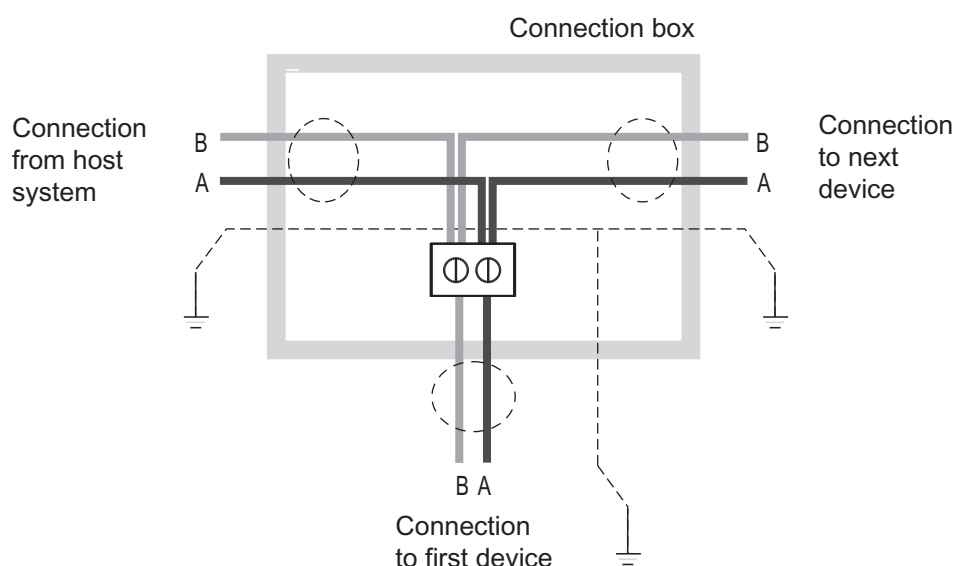
Equipment approved for hazardous areas

Ensure that the equipment is approved for installation in hazardous areas.

A.1.2 System wiring

The device is slave in a 2-wire Modbus RTU RS 485 bus system. Terminal A on the device must be connected to terminal A on the master/host system. Terminal B on the device must be connected to terminal B on the master/host system. This corresponds to a half-duplex communication where the slave will only reply to a request from the master.

This example shows an EMC shielded enclosure for multidrop installation. Cable shield must be grounded at host system, in connection box, and at flowmeter to comply with EMC requirements. Keep the cable shield to the ground as short as possible.



Topology

The device supports a two-wire electrical interface in accordance with EIA/TIA-485 standard.

An RS485 Modbus configuration without repeater has one trunk cable, along which devices are connected, directly (daisy chaining) or by short branch cables.

Note

Multidrop examples in this document show a trunk cable with short branch cables.

Maximum cable lengths

The end to end length of the trunk cable must be limited. The maximum length depends on the baud rate, the cable (gauge, capacitance or characteristic impedance), the number and types of loads on the daisy chain, and the network configuration.

Note

Maximum branch cable length

Branch cables must be short, never more than 20 m.

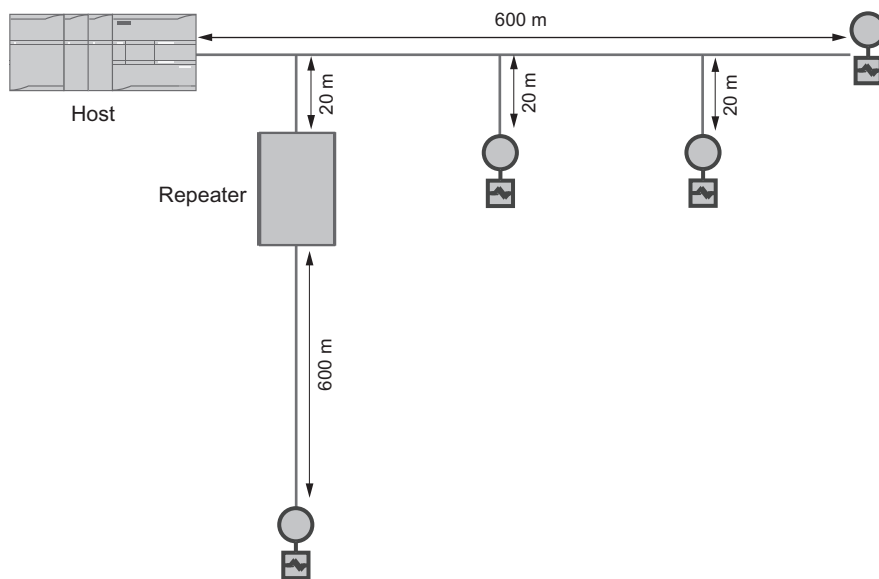


Figure A-6 Maximum cable lengths in multidrop configuration

Device description files

Available EDD drivers:

- SIMATIC PDM
- AMS Device Manager
- SITRANS DTM
- Field communicator V3.8

The drivers can be downloaded here:

Software downloads (<https://www.siemens.com/processinstrumentation/downloads>)

A.2 Modbus addressing model

The device allows read/write access to one holding register block. All devices are mapped to this Modbus address space.

A.3 Modbus communication

Table A-1 General Modbus settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8291	Unsigned / 2	Restart communication	Restarts the communication using configured slave address, baud rate and parity/framing.	-	0: Cancel 1: Restart	Write only
8005	Unsigned / 2	Slave address (HW)	DIP switch setting on the transmitter cassette. Address is used if DIP switch is set to a value > 0.	-	-	Read only
8297	Unsigned / 2	Slave address (SW)	Software address of Modbus interface. Address is used if switch is set to 0.	1	1 - 147	Read / write
8298	Unsigned / 2	Baud rate	Baud rate of Modbus interface.	19200 Bit/s	0: 9600 Bit/s 1: 19200 Bit/s 2: 115200 Bit/s 3: Reserved 4: 38400 Bit/s 5: 57600 Bit/s 6: 76800 Bit/s 7: 1200 Bit/s 8: 2400 Bit/s 9: 4800 Bit/s	Read / write
8299	Unsigned / 2	Parity and framing	Parity and framing of the Modbus communication interface.	Even parity, 1 stop	0: Even parity, 1 stop 1: Odd parity, 1 stop 2: No parity, 2 stops	Read / write

A.4 Coil configuration

The device provides 20 coil definitions which can be configured.

Table A-2 Coil configuration

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] ¹ (units register)	Value range / Setting options	Access level
10300	Unsigned / 2	Modbus coil address 1	Specifies the coil address with which the following bit coded register value is accessible. The register and bit(s) are specified by Modbus coil register 1 and Modbus coil bit-mask 1	1	0 - 65535	Read / write
10301	Unsigned / 2	Modbus coil register 1	Specifies the Modbus register whose value is checked against Modbus coil bitmask 1 to determine the coil value (false or true). A register value of 65535 specifies that this coil mapping is undefined.	Undefined	0 - 65535	Read / write
10302	Unsigned / 4	Modbus coil bit-mask 1	Bit mask which is compared against the register value specified with Modbus coil register 1 to determine the coil value. If any bit of the register value is set which is also set in the bit mask then the coil value is true, otherwise the coil is false.	0	0 - 4294967295	Read / write
10304	Unsigned / 2	Modbus coil length 1	Output parameter that informs about the size in bytes of the parameter that is specified by Modbus coil address 1. Could be used to identify the relevant bits of the Modbus coil bit-mask 1	-		Read only
10305	Unsigned / 2	Modbus coil address 2	Specifies the coil address with which the following bit coded register value is accessible. The register and bit(s) are specified by Modbus coil register 2 and Modbus coil bit-mask 2	2	0 - 65535	Read / write
10306	Unsigned / 2	Modbus coil register 2	Specifies the Modbus register whose value is checked against Modbus coil bitmask 2 to determine the coil value (false or true). A register value of 65535 specifies that this coil mapping is undefined.	Undefined		Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] ¹ (units register)	Value range / Setting options	Access level
10307	Unsigned / 4	Modbus coil bit-mask 2	Bit mask which is compared against the register value specified with Modbus coil register 2 to determine the coil value. If any bit of the register value is set which is also set in the bit mask then the coil value is true otherwise false.	0	0 - 4294967295	Read / write
10309	Unsigned / 2	Modbus coil length 2	Output parameter that informs about size in bytes of parameter that is specified by Modbus coil address 2. Could be used to identify the relevant bits of the Modbus coil bitmask 2	-		Read only
...						
10399	Unsigned / 2	Modbus coil length 20	Output parameter that informs about the size in bytes of the parameter that is specified by Modbus coil address 20. Could be used to identify the relevant bits of the Modbus coil bitmask 20	-		Read only

¹ If default value is "-" the command "Set to default" will not set this parameter to default.

A.5 Modbus register mapping

The device provides the possibility to map each existing parameter to a freely chosen Modbus register for communication purposes over channel 1.

The device provides means to remap 20 Modbus registers.

Table A-3 Modbus register mapping

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10448	Unsigned / 4	Enable mapping	Activation/deactivation of the register mapping. A set bit means that the mapping pair is activated, a cleared bit that the mapping pair is de-activated. Bit 0: Requested register 1 / Target register 1 ... Bit 19: Requested register 20 / Target register 20	0	0 - 1048575	Read / write
10450	Unsigned / 2	Register 1 source	Modbus register that appears within Modbus request is redirected to the parameter specified by Target register 1	65535	0 - 65535	Read / write
10451	Unsigned / 2	Register 1 target	Register of an existing product parameter to which a Modbus request is redirected	65535	0 - 65535	Read / write
...						
10488	Unsigned / 2	Register 20 source	Modbus register that appears within Modbus request is redirected to the parameter specified by Target register 20	65535	0 - 65535	Read / write
10489	Unsigned / 2	Register 20 target	Register of an existing product parameter to which a Modbus request is redirected	65535	0 - 65535	Read / write

A.6 Integer byte order

The device is able to adjust the byte order of integer values.

Table A-4 Integer byte order

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8295	Unsigned / 2	Integer order byte	The integer byte order used in Modbus messages. 0: MSB - LSB (big endian) 1: LSB - MSB (little endian) MSB = most significant byte / high byte LSB = least significant byte / low byte	MSB - LSB (big endian)	0 - 1	Read / write

A.7 Float byte order

The device is able to adjust the byte order of floating-point values.

Table A-5 Float byte order

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8296	Unsigned / 2	Float byte order	The float byte order used in Modbus messages. 0: 1-0-3-2 1: 0-1-2-3 2: 2-3-0-1 3: 3-2-1-0 The first mentioned byte is the first byte sent. Byte 3 corresponds to the left-most byte (MSB) of a 32 bit floating point number in big endian format, byte 0 to the right-most byte	3-2-1-0	0 - 3	Read / write

A.8 Modbus function codes

Table A-6 General Modbus settings

Function code	Command text	Description
01	Read Coils	Reads the status of single bit(s)
02	Read Discrete Inputs	Reads the status of single input bit(s)

Function code	Command text	Description
03	Read Holding Registers	Reads the binary content of multiple 16-bit registers
04	Read Input Registers	Reads the binary content of multiple 16-bit registers
05	Write Single Coil	Writes a single on/off bit
06	Write Single Register	Writes the binary content of single 16-bit register
07	Read Exception Status	Delivers the global alarm status of the device
08	Diagnostics	Provides a series of tests for checking the communication system
15	Write Multiple Coils	Writes multiple on/off bits
16	Write Multiple Registers	Writes the binary content of multiple 16-bit registers
17	Report Slave ID	The device will respond to a Report Slave ID command (command 17) request from the master by giving information about device type, vendor, and revision level
23	Read/Write Multiple Registers	Combined Write Multiple Registers / Read Holding Registers call

Function code 7 (Read exception status)

The device provides the content of the parameter Global alarm status as exceptions.

Function code 8 (Diagnostics)

The diagnostics function provides means for checking the communication between MODBUS master and slave. The function uses a sub-function code to select the functionality.

The following sub-function codes are supported:

Sub-function code	Name	Description
0	Return query data	The data passed in the request data field will be returned (looped back) in the response. The entire response message should be identical to the request.
1	Restart communications option	After having restarted the communication, select the baudrate, framing or Modbus address to get access to the device again.

Function code 17 (Report Slave ID)

The transmitter will respond to a Report Slave ID request from the master by giving information about device type, vendor, and firmware version in a format as shown:

Response

Slave address	1 byte	
Function code	1 byte	17
Byte count	1 byte	62
Slave ID	1 byte	Sensor device type 0: SITRANS FS
Run indicator	1 byte	255: Running
Manufacturer name	12 bytes	SIEMENS
Product name	32 bytes	SITRANS F
Product firmware version	16 bytes	-
CRC	2 bytes	

A.9 Access control

Access control manages whether the Modbus master is allowed to modify device parameters. Reading of parameters is always possible. The general access control rules are:

- The Modbus interface has an access level that can be changed by providing PIN information via the Modbus register 8292 (User PIN) or 8293 (Expert PIN).
- The default fieldbus access level can be set using Modbus register 6348, with the following possible values:
 - 32: End User Privilege
 - 16: Restricted User Privilege
- Each parameter has a protection level assigned that specifies the required access level to modify the parameter via the Modbus interface.
- If the access level of the Modbus interface is lower than the protection level of the parameter that is desired to be modified, then the attempt to modify the parameter is rejected by the device.

If the device is defined as a custody transfer (CT) device and the CT write protection DIP switch is ON (locked), the device will deny all writes to CT parameters independent of the access control.

Table A-7 Access control

Access level	Description
Read only	The Modbus master is not able to modify the device configuration (setup parameters). The Modbus master is only able to execute the command, to reset PINs. This is the default level of the Modbus interface.
User	The Modbus master has to provide the correct user PIN with Modbus register 8292 to reach this access level. The Modbus master is able to modify a subset of the device configuration.
Expert	The Modbus master has to provide the correct expert PIN with Modbus register 8293 to reach this access level. The Modbus master is able to modify the configuration of the device.

If an incorrect user PIN or an incorrect expert PIN is entered, or if the device does not receive any request within 10 minutes, the device resets the access level to read only.

A.10 Modbus holding registers tables

In the following the Modbus RTU holding registers available for SITRANS FS230 are described.

Note

All Write parameters require password access.

Note

In case of error message "Check if the device is set to CT or SIL Operation mode", please check for the following root causes:

- The device is set to CT mode
- The device is set to SIL mode
- The used Modbus register address is wrong

A.10.1 Process values

Table A-8 Process values for standard applications

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
3000	Float / 4	Volume flow	Measured volume flow	- [m³/s] (7500)	-	Read only
3004	Float / 4	Mass flow	Measured mass flow	- [kg/s] (7400)	-	Read only
3008	Float / 4	Flow velocity	Measured liquid flow velocity	0.0 [m/s] (8014)	-	Read only
3006	Float / 4	Sound velocity	Measured fluid sound speed	1500.0 [m/s] (7648)	-	Read only
3040	Float / 4	Density	Liquid density	0.0 [kg/m³] (7600)	-	Read only
3044	Float / 4	Pressure	Process pressure	- [Pa] (7548)	-	Read only
3046	Float / 4	Kinematic viscosity	Liquid viscosity	- [m²/s] (7524)	-	Read only
3042	Float / 4	Medium temperature	Measured medium temperature	- [°C] (7700)	-	Read only

Table A-9 Additional process values for hydrocarbon applications

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7533	Float / 4	Standard volume flow	Measured standard volume flow rate	- [Sm ³ /h] (7964)	-	Read only
3070	Float / 4	Standardizing factor	Measured standardizing factor	-	-	Read only
3054	Float / 4	Standard kinematic viscosity	Measured standard kinematic viscosity	- [m ² /s] (7524)	-	Read only
3056	Float / 4	Standard density	Measured standard density	- [kg/m ³] (7600)	-	Read only
3058	Float / 4	Liquident	Measured liquident	- [m/s]	-	Read only
3060	Float / 4	API gravity	Measured API gravity	- [°API]	-	Read only
3062	Float / 4	Base API gravity	Measured base API gravity	- [°API]	-	Read only
3066	Float / 4	Base specific gravity	Measured base specific gravity	- [SGU]	-	Read only
3068	Float / 4	ROC	Rate of change	- [m/s ²] (8564)	-	Read only
3150	Unsigned / 2	Liquid identifier	Liquid identifier	-	-	Read only

Table A-10 Additional process values for gas applications

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
3010	Float / 4	Standard volume flow	Measured standard volume flow rate	- [Sm ³ /h] (7964)	-	Read only
3070	Float / 4	Standardizing factor	Measured standardizing factor	-	-	Read only
3056	Float / 4	Base density	Measured base density	- [kg/m ³] (7600)	-	Read only

A.10 Modbus holding registers tables

Table A-11 IO values

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8803	Float / 4	Loop current CH2	Calculated current at output channel 2	- [mA]		Read only
8900	Float / 4	Output frequency CH2	Calculated frequency at output channel 2	- [Hz]		Read only
8969	Float / 4	Amount on CH2	Current totalized amount according to pulse output channel 2	- (Mass: 7400 / Volume: 7500 / Standard Volume: 7964)		Read only
8840	Unsigned / 2	Status output CH2	Calculated status at output channel 2	-	0 - 1	Read only
9103	Float / 4	Loop current CH3	Calculated current at output channel 3	- [mA]		Read only
9200	Float / 4	Output frequency CH3	Calculated frequency at output channel 3	- [Hz]		Read only
9269	Float / 4	Amount on CH3	Current totalized amount according to pulse output channel 3	- (Mass: 7400 / Volume: 7500 / Standard Volume: 7964)		Read only
9140	Unsigned / 2	Status output CH3	Calculated status at output channel 3	-	0 - 1	Read only
10503	Float / 4	Input current CH3	Measured current at input channel 3	- [mA]		Read only
9129	Unsigned / 2	Digital input signal CH3	Detected logical level at channel 3	-	0 - 1	Read only
9303	Float / 4	Loop current CH4	Calculated current at output channel 3	- [mA]		Read only
9400	Float / 4	Output frequency CH4	Calculated frequency at output channel 4	- [Hz]		Read only
9469	Float / 4	Amount on CH4	Current totalized amount according to pulse output channel 4	- (Mass: 7400 / Volume: 7500 / Standard Volume: 7964)		Read only
9340	Unsigned / 2	Status output CH4	Calculated status at output channel 4	-	0 - 1	Read only
10603	Float / 4	Input current CH4	Measured current at input channel 4	- [mA]		Read only
9329	Unsigned / 2	Digital input signal CH4	Detected logical level at channel 4	-	0 - 1	Read only

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
3072	Float / 4	Input current CH5	Measured current input value on channel 5	- [mA]	-	Read only
3074	Float / 4	Input current CH6	Measured current input value on channel 6	- [mA]	-	Read only

A.10.2 Totalizers

Table A-12 Totalizers

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8300	Float / 4	Totalizer 1 value	Totalized value of totalizer 1. Units depends on the selected process value the totalizer is configured to. Write access if Totalizer 1 target mode is set to 16: Manual	- (8321 / 8320 / 8322)	-	Read / write
8303	Unsigned / 2	Totalizer 1 set	Run, reset, or preset totalizer 1.	0	0: Totalize 1: Reset 2: Preset to Totalizer 1 preset value	Read / write
8304	Unsigned / 2	Totalizer 1 direction	Totalizer 1 direction.	1	0: Balanced 1: Positive 2: Negative 3: Hold	Read / write
8316	Float / 4	Totalizer 1 preset value	Preset value which will be used when Totalizer 1 set is set to 2	- (8321 / 8320 / 8322)	-	Read / write
8319	Unsigned / 2	Totalizer 1 target mode	Sets the desired mode for the totalizer.	8	8: Auto, the totalizer algorithm running 16: Man, the totalizer algorithm is stopped. The totalizer value can be written	Read / write
8400	Float / 4	Totalizer 2 value	Totalized value of totalizer 2. Units depends on the selected process value the totalizer is configured to. Write access if Totalizer 2 target mode is set to 16: Manual	- (8321 / 8320 / 8322)	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8403	Unsigned / 2	Totalizer 2 set	Run, reset, or preset totalizer 2. Possible selections:	0	0: Totalize 1: Reset 2: Preset to Totalizer 1 preset value	Read / write
8404	Unsigned / 2	Totalizer 2 direction	Totalizer 2 direction.	1	0: Balanced 1: Positive 2: Negative 3: Hold	Read / write
8416	Float / 4	Totalizer 2 preset value	Preset value which will be used when Totalizer 2 set is set to 2	- (8321 / 8320 / 8322)	-	Read / write
8419	Unsigned / 2	Totalizer 2 target mode	Sets the desired mode for the totalizer.	8	8: Auto, the totalizer algorithm running 16: Man, the totalizer algorithm is stopped. The totalizer value can be written	Read / write
8500	Float / 4	Totalizer 3 value	Totalized value of totalizer 3. Units depends on the selected process value the totalizer is configured to. Write access if Totalizer 3 target mode is set to 16: Manual	- (8321 / 8320 / 8322)	-	Read / write
8503	Unsigned / 2	Totalizer 3 set	Run, reset, or preset totalizer 3.	0	0: Totalize 1: Reset 2: Preset to Totalizer 1 preset value	Read / write
8504	Unsigned / 2	Totalizer 3 direction	Totalizer 3 direction.	1	0: Balanced 1: Positive 2: Negative 3: Hold	Read / write
8516	Float / 4	Totalizer 3 preset value	Preset value which will be used when Totalizer 3 set is set to 2	- (8321 / 8320 / 8322)	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8519	Unsigned / 2	Totalizer 3 target mode	Sets the desired mode for the totalizer	8	8: Auto, the totalizer algorithm running 16: Man, the totalizer algorithm is stopped. The totalizer value can be written	Read / write
8549	Unsigned / 2	Reset all totalizers	Reset command for totalizers 1 to 3.	0	0: Run 1: Reset all totalizers 11: Reset totalizer 1 12: Reset totalizer 2 13: Reset totalizer 3	Write only

A.10.3 Units

Table A-13 Units settings for values and quantities communicated via Modbus

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7500	Unsigned / 2	Volume flow units	Units for volume flow values.	19	15: ft³/min (cubic feet per minute) 16: gal/min (US gallons per minute) 17: l/min (liters per minute) 18: i.gal/min (Imperial gallons per minute) 19: m³/h (cubic meters per hour) 22: gal/s (US gallons per second) 23: Mgal/d (million US gallons per day) 24: l/s (liters per second) 25: Ml/d (million liters per day) 26: ft³/s (cubic feet per second) 27: ft³/d (cubic feet per day) 28: m³/s (cubic meters per second) 29: m³/d (cubic meters per day) 30: i.gal/h (Imperial gallons per hour) 31: i.gal/d (Imperial gallons per day) 130: ft³/h (cubic feet per hour) 131: m³/min (cubic meters per minute) 132: BBL42/s (1 barrel = 42 US gallons) 133: BBL42/min (1 barrel = 42 US gallons) 134: BBL42/h (1 barrel = 42 US gallons) 135: BBL42/d (1 barrel = 42 US gallons) 136: gal/h (US gallons per hour) 137: i.gal/s (Imperial gallons per second) 138: l/h (liters per hour) 170: BBL31/s (1 barrel = 31 US gallons)	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
					171: BBL31/min (1 barrel = 31 US gallons) 172: BBL31/h (1 barrel = 31 US gallons) 173: beer barrel per day 235: gal/d (US gallons per day) 253: custom units (see Custom volume flow units string (8470) / factor (8468))	
7400	Unsigned / 2	Mass flow units	Units for mass flow values.	75	70: g/s (grams per second) 71: g/min (grams per min) 72: g/h (grams per hour) 73: kg/s (kilograms per second) 74: kg/min (kilograms per minute) 75: kg/h (kilograms per hour) 76: kg/d (kilograms per day) 77: t/min (1 t = 1000 kg) 78: t/h (1 t = 1000 kg) 79: t/d (1 t = 1000 kg) 80: lb/s (pounds per second) 81: lb/min (pounds per minute) 82: lb/h (pounds per hour) 83: lb/d (pounds per day) 84: STon/min (1 STon = 2000 lb) 85: STon/h (1 STon = 2000 lb) 86: STon/d (1 STon = 2000 lb) 87: T/h (1 T = 2240 lb) 88: T/d (1 T = 2240 lb) 253: custom units (see Custom mass flow units string (8458) / factor (8456))	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7964	Unsigned / 2	Standard volume flow units	Units for standard volume flow values.	188	• 121: Nm³/h (normal cubic meters per hour) • 122: NI/h (normal liters per hour) • 123: Sft³/min (standard cubic feet per minute) • 174: NI/d (normal liters per day) • 175: NI/min (normal liters per minute) • 176: NI/s (normal liters per second) • 177: SI/d (standard liters per day) • 178: SI/h (standard liters per hour) • 179: SI/min (standard liters per minute) • 180: SI/s (standard liters per second) • 181: Nm³/d (normal cubic meters per day) • 182: Nm³/min (normal cubic meters per minute) • 183: Nm³/s (normal cubic meters per second) • 184: Sft³/d (standard cubic feet per day) • 185: Sft³/h (standard cubic feet per hour) • 186: Sft³/s (standard cubic feet per second) • 187: Sm³/d (standard cubic meters per day) • 188: Sm³/h (standard cubic meters per hour) • 189: Sm³/min (standard cubic meters per minute) • 190: Sm³/s (standard cubic meters per second) • 253: custom units (see Custom standard volume flow units string (7518) / factor (7516))	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8014	Unsigned / 2	Flow velocity units	Units for flow velocity values.	21	20: ft/s (feet per second) 21: m/s (meters per second) 114: in/s (inches per second) 115: in/min (inches per minute) 116: ft/min (feet per minute) 120: m/h (meters per hour) 253: custom units (see Custom velocity units string (8494) / factor (8492))	Read / write
7648	Unsigned / 2	Sound velocity units	Units for sound velocity values.	21	20: ft/s (feet per second) 21: m/s (meters per second) 114: in/s (inches per second) 115: in/min (inches per minute) 116: ft/min (feet per minute) 120: m/h (meters per hour) 253: custom units (see Custom velocity units string (8494) / factor (8492))	Read / write
7600	Unsigned / 2	Density units	Units for density values.	92	91: g/cm³ (grams per cubic centimeters) 92: kg/m³ (kilograms per cubic meter) 93: lb/gal (pounds per US gallon) 94: lb/ft³ (pounds per cubic foot) 95: g/ml (grams per milliliter) 96: kg/l (kilograms per liter) 97: g/l (grams per liter) 98: lb/in³ (pounds per cubic inch) 99: STon/yd³ (1 STon = 2000 lb) 146: µg/l (micrograms per liter) 147: µg/m³ (micrograms per cubic meter) 170: mg/l (milligrams per liter) 253: custom units (see Custom density units string (8464) / factor (8462))	Read / write
7524	Unsigned / 2	Viscosity units	Units for viscosity values.	54	54: cSt (centistokes, 1 cSt = 1 mm²/s)	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8015	Unsigned / 2	Pressure units	Units for pressure values.	11	• 1: inH₂O (inches of water at 68 °F) • 2: inHg (inches of mercury at 0 °C) • 3: ftH₂O (feet of water at 68 °F) • 4: mmH₂O (millimeters of water at 68 °F) • 5: mmHg (millimeters of mercury at 0 °C) • 6: psi (pounds per square inch) • 7: bar • 8: mbar • 9: gf/cm² (grams force per square cm) • 10: kgf/cm² (kilogram force per square cm) • 11: Pa (pascal) • 12: kPa (kilopascal) • 13: torr • 14: atm (atmosphere) • 170: cmH₂O (centimeters of water at 4 °C) • 171: mH₂O (meters of water at 4 °C) • 172: cmHg (centimeters of mercury at 0 °C) • 173: lb/ft² (pounds per square foot) • 174: hPa (hectopascal) • 176: kg/m² (kilograms per square meter) • 177: ftH₂O (feet water at 4 °C) • 178: ftH₂O (feet water at 60 °F) • 179: mHg (meters of mercury at 0 °C) • 237: MPa (Megapascal) • 238: in ftH₂O (inches of water at 4 °C) • 239: mmH₂O (millimeters of water at 4 °C)	Read / write
7700	Unsigned / 2	Temperature units	Units for temperature values.	32	• 32: °C (degrees Celsius) • 33: °F (degrees Fahrenheit) • 34: °R (degrees Rankine) • 35: K (kelvins)	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8556	Unsigned / 2	Length units	Units for length values.	45	44: ft (feet) 45: m (meters) 47: in (inches) 48: cm (centimeters) 49: mm (millimeters)	Read / write
8564	Unsigned / 2	Acceleration units	Units for acceleration values.	172	171: ft/s² (feet per second squared) 172: m/s² (meters per second squared)	Read / write
8321	Unsigned / 2	Totalizer 1 units	Units for volume quantities of totalizer 1 (totalizer 1 is configured to volume flow).	41	40: US gallons 41: l (liters) 42: i.gal (Imperial gallons) 43: m³ (cubic meters) 46: BBL42 (1 barrel = 42 US gallons) 110: bush (bushels) 111: yd³ (cubic yards) 112: ft³ (cubic feet) 113: in³ (cubic inches) 124: BBL31.5 (1 barrel = 31.5 US gallons) 170: BBL31 (1 barrel = 31 US gallons) 236: hl (hectoliters) 253: custom units (see Custom volume units string (8452) / factor (8450))	Read / write
8320	Unsigned / 2	Totalizer 1 units	Units for mass quantities of totalizer 1 (totalizer 1 is configured to mass flow).	61	60: g (grams) 61: kg (kilograms) 62: t (1 t = 1000 kg) 63: lb (pounds) 64: STon (1 STon = 2000 lb) 65: T (1 T = 2240 lb) 125: oz (ounces) 253: custom units (see Custom mass units string (8476) / factor (8474))	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8322	Unsigned / 2	Totalizer 1 units	Units for standard volume quantities of totalizer 1 (totalizer 1 is configured to standard volume flow).	171	• 166: Nm³ (normal cubic meters) • 167: NI (normal liters) • 168: Sft³ (standard cubic feet) • 171: SI (standard liters) • 172: Sm³ (standard cubic meters)	Read / write
8421	Unsigned / 2	Totalizer 2 units	Units for volume quantities of totalizer 2 (totalizer 2 is configured to volume flow).	41	• 40: US gallons • 41: l (liters) • 42: i.gal (Imperial gallons) • 43: m³ (cubic meters) • 46: BBL42 (1 barrel = 42 US gallons) • 110: bush (bushels) • 111: yd³ (cubic yards) • 112: ft³ (cubic feet) • 113: in³ (cubic inches) • 124: BBL31.5 (1 barrel = 31.5 US gallons) • 170: BBL31 (1 barrel = 31 US gallons) • 236: hl (hectoliters) • 253: custom units (see Custom volume units string (8452) / factor (8450))	Read / write
8420	Unsigned / 2	Totalizer 2 units	Units for mass quantities of totalizer 2 (totalizer 2 is configured to mass flow).	61	• 60: g (grams) • 61: kg (kilograms) • 62: t (1 t = 1000 kg) • 63: lb (pounds) • 64: STon (1 STon = 2000 lb) • 65: T (1 T = 2240 lb) • 125: oz (ounces) • 253: custom units (see Custom mass units string (8476) / factor (8474))	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8422	Unsigned / 2	Totalizer 2 units	Units for standard volume quantities of totalizer 2 (totalizer 2 is configured to standard volume flow).	171	• 166: Nm³ (normal cubic meters) • 167: NI (normal liters) • 168: Sft³ (standard cubic feet) • 171: SI (standard liters) • 172: Sm³ (standard cubic meters)	Read / write
8521	Unsigned / 2	Totalizer 3 units	Units for volume quantities of totalizer 3 (totalizer 3 is configured to volume flow).	41	• 40: US gallons • 41: l (liters) • 42: i.gal (Imperial gallons) • 43: m³ (cubic meters) • 46: BBL42 (1 barrel = 42 US gallons) • 110: bush (bushels) • 111: yd³ (cubic yards) • 112: ft³ (cubic feet) • 113: in³ (cubic inches) • 124: BBL31.5 (1 barrel = 31.5 US gallons) • 170: BBL31 (1 barrel = 31 US gallons) • 236: hl (hectoliters) • 253: custom units (see Custom volume units string (8452) / factor (8450))	Read / write
8520	Unsigned / 2	Totalizer 3 units	Units for mass quantities of totalizer 3 (totalizer 3 is configured to mass flow).	61	• 60: g (grams) • 61: kg (kilograms) • 62: t (1 t = 1000 kg) • 63: lb (pounds) • 64: STon (1 STon = 2000 lb) • 65: T (1 T = 2240 lb) • 125: oz (ounces) • 253: custom units (see Custom mass units string (8476) / factor (8474))	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8522	Unsigned / 2	Totalizer 3 units	Units for standard volume quantities of totalizer 3 (totalizer 3 is configured to standard volume flow).	171	• 166: Nm³ (normal cubic meters) • 167: NI (normal liters) • 168: Sft³ (standard cubic feet) • 171: SI (standard liters) • 172: Sm³ (standard cubic meters)	Read / write
8976	Unsigned / 2	Pulse width units CH2	Units of pulse duration values of CH2 in pulse mode.	51	• 51: s (seconds)	Read / write
8993	Unsigned / 2	Volume units CH2	Units for volume quantities related to CH2 if in pulse mode.	41	• 40: US gallons • 41: l (liters) • 42: i.gal (Imperial gallons) • 43: m³ (cubic meters) • 46: BBL42 (1 barrel = 42 US gallons) • 110: bush (bushels) • 111: yd³ (cubic yards) • 112: ft³ (cubic feet) • 113: in³ (cubic inches) • 124: BBL31.5 (1 barrel = 31.5 US gallons) • 170: BBL31 (1 barrel = 31 US gallons) • 236: hl (hectoliters) • 253: custom units (see Custom volume units string (8452) / factor (8450))	Read / write
8992	Unsigned / 2	Mass units CH2	Units for mass quantities related to CH2 if in pulse mode.	61	• 60: g (grams) • 61: kg (kilograms) • 62: t (1 t = 1000 kg) • 63: lb (pounds) • 64: STon (1 STon = 2000 lb) • 65: T (1 T = 2240 lb) • 125: oz (ounces) • 253: custom units (see Custom mass units string (8476) / factor (8474))	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8994	Unsigned / 2	Standard volume units CH2	Units for standard volume quantities related to CH2.	171	166: Nm³ (normal cubic meters) 167: NI (normal liters) 168: Sft³ (standard cubic feet) 171: SI (standard liters) 172: Sm³ (standard cubic meters)	Read / write
9276	Unsigned / 2	Pulse width units CH3	Units of pulse duration of CHh3 in pulse mode.	51	51: s (seconds)	Read / write
9293	Unsigned / 2	Volume units CH3	Units for volume quantities related to CH3 if in pulse mode.	41	40: US gallons 41: l (liters) 42: i.gal (Imperial gallons) 43: m³ (cubic meters) 46: BBL42 (1 barrel = 42 US gallons) 110: bush (bushels) 111: yd³ (cubic yards) 112: ft³ (cubic feet) 113: in³ (cubic inches) 124: BBL31.5 (1 barrel = 31.5 US gallons) 170: BBL31 (1 barrel = 31 US gallons) 236: hl (hectoliters) 253: custom units (see Custom volume units string (8452) / factor (8450))	Read / write
9292	Unsigned / 2	Mass units CH3	Units for mass quantities related to CH3 if in pulse mode.	61	60: g (grams) 61: kg (kilograms) 62: t (1 t = 1000 kg) 63: lb (pounds) 64: STon (1 STon = 2000 lb) 65: T (1 T = 2240 lb) 125: oz (ounces) 253: custom units (see Custom mass units string (8476) / factor (8474))	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9294	Unsigned / 2	Standard volume units CH3	Units for standard volume quantities related to CH3.	171	• 166: Nm³ (normal cubic meters) • 167: NI (normal liters) • 168: Sft³ (standard cubic feet) • 171: SI (standard liters) 172: Sm³ (standard cubic meters)	Read / write
9476	Unsigned / 2	Pulse width units CH4	Units of pulse duration values of CH4 in pulse mode.	51	• 51: s (seconds)	Read / write
9493	Unsigned / 2	Volume units CH4	Units for volume quantities related to CH4 if in pulse mode.	41	• 40: US gallons • 41: l (liters) • 42: i.gal (Imperial gallons) • 43: m³ (cubic meters) • 46: BBL42 (1 barrel = 42 US gallons) • 110: bush (bushels) • 111: yd³ (cubic yards) • 112: ft³ (cubic feet) • 113: in³ (cubic inches) • 124: BBL31.5 (1 barrel = 31.5 US gallons) • 170: BBL31 (1 barrel = 31 US gallons) • 236: hl (hectoliters) • 253: custom units (see Custom volume units string (8452) / factor (8450))	Read / write
9492	Unsigned / 2	Mass units CH4	Units for mass quantities related to CH4 if in pulse mode.	61	• 60: g (grams) • 61: kg (kilograms) • 62: t (1 t = 1000 kg) • 63: lb (pounds) • 64: STon (1 STon = 2000 lb) • 65: T (1 T = 2240 lb) • 125: oz (ounces) • 253: custom units (see Custom mass units string (8476) / factor (8474))	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9494	Unsigned / 2	Standard volume units CH4	Units for standard volume quantities related to CH4.	171	• 166: Nm³ (normal cubic meters) • 167: NI (normal liters) • 168: Sft³ (standard cubic feet) • 171: SI (standard liters) 172: Sm³ (standard cubic meters)	Read / write
8470	String / 8	Custom volume flow units string	User specific string for volume flow values.	-----	-	Read / write
8468	Float / 4	Custom volume flow units factor	Conversion factor for user specific volume flow values related to m ³ /s.	1.0	-	Read / write
7518	String / 8	Custom standard volume flow units string	User specific string for standard volume flow values.	-----	-	Read / write
7516	Float / 4	Custom standard volume flow units factor	Conversion factor for user specific standard volume flow values related to Sm ³ /s.	1.0	-	Read / write
8458	String / 8	Custom mass flow units string	User specific string for mass flow values.	-----	-	Read / write
8456	Float / 4	Custom mass flow units factor	Conversion factor for user specific mass flow values related to kg/s.	1.0	-	Read / write
8464	String / 8	Custom density units string	User specific string for density values.	-----	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8462	Float / 4	Custom density units factor	Conversion factor for user specific density values related to kg/m ³ .	1.0	-	Read / write
8494	String / 8	Custom velocity units string	User specific string for velocity values.	-----	-	Read / write
8492	Float / 4	Custom velocity units factor	Conversion factor for user specific velocity values related to m/s.	1.0	-	Read / write
8452	String / 8	Custom volume units string	User specific string for volume quantities.	-----	-	Read / write
8450	Float / 4	Custom volume units factor	Conversion factor for user specific volume quantities related to m ³ .	1.0	-	Read / write
8476	String / 8	Custom mass units string	User specific string for mass quantities.	-----	-	Read / write
8474	Float / 4	Custom mass units factor	Conversion factor for user specific mass quantities related to kg.	1.0	-	Read / write

A.10.4 Setup

A.10.4.1 Sensor

Sensor settings

Table A-14 General sensor settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1801	Unsigned / 2	Flow direction	Define positive and negative flow direction. Default positive flow direction is indicated by an arrow on the sensor.	1	0: Negative: The flow is measured '+' in default negative direction and '-' in default positive direction. 1: Positive: The flow is measured '+' in default positive direction and '-' in default negative direction.	Read / write

Pipe settings for FSS200

Table A-15 Pipe settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1200	Float / 4	Outer pipe diameter	External pipe diameter.	0.1 [m] (8556)	0.006 - 10.0	Read / write
1202	Float / 4	Wall thickness	Pipe wall thickness.	0.001 [m] (8556)	1.0E-6 - 0.5	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1226	Unsigned / 2	Pipe material	Pipe material.		• 0: Unspecified • 1: Custom • 2: Carbon steel • 3: Stainless steel • 4: ABS plastic • 5: Aluminum • 6: Black iron • 7: Brass • 8: Case iron • 9: Copper nickel 70/30 • 10: Copper nickel 90/10 • 11: Copper • 12: Ductile iron • 13: FRP plastic • 14: Glass • 15: Hastelloy • 16: Inconel • 17: Kynar plastic • 18: Monel • 19: Nickel • 20: Polyethylene • 21: PVC plastic • 22: Teflon • 23: Titanium	Read / write
1204	Float / 4	Wall sound velocity	Pipe wall material sound velocity. Use the shear velocity for metallic pipes. Use the longitudinal velocity for plastic pipes.	3000.0 [m/s] (7648)	200.0 - 4000.0	Read / write
1208	Float / 4	Liner thickness	Pipe liner thickness.	0.0 [m] (8556)	0.0 - 0.5	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1227	Unsigned / 2	Liner material	Liner material.		0: Not applicable 1: Custom 2: Cement 3: Coal tar 4: Enamel 5: Glass 6 Plastic 7: Hi_dens_Poly 8: PTFE 9: Rubber	Read / write
1210	Float / 4	Liner sound velocity	Liner material sound velocity.	2000.0 [m/s] (7648)	200.0 - 4000.0	Read / write
1214	Float / 4	Inner pipe roughness	Roughness of inner pipe/liner material.	0.0001 [m] (8556)	0.0 - 0.01	Read / write
1216	Float / 4	Inner pipe diameter	Calculated inner diameter of pipe.	- [m] (8556)	-	Read only
1715	Float / 4	Calibration reference temperature	Setup parameter for specifying the process medium temperature at which the flow calibration of the meter is performed. The value is used for compensation of pipe expansion due to temperature.	20.0 [°C] (7700)	-50.0 - +250.0	Read / write
1717	Float / 4	Pipe thermal expansion	Setup parameter for specifying the thermal expansion coefficient of the pipe material. The value is used for compensation of pipe expansion due to temperature.	0 [1/K]	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1719	Float / 4	Calibration reference pressure	Setup parameter for specifying the process pressure at which the flow calibration of the meter is performed. The value is used for compensation of pipe expansion due to pressure.	700000.0 [Pa] (8015)	0.0 - 100000000.0	Read / write
1721	Float / 4	Pipe modulus elasticity	Setup parameter for specifying the pipe material modulus of expansion. The value is used for compensation of pipe expansion due to pressure.	200.0E+9 [Pa] (8015)	1.0E+6 - 1.0E+12	Read / write

Upstream and downstream conditions

Table A-16 Upstream and downstream conditions

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1220	Unsigned / 2	Upstream pipe geometry	Compensation for upstream pipe geometry.	0	• 0: Straight run • 1: Single elbow • 2: Double elbow (in-plane) • 3: Double elbow (out-of-plane) • 4: Reducer • 5: Expansion	Read / write
1221	Unsigned / 2	Upstream distance	The distance to the upstream flow disturbance in multiples of inner pipe diameter.	0	0 - 40	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1223	Unsigned / 2	Downstream pipe geometry	Compensation for downstream pipe geometry.	0	0: Straight run 1: Single elbow 2: Double elbow (in-plane) 3: Double elbow (out-of-plane) 4: Reducer 5: Expansion	Read / write
1224	Unsigned / 2	Downstream distance	The distance to the downstream flow disturbance in multiples of inner pipe diameter.	0	0 - 40	Read / write

Process medium characteristics

Table A-17 Process medium characteristics

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1825	Float / 4	Expected sound velocity	Expected sound velocity in the medium at medium temperature.	1500.0 [m/s] (7648)	100.0 - 2500.0	Read / write
1701	Float / 4	Fixed medium temperature	Fixed medium temperature value used for compensation.	20 [°C] (7700)	-273 - 400	Read / write
1703	Float / 4	Fixed process pressure	Fixed process pressure value used for compensation.	700000.0 [Pa] (8015)	0.0 - 1E+8	Read / write
1705	Float / 4	Fixed process viscosity	Fixed process viscosity value used for compensation.	0.000001 [m ² /s] (7524)	0.0 - 5000.0	Read / write
1707	Float / 4	Fixed process density	Fixed process density used for compensation.	1000.0 [kg/m ³] (7600)	0.0 - 2000.0	Read / write
1735	Float / 4	Reference dynamic viscosity	Dynamic viscosity of the gas. The kinematic viscosity is calculated based on this value and the inferred gas density.	0.00001 [Pa]	0.1 - 5.0 [Pa]	Read / write

Sensor settings (clamp-on)

Table A-18 Sensor settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1324	Unsigned / 2	Sensor model	Installed sensor model (for multi-path all must be the same).	2	• 0: None • 1: 1011 High precision • 2: 1011 Universal • 3: 991 Universal (High temperature) • 4: Custom clamp-on (Lamb wave) • 5: Custom clamp-on (Shear wave)	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1327	Unsigned / 2	Clamp-on sensor model	Installed sensor size.	20	0: None selected / Custom sensor 1: A1H (High precision) 2: A2H (High precision) 3: A3H (High precision) 4: B1H (High precision) 5: B2H (High precision) 6: B3H (High precision) 7: C1H (High precision) 8: C2H (High precision) 9: D1H (High precision) 10: D2H (High precision) 11: D3H (High precision) 12: D4H (High precision) 13: A1 (Universal) 14: A2 (Universal) 15: B1 (Universal) 16: B2 (Universal) 17: B3 (Universal) 18: C1 (Universal) 19: C2 (Universal) 20: C3 (Universal) 21: D1 (Universal) 22: D2 (Universal) 23: D3 (Universal) 24: E1 (Universal) 25: E2 (Universal) 26: E3 (Universal) 27: 1 (High temperature) 28: 2 (High temperature) 29: 2A (High temperature) 30: 3 (High temperature) 31: 3A (High temperature) 32: 4 (High temperature) 33: 4A (High temperature)	Read / write
1312	Float / 4	Sensor crystal projection	Length of the crystal projection onto the emitting surface of the sensor.	0.03409 [m] (8556)	0.0 - 3.0	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1314	Float / 4	Sensor phase velocity	The velocity at which the wave fronts traverse the interface between the wedge and the pipe.	3695.5 [m/s] (7648)	2000.0 - 10000.0	Read / write
1316	Float / 4	Sensor inactive wedge	The part of the wedge that is not part of the sound path.	0.00076 [m] (8556)	0.0 - 0.05	Read / write
1318	Float / 4	Sensor fixed time	Fixed time in sensor wedge.	10.61E-6 [s]	2.0E-6 - 200.0E-6	Read / write
1320	Float / 4	Mounting hole offset	Distance between spacer hole and sensor front face.	0.00953 [m] (8556)	0.0 - 0.05	Read / write
1322	Unsigned / 2	Pipe travel time	Designated multiplier on the crystal projection value used in formula for calculating pipe travel.	0	0 - 200	Read / write
1711	Float / 4	Temperature compensation factor	Sensor temperature compensation slope factor.	0.00063761 [1/K]	0.0001 - 0.0009	Read / write
1713	Unsigned / 2	Reference temperature	Sensor reference (nominal) temperature.	0	• 0: 21 °C • 1: 60 °C • 2: 93 °C	Read / write

General path settings

Table A-19 General path settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1400	Unsigned / 2	Installed paths	Bit encoded value containing installed paths for clamp-on systems.	0	• Bit 0: Path 1 installed • Bit 1: Path 2 installed • Bit 2: Path 3 installed • Bit 3: Path 4 installed	Read / write
1402	Unsigned / 2	Pre amp selection	Enable or disable pre-amplifiers on all paths.	0	• 0: Based on register 1300 Sensor type (on for clamp-on) • 1: Off • 2: On • 3: Half TX signal amplitude	Read / write
1403	Unsigned / 2	Tx wave periods	Number of transmit periods in TX signal	5	1 - 10	Read / write
1407	Float / 4	Minimum ringdown delay	Minimum ringdown delay. Dynamically calculated ringdown values below this value it will be set to the next higher ringdown echo value.	0.002 [s]	0.0 - 0.01	Read / write
1411	Float / 4	Cable length	Length of the used sensor cables (One way). Used for calculating and compensating the time delay in the cables.	0.0 [m] (8556)	0.0 - 20.0	Read / write
1441	Unsigned / 2	Perform frequency search	Command to perform a frequency sweep on a path.	0	• 0: Frequency sweep done / not running • 1: Perform frequency sweep on path 1 • 2: Perform frequency sweep on path 2 • 3: Perform frequency sweep on path 3 • 4: Perform frequency sweep on path 4	Read / write

Sensor spacing

Table A-20 Sensor spacing settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1426	Unsigned / 2	Recommended space method	Recommended spacing method between clamp-on sensors for path X. Calculated on request.	-	0: None (default) 1: Track 1012TN 2: Track 1012TNH 3: Track 992 4: Spacer bar 1012BN 5: Manual 6: Spacing Error	Read only
1420	Unsigned / 2	Clamp-on recommended spacing path X	The path the current recommended spacing values were calculated for. 0 means not calculated since power up.	0	0 - 255	Read only
1421	Float / 4	Clamp-on recommended spacing ideal	Recommended ideal spacing distance (LTN) between clamp-on sensors for path X. Calculated on request.	0.0 [m] (8556)	-	Read only
1423	Float / 4	Recommended spacing	Recommended spacing distance (LTN corresponding to recommended spacing index) between clamp-on sensors for path X. Calculated on request.	0.0 [m] (8556)	-	Read only
1425	Unsigned / 2	Recommended spacing (index)	Recommended spacing index between clamp-on sensors for path X for the given spacing method. Calculated on request.	0	0 to 255	Read only
1442	Unsigned / 2	Calculate spacing	Command to calculate recommended spacing distance, recommended spacing method and recommended spacing index for a given path.	0	0: Calculation done / not running 1: Perform calculation on path 1 2: Perform calculation on path 2 3: Perform calculation on Path 3 4: Perform calculation on path 4	Read / write

Path 1 settings

Table A-21 Path 1 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1450	Float / 4	Sensor frequency	Desired sensor frequency for path 1.	1100000 [Hz]	80000.0 - 4000000.0	Read / write
1458	Unsigned / 2	Path geometry	The number of crossings the signal makes through the pipe (Reflect or direct geometry for path 1). E.g.: Z path = 1 V path = 2 W path = 4	1	1 - 10	Read / write
1465	Float / 4	Clamp-on spacing	Spacing (LTN) between clamp-on sensors for path 1.	0.0 [m] (8556)	-100.0 - 100.0	Read / write
1459	Float / 4	Path weight	Fixed weighting factor associated with path 1. For clamp-on systems the installed paths weightings should be identical but not zero. For inline systems the sum of the installed paths weightings should be 1.0.	1.0	0.01 - 2.0	Read / write (Expert)

Path 2 settings

Table A-22 Path 2 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1500	Float / 4	Sensor frequency	Desired sensor frequency for path 2.	1100000 [Hz]	80000.0 - 4000000.0	Read / write
1508	Unsigned / 2	Path geometry	The number of crossings the signal makes through the pipe (Reflect or direct geometry for path 2). E.g.: Z path = 1 V path = 2 W path = 4	1	1 - 10	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1515	Float / 4	Clamp-on spacing	Spacing (LTN) between clamp-on sensors for path 2.	0.0 [m] (8556)	-100.0 - 100.0	Read / write
1509	Float / 4	Path weight	Fixed weighting factor associated with path 2. For clamp-on systems the installed paths weightings should be identical but not zero. For inline systems the sum of the installed paths weightings should be 1.0.	1.0	0.01 - 2.0	Read / write (Expert)

Path 3 settings

Table A-23 Path 3 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1550	Float / 4	Sensor frequency	Desired sensor frequency for path 3.	1100000 [Hz]	80000.0 - 4000000.0	Read / write
1558	Unsigned / 2	Path geometry	The number of crossings the signal makes through the pipe (Reflect or direct geometry for path 3). E.g.: Z path = 1 V path = 2 W path = 4	1	1 - 10	Read / write
1565	Float / 4	Clamp-on spacing	Spacing (LTN) between clamp-on sensors for path 3.	0.0 [m] (8556)	-100.0 - 100.0	Read / write
1559	Float / 4	Path weight	Fixed weighting factor associated with path 3. For clamp-on systems the installed paths weightings should be identical but not zero. For inline systems the sum of the installed paths weightings should be 1.0.	1.0	0.01 - 2.0	Read / write (Expert)

Path 4 settings

Table A-24 Path 4 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1600	Float / 4	Sensor frequency	Desired sensor frequency for path 4.	1100000 [Hz]	80000.0 - 4000000.0	Read / write
1608	Unsigned / 2	Path geometry	The number of crossings the signal makes through the pipe (Reflect or direct geometry for path 4). E.g.: Z path = 1 V path = 2 W path = 4	1	1 - 10	Read / write
1615	Float / 4	Clamp-on spacing	Spacing (LTN) between clamp-on sensors for path 4.	0.0 [m] (8556)	-100.0 - 100.0	Read / write
1609	Float / 4	Path weight	Fixed weighting factor associated with path 4. For clamp-on systems the installed paths weightings should be identical but not zero. For inline systems the sum of the installed paths weightings should be 1.0.	1.0	0.01 - 2.0	Read / write (Expert)

User calibration

Table A-25 User calibration

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1000	Float / 4	Slope correction factor	Define positive and negative flow direction. Default positive flow direction is indicated by the arrow on the sensor.	1.0	0.5 - 2.0	Read / write
1006	Float / 4	Path 1 offset	User calibrated zero offset for path 1. Calibrated delta time = delta time + Path 1 factory offset + Path 1 offset.	0.0 [s]	-1.25E-6 - +1.25E-6	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1010	Float / 4	Path 2 offset	User calibrated zero offset for path 2. Calibrated delta time = delta time + Path 2 factory offset + Path 2 offset.	0.0 [s]	-1.25E-6 - +1.25E-6	Read / write
1014	Float / 4	Path 3 offset	User calibrated zero offset for path 3. Calibrated delta time = delta time + Path 3 factory offset + Path 3 offset.	0.0 [s]	-1.25E-6 - +1.25E-6	Read / write
1018	Float / 4	Path 4 offset	User calibrated zero offset for path 4. Calibrated delta time = delta time + Path 4 factory offset + Path 4 offset.	0.0 [s]	-1.25E-6 - +1.25E-6	Read / write
1004	Float / 4	Path 1 factory offset	Factory calibrated zero offset for path 1.	0.0 [s]	-	Read only
1008	Float / 4	Path 2 factory offset	Factory calibrated zero offset for path 2.	0.0 [s]	-	Read only
1012	Float / 4	Path 3 factory offset	Factory calibrated zero offset for path 3.	0.0 [s]	-	Read only
1016	Float / 4	Path 4 factory offset	Factory calibrated zero offset for path 4.	0.0 [s]	-	Read only

Auto offset adjustment

Table A-26 Auto offset adjustment

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
950	Unsigned / 2	Perform zero adjust - factory	Command to start an automatic factory zero offset adjustment. Queued command.	0	0: Automatic factory ZOA done / not running 1: Perform ZOA on path 1 2: Perform ZOA on path 2 3: Perform ZOA on path 3 4: Perform ZOA on path 4 6: Perform ZOA on all installed paths 7: Revert to last good factory offset values	Read / write
951	Unsigned / 2	Perform zero adjust - user	Command to start an automatic user zero offset adjustment. Queued command.	0	0: Automatic factory ZOA done / not running 1: Perform ZOA on path 1 2: Perform ZOA on path 2 3: Perform ZOA on path 3 4: Perform ZOA on path 4 6: Perform ZOA on all installed paths 7: Revert to last good factory offset values	Read / write
952	Unsigned / 2	Zero adjust time	The amount of time the zero offset adjustment runs (i.e. amount of time to average samples over).	30 [s]	5 - 300	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
953	Unsigned / 2	Zero adjust progress	The progress of the currently running Zero offset adjustment.	0	-	Read only
954	Unsigned / 2	Last zero adjust status	Status of the last performed zero offset adjustment. Bit enumerated. Each bit set to '1' equals an error. Note: Path X error indicates that path entered signal search, freq sweep or was uninstalled during the ZOA execution. Results may not be optimal	0	• Bit 0: Path 1 zero offset limit exceeded • Bit 1: Path 2 zero offset limit exceeded • Bit 2: Path 3 zero offset limit exceeded • Bit 3: Path 4 zero offset limit exceeded • Bit 5: Path 1 error during during zero offset adjustment • Bit 6: Path 2 error during during zero offset adjustment • Bit 7: Path 3 error during during zero offset adjustment • Bit 8: Path 4 error during during zero offset adjustment	Read only

Multipoint calibration

Table A-27 Multipoint calibration

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1050	Unsigned / 1	Calibration function	Specifies the input function for the multipoint calibration table.	0	0: Volume flow rate [m³/s] 1: Reynolds number 2: Sound velocity [m/s]	Read / write (Expert)
1051	Unsigned / 1	Protect calibration table	Specifies protection of the multipoint calibration table.	0	0: No protection of the calibration table. End users can use Calibration table command (1064) to change the multipoint calibration table. 1: Calibration table is protected. Calibration table command (1064) will not grant access to modify the multipoint calibration table.	Read / write (Expert)
1052	Unsigned / 1	Enable multipoint calibration	Enable or disable the Multipoint calibration.	0	0: Disabled 1: Enabled	Read / write
1053	Unsigned / 1	Asymmetric calibration table	Usage of the calibration table.	0	0: Unidirectional. All 20 calibration points are used for positive flow calibration and are then mirrored for negative flow. 1: Bidirectional. The first 10 calibration points are used for positive flow calibration and the 10 last calibration points are used for negative flow calibration.	Read / write (Expert)
1066	Float / 4	Calibration point	Calibration point that is to be transferred to the multipoint calibration table.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1068	Float / 4	Calibration value	Calibration correction factor that is to be transferred to the multipoint calibration table. E. g. 0.99 = -1% correction.	1.0	0.5 - 2.0	Read / write
1064	Unsigned / 2	Calibration table command	The register "Multipoint calibration status" is updated after each command has been handled. Command 21 will always be accepted. Remaining commands will only be accepted if register "Calibration table protection" is 0.	-	1..20: Transfer calibration data specified in registers "Calibration point" and "Calibration value" to according entry of the multipoint calibration table. 21: Perform sanity check of the calibration table (calibration point values must be in nominal ascending order). 22: Reset calibration table to default values (all "Calibration point X" values set to 0.0 and all "Calibration value X" values set to 1.0). 23: Set register "Asymmetric calibration table" to 0 to indicate that the calibration table is used as a uni-directional table. 24: Set register "Asymmetric calibration table" to 1 to indicate that the calibration table is used as a bi-directional table.	Read / write
1065	Unsigned / 2	Multipoint calibration status	Status of last performed Multipoint calibration command.	0	0: Command successfully performed. 1: Sanity check failed. Not all calibration points are in nominal ascending order. 2: Command not performed. Calibration table is protected.	Read only

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1070	Float / 4	Calibration point 1	Calibration point 1 for unidirectional flow or calibration point 1 for bi-directional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write (Expert)
1072	Float / 4	Calibration value 1	Calibration correction factor that is associated to Calibration point 1.	1.0	0.5 - 2.0	Read / write (Expert)
1074	Float / 4	Calibration point 2	Calibration point 2 for unidirectional flow or calibration point 2 for bi-directional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write (Expert)
1076	Float / 4	Calibration value 2	Calibration correction factor that is associated to Calibration point 2.	1.0	0.5 - 2.0	Read / write (Expert)
1078	Float / 4	Calibration point 3	Calibration point 3 for unidirectional flow or calibration point 3 for bi-directional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s]	0.0 - 100000.0	Read / write (Expert)
1080	Float / 4	Calibration value 3	Calibration correction factor that is associated to Calibration point 3.	1.0	0.5 - 2.0	Read / write (Expert)
1082	Float / 4	Calibration point 4	Calibration point 4 for unidirectional flow or calibration point 4 for bi-directional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write (Expert)
1084	Float / 4	Calibration value 4	Calibration correction factor that is associated to Calibration point 4.	1.0	0.5 - 2.0	Read / write (Expert)
1086	Float / 4	Calibration point 5	Calibration point 5 for unidirectional flow or calibration point 5 for bi-directional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write (Expert)
1088	Float / 4	Calibration value 5	Calibration correction factor that is associated to Calibration point 5.	1.0	0.5 - 2.0	Read / write (Expert)

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1090	Float / 4	Calibration point 6	Calibration point 6 for unidirectional flow or calibration point 6 for bi-directional positive flow. If 0.0 the calibration point is not used.	0.0 [m³/s] (7500)	0.0 - 100000.0	Read / write (Expert)
1092	Float / 4	Calibration value 6	Calibration correction factor that is associated to Calibration point 6.	1.0	0.5 - 2.0	Read / write (Expert)
1094	Float / 4	Calibration point 7	Calibration point 7 for unidirectional flow or calibration point 7 for bi-directional positive flow. If 0.0 the calibration point is not used.	0.0 [m³/s] (7500)	0.0 - 100000.0	Read / write (Expert)
1096	Float / 4	Calibration value 7	Calibration correction factor that is associated to Calibration point 7.	1.0	0.5 - 2.0	Read / write (Expert)
1098	Float / 4	Calibration point 8	Calibration point 8 for unidirectional flow or calibration point 8 for bi-directional positive flow. If 0.0 the calibration point is not used.	0.0 [m³/s] (7500)	0.0 - 100000.0	Read / write (Expert)
1100	Float / 4	Calibration value 8	Calibration correction factor that is associated to Calibration point 8.	1.0	0.5 - 2.0	Read / write (Expert)
1102	Float / 4	Calibration point 9	Calibration point 9 for unidirectional flow or calibration point 9 for bi-directional positive flow. If 0.0 the calibration point is not used.	0.0 [m³/s] (7500)	0.0 - 100000.0	Read / write (Expert)
1104	Float / 4	Calibration value 9	Calibration correction factor that is associated to Calibration point 9.	1.0	0.5 - 2.0	Read / write (Expert)
1106	Float / 4	Calibration point 10	Calibration point 10 for unidirectional flow or calibration point 10 for bidirectional positive flow. If 0.0 the calibration point is not used.	0.0 [m³/s] (7500)	0.0 - 100000.0	Read / write (Expert)
1108	Float / 4	Calibration value 10	Calibration correction factor that is associated to Calibration point 10.	1.0	0.5 - 2.0	Read / write (Expert)

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1110	Float / 4	Calibration point 11	Calibration point 11 for unidirectional flow or calibration point 11 for bidirectional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write (Expert)
1112	Float / 4	Calibration value 11	Calibration correction factor that is associated to Calibration point 11.	1.0	0.5 - 2.0	Read / write (Expert)
1114	Float / 4	Calibration point 12	Calibration point 12 for unidirectional flow or calibration point 12 for bidirectional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write (Expert)
1116	Float / 4	Calibration value 12	Calibration correction factor that is associated to Calibration point 12.	1.0	0.5 - 2.0	Read / write (Expert)
1118	Float / 4	Calibration point 13	Calibration point 13 for unidirectional flow or calibration point 13 for bidirectional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write (Expert)
1120	Float / 4	Calibration value 13	Calibration correction factor that is associated to Calibration point 13.	1.0	0.5 - 2.0	Read / write (Expert)
1122	Float / 4	Calibration point 14	Calibration point 14 for unidirectional flow or calibration point 14 for bidirectional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write (Expert)
1124	Float / 4	Calibration value 14	Calibration correction factor that is associated to Calibration point 14.	1.0	0.5 - 2.0	Read / write (Expert)
1126	Float / 4	Calibration point 15	Calibration point 15 for unidirectional flow or calibration point 15 for bidirectional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write (Expert)
1128	Float / 4	Calibration value 15	Calibration correction factor that is associated to Calibration point 15.	1.0	0.5 - 2.0	Read / write (Expert)

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1130	Float / 4	Calibration point 16	Calibration point 16 for unidirectional flow or calibration point 16 for bidirectional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write (Expert)
1132	Float / 4	Calibration value 16	Calibration correction factor that is associated to Calibration point 16.	1.0	0.5 - 2.0	Read / write (Expert)
1134	Float / 4	Calibration point 17	Calibration point 17 for unidirectional flow or calibration point 17 for bidirectional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write (Expert)
1136	Float / 4	Calibration value 17	Calibration correction factor that is associated to Calibration point 17.	1.0	0.5 - 2.0	Read / write (Expert)
1138	Float / 4	Calibration point 18	Calibration point 18 for unidirectional flow or calibration point 18 for bidirectional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write (Expert)
1140	Float / 4	Calibration value 18	Calibration correction factor that is associated to Calibration point 18.	1.0	0.5 - 2.0	Read / write (Expert)
1142	Float / 4	Calibration point 19	Calibration point 19 for unidirectional flow or calibration point 19 for bidirectional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write (Expert)
1144	Float / 4	Calibration value 19	Calibration correction factor that is associated to Calibration point 19.	1.0	0.5 - 2.0	Read / write (Expert)
1146	Float / 4	Calibration point 20	Calibration point 20 for unidirectional flow or calibration point 20 for bidirectional positive flow. If 0.0 the calibration point is not used.	0.0 [m ³ /s] (7500)	0.0 - 100000.0	Read / write (Expert)
1148	Float / 4	Calibration value 20	Calibration correction factor that is associated to Calibration point 20.	1.0	0.5 - 2.0	Read / write (Expert)

Limit monitoring (for path diagnostic alarms)

Table A-28 Limit monitoring (for path diagnostic alarms)

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
3332	Unsigned / 1	AlarmLimit %Accepted bursts	When any path's %Accepted bursts is < this value, an alarm will be reported	50 [%]	0 - 100	Read / write
3333	Float / 4	AlarmLimit Correlation factor	When any path's correlation factor is < this value, an alarm will be reported	0.95	0 - 1	Read / write
3335	Float / 4	AlarmLimit RxGain	When any path's RxGain is > this value, an alarm will be reported	50.0 [dB]	0.0 – 100.0	Read / write
3337	Float / 4	AlarmLimit SNR	When any path's SNR is < this value, an alarm will be reported	20.0 [dB]	0.0 – 100.0	Read / write

A.10.4.2 Process values

Volume flow settings

Table A-29 Volume flow settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7510	Float / 4	Low flow cut-off	Volume flow limit for low flow cut-off. Below limit volume flow output is forced to zero.	Sensor size specific	0 - max. volume flow	Read / write
7501	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	max. volume flow [m ³ /s] (7500)	-max. volume flow - +max. volume flow	Read / write
7503	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	max. volume flow [m ³ /s] (7500)	-max. volume flow - +max. volume flow	Read / write
7505	Float / 4	Lower warning limit	Falling below this limit causes a warning.	-max. volume flow [m ³ /s] (7500)	-max. volume flow - +max. volume flow	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7507	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	-max. volume flow [m³/s] (7500)	-max. volume flow - +max. volume flow	Read / write
7512	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0.0 [m³/s] (7500)	0 - max. volume flow	Read / write

Mass flow settings

Table A-30 Mass flow settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7410	Float / 4	Low flow cut-off	Mass flow limit for low flow cut-off. Below limit mass flow output is forced to zero.	0.001 x max. mass flow [kg/s] (7400)	0 - max. mass flow	Read / write
7401	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	max. mass flow [kg/s] (7400)	-max. mass flow - +max. mass flow	Read / write
7403	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	max. mass flow [kg/s] (7400)	-max. mass flow - +max. mass flow	Read / write
7405	Float / 4	Lower warning limit	Falling below this limit causes a warning.	-max. mass flow [kg/s] (7400)	-max. mass flow - +max. mass flow	Read / write
7407	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	-max. mass flow [kg/s] (7400)	-max. mass flow - +max. mass flow	Read / write
7412	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0 [kg/s] (7400)	0 - max. mass flow	Read / write

Standard volume flow settings

Table A-31 Standard volume flow settings (only hydrocarbon applications)

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1723	Float / 4	Standard condition temperature	Specifies temperature for standard conditions. The value is used to calculate standard process values.	15.0 [°C] (7700)	0.0 - 100.0	Read / write
1725	Float / 4	Standard condition pressure	Specifies pressure for standard conditions. The value is used to calculate standard process values.	101325 [Pa] (8015)	100000.0 - 200000.0	Read / write
1731	Float / 4	Standard condition gas density	Specifies gas density for standard conditions. The value is used to calculate standard process values.	1000.0 [kg/m³] (7600)	0.080 - 10000.0	Read / write
1733	Float / 4	Standard condition gas compressibility factor	Specifies the compressibility factor at standard conditions. This value is used to calculate gas density and standard volume process values.	0.5	0.1 - 5.0	Read / write
7531	Float / 4	Low flow cut-off	Standard volume flow limit for low flow cut-off. Below limit standard volume flow output is forced to zero.	0.0 [Sm³/h] (7964)	0 - max. standard volume flow	Read / write
7952	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	max. standard volume flow [Sm³/h] (7964)	-max. standard volume flow - +max. standard volume flow	Read / write
7954	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	max. standard volume flow [Sm³/h] (7964)	-max. standard volume flow - +max. standard volume flow	Read / write
7956	Float / 4	Lower warning limit	Falling below this limit causes a warning.	-max. standard volume flow [Sm³/h] (7964)	-max. standard volume flow - +max. standard volume flow	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7958	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	-max. standard volume flow [Sm ³ /h] (7964)	-max. standard volume flow - +max. standard volume flow	Read / write
7965	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0 [Sm ³ /h] (7964)	0 - max. standard volume flow	Read / write

Flow velocity settings

Table A-32 Flow velocity settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7644	Float / 4	Low flow cut-off	Flow velocity limit for low flow cut-off. Below limit flow velocity output is forced to zero.	0.0 [m/s] (8014)	-	Read / write
7634	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	Max. floating point value [m/s] (8014)	-	Read / write
7636	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	Max. floating point value [m/s] (8014)	-	Read / write
7638	Float / 4	Lower warning limit	Falling below this limit causes a warning.	Min. floating point value [m/s] (8014)	-	Read / write
7640	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	Min. floating point value [m/s] (8014)	-	Read / write
7642	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0.0 [m/s] (8014)	-	Read / write

Sound velocity settings

Table A-33 Sound velocity settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7624	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	Max. floating point value [m/s] (7648)	-	Read / write
7626	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	Max floating point value [m/s] (7648)	-	Read / write
7628	Float / 4	Lower warning limit	Falling below this limit causes a warning.	Min. floating point value [m/s] (7648)	-	Read / write
7630	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	Min. floating point value [m/s] (7648)	-	Read / write
7632	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0.0 [m/s] (7648)	-	Read / write

Liquident settings

Table A-34 Liquident settings (only hydrocarbon applications)

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1727	Float / 4	Liquident temperature slope factor	Specifies a temperature slope factor used in connection with the standard condition temperature for calculating liquident.	-4.10 [m/K*s]	-8.0 - 0.0	Read / write
1729	Float / 4	Liquident pressure slope factor	Specifies a pressure slope factor used in connection with the standard condition temperature for calculating liquident.	0.00000435	0.0 - 0.00003	Read / write
7040	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	Max. floating point value [m/s] (8014)	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7042	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	Max. floating point value [m/s] (8014)	-	Read / write
7044	Float / 4	Lower warning limit	Falling below this limit causes a warning.	Min. floating point value [m/s] (8014)	-	Read / write
7046	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	Min. floating point value [m/s] (8014)	-	Read / write
7048	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0.0 [m/s] (8014)	-	Read / write

Density settings

Table A-35 Density settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7601	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	max. density [kg/m ³] (7600)	0 - max. density	Read / write
7603	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	max. density [kg/m ³] (7600)	0 - max. density	Read / write
7605	Float / 4	Lower warning limit	Falling below this limit causes a warning.	1.0 [kg/m ³] (7600)	0 - max. density	Read / write
7607	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	1.0 [kg/m ³] (7600)	0 - max. density	Read / write
7612	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	.0 [kg/m ³] (7600)	0 - max. density	Read / write

Standard density settings

Table A-36 Standard density settings (only hydrocarbon applications)

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
11510	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	max. density [kg/m ³] (7600)	0 - max. density	Read / write
11512	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	max. density [kg/m ³] (7600)	0 - max. density	Read / write
11514	Float / 4	Lower warning limit	Falling below this limit causes a warning.	1.0 [kg/m ³] (7600)	0 - max. density	Read / write
11516	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	1.0 [kg/m ³] (7600)	0 - max. density	Read / write
11518	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	.0 [kg/m ³] (7600)	0 - max. density	Read / write

Kinematic viscosity settings

Table A-37 Kinematic viscosity settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7682	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	Max. floating point value [cSt] (7524)	-	Read / write
7684	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	Max. floating point value [cSt] (7524)	-	Read / write
7686	Float / 4	Lower warning limit	Falling below this limit causes a warning.	Min. floating point value [cSt] (7524)	-	Read / write
7688	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	Min. floating point value [cSt] (7524)	-	Read / write
7690	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0.0 [cSt] (7524)	-	Read / write

Standard viscosity settings

Table A-38 Standard viscosity settings (only hydrocarbon applications)

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
11500	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	Max. floating point value [cSt] (7524)	-	Read / write
11502	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	Max. floating point value [cSt] (7524)	-	Read / write
11504	Float / 4	Lower warning limit	Falling below this limit causes a warning.	Min. floating point value [cSt] (7524)	-	Read / write
11506	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	Min. floating point value [cSt] (7524)	-	Read / write
11508	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0.0 [cSt] (7524)	-	Read / write

Pressure settings

Table A-39 Pressure settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7662	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	Max. floating point value [Pa] (8015)	-	Read / write
7664	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	Max. floating point value [Pa] (8015)	-	Read / write
7666	Float / 4	Lower warning limit	Falling below this limit causes a warning.	Min. floating point value [Pa] (8015)	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7668	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	Min. floating point value [Pa] (8015)	-	Read / write
7670	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0.0 [Pa] (8015)	-	Read / write

Medium temperature settings

Table A-40 Medium temperature settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7701	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	max. medium temperature [°C] (7700)	min. medium temperature - max. medium temperature	Read / write
7703	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	max. medium temperature [°C] (7700)	min. medium temperature - max. medium temperature	Read / write
7705	Float / 4	Lower warning limit	Falling below this limit causes a warning.	min. medium temperature [°C] (7700)	min. medium temperature - max. medium temperature	Read / write
7707	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	min. medium temperature [°C] (7700)	min. medium temperature - max. medium temperature	Read / write
7712	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0.0 [K]	0.0 - 200.0	Read / write

API gravity settings

Table A-41 API gravity settings (only hydrocarbon applications)

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
11520	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	Max. floating point value [°API]	-	Read / write
11522	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	Max. floating point value [°API]	-	Read / write
11524	Float / 4	Lower warning limit	Falling below this limit causes a warning.	Min. floating point value [°API]	-	Read / write
11526	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	Min. floating point value [°API]	-	Read / write
11528	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0.0 [°API]	-	Read / write

Standard API gravity settings

Table A-42 Standard API gravity settings (only hydrocarbon applications)

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
11530	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	Max. floating point value [°API]	-	Read / write
11532	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	Max. floating point value [°API]	-	Read / write
11534	Float / 4	Lower warning limit	Falling below this limit causes a warning.	Min. floating point value [°API]	-	Read / write
11536	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	Min. floating point value [°API]	-	Read / write
11538	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0.0 [°API]	-	Read / write

Specific gravity settings

Table A-43 Specific gravity settings (only hydrocarbon applications)

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
11540	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	Max. floating point value [SGU]	-	Read / write
11542	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	Max. floating point value [SGU]	-	Read / write
11544	Float / 4	Lower warning limit	Falling below this limit causes a warning.	Min. floating point value [SGU]	-	Read / write
11546	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	Min. floating point value [SGU]	-	Read / write
11548	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0.0 [SGU]	-	Read / write

Standard specific gravity settings

Table A-44 Standard specific gravity settings (only hydrocarbon applications)

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
11550	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	Max. floating point value [SGU]	-	Read / write
11552	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	Max. floating point value [SGU]	-	Read / write
11554	Float / 4	Lower warning limit	Falling below this limit causes a warning.	Min. floating point value [SGU]	-	Read / write
11556	Float / 4	Lower alarm limit	Falling below this limit causes an alarm.	Min. floating point value [SGU]	-	Read / write
11558	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0.0 [SGU]	-	Read / write

Rate of change (ROC) settings

Table A-45 Rate of change (ROC) settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7540	Float / 4	Upper alarm limit	Exceeding this limit causes an alarm.	Max. floating point value [m/s ²] (8564)	-	Read / write
7538	Float / 4	Upper warning limit	Exceeding this limit causes a warning.	Max. floating point value [m/s ²] (8564)	-	Read / write
7542	Float / 4	Hysteresis	Hysteresis that affects the alarm and warning limits.	0.0 [m/s ²] (8564)	-	Read / write
1876	unsigned / 2	ROC time interval	Time interval for Rate Of Change calculation	10 [s]	1 - 300	Read / write

A.10.4.3 Totalizers

Totalizer 1 settings

Table A-46 Totalizer 1 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8305	Unsigned / 2	Process value	Select process value for totalization.	0	0: Cut-off filtered mass flow 1: Cut-off filtered volume flow 27: Cut-off filtered standard volume flow (only hydrocarbon and gas applications)	Read / write
8302	Unsigned / 2	Fail-safe behavior	Behavior of the totalizer during the occurrence of bad input value.	0	0: RUN; totalization is continued using the bad input value. 1: HOLD; totalization is stopped. 2: MEMORY; totalization is continued based on the last incoming good value.	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8323	Float / 4	Volume upper alarm limit	Exceeding this limit causes an alarm when volume flow is selected as input.	Max. floating point value [m ³] (8321)		Read / write
8325	Float / 4	Volume upper warning limit	Exceeding this limit causes a warning when volume flow is selected as input.	Max. floating point value [m ³] (8321)		Read / write
8327	Float / 4	Volume lower warning limit	Falling below this limit causes a warning when volume flow is selected as input.	Min. floating point value [m ³] (8321)		Read / write
8329	Float / 4	Volume lower alarm limit	Falling below this limit causes an alarm when volume flow is selected as input.	Min. floating point value [m ³] (8321)		Read / write
8331	Float / 4	Volume alarm hysteresis	Hysteresis that affects the alarm and warning limits when volume flow is selected as input.	0.0 [m ³] (8321)	-	Read / write
8306	Float / 4	Mass upper alarm limit	Exceeding this limit causes an alarm when mass flow is selected as input.	Max. floating point value [kg] (8320)		Read / write
8308	Float / 4	Mass upper warning limit	Exceeding this limit causes a warning when mass flow is selected as input.	Max. floating point value [kg] (8320)		Read / write
8310	Float / 4	Mass lower warning limit	Falling below this limit causes a warning when mass flow is selected as input.	Min. floating point value [kg] (8320)		Read / write
8312	Float / 4	Mass lower alarm limit	Falling below this limit causes an alarm when mass flow is selected as input.	Min. floating point value [kg] (8320)		Read / write
8314	Float / 4	Mass alarm hysteresis	Hysteresis that affects the alarm and warning limits when mass flow is selected as input.	0.0 [kg] (8320)	-	Read / write
8333	Float / 4	Standard volume upper alarm limit	Exceeding this limit causes an alarm when volume flow is selected as input.	Max. floating point value [SI] (8322)		Read / write
8335	Float / 4	Standard volume upper warning limit	Exceeding this limit causes a warning when volume flow is selected as input.	Max. floating point value [SI] (8322)		Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8337	Float / 4	Standard volume lower warning limit	Falling below this limit causes a warning when volume flow is selected as input.	Min. floating point value [SI] (8322)		Read / write
8339	Float / 4	Standard volume lower alarm limit	Falling below this limit causes an alarm when volume flow is selected as input.	Min. floating point value [SI] (8322)		Read / write
8341	Float / 4	Standard volume alarm hysteresis	Hysteresis that affects the alarm and warning limits when volume flow is selected as input.	0.0 [SI] (8322)	-	Read / write

Totalizer 2 settings

Table A-47 Totalizer 2 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8405	Unsigned / 2	Process value	Select process value for totalization.	0	0: Cut-off filtered mass flow 1: Cut-off filtered volume flow 27: Cut-off filtered standard volume flow (only hydrocarbon and gas applications)	Read / write
8402	Unsigned / 2	Fail-safe behavior	Behavior of the totalizer during the occurrence of bad input value.	0	0: RUN; totalization is continued using the bad input value. 1: HOLD; totalization is stopped. 2: MEMORY; totalization is continued based on the last incoming good value.	Read / write
8423	Float / 4	Volume upper alarm limit	Exceeding this limit causes an alarm when volume flow is selected as input.	Max. floating point value [m³] (8421)		Read / write
8425	Float / 4	Volume upper warning limit	Exceeding this limit causes a warning when volume flow is selected as input.	Max. floating point value [m³] (8421)		Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8427	Float / 4	Volume lower warning limit	Falling below this limit causes a warning when volume flow is selected as input.	Min. floating point value [m ³] (8421)		Read / write
8429	Float / 4	Volume lower alarm limit	Falling below this limit causes an alarm when volume flow is selected as input.	Min. floating point value [m ³] (8421)		Read / write
8431	Float / 4	Volume alarm hysteresis	Hysteresis that affects the alarm and warning limits when volume flow is selected as input.	0.0 [m ³] (8421)	-	Read / write
8406	Float / 4	Mass upper alarm limit	Exceeding this limit causes an alarm when mass flow is selected as input.	Max. floating point value [kg] (8420)		Read / write
8408	Float / 4	Mass upper warning limit	Exceeding this limit causes a warning when mass flow is selected as input.	Max. floating point value [kg] (8420)		Read / write
8410	Float / 4	Mass lower warning limit	Falling below this limit causes a warning when mass flow is selected as input.	Min. floating point value [kg] (8420)		Read / write
8412	Float / 4	Mass lower alarm limit	Falling below this limit causes an alarm when mass flow is selected as input.	Min. floating point value [kg] (8420)		Read / write
8414	Float / 4	Mass alarm hysteresis	Hysteresis that affects the alarm and warning limits when mass flow is selected as input.	0.0 [kg] (8420)	-	Read / write
8433	Float / 4	Standard volume upper alarm limit	Exceeding this limit causes an alarm when volume flow is selected as input.	Max. floating point value [SI] (8422)		Read / write
8435	Float / 4	Standard volume upper warning limit	Exceeding this limit causes a warning when volume flow is selected as input.	Max. floating point value [SI] (8422)		Read / write
8437	Float / 4	Standard volume lower warning limit	Falling below this limit causes a warning when volume flow is selected as input.	Min. floating point value [SI] (8422)		Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8439	Float / 4	Standard volume lower alarm limit	Falling below this limit causes an alarm when volume flow is selected as input.	Min. floating point value [SI] (8422)		Read / write
8441	Float / 4	Standard volume alarm hysteresis	Hysteresis that affects the alarm and warning limits when volume flow is selected as input.	0.0 [SI] (8422)	-	Read / write

Totalizer 3 settings

Table A-48 Totalizer 3 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8505	Unsigned / 2	Process value	Select process value for totalization.	0	0: Cut-off filtered mass flow 1: Cut-off filtered volume flow 27: Cut-off filtered standard volume flow (only hydrocarbon and gas applications)	Read / write
8502	Unsigned / 2	Fail-safe behavior	Behavior of the totalizer during the occurrence of bad input value.	0	0: RUN; totalization is continued using the bad input value. 1: HOLD; totalization is stopped. 2: MEMORY; totalization is continued based on the last incoming good value.	Read / write
8523	Float / 4	Volume upper alarm limit	Exceeding this limit causes an alarm when volume flow is selected as input.	Max. floating point value [m³] (8521)		Read / write
8525	Float / 4	Volume upper warning limit	Exceeding this limit causes a warning when volume flow is selected as input.	Max. floating point value [m³] (8521)		Read / write
8527	Float / 4	Volume lower warning limit	Falling below this limit causes a warning when volume flow is selected as input.	Min. floating point value [m³] (8521)		Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8529	Float / 4	Volume lower alarm limit	Falling below this limit causes an alarm when volume flow is selected as input.	Min. floating point value [m ³] (8521)		Read / write
8531	Float / 4	Volume alarm hysteresis	Hysteresis that affects the alarm and warning limits when volume flow is selected as input.	0.0 [m ³] (8521)	-	Read / write
8506	Float / 4	Mass upper alarm limit	Exceeding this limit causes an alarm when mass flow is selected as input.	Max. floating point value [kg] (8520)		Read / write
8508	Float / 4	Mass upper warning limit	Exceeding this limit causes a warning when mass flow is selected as input.	Max. floating point value [kg] (8520)		Read / write
8510	Float / 4	Mass lower warning limit	Falling below this limit causes a warning when mass flow is selected as input.	Min. floating point value [kg] (8520)		Read / write
8512	Float / 4	Mass lower alarm limit	Falling below this limit causes an alarm when mass flow is selected as input.	Min. floating point value [kg] (8520)		Read / write
8514	Float / 4	Mass alarm hysteresis	Hysteresis that affects the alarm and warning limits when mass flow is selected as input.	0.0 [kg] (8520)	-	Read / write
8533	Float / 4	Standard volume upper alarm limit	Exceeding this limit causes an alarm when volume flow is selected as input.	Max. floating point value [SI] (8522)		Read / write
8535	Float / 4	Standard volume upper warning limit	Exceeding this limit causes a warning when volume flow is selected as input.	Max. floating point value [SI] (8522)		Read / write
8537	Float / 4	Standard volume lower warning limit	Falling below this limit causes a warning when volume flow is selected as input.	Min. floating point value [SI] (8522)		Read / write
8539	Float / 4	Standard volume lower alarm limit	Falling below this limit causes an alarm when volume flow is selected as input.	Min. floating point value [SI] (8522)		Read / write
8541	Float / 4	Standard volume alarm hysteresis	Hysteresis that affects the alarm and warning limits when volume flow is selected as input.	0.0 [SI] (8522)	-	Read / write

A.10.4.4 Inputs and outputs

General channel 2 settings

Table A-49 General channel 2 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8801	Unsigned / 2	Operation mode	Operation mode.	0	0: Off 1: Current output 2: Frequency output 3: Pulse output 4: Signal output	Read / write
7420	Unsigned / 2	Active/passive operation	Shows application possibilities.	-	0: Active operation not possible, use passive wiring! 1: Active operation possible, hardware is able to drive the current loop.	Read only
9590	Unsigned / 2	Fail-safe activation condition	Fail-safe activation condition.	1	0: Bad status of selected process value 1: Active Maintenance alarm or Failure (NAMUR)	Read / write
8981	Unsigned / 2	Fail-safe min. time	Minimum time the output stays in fail-safe behavior.	0 [s]	0 - 100	Read / write

Channel 2 current output settings

Table A-50 Channel 2 current output settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8802	Unsigned / 2	Process value	Select process value for the current output.	-	• 0: Mass flow • 1: Volume flow • 2: Density • 3: Medium temperature • 18: Sound velocity • 19: Flow velocity • 20: Pressure • 21: Viscosity • 22: RTD temperature 1 • 23: RTD temperature 2 • 24: Medium concentration • 25: Measured current (Channel 5) • 26: Measured current (Channel 6) • 27: Standard volume flow rate (only hydro-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
					carbon and gas applications) • 28: Standardizing factor (only hydrocarbon and gas applications) • 29: Base viscosity (only hydrocarbon applications) • 30: Base density (only hydrocarbon applications) • 31: Liquident (only hydrocarbon applications) • 32: API gravity (only hydrocarbon applications) • 33: Base API gravity (only hydrocarbon applications) • 34: Specific gravity (only hydrocarbon applications) • 35: Base specific gravity (only hydrocarbon applications) • 36: Rate of change (ROC) (only hydrocarbon applications)	
8809	Unsigned / 2	Flow direction	Flow direction filter applicable for Process values (8802) = 0, 1, 19 and 27.	0	• 0: Positive direction • 1: Negative direction • 2: Positive and negative directions • 3: Positive and negative directions (symmetric mode)	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8806	Unsigned / 2	Current mode	Mode of current output.	0	0: 4-20 mA (3.5) 3.8-20.5 (22.6) NAMUR 1: 4-20 mA (3.75) 4.0-20.8 (22.6) US 2: 4-20 mA (2.0) 4.0-20.5 (22.0) 3: 4-20 mA (2.0) 4.0-24.0 (25.0) 4: 0-20 mA (0.0) 0.0-20.5 (22.0) 5: 0-20 mA (0.0) 0.0-24.0 (25.0)	Read / write
8866	Float / 4	Upper range value volume flow	Upper volume flow value that is mapped to the upper nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 1.	0.004 • max. volume flow [m³/s] (7500)	-	Read / write
8868	Float / 4	Lower range value volume flow	Lower volume flow value that is mapped to the lower nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 1.	0 [m³/s] (7500)	-	Read / write
8810	Float / 4	Upper range value mass flow	Upper mass flow value that is mapped to the upper nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 0.	0.2 • max. mass flow [kg/s] (7400)	-	Read / write
8812	Float / 4	Lower range value mass flow	Lower mass flow value that is mapped to the lower nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 0.	0.0 [kg/s] (7400)	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8870	Float / 4	Upper range value density	Upper process density value that is mapped to the upper nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 2.	Max. density [kg/m ³] (7600)	-	Read / write
8872	Float / 4	Lower range value density	Lower process density value that is mapped to the lower nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 2.	0.08 [kg/m ³] (7600)	-	Read / write
8874	Float / 4	Upper range value temperature	Upper medium temperature value that is mapped to the upper nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 3.	Max. medium temperature [°C] (7700)	-	Read / write
8876	Float / 4	Lower range value temperature	Lower medium temperature value that is mapped to the lower nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 3.	Min. medium temperature [°C] (7700)	-	Read / write
8878	Float / 4	Upper range value standard volume flow	Upper standard volume flow value that is mapped to the upper nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 27.	0.4 % • standard volume flow [Sm ³ /h] (7964)	-	Read / write
8880	Float / 4	Lower range value standard volume flow	Lower standard volume flow value that is mapped to the lower nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 27.	0.0 [Sm ³ /h] (7964)	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10000	Float / 4	Upper range value velocity	Upper velocity value that is mapped to the upper nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 18, 19 or 31.	1.0 [m/s] (8014 / 7648)	-	Read / write
10002	Float / 4	Lower range value velocity	Lower velocity value that is mapped to the lower nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 18, 19 or 31.	0.0 [m/s] (8014 / 7648)	-	Read / write
10004	Float / 4	Upper range value pressure	Upper process pressure value that is mapped to the upper nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 20.	100000.0 [Pa] (7548)	-	Read / write
10006	Float / 4	Lower range value pressure	Lower process pressure value that is mapped to the lower nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 20.	0.0 [Pa] (7548)	-	Read / write
10008	Float / 4	Upper range value dimensionless	Upper dimensionless value that is mapped to the upper nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 28, 32, 33, 34, or 36.	1.0	-	Read / write
10010	Float / 4	Lower range value dimensionless	Lower dimensionless value that is mapped to the lower nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 28, 32, 33, 34, or 36.	0.0	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10012	Float / 4	Upper range value current	Upper current value that is mapped to the upper nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 25 or 26.	20.0 [mA]	-	Read / write
10014	Float / 4	Lower range value current	Lower current value that is mapped to the lower nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 25 or 26.	4.0 [mA]	-	Read / write
10016	Float / 4	Upper range value viscosity	Upper process viscosity value that is mapped to the upper nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 21 or 29.	1.0 [m ² /s] (7524)	-	Read / write
10018	Float / 4	Lower range value viscosity	Lower process viscosity value that is mapped to the lower nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 21 or 29.	0.0 [m ² /s] (7524)	-	Read / write
10064	Float / 4	Upper range value ROC	Upper rate of change value that is mapped to the upper nominal range boundary selected by Current mode (8806). Applicable if Process value (8802) = 36.	1.0 [m/s ²] (8564)	-	Read / write
10066	Float / 4	Lower range value ROC	Lower rate of change value that is mapped to the lower nominal range boundary selected by current mode (8806). Applicable if Process value (8802) = 36.	0.0 [m/s ²] (8564)	-	Read / write
8807	Float / 4	Damping value	Time constant of damping filter for current output signal.	0.0 [s]	0.0 - 100.0	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8814	Unsigned / 2	Fail-safe behavior	Current output reaction in case of a fault.	0	0: Lower fault current 1: Upper fault current 2: Last valid value 3: Disabled 4: Custom value	Read / write
8815	Float / 4	Fail-safe value	Output value in case of a fault and when Fail-safe behavior (8814) is configured to 4.	0.0 [mA]	0.0 - 25.0	Read / write
7146	Float / 4	Forced value	Forced value when forcing is active.	4.0 [mA]	3.5 - 25.0	Read / write
8886	Float / 4	Offset adjustment	Command to trim the lower range value of the loop current. Simulate a loop current of 4.0 mA, measure the current with an ampere meter and write the measured value to this register.	[mA]	0.0 - 25.0	Write only
8888	Float / 4	Gain adjustment	Command to trim the upper range value of the loop current. Simulate a loop current of 20.0 mA, measure the current with an ampere meter and write the measured value to this register.	[mA]	0.0 - 25.0	Write only

Channel 2 frequency output settings

Table A-51 Channel 2 frequency output settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8904	Unsigned / 2	Process value	Select process value for the current output.	-	• 0: Mass flow • 1: Volume flow • 2: Density • 3: Medium temperature • 18: Sound velocity • 19: Flow velocity • 20: Pressure • 21: Viscosity • 22: RTD temperature 1 • 23: RTD temperature 2 • 24: Medium concentration • 25: Measured current (Channel 5) • 26: Measured current (Channel 6) • 27: Standard volume flow rate (only hydro-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
					carbon and gas applications) • 28: Standardizing factor (only hydrocarbon and gas applications) • 29: Base viscosity (only hydrocarbon applications) • 30: Base density (only hydrocarbon applications) • 31: Liquident (only hydrocarbon applications) • 32: API gravity (only hydrocarbon applications) • 33: Base API gravity (only hydrocarbon applications) • 34: Specific gravity (only hydrocarbon applications) • 35: Base specific gravity (only hydrocarbon applications) • 36: Rate of change (ROC) (only hydrocarbon applications)	
8910	Unsigned / 2	Flow direction	Flow direction filter applicable for Process values (8904) set to 0, 1, 19, or 27.	0	• 0: Positive direction • 1: Negative direction • 2: Positive and negative directions • 3: Positive and negative directions (symmetric mode)	Read / write
8935	Float / 4	Frequency value high	Upper frequency value. Upper nominal output range boundary.	10000.0 [Hz]	0.0 - 12500.0	Read / write
8937	Float / 4	Frequency value low	Lower frequency value. Lower nominal output range boundary.	0.0 [Hz]	0.0 - 12500.0	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8915	Float / 4	Upper range value volume flow	Upper volume flow value that is mapped to the upper nominal range boundary selected by Frequency value high (8935). Applicable if Process value (8904) = 1.	0.4 % • max. volume flow [m³/s] (7500)	-	Read / write
8917	Float / 4	Lower range value volume flow	Lower volume flow value that is mapped to the lower nominal range boundary selected by Frequency value low (8937). Applicable if Process value (8904) = 1.	0.0 [m³/s] (7500)	-	Read / write
8911	Float / 4	Upper range value mass flow	Upper mass flow value that is mapped to the upper nominal range boundary selected by Frequency value high (8935). Applicable if Process value (8904) = 0.	0.2 • max. mass flow- [kg/s] (7400)	-	Read / write
8913	Float / 4	Lower range value mass flow	Lower mass flow value that is mapped to the lower nominal range boundary selected by Frequency value low (8937). Applicable if Process value (8904) = 0.	0.0 [kg/s] (7400)	-	Read / write
8919	Float / 4	Upper range value density	Upper process density value that is mapped to the upper nominal range boundary selected by Frequency value high (8935). Applicable if Process value (8904) = 2.	1600 [kg/m³] (7600)	-	Read / write
8921	Float / 4	Lower range value density	Lower process density value that is mapped to the lower nominal range boundary selected by Frequency value low (8937). Applicable if Process value (8904) = 2.	600 [kg/m³] (7600)	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8923	Float / 4	Upper range value temperature	Upper medium temperature value that is mapped to the upper nominal range boundary selected by Frequency value high (8935). Applicable if Process value (8904) = 3.	Max. medium temperature [°C] (7700)	-	Read / write
8925	Float / 4	Lower range value temperature	Lower medium temperature value that is mapped to the lower nominal range boundary selected by Frequency value low (8937). Applicable if Process value (8904) = 3.	Min. medium temperature [°C] (7700)	-	Read / write
8927	Float / 4	Upper range value standard volume flow	Upper standard volume flow value that is mapped to the upper nominal range boundary selected by Frequency value high (8935). Applicable if Process value (8904) = 27.	0.4 % • max. standard volume flow [Sm³/h] (7964)	-	Read / write
8929	Float / 4	Lower range value standard volume flow	Lower standard volume flow value that is mapped to the lower nominal range boundary selected by Frequency value low (8937). Applicable if Process value (8904) = 27.	0.0 [Sm³/h] (7964)	-	Read / write
10024	Float / 4	Upper range value velocity	Upper velocity value that is mapped to the upper nominal range boundary selected by Frequency value high (8935). Applicable if Process value (8904) = 18, 19 or 31.	1.0 [m/s] (8014 / 7648)	-	Read / write
10026	Float / 4	Lower range value velocity	Lower velocity value that is mapped to the lower nominal range boundary selected by Frequency value low (8937). Applicable if Process value (8904) = 18, 19 or 31.	0.0 [m/s] (8014 / 7648)	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10028	Float / 4	Upper range value pressure	Upper process pressure value that is mapped to the upper nominal range boundary selected by Frequency value high (8935). Applicable if Process value (8904) = 20.	100000.0 [Pa] (7548)	-	Read / write
10030	Float / 4	Lower range value pressure	Lower process pressure value that is mapped to the lower nominal range boundary selected by Frequency value low (8937). Applicable if Process value (8904) = 20.	0.0 [Pa] (7548)	-	Read / write
10032	Float / 4	Upper range value dimensionless	Upper dimensionless value that is mapped to the upper nominal range boundary selected by Frequency value high (8935). Applicable if Process value (8904) = 28, 32, 33, 34, or 36.	1.0	-	Read / write
10034	Float / 4	Lower range value dimensionless	Lower dimensionless value that is mapped to the lower nominal range boundary selected by Frequency value low (8937). Applicable if Process value (8904) = 28, 32, 33, 34, or 36.	0.0	-	Read / write
10036	Float / 4	Upper range value current	Upper current value that is mapped to the upper nominal range boundary selected by Frequency value high (8935). Applicable if Process value (8904) = 25 or 26.	20.0 [mA]	-	Read / write
10038	Float / 4	Lower range value current	Lower current value that is mapped to the lower nominal range boundary selected by Frequency value low (8937). Applicable if Process value (8904) = 25 or 26.	4.0 [mA]	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10040	Float / 4	Upper range value viscosity	Upper process viscosity value that is mapped to the upper nominal range boundary selected by Frequency value high (8935). Applicable if Process value (8904) = 21 or 29.	1.0 [m ² /s] (7524)	-	Read / write
10042	Float / 4	Lower range value viscosity	Lower process viscosity value that is mapped to the lower nominal range boundary selected by Frequency value low (8937). Applicable if Process value (8904) = 21 or 29.	0.0 [m ² /s] (7524)	-	Read / write
10068	Float / 4	Upper range value ROC	Upper rate of change value that is mapped to the upper nominal range boundary selected by Frequency value high (8935). Applicable if Process value (8904) = 36.	1.0 [m/s ²] (8564)	-	Read / write
10070	Float / 4	Lower range value ROC	Lower rate of change value that is mapped to the lower nominal range boundary selected by Frequency value low (8937). Applicable if Process value (8904) = 36.	0.0 [m/s ²] (8564)	-	Read / write
8908	Float / 4	Damping value	Time constant of damping filter for frequency output signal.	0.0 [s]	0.0 - 100.0	Read / write
8939	Unsigned / 2	Fail-safe behavior	Frequency output reaction in case of a fault.	2	• 0: Frequency value low • 1: Frequency value high • 2: Last valid value • 3: Disabled • 4: Custom value	Read / write
8940	Float / 4	Fail-safe value	Output value in case of a fault and when Fail-safe behavior (8939) is configured to 4.	0.0 [Hz]	0.0 - 12500.0	Read / write
7149	Float / 4	Forced value	Forced value when forcing is active.	1.0 [Hz]	0.0 - 12500.0	Read / write

Channel 2 pulse output settings

Table A-52 Channel 2 pulse output settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8960	Unsigned / 2	Process value	Select process value for the pulse output.	0	0: Mass flow 1: Volume flow 27: Standard volume flow rate (only hydrocarbon and gas applications)	Read / write
8962	Unsigned / 2	Flow direction	Flow direction filter.	0	0: Positive direction 1: Negative direction 2: Positive and negative directions	Read / write
8965	Float / 4	Amount of volume	Amount value to generate an output pulse. Applicable if Process value (8960) is set to 1.	0.001 [m ³] (8993)	-	Read / write
8963	Float / 4	Amount of mass	Amount value to generate an output pulse. Applicable if Process value (8960) is set to 0.	1.0 [kg] (8992)	-	Read / write
8967	Float / 4	Amount of standard volume	Amount value to generate an output pulse. Applicable if Process value (8960) is set to 27.	1.0 [NI] (8994)	-	Read / write
10055	Unsigned / 2	Pulses per amount	Number of pulses which will be output when configured amount is reached.	1	-	Read / write
8974	Float / 4	Pulse width	Pulse duration.	0.1 [s]	0.00004 - 4.0	Read / write
8977	Unsigned / 2	Polarity	Logical polarity of pulse output.	0	0: Active high level 1: Active low level	Read / write
8961	Unsigned / 2	Fail-safe behavior	Pulse output reaction in case of a fault.	2	0: Last valid value 1: Hold. Value 0.0 substitutes the actual input value 2: Disabled 3: Custom value 4: Maximum pulses/s on CH2 and no pulses on CH3. Only if CH3 is configured to redundancy mode	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
7421	Float / 4	Fail-safe value	Output value in case of a fault and when Fail-safe behavior (8939) is configured to 4.	0.0 [pulses/s]	0.0 - 12500.0	Read / write
7151	Float / 4	Forced value	Forced value when forcing is active.	1.0 [pulses/s]	0.0 - 12500.0	Read / write

Channel 2 status output settings

Table A-53 Channel 2 status output settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8841	Unsigned / 2	Status mode	Select the functionality for the status output.	0	0: Alarm class 1: Alarm item	Read / write
8858	Unsigned / 2	Alarm class	Bit encoded selection of alarm classes which impact the status output. Each diagnostic event is allocated to an alarm class. See Alarm items (Page 324). Applicable if Status mode = 0.	0	- Bit 0: Process value alarm (PA) - Bit 1: Process value warning (PW) - Bit 2: Maintenance alarm (MA) - Bit 3: Maintenance warning (MW) - Bit 4: Maintenance required (MR) - Bit 5: Function check (FC)	Read / write
8899	Unsigned / 2	NAMUR status signals	Bit encoded selection of NAMUR status signals which impacts the status output. Applicable if Status mode = 0. NAMUR status is derived from Alarm class (8858).	0	- Bit 0: Out of specification (PA, PW) - Bit 1: Failure (MA) - Bit 2: Maintenance required (MR, MD) - Bit 3: Function check (FC)	Read / write
8842	Unsigned / 4	Alarm items 1	Bit encoded selection of alarm items that impact the output. Mainly sensor alarms. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8844	Unsigned / 4	Alarm items 2	Bit encoded selection of alarm items that impact the output. Mainly sensor alarms. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
8848	Unsigned / 4	Alarm items 4	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
8850	Unsigned / 4	Alarm items 5	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
8856	Unsigned / 4	Alarm items 8	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
10056	Unsigned / 4	Alarm items 9	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
8854	Unsigned / 4	Alarm items 7	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
8852	Unsigned / 4	Alarm items 6	Bit encoded selection of alarm items that impact the output. Mainly simulation alarms. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
8859	Unsigned / 2	Polarity	Logical polarity of status output.	0	• 0: Active high level • 1: Active low level	Read / write
8860	Float / 4	On delay	Time to delay the leading edge of the output.	0.0 [s]	0.0 - 100.0	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
8862	Float / 4	Off delay	Time to delay the trailing edge of the output.	0.0 [s]	0.0 - 100.0	Read / write
7148	Unsigned / 2	Forced value	Forced value when forcing is active.	0	0 1	Read / write

General channel 3 settings

Table A-54 General channel 3 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9101	Unsigned / 2	Operation mode	Operation mode.	0	0: Off 1: Current output 2: Frequency output 3: Pulse output 4: Signal output 5: Discrete input 6: Analog input	Read / write
7430	Unsigned / 2	Active/passive operation	Shows application possibilities.	-	0: Active operation not possible, use passive wiring! 1: Active operation possible, hardware is able to drive the current loop.	Read only

Channel 3 current output settings

Table A-55 Channel 3 current output settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9102	Unsigned / 2	Process value	Select process value for the current output.	0	• 0: Mass flow • 1: Volume flow • 2: Density • 3: Medium temperature • 18: Sound velocity • 19: Flow velocity • 20: Pressure • 21: Viscosity • 22: RTD temperature 1 • 23: RTD temperature 2 • 24: Medium concentration • 25: Measured current (Channel 5) • 26: Measured current (Channel 6) • 27: Standard volume flow rate (only hydro-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
					carbon and gas applications) • 28: Standardizing factor (only hydrocarbon and gas applications) • 29: Base viscosity (only hydrocarbon applications) • 30: Base density (only hydrocarbon applications) • 31: Liquident (only hydrocarbon applications) • 32: API gravity (only hydrocarbon applications) • 33: Base API gravity (only hydrocarbon applications) • 34: Specific gravity (only hydrocarbon applications) • 35: Base specific gravity (only hydrocarbon applications) • 36: Rate of change (ROC) (only hydrocarbon applications)	
9109	Unsigned / 2	Flow direction	Flow direction filter applicable for Process values (9102) = 0, 1, 19 and 27.	0	• 0: Positive direction • 1: Negative direction • 2: Positive and negative directions • 3: Positive and negative directions (symmetric mode)	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9106	Unsigned / 2	Current mode	Mode of current output.	0	0: 4-20 mA (3.5) 3.8-20.5 (22.6) NAMUR 1: 4-20 mA (3.75) 4.0-20.8 (22.6) US 2: 4-20 mA (2.0) 4.0-20.5 (22.0) 3: 4-20 mA (2.0) 4.0-24.0 (25.0) 4: 0-20 mA (0.0) 0.0-20.5 (22.0) 5: 0-20 mA (0.0) 0.0-24.0 (25.0)	Read / write
9166	Float / 4	Upper range value volume flow	Upper volume flow value that is mapped to the upper nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 1.	0.4 % • max. volume flow [m³/s] (7500)	-	Read / write
9168	Float / 4	Lower range value volume flow	Lower volume flow value that is mapped to the lower nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 1.	0.0 [m³/s] (7500)	-	Read / write
9110	Float / 4	Upper range value mass flow	Upper mass flow value that is mapped to the upper nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 0.	0.2 • max. mass flow [kg/s] (7400)	-	Read / write
9112	Float / 4	Lower range value mass flow	Lower mass flow value that is mapped to the lower nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 0.	0.0 [kg/s] (7400)	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9170	Float / 4	Upper range value density	Upper process density value that is mapped to the upper nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 2.	Max. density [kg/m ³] (7600)	-	Read / write
9172	Float / 4	Lower range value density	Lower process density value that is mapped to the lower nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 2.	0.08 [kg/m ³] (7600)	-	Read / write
9174	Float / 4	Upper range value temperature	Upper medium temperature value that is mapped to the upper nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 3.	Max. medium temperature [°C] (7700)	-	Read / write
9176	Float / 4	Lower range value temperature	Lower medium temperature value that is mapped to the lower nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 3.	Min. medium temperature [°C] (7700)	-	Read / write
9178	Float / 4	Upper range value standard volume flow	Upper standard volume flow value that is mapped to the upper nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 27.	0.4 % • max. standard volume flow [Sm ³ /h] (7964)	-	Read / write
9180	Float / 4	Lower range value standard volume flow	Lower standard volume flow value that is mapped to the lower nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 27.	0.0 [Sm ³ /h] (7964)	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10100	Float / 4	Upper range value velocity	Upper velocity value that is mapped to the upper nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 18, 19 or 31.	1.0 [m/s] (8014 / 7648)	-	Read / write
10102	Float / 4	Lower range value velocity	Lower velocity value that is mapped to the lower nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 18, 19 or 31.	0.0 [m/s] (8014 / 7648)	-	Read / write
10104	Float / 4	Upper range value pressure	Upper process pressure value that is mapped to the upper nominal range boundary selected by current mode (9106). Applicable if Process value (9102) = 20.	100000.0 [Pa] (7548)	-	Read / write
10106	Float / 4	Lower range value pressure	Lower process pressure value that is mapped to the lower nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 20.	0.0 [Pa] (7548)	-	Read / write
10108	Float / 4	Upper range value dimensionless	Upper dimensionless value that is mapped to the upper nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 28, 32, 33, 34, or 36.	1.0	-	Read / write
10110	Float / 4	Lower range value dimensionless	Lower dimensionless value that is mapped to the lower nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 28, 32, 33, 34, or 36.	0.0	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10112	Float / 4	Upper range value current	Upper current value that is mapped to the upper nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 25 or 26.	20.0 [mA]	-	Read / write
10114	Float / 4	Lower range value current	Lower current value that is mapped to the lower nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 25 or 26.	4.0 [mA]	-	Read / write
10116	Float / 4	Upper range value viscosity	Upper process viscosity value that is mapped to the upper nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 21 or 29.	1.0 [m ² /s] (7524)	-	Read / write
10118	Float / 4	Lower range value viscosity	Lower process viscosity value that is mapped to the lower nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 21 or 29.	0.0 [m ² /s] (7524)	-	Read / write
10164	Float / 4	Upper range value ROC	Upper rate of change value that is mapped to the upper nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 36.	1.0 [m/s ²] (8564)	-	Read / write
10166	Float / 4	Lower range value ROC	Lower rate of change value that is mapped to the lower nominal range boundary selected by Current mode (9106). Applicable if Process value (9102) = 36.	0.0 [m/s ²] (8564)	-	Read / write
9107	Float / 4	Damping value	Time constant of damping filter for current output signal.	0.0 [s]	0.0 - 100.0	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9591	Unsigned / 2	Filter-safe activation condition	Fail-safe activation condition.	1	0: Bad status of selected process value 1: Active Maintenance alarm or Failure (NAMUR)	Read / write
9281	Unsigned / 2	Fail-safe min. time	Minimum time the output stays in fail-safe behavior.	0 [s]	0 - 100	Read / write
9114	Unsigned / 2	Fail-safe behavior	Current output reaction in case of a fault.	0	0: Lower fault current 1: Upper fault current 2: Last valid value 3: Disabled 4: Custom value	Read / write
9115	Float / 4	Fail-safe value	Output value in case of a fault and when Fail-safe behavior (9114) is configured to 4.	0.0 [mA]	0.0 - 25.0	Read / write
7153	Float / 4	Forced value	Forced value when forcing is active.	4.0 [mA]	3.5 - 25.0	Read / write
9186	Float / 4	Offset adjustment	Command to trim the lower range value of the loop current. Simulate a loop current of 4.0 mA, measure the current with an ampere meter and write the measured value to this register.	-	0 - 25	Write only
9188	Float / 4	Gain adjustment	Command to trim the upper range value of the loop current. Simulate a loop current of 20.0 mA, measure the current with an ampere meter and write the measured value to this register.	-	0 - 25	Write only

Channel 3 frequency output settings

Table A-56 Channel 3 frequency output settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9299	Unsigned / 2	Redundancy mode	Redundancy mode.	0	0: Off. Channel 3 runs independently. 1: 90°. Channel 3 follows frequency on channel 2 with a 90° shift. 2: 180°. Channel 3 follows frequency on channel 2 with a 180° shift.	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9204	Unsigned / 2	Process value	Select process value for the current output.	0	• 0: Mass flow • 1: Volume flow • 2: Density • 3: Medium temperature • 18: Sound velocity • 19: Flow velocity • 20: Pressure • 21: Viscosity • 22: RTD temperature 1 • 23: RTD temperature 2 • 24: Medium concentration • 25: Measured current (Channel 5) • 26: Measured current (Channel 6) • 27: Standard volume flow rate (only hydro-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
					carbon and gas applications) • 28: Standardizing factor (only hydrocarbon and gas applications) • 29: Base viscosity (only hydrocarbon applications) • 30: Base density (only hydrocarbon applications) • 31: Liquident (only hydrocarbon applications) • 32: API gravity (only hydrocarbon applications) • 33: Base API gravity (only hydrocarbon applications) • 34: Specific gravity (only hydrocarbon applications) • 35: Base specific gravity (only hydrocarbon applications) • 36: Rate of change (ROC) (only hydrocarbon applications)	
9210	Unsigned / 2	Flow direction	Flow direction filter applicable for Process values (9204) = 0, 1, 19 and 27.	0	• 0: Positive direction • 1: Negative direction • 2: Positive and negative directions • 3: Positive and negative directions (symmetric mode)	Read / write
9235	Float / 4	Frequency value high	Upper frequency value. Upper nominal output range boundary.	10000.0 [Hz]	0.0 - 12500.0	Read / write
9237	Float / 4	Frequency value low	Lower frequency value. Lower nominal output range boundary.	0.0 Hz	0.0 - 12500.0	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9215	Float / 4	Upper range value volume flow	Upper volume flow value that is mapped to the upper nominal range boundary selected by Frequency value high (9235). Applicable if Process value (9204) = 1.	0.4 % • max. volume flow [m³/s] (7500)	-	Read / write
9217	Float / 4	Lower range value volume flow	Lower volume flow value that is mapped to the lower nominal range boundary selected by Frequency value low (9237). Applicable if Process value (9204) = 1.	0.0 [m³/s] (7500)	-	Read / write
9211	Float / 4	Upper range value mass flow	Upper mass flow value that is mapped to the upper nominal range boundary selected by Frequency value high (9235). Applicable if Process value (9204) = 0.	0.2 • max. mass flow [kg/s] (7400)	-	Read / write
9213	Float / 4	Lower range value mass flow	Lower mass flow value that is mapped to the lower nominal range boundary selected by Frequency value low (9237). Applicable if Process value (9204) = 0.	0.0 [kg/s] (7400)	-	Read / write
9219	Float / 4	Upper range value density	Upper process density value that is mapped to the upper nominal range boundary selected by Frequency value high (9235). Applicable if Process value (9204) = 2.	Max. density [kg/m³] (7600)	-	Read / write
9221	Float / 4	Lower range value density	Lower process density value that is mapped to the lower nominal range boundary selected by Frequency value low (9237). Applicable if Process value (9204) = 2.	0.08 [kg/m³] (7600)	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9223	Float / 4	Upper range value temperature	Upper medium temperature value that is mapped to the upper nominal range boundary selected by Frequency value high (9235). Applicable if Process value (9204) = 3.	Max. medium temperature [°C] (7700)	-	Read / write
9225	Float / 4	Lower range value temperature	Lower medium temperature value that is mapped to the lower nominal range boundary selected by Frequency value low (9237). Applicable if Process value (9204) = 3.	Min. medium temperature [°C] (7700)	-	Read / write
9227	Float / 4	Upper range value standard volume flow	Upper standard volume flow value that is mapped to the upper nominal range boundary selected by Frequency value high (9235). Applicable if Process value (9204) = 27.	0.4 % • max. standard volume flow [Sm ³ /h] (7964)	-	Read / write
9229	Float / 4	Lower range value standard volume flow	Lower standard volume flow value that is mapped to the lower nominal range boundary selected by Frequency value low (9237). Applicable if Process value (9204) = 27.	0.0 [Sm ³ /h] (7964)	-	Read / write
10124	Float / 4	Upper range value velocity	Upper velocity value that is mapped to the upper nominal range boundary selected by Frequency value high (9235). Applicable if Process value (9204) = 18, 19 or 31.	1.0 [m/s] (8014 / 7648)	-	Read / write
10126	Float / 4	Lower range value velocity	Lower velocity value that is mapped to the lower nominal range boundary selected by Frequency value low (9237). Applicable if Process value (9204) = 18, 19 or 31.	0.0 [m/s] (8014 / 7648)	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10128	Float / 4	Upper range value pressure	Upper process pressure value that is mapped to the upper nominal range boundary selected by Frequency value high (9235). Applicable if Process value (9204) = 20.	100000.0 [Pa] (7548)	-	Read / write
10130	Float / 4	Lower range value pressure	Lower process pressure value that is mapped to the lower nominal range boundary selected by Frequency value low (9237). Applicable if Process value (9204) = 20.	0.0 [Pa] (7548)	-	Read / write
10132	Float / 4	Upper range value dimensionless	Upper dimensionless value that is mapped to the upper nominal range boundary selected by Frequency value high (9235). Applicable if Process value (9204) = 28, 32, 33, 34, or 36.	1.0	-	Read / write
10134	Float / 4	Lower range value dimensionless	Lower dimensionless value that is mapped to the lower nominal range boundary selected by Frequency value low (9237). Applicable if Process value (9204) = 28, 32, 33, 34, or 36.	0.0	-	Read / write
10136	Float / 4	Upper range value current	Upper current value that is mapped to the upper nominal range boundary selected by Frequency value high (9235). Applicable if Process value (9204) = 25 or 26.	20.0 [mA]	-	Read / write
10138	Float / 4	Lower range value current	Lower current value that is mapped to the lower nominal range boundary selected by Frequency value low (9237). Applicable if Process value (9204) = 25 or 26.	4.0 [mA]	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10140	Float / 4	Upper range value viscosity	Upper process viscosity value that is mapped to the upper nominal range boundary selected by Frequency value high (9235). Applicable if Process value (9204) = 21 or 29.	1.0 [m ² /s] (7524)	-	Read / write
10142	Float / 4	Lower range value viscosity	Lower process viscosity value that is mapped to the lower nominal range boundary selected by Frequency value low (9237). Applicable if Process value (9204) = 21 or 29.	0.0 [m ² /s] (7524)	-	Read / write
10168	Float / 4	Upper range value ROC	Upper rate of change value that is mapped to the upper nominal range boundary selected by Frequency value high (9235). Applicable if Process value (9204) = 36.	1.0 [m/s ²] (8564)	-	Read / write
10170	Float / 4	Lower range value ROC	Lower rate of change value that is mapped to the lower nominal range boundary selected by Frequency value low (9237). Applicable if Process value (9204) = 36.	0.0 [m/s ²] (8564)	-	Read / write
9208	Float / 4	Damping value	Time constant of damping filter for frequency output signal.	0.0 [s]	0.0 - 100.0	Read / write
9591	Unsigned / 2	Fail-safe activation condition	Fail-safe activation condition.	1	0: Bad status of selected process value 1: Active Maintenance alarm or Failure (NAMUR)	Read / write
9281	Unsigned / 2	Fail-safe min. time	Minimum time the output stays in fail-safe behavior.	0 [s]	0 - 100	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9239	Unsigned / 2	Fail-safe behavior	Frequency output reaction in case of a fault.	2	0: Frequency value low 1: Frequency value high 2: Last valid value 3: Disabled 4: Custom value	Read / write
9240	Float / 4	Fail-safe value	Output value in case of a fault and when Fail-safe behavior (9239) is configured to 4.	0.0 [Hz]	0.0 - 12500.0	Read / write
7156	Float / 4	Forced value	Forced value when forcing is active.	1.0 [Hz]	0.0 - 12500.0	Read / write

Channel 3 pulse output settings

Table A-57 Channel 3 pulse output settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9280	Unsigned / 2	Redundancy mode	Redundancy mode.	0	0: Off. Channel 3 runs independently. 1: 90°. Channel 3 follows pulses on channel 2 with a 90° shift. 2: 180°. Channel 3 follows pulses on channel 2 with a 180° shift.	Read / write
9260	Unsigned / 2	Process value	Select process value for the pulse output.	0	0: Mass flow 1: Volume flow 27: Standard volume flow rate (only hydrocarbon and gas applications)	Read / write
9262	Unsigned / 2	Flow direction	Flow direction filter.	0	0: Positive direction 1: Negative direction 2: Positive and negative directions	Read / write
9265	Float / 4	Amount of volume	Amount value to generate an output pulse. Applicable if process value (9260) is set to 1.	0.001 [m³] (8993)	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9263	Float / 4	Amount of mass	Amount value to generate an output pulse. Applicable if process value (9260) is set to 0.	1.0 [kg] (8992)	-	Read / write
9267	Float / 4	Amount of standard volume	Amount value to generate an output pulse. Applicable if process value (9260) is set to 27.	1.0 [SI] (8994)	-	Read / write
10155	Unsigned / 2	Pulses per amount	Number of pulses which will be output when configured amount is reached.	1	-	Read / write
9274	Float / 4	Pulse width	Pulse duration.	0.1 [s]	0.00004 - 4.0	Read / write
9277	Unsigned / 2	Polarity	Logical polarity of pulse output.	0	0: Active high level 1: Active low level	Read / write
9591	Unsigned / 2	Fail-safe activation condition	Fail-safe activation condition.	1	0: Bad status of selected process value 1: Active Maintenance alarm or Failure (NAMUR)	Read / write
9281	Unsigned / 2	Fail-safe min. time	Minimum time the output stays in fail-safe behavior.	0 [s]	0 - 100	Read / write
9261	Unsigned / 2	Fail-safe behavior	Pulse output reaction in case of a fault. Only applicable if Redundancy mode (9280) = 0.	0	0: Last valid value 1: Hold. Value 0.0 substitutes the actual input value 2: Disabled 3: Custom value	Read / write
7431	Float / 4	Fail-safe value	Output value in case of a fault and when Fail-safe behavior (9261) is configured to 4.	0.0 [pulses/s]	0.0 - 12500.0	Read / write
7158	Float / 4	Forced value	Forced value when forcing is active.	1.0 [pulses/s]	0.0 - 12500.0	Read / write

Channel 3 status output settings (relay)

Table A-58 Channel 3 status output settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9141	Unsigned / 2	Status mode	Select the functionality for the status output.	0	0: Alarm class 1: Alarm item	Read / write
9158	Unsigned / 2	Alarm class	Bit encoded selection of alarm classes which impact the status output. Each diagnostic event is allocated to an alarm class. See Alarm items (Page 324). Applicable if Status mode = 0.	0	- Bit 0: Process value alarm (PA) - Bit 1: Process value warning (PW) - Bit 2: Maintenance alarm (MA) - Bit 3: Maintenance warning (MW) - Bit 4: Maintenance required (MR) - Bit 5: Function check (FC)	Read / write
9199	Unsigned / 2	NAMUR status signals	Bit encoded selection of NAMUR status signals which impacts the status output. Applicable if Status mode = 0. NAMUR status is derived from Alarm class (9158).	0	- Bit 0: Out of specification (PA, PW) - Bit 1: Failure (MA) - Bit 2: Maintenance required (MR, MD) - Bit 3: Function check (FC)	Read / write
9142	Unsigned / 4	Alarm items 1	Bit encoded selection of alarm items that impact the output. Mainly sensor alarms. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
9144	Unsigned / 4	Alarm items 2	Bit encoded selection of alarm items that impact the output. Mainly sensor alarms. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
9148	Unsigned / 4	Alarm items 4	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9150	Unsigned / 4	Alarm items 5	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
9156	Unsigned / 4	Alarm items 8	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
10156	Unsigned / 4	Alarm items 9	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
9154	Unsigned / 4	Alarm items 7	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
9152	Unsigned / 4	Alarm items 6	Bit encoded selection of alarm items that impact the output. Mainly simulation alarms. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
9159	Unsigned / 2	Polarity	Logical polarity of status output.	0	0: Active high level 1: Active low level	Read / write
9160	Float / 4	On delay	Time to delay the leading edge of the output.	0.0 [s]	0.0 - 100.0	Read / write
9162	Float / 4	Off delay	Time to delay the trailing edge of the output.	0.0 [s]	0.0 - 100.0	Read / write
7155	Unsigned / 2	Forced value	Forced value when forcing is active.	0	0 1	Read / write

Channel 3 discrete input settings

Table A-59 Channel 3 discrete input settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9131	Unsigned / 2	Input leading edge function	Select the functionality for the leading edge of the active discrete input signal.	0	• 0: Off • 6: Reset totalizer 1 • 7: Reset totalizer 2 • 8: Reset totalizer 3 • 9: Reset all totalizers • 10: Start zero point adjustment • 11: Force outputs • 12: Freeze process values • 13: Stop forcing outputs • 14: Unfreeze process values	Read / write
9132	Unsigned / 2	Input trailing edge function	Select the functionality for the trailing edge of the active discrete input signal.	0	• 0: Off • 6: Reset totalizer 1 • 7: Reset totalizer 2 • 8: Reset totalizer 3 • 9: Reset all totalizers • 10: Start zero point adjustment • 11: Force outputs • 12: Freeze process values • 13: Stop forcing outputs • 14: Unfreeze process values	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9135	Unsigned / 2	Polarity	Logical polarity of discrete input signal.	0	• 0: Active high level • 1: Active low level	Read / write
9139	Unsigned / 2	Debounce time	Debounce time to filter the input signal.	0	• 0: 0 ms • 1: 0.5 ms • 2: 1 ms • 3: 1.5 ms • 4: 2 ms • 5: 2.5 ms • 6: 3 ms • 7: 3.5 ms • 8: 4 ms • 9: 4.5 ms • 10: 5 ms • 11: 5.5 ms • 12: 6 ms • 13: 6.5 ms • 14: 7 ms • 15: 7.5 ms	Read / write

Channel 3 analog input settings

Table A-60 Channel 3 analog input settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10522	Unsigned / 2	Current mode	Mode of current output.	0	0: 4-20 mA (3.5) 3.8-20.5 (22.6) NAMUR 1: 4-20 mA (3.75) 4.0-20.8 (22.6) US 2: 4-20 mA (2.0) 4.0-20.5 (22.0) 3: 4-20 mA (2.0) 4.0-24.0 (25.0) 4: 0-20 mA (0.0) 0.0-20.5 (22.0) 5: 0-20 mA (0.0) 0.0-24.0 (25.0)	Read / write
10523	Unsigned / 2	Process value	Assignment of the current input value to a process value.	0	0: Pressure 1: Temperature 2: Density 3: Viscosity	Read / write
10525	Float / 4	Upper range value pressure	Upper process pressure value that is mapped to the upper nominal range boundary selected by Current mode (10522). Applicable if Process value (10523) = 0.	100000.0 [Pa] (7548)	-	Read / write
10527	Float / 4	Lower range value pressure	Lower process pressure value that is mapped to the lower nominal range boundary selected by Current mode (10522). Applicable if Process value (10523) = 0.	0.0 [Pa] (7548)	-	Read / write
10531	Float / 4	Upper range value temperature	Upper medium temperature value that is mapped to the upper nominal range boundary selected by Current mode (10522). Applicable if Process value (10523) = 1.	Max. medium temperature [°C] (7700)	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10533	Float / 4	Lower range value temperature	Lower medium temperature value that is mapped to the lower nominal range boundary selected by Current mode (10522). Applicable if Process value (10523) = 1.	Min. medium temperature [°C] (7700)	-	Read / write
10537	Float / 4	Upper range value density	Upper process density value that is mapped to the upper nominal range boundary selected by Current mode (10522). Applicable if Process value (10523) = 2.	Max. density [kg/m ³] (7600)	-	Read / write
10539	Float / 4	Lower range value density	Lower process density value that is mapped to the lower nominal range boundary selected by Current mode (10522). Applicable if Process value (10523) = 2.	0.08 [kg/m ³] (7600)	-	Read / write
10543	Float / 4	Upper range value viscosity	Upper process viscosity value that is mapped to the upper nominal range boundary selected by Current mode (10522). Applicable if Process value (10523) = 3.	1.0 [m ² /s] (7524)	-	Read / write
10545	Float / 4	Lower range value viscosity	Lower process viscosity value that is mapped to the lower nominal range boundary selected by Current mode (10522). Applicable if Process value (10523) = 3.	0.0 [m ² /s] (7524)	-	Read / write
10524	Unsigned / 2	Fail-safe behavior	Reaction in case of a fault at the current input.	0	0: Last valid value 1: Custom value	Read / write
10529	Float / 4	Fail-safe value pressure	Input value in case of a fault and when Fail-safe behavior (10524) configured to 1. Applicable if Process value (10523) = 0.	0.0 [Pa] (7548)	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10535	Float / 4	Fail-safe temperature value	Input value in case of a fault and when Fail-safe behavior (10524) configured to 1. Applicable if Process value (10523) = 1.	Min. medium temperature [°C] (7700)	-	Read / write
10541	Float / 4	Fail-safe value density	Input value in case of a fault and when Fail-safe behavior (10524) configured to 1. Applicable if Process value (10523) = 2.	600.0 [kg/m³] (7600)	-	Read / write
10547	Float / 4	Fail-safe value viscosity	Input value in case of a fault and when Fail-safe behavior (10524) configured to 1. Applicable if Process value (10523) = 3.	0.0 [m²/s] (7524)	-	Read / write
10520	Float / 4	Trimmed input value	Provides the measured current value.	-	-	Read only
10508	Float / 4	Offset adjustment	Command to trim the lower range value of the analog input. Provide a loop current of 4.0 mA, read out the value of Trimmed input value and write the value to this register.	-	-	Write only
10510	Float / 4	Gain adjustment	Command to trim the upper range value of the loop current. Simulate a loop current of 20.0 mA, measure the current with an amperemeter and write the measured value to this register.	-	-	Write only

General channel 4 settings

Table A-61 General channel 4 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9301	Unsigned / 2	Operation mode	Operation mode.	0	• 0: Off • 1: Current output • 2: Frequency output • 3: Pulse output • 4: Signal output • 5: Discrete input • 6: Analog input	Read / write
7440	Unsigned / 2	Active/passive operation	Shows application possibilities.	-	• 0: Active operation not possible, use passive wiring! • 1: Active operation possible, hardware is able to drive the current loop.	Read only

Channel 4 current output settings

Table A-62 Channel 4 current output settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9302	Unsigned / 2	Process value	Select process value for the current output.	0	• 0: Mass flow • 1: Volume flow • 2: Density • 3: Medium temperature • 18: Sound velocity • 19: Flow velocity • 20: Pressure • 21: Viscosity • 22: RTD temperature 1 • 23: RTD temperature 2 • 24: Medium concentration • 25: Measured current (Channel 5) • 26: Measured current (Channel 6) • 27: Standard volume flow rate (only hydro-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
					carbon and gas applications) • 28: Standardizing factor (only hydrocarbon and gas applications) • 29: Base viscosity (only hydrocarbon applications) • 30: Base density (only hydrocarbon applications) • 31: Liquident (only hydrocarbon applications) • 32: API gravity (only hydrocarbon applications) • 33: Base API gravity (only hydrocarbon applications) • 34: Specific gravity (only hydrocarbon applications) • 35: Base specific gravity (only hydrocarbon applications) • 36: Rate of change (ROC) (only hydrocarbon applications)	
9309	Unsigned / 2	Flow direction	Flow direction filter applicable for Process values (9302) = 0, 1, 19 and 27.	0	• 0: Positive direction • 1: Negative direction • 2: Positive and negative directions • 3: Positive and negative directions (symmetric mode)	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9306	Unsigned / 2	Current mode	Mode of current output.	0	0: 4-20 mA (3.5) 3.8-20.5 (22.6) NAMUR 1: 4-20 mA (3.75) 4.0-20.8 (22.6) US 2: 4-20 mA (2.0) 4.0-20.5 (22.0) 3: 4-20 mA (2.0) 4.0-24.0 (25.0) 4: 0-20 mA (0.0) 0.0-20.5 (22.0) 5: 0-20 mA (0.0) 0.0-24.0 (25.0)	Read / write
9366	Float / 4	Upper range value volume flow	Upper volume flow value that is mapped to the upper nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 1.	0.4 % • max. volume flow [m³/s] (7500)	-	Read / write
9368	Float / 4	Lower range value volume flow	Lower volume flow value that is mapped to the lower nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 1.	0.0 [m³/s] (7500)	-	Read / write
9310	Float / 4	Upper range value mass flow	Upper mass flow value that is mapped to the upper nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 0.	0.2 • max. mass flow [kg/s] (7400)	-	Read / write
9312	Float / 4	Lower range value mass flow	Lower mass flow value that is mapped to the lower nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 0.	0.0 [kg/s] (7400)	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9370	Float / 4	Upper range value density	Upper process density value that is mapped to the upper nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 2.	Max. density [kg/m ³] (7600)	-	Read / write
9372	Float / 4	Lower range value density	Lower process density value that is mapped to the lower nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 2.	0.08 [kg/m ³] (7600)	-	Read / write
9374	Float / 4	Upper range value temperature	Upper medium temperature value that is mapped to the upper nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 3.	Max. medium temperature [°C] (7700)	-	Read / write
9376	Float / 4	Lower range value temperature	Lower medium temperature value that is mapped to the lower nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 3.	Min. medium temperature [°C] (7700)	-	Read / write
9378	Float / 4	Upper range value standard volume flow	Upper standard volume flow value that is mapped to the upper nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 27.	0.4 % • max. standard volume flow [Sm ³ /h] (7964)	-	Read / write
9380	Float / 4	Lower range value standard volume flow	Lower standard volume flow value that is mapped to the lower nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 27.	0.0 [Sm ³ /h] (7964)	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10200	Float / 4	Upper range value velocity	Upper velocity value that is mapped to the upper nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 18, 19 or 31.	1.0 [m/s] (8014 / 7648)	-	Read / write
10202	Float / 4	Lower range value velocity	Lower velocity value that is mapped to the lower nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 18, 19 or 31.	0.0 [m/s] (8014 / 7648)	-	Read / write
10204	Float / 4	Upper range value pressure	Upper process pressure value that is mapped to the upper nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 20.	100000.0 [Pa] (7548)	-	Read / write
10206	Float / 4	Lower range value pressure	Lower process pressure value that is mapped to the lower nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 20.	0.0 [Pa] (7548)	-	Read / write
10208	Float / 4	Upper range value dimensionless	Upper dimensionless value that is mapped to the upper nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 28, 32, 33, 34, or 36.	1.0	-	Read / write
10210	Float / 4	Lower range value dimensionless	Lower dimensionless value that is mapped to the lower nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 28, 32, 33, 34, or 36.	0.0	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10212	Float / 4	Upper range value current	Upper current value that is mapped to the upper nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 25 or 26.	20.0 [mA]	-	Read / write
10214	Float / 4	Lower range value current	Lower current value that is mapped to the lower nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 25 or 26.	4.0 [mA]	-	Read / write
10216	Float / 4	Upper range value viscosity	Upper process viscosity value that is mapped to the upper nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 21 or 29.	1.0 [m ² /s] (7524)	-	Read / write
10218	Float / 4	Lower range value viscosity	Lower process viscosity value that is mapped to the lower nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 21 or 29.	0.0 [m ² /s] (7524)	-	Read / write
10264	Float / 4	Upper range value ROC	Upper rate of change value that is mapped to the upper nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 36.	1.0 [m/s ²] (8564)	-	Read / write
10266	Float / 4	Lower range value ROC	Lower rate of change value that is mapped to the lower nominal range boundary selected by Current mode (9306). Applicable if Process value (9302) = 36.	0.0 [m/s ²] (8564)	-	Read / write
9307	Float / 4	Damping value	Time constant of damping filter for current output signal.	0.0 [s]	0.0 - 100.0	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9592	Unsigned / 2	Filter-safe activation condition	Fail-safe activation condition.	1	0: Bad status of selected process value 1: Active Maintenance alarm or Failure (NAMUR)	Read / write
9481	Unsigned / 2	Fail-safe min. time	Minimum time the output stays in fail-safe behavior.	0 [s]	0 - 100	Read / write
9314	Unsigned / 2	Fail-safe behavior	Current output reaction in case of a fault.	0	0: Lower fault current 1: Upper fault current 2: Last valid value 3: Disabled 4: Custom value	Read / write
9315	Float / 4	Fail-safe value	Output value in case of a fault and when Fail-safe behavior (9314) is configured to 4.	0.0 [mA]	0.0 - 25.0	Read / write
7160	Float / 4	Forced value	Forced value when forcing is active.	4.0 [mA]	3.5 - 25.0	Read / write
9386	Float / 4	Offset adjustment	Command to trim the lower range value of the loop current. Simulate a loop current of 4.0 mA, measure the current with an ampere meter and write the measured value to this register.	-	0 - 25	Write only
9388	Float / 4	Gain adjustment	Command to trim the upper range value of the loop current. Simulate a loop current of 20.0 mA, measure the current with an ampere meter and write the measured value to this register.	-	0 - 25	Write only

Channel 4 frequency output settings

Table A-63 Channel 4 frequency output settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9404	Unsigned / 2	Process value	Select process value for the current output.	0	• 0: Mass flow • 1: Volume flow • 2: Density • 3: Medium temperature • 18: Sound velocity • 19: Flow velocity • 20: Pressure • 21: Viscosity • 22: RTD temperature 1 • 23: RTD temperature 2 • 24: Medium concentration • 25: Measured current (Channel 5) • 26: Measured current (Channel 6) • 27: Standard volume flow rate (only hydro-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
					carbon and gas applications) • 28: Standardizing factor (only hydrocarbon and gas applications) • 29: Base viscosity (only hydrocarbon applications) • 30: Base density (only hydrocarbon applications) • 31: Liquident (only hydrocarbon applications) • 32: API gravity (only hydrocarbon applications) • 33: Base API gravity (only hydrocarbon applications) • 34: Specific gravity (only hydrocarbon applications) • 35: Base specific gravity (only hydrocarbon applications) • 36: Rate of change (ROC) (only hydrocarbon applications)	
9410	Unsigned / 2	Flow direction	Flow direction filter applicable for Process values (9404) set to 0, 1, 19, or 27.	0	• 0: Positive direction • 1: Negative direction • 2: Positive and negative directions • 3: Positive and negative directions (symmetric mode)	Read / write
9435	Float / 4	Frequency value high	Upper frequency value. Upper nominal output range boundary.	10000.0 [Hz]	0.0 - 12500.0	Read / write
9437	Float / 4	Frequency value low	Lower frequency value. Lower nominal output range boundary.	0.0 Hz	0.0 - 12500.0	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9415	Float / 4	Upper range value volume flow	Upper volume flow value that is mapped to the upper nominal range boundary selected by Frequency value high (9435). Applicable if Process value (9404) = 1.	0.4 % • max. volume flow [m³/s] (7500)	-	Read / write
9417	Float / 4	Lower range value volume flow	Lower volume flow value that is mapped to the lower nominal range boundary selected by Frequency value low (9437). Applicable if Process value (9404) = 1.	0.0 [m³/s] (7500)	-	Read / write
9411	Float / 4	Upper range value mass flow	Upper mass flow value that is mapped to the upper nominal range boundary selected by Frequency value high (9435). Applicable if Process value (9404) = 0.	0.2 • max. mass flow [kg/s] (7400)	-	Read / write
9413	Float / 4	Lower range value mass flow	Lower mass flow value that is mapped to the lower nominal range boundary selected by Frequency value low (9437). Applicable if Process value (9404) = 0.	0.0 [kg/s] (7400)	-	Read / write
9419	Float / 4	Upper range value density	Upper process density value that is mapped to the upper nominal range boundary selected by Frequency value high (9435). Applicable if Process value (9404) = 2.	Max. density [kg/m³] (7600)	-	Read / write
9421	Float / 4	Lower range value density	Lower process density value that is mapped to the lower nominal range boundary selected by Frequency value low (9437). Applicable if Process value (9404) = 2.	0.08 [kg/m³] (7600)	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9423	Float / 4	Upper range value temperature	Upper medium temperature value that is mapped to the upper nominal range boundary selected by Frequency value high (9435). Applicable if Process value (9404) = 3.	Max. medium temperature [°C] (7700)	-	Read / write
9425	Float / 4	Lower range value temperature	Lower medium temperature value that is mapped to the lower nominal range boundary selected by Frequency value low (9437). Applicable if Process value (9404) = 3.	Min. medium temperature [°C] (7700)	-	Read / write
9427	Float / 4	Upper range value standard volume flow	Upper standard volume flow value that is mapped to the upper nominal range boundary selected by Frequency value high (9435). Applicable if Process value (9404) = 27.	0.4 % • max. standard volume flow [Sm³/h] (7964)	-	Read / write
9429	Float / 4	Lower range value standard volume flow	Lower standard volume flow value that is mapped to the lower nominal range boundary selected by Frequency value low (9437). Applicable if Process value (9404) = 27.	- [Sm³/h] (7964)	-	Read / write
10224	Float / 4	Upper range value velocity	Upper velocity value that is mapped to the upper nominal range boundary selected by Frequency value high (9435). Applicable if Process value (9404) = 18, 19 or 31.	1.0 [m/s] (8014 / 7648)	-	Read / write
10226	Float / 4	Lower range value velocity	Lower velocity value that is mapped to the lower nominal range boundary selected by Frequency value low (9437). Applicable if Process value (9404) = 18, 19 or 31.	0.0 [m/s] (8014 / 7648)	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10228	Float / 4	Upper range value pressure	Upper process pressure value that is mapped to the upper nominal range boundary selected by Frequency value high (9435). Applicable if Process value (9404) = 20.	100000.0 [Pa] (7548)	-	Read / write
10230	Float / 4	Lower range value pressure	Lower process pressure value that is mapped to the lower nominal range boundary selected by Frequency value low (9437). Applicable if Process value (9404) = 20.	0.0 [Pa] (7548)	-	Read / write
10232	Float / 4	Upper range value dimensionless	Upper dimensionless value that is mapped to the upper nominal range boundary selected by Frequency value high (9435). Applicable if Process value (9404) = 28, 32, 33, 34, or 36.	1.0	-	Read / write
10234	Float / 4	Lower range value dimensionless	Lower dimensionless value that is mapped to the lower nominal range boundary selected by Frequency value low (9437). Applicable if Process value (9404) = 28, 32, 33, 34, or 36.	0.0	-	Read / write
10236	Float / 4	Upper range value current	Upper current value that is mapped to the upper nominal range boundary selected by Frequency value high (9435). Applicable if Process value (9404) = 25 or 26.	20.0 [mA]	-	Read / write
10238	Float / 4	Lower range value current	Lower current value that is mapped to the lower nominal range boundary selected by Frequency value low (9437). Applicable if Process value (9404) = 25 or 26.	4.0 [mA]	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10240	Float / 4	Upper range value viscosity	Upper process viscosity value that is mapped to the upper nominal range boundary selected by Frequency value high (9435). Applicable if Process value (9404) = 21 or 29.	1.0 [m ² /s] (7524)	-	Read / write
10242	Float / 4	Lower range value viscosity	Lower process viscosity value that is mapped to the lower nominal range boundary selected by Frequency value low (9437). Applicable if Process value (9404) = 21 or 29.	0.0 [m ² /s] (7524)	-	Read / write
10268	Float / 4	Upper range value ROC	Upper rate of change value that is mapped to the upper nominal range boundary selected by Frequency value high (9435). Applicable if Process value (9404) = 36.	1.0 [m/s ²] (8564)	-	Read / write
10270	Float / 4	Lower range value ROC	Lower rate of change value that is mapped to the lower nominal range boundary selected by Frequency value low (9437). Applicable if Process value (9404) = 36.	0.0 [m/s ²] (8564)	-	Read / write
9408	Float / 4	Damping filter	Time constant of damping filter for frequency output signal.	0.0 [s]	0.0 - 100.0	Read / write
9592	Unsigned / 2	Fail-safe activation condition	Fail-safe activation condition.	1	0: Bad status of selected process value 1: Active Maintenance alarm or Failure (NAMUR)	Read / write
9481	Unsigned / 2	Fail-safe min. time	Minimum time the output stays in fail-safe behavior.	0 [s]	0 - 100	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9439	Unsigned / 2	Fail-safe behavior	Frequency output reaction in case of a fault.	2	0: Frequency value low 1: Frequency value high 2: Last valid value 3: Disabled 4: Custom value	Read / write
9440	Float / 4	Fail-safe value	Output value in case of a fault and when Fail-safe behavior (9439) is configured to 4.	0.0 [Hz]	0.0 - 12500.0	Read / write
7163	Float / 4	Forced value	Forced value when forcing is active.	1.0 [Hz]	0.0 - 12500.0	Read / write

Channel 4 pulse output settings

Table A-64 Channel 4 pulse output settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9460	Unsigned / 2	Process value	Select process value for the pulse output.	0	0: Mass flow 1: Volume flow 27: Standard volume flow rate (only hydrocarbon and gas applications)	Read / write
9462	Unsigned / 2	Flow direction	Flow direction filter.	0	0: Positive direction 1: negative direction 2: Positive and negative directions	Read / write
9465	Float / 4	Amount of volume	Amount value to generate an output pulse. Applicable if process value (9460) is set to 1.	0.001 [m ³] (8993)	-	Read / write
9463	Float / 4	Amount of mass	Amount value to generate an output pulse. Applicable if process value (9460) is set to 0.	1.0 [kg] (8992)	-	Read / write
9467	Float / 4	Amount of standard volume	Amount value to generate an output pulse. Applicable if process value (9460) is set to 27.	1.0 [SI] (8994)	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10255	Unsigned / 2	Pulses per amount	Number of pulses which will be output when configured amount is reached.	1	-	Read / write
9474	Float / 4	Pulse width	Pulse duration.	0.1 [s]	0.00004 - 4.0	Read / write
9477	Unsigned / 2	Polarity	Logical polarity of pulse output.	0	0: Active high level 1: Active low level	Read / write
9592	Unsigned / 2	Fail-safe activation condition	Fail safe activation condition.	1	0: Bad status of selected process value 1: Active Maintenance alarm or Failure (NAMUR)	Read / write
9481	Unsigned / 2	Fail-safe min. time	Minimum time the output stays in Fail-safe behavior.	0 [s]	0 - 100	Read / write
9461	Unsigned / 2	Fail-safe behavior	Pulse output reaction in case of a fault.	0	0: Last valid value 1: Hold. Value 0.0 substitutes the actual input value 2: Disabled 3: Custom value	Read / write
7441	Float / 4	Fail-safe value	Output value in case of a fault and when Fail-safe behavior (9461) is configured to 4.	0.0 [pulses/s]	0.0 - 12500.0	Read / write
7165	Float / 4	Forced value	Forced value when forcing is active.	1.0 [pulses/s]	0.0 - 12500.0	Read / write

Channel 4 status output settings

Table A-65 Channel 3 status output settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9341	Unsigned / 2	Status mode	Select the functionality for the status output.	0	0: Alarm class 1: Alarm item	Read / write
9358	Unsigned / 2	Alarm class	Bit encoded selection of alarm classes which impact the status output. Each diagnostic event is allocated to an alarm class. See Alarm items (Page 324). Applicable if Status mode = 0.	0	- Bit 0: Process value alarm (PA) - Bit 1: Process value warning (PW) - Bit 2: Maintenance alarm (MA) - Bit 3: Maintenance warning (MW) - Bit 4: Maintenance required (MR) - Bit 5: Function check (FC)	Read / write
9399	Unsigned / 2	NAMUR status signals	Bit encoded selection of NAMUR status signals which impacts the status output. Applicable if Status mode = 1. NAMUR status is derived from Alarm class (9358).	0	- Bit 0: Out of specification (PA, PW) - Bit 1: Failure (MA) - Bit 2: Maintenance required (MR, MD) - Bit 3: Function check (FC)	Read / write
9342	Unsigned / 4	Alarm items 1	Bit encoded selection of alarm items that impact the output. Mainly sensor alarms. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
9344	Unsigned / 4	Alarm items 2	Bit encoded selection of alarm items that impact the output. Mainly sensor alarms. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
9348	Unsigned / 4	Alarm items 4	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9350	Unsigned / 4	Alarm items 5	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
9356	Unsigned / 4	Alarm items 8	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
10256	Unsigned / 4	Alarm items 9	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
9354	Unsigned / 4	Alarm items 7	Bit encoded selection of alarm items that impact the output. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
9352	Unsigned / 4	Alarm items 6	Bit encoded selection of alarm items that impact the output. Mainly simulation alarms. See Alarm items (Page 324). Applicable if Status mode = 1.	0		Read / write
9359	Unsigned / 2	Polarity	Logical polarity of status output.	0	0: Active high level 1: Active low level	Read / write
9360	Float / 4	On delay	Time to delay the leading edge of the output.	0.0 [s]	0.0 - 100.0	Read / write
9362	Float / 4	Off delay	Time to delay the trailing edge of the output.	0.0 [s]	0.0 - 100.0	Read / write
7162	Unsigned / 2	Forced value	Forced value when forcing is active.	0	0 1	Read / write

Channel 4 discrete input settings

Table A-66 Channel 4 discrete input settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9331	Unsigned / 2	Input leading edge function	Select the functionality for the leading edge of the active discrete input signal.	0	• 0: Off • 6: Reset totalizer 1 • 7: Reset totalizer 2 • 8: Reset totalizer 3 • 9: Reset all totalizers • 10: Start zero point adjustment • 11: Force outputs • 12: Freeze process values • 13: Stop forcing outputs • 14: Unfreeze process values	Read / write
9332	Unsigned / 2	Input trailing edge function	Select the functionality for the trailing edge of the active discrete input signal.	0	• 0: Off • 6: Reset totalizer 1 • 7: Reset totalizer 2 • 8: Reset totalizer 3 • 9: Reset all totalizers • 10: Start zero point adjustment • 11: Force outputs • 12: Freeze process values • 13: Stop forcing outputs • 14: Unfreeze process values	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
9335	Unsigned / 2	Polarity	Logical polarity of discrete input signal.	0	• 0: Active high level • 1: Active low level	Read / write
9339	Unsigned / 2	Debounce time	Debounce time to filter the input signal.	0	• 0: 0 ms • 1: 0.5 ms • 2: 1 ms • 3: 1.5 ms • 4: 2 ms • 5: 2.5 ms • 6: 3 ms • 7: 3.5 ms • 8: 4 ms • 9: 4.5 ms • 10: 5 ms • 11: 5.5 ms • 12: 6 ms • 13: 6.5 ms • 14: 7 ms • 15: 7.5 ms	Read / write

Channel 4 analog input settings

Table A-67 Channel 4 analog input settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10622	Unsigned / 2	Current mode	Mode of current output.	0	0: 4-20 mA (3.5) 3.8-20.5 (22.6) NAMUR 1: 4-20 mA (3.75) 4.0-20.8 (22.6) US 2: 4-20 mA (2.0) 4.0-20.5 (22.0) 3: 4-20 mA (2.0) 4.0-24.0 (25.0) 4: 0-20 mA (0.0) 0.0-20.5 (22.0) 5: 0-20 mA (0.0) 0.0-24.0 (25.0)	Read / write
10623	Unsigned / 2	Process value	Assignment of the current input value to a process value.	0	0: Pressure 1: Temperature 2: Density 3: Viscosity	Read / write
10625	Float / 4	Upper range value pressure	Upper process pressure value that is mapped to the upper nominal range boundary selected by current mode (10622). Applicable if process value (10623) = 0.	100000.0 [Pa] (7548)	-	Read / write
10627	Float / 4	Lower range value pressure	Lower process pressure value that is mapped to the lower nominal range boundary selected by current mode (10622). Applicable if process value (10623) = 0.	0.0 [Pa] (7548)	-	Read / write
10631	Float / 4	Upper range value temperature	Upper medium temperature value that is mapped to the upper nominal range boundary selected by current mode (10622). Applicable if process value (10623) = 1.	Max. medium temperature [°C] (7700)	-	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10633	Float / 4	Lower range value temperature	Lower medium temperature value that is mapped to the lower nominal range boundary selected by current mode (10622). Applicable if process value (10623) = 1.	Min. medium temperature [°C] (7700)	-	Read / write
10637	Float / 4	Upper range value density	Upper process density value that is mapped to the upper nominal range boundary selected by current mode (10622). Applicable if process value (10623) = 2.	Max. density [kg/m³] (7600)	-	Read / write
10639	Float / 4	Lower range value density	Lower process density value that is mapped to the lower nominal range boundary selected by current mode (10622). Applicable if process value (10623) = 2.	0.08 [kg/m³] (7600)	-	Read / write
10643	Float / 4	Upper range value viscosity	Upper process viscosity value that is mapped to the upper nominal range boundary selected by current mode (10622). Applicable if process value (10623) = 3.	1.0 [m²/s] (7524)	-	Read / write
10645	Float / 4	Lower range value viscosity	Lower process viscosity value that is mapped to the lower nominal range boundary selected by current mode (10622). Applicable if process value (10623) = 3.	0.0 [m²/s] (7524)	-	Read / write
10624	Unsigned / 2	Fail-safe behavior	Reaction in case of a fault at the current input.	0	0: Last valid value 1: Custom value	Read / write
10629	Float / 4	Fail-safe value pressure	Input value in case of a fault and when Fail-safe behavior configured to 1. Applicable if process value (10623) = 0.	0.0 [Pa] (7548)	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
10635	Float / 4	Fail-safe value temperature	Input value in case of a fault and when Fail-safe behavior configured to 1. Applicable if process value (10623) = 1.	Min. medium temperature [°C] (7700)	-	Read / write
10641	Float / 4	Fail-safe value density	Input value in case of a fault and when Fail-safe behavior configured to 1. Applicable if process value (10623) = 2.	0.08 [kg/m ³] (7600)	-	Read / write
10647	Float / 4	Fail-safe value viscosity	Input value in case of a fault and when Fail-safe behavior configured to 1. Applicable if process value (10623) = 3.	0.0 [m ² /s] (7524)	-	Read / write
10620	Float / 4	Trimmed input value	Provides the measured current value.	-	-	Read only
10608	Float / 4	Offset adjustment	Command to trim the lower range value of the analog input. Provide a loop current of 4.0 mA, read out the value of Trimmed input value and write the value to this register.	-	-	Write only
10610	Float / 4	Gain adjustment	Command to trim the upper range value of the loop current. Simulate a loop current of 20.0 mA, measure the current with an amperemeter and write the measured value to this register.	-	-	Write only

Common channel 5 and 6 RTD configuration settings

Table A-68 Common channel 5 and 6 RTD configuration settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
2100	Unsigned / 2	RTD type	Type of connected RTDs. Configuration applies to channel 5 and channel 6.	0	0: 100 ohm RTD 1: 500 ohm RTD 2: 1000 ohm RTD	Read / write
2101	Unsigned / 2	RTD wire configuration	Wire configuration of connected RTDs. Configuration applies to channel 5 and channel 6.	0	0: 2-wire RTD 1: 3-wire RTD 2: 4-wire RTD	Read / write
2034	Float / 4	Upper range value pressure	Upper process pressure value that is mapped to the upper nominal range boundary selected by current mode (2020). Applicable if process value (2002) = 1.	700000.0 [Pa] (7548)	100000.0 - 100000000.0	Read / write
2032	Float / 4	Lower range value pressure	Lower process pressure value that is mapped to the lower nominal range boundary selected by current mode (9306). Applicable if process value (9302) = 1.	700000.0 [Pa] (7548)	100000.0 - 100000000.0	Read / write
2058	Float / 4	Upper range value density	Upper process density value that is mapped to the upper nominal range boundary selected by current mode (2020). Applicable if process value (2002) = 2.	1000.0 [kg/m ³] (7600)	0.08 - 10000.0	Read / write
2056	Float / 4	Lower range value density	Lower process density value that is mapped to the lower nominal range boundary selected by current mode (2020). Applicable if process value (2002) = 2.	1000.0 [kg/m ³] (7600)	0.08 - 10000.0	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
2064	Float / 4	Upper range value viscosity	Upper process viscosity value that is mapped to the upper nominal range boundary selected by current mode (2020). Applicable if process value (2002) = 3.	0.000001 [m ² /s] (7524)	0.00000001 - 10.0	Read / write
2062	Float / 4	Lower range value viscosity	Lower process viscosity value that is mapped to the lower nominal range boundary selected by current mode (2020). Applicable if process value (2002) = 3.	0.000001 [m ² /s] (7524)	0.00000001 - 10.0	Read / write
2040	Float / 4	Upper range value medium temperature	Upper process temperature value that is mapped to the upper nominal range boundary selected by current mode (2020). Applicable if process value (2002) = 4.	20.0 [°C] (7700)	-50.0 - +250.0	Read / write
2038	Float / 4	Lower range value medium temperature	Lower process temperature value that is mapped to the lower nominal range boundary selected by current mode (2020). Applicable if process value (2002) = 4.	20.0 [°C] (7700)	-50.0 - +250.0	Read / write
2046	Float / 4	Upper range value Sensor temperature	Upper sensor temperature value that is mapped to the upper nominal range boundary selected by current mode (2020). Applicable if process value (2002) = 5.	20.0 [°C] (7700)	-50.0 - +250.0	Read / write
2044	Float / 4	Lower range value Sensor temperature	Lower sensor temperature value that is mapped to the lower nominal range boundary selected by current mode (2020). Applicable if process value (2002) = 5.	20.0 [°C] (7700)	-50.0 - +250.0	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
2052	Float / 4	Upper range value auxiliary temperature	Upper auxiliary temperature value that is mapped to the upper nominal range boundary selected by current mode (2020). Applicable if process value (2002) = 6.	20.0 [°C] (7700)	-50.0 - +250.0	Read / write
2050	Float / 4	Lower range value auxiliary temperature	Lower auxiliary temperature value that is mapped to the lower nominal range boundary selected by current mode (2020). Applicable if process value (2002) = 6.	20.0 [°C] (7700)	-50.0 - +250.0	Read / write
2036	Float / 4	Fail-safe value pressure	Input value in case of a fault and when Fail-safe behavior is configured to 1. Applicable if process value (2002) = 1.	700000.0 [Pa] (7548)	100000.0 - 100000000.0	Read / write
2060	Float / 4	Fail-safe value density	Input value in case of a fault and when Fail-safe behavior is configured to 1. Applicable if process value (2002) = 2.	1000.0 [kg/m³] (7600)	0.08 - 10000.0	Read / write
2066	Float / 4	Fail-safe value viscosity	Input value in case of a fault and when Fail-safe behavior is configured to 1. Applicable if process value (2002) = 3.	0.000001.0 [m²/s] (7524)	0.00000001 - 10.0	Read / write
2042	Float / 4	Fail-safe value medium temperature	Input value in case of a fault and when Fail-safe behavior is configured to 1. Applicable if process value (2002) = 4.	20.0 [°C] (7700)	-50.0 - +250.0	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
2048	Float / 4	Fail-safe value sensor temperature	Input value in case of a fault and when Fail-safe behavior is configured to 1. Applicable if process value (2002) = 5.	20.0 [°C] (7700)	-50.0 - +250.0	Read / write
2054	Float / 4	Fail-safe value auxiliary temperature	Input value in case of a fault and when Fail-safe behavior is configured to 1. Applicable if process value (2002) = 6.	20.0 [°C] (7700)	-50.0 - +250.0	Read / write

Channel 5 RTD configuration settings

Table A-69 Channel 5 RTD configuration settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
2102	Float / 4	RTD wire resistance	Resistance of cables in a 2 wire RTD system.	0 [ohm]	0.0 - 50.0	Read / write
2106	Float / 4	Offset	Calibration offset.	0 [°C] (7700)	-100.0 - +100.0	Read / write
2108	Float / 4	Slope	Calibration slope.	1.0	0.5 - 2.0	Read / write

Channel 6 RTD configuration settings

Table A-70 Channel 6 RTD configuration settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
2104	Float / 4	RTD wire resistance	Resistance of cables in a 2 wire RTD system.	0 [ohm]	0.0 - 50.0	Read / write
2110	Float / 4	Offset	Calibration offset.	0 [°C] (7700)	-100.0 - +100.0	Read / write
2112	Float / 4	Slope	Calibration slope.	1.0	0.5 - 2.0	Read / write

A.10.4.5 Date and time

General settings

Table A-71 General settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6185	Unsigned / 2	Year	Holds current year after Get time command was carried out. Holds year before Set time command is carried out.	2016	2001 - 2099	Read / write
6186	Unsigned / 2	Month	Holds current month after Get time command was carried out. Holds month before Set time command is carried out.	1	1 - 12	Read / write
6187	Unsigned / 2	Day	Holds current day after Get time command was carried out. Holds day before Set time command is carried out.	1	1 - 31	Read / write
6188	Unsigned / 2	Hours	Holds current hours after Get time command was carried out. Holds hours before Set time command is carried out.	0	0 - 23	Read / write
6189	Unsigned / 2	Minutes	Holds current minutes after Get time command was carried out. Holds minutes before Set time command is carried out.	0	0 - 59	Read / write
6669	Unsigned / 2	Seconds	Holds current seconds after Get time command was carried out. Holds seconds before Set time command is carried out.	0	0 - 59	Read / write
6184	Unsigned / 2	Get time	Command to get the device's current time by using the separate parameters above.	-	0: Cancel 1: Get time	Write only

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6198	Unsigned / 2	Set time	Command to set the device's current time by using the separate parameters above.	-	0: Cancel 1: Set time	Write only
6190	String / 16	Current time	Current time in ISO 8610 format (YYYY-MM-DD hh:mm).	-	-	Read only
10864	String / 32	Current time high resolution	Current time in ISO 8610 format (YYYY-MM-DD hh:mm).	-	-	Read only

A.10.4.6 Local display

General settings

Table A-72 General settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9002	Unsigned / 2	Language	Language.	0	0: English 1: German	Read / write
9098	Unsigned / 2	Backlight	Duration of backlight activity after last key press.	30 [s]	0 - 240	Read / write
9094	Unsigned / 2	Inactivity time-out	Duration of display activity after last key press.	10 [min]	0 (always on) - 60	Read / write
9095	Unsigned / 2	Auto logout	Defines the need to enter PIN after leaving the menu and returning to any top level view.	1	0: Enter menu without PIN for 10 min. 1: Automatic logout.	Read / write
9096	Unsigned / 2	Help appearance	Duration until help text appears.	3 [s]	0 - 20	Read / write
9097	Unsigned / 2	Enable local access control	Controls local access.	1	0: Disabled. Allows users to modify settings without PIN. Expert access is excluded. 1: Enabled.	Read / write
9040	Unsigned / 2	Status icons	Type of alarm icons shown in local display.	Order-specific.	0: Standard (Siemens) 1: NAMUR	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6409	Float / 4	Filter time constant	Damping filter time for process values to be displayed.	1.0	0.0 - 100.0	Read / write
6411	Unsigned / 4	Process values (1)	Bit encoded selection group 1 of process values the display damping filter impacts. See Process value filter masks (Page 313).	0xFFFE37FF	-	Read / write
6413	Unsigned / 4	Process values (2)	Bit encoded selection group 2 of process values the display damping filter impacts. See Process value filter masks (Page 313).	0x00001E7F	-	Read / write

View 1 settings

Table A-73 View 1 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9007	Unsigned / 2	View	Type of appearance.	3	1: Single value. 3: Three values. 6: 1 value and bar graph. 7: 1 value and graph. 8: Six values. 9: Six diagnostic values.	Read / write
9018	Unsigned / 2	1 st value	Selection of the first value.	0	See Selectable values dependent on the view type (Page 310).	Read / write
9019	Unsigned / 2	2 nd value	Selection of the second value. Depending on the number of values.	2	See Selectable values dependent on the view type (Page 310).	Read / write
9020	Unsigned / 2	3 rd value	Selection of the third value. Depending on the number of values.	3	See Selectable values dependent on the view type (Page 310).	Read / write
9075	Unsigned / 2	4 th value	Selection of the fourth value. Depending on the number of values.	1	See Selectable values dependent on the view type (Page 310).	Read / write
9076	Unsigned / 2	5 th value	Selection of the fifth value. Depending on the number of values.	11	See Selectable values dependent on the view type (Page 310).	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9077	Unsigned / 2	6 th value	Selection of the sixth value. Depending on the number of values.	12	See Selectable values dependent on the view type (Page 310).	Read / write
8050	Unsigned / 2	Trend scale mode	Scaling mode for the graph and totalizer view.	0	0: Automatic scaling. 1: Fixed scaling defined by Trend scale lower limit (8052) and Trend scale upper limit (8054).	Read / write
8051	Unsigned / 2	Trend log time window	Scaling of the time axis. Effective when Trend scale mode (8050) is set to 1.	1	0: 1 min 1: 5 min 2: 15 min 3: 30 min 4: 1 h 5: 2 h 6: 3 h	Read / write
8052	Float / 4	Trend scale lower limit	Scaling of the y-axis. Lower limit. Effective when Trend scale mode (8050) is set to 1.	0.0	-	Read / write
8054	Float / 4	Trend scale upper limit	Scaling of the y-axis. Upper limit. Effective when Trend scale mode (8050) is set to 1.	0.0	-	Read / write

View 2 settings

Table A-74 View 2 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9013	Unsigned / 2	Enable or disable	Enable or disable view.	1	0: Disabled. 1: Enabled.	Read / write
9008	Unsigned / 2	View	Type of appearance.	1	1: Single value. 2: Active diagnostic events. 3: Three values. 4: Totalizer. 6: 1 value and bar graph. 7: 1 value and graph. 8: Six values. 9: Six diagnostic values.	Read / write
9021	Unsigned / 2	1 st value	Selection of the first value.	2	See Selectable values dependent on the view type (Page 310).	Read / write
9022	Unsigned / 2	2 nd value	Selection of the second value. Depending on the number of values.	0	See Selectable values dependent on the view type (Page 310).	Read / write
9023	Unsigned / 2	3 rd value	Selection of the third value. Depending on the number of values.	3	See Selectable values dependent on the view type (Page 310).	Read / write
9078	Unsigned / 2	4 th value	Selection of the fourth value. Depending on the number of values.	1	See Selectable values dependent on the view type (Page 310).	Read / write
9079	Unsigned / 2	5 th value	Selection of the fifth value. Depending on the number of values.	11	See Selectable values dependent on the view type (Page 310).	Read / write
9080	Unsigned / 2	6 th value	Selection of the sixth value. Depending on the number of values.	12	See Selectable values dependent on the view type (Page 310).	Read / write
8056	Unsigned / 2	Trend scale mode	Scaling mode for the graph and totalizer view.	0	0: Automatic scaling. 1: Fixed scaling defined by Trend scale lower limit (8058) and Trend scale upper limit (8060).	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
8057	Unsigned / 2	Trend log time window	Scaling of the time axis. Effective when Trend scale mode (8056) is set to 1.	1	0: 1 min 1: 5 min 2: 15 min 3: 30 min 4: 1 h 5: 2 h 6: 3 h	Read / write
8058	Float / 4	Trend scale lower limit	Scaling of the y-axis. Lower limit. Effective when Trend scale mode (8056) is set to 1.	0.0	-	Read / write
8060	Float / 4	Trend scale upper limit	Scaling of the y-axis. Upper limit. Effective when Trend scale mode (8056) is set to 1.	0.0	-	Read / write

View 3 settings

Table A-75 View 3 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9014	Unsigned / 2	Enable or disable	Enable or disable view.	1	0: Disabled. 1: Enabled.	Read / write
9009	Unsigned / 2	View	Type of appearance.	6	1: Single value. 2: Active diagnostic events. 3: Three values. 4: Totalizer. 6: 1 value and bar graph. 7: 1 value and graph. 8: Six values. 9: Six diagnostic values.	Read / write
9024	Unsigned / 2	1 st value	Selection of the first value.	3	See Selectable values dependent on the view type (Page 310).	Read / write
9025	Unsigned / 2	2 nd value	Selection of the second value. Depending on the number of values.	2	See Selectable values dependent on the view type (Page 310).	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9026	Unsigned / 2	3 rd value	Selection of the third value. Depending on the number of values.	0	See Selectable values dependent on the view type (Page 310).	Read / write
9081	Unsigned / 2	4 th value	Selection of the fourth value. Depending on the number of values.	1	See Selectable values dependent on the view type (Page 310).	Read / write
9082	Unsigned / 2	5 th value	Selection of the fifth value. Depending on the number of values.	11	See Selectable values dependent on the view type (Page 310).	Read / write
9083	Unsigned / 2	6 th value	Selection of the sixth value. Depending on the number of values.	12	See Selectable values dependent on the view type (Page 310).	Read / write
8062	Unsigned / 2	Trend scale mode	Scaling mode for the graph and totalizer view.	0	0: Automatic scaling. 1: Fixed scaling defined by Trend scale lower limit (8064) and Trend scale upper limit (8066).	Read / write
8063	Unsigned / 2	Trend log time window	Scaling of the time axis. Effective when Trend scale mode (8062) is set to 1.	1	0: 1 min 1: 5 min 2: 15 min 3: 30 min 4: 1 h 5: 2 h 6: 3 h	Read / write
8064	Float / 4	Trend scale lower limit	Scaling of the y-axis. Lower limit. Effective when Trend scale mode (8062) is set to 1.	0.0	-	Read / write
8066	Float / 4	Trend scale upper limit	Scaling of the y-axis. Upper limit. Effective when Trend scale mode (8062) is set to 1.	0.0	-	Read / write

View 4 settings

Table A-76 View 4 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9015	Unsigned / 2	Enable or disable	Enable or disable view.	1	0: Disabled. 1: Enabled.	Read / write
9010	Unsigned / 2	View	Type of appearance.	8	1: Single value. 2: Active diagnostic events. 3: Three values. 4: Totalizer. 6: 1 value and bar graph. 7: 1 value and graph. 8: Six values. 9: Six diagnostic values.	Read / write
9027	Unsigned / 2	1 st value	Selection of the first value.	1	See Selectable values dependent on the view type (Page 310).	Read / write
9028	Unsigned / 2	2 nd value	Selection of the second value. Depending on the number of values.	2	See Selectable values dependent on the view type (Page 310).	Read / write
9029	Unsigned / 2	3 rd value	Selection of the third value. Depending on the number of values.	3	See Selectable values dependent on the view type (Page 310).	Read / write
9084	Unsigned / 2	4 th value	Selection of the fourth value. Depending on the number of values.	0	See Selectable values dependent on the view type (Page 310).	Read / write
9085	Unsigned / 2	5 th value	Selection of the fifth value. Depending on the number of values.	11	See Selectable values dependent on the view type (Page 310).	Read / write
9086	Unsigned / 2	6 th value	Selection of the sixth value. Depending on the number of values.	12	See Selectable values dependent on the view type (Page 310)..	Read / write
8068	Unsigned / 2	Trend scale mode	Scaling mode for the graph and totalizer view.	0	0: Automatic scaling. 1: Fixed scaling defined by Trend scale lower limit (8070) and Trend scale upper limit (8072).	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
8069	Unsigned / 2	Trend log time window	Scaling of the time axis. Effective when Trend scale mode (8068) is set to 1.	1	0: 1 min 1: 5 min 2: 15 min 3: 30 min 4: 1 h 5: 2 h 6: 3 h	Read / write
8070	Float / 4	Trend scale lower limit	Scaling of the y-axis. Lower limit. Effective when Trend scale mode (8068) is set to 1.	0.0	-	Read / write
8072	Float / 4	Trend scale upper limit	Scaling of the y-axis. Upper limit. Effective when Trend scale mode (8068) is set to 1.	0.0	-	Read / write

View 5 settings

Table A-77 View 5 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9016	Unsigned / 2	Enable or disable	Enable or disable view.	1	0: Disabled. 1: Enabled.	Read / write
9011	Unsigned / 2	View	Type of appearance.	3	1: Single value. 2: Active diagnostic events. 3: Three values. 4: Totalizer. 6: 1 value and bar graph. 7: 1 value and graph. 8: Six values. 9: Six diagnostic values.	Read / write
9030	Unsigned / 2	1 st value	Selection of the first value.	11	See Selectable values dependent on the view type (Page 310).	Read / write
9031	Unsigned / 2	2 nd value	Selection of the second value. Depending on the number of values.	2	See Selectable values dependent on the view type (Page 310).	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9032	Unsigned / 2	3 rd value	Selection of the third value. Depending on the number of values.	3	See Selectable values dependent on the view type (Page 310).	Read / write
9087	Unsigned / 2	4 th value	Selection of the fourth value. Depending on the number of values.	1	See Selectable values dependent on the view type (Page 310).	Read / write
9088	Unsigned / 2	5 th value	Selection of the fifth value. Depending on the number of values.	0	See Selectable values dependent on the view type (Page 310).	Read / write
9089	Unsigned / 2	6 th value	Selection of the sixth value. Depending on the number of values.	12	See Selectable values dependent on the view type (Page 310).	Read / write
8074	Unsigned / 2	Trend scale mode	Scaling mode for the graph and totalizer view.	0	0: Automatic scaling. 1: Fixed scaling defined by Trend scale lower limit (8076) and Trend scale upper limit (8078).	Read / write
8075	Unsigned / 2	Trend log time window	Scaling of the time axis. Effective when Trend scale mode (8074) is set to 1.	1	0: 1 min 1: 5 min 2: 15 min 3: 30 min 4: 1 h 5: 2 h 6: 3 h	Read / write
8076	Float / 4	Trend scale lower limit	Scaling of the y-axis. Lower limit. Effective when Trend scale mode (8074) is set to 1.	0.0	-	Read / write
8078	Float / 4	Trend scale upper limit	Scaling of the y-axis. Upper limit. Effective when Trend scale mode (8074) is set to 1.	0.0	-	Read / write

View 6 settings

Table A-78 View 6 settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9017	Unsigned / 2	Enable or disable	Enable or disable view.	1	0: Disabled. 1: Enabled.	Read / write
9012	Unsigned / 2	View	Type of appearance.	2	1: Single value. 2: Active diagnostic events. 3: Three values. 4: Totalizer. 6: 1 value and bar graph. 7: 1 value and graph. 8: Six values. 9: Six diagnostic values.	Read / write
9033	Unsigned / 2	1 st value	Selection of the first value.	12	See Selectable values dependent on the view type (Page 310).	Read / write
9034	Unsigned / 2	2 nd value	Selection of the second value. Depending on the number of values.	2	See Selectable values dependent on the view type (Page 310).	Read / write
9035	Unsigned / 2	3 rd value	Selection of the third value. Depending on the number of values.	3	See Selectable values dependent on the view type (Page 310).	Read / write
9090	Unsigned / 2	4 th value	Selection of the fourth value. Depending on the number of values.	1	See Selectable values dependent on the view type (Page 310).	Read / write
9091	Unsigned / 2	5 th value	Selection of the fifth value. Depending on the number of values.	11	See Selectable values dependent on the view type (Page 310).	Read / write
9092	Unsigned / 2	6 th value	Selection of the sixth value. Depending on the number of values.	0	See Selectable values dependent on the view type (Page 310).	Read / write
8080	Unsigned / 2	Trend scale mode	Scaling mode for the graph and totalizer view.	0	0: Automatic scaling. 1: Fixed scaling defined by Trend scale lower limit (8082) and Trend scale upper limit (8084).	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
8081	Unsigned / 2	Trend log time window	Scaling of the time axis. Effective when Trend scale mode (8080) is set to 1.	1	• 0: 1 min • 1: 5 min • 2: 15 min • 3: 30 min • 4: 1 h • 5: 2 h • 6: 3 h	Read / write
8082	Float / 4	Trend scale lower limit	Scaling of the y-axis. Lower limit. Effective when Trend scale mode (8080) is set to 1.	0.0	-	Read / write
8084	Float / 4	Trend scale upper limit	Scaling of the y-axis. Upper limit. Effective when Trend scale mode (8080) is set to 1.	0.0	-	Read / write

A.10.4.7 Selectable values dependent on the view type

Table A-79 Selectable values dependent on the view type

Selected view type	Setting options
Single value, Three values, 1 value and bar graph, 1 value and graph	• 0: Mass flow • 1: Volume flow • 2: Density • 3: Medium temperature • 9: Reference density • 11: Totalizer 1 • 12: Totalizer 2 • 13: Totalizer 3 • 18: Sound velocity • 19: Flow velocity • 20: Pressure • 21: Viscosity • 24: Medium concentration • 27: Standard volume flow rate (only hydrocarbon and gas applications) • 28: Standardizing factor (only hydrocarbon and gas applications) • 29: Standard viscosity (only hydrocarbon applications) • 30: Standard density (only hydrocarbon applications) • 31: Liquident (only hydrocarbon applications) • 32: API gravity (only hydrocarbon applications) • 33: Standard API gravity (only hydrocarbon applications) • 34: Specific gravity (only hydrocarbon applications) • 35: Standard specific gravity (only hydrocarbon applications) • 36: Rate of change (ROC) (only hydrocarbon applications) • 94: Liquid identifier (only hydrocarbon applications)
Totalizer	• 11: Totalizer 1 • 12: Totalizer 2 • 13: Totalizer 3

Selected view type	Setting options
Six values	• 0: Mass flow • 1: Volume flow • 2: Density • 3: Fluid temperature • 11: Totalizer 1 • 12: Totalizer 2 • 13: Totalizer 3 • 18: Sound velocity • 19: Flow velocity • 20: Pressure • 21: Viscosity • 24: Medium concentration • 27: Standard volume flow rate (only hydrocarbon applications) • 28: Standardizing factor (only hydrocarbon applications) • 29: Standard viscosity (only hydrocarbon applications) • 30: Standard density (only hydrocarbon applications) • 31: Liquident (only hydrocarbon applications) • 32: API gravity (only hydrocarbon applications) • 33: Standard API gravity (only hydrocarbon applications) • 34: Specific gravity (only hydrocarbon applications) • 35: Standard specific gravity (only hydrocarbon applications) • 36: Rate of change (ROC) (only hydrocarbon application) • 94: Liquid identifier (only hydrocarbon applications)

A.10 Modbus holding registers tables

Selected view type	Setting options
Six diagnostic values	• 10: Transmitter internal temperature • 22: RTD temperature 1 • 23: RTD temperature 2 • 25: Measured current (Channel 5) • 26: Measured current (Channel 6) • 44: Ch2 value • 45: Ch3 value • 46: Ch4 value • 47: Sensor internal temperature • 50: Reynolds number • 51: RxGain up path 1 • 52: RxGain down path 1 • 53: SNR upstream path 1 • 54: SNR downstream path 1 • 55: Sound velocity path 1 • 56: Delta time path 1 • 57: Path 1 percentage of bursts accepted • 58: Actual sensor frequency path 1 • 59: Downstream peak amplitude path 1 • 60: Upstream peak amplitude path 1 • 61: SNR upstream path 2 • 62: SNR downstream path 2 • 63: Sound velocity path 2 • 64: Delta time path 2 • 65: Path 2 percentage of bursts accepted • 66: Downstream peak amplitude path 2 • 67: Upstream peak amplitude path 2 • 68: SNR upstream path 3 • 69: SNR downstream path 3 • 70: Sound velocity path 3 • 71: Delta time path 3 • 72: Path 3 percentage of bursts accepted • 73: Downstream peak amplitude path 3 • 74: Upstream peak amplitude path 3 • 75: SNR upstream path 4 • 76: SNR downstream path 4 • 77: Sound velocity path 4 • 78: Delta time path 4 • 79: Path 4 percentage of bursts accepted • 80: Downstream peak amplitude path 4 • 81: Upstream peak amplitude path 4

Selected view type	Setting options
Alarm list	No selections possible.

A.10.4.8 Process value filter masks

Table A-80 Process value filter masks

Selected view type	Setting options
Process value filter mask 1	Bit coded mask to specify the process values that are filtered. Bit set means filtered: • Bit 0: Mass flow • Bit 1: Volume flow • Bit 2: Density • Bit 3: Medium temperature • Bit 11: Totalizer 1 • Bit 12: Totalizer 2 • Bit 13: Totalizer 3 • Bit 18: Sound velocity • Bit 19: Flow velocity • Bit 20: Pressure • Bit 21: Viscosity • Bit 24: Medium concentration • Bit 27: Standard volume flow rate (only hydrocarbon and gas applications) • Bit 28: Standardizing factor (only hydrocarbon and gas applications) • Bit 29: Base viscosity (only hydrocarbon applications) • Bit 30: Base density (only hydrocarbon applications) • Bit 31: Liquident (only hydrocarbon applications)
Process value filter mask 2	Bit coded mask to specify the process values that are filtered. Bit set means filtered: • Bit 0: API gravity (only hydrocarbon applications) • Bit 1: Base API gravity (only hydrocarbon applications) • Bit 2: Specific gravity (only hydrocarbon applications) • Bit 3: Base specific gravity (only hydrocarbon applications) • Bit 4: Rate of change (ROC) (only hydrocarbon applications)

A.10.5 Maintenance and diagnostics

A.10.5.1 Maintenance & diagnostics

Table A-81 Maintenance & diagnostics

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6004	Unsigned / 4	Configuration counter	Configuration counter. Counts number of parameter content modified.	-	-	Read only

A.10.5.2 Identification

System with FT030 transmitter

Table A-82 SITRANS FS230

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6592	String / 12	Manufacturer	Device manufacturer.	SIEMENS	-	Read only
6104	String / 32	Product name	Product name. Also shown on the device nameplate.	SITRANS F	-	Read only
6020	String / 16	Version	Product version according to order.	-	-	Read only
6120	String / 32	System order number	System order number part 1 (MLFB). Also shown on the device nameplate.	-	-	Read only
7236	String / 32	System order number	System order number part 2 (MLFB). Also shown on the device nameplate.	-	-	Read only
7268	String / 32	System order number	System order number part 3 (MLFB). Also shown on the device nameplate.	-	-	Read only
6088	Unsigned / 4	Final assembly number	Final assembly number. Can be used to identify device upgrades.	0	-	Read / write
6576	String / 32	Product serial number	Unique alpha numerical serial number. Also shown on the device name plate.	-	-	Read only

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6334	String / 16	Hardware version	System hardware version. Also shown on the device name plate.	-	-	Read / write (Expert)
6030	String / 16	Firmware version	Product firmware version. Also shown on the device name plate.	-	-	Read / write (Expert)
8120	String / 32	Long TAG	Unique TAG name.	-	-	Read / write
8176	String / 16	Descriptor	Description of the measuring point.	-	-	Read / write
8136	String / 32	Message	Additional information.	-	-	Read / write
8152	String / 32	Location	Device location in the plant.	-	-	Read / write
8168	String / 16	Installation date	Installation date of the device.	-	-	Read / write

Transmitter

Transmitter FT030

Table A-83 Transmitter FT030

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
8104	String / 32	Transmitter order number	Transmitter order number part 1 (MLFB).	-	-	Read only
7310	String / 32	Transmitter order number	Transmitter order number part 2 (MLFB).	-	-	Read only
7342	String / 32	Transmitter order number	Transmitter order number part 3 (MLFB).	-	-	Read only

Transmitter cassette

Table A-84 Transmitter cassette

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6136	String / 16	HW version	Hardware version of the cassette.	-	-	Read only
6040	String / 16	FW version	Firmware version of the cassette.	-	-	Read only

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
7326	String / 16	Serial number	Serial number of the cassette.	-	-	Read only
7386	String / 16	Comm. HW version	Hardware version of the communication plug in module.	-	-	Read only
7358	String / 16	Comm. serial number	Serial number of the communication plug in module.	-	-	Read only

Local display

Table A-85 Local display

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9041	String / 16	HW version	Hardware version of the module.	-	-	Read only
9063	String / 16	FW version	Firmware version of the module.	-	-	Read only
7475	String / 16	HMI config. version	Version of the HMI configuration.	-	-	Read only

I/O cassette

Table A-86 I/O cassette

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
7260	String / 16	HW version	Hardware version of the cassette.	-	-	Read only
8184	String / 16	FW version	Firmware version of the cassette.	-	-	Read only
7284	String / 16	Serial number	Serial number of the cassette.	-	-	Read only

Sensor cassette

Table A-87 Sensor cassette

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
4135	String / 10	HW version	Hardware version of the cassette.	-	-	Read only
4020	String / 10	FW version	Firmware version of the cassette.	-	-	Read only
4145	String / 32	Serial number	Serial number of the cassette.	-	-	Read only

Sensor

Table A-88 Sensor

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
4010	String / 16	Sensor type	Name of the sensor.	-	-	Read only
4210	String / 20	Frontend serial number	Serial number of front end.	-	-	Read only
4033	String / 20	Sensor serial number	Sensor serial number of inline sensor.	-	-	Read only
4043	String / 20	Sensors serial number path 1	Serial number of sensor set path 1 (clamp-on).	-	-	Read only
4053	String / 20	Sensors serial number path 2	Serial number of sensor set path 2 (clamp-on).	-	-	Read only
4063	String / 20	Sensors serial number path 3	Serial number of sensor set path 3 (clamp-on).	-	-	Read only
4073	String / 20	Sensors serial number path 4	Serial number of sensor set path 4 (clamp-on).	-	-	Read only
1300	Unsigned / 2	Sensor type	Type of sensor.	-	0: FSS200 (Clamp-on) 1: FSS300 (Inline, SONO3100/3300) 2: FSS300 retrofit (Inline, SONOKIT) - FSS600 (Clamp-on spool, FUT1010) - FSS400 (Oil, inline)	Read only

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
4020	String / 10	Sensor firm-ware version	Sensor firmware version.	-	-	Read only
4135	String / 10	Sensor hard-ware version	Sensor hardware version.	-	-	Read only
4140	Unsigned / 2	Frontend variant	Frontend variant.	-	• 0: Remote • 1: Compact • 2: Integrated	Read only
4145	String / 32	Frontend PCBA serial number	Frontend PCBA serial number.	-	-	Read only

A.10.6 Diagnostic events

A.10.6.1 Active events

Active events

Table A-89 Active events

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6200	Unsigned / 4	Active alarm items 1	Bitwise indication of active alarms in alarm items 1. See Alarm items (Page 324).	-	-	Read only
6202	Unsigned / 4	Active alarm items 2	Bitwise indication of active alarms in alarm items 2. See Alarm items (Page 324).	-	-	Read only
6206	Unsigned / 4	Active alarm items 4	Bitwise indication of active alarms in alarm items 4. See Alarm items (Page 324).	-	-	Read only
6208	Unsigned / 4	Active alarm items 5	Bitwise indication of active alarms in alarm items 5. See Alarm items (Page 324).	-	-	Read only
6210	Unsigned / 4	Active alarm items 6	Bitwise indication of active alarms in alarm items 6. See Alarm items (Page 324).	-	-	Read only

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6212	Unsigned / 4	Active alarm items 7	Bitwise indication of active alarms in alarm items 7. See Alarm items (Page 324).	-	-	Read only
6214	Unsigned / 4	Active alarm items 8	Bitwise indication of active alarms in alarm items 8. See Alarm items (Page 324).	-	-	Read only
7000	Unsigned / 4	Active alarm items 9	Bitwise indication of active alarms in alarm items 9. See Alarm items (Page 324).	-	-	Read only

Supported events

Table A-90 Supported events

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6250	Unsigned / 4	Supported alarm items 1	Bitwise indication of supported alarms in alarm items 1. See Alarm items (Page 324).	-	-	Read only
6252	Unsigned / 4	Supported alarm items 2	Bitwise indication of supported alarms in alarm items 2. See Alarm items (Page 324).	-	-	Read only
6256	Unsigned / 4	Supported alarm items 4	Bitwise indication of supported alarms in alarm items 4. See Alarm items (Page 324).	-	-	Read only
6258	Unsigned / 4	Supported alarm items 5	Bitwise indication of supported alarms in alarm items 5. See Alarm items (Page 324).	-	-	Read only
6260	Unsigned / 4	Supported alarm items 6	Bitwise indication of supported alarms in alarm items 6. See Alarm items (Page 324).	-	-	Read only

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6262	Unsigned / 4	Supported alarm items 7	Bitwise indication of supported alarms in alarm items 7. See Alarm items (Page 324).	-	-	Read only
6264	Unsigned / 4	Supported alarm items 8	Bitwise indication of supported alarms in alarm items 8. See Alarm items (Page 324).	-	-	Read only
7016	Unsigned / 4	Supported alarm items 9	Bitwise indication of supported alarms in alarm items 9. See Alarm items (Page 324).	-	-	Read only

Enable events

Table A-91 Enable events

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6266	Unsigned / 4	Active alarm items 1	Bitwise indication of active alarms in alarm items 1. See Alarm items (Page 324).	-	-	Read / write
6268	Unsigned / 4	Active alarm items 2	Bitwise indication of active alarms in alarm items 2. See Alarm items (Page 324).	-	-	Read / write
6272	Unsigned / 4	Active alarm items 4	Bitwise indication of active alarms in alarm items 4. See Alarm items (Page 324).	-	-	Read / write
6274	Unsigned / 4	Active alarm items 5	Bitwise indication of active alarms in alarm items 5. See Alarm items (Page 324).	-	-	Read / write
6276	Unsigned / 4	Active alarm items 6	Bitwise indication of active alarms in alarm items 6. See Alarm items (Page 324).	-	-	Read / write
6278	Unsigned / 4	Active alarm items 7	Bitwise indication of active alarms in alarm items 7. See Alarm items (Page 324).	-	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6280	Unsigned / 4	Active alarm items 8	Bitwise indication of active alarms in alarm items 8. See Alarm items (Page 324).	-	-	Read / write
7008	Unsigned / 4	Active alarm items 9	Bitwise indication of active alarms in alarm items 9. See Alarm items (Page 324).	-	-	Read / write

Acknowledge events

Table A-92 Acknowledge events

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6248	Unsigned / 2	Acknowledge mode	Mode to acknowledge active events.	1	0: Manual alarm acknowledge (indication will remain even when event is gone) 1: Automatic acknowledge (indication will disappear when event is gone)	Read / write
6294	Unsigned / 2	Alarm acknowledgement	Command to acknowledge a specific alarm item in manual acknowledge mode. Enter ID related to the item. See Alarm items (Page 324).	-	-	Write only

Assign alarm class

Table A-93 Assign alarm class

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6328	Unsigned / 2	Transmitter temp. too high	Defines the mapping of this event to an alarm class respective NA-MUR status signal.	1	1: Process alarm (PA) resp. Out of specification. 4: Maintenance alarm (MA) resp. Failure.	Read / write
6329	Unsigned / 2	Transmitter temp. too low	Defines the mapping of this event to an alarm class respective NA-MUR status signal.	1	1: Process alarm (PA) resp. Out of specification. 4: Maintenance alarm (MA) resp. Failure.	Read / write

A.10.6.2 Diagnostic log

Table A-94 Diagnostic log

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6600	Unsigned / 2	Newest entry number	Entry number of newest entry. Older entries have a smaller entry number. (Wrap around from 0 - 100).	-	-	Read only
6614	Unsigned / 2	Entry number	Selection of the entry number.	0	0 - 100	Read / write
6615	String / 16	Time stamp	Time stamp of the diagnostic log entry specified by Entry number. Format is YYYY-MM-DD hh-mm.	-	-	Read only
10800	String / 32	Time stamp	Time stamp of the diagnostic log entry specified by Entry number. Format is YYYY-MM-DD hh-mm-ss.	-	-	Read only
6623	Unsigned / 2	State	Alarm state of the entry specified by Entry number.	-	0: Event is reset (going). 1: Event is set (coming). 2: Alarm is acknowledged.	Read only

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6624	Unsigned / 2	Alarm ID	Alarm ID of the entry specified by Entry number. See Alarm items (Page 324). 65335 specifies an empty entry that can be ignored.	-	-	Read only
6625	Unsigned / 2	Alarm class	Alarm class of the entry specified by Entry number. See Alarm items (Page 324). 65335 specifies an empty entry that can be ignored.	-	• 1: Process value alarm (PA) • 2: Process value warning (PW) • 4: Maintenance alarm (MA) • 8: Maintenance warning (MW) • 16: Maintenance required (MR) • 32: Function check (FC)	Read only
6638	Unsigned / 2	Available entries	Current number of available diagnostic log entries.	-	-	Read only
6601	Unsigned / 2	Reset log	Command to clear the alarm history log.	-	• 0: Cancel • 1: Clear log	Write only

A.10.6.3 Alarm items

Table A-95 Alarm items

Group	Bit	Alarm	ID	Restrictions	Associated alarm class
Alarm items 1 (Sensor alarm 1)	0	Sensor startup	0		
	1	Safety critical user parameters not validated	1		
	2	Safety critical factory parameters not validated	2		
	3	Safety critical factory parameters not validated	3		
	4	Safety critical factory parameters not validated	4		
	5	DSL voltages	5		
	6	DSL storage malfunction	6		
	7	Flow measurement	7		
	8	DSL internal error	8		
	9	Oil measurement: Density	9		
	10	Oil measurement: Viscosity	10		
	11	Oil measurement: Spec. gravity	11		
	14	Path 1: No signal	14		
	15	Path 2: No signal	15		
	16	Path 3: No signal	16		
	17	Path 4: No signal	17		
	19	Electronics temperature	19		
	20	Totalizer above alarm limit	20		
	21	Totalizer above warning limit	21		
	22	Density calculation failure	22		
	23	Medium temperature calculation failure	23		
	24	Pressure calculation failure	24		
	25	Viscosity calculation failure	25		
	26	Sensor temperature compensation failure	26		
	27	Scraper pig detected	27		
	28	Configuration error 1	28		
	29	Aeration detected	29		
	30	Turbulence detected	30		
	31	Sensor temperature out of specification	31		

Group	Bit	Alarm	ID	Restrictions	Associated alarm class
Alarm items 2 (Sensor alarms 2)	0	Auxiliary input failure	32		
	1	DSL Functional Safety event	33		
	2	Invalid flow measurement	34		
	3	Failure on channel 5 or channel 6	35		
	4	Configuration error 2	36		
	5	DSL system monitor	37		
	6	Path diagnostic alarm limit exceeded	38		
Alarm items 4 (Process alarms 1)	0	Mass flow above alarm limit	96		PA
	1	Mass flow above warning limit	97		PW
	2	Mass flow below warning limit	98		PW
	3	Mass flow below alarm limit	99		PA
	4	Volume flow above alarm limit	100		PA
	5	Volume flow above warning limit	101		PW
	6	Volume flow below warning limit	102		PW
	7	Volume flow below alarm limit	103		PA
	8	Density above alarm limit	104		PA
	9	Density above warning limit	105		PW
	10	Density below warning limit	106		PW
	11	Density below alarm limit	107		PA
	12	Medium temperature above alarm limit	108		PA
	13	Medium temperature above warning limit	109		PW
	14	Medium temperature below warning limit	110		PW
	15	Medium temperature below alarm limit	111		PA
	16 - 31	Reserved			

A.10 Modbus holding registers tables

Group	Bit	Alarm	ID	Restrictions	Associated alarm class
Alarm items 5 (Process alarms 2, totalizer alarms)	-3	Reserved			
	4	Standard volume flow above alarm limit	132	Only hydrocarbon and gas applications	PA
	5	Standard volume flow above warning limit	133		PW
	6	Standard volume flow below warning limit	134		PW
	7	Standard volume flow below alarm limit	135		PA
	8	Totalizer 1 above alarm limit	136		PA
	9	Totalizer 1 above warning limit	137		PW
	10	Totalizer 1 below warning limit	138		PW
	11	Totalizer 1 below alarm limit	139		PA
	12	Totalizer 2 above alarm limit	140		PA
	13	Totalizer 2 above warning limit	141		PW
	14	Totalizer 2 below warning limit	142		PW
	15	Totalizer 2 below alarm limit	143		PA
	16	Totalizer 3 above alarm limit	144		PA
	17	Totalizer 3 above warning limit	145		PW
	18	Totalizer 3 below warning limit	146		PW
	19	Totalizer 3 below alarm limit	147		PA
	20	Transmitter temperature above alarm limit	148		See Table A-93 As-sign alarm class (Page 322)
	21	Transmitter temperature below alarm limit	149		See Table A-93 As-sign alarm class (Page 322)
	22	Sensor signal disrupted	150		MA
	23	SensorFlash backup disabled	151		FC
	24	SensorFlash backup disabled	152		FC
	25	Reserved	153		
	26	Reserved	154		
	27	Reserved	155		
	28	Safety validation state	156		FC
	29	Functional Safety	157		MA
	30	Loop current cable break	158		MA
	31	Internal error in transmitter	159		MA

A.10 Modbus holding registers tables

Group	Bit	Alarm	ID	Restrictions	Associated alarm class
Alarm items 6 (Simulation alarms)	0	Mass flow simulated	160		FC
	1	Volume flow simulated	161		FC
	2	Density simulated	162		FC
	3	Medium temperature simulated	163		FC
	4 - 5	Reserved			
	6	Standard volume flow simulated	166		FC
	7	Totalizer 1 simulated	167		FC
	8	Totalizer 2 simulated	168		FC
	9	Totalizer 3 simulated	169		FC
	10	Loop current simulated	170		FC
	11	Product firmware incompatible	171		MA
	12	Transmitter FW incompatible	172		MA
	13	Sensor FW incompatible	173		MA
	14	Display FW incompatible	174		MA
	15	IO FW incompatible	175		MA
	16	Sensor type incompatible	176		MA
	17	Device is starting	177		FC
	18	Display configuration version mismatch	178		MA
	19	Alarm class simulation enabled	179		-
	20	Reserved	180		
	21	SensorFlash Chkdsk failed	181		MA
	23	Reserved	183		
	24	Reserved	184		
	25	Reserved	185		
	26	Channel 3 input current too low	186	If channel configured to analog input	PA
	27	Channel 3 input current too high	187		PA
	28	Channel 3 external failure	188		PA
	29	Channel 4 input current too low	189	If channel configured to analog input	PA
	30	Channel 4 input current too high	190		PA
	31	Channel 4 external failure	191		PA

A.10 Modbus holding registers tables

Group	Bit	Alarm	ID	Restrictions	Associated alarm class
Alarm items 7 (Inputs and outputs alarms)	0	Reserved	192		
	1	Reserved	193		
	2	Reserved	194		
	3	Channel 2 loop current in lower saturation	195	If channel configured to current output	PA
	4	Channel 2 loop current in upper saturation	196		PA
	5	Channel 2 cable break	197		MA
	6	Channel 2 output frequency too low	198	If channel configured to frequency output	PA
	7	Channel 2 output frequency too high	199		PA
	8	Channel 2 pulse overflow	200	If channel configured to pulse output	PA
	9	Channel 3 loop current in lower saturation	201	If channel configured to current output	PA
	10	Channel 3 loop current in upper saturation	202		PA
	11	Channel 3 cable break	203		MA
	12	Channel 3 output frequency too low	204	If channel configured to frequency output	PA
	13	Channel 3 output frequency too high	205		PA
	14	Channel 3 pulse overflow	206	If channel configured to pulse output	PA
	15	Channel 4 loop current in lower saturation	207	If channel configured to current output	PA
	16	Channel 4 loop current in upper saturation	208		PA
	17	Channel 4 cable break	209		MA
	18	Channel 4 output frequency too low	210	If channel configured to frequency output	PA
	19	Channel 4 output frequency too high	211		PA
	20	Channel 4 pulse overflow	212	If channel configured to pulse output	PA
	21	Reserved	213		
	22	Channel 2 simulated	214	If channel configured to output	FC
	23	Channel 3 simulated	215	If channel configured to output	FC
	24	Channel 4 simulated	216	If channel configured to output	FC
	25	Process values frozen	217		FC
	26	All outputs forced	218		FC
	27	Channel 2 loop current deviation	219		MA
	28	Channel 3 loop current deviation	220		MA
	29	Channel 4 loop current deviation	221		MA
	30	Invalid register mapping	222		MA
	31	Invalid coil configuration	223		MA

Group	Bit	Alarm	ID	Restrictions	Associated alarm class
Alarm items 8 (Process alarms 3)	0	Reserved	224		
	1	Reserved	225		
	2	Reserved	226		
	3	Reserved	227		
	4	Sound velocity above alarm limit	228		PA
	5	Sound velocity above warning limit	229		PW
	6	Sound velocity below warning limit	230		PW
	7	Sound velocity below alarm limit	231		PA
	8	Flow velocity above alarm limit	232		PA
	9	Flow velocity above warning limit	233		PW
	10	Flow velocity below warning limit	234		PW
	11	Flow velocity below alarm limit	235		PA
	12	Pressure above alarm limit	236		PA
	13	Pressure above warning limit	237		PW
	14	Pressure below warning limit	238		PW
	15	Pressure below alarm limit	239		PA
	20	Viscosity above alarm limit	244		PA
	21	Viscosity above warning limit	245		PW
	22	Viscosity below warning limit	246		PW
	23	Viscosity below alarm limit	247		PA
	24	Rate of change above alarm limit	248	Only hydrocarbon applications	PA
	25	Rate of change above warning limit	249		PW
	26	Reserved	250		
	27	Reserved	251		
	28	Standard kinematic viscosity above alarm limit	252	Only hydrocarbon applications	PA
	29	Standard kinematic viscosity above warning limit	253		PW
	30	Standard kinematic viscosity below warning limit	254		PW
	31	Standard kinematic viscosity below alarm limit	255		PA

A.10 Modbus holding registers tables

Group	Bit	Alarm	ID	Restrictions	Associated alarm class
Alarm items 9 (Process alarms 4)	0	Standard density above alarm limit	256	Only hydrocarbon applications	PA
	1	Standard density above warning limit	257		PW
	2	Standard density below warning limit	258		PW
	3	Standard density below alarm limit	259		PA
	4	API gravity above alarm limit	260	Only hydrocarbon applications	PA
	5	API gravity above warning limit	261		PW
	6	API gravity below warning limit	262		PW
	7	API gravity below alarm limit	263		PA
	8	Standard API gravity above alarm limit	264	Only hydrocarbon applications	PA
	9	Standard API gravity above warning limit	265		PW
	10	Standard API gravity below warning limit	266		PW
	11	Standard API gravity below alarm limit	267		PA
	12	Specific gravity above alarm limit	268	Only hydrocarbon applications	PA
	13	Specific gravity above warning limit	269		PW
	14	Specific gravity below warning limit	270		PW
	15	Specific gravity below alarm limit	271		PA
	16	Standard specific gravity above alarm limit	272	Only hydrocarbon applications	PA
	17	Standard specific gravity above warning limit	273		PW
	18	Standard specific gravity below warning limit	274		PW
	19	Standard specific gravity below alarm limit	275		PA
	20	Liquident above alarm limit	276	Only hydrocarbon applications	PA
	21	Liquident above warning limit	277		PW
	22	Liquident below warning limit	278		PW
	23	Liquident below alarm limit	279		PA
	24	Reserved	280		
	25	Reserved	281		
	26	Reserved	282		
	27	Reserved	283		
	28	Reserved	284		
	29	Reserved	285		
	30	Reserved	286		
	31	Reserved	287		

PA	Process value alarm (NAMUR: Out of specification)
PW	Process value warning (NAMUR: Out of specification)
FC	Function check
MR	Maintenance required (NAMUR: Maintenance required)
MD	Maintenance demanded (NAMUR: Maintenance required)
MA	Maintenance alarm (NAMUR: Failure)

A.10.7 Diagnostics

A.10.7.1 Sensor

Sensor diagnostics

Table A-96 Sensor diagnostics

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
3302	Unsigned / 4	Frontend total operating time	Operating time of frontend in hours	- [h]	-	Read only
3304	Unsigned / 4	Frontend total operating time power-up	Operating of frontend since last power-up	- [h]	-	Read only
3307	Float / 4	Reynolds number	Calculated Reynolds number	-	-	Read only
3319	Unsigned / 2	Path state	State of path 1-5. Bit 0-1: Path 1 Bit 2-3: Path 2 Bit 4-5: Path 3 Bit 6-7: Path 4	-	00: Not installed 01: Signal Search 10: Frequency Search 11: Measurement	Read only

Table A-97 Path 1 diagnostics

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
3400	Float / 4	RxGain up path 1	Rx gain of upstream signal	- [dB]	-	Read only
3402	Float / 4	RxGain down path 1	Rx gain of downstream signal	- [dB]	-	Read only
3404	Float / 4	SNR upstream path 1	Signal to noise ratio of upstream signal	- [dB]	-	Read only
3406	Float / 4	SNR downstream path 1	Signal to noise ratio of downstream signal	- [dB]	-	Read only
3408	Float / 4	Sound velocity path 1	Sound velocity	- [m/s]	-	Read only
3410	Float / 4	Flow velocity path 1	Flow velocity	- [m/s]	-	Read only
3412	Float / 4	Delta time path 1	Delta time	- [s]	-	Read only
3414	Float / 4	Travel time up path 1	Travel time of upstream signal	- [s]	-	Read only

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
3416	Float / 4	Travel time down path 1	Travel time of down-stream signal	- [s]	-	Read only
3418	Float / 4	Correlation factor path 1	Correlation factor	-	-	Read only
3424	Unsigned / 2	Accepted burst percentage path 1	% of bursts accepted (path 1).	- [%]	-	Read only
3425	Float / 4	Actual sensor frequency path 1	Sensor frequency	- [Hz]	-	Read only
3429	Float / 4	Upstream peak amplitude path 1	Upstream signal peak amplitude	- [dBmV]	-	Read only
3427	Float / 4	Downstream peak amplitude path 1	Downstream signal peak amplitude	- [dBmV]	-	Read only
3431	Float / 4	Fluid refraction angle path 1	Calculated fluid refraction angle on path 1 (clamp-on only).	- [rad]	-	Read only
3433	Float / 4	Lower sound velocity limit path 1	Minimum supported fluid sound velocity (path 1)	- [m/s]	-	Read only
3435	Float / 4	Upper sound velocity limit path 1	Maximum supported fluid sound velocity (path 1)	- [m/s]	-	Read only
3437	Float / 4	Min acc travel time path 1	Minimum supported transit-time (path 1)	- [s]	-	Read only
3439	Float / 4	Max acc travel time path 1	Maximum supported transit-time (path 1)	- [s]	-	Read only

Table A-98 Path 2 diagnostics

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
3450	Float / 4	RxGain up path 2	Rx gain of upstream signal	- [dB]	-	Read only
3452	Float / 4	RxGain down path 2	Rx gain of downstream signal	- [dB]	-	Read only
3454	Float / 4	SNR upstream path 2	Signal to noise ration of upstream signal	- [dB]	-	Read only
3456	Float / 4	SNR downstream path 2	Signal to noise ration of downstream signal	- [dB]	-	Read only
3458	Float / 4	Sound velocity path 2	Sound velocity	- [m/s]	-	Read only

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
3460	Float / 4	Flow velocity path 2	Flow velocity	- [m/s]	-	Read only
3462	Float / 4	Delta time path 2	Delta time	- [s]	-	Read only
3464	Float / 4	Travel time up path 2	Travel time of up-stream signal	- [s]	-	Read only
3466	Float / 4	Travel time down path 2	Travel time of down-stream signal	- [s]	-	Read only
3468	Float / 4	Correlation factor path 2	Correlation factor	-	-	Read only
3474	Unsigned / 2	Accepted burst percentage path 2	% of bursts accepted (path 2).	- [%]	-	Read only
3475	Float / 4	Actual sensor frequency path 2	Sensor frequency	- [Hz]	-	Read only
3479	Float / 4	Upstream peak amplitude path 2	Upstream signal peak amplitude	- [dBmV]	-	Read only
3477	Float / 4	Downstream peak amplitude path 2	Downstream signal peak amplitude	- [dBmV]	-	Read only
3481	Float / 4	Fluid refraction angle path 2	Calculated fluid refraction angle on path 2 (clamp-on only).	- [rad]	-	Read only
3483	Float / 4	Lower sound velocity limit path 2	Minimum supported fluid sound velocity (path 2)	- [m/s]	-	Read only
3485	Float / 4	Upper sound velocity limit path 2	Maximum supported fluid sound velocity (path 2)	- [m/s]	-	Read only
3487	Float / 4	Min acc travel time path 2	Minimum supported transit-time (path 2)	- [s]	-	Read only
3489	Float / 4	Max acc travel time path 2	Maximum supported transit-time (path 2)	- [s]	-	Read only

Table A-99 Path 3 diagnostics

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
3500	Float / 4	RxGain up path 3	Rx gain of upstream signal	- [dB]	-	Read only
3502	Float / 4	RxGain down path 3	Rx gain of downstream signal	- [dB]	-	Read only

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
3504	Float / 4	SNR upstream path 3	Signal to noise ration of upstream signal	- [dB]	-	Read only
3506	Float / 4	SNR down-stream path 3	Signal to noise ration of downstream signal	- [dB]	-	Read only
3508	Float / 4	Sound velocity path 3	Sound velocity	- [m/s]	-	Read only
3510	Float / 4	Flow velocity path 3	Flow velocity	- [m/s]	-	Read only
3512	Float / 4	Delta time path 3	Delta time	- [s]	-	Read only
3514	Float / 4	Travel time up path 3	Travel time of up-stream signal	- [s]	-	Read only
3516	Float / 4	Travel time down path 3	Travel time of down-stream signal	- [s]	-	Read only
3518	Float / 4	Correlation factor path 3	Correlation factor	-	-	Read only
3524	Unsigned / 2	Accepted burst percentage path 3	% of bursts accepted (path 3).	- [%]	-	Read only
3525	Float / 4	Actual sensor frequency path 3	Sensor frequency	- [Hz]	-	Read only
3529	Float / 4	Upstream peak amplitude path 3	Upstream signal peak amplitude	- [dBmV]	-	Read only
3527	Float / 4	Downstream peak amplitude path 3	Downstream signal peak amplitude	- [dBmV]	-	Read only
3531	Float / 4	Fluid refraction angle path 3	Calculated fluid refraction angle on path 3 (clamp-on only).	- [rad]	-	Read only
3533	Float / 4	Lower sound velocity limit path 3	Minimum supported fluid sound velocity (path 3)	- [m/s]	-	Read only
3535	Float / 4	Upper sound velocity limit path 3	Maximum supported fluid sound velocity (path 3)	- [m/s]	-	Read only
3537	Float / 4	Min acc travel time path 3	Minimum supported transit-time (path 3)	- [s]	-	Read only
3539	Float / 4	Max acc travel time path 3	Maximum supported transit-time (path 3)	- [s]	-	Read only

Table A-100 Path 4 diagnostics

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
3550	Float / 4	RxGain up path 4	Rx gain of upstream signal	- [dB]	-	Read only
3552	Float / 4	RxGain down path 4	Rx gain of downstream signal	- [dB]	-	Read only
3554	Float / 4	SNR upstream path 4	Signal to noise ration of upstream signal	- [dB]	-	Read only
3556	Float / 4	SNR down-stream path 4	Signal to noise ration of downstream signal	- [dB]	-	Read only
3558	Float / 4	Sound velocity path 4	Sound velocity	- [m/s]	-	Read only
3560	Float / 4	Flow velocity path 4	Flow velocity	- [m/s]	-	Read only
3562	Float / 4	Delta time path 4	Delta time	- [s]	-	Read only
3564	Float / 4	Travel time up path 4	Travel time of up-stream signal	- [s]	-	Read only
3566	Float / 4	Travel time down path 4	Travel time of down-stream signal	- [s]	-	Read only
3568	Float / 4	Correlation factor path 4	Correlation factor	-	-	Read only
3574	Unsigned / 2	Accepted burst percentage path 4	% of bursts accepted (path 4).	- [%]	-	Read only
3575	Float / 4	Actual sensor frequency path 4	Sensor frequency	- [Hz]	-	Read only
3579	Float / 4	Upstream peak amplitude path 4	Upstream signal peak amplitude	- [dBmV]	-	Read only
3577	Float / 4	Downstream peak amplitude path 4	Downstream signal peak amplitude	- [dBmV]	-	Read only
3581	Float / 4	Fluid refraction angle path 4	Calculated fluid refraction angle on path 4 (clamp-on only).	- [rad]	-	Read only
3583	Float / 4	Lower sound velocity limit path 4	Minimum supported fluid sound velocity (path 4)	- [m/s]	-	Read only
3585	Float / 4	Upper sound velocity limit path 4	Maximum supported fluid sound velocity (path 4)	- [m/s]	-	Read only

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
3587	Float / 4	Min acc travel time path 4	Minimum supported transit-time (path 4)	- [s]	-	Read only
3589	Float / 4	Max acc travel time path 4	Maximum supported transit-time (path 4)	- [s]	-	Read only

A.10.7.2 DSL

DSL error codes

Table A-101 DSL error codes

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
3800	Unsigned / 4	Low level errors 1	Every bit represents an active low level error signaled in the SEN Firmware.	-	-	Read only
3802	Unsigned / 4	Low level errors 2	Every bit represents an active low level error signaled in the SEN Firmware.	-	-	Read only
3804	Unsigned / 4	Low level errors 3	Every bit represents an active low level error signaled in the SEN Firmware.	-	-	Read only
3806	Unsigned / 4	Low level errors 4	Every bit represents an active low level error signaled in the SEN Firmware.	-	-	Read only

A.10.7.3 Temperature monitoring

Medium temperature

Table A-102 Medium temperature

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
3042	Float / 4	Current value	Measured value of medium temperature	-	-	Read only

Transmitter temperature

Table A-103 Transmitter temperature

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
8200	Float / 4	Current value	Measured value of transmitter internal temperature	-	-	Read only
10900	Float / 4	Minimum value	Drag indicator of minimum transmitter internal temperature	Max. floating point value [°C]	-	Read only
10902	String / 32	Minimum value timestamp	Shows timestamp of recorded minimum transmitter internal temperature		-	Read only
10918	Float / 4	Maximum value	Drag indicator of maximum transmitter internal temperature	Min. floating point value [°C]	-	Read only
10920	String / 32	Maximum value timestamp	Shows timestamp of recorded maximum transmitter internal temperature		-	Read only

DSL temperature

Table A-104 DSL temperature

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
3300	Float / 4	DSL temp	The temperature measured on the DSL.	-	-	Read only
3315	Float / 4	DSL temp lower alarm limit	Lower DSL temperature alarm limit. When exceeded an alarm is reported.	-40.0 [°C] (1001)	-55.0 to +130.0	Read / write
3317	Float / 4	DSL temp upper alarm limit	Upper DSL temperature alarm limit. When exceeded an alarm is reported.	80.0 [°C] (1001)	-55.0 to +130.0	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
3280	Float / 4	DSL temp min value	Warranty pointer for DSL temperature. Minimum DSL temperature encountered during the device lifetime.	200.0 [°C] (1001)	-200.0 to +800.0	Read / write
3282	Float / 4	DSL temp max value	Warranty pointer for DSL temperature. Maximum DSL temperature encountered during the device lifetime.	-200.0 [°C] (1001)	-200.0 to +800.0	Read / write

A.10.7.4 Inputs and outputs

General

Table A-105 General

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
8799	Unsigned / 2	Reset pulse counter	Command to reset pulse counters.	0	• 1: Reset all pulse totalizers and pulse counts • 2: Reset pulse totalizer in channel 2 • 3: Reset pulse totalizer in channel 3 • 4: Reset pulse totalizer in channel 4	Write only

Channel 2

Table A-106 Channel 2

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
8803	Float / 4	Current output value	Output current value if configured to current output.	-	-	Read only
8828	Unsigned / 2	Error status	Error status if configured to current output.	-	• Bit 0: Overflow • Bit 1: Underflow • Bit 2: Fail mode activated • Bit 3: Cable break • Bit 4: Output current cannot be established (read back deviation > 0.1 mA)	Read only
8840	Unsigned / 2	Status output	Status value if configured to status output.	-	0 - 1	Read only
8969	Float / 4	Pulse status output	Amount done if configured to pulse output.	-	-	Read only
8972	Unsigned / 2	Error status	Error status if configured to pulse output.	-	• Bit 0: The pulse putput has reached the maximum pulse output frequency • Bit 1: Fail mode is activated	Read only
8987	Unsigned / 4	Pulse counter	Pulse output since startup.	-	-	Read only
8900	Float / 4	Frequency output value	Frequency value if configured to frequency output.	-	-	Read only
8903	Unsigned / 2	Error status	Error status if configured to frequency output.	-	• Bit 0: Overflow • Bit 1: Underflow • Bit 2: Fail mode activated	Read only

Channel 3

Table A-107 Channel 3

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9103	Float / 4	Current output value	Output current value if configured to current output.	-	-	Read only
9128	Unsigned / 2	Error status	Error status if configured to current output.	-	• Bit 0: Overflow • Bit 1: Underflow • Bit 2: Fail mode activated • Bit 3: Cable break • Bit 4: Output current cannot be established (read back deviation > 0.1 mA)	Read only
9140	Unsigned / 2	Status output	Status value if configured to status output.	-	0 - 1	Read only
9269	Float / 4	Pulse status output	Amount done if configured to pulse output.	-	-	Read only
9272	Unsigned / 2	Error status	Error status if configured to pulse output.	-	• Bit 0: The pulse output has reached the maximum pulse output frequency • Bit 1: Fail mode is activated	Read only
9287	Unsigned / 4	Pulse counter	Pulse output since startup.	-	-	Read only
9200	Float / 4	Frequency output value	Frequency value if configured to frequency output.	-	-	Read only
9203	Unsigned / 2	Error status	Error status if configured to frequency output.	-	• Bit 0: Overflow • Bit 1: Underflow • Bit 2: Fail mode activated	Read only
10503	Float / 4	Current input value	Input current value if configured to current input.	-	-	Read only

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
10558	Unsigned / 2	Error status	Error status if configured to current input.	-	- Bit 0: Overflow (> 25 mA) - Bit 1: Underflow (< 0 mA) - Bit 2: Measured current out of measuring range	Read only
9129	Unsigned / 2	Digital input value	Input value if configured to digital input.	-	0 - 1	Read only

Channel 4

Table A-108 Channel 4

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9303	Float / 4	Current output value	Output current value if configured to current output.	-	-	Read only
9328	Unsigned / 2	Error status	Error status if configured to current output.	-	- Bit 0: Overflow - Bit 1: Underflow - Bit 2: Fail mode activated - Bit 3: Cable break - Bit 4: Output current cannot be established (read back deviation > 0.1 mA)	Read only
9340	Unsigned / 2	Status output	Status value if configured to status output.	-	0 - 1	Read only
9469	Float / 4	Pulse status output	Amount done if configured to pulse output.	-	-	Read only
9472	Unsigned / 2	Error status	Error status if configured to pulse output.	-	- Bit 0: The pulse output has reached the maximum pulse output frequency - Bit 1: Fail mode is activated	Read only
9487	Unsigned / 4	Pulse counter	Pulse output since startup.	-	-	Read only
9400	Float / 4	Frequency output value	Frequency value if configured to frequency output.	-	-	Read only

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9403	Unsigned / 2	Error status	Error status if configured to frequency output.	-	• Bit 0: Overflow • Bit 1: Underflow • Bit 2: Fail mode activated	Read only
10603	Float / 4	Current input value	Input current value if configured to current input.	-	-	Read only
10658	Unsigned / 2	Error status	Error status if configured to current input.	-	• Bit 0: Overflow (> 25 mA) • Bit 1: Underflow (< 0 mA) • Bit 2: Measured current out of measuring range	Read only
9329	Unsigned / 2	Digital input value	Input value if configured to digital input.	-	0 - 1	Read only

A.10.7.5 Peak values

Process value 1

Table A-109 Process value 1

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
11200	Unsigned / 2	Process value	Process value configured to be monitored	Disabled	3000: Volume flow 3004: Mass flow 3006: Sound velocity 3008: Flow velocity 3040: Density 3042: Medium temperature 3044: Pressure 3046: Viscosity 3048: RTD temperature 1 3050: RTD temperature 2 65535: Disabled	Read / write
11226	Float / 4	Maximum value	Drag indicator of maximum value specified by Process value (11200)	Min. floating point value [units depending on process value]	-	Read only
11228	String / 32	Maximum value timestamp	Shows timestamp of recorded maximum value specified by Process value (11200)		-	Read only
11208	Float / 4	Minimum value	Drag indicator of minimum value specified by Process value (11200)	Max. floating point value [units depending on process value]	-	Read only
11210	String / 32	Minimum value timestamp	Shows timestamp of recorded minimum value specified by Process value (11200)		-	Read only
11204	Unsigned / 2	Reset logging	Command to reset the drag pointers to the process value's default value.	-	1: Reset	Write only

Process value 2

Table A-110 Process value 2

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
11201	Unsigned / 2	Process value	Process value configured to be monitored	Disabled	• 3000: Volume flow • 3004: Mass flow • 3006: Sound velocity • 3008: Flow velocity • 3040: Density • 3042: Medium temperature • 3044: Pressure • 3046: Viscosity • 3048: RTD temperature 1 • 3050: RTD temperature 2 • 65535: Disabled	Read / write
11262	Float / 4	Maximum value	Drag indicator of maximum value specified by Process value (11201)	Min. floating point value [units depending on process value]	-	Read only
11264	String / 32	Maximum value timestamp	Shows timestamp of recorded maximum value specified by Process value (11201)		-	Read only
11244	Float / 4	Minimum value	Drag indicator of minimum value specified by Process value (11201)	Max. floating point value [units depending on process value]	-	Read only
11246	String / 32	Minimum value timestamp	Shows timestamp of recorded minimum value specified by Process value (11201)		-	Read only
11205	Unsigned / 2	Reset logging	Command to reset the drag pointers to the process value's default value.	-	1: Reset	Write only

Process value 3

Table A-111 Process value 3

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
11202	Unsigned / 2	Process value	Process value configured to be monitored	Disabled	• 3000: Volume flow • 3004: Mass flow • 3006: Sound velocity • 3008: Flow velocity • 3040: Density • 3042: Medium temperature • 3044: Pressure • 3046: Viscosity • 3048: RTD temperature 1 • 3050: RTD temperature 2 • 65535: Disabled	Read / write
11298	Float / 4	Maximum value	Drag indicator of maximum value specified by Process value (11202)	Min. floating point value [units depending on process value]	-	Read only
11300	String / 32	Maximum value timestamp	Shows timestamp of recorded maximum value specified by Process value (11202)		-	Read only
11280	Float / 4	Minimum value	Drag indicator of minimum value specified by Process value (11202)	Max. floating point value [units depending on process value]	-	Read only
11282	String / 32	Minimum value timestamp	Shows timestamp of recorded minimum value specified by Process value (11202)		-	Read only
11206	Unsigned / 2	Reset logging	Command to reset the drag pointers to the process value's default value.	-	1: reset	Write only

Process value 4

Table A-112 Process value 4

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
11203	Unsigned / 2	Process value	Process value configured to be monitored	Disabled	3000: Volume flow 3004: Mass flow 3006: Sound velocity 3008: Flow velocity 3040: Density 3042: Medium temperature 3044: Pressure 3046: Viscosity 3048: RTD temperature 1 3050: RTD temperature 2 65535: Disabled	Read / write
11334	Float / 4	Maximum value	Drag indicator of maximum value specified by Process value (11203)	Min. floating point value [units depending on process value]	-	Read only
11336	String / 32	Maximum value timestamp	Shows timestamp of recorded maximum value specified by Process value (11203)		-	Read only
11316	Float / 4	Minimum value	Drag indicator of minimum value specified by Process value (11203)	Max. floating point value [units depending on process value]	-	Read only
11318	String / 32	Minimum value timestamp	Shows timestamp of recorded minimum value specified by Process value (11203)		-	Read only
11207	Unsigned / 2	Reset logging	Command to reset the drag pointers to the process value's default value.	-	1: Reset	Write only

A.10.8 Characteristics

A.10.8.1 Product

Table A-113 Product

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6019	Unsigned / 2	CT variant	Shows whether or not this product is allowed to be operated in custody transfer mode	-	0: No 1: Yes	Read only
6199	Unsigned / 2	CT active	Shows whether custody transfer mode is activated	-	0: No 1: Yes	Read only

A.10.8.2 Transmitter

Table A-114 Transmitter

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6500	String / 32	Design 1	Information of design	-	-	Read only
6516	String / 32	Design 2	Information of design continued	-	-	Read only
6532	String / 32	Design 3	Information of design continued	-	-	Read only
6548	String / 32	Design 4	Information of design continued	-	-	Read only
6144	String / 32	Hazardous area approval	Text describing the hazardous area approval of the transmitter	-	-	Read only

A.10.8.3 Sensor frontend

Table A-115 Sensor frontend

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
4140	Unsigned / 2	Frontend variant	Sensor frontend variant.	-	0: Remote 1: Compact 2: Integrated	Read only

A.10.9 SensorFlash

A.10.9.1 SensorFlash

Table A-116 SensorFlash

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6164	Unsigned / 2	Installed	Shows status of SD card	-	0: SensorFlash not installed 1: SensorFlash installed 2: SensorFlash used as mass storage device	Read only
6165	Unsigned / 4	Capacity total	Total capacity of installed SensorFlash. 0 kB if card is not installed.	- [KB]	-	Read only
6564	String / 12	Capacity total	Total capacity of installed SensorFlash.	-	-	Read only
6167	Unsigned / 4	Capacity available	Free capacity of installed SensorFlash. 0 kB if card is not installed.	- [KB]	-	Read only
6570	String / 12	Capacity available	Free capacity of installed SensorFlash.	-	-	Read only
9499	Unsigned / 2	Check disc	Check disc command.	-	1: Execute check disc with repair	Write only

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6182	Unsigned / 2	Backup	Command to overwrite the existing backup data sets. This ensures that the current sensor serial number and transmitter serial numbers are updated in the backup dataset. This enables the automatic backup.	-	1: Overwrite existing backup files	Write only
6099	Unsigned / 2	Restore	Command to restore backup data. Coding is bitwise.	-	- Bit 0: Restore sensor setup parameters - Bit 1: Restore sensor application setup parameters - Bit 2: Restore transmitter application setup parameters - Bit 3: Restore customer transmitter configuration setup parameters - Bit 4: Restore totalizers - Bit 5: Restore system setup - Bit 6: Restore customer sensor configuration setup parameters	Write only

A.10.9.2 Data logging

Table A-117 Data logging

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
11400	Unsigned / 2	Enable / disable	Controls data logging.	0	0: Disabled 1: Enabled	Read / write
11401	Unsigned / 2	Data logging mode	Controls data logging mode.	0	0: Log instantaneous 1: Log average value	Read / write
11402	Unsigned / 4	Logging interval	Defines interval for logging. Granularity is 10 ms.	500 [x 10 ms]	1 - 8640000	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
11404	Unsigned / 2	Register 1	Modbus register that defines the parameter to be logged. Only parameter of type float or unsigned can be logged. 65535: No logging	65535	-	Read / write
11405	Unsigned / 2	Register 2	Modbus register that defines the parameter to be logged. Only parameter of type float or unsigned can be logged. 65535: No logging	65535	-	Read / write
...						
11493	Unsigned / 2	Register 90	Modbus register that defines the parameter to be logged. Only parameter of type float or unsigned can be logged. 65535: No logging	65535	-	Read / write

A.10.10 Simulation

A.10.10.1 Inputs and outputs

Channel 2 output current

Table A-118 Channel 2 output current

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
8825	Unsigned / 2	Simulation	Enables or disables simulation of channel 2 output current.	0	0: Disabled 1: Enabled	Read / write
8826	Float / 4	Simulated value	Current value that is output on the channel when simulation is enabled.	0 [mA]	0 - 25	Read / write

Channel 2 output status

Table A-119 Channel 2 output status

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
8864	Unsigned / 2	Simulation	Enables or disables simulation of channel 2 output status.	0	0: Disabled 1: Enabled	Read / write
8865	Unsigned / 2	Simulated value	Signal level that is output on the channel when simulation is enabled.	0	0, 1	Read / write

Channel 2 output frequency

Table A-120 Channel 2 output frequency

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
8905	Unsigned / 2	Simulation	Enables or disables simulation of channel 2 output frequency.	0	0: Disabled 1: Enabled	Read / write
8906	Float / 4	Simulated value	Frequency value that is output on the channel when simulation is enabled.	1.0 [Hz]	0.0 - 12500.0	Read / write

Channel 2 output pulse

Table A-121 Channel 2 output pulse

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
8973	Unsigned / 2	Simulation	Enables or disables simulation of channel 2 output pulses.	0	0: Disabled 1: Enabled	Read / write
8978	Float / 4	Simulated value	Pulse frequency value that is output on the channel when simulation is enabled.	0.0 [pulses/s]	0.0 - 12500.0	Read / write

Channel 3 output current

Table A-122 Channel 3 output current

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9125	Unsigned / 2	Simulation	Enables or disables simulation of channel 3 output current.	0	0: Disabled 1: Enabled	Read / write
9126	Float / 4	Simulated value	Current value that is output on the channel when simulation is enabled.	0 [mA]	0 - 25	Read / write

Channel 3 output status

Table A-123 Channel 3 output status

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9164	Unsigned / 2	Simulation	Enables or disables simulation of channel 3 output status.	0	0: Disabled 1: Enabled	Read / write
9165	Unsigned / 2	Simulated value	Signal level that is output on the channel when simulation is enabled.	0	0, 1	Read / write

Channel 3 output frequency

Table A-124 Channel 3 output frequency

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9205	Unsigned / 2	Simulation	Enables or disables simulation of channel 3 output frequency.	0	0: Disabled 1: Enabled	Read / write
9206	Float / 4	Simulated value	Frequency value that is output on the channel when simulation is enabled.	1.0 [Hz]	0.0 - 12500.0	Read / write

Channel 3 output pulse

Table A-125 Channel 3 output pulse

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9273	Unsigned / 2	Simulation	Enables or disables simulation of channel 3 output pulses.	0	0: Disabled 1: Enabled	Read / write
9278	Float / 4	Simulated value	Pulse frequency value that is output on the channel when simulation is enabled.	0.0 [pulses/s]	0.0 - 12500.0	Read / write

Channel 3 input current

Table A-126 Channel 3 input current

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
10505	Unsigned / 2	Simulation	Enables or disables simulation of channel 3 output current.	0	0: Disabled 1: Enabled	Read / write
10506	Float / 4	Simulated value	Current value that is output on the channel when simulation is enabled.	0 [mA]	0 - 25	Read / write

Channel 3 discrete input signal

Table A-127 Channel 3 discrete input signal

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9136	Unsigned / 2	Simulation	Enables or disables simulation of channel 3 discrete input signal.	0	0: Disabled 1: Enabled	Read / write
9137	Unsigned / 2	Simulated value	Signal level that that substitutes the input signal on the channel when simulation is enabled.	0	0, 1	Read / write

Channel 4 output current

Table A-128 Channel 4 output current

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9325	Unsigned / 2	Simulation	Enables or disables simulation of channel 4 output current.	0	0: Disabled 1: Enabled	Read / write
9326	Float / 4	Simulated value	Current value that is output on the channel when simulation is enabled.	0 [mA]	0 - 25	Read / write

Channel 4 output status

Table A-129 Channel 4 output status

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9364	Unsigned / 2	Simulation	Enables or disables simulation of channel 4 output status.	0	0: Disabled 1: Enabled	Read / write
9365	Unsigned / 2	Simulated value	Signal level that is output on the channel when simulation is enabled.	0	0, 1	Read / write

Channel 4 output frequency

Table A-130 Channel 4 output frequency

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9405	Unsigned / 2	Simulation	Enables or disables simulation of channel 4 output frequency.	0	0: Disabled 1: Enabled	Read / write
9406	Float / 4	Simulated value	Frequency value that is output on the channel when simulation is enabled.	1.0 [Hz]	0.0 - 12500.0	Read / write

Channel 4 output pulse

Table A-131 Channel 4 output pulse

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9473	Unsigned / 2	Simulation	Enables or disables simulation of channel 4 output pulses.	0	0: Disabled 1: Enabled	Read / write
9478	Float / 4	Simulated value	Pulse frequency value that is output on the channel when simulation is enabled.	0.0 [pulses/s]	0.0 - 12500.0	Read / write

Channel 4 input current

Table A-132 Channel 4 input current

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
10605	Unsigned / 2	Simulation	Enables or disables simulation of channel 4 output current.	0	0: Disabled 1: Enabled	Read / write
10606	Float / 4	Simulated value	Current value that is output on the channel when simulation is enabled.	0 [mA]	0 - 25	Read / write

Channel 4 discrete input signal

Table A-133 Channel 4 discrete input signal

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9336	Unsigned / 2	Simulation	Enables or disables simulation of channel 4 discrete input signal.	0	0: Disabled 1: Enabled	Read / write
9337	Unsigned / 2	Simulated value	Signal level that that substitutes the input signal on the channel when simulation is enabled.	0	0, 1	Read / write

A.10.10.2 Process values

Simulate process values

Table A-134 Channel 2 output current

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
2700	Unsigned / 4	Enable simulation	Defines enabling or disabling simulation of multiple process values at a time.	0	Set bit means enabling: • Bit 0: Density • Bit 1: Medium temperature • Bit 2: Pressure • Bit 3: Viscosity • Bit 4: AUX temperature • Bit 5: Sensor temperature • Bit 6: Concentration • Bit 7: Base viscosity • Bit 8: Base density • Bit 9: Liquident • Bit 10: API gravity • Bit 11: Base API gravity • Bit 12: Specific gravity • Bit 13: Base specific gravity • Bit 14: Rate of change • Bit 15: Standardizing factor • Bit 16: Mass flow • Bit 17: Standard volume flow • Bit 18: Volume flow • Bit 19: Sound velocity • Bit 20: Flow velocity • Bit 21: Liquid identifier	Read / write
2702	Float / 4	Density	Process density simulation value	1000.0 [kg/m ³] (7600)	0.08 - 10000.0	Read / write
2704	Float / 4	Medium temperature	Medium temperature simulation value	20.0 [°C]	-50.0 - 250.0	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
2706	Float / 4	Pressure	Process pressure simulation value	700000.0 [Pa] (8015)	100000.0 - 100000000.0	Read / write
2708	Float / 4	Viscosity	Process viscosity simulation value	0.000001 [m ² /s] (7524)	0.00000001 - 10.0	Read / write
2710	Float / 4	Sensor temperature	Sensor temperature simulation value	20.0 [°C] (7700)	-50.0 - 250.0	Read / write
2712	Float / 4	Auxiliary temperature	Auxiliary temperature simulation value	20.0 [°C] (7700)	-50.0 - 250.0	Read / write
2714	Float / 4	Concentration	Concentration simulation value	0.0 %	-	Read / write
2716	Float / 4	Base viscosity	Base viscosity simulation value	0.000001 [m ² /s] (7524)	0.00000001 - 10.0	Read / write
2718	Float / 4	Base density	Base density simulation value	1000.0 [kg/m ³] (7600)	0.08 - 10000.0	Read / write
2720	Float / 4	Liquident	Liquident simulation value	1500.0 [m/s] (8014)	100.0 - 2500.0	Read / write
2722	Float / 4	API gravity	API gravity simulation value	0.0 [°API]	-150.0 - +200.0	Read / write
2724	Float / 4	Base API gravity	Base API simulation value	0.0 [°API]	-150.0 - +200.0	Read / write
2726	Float / 4	Specific gravity	Specific gravity simulation value	0.0 [SGU]	0.0 - 10.0	Read / write
2728	Float / 4	Base specific gravity	Base specific gravity simulation value	0.0 [SGU]	0.0 - 10.0	Read / write
2730	Float / 4	Rate of change	Rate of change simulation value	0.0 [m ² /s] (7400)	-	Read / write
2732	Float / 4	Standardizing factor	Standardizing factor simulation value	0.0	0.0 - 10.0E+6	Read / write
2734	Float / 4	Mass flow	Mass flow simulation value	0.0 [m ³ /s] (7400)	-3.0E6 - +3.0E+6	Read / write
2736	Float / 4	Standard volume flow	Standard volume flow simulation value	0.0 [Sm ³ /h] (7964)	-1.0E5 - +1.0E+5	Read / write
2738	Float / 4	Volume flow	Volume flow simulation value	0.0 [m ³ /s] (7500)	-3000.0 - +3000.0	Read / write
2740	Float / 4	Sound velocity	Sound velocity simulation value	1500.0 [m/s] (7648)	200.0 - 3000.0	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
2742	Float / 4	Flow velocity	Flow velocity simulation value	0.0 [m/s] (8014)	-40.0 - 40.0	Read / write
2752	Unsigned / 2	Liquid identifier	Liquid identifier simulation value	0	-	Read / write

A.10.10.3 Alarms

Simulate alarms

Table A-135 Simulate alarms

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6229	Unsigned / 2	Simulation mode	Defines mode of alarm simulation.	0	0: Off 1: Simulate alarm item 2: Simulate alarm class	Read / write
6230	Unsigned / 4	Alarm items 1	Bitwise enabling of alarms in alarm items 1. Set bit means alarm item simulation activated. See Alarm items (Page 324).	0	-	Read / write
6232	Unsigned / 4	Alarm items 2	Bitwise enabling of alarms in alarm items 2. Set bit means alarm item simulation activated. See Alarm items (Page 324).	0	-	Read / write
6236	Unsigned / 4	Alarm items 4	Bitwise enabling of alarms in alarm items 4. Set bit means alarm item simulation activated. See Alarm items (Page 324).	0	-	Read / write
6238	Unsigned / 4	Alarm items 5	Bitwise enabling of alarms in alarm items 5. Set bit means alarm item simulation activated. See Alarm items (Page 324).	0	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6240	Unsigned / 4	Alarm items 6	Bitwise enabling of alarms in alarm items 6. Set bit means alarm item simulation activated. See Alarm items (Page 324).	0	-	Read / write
6242	Unsigned / 4	Alarm items 7	Bitwise enabling of alarms in alarm items 7. Set bit means alarm item simulation activated. See Alarm items (Page 324).	0	-	Read / write
6244	Unsigned / 4	Alarm items 8	Bitwise enabling of alarms in alarm items 8. Set bit means alarm item simulation activated. See Alarm items (Page 324).	0	-	Read / write
7032	Unsigned / 4	Alarm items 9	Bitwise enabling of alarms in alarm items 9. Set bit means alarm item simulation activated. See Alarm items (Page 324).	0	-	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6247	Unsigned / 2	Alarm class	Bit encoded selection of alarm classes. Applicable if simulation mode = 2. Set bit means alarm class simulation activated: Bit 0: Process value alarm (PA) Bit 1: Process value warning (PW) Bit 2: Maintenance alarm (MA) Bit 3: Maintenance warning (MW) Bit 4: Maintenance required (MR) Bit 5: Function check (FC)	0	0 - 63	Read / write
6249	Unsigned / 2	NAMUR status	Bit encoded selection of NAMUR status signals. Applicable if simulation mode = 2. Set bit means NAMUR status signal simulation activated: Bit 0: Out of specification (PA, PW) Bit 1: Failure (MW) Bit 2: Maintenance required (MR, MD) Bit 3: Function check (FC)	0	0 - 15	Read / write

A.10.11 Audit trail

A.10.11.1 Operating time

Table A-136 Operating time

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6160	Unsigned / 4	Operating time total	Operating time of the transmitter.	- [h]	-	Read only
6162	Unsigned / 4	Operating time	Operating time of the transmitter since last startup.	- [h]	-	Read only

A.10.11.2 Parameter change log

Table A-137 Parameter change log

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6650	Unsigned / 2	Newest entry number	Entry number of newest entry. Older entries have a smaller entry number. (Wrap around for 0 - 100).	-	-	Read only
6651	Unsigned / 2	Available entries	Current number of available parameter change log entries.	-	-	Read only
6652	Unsigned / 2	Clear parameter change log	Command to clear the parameter change log.	-	0: Cancel 1: Clear log	Write only
6750	Unsigned / 2	Entry number	Selection of the entry number.	-	0 - 100	Read / write
6751	String / 16	Time stamp	Time stamp of the parameter change log entry specified by Entry number. Format is YYYY-MM-DD hh-mm.	-	-	Read only
10832	String / 32	Time stamp	Time stamp of the parameter change log entry specified by Entry number. Format is YYYY-MM-DD hh-mm-ss.	-	-	Read only
6759	Unsigned / 2	Modbus register	Modbus register specified by Entry number.	-	-	Read only
6760	Unsigned / 2	Data type	Data type of Modbus register specified by Entry number.	-	0: No entry 1: Unsigned8 2: Unsigned16 3: Unsigned32 4: Float32 5: String	Read only
6761	Unsigned / 2	Old value unsigned8	Parameter value of type unsigned8 before modification.	-	-	Read only
6762	Unsigned / 2	Old value unsigned16	Parameter value of type unsigned16 before modification.	-	-	Read only
6763	Unsigned / 4	Old value unsigned32	Parameter value of type unsigned32 before modification.	-	-	Read only

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6765	Float / 4	Old value float	Parameter value of type float before modification. (Unit is corresponding default unit. See A.9.3)	-	-	Read only
6767	String / 32	Old value string	Parameter value of type string before modification.	-	-	Read only
6783	Unsigned / 2	New value unsigned8	Parameter value of type unsigned8 after modification.	-	-	Read only
6784	Unsigned / 2	New value unsigned16	Parameter value of type unsigned16 after modification.	-	-	Read only
6785	Unsigned / 4	New value unsigned32	Parameter value of type unsigned32 after modification.	-	-	Read only
6787	Float / 4	New value float	Parameter value of type float after modification. (Unit is corresponding default unit. See Units (Page 178))	-	-	Read only
6789	String / 32	New value string	Parameter value of type string after modification.	-	-	Read only
6805	Unsigned / 2	Initiator	Host that initiated the parameter change.	-	• 1: Transmitter internal • 2: Communication channel • 3: Local display • 4: USB	Read only

A.10.11.3 FW update change log

Table A-138 FW update change log

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6900	Unsigned / 2	Newest entry number	Entry number of newest entry. Older entries have a smaller entry number. (Wrap around for 0 - 100).	-	-	Read only
6981	Unsigned / 2	Entry number	Selection of the entry number.	-	0 - 20	Read / write

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
6919	String / 16	Time stamp	Time stamp of the parameter change log entry specified by Entry number. Format is YYYY-MM-DD hh-mm.	-	-	Read only
6927	String / 16	Version	Version string specified by Entry number.	-	-	Read only
6952	Unsigned / 2	Available entries	Current number of available firmware updates log entries.	-	-	Read only
6953	Unsigned / 2	Clear parameter change log	Command to clear the parameter change log.	-	1: Clear log	Write only (Expert)

A.10.12 Device reset

Table A-139 Device reset

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
700	Unsigned / 2	Set to default	Command to set all changeable parameters to their defined values.	0	1: Reset parameters	Write only
6000	Unsigned / 2	Restart device	Command to restart device.	-	1: Restart device	Write only

A.10.13 Oil table settings

Table A-140 Oil table settings (only hydrocarbon applications)

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
750	Unsigned / 2	Command	Command to update Liquident lookup table	0	0: Command done / not executing 1: Transfer information to oil table 2: Read information from oil table 3: Perform sanity check 4: Store table to flash 5: Erase flash 6: Reload latest valid table from flash 7: Sort oil table in ascending order by Liquident	Read / write
751	Unsigned / 2	Command status	Status of last performed Command	0	0: STATUS_OK - command executed successfully 1: SANITY_CHECK_FAILED - sanity check failed during command execution 2: MEMORY_FULL - out of flash storage space. Erase needed 3: MEMORY_TIMEOUT - indicates timeout during flash write/erase operation 4: MEMORY_LOAD_FAILED - indicates error with loading data from flash	Read only
752	Unsigned / 2	Index	Index affected by Command Write (ID 1) Read (ID 2)	1	1 - 30	Read / write

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
753	Float / 4	Liquident	Liquident value in lookup table. Set to 100.0 to terminate lookup table (if less, maximum entries are desired)	1500.0 [m/s]	0.0 - 2500.0	Read / write
755	Unsigned / 2	Liquid identifier	Liquid identifier value in lookup table.	-		Read / write
756	Float / 4	Base density	Base density value in lookup table.	1000.0 [kg/m ³] (7600)	0.080 - 10000	Read / write
758	Float / 4	Reference viscosity 1	Reference viscosity 1 value in lookup table.	0.000001 [m ² /s] (7524)	0.00000001 - 10.0	Read / write
760	Float / 4	Reference viscosity 2	Reference viscosity 2 value in lookup table.	0.000001 [m ² /s] (7524)	0.00000001 - 10.0	Read / write
762	Float / 4	Liquident coefficient K0	Liquident coefficient K0 value in lookup table.	0.0	0.0 - 2000.0	Read / write
764	Float / 4	Liquident coefficient K1	Liquident coefficient K1 value in lookup table.	0.0	0.0 - 1.0	Read / write
766	Float / 4	Liquident coefficient K2	Liquident coefficient K2 value in lookup table.	0.0	-1.0 - 0.0	Read / write
768	Float / 4	Reference temperature 1	Reference temperature 1 for all reference viscosity 1 values in lookup table.	0.0 [°C] (7700)	-50.0 - +250.0	Read / write
770	Float / 4	Reference temperature 2	Reference temperature 2 for all reference viscosity 2 values in lookup table.	40.0 [°C] (7700)	-50.0 - +250.0	Read / write
772	Float / 4	Reference temperature 3	Reference temperature for all API MPMS 11.1 density and K0, K1, K2 coefficients in oil lookup table.	15.55556 [°C] (7700)	15.55556	Read only

A.10.14 Scraper pig detection settings

Table A-141 Scraper pig detection settings

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [units] (units register)	Value range / Setting options	Access level
1802	Unsigned / 1	Enable scraper pig detection	Enables or disables scraper pig detection	0	0: Disabled 1: Enabled	Read / write
1803	Float / 4	Minimum length	Length of the shortest expected pipeline pig to be detected	0 [m]	0 – 30	Read / write
1837	Float / 4	Maximum length	Length of the longest expected pipeline pig to be detected	0 [m]	0 – 30	Read / write
1839	Float / 4	Signal threshold of scraper pig	Signal amplitude threshold for triggering the scraper pig detection.	12.0 [dBmV]	-20 – 100	Read / write
1841	Unsigned / 1	Blocked paths to start timer	Minimum number of paths required to be below the signal threshold to initiate pig detection. 0 selects the number of installed paths.	0	0 - 4	Read / write
1842	Unsigned / 1	Unblocked paths to end timer	Minimum number of paths required to be above the signal threshold before evaluating whether or not a pig as passed. 0 selects the number of installed paths.	0	0 - 4	Read / write
1843	Unsigned / 1	Percent change of VoS accepted	Maximum allowed percent change in liquid sound velocity before and after pig passage. Used to suppress implausible receive signals due to reflections off the pig.	5 [%]	0 - 50	Read / write
1844	Float / 4	Max. length of pig reflections	Used to suppress plausible receive signals due to reflections off the interior pig surface having the specified maximum length. Setting value to 0 disables this filter.	0.05 [m]	0 - 5	Read / write

A.10.15 Communication

A.10.15.1 Service channel

Table A-142 Service channel

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
9594	Unsigned / 2	USB mode	Returns the USB mode.	-	0: USB communication 1: Mass storage device (MSD)	Read only
9595	Unsigned / 2	Auto mode	Automatically connected as MSD when USB cable is plugged.	-	0: Disabled 1: Enabled	Read / write
9596	Unsigned / 2	MSD connect	Command to connect / disconnect to PC.	-	0: Cancel 1: Connect 2: Disconnect	Write only

A.10.16 Security

A.10.16.1 Access management

Table A-143 Access management

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
8292	Unsigned / 2	User PIN	Input of user PIN.	-	-	Write only
8293	Unsigned / 2	Expert PIN	Input of expert PIN.	-	-	Write only
8294	Unsigned / 2	Access level	Granted access level.	-	16: Read only 32: User privilege 64: Expert privilege	Read only
6169	Unsigned / 2	New user PIN	Input to change user PIN.	-	-	Write only
6170	Unsigned / 2	New expert PIN	Input to change expert PIN.	-	-	Write only (Expert)

A.10 Modbus holding registers tables

Modbus register	Data type / Size in bytes	Parameter	Description	Default value [unit] (unit register)	Value range / Setting options	Access level
7326	Unsigned / 2	Unique ID code	Unique ID code needed to request a PUK from Siemens customer support.	-	-	Read only
6177	Unsigned / 2	PUK	PUK to reset all PINs to default values.	-	-	Write only

Product documentation and support

B.1 Product documentation

Process instrumentation product documentation is available in the following formats:

- Certificates (<http://www.siemens.com/processinstrumentation/certificates>)
- Downloads (firmware, EDDs, software) (<http://www.siemens.com/processinstrumentation/downloads>)
- Catalog and catalog sheets (<http://www.siemens.com/processinstrumentation/catalogs>)
- Manuals (<http://www.siemens.com/processinstrumentation/documentation>)
You have the option to show, open, save, or configure the manual.
 - "Display": Open the manual in HTML5 format
 - "Configure": Register and configure the documentation specific to your plant
 - "Download": Open or save the manual in PDF format
 - "Download as html5, only PC": Open or save the manual in the HTML5 view on your PC

You can also find manuals with the Mobile app at Industry Online Support (<https://support.industry.siemens.com/cs/ww/en/sc/2067>). Download the app to your mobile device and scan the device QR code.

Product documentation by serial number

Using the PIA Life Cycle Portal, you can access the serial number-specific product information including technical specifications, spare parts, calibration data, or factory certificates.

Entering a serial number

1. Open the PIA Life Cycle Portal (<https://www.pia-portal.automation.siemens.com>).
2. Select the desired language.
3. Enter the serial number of your device. The product documentation relevant for your device is displayed and can be downloaded.

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

Scanning a QR code

1. Scan the QR code on your device with a mobile device.
2. Click "PIA Portal".

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

B.2 Technical support

Technical support

If this documentation does not completely answer your technical questions, you can enter a Support Request (<http://www.siemens.com/automation/support-request>).

Additional information on our technical support can be found at Technical Support (<http://www.siemens.com/automation/csi/service>).

Service & support on the Internet

In addition to our technical support, Siemens offers comprehensive online services at Service & Support (<http://www.siemens.com/automation/service&support>).

Contact

If you have further questions about the device, contact your local Siemens representative at Personal Contact (<http://www.automation.siemens.com/partner>).

To find the contact for your product, go to "all products and branches" and select "Products & Services > Industrial automation > Process instrumentation".

Contact address for business unit:

Siemens AG

Digital Industries

Process Automation

Östliche Rheinbrückenstr. 50

76187 Karlsruhe, Germany

Remote Operation

C.1 Commissioning with SIMATIC PDM

C.1.1 Overview SIMATIC PDM

SIMATIC PDM (Process Device Manager) is a general-purpose, manufacturer-independent tool for the configuration, parameter assignment, commissioning, diagnostics and maintenance of intelligent field devices and field components. Follow-up installations and additional information on SIMATIC PDM are available on the Internet at SIMATIC PDM (<https://www.siemens.com/simatic-pdm>).

SIMATIC PDM monitors the process values, alarms and status signals of the device. It allows you to display, compare, adjust, verify, and simulate process device data; also to set schedules for calibration and maintenance.

For information on, for example, how to install and integrate devices, commission the software, see Operating Manual 'Help for SIMATIC PDM'. The manual is delivered with SIMATIC PDM software. Once the SIMATIC PDM is installed on your computer you find the manual under: Start > All programs > Siemens Automation > SIMATIC > Documentation. Link at our website: SIMATIC PDM instructions and manuals (<https://support.industry.siemens.com/cs/ww/en/ps/16983/man>).

Note

Field device parameters

- For a list of parameters and additional information, consult section "Parameters accessed via PDM menus (Page 379)".
 - The field device remains in measurement mode during the time you configure the field device.
-

C.1.2 Check SIMATIC PDM version

Procedure

1. Go to Software downloads (<https://www.siemens.com/processinstrumentation/downloads>).
2. Check the support page to make sure you have:
 - The latest version of SIMATIC PDM
 - The most recent Service Pack (SP)
 - The most recent hot fix (HF)

C.1.3 Deactivate buffers when connecting via serial modem

Introduction

This deactivation is required to align SIMATIC PDM with the HART modem when using a Microsoft Windows operating systems.

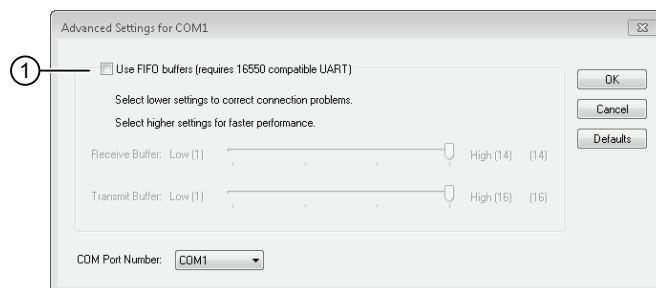
Deactivating buffers is not necessary when connecting via USB.

Condition

- You connect via RS232 (COM1).
- You have administrative rights on your operating system.
- You know the hardware and software requirements SIMATIC PDM installation documentation.

Procedure

1. Check the Operating Instructions for SIMATIC PDM for hardware and software requirements.
2. From the computer desktop, click "Start > Control Panel" to begin configuration.
3. Click "System and Security".
4. Select "Device Manager" under "System".
5. Open folder "Ports".
6. Double click the COM Port used by the system to open the properties window.
7. Select the tab "Port Settings".
8. Click the "Advanced" button.
If the "Use FIFO buffers" radio box is selected, click to deselect.



- ① Deselect "Use FIFO buffers" radio box

9. Click "OK" button to close out.
10. Close all screens.
11. Restart the computer.

C.1.4 Updating the Electronic Device Description (EDD)

Procedure

1. Check that the EDD revision match the Firmware revision in the device according to the table in section Product compatibility (Page 10).
2. Go to the support page Software downloads (<https://www.siemens.com/processinstrumentation/downloads>).
3. Enter the product name in the field "Enter search term...".
4. Download the most current EDD of your device.
5. Save files to your computer in an easily accessed location.
6. Launch SIMATIC PDM – Device Integration Manager.
From the File menu, click "Read device descriptions from compressed source...".
7. Browse to the zipped EDD file, select and open it.
8. Use the "Integration" function to integrate the EDD into the device catalog. The EDD is now accessible via SIMATIC Manager.

C.1.5 Adding device to communication network

Before setting the parameters, it is necessary to configure the FS230 project in PDM.

- 1. Add the device to SIMATIC Modbus network:
 - Open the project in the process device network view.
 - Right click on Networks and select Insert New Object → Communication network. The Insert Object(s) - <...> dialog box opens.
 - Click on Assign Device Type.
 - Select the inserted Modbus network in the right window and right-click.
 - Select the Object Properties command.
 - Enter the device-specific information in the Communication tab of the Properties dialog for the Modbus network.

Modbus communication type: Serial or IrDA (infrared)	
Serial	The interface must be set accordingly on the PC station.
IrDA	No additional setting required. Once the device is within range, it is available for Modbus communication. Only one infrared device can be coupled to Modbus at a given time. Several devices can be coupled under Windows.
Response time	General timeout within which the device is allowed to report. If the timeout is too long, the communication is slowed. If it is too short, some devices may not be found.

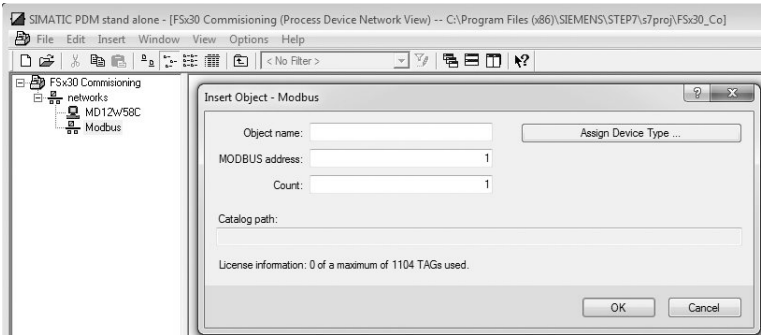


Figure C-1 Assigning Modbus device to network

- To check if the correct network and the correct port are assigned to the COM interface, double-click the PC object in the right window. Select the COM interface object in HW Config, and select the Object Properties menu command in the shortcut menu.
- 2. Set up the COM interface:

Note

The COM port is usually 1 for notebooks. Since most PCs have two COM ports, you have to specify which port the device is connected to in this tab.

- To insert the Modbus device, select the Modbus network object in the right window and right-click. In the displayed shortcut menu, select the Insert New Object → Object command. In the displayed dialog box, enter the name of the Modbus device

- To set the device address, select the inserted Modbus device in the right window and right-click. Select the Object Properties command in the displayed shortcut menu.
- Enter the device-specific information (Modbus address 0-247) in the Communication tab of the Properties dialog for the Modbus device.
- To change the device address, select the inserted Modbus device in the right window and then select the Object Properties menu command in the shortcut menu. Select the Communication tab in the displayed dialog and enter the new short address.
- Start SIMATIC PDM by double-clicking the newly inserted Modbus device in the right window. Select the relevant device in the menu tree (only required for the first call), and assign parameters for the device.

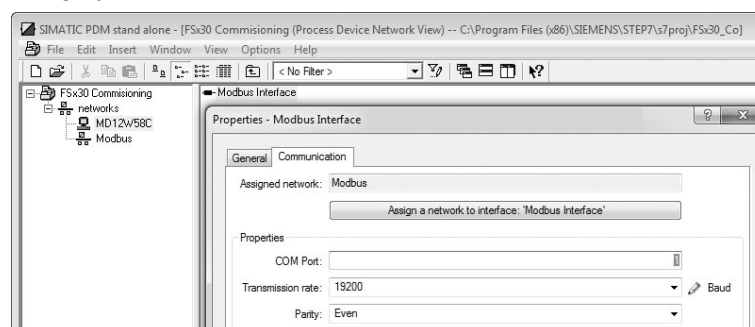


Figure C-2 Set COM port

Note**Multiple PCs in one project**

If there are several PCs in your project, you have to define one of them as the current one. To do this, select the desired PC object in the left window and then select the menu command Options → Define Current PC.

C.1.6 Configuring a new device

Note**Configuring device via SIMATIC PDM**

Clicking "Cancel" button during an upload from device to SIMATIC PDM will result in *some* parameters being updated.

1. Check that you have the most recent EDD, and if necessary update it. See Updating the Electronic Device Description (EDD) (Page 373).
2. Launch **SIMATIC Manager** and create a new project for the device.
3. Open the menu "Device > Operation > Reset > Restore ordered configuration". Select "Yes" button and click "OK" to perform a reset to customer ordered settings.

4. After the reset is complete click on "Upload to PG/PC..." to customer ordered settings.
5. Configure the device via the Quick Start wizard. (See Wizard - Quick Start via PDM (Page 376).)

C.1.7 Wizard - Quick Start via PDM

The graphic Quick Start Wizard provides an easy multistep procedure that configures the device for a simple application.

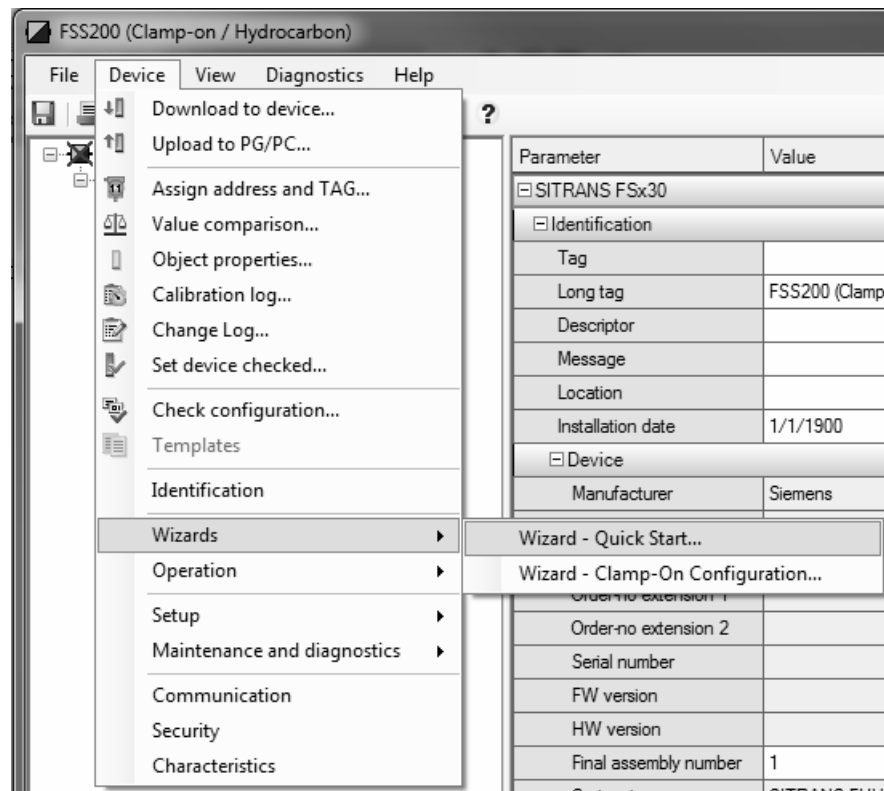
Please consult the SIMATIC PDM operating instructions or online help for details on using SIMATIC PDM.

Quick start

Note

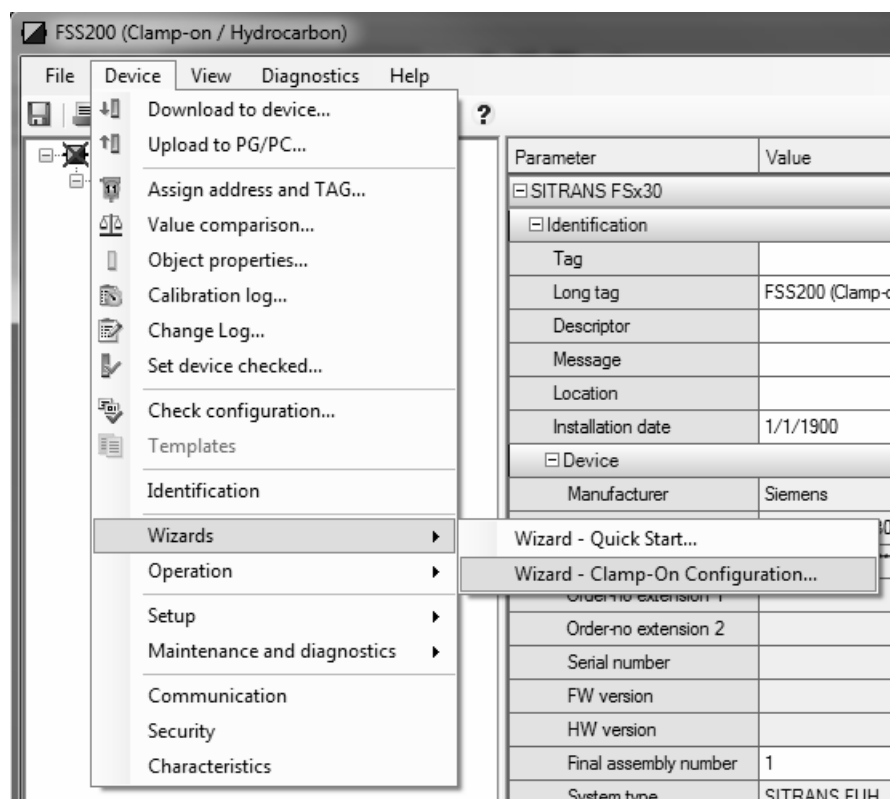
- The Quick Start wizard settings are inter-related and changes apply only after you click on Apply at the end of the wizard to transfer settings to the device.
- Do not use the Quick Start Wizard to modify individual parameters.
- Click on Back to return and revise settings or Cancel to exit the Quick Start.

Launch SIMATIC PDM, open the menu Device → Wizards → Wizard - Quick Start..., and follow the steps.



C.1.8 Wizard - Clamp-On Configuration

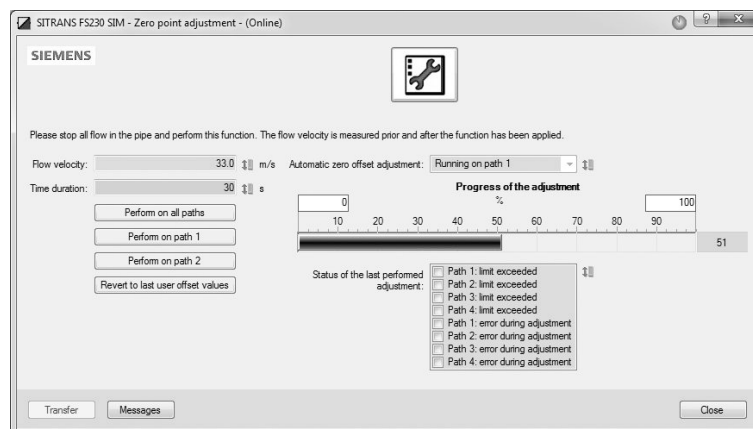
Open the menu Device → Wizards → Wizard - Clamp-On Configuration..., and follow the steps.



The clamp-on configuration wizard takes the user through the necessary steps to install the sensors to achieve proper operation.

C.1.9 Zero point adjustment

Open the menu Device → Operation → Zero point adjustment, and follow the steps.



Although the device zero is very stable from the factory the user has the ability to remove any residual zero offset that may exist by performing the Zero point adjustment.

C.1.10 Changing parameter settings using SIMATIC PDM

SIMATIC PDM monitors the process values, alarms and status signals of the device. It allows you to display, compare, adjust, verify, and simulate process device data; also to set schedules for calibration and maintenance.

Parameters in SIMATIC PDM are identified by name and organized into function groups, similar to the structure of the local display (HMI).

Within SIMATIC PDM, parameters can be found in a structured view (which can be accessed when the device is offline), or in the PDM menus (when device is online): Device, View, Diagnostics.

See:

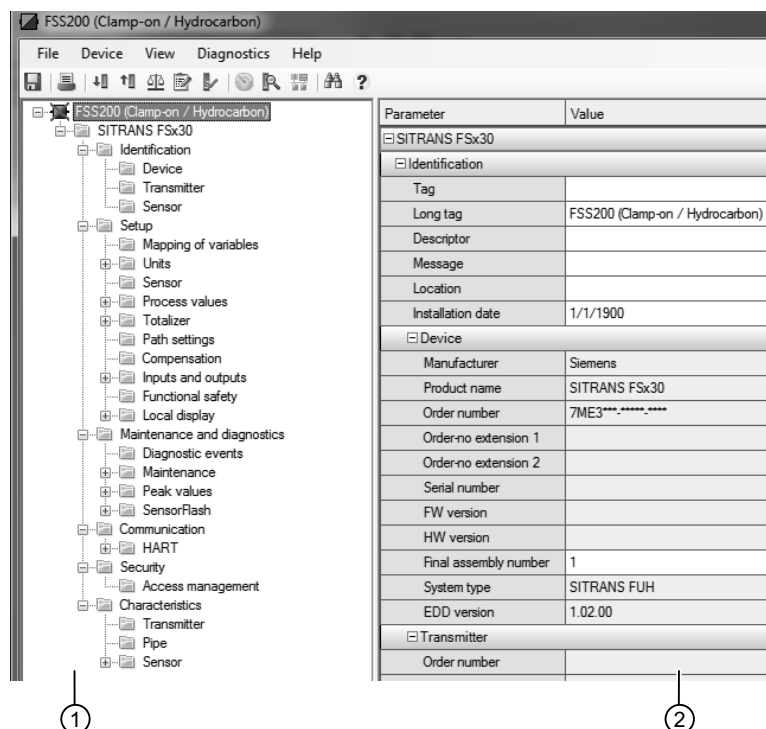
- SIMATIC PDM structure view image (Page 379)
- Parameters accessed via PDM menus (Page 379)

Note

- Clicking button "Cancel" during an upload from device to SIMATIC PDM will result in *some* parameters being updated.
 - While the device is in **Edit view** the output remains active and continues to respond to changes in the device.
-

1. Launch SIMATIC PDM, connect to device, and upload data from device.
2. Adjust parameter values in the parameter value field then press "Enter" key. The status fields read "Changed".
3. Open the Device menu, click "Download to device...". When complete, use "**File > Save**" to save settings offline. The status fields are cleared.

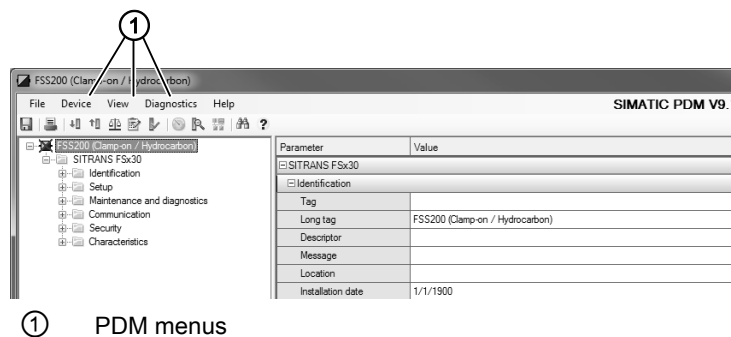
C.1.11 SIMATIC PDM structure view image



- ① Structure view (offline table)
- ② Value fields

C.1.12 Parameters accessed via PDM menus

Click on "Device", "View", or "Diagnostics" to open the associated PDM menu.



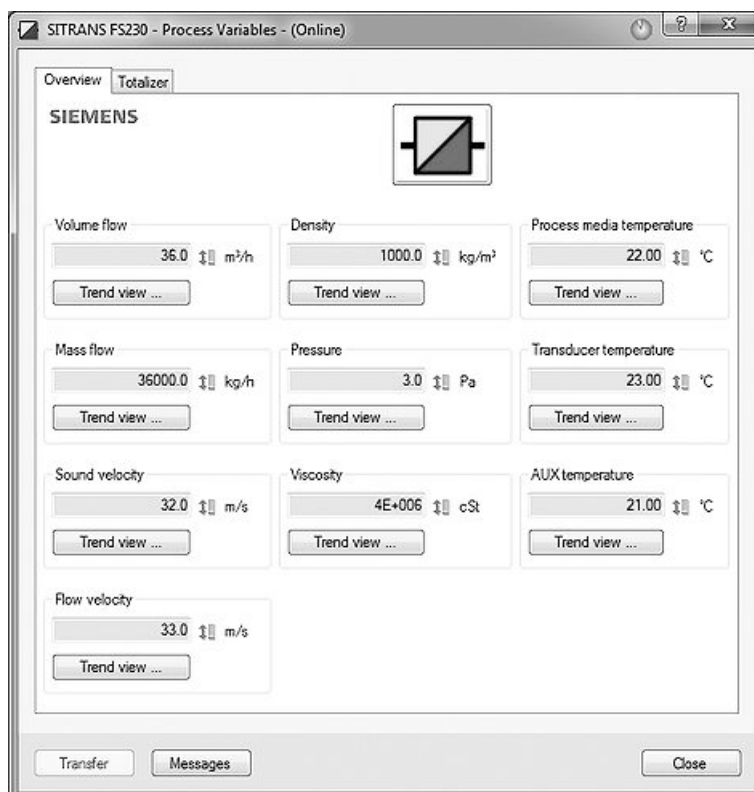
- ① PDM menus

PDM menus

Device	View	Diagnostics
Download to device Upload to PC/PG	Process values	Update diagnostics
Assign address and Tag... Value comparison... Object properties... Calibration log... Change Log... Set device checked...	Start Life List...	Alarms Advanced diagnostics Receiver signal
Check configuration... Templates		
Identification		
Wizards Operation		
Setup Maintenance and diagnostics		
Communication Security Characteristics		

C.1.13 Process variables

1. To compare outputs in real time select View → Process variables to see all process values, totalizers and loop current.
2. Verify that the process values show the expected values.



Trend view

Open the menu View → Process variables and click on a Trend view button to monitor the trend of one or all process values available at each tab.

C.2 Diagnosing with PDM

SIMATIC PDM is a suitable tool for diagnosing the device.

You can use SIMATIC PDM to read all available parameters to a table for analyzing offline, view online/actual process values and online/actual diagnostic information.

Requirements

Online diagnostic information is available under menu View → Device Status.

The following procedure must be completed before diagnosing:

- Installation of PDM and PDM device driver
- Connection of HART interface

Refer to Commissioning with SIMATIC PDM (Page 371).

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