

Introduction Safety notes Description Installing/Mounting Connecting Commissioning Operating Service and maintenance Diagnostics and troubleshooting Technical data **Dimension drawings** Product documentation and support

SITRANS F

Ultrasonic flowmeters SITRANS FST030 (HART)

**Operating Instructions** 

7ME372 (HART)

**12/2019** A5E35971532-AE

**Remote Operation** 

#### 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.



#### A 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 install accordance with Siemens control drawing A5E32778336A.			
02/2017	First edition		

#### Note

This manual applies to the SITRANS FST030 transmitter HART version only. HART® is a registered trademark of the HART Communication Foundation.

#### **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 (<a href="https://support.industry.siemens.com/cs/ww/en/ps/17317">https://support.industry.siemens.com/cs/ww/en/ps/17317</a>).

### 1.3 Product compatibility

# 1.3 Product compatibility

Docu- ment edi- tion	Remarks	Device revision	Compatible version of device integration package		
09/2019	Gas installations	HART	SIMATIC PDM V8.2 or later	EDD: 1.04.00	
	support	FW: 1.04.00 for gas FW: 1.03.00 for liquid	AMS Device Manager 12.0 or later	EDD: 1.04.00	
		HW: 002 and 003	SITRANS DTM V4.1	EDD: 1.04.00	
		Device revision 5 or later	Field communicator V3.8	EDD: 1.04.00	
08/2018	8 Defect solved HART FW: 1.00.01 HW: 002 Device revision 4 or later	SIMATIC PDM V8.2 or later	EDD: 1.02.00		
		HW: 002	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	HART	SIMATIC PDM V8.2 or later	EDD: 1.00.00 or 1.01.00	
		FW: 1.00.00 HW: 002	AMS Device Manager 12.0 or later	EDD: 1.00.00 or 1.01.00	
		Device revision 3 or later	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	Position Equition Liquid installations support HART  Which is the support HART  FW: 1.00.00  HW: 002  Device revision 3 or later	Liquid installa- FW: 1.00.00	HART	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
		Device revision 3 or later	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	<ul> <li>Contains all information needed to</li> <li>check and identify the delivered package</li> <li>install and electrically connect the product</li> <li>commission the product, (setting parameters via HMI menu)</li> <li>operate and maintain the device on a daily basis</li> <li>troubleshoot and remedy minor operation interruptions</li> </ul>	Instrument technicians, plant operators	<ul> <li>Available for download from homepage</li> <li>Hardcopy can be purchased via PIA Life Cycle Portal (English and German lan- guages)</li> </ul>
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.	<ul> <li>On documentation disk</li> <li>Available for download from homepage</li> <li>Hardcopy can be ordered via PIA Life Cycle Portal</li> </ul>
Function Manual	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



#### 1.6 Checking the consignment

#### 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).

#### 1.9 Notes on warranty



### A 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

#### 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.

Symbol	Explanation
$\triangle$	Consult operating instructions

### 2.1.1 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 explosible 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.

#### Requirements for special applications 2.3

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.

#### Use in hazardous areas 2.4

#### 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.

#### 2.4 Use in hazardous areas

### MARNING

#### 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 3

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, two resistive RTD inputs, HART communication, 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

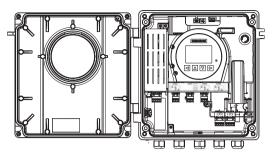


Figure 3-1 Wall mount enclosure with internal DSL

- 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

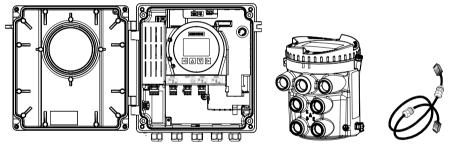


Figure 3-2 Wall mount enclosure without internal DSL, external DSL, and Siemens Sensor Link (SSL) cable

- 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 amd 6 on external DSL for RTD input, or 4-20 mA input for temperature, pressure, density or viscosity

<sup>&</sup>lt;sup>1)</sup> Siemens Sensor Link (SSL) cable provides both power to the external DSL, and communication between the external DSL and transmitter.

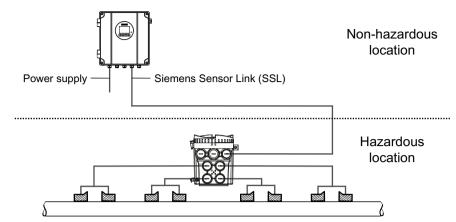
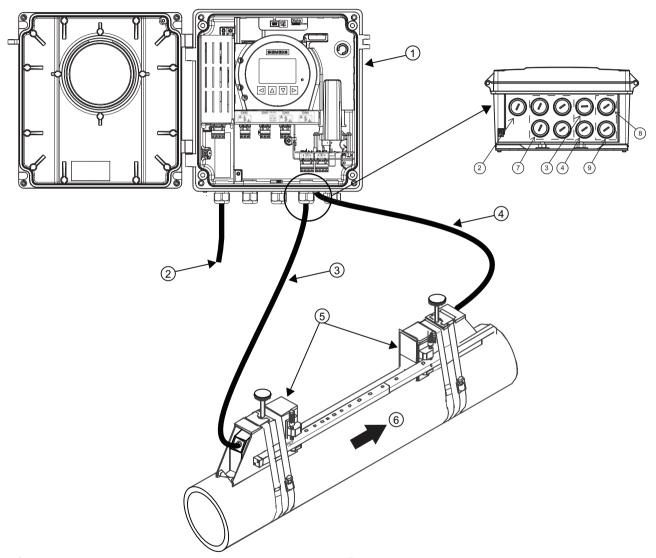


Figure 3-3 External DSL in hazardous location

# 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.



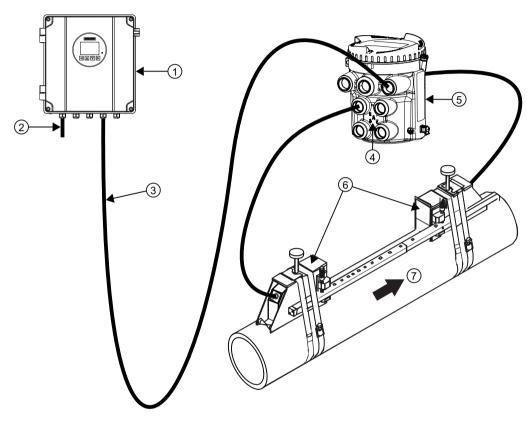
- ① FST030 wall mounted transmitter
- 2 Power cable
- 3 Path 1 Upstream sensor cable (1A)
- 4 Path 1 Downstream sensor cable (1B)
- Sensors
- 6 Flow direction
- 7 Ports for I/O, Communications, RTDs
- 8 Path 2 Upstream (2A)
- Path 2 Downstream (2B)

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

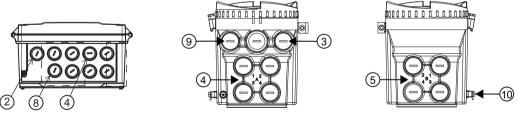
### 3.3 System overview with external DSL

### 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
- 2 Power cable
- 3 Cable connection between FST030 and external DSL, up to 150 m
- 4 Path 1-4 Upstream (A)
- ⑤ Path 1-4 Downstream (B)

- 6 Sensors
- 7 Flow direction
- 8 Ports for I/O, Communications
- Ports for Analog input or RTDs
- Protective earth

### 3.4 Features

- The flowmeter can be used as HART slave in operation on SIEMENS SIMATIC S7/PCS7 or third party automation systems
- 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 HART 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; can be parameterized as:

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, current input (4-20 mA)

- Current, frequency, and pulse outputs with configurable fail safe mode
- HART communication interface (HART 7.5)
- High immunity against process noise
- Fast response to step changes in flow
- High update rate (100 Hz) on all 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 alarms 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

#### 3.6 Approvals

- 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.

### 3.5 Applications

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

# 3.6 Approvals

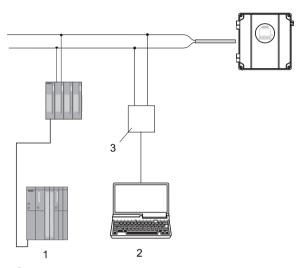
#### Note

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.

### 3.7 HART communication

Communication is via the HART protocol, using:



- SIMATIC PLC system with HART interface
- 2 PC with SIMATIC PDM or similar application
- (3) HART modem

Figure 3-5 System integration example

The flowmeter can be used in a number of system configurations to enable simple, secure, and reliable data transmission over long distances.

#### System communication

Table 3-1 HART protocol identification data

Manufacturer ID	42 (2A Hex)	Manufacturer ID parameter
Device type	34 (22 Hex)	Device type parameter
HART protocol revision	7.5	HART protocol revision parameter
Device revision	2	Device revision parameter

Note: Version numbers and other references shown above are typical or example values.

### **Device description files**

Available EDD drivers:

- SIMATIC PDM
- FDT/DTM
- AMS suite
- 375 Field Communicator

The drivers can be downloaded here:

#### 3.7 HART communication

Download EDD files (http://www.siemens.com/flowdocumentation)

#### Configuration of the HART polling address

The HART address can be set either via hardware (DIP switch) or via software (local display or SIMATIC PDM).

The DIP switch is located on the transmitter cassette.



Figure 3-6 HART slave address switch

- Configuration via DIP switch (HW polling address)
   Set 1 to 15 on the DIP switch if you wish to set a fixed (hardware-defined) HART polling address (SW polling address will be ignored). The configured HW polling address can be read via HMI in menu item 4.2.
- Configuration via the local display or SIMATIC PDM (SW polling address)
   Disable the HW polling address by setting all switches to "OFF" on the HART DIP switch.
   The device starts up with default slave address = 0. The SW polling address can be changed to a value between 0 and 63 via HMI (menu item 4.1) or SIMATIC PDM

#### **DIP** switch configuration

Table 3-2 HW polling address

Address	Switch 1	Switch 2	Switch 3	Switch 4
0	0	0	0	0
1	1	0	0	0
2	0	1	0	0
3	1	1	0	0
4	0	0	1	0
5	1	0	1	0
6	0	1	1	0
7	1	1	1	0
8	0	0	0	1
9	1	0	0	1
10	0	1	0	1
11	1	1	0	1
12	0	0	1	1
13	1	0	1	1
14	0	1	1	1
15	1	1	1	1

0: OFF; 1: ON

### Mapping of measured process variables

The device supports all four dynamic variables (PV, SV, TV and QV). Except for PV, they can be freely mapped to all device variables.

### The following table shows the possible and default mappings.

Device Varia- ble Num- ber	Device Variable Name	PV	SV	TV	QV
0	Volume flow	D	X	X	X
1	Mass flow	Х	D	X	X
2	Sound Velocity	X	X	D	X
3	Flow Velocity	X	X	X	D
4	Process Density	X	X	X	X
5	Process Temperature	X	X	X	X
6	Process Pressure	X	X	X	X
7	Process Viscosity	X	X	X	X
8	Temperature 1	Х	Х	Х	Х
9	Temperature 2	Х	Х	Х	Х
10	Concentration	X	Х	Х	X
11	Current in (Channel 5)	X	Х	Х	X
12	Current in (Channel 6)	Х	Х	Х	Х
13	Standard Volume Flow	X	Х	X	X
14	Standardizing Factor	X	X	X	X
15	Standard Viscosity	X	X	X	X
16	Standard Density	X	X	X	X
17	LiquIdent	X	X	X	X
18	API Gravity	X	X	X	X
19	Standard API Gravity	X	X	X	X
20	Specific Gravity	X	Х	X	X
21	Standard Specific Gravity	X	X	X	X
22	Rate of Change	X	Х	Х	X
23	Energy Flow	X	X	X	X
24	Delta Temperature	Х	Х	Х	Х
25	Energy Efficiency Rating	Х	Х	Х	Х
26	Coefficient of Performance	Х	Х	Х	Х
27	Totalized Value 1		Х	Х	Х
28	Totalized Value 2		Х	Х	Х
29	Totalized Value 3		Х	Х	Х

<sup>&</sup>quot;D" marking denotes default mapping.

### 3.7.1 Universal commands

The device supports the following universal commands:

Table 3-3 Universal commands

Command number	Function
0	Read Unique Identifier
1	Read Primary Variable
2	Read Loop Current And Percent Of Range
3	Read Dynamic Variables And Loop Current
6	Write Polling Address
7	Read Loop Configuration
8	Read Dynamic Variable Classifications
9	Read Device Variables With Status
11	Read Unique Identifier Associated With Tag
12	Read Message
13	Read Tag, Descriptor, Date
14	Read Primary Variable Transducer Information
15	Read Device Information
16	Read Final Assembly Number
17	Write Message
18	Write Tag, Descriptor, Date
19	Write Final Assembly Number
20	Read Long Tag
21	Read Unique Identifier Associated With Long Tag
22	Write Long Tag
38	Reset Configuration Changed Flag
48	Read Additional Device Status

# 3.7.2 Common practice commands

The device supports the following common practice commands:

Table 3-4 Common practice commands

Command number	Function
33	Read Device Variables
34	Write Primary Variable Damping Value
35	Write Primary Variable Range Values
36	Set Primary Variable Upper Range Value
37	Set Primary Variable Lower Range Value
40	Enter/Exit Fixed Current Mode
42	Perform Device Reset
44	Write Primary Variable Units

### 3.7 HART communication

Command number	Function
45	Trim Loop Current Zero
46	Trim Loop Current Gain
50	Read Dynamic Variable Assignments
51	Write Dynamic Variable Assignments
53	Write Device Variables Units
54	Read Device Variables Information
59	Write Number Of Response Preambles
60	Read Analog Channel And Percent Of Range
63	Read Analog Channel Information
70	Read Analog Channel Endpoint Values
95	Read Device Communications Statistics

3.7 HART communication

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.
- 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

- 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 T<sub>5</sub> 64 °C applies for ambient temperatures up to 50 °C; Temperature code T5 and dust temperature class T<sub>5</sub> 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 33).

#### **External DSL**

The external DSL can be mounted on a wall or on a pipe, see Mounting the external DSL (Page 35)

## 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.

#### Installation instructions 4.4

#### 4.4.1 Wall mount enclosure transmitter



### A CAUTION

#### Opening lid

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

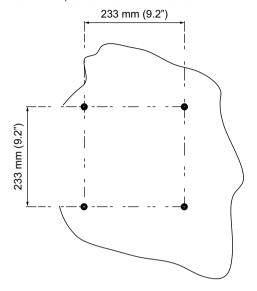
#### Note

#### Mounting screws are not included

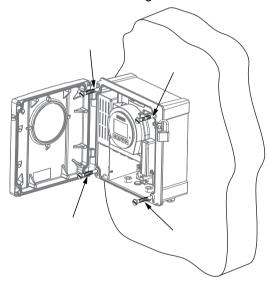
You will need four screws, able to support at least 55 lbs (25 kg). Siemens recommends M6x100 screws with appropriate anchors for the wall material.

#### 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.

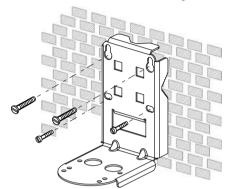


Figure 4-1 Mounting bracket on wall

3. Mount DSL on mounting bracket using four screws.

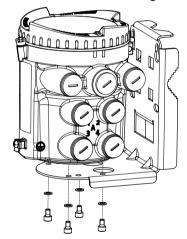


Figure 4-2 Mounting DSL to mounting bracket

#### 4.4 Installation instructions

### 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.

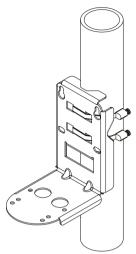


Figure 4-3 Mounting bracket on vertical pipe

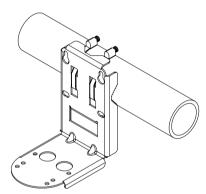


Figure 4-4 Mounting bracket on horizontal pipe

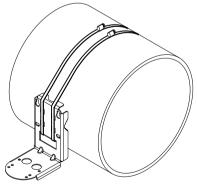


Figure 4-5 Mounting bracket on big horizontal pipe

3. Mount DSL on mounting bracket using four screws.

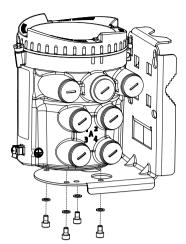


Figure 4-6 Mounting DSL to mount bracket

4.4 Installation instructions

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 47)

#### For all configurations:

- 1. Preparing for the connections (Page 57)
- 2. Terminal layout (Page 58)
- 3. Connecting channel 1 (Page 59)
- 4. Connecting channels 2 to 4 (Page 60)
- 5. Connecting the power supply (Page 65)
- 6. Finishing the transmitter connection (Page 67)

### See also

Connecting channels 5 and 6 on internal DSL (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.

#### 5.1 Basic safety notes



### 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

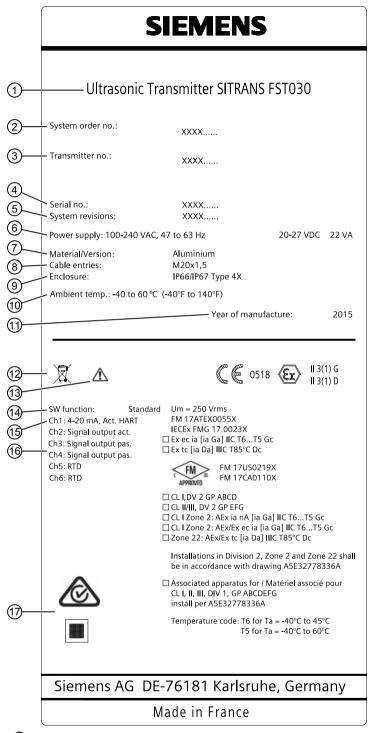
## 5.3 Device nameplates

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



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

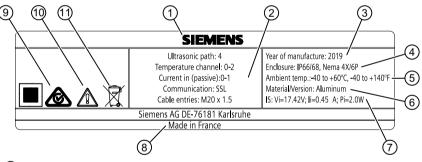
#### 5.3 Device nameplates

- 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
- ① Ambient temperature
- (1) Year when device was manufactured
- ② WEEE symbol, see Disposal (Page 104)
- 4 Software function
- (b) Communication interface on channel 1 (Ch1)
- (6) Input/output setup of channels 2 to 6, if ordered
- ⑦ C✓ / QR-code: C-tick logo and product-specific QR-code

Figure 5-1 Transmitter nameplate, example

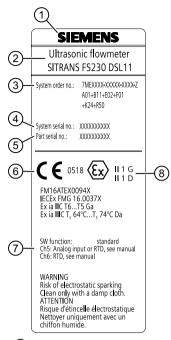
## 5.3.1 External DSL nameplates

### Nameplates of External DSL



- Manufacturer
- ② I/O connections
- 3 Year of manufacture
- Degree of protection
- 5 Ambient temperature range
- 6 Material
- 7 Intrinsic Safety (IS) parameters
- 8 Place of manufacture
- Conformity with country-specific directive
- © 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
- Onfigurations
- 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

# 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.

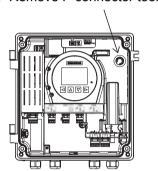
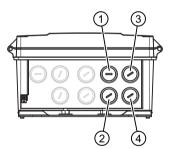


Figure 5-5 F-connector tool location

### Connecting the flow sensor cables

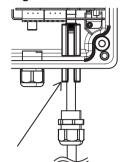
When connecting the sensors it is required for the system to function that the sensor cables are connected correctly. Both sensor cables for each path must be connected to the same port numbers (1A and 1B or 2A and 2B) on the transmitter.



- 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 ther 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:

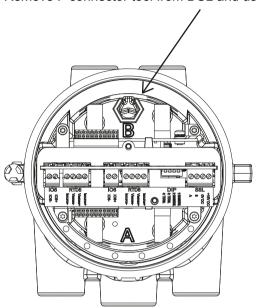
- 1. Preparing for the DSL connections (Page 48)
- 2. Connecting the sensor cables (Page 48)
- 3. Channel 5 and 6 input configuration (Page 49)
- 4. Connecting the SSL cable (Page 53)
- 5. Finishing the DSL connection (Page 55)

#### See also

Transmitter power supply, communications and I/Os connection (Page 56)

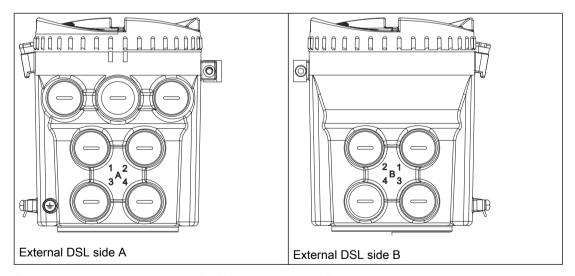
## 5.5.1 Preparing for the DSL connections

- 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

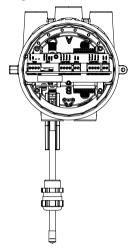
When connecting the sensor to the DSL make sure that you connect the sensor cables for each path to the corresponding numbers on the DSL (A and B).



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.

### 5.5 Connecting the external DSL

## 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	ChX+ U <sub>0</sub> U <sub>ext</sub>					
RTD input	Pt100 Pt500 Pt1000	Short    Isource +					
		3-wire RTD configuration    Source + Vsense + Vsense - Isource -					

## Connecting 4 to 20 mA current input cable (passive)

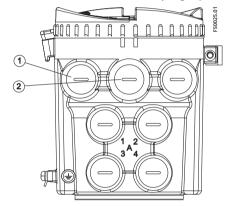
#### Note

#### Connection of optional devices

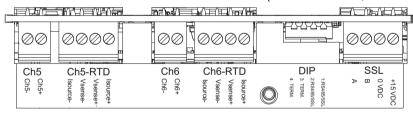
The DSL provides the option of connecting two additional devices to channels 5 and 6. Do not connect two devices to one channel.

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-).



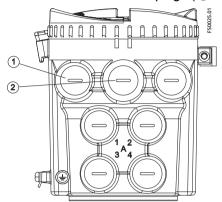
6. Assemble and tighten cable gland.

### 5.5 Connecting the external DSL

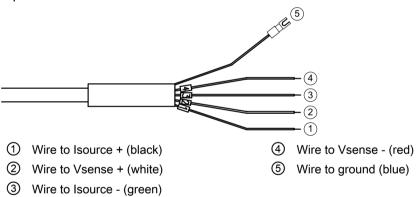
## Connecting RTD cable

Perform the following steps for each RTD cable.

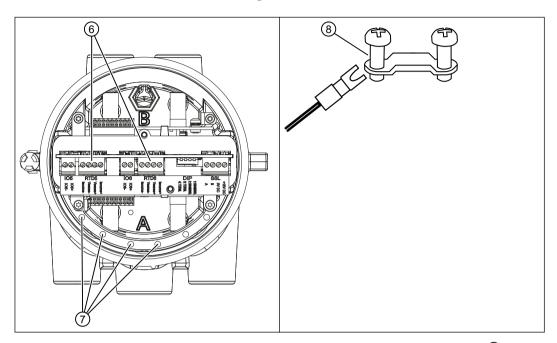
- 1. Remove cap and ferrule from cable gland and slide onto cable.
- 2. Remove one of the blind plugs (① or ②) and fit cable gland.



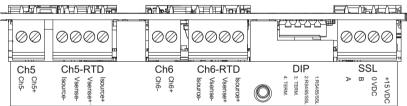
- 3. Push cable through gland opening.
- 4. Attach an RTD cable crimp lug on the blue wire ⑤ of the cable by using a crimp tool or equivalent.

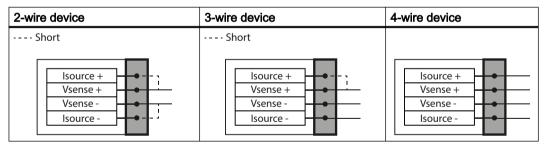


5. Ground the RTD cable shield in the external DSL ⑦, by sliding the crimp lug on wire ⑤ onto one of the installed strain reliefs screws ⑧.



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





7. Assemble and tighten cable gland.

## 5.5.4 Connecting the SSL cable

#### M12 connector version

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

### 5.5 Connecting the external DSL

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.

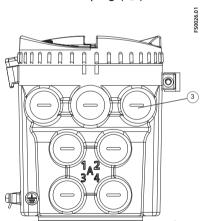
## M20 connector version

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

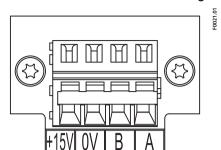


Figure 5-6 Cable end

- 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.



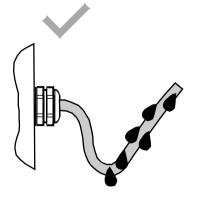
5. Connect the four wires according to list below.

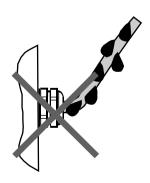
Terminal number	Description	Wire color
1	+15 V DC	Orange
2	0 V DC	Yellow
3	В	White
4	Α	Blue

6. Assemble and tighten cable gland.

## 5.5.5 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.

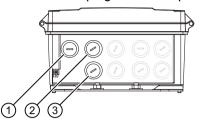
## 5.6 Transmitter power supply, communications and I/Os connection

### 5.6.1 Sensor connections reference

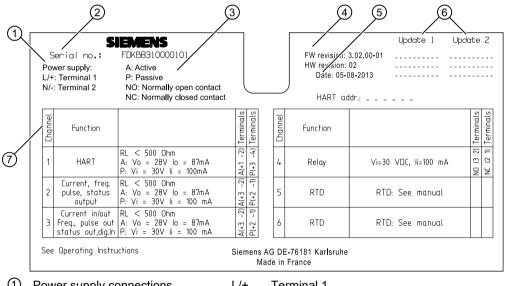
For sensor connection, see relevant sensor installation manual.

#### 5.6.2 Preparing for the connections

1. Remove blind plugs where required.



- 1 Power supply connection
- Input/output connection (channels 2 to 4)
- HART connection
- 2. Loosen spring screws on enclosure lid.
- 3. Open enclosure lid. A nameplate showing the configuration is placed on the inside of the enclosure lid, as shown in the example below.



- Power supply connections
- L/+ Terminal 1
- Terminal 2 N/-
- (<u>+</u>) Terminal 3

- Serial no.
- Key to symbols

- Α Configured as active input/output
- Р Configured as passive input/output
- NO Connected as normally open contact
- NC Connected as normally closed contact
- Initial firmware and hardware revisions
- ⑤ Device configuration date
- 6 Updates (to be filled in on firmware and hardware updates)
- Configuration of channels 1 to 6

Figure 5-7 Example configuration label

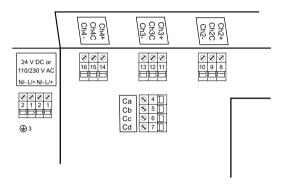
#### See also

Input/output configuration (Page 62)

Inputs (Page 144)

Technical data (Page 143)

## 5.6.3 Terminal layout



For configuration of the software parameters, see Input/output configuration (Page 62). 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

									Termin									
HW configuration	SW configuration	Power supply Ch1							Ch2				Ch3			Ch4		
HW Corniguration	Svv conliguration	1 2 3			l		111		-	1	- 40			40			- 40	
		1_	2		4	5	ь	- /	8	9	10	- 11	12	13	14	15	16	
Power supply		L/+	N/-	0														
Channel 1 HART	Current output HART				Active/+	Active/ -												
Gridino TTV	Carron Capativiti					Passive/+	Passive/-											
						In												
Channel 1 MODBUS					+ (B)	- (A)												
Charliner 1 MODBOO								Out										
							+ (B)	- (A)										
						In												
Channel 1 PROFIBUS					+ (B)	- (A)												
Charline 111 (Chiboo								Out										
							+ (B)	- (A)										
Channel 2 output	Current, Frequency, Pulse and Status								Active/+	Active/ -								
Charinei 2 output	Current, Frequency, Pulse and Status									Passive/+	Passive/-							
	Outputs: Current, Frequency, Pulse and Status											Active/+	Active/ -		Active/+	Active/ -		
Channel 3 & 4 Input and output	Inputs: Digital																	
	iripuis. Digital													Passive/-		Passive/+	Passive/-	
Channel 3 & 4 Relay	Status output											NO	NO		NO	NO		
Chariner 3 & 4 Relay	Status Output												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.

#### See also

Connecting channels 5 and 6 on internal DSL (Page 64)

Technical data (Page 143)

## 5.6.4 Connecting channel 1

#### Note

### 4 to 20 mA output

It is not required to use shielded cables for the pure 4 to 20 mA current output.

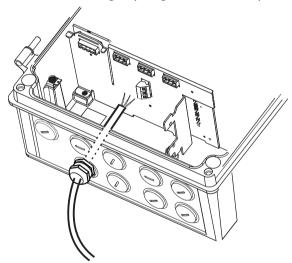
#### Note

## **HART** communication

It is recommended by the HART Communication Foundation (HCF) to use shielded cables for the HART communication.

## **Current output HART**

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



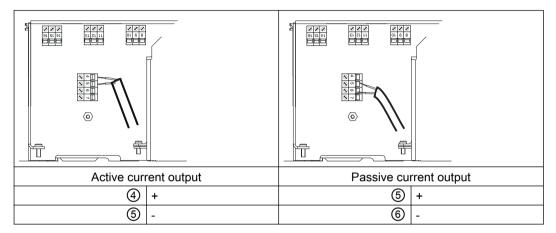
4. Restore ferrule and tighten cap to lightly hold cable in place.

5. Connect wires to terminals using a screwdriver.

#### Note

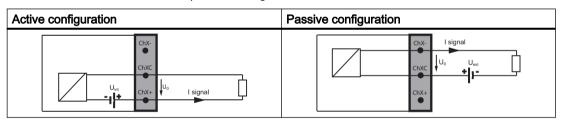
#### The terminal connector is detachable

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



- 6. Termination of channel 1. The numbers refer to table Terminal layout (Page 58).
- 7. Tighten cable gland.

Table 5-2 Schematic of active/passive configuration



#### Note

For Ex devices active or passive current output is preselected at ordering.

## 5.6.5 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 57)

#### 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

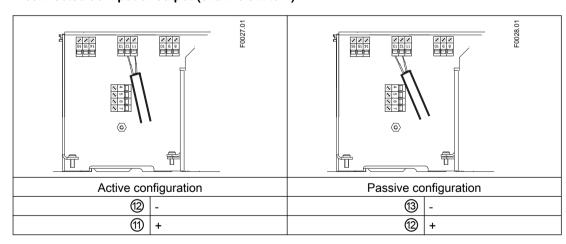
#### The terminal connector is detachable

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 Figure 5-8 Terminals/configuration overview (Page 58)

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



Termination example for channel 3

## 

### If connected as relay (channels 3 and 4 only)

Termination example for channel 3 - relay connection

#### See also

Terminal layout (Page 58)

## 5.6.5.1 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-	Software configuration	С	Channel		
tion		2	3	4	
Output	Current output	Х	Х	Х	
Active	Frequency output				ChXp-
	Pulse output				
	Status output				ChXC
	Alarm class				U <sub>int</sub> ChXa+ U₀ I signal
	Alarm item				
	NAMUR status signals				Active
Output	Current output	Х	Х	Х	
Passive	Frequency output				ChX- I signal
	Pulse output Status output				U <sub>ext</sub>
	Alarm class				ChXC U <sub>0</sub> U <sub>est</sub>
	Alarm item				ChX+ ●
	NAMUR status signals				Passive

Configura-	Software configuration	С	Channel		
tion		2	3	4	
Input Active Input Passive	Digital input  Reset totalizer 1  Reset totalizer 2  Reset totalizer 3  Reset all totalizers  Force outputs  Freeze process values  Zero adjust  Digital input  Reset totalizer 1  Reset totalizer 2  Reset totalizer 3  Reset all totalizers		X	X	Active  ChX-  ChX-  ChX-  I signal  ChX-  ChX-  U <sub>at</sub> U <sub>at</sub> ChX-  U <sub>at</sub> U <sub>at</sub> U <sub>at</sub> U <sub>at</sub>
Current input Active	<ul> <li>Reset all totalizers</li> <li>Force outputs</li> <li>Freeze process values</li> <li>Zero adjust</li> <li>Process values</li> <li>Pressure</li> <li>Medium temperature</li> <li>Viscosity</li> <li>Density</li> </ul>		×	X	Passive  ChXp- ChXc ChXc ChXc Active
Current input Passive	Process values     Pressure     Medium temperature     Viscosity     Density		X	X	ChX-  ChX-  L signal  ChX-  ChX-  U <sub>o</sub> U <sub>ext</sub> Passive

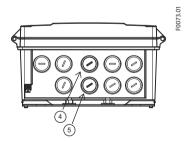
Configura-	Software configuration	С	hann	el	
tion		2	3	4	
Relay output Normally open	Alarm class Alarm item NAMUR status signals		X	X	ChXC ChXC
Relay output Normally closed	Alarm class Alarm item NAMUR status signals		X	X	Normally open  ChX- ChX- ChX- ChX- ChX- ChX- ChX- ChX

## 5.6.6 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

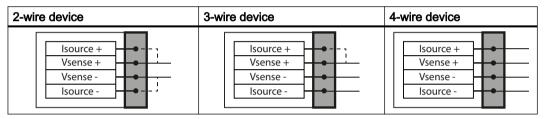
#### The terminal connector is detachable

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.



6. Assemble and tighten cable gland.

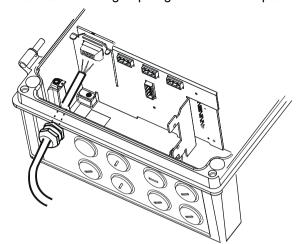
## 5.6.7 Connecting the power supply

#### 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
- 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



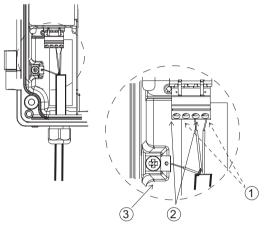
4. Restore ferrule and tighten cap to lightly hold cable in place.

5. 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 Protective Earth (PE)

AC connection	DC connection
L/+ L N/- N  - N - N	\(\frac{1}{2}\) \(\frac{1}{2}
Power: 85 to 264 V AC, 47 to 63 Hz	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.

## 5.7 Finishing the transmitter connection

- 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 73).

Furthermore, the device can be commissioned using SIMATIC PDM, see Commissioning with SIMATIC PDM (Page 161).

#### 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 31).



#### 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 31) and Connecting (Page 39).
- Device installed in hazardous areas meets the requirements described in Approvals (Page 154).

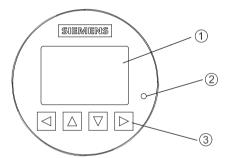
## 6.3 Power up

Power up the device. Devices with local display show a screen for initial startup (Page 72).

## 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

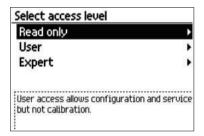
If no button is pressed for 10 minutes, the display switches to show operation view. If Backlight is set to Automatic, display backlight goes off automatically 30 seconds after the last button press.

#### 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 parameter values can be viewed only (indicated by a  $\widehat{\bullet}$  symbol). 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" (menu item 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" (menu item 5.3).

6.6 Initial startup

#### Disable access level control

If logged in as Expert you can **Deactivate user PIN**. As User you 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 button press.

#### **NOTICE**

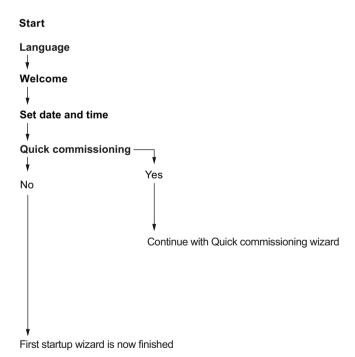
#### Device restart

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.



# 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

## 6.7.1.1 Wizard overview

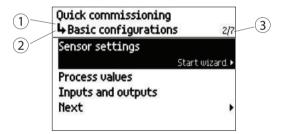
In this chapter it is described how to commission the device via the local display using the wizards.

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 pare saved immediately.

At any time in any wizard selectingExitwill bring you back to the main wizard menu without discarding changes.



- ① Wizard name
- 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

### 6.7 Commissioning via local display

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
$\Box$	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

#### 6.7.1.2 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** Quick commissioning Sensor settings Process values **Basic configuration** Inputs and outputs Sensor settings Copy configuration Process values Inputs and outputs Communication Next Identification Long tag Location Installation date Next **Finished**

#### Text Options/Description

Select a basic configuration wizard Set the identification paSensor settings, Process values, Inputs and outputs, Copy configuration

Long tag, Location, Installation date

rameters

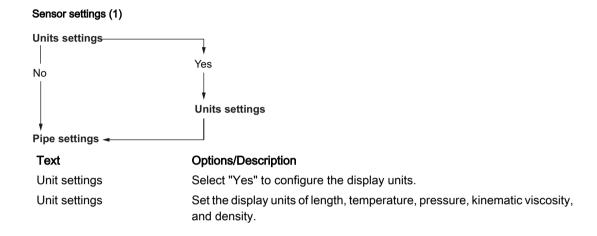
The "Quick commissioning" wizard comprises the following subwizards:

- Sensor settings wizard (Page 75)
- Process values wizard (Page 79)
- Inputs and outputs wizard (Page 82)

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.

# 6.7.1.3 Sensor settings wizard

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



## 6.7 Commissioning via local display



#### Text Options/Description Select "Yes" to configure the pipe. Pipe settings Pipe class Select the pipe class. Pipe size Select the pips size from the options available for the selected pipe class. Pipe circumference Enter pipe circumference. Only available if custom pipe class is selected. Outer pipe diameter Enter outer pipe diameter. Only available if custom pipe class is selected. Wall thickness Enter wall thickness. Only available if custom pipe class is selected. Select material Select the pipe material. Wall sound velocity 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 in-

duced 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.

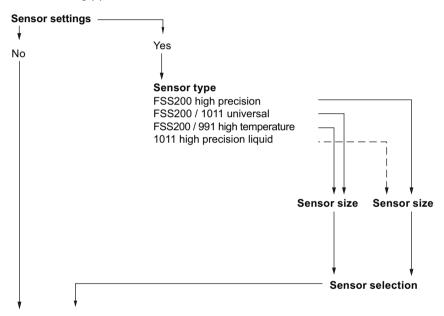
Disturbed flow Define the type of pipe configuration and the distance to the sensor.

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)



#### **Medium settings**

# Text Options/Description

Sensor settings Select "Yes" to configure the sensors.

Sensor settings Select the sensor type installed (found on sensor label).

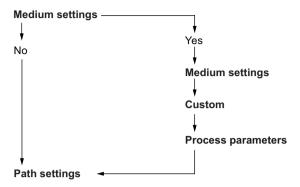
Sensor size Select the sensor size from the options list (found on sensor label).

Sensor selection Define the temperature compensation mode, the temperature class, the

spacing offset and the cable length

## 6.7 Commissioning via local display

#### Sensor settings (4)



Text Options/Description

Medium settings Select "Yes" to configure the medium.

Medium settings Select the process medium.

Process parameters Set the expected sound velocity (only available if custom process medium

is selected) and the process temperature, pressure, kinetic viscosity, and

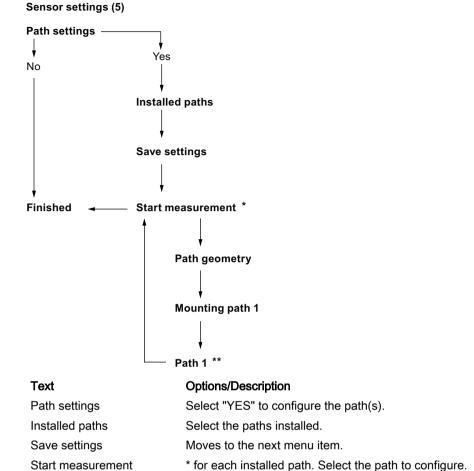
density.

#### 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.



\*\* Select "Next" to configure next path or to select "Next" to finish the wizard.

spacing distance.

### 6.7.1.4 Process values wizard

Path 1

Path geometry

Mounting path 1

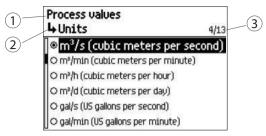
The Process values wizard will guide you through setup of process values for your application. The prioritizing of the process values automatically configures the measurement views on the display. The process value configured as first process value is set as first display view.

Define the geometry of the path (direct or reflect mode)

Displays the recommended sensor mounting method, spacing index and

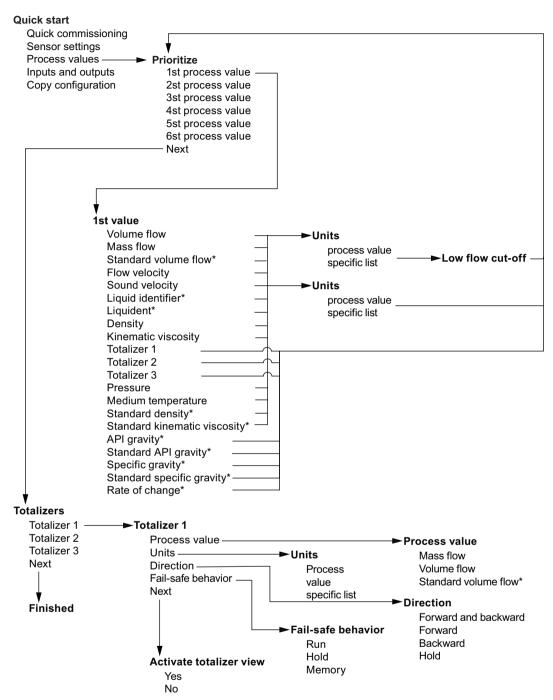
Select "Receiver signal" to view graphical display of the receiver signal.

# 6.7 Commissioning via local display



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

#### Start



<sup>\*</sup>only supported in hydrocarbon or gas meter variants

## 6.7.1.5 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.

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.

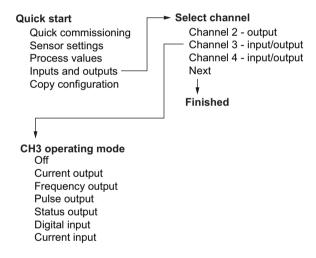
First you must set the output functionality you want the channel to operate. Choose between Off, Current output, Frequency output, Pulse output, or Status output, Digital input or Current input.

## Channel 2 provides output functionality only.

### Channel 3 and 4 provide input or output functionality.

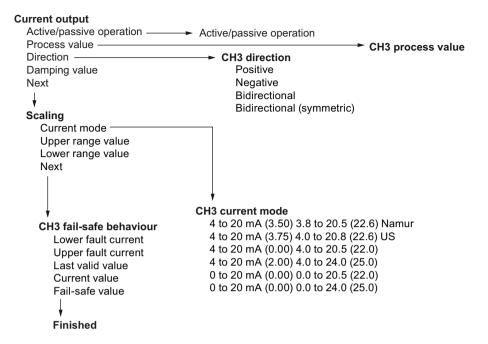
If one of the channels 3 or 4 is configured to relay the functionality of this channel is reduced to Status output.

#### Start



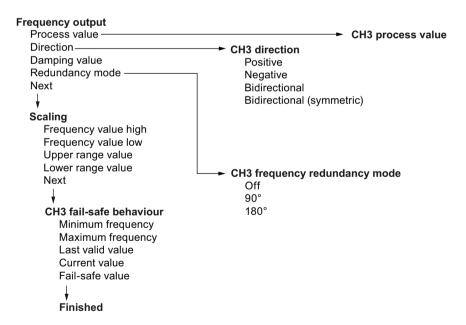
#### Current output - channels 2 to 4

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

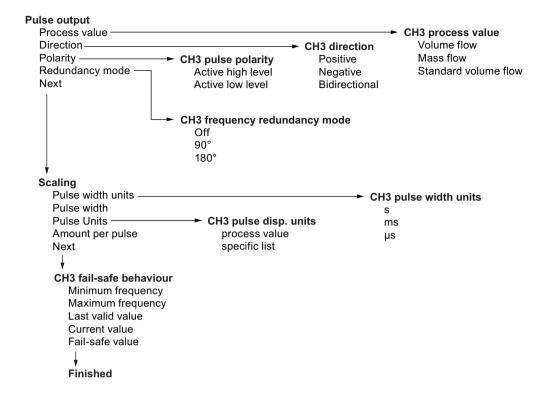
You can assign the process value, and you can set the direction, the damping value, the lower range value, the upper range value, and the fail-safe behavior.



# Pulse output - channels 2 to 4

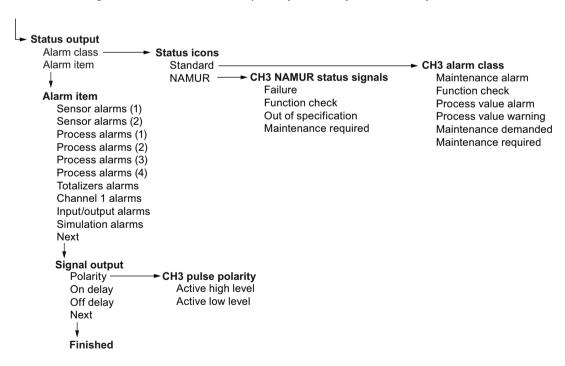
You can assign the process value, and you can set the direction, the polarity, the redundancy mode, the pulse width, pulse width units, pulse units amount per pulse, and the fail-safe behavior.

### 6.7 Commissioning via local display



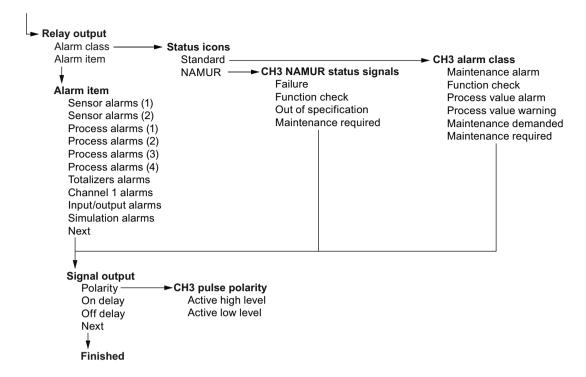
## Status output - channels 3 to 4

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



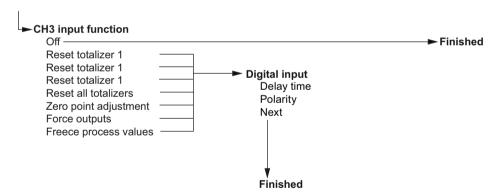
#### Relay output - channels 3 and 4

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



# Digital input - channels 3 to 4

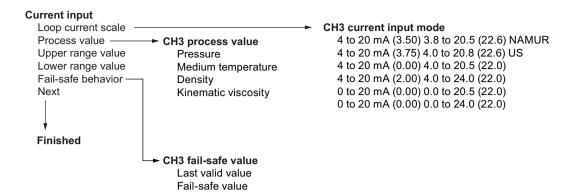
The Digital input can be used to control device functions such as reset of totalizers, zero point adjustment, force outputs, or freeze process values. You can set the delay time and the polarity.



## Analog input - channels 3 to 4

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

## 6.8 Commissioning FSS100 - SONOKIT



# 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<sub>i</sub>
  - Beam angle θ
  - Path length L
  - Chord height ratio h (0 for 1-path)
  - Expected sound velocity
  - Kinematic viscosity

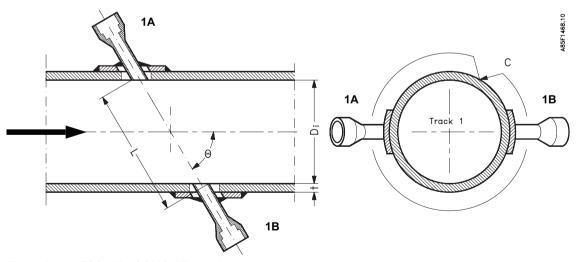


Figure 6-3 FSS100 - SONOKIT 1-path

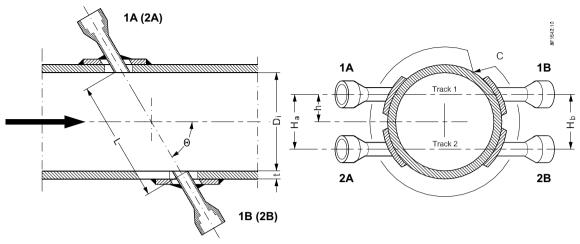


Figure 6-4 FSS100 - SONOKIT 2-path

#### **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 m²/s in menu 2.1.4.5

  The Kinematic viscosity is required for the reynolds compensation.

  For example: Water 20 °C → 1 cSt or 1 mm²/s = 0.000001 m²/s
- 4. Enter "Beam angle" in radians in menu 2.1.6.2 For example:  $45^{\circ} \rightarrow 0.7854$  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.

# 6.8 Commissioning FSS100 - SONOKIT

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  $\triangle$  and the  $\nabla$  keys to switch between the operator views.

Four different 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 measurement/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.

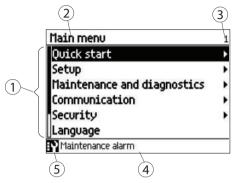
All items of the menu structure of the device are identified with a unique number.

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.
- Communication: Contains parameters which describe the communication settings of the device.

### 7.2 Operating the FST030

- 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.
$\Box$	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 hydroarbon 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 #

# 7.2 Operating the FST030

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

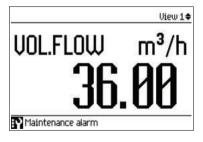
The current value of the process values can be displayed either as one or more numeric values or as numeric value(s) in combination with a graph/bargraph. The following view types are available:

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

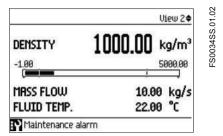
Table 7-4 Key functions - measurement view

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

# Single value



## Three values



## 1 value and bargraph

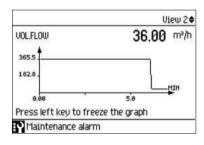


## Note

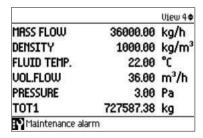
## **Bargraphs**

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 \bigcup to access the totalizer operation.

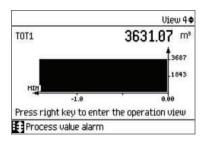
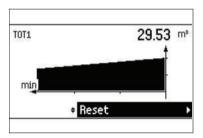


Table 7-5 Key functions - totalizer operation

Key	Function
	Exit totalizer operation
	Select action to perform
$\Box$	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.

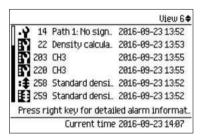
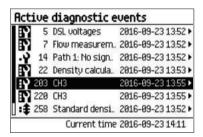
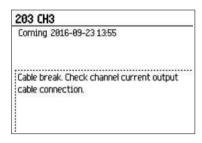


Table 7-6 Key functions - alarms list view

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



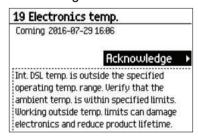


Press to exit the detailed alarm information.

## Alarm acknowledgement

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

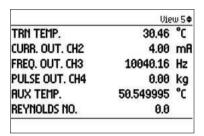
Manual: The alarm remains in the alarm list until the alarm is manually acknowledged (ack.).
 Before the alarm can be acknowledged, the cause must be eliminated. Press to go to the detailed alarm information. Press again to acknowledge the alarm. The time of the acknowledgement is shown in the history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



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.



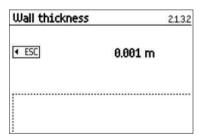
# 7.3 Reading / changing parameters

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 of to exit the view.



### Edit

Editable alphanumeric parameters are displayed as shown here.

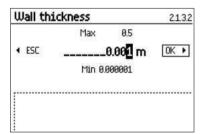


Table 7-7 Key functions - editing alphanumeric values

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.

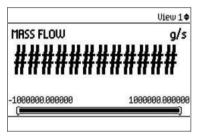
#### Note

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).

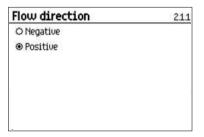
The resolution can also be changed by changing the resolution of one configuration parameter for this process value (for example **Low flow cut-off** menu number 2.2.2.5). Any changes in resolution will change the resolution of all other configuration parameters for this process value as well.

# 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

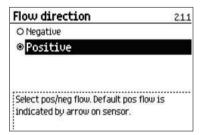


# Parameter list - editable

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

Table 7-9 Key functions - edit

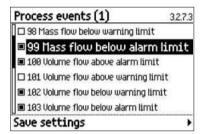
Key	Function
◁	Escape the view without changing the value.
	Select the option above.
$\Box$	Select the option below.
	Confirm selected option.



## 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.

7.3 Reading / changing parameters

Service and maintenance

# 8.1 Basic safety notes



# **WARNING**

## Impermissible repair of the device

Repair must be carried out by Siemens authorized personnel only.



# MARNING

## 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.

# 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 (<u>https://www.siemens.com/processinstrumentation/returngoodsnote</u>)

with the following information:

- Product (item description)
- Number of returned devices/replacement parts
- Reason for returning the item(s)
- Decontamination declaration (<a href="https://www.siemens.com/sc/declarationofdecontamination">https://www.siemens.com/sc/declarationofdecontamination</a>)
   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) (<a href="https://support.industry.siemens.com/cs/document/109479891/">https://support.industry.siemens.com/cs/document/109479891/</a>)

Diagnostics and troubleshooting

9

# 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).

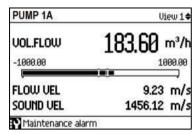


Figure 9-1 HMI display with alarm indication

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.

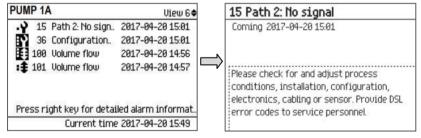


Figure 9-2 Display view 6 with all alarm and error codes shown

Note that the alarms will persist even after the problem is resolved, unless the **Diagnostic** events **Dacknowledge 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.

9.2 Troubleshooting Guide (example for 2 path installation)

#### 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.	<ul><li>Path 1 state: 0-0</li><li>Path 2 state: 0-0</li></ul>	No paths installed.	At least 1 path must be installed for flow measurement to start.
No Alarm codes			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.	Measured flow rate unex- pectedly jumps between two very different discrete	Poor SNR due to improperly applied pipe damping material.	Check adhesion of damping material to pipe wall/paint.
No Alarm codes	values.  • Measured flow rate indicates a large error greater		Roll out any trapped bub- bles under damping mate- rial.
	than +/-5% of expected for velocities over 10 m/s.  • Poor receive signal SNR		Reinstall new damping material after ensuring proper cleaning / degreas-
	(< 20 dB)		ing of pipe surface.
		High flow compensation factor requires update	Refer to Function Manual for details on how to ad- just the High flow compen- sation factor.

# 9.2 Troubleshooting Guide (example for 2 path installation)

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

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

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

Symptoms / Alarms	Diagnostics	Cause	Remedy
Display shows active flow with large sound velocity error.  No Alarm codes	<ul> <li>High positive or negative sound velocity error.</li> <li>Measured flow not the expected value.</li> </ul>	Incorrectly installed sensors or incorrect setup parameterization.  The entered Expected sound	Verify pipe dimensions, sensor selection, mounting configuration and spacing.  Optimal performance is ach-
		velocity is far from the actual fluid sound velocity.	ieved 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.  With Alarm code:  28: Configuration 1		Duplicate assignment of pressure, density, viscosity or temperature. Same process value assigned to more than 1 analog input (including RTD inputs).	Check "inputs and outputs" channels assignment. Reassign inputs or disable unused inputs.
		RTD input conversion indi- cates an out-of-range temper-	Check the RTD connections to CH5 and/or CH6.
		ature (limited between -50 to 250 °C).	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.  With Alarm code:		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
7: Flow measurement		scribor opading.	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.

Symptoms / Alarms	Diagnostics	Cause	Remedy
Flow rate appears to be correct, but sign (flow direction) is wrong  No Alarm codes	Nothing unusual	Upstream / downstream sensor cables reversed at frontend or sensors.	Verify that the upstream sensor is connected to the upstream F-connector on the frontend (labeled A).
		Flow direction 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 <b>A1</b> (Page 112)).

# Troubleshooting Symptoms: (Hardware issues)

Symptoms / Alarms	Alarm codes	Cause	Remedy
Display is completely blank, but communications is still possible on the service chan-		Display cable disconnected from Transmitter module or cable is broken.	Check cable connections between display and Transmitter module.
nel.		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	Check mains power connection.     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 chkdsk. Possible failed SD card.	Remove and try to repair the SD card in a PC.
			Replace SD card if repair unsuccessful.
		SD card not installed	Insert SD card
			Verify the SenorFlash is recognized as being in- stalled: 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	

#### 9.3 Using a pipe simulator test block (A1)

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.	<ol> <li>Check SSL cable connections.</li> <li>Verify that barrier module is fully plugged into backplane.</li> </ol>
		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.

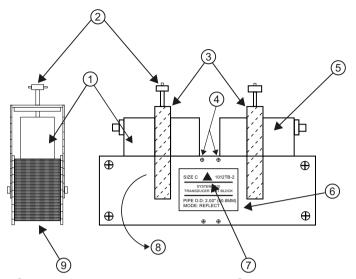
#### Note

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.



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

#### 9.4 Inspect the application (A2)

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 enclo- sure 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.	<ul> <li>Install the sensors in a different location with sufficient straight run conditions, especially upstream.</li> <li>Install sensors in the preferred reflect "V" configuration, if at all possible.</li> <li>Install 2 paths to minimize the impact</li> </ul>
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.	<ul> <li>For pipes <dn50, (<="" 1mm),="" a="" couplant="" especially="" is="" layer="" li="" of="" only="" pipe="" smooth.<="" surface="" the="" thin="" use="" very="" when=""> <li>Evaluate the Rx signal and SNR first with a moderate layer of couplant. Remove couplant to see if the signal improves.</li> </dn50,></li></ul>

# 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¢
P1.RXGAIN UP	5.0 dB
P1.SNR UP	5.0 dB
P1.DELTA TIME	234.1 ns
P1.TTIME UP	152.23 µs
P1.ACC.BURST	100 %
P1.CORR.FACT	0.98
Maintenance alarm	

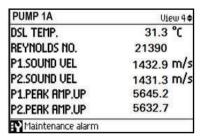


Figure 9-3 6 value diagnostic screen views

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.

### 9.5 Check sensor specific data

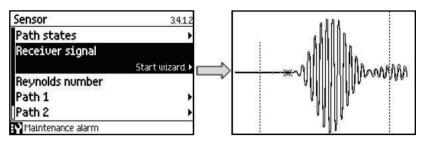


Figure 9-4 Sensor diagnostic screen with ideal Receiver signal shown

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

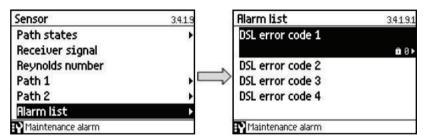


Figure 9-5 Detailed DSL error codes for advanced troubleshooting with Siemens service

#### 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 μs
Travel time down	Measured transit-time from transmission to reception of the downstream receive signal.	15 to 3000 μs

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.	99 to 100%
	Less than 100% generally indicates a disruption in the fluid, such as from suspended solids or bubbles in the liquid.	
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 μs
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 μs
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.

SIMATIC PDM/PLC

#### Device status symbols

NAMUR | Local display

Local display

- NAMUF	R NE 107		- HCF	- Siemens	•			O 1 DIVI/1 L		
Symbol	Device status	Priority *	Priority *	Symbol	Device status	Priority **	Sy	mbol	Device status	Priority **
<b>X</b>	Failure	1	1	P	Mainte- nance alarm	1	×		Mainte- nance alarm	1
Cause: 0	Output signal	invalid due	to fault in t	he field dev	ice or in the	peripherals				
Action: N	Maintenance	is required i	mmediately	/.						
		•	•	<u>'</u>						
	Mainte- nance re- quired	3	4	:Y	Mainte- nance de- manded	2		•	Mainte- nance de- manded	2
Cause: 0	 Dutput signal	is still valid	, but wear r	eserve is a	Imost exhaus	sted and/or	a functio	n will be lii	mited soon.	
Action: N	Maintenance	is strongly r	ecommend	ed as soon	as possible.					
	Mainte- nance re- quired	3	4	٧.	Mainte- nance re- quired	3		-	Mainte- nance re- quired	3

# 9.7 Device status symbols

ocal dis. NAMU	splay R NE 107		NAMUR - HCF	Local dis	play s standard		SIMATIO	C PDM/P	LC	
Symbol	Device status	Priority *	Priority *	Symbol	Device status	Priority **	Syr	mbol	Device status	Priority **
Cause: (	Output signal	is still valid	. No function	onal restric	tion detected	but end of v	vear rese	rve expe	cted in next w	eeks.
	Maintenance									
			1				Г			T
W	Function check	2	2	ŀή	Manual operation	4	W	2	Manual operation	4
			•	•	due to work b	eing perforn	ned on the	e device		
ction: [	Disable manu	ial mode via	a HMI or en	gineering s	system.					
<u> </u>	Function	2	2	_ ^	Simula-	5	TAD 7	-AN	Simula-	5
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V					substitute				substitute	
					value				value	
:ause: (	Output signal	temporarily	does not r	epresent t	he process he	ecause outo	ut based	on a sim	ulation value.	
				•	ig system or i	•				
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	Out of specifica-	of service" a	and enable		Process value		"Out of se	ervice".	value	8
ction: [	Out of specification	of service" a	and enable	normal op	Process value alarm	8	<u>?</u>	<b>:‡</b>	value alarm	
Cause: [ags/faukely greesult in	Out of specification Deviations froults in the deviation an unreliable out	of service" a  4  om permissi ice) indicate ticipated un utput.	3 ble ambien that the meder normal	t or proces easured val operating	Process value alarm s conditions oue is unreliab	8 detected by le or deviation rocess or an	the device	e (throug he set va nditions	value alarm h self-monitor lue in the actua will damage th	ing, or wai
Cause: [ags/faukely greesult in	Out of specification  Deviations froults in the deviater than an unreliable outleaded.	of service" a  4  om permissi ice) indicate ticipated un utput. nt temperate	and enable  3 ble ambien that the meder normal ure or process	t or proces easured val operating	Process value alarm s conditions of the conditions. Process value alarm s conditions. Process on the conditions. Process on the conditions of the conditions of the conditions of the conditions of the conditions.	8 detected by le or deviation rocess or an le, install de	the device	e (throug he set va nditions	value alarm h self-monitor lue in the actua will damage the cation.	ing, or wa ators is mo ne device o
ction: [	Out of specification Deviations froults in the devieter than an unreliable out. Out of	of service" a  4  om permissi ice) indicate ticipated un utput.	3 ble ambien that the meder normal	t or proces easured val operating	Process value alarm s conditions of the conditions. Process	8 detected by le or deviation rocess or an	the device	e (throug he set va nditions	value alarm h self-monitor lue in the actua will damage the cation.	ing, or war
ction: [	Out of specification  Deviations froults in the deviater than an unreliable outlined to the complete the complete than an unreliable outlined to the compl	of service" a  4  om permissi ice) indicate ticipated un utput. nt temperate	and enable  3 ble ambien that the meder normal ure or process	t or proces easured val operating	Process value alarm s conditions of the conditions. Process value	8 detected by le or deviation rocess or an le, install de	the device	e (throug he set va nditions	value alarm h self-monitor lue in the actua will damage the cation.  Process value	ing, or war ators is mo ne device o
ause: [ gs / fau kely greesult in	Out of specification Deviations froults in the devieter than an unreliable out. Out of	of service" a  4  om permissi ice) indicate ticipated un utput. nt temperate	and enable  3 ble ambien that the meder normal ure or process	t or proces easured val operating	Process value alarm s conditions of the conditions. Process	8 detected by le or deviation rocess or an le, install de	the device	e (throug he set va nditions	value alarm h self-monitor lue in the actua will damage the cation.	ing, or wa ators is mo ne device o
Cause: Ings / faukely greesult in action: Cause: Ings / faukely greesult in action: Cause: Ings / faukely greesult in	Out of specification Deviations froults in the device atter than an unreliable out of specification  Deviations froults in the device atter than an unreliable out of specification  Deviations froults in the device atter than an unreliable out of specification	of service" a  4  om permissi ice) indicate ticipated un utput.  14  om permissi de) indicate ticipated un utput.	ble ambien that the meder normal able ambient normal	t or proces easured val operating ess conditions.	Process value alarm s conditions. Pons. If possib Process value warning s conditions on the conditions of the conditions of the conditions. Pons. If possib process value warning s conditions of the conditions. Pons. Process value warning s conditions of the conditions of the conditions.	detected by le or deviation rocess or an arrow le, install de 10 detected by le or deviation rocess or an arrocess or an arrocess or an arrocess or an arrocess or	the device ons from to the device at divide the device ons from to the device ons from the device on the d	e (throughe set vanditions of the set vandit	value alarm h self-monitor lue in the actua will damage the cation.  Process value warning h self-monitor lue in the actua can damage the	ing, or war ators is mo ne device of 10 ing, or war ators is mo
Cause: Ings / faukely greesult in action: Cause: Ings / faukely greesult in action: Cause: Ings / faukely greesult in	Out of specification Deviations froults in the device atter than an unreliable out of specification  Deviations froults in the device atter than an unreliable out of specification  Deviations froults in the device atter than an unreliable out of specification	of service" a  4  om permissi ice) indicate ticipated un utput.  14  om permissi de) indicate ticipated un utput.	ble ambien that the meder normal able ambient normal	t or proces easured val operating ess conditions.	Process value alarm s conditions. Pons. If possib  Process value warning s conditions oue is unreliable to the conditions of the condition	detected by le or deviation rocess or an arrow le, install de 10 detected by le or deviation rocess or an arrocess or an arrocess or an arrocess or an arrocess or	the device ons from to the device at divide the device ons from to the device ons from the device on the d	e (throughe set vanditions of the set vandit	value alarm h self-monitor lue in the actua will damage the cation.  Process value warning h self-monitor lue in the actua can damage the	ing, or war ators is mo ne device of 10 ing, or war ators is mo
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Local display - NAMUR NE 107		NAMUR Local display - HCF - Siemens standard		SIMATIC PDM/PLC					
Symbol	Device status	Priority *	Priority *	Symbol	Device status	Priority **	Symbol	Device status	Priority **
Cause: A	At least one p	rocess valu	ie has exce	eded or fal	len below a	orocess tole	rance limit parame	ter set in devi	ice.
Action: C	Check that lin	nit paramete	er settings a	are suitable	for application	on.			
no sym- bol shown				no sym- bol shown	Configura- tion changed	12	no sym- bol shown	Configura- tion changed	12
	The device co	•	•		work processage.	SS.			
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 acti	ve diagnos	tic errors.		1	1		
Action: N	lo action req	uired.	_						

<sup>\*</sup> Lowest priority number equals highest fault severity.

### Information symbols

The following information symbols are used on the local display.

Local display	
Symbol	Description
<b></b>	Data exchanged
**	No data exchanged
9	Write access enabled
û	Device hardware lock enabled
a 6 6	Device button lock enabled
CT	Custody transfer enabled

## 9.8 Fault codes and corrective actions

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

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

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 <b>№</b>	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 <b>№</b>	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 <b>№</b>	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 <b>№</b>	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 <b>№</b>	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 <b>№</b>	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 <b>№</b>	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 <b>\S</b>	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 <b>S</b>	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 <b>\S</b>	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 <b>S</b>	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 <b>\S</b>	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 <b>№</b>	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 <b>1 3</b>	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 <b>№</b>	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 <b>№</b>	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 <b>\</b>	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 <b>\S</b>	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 <b>№</b>	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 <b>№</b>	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 <b>1</b>	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 <b>★</b>	Mass flow	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper alarm limit'.	
97 <b>'\$</b>	Mass flow	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	
98 <b>'\$</b>	Mass flow	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	
99 <b>1</b>	Mass flow	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower alarm limit'	
100 <b>1</b>	Volume flow	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper alarm limit'	
101 • <b>‡</b>	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	
<b>:‡</b>		parameter 'Lower warning limit'	
<u> </u>			
103	Volume flow	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower alarm limit'	
A			
104	Density	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper alarm limit'	
A			
105	Density	Value above warning limit. Check process con-	
<b>'</b> \$		ditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	
A			
106	Density	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	
A		parameter cower warning innit	
107	Density	Value below alarm limit. Check process condi-	
<b>‡</b>		tions or align limit to normal operation. Adjust parameter 'Lower alarm limit'	
A			
108	Medium temperature	Value above alarm limit. Check process condi-	
<b>†</b>		tions or align limit to normal operation. Adjust parameter 'Upper alarm limit'	
<u>^</u>			
109	Medium temperature	Value above warning limit. Check process conditions or align limit to permal exerction. Adjust	
<b>'</b> ‡		ditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	
A			
110	Medium temperature	Value below warning limit. Check process conditions or align limit to permal exercises. Adjust	
<b>'</b> ‡		ditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	
A			

ID/ Sym- bols	Diagnostic	Action	Comment
111 <b>1</b>	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 * <b>‡</b>	Standard volume flow	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	Only hydrocarbon
134 • <b>‡</b>	Standard volume flow	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	Only hydrocarbon
135 <b>1</b>	Standard volume flow	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower alarm limit'	Only hydrocarbon
136 <b>13</b>	Totalizer 1	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper alarm limit'	
137 <b>:‡</b>	Totalizer 1	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	
138 <b>:‡</b>	Totalizer 1	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	
139 <b>13</b>	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'	
A			
141 • <b>‡</b>	Totalizer 2	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	
A			
142 • <b>‡</b>	Totalizer 2	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	
A			
143	Totalizer 2	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust	
† <b>‡</b>		parameter 'Lower alarm limit'	
A			
144	Totalizer 3	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper alarm limit'	
<u> </u>	T 1 1 0	V I I I I I I I I I I I I I I I I I I I	
145 <b>'‡</b>	Totalizer 3	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Upper warning limit'	
A			
146 • <b>‡</b>	Totalizer 3	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter 'Lower warning limit'	
A			
147	Totalizer 3	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust	
<b>‡</b>		parameter 'Lower alarm limit'	
A			
148	Transmitter temperature	Transmitter temperature above alarm limit. Relocate the device if possible or lower the ambi-	
<b>‡</b>		ent temperature enough to cool the device. Inspect the device for heat-related damage.	
A			

ID/ Sym- bols	Diagnostic	Action	Comment
149 <b>1</b>	Transmitter temperature	Transmitter temperature below alarm limit. Relocate 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 <b>15</b> 5	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 <b>15</b>	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 <b>\S</b>	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 *{\bar{\bar{\bar{\bar{\bar{\bar{\bar	Volume flow	Value simulated. Disable 'Simulation' before returning to normal operation	
162 *(h)	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-	Only hydrocarbon
* <sub>6</sub> h		turning to normal operation	
$\mathbf{A}$			
167	Totalizer 1	Value simulated. Disable 'Simulation' before re-	
* <sub>6</sub> ŋ		turning to normal operation	
$\mathbf{A}$			
168	Totalizer 2	Value simulated. Disable 'Simulation' before returning to normal operation	
*¿ <sup>0</sup> 7		turning to normal operation	
A			
169	Totalizer 3	Value simulated. Disable 'Simulation' before returning to normal operation	
(h.)		turning to normal operation	
$\mathbf{A}$			
170	Loop current	Loop current simulated. Disable 'Simulation' before returning to normal operation	Only HART devices
* <sub>6</sub> °7		lore retaining to normal operation	
$\mathbf{A}$			
172	Transmitter	FW invalid. A component does not have the expected FW version. Start a product firmware	
Ş		update to update the component version or re-	
⊗		place the component.	
173	Sensor	FW invalid. A component does not have the ex-	
Ş		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-	
Ş		pected FW version. Start a product firmware update to update the component version or re-	
⊗		place the component.	
175	Ю	FW invalid. A component does not have the ex-	
Ş		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 <b>\\$\\$</b>	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 *{*1 ***	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. NA-MUR status signal and the priority in case of multiple alarm classes simulated.
181 <b>\S</b>	SensorFlash	SensorFlash Chkdsk failed. Start Chkdsk again. If error still exists replace SensorFlash.	
183 <b>(183)</b>	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 <b>1</b>	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 <b>1</b>	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 <b>18</b>	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-	Diagnostic	Action	Comment
bols			
187	СНЗ	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
A		Chamer	
188	СНЗ	External failure. Connected sensor or output to input channel is out of operation range. Please	If Operation mode is configured to Current input
<b>‡</b>		check connected sensor or output source.	ured to ourrent input
A			
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
A			
190	CH4	Input current too high. Check wiring and signal of connected sensor or output source to input	If Operation mode is configured to Current input
<b>†</b>		channel	ured to Current Input
A			
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
A			
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
A		, Janes de la company de la co	
196	CH2	Loop current in upper saturation. Check process conditions or align limit to normal operation.	If Operation mode is configured to Current output
<b>†</b>		Adjust channel 2 parameter 'Upper range value'	ured to Current output
<u>^</u>			
197	CH2	Cable break. Check channel 2 current output cable connection.	If Operation mode is configured to Current output
Ş			
$\otimes$			
198	CH2	Frequency too low. Check process conditions or align limit to normal operation. Adjust chan-	If Operation mode is configured to Frequency output
•		nel 2 parameter 'Lower range value'	
A			

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 <b>1</b>	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 <b>•••</b>	СНЗ	Cable break. Check channel 3 current output cable connection	If Operation mode is configured to Current output
204 <b>1</b>	СН3	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 <b>1</b>	СНЗ	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 <b>1</b>	СНЗ	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 <b>1</b>	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 <b>S</b>	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 <b>1</b>	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 *(h)	CH2	Channel simulated. Disable 'Simulation' before returning to normal operation	
215 *(h)	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 <b>1</b> 5	Outputs forced	Outputs are forced. To return to normal operation the related input signal has to switch	
219 <b>S</b>	CH2	Loop current deviation. Check current output cable connection. In passive mode check power supply.	If Operation mode is configured to Current output
220 <b>\bigstyle{\color}</b>	CH3	Loop current deviation. Check current output cable connection. In passive mode check power supply.	If Operation mode is configured to Current output
221 <b>\text{\tin}\text{\tetx{\text{\tetx{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\texi}\text{\text{\texi}\text{\text{\text{\text{\texi}\text{\text{\text{\text{\text{\text{\text{\tet{\te</b>	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 <b>\text{\tin}\text{\tetx{\text{\tetx{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\texi}\text{\text{\texi}\text{\text{\text{\text{\texi}\text{\text{\texi}\text{\text{\text{\text{\text{\tet{\text{\text{\text{\text{\text{\texi}\text{\text{\texi}\te</b>	Modbus	Invalid coil configuration. Modbus coils are not configured correctly. Check coil allocation.	
228 <b>1</b>	Sound velocity	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	
229 • <b>\$</b>	Sound velocity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	
230 • <b>\$</b>	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"	
A			
232	Flow velocity	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	
A			
233 • <b>‡</b>	Flow velocity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	
A			
234 • <b>‡</b>	Flow velocity	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	
<u> </u>			
235	Flow velocity	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	
236	Draggura	Value above plane limit Cheek process andi	
<b>‡</b>	Pressure	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	
A			
237 • <b>‡</b>	Pressure	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	
A			
238 • <b>‡</b>	Pressure	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	
A			
239	Pressure	Value below alarm limit. Check process condi-	
<b>\$</b>		tions or align limit to normal operation. Adjust parameter "Lower alarm limit"	
A			

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 • <b>‡</b>	Kinematic viscosity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	
246 <b>'\$</b>	Kinematic viscosity	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	
247 <b>1</b>	Kinematic viscosity	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	
248 <b>1</b>	Rate of change	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	Only hydrocarbon
249 • <b>‡</b>	Rate of change	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
252 <b>1</b>	Standard kinematic viscosity	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	Only hydrocarbon
253 <b>:‡</b>	Standard kinematic viscosity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
254 • <b>‡</b> ♠	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
<u>₹</u> 256	Standard density	Value above alarm limit. Check process condi-	Only hydrocarbon
<b>‡</b>		tions or align limit to normal operation. Adjust parameter "Upper alarm limit"	
257 ' <b>\$</b>	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	Only hydrocarbon
' <b>\$</b> <u>^</u>		parameter "Lower warning limit"	
259 <b>1</b>	Standard density	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	Only hydrocarbon
260 <b>1</b>	API gravity	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	Only hydrocarbon
261 <b>:‡</b>	API gravity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
262 • <b>‡</b>	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
A			

ID/ Sym- bols	Diagnostic	Action	Comment
264 <b>1</b>	Standard API gravity	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	Only hydrocarbon
265 • <b>‡</b>	Standard API gravity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
266 • <b>‡</b>	Standard API gravity	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	Only hydrocarbon
267 <b>1</b>	Standard API gravity	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	Only hydrocarbon
268 <b>1</b>	Specific gravity	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	Only hydrocarbon
269 <b>:‡</b>	Specific gravity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
270 • <b>‡</b>	Specific gravity	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	Only hydrocarbon
271 <b>1</b>	Specific gravity	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	Only hydrocarbon
272 <b>1</b>	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 ' <b>‡</b>	Standard specific gravity	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
A			
274 ' <b>‡</b>	Standard specific gravity	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	Only hydrocarbon
À		parameter 25wer warning innit	
275	Standard specific gravity	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	Only hydrocarbon
A			
276	Liquident	Value above alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper alarm limit"	Only hydrocarbon
A			
277 ' <b>\$</b>	Liquident	Value above warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Upper warning limit"	Only hydrocarbon
278 •• <b>‡</b>	Liquident	Value below warning limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower warning limit"	Only hydrocarbon
279 <b>1</b>	Liquident	Value below alarm limit. Check process conditions or align limit to normal operation. Adjust parameter "Lower alarm limit"	Only hydrocarbon
289 *(h)	Sound velocity	Value simulated. Disable 'Simulation' to return to normal operation.	
290 '(h)	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.	
<b>*</b> ℓh <b>&gt;&gt;</b>			
293	Sensor temperature	Value simulated. Disable 'Simulation' to return to normal operation.	
*{ <sup>1</sup> / <sub>2</sub>		to normal operation.	
294	Auxiliary temperature	Value simulated. Disable 'Simulation' to return	
*( <sup>h</sup> 7	ruxinary temperature	to normal operation.	
$\mathbf{v}$			
296 •{\gamma}	CH5	Channel simulated. Disable 'Simulation' to return to normal operation.	
$\mathbf{A}$			
297	CH6	Channel simulated. Disable 'Simulation' to return to normal operation.	
<b>:</b> ₹7			
298	Standard volume flow	Value simulated. Disable 'Simulation' to return to normal operation.	Only hydrocarbon
<b>'</b> ₹7 <b>V</b>			
299	Standardizing factor	Value simulated. Disable 'Simulation' to return	Only hydrocarbon
*&n	-	to normal operation.	
<b>A</b>			
300	Standard kinematic viscosity	Value simulated. Disable 'Simulation' to return to normal operation.	Only hydrocarbon
₩			

Diagnostic	Action	Comment
Standard density	Value simulated. Disable 'Simulation' to return to normal operation.	Only hydrocarbon
LiquIdent	Value simulated. Disable 'Simulation' to return	Only hydrocarbon
	to normal operation.	
API gravity	Value simulated. Disable 'Simulation' to return	Only hydrocarbon
	to normal operation.	
Standard API gravity	Value simulated. Disable 'Simulation' to return	Only hydrocarbon
	to normal operation.	
Specific gravity	Value simulated. Disable 'Simulation' to return	Only hydrocarbon
	to normal operation.	
Standard specific gravity	Value simulated. Disable 'Simulation' to return	Only hydrocarbon
	to normal operation.	
Rate of change	Value simulated. Disable 'Simulation' to return	Only hydrocarbon
	to normal operation.	
	Standard density  Liquident  API gravity  Standard API gravity  Specific gravity  Standard specific gravity	Standard density  Value simulated. Disable 'Simulation' to return to normal operation.  Liquident  Value simulated. Disable 'Simulation' to return to normal operation.  API gravity  Value simulated. Disable 'Simulation' to return to normal operation.  Standard API gravity  Value simulated. Disable 'Simulation' to return to normal operation.  Specific gravity  Value simulated. Disable 'Simulation' to return to normal operation.  Standard specific gravity  Value simulated. Disable 'Simulation' to return to normal operation.

Technical data 10

### 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 ±10 % of the nominal voltage.	
Reverse polarity protection (y / n)	Υ	
Galvanic isolation	2500 V AC	

# 10.2 HART interface

Table 10-2 HART communication

Description	Specification
HART revision	7.5

# 10.3 Inputs

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

Description	Channels 3 and 4
Load	15 to 30 V DC, R <sub>in</sub> 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 μΑ	
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 <sup>1)</sup>	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)	

<sup>&</sup>lt;sup>1)</sup> 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 <sup>1)</sup>	2, 3 or 4 wire	

<sup>&</sup>lt;sup>1)</sup> 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 μΑ		
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 <sup>1)</sup>	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)		

<sup>&</sup>lt;sup>1)</sup> 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 μΑ

## 10.4 Outputs

Description	Channels 2 to 4					
Load	• Ex i: <470 Ω					
	• Non-Ex: <7	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 v	value				
	– Lower	fault current				
	- Upper	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 <sup>1)</sup>	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)				

 $<sup>^{1)}</sup>$  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 μs to 5 s pulse duration	
Resolution	1 µs	
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	
Туре	Change-over voltage-free relay contact	
Load	0 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 <sub>o</sub>	17.42 V DC	17.43 V DC	4.52 V DC
Io	459 mA	452 mA	13.8 mA
P <sub>o</sub>	2000 mW	991 mW	26.6 mW
C <sub>o</sub>			
Group IIC	• 338 nF	• 169.5 nF	• 4.28 μF
Groups IIB, III	• 1969 nF	• 985 nF	• 139 μF
Group IIA	• 8199 nF	• 1000 nF	• 994 μF
L <sub>o</sub>			
Group IIC	• 134 μH	● 67 µH	• 1.87 mH
Groups IIB, III	• 675 µH	• 348 µH	• 7.47 mH
Group IIA	• 1.35 μH	● 697 µH	• 14.9 mH
L <sub>o</sub> /R <sub>o</sub>			
Group IIC	• 17.8 μH/Ω	• 18.0 μH/Ω	• NA
Groups IIB, III	• 71.2 μH/Ω	• 72.2 μH/Ω	• NA
Group IIA	• 142 μH/Ω	• 144 μH/Ω	• 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 <sub>o</sub>	28 V DC	4.2 V DC	28 V DC	28 V DC	28 V DC
I <sub>o</sub>	85 mA	118 mA	87 mA	87 mA	87 mA
P <sub>o</sub>	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 <sub>o</sub>					
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 <sub>o</sub>					
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
Ui	30 V DC	30 V DC	30 V DC	30 V DC	30 V DC	30 V DC
I <sub>i</sub>	100 mA	100 mA	100 mA	100 mA	100 mA	100 mA
P <sub>i</sub>	1000 mW	1000 mW	1000 mW	1000 mW	1000 mW	1000 mW
C <sub>i</sub>	15.8 nF	7.3 nF	7.3 nF	7.3 nF	7.3 nF	7.3 nF
Li	36 µH	36 µH	36 µH	36 µH	36 µH	36 µH

#### Note

### External capacitance and inductance

The  $C_{\circ}$  and  $L_{\circ}$  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 <sub>i</sub>	17.42 V DC	30 V DC
I <sub>i</sub>	459 mA	100 mA
P <sub>i</sub>	2.0 W	0.75 W
C <sub>i</sub>	2.52 nF	0 nF
L <sub>i</sub>	315 nH	105 nH

Table 10-14 Output parameters

	RTD 5, RTD 6 (any combination of con-	Sensor outputs, each	
	nections)	(up to 8)	
U <sub>o</sub>	4.52 V DC	17.43 V DC	
Io	13.8 mA	452 mA	
P <sub>o</sub>	26.6 mW	991 mW	
C <sub>o</sub>			
Group IIC	• 4.28 µF	• 169.5 nF	
Groups IIB, III	• 139.5 μF	• 985 nF	
Group IIA	• 994 μF	• 1000 nF	
L <sub>o</sub>			
Group IIC	• 1.87 mH	● 67 µH	
Groups IIB, III	• 7.47 mH	• 348 µH	
Group IIA	• 14.9 mH	● 697 µH	
L <sub>o</sub> /R <sub>o</sub>			
Group IIC	• NA	• 18.0 μH/Ω	
Groups IIB, III	• NA	• 72.2 μH/Ω	
Group IIA	• NA	• 144 μH/Ω	

#### Note

### External capacitance and inductance

The  $C_{\circ}$  and  $L_{\circ}$  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	

### 10.7 Construction

### 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 wtihout 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	• EN 55011 / CISPR-11
	Immunity	EN/IEC 61326-1 (Industry)     NAMUR

Table 10-21 Process medium conditions

Description	Specification
Process medium tempeature 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")

### 10.9 Cables and cable entries

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 [mm²]	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	<ul> <li>&gt;3 million cycles at ± 180° on 200 mm</li> </ul>
	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 [mm²]	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 [mm²]	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)
	<ul> <li>Brass/Ni plated</li> </ul>
	<ul> <li>Stainless steel AISI 316/1.4404</li> </ul>
	Cable cross section
	- ∅ 8 to 17 mm (0.31" to 0.67")
	- ∅ 5 to 13 mm (0.20" to 0.51")
Entries	9 x M20

 $<sup>^{1)}</sup>$ : 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 T6T5 Gc Class I, Zone 2; AEx/Ex ec ia [ia Ga] IIC T6T5 Gc Class II, Zone 22; AEx/Ex tc [ia Da] IIIC T85°C Dc Um = 250 Vrms
Explosive Atmospheres (ATEX & IECEx)	<ul><li>II 3(1) D Ex tc [ia Da] IIIC T85°C Dc</li><li>II 3(1) G Ex ec ia [ia Ga] IIC T6T5 Gc</li></ul>
Ambient Temperature range	-40 °C ≤ Ta ≤ 60 °C
Enclosure Rating	Enclosure Type 4X IP66/IP67
Temperature code	T6 for -40 °C $\leq$ Ta $\leq$ 45 °C, T5 for -40 °C $\leq$ Ta $\leq$ 60 °C, T5 85 °C for -40 °C $\leq$ Ta $\leq$ 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 T6T5 Ga Class II, Zone 20; AEx/Ex ia IIIC T64°CT74°C Da
Explosive Atmospheres (ATEX & IECEx)	<ul> <li>II 1 D Ex ia IIIC T₅ 64°CT₅ 74°C Da</li> <li>II 1 G Ex ia IIC T6T5 Ga</li> </ul>
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 $\leq$ Ta $\leq$ 50 °C, T5 for -40 °C $\leq$ Ta $\leq$ 60 °C, T <sub>5</sub> 64 °C for -40 °C $\leq$ Ta $\leq$ 50 °C, T <sub>5</sub> 74 °C for -40 °C $\leq$ Ta $\leq$ 60 °C

### Division 2, Zone 2, Zone 22 Installations

- 1. I/O shall be installed as intrinsically safe circuits.
- Active circuits are associated apparatus to external intrinsically safe apparatus where Ui (Vmax) ≥ Uo (Voc or Vt); Ii (Imax) ≥ Io (Isc or It); Pi (Pmax) ≥ Po; Co (Ca) ≥ Ci + Ccable; Lo (La) ≥ Li + Lcable
- 3. Passive circuits and relays shall be connected to external associated apparatus where Ui (Vmax) ≥ Uo (Voc or Vt); Ii (Imax) ≥ Io (Isc or It); Pi (Pmax) ≥ Po; Co (Ca) ≥ Ci + Ccable; Lo (La) ≥ Li + Lcable

## 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: Storage:	-40 to +85 °C (-40 to 185 °F) -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.

10.11 SensorFlash

Dimension drawings

# 11.1 Transmitter

### Wall mount enclosure

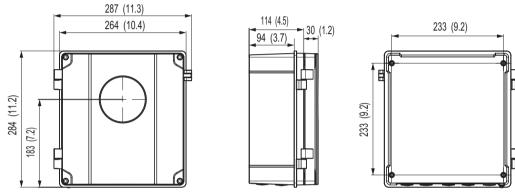


Figure 11-1 Transmitter dimensions in mm (")

### 11.1.1 External DSL dimensions

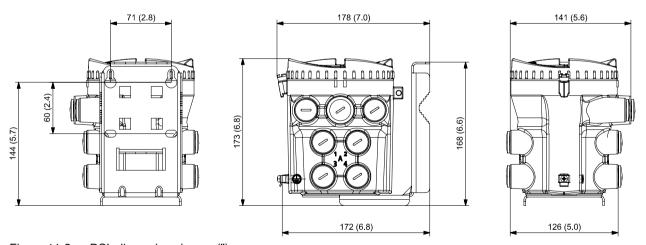


Figure 11-2 DSL dimensions in mm (")

11.1 Transmitter

# Product documentation and support



### A.1 Product documentation

Process instrumentation product documentation is available in the following formats:

- Certificates (<a href="http://www.siemens.com/processinstrumentation/certificates">http://www.siemens.com/processinstrumentation/certificates</a>)
- Downloads (firmware, EDDs, software) (<a href="http://www.siemens.com/processinstrumentation/downloads">http://www.siemens.com/processinstrumentation/downloads</a>)
- Catalog and catalog sheets (<a href="http://www.siemens.com/processinstrumentation/catalogs">http://www.siemens.com/processinstrumentation/catalogs</a>)
- Manuals (<a href="http://www.siemens.com/processinstrumentation/documentation">http://www.siemens.com/processinstrumentation/documentation</a>)
   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 (<a href="https://support.industry.siemens.com/cs/ww/en/sc/2067">https://support.industry.siemens.com/cs/ww/en/sc/2067</a>). 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.

## A.2 Technical support

### **Technical support**

If this documentation does not completely answer your technical questions, you can enter a Support Request (<a href="http://www.siemens.com/automation/support-request">http://www.siemens.com/automation/support-request</a>).

Additional information on our technical support can be found at Technical Support (<a href="http://www.siemens.com/automation/csi/service">http://www.siemens.com/automation/csi/service</a>).

### 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

## B.1 Commissioning with SIMATIC PDM

### B.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 (<a href="https://www.siemens.com/simatic-pdm">https://www.siemens.com/simatic-pdm</a>).

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 (<a href="https://support.industry.siemens.com/cs/ww/en/ps/16983/man">https://support.industry.siemens.com/cs/ww/en/ps/16983/man</a>).

#### Note

#### Field device parameters

- For a list of parameters and additional information, consult section "Parameters accessed via PDM menus (Page 170)".
- The field device remains in measurement mode during the time you configure the field device.

#### B.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)

### B.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.



- Deselect "Use FIFO buffers" radio box
- 9. Click "OK" button to close out.
- 10.Close all screens.
- 11. Restart the computer.

### B.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 8).
- 2. Go to the support page Software downloads (<a href="https://www.siemens.com/processinstrumentation/downloads">https://www.siemens.com/processinstrumentation/downloads</a>).
- 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.
- 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.

### B.1.5 Integrating a HART device in a HART modem network

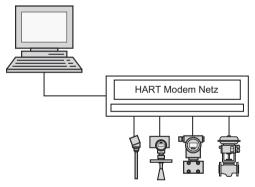


Figure B-1 HART modem

The following describes how to integrate a HART device in a HART modem network.

#### Requirements

- A project has been created.
- An access point of the computer is set to the COM port to which the HART modem network is connected.

### Integrating a HART device in a HART modem network

- 1. Open the project in the process device network view.
- Right-click the "Networks" object in the tree structure. In the shortcut menu that opens, select the menu command Insert New Object > Communication network. The "Insert Object(s) - <...>" dialog box opens.

#### B.1 Commissioning with SIMATIC PDM

- 3. Click the "Assign Device Type" button.

  The "Insert Object(s) Assign Device Type" dialog box opens. You can find additional information in the section "Insert Object Assign Device Type" dialog box.
- 4. To set the network properties, select the inserted HART modem network in the right window and right-click. Select the Object Properties command in the displayed shortcut menu.
- 5. Enter the device-specific information in the "Communication" tab of the Properties dialog for the HART modem network.

Set the master type (primary or secondary, usually secondary): Here, you can select the "Prefer 'Long address'" check box.

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.	

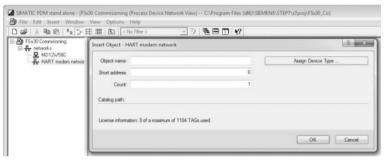


Figure B-2 Assigning HART device to network

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.

#### Note

The COM port is almost always "1" for notebooks. Since most PCs have two COM ports, you must specify the port to which the HART modem is connected in this tab. Check whether the settings for the FIFO buffer of the COM port are suitable, or immediately use a USB HART modem.

- To insert the HART device, select the HART modem 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 HART device
- 8. To set the device address, select the inserted Modbus device in the right window and rightclick. Select the Object Properties command in the displayed shortcut menu.

9. Enter the device-specific information (Modbus address 0-247) in the Communication tab of the Properties dialog for the HART device.

#### Note

#### Address with HART

- The short address must be entered for HART devices. This address must correspond to the connected HART device. The short address is always "0", unless the device is in the multi-drop function.
- For a HART interface, enter the long address. This address contains the following device-specific information:
  - Manufacturer
  - Device type
  - Device name
- 10.To change the device address, select the inserted HART 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.

#### Note

The address must correspond to the connected device. The short address for HART devices is always "0" unless the device is in the multi-drop function.

11.Start SIMATIC PDM by double-clicking the newly inserted HART 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 B-3 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  $\rightarrow$  Define Current PC.

#### B.1 Commissioning with SIMATIC PDM

### B.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 163).
- 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 166).)

### B.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.

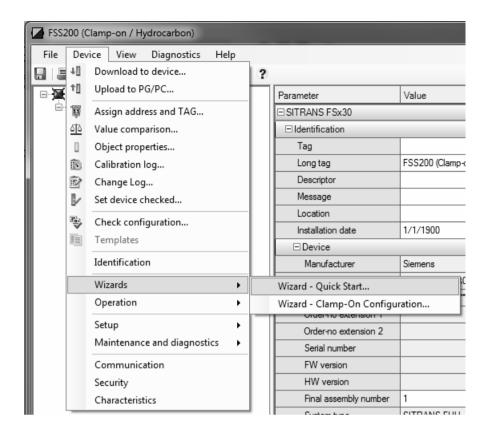
#### **Quick start**

#### 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.

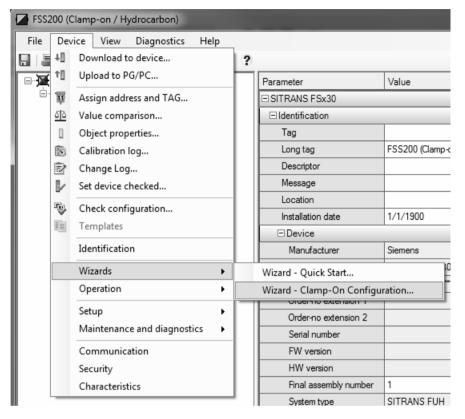
Launch SIMATIC PDM, open the menu Device  $\rightarrow$  Wizards  $\rightarrow$  Wizard - Quick Start..., and follow the steps.

### B.1 Commissioning with SIMATIC PDM



### B.1.8 Wizard - Clamp-On Configuration

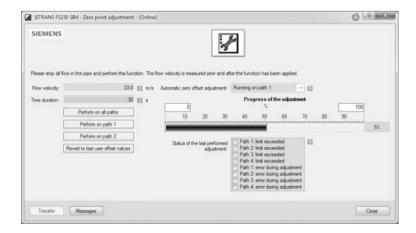
Open the menu Device  $\rightarrow$  Wizards  $\rightarrow$  Wizard - Clamp-On Configuration..., and follow the steps.



The clamp-on configuration wizard takes the user through the necessary steps to install the sensors to achieve proper operation.

### B.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.

### B.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.

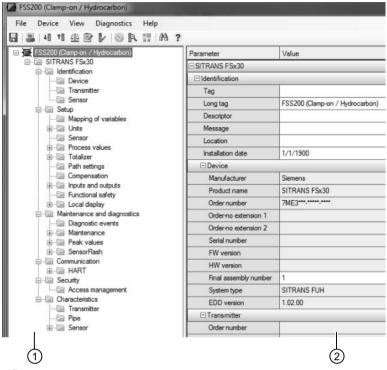
#### See:

- SIMATIC PDM structure view image (Page 170)
- Parameters accessed via PDM menus (Page 170)

#### 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.

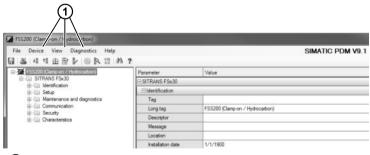
### B.1.11 SIMATIC PDM structure view image



- ① Structure view (offline table)
- 2 Value fields

### B.1.12 Parameters accessed via PDM menus

Click on "Device", "View", or "Diagnostics" to open the associated PDM menu.



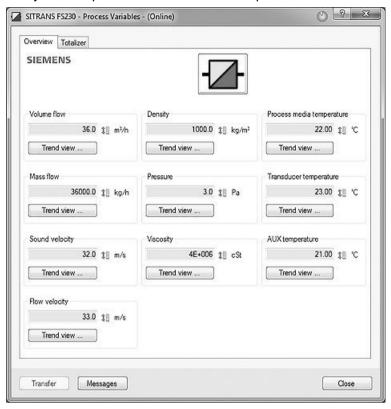
1 PDM menus

### PDM menus

Device	View	Diagnostics
Download to device	Process values	Update diagnostics
Upload to PC/PG		
Assign address and Tag	Start Life List	Alarms
Value comparison		Advanced diagnostics
Object properties		Receiver signal
Calibration log		
Change Log		
Set evice checked		
Check configuration		
Templates		
Identification		
Wizards		
Operation		
Setup		
Maintenance and diagnostics		
Communication		
Security		
Characteristics		

#### B.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.

## B.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 161).

B.2 Diagnosing with PDM

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