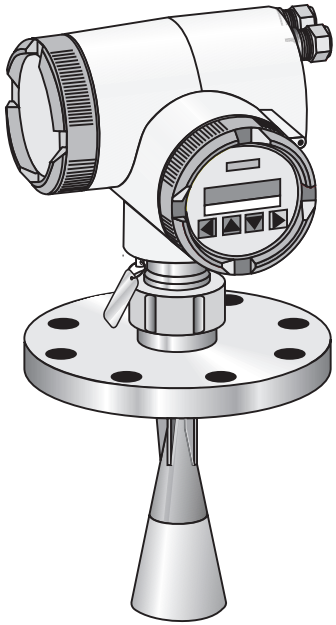
Instruction Manual • January 2003



sitrans

LR 400

SIEMENS

Safety Guidelines

Warning notices must be observed to ensure personal safety as well as that of others, and to protect the product and the connected equipment. These warning notices are accompanied by a clarification of the level of caution to be observed.

Qualified Personnel

This device/system may only be set up and operated in conjunction with this manual. Qualified personnel are only authorized to install and operate this equipment in accordance with established safety practices and standards.

Warning: This product can only function properly and safely if it is correctly transported, stored, installed, set up, operated, and maintained.

Note: Always use product in accordance with specifications.

MILLTRONICS® is a registered trademark of Siemens Milltronics Process Instruments Inc.

Contact SMPI Technical Publications at the following address:

Technical Publications
Siemens Milltronics Process Instruments Inc.
1954 Technology Drive, P.O. Box 4225
Peterborough, Ontario, Canada, K9J 7B1
Email: techpubs@siemens-milltronics.com

For the library of SMPI instruction manuals, visit our Web site: **www.siemens-milltronics.com**

Table of Contents

General Information **1**

The Manual 1
SITRANS LR 400 3
Structure 3

Specifications **4**

Dimensions 9

Installation **16**

Mounting Location 16
Electrical Connection 18

Start Up **20**

Self-test 20
Multi-display 20
Local Programming 20
Auto-Setup 20

Operation **21**

General Information 21
Measuring Principle 21
Operating the SITRANS LR 400 24
Changing a Parameter Value 25
Disabling and Enabling Programming 27
Operating Examples 28

Parameters (HART) **30**

Required Parameters 30
Additional Parameters 32

Parameters (Profibus-PA) **58**

Troubleshooting **66**

Classification of Faults 66
Self-test 66
Symptoms, Causes and Their Remedy 66
Fault Messages 67

Maintenance **69**

Disconnecting the Electronics 69
Cleaning the Antenna 69

Certificates **70**

Glossary **71**

Appendix I **72**

Alphabetical Parameter List 72

Appendix II **75**

Programming Chart 75

..... 77

Appendix III **78**

Ambient/Operating Temperature Specification 78

Appendix IV **79**

Process Pressure/Temperature De-rating 79

Appendix V **81**

HART Communications for the SITRANS LR 400 81

Appendix VI **86**

Profibus-PA Communications for the SITRANS LR 400 86

General Information

The Manual

Refer to this manual for proper installation, operation and maintenance of the SITRANS LR 400 Radar Level Instrument.

Special attention must be paid to warnings and notices highlighted from the rest of the text by grey boxes.

WARNING means that failure to observe the necessary precautions can result in death, serious injury, and/or considerable material damage.

Note means important information about the actual product or that part of the operating manual.

- These instructions do not claim to cover all details or variations in equipment, or to provide for every possible contingency that may arise during installation, operation, or maintenance.
- For further information or to resolve issues not covered in the manual, consult your Siemens Milltronics representative.
- The contents of the manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The Sales Contract contains the entire obligation of Siemens Milltronics. The warranty contained in the contract between the parties is the sole warranty of Siemens Milltronics.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNINGS:

- Changes or modifications not expressly approved by Siemens Milltronics could void the user's authority to operate the equipment.
- This equipment is intended to be used only in fully enclosed metal and concrete containers.

IMPORTANT: All specifications are subject to change without notice. Please ensure that any safety-related information is confirmed with a qualified Siemens Milltronics representative.

WARNINGS:

- Installation shall only be performed by qualified personnel and in accordance with local governing regulations.
- The SITRANS LR 400 is to be used only in the manner outlined in this manual, otherwise protection provided by equipment may be impaired.

Qualified personnel

Qualified personnel are familiar with the installation, commissioning, and operation of this equipment. In addition the person must be:

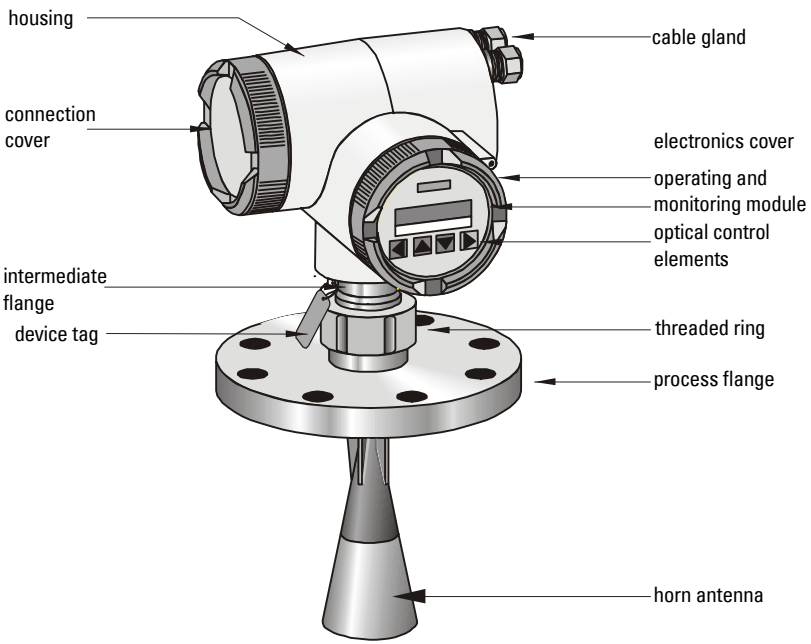
- trained and authorized to operate and service equipment/systems in accordance with established safety procedures relating to electrical circuits, high pressures and aggressive media.
- trained in the proper care and use of protective equipment in accordance with established safety practices.
- trained in rendering first aid.

IMPORTANT: The information in Appendix IV of this manual is not applicable to the flanges marked with serial numbers from 020102-001 to 020102-128. These flanges are intended for non-pressure applications in North America only.

SITRANS LR 400

The SITRANS LR 400 Radar Level Instrument is designed for medium to long range level-measuring of solids and liquids in storage vessels. SITRANS LR 400 uses a high microwave frequency and operates reliably even with poorly reflecting measuring media. The narrow antenna beam results in a sharp radiation cone, which makes the SITRANS LR 400 quite insensitive to vessel interferences.

Structure



The terminals for the power cable and the signal cable are behind the connection cover on the left side of the housing. The signal cable must be fed in from the right through the cable glands.

The device can be separated into electronic and mechanical sections at the threaded ring. An optional temperature extension is positioned between the threaded ring and the process flange.

The end of the antenna must reach inside the vessel through the vessel nozzle (see page 17).

After servicing, return the orientation of the housing to its previous position with reference to the flange, to ensure similar performance.

Specifications

Note: Siemens Milltronics makes every attempt to ensure the accuracy of these specifications, but reserves the right to change them at any time. Please ensure these are the most recent specifications. Contact your representative, or check our web site at www. siemens-milltronics.com for the most up-to-date information.

SITRANS LR 400

Power

- Power Supply — 120 to 230 Vac, ±15%, 50/60 Hz, 6W (12VA) or
  24 Vdc, +25/-20%, 6W
  Power failure: bridge of at least 1 mains period (> 20 ms)

Fuse

- Fuse (both ac and dc versions)

SI1	Fast acting ceramic, 4 x 20 mm, 1A, 250 Vac
SI2	Slow-Blow, 4 x 20 mm, 0.63 A, 250 Vac

Interface

- Analog output (Not applicable to Profibus-PA option)

Signal range	4 to 20 mA
Upper Limit	20 to 22.5 mA adjustable
Fail signal	3.6 mA; 22 mA; 24 mA or last value
Load	Max. 600 Ω, for HART communication min. 230 Ω

- Digital Output

Function	Configurable as a device status or limit value (level, volume)
Signal type	Relay, either NCC or NOC function max. 50 Vdc, max. 200 mA, rating max. 5 W. Self-resetting fuse, R_i = 9 Ω

- Electrical Isolation — Outputs electrically isolated from the power supply and from each other
- Display — LCD, two lines of 16 characters each, configurable for the following displays: level, volume, amplitude, digital output, temperature, validity, signal-to-noise ratio

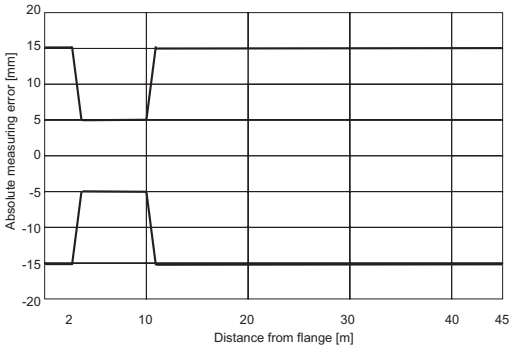
  Multi–display: 2 freely selectable measured values are displayed simultaneously
- Operation — 4 optical control elements, touch activated, menu-guided

Performance

Measured value error (under reference conditions)

- Measuring error — ≤ ± 15 mm at 0.26 to 2 m distance
≤ ± 5 mm at 2 to 10 m distance
≤ ± 15 mm at 10 to 45 m distance
(see next page)
- Dead zone — 0-260 mm from bottom edge of flange
- Additional contribution of analog output — ≤ 0.1% of the measured value
≤ 0.05% of full scale
- Influence of pressure (air, 20°C) — ≤ 0.3% to 10 bar without pressure correction
≤ 2 % at 10 to 64 bar without pressure correction
- Long-term stability — ≤ ± 1 mm/year
- Repetitive accuracy — ≤ ± 1 mm at 0 to 45 m, damping ≥ 1 s

Absolute Measuring Error



Mechanical

Flange

- Process Connection — Flange DIN 2527, ANSI B16.5, or JIS B2238 equivalent bolt pattern
- Materials of the wetted parts – in contact with the process — Stainless steel[1] flange and CF8M horn, PTFE emitter (or glass/PTFE, Zone 0 and Zone 20 devices)
- Pressure (vessel) — Pressure rating of flange is dependent on temperature. Refer to Appendix IV for charts, or obtain the reference drawing listed on the flange device tag.

1. Flange material may be either 316/316L or 1.4571 at the discretion of Siemens Milltronics Process Instruments Inc. Actual flange material will be noted on the side of the flange.

Weight

- Weight of instrument and flange

Process Connection	Weight
Universal, 3" / 80 mm, flat faced, 0.5 bar maximum	10.9 kg (24 lbs)
Universal, 4" / 100 mm, flat faced, 0.5 bar maximum	12.7 kg (28 lbs)
Universal, 6" / 150 mm, flat faced, 0.5 bar maximum	15.0 kg (33 lbs)
DN80 PN16, flat faced	11.9 kg (26.1 lbs)
DN80 PN40, flat faced	12.9 kg (28.4 lbs)
DN100 PN16, flat faced	13.2 kg (28.9 lbs)
DN100 PN40, flat faced	15.5 kg (34.1 lbs)
DN150 PN16, flat faced	19.2 kg (42.1 lbs)
DN150 PN40, flat faced	24.1 kg (43.1 lbs)
3", 150 lb class, raised faced	12.2 kg (26.8 lbs)
3", 300 lb class, raised faced	14.3 kg (31.5 lbs)
4", 150 lb class, raised faced	14.8 kg (32.5 lbs)
4", 300 lb class, raised faced	20.2 kg (44.4 lbs)
6", 150 lb class, raised faced	20.1 kg (44.2 lbs)
6", 300 lb class, raised faced	31.8 kg (69.9 lbs)
JIS DN80 10K, flat faced	11.9 kg (26.1 lbs)
JIS DN100 10K, flat faced	13.2 kg (28.9 lbs)
JIS DN150 10K, flat faced	19.2 kg (42.1 lbs)
Easy Aimer	11.8 kg (26 lbs)

Note: Please ensure these are the most recent specifications. Contact your Siemens Milltronics representative, or check our web site at www.siemens-milltronics.com for the most up-to-date information.

WARNING: This product is designated as a Pressure Accessory per Directive 97/23/EC and is not intended for use as a safety device.

Enclosure

- construction — Die-cast aluminum, painted
- conduit — 2 x M20 or 2 x ½" NPT
- ingress protection — Type 4X/NEMA 4X, Type 6/NEMA 6, IP 67[1]

Environmental[2]

location:	indoor/outdoor
altitude:	2000 m max
ambient temperature:	-40 to 65°C (-40 to 149°F)
relative humidity:	suitable for outdoor (Type / NEMA 4X, 6/ IP67)
installation category	II
pollution degree	4

- Process Temperature — -40 to 200°C (-40 to 392°F),optional -40 to 250°C (-40 to 482°F)

1. Use only approved, suitable sized hubs for **watertight** applications.
2. See Process/Ambient de-rating curves in Appendix III.

- Electromagnetic compatibility
  - Spurious emission: according to EN 50 081
  - Interference strength: according to EN 50 082 and NAMUR
- Perm. ambient temperature: -40 to 65°C (-40 to 149°F) (non-hazardous version)
  -20 to 65°C (-4 to 149°F) (hazardous version)
  LCD: -10 to 55 °C (14 to 131°F)
  Observe the temperature classes in hazardous areas!
- Perm. storage temperature: -30 to 80°C (-22 to 176°F),

WARNING: Materials of construction are chosen based on their chemical compatibility (or inertness) for general purposes. For exposure to specific environments, check with chemical compatibility charts before installing.

Communication

- Communication: HART
  - Load: 230 to 600 Ω, 230 to 500 Ω when connecting a coupling module
  - Line: two-wire shielded: ≤ 3 km
    multi-wire shielded: ≤ 1.5 km
  - Protocol: HART, Version 5.1

Communication: Profibus-PA
- Protocol: Layer 1 and 2 Profibus-PA,
  technology: IEC 61158-2, slave-functionality
- Device Class: A
- Device Profile: 3.0

- PC/Laptop requirements: IBM-compatible
  RAM ≥ 64 Mbytes
  Hard disk ≥ 100 Mbytes
  RS 232-C interface
  VGA graphic card (≥ 640 x 480)
- Software for PC/Laptop: Windows 95/98/2000 or NT 4.0
  SIMATIC PDM

Approvals (verify against device nameplate)

• Explosion Protection *Refer to device nameplate	Certificate No. PTB 00 ATEX 1024 II 1/2G EEx d IIC T6II 2G EEx d IIC T6 II 1/2G EEx dem IIC T6II 2G EEx dem IIC T6 II 1/2G EEx dem [ib] IIC T6II 2G EEx dem [ib] IIC T6 II 1/2G EEx dem [ia] IIC T6II 2G EEx dem [ia] IIC T6 FM/CSA[1] Class I, Div. 1, Groups B, C, D; Class II/III, Div. 1, Groups E, F, G Certificate No. DMT 01 ATEX E 038 II 1/2 D IP 65 (dust zone 20, zone 21 approval)
• General	CSAus/c, FM
• Radio	FCC, Industry Canada, European Radio

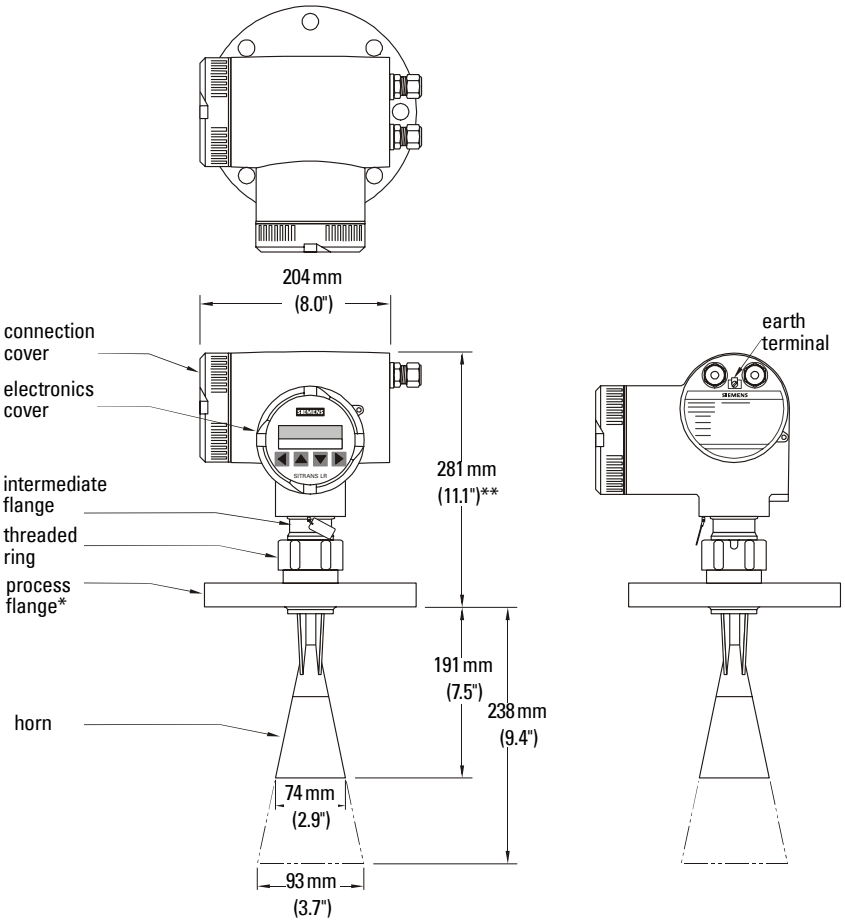
WARNING: This product is designated as a Pressure Accessory per directive 97/23/EC and is not intended for use as a safety device.

Note: Please ensure these are the most recent specifications. Contact your Siemens Milltronics representative, or check our web site at www.siemens-milltronics.com for the most up-to-date information.

1. CSA Hazardous approval is pending. See www.siemens-milltronics.com for current listing.

Dimensions

SITRANS LR 400 (without Temperature Extension)



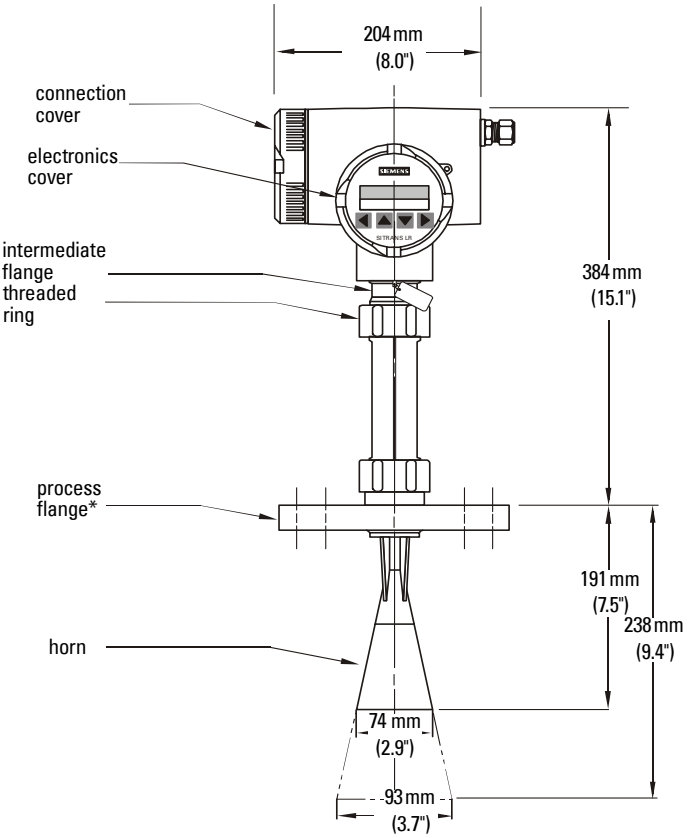
Note: Process temperature and pressure capabilities are dependent upon information on the process device tag. See Appendix IV (Process Pressure/ Temperature de-Rating). Reference drawing listed on the tag is available upon request.

WARNING: The user is responsible for the selection of bolting and gasket materials which will fall within the limits of the flange and its intended use and which are suitable for the service conditions.

*Flange acc. to DIN 2527 / ANSI B16.5 / JIS B2238 bolt hole pattern

**A purging system installed between the flange and the horn antenna is an option for the SITRANS LR 400. The system provides an inlet on the flange where cooling air or cleaning fluid passes through the flange and exits the inside of the horn to clean it. The customer will supply the purging medium by manual or automatic valve system. This option is only available with universal flanges.

SITRANS LR 400 with optional Temperature Extension

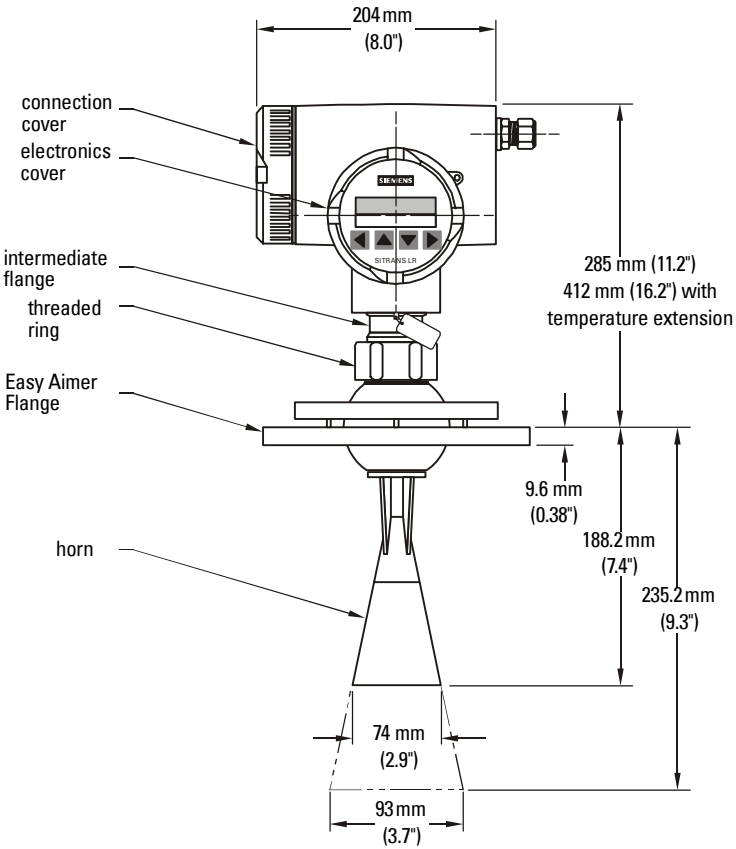


*Flange acc. to DIN 2527 / ANSI B16.5 / JIS B2238 bolt hole pattern

Note: Process temperature and pressure capabilities are dependent upon information on the process device tag. See Appendix IV (Process Pressure/ Temperature de-Rating). Reference drawing listed on the tag is available upon request.

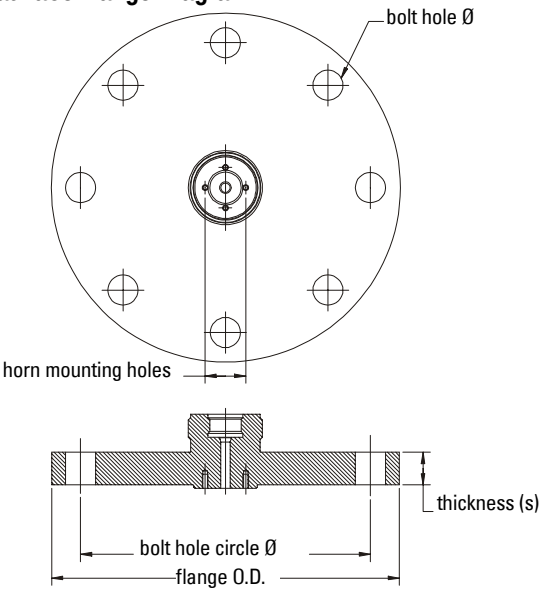
WARNING: The user is responsible for the selection of bolting and gasket materials which will fall within the limits of the flange and its intended use and which are suitable for the service conditions.

SITRANS LR 400 with optional Easy Aimer LR connection



WARNING: The user is responsible for the selection of bolting and gasket materials which will fall within the limits of the flange and its intended use and which are suitable for the service conditions.

DIN / JIS Flat Face Flange Diagram



Flange according to DIN 2527 (see Flange Diagram above)

Pipe Size	Flange Size	Flange O.D.	Thickness (s)	Bolt Hole Circle Ø	Bolt Hole Ø	Number of Bolts
80 mm	PN 16	200 mm	20.0 mm	160 mm	18.0 mm	8
100 mm	PN16	220 mm	20.0 mm	180 mm	18.0 mm	8
150 mm	PN 16	285 mm	22.0 mm	240 mm	22.0 mm	8
80 mm	PN 40	200 mm	24.0 mm	160 mm	18.0 mm	8
100 mm	PN 40	235 mm	24.0 mm	190 mm	22.0 mm	8
150 mm	PN 40	300 mm	28.0 mm	250 mm	26.0 mm	8

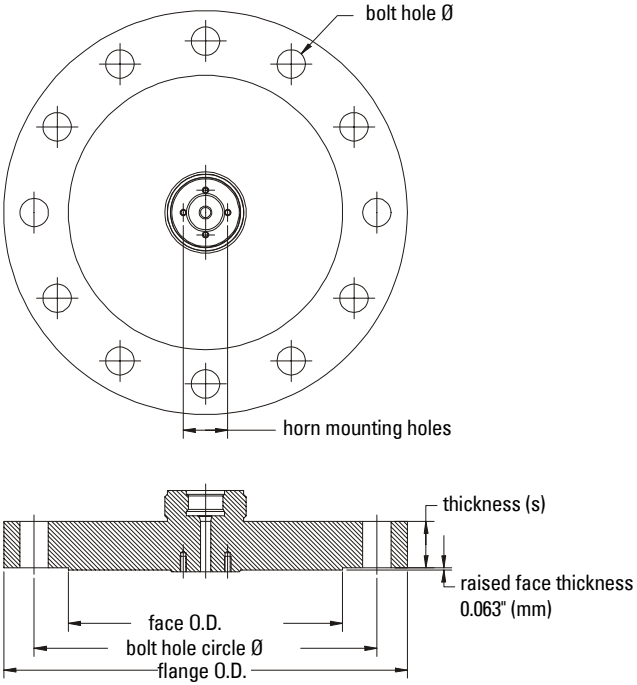
Flange according to JIS B 2238

Pipe Size	Flange Size	Flange O.D.	Thickness (s)	Bolt Hole Circle Ø	Bolt Hole Ø	Number of Bolts
80 mm	10 K	185 mm	20.0 mm	150 mm	19.0 mm	8
100 mm	10 K	210 mm	22.0 mm	175 mm	19.0 mm	8
150 mm	10 k	280 mm	24.0 mm	240 mm	23.0 mm	8

Note: Process temperature and pressure capabilities are dependent upon information on the process device tag. See Appendix IV (Process Pressure/ Temperature de-Rating). Reference drawing listed on the tag is available upon request.

WARNING: The user is responsible for the selection of bolting and gasket materials which will fall within the limits of the flange and its intended use and which are suitable for the service conditions.

ANSI Raised Face Flange Diagram



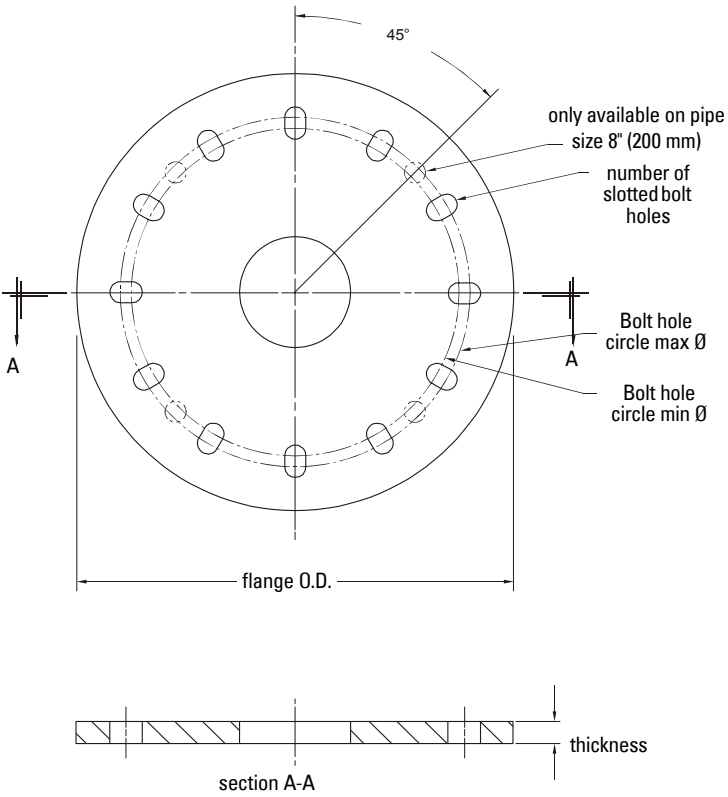
Flange according to ANSI B 16.5 (see Flange Diagram above)

Pipe Size	Flange Size	Flange O.D.	Thickness (s)	Face O.D.	Bolt Hole Circle Ø	Bolt Hole Ø	Number of Bolts
3"	150 #	7.50"	0.941"	5.0"	6.00"	0.75"	4
4"	150 #	9.00"	0.941"	6.19"	7.50"	075"	8
6"	150 #	11.00"	1.00"	8.5"	9.50"	0.88"	8
3"	300 #	8.25"	1.12"	5.0"	6.62	0.88"	8
4"	300 #	10.00"	1.25"	6.19"	7.88"	0.88"	8
6"	300 #	12.51"	1.44"	8.5"	10.62"	0.88"	12

Note: Process temperature and pressure capabilities are dependent upon information on the process device tag. See Appendix IV (Process Pressure/ Temperature de-Rating). Reference drawing listed on the tag is available upon request.

WARNING: The user is responsible for the selection of bolting and gasket materials which will fall within the limits of the flange and its intended use and which are suitable for the service conditions.

Universal Slotted Flange Diagram

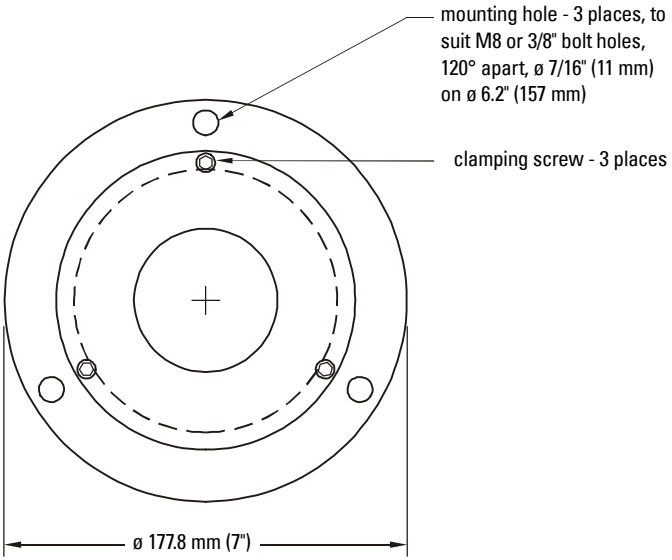


Flange according to Universal Slotted Flange (see Flange Diagram above)

Pipe Size	Flange O.D.	Thick-ness (s)	Bolt Hole Circle Max Ø	Bolt Hole Circle Min Ø	Bolt Hole radius	Number of Slotted Holes
3" or 80 mm	7.87"	0.40"	6.30"	5.90"	0.38"	8
4" or 100 mm	9.00"	0.40"	7.50"	6.89"	0.38"	8
6" or 150 mm	11.22"	0.40"	9.50"	9.44"	0.45"	8
8" or 200 mm	13.5"	0.40"	11.75"	11.4"	0.45"	12

WARNING: The user is responsible for the selection of bolting and gasket materials which will fall within the limits of the flange and its intended use and which are suitable for the service conditions.

Easy Aimer LR Flange Connection



Notes:

- The SITRANS LR 400 is rated for Type 4X/NEMA 4X, Type 6/NEMA 6, IP 67. Follow all installation and operating instructions to meet the requirements of this type of protection. Use only approved, suitable sized hubs for watertight applications.
- Observe all maximum permissible ambient and process temperatures. Refer to Appendix III (Ambient/Operating Temperature Specification).

Provide a warning sign and/or touch guard if the surface of the measuring instrument can become hotter than 70°C in use.

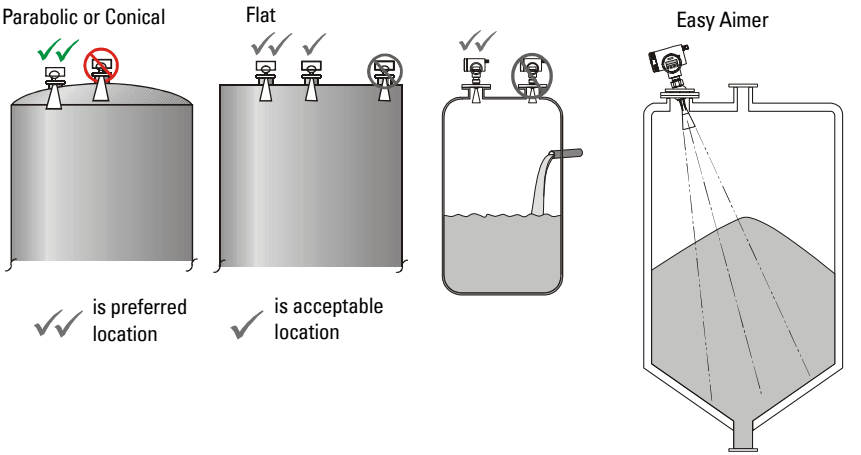
WARNINGS:

- This product is designated as a Pressure Accessory per directive 97/23/EC and is not intended for use as a safety device.
- Improper installation may result in loss of process pressure.

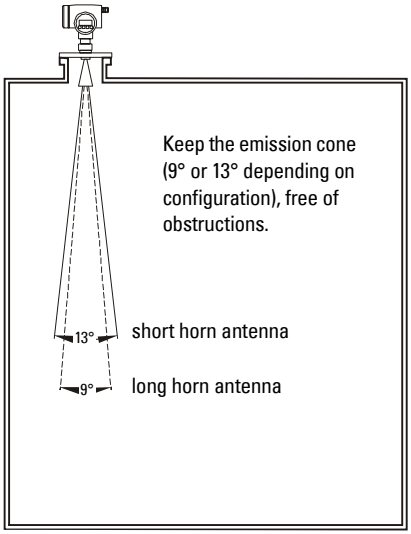
Mounting Location

- Do not mount in direct sunlight without the use of a sun shield. Refer to Appendix III (Ambient/Operating Temperature Specification) on page 78.
- Mount the unit more than 1 m away from the vessel walls, pipes and other assemblies as well as the filling stream, because all these influences will become noticeable as reflective interference. Align the antenna so that the radar cone intersects the surface of the measuring medium as vertically as possible
- When mounting the SITRANS LR 400 in outdoor applications, always set Parameter 5.2 Customer Code to prevent unwanted resetting of parameters.

WARNING: For vessels with conical or parabolic tops, avoid mounting the unit at the center. The concavity of the top can focus echoes into the centre, giving false readings.

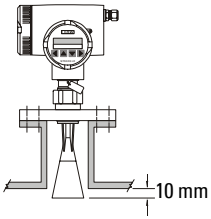


Beam Spreading

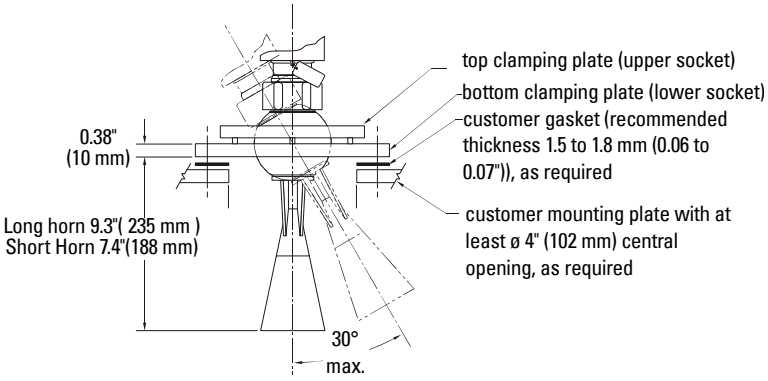


Correct Installation in Mounting Nozzle

The bottom edge of the antenna must project into the vessel to avoid reflective interference at the wall of the nozzle. Above flange size DN 150/6 inch, the antenna need not project beyond the nozzle unless the radiation cone (the extension of the antenna's angle) touches the nozzle wall.



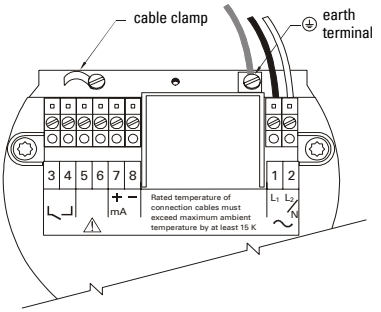
Installation using Easy Aimer LR



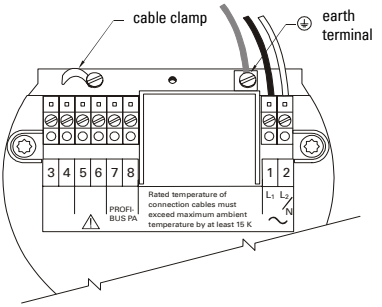
Electrical Connection

ac version:

Hart Wiring



Profibus Wiring

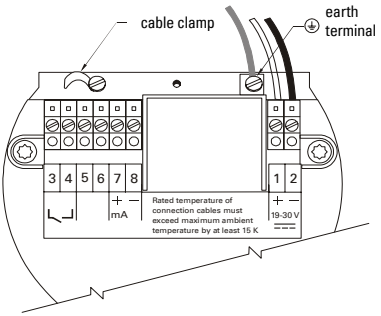


- The equipment must be protected by a 15A fuse or circuit breaker in the building installation.
- A circuit breaker or switch in the building installation, marked as the disconnect switch, shall be in close proximity to the equipment and within easy reach of the operator.

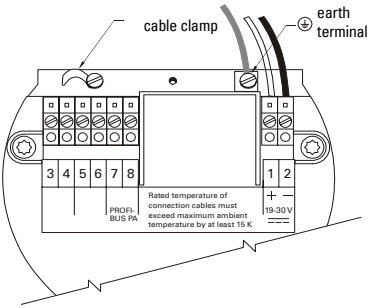
⚠ All field wiring must have insulation suitable for at least 250 V.

dc version:

Hart Wiring



Profibus Wiring



- DC input terminals shall be supplied from an SELV source in accordance with IEC 1010-1 Annex H.

Notes (AC and DC versions):

- 4-20 mA, Profibus-PA, DC input circuits, 14 - 20 AWG, shielded copper wire
- AC input circuit, min 14 AWG copper wire
- Recommended torque on terminal clamping screws, 0.5 - 0.6 Nm

Make the electrical connections as follows:

1. Release the cover lock on the connection box with a 3 mm Allen key.
2. Unscrew the cover from the connection box.
3. Push the power cable and signal cable through the cable gland on the right of the unit., up to the terminal strip. Lay the cable in a bend before the cable gland so that moisture cannot enter the connection box.
4. Connect the earth conductor of the power supply to the earth terminal ⏚ in the connection box. Adjust the cable length so that the earth conductor will be disconnected last if you pull on the cable.
5. In devices with ignition protection types II 1/2G EEx dem [ia] IIC T6 and II 1/2G EEx dem [ib] IIC T6 or II 2G EEx dem [ia] IIC T6 and II 2G EEx dem [ib] IIC T6, mount the cover for the power supply terminals.
6. Tighten the cable screw gland and check the strain relief (pull and turn).
7. In devices with ignition protection type II 1/2G EEx D IIC T6 or II 2G EEx d IIC T6, replace unused screw-type cable glands with a certified dummy plug.
8. Screw the cover onto the housing and tighten it without using a tool. The sealing ring must be clean and undamaged.
9. Mount the cover lock of the connection box cover.
10. Connect the earth terminal located between the screw-type cable glands to a ground connection at your vessel by using a cable of a cross-section at least 2.5 mm^2.

For error-free communication via the HART protocol, a load of at least 230 Ω must be available in the signal circuit.

Warning:

- **To avoid short-circuits, do not connect a load resistance with bare wires in the connection box.**
- **The housing cover may not be unscrewed in a hazardous area when the device is under voltage (power supply, digital outputs on external supply).**
- **In devices with ignition protection types II 1/2G EEx dem [ia] IIC T6 and II 1/2G EEx dem [ib] IIC T6 II 2G EEx dem [ia] IIC T6 and II 2G EEx dem [ib] IIC T6, only the cover of the connection box may be unscrewed for test purposes. The cover on the power supply terminals may not be removed!**

Start Up

Self-test

The device performs a self-test after power is supplied. Then, the unit is ready for programming when the multi-display appears and the control elements can be operated.

Note: Frequent switching off and on of the devices causes aging of the electronics (see Parameter 3.1).

Multi-display

The multi-display shows on the LCD after a successful self-test with the output of the level in the first line and the signal-to-noise ratio in the second line (factory setting):

+	1	2	.	3	0	0		m						
+	3	0		d	b									

Local Programming

When the multi-display appears on the LCD, begin local programming using the optical control elements. To access the parameter settings, touch the ◁ element once. Main Menu is displayed in the first line of the LCD. Then program the unit beginning with the Auto-Setup parameters.

Auto-Setup

After switching on the SITRANS LR 400, and after a successful self test, touch ◁ to access the parameters. Set the Auto-Setup parameters to make the system operational: (see page 30)

- The language of the local user interface
- The unit of length of the measured level
- The nozzle height in the selected unit of length
- The vessel height in the selected unit of length
- The LRV as a distance from the bottom of the vessel
- The URV as a distance from the bottom of the vessel
- The damping of the measured level in sec
- The application type
- The bus-address by Profibus-PA communication (on Profibus models)

Enter the necessary values as described in Parameters on page 30.

Note: It is strongly recommended that a Customer Code (Parameter 5.2) be entered after all programming is completed to secure the programmed values from changes. This code must be entered in outdoor applications where rain drops may inadvertently activate the optical control elements.

If the multi-display does not appear or displays incorrect measured values after Auto-Setup, proceed as described in Troubleshooting on page 66.

Refer to the Parameter section that begins on page 30 for a list of available parameters.

Operation

General Information

You can operate the SITRANS LR 400 with:

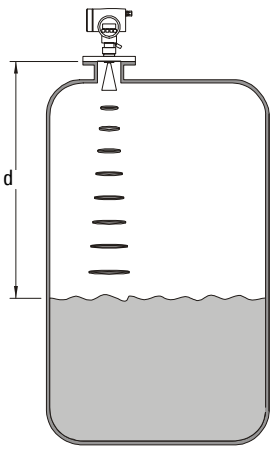
- Local operating and monitoring module
- HART-Communicator or Profibus-PA
- PC/Laptop and SIMATIC PDM software (recommended)

Notes:

- The SITRANS LR 400 can be operated and programmed most comfortably with the SIMATIC PDM software. This software gives you the added possibility of saving and archiving your application-specific parameters and copying them back into the device if necessary.
- It is best to perform the operations described in the following sections directly on the device to familiarize yourself with the operation.

Measuring Principle

The SITRANS LR 400 operates according to the FMCW (Frequency Modulated Continuous Wave) method. Its antenna sends microwaves to the surface of the measuring medium, the frequency of which is modulated continuously (see Determining the Differential Frequency on page 22). A receiver registers the reflection at the surface of the measuring medium and links it with the simultaneously radiated signal.



The propagation speed of microwaves in gases corresponds to the speed of light. The distance *d* is therefore proportional to the propagation time *t*:

$$d = \frac{c \cdot t}{2}$$

d= distance, t = measured time, c = speed of light

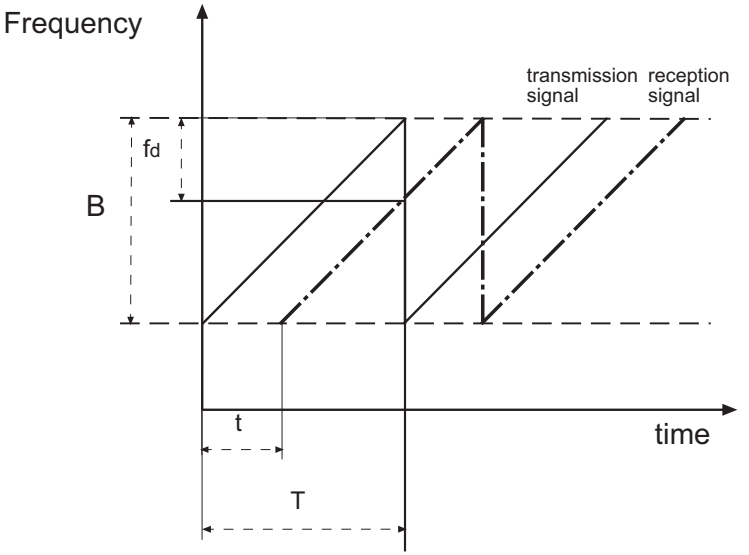
Since the transmission signal has changed its frequency until the reception signal arrives, the link gives a differential frequency f_d, which is proportional to the distance d from the reflecting surface.

The distance d is given by the ratio of the differential frequency f_d to the frequency deviation B and the duration of a frequency modulation phase T:

$$f_d = \frac{2 \cdot B \cdot d}{T \cdot c}, d = \frac{f_d \cdot T \cdot c}{2B}$$

B = bandwidth (frequency deviation), d = distance, T = modulation duration,
c = speed of light

Determining the Differential Frequency



Example

The linear frequency deviation is 200 MHz at a modulation duration of 10 ms. The surface of the measuring medium is 10 m away from the transmitting antenna. The difference signal then has a frequency of:

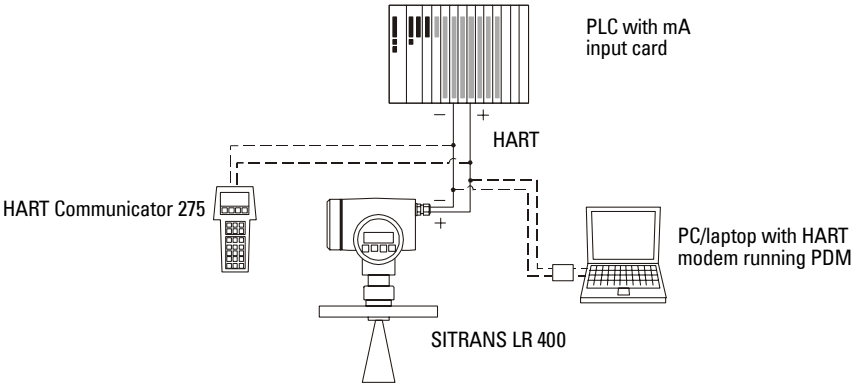
$$f_d = \frac{2 \cdot 2 \cdot 10^8 \cdot 10}{10^{-3} \cdot 3 \cdot 10^8} = 13,333 kHz$$

Every reflection at a surface generates a different frequency. The reception signal therefore consists of a frequency mix from which the disturbance frequencies must be filtered. These can be caused by fixed targets such as struts inside the vessel.

Warning: The coupling module (shown below) may not be used in areas where there is an explosion hazard and may not be connected to intrinsically safe circuits.

The electrical connection of the PC/Laptops and the HART-Communicator to the 4-20-mA signal cable is shown below.

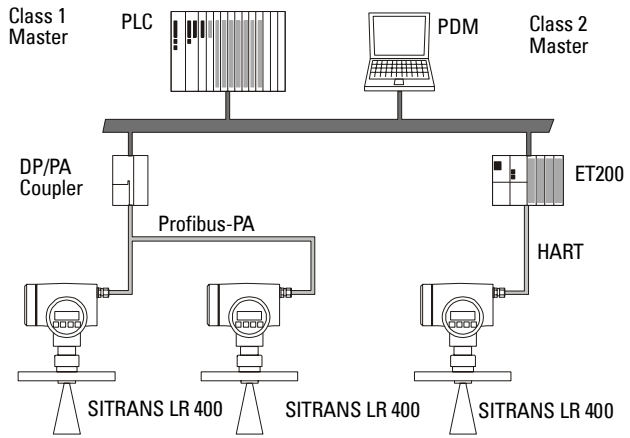
Connection, HART Schematic Diagram



Note: A 250 ohm loop resistor may be required, depending on PLC input resistance.

The connection of the PC/Laptops and Profibus-PA to the 4-20 mA signal cable is shown below.

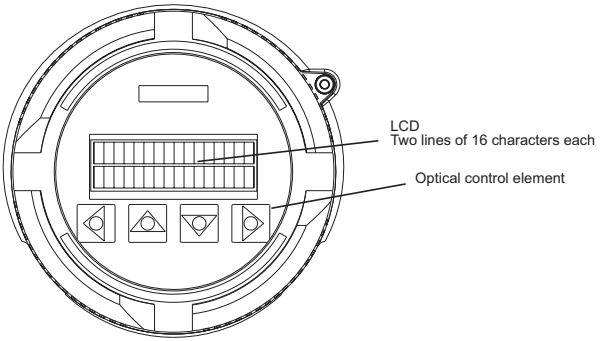
Connection, Profibus Schematic Diagram



Operating the SITRANS LR 400

To set parameters, touch ◁ to enter the parameter menus. Use the optical control elements on the operating and monitoring module (shown below). Touch the glass in the appropriate place with your fingertips like on a touch screen. The two-line LCD displays the parameters. You can alter the setting or change to other parameters using the controls (see page 25 for information on navigating the menus using the optical control elements).

Operating and Monitoring Module



Selecting a Parameter

After a successful self-test, the SITRANS LR 400 displays the two-line multi-display.

Touch ◁ to access the parameter menus. The first line of the display tells you the current parameter menu level. The second line shows one of the parameters you can access in the current parameter group. Scroll through the parameters in the group by touching the control elements ▽ (forward) and △ (backward). The control element ▷ accesses the parameter displayed on the second line. The fourth control element ◁ closes this parameter and moves up one level until you return to the multi-display.

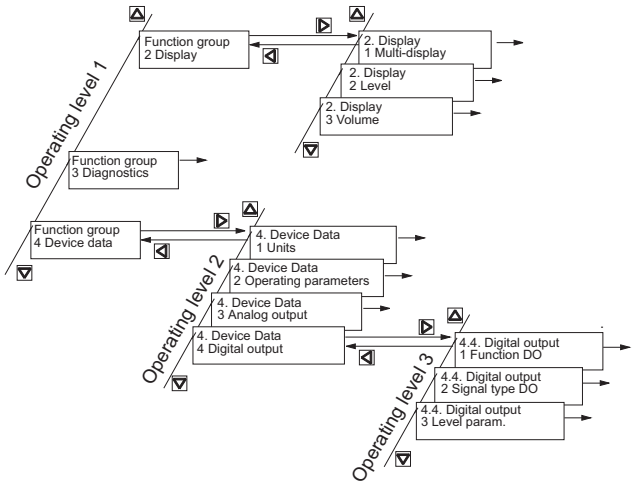
When you select a parameter, its current value is displayed in the second line. When the value flashes, programming is enabled, (see Disabling and Enabling Programming on page 27) and you can change the current setting. If the parameter value cannot be changed or if programming is disabled, the value will not flash. .

Notes

- The background illumination of the LCD switches on as soon as you use a control element. It goes out about three minutes after last use of a control element.
- The sensitivity of the elements is dependent on colour; having very dirty fingers can impair control.

Structure of Parameters

Operation is hierarchically structured: the parameters are arranged in groups and assigned a numerical menu identification (see example below).



Changing a Parameter Value

Selecting a Parameter Value from a List

In many cases, you can assign a parameter a value from a list of options.

You will see a single item of the selection list in the second line of the display.

- Touch △ or ▽ to cycle through the list and choose the desired entry. Touch ▷ to assign the current entry to the parameter. The device accepts the new setting, closes the input and returns to the next parameter level up.
- ◁ operates like a Cancel key: When you touch it, the device closes the parameter input but keeps the originally displayed value. It does not save a changed setting!

For an example of assigning a value from a selection list, see Operating Examples on page 28.

Entering a Parameter Value

The control elements operate like a cursor control when entering a parameter value. The input position is marked by flashing of a single character.

- Increase or decrease a character's value by using △ and ▽.
- Move the input position to the right using ▷. At the far right position, touch ▷ again: ▷ operates like an Enter key. The device saves the changed value and closes the parameter unless the value is not within the permissible input range. Then the operating module displays an error message.
- Use the control element ◁ to move the input position to the left. At the farthest left position, touch ◁ again: it now functions as a **Cancel** key. The device closes the parameter input without saving the changed value.

If you touch △ when the value is at the top of the representable range, SITRANS LR 400 automatically places the value at the next highest position. If 0.9 is displayed and you touch the control element △, the value becomes 1.0. So, 9 becomes 10, 90 or 99 become 100 (depending on whether you have set the input position to the second or first 9), etc.

This input system also works in the opposite direction: For example, when 100 is displayed and you use the control element ▽ on the first or second 0, the numeric value changes to 90 or 99 and the device cancels the places in front of the decimal point.

You can also set the cursor to the decimal point (unless an integer value is currently displayed). The control elements △ or ▽ then multiply or divide the displayed value by 10. The necessary additional places in front of the decimal point appear. You cannot change the number of displayed decimal places.

Display text assigned to a parameter may sometimes be longer than the field of the display. An arrow pointing outward on the right or left hand side of the display line indicates that the text continues outside the display. You can move the text with the control elements ▷ and ◁ by moving the pointer past the end of the line, to allow you to read the rest of the text.

See Operating Examples on page 28 for an example of manual input.

Disabling and Enabling Programming

To prevent unauthorized personnel causing programming errors through the operating and monitoring module, set a customer code – a personal, freely selectable code number which may be up to 9 digits. A device protected by a customer code still displays all functions and values but it requests input of the code number before allowing a parameter to be reset.

Note: The customer code is activated 10 minutes after you have programmed Parameter 5.2 Customer Code.

Programming is enabled when you:

- enter the requested customer code for the current parameter. (Only the current parameter is enabled for reprogramming. All the others are still waiting for input of the customer code.)
  or
- release the programming lock for all parameters at once using the Code Input Parameter (see Parameter 5.1 on page 56).

The programming lock will be released for approximately 10 minutes.

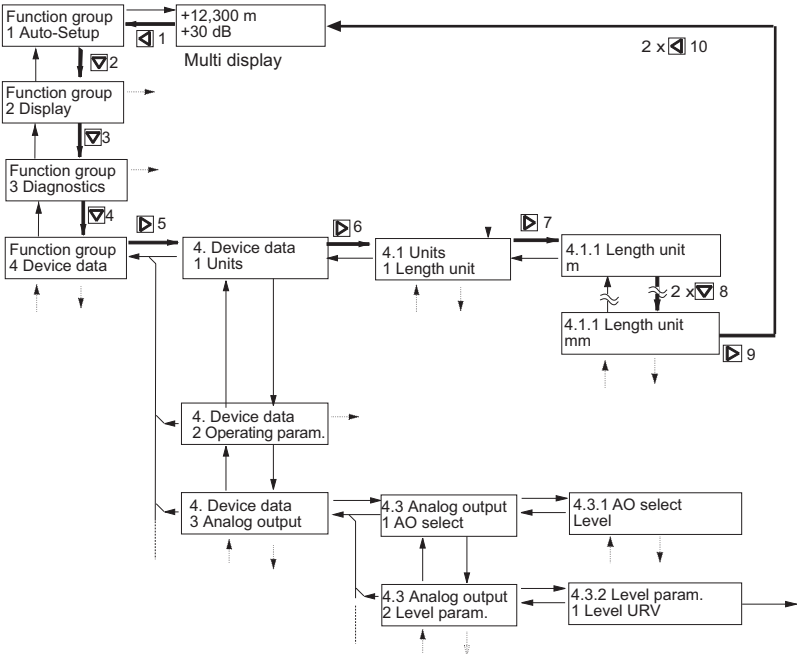
When you return to the multi-display or enter a number in the Code Input parameter which is different from the customer code, or do not operate the device for 10 minutes, the programming lock is enabled.

Note: If Customer Code (Parameter 5.2) is 0, programming of parameters is always enabled. We strongly recommend that a customer code be entered after all programming is completed to secure the programmed values from change. The code must be set for outdoor applications where rain drops may inadvertently activate the optical control elements.

Operating Examples

Example 1(HART)

The length unit should be changed from **m** to **mm**. The starting point is the multi-display.



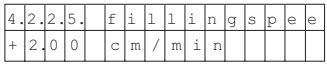
Follow the path traced with a bold line in the diagram above for input. The other paths lead to other device functions and parameters which are not required in this example. Touch the control elements shown next to the numbered operating steps.

Example 2

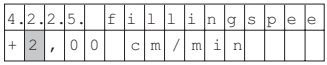
The filling speed should be changed from 2.0 cm/min to 100 cm/min.

Access the **Fill speed** parameter from the multi-display according to instructions on page 24.

The default setting appears in the display

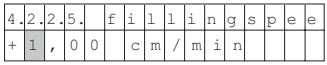


Enable the programming.
The second segment of the second display line flashes.



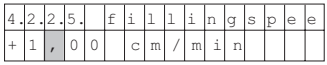
1 x ▽

Set the digit to 1 with the ▽ control element.



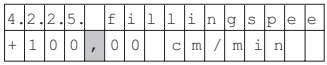
1 x ▷

Select the decimal point with the ▷ control element.



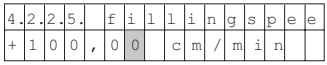
2 x △

Press the △ control element twice so that two other places appear in front of the decimal point.



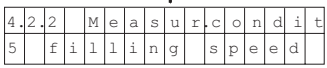
2 x ▷

Select the last decimal place with ▷



1 x ▷

And end the input with the ▷ control element ("Enter" function)

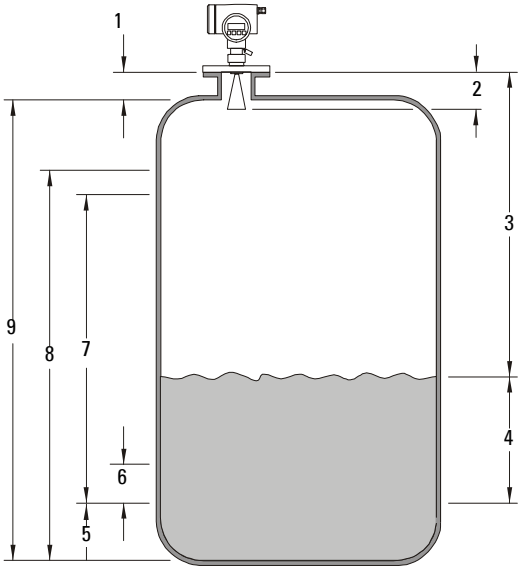


Parameters (HART)

The parameter groups are followed by the parameters within each group. The parameter tables show the values you need to enter and are followed by additional information when necessary. Factory settings are displayed after the parameter name, where applicable.

Functional Dimensions

1. Nozzle height
2. Dead band
3. Raw value (measured)
4. Level (=calculated value)
5. Lower range value
6. Lower limit
7. Upper limit
8. Upper range value
9. Vessel height



Required Parameters

Note: The following parameters are absolutely essential for proper operation of the device. They apply to all applications and are required to make the system operational.

1. Auto-Setup

Language Local (F = English)

Language of the local user interface

Value	English
	Deutsch

Length Unit (F = m)

Units of measurement

Value	cm
	m
	mm
	ft
	in

Nozzle Height (F = 0 m)

Length of nozzle from top of flange to top of vessel (see Functional Dimensions on page 30)

Value	numerical value

Tank Height (F = 20 m)

Height of vessel from bottom of nozzle to bottom of vessel (see Functional Dimensions on page 30)

Value	numerical value

Level URV (F = 20 m)

Full scale of level (see Functional Dimensions on page 30)

Value	numerical value

Set the URV as the level above the bottom of the vessel (see Functional Dimensions on page 30) in the units system selected with Function 4.1.1. It corresponds to an output current of 20 mA.

Level LRV (F = 0 m)

Empty scale of level (see Functional Dimensions on page 30)

Value	numerical value

Set the LRV as the level above the bottom of the vessel (see Functional Dimensions on page 30) in the units system selected with Function 4.1.1. It corresponds to an output current of 4 mA.

Level damping (F = 1 s)

Damping of level in s

Value	numerical value

Set the damping of the level value in seconds. It acts on the analog output, the limit value monitor and the local display. For damping of the sensor signal, set Parameter 4.2.3.

Application Type (F - Liquid [process])

Use of the vessel

Value	Liquid (store)
	Liquid (process)
	Silo1 (solids)
	Silo2 (solids)
	User tank1
	User tank2

Select Silo1 (solids) for tall, narrow silos. Select Silo 2 (solids) for large diameter silos, typically used for cement. In most cases you set one of the pre-specified applications here. The user vessels may adopt configurations which deviate from the factory settings. These are designed for special applications loaded at the factory or by service. The following parameters cannot be accessed when you set a user vessel: Parameter 4.2.2.2, Parameter 4.2.2.5, Parameter 4.2.2.6, Parameter 4.2.3.1 and Parameter 4.2.3.5.

Additional Parameters

2. Display

2.1: Multi-display (F = level in m Signal to noise ratio in db)

Display of two measured values. Values are determined in Parameter 4.5.1.1 (Line 1 Local) and in Parameter 4.5.1.4 (Line 2 Local).

2.2: Level (F = m)

Current level of measured medium (set unit using Length Unit in Auto-Setup)

2.3: Volume (F = m^3)

Volume of measured medium (set unit using Parameter 4.1.2 [Volume Unit])

2.5: Current Output

Value of the analog output in mA

When the device electronics are working properly, the displayed current value will correspond to the measured output current.

2.6: Digital Output

State of digital output

3. Diagnostics

3.1: Status

Here you can access current status messages of the device. Parameter 3.1.1 is always accessible; other parameters (Parameter 3.1.x) appear in the appropriate order if they contain error messages.

3.1.1: Wear

3.1.1.1: Operating Hours

Total previous operating time of the device in hours (approximate value)

3.1.1.2: Maximum Temperature (F = 26°C)

Previous maximum internal temperature of the device

Note: This temperature must not exceed 85°C (185°F) or warranty may be void.

3.1.1.3: Minimum Temperature (F = 26°C)

Previous minimum internal temperature of the device

3.1.1.4: Aging

Approximate value for the previous life of the device in % (100% = approx. 10 years)

This parameter outputs a calculated percentage which estimates the wear of the device due to aging.

3.1.1.5: Hours > 85°C

Total time the maximum permissible internal temperature was exceeded, in hours

3.1.x: Sensor, electronics, software, application, parameters, service

These parameters are only displayed if they contain an error message. The number of the menu items matches the number of defective functions and can range in extreme cases from 3.1.2 to 3.1.7.

See Troubleshooting on page 66 for the individual error messages and possible remedies.

3.1.x: Sensor

Diagnostic messages of the sensor

and/or

3.1.x: Electronics

Diagnostic messages of the electronics

and/or

3.1.x: Software

Diagnostic messages of the software

and/or

3.1.x: Application

Diagnostic messages to the application

and/or

3.1.x: Parameters

Display of the false parameters

and/or

3.1.x: Service

For service purposes only

3.2: Device Test

3.2.1: Self-test

Check device state

The device integrates the self-test routines in the ongoing measurements; it completes them after approximately 10 seconds. It confirms a successful self-test with the display **OK**. The display **not OK** signals an error. Read out the error type according to Parameter 3.1.x.

3.2.2: Display test

Visual check of LCD

You can test the LCD with this function. The display first goes blank for 5 seconds and then lights up for another 5 seconds so that you can determine whether individual display points have failed.

3.3: Simulation

This parameter can support testing the correct functions of the connections during commissioning or maintenance of the device. With the two sub-parameters, you can temporarily replace the measured values at the analog and digital output with known simulated output values.

Note: The Simulation parameter influences output to the control system.

3.3.1: Simulate AO (F = 4 mA)

Simulation of the analog output signal

Value	4 mA
	10 mA
	12 mA
	20 mA
	Error signal

When this parameter is accessed and a value is entered, the device sets the defined current value that can be validated.

Complete the parameter function by touching ◁ so the analog output again gives the measured value.

3.3.2: Simulate DO (F = End)

Simulation of the digital output signal

Value	Relay on
	Relay off
	End

Select the applied output value (relay on or relay off).

The parameter function is completed by touching ◁ so that the digital output again gives an alarm/limit.

3.4: Sensor Variables

You can read out device-internal data with this parameter group. The displayed values depend on the respective application. You can access the following data:

3.4.1: Raw Value (for service purposes only)

Distance from the flange to measuring medium

The measured distance from the flange to the surface of the measuring medium.

3.4.2: Echo Amplitude

Measure of quality of reflection

This dimensionless value is an absolute measure of the strength of reflection at the measuring medium. Its display can be evaluated as follows:

- **x > 1:** very good
- **1 > x > 0.5:** good
- **0.5 > x > 0.05:** satisfactory
- **x < 0.05:** uncertain

3.4.3: S/N Ratio

Signal-to-noise ratio of the measured value in dB

S/N ratio provides a relative measure of the strength of reflection of the measuring medium in dB. Its display can be evaluated as follows:

- **x > 20:** very good
- **20 > x > 10:** good
- **x < 10:** satisfactory

3.4.4: Validity

Validity of the measured value in %

This parameter provides a percentage measure of the certainty that the displayed measured value corresponds to the real level and does not represent a multiple echo or a fixed target. Its display can be evaluated as follows:

- **x > 70:** very good
- **70 > x > 50:** good
- **50 > x > 20:** uncertain
- **x < 20:** no plausible measured value

3.4.5: Sensor Temp

Sensor temperature

4. Device Data

4.1: Units

4.1.1: Length Unit = Parameter 1.2

4.1.2: Volume unit (F = m^3)

Value	bbl
	yd^3
	ft^3
	in^3
	bush
	bbl (liq)
	l
	m^3
	hL
	Gal
	ImpGal

4.1.4: Temperature Unit (F = °C)

Unit of the sensor temperature

Value	°C
	°F
	K

4.1.5: Other units (F = SI)

Units system for all other units

Value	SI unit
	US/UK unit

With this function, determine whether you want to enter the operating parameters (see Parameter 4.2) in SI or in British Imperial (US/UK) units. The selected units of the measured value output and sensor temperature as well as the decimal point are not influenced by this setting.

4.2: Operating Parameters

With this parameter group, define the parameters of your vessel, the measuring medium and the calculation of the measured signal. Signal-specific default settings such as the failure signal or the upper current limit of the analog output signal are assigned to the functions of the respective outputs (see Parameters 4.3 and 4.4).

4.2.1: Tank Geometry

4.2.1.1: Nozzle Height = Parameter 1.3

4.2.1.2: Tank Height = Parameter 1.4

4.2.1.3: Stilling Pipe? (F = no)

Stilling pipe available?

Value	yes
	no

By selecting **yes** or **no**, you specify whether the device is mounted on a stilling pipe. If you select **yes**, Parameter 4.2.1.3.2 is enabled so you can specify the internal diameter of the stilling pipe.

4.2.1.3: Pipe Diameter (F = 100 mm)

Internal diameter of the stilling pipe

Value	numerical value

4.2.2: Measuring Conditions

4.2.2.1: Application Type (F - Liquid [process])

Use of the vessel

Value	Liquid (store)
	Liquid (process)
	Silo1 (solids)
	Silo2 (solids)
	User tank1
	User tank2

Select Silo1 (solids) for tall, narrow silos. Select Silo 2 (solids) for large diameter silos typically used for cement. In most cases you set one of the pre-specified applications here. The user vessels may adopt configurations which deviate from the factory settings. These are designed for special applications loaded at the factory or by service. the following parameters cannot be accessed when you set a user vessel: Parameter 4.2.2.2, Parameter 4.2.2.5, Parameter 4.2.2.6, Parameter 4.2.3.1 and Parameter 4.2.3.5.

4.2.2.2: Surface (F = wavy)

Surface structure of the measuring medium. Not displayed if a user vessel is selected in Parameter 4.2.2.1.

Value	smooth
	wavy
	turbulent

This parameter is not displayed when a user vessel is selected in Parameter 4.2.2.1. In the case of poorly reflecting measuring media, you may be able to improve the measuring results by setting a different surface structure here. If your measuring medium forms waves more than 1 cm in height, you should select the **wavy** setting. The turbulent setting is recommended for waves greater than 10 cm.

4.2.2.3: Dead band (F = 0.4 m)

Area below the flange in which measured values are ignored

Value	numerical value, Minimum value = Length of the antenna

Specification of a dead band in the units system selected according to Parameter 4.1.5 defines a minimum distance from the flange which the measuring medium must have for the device to accept the measured values as valid. This suppresses reflective interference generated by the nozzle, close obstacles, or the antenna.

Note: The dead band should exceed the antenna's length.

4.2.2.4: Correction Factor (F = 1.0)

Correction factor for physical measuring influences

Value	numerical value

The propagation time of the microwaves between the antenna and the measuring medium changes slightly depending on the pressure inside the vessel. If this pressure is constant, however, it can be included in the evaluation according to the equation:

$$K = \frac{1}{\sqrt{1 + (\varepsilon_{r,\,Gas} - 1) \cdot \frac{273 \cdot p}{T_{Gas} + 273}}}$$

K = correction factor, p = pressure inside the vessel in bar, Tgas = gas temperature in °C, $\varepsilon_{r,\,Gas}$ = dielectric of the overlying gas, e.g. $\varepsilon\rho_{,\,air}$ = 1.00059

Enter the correction factor *K* as a dimensionless value.

4.2.2.5: Filling Speed (F = 200 mm/min)

Typical speed of change of the level. Not displayed if user vessel is selected in Parameter 4.2.2.1.

Value	numerical value

This parameter is not displayed when a user vessel is selected in Parameter 4.2.2.1. When you determine that the displayed measured value does not follow the change in the height of the level in the vessel, you can enter a value for the speed with which it generally changes. This assigns a greater probability to measuring targets which move at this speed.

If the display does not follow the level height continuously but in abrupt jumps, you should choose a higher filling speed. If multiple echoes are indicated during filling/emptying a vessel, select a lower filling speed. In the case of very low filling speeds (a few mm/min) switch off Parameter 4.2.3.3. If different filling/emptying speeds occur, select the higher speed.

4.2.2.7: Failsafe Level (F = Hold Continuously)

Selects the default measurement in the event that the failsafe timer expires

Value	100 %
	0 %
	Hold Continuously

4.2.2.8: Failsafe Timer (F = 10 min)

Sets the time delay, in minutes, before entering failsafe level

Value	1 min
	2 min, etc.

The failsafe timer begins when there is a loss of echo condition. This loss of echo condition will occur when there is no signal available above the Auto False Echo Suppression threshold as defined in Parameter 4.2.3.9.

4.2.2.9: Range Extension (F = 3 m)

Sets the amount of range extension as measured from the tank height and extending beyond the measurement range. For vessels with conical or parabolic bottoms, you may need to increase this value to ensure an empty vessel reads empty.

Value	numerical

4.2.3: Sensor Parameter

Here you can view and change the sensor parameters which you have selected according to Parameter 4.2.2.

Note: The factory settings for the user vessels are not editable.

4.2.3.1: Sensor Damping (F = 10 s)

Averaging of measuring signal. Not displayed if a user vessel is selected in Parameter 4.2.2.1.

Value	numerical

This parameter is not displayed when a user vessel is selected in Parameter 4.2.2.1. The sensor damping influences the evaluation of the measuring signal. If the level generally only changes slowly and continuously, a time constant set here can improve the measuring accuracy and the validity in poorly reflecting measuring media or those with a restless surface. The sensor damping must always be smaller than the interval of the time of change of the level (e.g. 1 mm/10 s), because too high a value would have a negative influence on the measuring result.

Enter the damping in seconds.

Note: Specification of a damping directly influences the evaluation of the measuring signal. If you only want to dampen the calculated outputs at the analog output, you should set the damping of level or volume described in Function 4.2.4.4.

4.2.3.2: Multiple Echo (F = on)

Evaluate multiple echo

Value	on
	off

The multiple echo evaluation suppresses multiple reflections by assigning them a lower probability than the measuring signal.

4.2.3.3: Echo Motion (F = off)

Evaluate echo motion

Value	on
	off

Dynamic processes in the vessel are included in the evaluation of the measuring targets. The typical filling speed can be set in Parameter 4.2.2.5. If the measured value still does not follow the level height, switching off echo motion may improve the result.

4.2.3.4: Window Tracking (F = on)

Value	on
	off

A window follows the measured value which it is forced to track. The window size is calculated from the set filling speed. Switch off window tracking for applications where the SITRANS LR 400 is unable to keep up to level changes or if the output remains By using SIMATIC PDM, you can display a list of all echoes in your vessel. It provides the distance between the flange and the measuring medium's surface, as well as the distances of fixed targets. These may be directly used and transferred to the fix distance list.

4.2.3.8: Auto False Echo Suppression (F = use)

Learns and records the current signal up to the suppression distance setting. These signals are then ignored during operation.

Value	Off
	Record
	Use

If all signals fall below this defined threshold, then the failsafe timer is initiated.

4.2.3.9: Auto False Echo Suppression Distance (F = 2/3 vessel height)

Defines the end point of the auto false echo suppression distance

Value	variable

4.2.4: Level Parameter

4.2.4.1: Level URV (= Parameter 1.5)

4.2.4.2: Level LRV (= Parameter 1.6)

4.2.4.3: Level Damping (= Parameter 1.7)

4.2.4.4: MinLim Level (F = 0 m)

Lower limit value of the level (see Functional Dimensions on page 30)

Value	numerical value

Set the lower limit value of the level as a height above the LRV.

4.2.4.5: MaxLim Level (F = 0 m)

Upper limit value of the level (see Functional Dimensions on page 30)

Value	numerical value

Set the upper limit value of the level as a height above the LRV.

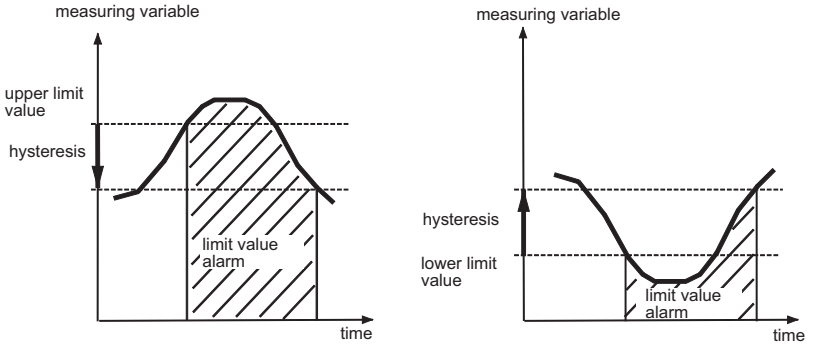
4.2.4.6: HYST Level (F = 0.5 m)

Hysteresis of the level limit values

Value	numerical value

Set the hysteresis of the limit values in the units system selected according to Parameter 4.1.1 (see diagram below).

Limit value alarm



4.2.5: Volume Parameters

To calculate the volume of the measuring medium, you need the level parameters (see Parameter 4.2.4) in the units selected according to Parameter 4.1.1 and additionally a vessel characteristic (Parameter 4.2.5.7).

4.2.5.1: Volume URV (F = 20 m^3)

Full scale of the volume

Value	numerical value

4.2.5.2: Volume LRV (F = 0 m^3)

Start of scale of the volume

Value	numerical value

4.2.5.3: Volume Damping (F = 1 s)

Damping of the volume

Value	numerical value

4.2.5.4: MinLim Volume (F = 0 m^3)

Lower limit value of the volume

Value	numerical value

4.2.5.5: MaxLim Volume (F = 0 m^3)

Upper limit value of the volume

Value	numerical value

4.2.5.6: HYST Volume (F = 0.5 m^3)

Hysteresis of the volume limit values

Value	numerical value

4.2.5.7: Tank Characteristic (F = Calibrate/table)

Determining the vessel characteristic

Value	Calibrate/table
	Calculate

Select the option Calibrate/table or Calculate as required. The selection controls the display of Parameter 4.2.5.8.

The possibilities of each parameter are listed below. For the values associated with Parameter 4.2.5.8: Calculate, go to page 47.

4.2.5.8: Calibrate/table

If your vessel deviates from the forms offered, the necessary data is not available or is unknown, or you need a vessel characteristic with greater accuracy you will need to use a level/volume calibration table. You can enter reference values from a table provided by the vessel manufacturer or do the calibration manually and enter the determined reference values.

You can only enter pairs of values consisting of level and volume.

Note: Entering the vessel characteristic with the operation and monitoring module can be a time-consuming procedure. It can be done more quickly and comfortably with the SIMATIC PDM software. There, an entered table can be edited simply – an option which is only conditionally possible with the operating and monitoring module.

The 4.2.5.8 Calibrate/table parameter offers the following selection possibilities:

4.2.5.8.1: Calibrate

Here you can enter up to 50 reference values whose levels SITRANS LR 400 measures. Enter the appropriate volume (determined by manual calibration).

If you access this parameter, first the currently measured level is displayed. Accept it by pressing ◁. Enter the appropriate volume: save it by pressing ▷ or reject it by pressing ◁.

Then the device displays **Calibrate**. Access again by pressing ▷ to select a further reference value. The device automatically offers you the next undefined reference value.

We recommend entering a maximum of two or three reference values for the linear range of the vessel and to use the others for the non-linear portion.

If you enter a second volume value for the same level, the reference value saved earlier is overwritten.

4.2.5.8.2: Enter table

Manual entry of a table

Value	numerical value

Here you can enter up to 50 reference values provided by the vessel manufacturer in any order.

The first reference value is offered when you access the parameter. Enter the level as a distance from the floor of the vessel in the units selected according to Parameter 4.1.1 (Enter level) and the volume corresponding to the level (Enter volume).

The device then displays **Enter table** again. Access again to enter a further reference value. The device automatically offers you the next undefined reference value.

We recommend entering a maximum of two or three reference values for the linear range of the vessel and to use the others for the non-linear part.

If you enter a second volume value for the same level, the reference value saved earlier is overwritten.

4.2.5.8.3: Show table

Display table

Value	selection

Here you can display the entered reference values sorted on levels. In the second line, the level corresponding to the first reference value appears first and then the corresponding volume value when you switch further. Each switching accesses a further reference value.

4.2.5.8.4: Clear table

Delete table

Value	selection

If you choose **all** in this parameter, the entire saved table is deleted. You can delete individual reference values with the selection **1st**, **2nd** etc. that were displayed in Parameter 4.2.5.8.3.

Note: The reference values are sorted in order of filling states and do not necessarily correspond to the order of the value pairs you have entered.

or

4.2.5.8: Calculate

Automatic calculation of a vessel characteristic is faster than manual entry by calibrating or a table. However, the calculated vessel characteristic is not as accurate as a manually calibrated characteristic – especially in the non-linear areas of the vessel in which errors of ≤ 1 % may occur. As well, the necessary data which you can get from the design documents of your vessel must still correspond to the real conditions.

The 4.2.5.8: Calculate parameter requires the following parameters:

4.2.5.8.1: Tank Design (F = Vertical Cylinder)

Value	Linear
	Vertical cylinder
	Horizontal cylinder
	Sphere

Enter the external form of your vessel. You can choose from:

- Linear (any form with vertical walls and a flat floor)
- Vertical cylinder (vertically standing cylindrical form with curved covers)
- Horizontal cylinder (horizontal cylindrical form with curved caps)
- Sphere

4.2.5.8.2: Bottom Design (F = Dished end)

Value	Dished end
	Basket end
	Bullet bottom

Enter the form of the two vessel cover caps. You can choose from:

- Dished (according to DIN 28011)
- Basket (according to DIN 28013)
- Bullet (hemispherical shaped floor)

4.2.5.8.3: Tank volume (F = 20 m^3)

Value	numerical value

4.3: Analog Output

4.3.1: Error Level (F = D: Error Signal)

Level for the error signal to alarm in Analog or Digital output

Value	D: Error Signal
	D+F: Error Signal
	D+F+W: Error Signal

When D is selected, all errors are displayed. When D+F is selected, there is special handling for failsafe. When D+F+W is selected, there is special handling for warnings.

4.3.2: AO Select (F = Level)

Assignment of a measured value to the analog output

Value	Level
	Volume

Here you can set whether the analog output supplies the level or the volume to the control system.

The selection controls the following Parameter 4.3.3.

4.3.3: Level Parameter (= Parameter 4.2.4)
or
4.3.3: Volume Parameter (= Parameter 4.2.5)

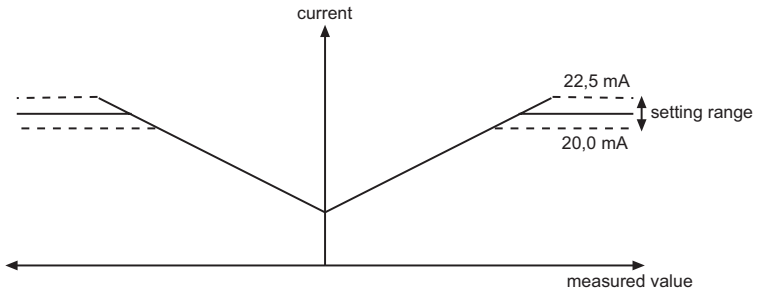
4.3.4: Current Limit (F = 20 mA)

Upper current limit

Value	20 - 22.5 mA

Here you can set the upper current limit of the output signal in steps of 0.1 mA (see Current limiting diagram below).

Current limiting



The URV is always at 20 mA. If you set the current limit to a higher value, you can have the measured values output outside the measuring range (up to approx. 115%).

4.3.5: Error Signal (F = 3.6 mA)

Current value of the error signal

Value	3.6 mA
	22.0 mA
	24.0 mA
	Hold 10 s
	Hold 1 min
	Hold 2 min
	Hold 3 min
	Hold continuously

In the event of a fault the device applies the current defined here to the analog output. You can choose between 3.6 mA, 22 mA, 24 mA, Hold 10 s, Hold 1 min, Hold 2 min, Hold 3 min and Hold continuously.

When the **Hold...** values are selected, the device outputs the last valid value until the set time has run out or the fault has been eliminated. If the fault persists after the set time runs out, the analog output switches to an error signal of 3.6 mA.

Note: A fault is different from a loss of echo which indicates a failsafe condition.

4.4 Digital Output

4.4.1: Function DO (F = Alarm)

Assignment of the digital output

Value	MaxLim Level
	MinLim Level
	MaxLim Volume
	MinLim Volume
	Alarm
	No Function

Here you can select whether the digital output supplies the upper or lower limit value of level or volume or an alarm (device error, measurement error; see Parameter 3.1) to the control system. If you select the **No function** option, the digital output is switched off.

Selection of a limit value enables Parameter 4.4.3.

4.4.2: Error Level (F = D: Error Signal)

Level for the error signal to alarm in Analog or Digital output

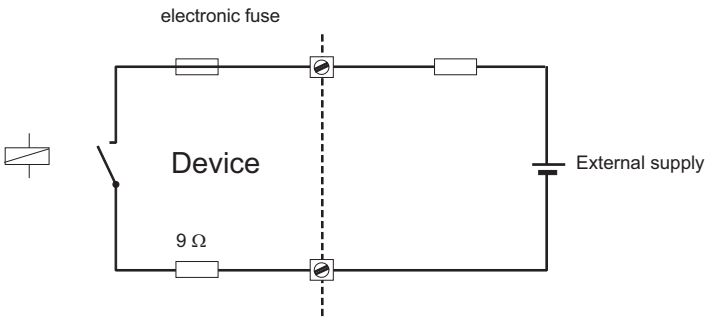
Value	D: Error Signal
	D+F: Error Signal
	D+F+W: Error Signal

When D is selected, all errors are displayed. When D+F is selected, there is special handling for failsafe. When D+F+W is selected, there is special handling for warnings.

4.4.3: Signal Type DO (F = Relay closes)

Value	Relay closes
	Relay opens

Here you can determine the behavior of the digital output. Select whether its contact closes or opens at an event.



The following parameters are only enabled when the digital output supplies a limit value.

4.6.8.6: Antenna offset (see page 56)

4.6.8.7: Reference distance (see page 56)

4.4.4: Level Parameter (= Parameter 4.2.4)
or
4.4.4: Volume Parameter (= Parameter 4.2.5)

4.5: Display Parameters

4.5.1: Multi-Display

4.5.1.1: Line 1 Local (F = Level)

Choice of measured value in line 1

Value	Level
	Volume

4.5.1.2: Display Local (F = Eng Unit)

Method of display in line 1

Value	Eng unit
	%
	Bar graph

4.5.1.3: Level Parameter (= Parameter 4.2.4)
or
4.5.1.3: Volume Parameter (= Parameter 4.2.5)

4.5.1.4: Line 2 Local (F = S/N ratio)

Display in line 2

Value	Level
	Volume
	Temperature
	Validity
	S/N ratio
	Amplitude
	Digital output
	Analog output

4.5.1.5: Level Parameter (= Parameter 4.2.4)
or
4.5.1.5: Volume Parameter (= Parameter 4.2.5)

4.5.2: Language Local (= parameter 1.1)

4.5.3: LCD Backlight (F = off)

Background illumination of the LCD

Value	on
	off

4.6: Device Information

4.6.1: Power Supply (according to customer specifications)

Voltage range of the built-in power supply unit

Value	non-editable

4.6.2: Process Temperature (according to customer specifications)

Temperature range of the flange in °C

Value	non-editable

4.6.3: Electrical Connection (according to customer specifications)

Value	non-editable

4.6.4: Antenna and Flange

4.6.4.1: Flange Size (according to customer specifications)

Size of the flange

Value	DN 80, 3 in
	DN 100, 4 in
	DN 150, 6 in
	Special Design

4.6.4.2: Flange Type (according to customer specifications)

Type of flange

Value	DIN 2527
	ANSI
	JIS
	Special Design

4.6.4.3: Pressure Stage (according to customer specifications)

Pressure range of the process connection

Value	non-editable

4.6.4.4: Antenna Type (according to customer settings)

Value	Horn type long
	Horn type short
	Special design

4.6.4.6: Flange Material (according to customer specifications)

Value	316/316L*
	Special Design

4.6.4.7: Seal Material (according to customer specifications)

Sealing material

Value	Teflon
	Kalrez
	Viton
	Special Design

4.6.5: Tag (according to customer specifications)

Device identification

Value	up to any eight characters

4.6.6: Descriptor (according to customer specifications)

Measuring point description

Value	up to any 16 characters

4.6.7: Message (according to customer specifications)

Measuring point message, e.g. the date of the last check or clean

Value	up to any 32 characters

4.6.8: Manufacturer Identification

4.6.8.1: Serial Number (F = unique number)

Factory serial number

Value	non-editable

4.6.8.2: Order Number (according to customer specifications)

Device order number (delivery state)

Value	non-editable

4.6.8.3: Fld Dev Rev (F = Number)

Device version

Value	non-editable

*Flange material may be either 316/316L or 1.4571 at the discretion of Siemens Milltronics Process Instruments Inc. Actual flange material will be noted on the side of the flange.

4.6.8.4: Software Revision (F = Number)

Value	non-editable

4.6.8.5: Hardware Revision (F = Number)

Value	non-editable

4.6.8.6: Antenna Offset (F = approx. 0.5 m [calibration value])

Distance sensor/flange

The antenna offset defines the propagation time of the measuring signal between the sensor and the flange as a distance. It is preset at the factory and cannot be changed.

4.6.8.7: Reference Difference (F = approx. 106 m [calibration value])

Internal reference distance

The length of the reference distance in the units system selected according to Parameter 4.1.5 can only be read out and not changed. The device uses this to calibrate itself so that no manual adjustment is necessary in long-term operation.

5. Options

5.1: Enter Code

Input of customer code to enable programmability

Value	Customer code

The device compares a code number which you enter here with the code defined in Parameter 5.2. If your entry matches the customer code completely, it releases the programming lock for all parameters. Any other code number locks and disables programming.

5.2: Customer Code (F = 0)

Determination of customer code

Value	up to 9-digit code

Here you define the customer code (up to nine digits), with which you can protect the device parameters against programming errors. It is strongly recommended that a customer code be entered after all programming is completed to secure the programmed values from changes. This is imperative for outdoor applications where rain drops may inadvertently activate the optical control elements.

Use of the customer code is explained in Disabling and Enabling Programming on page 27.

5.3: Factory Reset (F = no)

Reset all parameters to factory setting

Value	yes
	no

This parameter allows you to reset all parameters to the original factory setting as described in Parameters (HART) on page 30.

Parameters (Profibus-PA)

Parameter, menu identification	Description	Factory Setting	Setting Possibilities
1: Auto-Setup			
Language local	Language of the local user interface	English	English Deustch
Length Unit		m	cm m mm ft in
Nozzle height	Height flange to top of tank	0 m	numerical value
Tank Height	Height tank bottom to top	20 m	numerical value
Level URV	Full scale of level (see Functional Dimensions Diagram)	20 m	numerical value
Level LRV	Start of scale of level (See Functional Dimensions Diagram)	0 m	numerical value
Level damping	Damping of level in s	1 s	numerical value
Application type	Use of the vessel	Liquid (process)	Liquid (store) Liquid (process) Silo1 (solids) Silo2 (solids) User tank1 User tank2
Bus address	Current bus address	126	0 to 126
2: Display			
2.1: Multi-display	Display of two measured values	Level/Signal-to-noise ratio in dB	non-editable
2.2: Level	Level of measured medium	m	non-editable
2.3: Volume	Volume of measured medium	m^3	non-editable
2.5: Current Output	Value of the analog output in mA		non-editable
3: Diagnostics			
3.1: Status			

Parameters (Profibus-PA)

Parameter, menu identification	Description	Factory Setting	Setting Possibilities
3.1.1: Wear			
3.1.1.1: Operating Hours	Total previous operating time of the device in hours (approximate value)		non-editable
3.1.1.2: Maximum temp.	Previous maximum temperature of device	26°C	non-editable
3.1.1.3: Minimum temp.	Previous minimum temperature of the device	26°C	non-editable
3.1.1.4: Aging	Approximate value for the previous life of the device in % (100% = approx. 10 years)		non-editable
3.1.1.5: Hours > 85°C	Previous time during which the maximum permissible sensor temperature was exceeded in hours		non-editable
3.1.x: Sensor and/or	Diagnostic messages of the sensor		non-editable
3.1.x: Electronics and/or	Diagnostic messages of the electronics		non-editable
3.1.x: Software and/or	Diagnostic messages of the software		non-editable
3.1.x: Application and/or	Diagnostic messages to the application		non-editable
3.1.x: Parameters and/or	Display of the false parameters		non-editable
3.1.x: Service	for service purposes only		non-editable
3.2: Device test			
3.2.1: Self-test	Check device state		non-editable
3.2.2: Display test	Visual check of LCD		non-editable
3.3: Sensor variables			
3.3.1: Raw value	Distance from flange to measured medium		
3.3.2: Echo Amplitude	Measure of quality of reflection		
3.3.3: S/N ratio	Signal-to-noise ratio of the measured value in dB		
3.3.4: Validity	Validity of the measured value in %		
3.3.5: SensorTemp	Sensor temperature		
4: Device data			

Parameter, menu identification	Description	Factory Setting	Setting Possibilities
4.1: Units			
4.1.1 Length unit	= [1.2]		
4.1.2: Volume unit		m^3	bbl yd^3 ft^3 in^3 bush bbl (fl.) l m^3 hL Gal ImpGal
4.1.4: Temperature unit	Unit of the sensor temperature	°C	°C °F K
4.1.5: Other units	Units system for all other units	SI	SI unit US/UK unit
4.2: Operating parameters			
4.2.1: Tank geometry			
4.2.1.1: Nozzle height	= [1.3]		
4.2.1.2: Tank height	= [1.4]		
4.2.1.3: Stilling pipe?	Stilling pipe available?	no	yes no
If yes: Pipe diameter	Diameter (internal) of the stilling pipe	100 mm	numerical value
4.2.2: Measuring conditions			
4.2.2.1: Applic. type	Use of the tank	Liquid (process)	Liquid (store) Liquid (process) Silo1 (solids-pellets) Silo2 (solids-powders) User tank1 User tank2
4.2.2.2: Surface	Surface structure of the measured medium Not displayed if a user tank is selected in [4.2.2.3].	wavy	smooth wavy turbulent

Parameter, menu identification	Description	Factory Setting	Setting Possibilities
4.2.2.3: Dead band	Area beneath the flange in which measured values are ignored	0.4 m	numerical value, Minimum value = Length of the antenna
4.2.2.4: Correction factor	Correction factor for physical measuring influences	1.0	numerical value
4.2.2.5: Filling speed	Typical speed of change of the level Not displayed if a user tank is selected in [4.2.2.3].	200 mm/min	numerical value
4.2.2.7: Failsafe level	Selects the default measurement in the even the failsafe timer expires	Hold	100 % 0 % Hold
4.2.2.8: Failsafe timer	Sets the time delay, in minutes, before going into fail-safe level	10 min	1 min 2 min etc.
4.2.2.9: Range extension	Sets the distance below the tank height included in the evaluation	3 m	1 m 2 m etc.
4.2.3: Sensor parameter			
4.2.3.1: Sensor damping	Averaging of measuring signal Not displayed if a user tank is selected in [4.2.2.3].	10 s	numerical value
4.2.3.2: Multiple echo	Evaluate multiple echo	on	on off
4.2.3.3: Echo motion	Evaluate echo motion	on	on off
4.2.3.4: Window tracking		on	on off
4.2.3.8: Auto False Echo Suppression	Learns and records the current signal up to the suppression distance setting. These signals are then ignored during operation.	use	use record off
4.2.3.9: Auto False Echo Suppression Distance	Defines the end point of the Auto False echo suppression distance	0 m	variable
4.2.4: Level param.			

Parameter, menu identification	Description	Factory Setting	Setting Possibilities
4.2.4.1: Level URV	= [1.5]		
4.2.4.2: Level LRV	= [1.6]		
4.2.4.3: Level damping	= [1.7]		
4.2.4.4: Min Warn level	Limit before reach lower limit value	0 m	numerical value
4.2.4.5: MinLim level	Lower limit value of the level (See Functional Dimensions Diagram)	0 m	numerical value
4.2.4.6: MaxLim level	Upper limit value of the level (See Functional Dimensions Diagram)	0 m	numerical value
4.2.4.7: MaxWarn level	Limit before reach upper limit value	0 m	numerical value
4.2.4.8: HYST level	Hysteresis of the level limit values	0.5 m	numerical value
4.2.5: Volume param.			
4.2.5.1: Volume URV	Full scale of the volume	20 m^3	numerical value
4.2.5.2: Volume LRV	Start of scale of the volume	0 m^3	numerical value
4.2.5.3: Volume damping	Damping of the volume	1 s	numerical value
4.2.5.4: MinWarn volume	Limit before reach lower limit value	0 m	numerical value
4.2.5.5: MinLim volume	Lower limit value of the volume	0 m^3	numerical value
4.2.5.6: MaxLim volume	Upper limit value of the volume	0 m^3	numerical value
4.2.5.7: MaxWarn volume	Limit before reach upper limit value	0 m	numerical value
4.2.5.8: HYST volume	Hysteresis of the volume limit values	0.5 m^3	numerical value
4.2.5.9: Tank characteristic	Determining the tank characteristic	Calibrate/ table	Calibrate/table Calculate
4.2.5.9: Calibrate/table or 4.2.5.9: Calculate			

Parameter, menu identification	Description	Factory Setting	Setting Possibilities
4.2.5.9.1: Calibrate or 4.2.5.9.1: Tank design	Automatic litering		Confirm input
		Vertical cylinder	Linear Vertical cylinder Horizontal Cylinder Sphere
4.2.5.9.2: Enter table or 4.2.5.9.2: Bottom design	Manual entry of a table		numerical value
		Dished end	Dished end Basket end Bullet bottom
4.2.5.9.3: Show table or 4.2.5.9.3: Tank volume	Display table		Selection
		20 m^3	numerical value
4.2.5.9.4: Clear table or 4.2.5.9.4: Tank height	Delete table		Selection
	= [4.2.1.2]		
4.3: Output parameter			
4.3.1: BusIdentNr.			Profile specific Manufacturer specific
4.3.2: Bus address	= [1.8}		
4.4: Display param.			
4.4.1: Multi display			
4.4.1.1: Line 1 local	Choice of measured value in line 1	Level	Level Volume
4.4.1.2: Display local	Method of display in line 1	Eng unit	Eng unit % Bargraph
4.4.1.3: Level param. or 4.4.1.3: Volume param.	= [4.2.4]		
	= [4.2.5]		
4.4.1.4: Line 2 local	Display in line 2	S/N ratio	Level Volume Temperature Validity S/N ratio Amplitude Digital output Analog output
4.4.1.5: Level param.	= [4.2.4]		

Parameter, menu identification	Description	Factory Setting	Setting Possibilities
or 4.4.1.5: Volume param.	= [4.2.5]		
4.4.2: Language local	= [1.1]		
4.4.3: LCD backlight	Background illumination of the LCD	off	on off
4.5: Device info			
4.5.1: Power supply	Voltage range of the built-in power supply unit	according to customer specifications	non-editable
4.5.2: Process temperature	Temperature range of the flange in °C	according to customer specifications	non-editable
4.5.4: Electrical connection		according to customer specifications	non-editable
4.5.5: Antenna&flange			
4.5.5.1: Flange size	Rated width of the flange	according to customer specifications	DN 80, 3 in DN 100, 4 in DN 150, 6 in Special design
4.5.5.2: Flange type	Type of flange	according to customer specifications	DIN ANSI JIS Special design
4.5.5.3: Pressure range	Pressure range of the process connection	according to customer specifications	non-editable
4.5.5.4: Antenna type		according to customer specifications	Horn type long Horn type short Special design
4.5.5.6: Flange material		according to customer specifications	316/316L Special design
4.5.5.7: Seal material	Sealing material	according to customer specifications	Teflon Kalrez Viton Special design
4.5.6: Tag	Device identification	according to customer specifications	up to any eight characters

Parameter, menu identification	Description	Factory Setting	Setting Possibilities
4.5.7: Descriptor	Measuring point description	according to customer specifications	up to any 16 characters
4.5.8: Message	Measuring point message, e.g. the date of last check or clean	according to customer specifications	up to any 32 characters
4.5.9: Manufacturer identification			
4.5.9.1: Serial no.	Factory serial number	unique number	non-editable
4.5.9.2: Order no.	Delivery order no. (delivery state)	according to customer specifications	non-editable
4.5.9.3: Device revision	Device version	Number	non-editable
4.5.9.4: Software revision		Number	non-editable
4.5.9.5: Hardware revision		Number	non-editable
4.5.9.6: Antenna offset	Distance sensor/flange	approx. 0.5 m (calibration value)	non-editable
4.5.9.7: Reference distance	Internal reference distance	approx. 106 m (calibration value)	non-editable
5: Options			
5.1: Enter code	Input of customer code to enable programmability		Customer code
5.2: Customer code	Determination of customer code	0	up to 9 digit code
5.3: Factory reset	Reset all parameters to factory setting	no	yes no

Troubleshooting

The SITRANS LR 400 has left the factory in a fully tested condition. Carefully selected components and compliance with prescribed quality standards guarantee the high reliability of the SITRANS LR 400. In the unlikely event of a fault, please consult the instructions in this chapter before contacting the responsible customer services.

Classification of Faults

Faults occurring in the SITRANS LR 400 can be classified in the following groups:

- faults caused by ambient influences: over and undertemperature, moisture, contamination by the measuring medium and other substances, mains faults, vibration
- faults in the device: display, electronics, mechanics, connections

Please try to determine the fault and localize it as accurately as possible.

If the fault cannot be eliminated with the measures described, follow the instructions in Maintenance on page 69.

Self-test

Note: The device performs a self-test every time it is switched on. It is ready for operation when the LCD displays the multi-display and the control elements can be operated.

If you get fault messages after the self-test, please proceed according to Fault Messages on page 67.

If there is a malfunction in the device, you can also activate the self-test manually with Parameter 3.2.1.

Symptoms, Causes and Their Remedy

Symptom	Possible causes	Remedy
No display on the LCD	Defective or missing power supply	Check that the power supply is connected correctly.
	LCD is defective	Connect a HART Communicator or a PC/Laptop with SIMATIC PDM software. If the device can be parameterized from there, the LCD is defective.
	Electronics are defective	Measure the analog current output. If the output current is not between 3.6 mA < x < 22 mA, the electronics are defective. Replace the electronics unit as described in Maintenance on page 69.
A fault message is displayed	Internal fault	Call the fault display in Function 3.1. Proceed as described in Maintenance on page 69.

Symptom	Possible causes	Remedy
An incorrect measured value appears after Auto-Setup.	The device is not parameterized correctly according to the application	Set the device parameters and functions manually.
No measured value appears after the Auto-Setup (measured value 0 and the fault display flashes)	Internal fault	Call the fault display in Function 3.1. Proceed as described in Maintenance on page 69.
Material movement but output remains constant	Varying signal moves out of tracking window too frequently.	Set Window Tracking(4.2.3.4) to OFF.
SITRANS LR 400 reads 100% continually.	Check antenna for material buildup.	Clean antenna or order a purge (self-cleaning) kit.
	Nozzle interference, or end of horn is not inside vessel	Shorten nozzle or lower position of SITRANS LR 400.
SITRANS LR 400 reading stays above actual level	False echo from vessel (fixed obstruction)	Use 4.2.3.8 and 4.2.3.9 Auto False Echo Suppressions function
SITRANS LR 400 reads low or empty when material level is high	Multiple or indirect echo detected instead of first echo.	Set 4.2.3.2 Multiple Echo Tracking to ON. Try using Liquid Store application type 4.2.2.1.
	Highly sloped surface	Aim the SITRANS LR 400 using shims or order an Easy Aimer kit. Contact your Siemens representative for service and possible User parameter support.
SITRANS LR 400 reading is too slow.	Damping too high	Decrease 4.2.3.1 Sensor Damping Decrease Level Damping Set 4.2.3.4 to OFF (Window Tracking)
	Wndow Tracking was too slow.	
Optical Keypad doesn't function	Poor reflection from fingers	Try using a white object, like a business card.
	Alignment problem with glass window	Open cover and try optical elements with cover removed.
	Defective keypad	Return for replacement.
SITRANS LR 400 reading is drifting	Sloped material surface	Increase damping.

Fault Messages

The device indicates faults with a flashing letter on the right of the first line of the display. It has the following meaning:

- W: Warning – device is still ready for operation but faults may occur
- F: Fault – sporadic fault, device conditionally ready for operation
- D: continuous fault – device is not ready for operation

Under Parameter 3.1.x, you will find a fault log which indicates the type of the fault(s) that occured. It indicates the device function status in which the fault occurred and outputs an fault message in plain text.

The possible fault messages are as follows:

Function	Message	Possible causes	Remedy
Sensor	MW cable defective	Microwave cable not connected or line break	Contact your Siemens Milltronics representative
	Sensor defective	Overtemperature in device	Contact your Siemens Milltronics representative
	Check antenna	Antenna contaminated, damaged or not mounted	Check the antenna
	Sensor too hot	Sensor temperature exceeds 85 °C	Check the max. permissible ambient and process temperature
Electronics	all messages	Internal fault	Contact your Siemens Milltronics representative
Software	all messages	Internal fault	Contact your Siemens Milltronics representative
Application	No valid meas. value	fault in fixed target detection, fault in multiple echo detection, poorly reflecting measuring medium	1
	Tank empty detected	vessel is empty (only when sensor parameter **vessel empty detection** active)	Deactivate vessel empty detection if necessary
	false param.	incompatible parameters entered, e. g.: URV = LRV	Correct the parameters listed in the next function
Parameters	<Parameter to be corrected>	False parameterization	Perform the correction as indicated
Service	(various)		For service personnel only

1. Make the following modifications, starting with
   a. Check whether the fault still occurs after every step.
   b. Check the set measuring range and the deadband (Function 4.2.2.3).
   c. Check whether the filling speed has been correctly set (Function 4.2.2.5).
   d. Reduce the reflectivity (Function 4.2.2.6).
   e. Switch off the automatic fixed target detection (Function 4.2.3.6) if necessary.
   f. Switch off the multiple echo detection (Function 4.2.3.2) if necessary.

Maintenance

Disconnecting the Electronics

For maintenance, it is possible to separate the electronic enclosure of the device from the mechanical part (process flange) without endangering the pressure tightness of the vessel. Release the threaded ring of the electronics part from the mechanical part with a hook key 68/75 and remove the electronics part. Place the enclosed plastic cap on the mechanical part to prevent soiling.

Cleaning the Antenna

Depending on the type of measuring material, it may be necessary to clean the antenna at certain intervals to remove soiling which could affect the measuring result. You can clean it without removing the flange from the vessel.

1. Disconnect and remove the electronics part as described above.

Warning! As soon as you remove the pressure window from the mechanical part the vessel is no longer pressure-tight and explosion protected!

2. Remove the threaded ring with an M36 open-ended wrench, unscrew the pressure window and lift it off the mechanical part together with the white PTFE stopper.
3. Clean the inside of the antenna with compressed air and/or a brush. Make sure that the pressure window thread is clean. Apply fresh grease to the thread as required. Check the O-rings for damage and replace them if necessary.
4. If the PTFE stopper has come loose when removing from the pressure window, reinsert it long end first into the mechanical part. Push it into the guide up to its thickened stop.
5. Replace the pressure window and tighten it.
6. Reattach the electronics part to the mechanical part. Rotate the housing head to align it, before tightening the threaded ring.
7. Check the pressure tightness of the vessel.

WARNINGS:

- Never attempt to loosen, remove, or disassemble process connection or instrument housing with vessel contents.
- Improper installation may result in loss of process pressure.

For more frequent cleaning, apurging system installed between the flange and the horn antenna is an option. The system provides an inlet on the flange where cooling air or cleaning fluid passes through the flange and exits the inside of the horn to clean it. The customer will supply the purging medium by manual or automatic valve system. This option is only available with universal flanges.

Note: The glass pressure window is available on Zone 0 / Zone 20 ATEX versions. It is located under the threaded collar of the antenna and protects the electronics from conditions within the tank.

Certificates

The necessary certificates are enclosed separately.

Glossary

Term	Explanation
Antenna offset	Propagation time of the signal in the sensor, expressed as a distance
Current limit	The maximum possible value of the output signal in fault-free operation in mA. The value of the fail signal may be above the current limit with 24 mA.
Customer code	User-defined code which protects the device against accidental programming.
Dead band	Value range below the device flange declared unmeasurable.
Echo movement	Sensor parameter for a fuzzy rule which takes into account dynamic procedures in the measuring medium, for example, and therefore rules out fixed targets.
Fixed target	Permanently installed objects inside the vessel which may cause reflective interference, e.g. struts, agitators, feed pipes etc.
FMCW method	Frequency Modulated Continuous Wave method
Frequency deviation	Changing the transmission frequency in the FMCW method.
Level	Distance from the LRV to the surface of the measuring medium.
LRV	Lower limit of the valid measuring range as a distance from the bottom inside of the vessel.
Measuring medium	The (solid or liquid) contents of the vessel.
Multiple echo evaluation	Sensor parameter for a fuzzy rule which detects and suppresses multiple reflections of the measuring signal at the vessel walls.
Nozzle height	Distance from the top of the inside of the vessel to the bottom of the device flange.
PELV	Protected Extra Low Voltage
PTFE	Polytetrafluorethylene (Teflon®)
SELV	Safety Extra Low Voltage
Signal-to-noise ratio	Measure of the strength of reflection of the measuring medium in the current measuring situation in dB.
vessel height	Distance between the floor and top of the vessel.
Triple reflector	Metal instrument formed as a cubic segment with right angles.
URV	Upper limit of the valid measuring range as a distance from the bottom inside of the vessel.
Validity	Measure of the certainty of the current measured value in %.

Appendix I

Alphabetical Parameter List

Parameter Name	Menu Identification Number	Page Number
Aging	3.1.1.4	33
Analog output	4.3	48
Antenna offset	4.6.8.6	56
Antenna type	4.6.4.4	54
Antenna&flange	4.6.4	53
AO select	4.3.2	49
Application type	4.2.2.1	39
Auto False Echo Suppression	4.2.3.8	43
Auto False Echo Suppression Distance	4.2.3.9	43
Auto-Setup	1	30
Bottom design	4.2.5.8.2	48
Calculate	4.2.5.8	47
Calibrate	4.2.5.8.1	46
Calibrate/table	4.2.5.8	46
Clear table	4.2.5.8.4	47
Correction factor	4.2.2.4	40
Current limit	4.3.4	49
Current output	2.5	33
Customer code	5.2	57
Dead band	4.2.2.3	40
Descriptor	4.6.6	55
Device data	4	37
Device info	4.6	53
Device Revision	4.6.8.3	55
Device test	3.2	35
Diagnostics	3	33
Digital output	2.6	33
Digital output	4.4	50
Display	2	32
Display local	4.5.1.2	52
Display parameter	4.5	52
Display test	3.2.2	35
Echo amplitude	3.4.2	36
Echo motion	4.2.3.3	42
Electrical connection	4.6.3	53
Enter code	5.1	56
Enter table	4.2.5.8.2	46
Error signal	4.3.5	50
Factory reset	5.3	57

Parameter Name	Menu Identification Number	Page Number
Failsafe level	4.2.2.7	41
Failsafe timer	4.2.2.8	41
Filling speed	4.2.2.5	40
Flange material	4.6.4.6	54
Flange size	4.6.4.1	53
Process temperature	4.6.2	53
Flange type	4.6.4.2	54
Function DO	4.4.1	50
Hardware revision	4.6.8.5	56
Hours > 85°C	3.1.1.5	34
HYST level	4.2.4.6	44
HYST volume	4.2.5.6	45
Language local	1.1	30
Language local	4.5.2	52
LCD backlight	4.5.3	53
Length unit	1.2	31
Length unit	4.1.1	37
Level	2.2	32
Level damping	1.7	32
Level damping	4.2.4.3	43
Level LRV	1.6	31
Level LRV	4.2.4.2	43
Level parameters	4.2.4	43
Level URV	1.5	31
Level URV	4.2.4.1	43
Line 1 local	4.5.1.1	52
Line 2 local	4.5.1.4	52
Manufacturer identification	4.6.8	55
Maximum temperature	3.1.1.2	33
MaxLim level	4.2.4.5	44
MaxLim Volume	4.2.5.5	45
Measuring conditions	4.2.2	39
Message	4.6.7	55
Minimum temperature	3.1.1.3	33
MinLim level	4.2.4.4	44
MinLim Volume	4.2.5.4	45
Multi-display	2.1	32
Multi-display	4.5.1	52
Multiple echo	4.2.3.2	42
Nozzle height	1.3	31
Nozzle height	4.2.1.1	38
Operating hours	3.1.1.1	33
Operating Parameters	4.2	38
Options	5	56
Order no.	4.6.8.2	55
Other units	4.1.5	38
Pipe diameter (if 4.2.1.3 = yes)	4.2.1.3	39

Parameter Name	Menu Identification Number	Page Number
Power supply	4.6.1	53
Pressure stage	4.6.4.3	54
Range Extension	4.2.2.9	41
Raw value	3.4.1	36
Reference distance	4.6.8.7	56
S/N ratio	3.4.3	36
Seal material	4.6.4.7	54
Self-test	3.2.1	35
Sensor damping	4.2.3.1	42
Sensor parameter	4.2.3	41
Sensor temperature	3.4.5	37
Sensor variables	3.4	36
Sensor, electronics, software, application, parameters and or service	3.1.x	34
Serial no.	4.6.8.1	55
Show table	4.2.5.8.3	48
Signal type DO	4.4.3	51
Simulate AO	3.3.1	35
Simulate DO	3.3.2	36
Simulation	3.3	35
Software revision	4.6.8.4	56
Status	3.1	33
Stilling pipe?	4.2.1.3	38
Surface	4.2.2.2	39
Tag	4.6.5	55
Tank characteristic	4.2.5.7	45
Tank design	4.2.5.8.1	48
Tank geometry	4.2.1	38
Tank height	1.4	31
Tank height	4.2.1.2	38
Tank volume	4.2.5.8.3	48
Temperature unit	4.1.4	38
Units	4.1	37
Validity	3.4.4	37
Volume	2.3	33
Volume damping	4.2.5.3	45
Volume LRV	4.2.5.2	45
Volume Parameters	4.2.5	44
Volume unit	4.1.2	37
Volume URV	4.2.5.1	45
Wear	3.1.1	33
Window tracking	4.2.3.4	43

Appendix II

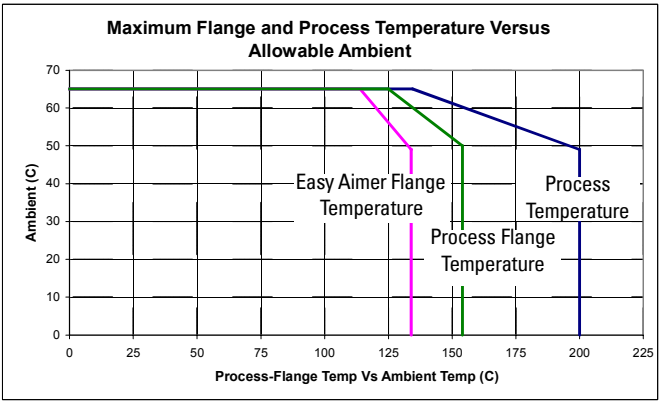
Programming Chart

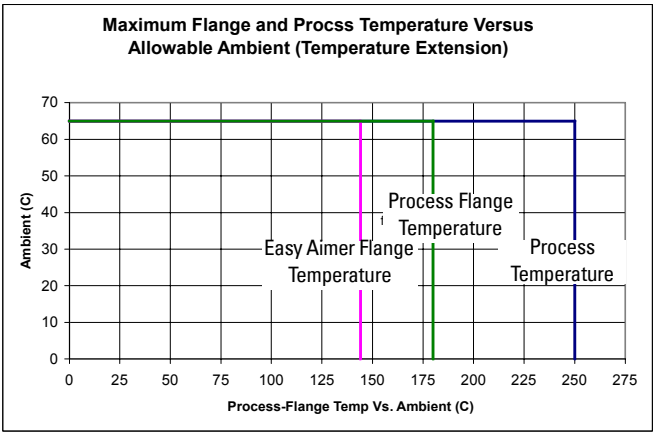
Menu Identification Number	Parameter Name	Value
1	Language local	
1	Length unit	
1	Nozzle height	
1	Tank height	
1	Level URV	
1	Level LRV	
1	Level damping	
2.1	Multi-display	
2.2	Level	
2.3	Volume	
2.5	Current output	
2.6	Digital output	
3.1.x	Sensor, electronics, software, application, parameters and or service	
3.1.1.1	Operating hours	
3.1.1.2	Maximum temperature	
3.1.1.3	Minimum temperature	
3.1.1.4	Aging	
3.1.1.5	Hours > 85°C	
3.2.1	Self-test	
3.2.2	Display test	
3.3.1	Simulate AO	
3.3.2	Simulate DO	
3.4.1	Raw value	
3.4.2	Echo amplitude	
3.4.3	S/N ratio	
3.4.5	Sensor temperature	
3.4.4	Validity	
4.1	Units	
4.1.1	Length unit	
4.1.2	Volume unit	
4.1.4	Temperature unit	
4.1.5	Other units	
4.2.1.1	Nozzle height	
4.2.1.2	Tank height	
4.2.1.3	Stilling pipe?	
4.2.1.3	Pipe diameter (if 4.2.1.3 = yes)	
4.2.2.1	Application type	
4.2.2.2	Surface	
4.2.2.3	Dead band	

Menu Identification Number	Parameter Name	Value
4.2.2.4	Correction factor	
4.2.2.5	Filling speed	
4.2.2.7	Failsafe level	
4.2.2.8	Failsafe timer	
4.2.2.9	Range Extension	
4.2.3	Sensor parameter	
4.2.3.1	Sensor damping	
4.2.3.2	Multiple echo	
4.2.3.3	Echo motion	
4.2.3.4	Window tracking	
4.2.3.8	Auto False Echo Suppression	
4.2.3.9	Auto False Echo Suppression Distance	
4.2.4.1	Level URV	
4.2.4.2	Level LRV	
4.2.4.3	Level damping	
4.2.4.4	MinLim level	
4.2.4.5	MaxLim level	
4.2.4.6	HYST level	
4.2.5.1	Volume URV	
4.2.5.2	Volume LRV	
4.2.5.3	Volume damping	
4.2.5.4	MinLim Volume	
4.2.5.5	MaxLim Volume	
4.2.5.6	HYST volume	
4.2.5.7	Tank characteristic	
4.2.5.8	Calibrate/table	
4.2.5.8.1	Calibrate	
4.2.5.8.2	Enter table	
4.2.5.8.3	Show table	
4.2.5.8.4	Clear table	
4.2.5.8	Calculate	
4.2.5.8.1	Tank design	
4.2.5.8.2	Bottom design	
4.2.5.8.3	Tank volume	
4.2.5.8.4	Tank height	
4.3.1	Error Level	
4.3.2	AO Select	
4.3.3	Level parameter	
4.3.3	Volume parameter	
4.3.4	Current limit	
4.3.5	Error signal	
4.4.1	Function DO	
4.4.2	Error Level	
4.4.3	Signal type DO	
4.4.4	Level parameter	
4.4.4	Volume parameter	
4.5.1.1	Line 1 local	

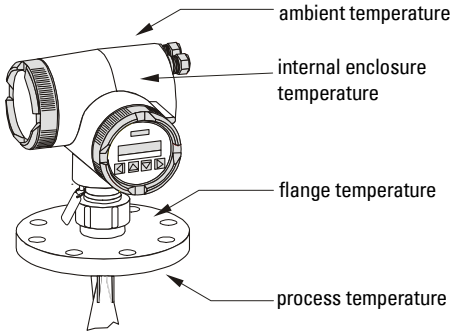
Menu Identification Number	Parameter Name	Value
4.5.1.2	Display local	
4.5.1.3	Level parameter	
4.5.1.3	Volume parameter	
4.5.1.4	Line 2 local	
4.5.1.5	Level parameter	
4.5.1.5	Volume parameter	
4.5.2	Language local	
4.5.3	LCD backlight	
4.6.1	Power supply	
4.6.2	Process temperature	
4.6.3	Electrical connection	
4.6.4	Antenna&flange	
4.6.4.1	Flange size	
4.6.4.2	Flange type	
4.6.4.3	Pressure stage	
4.6.4.4	Antenna type	
4.6.4.6	Flange material	
4.6.4.7	Seal material	
4.6.5	Tag	
4.6.6	Descriptor	
4.6.7	Message	
4.6.8	Manufacturer identification	
4.6.8.1	Serial no.	
4.6.8.2	Order no.	
4.6.8.3	Device Revision	
4.6.8.4	Software revision	
4.6.8.5	Hardware revision	
4.6.8.6	Antenna offset	
4.6.8.7	Reference distance	
5	Options	
5.1	Enter code	
5.2	Customer code	
5.3	Factory reset	

Ambient/Operating Temperature Specification





The chart above is provided for guidance only. The chart does not represent every possible process connection arrangement. The chart also does not take into consideration heating from direct sunshine exposure.



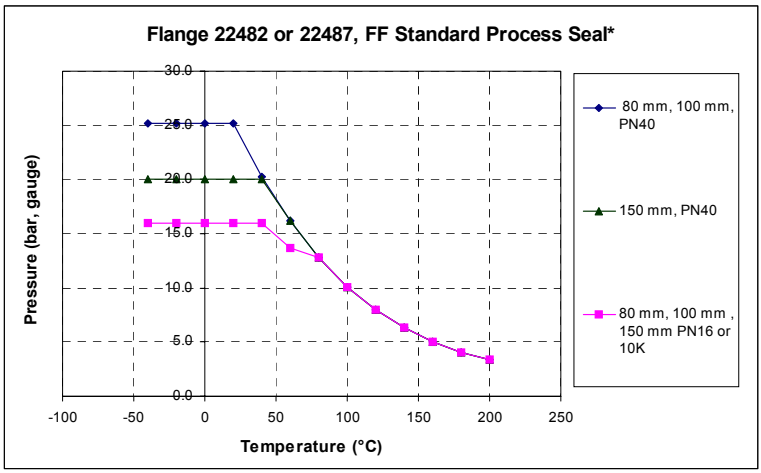
Warning: Internal temperature must not exceed 85°C! Warranty may be void.

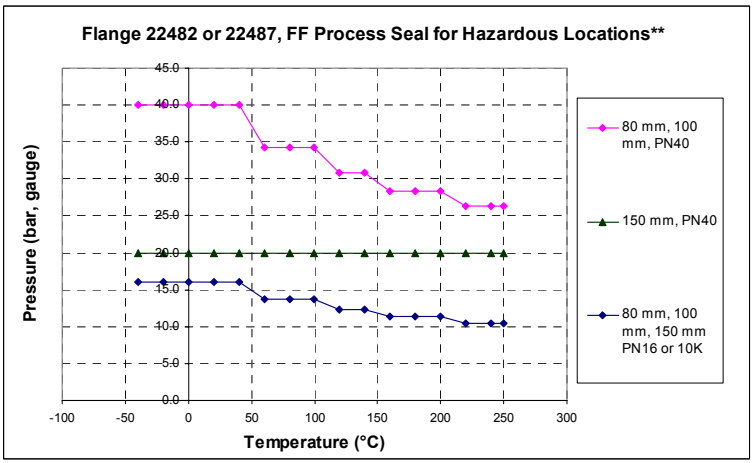
Appendix IV

IMPORTANT: The information below is not applicable to the flanges marked with serial numbers from 020102-001 to 020102-128. These flanges are intended for non-pressure applications in North America only.

WARNING: Never attempt to loosen, remove, or disassemble process connection or instrument housing with vessel contents.

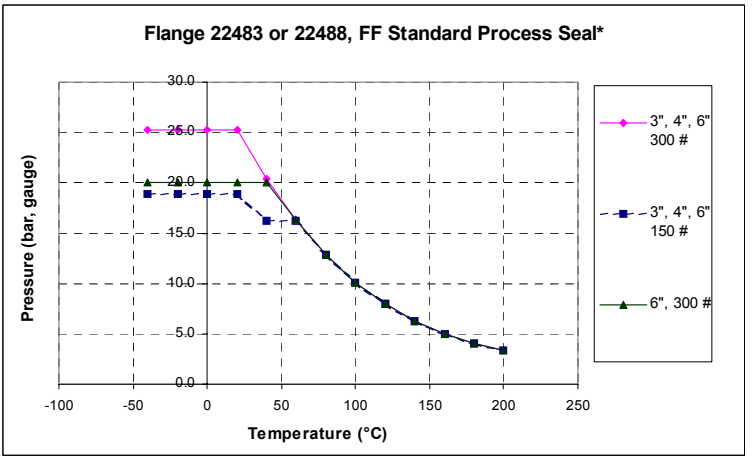
Process Pressure/Temperature De-rating

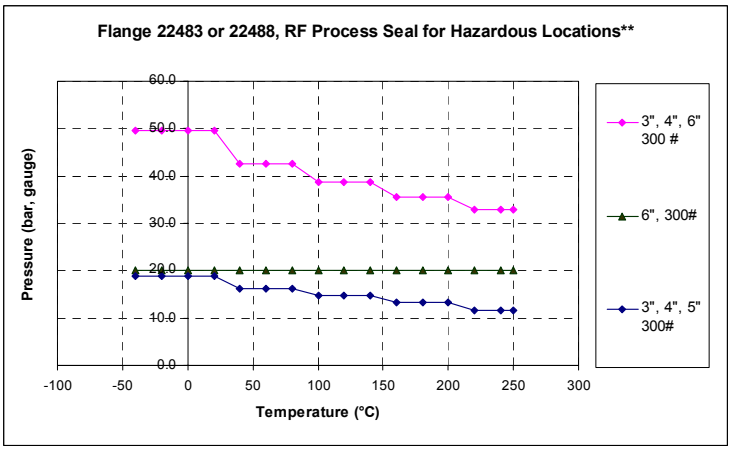




* standard process seal is rated to a max. of 200°C of continuous duty.

**process seal for hazardous location is rated to a max. of 250°C of continuous duty.





* standard process seal is rated to a max. of 200°C of continuous duty.

**process seal for hazardous location is rated to a max. of 250°C of continuous duty.

WARNINGS:

- Materials of construction are chosen based on their chemical compatibility (or inertness) for general purposes. For exposure to specific environments, check with chemical compatibility charts before installing.
- The user is responsible for the selection of bolting and gasket materials which will fall within the limits of the flange and its intended use and which are suitable for the service conditions.
- Never attempt to loosen, remove, or disassemble process connection or instrument housing with vessel contents.
- Improper installation may result in loss of process pressure.

Appendix V

HART Communications for the SITRANS LR 400

Highway Addressable Remote Transducer, HART, is an industrial protocol that rides on top of a 4-20 mA signal. It is an open standard, and full details about HART can be obtained from the HART Communication Foundation www.hartcomm.org

The SITRANS LR 400 can be configured over the HART network using either the HART Communicator 275 by Fisher-Rosemount, or a software package. There are a number of different software packages available, and the SITRANS LR 400 should work well with any of them. The recommended software package is the Simatic Process Device Manager (PDM) by Siemens.

HART Device Descriptor (DD)

In order to configure a HART device, the configurator must have the HART Device Descriptor for the unit in question. HART DD's are controlled by the HART Communications Foundation. The HART DD for the SITRANS LR 400 is being released in 2001. Please check availability with the HART Communications Foundation. Older versions of the library will have to be updated in order to use all the features in the SITRANS LR 400.

Simatic Process Device Manager (PDM):

This software package is designed to permit easy configuration, monitoring and troubleshooting of HART and Profibus PA devices. The HART DD for the SITRANS LR 400 was written with Simatic PDM in mind and has been extensively tested with this software.

HART Communicator 275:

Chart 1

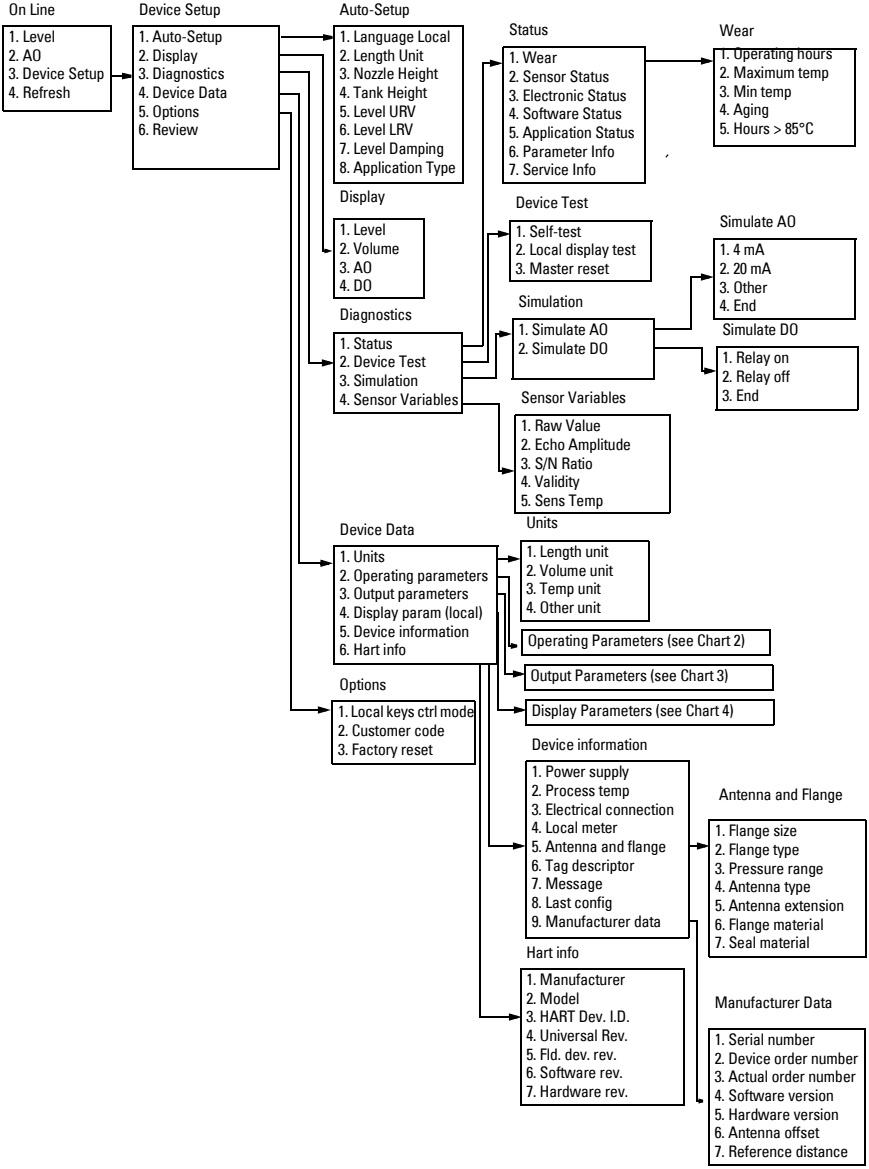


Chart 2

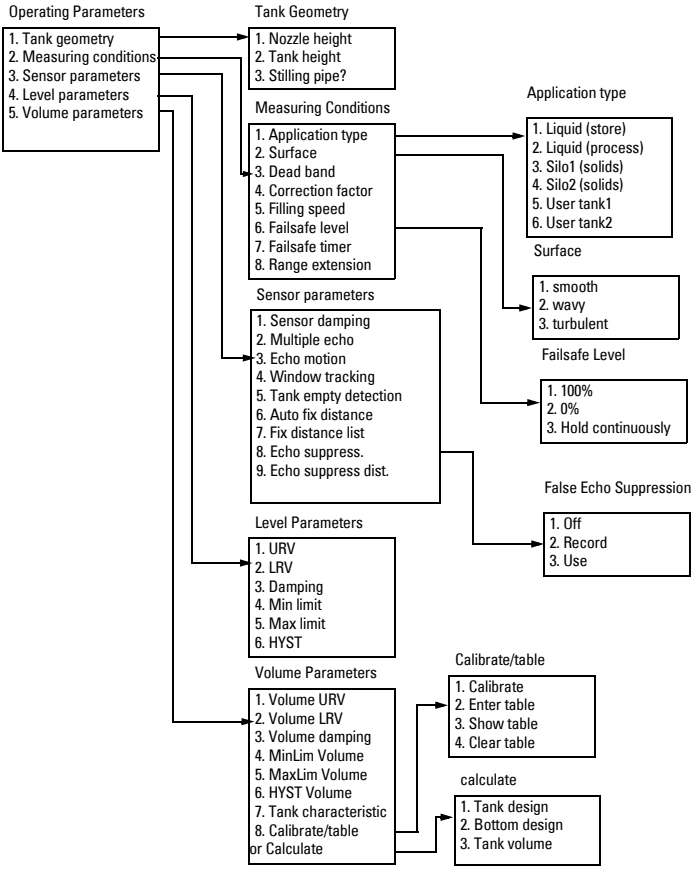


Chart 3

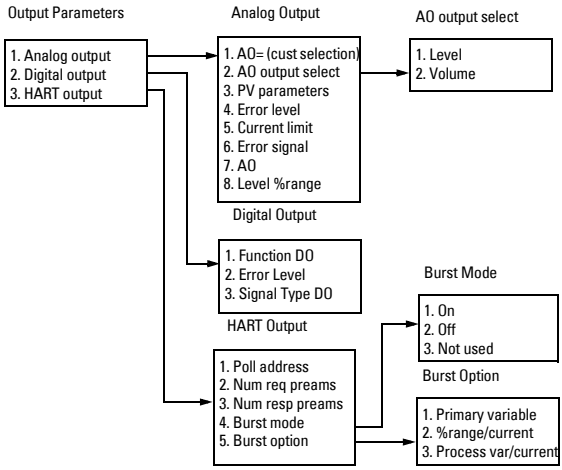
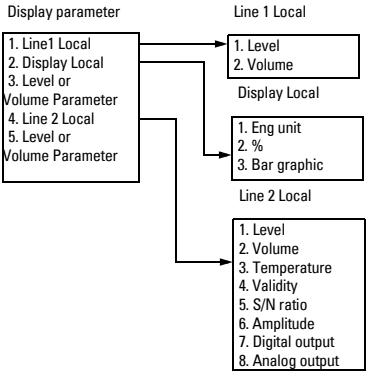


Chart 4



Supported HART Commands:

The SITRANS LR 400 conforms to HART rev. 5 and supports the following:

Universal Commands
0, 1, 2, 3, 6, 11, 12, 13, 14, 15, 16, 17, 18, 19

Common Practice Commands
33, 34, 35, 36, 37, 38, 40, 41, 42, 43, 44, 48, 50, 51, 53, 59, 108, 109, 110

Device Specific Commands

Command 128	Read static data material
Command 129	Write static data material
Command 130	Read dynamic variables 1
Command 131	Read dynamic variables 2
Command 132	Read tank parameters
Command 133	Write tank parameters
Command 134	Read tank design
Command 135	Write tank design
Command 136	Read calibration array
Command 137	Read calibration array
Command 138	Read stilling pipe conditions
Command 139	Write stilling pipe conditions
Command 140	Read measuring conditions
Command 141	Write measuring conditions
Command 142	Read sensor set-up 1
Command 143	Write sensor set-up 1
Command 144	Read fix distance
Command 145	Write fix distance
Command 146	Read customer code
Command 147	Write customer code
Command 148	Read sensor set-up 2
Command 149	Write sensor set-up 2
Command 150	Read analog parameters

Command 151 Write analog parameters
Command 152 Read temperature indicator
Command 154 Read trim values
Command 155 Write trim values
Command 156 Clear tank calibration
Command 157 Read device order number
Command 158 Read serial number
Command 159 Read local display select
Command 160 Write local display select
Command 161 Read display parameters
Command 162 Write display parameters
Command 163 Read digital out parameters 1
Command 164 Write digital out parameters 1
Command 165 Read digital out parameters 2
Command 166 Write digital out parameters 2
Command 167 Read lower range values
Command 168 Write lower range values
Command 169 Read upper range values
Command 170 Write upper range values
Command 171 Read damping values
Command 172 Write damping values
Command 173 Read tank characteristic set
Command 174 Write tank characteristic set
Command 175 Execute display test
Command 176 Write digital out test code
Command 177 Read digital output
Command 178 Read service information
Command 179 Read parameter information
Command 180 Read software revision
Command 181 Read hardware revision
Command 182 Write factory reset
Command 183 Read analog lost echo and range extension
Command 184 Write analog lost echo and range extension
Command 196 Read tank noise action
Command 197 Write tank noise action
Command 198 Read error level
Command 199 Write error level

The HART commands are rarely if ever used by end users. For details on the Universal and Common Practice Commands, please contact the HART Communication Foundation. For details on the Device Specific Commands, please contact Siemens Milltronics.

Appendix VI

Profibus-PA Communications for the SITRANS LR 400

Profibus-PA is an open industrial protocol. Full details about Profibus PA can be obtained from Profibus International at www.profibus.com

The SITRANS LR 400 is a Class A, Profile Version 3.0, PA device. It supports Class 1 Master for Cyclic data exchange, and Class 2 for acyclic services: (See below for details).

The SITRANS LR 400 can be configured using a software package. There are a number of different software packages available and the SITRANS LR 400 should work well with any one of them. The recommended software package is the Simatic Process Device Manager (PDM) by Siemens.

Device Descriptor

In order to use **Process Device Manager (PDM)** with Profibus-PA, you will need the Device Descriptor, which will be included with new versions of PDM. Currently you can locate the Device Descriptor in **Device Catalog**, under **Level/Echo/Siemens Milltronics**. If you do not see **SITRANS LR 400** under Siemens Milltronics, you will need to download an update file from the Siemens Milltronics Web site: www.siemens-milltronics.com

The GSD file

The GSD file **SM_062A.GSD** can be obtained from Siemens Milltronics at our web site: www.siemens-milltronics.com. (There is an example on page 90, To configure and use Profibus-PA with an S7-300 PLC.)

Bus address (Device Address)

Values	Range: 0 to 126
	Pre-set: 126

- This value can be set via Bus Address in the Auto-setup parameters, or over the network. (After changing the value, turn the unit off and back on again in order for the change to take effect.)

Power Demands

The maximum number of devices that can be connected to a bus line depends on their current consumption and the respective application conditions. When operating in an area where there is no risk of explosion, the couplers/links can feed up to 400 mA into the bus.

When operating in explosion risk areas, the intrinsic safety is only guaranteed when the maximum power fed into the bus does not exceed certain voltage and current values.

These are normally:

Current I_S < 128 mA, voltage U_0 < 15 V

Warning: Only certified supply units (DP/PA couplers or DP/PA links) may be used to feed the intrinsically safe PROFIBUS. See the EC Type Examination Certificate for requirements.

The number of devices which can be connected to a bus line is determined by finding the combined maximum current consumption of all the connected devices (10.5 mA for the SITRANS LR 400). Plan to allow a current reserve for safety.

Cyclic versus Acyclic Data

When you request data from a device via Profibus-PA, you have two choices. Cyclic data is provided at every bus scan: acyclic data is requested and provided as needed.

Input and output information is always requested at every bus scan and is set up as cyclic data. Configuration information is only needed periodically and is set up as acyclic data.

Cyclic Data

When you configure the SITRANS LR 400 on the Profibus-PA bus, there are two slots available for modules.

Note: Each of the slots has to have a module defined in it.

Slot 0 always transmits **Level** information and slot 1always **Volume** information. If you do not wish to have data transmitted, then you must use a **Free Place** module in that slot.

When you select a module, for the two values there are two alternatives: a normal version and a short version, for example, **Level (short)** and **Level**. The difference between the two is the way each one identifies the function block used. **Level** uses both the identifier and the extended identifier byte to determine which function block in the unit to use. **Level (short)** uses only the identifier byte. In the current release of Profibus PA there is no functional difference between the short and normal versions. However, the longer identifier is the preferred way to identify the function block and you should select the normal version in each case.

The 2 function blocks **(Level, Volume)** return 5 bytes of data each:

	Floating Point				Status
Level	byte 1	byte 2	byte 3	byte 4	byte 5
Volume	byte 6	byte 7	byte 8	byte 9	byte10

The first 4 bytes are the floating point representation (IEEE) of the variable. The variables are the outputs of the function block. The default setting for the variable **level** is meters**.** The default setting for the variable **volume** is m^3. You can change the settings of the variables by changing the settings of the function block. This is typically done using PDM.

The 5th byte is the status word and the list of possible values is given in the chart on page 89.

The 5 bytes must be read consistently, in a contiguous chunk: they cannot be read byte by byte, and cannot suffer an interrupt. If you are using an S7-300/400, you will need to use SFC14 DPRD_DAT: Read Consistent Data of a Standard PD Slave.

If you select a Free Place module to fill one of the slots, this will affect the byte number. Example 1:

	Floating Point				Status
Free Place	—	—	—	—	—
Volume	byte 1	byte 2	byte 3	byte 4	byte 5

Example 2:

	Floating Point				Status
Level	byte1	byte 2	byte 3	byte 4	byte 5
Free Place	—	—	—	—	—

Status Word

Values in hex notation	Description
0x1F	out of service
0x0F	constant device failure
0x0C	device failure
0x13	constant sensor failure
0x12	high limited sensor failure
0x11	low limited sensor failure
0x10	sensor failure
0x07	constant configuration error
0x52	sensor conversion not accurate
0x4F	initial value
0x4B	substitute set
0x47	last usable value
0x42	high limited non-specific
0x41	low limited non-specific
0x40	non-specific
0x8E	high limited active critical alarm
0x8D	low limited active critical alarm
0x8A	high limited active advisory alarm
0x89	low limited active advisory alarm
0x84	active update event
0x80	ok

Extended Diagnostics

The last four bytes of the extended diagnostics message are as follows:

Values in hex notation	Description
0x01000000	Electronics failure
0x02000000	Mechanical failure
0x04000000	Motor Temperature
0x08000000	Electronics temperature too high
0x10000000	Memory cheksum error
0X20000000	Measurement failure
0X40000000	Not initialized properly
0x80000000	Initial calibration error
0x00010000	Zero error
0x00020000	Power supply failure
0x00040000	Configuration invalid
0x00080000	Warm Start
0x00100000	Cold Start
0x00200000	Maintenance required
0x00400000	Characterization invalid
0x00000080	More information available

Acyclic Data

The SITRANS LR 400 supports up to three simultaneous connections by a class 2 Master (C2 connection). It does not support Master class 1 (C1 connection). A list of all parameters including address (slot and index), format, range of values, start value and attributes are compiled in a document which is available on request. Contact Siemens Milltronics Technical Publications at the following address: techpubs@milltronics.com

Configuration Example:

To configure and use Profibus PA with an S7-300/400 PLC

1. Import the GSD file **SM_062A.GSD** from the Siemens Milltronics Web site: www.siemens-milltronics.com into Step 7 software.
2. Add the SITRANS LR 400 "rack": click and drag the SITRANS LR 400 folder from the hardware catalog.
3. Fill the rack with desired modules, by dragging and dropping them from the hardware catalog.
4. After configuring Profibus PA in steps 2 and 3, download it to the PLC.
5. Add code to the PLC program to read data consistently using the SFC14.

Index

A
analog output 48
antenna
  cleaning 69
approvals 8
auto-setup 20

B
beam spreading 17
bus address (device address) 86

C
certificates 70
communication 7
connection 18
  HART 23
  Profibus 23
cyclic data 87

D
de-rating curves 79
device descriptor 86
digital output 50
dimensions 9
  functional 30
display parameters 52

E
Easy Aimer LR 11
extended diagnostics 90

F
fault messages 67
flanges 12
FMCW 21, 71

G
glossary 71
GSD file 86

H
HART Communications
  detailed information 81
hysteresis 44

M
maintenance 69
mounting
  location 16

O
operation 24
output
  analog 48
  digital 50

P
parameters
  alphabetical 72
  analog output 48
  auto-setup 30
  digital output 50
  display 52
  HART 30
  hysteresis 44
  measuring conditions 39
  profibus 58
  programming chart 75
  troubleshooting 34
PDM 81
profibus 58
programming
  disabling 27
  enabling 27
programming chart 75
purging system 9

S
self-test 66
Simatic Process Device Manager 81
specifications 4
  approvals 8
  communication 7
  de-rating curves 79
  performance 5
  power 4
  temperature charts 78
status word 89
structure 3

T
troubleshooting 66

www.siemens-milltronics.com

Siemens Milltronics Process Instruments Inc.
1954 Technology Drive, P.O. Box 4225
Peterborough, ON, Canada K9J 7B1
Tel: (705) 745-2431 Fax: (705) 741-0466
Email: techpubs@siemens-milltronics.com

7ML19985FH03
Printed in Canada

Rev. 3.0