SIEMENS

SITRANS L

Ultrasonic level controllers MultiRanger 200 HMI

Operating Instructions

7ML5033 (MultiRanger 200 HMI)

11/2019

A5E35857004-AF

Legal information

Warning notice system

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

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

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

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

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

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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

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

Trademarks

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

Disclaimer of Liability

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

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Document order number: A5E35857004
Ⓟ 11/2019 Subject to change

Table of contents

1 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 Checking the consignment

1. Check the packaging and the delivered items for visible damages.
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.
• Do not use damaged or incomplete devices.

1.3 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 (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 (https://www.siemens.com/industrialsecurity).

1.4 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 288).

1.5 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.

This history establishes the correlation between the current documentation and the valid firmware of the device.

Edition	Remarks	EDD version	Firmware revision
10/2015	Initial release	1.13.02	2.00.00
12/2015	Added support for Echo Profile view on the display	1.13.02	2.01.00
10/2017	Operating Instructions maintenance	1.13.02	2.01.00
11/2017	Battery was removed. Added ProfiNet, Modbus/TCP, Ethernet/IP. Added slot/index access and Siemens device IDs for DPV1.	1.13.02	2.01.01-10
10/2019	Improved robustness of flash programming.	1.13.02	2.01.01-20

Safety notes 2

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
	Consult operating instructions
	Hot surface
	Dangerous electrical voltage

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)

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
Low voltage directive LVD 2014/35/EU	Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits
Pressure equipment directive PED 2014/68/EU	Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment
Measuring instruments directive MID 2014/32/EU	Directive of the European Parliament and the Council on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments

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

WARNING

Improper device modifications

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.

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.

WARNING

Use in hazardous area

Risk of explosion.

- Only use equipment that is approved for use in the intended hazardous area and labelled accordingly.
- Don't use devices that have been operated outside the conditions secified for hazardous areas. If you have used the device outside the conditions for hazardous areas permanently make all Ex markings unrecognizable on the nameplate.

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:

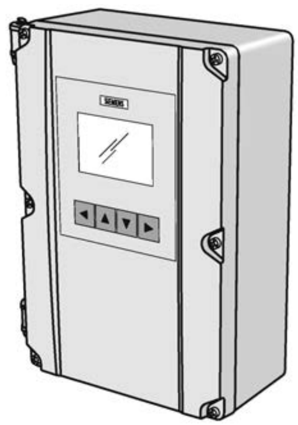
- They are authorized, trained or instructed in operating and maintaining devices and systems according to the safety regulations for electrical circuits, high pressures, aggressive, and hazardous media.
- They are authorized, trained, or instructed in carrying out work on electrical circuits for hazardous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

Description 3

3.1 Overview

The device is a six-relay ultrasonic controller for Level and Volume measurements, available in single- or dual-point models. It has Open Channel Monitoring capabilities, a large number of advanced pump control algorithms, and is equipped with digital communications.

The device features menu-driven programming and a host of wizards for plug-and-play performance, accessed through its four-button navigation panel with backlit graphical display.



3.2 Features

- Easy to use HMI display with local four-button programming, menu-driven parameters, and Wizard support for key applications
- English, German, French, Spanish, Chinese, Italian, Portuguese, and Russian texts on the HMI
- Removable terminal blocks for ease of wiring
- Digital input for back-up level override from point level device
- Communication using built-in Modbus RTU via RS 485 and SIMATIC PDM configuration software
- Compatible with SmartLinx system: PROFIBUS DP (cyclic access of process values only) and DeviceNET
- Single or dual point level monitoring
- Auto False-Echo Suppression for fixed obstruction avoidance
- Differential amplifier transceiver for common mode noise reduction and improved signal-to-noise ratio
- Level, volume, and flow measurements in open channels, differential control, extended pump control, and alarm functions
- Wall and panel mounting options

3.3 Applications

The device

- Can be used with various materials, including water, municipal waste, acids, woodchips, or on materials with high angles of repose.
- Offers true dual point monitoring, digital communications with built-in Modbus RTU via RS 485, as well as compatibility with SIMATIC PDM, allowing PC configuration and set-up.
- Features Sonic Intelligence advanced echo-processing software for increased reading reliability.
- Can monitor open channel flow and features more advanced relay alarming and pump control functions as well as volume conversion.
- Compatible with chemical-resistant EchoMax transducers that are approved for hostile environments.

Key Applications:

Wet wells, flumes/weirs, bar screen control, hoppers, chemical storage, liquid storage, crusher bins, dry solids storage

3.4 Approvals

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

Note

For more details, see Approvals (Page 292).

3.5 Modbus communication

This device supports Modbus communication protocol. For further information on the Modbus communication, see Communications installation (Page 315) and Modbus register map (Page 319).

Installing/mounting 4

4.1 Basic safety notes

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

CAUTION
Aggressive atmospheres
Damage to device through penetration of aggressive vapors.
• Ensure that the device is suitable for the application.

CAUTION
Direct sunlight
Device damage.
The device can overheat or materials become brittle due to UV exposure.
• Protect the device from direct sunlight.
• Make sure that the maximum permissible ambient temperature is not exceeded. Refer to the information in Technical data (Page 288).

WARNING

Improper installation

Danger to personnel, system and environment can result from improper installation.

- Installation shall only be performed by qualified personnel and in accordance with local governing regulations.
- This product is susceptible to electrostatic shock. Follow proper grounding procedures.
- All field wiring shall have insulation suitable for the highest applied input or relay voltage (whichever is greater).
- Hazardous voltages present on transducer terminals during operation.
- DC input terminals shall be supplied from a source providing electrical isolation between the input and output, in order to meet applicable safety requirements of IEC 61010-1 (e.g. Class 2 or Limited Energy Source).

CAUTION

Electrostatic discharge precaution

Observe electrostatic discharge precautions prior to handling electronic components within the wiring compartment.

Note

- If relay contact terminals are used to control hazardous live circuits (≥ 16 Vrms @ 0.5 A), the equipment connected to the relay contacts shall have no accessible live parts and its wiring shall have insulation suitable for the highest applied input or relay voltage (whichever is greater). The maximum allowable working voltage between adjacent relay contacts shall be 250 V.
- The non-metallic enclosure does not provide grounding between conduit connections. Use grounding type bushings and jumpers.
- Before opening the lid, ensure that the inside of the enclosure will not be contaminated with liquids or dust from the local environment.

Note

- Ensure power is removed from the device before servicing. Follow all local electrical safety codes and guidelines.
- Ensure power is removed from the device before disconnecting or connecting the HMI.
- If the device is to be shipped by air for any reason, e.g. return to the factory for repair, etc., use the pressure relief tag, or similar means, installed between the lid and enclosure base.
- [AC-Powered Units] All current-carrying conductors must be protected by a fuse or circuit breaker in the building installation, having a breaking capacity of up to 15 A.

4.2 Mounting Instructions

4.2.1 Mounting locations

Recommended

- Ambient temperature is always within -20 to +50 °C (-4 to +122 °F)
- Device display window is at shoulder level, unless most interaction is through a SCADA system
- Local display buttons are easily accessible
- Cable length requirements are minimized
- Mounting surface is free from vibration
- Sufficient room to swing device lid open

Avoid

- Exposure to direct sunlight. (Provide a sun shield to avoid direct sunlight.)
- Proximity to high voltage/current runs, contactors, SCR or variable frequency motor speed controllers

---

Note

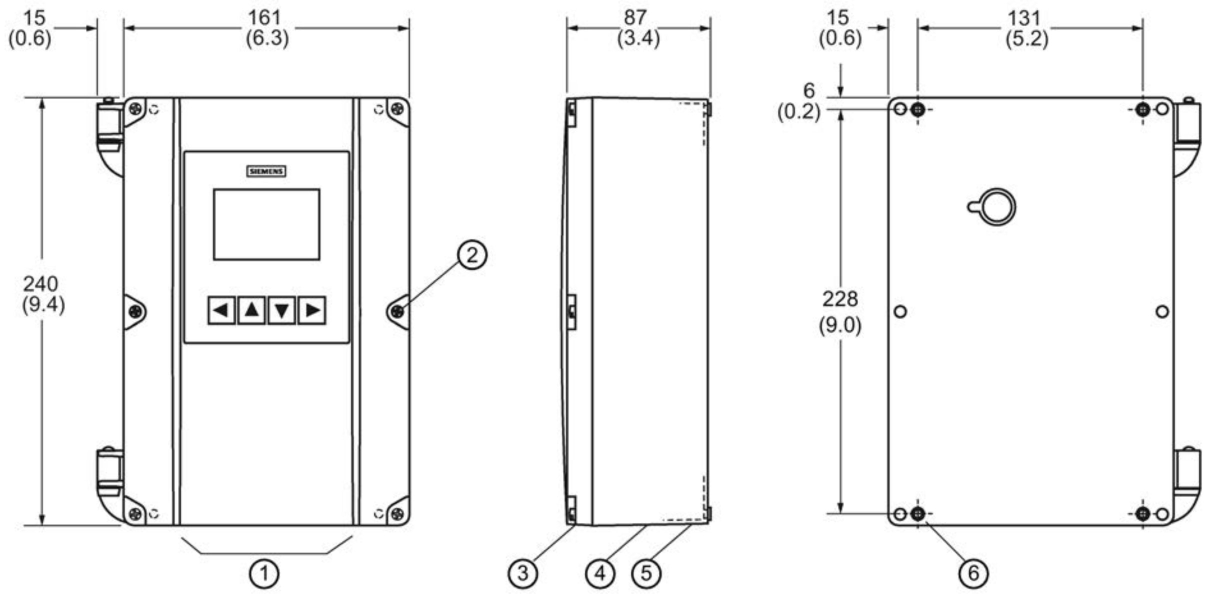
Recommended maximum torque for lid screws must not exceed 0.9 Nm (8 in-lbs).

4.2.2 Mounting on wall

Note

When routing cable through a conduit, please follow the instructions in routing cable through a conduit (Page 29).

Enclosure dimensions

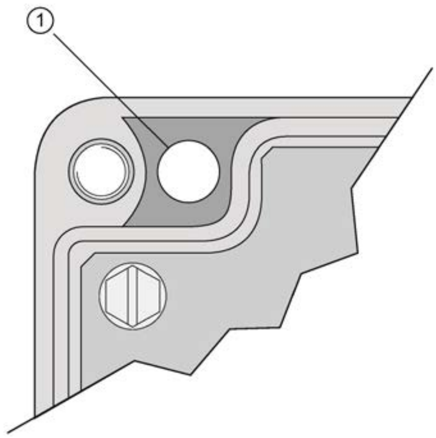


Dimensions in mm (inch)

① Cable entry location	④ Cable entry
② Lid screws (6)	⑤ Enclosure base
③ Enclosure lid	⑥ 4.3 mm diameter (0.17 inch), 4 mounting holes

Mounting the enclosure

1. Remove the lid screws and open the lid to reveal the mounting screw holes.
2. Mark and drill four holes in the mounting surface for the four screws (customer supplied).
3. Fasten with a long screwdriver.



① Mounting screw holes

Note

It is recommended to mount directly to wall or to electrical cabinet back panel with mounting screws: #6. If alternate mounting surface is used, it MUST be able to support four times the weight of the unit.

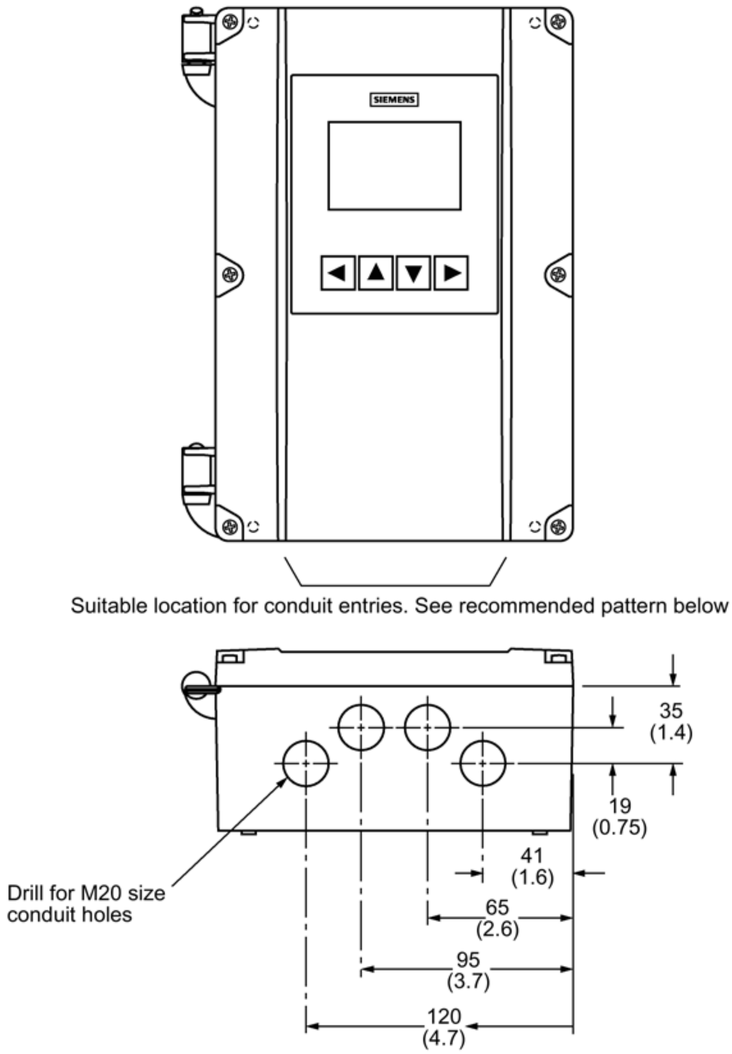
4.2.3 Cable routed through a conduit

> **CAUTION**
>
> **Electrostatic discharge precautions**
>
> Observe electrostatic discharge precautions prior to handling electronic components within the wiring compartment.

1. Disconnect the Display cable by pressing the locking tab and pulling it straight out.
2. Remove the four mounting screws holding the plastic cover and motherboard to the enclosure.
3. Remove the plastic cover by pulling it straight out. Be careful not to damage the motherboard and other electronic components with static electricity.
4. Remove the motherboard from the enclosure by pulling the board straight out. Be careful not to damage the electronics with static electricity.
5. Drill the required cable entry holes. Make sure conduit holes do not interfere with the lower areas on the terminal block, circuit board, or SmartLinx card. Please see the illustration below.
6. Attach the conduit to the hub before connecting the hub to the enclosure, using only approved suitable-sized hubs for watertight applications.
7. Reinstall the motherboard and plastic cover; secure them with the mounting screws.
8. Reconnect the Display cable.

Note

For conduit locations and assembly for hazardous mounting in Class I, Div 2 applications, see Conduit entry for Class I, Div 2 applications (Page 345).



Dimensions in mm (inch)

4.2.4 Cable exposed and entering through the cable glands

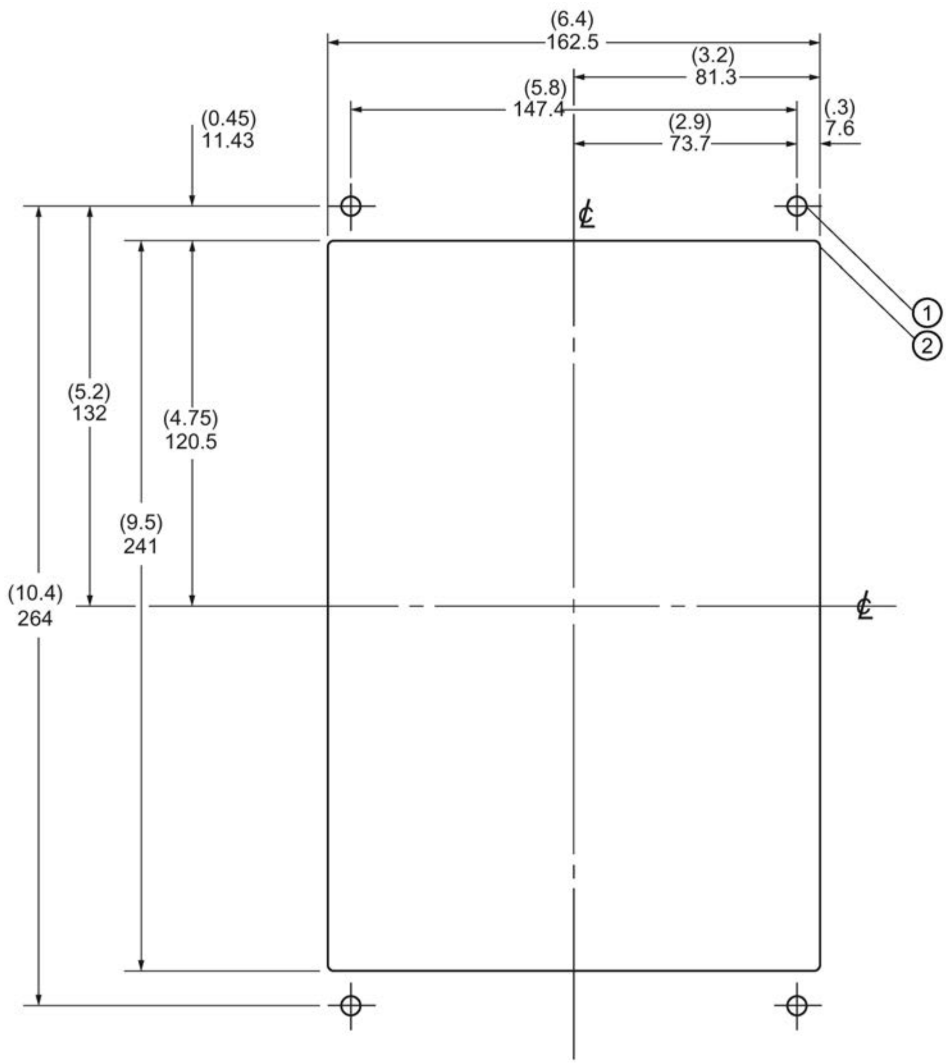
1. Unscrew the glands and attach them loosely to the enclosure.
2. Thread the cables through the glands. To avoid interference, ensure that the power cable is kept separated from the signal cables, and then wire the cables to the terminal blocks.
3. Tighten the glands to form a good seal.

Note

Where more holes are required than are supplied in the enclosure, follow the instructions in Cable routed through a conduit (Page 29).

4.2.5 Panel mount

Installing the panel mount unit requires making a cutout in the panel. The dimensions for the cutout are provided in the illustration below. A full size cutout template is provided with your unit or may be downloaded from https://support.industry.siemens.com (https://support.industry.siemens.com/cs/ww/en/view/18619938).



Dimensions in mm (inch)

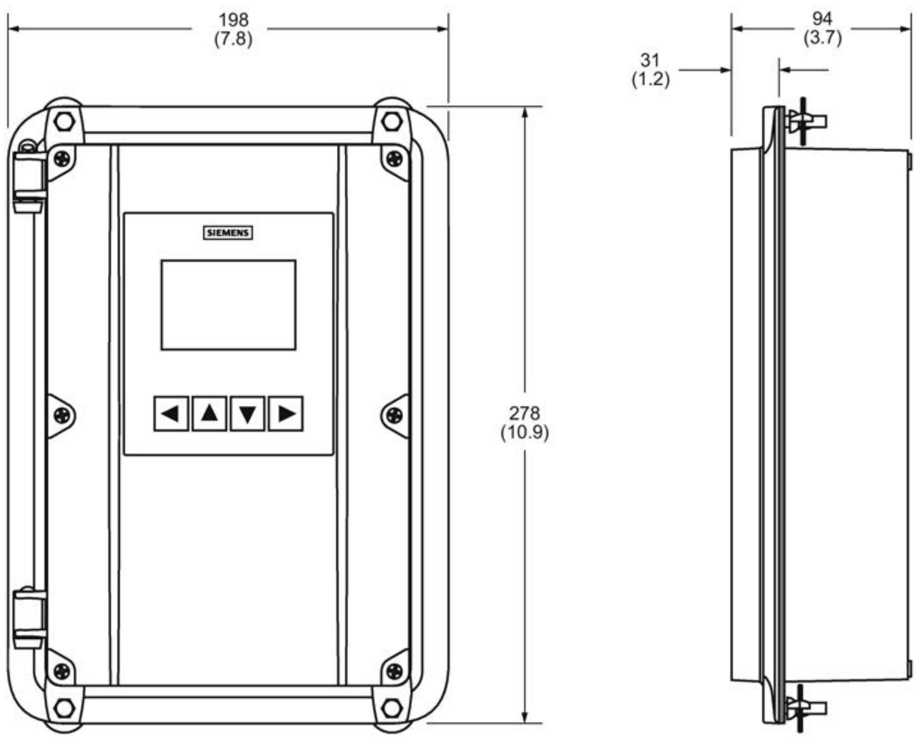
① 6.3 mm diameter (0.25 inch)

② Min. rad. (type)

4.2.6 Cutout instructions

1. Select a place for the unit and fasten the template onto the panel (use tape or tacks).
2. Drill the four fastener holes.
3. Make the cutout using the appropriate tools.
4. Mount unit according to the instructions in Mounting the enclosure (Page 33).

4.2.7 Panel mount dimensions



4.2.8 Mounting the enclosure

Once cutout is complete and mounting holes are drilled, follow these steps:

1. Remove the lid from the device by undoing its six lid screws and lifting it off its hinges.
2. Disconnect the display cable by pressing the locking tab and pulling straight out.
3. Remove the four screws holding the plastic cover and motherboard to the enclosure.
4. Remove the plastic cover by pulling it straight out. Be careful not to damage the motherboard electronics with static electricity.
5. Remove the motherboard from the enclosure by pulling the board straight out. Be careful not to damage the electronics with static electricity.
6. Drill the required cable entry holes. Be sure to compensate for panel door dimensions and make sure conduit holes do not interfere with the lower areas on the terminal block, circuit board, or SmartLinx card.
7. Reinstall the motherboard and plastic cover; secure them with the mounting screws.
8. Reconnect the display cable.
9. Place the unit into the panel and insert hexagonal fasteners through bevel slots and pre-drilled panel holes.
10. Fasten with wingnuts and hand tighten.
11. Add conduit or glands and wire as required.

Note

Use tape to hold the hexagonal heads in slots while attaching the wingnuts.

4.2.9 Wiring compartment

WARNING

Verify approval rating.

Check the device label on your instrument to verify the approval rating.

Use appropriate conduit seals to maintain applicable IP and NEMA ratings.

CAUTION

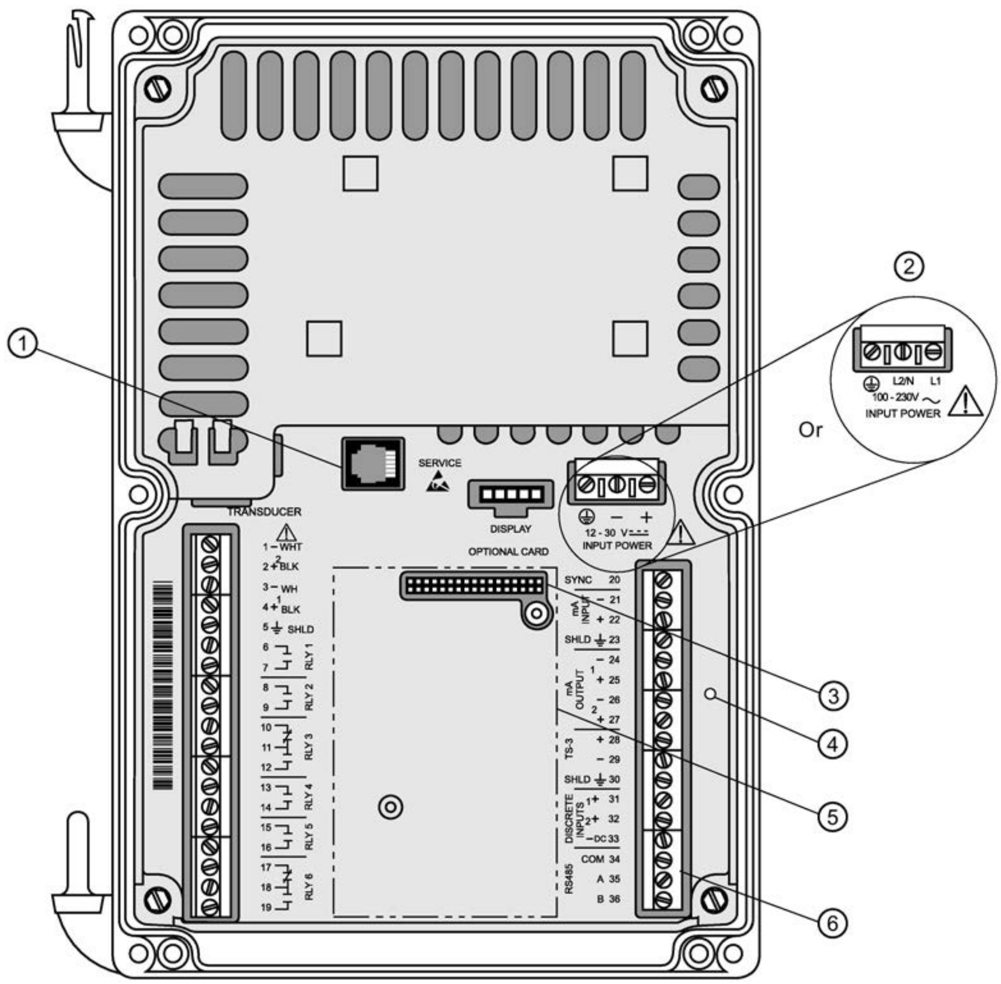
Ensure the terminal strips are terminated to the correct location during re-installation.

Failure to do so may result in damage to the device or the external equipment that is attached.

Note

- Terminal strips can be removed to improve ease of wiring.
- Separate cables and conduits may be required to conform to standard instrumentation wiring practices or electrical codes.

4.3 Wiring compartment



①	RS-232 RJ-11 connector	⑤	SmartLinx card (optional)
②	Power supply	⑥	RS-485 connections
③	Female connector for SmartLinx card		
④	Diagnostic LED		

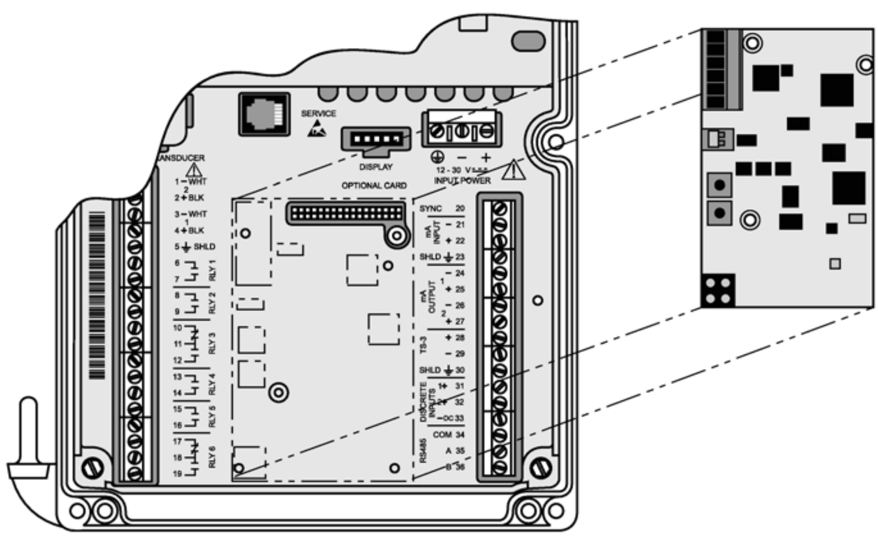
4.4 Installing the SmartLinx communication card

SmartLinx communications cards are generally pre-installed. If unit does not have a SmartLinx card, follow these steps to install the card:

1. Disconnect power to the device.
2. Align card with the two mounting posts and then press-fit with the female connector.
3. Use the screws supplied with the card to attach it to the mounting posts.
4. Wire in the SmartLinx card according to SmartLinx manual.

Note

For EMC compliance, it is necessary to install the provided clamp-on ferrite to the communications cable, at the connection point to the SmartLinx card.

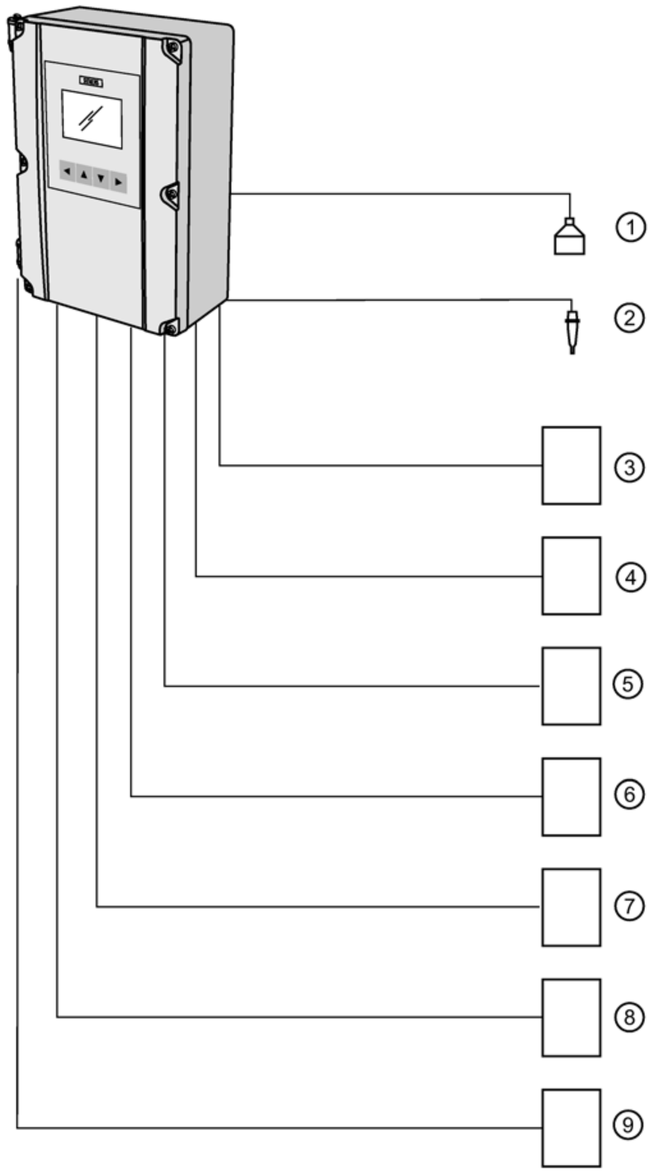


Connecting 5

5.1 Basic safety notes

> **WARNING**
>
> **Hazardous contact voltage**
>
> Risk of electric shock in case of incorrect connection.
>
> - For the electrical connection specifications, refer to the information in Technical data (Page 288).
> - At the mounting location of the device observe the applicable directives and laws for installation of electrical power installations with rated voltages below 1000 V.

5.2 Connecting diagram



① Siemens transducers

② Siemens TS-3 temperature sensor

③ Laptop

④ Customer alarm, pump, or control device

⑤ Customer device, digital output

⑥ Customer device, analog output

⑦ Customer network

⑧ SmartLinx card

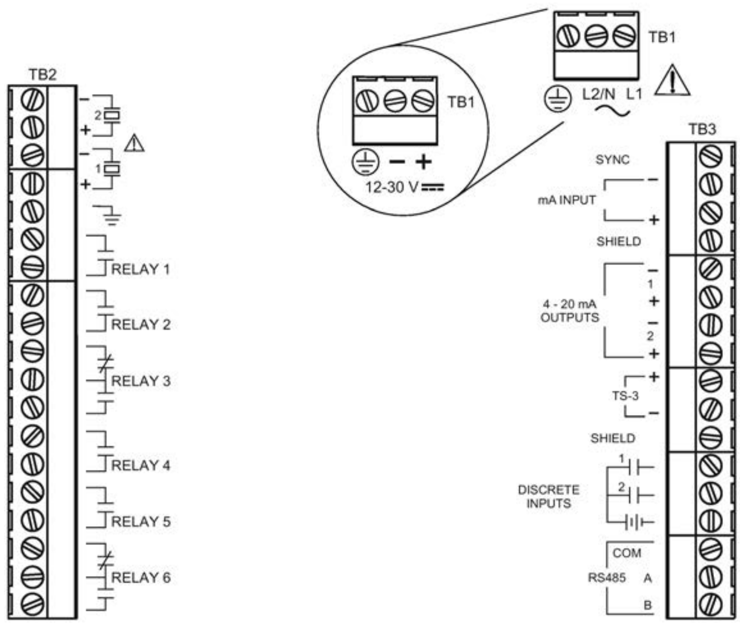
⑨ Display, PLC, chart recorder, or other control device

5.3 Terminal board

Note

Do not overtighten the terminal clamping screws. Recommended torque:

- 0.56 ... 0.79 Nm
- 5 ... 7 inch/lb



5.4 Cables

The device transceiver requires a shielded two-wire connection to the transducer.

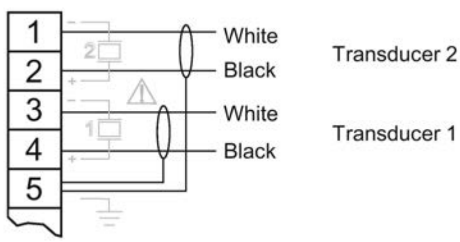
Connection	Cable type
mA input and mA output sync, temperature sensor, discrete input, DC input, transducer	2 copper conductors, twisted, with shield[1]/drain wire, 300 V 0.324 ... 0.823 mm^2 (22 ... 18 AWG) Maximum length: 365 m
Relay output, AC input	Relay to be copper conductors per local requirements to meet 250 V 5A contact rating.
	Using a co-axial transducer cable extension with this device is NOT recommended. If it is really necessary to use this cable, see Co-axial transducer extension (Page 343).

[1] Preferred shielding is braided screen.

5.5 Transducers

WARNING
Hazardous voltage on transducer terminals during operation
• Using a co-axial transducer cable extension with the device is NOT recommended[1)]
• Do not connect the shield and white transducer wires together; wire to separate terminals.
• Disregard older transducer manuals that recommend practices different from those listed above

[1)] If it is really necessary to use such cable, see Co-axial transducer extension (Page 343) for instructions.



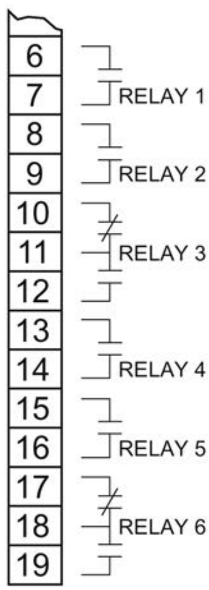
A 0.1 µF (100 V or greater) capacitor is included with the device for retrofitting older installations. For instruction on how to use a co-axial cable, see Co-axial transducer extension (Page 343)

5.6 Relays

Relay contacts are shown in the de-energized state. All relays are handled identically and can be configured as positive or negative logic using parameter Relay logic (2.8.1.11.) (Page 194).

Relay ratings

- Four Form A, NO relays (1,2,4,5)
- Two Form C, NO or NC relays (3,6)
- 5A at 250V ac, non-inductive



Note

Power failure

- All relays will fail in their de-energized states. Relays 1, 2, 4, and 5 are normally open and will fail open.
- Relays 3 and 6 can be wired either normally open or normally closed.

5.7 Temperature sensor

Accurate temperature readings are critical to accurate level measurements because the speed of sound changes, depending on air temperature, and all Siemens Echomax and ST-H transducers have an internal temperature sensor.

Having a separate TS-3 temperature sensor will ensure optimum accuracy if the following conditions apply:

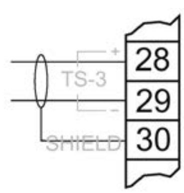
- The transducer is exposed to direct sunlight (or other radiant heat source).
- The transducer face and monitored surface temperature differs.
- Faster response to temperature changes is required.

To achieve the best performance of temperature measurement in a typical open channel flow application, the temperature sensor should be shielded from direct sunlight and mounted halfway between the ultrasonic transducer face and the maximum head achievable in the application. Care should be taken to avoid obstructing the direct sound path of the ultrasonic transducer.

Note

Use a TS-3 Temperature Sensor only. Leave terminals open (unused) if TS-3 is not deployed.

Temperature sensor

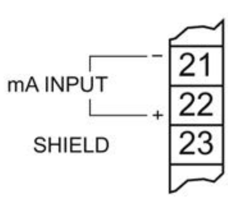


Black

White

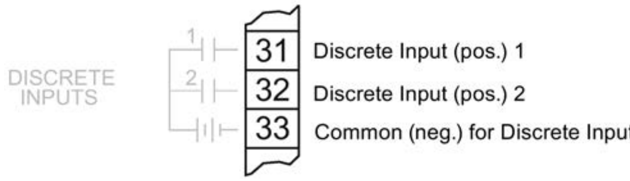
5.8 mA input

For more information, consult parameters Transducer (2.1.5.) (Page 160), mA input range (2.6.1.) (Page 180), 0/4 mA level value (2.6.2.) (Page 180), and 20 mA level value (2.6.3.) (Page 180).



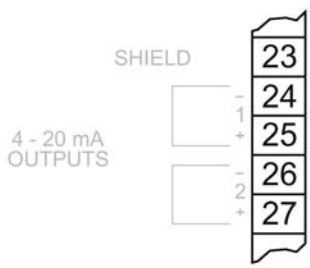
5.9 Discrete inputs

Discrete inputs that have a positive and negative terminal require an external power supply.



5.10 mA output

For more information, consult parameter Current Output (2.5.) (Page 176).



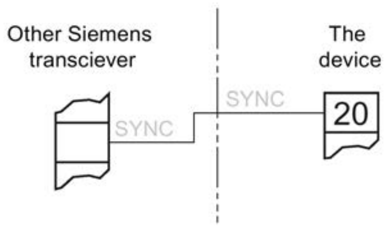
Note

The device CANNOT be synchronized with the following products: MultiRanger Plus, HydroRanger Plus, OCM III.

5.11 Level system synchronization

When using multiple ultrasonic level monitors, running the transducer cables in separate grounded metal conduits is recommended.

When separate conduits are not possible, synchronize the level monitors so that no unit transmits while another is waiting for echo reception.



Synchronizing with another MultiRanger 200 HMI/HydroRanger 200 HMI, or other Siemens instruments (DPL+, SPL, XPL+, LU01, LU02, LU10, LUC500, MultiRanger 100/200, HydroRanger 200, EnviroRanger, MiniRanger, SITRANS LUT400):

- Mount the level monitors together in one cabinet.
- Use a common power (mains) supply and ground (earth) for all units.
- Interconnect the SYNC terminals of all level monitors
- Set parameter Shot synchro (2.1.13.) (Page 163)
- For assistance, contact your Siemens representative, or go to www.siemens.com/processinstrumentation (http://www.siemens.com/processinstrumentation)

5.12 Power

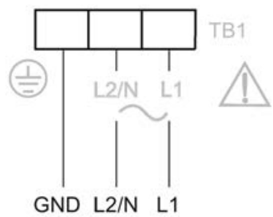
Note

Before applying power to the device for the first time, ensure any connected alarm/control equipment is disabled until satisfactory system operation and performance is verified.

Notes for AC power connections:

- [AC-Powered Units] All current-carrying conductors must be protected by a fuse or circuit breaker in the building installation, having a breaking capacity of up to 15A.
- [AC-Powered Units] A circuit breaker or switch in the building installation, marked as the disconnect switch, must be in close proximity to the equipment and within easy reach of the operator, and must disconnect all current-carrying conductors.

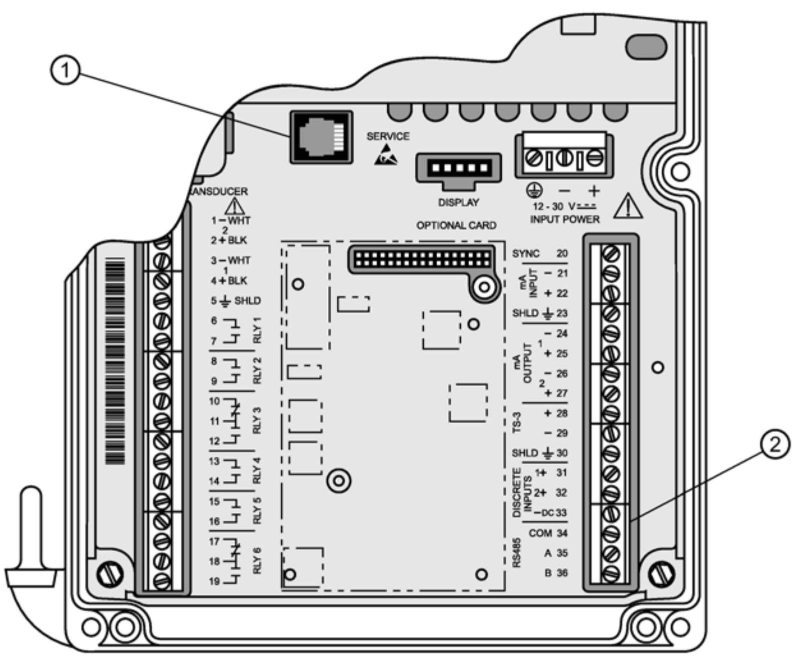
Ensure that the device is connected to a reliable ground.



5.13 Digital communication

Wiring the device for communications allows it to be integrated into a full SCADA system or an industrial LAN. The device can also be directly connected to a computer running SIMATIC PDM.

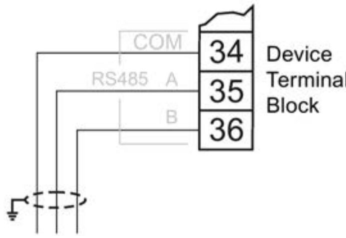
5.13.1 RS-232 serial connection



① RJ-11 jack

② RS-485

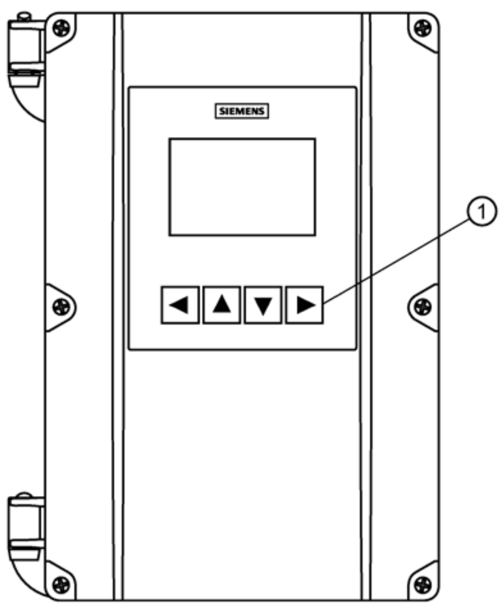
5.13.2 RS-485 serial connection



Commissioning 6

6.1 Local commissioning

The device is built for easy operation, making it possible to be commissioned quickly. Its parameters are menu-driven and can be modified locally using the local display and buttons, also known as the Human Machine Interface (HMI).



① Local push buttons

A Quick Start Wizard provides simple step-by-step procedures to help you configure the device for various applications. We recommend that configuration is done in the following order:

1. Run the appropriate Quick Start Wizard for your application (Level, Volume, Flow).
2. Set up pumps via the Pump Control Wizard (if applicable).
3. Configure alarms, or other controls, totalizers and samplers, referencing the respective parameters [see Parameter reference (Page 152). It is important that alarms and other controls are configured last to avoid pump relay assignments being overridden by the Quick Start Wizard.

Refer to Level application (Page 86) or Flow application (Page 87) for illustration examples. For the complete list of parameters, refer to Parameter reference (Page 152).

6.2 Activating the device

- The device has two modes of operation: RUN and PROGRAM.
- While the device is in PROGRAM mode, outputs are de-activated and the device does not measure the process.
- To enter PROGRAM mode using the device local push buttons, press ▶. Press ◀ to return to Measurement mode.
- The display will return to Measurement mode after ten minutes of inactivity (from last button press), when in PROGRAM mode and from within a Wizard. Pressing ▶ will then take you to the main navigation menu. (It will not return to the screen from which the timeout occurred.)

6.3 RUN mode

In RUN mode, the device detects material level and provides control functions. The device automatically starts in RUN mode when power is applied.

System status is shown on the display, or on a remote communications terminal.

Measurement views in RUN mode

The device provides two measurement views:

- Measurement View 1 displays the Primary Reading
- Measurement View 2 displays both the Primary Reading and the Auxiliary Reading.

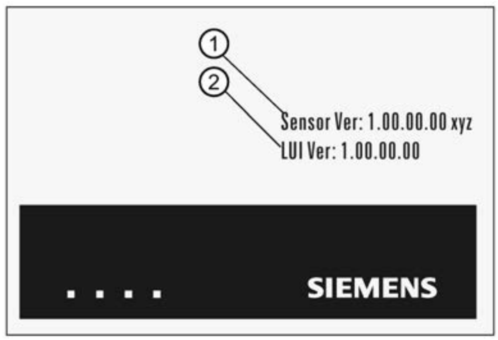
When the device is in RUN mode, you can switch between these views using the ▲ and ▼ arrow keys.

The value displayed in Primary Reading is determined by parameter Sensor mode (2.1.3.) (Page 159). On the other hand, the value displayed in Auxiliary Reading is preset when you adjust Sensor mode (2.1.3.) (Page 159), although you can change the selection later using Default auxiliary reading (2.12.7.) (Page 233).

6.3.1 The local display

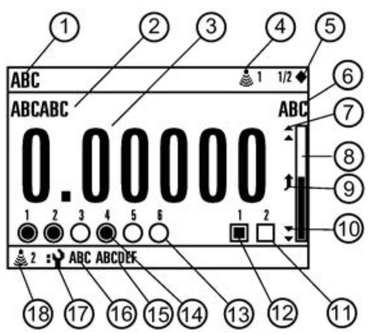
Measurement Mode Display: Normal operation

Startup splash screen

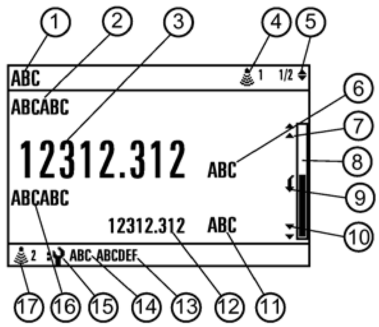


① Firmware version of sensor board
② Firmware version of display board

Measurement view 1



① Tag
② Primary reading type
③ Primary reading
④ Point identifier
⑤ Current view number
⑥ Primary reading units
⑦ Level alarm status (high)
⑧ Level bar graph
⑨ Filing
⑩ Level alarm status (low)
⑪ Discrete inputs (inactive)
⑫ Discrete inputs (active)
⑬ Relay (inactive)
⑭ Relay (active)
⑮ Fault text
⑯ Fault number
⑰ Device status indicator
⑱ Fault point



① Tag
② Primary reading type
③ Primary reading
④ Point identifier
⑤ Current view number
⑥ Primary reading units
⑦ Level alarm status (high)

⑧ Level bar graph
⑨ Emptying
⑩ Level alarm status (low)
⑪ Auxiliary reading units
⑫ Auxiliary reading
⑬ Fault text
⑭ Fault number
⑮ Device status indicator
⑯ Auxiliary reading name
⑰ Fault point

6.3.2 Display field descriptions

Display field	Description
Tag	A short description that can be set using parameter Tag (3.1.1.) (Page 248)
Primary Reading type	Identifies the type of measurement shown in the Primary Reading field.
Primary Reading	Displays the value of the Primary Reading. This value is selected by using a Quick Start Wizard or Sensor mode (2.1.3.) (Page 159). For more information on how to select a value, see Operating (Page 89).
Point Identifier	Level Point number for data currently displayed. For more information on measurement view scrolling, see Auxiliary reading (Page 52).
Current View Number	Displays the number of the Measurement View (1 or 2).
Primary Reading Units	The measurement of units corresponding to the Primary Reading. The field will be blank if the Primary Reading has no units.
Level Alarm Status (high/low)	Show the Hi/Hi-Hi and Lo/Lo-Lo level alarm statuses. Will display if one or more relays have been programmed for level alarms. For information about programming level alarms, see parameter Relay function (2.8.1.4.) (Page 191).
Level Bar Graph	Bar graph indicator that visually represents the level of the Point being displayed
Filling/Emptying	Indicates if the level is rising or falling. For information about programming, see Emptying indicator (2.3.10.) (Page 172) and Filling indicator (2.3.9.) (Page 172).
Discrete Inputs (active/inactive)	Displays information about which discrete inputs are programmed and the current state of each input. Discrete inputs are used to trigger or alter the way the device controls other devices such as pumps and alarms.
Relays	Information about which relays are programmed and what the current states of each relay are.
Fault Text	If there is a fault, this displays the description of the active fault. If there is no fault, the field will appear blank.
Fault Number	If there is an active fault, this field displays the number of the fault. For descriptions of possible faults, see General fault codes (Page 276).
Device Status Indicator	If two faults are present at the same time, the device status indicator and text for the highest priority will display.
Fault Point	The point number (1 or 2) of the fault.
Auxiliary Reading Units	The measurement units corresponding to the Auxiliary Reading. The field will appear blank if the Auxiliary Reading has no units.
Auxiliary Reading	Displays the value of the Auxiliary Reading. The value shown here is selected using Default auxiliary reading (2.12.7.) (Page 233). For more information on how to select the value display, see Auxiliary reading (Page 52).
Auxiliary Reading Name	Identifies the value shown in the Auxiliary Reading field.

6.3.3 Auxiliary reading

Measurement View 2 displays an Auxiliary Reading area in addition to the Primary Reading. The Auxiliary Reading can display additional information that you choose.

Setting a specific Auxiliary Reading

To set the value initially displayed in the Auxiliary Reading, use Default auxiliary reading (2.12.7.) (Page 233).

The Auxiliary Reading value that you choose is automatically synchronized with the Primary Reading value as the display scrolls through the Level Points. For example, if the Primary Reading is **Level** and you have chosen **Volume** for the Auxiliary Reading, the device will always show Level (in the Primary) and Volume (in the Auxiliary) for the same Level Point. The Level Point is shown in Measurement Mode Display as caption number 6 on the local display diagram (Page 49).

Temporarily overriding the Auxiliary Reading

You can temporarily override the value displayed in the Auxiliary Reading by pressing the ◀ arrow in RUN mode. This allows you to see values in the Auxiliary Reading area that are not associated with a particular Level Point.

For example, you may have configured the Primary Reading to display Flow, and the Auxiliary Reading to display Head. If you want to see what the milliamp outputs are, you can press the ◀ arrow. This first press of ◀ arrow will temporarily replace the Auxiliary Reading with milliamp output #1. Press the ◀ arrow again to display milliamp output #2, and press it a third time to see the milliamp input.

The device will continue to display your selected temporary value until the next power cycle. After a power cycle, the device will show the default auxiliary reading [see Default auxiliary reading (2.12.7.) (Page 233)] when you display Measurement View 2.

6.3.4 Multiple readings

During **differential** or **average** operation [Sensor Mode (2.3.1.) (Page 159) = Dual-Point Difference/Dual-Point Average (Page 159)], Measurement Views 1 and 2 scrolls sequentially through Point Numbers 1, 2, and 3. Point 3 is the difference between (or average of) Points 1 and 2.

Changing number scrolling speed

Parameter	Value	Description
Display Delay (2.12.8.) (Page 233)	5	Hold each value for 5 seconds

6.4 PROGRAM mode

The device is programmed by setting its parameters to match your specific application. Most parameters are indexed, allowing you to set the parameter to specific conditions and to more than one input or output. When the device is in PROGRAM mode, you can change these parameter values and set operating conditions.

The device's primary programming is through the four-button interface. For a full listing and explanation of parameter values, see Parameter reference (Page 152).

6.4.1 Key functions in Measurement mode

Key		Function	Result
		RIGHT arrow opens PROGRAM mode	Opens the top level menu
		LEFT arrow displays the next Auxiliary Reading value in Measurement View 2.	Scrolls through a list of available Auxiliary Reading values, such as Distance, Temperature, or Milliamp Output. For a complete list, see Default auxiliary reading (2.12.7.) (Page 233).
		UP or DOWN arrow toggles between Measurement View 1 and Measurement View 2	Local display shows Measurement View 1 or 2.

6.4.2 Programming the device

Note

- To enter PROGRAM mode using the device buttons, press ▶. Press ◀ repeatedly to return to RUN mode.
- While the device is in PROGRAM mode, outputs are de-activated and the device does not measure the process.

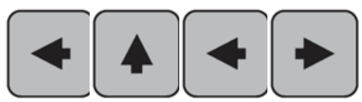
Change parameter settings and set operating conditions to suit your specific application.

6.4.3 Parameter menus

Note

For the complete list of parameters with instructions, see Parameter reference (Page 152).

Parameters are identified by name, organized into function groups, then arranged in a 5-level menu structure, as in the example below. For the full menu, see LCD Menu Structure (Page 357).



Quick Start Wizards (Page 57)
 Setup (2.) (Page 158)
   Sensor (2.1.) (Page 158)
   ...
   Relays (2.8.) (Page 189)
     Basic Setup (2.8.1.) (Page 189)
     Modifiers (2.8.2.) (Page 195)
       Wall Cling Reduction (2.8.2.6.) (Page 199)
         Transducer selector (2.8.2.6.1.) (Page 199)

Enter PROGRAM mode using local buttons:

RIGHT arrow ▶ activates PROGRAM mode and opens menu level 1.

Navigating: key functions in PROGRAM mode

Note

- In PROGRAM mode, ARROW keys move to the next menu item in the direction of the arrow.
- Press and hold any arrow key to scroll through a list of options or menus (in the direction of the arrow).
- A visible scroll bar indicates the menu list is too long to display all items.

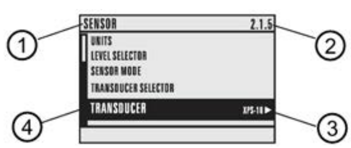
Key		Name	Menu level	Function
		**UP** or **DOWN** arrow	Menu or parameter	Scroll to previous or next menu or parameter.
		**RIGHT** arrow	Menu	Go to first parameter in the selected menu, or open next menu.
			Parameter	Open **Edit** mode.
		LEFT arrow	Menu or parameter	Open parent menu

Editing in PROGRAM mode

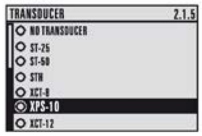
To select a listed option

1. Navigate to the desired parameter.
2. Press **RIGHT** arrow ▶ to open **Edit** mode. The current selection is highlighted.
3. Scroll to a new selection.
4. Press **RIGHT** arrow ▶ to accept current selection.

The LCD returns to parameter view and displays the new selection.

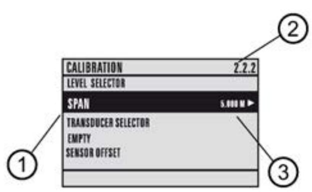


① Menu name
② Parameter number
③ Current value
④ Parameter name



Changing a numeric value

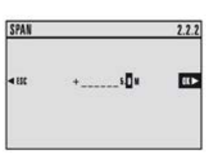
1. Navigate to the desired parameter.
2. When selected, the current value is displayed.
3. Press **RIGHT** arrow ▶ to open **Edit** mode. The cursor position is highlighted.
4. Use **LEFT** ◀ and **RIGHT** arrow ▶ to move cursor to digit position you wish to change.
5. As each digit is highlighted (selected), use the **UP** ▲ and **DOWN** arrow ▼ to increase or decrease the digit respectively.
6. While decimal point is selected, use **UP** ▲ and **DOWN** arrow ▼ to shift decimal position.
7. To escape without saving your changes, press **LEFT** ◀ arrow continually until **ESC** is highlighted. Press **LEFT** arrow ◀ again to escape without saving changes. Otherwise, when new parameter value is correct, press **RIGHT** arrow ▶ continually until **OK** is highlighted.
8. Press **RIGHT** arrow ▶ to accept the new value. The LCD returns to parameter view and displays the new selection. Review for accuracy.



① Parameter name

② Parameter number

③ Current value



6.4.4 Key functions in Edit mode

Key	Name		Function
 	**UP** or **DOWN** arrow	Selecting options	Scrolls to item
		Alpha-numeric editing	• increments or decrements digits • toggles plus and minus sign
	**RIGHT** arrow	Selecting options	• Accepts the data (writes the parameter) • Changes from **Edit** to **Navigation** mode
		Numeric editing	• Moves cursor one space to the right • or, with selection highlighted, accepts the data and changes from **Edit** to **Navigation** mode
	**LEFT** arrow	Selecting options	Cancels Edit mode without changing the parameter
		Numeric editing	• Moves cursor to plus/minus sign if this is the first key pressed • or, moves cursor one space to the left • or, with cursor on Enter sign, cancels the entry

6.5 Quick Start Wizards

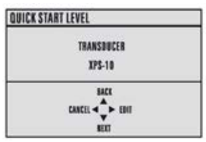
Wizards provide step-by-step Quick Start (QS) procedures that configure the device for simple applications. To configure the device for applications of Level, Volume (standard vessel shapes), or Flow, see Setting wizards via graphical display (Page 58).

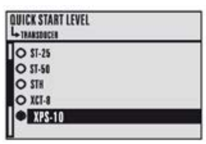
Wizards for applications employing more complex vessel shapes are available via SIMATIC PDM. For more details, see SIMATIC Process Device Manager (PDM) (Page 318).

Before initiating a Quick Start Wizard to configure the device, you may wish to gather the necessary parameter values. Parameter Configuration Charts that list all parameters and available options for each application type are available at www.siemens.com/processautomation (https://www.industry.siemens.com/topics/global/en/process-automation/pages/default.aspx). You can record data and select from options on the chart that apply to your application, then with this data on hand, complete the Setting wizards via graphical display (Page 58) below, or via another Quick Start Wizard, as referenced above.

6.5.1 Setting wizards via graphical display

1. Press **RIGHT** arrow ▶ to enter PROGRAM mode.
2. Choose Wizards (1.) (Page 57) > Quick Start (1.1) (Page 60), and then the appropriate quick start:
   – Quick Start Level (1.1.1.) (Page 60)
   – Quick Start Volume (1.1.2.) (Page 65)
   – Quick Start Flow (1.1.3.) (Page 72)
   – Pump Control (1.2.) (Page 81)
3. At each step, press **DOWN** arrow ▼ to accept default values and move directly to the next item, or **RIGHT** arrow ▶ to open Edit mode: the current selection is highlighted.





4. In Edit mode, scroll to desired item and press **RIGHT** arrow ▶ to store the change, then press **DOWN** arrow ▼ to continue.
5. Repeat steps 3 and 4 until you complete all the settings and get a prompt to configure another measurement point or relay (for Pump Control wizard). Pressing ▶ for YES lets you set another point or relay. Pressing ▼ for NO takes you to the end of the chosen wizard.
6. Press ▼ to FINISH and apply the settings made in that particular wizard. The display will then return to PROGRAM menu. Press ◀ to return to Measurement mode.

While configuring the device through the wizards, you can press **UP** arrow ▲ to go one step back, or **LEFT** arrow ◀ to cancel.

Notes:

- The Quick Start Wizard settings are inter-related and changes apply only after you choose Finish in the final step.
- After running the wizard, put the device in run mode in order to save the parameter settings.
- Perform customization for your application only after the Quick Start has been completed.
- The following are key terms used throughout the QSW and Parameters:

  Default: the factory-set value or option; indicated with an asterisk (*) or specified as a **preset value**.

  Global: pertains to values that are common for all inputs and outputs on the unit.

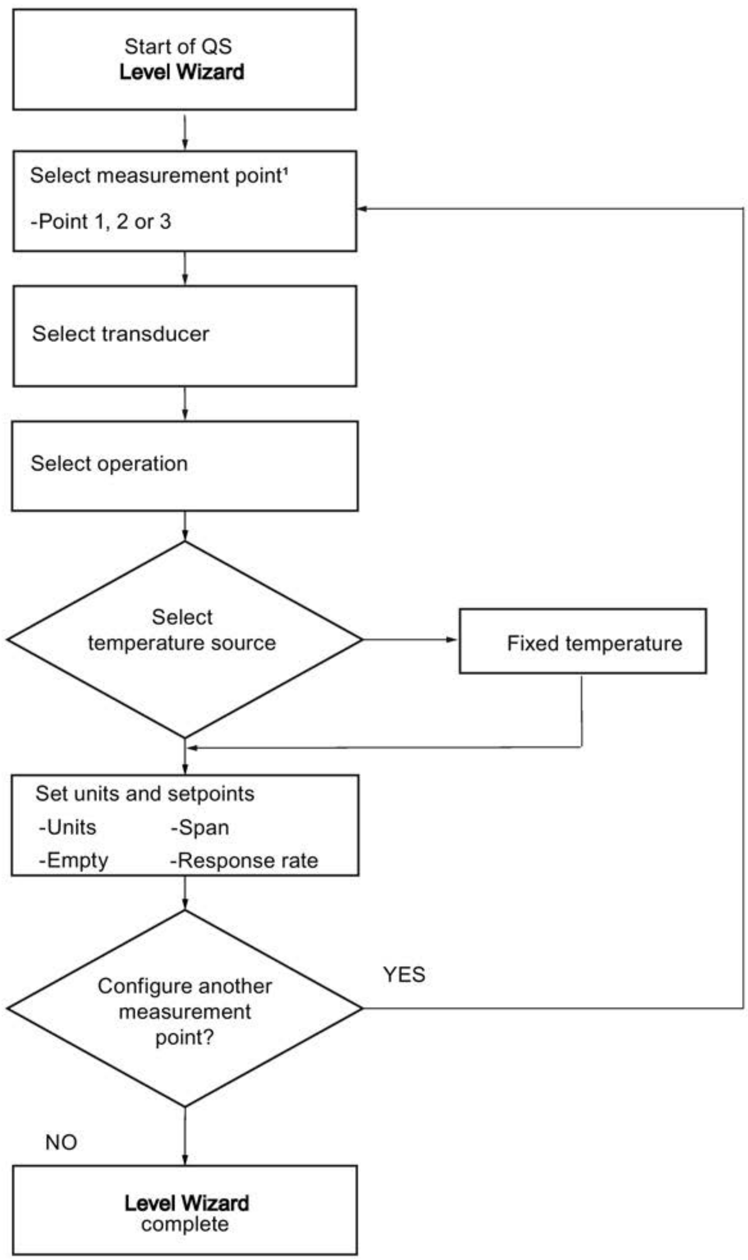
  Index: when parameters apply to more than one input, they are indexed. The index selector value defines the input/output for that parameter. For example, index relates to transducer inputs or mA outputs, and can also refer to relays, communications ports, and other parameters.

6.5.2 Wizards (1.)

6.5.2.1 Quick Start (1.1.)

Quick Start Level (1.1.1.)

Use this wizard to configure simple Level applications.



1) Available only on dual-point models.

Start of Quick Start Level wizard

Shows the type of Wizard to be executed.

Options	CANCEL
	START

Measurement point selector

Selects the measurement points to configure.

Note

This is available on the dual-point model only.

Options	Point 1
	Point 2
	Point 3

Transducer

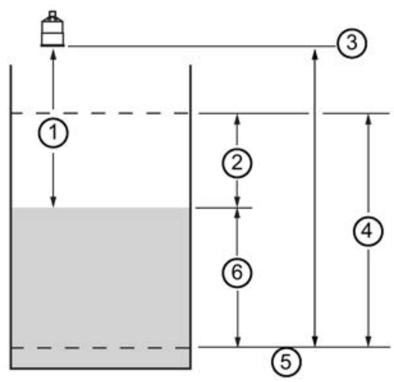
Specifies the model of the Siemens transducer connected to the device.

	Single-point model	**Dual-point model**
Index	Global	Transducer
Options	*No transducer (dual-point preset)	
	ST-25	
	ST-50	
	STH	
	XCT-8	
	*XPS-10 (single-point preset)	
	XCT-12	
	XPS-15	
	XRS-5	
	mA input	

Operation

Sets the type of measurement (and the corresponding mA output) required for the application.

Mode	Description	Reference point
Out of Service	Level Point is not activated	Not applicable
Level	Height of material	Empty (2.2.4.) (Page 166)
Space	Distance to material surface	Span (2.2.2) (Page 165)
Distance		Sensor reference point



① Distance
② Space
③ Sensor reference point
④ Span (2.2.2.) (Page 165)
⑤ Empty (2.2.4.) (Page 166)
⑥ Level

Temperature source

Selects the source of the temperature reading used to adjust the speed of sound.

Index	Transducer
Options	*AUTO
	Fixed Temperature
	Transducer
	External TS-3
	Average of Sensors

For more information, see Temperature source (2.11.1.4.) (Page 214).

Fixed Temperature

Sets the temperature of the source when there is no temperature-sensing device connected.

This parameter only displays if Fixed Temperature is selected for Temperature Source.

Value	Range: -100.0 ... +150.0 °C
	Default: +20.0 °C

Units

Sensor measurement units

Options	*M (meters)
	CM (centimeters)
	MM (millimeters)
	FT (feet)
	IN (inches)

Note

For the purpose of this example, all values are assumed to be in meters.

Empty

Sets the distance from the face of the transducer to the process empty point

Index	Level
Values	Range: 0.000 ... 99.000 m
	Preset: 5.000 m

Span

Sets the range to be measured

Index	Level
Options	Range: 0.000 ... 99.000 m [or equivalent, depending on Units (2.1.1.) (Page 158)]
	Preset: based on Empty (2.2.4.) (Page 166)

Response rate

Sets the reaction speed of the device to measurement changes in the target range.

Note

- Any changes made to Fill rate/minute (2.3.2.) (Page 169), Empty rate/minute (2.3.3.) (Page 169), or Response rate (2.3.4.) (Page 170) parameters following the completion of the wizard will supersede the Response Rate setting.
- Response Rate always displays in meters per minute (m/min).

Index	Transducer
Options	Slow (0.1 m/min)
	*Medium (1.0 m/min)
	Fast (10.0 m/min)
Factory setting	Medium (1.0 m/min)

Use a setting just faster than the maximum filling or emptying rate (whichever is greater). Slower settings provide higher accuracy, faster settings allow for more rapid level fluctuations.

Configure another measurement point

Gives option to configure more measurement points or end the wizard

---

Note

This is available on the dual-point model only.

Options	Yes	Returns to the Measurement Point menu
	No	Completes the Quick Start Level configuration

End of QS Level Wizard

Note

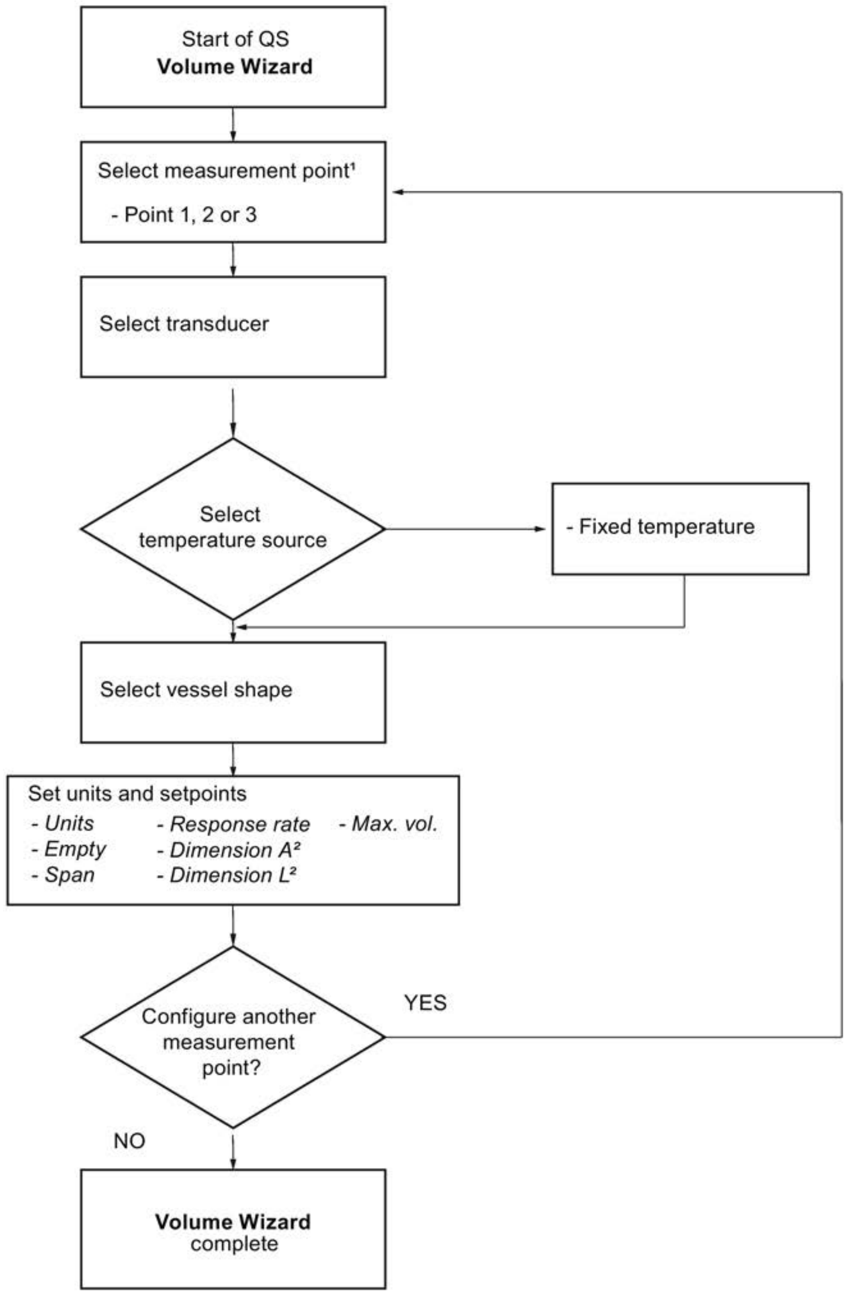
For QS to be successful, all changes must be applied.

Options	BACK, CANCEL, FINISH
	Display returns to Quick Start (1.1.) menu when Quick Start is successfully completed or cancelled. If CANCEL is selected, no changes are written to the device.

To transfer Quick Start values to the device and return to PROGRAM menu, press DOWN arrow ▼ (Finish). Then press LEFT arrow ◀ three times to return to Measurement mode.

Quick Start Volume (1.1.2.)

Use this wizard to configure Volume applications employing standard vessel shapes.



1) Available only on dual-point models

2) Depends on choice of vessel shape

Start of Quick Start Volume wizard

Shows the type of Wizard to be executed.

Options	CANCEL
	START

Measurement point selector

Selects the measurement points to configure.

Note

This is available on the dual-point model only.

Options	Point 1
	Point 2
	Point 3

Transducer

Specifies the model of the Siemens transducer connected to the device.

	Single-point model	Dual-point model
Index	Global	Transducer
Options	*No transducer (dual-point preset)	
	ST-25	
	ST-50	
	STH	
	XCT-8	
	*XPS-10 (single-point preset)	
	XCT-12	
	XPS-15	
	XRS-5	
	mA input	

Temperature source

Selects the source of the temperature reading used to adjust the speed of sound.

Index	Transducer
Options	*AUTO
	Fixed Temperature
	Transducer
	External TS-3
	Average of Sensors

For more information, see Temperature source (2.11.1.4.) (Page 214).

Fixed Temperature

Sets the temperature of the source when there is no temperature-sensing device connected.

This parameter only displays if Fixed Temperature is selected for Temperature Source.

Value	Range: -100.0 ... +150.0 °C
	Default: +20.0 °C

Vessel shape

Defines the vessel shape and allows the device to calculate **Volume** instead of **Level**. If **None** is selected, no volume conversion is performed. Select the vessel shape matching the monitored vessel or reservoir.

Options	None
	Flat Level Bottom
	Conical Bottom
	Parabolic Bottom
	Half Sphere Bottom
	Flat Sloped Bottom
	Flat Ends
	Parabolic Ends
	Sphere
	Universal Linear
	Universal Curved

For illustrations, see Vessel shape (2.7.2.) (Page 181). If Universal Linear or Universal Curved is selected, enter values for level and volume breakpoints after completing the wizard Table 1-8 (2.7.8.) (Page 186).

A vessel shape must be selected to proceed through the Quick Start Volume Wizard.

Units

Sensor measurement units

Options	*M (meters)
	CM (centimeters)
	MM (millimeters)
	FT (feet)
	IN (inches)

Note

For the purpose of this example, all values are assumed to be in meters.

Empty

Sets the distance from the face of the transducer to the process empty point

Index	Level
Values	Range: 0.000 ... 99.000 m
	Preset: 5.000 m

Span

Sets the range to be measured

Index	Level
Options	Range: 0.000 ... 99.000 m [or equivalent, depending on Units (2.1.1.) (Page 158)]
	Preset: based on Empty (2.2.4.) (Page 166)

Response rate

Sets the reaction speed of the device to measurement changes in the target range.

Note

- Any changes made to Fill rate/minute (2.3.2.) (Page 169), Empty rate/minute (2.3.3.) (Page 169), or Response rate (2.3.4.) (Page 170) parameters following the completion of the wizard will supersede the Response Rate setting.
- Response Rate always displays in meters per minute (m/min).

Index	Transducer
Options	Slow (0.1 m/min)
	*Medium (1.0 m/min)
	Fast (10.0 m/min)
Factory setting	Medium (1.0 m/min)

Use a setting just faster than the maximum filling or emptying rate (whichever is greater). Slower settings provide higher accuracy, faster settings allow for more rapid level fluctuations.

Dimension A

The height of the vessel bottom when the bottom is conical, pyramidal, parabolic, spherical, or flat-sloped.

Dimension A as used in Vessel shape (2.7.2.) (Page 181).

Index	Level
Values	Range: 0.0 ... 99.00 m or equivalent, depending on Units (2.1.1.) (Page 158).
	Preset: 0.000

Enter ONE of the following:

- Height of the tank bottom, if Vessel Shape (2.7.2.) (Page 181) = Conical Bottom, Parabolic Bottom, Half Sphere Bottom, or Flat Sloped Bottom
- Length of one end section of the tank, if Vessel Shape (2.7.2.) (Page 181) = Parabolic Ends, in Units (2.1.1.) (Page 158)

Dimension L

Length of the cylindrical section of a horizontal parabolic end vessel.

Dimension L as used in Vessel shape (2.7.2.) (Page 181).

Index	Level
Values	Range: 0.0 ... 99.00 m or equivalent, depending on Units (2.1.1.) (Page 158).
	Preset: 0.000

Enter: Tank length (excluding both end sections) if Vessel Shape (2.7.2.) (Page 181) = Parabolic Ends.

Maximum volume

The maximum volume of the vessel.

Enter the vessel volume corresponding to Span (2.2.2.) (Page 165). For example, if your maximum vessel volume is 8000 L, enter a value of 8000.

For readings in volumetric units (rather than percent), enter the equivalent vessel volume for Span (2.2.2.) (Page 165).

Index	Level
Values	Range: 0.000 ... 99999
	Preset: 100.0

Any volume units can be chosen because volume is calculated from empty to maximum span, and is scaled according to the Vessel shape (2.7.2.) (Page 181) value.

Note

Ensure the selected units allow LCD volume display.

Example:

- If max. volume = 3650 m^3, enter 3650
- If max. volume = 267500 gallons, enter 267.5 (thousands of gallons)

Configure another measurement point

Gives option to configure more measurement points or end the wizard.

Note

This is available on the dual-point model only.

Options	Yes	Returns to the Measurement Point menu
	No	Completes the Quick Start Volume configuration

End of QS Volume Wizard

Note

For Quick Start to be successful, all changes must be applied.

Options	BACK, CANCEL, FINISH
	Display returns to Quick Start (1.1.) menu when Quick Start is successfully completed or cancelled. If CANCEL is selected, no changes are written to the device.

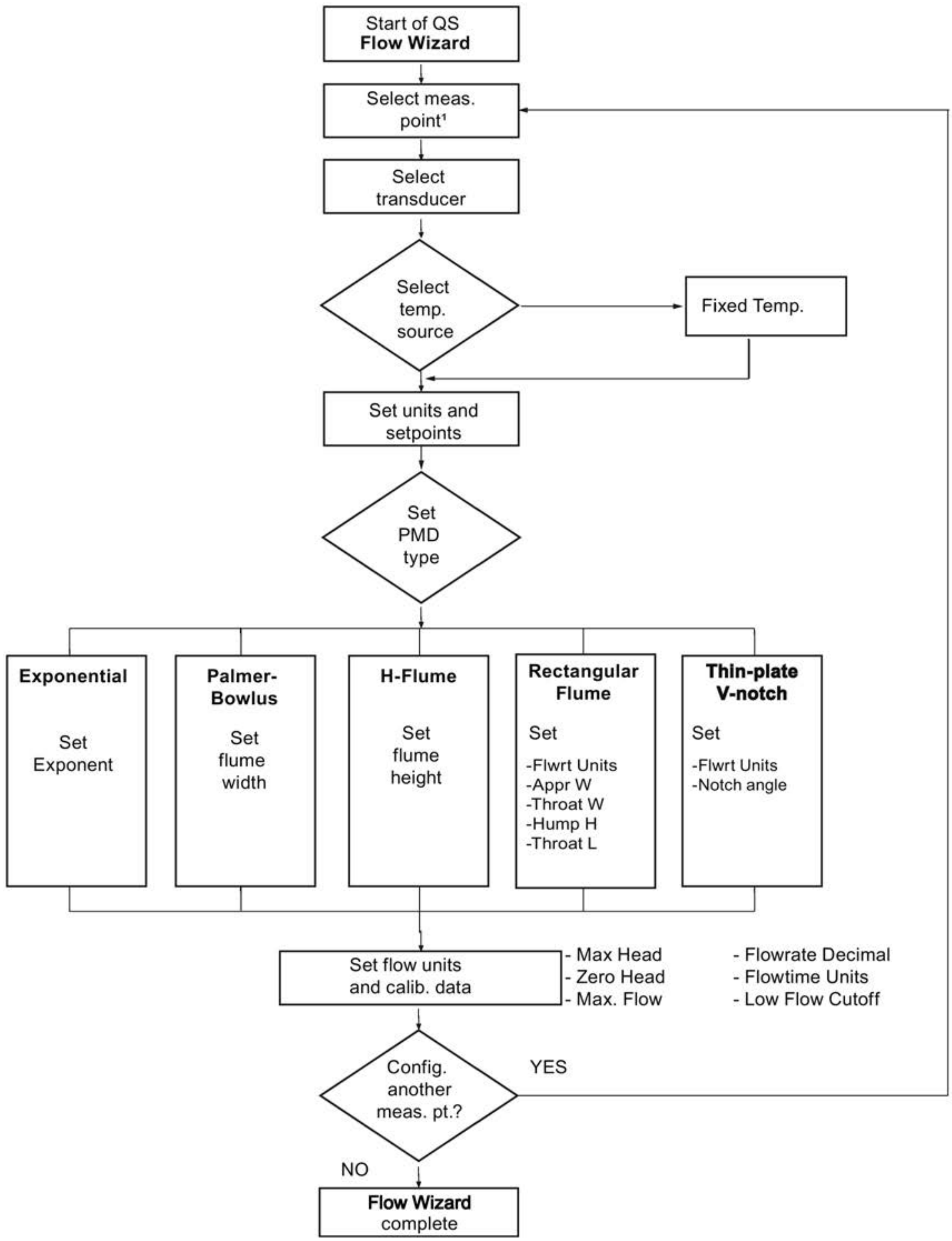
To transfer Quick Start values to the device and return to PROGRAM menu, press **DOWN** arrow ▼ (Finish). Then press **LEFT** arrow ◀ three times to return to Measurement mode.

Note

It is strongly recommended that an Auto Zero Head be performed after completion of the wizard to ensure best accuracy. For more information see Auto Zero Head (2.13.3.) (Page 235).

Quick Start Flow (1.1.3.)

Use this wizard to configure simple Flow applications.



1) Available only on dual-point models

Start of Quick Start Flow wizard

Shows the type of Wizard to be executed.

Options	CANCEL
	START

Measurement point selector

Selects the measurement points to configure.

Note

This is available on the dual-point model only.

Options	Point 1
	Point 2

Transducer

Specifies the model of the Siemens transducer connected to the device.

	Single-point model	**Dual-point model**
Index	Global	Transducer
Options	*No transducer (dual-point preset)	
	ST-25	
	ST-50	
	STH	
	XCT-8	
	*XPS-10 (single-point preset)	
	XCT-12	
	XPS-15	
	XRS-5	
	mA input	

Temperature source

Selects the source of the temperature reading used to adjust the speed of sound.

Index	Transducer
Options	*AUTO
	Fixed Temperature
	Transducer
	External TS-3
	Average of Sensors

For more information, see Temperature source (2.11.1.4.) (Page 214).

Fixed Temperature

Sets the temperature of the source when there is no temperature-sensing device connected.

This parameter only displays if Fixed Temperature is selected for Temperature Source.

Value	Range: -100.0 ... +150.0 °C
	Default: +20.0 °C

Units

Sensor measurement units

Options	*M (meters)
	CM (centimeters)
	MM (millimeters)
	FT (feet)
	IN (inches)

Note

For the purpose of this example, all values are assumed to be in meters.

Empty

Sets the distance from the face of the transducer to the process empty point

Index	Level
Values	Range: 0.000 ... 99.000 m
	Preset: 5.000 m

Span

Sets the range to be measured

Index	Level
Options	Range: 0.000 ... 99.000 m [or equivalent, depending on Units (2.1.1.) (Page 158)
	Preset: based on Empty (2.2.4.) (Page 166)

Response rate

Sets the reaction speed of the device to measurement changes in the target range.

Note

- Any changes made to Fill rate/minute (2.3.2.) (Page 169), Empty rate/minute (2.3.3.) (Page 169), or Response rate (2.3.4.) (Page 170) parameters following the completion of the wizard will supersede the Response Rate setting.
- Response Rate always displays in meters per minute (m/min).

Index	Transducer
Options	Slow (0.1 m/min)
	*Medium (1.0 m/min)
	Fast (10.0 m/min)
Factory setting	Medium (1.0 m/min)

Use a setting just faster than the maximum filling or emptying rate (whichever is greater). Slower settings provide higher accuracy, faster settings allow for more rapid level fluctuations.

Primary measuring device

The type of primary measuring device (PMD) used.

Index	Single-point model	Dual-point model
	Global	Transducer
Options1)	OFF	
	Exponential devices	see Flow exponent (2.13.4.1) (Page 235)
	Palmer-Bowlus Flume	see PMD dimensions (2.13.5.) (Page 241)
	H-Flume	
	Rectangular Flume BS- 3680	
	Thin Plate V-Notch Weir BS-3680	

1) Option will be set to **Other** if the wizard was run previously and the device was set to **OFF** or **Universal Head** vs. **Flow**. If this is the initial configuration, the PMD can only be set for no calculation (OFF), or for linearization (Universal Head vs. Flow).

Flow exponent

(Primary Measuring Device (Page 234) = Exponential devices (Page 234))

The exponent for the flow calculation formula.

Values	Range: -999.000 ... 9999.000
	Default: 1.550

Flowrate units

(Primary Measuring Device (Page 234) = Rectangular Flume BS-3680 (Page 234) or Thin Plate V-Notch Weir BS-3680 (Page 234))

The units used for flow calculations.

Note

Shown only when 2.13.2. Primary Measuring Device (Page 234)= Rectangular Flume BS-36806 or Thin Plate V-Notch Weir BS-36807.

	Single-point model	**Dual-point model**
Index	Global	Transducer
Options	**Ratiometric** Primary Measuring Device (2.13.2.) (Page 234) = all	*Ratiometric calculation
	Absolute Primary Measuring Device (2.13.2.) (Page 234) = Rectangular Flume BS-3680 or Thin Plate V-Notch Weir BS-3680 only)	L/S (Liters/second)
		M^3/H (Cubic meters/hour)
		M^3/D (Cubic meters/day)
		FT^3/S (Cubic feet/second)
		IMPGAL/MIN (Gallons/minute – Imperial)
		MIMPGAL/D (Million gallons/day – Imperial)
		GAL/MIN (Gallons/minute – U.S.)
		MUSGAL/D (Million gallons/day – U.S.)

V-notch angle

(Primary Measuring Device (Page 234) = Thin Plate V-Notch Weir BS-3680 (Page 234))

The V-Notch angle used in the flow calculation formula.

Values	Range: 25.000 ... 95.000
	Default: 25.000

Use this parameter if the Primary Measuring Device is directly supported. The dimensions required for each PMD vary.

PMD dimensions

The dimensions of the Primary Measuring Device (PMD).

Note

- For each PMD excluding Exponential Devices, [see Primary measuring device (2.13.2.) (Page 234), you must enter up to four dimensions.
- In the wizard, you will be prompted for each dimension required for the PMD selected, and the respective PMD dimension name will be displayed.

Index	Single-point model	Dual-point model
	Global	Transducer and Dimension

Index values for supported PMDs	**Dimension name (parameter menu reference)**	
	Palmer-Bowlus	
		Flume width (2.13.5.1. OCM Dimension 1) (Page 241)
	H-Flume	
		Flume height (2.13.5.1. OCM Dimension 1) (Page 241)
	Rectangular Flume BS-3680/ISO 4359	
		Approach width B (2.13.5.1. OCM Dimension 1) (Page 241)
		Throat width b (2.13.5.2. OCM Dimension 2) (Page 241)
		Hump height P (2.13.5.3. OCM Dimension 3) (Page 241)
		Throat Length L (2.13.5.4. OCM Dimension 4) (Page 241)
		Velocity coefficient (read only) (2.13.5.5. OCM Dimension 5) (Page 241)
		Discharge coefficient (read only) (2.13.5.6. OCM Dimension 6) (Page 241)
	Thin Plate V-Notch Weir	
		Notch angle (2.13.5.1. OCM Dimension 1) (Page 241)
		Discharge coefficient (read only) (2.13.5.2. OCM Dimension 2) (Page 241)

Maximum head

The level value associated with Maximum Flow, in Units (2.1.1.) (Page 158).

	Single-point model	Dual-point model
Index	Global	Transducer
Values	Range: -999 ... 999999	
	Preset: Span value (2.2.2.) (Page 165)	

This represents the highest head level supported by the PMD and works in conjunction with Maximum flow (2.13.4.3.) (Page 238) to define the highest point in the exponential curve. Use it when the PMD requires a maximum head and flow reference point. This would include Exponential, Palmer-Bowlus Flume, H-Flume, and Universal breakpoints.

Zero head

The distance above Empty (2.2.4.) (Page 166), in Units (2.1.1.) (Page 158) representing zero head (and zero flow).

	Single-point model	Dual-point model
Index	Global	Transducer
Values	Range: -999 ... 9999	
	Preset: 0.000	

This feature can be used for most weirs and some flumes (e.g. Palmer-Bowlus) where the zero reference is at a higher elevation than the channel bottom.

Maximum flow

The maximum flowrate associated with Maximum head (2.13.4.2.) (Page 237).

	Single-point model	Dual-point model
Index	Global	Transducer
Values	Range: -999 ... 9999	
	Preset: 1000	

This represents the flow at the highest head level supported by the PMD and works in conjunction with Maximum head (2.13.4.2.) (Page 237) to define the highest point in the exponential curve. Use it when the PMD requires a maximum head and flow reference point. This would include Exponential, Palmer-Bowlus Flume, H-Flume, and Universal breakpoints.

Also, use this parameter with Flow time units (2.13.4.4.) (Page 239) to define the flowrate units. The limitation of four digits is for the LCD only, and the flowrate value is available with greater precision through communications.

Note

- The display of the measured value is limited to six digits. A Maximum Flow value larger than seven characters will not display correctly.
- If measured value is larger than seven characters, the screen displays ####. A larger unit [Flow time units (2.13.4.4.) (Page 239)] should be used, or number of decimal points [Flowrate decimal (2.13.4.6.) (Page 240)] should be reduced.

Flowrate decimal

The maximum number of decimal places to be displayed.

Index	Single-point model	Dual-point model
	Global	Transducer
Options	No digits	
	1 digit	
	*2 digits	
	3 digits	

In RUN mode, the number of decimal places displayed is automatically adjusted (if necessary) to prevent the number of Flowrate digits from exceeding display capabilities.

The maximum number of head decimal places is controlled by Decimal position (2.12.4.) (Page 232)

Flow time units

Defines the units used to display current flow and logging flow values.

Index	Single-point model	Dual-point model
	Global	Transducer
Options	Seconds	
	Minutes	
	Hours	
	*Days	
Altered by	Flowrate units (2.13.4.7.) (Page 240)	

This is used when the Primary Measuring Device is Ratiometric (Flowrate units (2.13.4.7.) (Page 240) = Ratiometric).

Example:

Conditions	Enter
Flowrate display: millions of gallons/day, maximum flowrate is 376,500,000 gal-lons/day	**376.5** for Maximum flow (2.13.4.3.) (Page 238) **Days** for Flow time units (2.13.4.4.) (Page 239)

Low flow cutoff

Eliminates totalizer activity for flows at, or below the cutoff value.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 0.000 ... 9999	
	Preset = 5.000 %, in equivalent units	

Use this to enter the minimum head in Units (2.1.1.) (Page 158)

Configure another measurement point

Gives option to configure more measurement points or end the wizard.

Note

This is available on the dual-point model only.

Options	Yes	Returns to the Measurement Point menu
	No	Completes the Quick Start Volume configuration

End of QS Volume Wizard

Note

For Quick Start to be successful, all changes must be applied.

Options	BACK, CANCEL, FINISH
	Display returns to Quick Start (1.1.) menu when Quick Start is successfully completed or cancelled. If CANCEL is selected, no changes are written to the device.

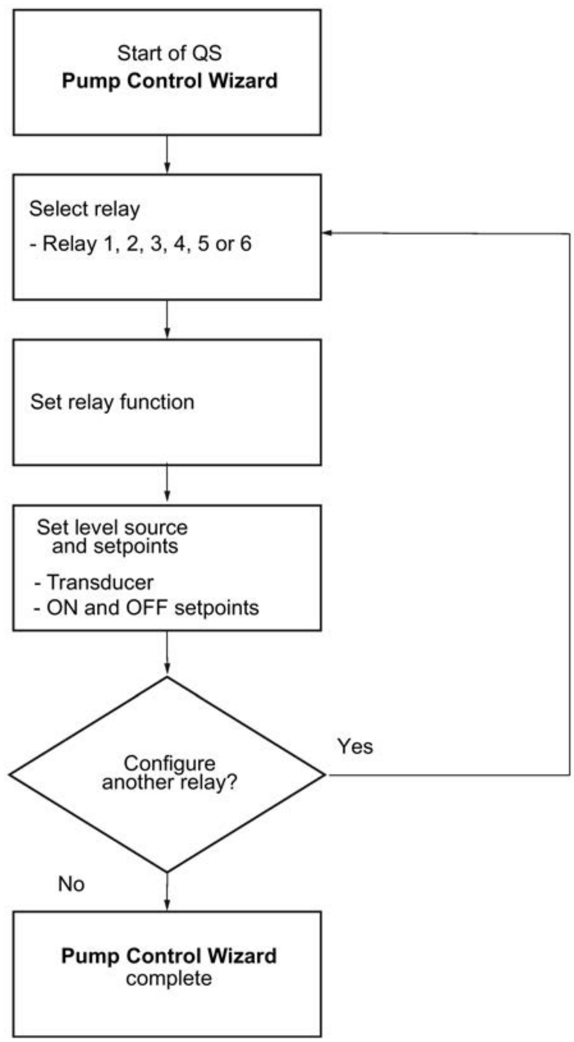
To transfer Quick Start values to the device and return to PROGRAM menu, press **DOWN** arrow ▼ (Finish). Then press **LEFT** arrow ◀ three times to return to Measurement mode.

Note

It is strongly recommended that an Auto Zero Head be performed after completion of the wizard to ensure best accuracy. For more information see Auto Zero Head (2.13.3.) (Page 235).

Pump control (1.2.)

Use this wizard to configure pumps if they will be used in your application. First, be sure to complete the applicable Quick Start Wizards.



Start of Quick Start Pump Control wizard

Shows the type of Wizard to be executed.

Options	CANCEL
	START

Relay selector

Selects the relay to be configured.

Options	Relays
	Relay 2
	Relay 3
	Relay 4
	Relay 5
	Relay 6

Relay function

Sets the pump function for the relay.

Options	Fixed Duty Assist
	Fixed Duty Backup
	Alternate Duty Assist
	Alternate Duty Backup
	Service Ratio Duty Assist
	Service Ratio Duty Backup
	First In First Out

For more details, see Relay function (2.8.1.4.) (Page 191).

Level source

Sets the level source for the indexed relay.

Index	Relays
Options	*Point 1
	Point 2
	Point 3

For more details, see Level source (2.8.1.2.) (Page 190).

Service ratio

Selects pump usage based on the RUN time ratio rather than last used.

Value	Range: 0 ... 255
	Default: 1

This parameter displays only if a Service Ratio algorithm is selected for Relay Function.

Pump hours

Sets the amount of time that pump relay has run, defined in hours.

Index	Relay
Values	Range: 0 ... 999999

This parameter displays only if a Service Ratio algorithm is selected for Relay Function.

ON setpoint

Sets the process point at which the relay changes from its **Normal** state.

Index	Relay
Values	Range: -999 ... 9999
	Preset: ----

For most applications, the relay is tripped at this point. This parameter is set according to Span (2.2.2.) (Page 165), even when another reading, such as volume, is shown on the LCD.

OFF setpoint

Sets the process point at which the relay returns to its **Normal** state.

Index	Relay
Values	Range: -999 ... 9999
	Preset: ----

For most applications, the relay is reset at this point. This parameter is set to Span (2.2.2.) (Page 165), even when another reading, such as volume, is shown on the LCD.

Configure another relay

Gives option to configure more relays or end the wizard.

Options	YES	Returns to the Relay Function menu
	NO	Completes the QS Pump Control configuration

End of QS Volume Wizard

Note

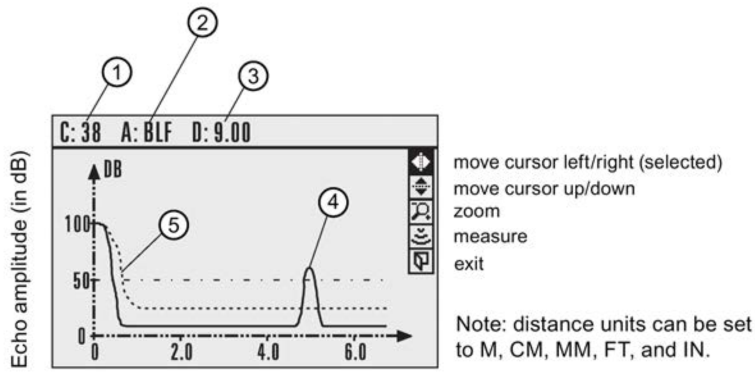
For QS to be successful, all changes must be applied.

Options	BACK, CANCEL, FINISH
	Display returns to 1.1 Quick Start menu when Quick Start is successfully completed or cancelled. If CANCEL is selected, no changes are written to the device.

To transfer Quick Start values to the device and return to PROGRAM menu, press **DOWN** arrow ▼ (Finish). Then press **LEFT** arrow ◀ three times to return to Measurement mode.

6.6 Requesting an echo profile

1. In PROGRAM mode, navigate to: **Main Menu > Diagnostics (3.2.) > Echo Profile (3.2.2.).**
2. Press **RIGHT** arrow ▶ to request a profile.



① Confidence[1]
② Algorithm BLF (best of first or largest echo)[2]
③ Distance from transducer to target
④ Echo
⑤ TVT

3. Use **UP** ▲ or **DOWN** arrow ▼ to scroll to an icon. When an icon is highlighted, that feature becomes active.
4. To move a cursor, press **RIGHT** arrow ▶ to increase the value, **LEFT** arrow ◀ to decrease.
5. To **zoom** into an area, position the intersection of the cursors at the center of that area, select Zoom, and press RIGHT arrow ▶. Press **LEFT** arrow ◀ to zoom out.
6. To update the profile, select **Measure** and press **RIGHT** arrow ▶ .
7. To return to the previous menu, select **Exit** then press **RIGHT** arrow ▶ .

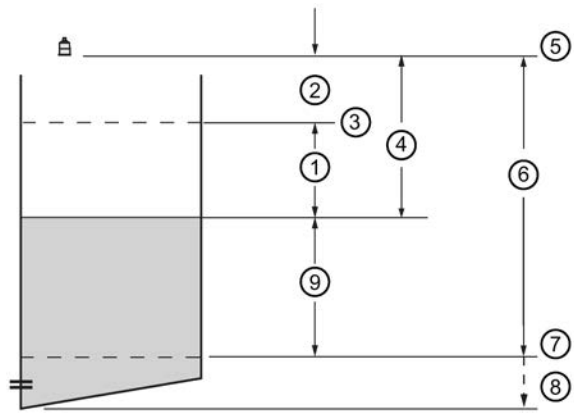
[1] Selected confidence. See Long confidence (3.2.11.2.) (Page 258) and Short confidence (3.2.11.3.) (Page 258).

[2] See Algorithm (2.11.2.2.) (Page 217) .

6.7 Application examples

In the examples that follow, substitute your own application details. If the examples are not suitable to your application, check the relevant parameter references for other available options.

6.7.1 Level application



① Space 7.5 m
② 1.0 m
③ Span
④ Distance 8.5 m
⑤ Sensor reference point
⑥ 15.0 m
⑦ Empty
⑧ Range extension
⑨ Level 6.5 m

Quick Start parameter	Setting	Description
Transducer	XPS-15	Transducer to be used with the device
Operation	Level	Material level referenced from Low Cal. Point
Temperature Source	TS-3	Temperature source
Units	m	Sensor measurement units
Empty	15.0	Process empty level
Span	1.0	Process full level
Response Rate	Slow	Sets Fill Rate[1]/ Empty Rate to 0.1 m/minute

[1] See Fill rate/minute (2.3.2.) (Page 169)

The application is a vessel that takes an average 3 hours (180 minutes) to fill and 3 weeks to empty.

Fill rate = (Empty – Span) / fastest of fill or empty time

= (15.5 m – 1 m) / 180 min.

= 14.5 m /180 min. = 0.08 m/min.

6.7.2 Flow application

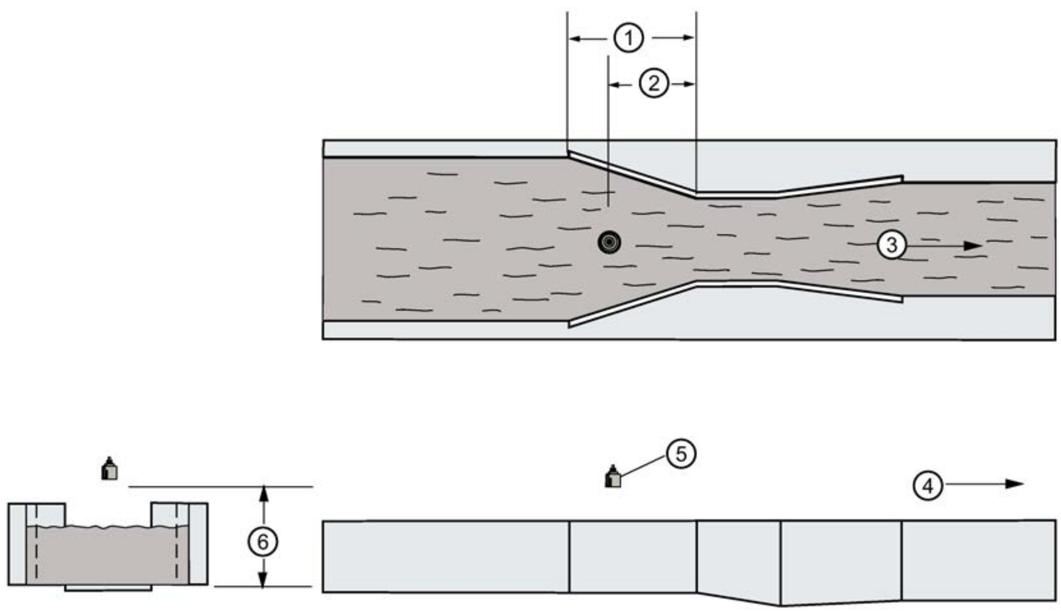
Parshall Flume

In this example, a 12-inch (0.305 m) Parshall Flume has been installed in an open channel. As per the supplier's data sheet, the device has been rated for a maximum flow of 1143 m^3 per hour at a maximum head of 0.6 m.

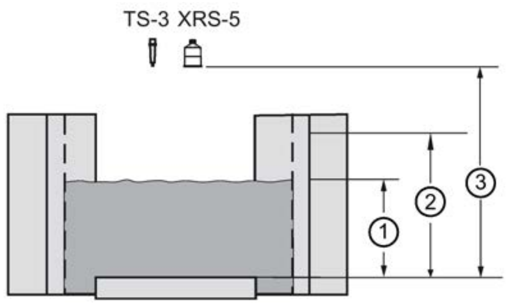
The Parshall Flume is considered an exponential device, therefore the supplier's data sheet includes a flow exponent value of 1.522.

The measuring device, and the XRS-5 transducer have been installed 1.6 m above the channel beside the TS-3 external temperature sensor.

During intermittent peak flow times, the head level can be expected to rise at a rate of approximately 0.12 m/min. The application also calls for a flow sampler to be activated every 1000 m^3, or 24 hours (whichever comes first), and for a fail-safe alarm to activate in the event of a loss of echo or cable fault.



① C = converging dimension
② 2/3 C
③ Q
④ Flow
⑤ Transducer
⑥ Zero head



① Head = 0.6 m
② Span = 1.0 m
③ Empty = 1.6 m

Operating 7

This chapter provides details on the general operation and functionality of the device. For instructions on the use of the device LCD and local push buttons, refer to The local display (Page 49)and LCD Menu Structure (Page 357).

Power up display

Single-point model	• Preset to display distance from the face of the transducer to the material • Transducer selection is preset for the XPS-10 • Empty distance is preset to 5 m (meters)
Dual-point model	• Starts in an OFF state and does not take Level measurements. • To set up measurement, the quick start parameters must be configured. • See Quick Start Wizards (Page 57)

Note

The number of points is an order option and is set by the factory. On a single-point model, the index for Sensor Mode (2.1.3.) (Page 159) is Global. On a dual-point model, the index for Sensor Mode (2.1.3.) (Page 159) is 1 or 2. For the index number location, see The local display (Page 49).

7.1 Single-point models

The device starts in **Distance** mode with the transducer preset for the XPS-10 and an empty distance of 5 meters. Change the following parameters to reflect your application parameters.

Parameter	Index	Value/mode	Description
Sensor mode (2.1.3.) (Page 159)	Global	*Level	Operation = *Level
Material (2.1.6.) (Page 161)	Global	Liquid	Material = *Liquid
Response rate (2.3.4.) (Page 170)	Global	Medium	Maximum Process Speed= *Medium (1.0 m/ min)
Transducer (2.1.5.) (Page 160)	Global	XPS-15	Read only = XPS-15
Units (2.1.1.) (Page 158)	Global	Meters	Units = Meters
Empty (2.2.4.) (Page 166)	Global	12	Empty = 12 m
Span (2.2.2.) (Page 165)	Global	10	Span = 10 m

7.1.1 Average or differential

For differential or average operation with a single-point device, set Operation to Sensor Mode (2.1.3.) (Page 159) = Dual-Point Difference (differential) (Page 159) or Dual-Point Average (average) (Page 159) and connect two transducers of the same type. All of the relevant parameters then become indexed by the correct transducer:

Index	Description
2	Indexed by Transducer 1 or 2
3	Indexed by **Level** measurement 1 = Transducer 1 2 = Transducer 2 3 = Calculated Level (average or difference)

7.2 Dual-point models

The device starts in an OFF state and does not take Level measurements. For measurement setup, configure these basic parameters:

If the application uses two Level Points, provide the basic information for each point separately.

Parameter	Index	Value/mode	Description
Sensor mode (2.1.3.) (Page 159)	1	*Distance	Operation =*Distance
	2	*Distance	Operation = *Distance
Material (2.1.6.) (Page 161)	1	Liquid	Material = *Liquid
	2	Liquid	
Response rate (2.3.4.) (Page 170)	1	Medium	Max. Process Speed = *Medium (1.0 m/min)
	2	Fast	Max. Process Speed = Fast (10.0 m/ min)
Transducer (2.1.5.) (Page 160)	1	XPS-15	Transducer = XPS-15
	2	XPS-10	Transducer = XPS-10 (single-point preset)
Units (2.1.1.) (Page 158)	Global	Meters	Units = Meters
Empty (2.2.4.) (Page 166)	1	12	Empty = 12 m
	2	4	Empty = 4 m
Span (2.2.2.) (Page 165)	1	11	Span = 11 m
	2	3.5	Span = 3.5 m

7.2.1 Average or differential

For differential or average operation dual-point device, set Operation to Sensor Mode (2.1.3.) (Page 159) = Dual-Point Difference (differential) (Page 159) or Dual-Point Average (average) (Page 159) and connect two transducers.

Note

If the device is a single point unit, transducers must be of the same type.

All the relevant parameters are filtered by the transducer selector.

Transducer Selector	Description
2	Indexed by Transducer 1 or 2
3	Indexed by **Level** measurement 1 = Transducer 1 2 = Transducer 2 3 = Calculated Level (average or difference)

7.2.2 Measurement conditions

The following information will help you configure your device for optimal performance and reliability.

Response rate

The response rate of the device influences the measurement reliability. Use the slowest rate possible with the application requirements.

The response rate is also important to functions connected to the filling or emptying indicators.

Dimensions

The dimensions of the vessel, wet well, or reservoir (except empty and span) are only important if you require volume. Volume is required to report the level value in terms of Volume. The pumped volume function can also report pumped volume or pump efficiencies.

Fail-safe indexes

The fail-safe parameters ensure that other devices controlled by the device default to an appropriate state when a valid level reading is not available.

- LOE timer (2.4.2.) (Page 173)
  - Fail-safe timer activates if an error condition is detected. Upon expiration of the timer, relay status defaults to values based on Material Level.
- Material level (2.4.5.) (Page 174)
  - Fail-safe material level determines the level reading if the fail-safe timer expires and the unit is still in an error condition.
- Relay fail-safe (2.8.2.3.) (Page 196)
  - Relay fail-safe controls the reaction of each relay. For more information, see Relay fail-safe (Page 101).

If Fail-safe Operation activates frequently, see Diagnosing and troubleshooting (Page 275).

7.3 Relays

7.3.1 General Introduction

Relays are the primary controls of external devices such as pumps or alarms. The device comes with extensive functions for relays. The device has six relays. Each one may be independently assigned to one function and has a corresponding status icon on the LCD.

The functions fall under three modes of operation:

Mode	Function
Alarm	Alarm ON = LCD Icon ON = relay coil de-energized
Pump	Pump ON = LCD Icon ON = relay coil energized
Miscellaneous	Contact closed = LCD Icon ON = relay coil energized

7.3.2 Relay functions

Each relay on the device can be programmed for a wide range of functions according to your application needs. The available function categories are Alarms, Pumps, Totalizing and Sampling, and Miscellaneous.

Setpoint - ON/OFF

If the ON setpoint is higher than the OFF setpoint, the relay operates as:

- High alarm
- Pump down control

If the ON setpoint is lower than the OFF setpoint, the relay operates as:

- Low alarm
- Pump up control

The ON and OFF setpoints can not be the same on an individual relay but may be common to other relays. The dead band or hysteresis is the difference between the ON and OFF setpoints. For in and out of bounds level alarms, the hysteresis is set at ± 2 % of span from either boundary.

7.3.3 Alarm

Level	In high alarm, the alarm is activated when the level rises to the ON setpoint and turns off when the level lowers to the OFF setpoint. In low alarm, the alarm is activated when the level lowers to the ON setpoint and turns off when the level rises to the OFF setpoint.
In-bounds	The relay will be in alarm if the level is inside the zone between the setpoints.
Out-of-bounds	The relay will be in alarm if the level is outside the zone between the setpoints.
Rate of change	The filling alarm **activates** when the rate of filling increases to the ON setpoint and **deactivates** when the rate of filling drops to the OFF setpoint. The emptying alarm **activates** when the rate of emptying increases to the ON setpoint and **deactivates** when the rate of emptying drops to the OFF setpoint. For emptying alarm, the setpoints must be entered as negative values.
Temperature	In high alarm, the function goes on when the temperature rises to the ON set-point and goes off when the temperature lowers to the OFF setpoint. In low alarm, the function goes on when the temperature lowers to the ON setpoint and goes off when the temperature rises to the OFF setpoint.
Loss of echo (LOE)	The function starts when the fail-safe timer expires. The function stops when a valid echo is received (fail-safe timer is reset).
Cable fault	The alarm is activated when a transducer cable is not connected properly (shorted or open).

7.3.4 Pump

Level

In pump down, the function goes on when the level rises to the ON setpoint and goes off when the level lowers to the OFF setpoint. In pump up, the function goes on when the level lowers to the ON setpoint and goes off when the level rises to the OFF setpoint.

7.3.5 Totalizing and sampling

For more details, refer to Totalizing pumped volume (Page 125). Relays are normally de-energized; contact closure is approximately 200 ms duration.

7.3.6 Relay status - Navigation pane

When the fail-safe timer expires, pump control relays respond as previously described. However, alarm relays will respond in the following manner:

Fail-safe mode	**Relay status**	
	High Alarm	Low Alarm
Fail-safe High	ON	OFF
Fail-safe Low	OFF	ON
Fail- safe Hold	HOLD	HOLD

Upon entering the Navigation View, all pump control relays will be turned OFF. Alarm relays will hold their prior status.

Note

- If the relay status can affect plant operation or personnel safety, it is advisable to override the relay functions or disconnect the relay wiring during calibration.
- Keep power disconnected at main breaker when device cover is opened.

7.3.7 Relay-related parameters

Some parameters affect how relays react during normal conditions:

<table>
<tr><td>Setpoint</td><td colspan="2">When a setpoint is reached, the corresponding action is taken. The setpoint can be an ON or OFF setpoint related to a process variable.</td></tr>
<tr><td>ON and OFF setpoints</td><td colspan="2">Sets the process point at which the relay is activated (ON setpoint) then reset (OFF setpoint). These setpoints are set separately for each pump within each pump control, and for each alarm type.</td></tr>
<tr><td>Preset Applications (2.8.1.3.) (Page 190)</td><td colspan="2">Sets the device to a preset application. These preset applications quickly set up the device with a minimum number of parameters.</td></tr>
<tr><td>Relay Function (2.8.1.4.) (Page 191)</td><td colspan="2">Sets the default state differently, depending on whether the relay is programmed as an alarm or a control. The alarm function de-energizes the relay coils. During normal operation (no alarms), the relay coils are energized. The control function energizes the relay coils. When the instrument is at rest (no controls operating) the relay coils are de-energized.</td></tr>
<tr><td>ON Setpoint (2.8.1.5.) (Page 192)</td><td colspan="2">Sets the process point at which the relay is activated.</td></tr>
<tr><td>OFF Setpoint (2.8.1.6.) (Page 192)</td><td colspan="2">Sets the process point at which the relay is de-activated.</td></tr>
<tr><td>Relay Logic (2.8.1.11.) (Page 194)</td><td colspan="2">Affects relay reaction. Reverses the logic (normally-open to normally-closed or vice versa).</td></tr>
<tr><td>Relay Fail-safe (2.8.2.3.) (Page 196)</td><td colspan="2">Changes how individual relays react to a fail-safe condition on the instrument.</td></tr>
<tr><td>Relay wiring test</td><td>Relay Logic Test (3.2.7.) (Page 251)</td><td>Checks the application wiring by forcing a relay control function, such as a level alarm or pump control setpoint. Ensure all the relay programming and wiring works properly.
Verify that ON and OFF respond correctly. Use this parameter as a final test once all of the relay programming is done.</td></tr>
</table>

7.3.8 Relay activation

The flexibility of the relay functions ensures that the device can support relay wiring for different systems and applications. Use the following as a guide to the most common parameters.

Relay setpoints and functionality

The setpoint can be an ON or OFF setpoint related to a process variable, or a timed setpoint based on interval and duration.

Functions affected by setpoint are configured by parameters that determine the application requirements such as timing. Relay Function (2.8.1.4.) (Page 191) sets the function requirements. Other function parameters:

- Delay Between Starts (2.8.2.8.1.) (Page 201)
- Power Resumption Delay (2.8.2.8.2.) (Page 202)
- Relay duration (2.10.1.3.) (Page 207)

Relay logic is modified

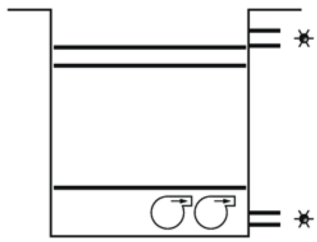
Normal operating conditions mean that alarm relays are energized and pumps are de-energized. This can be reversed using Relay Logic (2.8.1.11.). (Page 194)

7.3.9 Preset applications

Preset applications set up the relay parameters to predetermined values shown below:

OFF: all relays set to OFF

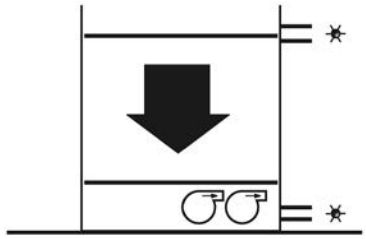
Wet Well 1



Pump down with the following settings:

Parameter	Relay #					
	1	2	3	4	5	6
Relay Function (2.8.1.4.) (Page 191)	Alternate Duty Assist	Alternate Duty Assist	Level (H)	Level (L)	OFF	OFF
ON Setpoint (2.8.1.5.) (Page 192)	70%	80%	90%	10%	--	--
OFF Setpoint (2.8.1.6.) (Page 192)	20%	20%	85%	15%	--	--

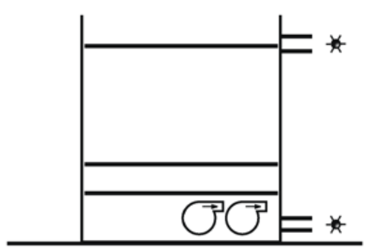
Wet Well 2



Pump down with the following level and rate settings:

Parameter	Relay #					
	1	2	3	4	5	6
Relay Function (2.8.1.4.) (Page 191)	Alternate Duty Assist	Alternate Duty Assist	Level (H)	Level (L)	OFF	OFF
ON Setpoint (2.8.1.5.) (Page 192)	70%	80%	90%	10%	--	--
OFF Setpoint (2.8.1.6.) (Page 192)	20%	20%	85%	15%	--	--
Pump by Rate (2.8.1.8.) (Page 193)	ON					
Pump by Rate (2.8.1.8.) (Page 193) sets the pump relays to accept control by rate of level change once the first ON setpoint is reached. Because the pumps are started by rate, you must change Emptying Indicator (2.3.10.) (Page 194) to desired empty rate.						

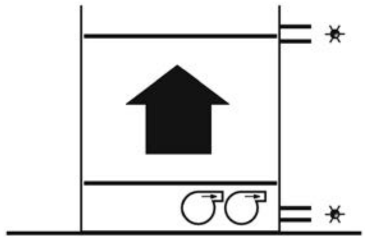
Reservoir 1



Pump up with the following level settings:

Parameter	Relay #					
	1	2	3	4	5	6
Relay Function (2.8.1.4.) (Page 191)	Alternate Duty Assist	Alternate Duty Assist	Level (H)	Level (L)	OFF	OFF
ON Setpoint (2.8.1.5.) (Page 192)	30%	20%	90%	10%	--	--
OFF Setpoint (2.8.1.6.) (Page 192)	80%	80%	85%	15%	--	--

Reservoir 2



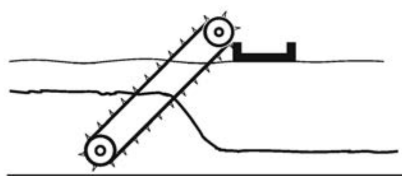
Pump up with the following level and rate settings:

Parameter	Relay #					
	1	2	3	4	5	6
Relay Function (2.8.1.4.) (Page 191)	Alternate Duty Assist	Alternate Duty Assist	Level (H)	Level (L)	OFF	OFF
ON Setpoint (2.8.1.5.) (Page 192)	20%	20%	90%	10%	--	--
OFF Setpoint (2.8.1.6.) (Page 192)	80%	80%	85%	15%	--	--
Pump by Rate (2.8.1.8.) (Page 193)	ON					
Pump by Rate (2.8.1.8.) (Page 193)sets the pump relays to accept control by rate of level change once the first ON setpoint is reached. Because the pumps are started by rate, you must change Filling Indicator (2.3.9.) (Page 172) to desired fill rate.						

Screen

Note

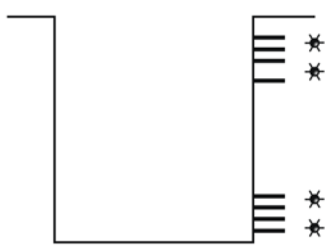
Before activating this preset, Sensor Mode (2.1.3.) (Page 159) must be set to Dual-Point Difference, and Span (2.2.2.) (Page 165) for Level 3 must be set.



Differential control of a screen or rake:

Parameter	Relay #					
	1	2	3	4	5	6
Level Source (2.8.1.2.) (Page 190)	Difference or average	Transducer 1	Transducer 2	Difference or average	OFF	OFF
Relay Function (2.8.1.4.) (Page 191)	Fixed Duty Assist	Level (H)	Level (L)	Level (H)	--	--
ON Setpoint (2.8.1.5.) (Page 192)	80%	90%	10%	90%	--	--
OFF Setpoint (2.8.1.6.) (Page 192)	20%	85%	15%	10%	--	--

Alarms



General alarms at four setpoints:

Parameter	Relay #					
	1	2	3	4	5	6
Relay Function (2.8.1.4.) (Page 191)	Level (H)	Level (L)	Level (HH)	Level (LL)	OFF	OFF
ON Setpoint (2.8.1.5.) (Page 192)	80%	20%	90%	10%	--	--
OFF Setpoint (2.8.1.6.) (Page 192)	75%	25%	85%	15%	--	--

7.3.10 Relay fail-safe

Adjusts how individual relays react to a fail-safe condition. Relays can be set to:

OFF	Response set by Material Level (2.4.5.) (Page 174)
HOLD	Stay at the last-known state
ENERGIZE	Energizes the relay
DE-ENERGIZE	De-energizes the relay coil

7.3.11 Security

The unit can still be put into PROGRAM mode when locked. Parameter values can also be viewed, but they cannot be changed. When Write Protection (5.1.) (Page 266) is set, programming is enabled. To disable programming, enter another value.

7.3.12 Parameter types

Read only parameters	Parameter values indicating status only. They cannot be altered.
Global values	Parameter values common to all inputs and outputs on the device.
Default values	Parameter default values are indicated with an * in the parameter tables.
Parameter reset	Master Reset (3.2.3.) (Page 250) returns all parameters to factory default values. Use conditions: • Before initial system installation • Following a software upgrade

7.3.13 Display readout

The following readouts are shown when the device cannot display a number.

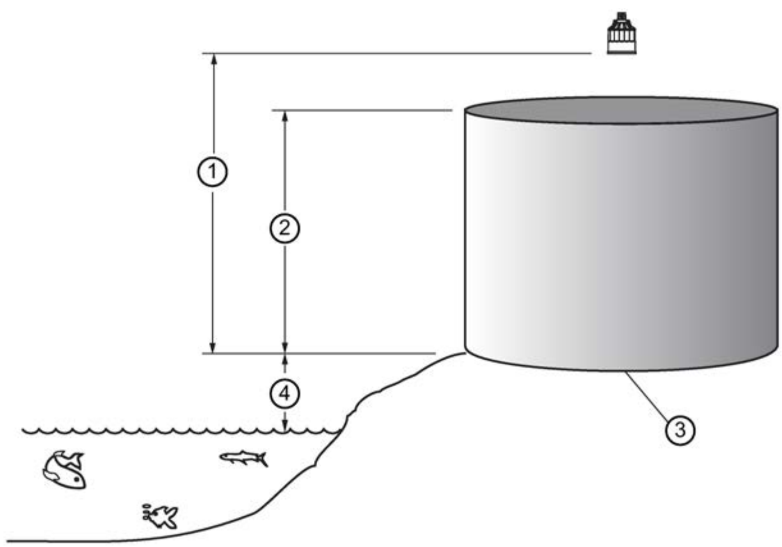
Display	Definition
- - - -	Parameter has not been set
####	Value too large to display

7.3.14 Adjusting the primary reading

Parameter	Action
Decimal position (2.12.4.) (Page 232)	Sets number of decimals
Convert Reading (2.12.5.) (Page 232)	Scales the reading to fit
Offset Reading (2.12.6.) (Page 233)	Shifts the reading up or down by a fixed amount

Example

To reference the displayed level to sea level, enter the distance in Units (2.1.1.) (Page 158), between Empty (2.2.4.) (Page 166) and sea level. (Enter a negative value if Empty is below sea level.)



① Empty (2.2.4.) (Page 166)
② Span (2.2.2.) (Page 165)
③ Reservoir
④ Offset Reading (2.12.6.) (Page 233)

Note

Offset Reading (2.12.6.) (Page 233) is the distance between sea level and Empty

---

7.4 Backup level override

Backup level override provides the option of overriding the ultrasonic input with another contacting point level device (for example, the Pointek CLS200). The ultrasonic reading is fixed at the programmed switch level until the discrete input is released; the override is then removed, and the device returns to normal measurement.

7.4.1 Backup level override parameters

Discrete Input Number (2.9.1.2.)

Sets the discrete input as the source of a level reading override

Level Override Value (2.9.1.3.)

Substitutes value for current reading when Discrete Input Number (2.9.1.2.) (Page 202) is activated. Value is added in current units and is valid only for the following:

- Level
- Space
- Distance
- Difference
- Average modes of operation
- Head level in OCM mode

Example

A high level backup switch is connected to Digital Input 2 in the same application as Transducer 1 at level value 4.3 m.

Settings

Parameter	Index	Value
Discrete Input Number (2.9.1.2.) (Page 202)	1	DI 2 Override Signal (Page 202)
Discrete Input Number (2.9.1.2.) (Page 202)	2	*No Override (Page 202)
Level Override Value (2.9.1.3.) (Page 203)	1	4.3
Level Override Value (2.9.1.3.) (Page 203)	2	–

When the level rises to 4.3 m and the switch is activated, the reading is forced to 4.3 m where it stays until the switch is de-activated.

Override Time Delay (2.9.1.4.)

Sets the time (in seconds) used to calm the override condition input

7.5 Discrete inputs

Discrete input logic affects the reaction of the discrete input. Normal state is the standard operation, with the device sensing the material level and controlling the pumps.

7.5.1 Wiring the discrete inputs

The contacts of the signalling device connected to the discrete inputs may be **Normally Open** or **Normally Closed**.

Example

Normal state for a backup high level switch is open, and the contacts on the discrete input are wired as normally open. This logic can also be reversed (Normally Open to Normally Closed or vice versa). Use the Discrete Input Logic (2.9.2.) (Page 204) parameters to set the state of each discrete input.

7.5.2 Adjusting the discrete input logic

The default for discrete inputs is **Normally Open**, which is an **Inactive** state because no signal is present on the terminal block connector. It becomes **Active** only when a signal is present on the terminal block. To change between **Inactive** and **Active**, use Discrete Input Logic (2.9.2.). (Page 204)

7.6 mA I/0

To integrate the device with other equipment, use the mA input and outputs. The mA input can be used as a **Level** measurement or can be passed on to a SCADA system.

7.6.1 mA Input

Level reading parameters

Parameter	Value	Description
Transducer (2.1.5.) (Page 160)	mA input	Transducer = mA input
mA Input Range (2.6.1.) (Page 180)	*4 to 20 mA	Scale = *4 to 20 mA
0/4 mA Level Value (2.6.2.) (Page 180)	0	4 mA = 0% of span
20 mA Level Value (2.6.3.) (Page 180)	100	20 mA = 100% of span
mA Damp Filter (2.6.4.) (Page 181)	0	Do not damp the input signal

To pass the mA input on to a SCADA system, read the value from the appropriate communication registers. For more information, see Input/output (R41,070 – R41,143) (Page 321).

7.6.2 mA Output

The device has two mA outputs used to send measurements to other devices. Below are settings for configuring the mA output to send a 4 to 20 mA signal, scaled from 10 % to 90 % of span, of the second transducer:

Parameter	Index	Value	Description
mA output range (2.5.2.) (Page 176)	1	*4 to 20 mA	Set to *4 to 20 mA range
Current output function (2.5.3.) (Page 177)	1	Level	Send mA proportional to Level reading
mA output allocation (2.5.4.) (Page 177)	1	Point 2	Base mA on Level Point 2
4 mA setpoint (2.5.5.) (Page 178)	1	10	Set 4 mA at 10% of span[1]
20 mA setpoint (2.5.6.) (Page 178)	1	90	Set 20 mA at 90% of span[2]
Fail-safe mode (2.4.4.) (Page 174)	1	0	Set fail-safe action as 0 mA

[1] If the level reading drops below 10% of span, the mA output drops below 4 mA.

[2] If the level reading rises above 90% of span, the mA output rises above 20 mA.

Calibrating 4 mA Output

1. Connect the mA receiving device to the device.
2. Put the device into Navigation View.
3. Set Milliamp Output (2.5.9.) (Page 178) to 4.0 for the selected mA output.
4. View the mA level on the receiving device.
5. If there is a discrepancy, do the following steps:
   - Attach an ammeter to the device's mA output.
   - Enter the exact value displayed on the ammeter into 4 mA Output Trim (2.5.11.) (Page 179)
   - The ammeter should then read exactly 4.00 mA.

The unit is now calibrated for 4 mA for the receiving device.

Calibrating 20 mA Output

1. Connect the mA receiving device to the device.
2. Put the device into Navigation View.
3. Set Milliamp Output (2.5.9.) (Page 178) to 20.0 for the selected mA output.
4. View the mA level on the receiving device.
5. If there is a discrepancy, do the following steps:
   – Attach an ammeter to the device's mA output.
   – Enter the exact value displayed on the ammeter into 20 mA Output Trim (2.5.12.) (Page 179)
   – The ammeter should then read exactly 20.00 mA.

The unit is now calibrated for 20 mA for the receiving device.

7.7 Volume

Volume is used in two situations:

1. To calculate and display **Volume** instead of **Level**.
2. To calculate pumped volume to accomplish the following:

- Totalize the volume of material that is pumped out of the wet well
- Set an alarm on pump efficiency

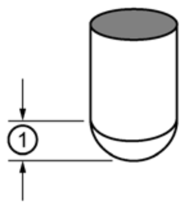
7.7.1 Readings

When using volume, volume values are presented in the same units specified in Maximum Volume (2.7.3.) (Page 183). The default is 100, which gives a reading in percent of total. Use whatever unit is applicable. If the value is too large for the six-digit LCD, use a larger unit.

7.7.2 Vessel shape and dimensions

The device can be configured to suit many common vessel or tank shapes [See Vessel shape (2.7.2.) (Page 181)]. Whenever possible, use one of those pre-defined selections. Each shape uses the Empty distance [Empty (2.2.4.)] (Page 166)] in its calculations of volume.

Some tank shapes also require extra dimensions to calculate the volumes. Do not estimate these values as they must be exact to ensure the accuracy of your volume calculations.



① A

To configure volume for a tank with a half-sphere bottom, set the following:

Parameter	Index	Mode/Value	Description
Vessel shape (2.7.2.) (Page 181)	1	Half Sphere Bottom	Selects the correct tank shape
Maximum volume (2.7.3.) (Page 183)	1	100	Sets maximum volume at 100 (per-cent)
Dimension A (2.7.4.) (Page 184)	1	1.3	Sets A to 1.3 m

Note

- The default reading changes to a range from 0 to 100 [the value in Maximum Volume (2.7.3.)] (Page 183)
- Empty [Empty (2.2.4.) (Page 166)] is still measured to the bottom of the tank, not the top of **A**.

7.7.3 Characterization chart

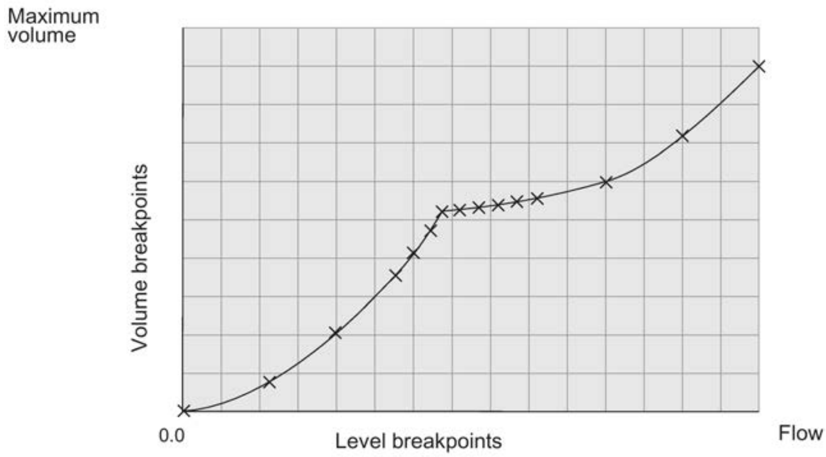
If you cannot use a pre-defined tank, then use one of the universal tank shapes and program the characterization curve.

1. Plot a volume-to-height chart. Usually, a tank supplier provides this chart. However, for custom-built wet wells, you need to have the complete drawings of the well or its accurate measurements.
2. Enter the curve values from this chart into the Volume tables under Table 1-8 (2.7.8.); (Page 186) Table 9-16 (2.7.9.); (Page 187)Table 17-24 (2.7.10.); (Page 188) and Table 25-32 (2.7.11.) (Page 189)
3. Ensure extra points are added around sharp transitions in the wet well volume (for example, as steps in the well wall).

Note

The end points in the curve are 0,0 (fixed) and the point defined by Span (2.2.2.) (Page 165) and Maximum Volume (2.7.3.) (Page 183)

Example



Maximum volume
Volume breakpoints
0.0
Level breakpoints
Flow

Parameter	Transducer Selector[1]	Value	Description
Level (3.2.8.3.) (Page 252)	1	0.0	Determines the Level breakpoints at which the volumes are known
		0.8	
		2.0	
		3.5	
		4.1	
		4.7	
		5.1	
		5.2	
		5.3	
		5.4	
		5.5	
		5.6	
		6.0	
		7.2	
		9.0	
Head (3.2.8.13.) (Page 254)	1	0.0	Determines the volumes which correspond to the level breakpoints. The universal calculations interpret between the breakpoints to produce an accurate model of the volume at all level readings. **Settings:** • Vessel Shape (2.7.2.) (Page 181) = Universal Linear (for linear approximation) • Vessel Shape (2.7.2.) (Page 181) = Universal Curved (for curved approximation) Linear approximation uses a linear algorithm; curved approximation uses a cubic spline algorithm.
		2.1	
		4.0	
		5.6	
		5.9	
		6.3	
		6.7	
		7.1	
		7.8	
		8.2	
		8.8	
		9.2	
		10.9	
		13.0	
		15.0	

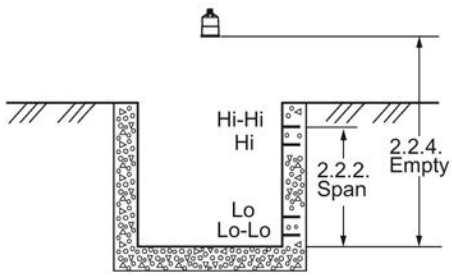
[1] To configure the breakpoint table for Level Point 1, set the Transducer Selector to 1. Enter the appropriate Level and Volume values into the menus <x.y.z> and <x.y.t> where x.y.z refers to Level and x.y.t refers to Volume.

7.8 Alarms

7.8.1 Level

The level alarm is the most common. Use this alarm to warn you when the process is in danger of being upset due to high or low levels. Generally, the four alarms used are Hi, Hi-Hi, Lo, and Lo-Lo.

Set the common parameters



Prerequisite:

You must know the details of your application and substitute the values for the sample values provided. If you are bench testing the unit, set your test values to be the same as the sample values.

Parameter	Index[1]	Value	Description
Sensor Mode (2.1.3.) (Page 159)	Global	*Level	Operation = *Level
Material (2.1.6.) (Page 161)	Global	Liquid	Material = *Liquid
Response Rate (2.3.4.) (Page 170)	Global	Medium	Maximum Process Speed = *Medium (1.0 m/min)
Transducer (2.1.5.) (Page 160)	Global	XPS-10	Transducer = XPS-10 (single-point preset)
Units (2.1.1.) (Page 158)	Global	Meters	Units = Meters
Empty (2.2.4.) (Page 166)	Global	1.8	Empty = 1.8 m
Span (2.2.2.) (Page 165)	Global	1.4	Span = 1.4 m

[1] This example assumes a base, single measurement unit. If your unit has optional dual-point software installed, then some parameters are indexed by two level points.

7.8.2 Setting simple level alarms

Set Relay selector (2.8.1.1.) (Page 189) to Relay 5 and set the other parameters according to the table below:

Parameter	Index	Mode/Value	Description
Level Source (2.8.1.2.) (Page 190)	5	Trans. 1	Set Level Source (2.8.1.2.) (Page 190), indexed to relay, to option Transducer 1
Relay Function (2.8.1.4.) (Page 191)	5	Level	Set Relay Function (2.8.1.4.) (Page 191), indexed to relay, to option Level for level alarm. Choose H, HH, L, or LL from the list of available designations, below.
ON Setpoint (2.8.1.5.) (Page 192)	5	1.2 m	Set the ON setpoint
OFF Setpoint (2.8.1.6.) (Page 192)	5	1.15 m	Set the OFF setpoint

7.8.3 Rate

Rate alarms can trigger an alarm if the vessel is filling/emptying too quickly.

Setting a filling rate alarm

Parameter	Index	Mode/Value	Description
Relay Function (2.8.1.4.) (Page 191)	5	Rate of Change	These settings trip the alarm when the reservoir is filling faster than 1 m per minute, and reset it at 0.9 m per minute.
ON Setpoint (2.8.1.5.) (Page 192)	5	1 m	
OFF Setpoint (2.8.1.6.) (Page 192)	5	0.9 m	

Setting an emptying rate alarm

Parameter	Index	Mode/Value	Description
Relay Function (2.8.1.4.) (Page 191)	5	Rate of Change	These settings trip the alarm when the reservoir is emptying faster than 1 meters per minute, and reset the alarm when emptying falls to -0.9 meters per minute.
ON Setpoint (2.8.1.5.) (Page 192)	5	-1 m	
OFF Setpoint (2.8.1.6.) (Page 192)	5	- 0.9 m	

7.8.4 In-bounds/Out-of-bounds Range

Use the bounded range alarms to detect when the level is inside or outside the range. By using a bounded range alarm, you can effectively put two level alarms (high and low) on one relay.

Setting an Out-of-bounds Alarm

Parameter	Index	Mode/Value
Relay Function (2.8.1.4.) (Page 191)	5	Out-of-bounds
ON Setpoint (2.8.1.5.) (Page 192)	5	1.3
OFF Setpoint (2.8.1.6.) (Page 192)	5	0.3
Relay Dead Band (2.8.2.5.) (Page 197)	5	0.05

Results:

- Trips alarm above 1.35 m and below 0.25 m
- Resets alarm below 1.25 m and above 0.35 m

Setting an In-bounds Alarm

Parameter	Index	Mode/Value
Relay Function (2.8.1.4.) (Page 191)	5	In-bounds
ON Setpoint (2.8.1.5.) (Page 192)	5	1.3
OFF Setpoint (2.8.1.6.) (Page 192)	5	0.3
Relay Dead Band (2.8.2.5.) (Page 197)	5	0.05

Results:

- Trips alarm below 1.25 m and above 0.35 m
- Resets alarm above 1.35 m and below 0.25 m

7.8.5 Cable fault

Activates an alarm if transducer cable circuit enters a shorted or opened state.

Parameter	Index	Mode/Value	Description
Relay Function (2.8.1.4.) (Page 191)	5	Cable Fault	Alarm on transducer cable fault
Level Source (2.8.1.2.) (Page 190)	5	Transducer 1	Alarm on Transducer 1

7.8.6 Temperature

Use the temperature alarm to activate an alarm when the temperature reaches the ON setpoint (2.8.1.5.) (Page 192). This alarm uses the same setpoint parameters as the level alarms [ON Setpoint (2.8.1.5.) (Page 192) and OFF Setpoint (2.8.1.6.) (Page 192)]

You can set a high alarm (ON Setpoint > OFF Setpoint) or a low alarm (ON Setpoint < OFF Setpoint).

This shows a high alarm:

Parameter	Index	Mode/Value	Description
Relay Function (2.8.1.4.) (Page 191)	5	Temperature	Alarm on temperature
ON Setpoint (2.8.1.5.) (Page 192)	5	45	ON setpoint at 45 °C
OFF Setpoint (2.8.1.6.) (Page 192)	5	43	OFF setpoint at 43 °C
Level Source (2.8.1.2.) (Page 190)	5	Transducer 1	Take the temperature reading from Transducer 1

The temperature source can be the temperature sensor built into the transducer or an external TS-3, as set by Temperature Source (2.11.1.4.). (Page 214)

7.8.7 Loss of Echo (LOE)

Activates an alarm when the device loss of echo timer passes without detecting a valid echo.

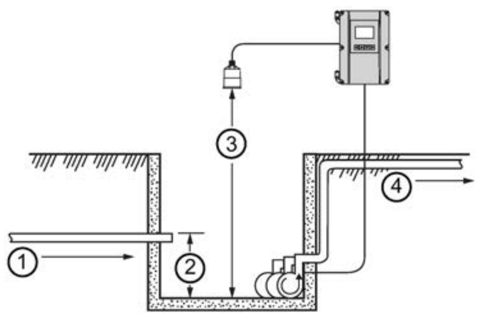
Parameter	Index	Mode/Value	Description
Level Source (2.8.1.2.) (Page 190)	5	Transducer 1	Alarm on LOE for Transducer 1
Relay Function (2.8.1.4.) (Page 191)	5	LOE	Alarm on LOE
LOE Timer (2.4.2.) (Page 173)	Global	0.5	Trip alarm when 0.5 minutes (30 seconds) pass without detecting a valid echo.

7.9 Pump control

7.9.1 Setting a pump down group

Example: sewage wet well

Set a group of three pumps to pump down a wet well



①	Inflow	③	Empty (2.2.4.) (Page 166)
②	Span (2.2.2) (Page 165)	④	Outflow

Set the common parameters

Prerequisite: Substitute the details of your application in place of the sample values provided. If you are bench testing the unit, set your test values to be the same as the sample values.

Parameter	Index[1]	Value/Mode	Description
Sensor Mode (2.1.3.) (Page 159)	Global	*Level (Page 159)	Operation = *Level (Page 159)
Material (2.1.6.) (Page 161)	Global	Liquid	Material = *Liquid
Response Rate (2.3.4.) (Page 170)	Global	Medium	Maximum Process Speed = *Medium (1.0 m/min) (Page 170)
Transducer (2.1.5.) (Page 160)	Global	XPS-10	Transducer = XPS-10 (single-point preset)
Units (2.1.1) (Page 158)	Global	Meters	Units = Meters
Empty (2.2.4.) (Page 166)	Global	1.8	Empty = 1.8 m
Span (2.2.2.) (Page 165)	Global	1.4	Span = 1.4 m

[1] Example assumes a single measurement unit. If your device has dual-point software installed, then some parameters are indexed by two level points.

7.9.1.1 Set relays to Alternate Duty Assist

Parameter	Index	Mode	Description
Relay Function (2.8.1.4.) (Page 191)	1	Alternate Duty Assist	Sets the pump relays (Relays 1, 2, and 3) to Alternate Duty Assist.
Relay Function (2.8.1.4.) (Page 191)	2	Alternate Duty Assist	
Relay Function (2.8.1.4.) (Page 191)	3	Alternate Duty Assist	

7.9.1.2 Set the ON setpoints

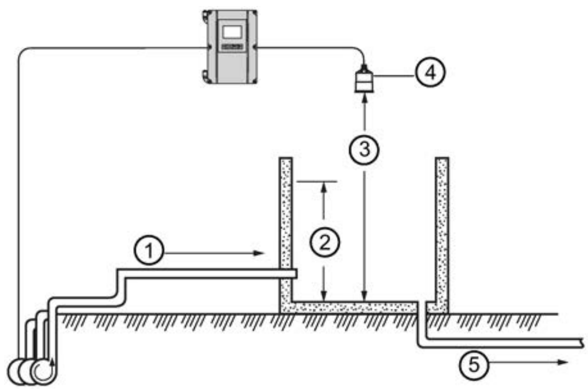
Parameter	Index	Value	Description
ON Setpoint (2.8.1.5.) (Page 192)	1	1.0 m	Sets the three setpoints for the pump relays. The first cycle will use these setpoints. Subsequent cycles rotate the setpoints among the pumps.
ON Setpoint (2.8.1.5.) (Page 192)	2	1.1 m	
ON Setpoint (2.8.1.5.) (Page 192)	3	1.2 m	

7.9.1.3 Set the OFF setpoints

Parameter	Index	Value	Description
OFF Setpoint (2.8.1.6.) (Page 192)	1	0.5 m	Sets the three setpoints for the pump relays. The first cycle will use these setpoints. Subsequent cycles rotate the setpoints among the pumps.
OFF Setpoint (2.8.1.6.) (Page 192)	2	0.5 m	
OFF Setpoint (2.8.1.6.) (Page 192)	3	0.5 m	

7.9.2 Setting a pump up (reservoir) group

Set a group of three pumps to pump up a reservoir.



① Inflow
② Span (2.2.2.) (Page 165)
③ Empty (2.2.4.) (Page 166)
④ Transducer
⑤ Outflow

Set the common parameters

Prerequisite: Substitute the details of your application in place of the sample values provided. If you are bench testing the unit, set your test values to be the same as the sample values.

Parameter	Index[1]	Value/Mode	Description
Sensor Mode (2.1.3.) (Page 159)	Global	*Level (Page 159)	Operation=*Level (Page 159)
Material (2.1.6.) (Page 161)	Global	Liquid	Material = *Liquid
Response Rate (2.3.4.) (Page 170)	Global	Medium	Maximum Process Speed = *Medium (1.0 m/min) (Page 170)
Transducer (2.1.5.) (Page 160)	Global	XPS-10	Transducer = XPS-10 (single-point preset)
Units (2.1.1) (Page 158)	Global	-	Units = Meters
Empty (2.2.4.) (Page 166)	Global	1.8	Empty = 1.8 m
Span (2.2.2.) (Page 165)	Global	1.4	Span = 1.4 m

[1] Example assumes a single measurement unit. If your device has dual-point software installed, then some parameters are indexed by two level points.

7.9.2.1 Set relays to Alternate Duty Assist

Parameter	Index	Mode	Description
Relay Function (2.8.1.4.) (Page 191)	1	Alternate Duty Assist	Sets the pump relays (Relays 1, 2, and 3) to Alternate Duty Assist.
Relay Function (2.8.1.4.) (Page 191)	2	Alternate Duty Assist	
Relay Function (2.8.1.4.) (Page 191)	3	Alternate Duty Assist	

7.9.2.2 Set the Relay ON Setpoints

Parameter	Index	Value	Description
ON Setpoint (2.8.1.5.) (Page 192)	1	0.4 m	Sets the three setpoints for the pump relays. The first cycle will use these setpoints. Subsequent cycles rotate the setpoints among the pumps.
ON Setpoint (2.8.1.5.) (Page 192)	2	0.3 m	
ON Setpoint (2.8.1.5.) (Page 192)	3	0.2 m	

7.9.2.3 Set the Relay OFF Setpoints

Parameter	Index	Value	Description
OFF Setpoint (2.8.1.6.) (Page 192)	1	1.3 m	Sets the three setpoints for the pump relays
OFF Setpoint (2.8.1.6.) (Page 192)	2	1.3 m	
OFF Setpoint (2.8.1.6.) (Page 192)	3	1.3 m	

For more information, see Pump control reference (Page 305)

7.9.3 Other pump control algorithms

7.9.3.1 Set relays to Alternate Duty Backup

Parameter	Index	Mode	Description
Relay Function (2.8.1.4.) (Page 191)	1	Alternate Duty Backup	Sets the pump relays (Relays 1, 2, and 3) to Alternate Duty Backup.
Relay Function (2.8.1.4.) (Page 191)	2	Alternate Duty Backup	
Relay Function (2.8.1.4.) (Page 191)	3	Alternate Duty Backup	

Set the Relay ON Setpoints

Parameter	Index	Value	Description
ON Setpoint (2.8.1.5.) (Page 192)	1	0.4 m	Sets the three setpoints for the pump relays. The first cycle will use these setpoints. Subsequent cycles rotate the setpoints among the pumps.
ON Setpoint (2.8.1.5.) (Page 192)	2	0.3 m	
ON Setpoint (2.8.1.5.) (Page 192)	3	0.2 m	

Set the Relay OFF Setpoints

Parameter	Index	Value	Description
OFF Setpoint (2.8.1.6.) (Page 192)	1	1.3 m	Sets the three setpoints for the pump relays.
OFF Setpoint (2.8.1.6.) (Page 192)	2	1.3 m	
OFF Setpoint (2.8.1.6.) (Page 192)	3	1.3 m	

7.9.3.2 Set relays to Fixed Duty Assist

Parameter	Index	Mode	Description
Relay Function (2.8.1.4.) (Page 191)	1	Fixed Duty Assist	Sets the pump relays (Relays 1, 2, and 3) to Fixed Duty Assist. Multiple pumps can run simultaneously.
Relay Function (2.8.1.4.) (Page 191)	2	Fixed Duty Assist	
Relay Function (2.8.1.4.) (Page 191)	3	Fixed Duty Assist	

Set the Relay ON Setpoints

Parameter	Index	Value	Description
ON Setpoint (2.8.1.5.) (Page 192)	1	0.4 m	Sets the three setpoints for the pump relays. The setpoints remain attached to the pump relays.
ON Setpoint (2.8.1.5.) (Page 192)	2	0.3 m	
ON Setpoint (2.8.1.5.) (Page 192)	3	0.2 m	

Set the Relay OFF Setpoints

Parameter	Index	Value	Description
OFF Setpoint (2.8.1.6.) (Page 192)	1	1.3 m	Sets the three setpoints for the pump relays.
OFF Setpoint (2.8.1.6.) (Page 192)	2	1.3 m	
OFF Setpoint (2.8.1.6.) (Page 192)	3	1.3 m	

7.9.3.3 Set relays to Fixed Duty Backup

Parameter	Index	Mode	Description
Relay Function (2.8.1.4.) (Page 191)	1	Fixed Duty Backup	Sets the pump relays (Relays 1, 2, and 3) to Fixed Duty Backup. Only one pump will ever run at one time.
Relay Function (2.8.1.4.) (Page 191)	2	Fixed Duty Backup	
Relay Function (2.8.1.4.) (Page 191)	3	Fixed Duty Backup	

Set the Relay ON Setpoints

Parameter	Index	Value	Description
ON Setpoint (2.8.1.5.) (Page 192)	1	0.4 m	Sets the three setpoints for the pump relays. The setpoints remain attached to the pump relays.
ON Setpoint (2.8.1.5.) (Page 192)	2	0.3 m	
ON Setpoint (2.8.1.5.) (Page 192)	3	0.2 m	

Set the Relay OFF Setpoint

Parameter	Index	Value	Description
OFF Setpoint (2.8.1.6.) (Page 192)	1	1.3 m	Sets the three setpoints for the pump relays.
OFF Setpoint (2.8.1.6.) (Page 192)	2	1.3 m	
OFF Setpoint (2.8.1.6.) (Page 192)	3	1.3 m	

7.9.3.4 Set relays to Service Ratio Duty Assist

Parameter	Index	Mode/Value	Description
Relay Function (2.8.1.4.) (Page 191)	1	Service Ratio Duty Assist	Sets the pump relays (Relays 1, 2, and 3) to Service Ratio Duty Assist.
Relay Function (2.8.1.4.) (Page 191)	2	Service Ratio Duty Assist	
Relay Function (2.8.1.4.) (Page 191)	3	Service Ratio Duty Assist	
Service Ratio (2.8.1.12.) (Page 195)	1	25	Sets the ratio to: • 25% – Pump 1 • 50% – Pump 2 • 25% – Pump 3
Service Ratio (2.8.1.12.) (Page 195)	2	50	
Service Ratio (2.8.1.12.) (Page 195)	3	25	

Set the Relay ON Setpoints

Parameter	Index	Value	Description
ON Setpoint (2.8.1.5.) (Page 192)	1	0.4 m	Sets the three setpoints for the pump relays. The first cycle will use these setpoints. Subsequent cycles rotate the setpoints among the pumps.
ON Setpoint (2.8.1.5.) (Page 192)	2	0.3 m	
ON Setpoint (2.8.1.5.) (Page 192)	3	0.2 m	

Set the Relay OFF Setpoints

Parameter	Index	Value	Description
OFF Setpoint (2.8.1.6.) (Page 192)	1	1.3 m	Sets the three setpoints for the pump relays.
OFF Setpoint (2.8.1.6.) (Page 192)	2	1.3 m	
OFF Setpoint (2.8.1.6.) (Page 192)	3	1.3 m	

7.9.3.5 Set relays to First in First Out

Parameter	Index	Mode	Description
Relay Function (2.8.1.4.) (Page 191)	1	FIFO	Sets the pump relays (Relays 1, 2, and 3) to First In First Out.
Relay Function (2.8.1.4.) (Page 191)	2	FIFO	
Relay Function (2.8.1.4.) (Page 191)	3	FIFO	

Set the Relay ON Setpoints

Parameter	Index	Value	Description
ON Setpoint (2.8.1.5.) (Page 192)	1	0.4 m	Sets the three setpoints for the pump relays. The first cycle will use these setpoints. Subsequent cycles rotate the setpoints among the pumps.
ON Setpoint (2.8.1.5.) (Page 192)	2	0.3 m	
ON Setpoint (2.8.1.5.) (Page 192)	3	0.2 m	

Set the Relay OFF Setpoints

Parameter	Index	Value	Description
OFF Setpoint (2.8.1.6.) (Page 192)	1	1.3 m	Sets the three setpoints for the pump relays.
OFF Setpoint (2.8.1.6.) (Page 192)	2	1.3 m	
OFF Setpoint (2.8.1.6.) (Page 192)	3	1.3 m	

7.9.4 Optional pump controls

7.9.4.1 Starting pumps by rate of level change

Use this function when multiple pumps will be controlled by rate of level change rather than setpoints. Pumping costs can be reduced because only the highest ON setpoint needs to be programmed. This results in a lower difference in head to the next wet well which, in turn, results in less energy being used to pump out the well.

Parameter	Index	Mode/Value	Description
ON Setpoint (2.8.1.5.) (Page 192)	1	1.35	Starting pumps by rate allows all setpoints to be set higher, to save money by pumping from the highest safe level of the wet well.
ON Setpoint (2.8.1.5.) (Page 192)	2	1.35	
ON Setpoint (2.8.1.5.) (Page 192)	3	1.35	
OFF Setpoint (2.8.1.6.) (Page 192)	1	0.5 m	Notice that all indexed relays for both ON Setpoint (2.8.1.5.) and OFF Setpoint (2.8.1.6.) are set to the same levels.
OFF Setpoint (2.8.1.6.) (Page 192)	2	0.5 m	
OFF Setpoint (2.8.1.6.) (Page 192)	3	0.5 m	
Pump by Rate (2.8.1.8.) (Page 193)	1	ON	The pumps will start on 20-second intervals until the rate set in Emptying Indicator (2.3.10.) (Page 194) is met.
Pump by Rate (2.8.1.8.) (Page 193)	2	ON	
Pump by Rate (2.8.1.8.) (Page 193)	3	ON	
Delay Between Starts (2.8.2.8.1.) (Page 201)	Global	20.0	

When the first ON setpoint is reached, the pumps will start, one by one, until the material level rate of change is set at the same value or greater than the value in:

- Filling Indicator (2.8.1.9.) (Page 193) - pump up applications
- Emptying Indicator (2.8.1.10.) (Page 194) - pump down applications

Set delay between pump starts using Delay Between Starts (2.8.2.8.1.) (Page 201)

Single- and dual-point

- Single-point Mode: One pump by rate control available that affects all pumps
- Dual-point Mode: A single pump by rate control can be set up for each of the three available level points. Set Operation for difference or average [Sensor mode (2.1.3.) (Page 159) = Dual-Point Difference or Dual-Point Average].

Note

- Set all pump control relay ON and OFF setpoints to the same value.
- If the level is within 5% of Span (2.2.2.) (Page 165) of the OFF setpoint, then the next pump is not started.

7.9.4.2 Rotating pumps by service ratio

Prerequisite: Set pump relays to a service ratio value [(Relay Function (2.8.1.4.) (Page 191) = Service Ratio Duty Assist or Service Ratio Duty Backup].

Parameter	Index	Value	Description
Service Ratio (2.8.1.12.) (Page 195)	1	1	These values will start Pump 2 fifty percent of the time, and Pumps 1 and 3 each, twenty-five percent of the time.
Service Ratio (2.8.1.12.) (Page 195)	2	2	
Service Ratio (2.8.1.12.) (Page 195)	3	1	

Note

- The device will not sacrifice other pumping strategies to ensure that the ratio is held true.
- If the pump relays are set to the same value, then the ratio equals 1:1 and all pumps are used equally (preset).

When more than one pump is assigned a pump service ratio value (in any time units) and a pump start is required [ON setpoint (2.8.1.5.) (Page 192)], the pump with the fewest running hours (with respect to the assigned ratio values) starts. Conversely, when a pump stop is required [OFF setpoint (2.8.1.6.) (Page 192)], the pump with the most running hours (as compared to the assigned ratio values) stops.

7.9.4.3 Totalizing pumped volume

Prerequisite: The volume of the vessel must be known.

Parameter	Index	Mode/Value	Description
Sensor Mode (2.1.3.) (Page 159)	Global	Pump Totalizer	Operation = Pumped volume
Material (2.1.6.) (Page 161)	Global	*Liquid	These parameters are as shown above.
Response Rate (2.3.4.) (Page 170)	Global	*Medium (1.0 m/ min)	
Transducer (2.1.5.) (Page 160)	Global	XPS-10 (singlepoint preset)	
Units (2.1.1.) (Page 158)	Global	Meters	
Empty (2.2.4.) (Page 166)	Global	1.8	
Span (2.2.2.) (Page 165)	Global	1.4	
Vessel Shape (2.7.2.) (Page 181)	Global	Flat Level Bottom	Tank shape is Flat Level Bottom.
Maximum Volume (2.7.3.) (Page 183)	Global	17.6	Max volume is 17.6 m^3 or 17,600 liters.
Relay Function (2.8.1.4.) (Page 191)	1	Alternate Duty Assist	Sets Relays 1, 2, and 3 as a pump group using Alternate Duty Assist.
Relay Function (2.8.1.4.) (Page 191)	2	Alternate Duty Assist	
Relay Function (2.8.1.4.) (Page 191)	3	Alternate Duty Assist	
ON Setpoint (2.8.1.5.) (Page 192)	1	1.0	Sets the ON setpoints for the pump group.
ON Setpoint (2.8.1.5.) (Page 192)	2	1.2	
ON Setpoint (2.8.1.5.) (Page 192)	3	1.4	
OFF Setpoint (2.8.1.6.) (Page 192)	1	0.2	Sets the OFF setpoints for the pump group.
OFF Setpoint (2.8.1.6.) (Page 192)	2	0.2	
OFF Setpoint (2.8.1.6.) (Page 192)	3	0.2	

Set in RUN Mode

1. Press the LEFT arrow ◀ to go to Measurement View mode.
2. Once there, press the DOWN arrow ▼ to show Measurement View 2.
3. Press the LEFT arrow ◀ until Totalizer is shown.

7.9.4.4 Setting independent fail-safe controls

Independent fail-safe controls allow you to vary an individual relay from the global failsafe controls programmed in:

- Material Level (2.4.5.) (Page 174)
- LOE Timer (2.4.2.) (Page 173)
- Fail-safe Advance (2.4.6.) (Page 175)

Example:

The global fail-safe controls are set to hold, and Relay 5 is set to trigger an alarm bell.

Parameter	Index	Mode/Value	Description
Fail-safe Mode (2.4.4.) (Page 174)	Global	HOLD	Keep level at known value
Relay Fail-safe (2.8.2.3.) (Page 196)	5	DE-ENERGIZE	De-energize Relay 5, and trigger alarm.

7.9.4.5 Setting a pump to Run-ON

When you need to pump below the normal OFF setpoint, use Run-ON Interval (2.8.2.7.1.) (Page 200) and Run-ON Duration (2.8.2.7.3.) (Page 200) to control this event.

Example:

The pump connected to Relay 3 is set to pump for an extra 60 seconds every 5 hours.

Parameter	Index	Mode/Value	Description
Run-ON Interval (2.8.2.7.1.) (Page 200)	Global	5	Time in hours of Run-ON interval.
Run-ON Duration (2.8.2.7.3.) (Page 200)	3	60	Run-ON for 60 seconds.

Note

Run-ON Interval (2.8.2.7.1.) (Page 200) counts when the indexed relay is tripped, not the number of pump cycles. If the indexed relay only trips once every four pump cycles, then the actual interval of the run-ON will be 20 pump cycles, or five cycles of Relay 3.

Note

Setting a value in Run-ON Duration (2.8.2.7.3.) (Page 200) enables run-on for that relay. The default value of 0.0 seconds disables run-on. Any relay with a pump duration value other than 0.0 seconds will use the value from the highest indexed relay in the pump group set in Pump Group (2.8.2.2.). (Page 196)

7.9.4.6 Setting the pump start delays

The pump start delay ensures that all of the pumps do not start at once to avoid power surges. There are two parameters used: Delay Between Starts (2.8.2.8.1.) (Page 201) and Power Resumption Delay (2.8.2.8.2.) (Page 202). The default is 10 seconds, but you can increase this if your pumps take longer to spin up.

Example:

The delay between pumps is set to 20 seconds and the delay of the first pump is set to 30 seconds.

Parameter	Index	Value	Description
Delay Between Pump Starts (2.8.2.8.1.) (Page 201)	Global	20	Wait at least 20 seconds between pump starts
Power Resumption Delay (2.8.2.8.2.) (Page 202)	Global	30	Wait for 30 seconds when power is restored

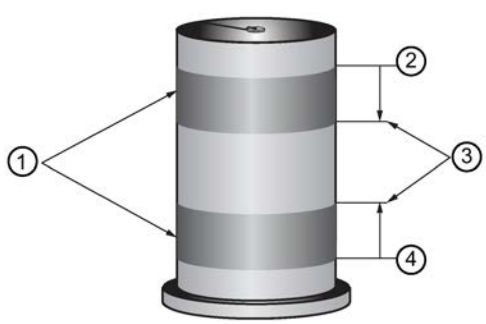
7.9.4.7 Reducing wall cling

Use the wall cling parameter to randomly alter the ON and OFF setpoints over a range. This eliminates the ridge of material buildup at the setpoint that can give false echoes. This setting may increase the number of days between trips to clean the wet well.

Wall cling reduction is set by Level Setpoint Variation (2.8.2.6.2.) (Page 199). The relay setpoints ON and OFF are randomly varied inside a range so the material level does not stop at the same point.

Example:

A range of 0.5 meters is used to vary the setpoint. The randomly-selected setpoints are always inside the ON and OFF setpoints.



① Random setpoint range
② Level setpoint ON
③ Level setpoint variation
④ Level setpoint OFF

7.9.4.8 Grouping pumps

You can group pumps and use the same pumping algorithm separately on each group. If you specify different pumping algorithms, then you do not need to use this parameter because the pumps are already grouped by algorithm.

Group pumps only when four pumps are using the same algorithm, and you want to split them into two groups.

Example:

Pumps 1 and 2 will operate as a group, and Pumps 3 and 4 will operate as another group.

Parameter	Index	Mode	Description
Pump Group (2.8.2.2.) (Page 196)	1	*Group 1 (Page 196)	Groups Pumps 1 and 2
Pump Group (2.8.2.2.) (Page 196)	2	*Group 1 (Page 196)	
Pump Group (2.8.2.2.) (Page 196)	3	Group 2 (Page 196)	Groups Pumps 3 and 4
Pump Group (2.8.2.2.) (Page 196)	4	Group 2 (Page 196)	

7.9.4.9 Setting a flush valve

A flush valve stirs up the sediment at the bottom of the well during pumping, so that it doesn't accumulate. These parameters will control any relays set with Relay Function (2.8.1.4.) (Page 191) = Flush Valve. Most sets of parameters will work with only one or two changes; however, for these parameters to work, all of them must be set to a value.

Example:

The flush valve connects to Relay 4 and the watched pump is on Relay 1.

Parameter	Index	Value	Description
Relay Selector (2.10.3.1.) (Page 211)	-	4	Flush valve is connected to Relay 4
Flush Pump (2.10.3.2.) (Page 211)	Global	1	Watch Relay 1 to count pump cycles
Flush Cycles (2.10.3.3.) (Page 212)	Global	3	Open the flush valve for 3 cycles
Flush Interval (2.10.3.4.) (Page 212)	Global	10	Use the flush value every 10 cycles
Flush Duration (2.10.3.5.) (Page 212)	Global	120	Open the flush valve for 120 seconds

7.9.4.10 Relay controlled by communications

A relay can be controlled directly by a remote system through communications. No other control schemes can then be used with a relay configured this way. Communications can be used to force status of some control relays, such as pumps.

Settings

Parameter	Index	Mode	Description
Relay Function (2.8.1.4.) (Page 191)	5	Communication	Sets Relay 5 to communications control

7.9.4.11 Tracking pump usage

You can find out how much an individual pump has been used by viewing the pump records parameters.

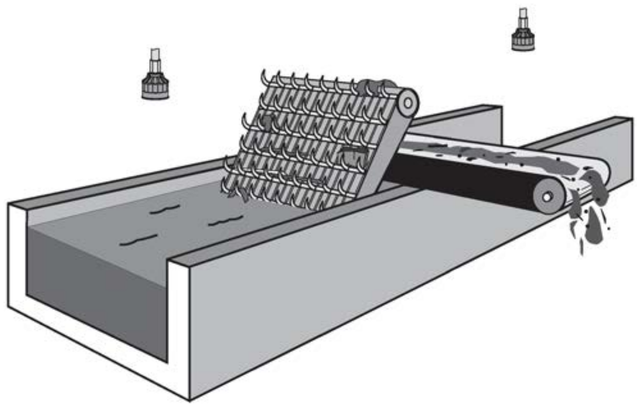
Information available	Parameter access
Current RUN time	Pump Run Time (3.2.9.3.) (Page 255)
Total pump hours	Pump Hours (3.2.9.2.) (Page 255)
Total pump starts	Pump Starts (3.2.9.4.) (Page 256)
Total pump RUN on occurrences	Pump Run-ONs (3.2.9.5.) (Page 256)

7.10 Rake (screen) control

Rakes or screens are mounted on the inflow channel of the wastewater treatment plant to prevent debris from clogging the equipment. When material builds up on the screen, a level differential is created, and the water level is higher in front of the screen than behind it. When this differential reaches the programmed setpoint, the device activates a relay to operate mechanical rakes that clean the screen and ensure a steady flow.

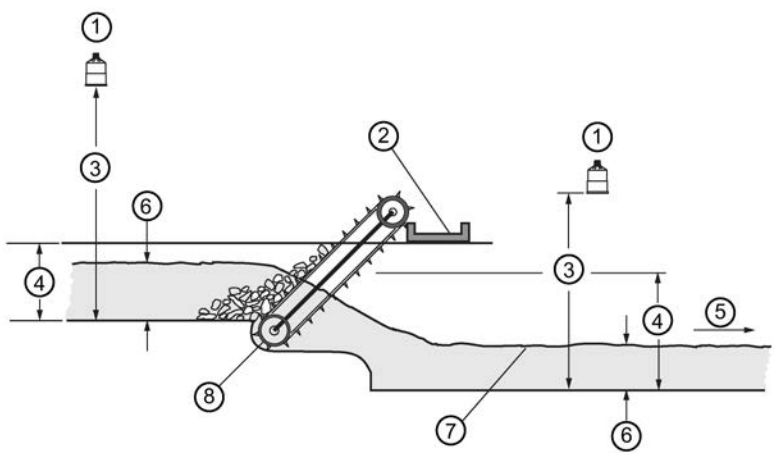
7.10.1 Setting a rake control

Transducers may be mounted at various heights.



Note: Span (2.2.2.) (Page 165)

Maximum differential between point 1 and point 2 reading also sets 100 % scale for bar graph and mA output.



①	Transducer (1 & 2)	⑤	Flow
②	Debris conveyor	⑥	h(1) & h(2)
③	Empty (2.2.4.) (Page 166) (1&2)	⑦	Water level
④	Span (2.2.2.) (Page 165) (1&2)	⑧	Rake

Point 3: Level distance = h[1] – h[2]

7.10.2 Setting common parameters

Prerequisite:

Substitute the details of your application in place of the sample values provided. If you are bench testing the unit, set your test values to be the same as the sample values.

Parameter	Index	Mode/Value	Description
Sensor mode (2.1.3.) (Page 159)	Global	Dual-point Difference (Page 159)	Operation=Differential
Material (2.1.6.) (Page 161)	Global	*Liquid (Page 161)	Material=Liquid
Response rate (2.3.4.) (Page 170)	1 & 2	*Medium (1.0 m/min) (Page 170)	Max. Process Speed=Medium
Transducer (2.1.5.) (Page 160)	1 & 2	XPS-10 (single-point pre-set)	Transducer=XPS-10
Units (2.1.1.) (Page 158)	Global	1	Units=Meters
Empty (2.2.4.) (Page 166)	1	1.8	Empty=1.8 m
	2	2.2	Empty=2.2 m
Span (2.2.2.) (Page 165)	1	1.4	Span=1.4 m
	2	1.4	Span=1.4 m
	3	1.4	Max Differential=1.4 m

7.10.3 Set Relay 1 (Operate Rake)

Parameter	Index	Mode/value	Description
Level Source (2.8.1.2.) (Page 190)	1	Difference or average	Starts the rake when the difference between the two levels rises above 0.4 m and stops the rake when the difference falls below 0.1 m.
Relay Function (2.8.1.4.) (Page 191)	1	Fixed Duty Assist	
ON Setpoint (2.8.1.5.) (Page 192)	1	0.4	
OFF Setpoint (2.8.1.6.) (Page 192)	1	0.1	

7.10.4 Set Relays 2 to 4 (Level Alarms)

Parameter	Index	Mode/value	Description
Level Source (2.8.1.2.) (Page 190)	2	Transducer 1	Sets Relay 2 as a high level alarm for Transducer 1, with an ON setpoint of 1.3 m and an OFF setpoint of 1.2 m.
Relay Function (2.8.1.4.) (Page 191)	2	Level	
ON Setpoint (2.8.1.5.) (Page 192)	2	1.3	
OFF Setpoint (2.8.1.6.) (Page 192)	2	1.2	
Level Source (2.8.1.2.) (Page 190)	3	Transducer 2	Sets Relay 3 as a low level alarm for Transducer 2, with an ON setpoint of 0.2 m and an OFF setpoint of 0.4 m.
Relay Function (2.8.1.4.) (Page 191)	3	Level	
ON Setpoint (2.8.1.5.) (Page 192)	3	0.2	
OFF Setpoint (2.8.1.6.) (Page 192)	3	0.4	
Level Source (2.8.1.2.) (Page 190)	4	Difference or average	Sets Relay 4 as a **rake failure** alarm as it uses the differential level point (3), with an ON set-point of 1.0 and an OFF setpoint of 0.9 m.
Relay Function (2.8.1.4.) (Page 191)	4	Level	
ON Setpoint (2.8.1.5.) (Page 192)	4	1.0	
OFF Setpoint (2.8.1.6.) (Page 192)	4	0.9	

7.11 External totalizers and flow samplers

External totalizers are simple counters which count the number of relay clicks produced by the device. This is generally used to keep track of Open Channel Monitoring (OCM) or pumped volume totals. Note that both of these values are also stored in the device and are available through communications.

Flow samplers are devices which take a sample of liquid when triggered by a relay click. These samples are used to monitor water quality over time. Flow samplers can be driven by OCM volume or by relay click volume settings depending on the application requirements.

Note

Lost totalizer values

If power is lost to the device, totalizer values may also be lost. Totalizer values are only wriiten to non-volatile memory once every hour.

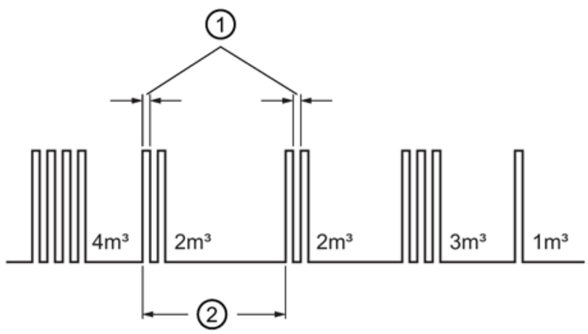
7.11.1 Relay contacts

Pumped volume is calculated at the end of the pump cycle. Totalized volume given through a relay set up for totalizer [Relay Function (2.8.1.4.) (Page 191) = Totalizer] will be given in bursts at this time.

Both the open and closed times for the relay contact are provided by Relay Duration (2.10.1.3.) (Page 207) and are preset to 0.2 seconds. Partial units are added to the next pump cycle.

Example:

A relay set up to make one contact for every cubic meter (m^3) of liquid.



① Relay Duration (2.10.1.3.) (Page 207)

② Pump cycle

7.11.2 Totalizer

To set the totalizer to provide relay contact to an external counter, use the following:

Counter formula	
1 Contact per $10^{\text{Multiplier (2.10.1.2.)}}$ units	Multiplier (2.10.1.2.) (Page 206) is preset to 0 so the default number of contacts for a pumped volume cycle is equivalent to the number of volume units.

The source of units depends on the operation:

Operation	Units source parameter
OCM [Sensor Mode (2.1.3.) (Page 159) = Flow rate in open channel]	Maximum Flow (2.13.4.3.) (Page 238) or Flowrate Units (2.13.4.7.) (Page 240)
Pumped Volume [Sensor Mode (2.1.3.) (Page 159) = Pump Totalizer]	Maximum Volume (2.7.3.) (Page 183)

7.11.3 Flow sampler

7.11.3.1 Based on volume and time

To trigger a flow sampler relay based on flow, use Relay Function (2.8.1.4.) (Page 191) = Flow Sampler and set the other parameters for the selected relay:

Counter formula	
	1 Contact per Multiplier (2.10.1.2.) (Page 206) x $10^{\text{Exponent (2.10.2.3.)}}$ units

Operation	Units source parameter
OCM [Sensor Mode (2.1.3.) (Page 159) = Flow rate in open channel]	Maximum Flow (2.13.4.3.) (Page 238) or Flowrate Units (2.13.4.7.) (Page 240)

By using a mantissa [Mantissa (2.10.2.2) (Page 208)] and an exponent [Exponent (2.10.2.3.) (Page 209)], the relay contacts can be based on a volume other than a multiple of ten.

During the periods of low flow, the sampler may be idle for lengths of time. Program Relay Interval Setpoint (2.8.2.4.) (Page 197) to a time interval in hours, to drive the sampler. The sampler will operate based on the volume of flow or the time interval, whichever comes first.

7.12 Open Channel Monitoring (OCM)

An OCM installation is defined three ways, with each one based on the Primary Measuring Device (PMD) used:

1. **Dimensional [Primary Measuring Device (2.13.2.) = Palmer-Bowlus Flume, H-Flume, Rectangular Flume BS-3680, or Thin Plate V-Notch Weir BS-3680]**
   - BS-3680/ISO 1438/1 Thin Plate V-notch weir (Page 139)
   - BS-3680/ISO 4359 Rectangular Flume (Page 140)
   - Palmer-Bowlus flume (Page 141)
   - H-flume (Page 142)

   For some common weir and flume types. PMD dimensions [PMD Dimensions (2.13.5.) (Page 241)] are entered directly.

2. **Exponential [Primary Measuring Device (2.13.2.) = Exponential devices]**

   For most other weir and flume types. PMD exponents provided by the manufacturer are entered. Flow is calculated using the exponent [Flow Exponent (2.13.4.1.) (Page 235)] and the maximum values [Maximum Head (2.13.4.2.) (Page 237) and Maximum Flow (2.13.4.3.) (Page 238)].
   - Standard weirs (Page 143)
   - Parshall Flume (Page 145)
   - Leopold-Lagco flume (Page 146)
   - Cut throat flume (Page 147)

3. **Universal [Primary Measuring Device (2.13.2.) = Universal Linear Flow Calculation, Universal Curved Flow Calculation]**

   For all other PMDs, the head-to-flow curve can be plotted based on known breakpoints, usually supplied by the PMD manufacturer.
   - Example flumes (Page 149)
   - Example weir profiles (Page 150)
   - Typical flow characterization (Page 148)

7.12.1 Common parameters

These parameters are required for all installations.

Parameter	Index	Mode/value	Description
Sensor Mode (2.1.3.) (Page 159)	Global	Flow rate in open channel	Operation
Material (2.1.6.) (Page 161)	Global	Liquid	Material
Response Rate (2.3.4.) (Page 170)	Global	Medium	Max. Process Speed
Transducer (2.1.5.) (Page 160)	Global	XPS-10	Transducer
Units (2.1.1.) (Page 158)	Global	Meters	Units
Empty (2.2.4.) (Page 166)	Global	1.8	Empty
Span (2.2.2.) (Page 165)	Global	1.0	Span
Range Extensions (2.2.7.) (Page 168)	Global	0.8	Range Extension to avoid LOE

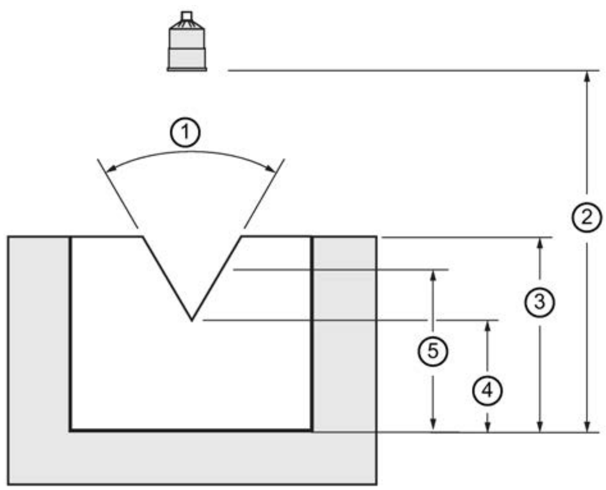
7.12.2 Setting Zero Head

Many PMDs start flowing higher than the traditional empty distance of the application. You can account for the flow in one of two ways:

1. Use Zero Head (2.13.4.5) (Page 239) to have OCM calculations ignore levels below that value. Possible head = Span (2.2.2.) (Page 165) minus Zero Head (2.13.4.5.) (Page 239)

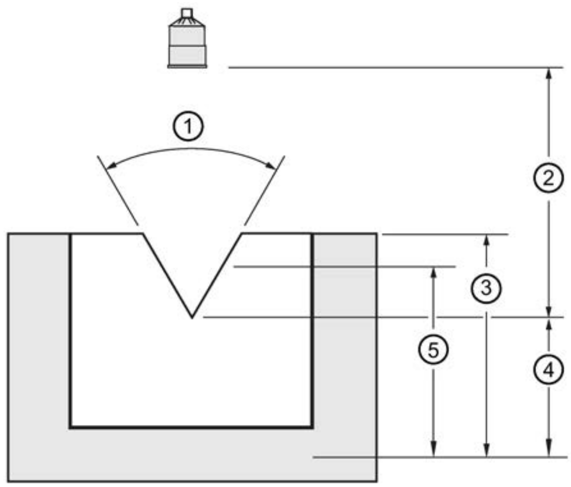
Note

Maximum Head (2.13.4.2.) (Page 237) is preset to Span (2.2.2.) (Page 165) , and is not updated when Zero Head (2.13.4.5.) (Page 239) is used. Make sure you set Maximum Head (2.13.4.2.) (Page 237) to the correct value when using Zero Head (2.13.4.5.) (Page 239)



① α
② Empty (2.2.4.) (Page 166)
③ Span (2.2.2.) (Page 165)
④ Zero Head (2.13.4.5.) (Page 239)
⑤ Maximum Head (2.13.4.2.) (Page 237)

2. Use Range Extension (2.2.7.) (Page 168) where the Empty (2.2.4.) (Page 166) level is set to the bottom of the weir, and above the bottom of the channel. It should be used if the surface monitored can fall past the Empty level in normal operation without reporting an LOE. The value in Range Extension (2.2.7.) (Page 168) is added to Empty (2.2.4.) (Page 166) and can be greater than the range of the transducer.



① α
② Empty (2.2.4.) (Page 166)
③ Span (2.2.2.) (Page 165)
④ Range extension (2.2.7.) (Page 168)
⑤ Maximum Head (2.13.4.2.) (Page 237)

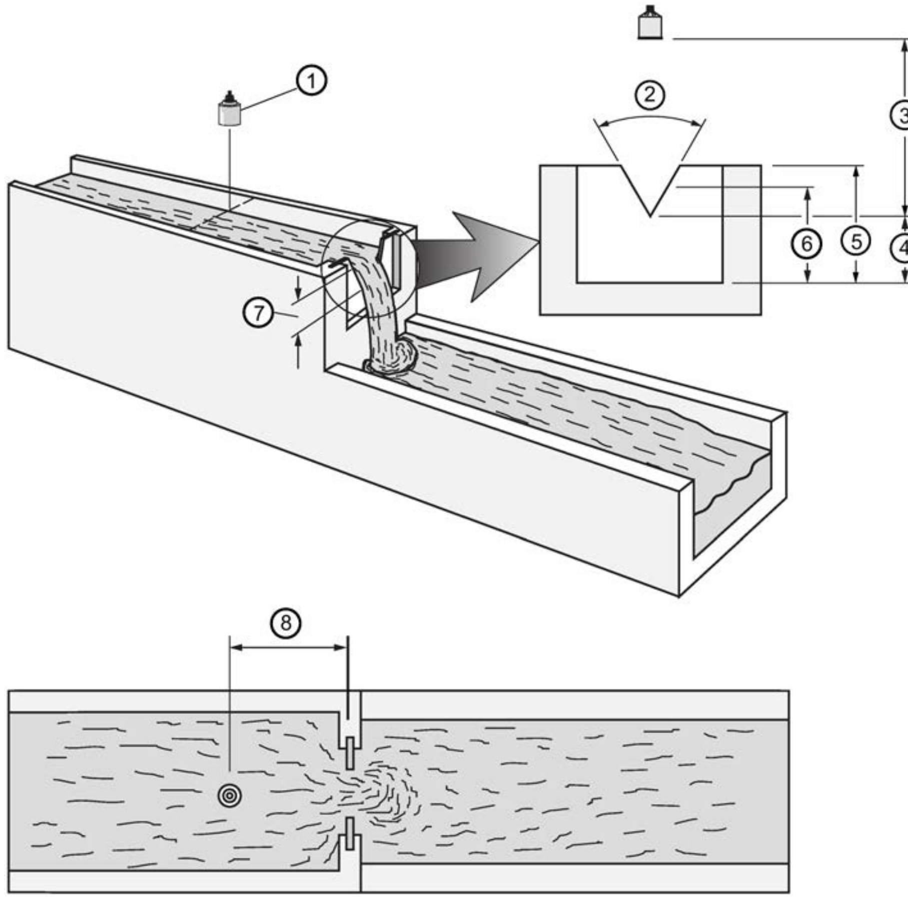
The examples on the following pages show both methods.

7.12.3 Setting totalized volume

The device displays the totalized volume in the auxiliary reading area of Measurement View 2 by default.

7.12.4 Applications supported by the device

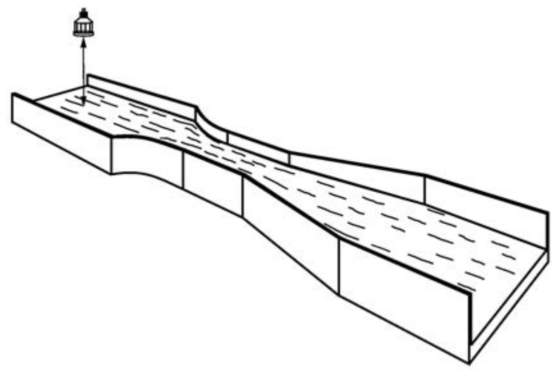
7.12.4.1 BS-3680/ISO 1438/1 Thin Plate V-notch weir

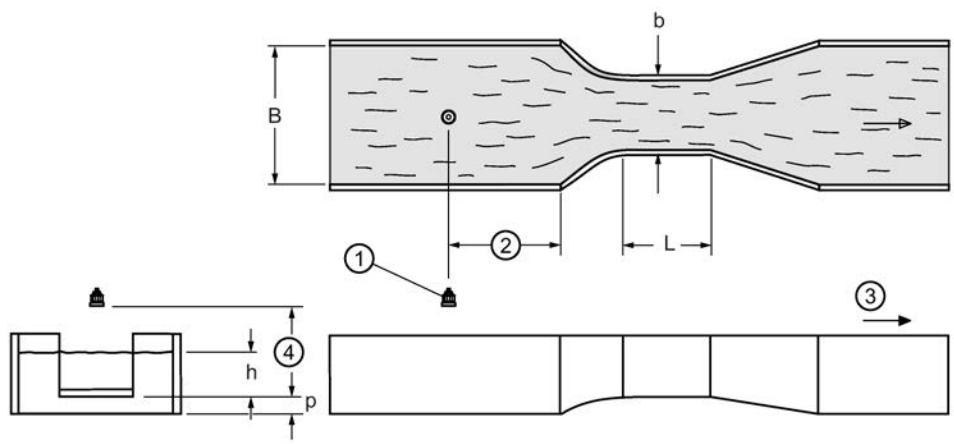


① Transducer
② Notch angle a
③ Empty (2.2.4.) (Page 166)
④ Range Extension (2.2.7.) (Page 168)
⑤ Span (2.2.2.) (Page 165)
⑥ Max. Head (2.13.4.2.) (Page 237)
⑦ h
⑧ 4 to 5 x h_{max} [h_{max} = Span (2.2.2.) (Page 165)]

Parameter		Mode
Primary Measuring Device (2.13.2.) (Page 234)		ISO 1438/1 Thin Plate V-Notch Weir BS- 3680 (Page 234)
PMD Dimensions (2.13.5.) (Page 241)		
OCM Dimension 1 (2.13.5.1.) (Page 241)		Notch angle
OCM Dimension 2 (2.13.5.2.) (Page 241)	(read only)	Discharge coefficient (Cd)
Maximum Head (2.13.4.2.) (Page 237)		Maximum Head (Page 237)
Range Extension (2.2.7.) (Page 168)		Range Extension (Page 168)
Flowrate Units (2.13.4.7.) (Page 240)		Flowrate Units (Page 240)

7.12.4.2 BS-3680/ISO 4359 Rectangular Flume





① Transducer

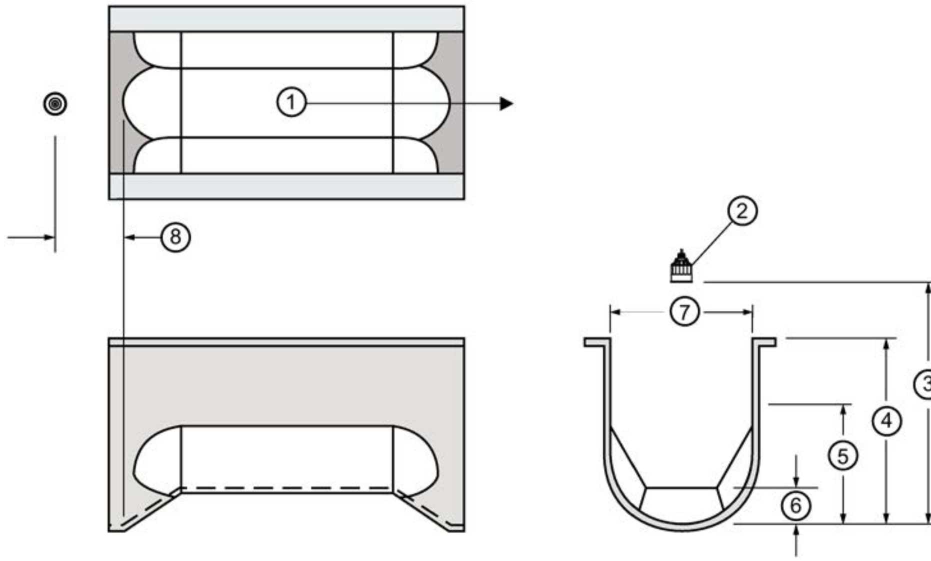
② 4 to 5 x h_{max} [h_{max} = Span 2.2.3.) (Page 165)]

③ Flow

④ Empty (2.2.4.) (Page 166)

Parameter	Mode
Primary Measuring Device (2.13.2.) (Page 234)	ISO 4359 Rectangular Flume BS-3680 (Page 234)
PMD Dimensions (2.13.5.) (Page 241)	
OCM Dimension 1 (2.13.5.1.) (Page 241)	Approach width (B)
OCM Dimension 2 (2.13.5.2.) (Page 241)	Throat width (b)
OCM Dimension 3 (2.13.5.3.) (Page 241)	Hump height (p)
OCM Dimension 4 (2.13.5.4.) (Page 241)	Throat length (L)
OCM Dimension 5 (2.13.5.5.) (Page 241) Read only	Velocity coefficient (Cv)
OCM Dimension 6 (2.13.5.6.) (Page 241) Read only	Discharge coefficient (Cd)
Zero Head (2.13.4.5.) (Page 239)	Zero Head
Flowrate Units (2.13.4.7.) (Page 240)	Flowrate Units

7.12.4.3 Palmer-Bowlus flume



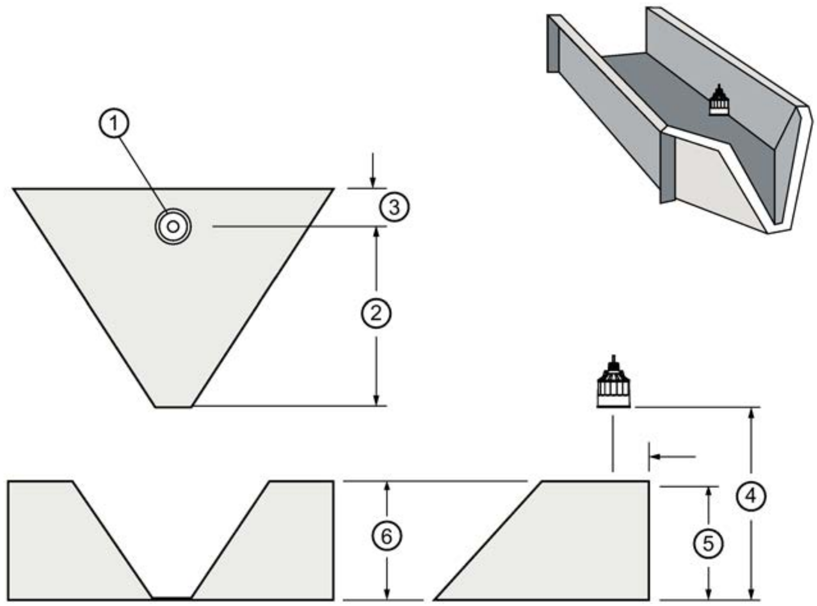
①	Flow	⑤	Upper scaling point
②	Transducer[1)]	⑥	Zero head (2.13.4.5.) (Page 239)
③	Empty (2.2.4.) (Page 166)	⑦	D = pipe or sewer diameter
④	Span (2.2.2.) (Page 165)	⑧	D/2, point of measurement[2)]

Parameter	Mode
Primary Measuring Device (2.13.2.) (Page 234)	Palmer-Bowlus
PMD Dimensions (2.13.5.) (Page 241)	
OCM Dimension 1 (2.13.5.1.) (Page 241)	Flume width (D)
Maximum Head (2.13.4.2.) (Page 237)	Maximum Head
Maximum Flow (2.13.4.3.) (Page 238)	Maximum Flow
Zero Head (2.13.4.5.) (Page 239)	Zero Head
Flow Time Units (2.13.4.4.) (Page 239)	Time Units

Application information

- Sized by pipe diameter D
- Flume relief is trapezoidal
- Designed to install directly into pipelines and manholes
- Head is referenced to bottom of the throat, not bottom of the pipe
- For rated flows under free flow conditions, the head is measured at a distance of D/2 upstream from the beginning of the converging section.

7.12.4.4 H-flume



① Transducer[1)]
② Flow
③ Point of measurement
④ Empty (2.2.4.) (Page 166)
⑤ Span (2.2.2.) (Page 165)
⑥ D=flume height

Parameter	Mode
Primary Measuring Device (2.13.2.) (Page 234)	H-Flume
PMD Dimensions (2.13.5.) (Page 241)	
OCM Dimension 1 (2.13.5.1.) (Page 241)	Flume height (D)
Maximum Head (2.13.4.2.) (Page 237)	Maximum Head
Maximum Flow (2.13.4.3.) (Page 238)	Maximum Flow
Flow Time Units (2.13.4.4.) (Page 239)	Time Units

- Sized by maximum depth of flume
- Approach is preferably rectangular, matching width and depth for distance, 3 to 5 times the depth of the flume.
- May be installed in channels under partial submergence (ratio of downstream level to head). Typical errors are:
  - 1% @ 30% submergence
  - 3% @ 50% submergence
- For rated flows under free flow conditions, the head is measured at a point downstream from the flume entrance.

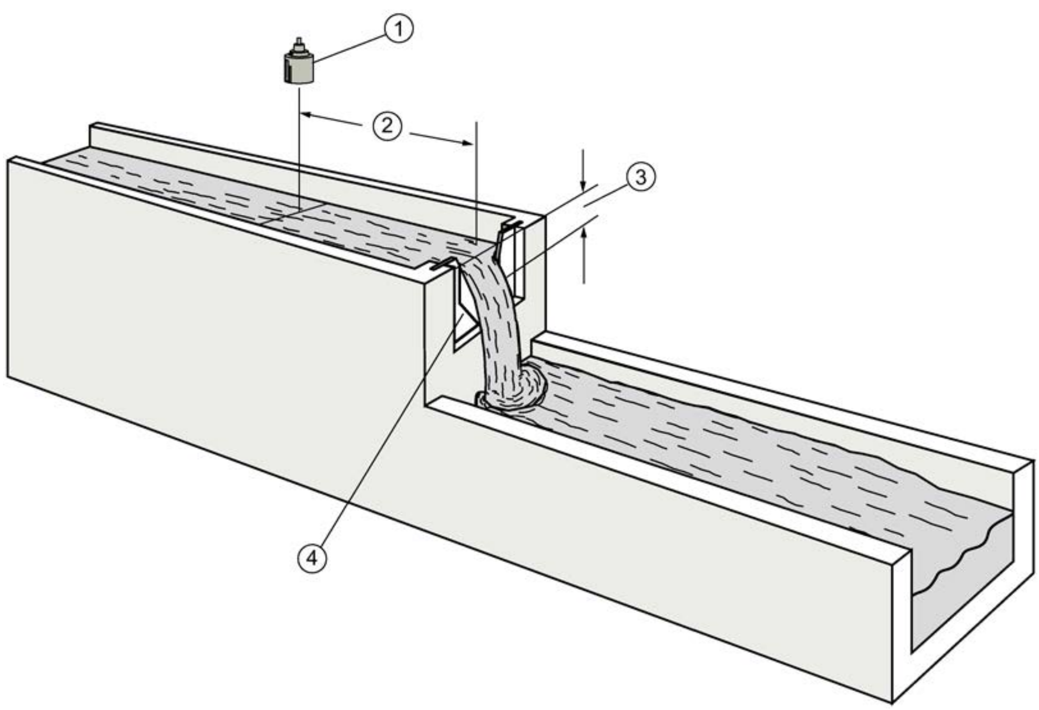
Flume size (Diameter in feet)	Point of measurement	
	centimeters	inches
0.5	5	1 3/4
0.75	7	2 3/4
1.0	9	3 3/4
1.5	14	5 1/2
2.0	18	7 1/4
2.5	23	9
3.0	28	10 3/4
4.5	41	16 1/4

- H-Flumes come with a flat or sloping floor. The same flow table can be used because error is less than 1%.

7.12.4.5 PMDs with exponential flow to Head Function

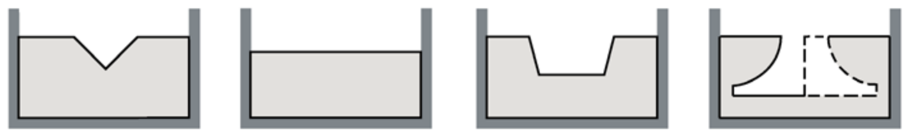
For Primary Measuring Devices (PMDs) that measure flow by an exponential equation, use these parameters. Ensure that you use the correct exponent for your PMD; the values below are samples only.

Standard weirs



① Transducer
② 3 to 4 x h_{max}
③ h
④ Weir profile

Applicable weir profiles

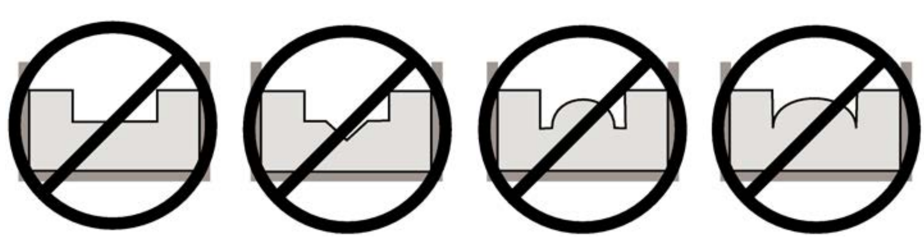


V-notch or triangular | Suppressed rectangular | Cipolleti or trapezoidal | Sutro or proportional

Parameter	Index	Mode	
Primary Measuring Device (2.13.2.) (Page 234)	Global	Exponential devices	
Flow exponent (2.13.4.1.) (Page 235)	Global	**Weir type**	**Value**[1]
		V-notch Weir	2.50
		Suppressed Rectangular Weir	1.50
		Cipolletti weir or trapezoidal Sutro or proportional	1.00
Maximum Head (2.13.4.2.) (Page 237)	Global	Maximum Head	
Maximum Flow (2.13.4.3.) (Page 238)	Global	Maximum Flow	
Flow Time Units (2.13.4.4.) (Page 239)	Global	Time Units	
Range Extension (2.2.7.) (Page 168)	Global	Range Extension	

[1] Values are samples only. Consult weir manufacturer's documentation for correct flow exponent.

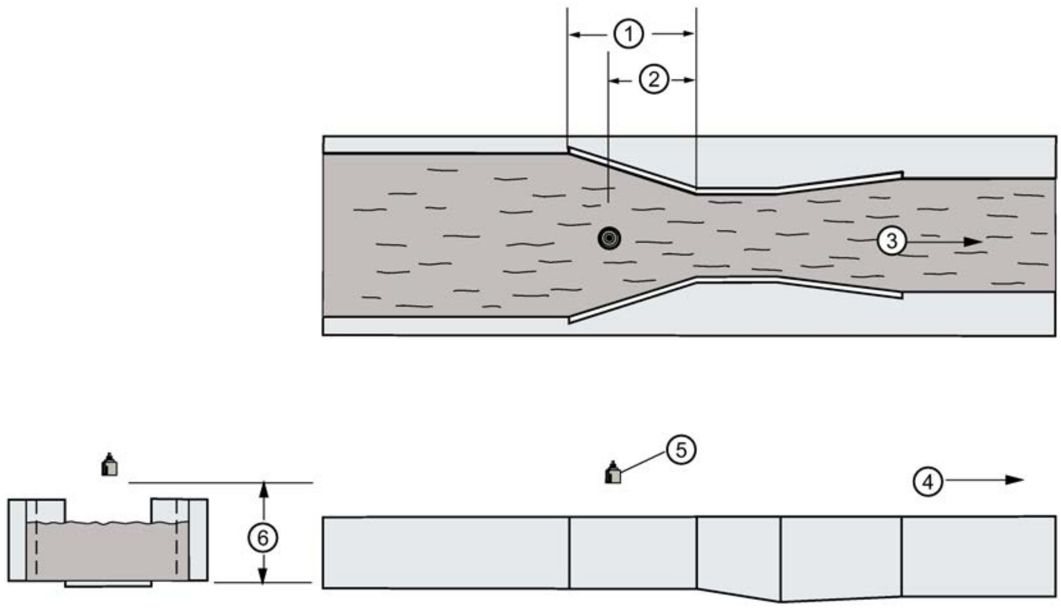
Non-applicable weir profiles



Contracted regular | Compound | Poebing | Approximate exponential

Flows through these weirs can be measured using Primary Measuring Device (2.13.2.) (Page 234) set to Universal Linear Flow Calculation or Universal Curved Flow Calculation. For more information, see Universal calculation support (Page 148).

7.12.4.6 Parshall Flume



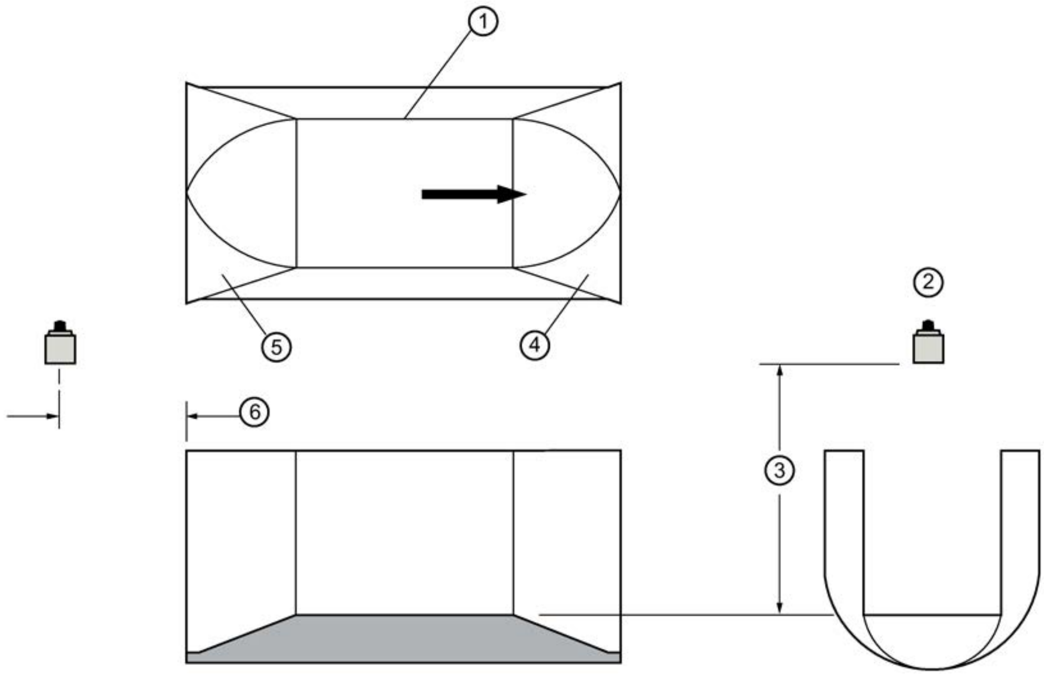
①	C = converging dimension	④	Flow
②	2/3 C	⑤	Transducer [1)]
③	Q	⑥	Empty (2.2.4.) (Page 166)

Application information

- Sized by throat width
- Set on solid foundation
- For rated flows under free flow conditions, the head is measured at 2/3 the length of the converging section from the beginning of the throat section

Parameter	Index	Mode
Primary Measuring Device (2.13.2.) (Page 234)	Global	Parshall Flume
Flow Exponent (2.13.4.1.) (Page 235)	Global	1.22–1.607 (consult your flume documentation)
Maximum Head (2.13.4.2.) (Page 237)	Global	Maximum Head
Maximum Flow (2.13.4.3.) (Page 238)	Global	Maximum Flow (Q)
Flow Time Units (2.13.4.4.) (Page 239)	Global	Time Units

7.12.4.7 Leopold-Lagco flume



① Throat
② Transducer1)
③ Zero head
④ Diverging
⑤ Converging
⑥ Point of measurement

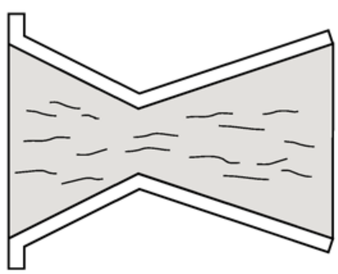
Parameter	Index	Mode
Primary Measuring Device (2.13.2.) (Page 234)	Global	Leopold Lagco
Flow Exponent (2.13.4.1.) (Page 235)	Global	1.55
Maximum Head (2.13.4.2.) (Page 237)	Global	Maximum Head
Maximum Flow (2.13.4.3.) (Page 238)	Global	Maximum Flow
Zero Head (2.13.4.5.) (Page 239)	Global	Zero Head
Flow Time Units (2.13.4.4.) (Page 239)	Global	Time Units

Application information

- Designed to be installed directly into pipelines and manholes
- Leopold Lagco may be classed as a rectangular Palmer-Bowlus flume
- Sized by pipe (sewer) diameter
- For rated flows under free flow conditions, the head is measured at a point upstream referenced to the beginning of the converging section.

Flume size (pipe diameter in inches)	Point of measurement	
	centimeters	inches
4-12	2.5	1
15	3.2	1 1/4
18	4.4	1 3/4
21	5.1	2
24	6.4	2 1/2
30	7.6	3
42	8.9	3 1/2
48	10.2	4
54	11.4	4 1/2
60	12.7	5
66	14.0	5 1/2
72	15.2	6

7.12.4.8 Cut throat flume



Application information

- Similar to Parshall flume except that the floor is flat bottomed and throat has no virtual length.
- Refer to manufacturer's specifications for flow equation and point of level measurement.

Parameter	Index	Mode/value
Primary Measuring Device (2.13.2) (Page 234)	Global	Cut Throat Flume
Flow Exponent (2.13.4.1.) (Page 235)	Global	1.55
Maximum Head (2.13.4.2.) (Page 237)	Global	Maximum head
Maximum Flow (2.13.4.3.) (Page 238)	Global	Maximum flow
Flow Time Units (2.13.4.4.) (Page 239)	Global	Time units

7.12.5 Universal calculation support

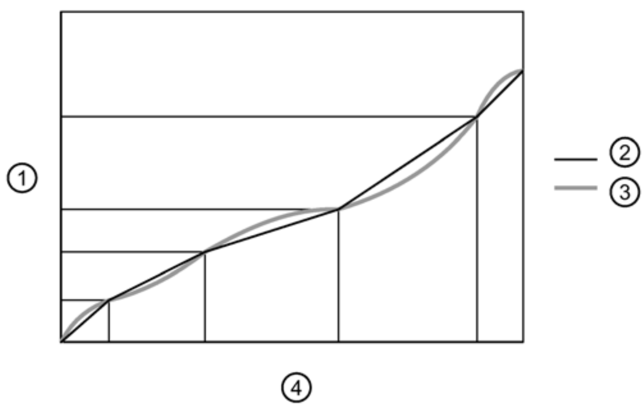
When the Primary Measuring Device (PMD) doesn't fit one of the standard types, it can be programmed using a universal characterization. When Primary Measuring Device (2.13.2.) (Page 234) = Universal, then the head/flow breakpoints must be entered into Universal Head vs. Flow (2.13.6.) (Page 242)

Two curve types are supported:

- Universal Linear Flow Calculation (Page 234) (piece wise linear)
- Universal Curved Flow Calculation (Page 234) (cubic spline)

Both are shown in the following chart.

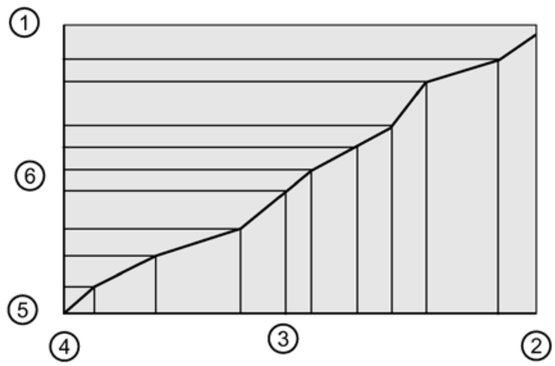
7.12.6 Typical flow characterization



① Flow	③ Curved
② Linear	④ Head

Characterization is achieved by entering Head 1 (2.13.6.1.1.) (Page 242) and its corresponding Flow 1 (2.13.6.1.2.) (Page 243), either from empirical measurement or from the manufacturer's specification.

- Increasing the number of defined breakpoints will increase the accuracy of the flow measurement.
- Breakpoints should be concentrated in areas exhibiting the higher degrees of nonlinear flow. A maximum of 32 breakpoints can be defined.
- For Universal Linear Flow Calculation, Maximum Head and Maximum Flow must be entered as breakpoints.
- For Universal Curved Flow Calculation, values in Maximum Head (2.13.4.2.), Maximum Flow (2.13.4.3.) are automatically used.



① Max. flow

② Max. head

③ Head breakpoints

④ Zero head

⑤ Zero flow

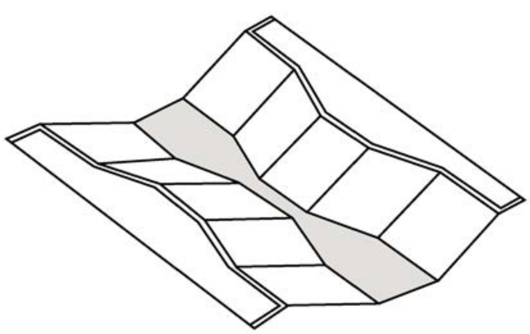
⑥ Flow breakpoints

- Use as many breakpoints as required by the complexity of your PMD.
- For additional information, see Volume (2.7.) (Page 181).

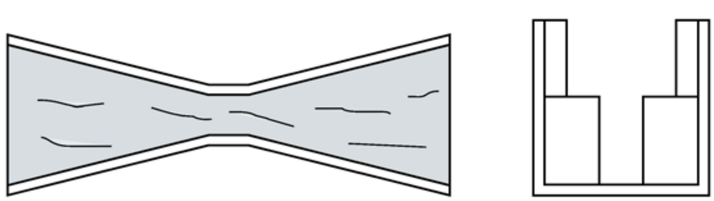
7.12.7 Example flumes

These example flumes would both require a universal calculation.

Trapezoidal flume

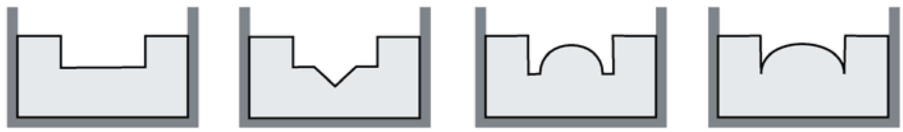


Dual range (nested) Parshall



7.12.8 Example weir profiles

These weirs could require universal calculation.



Contracted regular | Compound | Poebing | Approximate exponential

7.13 Configuration testing

After programming the unit, you must test the device to ensure that it performs to your specifications. This test can be run by varying the level in the application.

7.13.1 I/0 Checkout

After the unit is installed, test to verify the wiring.

Relays

Use Relay Logic Test (3.2.7.) (Page 251) to force a state change and verify that the results are as expected (pump starts, alarm sounds, etc.).

Discrete inputs

Use Discrete Input 1 (2.9.2.1.) (Page 204) or Discrete Input 2 (2.9.2.2.) (Page 204) to force the input and verify that the results are as expected.

1. Go to [DI] where DI = the discrete input to be tested.
2. Set to OFF.
3. Go to Discrete Input 1 Scaled State [DI] (2.9.2.3.) (Page 205) to verify that the value is forced.
4. Check the state of outputs to ensure that they respond as expected.
5. Go to [DI].
6. Set to **Forced ON**.
7. Go to Discrete Input 1 Scaled State [DI] (2.9.2.3.) (Page 205) to verify that the value is forced.
8. Check the state of outputs to ensure that they respond as expected.

For further information, see Discrete inputs (Page 103).

mA Input

Use Scaled mA Input Value (2.6.5.) (Page 181) to test the mA input value against a true level. Use a trusted external mA source to generate the signal required for testing, and verify the incoming signal with Raw mA Input Value (2.6.6.) (Page 181). Check that the system responds as expected when the mA level is changed.

mA Output

Use an external device to test the mA output against the measured level. Check that the mA value changes to reflect the changes in the measured level.

7.13.2 Application test

If you are testing the application by varying the material level, make sure that none of the control devices are connected (or that at least no power is available to them).

While the level is being cycled, check the results of the discrete inputs either by closing the circuit externally (preferred) or by using Discrete Input (12.9.2.1.) (Page 204) or Discrete Input 2 (2.9.2.2.) (Page 204) to force the input ON or OFF. Try all possible combinations to thoroughly test the setup. For each combination, run a complete cycle to verify that the relays operate as expected.

Monitor system performance carefully, under all anticipated operating conditions.

1. When the device performs exactly as required, programming is complete.
2. If alternate reading units, fail-safe action, or relay operation is desired, update the parameters for the new functionality.
3. If the system performance experiences problems, see Diagnosing and troubleshooting (Page 275).

Retest the system every time you adjust any control parameters.

Parameter reference 8

The device is configured through its parameters, and the application determines the parameter values which are entered into the unit. Please check your value entries carefully before operating the device to ensure optimum performance.

Note

Loss of parameter settings

To prevent loss of parameter settings, ensure you save parameter settings before a power cycle/power down.

8.1 Key terms

In the following parameter tables, please note these key terms:

- Default - the factory-set value or option; indicated with an asterisk (*) or specified as a preset value.
- Global - pertains to values that are common for all inputs and outputs on the unit.
- Index - when parameters apply to more than one input, they are indexed. The index selector value defines the input/output for that parameter. For example, index relates to transducer inputs or mA outputs, and can also refer to relays, communications ports, and other parameters.

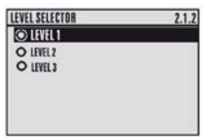
Note

- Parameter range values are displayed in the default of the defined unit of measure. For example, if a parameter description states that it is "defined in Units", the range for that parameter will be shown in meters [as meters (m) is the default for Units].
- The number of decimals displayed for a parameter value will depend on the unit of measure, unless decimal places can be set by the user [such as, Totalizers - Totalizer Decimal Position (2.14.4.) (Page 246)].
- To enter Program mode using the local push buttons, press ▶ . Press to ◀ to return to Measurement mode.

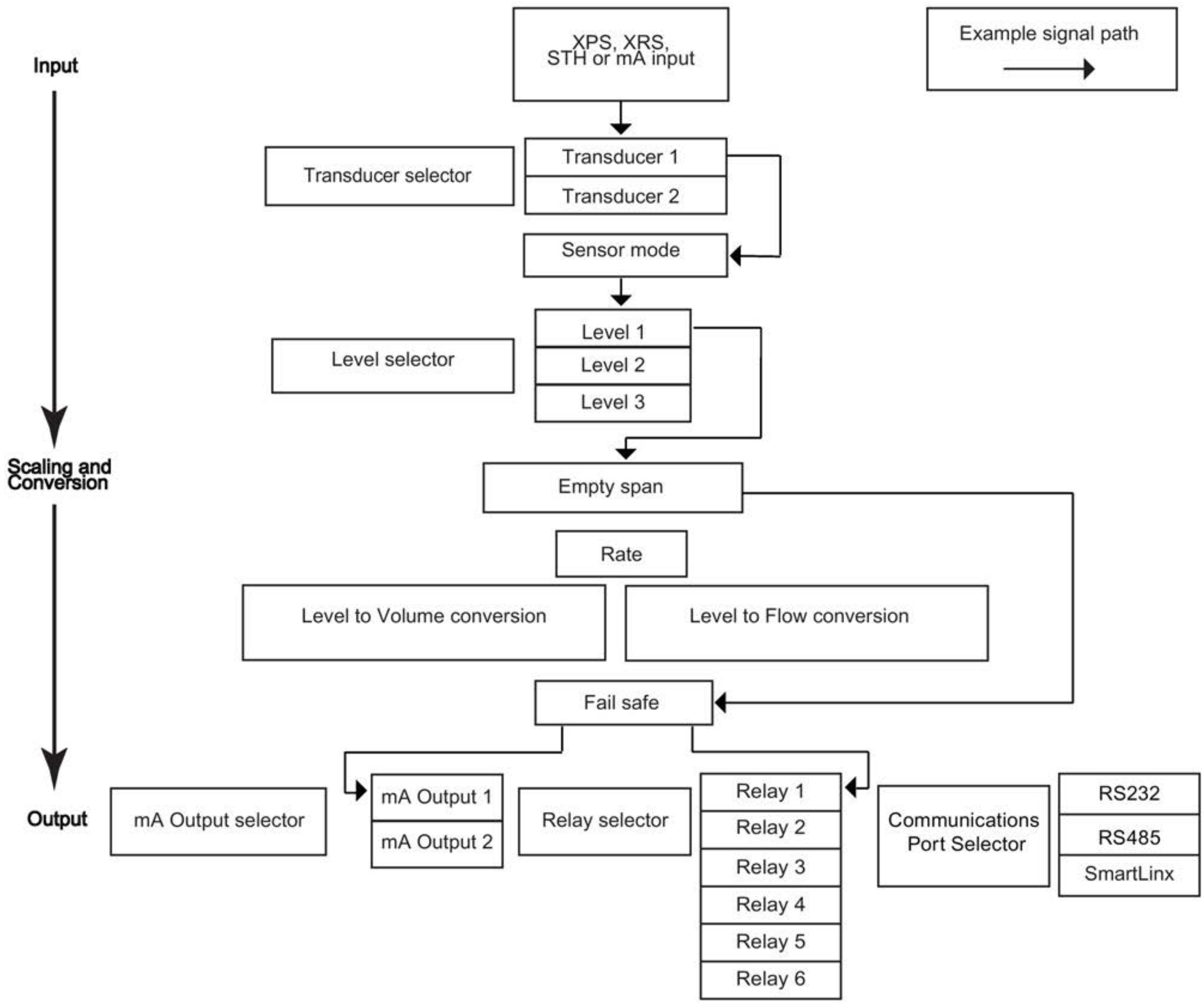
8.2 Parameter indexing

When certain parameters apply to more than one input or output, an **index selector parameter** is used. The index selector parameter defines the measurement signal path for each input or output of its applicable parameter.

The **Level Selector** is the most commonly used index selector parameter; it is required for almost all inputs and outputs. In the illustration below, Level Selector (2.1.2.) (Page 158) assigns the Point (Level 1, 2 or 3) to the succeeding options to be made, such as transducer number [Transducer selector (2.1.4.) (Page 160)] and transducer type [Transducer (2.1.5.) (Page 160)].



The block diagram below traces an example signal path where an input is scaled and converted into an output, using various index selector parameters [Transducer Selector (2.1.4.) (Page 160), Level Selector (2.1.2.) (Page 158), mA Output Selector (2.5.1.) (Page 176), and Relay Selector (2.8.1.1.) (Page 189)]


Input
XPS, XRS,
STH or mA input
Example signal path
Transducer selector
Transducer 1
Transducer 2
Sensor mode
Level selector
Level 1
Level 2
Level 3
Scaling and
Conversion
Empty span
Rate
Level to Volume conversion
Level to Flow conversion
Fail safe
Output
mA Output selector
mA Output 1
mA Output 2
Relay selector
Relay 1
Relay 2
Relay 3
Relay 4
Relay 5
Relay 6
Communications
Port Selector
RS232
RS485
SmartLinx

Note

- Setting up the device may be done through the index selector parameters; however, using the Quick Start Wizards is still the preferred method to commission the device.
- An indexed transducer is commonly referred to as a Point (short for Level Point). A Point number refers to indexed transducers.
- Indexes are set in each sub-menu by one or more selector parameters.
- Transducers are always indexed when the dual-point option is enabled.
- On a single-point device, transducer parameters are indexed only if Operation [Sensor Mode (2.1.3.) (Page 159)] is set to Difference (mode = Dual-Point Difference) or Average (mode = Dual-Point Average)
- Index selector parameters contain a value for each selector regardless if that selector is used or not.
- To view or change a parameter that applies to a different index in the same sub-menu , the new index must be first set in the selector parameter.
- For optimum performance, set selector values accurately for indexed parameters. Ensure that the correct index value is being changed for each parameter value.
- If the device is a single point unit, some selector parameters will not be visible unless Differential or Average operation is selected.

8.3 Index selector examples

The examples provided below show the behavior of the index selector parameters for an application requiring Level measurement and relays to control a small level in small vessels with pumps and high alarm. For more details, see Parameter reference (Page 152).

8.3.1 Sensor and measurement

1. Navigate to Sensor (2.1.) (Page 158)
2. Set Units (2.1.1.) (Page 158) to meters.
3. Set Transducer Selector (2.1.4.) (Page 160) to Transducer 1 for the first vessel.
4. Set Sensor Mode (2.1.3.) (Page 159) to Level.
5. Set Transducer (2.1.5.) (Page 160) to XPS-10.

Note

Repeat this procedure if a second ultrasonic sensor or mA is needed. Choose Transducer 2 in Transducer Selector (2.1.4.) (Page 160)

8.3.2 Calibration

1. Navigate to Calibration (2.2.) (Page 164).
2. Set Calibration (2.2.) (Page 164) to Transducer 1 for the first vessel.
3. Set Empty (2.2.4.) (Page 166) to 2.5 meters.
4. Set Span (2.2.2.) (Page 165) to 2 meters.

Note

- Repeat this procedure for the second ultrasonic sensor or when mA input has been configured.
- Choose Transducer 2 in Calibration (2.2.) (Page 164).
- If the device is a dual-point model, Transducer 3 will be available in Calibration (2.2.) (Page 164) for Differential or Average calculations between the Transducer 1 and Transducer 2 measurements.

8.3.3 Pumps

1. Navigate to Basic Setup (2.8.1.) (Page 189)
2. Set Relay Selector (2.8.1.1.) (Page 191) to Relay 1 to program the first pump.
3. Set Level Source (2.8.1.2.) (Page 190) to Transducer 1. Relay 1 will activate or de-activate based on the values of this measurement.
4. Set Relay Function (2.8.1.4.) (Page 191) to Alternate Duty Assist.
5. Set ON Setpoint. (2.8.1.5.) (Page 192) to 1.25 meters.
6. Set OFF Setpoint (2.8.1.6.) (Page 192) to 0.25 meters.
7. Navigate back to Relay Selector (2.8.1.1.) (Page 189) and select Relay 2 to program the second pump, using new setpoint values.
8. If the relay is controlled by the second transducer measurement, set Level Source (2 2.8.1.2.) (Page 190) to Transducer 2.
9. Repeat this procedure for each required relay. Ensure that the correct relay index is selected in Relay Selector (2.8.1.1.) (Page 191).

8.3.4 High level alarm

1. Navigate to Basic Setup (2.8.1.) (Page 189).
2. Set Relay Selector (2.8.1.1.) (Page 189) to Relay 1 to program the high level alarm.
3. Set Level Source (2.8.1.2) (Page 190) to Transducer 1.
4. Set Relay Function (2.8.1.4.) (Page 191) to Level.
5. Set ON Setpoint (2.8.1.5.) (Page 192) to 2 meters.
6. Set OFF Setpoint (2.8.1.6.) (Page 192) to 1.75 meters.
7. Repeat this procedure for each required relay. Ensure that the correct relay index is selected in Relay Selector (2.8.1.1.) (Page 189).

8.4 Index types

Indexes are set in each sub-menu by one or more selector parameters. To view or change a parameter that applies to a different index, the new index must be set in the selector parameter first.

Name	Description	# of indexes
Global	This parameter applies to the entire device.	n/a
Read only	This parameter cannot be set, only viewed.	n/a
Discrete Input	Indexed by discrete input	2
Echo Profile	Indexed by stored echo profile	10
Level[1)]	Indexed by level point	1, 2, or 3
mA input[1)]	Indexed by mA input	1
mA output[1)]	Indexed by mA output	0 or 2
Comm. Port	Indexed by communications port	2
Relay	Indexed by relay	6
Transducer[2)]	Indexed by transducer	1 or 2

[1)] The three Level points are

- Transducer 1
- Transducer 2
- The calculated point which can be difference [Sensor mode (2.1.3.) (Page 159) = Dual-Point Difference] or average [Sensor mode (2.1.3.) (Page 159) = Dual-Point Average].

Level point typically has 1 index in Single- point Mode (standard), and 2 indexes in Dual-Point Mode (optional). A third index is available in both modes when Operation [Sensor mode (2.1.3.) (Page 159)] is set for DPD [Sensor mode (2.1.3.) (Page 159) = Dual-Point Difference] or DPA [Sensor mode (2.1.3.) (Page 159) = Dual-Point Average].

[2)] The number of indexes available in Single-point Mode (standard) is typically 1, but can be expanded to 2 if Sensor mode (2.1.3.) (Page 159) is set for DPD [Sensor mode (2.1.3.) (Page 159) = Dual-Point Difference] or DPA [Sensor mode (2.1.3.) (Page 159) = Dual-Point Average].

In Dual-Point Mode (optional), the number of available indexes is always 2.

8.5 Quick Start Wizards

Wizards group together all the settings needed for a particular feature, for easy configuration. The device offers several Wizards. All can be accessed via the local push buttons.

For more details on the Wizards listed below, see Quick Start Wizards (Page 57).

8.6 Setup (2.)

8.6.1 Sensor (2.1.)

8.6.1.1 Units (2.1.1.)

Determines sensor measurement units used when Sensor Mode (2.1.3.) (Page 159) is set to Level, Space, Distance, or Head.

Options	*M (meters)
	CM (centimeters)
	MM (millimeters)
	FT (feet)
	IN (inches)

8.6.1.2 Level selector (2.1.2.)

Sets the Level Point index for all parameters applicable to this sub-menu.

Options	*Level 1
	Level 2
	Level 3

8.6.1.3 Sensor mode (2.1.3.)

Sets the type of measurement required for the application.

Index	Single-point model	Dual-point model
	Global	Transducer
Options (mode)	Out of service	
	*Level	how full the vessel is; default for dual-point model
	Space	how empty the vessel is
	*Distance	distance from transducer to material; default for single-point model
	Dual-point difference	DPD
	Dual-point average	DPA
	Flow rate in open channel	OCM
	Pump totalizer	total pumped volume
Alters	Primary measuring device (2.13.2.) (Page 234)	

Dual-Point Difference (DPD) and Dual-Point Average (DPA)

Single-point model use

For DPD or DPA, the unit requires either two transducers of the same type, or one transducer and one mA input. If two transducers are used, all transducer parameters become indexed, and a third level point is calculated.

- DPD (difference) = Point 1 - Point 2
- DPA (average) = (Point 1 + Point 2)/2. The calculated DPD or DPA is always based on level measurements of Points 1 and 2.

For these operations any of three level points (Transducer 1, Transducer 2, or the calculated point) can be used to trigger relays [Level source (2.8.1.2.) (Page 190)].

The points must be globally set to either Dual-Point Difference or Dual-Point Average, as required. Point 3 becomes the calculated value as shown above. See Setting a rake control (Page 130).

Dual-point model use

To set a dual-point device for DPD or DPA functions, Point 3 must be set to either Dual-Point Difference or Dual-Point Average, as required. Points 1 and 2 cannot be set do Dual-Point Difference or Dual-Point Average, but these points are used to calculate the value in Point 3. The calculated DPA is always based on level measurements of Points 1 and 2.

This table shows the available functions:

Operation	Index	Available options
Sensor Mode (2.1.3.)	1	*Level, Space, *Distance, Flow rate in open channel, Pump Totalizer
	2	*Level, Space, *Distance, Flow rate in open channel, Pump Totalizer
	3	Dual-Point Difference, Dual-Point Average

8.6.1.4 Transducer selector (2.1.4.)

Sets the transducer index for all parameters applicable to this sub-menu. All parameter values will then apply to the selected index.

To view or set a parameter for a different index, select it in this parameter.

Options	*Transducer 1
	Transducer 2

If Transducer 1 is selected, the Empty (2.2.4.) (Page 166) and Span (2.2.2.) (Page 165) values viewed in that particular parameter apply only to Transducer 1. Any change to the values will be applied to Transducer 1.

Note

To set or read Empty (2.2.4.) (Page 166) and Span (2.2.2.) (Page 165) for Transducer 2, the selector parameter must first be changed to Transducer 2.

8.6.1.5 Transducer (2.1.5.)

Specifies the model of the Siemens transducer connected to the device.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Options	*No transducer (dual-point preset)	
	ST-25	
	ST-50	
	STH	
	XCT-8	
	*XPS-10 (single-point preset)	
	XCT-12	
	XPS-15	
	XRS-5	
	mA input	
Related	• Current Input (2.6.) (Page 180) • Blanking (2.2.6.) (Page 168) • Reform echo (2.11.2.5.) (Page 218) • TVT Shaper (2.11.4.) (Page 226) • Number of short shots (2.1.11.) (Page 162) • Number of long shots (2.1.12.) (Page 163) • Short shot frequency (2.1.7.) (Page 161) • Long shot frequency (2.1.8.) (Page 161) • Long shot duration (2.1.10.) (Page 162) • Short shot duration (2.1.9.) (Page 162) • Short shot range (2.11.2.12.) (Page 221)	

8.6.1.6 Material (2.1.6.)

Specifies material type.

Index	Single-point model	Dual-point model
	Global	Transducer
Options	*Liquid	
	Solid	
Alters	TVT type (2.11.3.6.) (Page 225)	

8.6.1.7 Short shot frequency (2.1.7.)

Adjusts the short shot transmit pulse frequency, in kHz.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 41 to 46 kHz, nearest acceptable value is returned	
Altered by	Transducer (2.1.5.) (Page 160)	
Related	• Number of short shots (2.1.11.) (Page 162) • Long shot duration (2.1.10.) (Page 162) • Short shot bias (2.11.2.10.) (Page 220) • Short shot floor (2.11.2.11.) (Page 221) • Short shot range (2.11.2.12.) (Page 221)	

8.6.1.8 Long shot frequency (2.1.8.)

Adjusts the long shot transmit pulse frequency, in kHz.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 41 to 46 kHz, nearest acceptable value is returned	
Altered by	Transducer (2.1.5.) (Page 160)	
Related	• Number of long shots (2.1.12.) (Page 163) • Short shot frequency (2.1.7.) (Page 161) • Short shot duration (2.1.9.) (Page 162)	

8.6.1.9 Short shot duration (2.1.9.)

Adjusts the duration of the short shot transmit pulse, in milliseconds.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 0.000 to 5.000	
Altered by	Transducer (2.1.5.) (Page 160)	
Related	• Number of long shots (2.1.12.) (Page 163) • Long shot duration (2.1.10.) (Page 162) • Long shot frequency (2.1.8.) (Page 161)	

8.6.1.10 Long shot duration (2.1.10.)

Adjusts the duration of the long shot transmit pulse, in milliseconds .

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 0.000 to 5.000	
Altered by	Transducer (2.1.5.) (Page 160)	
Related	• Number of short shots (2.1.11.) (Page 162) • Short shot frequency (2.1.7.) (Page 161) • Short shot duration (2.1.9.) (Page 162) • Short shot bias (2.11.2.10.) (Page 220) • Short shot floor (2.11.2.11.) (Page 221) • Short shot range (2.11.2.12.) (Page 221)	

8.6.1.11 Number of short shots (2.1.11.)

Sets the number of short shots to be fired (and results averaged) per transmit pulse.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 0 to 100	
	Preset: 1	
Related	• Number of long shots (2.1.12.) (Page 163) • Short shot frequency (2.1.7.) (Page 161) • Long shot duration (2.1.10.) (Page 162) • Short shot bias (2.11.2.10.) (Page 220) • Short shot floor (2.11.2.11.) (Page 221) • Short shot range (2.11.2.12.) (Page 221)	

8.6.1.12 Number of long shots (2.1.12.)

Sets the number of long shots to be fired (and results averaged) per transmit pulse.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 0 to 200	
	Preset: 5	
	Response rate (2.3.4.) (Page 170)	
Related	• Number of short shots (2.1.11.) (Page 162) • Long shot frequency (2.1.8.) (Page 161) • Short shot duration (2.1.9.) (Page 162)	

This value is automatically altered by Response rate (2.3.4.) (Page 170)

8.6.1.13 Shot synchro (2.1.13.)

Enables the System Sync on the terminal block.

Index	Global
Options	Not required
	*Synchronized level monitors

Use this if another level measurement system is mounted nearby, and wired together on the Sync terminal.

8.6.1.14 Scan delay (2.1.14.)

Adjusts the delay between measurements from transducer points, in seconds. Dual-point model only.

Index	Global
Values	Range: 0 to 60 seconds
	Preset: 5
Altered by	Response rate (2.3.4.) (Page 170)
Related	Sensor mode (2.1.3.) (Page 159)

This feature may only be used to adjust the delay before the next point is scanned. This value is automatically altered when Response Rate (2.3.4.) (Page 170) is altered.

8.6.1.15 Scan time (2.1.15.)

Shows the elapsed time, in seconds, since the point displayed was last scanned.

Index	Level
Values	Range: 0.000 ... 9999 (Read only)
Related	Sensor mode (2.1.3.) (Page 159)

This may be viewed as an Auxiliary Reading in the RUN mode.

8.6.1.16 Shot delay (2.1.16.)

Adjusts the delay (in seconds) between transducer shots.

Index	Transducer
Values	Range: 0.1 ... 4.0
	Preset: 0.5

Use this if transient acoustic noise within the vessel is causing measurement difficulties due to echoes from one shot being received on the next. If more than one ultrasonic unit is installed for redundancy, this value should be 0.

8.6.1.17 Shot/pulse mode (2.1.17.)

Determines what type of ultrasonic shots are fired.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Options	Short	
	*Short and long	
Related	• Empty (2.2.4.) (Page 166) • Long confidence (3.2.11.2.) (Page 258) • Long echo threshold (2.11.2.3.) (Page 217) • Short shot range (2.11.2.12.) (Page 221)	

Increases the device's response when the monitored surface is close to the transducer face. Select **Short and long** to have short and long acoustic shots fired for each measurement, regardless of the transducer to surface distance. Select **Short** to have only short shots fired if the Long confidence (3.2.11.2.) (Page 258) produced by a short shot exceeds the short Long echo threshold (2.11.2.3.) (Page 217) and the monitored surface is always within the Short shot range (2.11.2.12.) (Page 221).

8.6.2 Calibration (2.2.)

8.6.2.1 Level selector (2.2.1)

Sets the Level Point index for all parameters applicable to this sub-menu.

8.6.2.2 Span (2.2.2.)

Sets the range to be measured.

Index	Level
Values	Range: 0.000 ... 99.000 m [or equivalent, depending on Units (2.1.1.) (Page 158)]
	Preset: based on Empty (2.2.4.) (Page 166)
Alters	• Zero head (2.13.4.5.) (Page 239) • ON setpoint (2.8.1.5.) (Page 192) • OFF setpoint (2.8.1.6.) (Page 192)
Altered by	• Units (2.1.1.) (Page 158) • Empty (2.2.4.) (Page 166)
Related	• Volume (2.7.) (Page 181) • Blanking (2.2.6.) (Page 168) • Level (3.2.8.3.) (Page 252) • Space (3.2.8.11.) (Page 253) • Head (3.2.8.13) (Page 254)

Enter a value reflecting maximum application range.

Always prevent the monitored surface from approaching within 0.3 m (1 ft) of the transducer face as this is the minimum blanking for most Siemens transducers (some require more blanking – see your transducer manual).

Many other parameters are set as a percentage of span [even if they are entered in Units (2.1.1.) (Page 158)]. The values of these other parameters may change if the span is altered after installation and the other parameters are measured using a level determined upward from the Empty level toward the transducer face.

All volumes are based on span so it should be set for the maximum volume point if volume calculations are needed.

8.6.2.3 Transducer selector (2.2.3.)

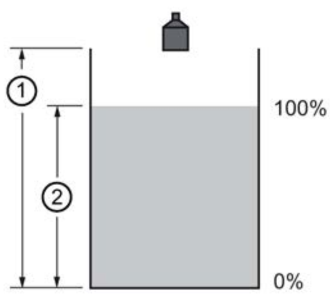
Sets the transducer index for all parameters applicable to this sub-menu.

8.6.2.4 Empty (2.2.4.)

Enters distance, in Units (2.1.1.) (Page 158), from the face of the transducer to the process empty point.

Index	Transducer
Values	Range: 0.000 ... 99.000 m [or equivalent, depending on Units (2.1.1.) (Page 158)]
	Preset: 5.000 m [or equivalent, depending on Units (2.1.1. (Page 158))]
Alters	• Span (2.2.2.) (Page 165)
Altered by	• Units (2.1.1.) (Page 158)
Related	• Blanking (2.2.6.) (Page 168) • Level (3.2.8.3.) (Page 252) • Distance % (3.2.8.4.) (Page 252)

Setting this value also sets Span (2.2.2.) (Page 165), unless Span was already set to another value. For distance operation [Sensor Mode (2.1.3) (Page 159) = Distance], Span is preset to Empty.



① Empty
② Span

8.6.2.5 Sensor offset (2.2.5.)

Calibrates Empty (2.2.4.) (Page 166) if the reported level is consistently high or low by a fixed amount.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: -999 ... 9999	
Related	• Empty (2.2.4.) (Page 166) • Offset reading (2.12.6.) (Page 233) • Zero head (2.13.4.5.) (Page 239) • Offset correction (2.11.1.9.) (Page 216) • Process temperature (2.11.1.3.) (Page 213)	

Before using this feature, verify the following parameters are correct:

- Empty (2.2.4.) (Page 166)
- Process temperature (2.11.1.3.) (Page 213)
- Offset reading (2.12.6.) (Page 233) (if using OCM)
- Zero head (2.13.4.5.) (Page 239)

Offset calibration

Begin with a steady level.

1. Measure the actual reading (use tape measure).
2. Enter the measured value from Step 1 into this parameter.

The deviation between the entered Empty (2.2.4) (Page 166) value and the calibrated Empty value is stored in Offset Correction (2.11.1.9.) (Page 216)

8.6.2.6 Blanking (2.2.6.)

The space near the transducer face which cannot be measured.

Index	**Single-point model**		**Dual-point model**
	Global		Transducer
Values	Range: Range: 0.000 ... 99.00 m or equivalent, depending on Units (2.1.1.) (Page 158)		
	Preset	0.300 m (most transducers)	
		0.450 m (XCT-8, XCT-12)	
Related	• Empty (2.2.4.) (Page 166) • Span (2.2.2.) (Page 165) • TVT dB (2.11.3.7.) (Page 225)		

Use this feature if the surface is reported to be near the transducer face but is in fact much further away. Extend this value when changing transducer location, mounting, or aiming.

Please note that changing the Blanking cannot correct measurement problems. Ensure that Span (2.2.2.) (Page 165) < Empty (2.2.4.) (Page 166) minus Blanking (2.2.6.).

8.6.2.7 Range extension (2.2.7.)

Allows the material level to fall below the Empty setting without reporting LOE.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 0.000 ... 99.00 m, or max. Span (2.2.2.) (Page 165), or equivalent, depending on Units (2.1.1.) (Page 158)	
	Preset: 20% of Span (2.2.2.) (Page 165)	
Related	• Units (2.1.1.) (Page 158) • Empty (2.2.4.) (Page 166) • Span (2.2.2.) (Page 165) • Transducer (2.1.5.) (Page 160)	

This feature is useful in OCM applications where the Empty level is set to the bottom of the weir, and above the bottom of the channel, and should be used if the surface monitored can fall past the Empty (2.2.4.) (Page 166) level in normal operation.The value is added to Empty (2.2.4.) (Page 166) and can be greater than the range of the transducer. If the surface monitored can extend beyond Empty (2.2.4.) (Page 166), increase Range Extension (2.2.7.) [in Units (2.1.1.) (Page 158)] such that Empty plus Range Extension is greater than the transducer face to furthest surface to be monitored distance. This is often the case with OCM when using weirs and some flumes.

8.6.3 Rate (2.3.)

8.6.3.1 Transducer selector (2.3.1.)

Sets the transducer index for all parameters applicable to this sub-menu.

8.6.3.2 Fill rate/minute (2.3.2.)

Adjusts the device's response to increases in the actual material level [or advance to a higher Material Level (2.4.5.) (Page 174)].

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 0.000 ... 99.00 m [or equivalent, depending on Units (2.1.1.) (Page 158)]	
	Preset: 20% of Span (2.2.2.)	
Altered by	Response Rate (2.3.4.) (Page 170)	
Related	• Units (2.1.1.) (Page 158) • Span (2.2.2.) (Page 165) • Material level (2.4.5.) (Page 174)	

Enter a value slightly greater than the maximum vessel filling rate. This value, in Units (2.1.1.) (Page 158) per minute, is automatically altered when Response Rate (2.3.4.) (Page 170) is altered.

Response rate (2.3.4.) value	Meters/minute
1	0.1
2	1
3	10

8.6.3.3 Empty rate/minute (2.3.3.)

Adjusts the device's response to decreases in the actual material level [or advance to a lower Material Level (2.4.5.) (Page 174)].

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 0.000 ... 99.00 m [or equivalent, depending on Units (2.1.1.) (Page 158)]	
Altered by	Response Rate (2.3.4.) (Page 170)	
Related	• Units (2.1.1.) (Page 158) • Span (2.2.2.) (Page 165) • Material level (2.4.5.) (Page 174)	

Enter a value slightly greater than the maximum vessel emptying rate. This value, in Units (2.1.1.) (Page 158) per minute, is automatically altered when Response Rate (2.3.4.) (Page 170) is altered.

Response rate (2.3.4.) value	Meters/minute
1	0.1
2	1
3	10

8.6.3.4 Response rate (2.3.4.)

Determines the level change reaction.

Index	Transducer
Options	Slow (0.1 m/min)
	*Medium (1.0 m/min)
	Fast (10.0 m/min)
Alters	• LOE timer (2.4.2.) (Page 173) • Fill rate/minute (2.3.2.) (Page 169) • Empty rate/minute (2.3.3.) (Page 169) • Filling indicator (2.3.9.) (Page 172) • Emptying indicator (2.3.10.) (Page 172) • Rate filter (2.3.5.) (Page 171) • Fuzz filter (2.11.5.6.) (Page 231) • Echo lock window (2.11.5.5.) (Page 230) • Scan delay (2.1.14.) (Page 163) • Number of long shots (2.1.12.) (Page 163)
Related	• Material level (2.4.5.) (Page 174) • Fail-safe advance (2.4.6.) (Page 175) • Pump by rate (2.8.1.8.) (Page 193) • Rate filter time (2.3.6.) (Page 171) • Rate filter distance (2.3.7.) (Page 171) • Rate (2.3.) (Page 169) • Echo lock (2.11.5.4.) (Page 230) • Measurement verification (2.11.5.) (Page 228) • Shot synchro (2.1.13.) (Page 163) • Shot delay (2.1.16.) (Page 164) • Scan time (2.1.15.) (Page 164)

Use a setting just fast enough to keep up with your process. Slower settings provide higher accuracy. Faster settings allow for more level fluctuations.

8.6.3.5 Rate filter (2.3.5.)

Damps the Flow Maximum (3.2.8.15.) (Page 254) fluctuations

Index	Single-point model	Dual-point model
	Global	Transducer
Options	Rate display not required	
	Filtered Output: Continuous filtering and update	
	Interval Output: *1 min or 50 mm (2 in) 5 min or 100 mm (3.9 in) 10 min or 300 mm (11.8 in) 10 min or 1000 mm (39.4 in)	
Alters	Flow Maximum (3.2.8.15.) (Page 254)	
Altered by	Response Rate (2.3.4.) (Page 170)	
Related	Rate Filter Time (2.3.6.) (Page 171) Rate Filter Distance (2.3.7.) (Page 171)	

Enter the time or distance interval over which the Flow Maximum (3.2.8.15.) (Page 254) is to be calculated before the display updates.

This is automatically altered along with Response Rate (2.3.4.) (Page 170).

This value automatically alters the Rate Filter Time (2.3.6.) (Page 171) and/or Rate Filter Distance (2.3.7.) (Page 171). Alternatively, these parameter values may be altered independently.

8.6.3.6 Rate filter time (2.3.6.)

The time period, in seconds, over which the material level rate of change is averaged before Flow Maximum (3.2.8.15.) (Page 254) updates.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 0.000 ... 9999 seconds	
Related	Flow Maximum (3.2.8.15.) (Page 254)	

8.6.3.7 Rate filter distance (2.3.7.)

The material level change, in meters, to initiate a Flow Maximum (3.2.8.15.) (Page 254) update.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 0.000 ... 9999 meters	
Related	Flow Maximum (3.2.8.15.) (Page 254)	

8.6.3.8 Level selector (2.2.8)

Sets the Level Point index for all parameters applicable to this sub-menu.

8.6.3.9 Filling indicator (2.3.9.)

The fill rate required to activate the LCD Filling indicator

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 0.000 ... 99.00 m [or equivalent, depending on Units (2.1.1.) (Page 158)]	
Altered by	Response Rate (2.3.4.) (Page 170)	
Related	• Units (2.1.1.) (Page 158) • Span (2.2.2.) (Page 165) • Empty rate/minute (2.3.3.) (Page 169)	

This value [in Units (2.1.1.) (Page 158) per minute] is automatically set to 1/10 of the Fill Rate/minute (2.3.2.) (Page 169).

8.6.3.10 Emptying indicator (2.3.10.)

The empty rate required to activate the LCD emptying indicator

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 0.000 ... 99.00 m [or equivalent, depending on Units (2.1.1.) (Page 158)]	
Altered by	Response Rate (2.3.4.) (Page 170)	
Related	• Units (2.1.1.) (Page 158) • Span (2.2.2.) (Page 165) • Empty rate/minute (2.3.3.) (Page 169)	

This value [in Units (2.1.1.) (Page 158) per minute] is automatically set to 1/10 of the Empty Rate/minute (2.3.3.) (Page 169).

8.6.4 Fail-safe (2.4.)

The fail-safe parameters ensure that the devices controlled by the main device default to an appropriate state when a valid level reading is not available. The Primary Reading region on the HMI will display dashes (– – – –) until the fail-safe fault has been cleared.

For a list of faults that will cause fail-safe, see General fault codes (Page 276).

Note

When a Loss of Echo occurs, Material Level (2.4.5.) (Page 174) determines the material level to be reported when the fail-safe timer expires. For more details, see Fail-safe mode (Page 304).

8.6.4.1 Transducer selector (2.4.1.)

Sets the transducer index for all parameters applicable to this sub-menu.

8.6.4.2 LOE timer (2.4.2.)

The time for invalid measurements to elapse before a fail-safe state activates.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 0 ... 15 minutes	
	Preset 10.00 minutes	
Altered by	Response rate (2.3.4.) (Page 170)	
Related	Relay fail-safe (2.8.2.3.) (Page 196)	

Once activated, the fail-safe state initiates the following:

1. The material level is reported based on Material level (2.4.5.) (Page 174)
   – The unit responds to the new level as programmed (control and alarm relays activate as defined by the programming).
   – Individual relays can have independent fail-safe responses. See Relay fail-safe (2.8.2.3.) (Page 196).
2. The appropriate error is displayed:
   – **LOE** for loss of echo from the transducer.
   – **Short** for a shorted transducer cable.
   – **Open** for a cut transducer cable.
   – **Error** for all other problems.

When modifying the preset value, set it short enough to protect the process, but long enough to avoid false alarms. Only use 0.0 minutes (no delay) for testing.

8.6.4.3 Level selector (2.4.3.)

Sets the Level Point index for all parameters applicable to this sub-menu.

8.6.4.4 Fail-safe mode (2.4.4.)

Sets how the device responds to a fail-safe state.

Index	Transducer	
Options	HI	Level goes to maximum Span (2.2.2.) (Page 165).
	LO	Level goes to 0 span [Empty (2.2.4.) (Page 166)]
	*Hold	Level remains at last reading
	Value	Level goes to user-selected value defined in Material level (2.4.5.) (Page 174)
Related	• Sensor mode (2.1.3.) (Page 159) • Empty (2.2.4.) (Page 166) • Span (2.2.2.) (Page 165) • Relay function (2.8.1.4.) (Page 191) • ON setpoint (2.8.1.5.) (Page 192) • OFF setpoint (2.8.1.6.) (Page 192) • Relay fail-safe (2.8.2.3.) (Page 196)	

Select the Fail-safe Mode based on the relay operation required during fail-safe operation.

Relay reaction

The way in which relay programming reacts to the fail-safe level depends on Relay Fail-safe (2.8.2.3.) (Page 196). By default:

- Alarm relays have Relay Fail-safe (2.8.2.3.) (Page 196) = **OFF** and so react to the Material Level.
- Control relays have Relay Fail-safe (2.8.2.3.) (Page 196) = **De-energize** and so de-energize the relay when the unit enters Fail-safe mode regardless of the Material Level.

8.6.4.5 Material level (2.4.5.)

The material level reported when a fail-safe state is initiated.

Index	Transducer
Values	Range: -4999 ... 9999, value in Units (2.1.1.) (Page 158)

8.6.4.6 Fail-safe advance (2.4.6.)

Sets the speed the device advances to, and returns from, the Fail-safe Material Level.

Index	Level	
Options	*Restricted	Advances to/from Fail-safe Material Level as set by • Response Rate (2.3.4.) (Page 170) • Fill rate/minute (2.3.2.) (Page 169) • Empty rate/minute (2.3.3.) (Page 169)
	Immediate	Fail-safe Material Level assumed right away.
	Fast back	Fail-safe Level Advance is restricted, return is immediate.
Related	• Response rate (2.3.4.) (Page 170) • LOE timer (2.4.2.) (Page 173) • Material level (2.4.5.) (Page 174) • Fill rate/minute (2.3.2.) (Page 169) • Empty rate/minute (2.3.3.) (Page 169)	

8.6.4.7 mA Output selector (2.4.7.)

Sets the mA Output index for all applicable parameters in this sub-menu.

Options	*mA Output 1
	mA Output 2

8.6.4.8 mA Fail-safe mode (2.4.8.)

Use for fail-safe operation, independent of the Material Level (2.4.5.) (Page 174).

Index	mA Output	
Options	*OFF	mA output responds to Material level (2.4.5.) (Page 174).
	HI	Produce the Span mA output immediately.
	LO	Produce the Empty mA output immediately.
	Hold	Last known value is held until normal operation resumes.
	Value	mA output goes to user-selected value defined in mA Fail-safe Value (2.4.9.) (Page 176)
Related	Current output function (2.5.3.) (Page 177)	

8.6.4.9 mA Fail-safe value (2.4.9.)

Sets the mA value to be reported when the fail-safe timer expires.

Note

Fail-safe mode (2.4.4.) (Page 174) must be set to **Value** in order for the **Material Level** value to be reported.

Index	mA Output
Values	Range: 0 ... 22 mA
	Preset: 3.58 mA

8.6.5 Current Output (2.5.)

Sets the parameters applicable to the current value of the mA output.

8.6.5.1 mA output selector (2.5.1.)

Sets the mA output index for all parameter settings.

Options	*mA Output 1
	mA Output 2

8.6.5.2 mA output range (2.5.2.)

Determines the mA output range.

Index	mA Output
Options	OFF
	0 ... 20 mA
	*4 ... 20 mA
	20 ... 0 mA
	20 ... 4 mA
Related	Milliamp output (2.5.9.) (Page 178)

If either 0 to 20 mA or 4 to 20 mA is selected, the mA output is directly proportional to the mA Function. If either 20 to 0 mA or 20 to 4 mA is selected, then the output is inversely proportional. After setting mA output range (2.5.2.), verify that Minimum mA limit (2.5.7.) (Page 178) has a valid entry, as it is not changed automatically by setting the mA output range (2.5.2.).

8.6.5.3 Current output function (2.5.3.)

Alters the mA output/measurement relationship.

Index	mA output	
Options	**mA function**	**Sensor mode (2.1.3.)**
	OFF	
	Level	Level, differential, or average
	Space	Space
	*Distance	Distance
	Volume	Level or space
	Flow	OCM
	Head	
	Volume Rate	
	mA Input	
Related	• mA output allocation (2.5.4.) (Page 177) • Milliamp output (2.5.9.) (Page 178)	
Altered by	Sensor mode (2.1.3.) (Page 159)	

8.6.5.4 mA output allocation (2.5.4.)

Sets the input source from which the mA output is calculated.

Index	mA Output
Options	*Point 1
	Point 2
	Average of readings from Point 1 and Point 2
	Point 3
Related	Current output function (2.5.3.) (Page 177)

Enter the point number the mA output is based on. This value depends on whether Current Output Function (2.5.3.) (Page 177) is set as transducer or mA input.

For a single-point device, if Current Output Function (2.5.3) (Page 177) uses a transducer, parameter mA Output Allocation (2.5.4) can only be altered if Sensor Mode (2.1.3.) (Page 159) is set for DPD or DPA.

Parameter mA Output Allocation (2.5.4.) can be set to a particular point or range of points. When set to a range of points, the mA output will be the average of the readings from all in service transducers in the range. Out-of-service transducers will be ignored.

8.6.5.5 4 mA setpoint (2.5.5.)

Sets the process level corresponding to the **0 or 4 mA** value.

Index	mA Output
Values	Range: -999 ... 9999
Related	20 mA setpoint (2.5.6.) (Page 178)

Enter the value [in applicable Units (2.1.1.) (Page 158)] to correspond to **0 or 4 mA.**

8.6.5.6 20 mA setpoint (2.5.6.)

Sets the process level that corresponds to the **20 mA** value.

Index	mA Output
Values	Range: -999 ... 9999
Related	4 mA setpoint (2.5.5.) (Page 178)

Enter the value [in applicable Units (2.1.1.) (Page 158)] to correspond to **20 mA.**

8.6.5.7 Minimum mA limit (2.5.7.)

Sets the minimum mA output value to be produced.

Index	mA Output
Values	Range: 0.000 .. 22.000 mA
	Preset: 3.800 mA
Related	• mA output range (2.5.2.) (Page 176) • Maximum mA limit (2.5.8.) (Page 178)

8.6.5.8 Maximum mA limit (2.5.8.)

Sets the maximum mA output value to be produced.

Index	mA Output
Values	Range: 0.000 ... 22.000 mA
	Preset: 20.200 mA
Related	• mA output range (2.5.2.) (Page 176) • Minimum mA limit (2.5.7.) (Page 178)

8.6.5.9 Milliamp output (2.5.9.)

Displays the current mA output value.

Range: 3.500 ... 22.2 mA

8.6.5.10 Fail-safe mode (2.5.10.)

Use for fail-safe operation, independent of the Material Level (2.4.5.) (Page 174).

Index	mA output	
Options	*OFF	mA output responds to Material Level (2.4.5.) (Page 174)
	HI	Produce the **Span** mA output immediately.
	LO	Produce the **Empty** mA output immediately.
	Hold	Last **known** value is held until normal operation resumes.
	Value	mA output goes to user-selected value defined in mA Fail-safe Value (2.4.9.) (Page 176).
Related	Current output function (2.5.3.) (Page 177)	

8.6.5.11 4 mA output trim (2.5.11.)

Calibrates the 4 mA output

Index	mA Output
Values	Preset: 4.00
Related	20 mA output trim (2.5.12.) (Page 179)

Adjust this value so the device indicates 4.00 mA when 4 mA Output Trim (2.5.11.) is accessed.

Trimming the 4 mA value:

1. Go to Milliamp Output (2.5.9.) (Page 178) and enter 4.00 mA.
2. Read the value indicated on the current meter or other connected device, and enter it in mA output trim (2.5.11.)

The new **trimmed value** will be shown in the current meter or other connected device.

8.6.5.12 20 mA output trim (2.5.12.)

Calibrates the 20 mA output

Index	mA Output
Values	Preset: 20.00
Related	4 mA Output Trim (2.5.11.) (Page 179)

Adjust this value so the device indicates 20.00 mA when 20 mA output trim (2.5.12.) is accessed

Trimming the 20 mA value:

1. Go to Milliamp Output (2.5.9.) (Page 178) and enter 20.00 mA.
2. Read the value indicated on the current meter or other connected device, and enter it in mA output trim (2.5.12.)

The new **trimmed value** will be shown in the current meter or other connected device.

8.6.6 Current Input (2.6.)

8.6.6.1 mA input range (2.6.1.)

Shows the mA input range of the connected mA device.

Index	Global
Options	0 ... 20 mA
	*4 ... 20 mA

Ensure this range corresponds to the output range of the external device. All level measurements will equate % of Span with the % of the mA range.

8.6.6.2 0/4 mA level value (2.6.2.)

Shows the process level corresponding to the 0 or 4 mA value.

Index	Global
Values	Range: -999 ... 9999%
	Preset: 0%
Related	• Empty (2.2.4.) (Page 166) • Span (2.2.2.) (Page 165)

When using an external mA signal to determine level, the input range must be scaled to give accurate results.

8.6.6.3 20 mA level value (2.6.3.)

Shows the process level corresponding to the 20 mA value.

Index	Global
Values	Range: -999 ... 9999%
	Preset: 100%
Related	• Empty (2.2.4.) (Page 166) • Span (2.2.2.) (Page 165)

Input range is scaled for accuracy if an external mA signal calculates level.

8.6.6.4 mA Damp Filter (2.6.4.)

Shows the time constant used in the mA input filter to dampen signal fluctuations.

Index	Global
Values	Range: 0 ... 9999 seconds
	Preset: 1 second

This number is used in the damping calculations. Larger values damp more than smaller values and 0 disables the signal filter.

8.6.6.5 Scaled mA input value (2.6.5.)

Shows the resulting level value after scaling.

Index	Global
Values	Range: -999 ... 9999% (read only)
	Preset: calculated from the input mA signal

8.6.6.6 Raw mA input value (2.6.6.)

Shows the raw mA input supplied by an external device.

Index	mA Input
Values	Range: 0.000 ... 20.00 (Read only)

8.6.7 Volume (2.7.)

Carries out a volume conversion from a Level measurement.

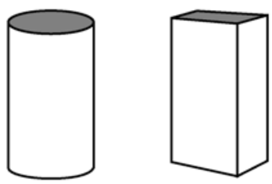
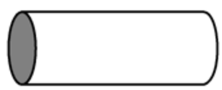
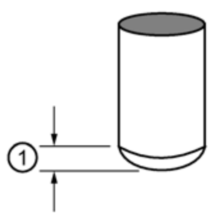
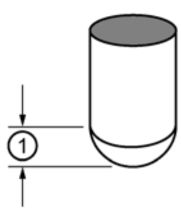
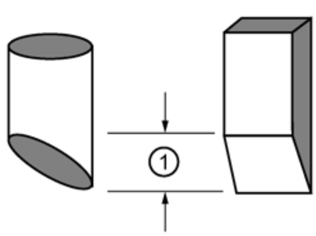
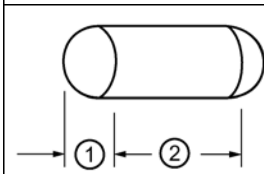
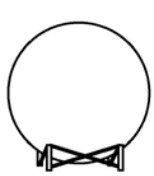
8.6.7.1 Level selector (2.7.1.)

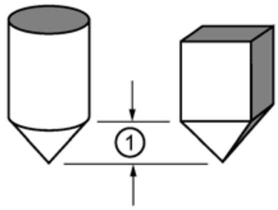
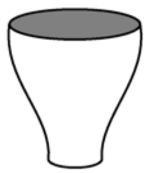
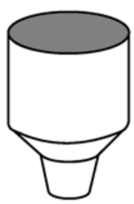
Sets the Level Point index for all parameters applicable to this sub-menu.

8.6.7.2 Vessel shape (2.7.2.)

Enters the Vessel Shape value matching the monitored vessel or wet well.

Liquid (material) volume is calculated when Sensor Mode (2.1.3.) (Page 159) = *Level. Alternatively, the remaining vessel capacity is calculated when Sensor Mode (2.1.3.) (Page 159) = Space. In RUN mode, readings are displayed in percent of maximum volume. To convert readings to volumetric units, see Maximum Volume (2.7.3.) (Page 183).

Vessel shape	Display/description
None	* NONE
	Flat level bottom
	Flat ends
	Parabolic bottom
	Half sphere bottom
	Flat sloped bottom
	Parabolic ends
	Sphere

Vessel shape	Display/description
	Conical bottom
	Universal curved
	Universal linear

① = dimension A

② = dimension L

8.6.7.3 Maximum volume (2.7.3.)

Enters the maximum volume of the vessel.

Index	Level
Values	Range: 0.000 ... 99999
	Preset: 100.000
Alters	Decimal position (2.12.4.) (Page 232)
Related	• Empty (2.2.4.) (Page 166) • Span (2.2.2.) (Page 165) • Head (3.2.8.13) (Page 254)

Enter the vessel volume corresponding to Span (2.2.2.) (Page 165). For example, if your maximum vessel volume is 8000 L, enter a value of 8000. For readings in volumetric units (rather than percent), enter the equivalent vessel volume for Span (2.2.2.) (Page 165). Any volume units can be chosen because volume is calculated from empty to maximum span, and is scaled according to the Vessel Shape (2.7.2.) (Page 181) value.

Note

Make sure selected chosen units allow LCD volume display.

Examples:

- If max. volume = 3650 m^3, enter 3650
- If max. volume = 267500 gallons, enter 267.5 (thousands of gallons)

8.6.7.4 Dimension A (2.7.4.)

Enters the height of the vessel bottom when the bottom is conical, parabolic, spherical, or flat sloped. If the vessel is horizontal with parabolic ends, the depth of the end. For illustrations, see Vessel shape (2.7.2.) (Page 181)

Dimension A as used in Vessel shape (2.7.2.) (Page 181).

Index	Level
Values	Range: 0.000 ... 99.000 m or equivalent, depending on Units (2.1.1.) (Page 158)
	Preset: 0.000
Related	Vessel shape (2.7.2.) (Page 181)

Enter one of the following:

- Height of the tank bottom, if Vessel Shape (2.7.2.) (Page 181) = Conical Bottom, Parabolic Bottom, Half Sphere Bottom, or Flat Sloped Bottom, or
- Length of one end section of the tank, if Vessel Shape (2.7.2.) (Page 181) = Parabolic Ends, in Units (2.1.1.) (Page 158).

8.6.7.5 Dimension L (2.7.5.)

Enters the length of the cylindrical section of a horizontal parabolic end vessel. For illustrations, see Vessel shape (2.7.2.) (Page 181).

Dimension L as used in Vessel shape (2.7.2.) (Page 181).

Index	Level
Values	Range: 0.000 ... 99.000 m or equivalent, depending on Units (2.1.1.) (Page 158)
	Preset: 0.000
Related	Vessel shape (2.7.2.) (Page 181)

Enter the tank length (excluding both end sections) if Vessel shape (2.7.2.) (Page 181) = parabolic ends.

8.6.7.6 Transducer selector (2.7.6.)

Sets the transducer index for all parameters applicable to this sub-menu.

8.6.7.7 Inflow/discharge adjust (2.7.7.)

The method used to calculate the volume pumped, for pumped total [Sensor Mode (2.1.3.) (Page 159) = Pump Totalizer].

Index	Single-point model	Dual-point model
	Global	Transducer
Options	Based on Pump Cycle	
	No adjustment	
	*Based on Rate Estimation	
Related	• Sensor mode (2.1.3.) (Page 159) • Rate filter (2.3.5.) (Page 171) • Rate filter time (2.3.6.) (Page 171) • Rate filter distance (2.3.7.) (Page 171) • Rate (2.3.) (Page 169)	

8.6.7.8 Table 1-8 (2.7.8.)

Allows for the Volume to be specified based on segments, if the tank shape is too complex for any of the preconfigured shapes.

Enter up to 32 Level and Volume breakpoints (where Volume is known), if Vessel Shape (2.7.2.) (Page 181) is set to Universal Linear or Universal Curved.

Each segment defined by the Level breakpoints (example: Level 1) requires a Volume (example: Volume 1) for the level-to-volume calculations.

- 2.7.8.1. Level 1
- 2.7.8.2. Volume 1
- 2.7.8.3. Level 2
- 2.7.8.4. Volume 2
- 2.7.8.5. Level 3
- 2.7.8.6. Volume 3
- 2.7.8.7. Level 4
- 2.7.8.8. Volume 4
- 2.7.8.9. Level 5
- 2.7.8.10. Volume 5
- 2.7.8.11. Level 6
- 2.7.8.12. Volume 6
- 2.7.8.13. Level 7
- 2.7.8.14. Volume 7
- 2.7.8.15. Level 8
- 2.7.8.16. Volume 8

8.6.7.9 Table 9-16 (2.7.9.)

2.7.9. Table 9-16

- 2.7.9.1. Level 9
- 2.7.9.2. Volume 9
- 2.7.9.3. Level 10
- 2.7.9.4. Volume 10
- 2.7.9.5. Level 11
- 2.7.9.6. Volume 11
- 2.7.9.7. Level 12
- 2.7.9.8. Volume 12
- 2.7.9.9. Level 13
- 2.7.9.10. Volume 13
- 2.7.9.11. Level 14
- 2.7.9.12. Volume 14
- 2.7.9.13. Level 15
- 2.7.9.14. Volume 15
- 2.7.9.15. Level 16
- 2.7.9.16. Volume 16

8.6.7.10 Table 17-24 (2.7.10.)

2.7.10. Table 17-24

2.7.10.1. Level 17
2.7.10.2. Volume 17
2.7.10.3. Level 18
2.7.10.4. Volume 18
2.7.10.5. Level 19
2.7.10.6. Volume 19
2.7.10.7. Level 20
2.7.10.8. Volume 20
2.7.10.9. Level 21
2.7.10.10. Volume 21
2.7.10.11. Level 22
2.7.10.12. Volume 22
2.7.10.13. Level 23
2.7.10.14. Volume 23
2.7.10.15. Level 24
2.7.10.16. Volume 24

8.6.7.11 Table 25- 32 (2.7.11.)

2.7.11. Table 25- 32

2.7.11.1. Level 25
2.7.11.2. Volume 25
2.7.11.3. Level 26
2.7.11.4. Volume 26
2.7.11.5. Level 27
2.7.11.6. Volume 27
2.7.11.7. Level 28
2.7.11.8. Volume 28
2.7.11.9. Level 29
2.7.11.10. Volume 29
2.7.11.11. Level 30
2.7.11.12. Volume 30
2.7.11.13. Level 31
2.7.11.14. Volume 31
2.7.11.15. Level 32
2.7.11.16. Volume 32

8.6.8 Relays (2.8.)

8.6.8.1 Basic Setup (2.8.1.)

Relay selector (2.8.1.1.)

Sets the relay index for all parameters applicable to this sub-menu.

Options	*Relay 1, Relay 2, Relay 3, Relay 4, Relay 5, Relay 6

Level source (2.8.1.2.)

Sets the level source for the indexed relay.

Index	Relays
Options	*Transducer 1
	Transducer 2
	Difference or Average
Altered by	• Response rate (2.3.4.) (Page 170) • Fill rate/minute (2.3.2.) (Page 169) • Empty rate/minute (2.3.3.) (Page 169) • LOE timer (2.4.2.) (Page 173) • Material level (2.4.5.) (Page 174)

Preset applications (2.8.1.3.)

Selects the preset options to configure or bench test the unit.

Index	Global
Options	*OFF
	Wet well 1
	Wet well 2
	Reservoir 1
	Reservoir 2
	Screen
	Alarms
Alters	• Level source (2.8.1.2.) (Page 190) • Relay function (2.8.1.4.) (Page 191) • ON setpoint (2.8.1.5.) (Page 192) • OFF setpoint (2.8.1.6.) (Page 192) • Pump by rate (2.8.1.8.) (Page 193)
Related	Sensor mode (2.1.3.) (Page 159)

Note

- For detailed descriptions of the various preset applications, see Preset applications (Page 97).
- Before selecting a Preset Application, a Level, Volume or Flow Quick Start Wizard must first be completed.

Select an application that is similar to yours and change the parameters required. If nothing suits your application, refer to Relay function (2.8.1.4.) (Page 191).

Relay function (2.8.1.4.)

Sets the control algorithm used to trip the relay.

Index	Relay
Options	See chart below
Altered by	Preset applications (2.8.1.3.) (Page 190)

Note

All relay ON/OFF points must be referenced from Empty (2.2.4.) (Page 166) (bottom of the vessel), regardless of Sensor Mode (2.1.3.) (Page 159) selection.

Control	Type	Relay control
	*OFF	Relay set off, no action (preset).
	Level	Based on level setpoints ON and OFF.
Alarm	Low Low Alarm	
	Low Alarm	
	High Alarm	
	High High Alarm	
General	In-bounds	When level enters the range between ON and OFF setpoints.
	Out-of-bounds	When level exits the range between ON and OFF setpoints.
	Rate of Change	Based on rate setpoints ON and OFF.
	Temperature	Based on temperature setpoints ON and OFF.
	LOE	Loss of echo; when echo is lost.
	Cable Fault	When the circuit to a transducer is opened.
Flow	Totalizer	Every 10^y units [Mantissa (2.10.2.2.) (Page 208) - Relay Duration (2.10.2.4.) (Page 210)]
	Flow Sampler	Every y x 10^2 units [Mantissa (2.10.2.2.) (Page 208) - Relay Duration (2.10.2.4.) (Page 210)] or time duration [Relay Interval Setpoint (2.10.2.6.) (Page 210)]
Pump	Fixed Duty Assist	At fixed ON and OFF setpoints and allows multiple pumps to run or for rake control.
	Fixed Duty Backup	At fixed ON and OFF setpoints and allows only one pump to run.
	Alternate Duty Assist	At rotating ON and OFF setpoints and allows multiple pumps to run.
	Alternate Duty Backup	At rotating ON and OFF setpoints and allows only one pump to run.
	Service Ratio Duty Assist	On service ratio at ON and OFF setpoints and allows multiple pumps to run.

Control	Type	Relay control
	Service Ratio Duty Backup	On service ratio at ON and OFF setpoints and allows only one pump to run.
	First In First Out	As Alternate Duty Assist, resets the relay from staggered OFF setpoints.
Control	Flush Valve	Used to control a pump flushing device based on Flush Systems [Flush pump (2.10.3.2.) (Page 211) to Flush duration (2.10.3.5.) (Page 212)].
	Communication	Based on input from external communications. For more information, see Modbus register map (Page 319).

ON setpoint (2.8.1.5.)

Sets the process point at which the relay changes from its Normal state.

Index	Relay
Values	Range: -999 ... 9999
	Preset: ----
Altered by	Span (2.2.2.) (Page 165)
Related	• Relay function (2.8.1.4.) (Page 191) • OFF setpoint (2.8.1.6.) (Page 192) • Preset applications (2.8.1.3.) (Page 190)

For most applications, the relay is tripped at this point. For In-bounds and Out-of-bounds alarms, it is the high point in the specified range. This parameter is set according to Span (2.2.2.) (Page 165) even when another reading, such as volume, is shown on the local display.

OFF setpoint (2.8.1.6.)

Sets the process point at which the relay returns to its Normal state.

Index	Relay
Values	Range: -999 ... 9999
	Preset: ----
Altered by	Span (2.2.2.) (Page 165)
Related	• Relay function (2.8.1.4.) (Page 191) • ON setpoint (2.8.1.5.) (Page 192) • Preset applications (2.8.1.3.) (Page 190)

For most applications, the relay is tripped at this point. For In-bounds and Out-of-bounds alarms, it is the high point in the specified range. This parameter is set according to Span (2.2.2.) (Page 165) even when another reading, such as volume, is shown on the local display.

Level selector (2.8.1.7.)

Sets the Level Point index for all parameters applicable to this sub-menu.

Pump by rate (2.8.1.8.)

Sets the pump relays to accept control by rate of level change once the first ON setpoint is reached.

Index	Single-point model	Dual-point model
	Transducer	Level
Options	*OFF (pump by level)	
	ON	
Related	• Span (2.2.2.) (Page 165) • Relay function (2.8.1.4.) (Page 191) • Delay Between Starts (2.8.2.8.1.) (Page 201) • Rate (2.3.) (Page 169)	

Use this function when multiple pumps are to be controlled by rate of level change rather than by setpoints.

The delay between pump starts is set by Delay Between Starts (2.8.2.8.1.) (Page 201).

This only applies to any relays set to pump control [RelayFunction (2.8.1.4.) (Page 191) = Fixed Duty Assist, Fixed Duty Backup, Alternate Duty Assist, Alternate Duty Backup, Service Ratio Duty Assist, Service Ratio Duty Backup, or First In First Out].

Note

- All pump control relay ON and OFF setpoints must be the same value.
- If the level is within 5% of Span (2.2.2.) (Page 165) of the OFF setpoint, the next pump is not started.

Filling indicator (2.8.1.9.)

Sets the fill rate required to activate the local display filling indicator

Index	**Single-point model**	**Dual-point model**
	Transducer	Level
Values	Range: 0.000 ... 99.00 m (or equivalent, depending on units)	
	Response rate (2.3.4.) (Page 170)	
Related	• Units (2.1.1.) (Page 158) • Span (2.2.2.) (Page 165) • Fill rate/minute (2.3.2.) (Page 169)	

This value [in Units (2.1.1.) (Page 158) per minute] is automatically set to 1/10 of Fill Rate/minute (2.3.2.) (Page 169).

Emptying indicator (2.8.1.10.)

Sets the empty rate required to activate the local display emptying indicator

Index	**Single-point model**	**Dual-point model**
	Transducer	Level
Values	Range: 0.000 ... 99.00 m (or equivalent, depending on units)	
	Response rate (2.3.4.) (Page 170)	
Related	• Units (2.1.1.) (Page 158) • Span (2.2.2.) (Page 165) • Empty rate/minute (2.3.3.) (Page 169)	

This value [in Units (2.1.1.) (Page 158) per minute] is automatically set to 1/10 of Empty Rate/minute (2.3.3.) (Page 169).

Relay logic (2.8.1.11.)

Sets the logic applied to relays to determine the contact Open or Closed state.

Index	Relay		
Options	**Logic**	**Alarm contact**	**Pump or control contact**
	*Positive	Normally Closed	Normally Open
	Negative	Normally Open	Normally Closed
Related	Relay function (2.8.1.4.) (Page 191)		

The relay contact operation is Normally Closed for alarms and Normally Open for controls. For more information, see Relay function (2.8.1.4.) (Page 191).

Note

This parameter is not reset by Master Reset (3.2.3.) (Page 250).

Power failure

When power is cut to the device, its relays fail to the following states:

Relay states	
Relay	Fail State
1,2,4,5	Open
3,6	Open or Closed[1)]

1) Relays 3 and 6 are Form C types, so you can wire it either Normally Open or Normally Closed. Check the wiring before programming.

To use Relays 3 or 6 as general alarm indicators, set Relay Logic (2.8.1.11.) to Negative and wire the alarm for Normally Open operation. When an alarm event occurs (see below) or when power is cut, the circuit closes and the alarm activates.

Positive logic

In software, all relays are programmed the same way, with ON setpoints indicating when to change the relay contact state (open or closed). This parameter allows the reversal of the operation so that relay contacts can be Normally Closed or Normally Open. Relay Logic (2.8.1.11.) is preset to Positive logic.

Negative logic

When Relay Logic (2.8.1.11.) = Negative logic, the operation for the indexed relay is reversed from normal.

Service ratio (2.8.1.12.)

Selects pump usage based on the RUN time ratio rather than Last used.

Index	Relay
Values	Range: 0.000 ... 9999
	Preset: 20.000
Related	Relay function (2.8.1.4.) (Page 191)

This parameter only applies to relays with Relay Function (2.8.1.4.) (Page 191) = Service Ratio Duty Assist or Service Ratio Duty Backup.

To make this parameter useful, assign it to all of the pump relays. The number assigned to each pump relay represents the ratio applied to decide the next pump to start or stop.

Note

- The device will not sacrifice other pumping strategies to ensure that the ratio is held true.
- If the pump relays are set to the same value, then the ratio equals 1:1 and all pumps are used equally (preset).

8.6.8.2 Modifiers (2.8.2.)

Provides alternate ways of starting the pumps in the pump group.

Relay selector (2.8.2.1.)

Sets the relay index for all parameters applicable to this sub-menu.

Pump group (2.8.2.2.)

Organizes pumps into groups, for multiple pump rotations on one transducer.

Index	Relay
Options	*Group 1
	Group 2
Alters	Relay Function (2.8.1.4.) (Page 191), when Relay Function (2.8.1.4.) (Page 191) = Alternate Duty Assist or Alternate Duty Backup

Note

All relay ON/OFF points must be referenced from Empty (2.2.4.) (Page 166) (bottom of the vessel), regardless of Sensor Mode (2.1.3.) (Page 159) selection.

Relay fail-safe (2.8.2.3.)

Sets how individual relays react to a fail-safe condition, to allow for more flexible programming.

Index	Relay	
Options	OFF	Response governed by Material level (2.4.5.) (Page 174)
	Hold	Last known relay state retention.
	Energize	To have the relay energize immediately on fail-safe.
	De-energize	To have the relay de-energize immediately on fail-safe.
Altered by	Material level (2.4.5.) (Page 174)	
Related	• LOE timer (2.4.2.) (Page 173) • Relay function (2.8.1.4.) (Page 191)	

Use this for operations independent of the Material Level (2.4.5.) (Page 174).

Relay Fail-safe is available only for the relay functions listed in the table below. Preset options depend on the relay functions selected.

Relay function (2.8.1.4.)	Preset (Relay fail-safe 2.8.2.3.)
Level alarm	OFF
In-bounds alarm	
Out-of-bounds alarm	
Rate of Change alarm	
Temperature alarm	
Fixed Duty Assist, Fixed Duty Backup, Alternate Duty Assist, Alternate Duty Backup, Service Ratio Duty Assist, Service Ratio Duty Backup, First In First Out: all pump controls	De-energize

Relay interval setpoint (2.8.2.4.)

Sets the length of time, in hours, between starts.

Index	Relay
Values	Range: 0 ... 9000 hours
	Preset: 0.000 hours
Altered by	Preset applications (2.8.1.3.) (Page 190)
Related	Relay function (2.8.1.4.) (Page 191)

Relay dead band (2.8.2.5.)

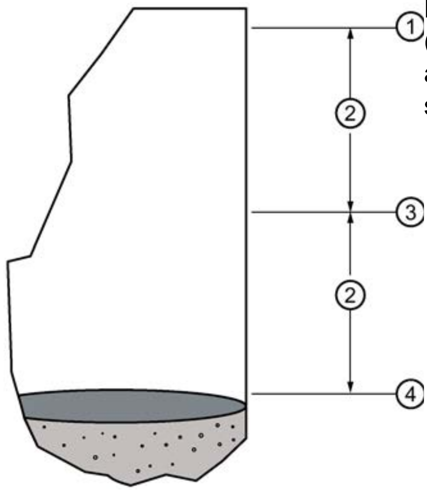
Sets the distance above and below the bound alarm setpoints.

Index	Relay
Values	Range: 0.000 ... Span(2.2.2.) (Page 165) value, or equivalent, depending on Units (2.1.1.) (Page 158).
	Preset: 2% of Span (2.2.2.) (Page 165).
Related	• Relay function (2.8.1.4.) (Page 191) • ON setpoint (2.8.1.5.) (Page 192) • OFF setpoint (2.8.1.6.) (Page 192)

Note

This parameter applies only to in-bounds and out-of bounds relay functions.

For In-bounds and Out-of-bounds Relay Functions [Relay Function (2.8.1.4.) (Page 191) = In-bounds and Out-of-bounds, respectively], a dead band prevents relay chatter due to material level fluctuations at both the upper and lower setpoints.



Enter the dead band in units of measure [Units (2.1.1.) (Page 158)]. The dead band value is applied both above and below the upper and lower bound setpoints as shown in the figure.

① Actual On or OFF setpoint
② Relay dead band (2.8.2.5.)
③ Setpoint set in ON setpoint (2.8.1.5.) (Page 192) or OFF setpoint (2.8.1.6.) (Page 192)
④ Actual OFF or ON setpoint

Wall Cling Reduction (2.8.2.6.)

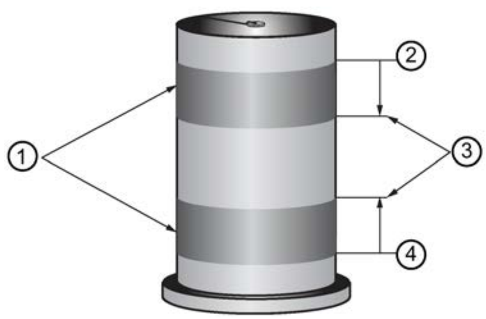
Transducer selector (2.8.2.6.1.)

Sets the transducer index for all parameters applicable to this sub-menu.

Level setpoint variation (2.8.2.6.2.)

Varies the ON and OFF setpoints to reduce material buildup on the walls [defined in Units (2.1.1.) (Page 158)].

Values	Range: 0.000 ... 99999.000
	Default: 0.000



① Random setpoint range
② Level setpoint ON
③ Level setpoint variation
④ Level setpoint OFF

This value is the range in which the setpoints are allowed to deviate. The pump ON and OFF Setpoint values are randomly varied inside the range to ensure that the material level does not consistently stop at the same point.

Advanced pump control modifiers

The following parameters from Pump Run-ON (2.8.2.7.) (Page 200) to Power Resumption Delay (2.8.2.8.2.) (Page 202) affect only the relays set to Pump Control in Relay Function (2.8.1.4.) (Page 191). See the Pump row in the Control column for details.

Pump run-on (2.8.2.7.)

Run-ON Interval (2.8.2.7.1.)

Sets the number of hours between pump Run-ON occurrences.

Index	Global
Values	Range: 0.000 ... 1000
	Preset: 0.000
Related	• Run-ON Duration (2.8.2.7.3.) (Page 200) • Delay Between Starts (2.8.2.8.1.) (Page 201) • Power Resumption Delay (2.8.2.8.2.) (Page 202) • Level setpoint variation (2.8.2.6.2.) (Page 199)

To clear sediment in a pump-down wet well, run the pump after the normal OFF setpoint is reached to force some solid material through. This parameter sets the time between such events. Only the last pump running can run-ON.

Relay selector (2.8.2.7.2.)

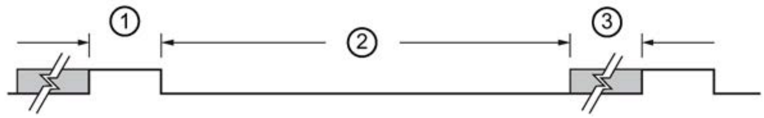
Sets the relay index for all parameters applicable to this sub-menu.

Run-ON Duration (2.8.2.7.3.)

Sets the number of seconds that the pump runs ON.

Index	Global
Values	Range: 0.0 ... 9999 seconds
	Preset: 0.000 seconds
Related	• Run-ON Interval (2.8.2.7.1.) (Page 200) • Delay Between Starts (2.8.2.8.1.) (Page 201) • Power Resumption Delay (2.8.2.8.2.) (Page 202) • Level setpoint variation (2.8.2.6.2.) (Page 199)

Your pump capacity determines the amount of material that can be removed. Choose a value long enough to clean out the vessel bottom, yet short enough not to run the pump dry. Also be sure that this value does not overlap with Run-ON Interval (2.8.2.7.1.) (Page 200). The timing should look like this:



① Run-ON Duration (2.8.2.7.3.)
② Run-ON interval (2.8.2.7.1.) (Page 200)
③ Delay between starts (2.8.2.8.1.) (Page 201)

Note

Setting a value in Run-ON Duration (2.8.2.7.3.) enables run-on for that relay. The default value of 0.0 seconds disables run-on. Any relay with a pump duration value other than 0.0 seconds will use the value from the highest indexed relay in the pump group set in Pump Group (2.8.2.2.) (Page 196).

Pump Start Delays (2.8.2.8.)

Sets when the pumps are permitted to start. Use this feature to reduce power surge by not having all the pumps start at the same time.

Delay Between Starts (2.8.2.8.1.)

Sets the minimum delay (in seconds) between pump starts. This delay determines when the next pump is permitted to start.

Index	Global
Values	Range: 0.0 ... 9999
	Preset: 10 seconds
Related	• Run-ON Interval (2.8.2.7.1.) (Page 200) • Power Resumption Delay (2.8.2.8.2.) (Page 202) • Level setpoint variation (2.8.2.6.2.) (Page 199) • Pump by rate (2.8.1.8.) (Page 193)

Power Resumption Delay (2.8.2.8.2.)

Sets the minimum delay before the first pump restarts after power failure.

Index	Global
Values	Range: 0.000 ... 9999
	Preset: 10 seconds
Related	• Run-ON Interval (2.8.2.7.1.) (Page 200) • Level setpoint variation (2.8.2.6.2.) (Page 199) • Pump by rate (2.8.1.8.) (Page 193) • Delay Between Starts (2.8.2.8.1.) (Page 201)

This reduces power surge by not having the first pump start immediately upon power resumption. When this delay expires, other pumps will start as per Delay Between Starts (2.8.2.8.1.) (Page 201).

8.6.9 Discrete Inputs (2.9.)

Discrete inputs can be used for the following:

- Passing other information to a remote system through communications
- Backup level override

Use the parameters listed above to have discrete inputs modify the unit's operation. To configure the discrete input itself, use the following parameters:

8.6.9.1 Backup Level Override (2.9.1.)

Overrides the transducer reading by a discrete input, such as a contacting point device. The transducer reading will be fixed at the programmed override value until the discrete input is released.

The device makes decisions based on the override values.

Transducer selector (2.9.1.1.)

Sets the transducer index for all parameters applicable to this sub-menu.

Discrete input number (2.9.1.2.)

Sets the discrete input to act as the source for a Level reading override.

Index	Transducer
Options	*No Override
	DI 1 Override Signal
	DI 2 Override Signal
Related	Level override value (2.9.1.3.) (Page 203)

Level override value (2.9.1.3.)

This value is substituted for the current reading when the selected discrete input is enabled and activated.

Index	Transducer
Values	Range: 0.0 ... 99.00 m or equivalent, depending on Units (2.1.1.) (Page 158)
	Preset: 0.00
Alters	Current reading
Related	• Sensor mode (2.1.3.) (Page 159) • Units (2.1.1.) (Page 158) • Empty (2.2.4.) (Page 166) • Span (2.2.2.) (Page 165) • Discrete input number (2.9.1.2.) (Page 202)

Note

- Enter value in current Units (2.1.1.) (Page 158).
- Valid for Level, Space, and Distance.
- Volume is calculated based on the Backup Level.

Example

Transducer 1 is configured for a Level measurement. Digital Input 2 is connected to a Hi Level Backup switch located a level of 4.3 m.

Parameter	Index	Value
Discrete input number (2.9.1.2.) (Page 202)	1	2
Level Override Value (2.9.1.3.)	1	4.3

When the level rises to 4.3 m, and the switch is activated, the reading is forced to 4.3 m. The reading stays at 4.3 m until the switch is deactivated.

Override time delay (2.9.1.4.)

Defines the time used to calm (debounce) the override condition input.

Index	Transducer
Values	Range: 0.0 ... 9999
	Preset: 5 seconds
Related	• Discrete input number (2.9.1.2.) (Page 202) • Level override value (2.9.1.3.) (Page 203) • Discrete input 1 (2.9.2.1.) (Page 204)

Note

Activation of the Level Override is subject to the measurement cycle. This can add up to four seconds to the overall response time depending on operating conditions and programming.

8.6.9.2 Discrete Input Logic (2.9.2.)

Discrete input 1 (2.9.2.1.)

Changes the behavior of Discrete Input 1.

Options	Forced OFF
	Forced ON
	* Normally Open
	Normally Closed

Discrete input 2 (2.9.2.2.)

Changes the behavior of the Discrete Input 2.

Options	Forced OFF
	Forced ON
	* Normally Open
	Normally Closed

Discrete input 1 scaled state (2.9.2.3.)

Shows the current value of the discrete input after any scaling is applied. Read only.

Index	Discrete input
Modes	Active
	Inactive

Readings are updated continuously even in PROGRAM mode. The value signals a level override event.

Discrete input 2 scaled state (2.9.2.4.)

Shows the current value of the discrete input after any scaling is applied. Read only.

Index	Discrete input
Modes	Active
	Inactive

Readings are updated continuously even in PROGRAM mode. The value signals a level override event.

8.6.10 Other Control (2.10.)

Sets other relay control features.

8.6.10.1 External totalizer (2.10.1.)

Tracks the volume of material that passes through a system. The external totalizer controls a relay to signal an external totalizing device. The relay toggles ON and OFF at a rate set by the parameters below.

8.6.10.2 Transducer selector (2.10.1.1.)

Sets the transducer index for all parameters applicable to this submenu. The parameters will only affect the relays set to Relay Function (2.8.1.4.) (Page 191) = Totalizer.

8.6.10.3 Multiplier (2.10.1.2.)

Use this feature if the remote totalizer (the device connected to the relay set to Relay Function (2.8.1.4.) (Page 191) = Totalizer) updates too slowly or rapidly.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Options	0.001	
	0.01	
	0.1	
	*1	
	10	
	100	
	1,000	
	10,000	
	100,000	
	1,000,000	
	10,000,000	
Related	• Sensor mode (2.1.3.) (Page 159) • Relay function (2.8.1.4.) (Page 191) • Relay interval setpoint (2.8.2.4.) (Page 197) • Relay duration (2.10.1.3.) (Page 207)	

This parameter is relevant only if Operation is set to OCM or Pumped Volume [Sensor Mode (2.1.3.) (Page 159) = Flow rate in open channel or Pump Totalizer].

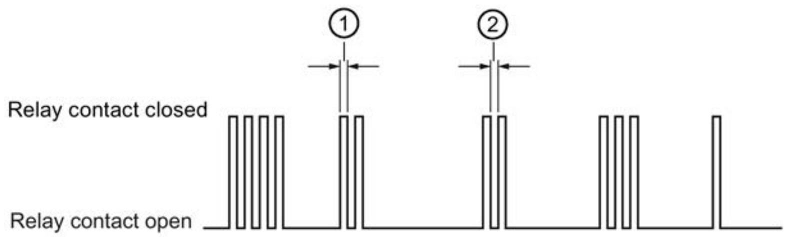
The relays on the device have a maximum frequency of 2.5 Hz. Enter the factor (powers of 10 only) by which actual volume is divided, prior to Remote Totalizer count increment. Example: For a Remote Totalizer update by 1000s of volume units, enter 3.

8.6.10.4 Relay duration (2.10.1.3.)

Use this feature (if desired) to adjust the minimum contact closure duration of a relay set as a totalizer or flow sampler [Relay Function (2.8.1.4.) (Page 191) = Totalizer or Flow Sampler].

Index	Global
Values	Range: 0.1 ... 1024 seconds
	Preset: 0.188 seconds
Related	Relay function (2.8.1.4.) (Page 191)

Enter minimum contact closure duration (in seconds) required by the device connected.



① Relay duration (2.10.1.3.) ON time

② Relay duration (2.10.1.3.) OFF time

8.6.10.5 External sampler (2.10.2.)

Transducer selector (2.10.2.1.)

Sets the transducer index for all parameters applicable to this sub-menu.

Mantissa (2.10.2.2.)

Establishes the number of flow units required to increment the Flow Sampler (the device connected to the relay set to Relay Function (2.8.1.4.) (Page 191) = Flow Sampler), in conjunction with Exponent (2.10.2.3.) (Page 209).

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 0.001 ... 9999	
	Preset: 1.000	
Related	• Sensor mode (2.1.3.) (Page 159) • Relay function (2.8.1.4.) (Page 191) • Primary measuring device (2.13.2.) (Page 234) • Flow exponent (2.13.4.1) (Page 235) • PMD dimensions (2.13.5.) (Page 241) • Maximum head (2.13.4.2.) (Page 237) • Maximum flow (2.13.4.3.) (Page 238) • Zero head (2.13.4.5.) (Page 239) • Flow time units (2.13.4.4.) (Page 239) • Flowrate decimal (2.13.4.6.) (Page 240) • Head 1 (2.13.6.1.1.) (Page 242) • Flow 1 (2.13.6.1.2.) (Page 243) • Low flow cutoff (2.13.4.8.) (Page 241) • Auto zero head (2.13.3.) (Page 235) • Exponent (2.10.2.3.) (Page 209)	

This parameter is relevant only if Operation is set to OCM [Sensor Mode (2.1.3.) (Page 159) = Flow rate in open channel].

Enter the mantissa (Y) for the exponent (Z) in the formula:

Flow Sampler Increment = Y x 10^Z Flow units

Example: To count once every 4310 (4.31 x 10^3) flow units: set Mantissa (2.10.2.2.) to 4.31 and Exponent (2.10.2.3.) (Page 209) to 3.

Exponent (2.10.2.3.)

Establishes the number of flow units required to increment the Flow Sampler (the device connected to the relay set to Relay Function (2.8.1.4.) (Page 191) = Flow Sampler), in conjunction with Mantissa (2.10.2.2.) (Page 208).

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: -3 to +7 (integers only)	
	Preset: 0	
Related	• Sensor mode (2.1.3.) (Page 159) • Relay function (2.8.1.4.) (Page 191) • Primary measuring device (2.13.2.) (Page 234) • Flow exponent (2.13.4.1) (Page 235) • PMD dimensions (2.13.5.) (Page 241) • Maximum head (2.13.4.2.) (Page 237) • Maximum flow (2.13.4.3.) (Page 238) • Zero head (2.13.4.5.) (Page 239) • Flow time units (2.13.4.4.) (Page 239) • Flowrate decimal (2.13.4.6.) (Page 240) • Head 1 (2.13.6.1.1.) (Page 242) • Flow 1 (2.13.6.1.2.) (Page 243) • Low flow cutoff (2.13.4.8.) (Page 241) • Auto zero head (2.13.3.) (Page 235) • Mantissa (2.10.2.2.) (Page 208)	

This parameter is relevant only if Operation is set to OCM [Sensor Mode (2.1.3.) (Page 159) = Flow rate in open channel].

Enter the exponent (Z) for the mantissa (Y) in the formula:

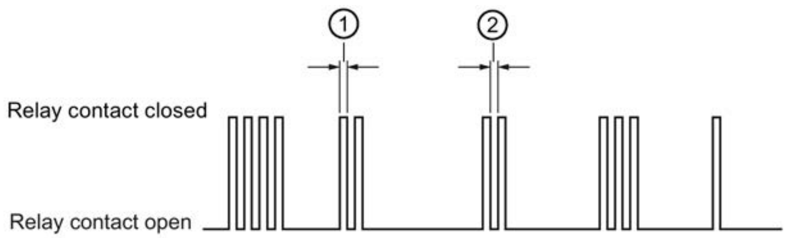
Flow Sampler Increment = Y x 10^Z Flow units

Relay duration (2.10.2.4.)

Adjusts the minimum contact closure duration of a relay set as a flow sampler [Relay Function (2.8.1.4.) (Page 191) = Flow Sampler], if desired.

Index	Global
Values	Range: 0.1 ... 1024
	Preset: 0.2 seconds
Related	Relay function (2.8.1.4.) (Page 191)

Enter minimum contact closure duration (in seconds) required by the device connected.



① Relay duration (2.10.1.3.) ON time

② Relay duration (2.10.1.3.) OFF time

Relay selector (2.10.2.5.)

Sets the relay index for all parameters applicable to this sub-menu.

Relay interval setpoint (2.10.2.6.)

Sets the length of time between starts, in hours.

Index	Relay
Values	Range: 0 ... 9000 hours
	Preset: 0.000 hours
Altered by	Preset applications (2.8.1.3.) (Page 190)
Related	Relay function (2.8.1.4.) (Page 191)

Flush system (2.10.3.)

Controls an electrically operated flush valve on a pump to divert some pump output back into the wet well to stir up sediment.

Note

- If any of the following parameters are set to 0, this feature will not work.
- In Dual-point mode, a flush valve can be set up for each of the three available level inputs [Sensor Mode (2.1.3.) (Page 159) = Dual-Point Difference or Dual-Point Average].

Single-point mode

Enter the device relay number of the pump with the flush valve. The activation of this pump relay drives the usage of the flush system. Both Flush Cycles (2.10.3.3.) (Page 212) and Flush Interval (2.10.3.4.) (Page 212) are based on the operation of this relay, and control any relay set to Relay Function (2.8.1.4.) (Page 191) = Flush Valve.

Dual-point mode

The indexed relay is the one that controls the flush device. The value is the pump relay that is watched by the flush system. Enter the pump relay value into the parameter at the flush relay index.

Example: If you need to watch pump Relay 1 to control a flush valve on Relay 2 (with Relay index 2 selected), set Flush Pump (2.10.3.2.) (Page 211) = 1.

Relay selector (2.10.3.1.)

Sets the relay index for all parameters applicable to this sub-menu. These parameters only affect relays set to Relay Function (2.8.1.4.) (Page 191) = Flush Valve.

Flush pump (2.10.3.2.)

Picks the number of the pump relay which triggers the flushing device.

Index	**Single-point model**	**Dual-point model**
	Global	Relay
Values	Range: 0 ... 6	
	Preset: 0	
Related	Relay Function (2.8.1.4.) (Page 191) = Flush Valve	

Enter the device relay number of the pump with the flush valve. The activation of this pump relay drives the usage of the flush system. Both Flush Interval (2.10.3.4.) (Page 212) and Flush Cycles (2.10.3.3.) (Page 212) are based on the operation of this relay and controls any relay set to Relay Function (2.8.1.4.) (Page 191) = Flush Valve.

Flush cycles (2.10.3.3.)

Sets the number of pump cycles requiring flush control.

Index	Single-point model	Dual-point model
	Global	Relay
Values	Range: 0 ... 34464	
	Preset: 0	
Related	Relay Function (2.8.1.4.) (Page 191) = Flush Valve	

If three flush cycles are required after every ten pump cycles, then:

Flush Interval (2.10.3.4.) (Page 212) = **10**

Flush Cycles (2.10.3.3.) = **3**

Flush interval (2.10.3.4.)

Sets the number of pump cycles before flush control is enabled.

Index	Single-point model	Dual-point model
	Global	Relay
Values	Range: 0 ... 37856	
	Preset: 0	
Related	Relay Function (2.8.1.4.) (Page 191) = Flush Valve	

To start a new flush cycle every ten times the pumps are run, set this to **10**.

Flush duration (2.10.3.5.)

Sets the length of time for each flush cycle that the flush control is active.

Index	Single-point model	Dual-point model
	Global	Relay
Values	Range: 0.000 ... 9999 seconds	
	Preset: 0.000 seconds	
Related	Relay Function (2.8.1.4.) (Page 191) = Flush Valve	

8.6.11 Signal Processing (2.11.)

8.6.11.1 Temperature and Velocity (2.11.1.)

Transducer selector (2.11.1.1.)

Sets the transducer index for all parameters applicable to this sub-menu.

Sound velocity (2.11.1.2.)

Enters the value adjusted based on parameter Sound Velocity at 20°C (2.11.1.7.) (Page 215) vs. Process Temperature (2.11.1.3.) (Page 213) characteristics of air.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 50.3 ... 20011.9 m/s (165 to 6601 ft/s)	
Related	• Auto sound velocity (2.11.1.8.) (Page 215) • Sound velocity at 20°C (2.11.1.7.) (Page 215)	

Alternatively, enter the current sound velocity (if known), or perform a Auto Sound Velocity (2.11.1.8.) (Page 215) calibration. The units are in m/s if Units (2.1.1.) (Page 158) = meters, centimeters, or millimeters; if Units (2.1.1.) (Page 158) = feet or inches, then they are in ft/s).

Note

If this value is set to 0, the device will be unable to measure. Perform a master reset to recover to default values.

Process temperature (2.11.1.3.)

Displays the transducer temperature in °C.

Index	Transducer
Values	Range: -50 ... 150 °C (Read only)
Altered by	Temperature source (2.11.1.4.) (Page 214)
Related	• Auto sound velocity (2.11.1.8.) (Page 215) • Sound velocity (2.11.1.2.) (Page 213) • Sound velocity at 20°C (2.11.1.7.) (Page 215) • Fixed temperature (2.11.1.6.) (Page 215)

If Temperature Source (2.11.1.4.) (Page 214) is set to any value other than Fixed Temperature, the value displayed is the temperature measured. If Temperature Source (2.11.1.4.) (Page 214) is set to Fixed Temperature, the Fixed Temperature (2.11.1.6.) (Page 215) value is displayed.

Temperature source (2.11.1.4.)

Selects the source of the temperature reading used to adjust the speed of sound.

Index	Transducer
Options	*AUTO
	Fixed Temperature
	Transducer
	External TS-3
	Average of Sensors
Alters	Process temperature (2.11.1.3.) (Page 213)
Related	• Auto sound velocity (2.11.1.8.) (Page 215) • Sound velocity (2.11.1.2.) (Page 213) • Sound velocity at 20°C (2.11.1.7.) (Page 215) • Fixed temperature (2.11.1.6.) (Page 215)

The device uses the TS-3 temperature sensor assigned to the transducer. If one is not connected, the ultrasonic/temperature transducer is used. If the transducer does not have an internal temperature sensor, the Fixed Temperature (2.11.1.6.) (Page 215) value is used. If the acoustic beam atmosphere temperature varies with distance from the transducer, connect a TS-3 Temperature Sensor and ultrasonic/temperature transducers, and select average. In gasses other than air, the temperature variation may not correspond with the speed of sound variation. In these cases, turn off the temperature sensor and use a fixed temperature.

Temperature transducer allocation (2.11.1.5.)

This feature may only be used for differential or average Operation [Sensor Mode (2.1.3.) (Page 159) = Dual-Point Difference or Dual-Point Average].

Index	Transducer
Options	*Transducer 1
	Transducer 2
	Transducer 1 and 2 average
Related	• Auto sound velocity (2.11.1.8.) (Page 215) • Sound velocity (2.11.1.2.) (Page 213) • Sound velocity at 20°C (2.11.1.7.) (Page 215)

As preset, the temperature measurements of ultrasonic/temperature Transducer 1 and 2 are allocated to Points 1 and 2, respectively.

If there is a need to have the temperature measurements from both transducers to be identical while one device is located close to a radiant heat source, use this feature. Allocate the temperature measurement of the other transducer to both transducer Point Numbers.

Enter the number of the Transducer whose temperature measurement will be used for the distance calculation of the Point Number displayed. When both transducers are allocated to a Point Number, the temperature measurements from each are averaged.

Fixed temperature (2.11.1.6.)

Sets a fixed temperature value if a temperature-sensing device is not used.

Index	Transducer
Values	Range: -199 ... 200°C
	Preset: 20 °C
Related	• Auto sound velocity (2.11.1.8.) (Page 215) • Sound velocity (2.11.1.2.) (Page 213) • Sound velocity at 20°C (2.11.1.7.) (Page 215) • Temperature source (2.11.1.4.) (Page 214)

Enter the temperature of the atmosphere within the transducer acoustic beam. If the temperature varies with distance from the transducer, enter the average temperature.

Sound velocity at 20°C (2.11.1.7.)

This value is used to automatically calculate Sound Velocity (2.11.1.2.) (Page 213).

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 50.0 ... 2000.0 m/s (164 to 6562 ft/s)	
	Preset: 344.1 m/s	
Related	• Units (2.1.1.) (Page 158) • Auto sound velocity (2.11.1.8.) (Page 215) • Sound velocity (2.11.1.2.) (Page 213)	

Check this value to verify the acoustic beam atmosphere is air (344.1 m/s or 1129 ft/s) after performing a Sound Velocity Calibration (for the procedures, see Using Sound Velocity Calibration (Page 215) below) .

Alternatively, if the acoustic beam atmosphere Sound Velocity at 20°C (68 °F) is known, and the sound velocity vs. temperature characteristics are similar to that of air, enter the sound velocity. The units are in m/s if Units (2.1.1.) (Page 158) = meters, centimeters, or millimeters; if Units (2.1.1.) (Page 158) = feet or inches, then they are in ft/s).

Auto sound velocity (2.11.1.8.)

Changes the speed of sound constant.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: -999 ... 9999	
Related	• Sound velocity (2.11.1.2.) (Page 213) • Sound velocity at 20°C (2.11.1.7.) (Page 215)	

Conditions for use of this feature:

- The acoustic beam atmosphere is other than air.
- The acoustic beam atmosphere temperature is unknown.
- The Reading accuracy is acceptable at higher material levels only.

For best results, calibrate with the level at a known value near empty.

Using sound velocity calibration

Ensure a steady level at some low value [Sound Velocity (2.11.1.2.) (Page 213) and Sound Velocity at 20°C (2.11.1.7.) (Page 215) adjusted accordingly]:

1. Measure the actual reading (such as with a tape measure).
2. Enter the actual value.

Repeat this procedure if the atmosphere type, concentration, or temperature conditions are different from when the last sound velocity calibration was performed.

Note

In gasses other than air, the temperature variation may not correspond with the speed of sound variation. Turn off temperature sensor and use a fixed temperature.

Offset correction (2.11.1.9.)

The value altered when a sensor offset calibration is performed using Sensor Offset (2.2.5.) (Page 167).

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: -999 ... 999.0	
Related	Sensor offset (2.2.5.) (Page 167)	

Alternatively, if the amount of offset correction required is known, enter the amount to be added to the reading before display.

8.6.11.2 Echo Select (2.11.2.)

Transducer selector (2.11.2.1.)

Sets the transducer index for all parameters applicable to this sub-menu.

Algorithm (2.11.2.2.)

Selects the algorithm to generate the measured value from the profile.

Index	Single-point model	Dual-point model
	Global	Transducer
Options	ALF Area Largest First	
	A Echo Area	
	L Largest Echo	
	F First Echo	
	AL Area Largest	
	AF Area First	
	LF Largest First	
	*BLF Best F-L	
	BL Best L	
	BF Best F	
	TF True First Echo	
Related	• Reform echo (2.11.2.5.) (Page 218) • Narrow echo filter (2.11.2.6.) (Page 218) • Spike filter (2.11.2.7.) (Page 219) • Echo marker (2.11.2.9.) (Page 220) • Long confidence (3.2.11.2.) (Page 258)	

Use this to select the algorithm(s) the Sonic Intelligence echo selection is based on. Use Long Confidence (3.2.11.2.) (Page 258) to determine which algorithm gives the highest confidence under all level conditions. If the wrong echo is processed, observe the echo processing displays and select an alternate algorithm using this parameter.

For details on echo determinations and suggested usage, see Algorithm (Page 296).

Long echo threshold (2.11.2.3.)

Determines which echoes are evaluated by software.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 0 ... 99	
	Preset: 5	
Related	Long confidence (3.2.11.2.) (Page 258)	

When Long Confidence (3.2.11.2.) (Page 258) exceeds the Long Echo Threshold, the echo is evaluated by Sonic Intelligence.

Short echo threshold (2.11.2.4.)

Determines which echoes are evaluated by software

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 0 ... 99	
	Preset: 10	
Related	Long confidence (3.2.11.2.) (Page 258)	

When Long Confidence (3.2.11.2.) (Page 258) exceeds the Short Echo Threshold, the echo is evaluated by Sonic Intelligence.

Reform echo (2.11.2.5.)

Smoothes jagged peaks in the echo profile.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Preset: 0 (Larger values mean more smoothing. Nearest acceptable value is returned.)	
Related	• Material (2.1.6.) (Page 161) • Algorithm (2.11.2.2.) (Page 217) • Spike filter (2.11.2.7.) (Page 219) • Narrow echo filter (2.11.2.6.) (Page 218) • Echo marker (2.11.2.9.) (Page 220)	

Use this feature when monitoring solids [Material (2.1.6.) (Page 161) = Solid] if the reported Level fluctuates slightly, though the monitored surface is still. Enter the amount (in ms) of long shot Echo Profile smoothing required. When a value is keyed in, the nearest acceptable value is entered.

Narrow echo filter (2.11.2.6.)

Filters out echoes of a specific width.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Preset: 0 (= OFF); the nearest acceptable value is returned; Greater = Wider	
Related	• Algorithm (2.11.2.2.) (Page 217) • Spike filter (2.11.2.7.) (Page 219) • Reform echo (2.11.2.5.) (Page 218) • Echo marker (2.11.2.9.) (Page 220)	

Use this for transducer acoustic beam interference (e.g. ladder rungs). Enter the width of false echoes (in ms) to be removed from the long shot Echo Profile. When a value is keyed in, the nearest acceptable value is entered.

Spike filter (2.11.2.7.)

Dampens spikes in the echo profile to reduce false readings.

Index	Single-point model	Dual-point model
	Global	Transducer
Options	OFF	
	*ON	
Related	• Algorithm (2.11.2.2.) (Page 217) • Narrow echo filter (2.11.2.6.) (Page 218) • Reform echo (2.11.2.5.) (Page 218) • Echo marker (2.11.2.9.) (Page 220)	

Use Spike Filter (2.11.2.7.) if interference spikes are on the long shot Echo Profile display.

Submergence detection (2.11.2.8.)

Used when the transducer is expected to be submerged on occasion.

Index	Single-point model	Dual-point model
	Global	Transducer
Options	OFF	
	*ON	
Related	• Empty (2.2.4.) (Page 166) • Material level (2.4.5.) (Page 174)	

When a transducer with a submergence shield is submerged, the shield traps an air pocket that creates a special echo. The device recognizes the echo and advances the reading to the highest level and operates displays and outputs accordingly. This feature is effective for when power is returned while the transducer is submerged.

Echo marker (2.11.2.9.)

The point on the primary echo on which the measured value is based.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 5 ... 95%	
	Preset: 50%	
Related	• Algorithm (2.11.2.2.) (Page 217) • Spike filter (2.11.2.7.) (Page 219) • Narrow echo filter (2.11.2.6.) (Page 218) • Reform echo (2.11.2.5.) (Page 218)	

Use this feature if the reported material level fluctuates slightly, due to a variable rise in the leading edge of the true echo on the Echo Profile.

Enter the value (in percent of echo height) to ensure the Echo Lock Window intersects the Echo Profile at the sharpest rising portion of the Echo Profile representing the true echo.

Short shot bias (2.11.2.10.)

Slants the echo evaluation in favor of the short shot echo when both short and long shots are evaluated [see Shot/pulse mode (2.1.17.) (Page 164).

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 0 ... 100	
	Preset: 20	
Related	• Shot/pulse mode (2.1.17.) (Page 164) • Number of short shots (2.1.11.) (Page 162) • Short shot frequency (2.1.7.) (Page 161) • Long shot duration (2.1.10.) (Page 162) • Short shot floor (2.11.2.11.) (Page 221) • Short shot range (2.11.2.12.) (Page 221)	

Short shot floor (2.11.2.11.)

Enter the minimum echo strength, in dB above 1 uV, derived from a short shot to be considered for evaluation.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 0 ... 100	
	Preset: 50	
Related	• Number of short shots (2.1.11.) (Page 162) • Short shot frequency (2.1.7.) (Page 161) • Long shot duration (2.1.10.) (Page 162) • Short shot bias (2.11.2.10.) (Page 220) • Short shot range (2.11.2.12.) (Page 221)	

Short shot range (2.11.2.12.)

Enter the maximum distance in Units (2.1.1.) (Page 158) to be measured using short shot echoes.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 0 ... 10 m or equivalent, depending on Units (2.1.1.) (Page 158)	
	Preset: 1.000	
Altered by	Transducer (2.1.5.) (Page 160)	
Related	• Number of short shots (2.1.11.) (Page 162) • Short shot frequency (2.1.7.) (Page 161) • Long shot duration (2.1.10.) (Page 162) • Short shot bias (2.11.2.10.) (Page 220) • Short shot floor (2.11.2.11.) (Page 221) • Short Shot Range (2.11.2.12.)	

This feature is automatically altered when Transducer (2.1.5.) (Page 160) is altered.

8.6.11.3 TVT Setup (2.11.3.)

Transducer selector (2.11.3.1.)

Sets the transducer index for all parameters applicable to this sub-menu.

Auto false echo suppression (2.11.3.2.)

Sets the device to ignore false echoes, together with Auto Suppression Range (2.11.3.3.) (Page 223). Use Auto Suppression Range (2.11.3.3.) (Page 223) to set the Auto TVT distance first.

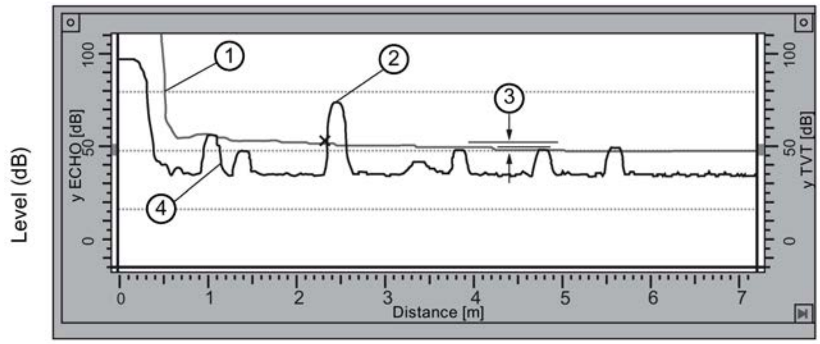
Options	*OFF
	ON
	Learn

Note

- This function works best when the vessel is empty or nearly empty: use it only if there is a minimum distance of 2 meters from the transducer face to the material.
- Set Auto False Echo Suppression (2.11.3.2.) and Auto Suppression Range (2.11.3.3.) (Page 223) during start up, if possible.
- If the vessel contains an agitator, the agitator should be running.

If the device displays a full level, or if the reading fluctuates between a false high level and a correct level, set Auto False Echo Suppression (2.11.3.2.) to elevate the TVT in this region and to de-sensitize the receiver from any ‘base noise’ caused by internal transducer reflections, nozzle echoes, or other vessel false echoes. Set Auto Suppression Range (2.11.3.3.) (Page 223) and then Auto False Echo Suppression (2.11.3.2.) (detailed instructions follow Auto Suppression Range 2.11.3.3.) (Page 223).

Display before Auto False Echo Suppression (or when Auto False Echo Suppression = OFF)



Distance (meters)

① Default TVT

② Material echo

③ Hover level

④ False echo

Auto false echo suppression range (2.11.3.3.)

Defines the range of Auto False Echo Suppression (2.11.3.2.) (Page 222) to use for ignoring false echoes.

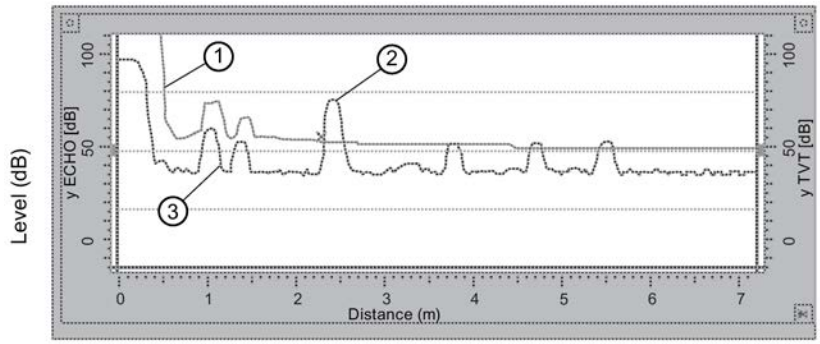
Values	Range: 0.000 ... 15 m (50 ft)
	Preset: 1.000 m (3.28 ft)

Determine the actual distance from the transducer face to the material surface. Subtract 0.5 m from this distance, and enter the result.

Set up (perform this function when vessel is empty or nearly empty):

1. Determine actual distance from transducer face to material level.
2. Enter the distance to material surface minus 0.5 m in to Auto Suppression Range (2.11.3.3.).
3. Select Auto False Echo Suppression (2.11.3.2.) (Page 222).
4. Select **Learn**. [Auto False Echo Suppression (2.11.3.2.) (Page 222) will revert to ON (use Learned TVT) automatically after a few seconds.]

Display after Auto False Echo Suppression



Distance (meters)

① TVT curve (learned)

② Material level

③ False echo

Hover level (2.11.3.4.)

Defines (in percent) how high the TVT curve is placed above the profile, relative to the largest echo. When the device is located in the center of the vessel, lower this parameter to prevent multiple echo detections.

Values	Range: 0 ... 100%
	Preset: 33 %

Shaper mode (2.11.3.5.)

Turns the TVT Shaper ON or OFF.

Index	Single-point model	Dual-point model
	Global	Transducer
Options	*OFF	
	ON	
Related	TVT Shaper (2.11.4.) (Page 226)	

Turn the TVT Shaper ON before using TVT Shaper (2.11.4) (Page 226) and afterwards. Turn the TVT Shaper ON and OFF while monitoring the effect to pick up the true echo.

TVT type (2.11.3.6.)

Selects the TVT Curve used.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	*Short Curved	
	Short Flat	
	Long Flat	
	Long Smooth Front	
	Long Smooth	
	Slopes	
Altered by	Material (2.1.6.) (Page 161)	
Related	• Long confidence (3.2.11.2.) (Page 258) • TVT slope minimum (2.11.3.9.) (Page 226)	

Select the TVT type which gives the highest Long Confidence (3.2.11.2.) (Page 258) under all level conditions. Use this parameter with caution, and do not use TVT **Slopes** with the **BF Best F** or **BLF Best F-L** Algorithm (2.11.2.2.) (Page 217).

TVT dB (2.11.3.7.)

Adjusts the TVT Curve height to ignore false echoes (or pick up true echoes) near the start of the Echo Profile.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: -30 ... 225	
	Preset: 50	
Related	• Blanking (2.2.6.) (Page 168) • TVT ms (2.11.3.8) (Page 226)	

Enter the minimum TVT Curve start point (in dB above 1 µV RMS).

This feature should only be used if increased Blanking (2.2.6.) (Page 168) would extend into the measurement range farther than desired.

TVT ms (2.11.3.8)

Sets the device to ignore false echoes (or pick up true echoes) near the start of the Echo Profile, in conjunction with TVT dB (2.11.3.7.) (Page 225).

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 0 ... 9999 milliseconds	
	Preset: 30 milliseconds	
Related	• TVT dB (2.11.3.7.) (Page 225) • TVT slope minimum (2.11.3.9.) (Page 226)	

Enter the time (in ms) for the TVT Curve to decrease from the TVT dB (2.11.3.7.) (Page 225) point to the TVT Curve baseline.

TVT slope minimum (2.11.3.9.)

Enters the minimum slope (in dB/s) for the middle of the TVT Curve.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 0 ... 9999 dB/s	
	Preset: 200 dB/s	
Related	• TVT type (2.11.3.6.) (Page 225) • TVT ms (2.11.3.8) (Page 226)	

Use this feature to adjust the slope declination, and use it in conjunction with TVT ms (2.11.3.8.) (Page 226) [when a Long Flat TVT Type (2.11.3.6.) (Page 225) is selected] to ensure the TVT Curve remains above the false echoes in the middle of the Echo Profile. Alternatively, if TVT Type (2.11.3.6.) (Page 225) = Slopes, preset is 2000.

8.6.11.4 TVT Shaper (2.11.4.)

Allows the manual adjustment of the TVT curve. Use this parameter in conjunction with SIMATIC PDM.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: -50 ... 50	
	Preset: 0	
Related	• Shaper mode (2.11.3.5.) (Page 224)	

Use this feature to bias the shape of the TVT curve to avoid selecting false echoes from fixed objects.

Adjustment to this parameter is best done while viewing the echo profile with SIMATIC PDM.

The TVT curve is divided into 40 breakpoints, accessible by enabling the point number as the breakpoint index field. Each breakpoint is normalized to a value of 0, as displayed in the parameter value field. By changing the breakpoint value, up or down, the intensity of the bias applied to that breakpoint of the curve is respectively changed. By changing the value of adjacent breakpoints, the effective bias to the shaper can be broadened to suit the desired correction. In the case of multiple false echoes, shaping can be applied along different points of the curve. Shaping should be applied sparingly in order to avoid missing the true echo.

2.11.4.1. Brkpt. 1-10
- 2.11.4.1.1. TVT Brkpt. 1
- 2.11.4.1.2. TVT Brkpt. 2
- 2.11.4.1.3. TVT Brkpt. 3
- 2.11.4.1.4. TVT Brkpt. 4
- 2.11.4.1.5. TVT Brkpt. 5
- 2.11.4.1.6. TVT Brkpt. 6
- 2.11.4.1.7. TVT Brkpt. 7
- 2.11.4.1.8. TVT Brkpt. 8
- 2.11.4.1.9. TVT Brkpt. 9
- 2.11.4.1.10. TVT Brkpt. 10

2.11.4.2. Brkpt. 11-20
- 2.11.4.2.1. TVT Brkpt. 11
- 2.11.4.2.2. TVT Brkpt. 12
- 2.11.4.2.3. TVT Brkpt. 13
- 2.11.4.2.4. TVT Brkpt. 14
- 2.11.4.2.5. TVT Brkpt. 15
- 2.11.4.2.6. TVT Brkpt. 16
- 2.11.4.2.7. TVT Brkpt. 17
- 2.11.4.2.8. TVT Brkpt. 18
- 2.11.4.2.9. TVT Brkpt. 19
- 2.11.4.2.10. TVT Brkpt. 20

2.11.4.3. Brkpt. 21-30
- 2.11.4.3.1. TVT Brkpt. 21
- 2.11.4.3.2. TVT Brkpt. 22
- 2.11.4.3.3. TVT Brkpt. 23
- 2.11.4.3.4. TVT Brkpt. 24
- 2.11.4.3.5. TVT Brkpt. 25
- 2.11.4.3.6. TVT Brkpt. 26
- 2.11.4.3.7. TVT Brkpt. 27
- 2.11.4.3.8. TVT Brkpt. 28
- 2.11.4.3.9. TVT Brkpt. 29
- 2.11.4.3.10. TVT Brkpt. 30

2.11.4.4. Brkpt. 31-40
2.11.4.4.1. TVT Brkpt. 31
2.11.4.4.2. TVT Brkpt. 32
2.11.4.4.3. TVT Brkpt. 33
2.11.4.4.4. TVT Brkpt. 34
2.11.4.4.5. TVT Brkpt. 35
2.11.4.4.6. TVT Brkpt. 36
2.11.4.4.7. TVT Brkpt. 37
2.11.4.4.8. TVT Brkpt. 38
2.11.4.4.9. TVT Brkpt. 39
2.11.4.4.10. TVT Brkpt. 40

8.6.11.5 Measurement verification (2.11.5.)

Transducer selector (2.11.5.1.)

Sets the transducer index for all parameters applicable to this sub-menu.

Up sampling (2.11.5.2.)

Sets the number of consecutive echoes that must occur above the echo currently locked onto before the measurements are validated as the new reading [for Echo Lock (2.11.5.4.) (Page 230) = Maximum verification or Material agitator].

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 1 ... 50	
	Preset: 5	
Related	• Echo lock (2.11.5.4.) (Page 230) • Down sampling (2.11.5.3.) (Page 229)	

Echo Lock (2.11.5.4.) (Page 230)	**Up Sampling value**
Maximum verification	5
Material agitator	5

For more details, see Down sampling (2.11.5.3.) (Page 229).

Down sampling (2.11.5.3.)

Sets the number of consecutive echoes that must occur below the echo currently locked onto before the measurements are validated as the new reading [for Echo Lock (2.11.5.4.) (Page 230) = Maximum verification or Material agitator]

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 1 ... 50	
	Preset: 2	
Related	• Echo lock (2.11.5.4.) (Page 230) • Up sampling (2.11.5.2.) (Page 228)	

Echo Lock (2.11.5.4.) (Page 230)	Up Sampling value
Maximum verification	5
Material agitator	2

Example setting:

- Echo Lock (2.11.5.4.) (Page 230) = Material agitator
- Up Sampling (2.11.5.2.) (Page 228) = 5
- Down sampling (2.11.5.3.) = 2

Result:

- Five consecutive measurements higher than the current reading will validate a new reading.

OR

- Two consecutive measurements lower than the current reading will validate a new reading.

Resetting Echo Lock (2.11.5.4.) (Page 230) returns Up Sampling (2.11.5.2) (Page 228) and Down Sampling (2.11.5.3.) to their respective preset values.

Echo lock (2.11.5.4.)

Selects the measurement verification process.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Lock OFF	
	Maximum verification	
	*Material agitator	
	Total lock	
Related	• Fill rate/minute (2.3.2.) (Page 169) • Empty rate/minute (2.3.3.) (Page 169) • Algorithm (2.11.2.2.) (Page 217) • Measurement verification (2.11.5.) (Page 228) • Echo lock window (2.11.5.5.) (Page 230)	

If a material agitator (mixer) is used in the vessel monitored, set Echo Lock for **Maximum verification** or **Material agitator** to avoid agitator blade detection. Ensure the agitator is always ON while the device is monitoring the vessel to avoid stationary blade detection.

When set for **Maximum verification** or **Material agitator**, a new measurement outside of the Echo Lock Window (2.11.5.5.) (Page 230) must meet the Measurement Verification (2.11.5.) (Page 228) criterion.

For, Echo Lock Window (2.11.5.5.) (Page 230) is preset to zero (**0**). The device continuously searches for the best echo according to the Algorithm (2.11.2.2.) (Page 217) chosen. If the selected echo is within the window, the window is then centered about the echo. If not, the window widens with each successive shot until the selected echo is within the window. The window then returns to its normal width.

When Echo Lock is OFF, the device responds immediately to a new measurement as restricted by the Fill Rate/minute (2.3.2.) (Page 169) and Empty Rate/minute (2.3.3.) (Page 169); however, measurement reliability is affected.

Echo lock window (2.11.5.5.)

Adjusts the size of the Echo Lock Window.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Preset: 0.000	
	Response rate (2.3.4.) (Page 170)	
Related	• Units (2.1.1.) (Page 158) • Echo lock (2.11.5.4.) (Page 230)	

The Echo Lock Window is a distance window [Units (2.1.1.) (Page 158)] centered on the echo and used to derive the Reading. When a new measurement is in the window, it is re-centered and the new reading calculated. Otherwise, the new measurement is verified by Echo Lock (2.11.5.4.) (Page 230) before the reading is updated.

When **0** is entered, the window is automatically calculated after each measurement. For slower Response Rate (2.3.4.) (Page 170) values, the window is narrow; for faster Response Rate (2.3.4.) (Page 170) values, the window becomes wider.

Fuzz filter (2.11.5.6.)

Stabilizes the reported level, due to level fluctuations (such as a rippling or splashing liquid surface) within the Echo Lock Window (2.11.5.5.) (Page 230).

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 0 ... 100 (0 = OFF)	
Altered by	Response rate (2.3.4.) (Page 170)	
Related	• Span (2.2.2.) (Page 165) • Echo lock window (2.11.5.5.) (Page 230)	

This value [in % of Span (2.2.2.) (Page 165)] is automatically altered when Response Rate (2.3.4.) (Page 170) is changed. The higher the value entered, the greater the fluctuation stabilized.

8.6.12 Display (2.12.)

8.6.12.1 Local display backlight (2.12.1)

Controls the LCD backlighting.

Index	Global
Options	OFF
	*ON
	Timed

The backlight can be forced ON or OFF, or be controlled by a programmer, in which case it will turn OFF five minutes after the last key is pressed.

8.6.12.2 LCD contrast (2.12.2.)

Adjusts the luminance of the bright and dark colors of the display.

Options	Range: 0 (Low contrast) to 20 (High contrast)
	Preset: 10

The factory setting is for optimum visibility at room temperature and in average lighting conditions. Extremes of temperature will lessen the contrast. Adjust the value to improve visibility in different temperatures and lighting conditions.

8.6.12.3 Level selector (2.12.3.)

Sets the Level Point index for all parameters applicable to this sub-menu.

8.6.12.4 Decimal position (2.12.4.)

Defines the maximum number of decimal places used on the LCD.

Index	Level
Options	No digits
	1 digit
	*2 digits
	3 digits
Alters	Flowrate decimal (2.13.4.6.) (Page 240)
Altered by	Maximum volume (2.7.3.) (Page 183)
Related	Reading (3.2.8.2.) (Page 251)

In RUN mode, the decimal position adjusts to prevent the number of digits from exceeding the display capabilities. To keep the decimal place from shifting, reduce the number of decimal places to that shown at 100%.

Example: If 100% is 15 m, use two decimal places for sample readings of **15.00** or **12.15**.

8.6.12.5 Convert reading (2.12.5.)

Multiplies the current value by the specified amount, to allow for scaling.

Index	Level
Values	Range: -999 ... 9999
	Preset: 1.000
Related	Reading (3.2.8.2.) (Page 251)

Example:

- If the measured value is in feet, enter **0.3333** to display the number of yards.
- For simple linear volume conversions, set Units to **1** (meter) and then enter the volume measurement per unit to get the correct conversion. For example, if the reservoir contains 100 liters per vertical meter, use **100** to get the reading in liters.

Note

- This method does not calculate volume. It must not be used in place of the volume parameters if any volume dependent features (such as pump efficiency) are used. To calculate true volumes, see Volume (2.7.) (Page 181).
- Avoid entering a value that exceeds the display capabilities when multiplied by the maximum current reading. If value exceeds four digits, #### is shown.

8.6.12.6 Offset reading (2.12.6.)

Adds the specified value to the level reading, usually to reference the reading to sea level or another data level.

Index	Level
Values	Range: -999 ... 9999
	Preset: 0.000
Related	Reading (3.2.8.2.) (Page 251)

The operation of the device is not affected by the Offset Reading. This value is used for display purposes only. All control measurements are still referenced to Empty.

8.6.12.7 Default auxiliary reading (2.12.7.)

Determines the parameter that displays in the Auxiliary Reading after powering up the device.

Index	Global
Options	*Totalizer
	Level
	Space
	Distance
	Volume
	Flow
	Head
	Temperature
	Rate
	Fail-safe remaining
	Confidence
	Echo Strength
	mA Output 1
	mA Output 2
	mA Input

8.6.12.8 Display delay (2.12.8.)

Adjusts the time before the next Point reading is displayed.

Index	Level
Values	Range: 0.5 ... 10
	Preset: 1.5 seconds
Related	Sensor mode (2.1.3.) (Page 159)

Use this feature to adjust the delay before the display advances to the next Point reading. Display scrolling is independent from transducer scanning.

8.6.13 Flow (2.13.)

The calculated flowrate in Maximum Flow units (2.13.4.3.) (Page 238).

8.6.13.1 Transducer selector (2.13.1.)

Sets the transducer index for all parameters applicable to this sub-menu. The parameters set will only apply if Sensor Mode (2.1.3.) (Page 159) = Flow rate in open channel.

8.6.13.2 Primary measuring device (2.13.2.)

The type of primary measuring device (PMD) used.

Index	Single-point model	Dual-point model
	Global	Transducer
Options	* OFF (no calculation)	
	Exponential devices [see Flow Exponent (2.13.4.1.) (Page 235)]	
	Palmer-Bowlus Flume [see PMD Dimensions (2.13.5.) (Page 241)]	
	H-Flume [see PMD Dimensions (2.13.5.) (Page 241)]	
	Universal Linear Flow Calculation [see Head 1 (Page 242) and Flow 1 (Page 243)]	
	Universal Curved Flow Calculation [see Head 1 (Page 242) and Flow 1 (Page 243)]	
	Rectangular Flume BS-3680 [see PMD Dimensions (2.13.5.) (Page 241)]	
	Thin Plate V-Notch Weir BS-3680 [see PMD Dimensions (2.13.5.) (Page 241)]	
Alters	• Flow Exponent (2.13.4.1.) (Page 235) • PMD Dimensions (2.13.5.) (Page 241) • Flowrate Units (2.13.4.7.) (Page 240)	
Altered by	Sensor Mode (2.1.3.) (Page 159)	
Related	• Maximum Head (2.13.4.2.) (Page 237) • Maximum Flow (2.13.4.3.) (Page 238) • Zero Head (2.13.4.5.) (Page 239) • Head 1 (2.13.6.1.1.) (Page 242) • Flow 1 (2.13.6.1.2.) (Page 243)	

The device is pre-programmed for common PMD flow calculations. If your PMD is not listed, select the appropriate Universal Flow Calculation.

Associated parameters Maximum Head (2.13.4.2.) (Page 237), Maximum Flow (2.13.4.3.) (Page 238), and Zero Head (2.13.4.5.) (Page 239) may be scroll accessed. If Sensor Mode (2.1.3.) (Page 159) = Flow rate in open channel, this value is preset to **1**. If Sensor Mode (2.1.3.) (Page 159) is not set for **OCM**, it is preset to **0**.

8.6.13.3 Auto zero head (2.13.3.)

Calibrates Zero Head (2.13.4.5.) (Page 239) based on actual head measurements.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: -999 ... 9999	
Altered by	Response rate (2.3.4.) (Page 170)	
Related	• Empty (2.2.4.) (Page 166) • Offset reading (2.12.6.) (Page 233) • Zero head (2.13.4.5.) (Page 239) • Process temperature (2.11.1.3.) (Page 213)	

Use this parameter when the reported head is consistently high or low by a fixed amount.

Before using this feature, verify the following parameters are correct:

- Empty (2.2.4.) (Page 166)
- Process Temperature (2.11.1.3.) (Page 213)
- Offset Reading (2.12.6.) (Page 233) = 0
- Zero Head (2.13.4.5) (Page 239)

To measure with "head" steady:

1. Measure the actual head (with a tape measure or solid rule).
2. Enter the actual head value.

The deviation between the entered Empty (2.2.4.) (Page 166) value and the calibrated Empty value is stored in Offset Correction (2.11.1.9.) (Page 216). Alternatively, the Empty (2.2.4.) (Page 166) can be corrected directly.

8.6.13.4 Basic setup (2.13.4.)

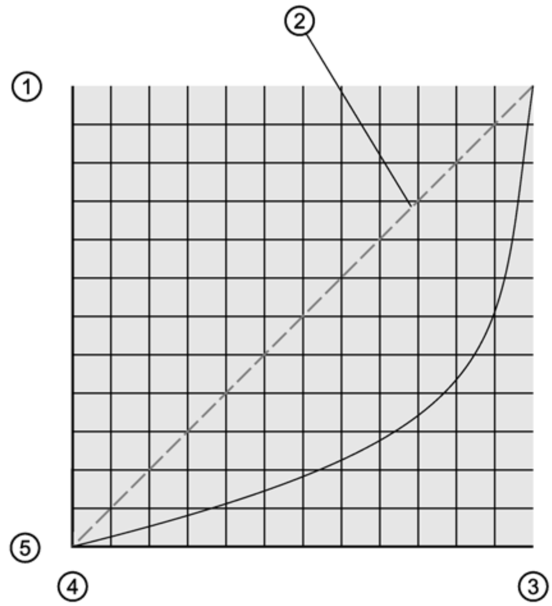
Flow exponent (2.13.4.1)

Sets the exponent for the flow calculation formula.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: -999 ... 9999	
	Preset: 1.55	
Altered by	Primary measuring device (2.13.2.) (Page 234)	
Related	• Maximum head (2.13.4.2.) (Page 237) • Maximum flow (2.13.4.3.) (Page 238) • Zero head (2.13.4.5.) (Page 239)	

Use this parameter if the Primary Measuring Device (2.13.2.) (Page 234) is set to Exponential devices. It creates an exponential curve with end points set by Maximum Head (2.13.4.2.) (Page 237) and Maximum Flow (2.13.4.3.) (Page 238) and with the curve based on the specified exponent.

Use the exponent specified by the PMD manufacturer, if available, or the sample value given below.



① Max. flow

② If flow exponent = 1, the flow characteristic is a straight line.

③ Max. head

④ Zero head

⑤ Zero flow

Note

The exponential equation is $Q=KH^{\text{Flow Exponent (2.13.4.1.)}}$

Q = flow

K = internal constant

H = head

Example exponents

PMD type	Exponent (sample only)
Suppressed Rectangular Weir	1.50
Cipolletti Weir	1.50
Venturi Flume	1.50
Parshall Flume	1.22 ... 1.607
Leopold Lagco	1.547
V-Notch Weir	2.50

Maximum head (2.13.4.2.)

Sets the level value associated with Maximum Flow, in Units (2.1.1.) (Page 158).

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: -999 ... 9999	
	Preset: Span (2.2.2.) (Page 165) value	
Altered by	• Units (2.1.1.) (Page 158) • Primary measuring device (2.13.2.) (Page 234)	
Related	• Maximum flow (2.13.4.3.) (Page 238) • Zero head (2.13.4.5.) (Page 239)	

This represents the highest head level supported by the PMD and works in conjunction with Maximum Flow (2.13.4.3.) (Page 238) to define the highest point in the exponential curve. Use it when the PMD requires a maximum head and flow reference point. This would include Exponential, Palmer-Bowlus Flume, H-Flume, and Universal breakpoints.

Maximum flow (2.13.4.3.)

Sets the maximum flowrate associated with Maximum Head (2.13.4.2.) (Page 237).

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: -999 ... 9999	
	Preset: 1000	
Altered by	• Primary measuring device (2.13.2.) (Page 234)	
Related	• Maximum head (2.13.4.2.) (Page 237) • Flow time units (2.13.4.4.) (Page 239) • Flow (3.2.8.14.) (Page 254)	

This represents the flow at the highest head level supported by the PMD and works in conjunction with Maximum Head (2.13.4.2.) (Page 237) to define the highest point in the exponential curve. Use it when the PMD requires a maximum head and flow reference point. This would include Exponential, Palmer-Bowlus Flume, H-Flume, and Universal breakpoints.

Also, use this parameter with Flow Time Units (2.13.4.4.) (Page 239) to define the flow rate units.

Note

- The display of the measured value is limited to seven characters. A Maximum Flow value larger than seven characters will not display correctly.
- If measured value is larger than seven characters, the screen displays ####. A larger unit [Flow Time Units (2.13.4.4.) (Page 239)] should be used, or number of decimal points [Flowrate Decimal (2.13.4.6.) (Page 240)] should be reduced.

Example

Conditions	Enter
Flowrate display: millions of gallons/ day, and maximum flowrate is 376,500,000 gallons/day.	376.5 for Maximum Flow (2.13.4.3.), and Days for Flow Time Units (2.13.4.4.) (Page 239)

Flow time units (2.13.4.4.)

Defines the units used to display current flow and logging flow values.

Index	Single-point model	Dual-point model
	Global	Transducer
Options	Seconds	
	Minutes	
	Hours	
	*Days	
Altered by	Flowrate units (2.13.4.7.) (Page 240)	

This is used when the Primary Measuring Device is Ratiometric [Flowrate Units (2.13.4.7.) (Page 240) = Ratiometric].

Example

Conditions	Enter
Flowrate display: millions of gallons/day, and maximum flowrate is 376,500,000 gallons/day.	376.5 for Maximum Flow (2.13.4.3.) (Page 238), and Days for Flow Time Units (2.13.4.4.)

Zero head (2.13.4.5.)

The distance above Empty (2.2.4.) (Page 166), in Units (2.1.1.) (Page 158) representing zero head (and zero flow).

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: -999 ... 9999	
	Preset: 0.000	
Altered by	• Units (2.1.1.) (Page 158) • Span (2.2.2.) (Page 165)	
Related	• Empty (2.2.4.) (Page 166) • Range extension (2.2.7.) (Page 168) • Head (3.2.8.13) (Page 254)	

This feature can be used for most weirs and some flumes (e.g. Palmer-Bowlus) where the zero reference is at a higher elevation than the channel bottom.

Flowrate decimal (2.13.4.6.)

Sets the maximum number of decimal places to be displayed in the auxiliary reading.

Index	Single-point model	Dual-point model
	Global	Transducer
Options	No digits	
	1 digit	
	*2 digits	
	3 digits	
Altered by	Decimal position (2.12.4.) (Page 232)	

The maximum number of decimal places shown in the Primary Reading is controlled by Decimal Position (2.12.4.) (Page 232).

Flowrate units (2.13.4.7.)

Defines the units used for flow calculations.

Note

Set this parameter only when using BS-3680/ISO 4359 Rectangular Flume or BS-3680/ISO 1438/1 Thin Plate V-Notch Weir [Primary Measuring Device (2.13.2.) (Page 234) = Rectangular Flume BS-36806 or Thin Plate V-Notch Weir BS-36807]. Use the default option of Ratiometric calculation for Flowrate Units (2.13.4.7.) when Primary Measuring Device (2.13.2.) (Page 234) = Exponential devices, Palmer-Bowlus Flume, H-Flume, Universal Linear Flow Calculation, or Universal Curved Flow Calculation.

Index	Single-point model	Dual-point model
	Global	Transducer
Options	**Ratiometric** [Primary Measuring Device (2.13.2.) (Page 234) = all]	*Ratiometric calculation
	Absolute [Primary Measuring Device (2.13.2.) (Page 234) = Rectangular Flume BS-3680 or Thin Plate VNotch Weir BS-3680 only]	L/S (Liters/second)
		M^3/H (Cubic meters/hour)
		M^3/D (Cubic meters/day)
		FT^3/S (Cubic feet/second)
		IMPGAL/MIN (Gallons/minute – Imperi-al)
		MIMPGAL/D (Million gallons/day – Imperial)
		GAL/MIN (Gallons/minute – U.S.)
		MUSGAL/D (Million gallons/day – U.S.)
Alters	Flow time units (2.13.4.4.) (Page 239)	
Altered by	Primary measuring device (2.13.2.) (Page 234)	
Related	Flowrate decimal (2.13.4.6.) (Page 240)	

Low flow cutoff (2.13.4.8.)

Eliminates totalizer activity for flows at, or below the cutoff value.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: 0.000 ... 9999	
	Preset: 5.000 %, in equivalent units	
Altered by	• Units (2.1.1.) (Page 158)	
Related	• Span (2.2.2.) (Page 165)	

Use this to enter the minimum head in Units (2.1.1.) (Page 158)

8.6.13.5 PMD dimensions (2.13.5.)

Sets the dimensions of the Primary Measuring Device (PMD).

Use this parameter if the Primary Measuring Device (2.13.2.) (Page 234) is directly supported. The dimensions required for each PMD vary.

The following table is a reference to the parameters that must be set for each PMD.

Index	Single-point model	Dual-point model
	Global	Transducer and dimension
Index values for supported PMDs	Dimension name (parameter menu reference)	
PMD selected	**Thin Plate V-Notch Weir**	
	Notch angle [OCM Dimension 1 (2.13.5.1.)]	
	Discharge coefficient [OCM Dimension 2 (2.13.5.2.)], Read only	
	Rectangular Flume BS-3680/ISO 4359	
	Approach width B [OCM Dimension 1 (2.13.5.1.)]	
	Throat width b [OCM Dimension 2 (2.13.5.2.)]	
	Hump height P [OCM Dimension 3 (2.13.5.3.)]	
	Throat Length L [OCM Dimension 4 (2.13.5.4.)]	
	Velocity coefficient [OCM Dimension 5 (2.13.5.5.)], Read only	
	Discharge coefficient [OCM Dimension 6 (2.13.5.6.)], Read only.	
	Cross sectional area [OCM Dimension 7 (2.13.5.7.)], Read only.	
	Palmer-Bowlus	
	Flume width [OCM Dimension 1 (2.13.5.1.)]	
	H-Flume	
	Flume height [OCM Dimension 1 (2.13.5.1.)]	
Altered by	Primary Measuring Device (2.13.2.) (Page 234)	

2.13.5.1. OCM Dimension 1

2.13.5.2. OCM Dimension 2

2.13.5.3. OCM Dimension 3

2.13.5.4. OCM Dimension 4

2.13.5.5. OCM Dimension 5

2.13.5.6. OCM Dimension 6

2.13.5.7. OCM Dimension 7

8.6.13.6 Universal head vs flow (2.13.6.)

Head 1 (2.13.6.1.1.)

Specifies the head breakpoints for which flowrate is known.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: -999 ... 9999	
Related	Flow 1 (2.13.6.1.2.) (Page 243)	

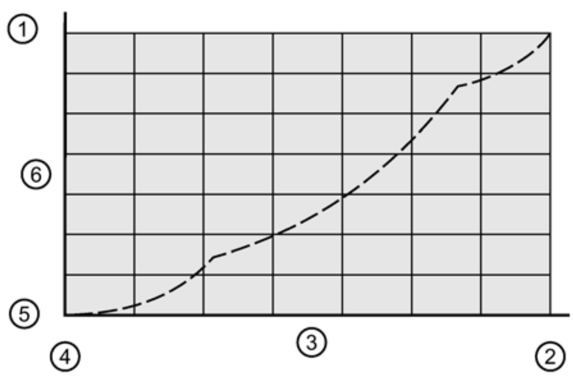
The values in the Span (2.2.2.) (Page 165) for which flowrates are known. See Universal calculation support (Page 148) for how to specify universal flows.

Flow 1 (2.13.6.1.2.)

Specifies the flowrate corresponding to each Head Breakpoint entered.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: -999 ... 9999	
Related	Head 1 (2.13.6.1.1.) (Page 242)	

These are the flowrates for the related breakpoints. See Universal calculation support (Page 148) for how to specify universal flows.



① Max. flow
② Max. head
③ Head breakpoints
④ Zero head
⑤ Zero flow
⑥ Flow breakpoints

2.13.6.1.3. Head 2
2.13.6.1.4. Flow 2
2.13.6.1.5. Head 3
2.13.6.1.6. Flow 3
2.13.6.1.7. Head 4
2.13.6.1.8. Flow 4
2.13.6.1.9. Head 5
2.13.6.1.10. Flow 5
2.13.6.1.11. Head 6
2.13.6.1.12. Flow 6
2.13.6.1.13. Head 7
2.13.6.1.14. Flow 7
2.13.6.1.15. Head 8
2.13.6.1.16. Flow 8

2.13.6.2. Table 9-16
2.13.6.2.1. Head 9
2.13.6.2.2. Flow 9
2.13.6.2.3. Head 10
2.13.6.2.4. Flow 10
2.13.6.2.5. Head 11
2.13.6.2.6. Flow 11
2.13.6.2.7. Head 12
2.13.6.2.8. Flow 12
2.13.6.2.9. Head 13
2.13.6.2.10. Flow 13
2.13.6.2.11. Head 14
2.13.6.2.12. Flow 14
2.13.6.2.13. Head 15
2.13.6.2.14. Flow 15
2.13.6.2.15. Head 16
2.13.6.2.16. Flow 16

2.13.6.3. Table 17-24
2.13.6.3.1. Head 17
2.13.6.3.2. Flow 17
2.13.6.3.3. Head 18
2.13.6.3.4. Flow 18
2.13.6.3.5. Head 19
2.13.6.3.6. Flow 19
2.13.6.3.7. Head 20
2.13.6.3.8. Flow 20
2.13.6.3.9. Head 21
2.13.6.3.10. Flow 21
2.13.6.3.11. Head 22
2.13.6.3.12. Flow 22
2.13.6.3.13. Head 23
2.13.6.3.14. Flow 23
2.13.6.3.15. Head 24
2.13.6.3.16. Flow 24

2.13.6.4. Table 25-32
2.13.6.4.1. Head 25
2.13.6.4.2. Flow 25
2.13.6.4.3. Head 26
2.13.6.4.4. Flow 26
2.13.6.4.5. Head 27
2.13.6.4.6. Flow 27
2.13.6.4.7. Head 28
2.13.6.4.8. Flow 28
2.13.6.4.9. Head 29
2.13.6.4.10. Flow 29
2.13.6.4.11. Head 30
2.13.6.4.12. Flow 30
2.13.6.4.13. Head 31
2.13.6.4.14. Flow 31
2.13.6.4.15. Head 32
2.13.6.4.16. Flow 32

8.6.14 Totalizers (2.14.)

8.6.14.1 Transducer selector (2.14.1.)

Sets the transducer index for all parameters applicable to this sub-menu.

8.6.14.2 Running Totalizers (2.14.)

Use these features to view, reset, or preset the eight-digit display totalizer when Sensor Mode (2.1.3.) (Page 159) is set for **Flow rate in open channel** or **Pump Totalizer**. The eight-digit totalizer is divided into two groups of four digits. The four most significant totalizer digits are stored in Running Totalizer High (2.14.2.) (Page 245), and the four least significant digits are stored in Running Totalizer Low (2.14.3.) (Page 246). Adjust these values separately to set a new total.

Example

Running Totalizer High (2.14.2.) (Page 245) = 0017

Running Totalizer Low (2.14.3.) (Page 246) = 6.294

Totalizer Display = 00176.294

Totalizer units are dependent upon programming. Enter zero 0 (if required) to reset the totalizer to zero. Alternatively, enter any other (applicable) value, to preset the totalizer to the necessary value.

In RUN mode, the full totalizer value can be viewed in Measurement View 2 in Auxiliary Reading (see The LCD Display (Page 49)).

Note

A second point is available only if the dual-point feature is enabled.

8.6.14.3 Running totalizers high (2.14.2.)

Shows and/or alters the four most significant digits of the totalizer value.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 0 ... 9999	
Related	• Running totalizers low (2.14.3.) (Page 246) • Totalizer decimal position (2.14.4.) (Page 246) • Totalizer multiplier (2.14.5.) (Page 247)	

8.6.14.4 Running totalizers low (2.14.3.)

Shows and/or alters the four least significant digits of the totalizer value.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 0 ... 9999	
Related	• Running totalizers high (2.14.2.) (Page 245) • Totalizer decimal position (2.14.4.) (Page 246) • Totalizer multiplier (2.14.5.) (Page 247)	

8.6.14.5 Totalizer decimal position (2.14.4.)

Sets the maximum number of decimal places to be displayed.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Options	No digits	
	1 digit	
	*2 digits	
	3 digits	
Related	• Running totalizers high (2.14.2.) (Page 245) • Running totalizers low (2.14.3.) (Page 246)	

Note

Set the decimal position during initial commissioning of the device. If the position is changed later, the totalizer data in Running Totalizer High (2.14.2.) (Page 245) and Running Totalizer Low (2.14.3.) (Page 246) will be incorrect and must be reset according to the new decimal value.

In RUN mode, the number of decimal places displayed is not automatically adjusted. When the LCD Total value is so large as to exceed display capabilities, the total rolls over to 0 and continues incrementing.

8.6.14.6 Totalizer multiplier (2.14.5.)

Use this feature if the LCD Total increments by too large (or too small) an amount.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Options	0.001	
	0.01	
	0.1	
	*1	
	10	
	100	
	1,000	
	10,000	
	100,000	
	1,000,000	
	10,000,000	
Related	• Running totalizers high (2.14.2.) (Page 245) • Running totalizers low (2.14.3.) (Page 246)	

Enter the factor (powers of 10 only) by which actual volume is divided, prior to display on the LCD. Use a value such that the eight-digit totalizer doesn’t roll over between readings.

Example: For an LCD Total display in 1000s of volume units, choose option 1,000.

8.7 Maintenance and Diagnostics (3.)

8.7.1 Identification (3.1.)

8.7.1.1 Tag (3.1.1.)

Sets the text to label the device. Limited to 32 alphanumeric characters. Appears at the top left corner of the display in Measurement mode. For more information, see The local display (Page 49).

8.7.1.2 Descriptor (3.1.2.)

Sets the text that can be used in any way. Limited to 32 ASCII characters. No specific recommended use.

8.7.1.3 Message (3.1.3.)

Sets the text that can be used in any way. Limited to 32 ASCII characters. No specific recommended use.

8.7.1.4 Order number (3.1.4.)

8.7.1.5 Serial number (3.1.5.)

Shows the unique factory-set serial number of the device. Read only.

8.7.1.6 Hardware revision (3.1.6.)

Shows to the electronics hardware of the device. Read only.

8.7.1.7 Firmware revision (3.1.7.)

Shows the sensor firmware revision value. Read only.

8.7.1.8 Loader revision (3.1.8.)

Shows the software revision value used to update the device. Read only.

8.7.1.9 Manufacture date (3.1.9.)

Displays the manufacture date of this unit. Read only.

Index	Global
Values	Format: YY:MM:DD (Read only)
Related	Power-ON resets (3.2.4.) (Page 250)

8.7.1.10 Date last configured (3.1.10.)

Shows the date when the device was last configured by SIMATIC PDM. Read only.

8.7.2 Diagnostics (3.2.)

8.7.2.1 Transducer selector (3.2.1.)

Sets the transducer index for all parameters applicable to this sub-menu.

8.7.2.2 Echo profile (3.2.2.)

Allows you to request the current echo profile either locally via the local push buttons, or remotely via SIMATIC PDM.

To request a profile via the local push buttons:

1. In PROGRAM mode, navigate to MAIN MENU > DIAGNOSTICS > ECHO PROFILE
2. Press RIGHT arrow to request a profile.

Note

An Echo Profile (3.2.2.) cannot be requested when:

- Sensor Mode (2.1.3.) (Page 159) is out of service, or when
- Transducer (2.1.5.) (Page 160) is set to NO TRANSDUCER.

In either case, the local push button will not operate.

For more detail, see Requesting an echo profile (Page 85).

For more detail on how to request an echo profile, see Echo processing (Page 294).

8.7.2.3 Master reset (3.2.3.)

Resets all parameters to original values, with the exception of the AFES, TVT shaping, and all relative identification parameters (Tag, Description, etc.).

	Single-point model	**Dual-point model**
Index	Global	Transducer
Global	*Do nothing	
	Factory defaults	

Use this feature prior to initial programming if arbitrary parameter values were used during a **bench test**, or after upgrading the software. Following a Master Reset, complete reprogramming is required.

When the factory default option is selected, the display will pause while reset is processed. When the display returns to the Diagnostics menu, the Master Reset is complete.

CAUTION

Master Reset

Be careful when using this feature. All data for all points will be reset. For convenience, be sure to record the values you want to re-enter.

8.7.2.4 Power-ON resets (3.2.4.)

Displays the number of times power has been applied since Manufacture Date (3.1.9.) (Page 249).

Index	Global
Values	Range: 1 ... 9999 (Read only)
Related	• Manufacture date (3.1.9.) (Page 249) • Power-ON time (3.2.5.) (Page 250)

8.7.2.5 Power-ON time (3.2.5.)

Displays the number of days this device has been in operation.

Index	Global
Values	Range: 1 ... 9999 (Read only)
Related	• Manufacture date (3.1.9.) (Page 249) • Power-ON resets (3.2.4.) (Page 250)

The RUN Time value is updated once a day, and cannot be reset. However, in the event of a power interruption, the counter won't advance. Therefore, a unit that is powered down on a regular basis will not have an accurate value.

8.7.2.6 Relay selector (3.2.6.)

Sets the relay index for all parameters applicable to this sub-menu.

8.7.2.7 Relay logic test (3.2.7.)

Forces the relay control logic into an activated or de-activated state.

Index	Relay
Options	*OFF
	Activate relay control
	De-activate relay control
Related	• Relay function (2.8.1.4.) (Page 191)

This parameter tests site wiring and control logic programming. Forcing the relay to an **activated** or **de-activated** state is similar to the device detecting an event and responding to it. Helpful in testing new installations and diagnosing control problems.

8.7.2.8 Measurement values (3.2.8.)

Level selector (3.2.8.1.)

Sets the Level Point index for all parameters applicable to this sub-menu.

Reading (3.2.8.2.)

Corresponds to the final reading after all programming is applied.

Index	Level
Values	Range: -999 ... 9999

In general, this means that: Reading (3.2.8.2.) = [Reading x Convert Reading (2.12.5.) (Page 232)] + Offset Reading (2.12.6.) (Page 233).

Reading measurements by operation:

Sensor mode	Vessel shape=0	Vessel shape≠0
OFF	----	----
Level	Level (3.2.8.3.) (Page 252)	Head (3.2.8.13.) (Page 254)
Space	Space (3.2.8.11.) (Page 253)	100% minus Head (3.2.8.13.) (Page 254)
Distance	Distance (%) (3.2.8.4.) (Page 252)	Distance (%) (3.2.8.4.) (Page 252)
Difference	Level (3.2.8.3.) (Page 252)	Level (3.2.8.3.) (Page 252)
Average	Level (3.2.8.3.) (Page 252)	Level (3.2.8.3.) (Page 252)
OCM	Flow (3.2.8.14.) (Page 254)	Flow (3.2.8.14.) (Page 254)
Pump totalizer	Head (3.2.8.13.) (Page 254)	Head (3.2.8.13.) (Page 254)

Level (3.2.8.3.)

Shows the distance in Units (2.1.1.) (Page 158) between Empty (2.2.4.) (Page 166) and the monitored surface.

Index	Level
Values	Range: -999 ... 9999
Related	• Units (2.1.1.) (Page 158) • Empty (2.2.4.) (Page 166) • Span (2.2.2.) (Page 165)

Distance % (3.2.8.4.)

Shows the distance between the surface and the transducer face (displays only as % of Empty).

Index	Level
Values	Range: 0.000 ... 9999% (Displays as % of Empty; Read only)
Related	• Units (2.1.1.) (Page 158) • Empty (2.2.4.) (Page 166)

Use Distance (3.2.8.12.) (Page 254) unless the distance information is required in percent.

Volume (3.2.8.5.)

Shows the calculated volume of material.

Index	Level
Values	Range: -999 ... 9999
Related	• Maximum volume (2.7.3.) (Page 183)

Rate (3.2.8.6.)

Shows the rate of material level change in Units (2.1.1) (Page 158) per minute.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: -999 ... 9999 (Read only)	
Altered by	Rate filter (2.3.5.) (Page 171)	
Related	• Units (2.1.1.) (Page 158) • Span (2.2.2.) (Page 165)	

A negative rate indicates the vessel is emptying.

Volume rate (3.2.8.7.)

Shows the rate of change of volume in percent of maximum volume per minute.

Index	Single-point model	Dual-point model
	Global	Transducer
Values	Range: -999 ... 9999 (Read only)	
Related	Inflow/discharge adjust (2.7.7.) (Page 185)	

This value is used internally to calculate inflow in pumped volume applications [Inflow/discharge Adjust (2.7.7.) (Page 185) = Based on Rate Estimation].

Reading maximum (3.2.8.8.)

Shows the highest reading calculated (in normal Reading units).

Index	Level
Values	Range: -999 ... 9999 (read only)
Related	• Reading minimum (3.2.8.9.) (Page 253)

To reset the values once the installation is working correctly, enter the value **0.0**.

Reading minimum (3.2.8.9.)

Shows the lowest reading calculated (in normal Reading units).

Index	Level
Values	Range: -999 ... 9999 (read only)
Related	• Pump records (3.2.9.) (Page 255)

To reset the values once the installation is working correctly, enter the value 9999.

Transducer selector (3.2.8.10.)

Sets the transducer index for all parameters applicable to this sub-menu.

Space (3.2.8.11.)

Shows the distance between the monitored surface and Span (2.2.2.) (Page 165).

Index	Level
Values	Range: -999 ... 9999 (read only)
Related	• Span (2.2.2.) (Page 165)

Distance (3.2.8.12.)

Shows the distance between the monitored surface and the transducer face.

Index	Transducer
Values	Range: 0.000 ... 9999 (Read only)

Head (3.2.8.13)

Shows the distance from Zero Head (2.13.4.5.) (Page 239) to the monitored surface in Units (2.1.1.) (Page 158).

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 0.000 ... 9999 (Read only)	
Related	• Units (2.1.1.) (Page 158) • Span (2.2.2.) (Page 165) • Zero head (2.13.4.5.) (Page 239)	

Flow (3.2.8.14.)

Shows the calculated flowrate in Maximum Flow (2.13.4.3.) (Page 238) units.

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: 0.000 ... 9999 (Read only)	
Related	• Maximum flow (2.13.4.3.) (Page 238)	

Flow maximum (3.2.8.15.)

Shows the highest flow rate calculated (in units).

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: -999 ... 9999 (Read only)	
Related	• Maximum flow (2.13.4.3.) (Page 238)	

Flow minimum (3.2.8.16.)

Shows the lowest flow rate calculated (in units).

Index	**Single-point model**	**Dual-point model**
	Global	Transducer
Values	Range: -999 ... 9999 (Read only)	
Related	• Maximum flow (2.13.4.3.) (Page 238)	

Transducer temperature (3.2.8.17.)

Displays the temperature in °C (as monitored by the connected transducer).

Index	Transducer
Related	Range: -50 ... 150

TS-3 temperature (3.2.8.18.)

Displays the temperature in °C (as monitored by the TS-3 temperature sensor).

Index	Transducer
Related	Range: -50 ... 150

mA input (3.2.8.19.)

Displays the mA input value.

Index	mA Input
Related	Range: 0.000 ... 24.00 mA

8.7.2.9 Pump records (3.2.9.)

Identifies pump usage and if the associated Relay Function [Relay Function (2.8.1.4.) (Page 191)] is set for any pump control feature. The value is that of the pump connected to the associated terminals.

Enter a value to set the current record to that value. Use this if a pump is added with a known number of hours logged, or the value can be reset to 0 after maintenance.

Relay selector (3.2.9.1.)

Sets the relay index for all parameters applicable to this sub-menu.

Pump hours (3.2.9.2.)

Sets or shows the total running time of the selected relay, in hours.

Range: 0 ... 999999

Pump run time (3.2.9.3.)

Sets or shows the total running time of the selected relay, in hours.

Range: 0 ... 999999

Pump starts (3.2.9.4.)

Shows or resets the accumulated number of times the selected relay has been ON.

Index	Relay
Values	Range: 0 ... 9999
Related	Relay function (2.8.1.4.) (Page 191)

To change the relay assignment, see Relay selector (3.2.9.1.) (Page 255).

Pump run-ONs (3.2.9.5.)

Shows or resets the accumulated number of times the selected relay has been held ON via Run-ON Interval (2.8.2.7.1.) (Page 200).

Index	Relay
Values	Range: 0 ... 9999
Related	Relay function (2.8.1.4.) (Page 191)

To change the relay assignment, see Relay selector (3.2.9.1.) (Page 255).

8.7.2.10 Temperature peak values (3.2.10)

The following features display the high and/or low temperatures in °C.

If the unit is powered up without a temperature sensor connected, the value – 50°C is displayed. This information can help trace problems with both built-in and external temperature sensors.

Transducer selector (3.2.10.1.)

Sets the transducer index for all parameters applicable to this sub-menu.

Transducer temperature maximum (3.2.10.2.)

Shows the highest temperature encountered, as measured by the temperature sensor in the transducer (if applicable).

Index	Transducer
Values	Range: - 50 ... 150 °C (Read only)
	Preset: - 50 °C
Related	Transducer Temperature Minimum (3.2.10.3.) (Page 257)

To reset the log after a short circuit on the transducer wiring, enter the value -50.

Transducer temperature minimum (3.2.10.3.)

Shows the lowest temperature encountered, as measured by the temperature sensor in the transducer (if applicable).

Index	Transducer
Values	Range: - 50 ... 150 °C (Read only)
	Preset: 150 °C
Related	Transducer temperature maximum (3.2.10.2.) (Page 256)

To reset the log after an open circuit on the transducer wiring, enter the value 150.

TS-3 temperature maximum (3.2.10.4.)

Shows the highest temperature encountered, as measured by the TS-3 temperature sensor (if applicable).

Index	Global
Values	Range: - 50 ... 150 °C (Read only)
	Preset: - 50 °C
Related	TS-3 temperature minimum (3.2.10.5.) (Page 257)

To reset the log after a short circuit on the transducer wiring, enter the value -50.

TS-3 temperature minimum (3.2.10.5.)

Shows the lowest temperature encountered, as measured by the TS-3 Temperature Sensor (if applicable).

Index	Global
Values	Range: - 50 ... 150 °C (Read only)
	Preset: 150 °C
Related	TS-3 temperature maximum (3.2.10.4.) (Page 257)

To reset the log after an open circuit on the transducer wiring, enter the value 150.

8.7.2.11 Echo quality (3.2.11.)

Transducer selector (3.2.11.1.)

Sets the transducer index for all parameters applicable to this sub-menu.

Long confidence (3.2.11.2.)

Displays the Long Echo Confidence of the measurement echo from the last shot.

Index	Transducer
Values	Range: 0 ... 99
Related	• Long echo threshold (2.11.2.3.) (Page 217) • TVT type (2.11.3.6.) (Page 225)

Use this feature to monitor the effect of transducer aiming, location, and mechanical transducer/mounting isolation.

Short confidence (3.2.11.3.)

Displays the Short Echo Confidence of the measurement echo from the last shot.

Index	Transducer
Values	Range: 0 ... 99
Related	• Long echo threshold (2.11.2.3.) (Page 217) • TVT type (2.11.3.6.) (Page 225)

Use this feature to monitor the effect of transducer aiming, location, and mechanical transducer/mounting isolation.

Echo strength (3.2.11.4.)

Displays the strength (in dB above 1 μV RMS) of the echo which was selected as the measurement echo.

Index	Transducer
Values	Range: 0 ... 99 (Read only)

Noise average (3.2.11.5.)

Displays the average ambient noise (in dB above 1 μV RMS) of a noise profile after each measurement.

The noise level is a combination of transient acoustic noise and electrical noise (induced into the transducer cable or receiving circuitry). For more information, see Noise problems (Page 280).

Noise peak (3.2.11.6.)

Displays the peak ambient noise (in dB above 1 μV RMS) of a noise profile after each measurement.

Echo time filtered (3.2.11.7.)

Displays the time, in ms, from the transmission of the pulse, to when it is processed.

Index	Transducer
Values	Range: 0.0 ... 9999 milliseconds (Read only)
Related	Echo time raw (3.2.11.8.) (Page 259)

Echo time raw (3.2.11.8.)

Displays the time, in ms, from the transmit pulse to the processed echo.

Index	Transducer
Values	Range: 0.0 ... 9999 milliseconds (Read only)
Related	Echo time filtered (3.2.11.7.) (Page 259)

8.7.2.12 SmartLinx diagnostics (3.2.12.)

Note

These parameters are used to test and debug the SmartLinx card (if installed). Disregard these parameters if you do not have a SmartLinx card installed.

Hardware status (3.2.12.1.)

Shows the results of ongoing hardware tests in the communications circuitry.

Index	Global	
Values	*Pass	No errors
	Fail	Error occurred communicating with card; communications should resume.
	Err1	No module installed, or module not supported; SmartLinx communications have been disabled
Related	• Hardware Status Code (3.2.12.2.) (Page 260) • Hardware Error Count (3.2.12.3.) (Page 260)	

If **Fail** or **Err1** is displayed in Hardware Status (3.2.12.1.), go to Hardware Status Code (3.2.12.2.) (Page 260) and Hardware Error Count (3.2.12.3.) (Page 260) for information about the error.

Hardware status code (3.2.12.2.)

Indicates the precise cause of **Fail** or **Err1** condition from Hardware Status (3.2.12.1.) (Page 259).

Index	Global	
Value	*	No error
	8	No SmartLinx card installed
	Any other value	Error code; provide this code to your Siemens representative for troubleshooting
Related	Hardware Status (3.2.12.1.) (Page 259)	

Hardware error count (3.2.12.3.)

Shows the count that increments by **1** each time **Fail** is reported in Hardware Status (3.2.12.1.) (Page 259).

Index	Global
Values	Range: 0 ... 9999
	Error count; provide this number to your Siemens representative for troubleshooting.
Related	Hardware Status (3.2.12.1.) (Page 259)

SmartLinx module type (3.2.12.4.)

Identifies the module type when SmartLinx is used. If you are not using SmartLinx, this parameter is not functional. Please see the associated SmartLinx instruction manual for a full description of this parameter.

SmartLinx protocol (3.2.12.5.)

Identifies the protocol when SmartLinx is used. If you are not using SmartLinx, this parameter is not functional. Please see the associated SmartLinx instruction manual for a full description of this parameter.

8.7.3 Simulation (3.3.)

Tests the application.

8.7.3.1 Discrete Inputs

Discrete input 1 (3.3.1.1.)

Sets how Discrete Input 1 signals are interpreted by the device.

Index	Discrete Input (DI)
Options	Forced OFF
	Forced ON
	*Normally open
	Normally closed
Related	Discrete input number (2.9.1.2.) (Page 202) Level override value (2.9.1.3.) (Page 203)

Discrete input 2 (3.3.1.2.)

Sets how Discrete Input 2 signals are interpreted by the device.

Index	Discrete Input (DI)
Options	Forced OFF
	Forced ON
	*Normally open
	Normally closed
Related	Discrete input number (2.9.1.2.) (Page 202) Level override value (2.9.1.3.) (Page 203)

Discrete input 1 scaled state (3.3.1.3.)

Shows the current value of the discrete input after any scaling is applied. Read only.

Index	Discrete Input
Modes	Active
	Inactive

Readings are updated continuously even in PROGRAM mode. The value signals a level override event.

Discrete input 2 scaled state (3.3.1.4.)

Shows the current value of the discrete input after any scaling is applied. Read only.

Index	Discrete Input
Modes	Active
	Inactive

Readings are updated continuously even in PROGRAM mode. The value signals a level override event.

8.8 Communication (4.)

The device communications ports are configured by a series of parameters that are indexed by port. See Communications (Page 312) for a complete description of the communications set-up.

Unless otherwise noted, communication parameters are indexed to the following communications ports:

Port	Description
1	RS-232 port (RJ-11 modular telephone)
2	RS 485 port on terminal block

8.8.1 Communications port selector (4.1.)

Sets the communications port index for all parameters applicable to this sub-menu.

Options	*Communications Port 1
	Communications Port 2

8.8.2 Device address (4.2.)

Sets the unique identifier of the device on the network.

Index	Communications Port
Options	Range: 0 ... 9999

For devices connected with the Siemens protocol, this parameter is ignored. For devices connected with a serial Modbus slave protocol, this parameter is a number from 1-247. The network administrator must ensure that all devices on the network have unique addresses. Do not use the value 0 for Modbus communications as this is the broadcast address and is inappropriate for a slave device.

8.8.3 Communications timeout (4.3.)

Sets the maximum time allowed between receiving a request and transmitting the response.

Index	Communications Port
Options	Range: 0 ... 60 000 milliseconds
	Preset: 5 000 milliseconds

If the maximum time is exceeded, no response will be transmitted, and the action required may not be completed.

8.8.4 Protocol (4.4.)

Sets the communications protocol used between the device and other devices.

Index	Communications Port
Options	Communications Port disabled
	Dolphin protocol
	Modbus ASCII slave serial
	*Modbus RTU slave serial

The device supports the internationally recognized Modbus standard in both ASCII and RTU formats. Other protocols are available with optional SmartLinx cards.

8.8.5 Serial baud rate (4.5.)

Sets the communication rate with the master device.

Index	Communications Port
Options	4.8 kbaud
	9.6 kbaud
	*19.2 kbaud (preset for Port 2)
	*115.2 kbaud (preset for Port 1)

This specifies the rate of communication in kbaud. Any value may be entered but only the values shown above are supported. The baud rate should reflect the speed of the connected hardware and protocol used.

8.8.6 Parity (4.6.)

Sets the serial port parity.

Index	Communications Port
Options	*No parity
	Odd parity
	Even parity

Ensure that the communications parameters are identical between the device and all connected devices. For example, many modems default to N-8-1 which is **No parity**, **8 Data Bits**, and **1 Stop Bit**.

8.8.7 Data bits (4.7.)

Sets the number of data bits per character.

Index	Communications Port
Values	Range: 5 ... 8

8.8.8 Stop bits (4.8.)

Sets the number of bits between the data bits.

Index	Communications Port
Values	Range: 1 ... 2
	Preset: 1

8.8.9 Modem available (4.9.)

Sets the device to use an external modem.

Index	Communications Port
Options	*No modem connected
	Answer only

8.8.10 Modem inactivity timeout (4.10.)

Sets the time that the device will keep the modem connected with no activity.

Index	Communications Port
Options	Range: 0 ... 9999 seconds
	Preset: 0 (No timeout)
Related	Modem available (4.9.) (Page 264) Modem Inactivity Timeout (4.10.)

To use this parameter, ensure that Modem Available (4.9.) (Page 264) = Answer only. Ensure that the value is low enough to avoid unnecessary delays when an unexpected disconnect occurs but long enough to avoid timeout while you are still legitimately connected. This parameter value is ignored by the Modbus Master Drivers, as they automatically disconnect when done.

Hanging up

If the line is idle and the Modem Inactivity Timeout (4.10.) expires, then the modem is directed to hang up the line. Ensure that Modem Inactivity Timeout (4.10.) is set longer than the standard polling time of the connected master device. 0 disables the inactivity timer, meaning there is no timeout.

8.8.11 Parameter index location (4.11.)

Determines where index information is stored for the parameter access area.

Index	Global
Options	*Global
	Parameter-specific
Related	Protocol (4.4.) (Page 263)

Global

The primary and secondary index values are global (they affect all of the parameter access area at once) and stored in:

- Primary index – R43,999
- Secondary index – R43,998

Parameter-specific

The primary and secondary index values are encoded into the format words found between R46,000 and R46,999. Each format word corresponds with the R44,000 series number in the parameter access map. For example, the format register R46,111 corresponds to the parameter Relay Function (2.8.1.4.) and the value is stored in R44,111. If the Modbus protocol (4.4. Protocol = [Modbus ASCII slave serial] or [Modbus RTU slave serial]) is not used, this parameter is ignored.

8.8.12 SmartLinx reserved parameters (4.12.1. to 4.12.5.)

These are reserved for optional SmartLinx communications cards and vary by card. Refer to the SmartLinx documentation (A5E36197302) to determine if any of them are used.

8.9 Security (5.)

8.9.1 Write protection (5.1.)

Sets the password to prevent any changes to parameters via local push buttons or Windows-based web browser. Write protection must match User PIN (5.2.) (Page 267) for the device to be unlocked.

Values/Options	Range: -32768 ... 32767	
	Unlock value: 1954	Lock OFF
	Any other value	Lock ON

- To turn Lock ON, key in any value other than the Unlock Value.
- To turn Lock OFF, key in the Unlock Value (1954).

8.9.2 User PIN (5.2.)

Sets the private password to prevent any changes to the parameters via local push buttons or remote communications.

Values/Options	Range: 0 ... 65535
	Preset: 1954

Note

- To view or change the User PIN, Write Protection (5.1.) (Page 266) must match the current User PIN value. If the PIN does not match, the screen displays '*****'
- If '*****' is displayed, the device parameters cannot be changed and shows the lock icon, except for Write Protection (5.1.) (Page 266)
- User PIN cannot be changed via communications.

CAUTION

PIN recovery

The User PIN value cannot be recovered in the field. Record a new User PIN in a secure manner. If user PIN information is lost, please consult a local sales person: http://www.automation.siemens.com/aspa_app (http://www.automation.siemens.com/aspa_app).

8.9.3 Protocol selector (5.3.)

Sets the protocol index for all parameters applicable to this sub-menu.

8.9.4 Communications control (5.4.)

Enables the read/write access to parameters via remote communications.

Note

This parameter controls the lock access via communications.

Index	Protocol (Index 1 controls the Modbus Master (RS-485 or RS-232); Index 2 controls the Fieldbus Master (PROFIBUS DP, DeviceNet, or Allen Bradley Remote I/ O)
Values	Read only
	*Read/write
	Restricted access (Read only, except for Communications Control (5.4.), which is Read/Write.)

8.10 Language (6.)

Options	*ENGLISH
	DEUTSCH
	FRANCAIS
	ESPANOL
	简体中文
	ITALIANO
	PORTUGUÊS
	русский

9 Service and maintenance

The device requires no maintenance or cleaning under normal operating conditions.

9.1 Firmware updates

To update the device firmware, please contact your Siemens representative to obtain the installer (self-executable .exe file). For a complete list of representatives, go to www.siemens.com/processinstrumentation (www.siemens.com/processinstrumentation)

Two installers are available: one to update the firmware in the Human Machine Interface (HMI) node, and one for the sensor node. One or both may be required, depending on the reason for the update.

To update, follow the steps below:

1. Connect your computer to the device RJ-11 port.
2. Before running the **.exe** installer received from your Siemens representative, note the computer Comm. Port to which the device is connected.
3. From your computer, double-click the .exe file and follow the installer steps. The first step will prompt for Communication Options. These options are set to factory defaults. Ensure the Comm. Port is set to that noted in step 2 above. No other changes are required.
4. Follow remaining installer steps.
5. Once complete, verify the update was successful by checking the current firmware revision:
   – If updating the **HMI node**, re-cycle the power on the device. On power-up, you will see the current HMI firmware revision on the device display.
   – If updating the sensor node, view parameter Firmware Revision (3.1.7.) (Page 248) to see the current sensor node firmware revision.

Before re-entering parameters, complete a Master Reset (3.2.3.) (Page 250) to factory defaults after a successful upgrade of the sensor node.

9.2 Basic safety notes

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

An inspection can include check of:

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

CAUTION

Corrosive substances

Risk of chemical burns when replacing the sensor.

The sensor in the device contains corrosive substances that result in burns on unprotected skin.

- Make sure that the sensor enclosure is not damaged when replacing the sensor.
- If contact with the corrosive substances occurs, rinse the affected skin immediately with large amount of water to dilute substance.

WARNING

Impermissible repair and maintenance of the device

- Repair and maintenance must be carried out by Siemens authorized personnel only.

NOTICE

Penetration of moisture into the device

Device damage.

- Make sure when carrying out cleaning and maintenance work that no moisture penetrates the inside of the device.

WARNING

Hot, toxic or corrosive process media

Risk of injury during maintenance work.

When working on the process connection, hot, toxic or corrosive process media could be released.

- As long as the device is under pressure, do not loosen process connections and do not remove any parts that are pressurized.
- Before opening or removing the device ensure that process media cannot be released.

CAUTION

Hazardous voltage at open device

Risk of electric shock when the enclosure is opened or enclosure parts are removed.

- Before you open the enclosure or remove enclosure parts, de-energize the device.
- If maintenance measures in an energized state are necessary, observe the particular precautionary measures. Have maintenance work carried out by qualified personnel.

WARNING

Enclosure open

Risk of explosion in hazardous areas as a result of hot components and/or charged capacitors inside the device.

To open the device in a hazardous area:

1. Isolate the device from power.
2. Observe the wait time specified in Technical data (Page 288) or on the warning sign before opening the device.
3. Visually inspect sensor inlet and outlet.

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

CAUTION

Hot parts in the device

Temperatures that can burn unprotected skin may be present for some time after the device has been switched off.

- Observe the waiting time specified in Technical data (Page 288) or on the device before starting with maintenance work.

9.3 Cleaning

9.3.1 Cleaning the enclosure

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.

> **WARNING**
>
> **Electrostatic charge**
>
> 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.

9.4 Maintenance and repair work

> **WARNING**
>
> **Improper connection after maintenance**
>
> Risk of explosion in areas subject to explosion hazard.
>
> - Connect the device correctly after maintenance.
> - Close the device after maintenance work.
>
> Refer to Power (Page 288).

> **WARNING**
>
> **Impermissible accessories and spare parts**
>
> Risk of explosion in areas subject to explosion hazard.
>
> - Only use original accessories or original spare parts.
> - Observe all relevant installation and safety instructions described in the instructions for the device or enclosed with the accessory or spare part.

9.5 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 (http://www.siemens.com/processinstrumentation/returngoodsnote)

  with the following information:

  – Product (item description)

  – Number of returned devices/replacement parts

  – Reason for returning the item(s)

- Decontamination declaration (http://www.siemens.com/sc/declarationofdecontamination)

  With this declaration you warrant "that the device/replacement part has been carefully cleaned and is free of residues. The device/replacement part does not pose a hazard for humans and the environment."

  If the returned device/replacement part has come into contact with poisonous, corrosive, flammable or water-contaminating substances, you must thoroughly clean and decontaminate the device/replacement part before returning it in order to ensure that all hollow areas are free from hazardous substances. Check the item after it has been cleaned.

  Any devices/replacement parts returned without a decontamination declaration will be cleaned at your expense before further processing.

9.6 Transport

NOTICE
Transport with fitted battery If the battery is still present in the device when transporting, it could become loose as a result of vibrations and cause damage within the device. • Remove the batteries before returning the device. • Dispose of the batteries according to regulations or include them separately in the return consignment.

9.7 Disposal

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

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

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

Diagnosing and troubleshooting 10

Note

- Many of the parameters referenced and techniques described here require a good understanding of ultrasonic technologies and Siemens echo processing software. Use this information with caution.
- If the setup becomes too confusing, do a Master reset (3.2.3.) (Page 250) and start again.

10.1 Communication troubleshooting

General

1. Check the following:
   - There is power at the device.
   - The HMI is showing the relevant data.
   - The device can be programmed using the local push buttons.
   - If any fault codes are being displayed, see General fault codes (Page 276).
2. Verify that the wiring connections are correct.
3. A device parameter is set via remote communications, but the parameter remains unchanged.
   - Try setting the parameter from the local push buttons. If it cannot be set using the buttons, ensure Write Protection (5.1.) (Page 266) is set to the unlock value (1954).

If you continue to experience problems, check the FAQ on our website: www.siemens.com/ultrasonics (https://www.siemens.com/ultrasonics), or contact your Siemens representative.

10.2 General fault codes

Note

If two faults are present at the same time, the device status indicator and text for the fault with the higher priority will display.

HMI icon	Priority	Fault #	Fault text	Cause
	1	17	INT Error	The contents of flash are corrupt. All calibration is lost. If this occurs the unit will need to be returned to be recalibrated.
	2	16	INT Error	The last attempt to write to flash failed. Any changes have not been saved. If this occurs try switching into calibration mode and back to run mode this may clear the error. The next hourly update may also clear this error.
	3	14	Trans. 1 Loss of Echo	Point 1 fail-safe.
	4	15	Trans. 2 Loss of Echo	Point 2 fail-safe.
	5	1	TS-3 short (TB:28/29)	TS-3 terminals shorted.
	6	2	Trans. 1 open (TB:3/4)	Transducer 1 open.
	7	3	Trans. 2 open (TB:1/2)	Transducer 2 open.
	8	4	Trans. 1 short (TB:3/4)	Transducer 1 short.
	9	5	Trans. 2 short (TB:1/2)	Transducer 2 short.
	10	6	Trans. 1 short (TB:3/4)	Transducer 1 short.
	11	7	Trans. 2 short (TB:1/2)	Transducer 2 short.
	12	8	Trans. 1 error (TB:3/4)	Transducer 1 specified incorrectly, connections reversed, faulty inter-nal temp sensor.
	13	9	Trans. 2 error (TB:1/2)	Transducer 2 specified incorrectly, connections reversed, faulty inter-nal temp sensor.
	14	10	Point 1 Temp. open	Temp sensor assigned to Point 1 open.
	15	11	Point 2 Temp. open	Temp sensor assigned to Point 2 open.
	16	12	Point 1 Temp. Error	Temp sensor assigned to Point 1 reversed, shorted cable, temp sensor failed.
	17	13	Point 2 Temp. Error	Temp sensor assigned to Point 2 reversed, shorted cable, temp sensor failed.

10.3 Common problems chart

Symptom	Possible cause	Action
Display blank, transducer not pulsing	No power, incorrect power	Check mains voltage at terminals; Check fuse; Check wiring connections; Check wiring.
Display blank, transducer is pulsing	Loose or disconnected display cable	Reconnect display cable.
Display active, transducer not pulsing	Incorrect transducer connections or wiring; Incorrect transducer selection (or set to **NO Transducer**); Transducer has been disabled through the software.	Verify terminal connections; Check transducer field wiring; Check any junction box connections; Check that transducer is enabled [see Transducer (2.1.5.) (Page 160)].
Reading fluctuates while material level is still	Material level is changing	Visually verify, if possible.
	Strong false echoes	Determine source of false echoes; Relocate transducer to avoid source.
	Incorrect damping	Adjust damping. See Response rate (2.3.4.) (Page 170).
	Improper echo algorithm selection	Set algorithm to default. If no improvement, try a different algorithm. See Algorithm (2.11.2.2.) (Page 217).
	High noise levels	Verify source and minimize. See Noise problems (Page 280).
	Weak echo	Determine cause; Check noise, confidence, and echo strength. See Echo quality (3.2.11.) (Page 257).
	Foam on surface of material	Eliminate source of foaming; Use stilling well.
	Rapid temperature changes	Use an external temperature sensor. See Temperature source (2.11.1.4.) (Page 214).
	Faulty temperature sensor	Verify operation; Replace if required, or use fixed temperature. See Temperature source (2.11.1.4.) (Page 214).
	Vapours	If fluctuation is unacceptable, consider an alternative technology. Contact your Siemens representative.
Reading is fixed, but material level changes or reading does not follow material level	Incorrect speed of response	Verify response speed setting is adequate for process. See Response rate (2.3.4.) (Page 170) (set in the Quick Start Wizard).
	Loss of Echo condition (LOE)	Check Noise, Echo Strength, Confidence. See Echo quality (3.2.11.) (Page 257). Check LOE Timer is not set too short. See LOE timer (2.4.2.) (Page 173).
	Agitator blade stopped in front of transducer (false echo)	Ensure agitator is running.
	Foam on surface of material	Eliminate source of foaming. Use stilling well.

Symptom	Possible cause	Action
	Incorrect Algorithm used	Set algorithm to default. If no improvement, try a different algorithm. See Algorithm (2.11.2.2.) (Page 217).
	Transducer mounting: wrong location or incorrectly mounted	Ensure beam has a clear path to material surface; Verify transducer is not too tight; Use an isolation coupling.
	Incorrect transducer used for the application	Use correct transducer. Contact your Siemens representative.
	Unavoidable false echoes from obstructions	Relocate transducer to ensure beam has a clear path to material surface; Use manual TVT shaping or Auto False Echo Suppression. See TVT Shaper (2.11.4.) (Page 226) or Auto false echo suppression (2.11.3.2.) (Page 222).
Accuracy Varies	Faulty temperature sensor	Verify operation; Replace if required, or use fixed temperature. See Temperature source (2.11.1.4.) (Page 214).
	Vapours present in varying concentrations	Eliminate vapours or consider a different technology. Contact your Siemens representative.
	Thermal gradients	Insulate vessel; Consider external temperature sensor.
	Calibration required	If accuracy is better when level is close to transducer, and worse when level is far from transducer, perform calibration [see Auto sound velocity (2.11.1.8.) (Page 215)]. If accuracy is consistently incorrect, use Sensor offset (2.2.5.) (Page 167) or perform calibration.
Reading erratic	Transducer mounting: wrong location or incorrectly mounted	Ensure beam has a clear path to material surface; Verify transducer is not too tight; Use an isolation coupling.
	Unavoidable false echoes from obstructions	Use Auto False Echo Suppression. See Auto false echo suppression (2.11.3.2.) (Page 222).
	Confidence too low	Check Noise, Echo Strength, Confidence. See Echo quality (3.2.11.) (Page 257). Check LOE Timer is not set too short. See LOE timer (2.4.2.) (Page 173).
	Multiple echoes	Check mounting location; Verify material is not entering near range or blanking zone. See Blanking (2.2.6.) (Page 168).
	Noise in the application	Verify source and minimize. See Noise problems (Page 280).
Incorrect reading (mA output and/or displayed value)	mA function not assigned to correct measurement	Check mA assignment. See Current output function (2.5.3.) (Page 177).
	When device configured for flow: exponent or breakpoint not correctly selected	Check configuration: if Sensor mode (2.1.3.) (Page 159) is set to FLOW, verify correct exponent [Flow exponent (2.13.4.1) (Page 235)] and breakpoints [Universal head vs flow (2.13.6.) (Page 242)].

Symptom	Possible cause	Action
	Incorrect vessel or PMD dimensions	For volume application: Verify vessel dimensions. See Vessel shape (2.7.2.) (Page 181). For flow application: Verify PMD dimensions. See PMD dimensions (2.13.5.) (Page 241).

Symptom	cause	Action
Relay not activating	Relay not programmed	Program relay.
	Incorrect relay setpoints	Verify setpoints.
Relay not activating correctly	Incorrect relay setpoints	Verify setpoints.
Configuration error 130 displayed	Relay/pump configuration errors - possible causes include: • A relay is assigned to more than one function (e.g. Relay 2 is as-signed to both an ex-ternal totalizer and a pump). • Pump setpoints are out of order. • Wall cling adjustment range is too large.	• Verify that each relay is assigned to one function only. Review relay assignments under Relay selector (2.8.1.1.) (Page 189) and Other Control (2.10.) (Page 205). • Verify that all 'ON' setpoints are greater than their respective 'OFF' setpoints for pump down applications (or vice versa for pump up applications). • Ensure range set in Level setpoint varia-tion (2.8.2.6.2.) (Page 199) has not caused 'ON' or 'OFF' setpoints to overlap.
Echo profile request results in an error icon that displays for 5 sec-onds before returning to the echo profile request menu.	Another external commu-nication is trying to access an echo profile at the same time.	Wait for several seconds and then retry the echo profile request, or disconnect / disable any external communications that may be requesting an echo profile.
Display blank, trans-ducer not pulsing.	No power.	Check power supply, wiring, or power fuse.
No response to pro-grammer.	Obstructed infrared inter-face, defective program-mer.	Check programmer usage: 15 cm (6 inch) from faceplate pointed at upper target.
Displays Short and tb:(#).	Short circuited transducer cable, or defective trans-ducer at indicated terminal block number.	Repair or replace as necessary.
Displays Open and tb:(#).	Transducer not connected or connection reversed.	Check connection to displayed terminal blocks.
	Open circuited transducer cable, or defective trans-ducer at indicated terminal block number.	Repair or replace as necessary.
Displays LOE.	Weak or non-existent echo.	Relocate and/or re-aim transducer at material.
		Proceed toMeasurement difficulties (Page 283).

Symptom	cause	Action
Displays Error and tb:(#).	Wrong transducer selected Transducer selector (2.1.4.) (Page 160).	Verify transducer type and re-enter value.
	Transducer connected in “two-wire” method.	Do not tie white and shield together. Use all three terminal blocks.
	Transducer connected backwards.	Reverse black and white wires on terminal block.
Displays EEEE	Value too large to display in 4 or 5 characters.	Select larger units [Units (2.1.1.) (Page 158)], or lower convert reading [Convert reading (2.12.5.) (Page 232)].
Reading fluctuates while material level is still (or vice versa).	Incorrect measurement stabilization.	Alter rate of response [Response rate (2.3.4.) (Page 170)] or rate filter [Rate filter (2.3.5.) (Page 171)] accordingly.
Reading is fixed, regardless of the actual material level.	Transducer acoustic beam obstructed, standpipe too narrow, or transducer ringing (reads over 100%).	Relocate and / or re-aim transducer at material level or object.
		Proceed to Measurement difficulties (Page 283).
Material level reported is always incorrect by the same amount.	Incorrect empty (zero) reference for level operation [Sensor Mode (2.1.3.) (Page 159) = *Level].	See Empty (2.2.4.) (Page 166), Offset reading (2.12.6.) (Page 233), Sensor offset (2.2.5.) (Page 167), Offset correction (2.11.1.9.) (Page 216)
Measurement accuracy improves as level nears transducer.	Incorrect Sound Velocity used for distance calculation.	Use a transducer with a built-in temperature sensor or a TS-3 temperature sensor.
		See Sound velocity (2.11.1.2.) (Page 213).
Reading is erratic, with little or no relation to material level.	True echo too weak or wrong echo being processed.	Relocate and/or re-aim transducer at material.
		Check noise parameters. See Noise problems (Page 280).

10.4 Noise problems

Incorrect readings can be the result of noise problems, either acoustic or electrical, in the application. The noise present at the input to the ultrasonic receiver can be determined by viewing the echo profile locally via the HMI, or alternatively, using remote software such SIMATIC PDM. View also parameters Noise Average (3.2.11.5.) (Page 258) and Noise Peak (3.2.11.6.) (Page 258). In general, the most useful value is the average noise.

With no transducer attached the noise is under 5 dB. This is often called the noise floor. If the value with a transducer attached is greater than 5 dB, signal processing problems can occur. High noise decreases the maximum distance that can be measured. The exact relationship between noise and maximum distance is dependent on the transducer type and the material being measured. An average noise level greater than 30 dB may be cause for concern if the installed transducers maximum operation range matches the range of the application (e.g. 8 m application using an 8 m XRS-5). Using a larger transducer with greater transmitted energy should help to improve performance in a noise condition.

10.4.1 Determining the noise source

Disconnect the transducer from the device. If the measured noise is below 5 dB, then continue here. If the measured noise is above 5 dB go to Non-Transducer Noise Sources below.

1. Connect only the shield wire of the transducer to the device. If the measured noise is below 5 dB, continue with the next step. If the noise is above 5 dB, go to Avoiding common wiring problems (Page 282).
2. Connect the white and black transducer wires to the device. Record the average noise.
3. Remove the black wire of the transducer. Record the average noise.
4. Re-connect the black wire and remove the negative wire. Record the average noise.

Using the table below, determine the appropriate next step. The terms higher, lower and unchanged refer to the noise recorded in the previous steps.

These are guidelines only. If the suggested solution does not solve the problem, try the other options also.

Noise	- removed	+ removed	Go to:
	higher	higher	Reducing electrical noise (Page 282)
		unchanged	Avoiding common wiring problems (Page 282)
		lower	Reducing acoustical noise (Page 283)
	unchanged	higher	Reducing electrical noise (Page 282)
		unchanged	Contact Siemens representative
		lower	Reducing acoustical noise (Page 283)
	lower	higher	Reducing electrical noise (Page 282)
		unchanged	Avoiding common wiring problems (Page 282)
		lower	Reducing acoustical noise (Page 283)

Acoustical noise

To confirm that the problem is acoustical, place several layers of cardboard over the face of the transducer. If the noise is reduced, the noise is definitely acoustical.

10.4.2 Non-transducer noise sources

Remove all input and output cables from the device individually while monitoring the noise. If removing a cable reduces the noise, that cable may be picking up noise from adjacent electrical equipment. Check that low voltage cables are not being run adjacent to high voltage cables or near to electrical noise generators such as variable speed drives.

Filtering cables is an option but is not recommended unless all other options have been exhausted.

The device is designed to work near heavy industrial equipment such as variable speed drives. Even so, it should not be located near high voltage wires or switch gear.

Try moving the electronics to a different location. Often moving the electronics a few meters farther from the source of noise will fix the problem. Shielding the electronics is also an option, but it should be a last resort. Proper shielding is expensive and is difficult to install properly–the shielding box must enclose the device electronics completely, and all wires must be brought to the box through grounded metal conduit.

10.4.3 Avoiding common wiring problems

- Make sure that the transducer shield wire is connected at the electronics end only. Do not ground it at any other location.
- Do not connect the transducer shield wire to the white wire.
- The exposed transducer shield wire must be as short as possible.
- Connections between the wire supplied with the transducer, and any customer installed extension wire should only be grounded at the device.
- On Siemens transducers the white wire is negative and the black wire is positive. If the extension wire is colored differently, make sure that it is wired consistently.
- Extension wire must be shielded twisted pair. See the installation section for specifications.

10.4.4 Reducing electrical noise

- Ensure that the transducer cable does not run parallel to other cables carrying high voltage or current.
- Move the transducer cable away from noise generators like variable speed drives.
- Put the transducer cable in grounded metal conduit.
- Filter the noise source.
- Check grounding.

10.4.5 Reducing acoustical noise

- Move the transducer away from the noise source.
- Use a stilling well.
- Install a rubber or foam bushing or gasket between the transducer and the mounting surface.
- Relocate or insulate the noise source.
- Change the frequency of the noise. Ultrasonic devices are sensitive to noise in the frequency range of the transducer employed.
- Check that transducer is not mounted too tightly; only hand-tight.

10.5 Measurement difficulties

If the LOE Timer (2.4.2.) (Page 173) expires due to a measurement difficulty, the mA Fail-safe Value (2.4.9.) (Page 176) displays. In rare cases, the device may lock on to a false echo and report a fixed or wrong reading.

10.5.1 Loss of Echo (LOE)

The mA Fail-safe Value (2.4.9.) (Page 176) displays [seen in Milliamp Output (2.5.9.) (Page 178)] when the echo confidence is below the threshold value set in Long Echo Threshold (2.11.2.3.) (Page 217).

LOE occurs when:

- The echo is lost and no echo is shown above the ambient noise. See confidence [Long Confidence (3.2.11.2.) (Page 258) and Short Confidence (3.2.11.3.) (Page 258)] and echo strength [Echo Strength (3.2.11.4.) (Page 258)].
- Two echoes are too similar to differentiate (when BLF Best F-L algorithm is used). See confidence [Long Confidence (3.2.11.2.) (Page 258) and Short Confidence (3.2.11.3.) (Page 258)] and echo strength [Echo Strength (3.2.11.4.) (Page 258)].
- No echo can be detected within the programmed range.

If mA Fail-safe Value (2.4.9.) (Page 176) **is displayed, ensure the following conditions:**

- Surface monitored is within the transducer maximum range.
- Transducer (2.1.5.) (Page 160) matches the transducer used.
- Transducer is located and aimed properly.
- Transducer that has no submergence shield is not submerged.

10.5.1.1 Adjust transducer aiming

See the transducer manual for range, mounting, and aiming details. For optimum performance, adjust transducer aiming to provide the best Long Confidence (3.2.11.2.) (Page 258) and Echo Strength (3.21.11.4.) (Page 258) for all material levels within the measurement range.

Displaying echoes

Check for echoes remotely using SIMATIC PDM.

10.5.1.2 Increase fail-safe timer value

Increase the LOE Timer (2.4.2.) (Page 173) value if fail-safe operation will not be compromised by doing so. Try this only if LOE exists for short periods of time.

10.5.1.3 Install a transducer with a narrower beam

A consistently incorrect level reading may be due to interference echoes from the sides of a vessel. If this occurs, try installing a longer range (narrower beam) transducer, enter the new transducer model, and (if necessary) optimize aiming and frequency again.

Always contact Siemens service personnel before selecting a transducer to solve this type of problem.

10.6 Fixed reading

If the Reading is a fixed value, regardless of the transducer to material surface distance, ensure the:

- Transducer acoustic beam is free from obstruction.
- Transducer is properly aimed
- Transducer is not in contact with any metal object.
- Material mixer (if used) is operating while the device is operating. If it is stopped, ensure that the mixer blade is not stopped under the transducer.

10.7 Obstructions in the sound beam

Check for (and remove if present) any acoustic beam obstruction, or relocate the transducer.

If an obstruction cannot be removed or avoided, adjust the Time Varying Threshold (TVT) curve to reduce the Echo Confidence derived from the sound reflected by the obstruction. Use SIMATIC PDM to adjust the TVT curve.

10.8 Nozzle mountings

If the transducer is mounted on or in a nozzle, grind smooth any burrs or welds on the inside or open end (the end that opens into the vessel). If the problem persists, install a larger diameter or shorter length nozzle, bevel the inside of the bottom end, or cut the open end of the nozzle at a 45° angle.

See the transducer manual for complete mounting instructions.

If the mounting hardware is over tightened, loosen it. Over tightening changes the resonance characteristics of the transducer and can cause problems.

10.9 Set the device to ignore the bad echo

If the preceding remedies have not fixed the problem, the false echo has to be ignored.

If the echo is close to the transducer

If there is a static, incorrect, high level reading from the device there is probably something reflecting a strong echo back to the transducer. If the material level never reaches that point, extend the Blanking (2.2.6.) (Page 168) to a distance to just past the obstruction.

Adjust the TVT to ignore the bad echoes

Use Auto False Echo Suppression (2.11.3.2.) (Page 222). If this does not correct the problem, use TVT Shaper (2.11.4.) (Page 226) to manually shape around false echoes.

10.10 Wrong reading

If the reading is erratic, or jumps to some incorrect value periodically, ensure the following conditions:

1. Surface monitored is not beyond the device's programmed range or the transducer's maximum range.
2. Material is not falling into the transducer's acoustic beam.
3. Material is not inside the blanking distance [Blanking (2.2.6.) (Page 168)] of the transducer.

Types of wrong readings

If a periodic wrong reading always produces the same value, see Fixed reading (Page 284).

If the wrong reading is random, ensure the distance from the transducer to the material surface is less than Range Extension (2.2.7.) (Page 168) value plus one meter (i.e. ensure you are still within the measurement range programmed in the device). If the material/object monitored is outside this range, increase Range Extension (2.2.7.) (Page 168) as required. This error is most common in OCM applications using weirs.

Liquid splashing

If the material monitored is a liquid, check for splashing in the vessel. Enter a lower response rate value to stabilize the reading, or install a stilling well. Contact your Siemens representative for assistance.

Adjust the echo algorithm

Use SIMATIC PDM to view echo profiles and make adjustments to the Algorithm parameter. See Algorithm (2.11.2.2.) (Page 217).

If narrow noise spikes are evident on the echo profile, widen the Narrow Echo Filter (2.11.2.6.) (Page 218). Also, if the true echo has jagged peaks, use Reform Echo (2.11.2.5.) (Page 218).

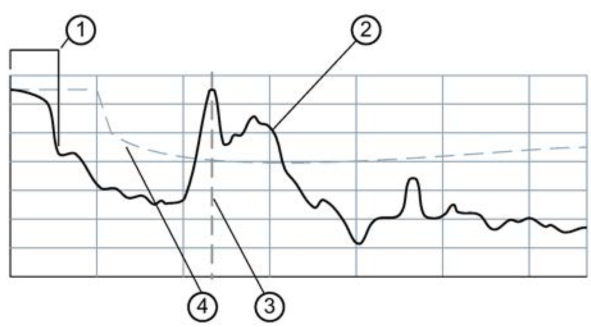
If multiple echoes appear on the echo profile, typical of a flat material profile (especially if the vessel top is domed), use the “TF ” (True First) algorithm.

Should a stable measurement still not be attainable, contact Siemens representative.

10.11 Transducer ringing

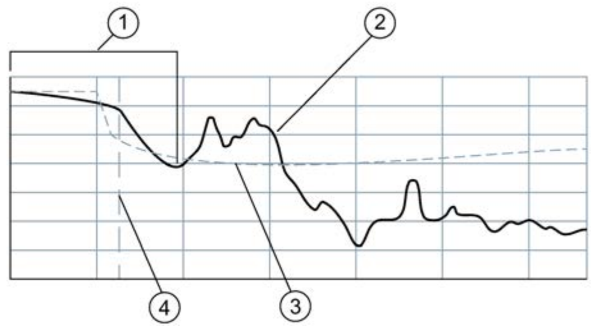
If the transducer is mounted too tightly, or if it is mounted so that its side touches something (such as a vessel wall, or standpipe), its resonance characteristics change and this can cause problems. Hand tighten only. PTFE tape is not recommended as it reduces friction resulting in a tighter connection that can lead to ringing.

Normal ring down



①	Ring down	③	Time of correct echo
②	Echo profile	④	TVT curve

Poor ring down



① Ring down
② Echo profile
③ TVT curve
④ Time of correct echo

Ring down times that extend into the valid measurement range can be interpreted by the device as the material level, and reported as a steady high level.

10.12 Unit repair and excluded liability

All changes and repairs must be done by qualified personnel only, and applicable safety regulations must be followed. Please note the following:

- The user is responsible for all changes and repairs made to the device.
- All new components must be provided by Siemens.
- Restrict repair to faulty components only.
- Do not re-use faulty components.

11 Technical data

Note

Device specifications

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

Note

The device is to be used only in the manner outlined in this instruction manual or protection provided by the equipment may be impaired.

Note

Device-specific approvals

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

11.1 Power

AC version	• 100 ... 230 V AC ± 15%, 50 / 60 Hz, 36 VA (17W)[1] • Fuse: F3: 2 AG, Slow Blow, 0.375 A, 250 V
DC version	• 12 ... 30 V DC, 20 W[1] • Fuse: F3: 2 AG, Slow Blow, 2A, 250 V

[1] Power consumption is listed at maximum

11.2 Operating conditions

Location	Indoor/outdoor
Altitude	2 000 m max.
Ambient temperature	-20 ... 50 °C (-5 ... 122 °F)
Relative humidity	• Wall Mount: suitable for outdoors (Type 4X / NEMA 4X, IP65 Enclosure) • Panel Mount: suitable for outdoors (Type 3 / NEMA 3, IP54 Enclosure)
Installation category	II
Pollution degree	4

11.3 Performance

Accuracy1)	0.25 % of maximum range or 6 mm (0.24 inch), whichever is greater.
Resolution1)	0.1 % of program range2) or 2 mm (0.08 inch), whichever is greater.
Memory	• 2 MB static RAM • 1 MB flash EPROM
Range	0.3 m (1 ft) to 15 m (50 ft), dependent on transducer
Temperature compensation	Range: -50 to 150 °C (-58 to 302 °F)
• Source	• Integral transducer sensor • TS-3 temperature sensor • Programmable fixed temperature

1) Measurement performance under reference operating conditions and configuration.

2) Program range is defined as the empty distance from the face of the transducer [Empty (2.2.4.) (Page 166)] plus any range extension [Range Extension (2.2.7.) (Page 168)].

11.4 Programming

Primary	Local push buttons
Secondary	PC running SIMATIC PDM

11.5 Outputs

mA analog	
Single- or dual-point versions include two mA outputs	• 0 ... 20 mA • 4 ... 20 mA[2] • 750 ohm maximum • Resolution of 0.1 % • Isolated
Relays[1]	
Six	• 4-control • 2- alarm control • All relays rated 5A at 250 V AC, 5A at 30 V DC, non-inductive.
Control relays	4 Form A, NO relays (numbers 1, 2, 4, 5)
Alarm relay	2 Form C, NO, or NC relay (numbers 3, 6)
Communication	• RS-232 running Modbus RTU and ASCII via RJ-11 connector • RS-485 running Modbus RTU and ASCII via terminal blocks
Optional	SmartLinx communication card compatible

[1] All relays are certified only for use with equipment that fails in a state at or under the rated maximums of the relays.

[2] Device may output a high current reading when power is applied or removed.

11.6 Inputs

mA (analog) (1)	0 ... 20 or 4 ... 20 mA, from alternate device, scalable
Discrete (2)	• 10 ... 50 V DC switching level • Logical 0 = < 0.5 V DC • Logical 1 = 10 ... 50 V DC • 3 mA maximum draw

11.7 Construction

Enclosure	
• Wall mount	• 240 mm (9.5 inch) x 175 mm (6.9 inch). Width dimension includes hinges. • Type 4X / NEMA 4X / IP65[1)] • Polycarbonate
• Panel mount	• 278 mm (10.93 inch) x 198 mm (7.8 inch), width dimension includes flange. • Type 3 / NEMA 3 / IP54 • Polycarbonate
Display	Backlit HMI LCD display
Cable	• Using a co-axial cable with the device is NOT recommended. If it is really necessary to use such cable, see Upgrading, co-axial transducer extension (Page 343) for instructions. • Split cables: transducer cable to be two copper conductors, twisted shielded wire, 300 Vrms, 0.324 ... 0.823 mm^2 (22 ... 18 AWG), nominal capacitance between adjacent conductors @ 1 kHz = 62.3 pF/m (19 pF/ft), nominal capacitance between conductor and shield @ 1 kHz = 108.3 pF/m (33 pF/ft) (Belden[2)] 8760 is acceptable). • mA output cable to be two copper conductors, twisted shielded wire, 300 Vrms, 0.324 ... 0.823 mm^2 (22 ... 18 AWG), nominal capacitance between adjacent conductors @ 1 kHz = 62.3 pF/m (19 pF/ft), nominal capacitance between conductor and shield @ 1 kHz = 108.3 pF/m (33 pF/ft) (Belden[2)] 8760 is acceptable). • 365 m maximum
Weight	• Wall mount: 1.22 kg (2.68 lb) • Panel mount: 1.35 kg (2.97 lb)

[1)] For watertight applications, use only approved, suitable-sized hubs in the enclosure's conduit holes.

[2)] Belden is a registered trademark of Belden Wire & Cable Company.

11.8 Approvals

Note

The device nameplate lists the approvals that apply to your device.

Application type	Device approval version	Approval rating	Valid for
Non-hazardous	General purpose	$CSA_{US/C}$, CE, FM, UL, RCM	N. America, Europe, Australia
Hazardous	Non-incendive	CSA Class I, Div. 2, Groups A, B, C, D; Class II, Div 2, Groups F, G; Class III	Canada

11.9 Transducers

Compatible transducers	EchoMax series and ST-H series
Transducer frequency	44 kHz

Technical reference A

A.1 Transmit pulse

The transmit pulse consists of one or more electrical “shot” pulses, which are supplied to the transducer connected to the device terminals. The transducer fires an acoustic “shot” for each electrical pulse supplied. After each shot is fired, sufficient time is provided for echo (shot reflection) reception before the next (if applicable) shot is fired. After all shots of the transmit pulse are fired, the resultant echoes are processed.

The transmit pulse shot number, frequency, duration, delay, and associated measurement range are defined by the following:

- Short shot frequency (2.1.7.) (Page 161)
- Long shot frequency (2.1.8.) (Page 161)
- Short shot duration (2.1.9.) (Page 162)
- Long shot duration (2.1.10.) (Page 162)
- Number of short shots (2.1.11.) (Page 162)
- Number of long shots (2.1.12.) (Page 163)
- Shot/pulse mode (2.1.17.) (Page 164)
- Short shot bias (2.11.2.10.) (Page 220)
- Short shot floor (2.11.2.11.) (Page 221)
- Short shot range (2.11.2.12.) (Page 221)

A.2 Echo processing

Echo processing consists of echo enhancement, true echo selection, and selected echo verification.

Echo Enhancement is achieved by filtering[1)] and reforming[2)] the echo profile. The true echo (echo reflected by the intended target) is selected when that portion of the echo profile meets the evaluation criteria of Sonic Intelligence. Insignificant portions of the echo profile outside of the measurement range[3)], below the TVT curve[4)], and less than the confidence threshold[5)] and short shot floor[6)], are automatically disregarded. The remaining portions of the echo profile are evaluated using algorithm[7)] and short shot bias[8)]. The echo profile portion providing the best echo confidence[9)] is selected.

True echo verification is automatic. The position (relation in time after transmit) of the new echo is compared to that of the previously accepted echo. When the new echo is within the echo lock window[10)], it is accepted and displays, outputs, and relays are updated per the fuzz filter[11)] and rate parameters[12)]. If the new echo is outside of the window, it is not accepted until echo lock requirements are satisfied.

1) Narrow Echo Filter (2.11.2.6.) (Page 218) and Spike Filter (2.11.2.7.2.) (Page 219)

2) Reform Echo (2.11.2.5.) (Page 218)

3) Span (2.2.2.) (Page 165) + Range Extension (2.2.7.) (Page 168)

4) TVT Type (2.11.3.6.) (Page 225), TVT Shaper (2.11.4.) (Page 226), TVT dB (2.11.3.7.) (Page 225), TVT ms (2.11.3.8.) (Page 226), TVT Slope Minimum (2.11.3.9.) (Page 226)

5) Long Echo Threshold (2.11.2.3.) (Page 217)

6) Short Shot Floor (2.11.2.11.) (Page 221)

7) Algorithm (2.11.2.2.) (Page 217)

8) Short Shot Bias (2.11.2.10.) (Page 220)

9) Long Confidence (3.2.11.2.) (Page 258)

10) Echo Lock Window (2.11.5.5.) (Page 230)

11) Fuzz Filter (2.11.5.6.) (Page 231)

12) Fill Rate/minute (2.3.2.) (Page 169), Empty Rate/minute (2.3.3.) (Page 169), Filling Indicator (2.3.9.) (Page 172) and Emptying Indicator (2.3.10.) (Page 172)

13) Echo Lock (2.11.5.4.) (Page 230)

A.3 TVT (time varying threshold) curves

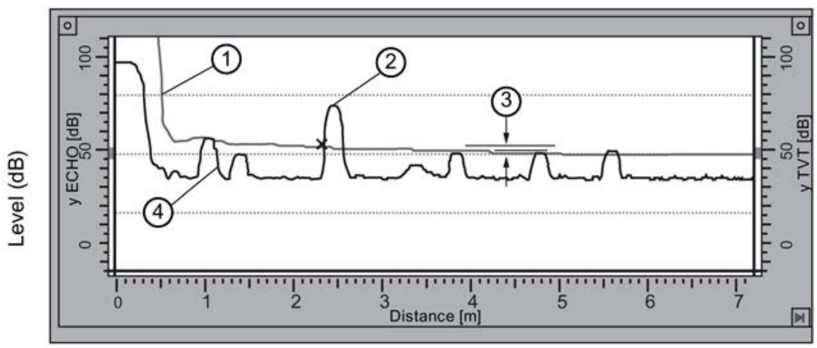
A TVT curve describes a threshold below which any echoes will be ignored. The default TVT curve is used, until Auto false echo suppression (2.11.3.2.) (Page 222) and Auto false echo suppression range (2.11.3.3.) (Page 223) are used to create a new ’learned TVT curve’.

A.4 Auto False Echo Suppression

False echoes can be caused by an obstruction in the beam path (pipes, ladders, chains, and such). Such false echoes may rise above the default TVT curve.

Auto Suppression Range (2.11.3.3.) (Page 223) allows you to set a distance, and Auto False Echo Suppression (2.11.3.2.) (Page 222) then instructs the device to 'learn' where the obstructions/false echoes are within that distance. The new TVT curve is set above the false echoes, screening them out.

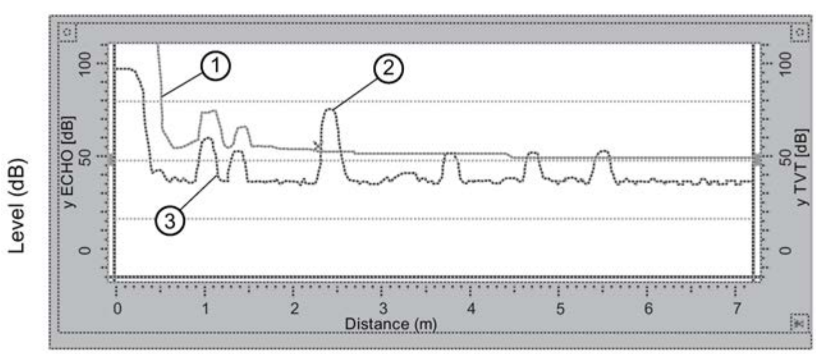
Display before Auto False Echo Suppression



Distance (meters)

① Default TVT
② Material echo
③ Hover Level
④ False echo

Display after Auto False Echo Suppression



Distance (meters)

① TVT curve (learned)
② Material level
③ False echo

A.5 Algorithm

The true echo is selected based on the setting for the echo selection algorithm. For a list of options, see Algorithm (2.11.2.2.) (Page 217). All algorithms ultimately use confidence to select the true echo.

Below are the preferred algorithm types because they provide the best echo selection results in most applications. Other algorithms [Algorithm (2.11.2.2.) (Page 217)] may produce better results in specialized applications, but they should only be used after consulting an experienced technical expert.

Algorithm		Echo determination	Suggested use
TF	**T**rue **F**irst echo	Selects the first echo that crosses TVT curve.	Use in liquids applications free of obstructions when confidence of first echo is high.
L	**L**argest echo	Selects the largest echo above the TVT curve.	Use in long range liquids applications with large (tall) material return echoes.
BFL	**B**est of **F**irst and **L**argest echo	Selects the echo (first and highest) with the highest confidence value.	Default and most commonly used. Use in all short to mid range general liquids and solids applications where there is a relatively large (tall), sharp echo.
ALF	**A**rea, **L**argest, and **F**irst	Selects the echo with the highest confidence value based on the three criterion (widest, highest, and first).	Use in mid to long range solids applications where the material return echo is wide and large, and where competing smaller echoes challenge BLF.

A.6 Distance calculation

To calculate the transducer to material level (object) distance, the transmission medium (atmosphere) Sound velocity (2.11.1.2.) (Page 213) is multiplied by the acoustic transmission to reception time period. This result is divided by 2 to calculate the one way distance.

Distance = Sound Velocity x Time / 2

The reading displayed is the result of performing any additional modification to the calculated distance, as determined by:

Parameter	
Sensor mode (2.1.3.) (Page 159)	
Units (2.1.1.) (Page 158)	
Volume conversion	
	Vessel shape (2.7.2.) (Page 181)
	Maximum volume (2.7.3.) (Page 183)
	Dimension A (2.7.4.) (Page 184)
	Dimension L (2.7.5.) (Page 184)
Reading	
	Decimal position (2.12.4.) (Page 232)
	Convert reading (2.12.5.) (Page 232)
	Offset reading (2.12.6.) (Page 233)
Open Channel Monitoring (OCM)	
	Primary measuring device (2.13.2.) (Page 234)
	Flow exponent (2.13.4.1) (Page 235)
	PMD dimensions (2.13.5.) (Page 241)
	Maximum head (2.13.4.2.) (Page 237)
	Maximum flow (2.13.4.3.) (Page 238)
	Zero head (2.13.4.5.) (Page 239)
	Flow time units (2.13.4.4.) (Page 239)
	Flowrate decimal (2.13.4.6.) (Page 240)
	Flowrate units (2.13.4.7.) (Page 240)
	Head 1 (2.13.6.1.1.) (Page 242)
	Flow 1 (2.13.6.1.2.) (Page 243)
Totalizer	
	Inflow/discharge adjust (2.7.7.) (Page 185)
	Totalizer decimal position (2.14.4.) (Page 246)
	Totalizer multiplier (2.14.5.) (Page 247)

A.7 Sound velocity

The sound velocity of the transmission medium is affected by the type, temperature, and vapor pressure of the gas or vapor present. As preset, the device assumes the vessel atmosphere is air at 20°C (68°F). Unless altered, the sound velocity used for the distance calculation is 344.1 m/s (1129 ft/s).

Variable air temperature is automatically compensated when a Siemens ultrasonic/ temperature transducer is used. If the transducer is exposed to direct sunlight, use a sunshield or a separate TS-3 temperature sensor.

Also, if the temperature varies between the transducer face and the liquid monitored, use a TS-3 temperature sensor (submerged in the liquid) in combination with an ultrasonic/temperature transducer. Set Temperature source (2.11.1.4.) (Page 214) for both to average the transducer and TS-3 measurements.

Atmosphere composition other than air can pose a challenge for ultrasonic level measurement. However, excellent results may be obtained by performing a sound velocity calibration[1)] if the atmosphere is

- homogenous (well-mixed)
- at a fixed temperature
- under constant vapor pressure

The device automatic temperature compensation is based on the sound velocity/temperature characteristics of “air” and may not be suitable for the atmosphere present. If the atmosphere temperature is variable, perform frequent sound velocity calibrations to optimize measurement accuracy.

Sound velocity calibration frequency may be determined with experience. If the sound velocity in two or more vessels is always similar, future calibrations may be performed on one vessel and the resultant velocity[2)] entered directly for the other vessel(s).

If the sound velocity of a vessel atmosphere is found to be repeatable at specific temperatures, a chart or curve may be developed. Then, rather than performing a sound velocity calibration each time the vessel temperature changes significantly, the anticipated velocity[2)] may be entered directly.

[1)] Auto sound velocity (2.11.1.8.) (Page 215)

[2)] Sound velocity (2.11.1.2.) (Page 213)

A.8 Scanning

The device

When echo processing is complete (if more than one vessel is monitored) the scanning relay changes state to supply the transmit pulse to the other transducer after the Scan delay (2.1.14.) (Page 163).

Scan Delay is automatically set by Response rate (2.3.4.) (Page 170). When high speed scanning is required (sometimes the case for equipment position monitoring), the Scan Delay may be reduced. Reduce the Scan Delay only as required, otherwise premature scanning relay fatigue could occur.

When two transducers are connected and configured in a dual-point unit, the device will scan each in turn via the scanner relay. When a single-point device is programmed for differential or average level Operation (Sensor mode (2.1.3.) (Page 159) = Dual-Point Difference or Dual-Point Average), two transducers of the same type must be used.

A.9 Volume calculation

The device provides a variety of volume calculation features such as:

- Vessel shape (2.7.2.) (Page 181)
- Maximum volume (2.7.3.) (Page 183)
- Dimension A (2.7.4.) (Page 184)
- Dimension L (2.7.5.) (Page 184)

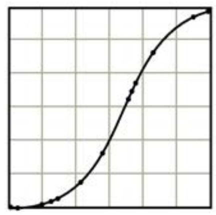
If the vessel does not match any of the eight preset vessel shape calculations, a universal volume calculation may be used. Use the level/volume graph or chart provided by the vessel fabricator (or create one based on the vessel dimensions). Based on the graph, choose the universal volume calculation and select the level vs. volume breakpoints to be entered (maximum of 32). Generally, the more breakpoints entered, the greater the accuracy.

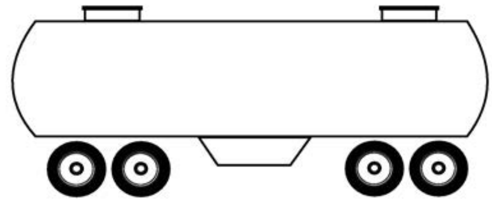
Vessel shape[1)] set to Universal Linear

This volume calculation creates a piece-wise linear approximation of the level/volume curve. This option provides best results if the curve has sharp angles joining relatively linear sections.

Enter a Level Breakpoint at each point where the level/volume curve bends sharply (minimum of two). For combination curves (mostly linear but include one or more arcs), enter numerous breakpoints along the arc, for best volume calculation accuracy.

Vessel shape[1)] set to Universal Curved





This calculation creates a cubic spline approximation of the level/volume curve, providing best results if the curve is non-linear and there are no sharp angles.

Select at least enough breakpoints from the curve to satisfy the following:

- two breakpoints very near the minimum level
- one breakpoint at the tangent points of each arc
- one breakpoint at each arc apex
- two breakpoints very near the maximum level

For combination curves, enter at least two breakpoints immediately before and after any sharp angle (as well as one breakpoint exactly at the angle) on the curve.

[1)] Vessel shape (2.7.2.) (Page 181)

A.10 Flow calculation

The device provides numerous OCM flow calculation features:

- Primary measuring device (2.13.2.) (Page 234)
- PMD dimensions (2.13.5.) (Page 241)
- Flow exponent (2.13.4.1) (Page 235)
- Maximum head (2.13.4.2.) (Page 237)
- Maximum flow (2.13.4.3.) (Page 238)
- Flow time units (2.13.4.4.) (Page 239)
- Zero head (2.13.4.5.) (Page 239)
- Flowrate decimal (2.13.4.6.) (Page 240)
- Flowrate units (2.13.4.7.) (Page 240)
- Head 1 (2.13.6.1.1.) (Page 242)
- Flow 1 (2.13.6.1.2.) (Page 243)

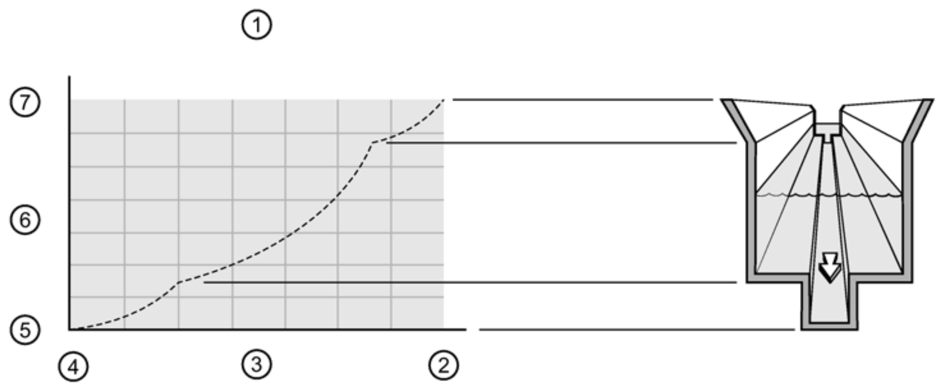
If the PMD (primary measuring device) does not match any of the eight preset PMD calculations, or if a PMD is not used, select a Universal Volume calculation. Use the head/ flow graph or chart provided by the PMD fabricator (or create one based on the PMD or channel dimensions).

Based on the graph, choose the Universal Flow calculation, and select the head versus flow breakpoints to be entered (maximum of 32). Generally, the more breakpoints entered, the greater the flow calculation accuracy.

Universal linear

Set PMD dimensions (2.13.5.) (Page 241) = Universal Linear Flow Calculation.

This flow calculation creates a piece-wise linear approximation of the head/flow curve. This option provides best results if the curve has sharp angles joining relatively linear sections.



①	Head vs Flowrate	⑤	Zero flow
②	Max. Head	⑥	Flow
③	Head	⑦	Max. Flow
④	Zero Head		

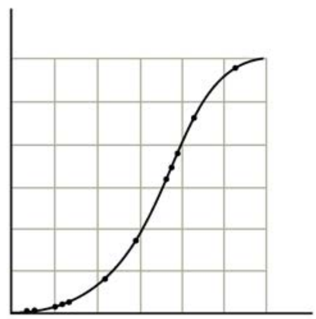
Enter a Head Breakpoint at each point where the head/flow curve bends sharply (minimum of two). For combination curves (mostly linear but include one or more arcs), enter numerous breakpoints along the arc, for best flow calculation accuracy.

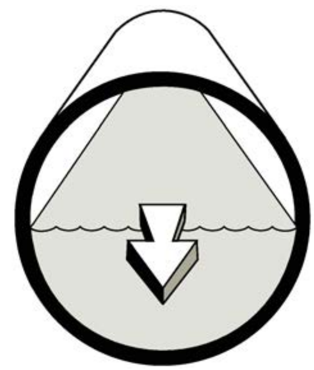
For more information, refer to Typical flow characterization (Page 148).

Universal curved

This calculation creates a cubic spline approximation of the head/flow curve, providing best results if the curve is non-linear and there are no sharp angles.

Select at least enough breakpoints from the curve to satisfy the following:





- two breakpoints very near the minimum head
- one breakpoint at the tangent points of each arc
- one breakpoint at each arc apex
- two breakpoints very near the maximum head

For combination curves, enter at least two breakpoints immediately before and after any sharp angle (as well as one breakpoint exactly at the angle) on the curve. For more information, refer to Typical flow characterization (Page 148).

A.11 Response rate

The device's ability to respond to material level changes is designed to exceed even the most demanding installation requirements.

The Response rate (2.3.4.) (Page 170) setting automatically presets various parameters affecting the device response to material level changes as follows:

Parameter (Units)	Values dependent on response rate		
	Slow	Medium	Fast
LOE timer (2.4.2.) (Page 173) (min)	100	10	1
Fill rate/minute (2.3.2.) (Page 169) (m/min)	0.1	1	10
Empty rate/minute (2.3.3.) (Page 169) (m/min)	0.1	1	10
Filling indicator (2.3.9.) (Page 172) (m/min)	0.01	0.1	1
Emptying indicator (2.3.10.) (Page 172) (m/min)	0.01	0.1	1
Rate filter (2.3.5.) (Page 171) (option)	10 min. or 300 mm (11.8 inch)	*1 min or 50 mm (2 inch)	*1 min or 50 mm (2 inch)
Fuzz filter (2.11.5.6.) (Page 231) (% of span)	100	50	10
Echo lock window (2.11.5.5.) (Page 230)	(per Empty rate/minute (2.3.3.) (Page 169) /Filling indicator (2.3.9.) (Page 172) and time since last valid measurement)		
Scan delay (2.1.14.) (Page 163) (seconds)	5	5	3
Number of long shots (2.1.12.) (Page 163)	10	5	2

If any of these parameters are independently altered, a Response rate (2.3.4.) (Page 170) parameter alteration automatically resets the independently altered value.

Slower Response rate (2.3.4.) (Page 170) provides greater measurement reliability.

Faster performance may be obtained by independently setting Fill rate/minute (2.3.2.) (Page 169) and Empty rate/minute (2.3.3.) (Page 169). Maximum rates may be impeded by Echo lock (2.11.5.4.) (Page 230),Scan delay (2.1.14.) (Page 163) and Shot delay (2.1.16.) (Page 164) values.

A.12 Analog output

The mA output (current output) is proportional to material level in the range 4 to 20 mA. 0% and 100% are percentages of the full-scale reading (m, cm, mm, ft, in). Typically, mA output is set so that 4 mA equals 0% and 20 mA equals 100%.

A.13 Current output function

Current output function (2.5.3.) (Page 177) controls the mA output and applies any relevant scaling. By default, it is set to Level. Other options are Space, Distance, Volume, Flow, or Head.

You can also set the mA output to report when the device is in an error condition and the fail-safe timer has expired. By default, the reported value depends on the device type. A standard device reports the last valid reading, and a NAMUR NE43 compliant device reports the user-defined value for mA Fail-safe value (2.4.9.) (Page 176) (3.58 mA by default).

A.14 Loss of echo (LOE)

A loss of echo (LOE) occurs when the calculated measurement is judged to be unreliable because the echo confidence value has dropped below the echo confidence threshold.

If the LOE condition persists beyond the time limit set in LOE timer (2.4.2.) (Page 173), the display shows the Service Required icon, and the text region displays the fault code 0 and the text LOE.

If two faults are present at the same time, the device status indicator and text for the highest priority fault will display. For example, if both loss of echo and broken cable faults are present, the broken cable fault will display.

A.15 Fail-safe mode

The purpose of the Fail-safe setting is to put the process into a safe mode of operation in the event of a fault or failure. The value to be reported in the event of a fault [as displayed in Milliamp output (2.5.9.) (Page 178) is selected so that a loss of power or loss of signal triggers the same response as an unsafe level.

LOE timer (2.4.2.) (Page 173) determines the length of time a Loss of Echo (LOE) condition will persist before a Fail-safe state is activated. The default setting is 100 seconds.

Material level (2.4.5.) (Page 174) determines the mA value (corresponding to the selected PV) to be reported when LOE Timer (2.4.2.) (Page 173) expires.

Upon receiving a reliable echo, the loss of echo condition is aborted, the Maintenance Required icon and error message are cleared, and the mA output return to the current material level. [The Primary reading on the HMI display will show dashes (– – – – – – –) when a fault that causes fail-safe is present, and will return to the current reading when the fault is cleared.]

Pump control reference B

This device has the pump control strategies to suit nearly any water/ wastewater application. This section details these strategies for engineers requiring indepth knowledge of the system and how it operates.

B.1 Pump control options

The various methods of pump control are made up of a combination of two control variables:

Pump duty

Indicates in what sequence pumps are started.

Pump start method

Indicates whether new pumps start and run with any currently running pumps (most common) or whether new pumps start and shut off currently running pumps.

B.2 Pump groups

The device groups pumps that use identical pumping strategies based on the value of Relay Control Function [Relay function (2.8.1.4.) (Page 191)]. Generally, one group of pumps corresponds to one wet well or reservoir.

B.3 Pump by rate

To trigger pump starts by the rate of change in material level, use Pump by rate (2.8.1.8.) (Page 193). New pumps are started, one at a time, until the rate setpoint [Filling indicator (2.3.9.) (Page 172), or Emptying indicator (2.3.10.) (Page 172)] is reached.

B.4 Pump control algorithms

Fixed

Starts pumps based on individual setpoints and always starts the same pumps in the same sequence.

Alternate

Starts pumps based on the duty schedule and always leads with a new pump.

Service Ratio

Starts pumps based on user-defined ratio of running time.

B.5 Fixed Duty Assist

Relay function (2.8.1.4.) (Page 191) = *Fixed Duty Assist ties the indexed pump relay directly to the indexed setpoint.*

Relay operation

(for Relay logic (2.8.1.11.) (Page 194) **= Positive)**

The relay contact closes at the ON setpoint and opens at the OFF setpoint. Multiple relay contacts in the pump group can be closed at the same time.

Relay table

The following table shows relay status when each setpoint is reached.

		Relays		
Setpoints	**Index**	1	2	3
	ON 3	ON	ON	ON
	ON 2	ON	ON	OFF
	ON 1	ON	OFF	OFF
	OFF	OFF	OFF	OFF

B.6 Fixed Duty Backup

Relay function (2.8.1.4.) (Page 191) = *Fixed Duty Backup ties the indexed pump relay directly to the indexed setpoint*.

Relay operation

(for Relay logic (2.8.1.11.) (Page 194) **= Positive)**

The relay contact closes at the ON setpoint and opens at the OFF setpoint. When a new relay trips the previously closed relay contact opens to shut down the running pump.

Only one relay contact in the pump group can be closed at any one time.

Relay table

The following table shows relay status when each setpoint is reached.

		Relays		
Setpoints	**Index**	1	2	3
	ON 3	OFF	OFF	ON
	ON 2	OFF	ON	OFF
	ON 1	ON	OFF	OFF
	OFF	OFF	OFF	OFF

B.7 Alternate Duty Assist

Relay function (2.8.1.4.) (Page 191) = *Alternate Duty Assist alternates the lead pump each time the material level cycles and runs all pumps together.*

Relay operation

(for Relay logic (2.8.1.11.) (Page 194) **= Positive)**

The setpoints associated with the relays are grouped so that they can be rotated.

Setpoint 1 does not relate directly to Relay 1. The pumping algorithm manages the mapping of setpoints to relays.

When pumps are run, they RUN in parallel.

Relay table

Cycle 1		Relays		
Setpoints		1	2	3
	ON 3	ON	ON	ON
	ON 2	ON	ON	OFF
	ON 1	ON	OFF	OFF
	OFF	OFF	OFF	OFF

Cycle 2		Relays		
Setpoints		1	2	3
	ON 3	ON	ON	ON
	ON 2	OFF	ON	ON
	ON 1	OFF	ON	OFF
	OFF	OFF	OFF	OFF

Cycle 3		Relays		
Setpoints		1	2	3
	ON 3	ON	ON	ON
	ON 2	ON	OFF	ON
	ON 1	OFF	OFF	ON
	OFF	OFF	OFF	OFF

B.8 Alternate Duty Backup

Relay function (2.8.1.4.) (Page 191) = *Alternate Duty Backup alternates the lead pump each time the material level cycles.*

Relay operation

(for Relay logic (2.8.1.11.) (Page 194) **= Positive)**

The setpoints associated with the relays are grouped so that they can be rotated. Setpoint 1 does not relate directly to Relay 1. The pumping algorithm manages the mapping of setpoints to relays. When pumps are run, they can RUN only one at a time.

Relay table

Cycle 1	Index	Relays		
Setpoints		1	2	3
	ON 3	OFF	OFF	ON
	ON 2	OFF	ON	OFF
	ON 1	ON	OFF	OFF
	OFF	OFF	OFF	OFF

Cycle 2	Index	Relays		
Setpoints		1	2	3
	ON 3	ON	OFF	OFF
	ON 2	OFF	OFF	ON
	ON 1	OFF	ON	OFF
	OFF	OFF	OFF	OFF

Cycle 3	Index	Relays		
Setpoints		1	2	3
	ON 3	OFF	ON	OFF
	ON 2	ON	OFF	OFF
	ON 1	OFF	OFF	ON
	OFF	OFF	OFF	OFF

B.9 Service Ratio Duty Assist

Relay function (2.8.1.4.) (Page 191) = *Service Ratio Duty Assist selects the lead pump based on number of hours each pump has run and the specified ratios that each pump requires. Multiple pumps can run at one time.*

Relay operation

(for Relay logic (2.8.1.11.) (Page 194) **= Positive)**

The setpoints associated with the relays are grouped so they can be redistributed based on pump RUN time ratios. The next pump to start or stop is the one with the required time to actual time ratio.

Over time, the number of hours demanded of each pump will conform to the ratios specified. Usually, the ratios are specified in percent values.

To create a grouping of pumps where two pumps make up 50 % of the run time and the third pump makes up the other 50 %, Service ratio (2.8.1.12.) (Page 195) is set to the following:

Relay Index	Value
1	25
2	25
3	50

B.10 Service Ratio Duty Backup

Relay function (2.8.1.4.) (Page 191) = *Service Ratio Duty Backup selects the lead pump based on the number of hours each pump has run and the specified ratios that each pump requires. Only one pump can run at a time.*

This algorithm is the same as Service Ratio Duty Assist except that it will **run only one** pump at a time. When the next pump in the sequence starts, the previous pump stops.

B.11 First In First Out

Relay function (2.8.1.4.) (Page 191) = *First In First Out selects the lead pump based on the* **Alternate** *duty, but uses staggered OFF setpoints and shuts down pumps based on the* **first in, first out** *rule.*

This algorithm starts pumps in the same way as Alternate Duty Assist but uses staggered OFF setpoints to shut the pumps down. When the first OFF setpoint is reached, the FIFO rule shuts down the first pump started. For example: pumps started in sequence 2, 3, 1 would be shut down in sequence 2, 3, 1.

B.12 Pump by Rate

Pump by rate (2.8.1.8.) (Page 193) *starts pumps until the level is changing at the rate specified in* Filling indicator (2.3.9.) (Page 172) *or* Emptying indicator (2.3.10.) (Page 172)*.*

Pumping costs can be less because only the highest ON setpoint needs to be programmed and this results in a lower difference in Head to the next wet well which, in turn, results in less energy being used to pump out the well.

B.13 Other pump controls

There are a number of other controls available to modify pump behavior.

Pump Run-ON

Run-ON Interval (2.8.2.7.1.) (Page 200), Run-ON Duration (2.8.2.7.3.) (Page 200)

Extends the RUN period for a pump based on a set time interval. This allows for the wet well to be pumped lower than usual, and reduces sludge build-up on the well bottom.

Wall Cling Reduction

Level setpoint variation (2.8.2.6.2.) (Page 199)

Varies the ON and OFF setpoints to keep a fat ring from forming around the walls of the wet well.

Pump Group

Pump group (2.8.2.2.) (Page 196)

Allows for two different Alternate Duty Assist or Alternate Duty Backup pump groups in the same application.

Flush Device

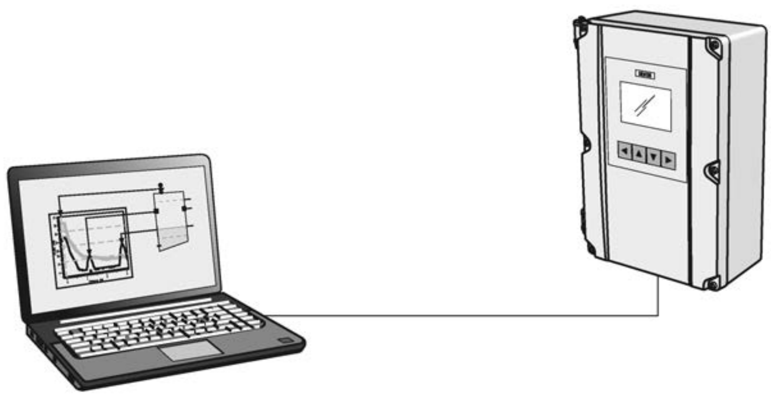
Flush pump (2.10.3.2.) (Page 211), Flush cycles (2.10.3.3.) (Page 212), Flush interval (2.10.3.4.) (Page 212), Flush duration (2.10.3.5.) (Page 212)

Operates a flush valve or special flush device based on the number of pump starts, usually to aerate wet well wastewater.

Communications C

C.1 Device communication systems

The device is an integrated level controller capable of communicating process information to a Supervisory Control and Data Acquisition (SCADA) system, via a serial device such as a radio modem, leased line, or dial-up modem.



Connection via radio modem, dial-up mode, or leased line modem.

C.2 Modbus

The device supports the Modbus protocol, an industry standard used by SCADA and HMI systems. The device uses Modbus to communicate via the RS-485 port.

C.3 Optional SmartLinx cards

The standard unit may also be enhanced with Siemens SmartLinx communication modules that provide an interface to popular industrial communication systems.

This manual only describes the built-in communications. Please consult the appropriate SmartLinx manual for other information.

C.4 Communication systems

The device is capable of communicating with most SCADA systems, PLCs, and PCs. The supported protocols are:

- Modbus RTU/ASCII – built-in, supported on both RS-232 and RS-485 ports.
- PROFIBUS DPV0 – optional SmartLinx module.
- PROFIBUS DPV1 – optional SmartLinx module.
- DeviceNet[1] – optional SmartLinx module.

[1] DeviceNet is a registered trademark of Open DeviceNet Vendor Association.

C.5 Communication ports

The device comes with two communications ports on the base unit.

Port	Connection	Location	Interface
1	RJ-11 connector	Inside enclosure on the main board	RS-232
2	Terminal block	Terminal block	RS-485

RS-232

Note

The RS-232 port is not intended for connection to a network (bus). Use it only for direct connection to a laptop, PC, or modem.

The RJ-11 jack connects to a laptop computer for the following:

- Initial setup
- Configuration
- Troubleshooting
- Periodic maintenance
- Firmware updates

RS-485

The RS-485 port on the terminal blocks connects into industrial communications wiring and has the following advantages:

- Runs communications cable farther
- Allows multiple slave units on the network, addressed by parameter Device Address (4.2.) (Page 262).

C.6 Modbus

The Modbus protocol is supported in the base unit and can be configured using the Communication (4.) (Page 262) parameters.

To set up communications with a Modbus RTU master device on Port 2 using RS-485, set the following parameters:

Parameter	Index	Value/Mode
Protocol (4.4.) (Page 263)	2	*Modbus RTU slave serial (Page 262)
Device Address (4.2.) (Page 263)	2	1
Serial Baud Rate (4.5.) (Page 264)	2	19.2 kbaud
Parity (4.6.) (Page 264)	2	No Parity
Data Bits (4.7.) (Page 264)	2	8 data bits
Stop Bits (4.8.) (Page 265)	2	1 stop bit
Modem Available (4.9.) (Page 263)	2	No modem connected
Parameter Index Location (4.11.) (Page 263)	2	Global

C.7 SmartLinx

Other protocols are available through optional SmartLinx communications modules. Details on how to install and program these modules are contained in the SmartLinx documentation.

C.8 Communications installation

C.8.1 Wiring guidelines

- The RJ-11 cable maximum length is 3 meters.
- RS-485 maximum length is 1 200 meters (4 000 feet).
- Use 24 AWG (minimum).
- Use good quality communication grade (shielded twisted pairs) cable that is recommended for RS-485 for port 2 (Belden 9842).
- Run the communication cable separately from power and control cables (do not tie wrap your RS-232 or RS-485 cable to the power cable or have them in the same conduit).
- Use shielded cable and connect to ground at one end only.
- Follow proper grounding guidelines for all devices on the bus.

Note

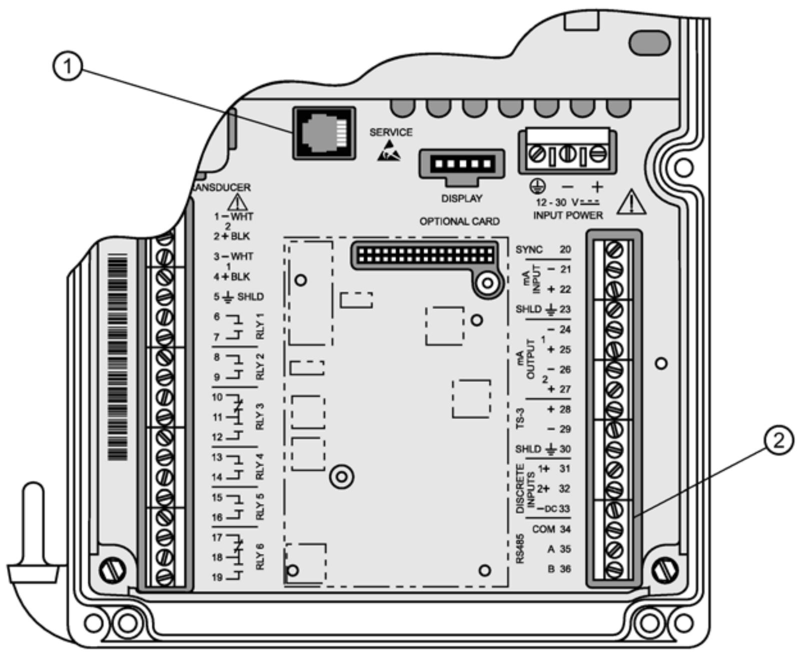
Improper wiring and incorrect choice of cables are two of the most common causes of communication problems.

Ports 1 and 2

Port	Wall mount
1	RS-232 port (RJ-11 modular telephone jack) is generally used with a laptop computer or modem.
2	Connections for the RS-485 port are on the terminal block.

Ports 1 and 2: RS-232 RJ-11 jack and RS-485 locations

The RJ-11 jack and the RS-485 port are inside the enclosure of the unit.

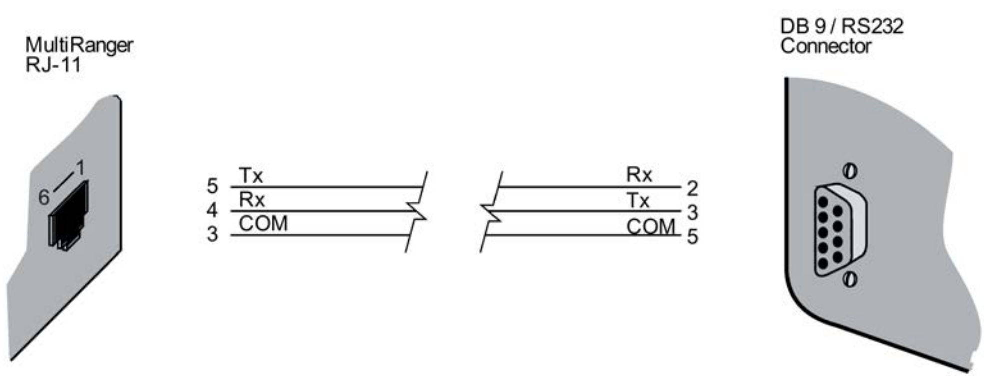


① RJ-11 jack

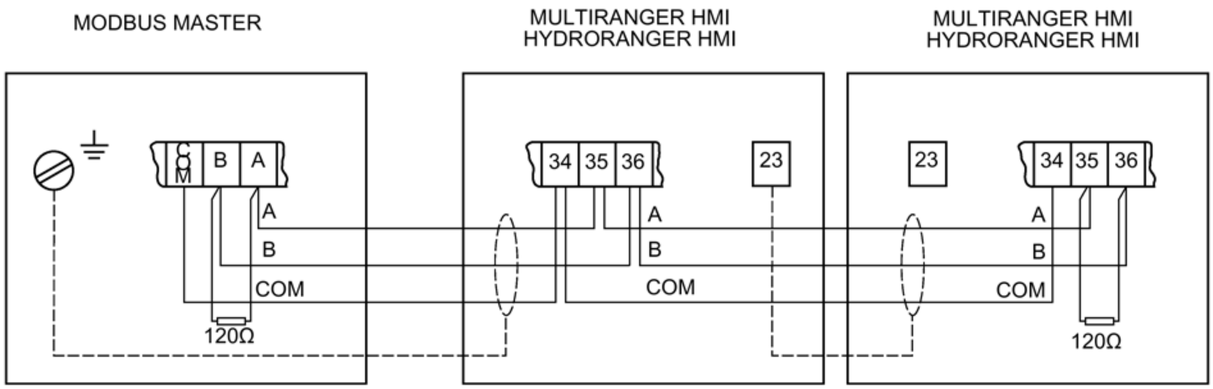
② RS-485 port

Port 1: RS-232 RJ-11 jack

To connect the unit to a PC or modem using an RS-232 jack, use the cable as shown:



To connect the device to an RS-485 MODBUS RTU network:



C.8.2 Configuring communications ports (parameters)

The parameters listed below are indexed to the two communications ports, unless otherwise noted.

Port	Description
1	RS-232 port (RJ-11 modular telephone)
2	The RS-485 port is on the terminal blocks

Parameters	
	Protocol (4.4.) (Page 263)
	Device Address (4.2.) (Page 262)
	Serial Baud Rate (4.5.) (Page 263)
	Parity (4.6.) (Page 264)
	Data Bits (4.7.) (Page 264)
	Stop Bits (4.8.) (Page 264)
	Modem Available (4.9.) (Page 264)
	Modem Inactivity Timeout (4.10.) (Page 265)
	Parameter Index Location (4.11.) (Page 265)

C.9 SIMATIC Process Device Manager (PDM)

SIMATIC PDM is a software package for parameterizing, commissioning, diagnosing and maintaining process devices. For this device, SIMATIC PDM connects directly to the unit using Modbus over Port 1 (the RJ-11 jack) or Port 2 (RS-485 on the terminal block).

The device comes with Port 1 (the RJ-11 jack) set for communications to SIMATIC PDM.

SIMATIC PDM contains a simple process monitor of the process values, alarms and status signals of the device. Using SIMATIC PDM, you can do the following to process device data:

- Display
- Set
- Change
- Compare
- Check the plausibility
- Manage
- Simulate

PDM must be switched from PROGRAM mode to RUN mode in order to download parameters to the device.

More information about SIMATIC PDM is available at www.siemens.com/processinstrumentation (www.siemens.com/processinstrumentation): go to Communication and Software > Process Device Manager. Please consult the operating instructions or online help for details on using SIMATIC PDM. An Application Guide on using the device with PDM and Modbus is available on our website: www.siemens.com/processinstrumentation (www.siemens.com/processinstrumentation).

C.9.1 Device description

To use Process Device Manager (PDM) with the device, you need the Device Description, which will be included with new versions of PDM. You can locate the Device Description in **Device Catalog**, under **Sensors/Level/ Echo/Siemens Milltronics**. If you do not see the device description for this device under Siemens Milltronics, you can download it from our website: www.siemens.com/processinstrumentation (www.siemens.com/processinstrumentation). Go to the device product page and click Downloads.

C.10 Modbus register map

The memory map of the device occupies the Modbus holding registers (R40,001 and up). This map is used when the protocol is Modbus RTU slave or Modbus ASCII slave.

Register map for most common data

Legend	
Type	The type of data held in the group of registers.
Start	The first register to hold the referenced data.
Data type	The possible values of the data in the register. See Data types (Page 330) for more information.
Description	The type of data held in the individual registers.
#R	The number of registers used for the referenced data.
Read/write	Indicates whether the register is readable, writeable or both.

Type	Description	Start	#R[1]	Data type	Read/write
	Word order	40,062		0/1	R/W
Map ID	Register map type	40,063	1	0/1 = P782	R/W
ID	Siemens Product Code	40,064	1	4 = The device	R
Single Parameter Access (SPA)		R40,090	7	See Single parameter access (SPA) (Page 338)	
Point data	Reading (3)[2]	41,010	2	-20,000 ... 20,000	R
	Volume (2)[3]	41,020	2	-20,000 ... 20,000	R

[1] Maximum registers shown; fewer may be used depending on options installed.

[2] The device: Available as Reading 1, Reading 2, and Average or Difference when in either single- or dual-point mode. In single-point mode, Points 2 and 3 are only available if 2.1.3. Sensor Mode (Page 159) = Dual-Point Average or Dual-Point Difference. In dual-point mode, Readings 1 and 2 are always available. Point 3 is only available if 2.1.3. Sensor Mode (Page 159) [3] = Dual-Point Average or Dual-Point Difference.

[3] 2nd volume available in dual-point mode only.

Type	Description	Start	#R[1]	Data type	Read/write
Point data	Temperature (2)	41,030	2	–50 ... 150	R
	Totalizer for Points 1 and 2	41,040	4	UINT32	R/W
I/O	Discrete Inputs (2)	41,070	1	Bit Mapped	R
	Relay Outputs (3 or 6)	41,080	1	Bit Mapped	R/W
	mA Input (1)	41,090	1	0000 ... 20,000	R
	mA Output (2)	41,110	2	0000 ... 20,000	R/W
Pump control	Pump ON Setpoint (3 or 6)	41,420	6	0000 ... 10,000	R/W
	Pump OFF Setpoint (3 or 6)	41,430	6	0000 ... 10,000	R/W
	Pumped Volume (2)	41,440	4	UINT32	R
	Pump Hours (3 or 6)	41,450	12	UINT32	R
	Pump Starts (3 or 6)	41,470	6	0000 ... 10,000	R
Parameter access		43,998 ... 46,999			R/W

[1] Maximum registers shown; fewer may be used depending on options installed.

The device was designed to make it easy for master devices to get useful information via Modbus. This chart gives an overview of the different sections. A more detailed explanation of each section follows below.

C.11 Word order (R40,062)

This determines the format of unsigned, double-register integers (UINT32).

- **0** indicates that the most significant word (MSW) is given first
- **1** indicates that the least significant word (LSW) is given first

See Unsigned double precision integer (UINT32) (Page 331) for more information.

C.12 Map ID (R40,063)

This value identifies the register map used by the device. See Parameter Index Location (4.11.) (Page 265) and Parameter access (R43,998-R46,999) (Page 324) for details.

C.13 Product ID (R40,064)

Product ID identifies the Siemens device type. The product ID for this device is 32.

C.14 Point data (R41,010 – R41,031)

Level Point data contain the current instrument readings. These are the values shown for the reading measurement for each Level Point. The reading is based on the setting for Sensor Mode (2.1.3.) (Page 159), which can be set to **Level**, **Distance**, **OCM Flow**, or **Volume**.

The measurement registers are 41,010 to 41,012. The device uses 41,010 when configured with a single transducer and 41,010 to 41,012 when configured with two transducers [Relay Function (2.8.1.4.) (Page 191) = Rate of Change or Temperature only]. Two transducers can create three readings because they can generate an average or differential reading (R41,012) as well as the two level readings (R41,010 and R41,011).

Available registers

Data	Registers	Parameter
Reading	41,010 to 41,012	Reading (3.2.8.2.) (Page 251)
Volume	41,020, 41,021	Head (3.2.8.13.) (Page 254)
Temperature	41,030 and 41,031	Transducer Temperature (3.2.8.17.) (Page 255)

The reading is expressed as a percentage of full scale, multiplied by 100:

Reading	Value
0	0.00 %
5000	50.00 %
7564	75.64 %
20 000	200.00 %

C.15 Totalizer (R41,040 – R41,043)

The totalizers are stored as 32-bit integers using two registers. The totalizers can be read with R41,040 and R41,041 as totalizer for Point 1, and R41,042 and R41,043 as totalizer for Point 2. The totalizer values can be reset to any value by writing that value to the registers. The values can be cleared by writing zero (0) to the registers.

C.16 Input/output (R41,070 – R41,143)

The device has discrete inputs, mA inputs, mA outputs and relay outputs. See below for details for each I/O type.

C.17 Discrete inputs (R41,070)

This table shows the current status of the discrete inputs. Only register 41,070 is used.

Discrete input	Data address
1	41,070, bit 1
2	41,070, bit 2

C.18 Relay outputs (R41,080)

This table shows the current status of the relays. A reading of **0** means that the relay function is not asserted and a **1** means that it is asserted. For example, a **1** for a pump relay means that the pump is running.

Relay	Data address
1	41,080, bit 1
2	41,080, bit 2
3	41,080, bit 3
4	41,080, bit 4
5	41,080, bit 5
6	41,080, bit 6

Values are written to control a relay only if the Relay Control Function [Relay Function (2.8.1.4.) (Page 191)] is set to Communication. See Relay function codes (2.8.1.4. Relay function only) (Page 334)

C.19 mA input (R41,090)

The mA input is scaled from 0 to 2 000 (0 to 20 mA multiplied by 100). Parameter Scaled mA Input Value (2.6.5.) (Page 181) displays the value of the input. It is indexed by the input number.

C.20 mA outputs (R41,110-41,111)

The mA output is scaled from 0 to 2 000 (0 to 20 mA multiplied by 100). This is displayed in Milliamp Output (2.5.9.) (Page 178).

C.21 Pump control (R41,400-R41,474)

Only relays set for pump control [Relay Function (2.8.1.4.) (Page 191)] = Fixed Duty Assist, Fixed Duty Backup, or Alternate Duty Assist) are available. These registers have no effect on relays programmed for other uses.

C.22 Pump ON setpoint (R41,420-R41,425)

The ON setpoint level [ON Setpoint (2.8.1.5.) (Page 192)] for the referenced pump relay.

The setpoint is scaled from 0 to 10 000 (0 to 100 % of span multiplied by 100). So 54.02 % is shown in the register as 5402.

C.23 Pump OFF setpoint (R41,430-R41,435)

The OFF setpoint level [OFF Setpoint (2.8.1.6.) (Page 192)], for the referenced pump relay.

The setpoint is scaled from 0 to 10 000 (0 to 100 % of span multiplied by 100). So 54.02 % is shown in the register as 5402.

C.24 Pumped volume (R41,440-R41,443)

The pumped volume registers hold the current total for all of the pumps associated with a level point. These registers are available only if operation is set to **pumped volume**, [Sensor Mode (2.1.3.)] (Page 159) = Pump Totalizer).

These volumes can become very large. Therefore, two registers are used to hold the value. See Unsigned double precision integer (UINT32) (Page 331) for more information.

The value in the registers is given as an integer value but must be interpreted as having the number of decimals set in Totalizer Decimal Position (2.14.4.) (Page 246): this number can be **0** to **3**.

Ensure that your software accounts for these decimal places before you report the pumped volume totals.

C.25 Pump hours (R41,450-R41,461)

The number of running hours for the referenced pump relay. The hours are given to three decimal places, so the integer must be divided by 1 000 to get the correct value. For example, 12,340 represents 12.34 hours.

This value comes from parameter Pump hours (3.2.9.2.) (Page 255)

C.26 Pump starts (R41,470-R41,475)

The number of pump starts for the referenced pump relay.

This value comes from parameter Pump Starts (3.2.9.4.) (Page 256).

C.27 Parameter access (R43,998-R46,999)

Parameter values are given as integers in the range of registers from R44,000 to R44,999.

The last three numbers of the register correspond to the parameter number.

Parameter register #	Format register #	Parameter
44,000	46,000	Write Protection (5.1.) (Page 266)
44,001	46,001	Sensor Mode (2.1.3.) (Page 159)
44,002	46002	Material (2.1.6.) (Page 161)
...	...	...
44,999	46,999	Master Reset (3.2.3.) (Page 250)

Usually, the parameters are all **read / write**.

Note

- Parameters Write Protection (5.1.) (Page 266) and Master Reset (3.2.3.) (Page 250) are **Read only.**
- Master Reset (3.2.3.) (Page 250) cannot be used via Modbus.
- See Data types (Page 330) for a description of the types associated with different parameters.

Each parameter register has a corresponding format register that holds the format information required to interpret the value. See Format words (Page 328).

C.28 Parameter indexing

Many parameters are indexed. There are two possible indexes: a primary index and a secondary index. A secondary index is a sub-address of the primary index. Some indexed parameters affect multiple I/O devices.

The following is an example of a primary index:

Relay Function (2.8.1.4.) (Page 191) is the Relay Control Function. This parameter determines how a relay is controlled by the device (used as an alarm, for pump control, etc.). Because there are up to six relays on the device, Relay Function (2.8.1.4.) (Page 191) is indexed by six to allow each relay to be programmed independently.

A few parameters also have a secondary index. While a secondary index is important for setting up the device, it is almost never needed through remote communications.

Indexing the parameter access area

Each parameter communicates its value to only one register. You must know the index(es) for the parameter in order to interpret the information in the register correctly.

For example, to make use of the value returned in register R44,111 you must know which relay it is referring to. See Relay function codes (2.8.1.4. Relay function only) (Page 334) for details on Relay Function (2.8.1.4.) (Page 191) values.

To determine the index values, the primary and secondary index must be **read** or **write**. The two possible methods of handling these index values are described in Global index method (Page 326) and Parameter-specific index method (Page 327), below.

C.29 Reading parameters

To read parameter values, follow the steps listed in either the Global or the Parameter specific index methods that follow. You must be able to program your HMI or SCADA system before completing these methods.

C.29.1 Global index method

Set Parameter Index Location (4.11.) (Page 265) = Global.

Global format method sets index values for all parameters simultaneously. Use this method to read multiple values set to the same index values.

1. Write the primary index value into R43,999.

   This is a value between **0** and **40** which specifies the input or output indexed by the parameter.

   Examples are:

   – Transducer 1 is Index 1.

   – Discrete input 2 is Index 2.

   – Relay 5 is Index 5.

2. Write the secondary index value into R43,998.

   This is a value between **0** and **40** that specifies the secondary index on the parameter. This value is usually **0**.

3. Write the desired format value into the appropriate format register. Because the primary and secondary indexes are already specified, these portions of the format word are ignored and only the last digit is significant.
   See Format register (Page 339).

4. Read the value from the appropriate parameter register.

Types of values are:

- Numeric values (Page 330)
- Bit values (Page 330)
- Split values (Page 332)
- Text messages (Page 333)
- Relay function codes (2.8.1.4. Relay function only) (Page 334)

A value of 22,222 indicates that an error has occurred. Specify a different format type and try again.

C.29.2 Parameter-specific index method

Set Parameter Index Location (4.11.) (Page 265)= Parameter-specific.

The Parameter-specific index method sets the index values for each parameter independently. Use this method to read multiple parameters with different index values.

1. Write the primary index, secondary index, and data format values into the appropriate format register.

   For example, send the integer value 01008 to register 46,921, in order to read the following information:

   – Measured level [Level (3.2.8.3.)] (Page 252)

   – In units with three decimal places

   – From Transducer 1

2. Read the value from the appropriate parameter register (the example uses 44,921).

Types of values are:

- Numeric values (Page 330)
- Bit values (Page 330)
- Split values (Page 332)
- Text messages (Page 333)
- Relay function codes (2.8.1.4. Relay function only) (Page 334)

A value of 22,222 indicates that an error occurred. Specify a different format type and try again.

C.30 Writing parameters

The method of writing parameters is similar to the method of reading them. Become familiar with Reading parameters (Page 325) before attempting to write any.

To write parameter values to the device, follow these steps:

C.30.1 Global index method

Set Parameter Index Location (4.11.) (Page 265) = *Global.

1. Write the primary index value into R43,999.
2. Write the secondary index value into R43,998.
3. Write the desired format value into the appropriate format register.
4. Write the value to the appropriate parameter register.

C.30.2 Parameter-specific index method

Set Parameter Index Location (4.11.) (Page 265) = Parameter-specific.

1. Write the primary index, secondary index, and data format values into the appropriate format register.
2. Write the value to the appropriate parameter register.

C.31 Format words

Format words are unsigned integers that contain up to three values (described below). The number of values used in the format words depends on the Parameter Index Location (4.11.) (Page 265), that is used.

Parameter Index Location (4.11.) (Page 265), determines which of two methods is used to access the format words: Global Index Method or Parameter-specific Index Method.

C.31.1 Global index method

Set Parameter Index Location (4.11.) (Page 265) = *Global

Only the final digit of the format word determines the decimal offset (below).

C.31.2 Parameter-specific index method

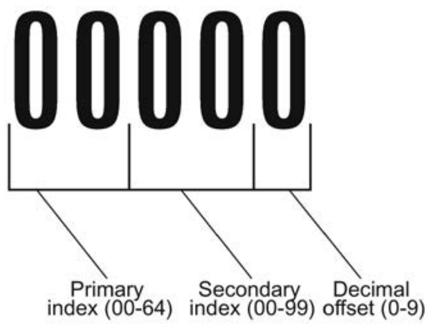
Set Parameter Index Location (4.11.) (Page 265) = parameter-specific

All three decimal fields are used to determine the parameter value’s primary index, secondary index, and decimal offset.

C.31.3 Format registers

Each format register is made up of three decimal fields:

- Decimal offset
- Secondary index
- Primary index



The primary and secondary indexes correspond to those that are used by the parameter. The decimal offset indicates how the remote system must interpret the integer value that is stored in the parameter access register. The following table shows how different parameter values can be shown based on a register value (integer) of **1234**.

Decimal	Offset	Example
0	0	1,234
1	-1	12,340
2	-2	123,400
3	-3	1,234,000
4	-4	12,340,000
5	-5	123,400,000
6	+1	123.4
7	+2	12.34
8	+3	1.234
9	Percent	12.34 %

Examples of using the format word for both the index values and the decimal offset value are shown below:

Format	Primary index	Secondary index	Decimal
00000	00	00	0
01003	01	00	3 right
02038	02	03	3 left
05159	05	15	Percent

To write these values you can use a decimal offset as follows: format word = (primary index x 1 000) + (secondary index x 10) + (decimal).

C.32 Data types

The device parameters do not always use integers to hold values. For the convenience of the programmer, those values are converted to and from a 16-bit integer number. This section describes the conversion process. The sections that follow describe where those values are in the discrete I/O and block transfer addresses, and how to get the parameters you need.

C.33 Numeric values

Numeric parameter values are the most common. For example, parameter Reading (3.2.8.2.) (Page 251) returns a number that represents the current reading (either **Level** or **Volume**, depending on the device configuration).

Numeric values are requested or set in units or percent of span, and may be specified with a number of decimal places.

Numeric values must be in the range –20,000 to +20,000 to be valid. If a parameter is requested and its value is more than +20,000, the number 32,767 is returned; if it is less than –20,000, the number –32,768 is returned. If this overflow happens, decrease the number of decimal places.

If a parameter cannot be expressed in terms of percent of **Span**, or has no meaningful value, the number 22,222 is returned. Try requesting the parameter in units, or refer to Units (2.1.1.) (Page 158).

C.34 Bit values

Bits are packed into registers in groups of 16 bits (1 word). In this manual, the bits are numbered from 1 to 16, with bit 1 as the least significant bit (LSB) and bit 16 as the most significant bit (MSB).

16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01
MSB															LSB

C.35 Unsigned double precision integer (UINT32)

Large numbers are put into unsigned 32-bit integers. By default, they are set up so that the first word (register) is the most significant word (MSW) and the second word (register) is the least significant word (LSW). For example, if R41,442 is read as a UINT32, the 32 bits would look like this:

R41,442	R41,443
16 MSW 1	16 LSW 1
32 32-bit integer value (UINT32) 1	

The two registers are read as a 32-bit integer.

The most significant word (MSW) and least significant word (LSW) can be reversed to accommodate some Modbus drivers. See Word order (R40,062) (Page 320) for details.

The position of the decimal place is dependent on the register. For more details, see the description of the register.

C.36 Split values

Certain parameters are actually pairs of numbers separated by a colon, using this format: **xx:yy**.

One example is Echo Confidence as shown in Measurement View 2 [The local display (Page 49)**], where:**

xx = the average noise value in dB

yy = the peak noise in dB

The number which corresponds to **xx:yy**, either for reading or setting a parameter, is determined by the following formula:

For storing to the device:

value = (**xx** + 128) x 256 + (**yy** + 128)

For reading from the device:

xx = (value / 256) – 128

yy = (value % 256) – 128

where % is the modulus operator.

The modulus can be computed by following these steps:

$value_1$ = value / 256

$value_2$ = remainder of $value_1$

$value_3$ = $value_2$ x 256

yy = $value_3$ – 128

It may simplify parameter to notice:

xx = (most significant byte of value) – 128

yy = (least significant byte of value) – 128

C.37 Text messages

If a device parameter returns a text message, that message is converted to an integer and provided in the register. The numbers are shown in the following table.

Number	Text message
22222	Invalid value
30000	OFF
30001	ON
30002	Parameter values of multiple points do not match.
30003	Parameter does not exist.
30004	ERR
30005	ERR1
30006	OPEN
30007	SHORT
30008	PASS
30009	FAIL
30010	HOLD
30011	LO
30012	HI
30013	DE
30014	EN
30015	Parameter has not been set.
-32768	Value is less than –20,000
32767	Value is greater than 20,000

C.38 Relay function codes (2.8.1.4. Relay function only)

Please note that the device offers more function codes.

If a device parameter returns a relay function code, that message is converted to a number and is then provided in the register. The numbers are shown in the following table:

Control	Relay function code	Number	Relay function (2.8.1.4.) (Page 191)
General	OFF, relay not used	0	*OFF (Page 191)
	Undesignated Level Alarm	1	Level (Page 191)
	Lo-Lo Level Alarm	2	Level – LL (Page 191)
	Low Level Alarm	3	Level – L (Page 191)
	High Level Alarm	4	Level – H (Page 191)
	Hi-Hi Level Alarm	5	Level – HH (Page 191)
	In-bounds Alarm	6	In-bounds (Page 191)
	Out-of-bounds Alarm	9	Out-of-bounds (Page 191)
	Rate of Level Change Alarm	12	Rate of Change (Page 191)
	Temperature Alarm	15	Temperature (Page 191)
	Loss of Echo (LOE) Alarm	20	LOE (Page 191)
	Transducer Cable Fault Alarm	16	Cable Fault (Page 191)
Flow	Totalizer	22	Totalizer (Page 191)
	Flow Sampler	23	Flow Sampler (Page 191)
Pump	Fixed Duty Assist	25	Fixed Duty Assist (Page 191)
	Fixed Duty Backup	26	Fixed Duty Backup (Page 191)
	Alternate Duty Assist	30	Alternate Duty Assist (Page 191)
	Alternate Duty Backup	31	Alternate Duty Backup (Page 191)
	Service Ratio Duty Assist	35	Service Ratio Duty Assist (Page 191)
	Service Ratio Duty Backup	36	Service Ratio Duty Backup (Page 191)
	First In First Out (FIFO)	40	First In First Out (Page 191)
Control	Flush Value	65	Flush Valve (Page 191)
	Communication	66	Communication (Page 191)

See Relay function (2.8.1.4.) (Page 191)

C.39 Error handling

C.39.1 Modbus responses

When polled by a Modbus Master, a slave device will do one of the following:

1. Not reply. This means that something went wrong with the transmission of the message.
2. Echo back the command with the correct response (see the Modbus specification (http://www.modbus.org/specs.php) for more details). This is the normal response.
3. Return an Exception Code. This reflects an error in the message.

The device uses the following exception codes:

Code	Name	Meaning
01	Illegal Function	The function code received in the query is not an allowable action for the slave.
02	Illegal Data Address	The data address received in the query is not an allowable address for the slave.
03	Illegal Data Value	A value contained in the query data field is not an allowable value for the slave.

C.39.2 Error handling

Errors can be traced to two general sources:

1. There is an error in transmission.
   OR
2. The host tries to do something that is not a valid action.

In the first case, the device does not respond and the master waits for a response time out error, which causes the master to re-send the message.

In the second case, the response depends on what the host tries to do. In general, the device will not give an error to the host request. Various actions and the expected outcome are as follows:

- If the host reads an invalid register, the host will get an undetermined value back.
- If the host writes an invalid register (a non-existing parameter or a **read only** parameter), the value will be ignored and no error response will be made. However, the current value will not reflect the desired new value.
- If the host writes a **read only** register, then the value will be ignored and no error response will be made. However, the current value will not reflect the desired new value.
- If Write Protection (5.1.) (Page 266) is activated, then the value will be ignored and no error response will be made. However, the current value will not reflect the desired new value.
- If the host attempts to write one or more registers that are out of range, an exception code **02** or **03** is generated, depending if the start address is valid.
- If the host used an unsupported function code, an exception code of **01** should be generated. However, this is not guaranteed and there may be no response.

C.40 Communication troubleshooting

C.40.1 General

1. Check the following:
   - There is power in the unit.
   - The LCD is showing the relevant data.
2. Check the wiring pin outs and verify that the connection is correct.
3. Verify that the settings in the computer used to communicate with the unit match the values in the set-up parameters listed below:

	Parameter
	Protocol (4.4.) (Page 263)
	Device Address (4.2.) (Page 262)
	Serial Baud Rate (4.5.) (Page 263)
	Parity (4.6.) (Page 264)
	Data Bits (4.7.) (Page 264)
	Stop Bits (4.8.) (Page 264)
	Modem Available (4.9.) (Page 264)
	Modem Inactivity Timeout (4.10.) (Page 265)

4. Check that the port on the computer is correct. Sometimes, trying a different Modbus driver will solve the problem.

C.40.2 Specific

1. The device is set to communicate via a modem but no communication is returning to the master.
   - Check that the parameters are set up correctly and that the correct port is configured
   - Verify the wiring diagram. Note that there is a difference between wiring directly to a computer and wiring to a modem.
   - Verify that the modem is set up correctly. Siemens has a series of application guides that may help. Please contact your local Siemens representative for more information on application guides.
2. A device parameter is set via remote communications, but the parameter remains unchanged.
   - Some parameters can only be changed when the device is not scanning. Try putting the device in PROGRAM mode, using the operating mode function.
   - Try setting the parameter from the keypad. If it can not be set using the keypad, check Write Protection (5.1.) (Page 266) and set it to **1954**.

C.41 Single parameter access (SPA)

This section is intended to provide someone with advanced communications knowledge and the ability to access any parameter value in any available format.

Built in to the device is an advanced handshaking area that can be used to read and write single registers to the device. This section performs a similar function to the Parameter access section. The differences are:

1. Advanced section is more powerful and harder to program.
2. Advanced section only gives you access to one parameter at a time.

C.41.1 Mapping

Parameter Read and Write (40,090 – 40,097) is a series of eight registers used for reading and writing parameter values to and from the device. The first three registers are always unsigned integers representing parameters and index values. The second five registers are the format and value(s) of the parameter.

Address	Description
40,090	Parameter (integer)
40,091	Primary index (integer)
40,092	Secondary index (integer)
40,093	Format word (bit mapped)
40,094	Read value, word 1
40,095	Read value, word 2
40,096	Write value, word 1
40,097	Write value, word 2

C.41.2 Reading parameters

To read parameters through Modbus, do the following steps:

1. Send the parameter, its primary index, its secondary index (usually 0), and format to registers 40,090 to 40,093.
2. Wait until you can read the written values from the registers (40,090 to 40,093) to confirm that the operation is complete.
3. Read the value from registers 40,094 and 40,095.

C.41.3 Writing parameters

To set parameters through Modbus, do the following steps:

1. Send the parameter, its primary index, and its secondary index (usually **0**) to registers 40,090, 40,091, and 40,092.
2. Write the value to registers 40,096 and 40,097.
3. Write the desired format word to register 40,093 to enable the device to interpret the value correctly.

C.41.4 Format register

Bits	Values	Description
1-8	0-2	Error Code
9-11	0-7	3-bit number representing decimal offset
12	0/1	Direction of offset (0 = right, 1 = left)
13	0/1	Numeric format: Fixed (0) or Float (1)
14	0/1	Read or Write of data, Read (0), Write (1)
15	0/1	Word order: Most Significant Word first (0), Least Significant Word first (1)
16		Reserved

For example, to format the level reading so that it is shown in percent with two decimal places shifted left, the format bits would look like this:

Bit numbers	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01
Bit values	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	Reserved	Most significant first	Read	Fixed format	Offset direction to right	Decimal offset of 2			No error code							

The value sent to the device is 0001001000000000 binary or 512 decimal. The value **512** is sent as an integer to register 40,093 to format the output words 40,094 and 40,095 accordingly.

If the numeric data type is set for integer and the value contains decimal places, they are ignored. In this situation, use the decimal offset to ensure that you have an integer value and then write your code to recognize and handle the decimal offset.

C.41.5 Error codes

The error codes returned in the format area are 8-bit integers found in the lowest eight bits of the format word. This allows for 256 potential error codes.

Currently, the device has two error codes available.

Values	Description
0	No error
1	Data not available as percent (available as units).
2-255	Reserved

Updating software

D

Please contact your Siemens representative to obtain the software update for the device. A complete list of representatives is available here: www.siemens.com/processinstrumentation (www.siemens.com/processinstrumentation), and choose Service on the right side.

Note

1. All parameter values will be lost during software update. Record your current parameters manually or using SIMATIC PDM before updating.

2. Disable all pumps and alarms before updating software, as relays can change state during the procedure, causing pumps to turn ON or OFF.

To install the software, please complete the following:

1. Connect your PC or laptop to the device's RJ-11 RS-232 port.
2. Run the **.exe Downloader** program in the software. Use this to make the RS-232 settings match your device. Please note that the software default settings will already match the default settings of the unit. Changes are only necessary if the RS-232 settings in the unit have been changed.
3. Complete the **Downloader** program steps.
4. Verify that **Downloader** confirms a successful upgrade before exiting.
5. Complete a master reset [Master Reset (3.2.3.) (Page 250)] after a successful upgrade before re-entering parameters.

Upgrading

E

The following procedure will assist you if you are upgrading from a MultiRanger Plus/HydroRanger Plus or MultiRanger 100/200/HydroRanger 200 to a MultiRanger 200 HMI/HydroRanger 200 HMI.

If the application is unchanged, copy the parameters in the old Siemens level controller before de-commissioning the unit.

E.1 Mounting a device

Please read the section on Installing and mounting (Page 24), then follow these steps:

1. Turn OFF the old Siemens level controller.
2. Disconnect and label all cables from the terminal blocks.
3. Remove the enclosure from the wall and pull all cables through the conduit entries.
4. Install the new device on the same mounting holes used by the old Siemens level controller.
5. Feed all cables through the conduit entries.
6. Connect all cables to the appropriate terminal block on the new device.

E.2 Connecting the transducer

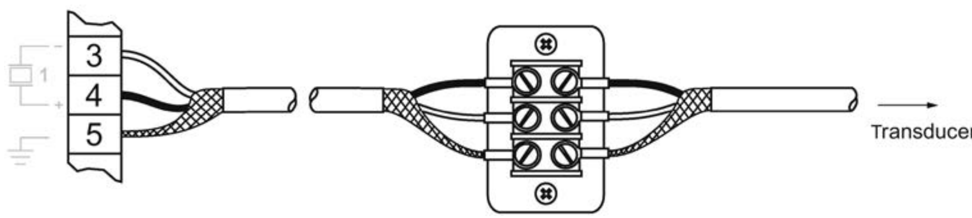
Important: Unlike in the MultiRanger Plus/HydroRanger Plus, co-axial cable is not recommended for use with the MultiRanger 200 HMI/HydroRanger 200 HMI for transducer cable extensions. The MultiRanger 200 HMI/HydroRanger 200 HMI circuit is designed to use shielded twisted pair cable. Ideally, the co-axial cable should be replaced with twisted pair.

If this is not practical, please refer to the section below.

E.3 Co-axial transducer extension

This device uses a differential input receiver that works either directly connected to the transducer lead, or with a screened twisted pair extension cable via a field junction box. This arrangement, using two conductors and a screen, gives considerably better electrical noise immunity than the previous co-axial arrangement (up to 20 dB). It gives a more reliable operation in applications where the proximity of power cables, variable speed drives, etc. would have caused problems.

If you are installing a new device and an extension is required, we strongly recommend that you use a good quality screened, twisted pair cable. If the integral transducer cable is used, you only need to connect the device and benefit from its superior performance.

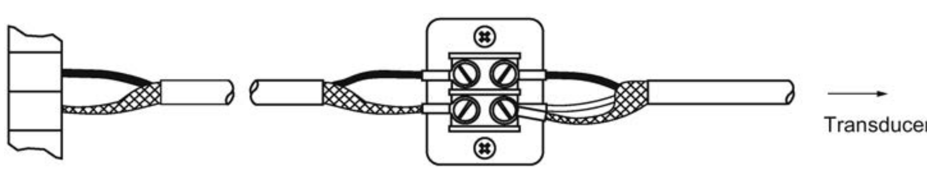


E.4 Connecting a transducer with RG62 co-axial extension cable

If you are replacing an older Siemens Milltronics Ultrasonic Level Controller with a new device where an RG62 co-axial extension is fitted, and you are unable to replace the extension with a new cable, please refer to the connection diagram below. Please note that the noise immunity performance will be similar to our older model ultrasonic level controllers if you use a co-axial cable.

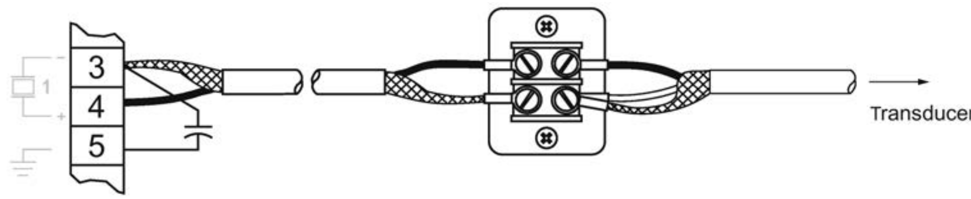
Existing installation

RG62 co-axial cable has been used to make the extension. The level controller might be a MultiRanger 100/200, MultiRanger Plus, HydroRanger 200, HydroRanger Plus or our other similar devices.

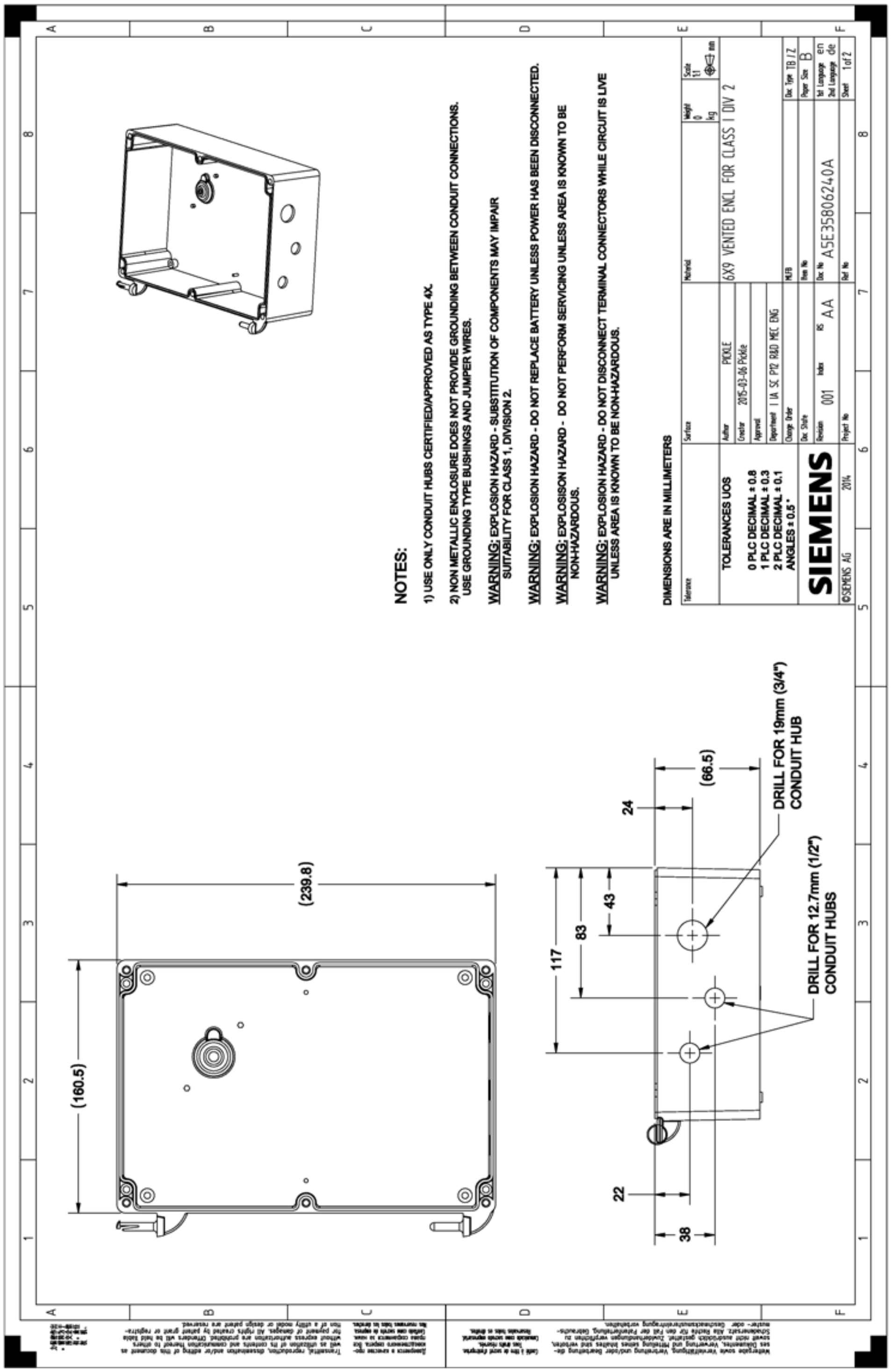


E.5 Device installation (for retrofitting older installations)

Connect with a 0.1 µF (100 V or greater) capacitor (included with the device) between the shield and negative terminals. Connect the center core of the co-axial to the positive terminal, and the screen to the negative terminal.



F Conduit entry for Class I, Div 2 applications


NOTES:
1) USE ONLY CONDUIT HUBS CERTIFIED/APPROVED AS TYPE 4X.
2) NON METALLIC ENCLOSURE DOES NOT PROVIDE GROUNDING BETWEEN CONDUIT CONNECTIONS. USE GROUNDING TYPE BUSHINGS AND JUMPER WIRES.
WARNING: EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.
WARNING: EXPLOSION HAZARD - DO NOT REPLACE BATTERY UNLESS POWER HAS BEEN DISCONNECTED.
WARNING: EXPLOSION HAZARD - DO NOT PERFORM SERVICING UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.
WARNING: EXPLOSION HAZARD - DO NOT DISCONNECT TERMINAL CONNECTORS WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.
DIMENSIONS ARE IN MILLIMETERS
TOLERANCES UOS
0 PLC DECIMAL ± 0.8
1 PLC DECIMAL ± 0.3
2 PLC DECIMAL ± 0.1
ANGLES ± 0.5°
SIEMENS
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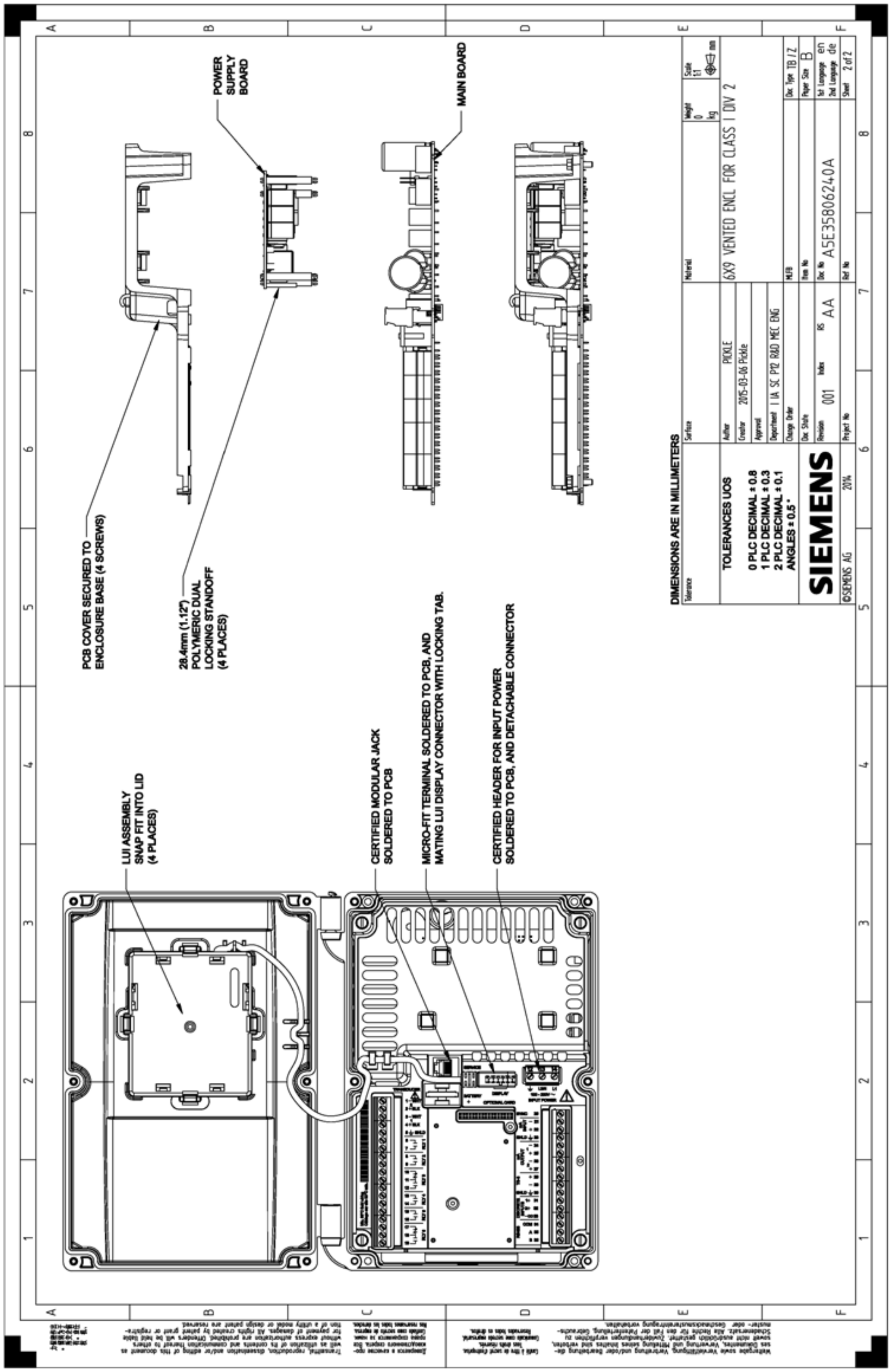
6X9 VENTED ENCL FOR CLASS I DIV 2
A5E35806240A
PICKLE
2015-03-06 Pickle
I IA SC PI2 R&D MEC ENG
001
AA
(239.8)
(160.5)
117
83
43
24
(66.5)
22
38
DRILL FOR 19mm (3/4") CONDUIT HUB
DRILL FOR 12.7mm (1/2") CONDUIT HUBS



POWER SUPPLY BOARD
MAIN BOARD
PCB COVER SECURED TO ENCLOSURE BASE (4 SCREWS)
28.4mm (1.12") POLYMERIC DUAL LOCKING STANDOFF (4 PLACES)
LUI ASSEMBLY SNAP FIT INTO LID (4 PLACES)
CERTIFIED MODULAR JACK SOLDERED TO PCB
MICRO-FIT TERMINAL SOLDERED TO PCB, AND MATING LUI DISPLAY CONNECTOR WITH LOCKING TAB.
CERTIFIED HEADER FOR INPUT POWER SOLDERED TO PCB, AND DETACHABLE CONNECTOR
DIMENSIONS ARE IN MILLIMETERS
TOLERANCES UOS
0 PLC DECIMAL ± 0.8
1 PLC DECIMAL ± 0.3
2 PLC DECIMAL ± 0.1
ANGLES ± 0.5°
SIEMENS
6X9 VENTED ENCL FOR CLASS I DIV 2
A5E35806240A
PICKLE
2015-03-06 Pickle
I IA SC PI2 R&D MEC ENG
001
AA
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Programming chart

G

G.1 Programming chart

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LCD menu structure

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H.1 LCD Menu Structure

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- In Navigation mode **ARROW** keys navigate the menu in the direction of the arrow.
- See Quick Start Wizards (Page 57) and Parameters (Page 152) for detailed information and instructions.

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Product documentation and support

I

I.1 Product documentation

Process instrumentation product documentation is available in the following formats:

- Certificates (http://www.siemens.com/processinstrumentation/certificates)
- Downloads (firmware, EDDs, software) (http://www.siemens.com/processinstrumentation/downloads)
- Catalog and catalog sheets (http://www.siemens.com/processinstrumentation/catalogs)
- Manuals (http://www.siemens.com/processinstrumentation/documentation)

  You have the option to show, open, save, or configure the manual.

  – "Display": Open the manual in HTML5 format
  – "Configure": Register and configure the documentation specific to your plant
  – "Download": Open or save the manual in PDF format
  – "Download as html5, only PC": Open or save the manual in the HTML5 view on your PC

You can also find manuals with the Mobile app at Industry Online Support (https://support.industry.siemens.com/cs/ww/en/sc/2067). Download the app to your mobile device and scan the device QR code.

Product documentation by serial number

Using the PIA Life Cycle Portal, you can access the serial number-specific product information including technical specifications, spare parts, calibration data, or factory certificates.

Entering a serial number

1. Open the PIA Life Cycle Portal (https://www.pia-portal.automation.siemens.com).
2. Select the desired language.
3. Enter the serial number of your device. The product documentation relevant for your device is displayed and can be downloaded.

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

Scanning a QR code

1. Scan the QR code on your device with a mobile device.
2. Click "PIA Portal".

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

I.2 Technical support

Technical support

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

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

Service & support on the Internet

In addition to our technical support, Siemens offers comprehensive online services at Service & Support (http://www.siemens.com/automation/service&support).

Contact

If you have further questions about the device, contact your local Siemens representative at Personal Contact (http://www.automation.siemens.com/partner).

To find the contact for your product, go to "all products and branches" and select "Products & Services > Industrial automation > Process instrumentation".

Contact address for business unit:
Siemens AG
Digital Industries
Process Automation
Östliche Rheinbrückenstr. 50
76187 Karlsruhe, Germany

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