Instruction Manual · August 2006

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sitrans

LR 200 (PROFIBUS PA)

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.

Unit Repair and Excluded Liability:

- The user is responsible for all changes and repairs made to the device by the user or the user's agent.
- All new components are to be provided by Siemens Milltronics Process Instruments Inc.
- Restrict repair to faulty components only.
- Do not reuse faulty components.

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.

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.smpi@siemens.com**

- For a selection of Siemens Milltronics level measurement manuals, go to: **www. siemens.com/processautomation**. Under Process Instrumentation, select *Level Measurement* and then go to the manual archive listed under the product family.
- For a selection of Siemens Milltronics weighing manuals, go to: **www. siemens.com/processautomation**. Under Weighing Technology, select *Continuous Weighing Systems* and then go to the manual archive listed under the product family.

Table of Contents

Safety Notes

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

WARNING: relates to a caution symbol on the product, and means that failure to observe the necessary precautions can result in death, serious injury, and/or considerable material damage.

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 product or that part of the operating manual.

Safety marking symbols

In manual:	On product:	Description
		Earth (ground) Terminal
		Protective Conductor Terminal
		(Label on product: yellow background.) WARNING: refer to accompanying documents (manual) for details.

The Manual

Notes:

- Please follow the installation and operating procedures for a quick, trouble-free installation and to ensure the maximum accuracy and reliability of your SITRANS LR 200 (PROFIBUS PA). This manual applies to the SITRANS LR 200 only.

This manual will help you set up your SITRANS LR 200 for optimum performance. We always welcome suggestions and comments about manual content, design, and accessibility. Please direct your comments to techpubs.smpi@siemens.com.

For other Siemens Milltronics level measurement manuals, go to: www.siemens.com/level, and look under **Level Measurement.**

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.

Application Examples

The application example used in this manual illustrates a typical installation using SITRANS LR 200 (PROFIBUS PA). Because there is often a range of ways to approach an application, other configurations may also apply. If the example does not apply to your application, check the applicable parameter reference for the available options.

A standard level application is found on page 23: see also *Appendix E: Special Applications* on page 59.

If you require more information, please contact your Siemens Milltronics representative. For a complete list of Siemens Milltronics representatives, go to www.siemens.com/processautomation.

Abbreviations and Identifications

Short form	Long Form	Description	Units
A/D	Analog to digital		
AIFB	Analog Input Function Block		
CE / FM / CSA	Conformitè Europèene / Factory Mutual / Canadian Standards Association	safety approval	
C_i	Internal capacitance		
D/A	Digital to analog		
DAC	Digital Analog Converter		
DCS	Distributed Control System	control room apparatus	

Short form	Long Form	Description	Units (cont'd)
FV	Full Vacuum		
ESD	Electrostatic Discharge		
I_i	Input current		mA
I_o	Output current		mA
IS	Intrinsically Safe	safety approval	
L_i	Internal inductance		mH
LR	Level Radar		
LTB	Level Transducer Block		
mH	milliHenry	10^{-3}	Henry
µF	microFarad	10^{-6}	Farad
µs	microsecond	10^{-6}	Second
PA	Process Automation (PROFIBUS)		
PDM	Process Device Manager (SIMATIC)		
PED	Pressure Equipment Directive	safety approval	
pF	pico Farads	10^{-12}	Farad
ppm	parts per million		
PV	Primary Value[1]	measured value	
SELV	Safety extra low voltage		
SV	Secondary Value[1]	equivalent value	
TB	Transducer Block		
TV	Transmitter Variable		
TVT	Time Varying Threshold	sensitivity threshold	
U_i	Input voltage		V
U_o	Output voltage		V

1. The output from the Level Transducer Block can be called the Primary Value (or Secondary Value). When it becomes the input to the AIFB, it is called the Process Variable.

SITRANS LR 200 (PROFIBUS PA) is a 2-wire loop-powered, continuous level measuring instrument that uses advanced pulse radar technology at 5.8 GHz (6.3 GHz in North America). The instrument consists of an electronic component coupled to the antenna and process connection. It is very easy to install and set up, using either the infrared hand-held programmer locally, or using SIMATIC® PDM from a remote location.

Communication is via PROFIBUS PA. Signals are processed using Sonic Intelligence® which has been field-proven in over 500,000 applications worldwide (ultrasonic and radar). This device supports acyclic communications from both a PROFIBUS Class I and Class II master.

SITRANS LR 200 is available in two versions

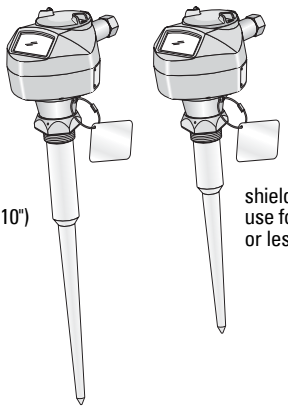
- General Purpose (non-hazardous)
- Intrinsically Safe (with suitable barrier)

A wide range of process connections and antenna options is available to suit virtually any vessel configuration.

Applications

SITRANS LR 200 is designed to measure liquid levels in a variety of applications:

- liquid bulk storage vessels
- simple process vessels with gentle agitation
- liquids or slurries



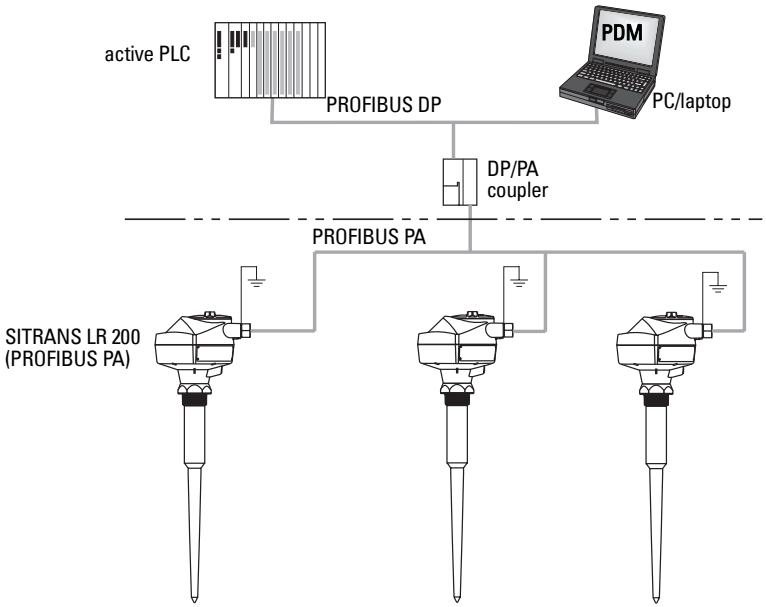
shield length 250 mm (10"): use for long nozzles of 250 mm (10") or less in length

shield length: 100 mm (4"): use for nozzles of 100 mm (4") or less in length

System Implementation

SITRANS LR 200 supports PROFIBUS communication protocol, and SIMATIC PDM software.

Basic PLC configuration with PROFIBUS PA



Programming

SITRANS LR 200 carries out its level measurement function according to the set of built-in parameters. You can make parameter changes via the hand programmer, or via a PC using SIMATIC PDM.

Approvals and Certificates

Note: Please see *Approvals (verify against device nameplate)* on page 9.

Specifications

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

SITRANS LR 200 (PROFIBUS PA)

Power

Bus powered	On PROFIBUS PA, as per IEC 61158-2
Current consumed	10.5 mA (General Purpose or Intrinsically Safe version)

Performance[1]

• frequency	5.8 GHz (6.3 GHz in N. America): refer to product nameplate for confirmation
• measurement range	0.3 to 20 m (1 ft to 65 ft)
• blanking distance[2]	0.3 m (1 ft), plus the shield length (if any)
• accuracy	± the greater of: 0.1% of range, or 10 mm (0.4")
• influence of ambient temperature	0.006% / K
• repeatability	±5 mm (0.2")
• dielectric constant	$\varepsilon_r > 3$ (for < 3 use waveguide antenna or stillpipe)
• update time	1 second
• memory	non-volatile EEPROM, no battery required.

Interface

• PROFIBUS PA	
• configuration	Siemens SIMATIC PDM (PC), or Siemens Milltronics infrared hand-held programmer
• display (local)	multi-segment alphanumeric liquid crystal with bar graph (representing level)

1. Reference conditions.
2. For details, please see *Near Range (Blanking)* on page 35. For reference points, please see *SITRANS LR 200 Dimensions* on page 13 for the standard version, or *Appendix D: Flange Adapter Versions*, page 44 onwards.

Programmer (infrared keypad)

Siemens Milltronics Infrared IS (Intrinsically Safe) Hand Programmer for hazardous and all other locations (battery is non-replaceable).

- approval — ATEX II 1 G, EEx ia IIC T4, certificate SIRA 01ATEX2147
  FM/CSA: Class I, Div. 1, Groups A, B, C, D
- ambient temperature — –20 to 40° C (–5 to 104° F)
- interface — proprietary infrared pulse signal
- power — 3 V lithium battery
- weight — 150 g (0.3 lb)
- color — black

Mechanical

Process Connections:

- threaded connection — 1.5" NPT, BSP, or 'G' (ISO 228) Series (polypropylene rod antenna)
  2" NPT, BSP, 'G' (ISO 228) Series (stainless steel connection, PTFE antenna)
- flange connection — See table on page 52

Antenna:

- polypropylene rod — hermetically sealed construction
  standard 100 mm (4") shield for maximum 100 mm (4") nozzle, or optional 250 mm (10") long shield
- PTFE rod — see *Appendix D: Flange Adapter Versions*, page 44 onwards
- horns/waveguide — see *Appendix D: Flange Adapter Versions*, page 44 onwards

Notes:

- Please check the ambient and operating temperatures under *Enclosure:* on page 8, and *Process* on page 8; also check *Approvals (verify against device nameplate)* on page 9, for the specific configuration you are about to use or install.
- The use of approved watertight conduit hubs/glands is required for Type 4X / NEMA 4X, Type 6 / NEMA 6, IP67, IP68 (outdoor applications).

Enclosure:

- construction — aluminum, polyester powder-coated
- conduit entry — 2 x M20, or 2 x 1/2" NPT with adaptor
- ingress protection — Type 4X / NEMA 4X, Type 6 / NEMA 6, IP 67, IP68 (see note below)

Weight:

- standard model — < 2 kg (4.4 lb) polypropylene rod antenna

Environmental

- location — indoor/ outdoor
- altitude — 5000 m (16,404 ft) max.
- ambient temperature — –40 to 80° C (–40 to 176° F)
- relative humidity — suitable for outdoor
  Type 4X / NEMA 4X, Type 6 / NEMA 6, IP67, IP68 enclosure (see note below)
- installation category — I
- pollution degree — 4
- pressure rating — vented to atmosphere

Process

- temperature[1] (at process connection) — –40 to 80 °C (–40 to 176 °F).
- pressure (vessel)[1] — 3 bar, gauge (43.5 psi, gauge)

Notes:

- Please check the ambient and operating temperatures under *Enclosure:* on page 8, and *Process* on page 8; also check *Approvals (verify against device nameplate)* on page 9, for the specific configuration you are about to use or install.
- The use of approved watertight conduit hubs/glands is required for Type 4X / NEMA 4X, Type 6 / NEMA 6, IP67, IP68 (outdoor applications).

1. The specifications apply to the polypropylene rod antenna only. The maximum temperature is dependent on the process connection, antenna materials, and vessel pressure. For more detail, or for other configurations, see *Maximum Process Temperature Chart* on page 37, and *Process Pressure/Temperature derating curves* beginning on page 38.

Approvals (verify against device nameplate)

• General	$CSA_{US/C}$, FM, CE		
• Radio	Europe: R&TTE US:FCC Canada:Industry Canada		
• Hazardous	Intrinsically Safe:	(Europe)	ATEX II 1 G EEx ia IIC T4
		(US/Canada)	FM/CSA: (barrier required)[1] Class I, Div. 1, Groups A, B, C, D Class II, Div. 1, Groups E, F, G Class III T4
		(Australia)	ANZEx Ex ia IIC T4 (Tamb = –40 to +80 °C) IPL67, IP68
		(International)	IECEx TSA 05.0009X Ex ia IIC T4
	Non-incendive:	(US)	FM: [2] Class I, Div. 2, Groups A, B, C, D T5
• Marine	Lloyd's Register of Shipping ABS Type Approval		

Note: The use of approved watertight conduit hubs/glands is required for Type 4X / NEMA 4X, Type 6 / NEMA 6, IP67, IP68 (outdoor applications).

1. See *FM/CSA Intrinsically Safe connection drawing* on page 111.
2. See *FM Class 1, Div. 2 connection drawing* on page 115.

Installation

WARNINGS:

- **SITRANS LR 200 is to be used only in the manner outlined in this manual, otherwise protection provided by the equipment may be impaired.**
- **Installation shall only be performed by qualified personnel and in accordance with local governing regulations.**
- **Please handle the device using the enclosure, not the antenna, to avoid damage.**

Note: Please refer to product label for approval information.

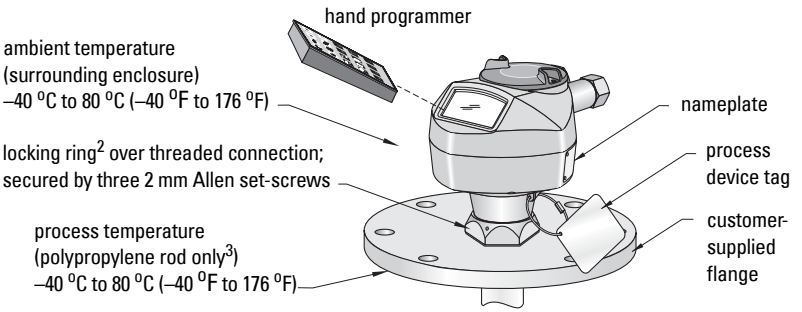
Mounting location

Recommendations:

- Ensure the ambient temperature is within –40 to 80 °C (–40 to 176 °F)[1].
- Ensure the environment is suitable to the housing rating and materials of construction.
- Provide easy access for viewing the display and programming via the hand programmer.

Precautions:

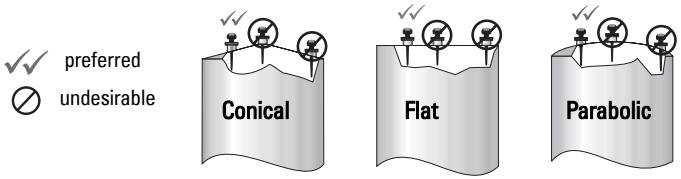
- Avoid proximity to high voltage or current wiring, high voltage or current contacts, and to variable frequency motor speed controllers.
- Avoid interference to the emission cone from obstructions or from the fill path.
- Avoid central locations on vessels.



1. For more detail on maximum interface and process temperatures, see *Maximum Process Temperature Chart*, on page 37.
2. When the locking ring is secured, it prevents the enclosure rotating on the threaded connection.
3. For other configurations, see *Maximum Process Temperature Chart*, on page 37, and *Process Pressure/Temperature derating curves* beginning on page 38.

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

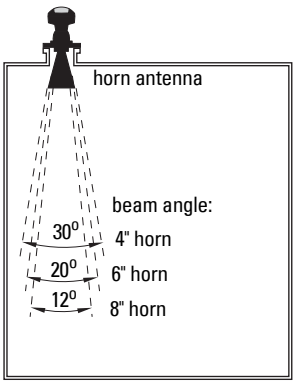
Note: Under certain circumstances, it may be acceptable to mount SITRANS LR 200 at the centre of a flat-topped tank: please discuss this with your Siemens Milltronics Representative.

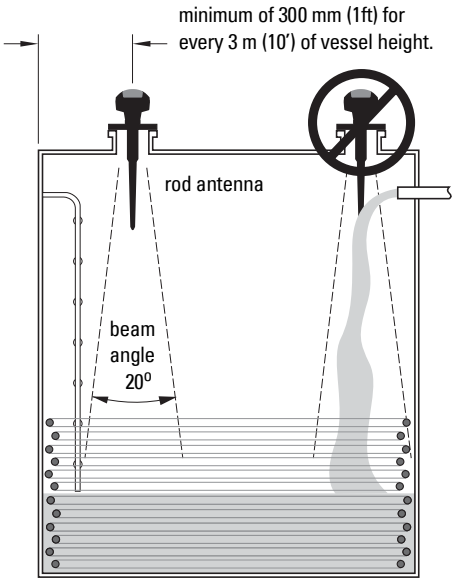


Keep the emission cone free of interference:

- Make allowance for the emission cone spreading: allow a minimum of 300 mm (1 ft) for every 3 m (10 ft) of vessel height.
- Locate the antenna away from the side wall, to avoid interference from indirect echoes.
- Avoid interference (from objects such as ladders or pipes, or from the fill path) which can cause false reflections[1].

Note:
- Beam angle defined at –3dB boundary





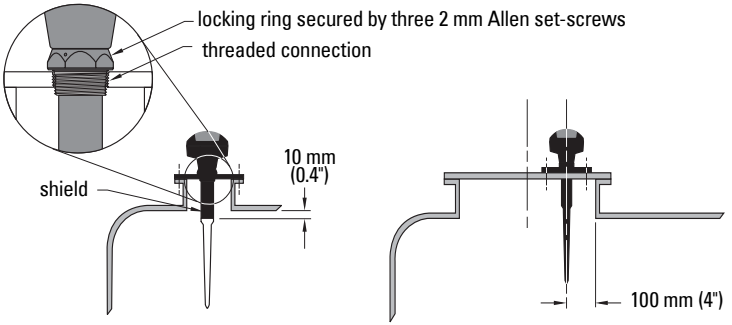
1. For more detail on False Echo suppression, see *Auto False-Echo Suppression* on page 35, and *TVT (Auto False Echo Suppression) setup* on page 100.

Location on a nozzle, or on a manhole cover

Notes:
- Use the 100 mm (4") shield on nozzles that are 100 mm (4") in length, or shorter.
- Use the 250 mm (10") shield on nozzles that are 250 mm (10") in length, or shorter.

On a nozzle, the end of the shield section should protrude a minimum of 10 mm (0.4") to avoid interference.

A manhole cover is typically a covered nozzle with a diameter 610 mm (24") or greater. To provide optimum signal conditions on a manhole cover, locate the antenna off-center, typically 100 mm (4") from the side.



Note: See also *Appendix E: Special Applications* on page 59.

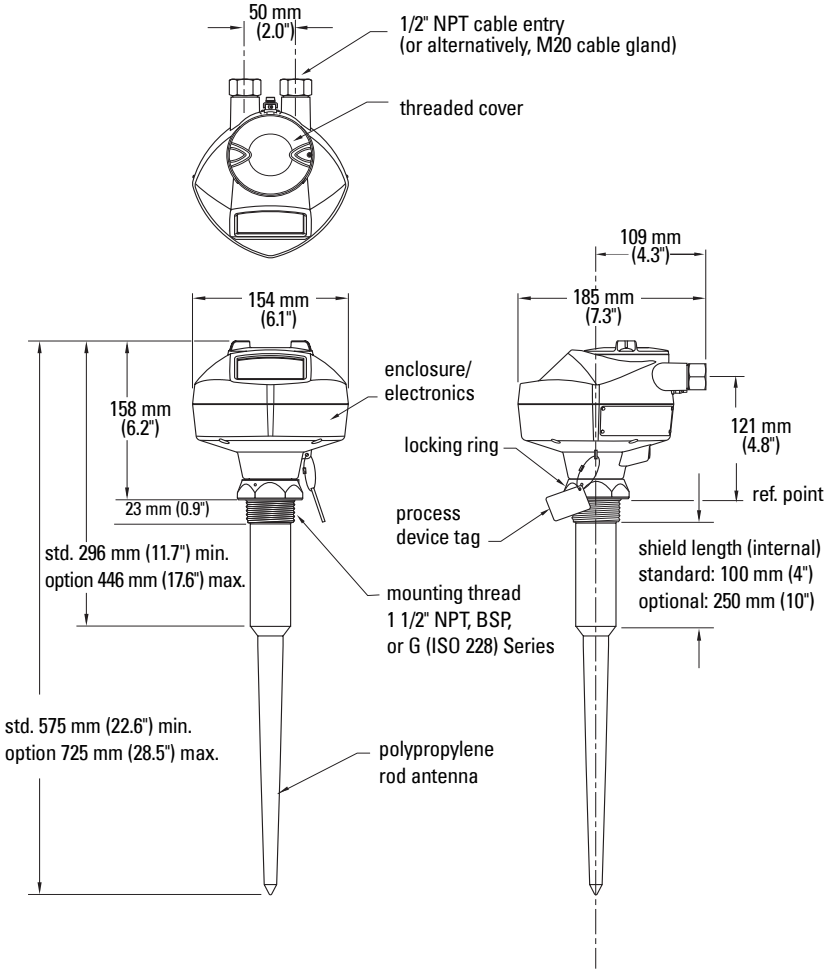
Mounting Instructions

1. Before inserting SITRANS LR 200 into its mounting connection, check to ensure the threads are matching, to avoid damaging them.
2. Simply screw the LR 200 into the process connection, and hand tighten. For pressure applications, it will be necessary to use PTFE tape (or other appropriate thread sealing compound) and tighten the process connection beyond hand tight.

   The maximum torque is 40 N-m (30 ft.lbs).
3. If you want to rotate the enclosure, use a 2 mm Allen key to loosen the set-screws that secure the locking ring.
4. Once the enclosure is in a suitable position, tighten the set-screws.

Note: Do not rotate the enclosure after programming and vessel calibration, otherwise an error may occur, caused by a polarity shift of the transmit pulse.

SITRANS LR 200 Dimensions



Wiring

Power

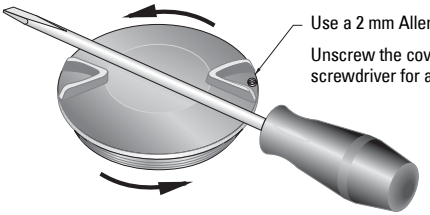
WARNINGS:

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

All field wiring must have insulation suitable for rated voltages.

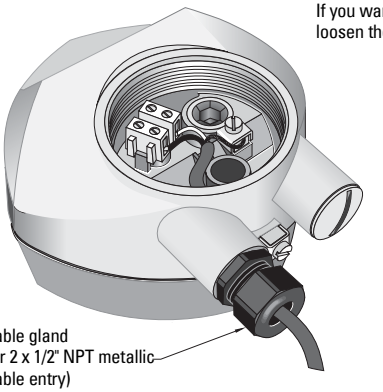
Connecting SITRANS LR 200 (PROFIBUS PA)

Note: For detailed information on Intrinsically Safe setups, please see *Wiring Details* on page 107.



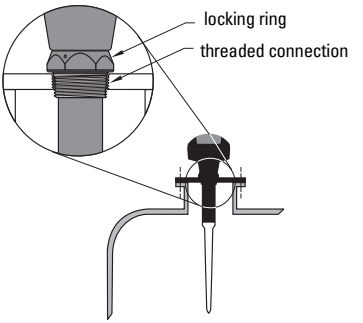
Use a 2 mm Allen key to loosen the lid-lock set screw.

Unscrew the cover for access to the terminals. Use a screwdriver for added leverage, if necessary.



cable gland
(or 2 x 1/2" NPT metallic cable entry)

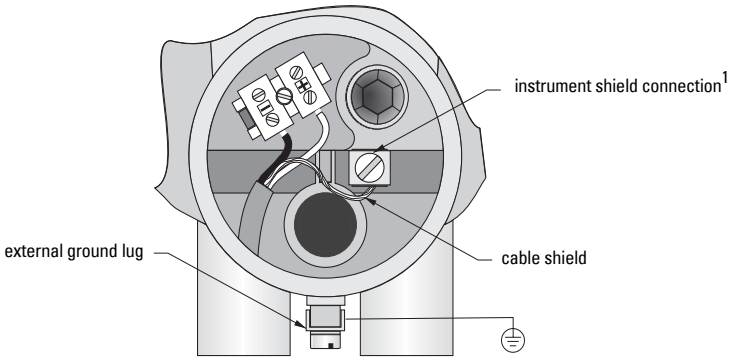
If you want to rotate the enclosure, use the 2 mm Allen key to loosen the locking ring.



locking ring

threaded connection

1. Strip the cable jacket for approximately 70 mm (2.75") from the end of the PROFIBUS PA cable, and thread the wires through the gland.
2. Connect the wires to the terminals as shown below (SITRANS LR 200 is not polarity sensitive).
3. Ground the instrument according to local regulations.
   - For Intrinsically Safe applications, connect the cable shield to the instrument shield connection, and ground the shield to the device using the external ground lug and an equal-potential grounding grid. For more detail on Explosion Protection, you can download the brochure *Siemens Process Automation Explosion Protection* (part number A5E00265440) from: https://pia.khe.siemens.com/index.asp?Nr=4236.
   - For general purpose applications, ground the shield at one point only (usually the power supply side) and continue the shield from device to device. Do not connect the shield at the device.
4. Tighten the gland to form a good seal.



5. Close the lid and secure the locking ring before programming and calibration. Do not rotate the instrument after calibration, as this may cause an error.

Note: PROFIBUS PA must be terminated at both extreme ends of the cable for it to work properly. Please refer to the *PROFIBUS PA User and Installation Guidelines* (order number 2.092), available from www.profibus.com.

1. The instrument shield connection is internally connected to the external ground lug.

Startup

Only two steps are necessary for a Quick Setup (see page 21 for detailed instructions):

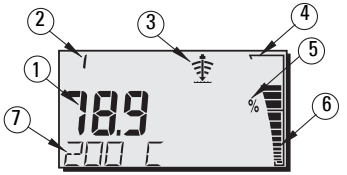
1. Use the hand programmer to set the PROFIBUS address locally.
2. Use SIMATIC PDM to calibrate the four set points: High and Low Calibration Point, and High and Low Level Point.

SITRANS LR 200 automatically starts up in **RUN** mode and detects the material level. The LCD displays the material level referenced from the Low Level Point[1] (the output of Analog Input Function Block 1/AIFB1). System status is displayed on the LCD, or on a remote communications terminal.

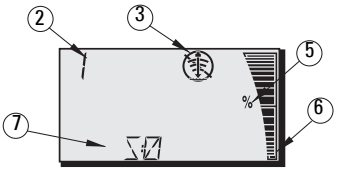
Note: SITRANS LR 200 (PROFIBUS PA) continues to monitor in and out values even when the device is in PROGRAM mode.

Startup Display (RUN mode)

Normal operation



Failsafe operation



1 – Primary region displays material level (Output of the active AIFB)

2 – Menu number (displays the number of the active AIFB: 1 or 2)

3 – Echo status indicator: Reliable Echo or Unreliable Echo

(The Unreliable Echo border flashes if LOE is pending[2]. When LOE becomes active, the border is solid and the text region displays S: 0.)

4 – Bar graph border (always visible in RUN mode)

5 – Units or Percent

6 – Active bar graph represents material level

(The lowest bar flashes once per second as a heartbeat.)

7 – Secondary region displays one of the following:

- Internal electronics temperature
- Value representing echo confidence
- Distance (Secondary Value 2)
- General status information, or a fault code[3]

1. See *Calibration* on page 22 for an illustration.
2. Please see *Loss of Echo (LOE)* on page 34, for more details.
3. For a list of fault codes, their meanings, and corrective actions, please see *Acyclic Extended Diagnostics (General Fault Codes)* on page 29.

Hand Programmer: key functions in RUN mode

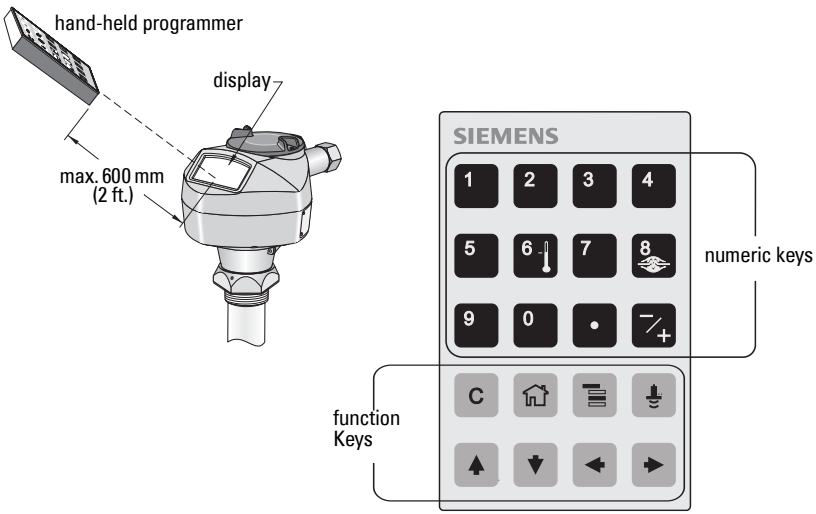
Key	Function
6	Updates internal enclosure temperature value and displays it in LCD secondary region.
8	Updates echo confidence value and displays it in LCD secondary region.
	Updates measurement value and displays it in LCD secondary region.

Programming SITRANS LR 200 (PROFIBUS PA)

The parameters that control the operation of the LR 200 are organized into function groups, and arranged in a 4-level menu structure that can be accessed either via the hand programmer, or via PDM and PROFIBUS PA. (For charts showing the complete menu structure, please see *Appendix G: LCD menu structure* starting page 65.)

The hand programmer[1]

To activate PROGRAM mode, point the hand programmer at the display (from a maximum distance of 600 mm [2 ft.]), and press the Mode key .



1. For more instructions on local programming using the hand programmer, please see *Appendix F: programming via the hand programmer* on page 61.

The hand programmer has two modes of operation:

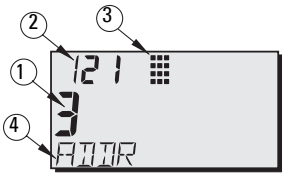
1. Navigation Mode
   - in this mode, the rightmost digit of the menu number flashes (the PROGRAM icon is not visible)
   - up/down arrows change the mode number
   - pressing the right/left arrows once moves to the next/previous menu
   - pressing the right arrow a second time changes the mode from Navigation to Edit mode

Note: For Quick Access to parameters via the hand programmer, press Mode key to activate PROGRAM mode, then enter the menu number.

2. Edit Mode
   - in this mode, the PROGRAM icon appears and flashes
   - pressing the number keys enters parameter data
   - only parameter items can be in Edit mode
   - in the case of read-only parameters, no change is permitted

PROGRAM Mode Display

Note: SITRANS LR 200 (PROFIBUS PA) continues to monitor In and Out values even when the device is in PROGRAM mode.



1 – Primary region (displays parameter value)
2 – Menu number region (displays Menu number)
3 – PROGRAM mode icon
4 – Secondary region (displays text label)

When you activate PROGRAM mode for the first time in any power cycle, the LCD displays the first menu. If, during the same power cycle, you switch to RUN mode, and then back to PROGRAM mode, then the LCD will display the menu or item that was last accessed in PROGRAM mode.

Hand Programmer: key functions in Navigation mode

Key	Name	When displaying:	Navigation Mode
▲ ▼	Up or down arrow	menu or item	Show previous or next menu or item.
▶	Right arrow	menu	Show first item in the selected menu, or next menu.
		item	Change to Edit mode.
◀	Left arrow	menu or item	Show parent menu.
	Mode key	menu or item	Change to **RUN** mode.
	Home key	menu or item	Show first item of top level menu (menu 1, item 1).
0 to 9		menu or item	Select appropriate item or menu[1].

1. For example, press **3** to move to the third item in the current menu.

Hand Programmer: key functions in Edit mode

Key	Edit Mode
▶	Right arrow: accept the data (write the parameter) and change from Edit to Navigation mode.
◀	Left arrow: cancel Edit mode without changing the parameter.
C	Erase the most recently changed character. If this is the first key in Edit mode, erase the display.
•	Add a decimal point.
+/-	Change the sign of the entered value.
0 to 9	Add the corresponding character.

Security

Local operation enable

Local Operation can be enabled or disabled via PDM. Go to **Identification > Device > Local Operation Enable** and select the desired setting.

Remote operation enable

Remote Operation can be enabled or disabled via the hand programmer. To change the setting:

- Open **Identification** Menu, then scroll down to CONFIG.
- Press **Right ARROW** to open the Config Menu, then scroll down to REMLOCK.

  1. Identification

  1.2. Configuration

  1.2.2. Remote Lock
- To enable programming, set REMLOCK to **0**. To disable programming, enter **1.**

Write locking

Write locking prevents any changes to parameters, either via PDM or the hand programmer, but still allows access to the device.

Open the menu **Device – Write Locking**, and select On or Off.

How to do a Master Reset

Open the menu **Device– Master Reset** to access the reset options, including Factory Reset.

Fault Reset

This resets the Fault message after an active fault has occurred and been corrected. A manual reset is required only for certain faults, identified by an asterisk (*) in the General Fault Code list on page 29.

To reset, key in the value of the fault code in question.

Quick Setup

Activating SITRANS LR 200

Note: Keep infrared devices such as laptops, cell phones, and PDAs, away from SITRANS LR 200 to prevent inadvertent operation.

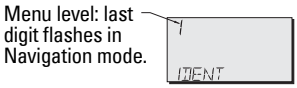
Power up the instrument. SITRANS LR 200 starts in **RUN** mode, and the LCD displays the output of AIFB1.

Setting the PROFIBUS address via the hand programmer [1]

Notes:

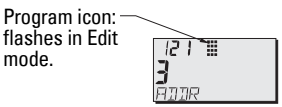
- Local programming must be enabled, to allow changes (see *Local operation enable* on page 20).
- **CLEAR** [c] can be used to clear the field.
- Press **Right ARROW** [→] to open Edit mode: the PROGRAM icon flashes.
- Press **Left ARROW** [←] to cancel Edit mode: the Menu number flashes (the PROGRAM icon is not visible).

1. Press **Mode** [≡] to activate **PROGRAM** mode and open Menu level 1.

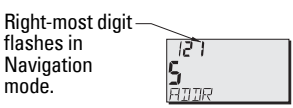


2. Press **Right ARROW** [→] twice to navigate to PROFIBUS address.

3. Press **Right ARROW** [→] again to open Edit mode: the PROGRAM icon will flash.



4. Key in a new value and press **Right ARROW** [→] to accept it.
   The LCD displays the new value; PROGRAM icon disappears, and the last menu digit flashes to indicate Navigation mode.



5. Press **Mode** [≡] to return to RUN mode.

1. Default address is 126.

Performing calibration via PROFIBUS PA

To use PROFIBUS PA, you will need a PC configuration tool: we recommend SIMATIC PDM. Please consult the operating instructions or online help for details on using SIMATIC PDM. (An Application Guide *SMPI PROFIBUS PA instruments and SIMATIC PDM* is available on our website: www.siemens.com/processautomation.)

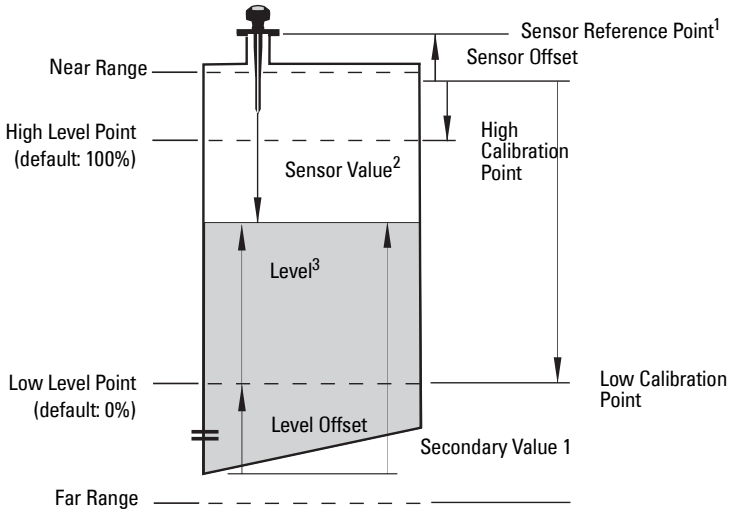
Changing parameter settings

- First launch SIMATIC PDM, connect to SITRANS LR 200, and upload data from the device.
- Adjust parameter values in the parameter view field (right side of screen).
- After adjusting the value, press Enter (the status fields read Changed).
- When you have completed the adjustments, open the Device menu, download data to the device, and save parameter settings offline (the status fields go blank).

Calibration

Only four settings are required for a Quick Setup:

- High Calibration Point and High Level Point
- Low Calibration Point and Low Level Point



1. The point to which all of the above parameters are referenced. For the standard rod antenna, please see *SITRANS LR 200 Dimensions* on page 13. For other configurations, please see *Appendix D: Flange Adapter Versions*, from page 44 onwards.
2. The value produced by the echo processing, representing the distance from the Sensor Reference Point to the target.
3. Level Value: the level measured in level units.

Calibration – steps 1 to 7

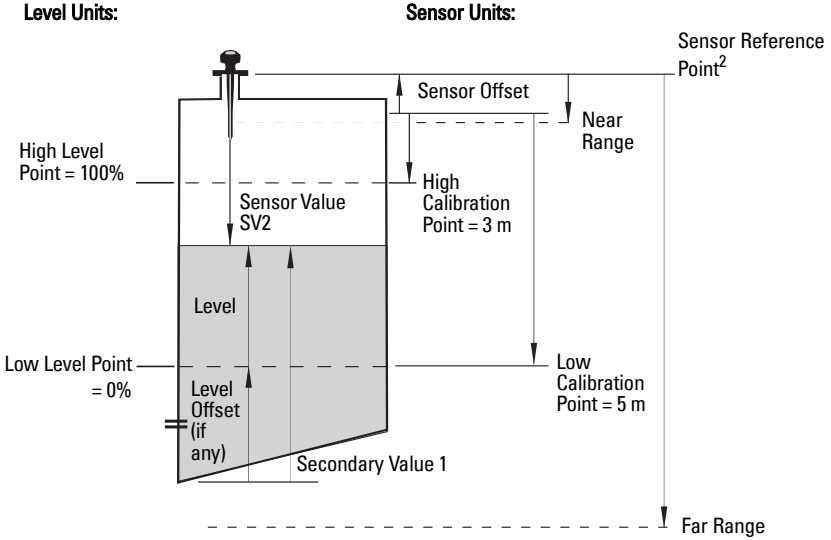
1. Open the menu **Device – Sensor Calibration** and select the button **Dry Calibration**[1]. (Click on **Additional Information** to see the schematic showing the PROFIBUS parameters.)
2. Enter the new value for Low Calibration Point (default units are meters).
3. Enter the corresponding value for Low Level Point in percent (default is 0).
4. Enter the new value for High Calibration Point (default units are meters).
5. Enter the corresponding value for High Level Point in percent (default is 100).
6. Click on **Transfer**.
7. SITRANS LR 200 is now ready to operate.

Using Auto False Echo Suppression

If SITRANS LR 200 displays a false high level, or the reading is fluctuating between the correct level and a false high level, you can use the Auto False Echo Suppression parameters to prevent false echo detection. See *TVT (Auto False Echo Suppression) setup* on page 100 for instructions.

Level application example

If volume conversion is not selected, Primary Value (PV) will be level (SV1). SV1 is the sum of level plus level offset (if any).



1. The "wet calibration" process is not recommended for SITRANS LR 200 (PROFIBUS PA).
2. For standard configuration reference point, please see *SITRANS LR 200 Dimensions* on page 13. For other configurations, see *Appendix D: Flange Adapter Versions*, page 44 onwards.

Remote operation via PROFIBUS PA

SITRANS LR 200 (PROFIBUS PA) is a Class B, Profile Version 3.0, PA device. It supports Class 1 Master for cyclic and acyclic data exchange, and Class 2 for acyclic services. The full range of SITRANS LR 200 functions is available only over a PROFIBUS PA network.

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

To use PROFIBUS PA, you will need a PC configuration tool: we recommend SIMATIC PDM. Please consult the operating instructions or online help for details on using SIMATIC PDM. (You can find more information at www.fielddevices.com: go to Products and Solutions > Products and Systems > Process Device Manager.)

SIMATIC PDM

SIMATIC PDM is a software package for designing, parameterizing, commissioning, diagnosing and maintaining SITRANS LR 200 and other process devices.

SIMATIC PDM contains a simple process monitor of the process values, alarms and status signals of the device. Using SIMATIC PDM you can

- display
- set
- change
- compare
- check the plausibility of
- manage
- simulate

process device data.

Device Description

In order to use **Process Device Manager (PDM)** with PROFIBUS PA, you will need the Device Description for SITRANS LR 200, which will be included with new versions of PDM. You can locate the Device Description in **Device Catalog**, under **Sensors/Level/ Echo/Siemens Milltronics**. If you do not see **SITRANS LR 200** under Siemens Milltronics, you can download it from our web site. Go to the SITRANS LR 200 product page at https://pia.khe.siemens.com/index.asp?Nr=7427 and click **Downloads**. After downloading the DD file, you need to execute DeviceInstall.

Configuration

To configure a PROFIBUS PA Class 1 Master (for example, a PLC), you will need a **GSD** file.

The GSD file

The GSD file **SIEM810F.gsd** is available from the SITRANS LR 200 product page on our web site. Go to https://pia.khe.siemens.com/index.asp?Nr=7427 and click **Downloads**. Download the DeviceInstall, and run it from your computer. This will install the GSD file into your system (as long as you are using SIMATIC software).

Note: If you are not using SIMATIC software, you can download the GSD file separately, and import it with the software you are using.

Setting the PROFIBUS address

When your instrument is shipped, the PROFIBUS address is set to 126. You can set it locally (see *Setting the PROFIBUS address via the hand programmer* on page 21) or remotely via the bus, using a parameterization tool such as SIMATIC PDM (see *Address (default 126)* on page 85).

PROFIBUS address

Values	Range: 0 to 126
	Pre-set: 126

Bus Termination

Note: PROFIBUS PA MUST be terminated at both extreme ends of the cable for it to work properly. Please refer to the PROFIBUS PA User and Installation Guidelines (order number 2.092), available from www.profibus.com.

Power Demands

To determine how many devices can be connected to a bus line, calculate the combined maximum current consumption of all the connected devices: 10.5 mA for SITRANS LR 200. 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 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

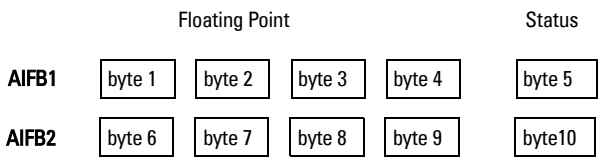
When you configure SITRANS LR 200 on the PROFIBUS PA bus, there are two slots available for modules.

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

Slot 0 always transmits **AIFB1** information[1]; slot 1 defaults to Free Place, but can be changed to **AIFB2** information. If you do not wish to have data transmitted, then you must use a **Free Place** module in that slot.

Each of the two Analog Input Function Blocks can be set up to return **Level**, **Distance**, or **Volume**. Within the function blocks, the values are scaled according to the user requirements (please see *Analog Input Function Blocks 1 and 2* on page 72 for details).

AIFB1 and **AIFB2** return 5 bytes of data each:



The first 4 bytes are the floating point representation (IEEE) of the variable. The variables are the outputs of the function block. The 5th byte is the status word and the list of possible values is given in the chart below.

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.

Status Byte

Status Codes for Good Quality	
Values in hex notation	**Description**
0x80	Data is GOOD.
0x84	A parameter in the function block has been changed: status active for 10 s
0x89	Active low warning.
0x8A	Active high warning.
0x8D	Active low alarm.
0x8E	Active high alarm.

1. For more information, please see *Analog Input Function Blocks 1 and 2* on page 72.

Status Codes for Bad Quality	
Values in hex notation	**Description**
0x10	The LOE timer has expired: this could be caused by LOE or by a sensor malfunction: value is BAD.
0x01	There is an error in the configuration of the function blocks in PROFIBUS PA[a].
0X1F	The function block has been placed out of service. (You will see this only if you read status word via acyclic services, after placing the function block out of service.)
0xC4	Bad configuration: value is BAD.
0XDE	AI block out of service: value is BAD.

a. This could happen when a firmware download has been done, but a system reset has not been done. This could also happen if the function blocks are not configured properly using PDM or acyclic services.

Status Codes for Uncertain Quality	
Values in hex notation	**Description**
0x4B	Value is a substituted value (normally used in Failsafe).
0x4C/0x4F	Initial value.
0x47	Last usable value.

Diagnostics

All diagnostic information shown below is viewable via PDM.

Diagnosis reply (applies only to cyclic masters)

This is a response to a GET-DIAG message.

During DPV0 data exchange, the PROFIBUS PA slave will notify the Master when a serious error occurs. The Master will then send a Diagnosis request. The reply to this request is normally logged in the PLC and is referred to as the "Hex values."

The reply may contain two parts. The first part is 6 bytes long and is defined by the PROFIBUS standard. If there is a second part, it is called the 'extended diagnostic' and it is eight bytes long. The last four bytes of the extended diagnostic message give the error code shown below. (The same information is also available acyclically via the Diagnosis Object.

Acyclic Diagnostics

This consists of four bytes.

Hex values	Byte	Bit	Description	Indication class[a]
0x01000000	0	0	Electronics failure	R
0x02000000		1	Mechanical failure	R
0x04000000		2	Motor Temperature too high	R
0x08000000		3	Electronics temperature too high	R
0x10000000		4	Memory error	R
0X20000000		5	Measurement failure	R
0X40000000		6	Device not initialized (no calibration)	R
0x80000000		7	Self calibration failed	R
0x00010000	1	0	Zero point error (limit position)	R
0x00020000		1	Power supply failure (electrical, pneumatic)	R
0x00040000		2	Configuration invalid	R
0x00080000		3	New startup carried out (Warm Start)	A
0x00100000		4	Restart carried out (Cold Start)	A
0X00200000		5	Maintenance required	R
0X00400000		6	Characterization invalid	R
0X00800000		7	Set to 1 (one), if the Ident_Number of the running cyclic data transfer and the value of Physical Block IDENT__NUMBER_SELECTOR parameter are different.	R
	2	0 to 7	Reserved for use within the PNO	
	3	0 to 6	Reserved for use within the PNO	
0X00000080		7	More diagnosis information is available	

a. **R** indicates the message remains active as long as the reason for the message exists.
A indicates the message will automatically reset after 10 seconds

Values of the DIAGNOSIS bit:
0 = not set
1 = set

Acyclic Extended Diagnostics (General Fault Codes)

In addition to the extended diagnostics available by cyclic data exchange (shown above), further extended diagnostics are available via acyclic communications. This consists of six bytes. Please see *Appendix J: Asynchronous Communications Data Map* on page 75, for the location of the "Extended Diagnostics".

Note: Certain fault codes (identified by an asterisk [*] in the table below) will persist until a manual reset has been performed (see *Fault Reset* on page 20).

LCD display		Meaning	Corrective Action	Byte	Bit
S:0		The device was unable to get a measurement for the LOE timer period.	Check the application and echo profile to determine optimum configuration for the application, to ensure the device can obtain a measurement.	0	0
S:2		Internal electronics failure.	Cycle the power. If the condition persists, call the factory.		2
S:10		The Input parameters High Calibration Point and Low Calibration Point are equal.	Check the calibration settings of the device. Ensure that the settings for High Calibration Point and Low Calibration Point are different.	1	3
S:11		Internal temperature sensor failure.	Return the device to the factory.		4
S:12	*	Internal temperature of the device has been exceeded: it is operating outside its temperature range.	Lower the ambient temperature enough to cool the device. This fault code will persist until a manual reset is performed using PDM or the LCD interface.		5

LCD display		Meaning	Corrective Action	Byte	Bit (cont'd)
S:14		The input values for Process Value Scale for AIFB1 are equal.	Check the configuration for AIFB1. Ensure that Upper Value and Lower Value (Process Value Scale) are not equal.	1	6
S:15		The input values for Process Value Scale for AIFB2 are equal.	Check the configuration for AIFB2. Ensure that Upper Value and Lower Value (Process Value Scale) are not equal.		7
S:28		Internal device failure caused by a memory error.	Report the fault to the factory.	3	4
S:29		EEPROM damaged.	Replace product.		5
S:30		EEPROM corrupt.	Cycle power. Replace product if this condition persists.		6
S:31		Flash error.	Reload the firmware. Replace product if this condition persists.		7
S: 32		There is a conflict between the IDENT number used in communications, and the number selected by the Ident Number Selector.	Check the value of the Ident number selector, and make sure that it is correct for the network configuration. If it is correct, the device needs to be re-parameterized by the PLC.	4	0
S:33		The calibration settings for the internal temperature sensor are incorrect.	Return the device to the factory.		1

LCD display		Meaning	Corrective Action	Byte	Bit (cont'd)
S:34		The velocity calibration for the device is incorrect.	Return the device to the factory.	4	2
S:35		The device did not initialize properly.	Cycle the power. This may temporarily solve the problem. Do not use the device for measurement, but return it to the factory as soon as possible.		3
S:36		The receive calibration is invalid.	Return the device to the factory.		4
S:37		Measurement hardware problem.	Cycle the power. This may temporarily solve the problem. Do not use the device for measurement, but return it to the factory as soon as possible.		5
S:38		Measurement hardware problem.	Cycle the power. This may temporarily solve the problem. Do not use the device for measurement, but return it to the factory as soon as possible.		6

Acyclic Data

SITRANS LR 200 supports up to four simultaneous connections by a Class 2 Master (C2 connection). It supports one connection by a Class 1 Master (C1 connection). A list of all acyclic data, including address (slot and index), format, range of values, start value, and attributes, can be found at *Appendix J: Asynchronous Communications Data Map* on page 75.

Configuration Example

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

1. If SITRANS LR 200 is not listed in the STEP 7 device catalog, you can download the DeviceInstall file from the Siemens Milltronics Web site and run it from your computer. Go to https://pia.khe.siemens.com/index.asp?Nr=7427 and click **Downloads**.
2. Add the SITRANS LR 200 "rack": click and drag the SITRANS LR 200 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.

Accessing parameters remotely

Functions

The PDM Device Menu gives you access to the following functions:

- upload from/download to the device
- set address
- simulation
- master reset
- Auto TVT
- write locking
- sensor calibration

Changing parameter settings

- First launch SIMATIC PDM, connect to SITRANS LR 200, and upload data from the device (the status fields change to **Loaded**).
- Adjust parameter values in the parameter view field (right side of screen).
- After adjusting the value, press **Enter** (the status fields read **Changed**).
- When you have completed the adjustments, open the **Device** menu, download data to the device, and save parameter settings offline (the status fields go blank).

For a complete list of parameters, please see *Appendix K: Parameter Descriptions* on page 85.

Appendix A: Technical Reference

Principles of Operation

SITRANS LR 200 is a sophisticated radar instrument that uses advanced microwave pulse technology[1] to provide non-contacting continuous level measurement in liquids or slurries. Radar level measurement uses the time of flight principle to determine distance to a material surface. The transmit time is directly proportional (to the distance to the material).

Pulse radar uses polarized electromagnetic waves. Microwave pulses are emitted from the antenna at a fixed repetition rate, and reflect off the interface between two materials with different dielectric constants (the atmosphere and the material being monitored). The echo is detected by a receiver, and the transmit time is used to calculate level.

Electromagnetic wave propagation is virtually unaffected by temperature or pressure changes, or by changes in the vapor or dust levels inside a vessel.

SITRANS LR 200 consists of an enclosed electronic component coupled to an antenna and process connection. The electronic component generates a radar signal at 5.8 GHz (6.3 GHz in North America) that is directed to the antenna.

The signal is emitted from the antenna, and the reflected echoes are digitally converted to an echo profile. The profile is analyzed to determine the distance from the material surface to the reference point on the instrument. This distance is used as a basis for the display of material level and output.

Measurement Response

The measurement response (response rate) limits the maximum rate at which the display and output respond to changes in the measurement. Once the real process fill/empty rate (m/s) is established, a response rate can be selected that is slightly higher than the application rate. The response rate automatically adjusts the filters that affect the output response rate.

There are three preset options: slow, medium, and fast.

Related Parameters	Response Rate			LOE Timer (minutes)	Fill Rate	Empty Rate	Echo Lock	
Values	1	*	slow	100	**0.1** m/minute	**0.1** m/minute	2	material agitator
	2		medium	10	**1** m/minute	**1** m/minute		
	3		fast	1	**10** m/minute	**10** m/minute		

If none of the preset options is satisfactory, the filters can be adjusted individually.

1. The microwave output level is significantly less than that emitted from cellular phones.

Echo Lock

When the echoes are received, the relevant echo algorithm is applied to determine the true material echo. If the selected echo is within the window, the window is then centered about the echo. Otherwise the window widens with each successive shot until the selected echo is within the window, which then returns to its normal width.

Echo Lock selects the measurement verification process:

Values	**0**		Off
	1		Maximum Verification
	2	*	Material Agitator
	3		Total Lock

- When Echo Lock is Off, SITRANS LR 200 responds immediately to a new measurement (within the restrictions set by the Maximum Fill / Empty Rate). However, measurement reliability is affected.
- When Maximum Verification or Material Agitator is selected, a new measurement outside the Echo Lock Window must meet the sampling criteria.
- When Total Lock is selected, Echo Lock Window is pre-set to **0,** and the window is automatically calculated after each measurement.

Loss of Echo (LOE)

A loss of echo (LOE) occurs when the calculated measurement is judged to be unreliable because the echo confidence value has dropped below the echo confidence threshold. The LOE timer starts running, and if the LOE condition persists beyond the time limit set by the LOE timer, the Reliable Echo indicator is replaced by the Unreliable Echo indicator.

Reliable Echo indicator

Unreliable Echo indicator: border flashes when LOE is pending.

When LOE is active border is solid and text region displays **S: 0**

Upon receiving a reliable echo, the loss of echo condition is aborted, the Reliable Echo indicator replaces the Unreliable Echo indicator, and the reading returns to the current level.

LOE Timer

The LOE timer determines the time (in minutes) to elapse after the last valid reading before Failsafe mode is activated. When the LOE timer expires, the material level to be reported is determined by Failsafe Mode.

Failsafe Mode

Failsafe mode may be triggered by a loss of echo, a bad configuration, or certain device faults. You can select can select one of three possible values to be reported when a Failsafe mode occurs:

- Default value (Failsafe value) used as output value.
- Store last valid output value.
- Calculated output value is incorrect.

Failsafe value

Failsafe value is a user-defined value. This allows you to enter the safest output value for your application.

For example, you may want to select a user-defined high value, to prevent an overfill (Failsafe Hi). Or you may want to select a low value, to protect a pump from operating dry (Failsafe Lo).

False Echoes

False echoes can appear during the receive cycle. They are often created by internal impediments like a ladder rung, and are usually indicated by an incorrect high level reading.

Near Range (Blanking)

Near Range allows you to set a distance in front of the antenna, within which any echoes will be ignored. But Auto False-Echo Suppression is generally recommended in preference to using Near Range.

Auto False-Echo Suppression

The TVT adjustment parameters allow you to set a TVT (Time Varying Threshold) curve, so that SITRANS LR 200 will ignore false echoes.

The default TVT curve hovers above the echo profile, and effectively screens out small false echoes. But if an obstruction is causing a large echo before the material level echo, that echo will rise above the default TVT curve. You can use Auto False-Echo Suppression to filter it out. If possible, rotate the instrument before using Auto False-Echo Suppression, to lower the amplitude of false echoes.

When you set Auto False-Echo Suppression to "Learn," the instrument learns the echo profile at that moment[1]. Then it uses the learned profile instead of the default TVT curve, for the distance set in Auto False Echo Suppression Distance. The learned profile (learned TVT curve) follows the echo profile, so that no large false echoes rise above the learned TVT curve. From the end of the Auto False-Echo Suppression Distance, the default TVT curve is used. The material level echo rises above this, and is selected as the true echo.

See page 101 for examples of the echo profile before and after using Auto False-Echo Suppression.

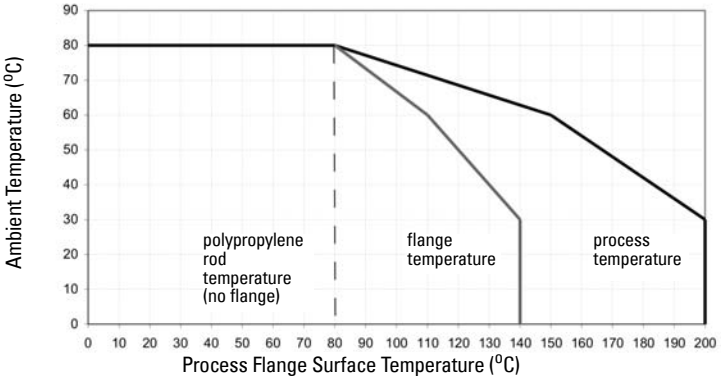
1. Turn on Auto False-Echo Suppression when the material level is substantially lower than process full level (ideally when the tank is empty or almost empty).

Maximum Process Temperature Chart

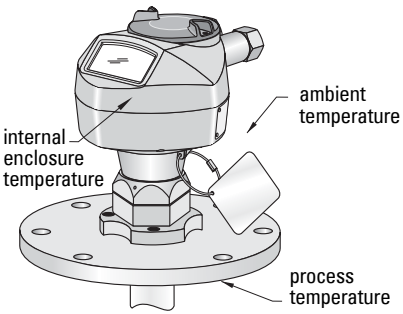
! WARNING: Internal temperature must not exceed 80 °C (176 °F).

Note: The chart below is for guidance only.

Maximum Flange and Process Temperatures versus Allowable Ambient for Polypropylene Rod or Flange Adaptor versions of SITRANS LR 200



- The chart does not represent every possible process connection arrangement. For example, it will NOT apply if you are mounting the LR 200 on a nozzle greater than 8" nominal, or directly on a metallic vessel surface.
- The chart does not take into consideration heating from direct sunshine exposure.



Where the chart does not apply, please use your own judgement regarding the use of SITRANS LR 200. Open the menu **View – Peak Values**, and click on the temperature tab to see the maximum and minimum temperatures recorded. These can be used to determine whether the installation needs to be redesigned.

For example, if the internal temperature exceeds the maximum allowable limit, a sun shield or a longer nozzle may be required.The peak temperatures indicate the extent of change required to the installation in order to provide a reliable thermal-operating zone for SITRANS LR 200.

Process Pressure/Temperature derating curves

Notes:

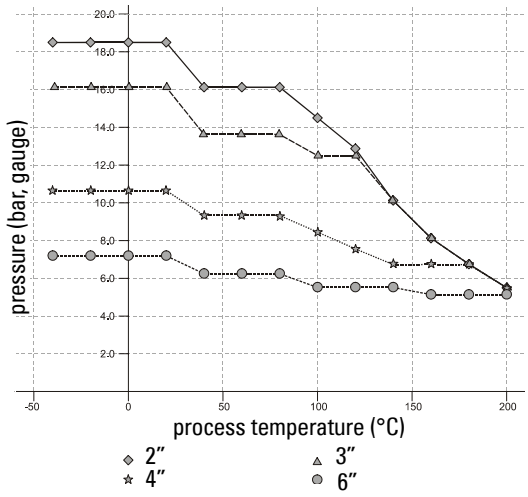
- These configurations are subject to revision: other options may be added.
- Process configuration numbers are not final.
- The Process Device Tag[1] shall remain with the process pressure boundary assembly[2]. In the event the instrument package is replaced, the Process Device Tag shall be transferred to the replacement unit.
- SITRANS LR 200 units are hydrostatically tested, meeting or exceeding the requirements of the ASME Boiler and Pressure Vessel Code and the European Pressure Equipment Directive.
- The serial numbers stamped in each process connection body, (flange, threaded, or sanitary), provide a unique identification number indicating date of manufacture.
  Example: MMDDYY – XXX (where MM = month, DD = day, YY = year, and
  XXX= sequential unit produced
  Further markings (space permitting) indicate flange configuration, size, pressure class, material, and material heat code.

! WARNINGS:

- **Never attempt to loosen, remove, or disassemble process connection or instrument housing while vessel contents are under pressure.**
- **This product is designated as a Pressure Accessory per Directive 97/ 23 / EC and is not intended for use as a safety device.**
- **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.**
- **Improper installation may result in loss of process pressure.**

1. For an illustration, see *Mounting location* on page 10.
2. The process pressure boundary assembly comprises the components that act as a barrier against pressure loss from the process vessel: that is, the combination of process connection body and emitter, but normally excluding the electrical enclosure.

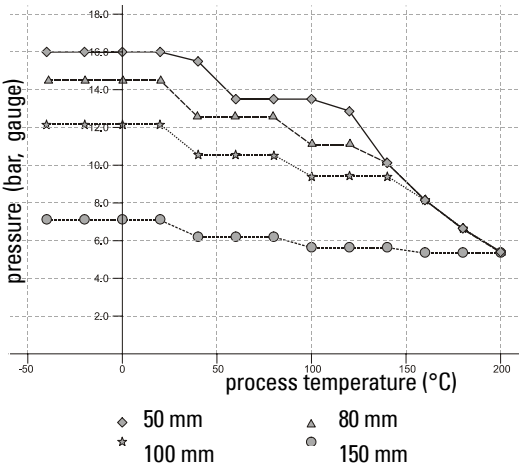
Rod Antenna ANSI Hole Pattern Flanges[1, 2]



Process Configuration:

- 51003 with flange series 22452.
- Flange will be stamped 22452. Process connection tag will have the series identified as 51003.
- Reference drawing number is shown on the process device tag. You can find this drawing on our website: www.siemens.com/processautomation, on the LR 200 product page, under **Process Connection Specifications**.

Rod Antenna DN Hole Pattern Flanges[1, 2,



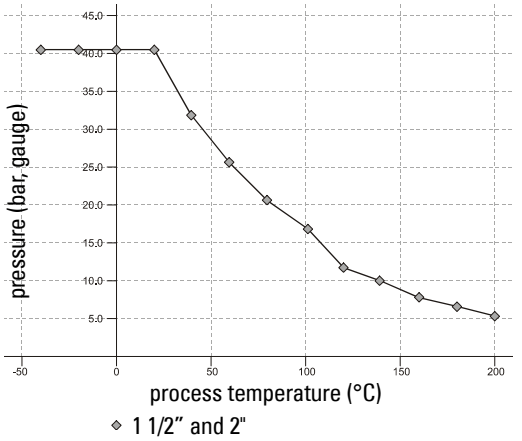
Process Configuration:

- 51003 with flange series 22452.
- Flange will be stamped 22452. Process connection tag will have the series identified as 51003.
- Reference drawing number is shown on the process device tag. You can find this drawing on our website: www.siemens.com/processautomation, on the LR 200 product page, under **Process Connection Specifications**.

! WARNING: Never attempt to loosen, remove, or disassemble process connection or instrument housing while vessel contents are under pressure.

1. UHMW-PE antennas are rated to a maximum of 80°C (176°F) of continuous duty.
2. Customer to provide adequate bolting to retain vessel pressure and provide sufficient sealing.

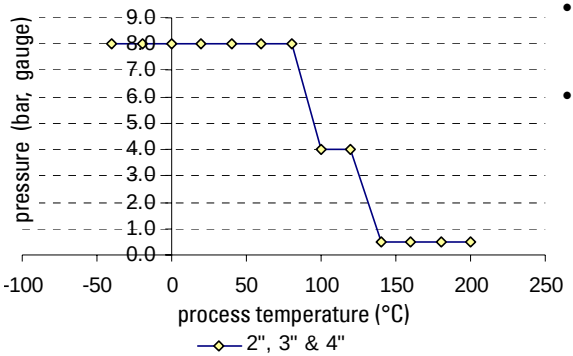
Rod Antenna Threaded Connections



Process Connection Series:

- 51002, 51004, 51005
- Ensure the instrument has a process connection identification tag showing one of this series.
- Reference drawing number is shown on the process device tag. You can find this drawing on our website: www.siemens.com/processautomation, on the LR 200 product page, under **Process Connection Specifications**.

Rod Antenna Sanitary Connections[1]



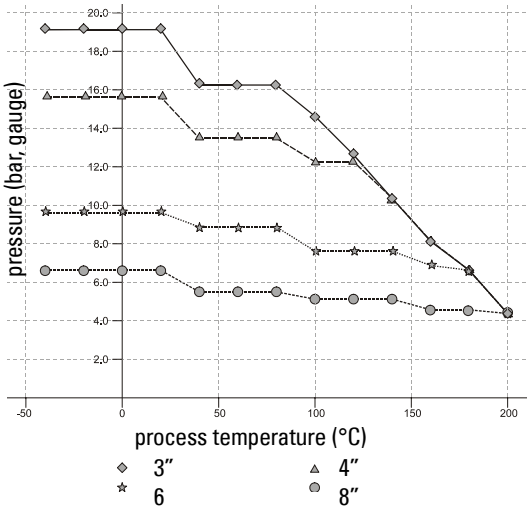
Process Connection Series:

- 51010
- Ensure instrument has the process identification tag showing this series number.
- Reference drawing number is shown on the process device tag. You can find this drawing on our website: www.siemens.com/processautomation, on the LR 200 product page, under **Process Connection Specifications**.

! WARNING: Never attempt to loosen, remove, or disassemble process connection or instrument housing while vessel contents are under pressure.

1. UHMW-PE antennas are rated to a maximum of 80°C (176°F) of continuous duty; however, they can be used for periods of up to 3 hours at temperatures up to 120°C (248°F) at 1 bar pressure.

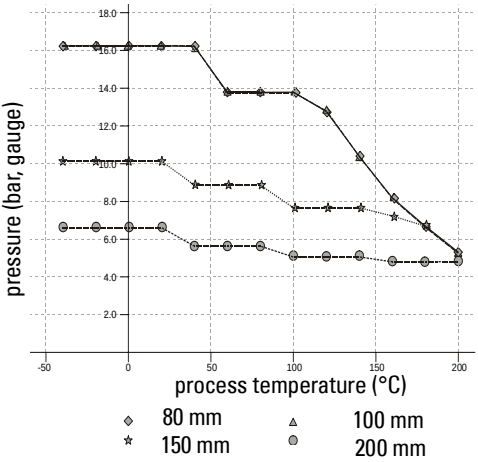
Horn Antenna or Wave Guide – ANSI Hole Pattern Flanges[1]



Process Connection Series:

- 51006 to 51008, and 51010 to 51012, with 22452 series flange.
- Ensure your instrument has the process identification tag showing one of this series, and 22452 stamped on flange.
- Reference drawing number is shown on the process device tag. You can find this drawing on our website: www.siemens.com/processautomation, on the LR 200 product page, under **Process Connection Specifications**.

Horn Antenna or Wave Guide DN Hole Pattern Flanges[2]



Process Connection Series:

- 51006 to 51008, and 51010 to 51012 with 22452 series flange.
- Ensure your instrument has the process identification tag showing one of this series, and 22452 stamped on flange.
- Reference drawing number is shown on the process device tag. You can find this drawing on our website: www.siemens.com/processautomation, on the LR 200 product page, under **Process Connection Specifications**.

! WARNING: Never attempt to loosen, remove, or disassemble process connection or instrument housing while vessel contents are under pressure.

1. Customer to provide adequate bolting and flat-faced gasket to retain vessel pressure and provide sufficient sealing.
2. Customer to provide adequate bolting and flat-faced gasket to retain vessel pressure and provide sufficient sealing.

Appendix B: Troubleshooting

1. Check the following:
   - There is power at the instrument.
   - The LCD shows the relevant data.
   - Check whether any fault codes are being displayed (see *Acyclic Extended Diagnostics (General Fault Codes)* on page 29 for a detailed list).
   - The device can be programmed using the hand programmer.
2. Verify that the wiring connections are correct.
3. Check the PROFIBUS address and make sure all devices are at unique PROFIBUS addresses.
4. If the device cannot be programmed via the hand programmer, make sure local operation is enabled. See *Local operation enable* on page 20. Also make sure that Write Locking is Off. See *Write locking* on page 62.
5. If you try to set a SITRANS LR 200 parameter via remote communications, but the parameter remains unchanged, make sure remote operation is enabled. See *Remote operation enable* on page 20. Also make sure that Write Locking is Off. See *Write locking* on page 20.
6. If you continue to experience problems, go to our website at www.siemens.com/processautomation, and check the FAQs for SITRANS LR 200, or contact your Siemens Milltronics representative.
7. If the PLC value equals the display value, but does not correspond to actual material level, either:
   - scaling in AIFB1 is incorrect, or
   - High Calibration Point is incorrectly entered, or
   - the wrong echo is being selected.
8. If the PLC value is not equal to the displayed value (regardless of actual material level), either:
   - you may not be looking at the right spot in the PLC, or
   - you may have programmed scaling into the PLC, instead of leaving all scaling to be performed in the LR 200, or
   - the PCL may not be communicating with the LR 200. Check the network to verify that you are communicating.

General Fault Codes

For a table listing the fault codes, meanings, and suggested corrective action to take, please see *Acyclic Extended Diagnostics (General Fault Codes)* on page 29.

Appendix C: Maintenance

SITRANS LR 200 requires no maintenance or cleaning under normal operating conditions.

Under severe operating conditions, the antenna may require periodic cleaning. If cleaning becomes necessary:

- Note the antenna material and the process medium, and select a cleaning solution that will not react adversely with either.
- Remove the instrument from service and wipe the antenna clean using a cloth and suitable cleaning solution.

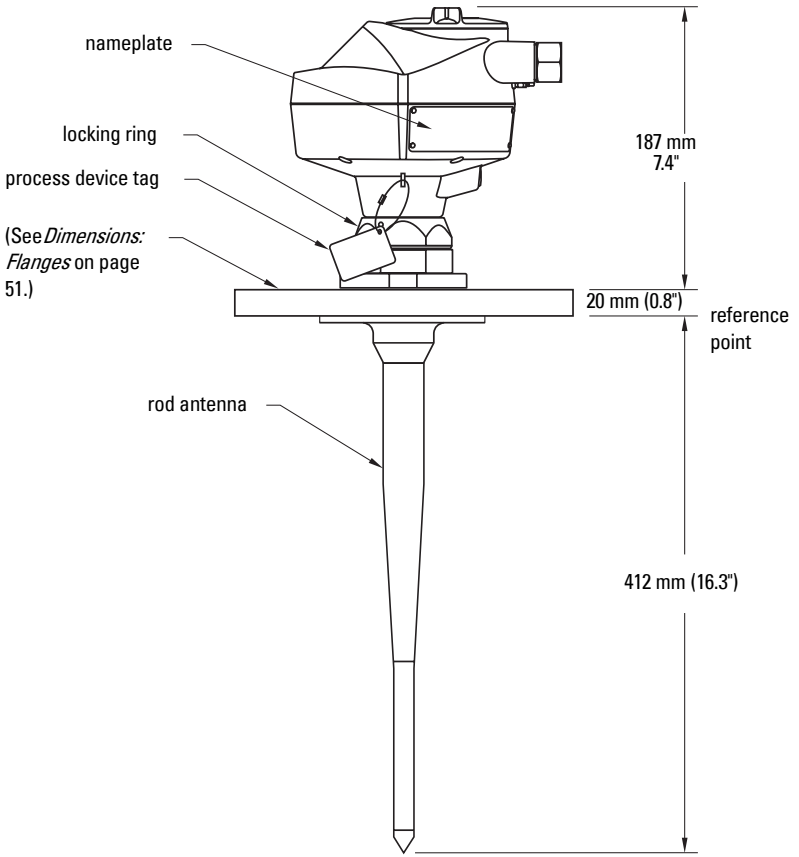
Unit Repair and Excluded Liability

All changes and repairs must be done by qualified personnel, and applicable safety regulations must be followed. Please note the following:

- The user is responsible for all changes and repairs made to the device.
- All new components must be provided by Siemens Milltronics Process Instruments Inc.
- Restrict repair to faulty components only.
- Do not re-use faulty components.

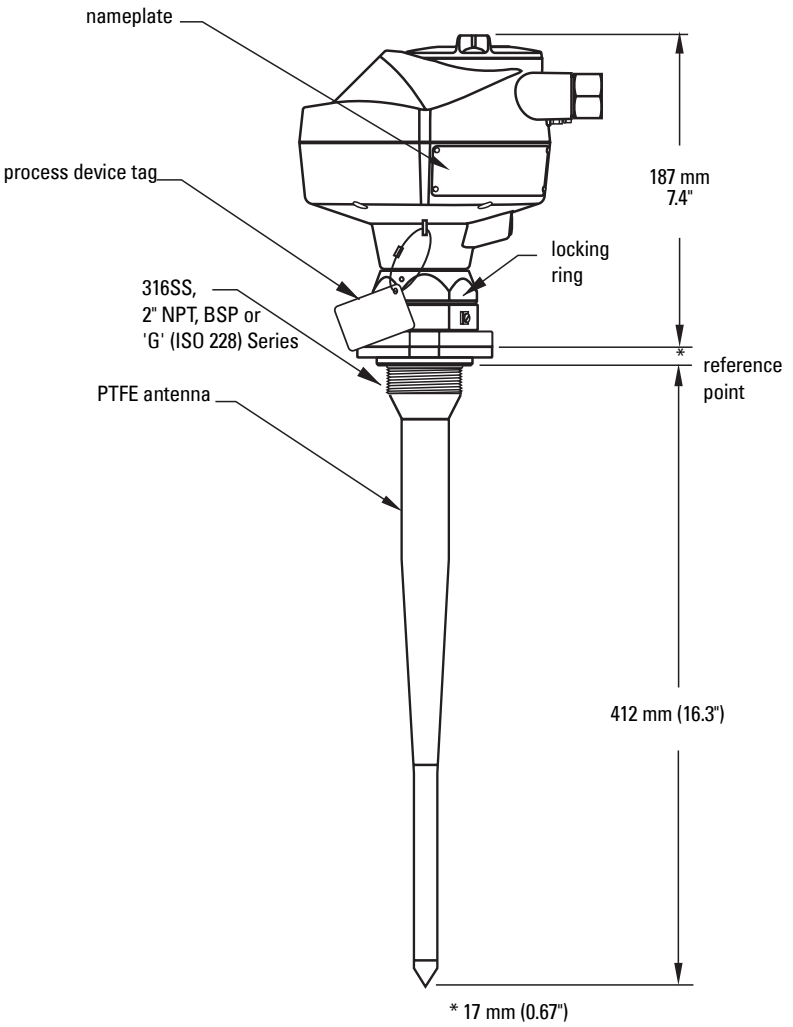
Appendix D: Flange Adapter Versions

Dimensions: PTFE Rod Antenna, FF Flange



Note: Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available on our website at www.siemens.com/processautomation, on the product page for SITRANS LR 200, under **Process Connection Specifications**.

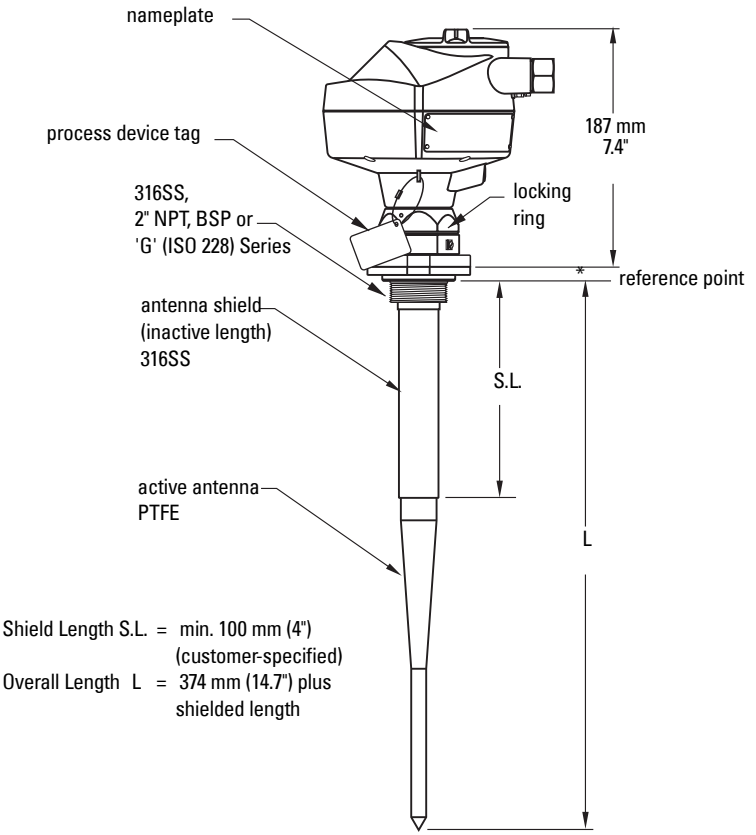
Dimensions: PTFE Rod, Threaded Connection



Note: Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available on our website at www.siemens.com/processautomation, on the product page for SITRANS LR 200, under **Process Connection Specifications**.

! WARNING: For pressure applications, it will be necessary to use PTFE tape or other appropriate thread sealing compound, and to tighten the process connection beyond hand-tight.

Dimensions: PTFE Rod, Threaded Connection, Shielded



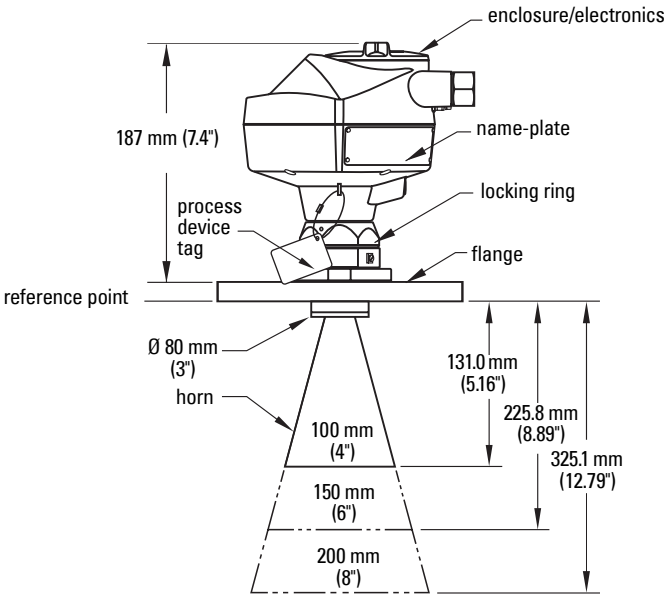
Shield Length S.L. = min. 100 mm (4")
(customer-specified)
Overall Length L = 374 mm (14.7") plus
shielded length

* 18 mm (0.7 ")

Note: Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available on our website at www.siemens.com/processautomation, on the product page for SITRANS LR 200, under **Process Connection Specification**s.

! WARNING: For pressure applications, it will be necessary to use PTFE tape or other appropriate thread sealing compound, and to tighten the process connection beyond hand-tight.

Dimensions: Horn Antenna with FF Flange



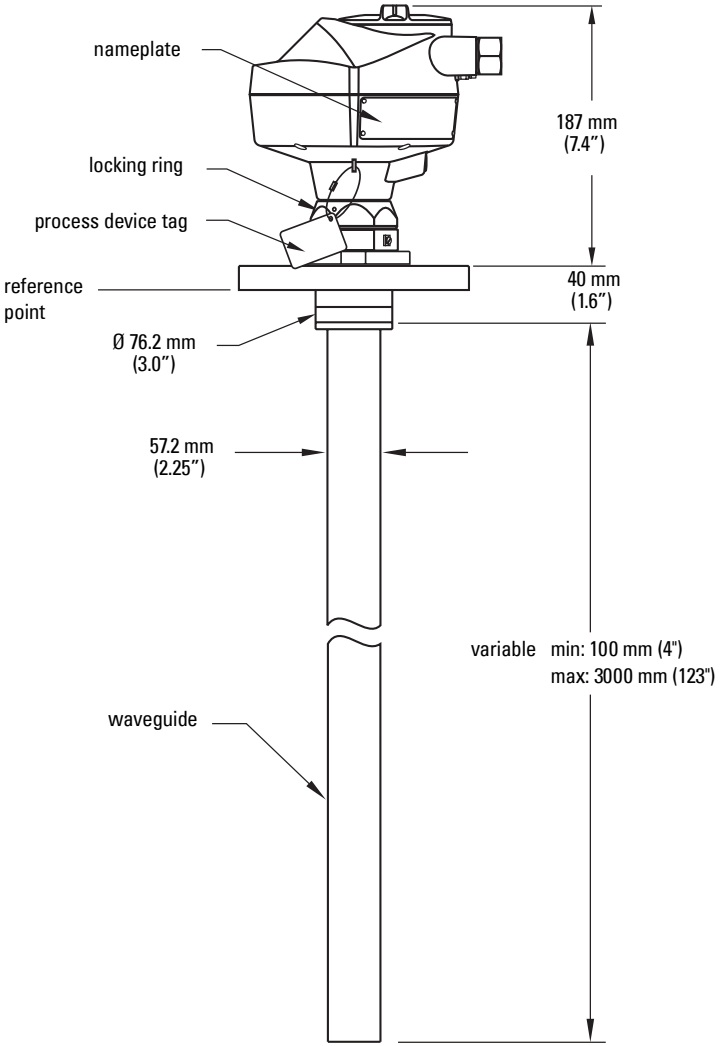
Nominal Horn Size	Horn O.D.	Horn Height	Beam Angle
100 mm (4″)	95.3 mm (3.75″)	131.0 mm (5.16″)	29 degrees
150 mm (6″)	146.0 mm (5.75″)	225.8 mm (8.89″)	20 degrees
200 mm (8″)	199.4 mm (7.85″)	325.1 mm (12.79″)	17 degrees

Notes:

- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available on our website at www.siemens.com/processautomation, on the product page for SITRANS LR 200 (PROFIBUS PA), under **Process Connection Specifications**.
- Signal amplitude increases with horn diameter, so use the largest practical size.
- 4" Horn version is recommended only for stilling well applications
- Optional waveguide extensions and/or purging[1] system can be installed between the flange and the antenna.

1. A purging system is an option available for this antenna type. This provides an inlet on the flange where cooling air or cleaning fluid may be supplied. The air or liquid passes through the flange and exits the inside of the horn to clean the antenna system.

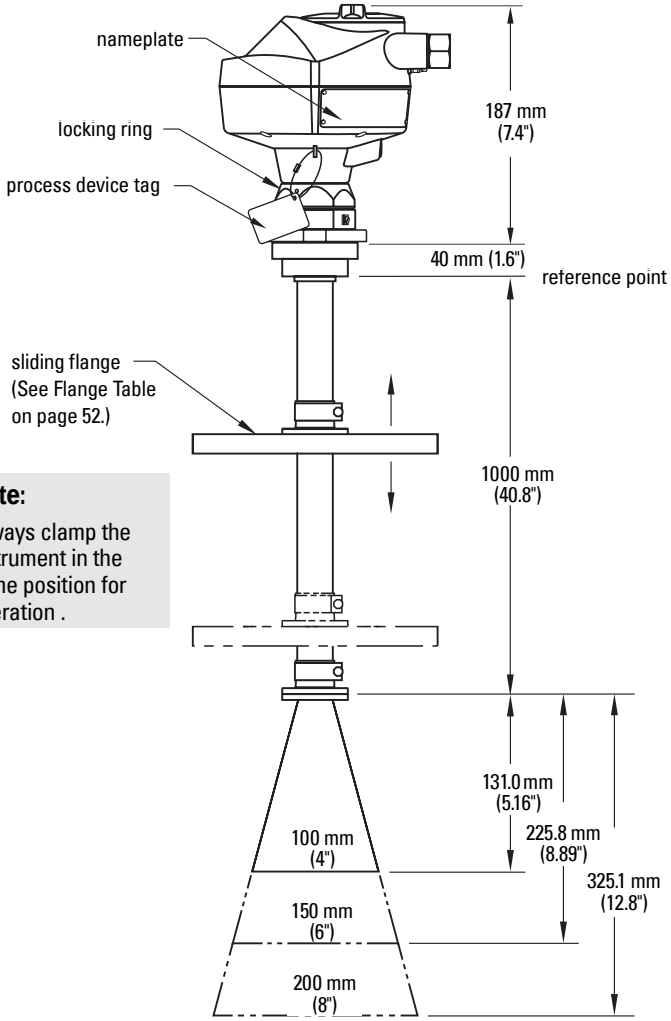
Dimensions: Waveguide Antenna with FF Flange



Notes:

- This option is recommended only for clean liquids on vessels without agitators or turbulence.
- Horizontal stress on this antenna must be avoided, otherwise mechanical support may be required.
- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available on our website at www.siemens.com/processautomation, on the product page for SITRANS LR 200, under **Process Connection Specification**s.

Dimensions: Sliding Waveguide Configuration



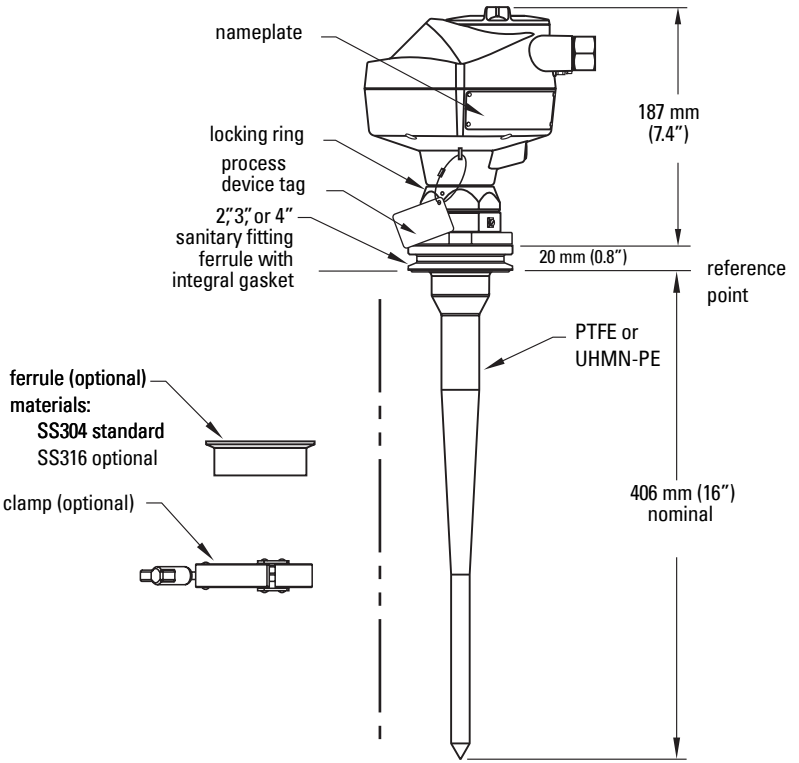
Note:

Always clamp the instrument in the same position for operation .

Notes:

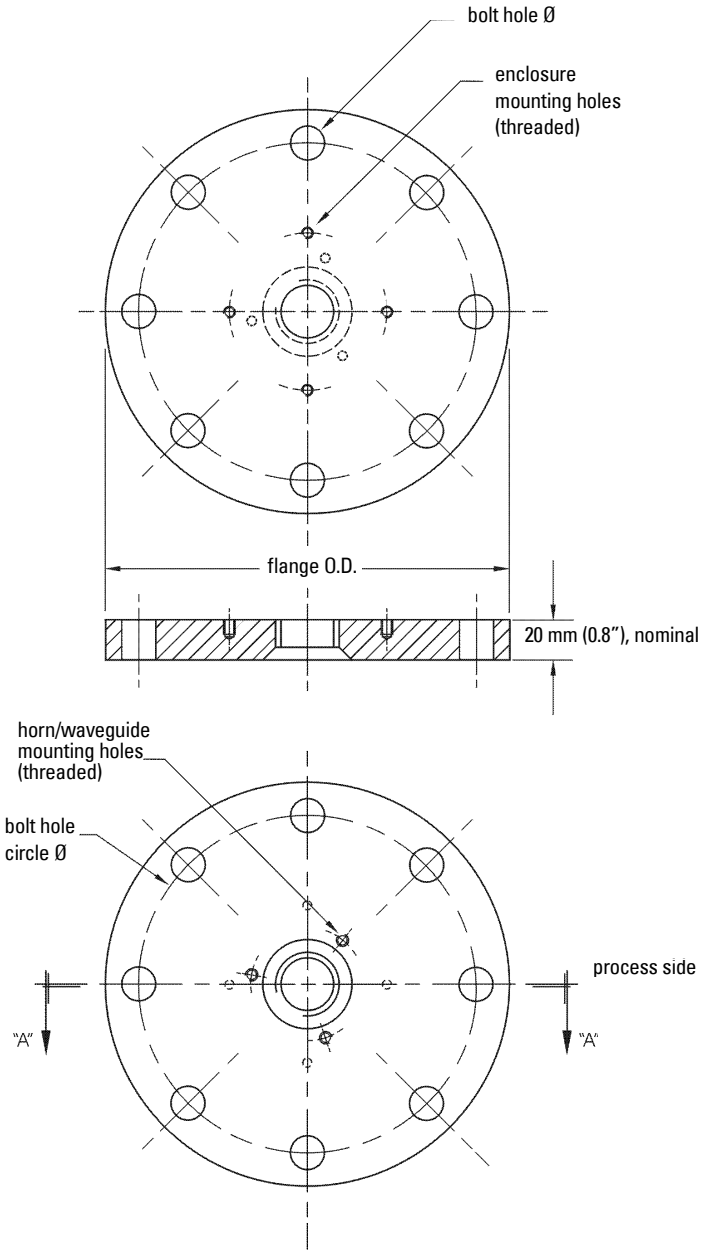
- Maximum pressure 0.5 bar at 60° C (140° F) for sliding flange option.
- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available on our website at www.siemens.com/processautomation, on the product page for SITRANS LR 200, under **Process Connection Specifications**.

Dimensions: Sanitary Rod Antenna



Note: Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available on our website at www.siemens.com/processautomation, on the product page for SITRANS LR 200, under **Process Connection Specifications**.

Dimensions: Flanges

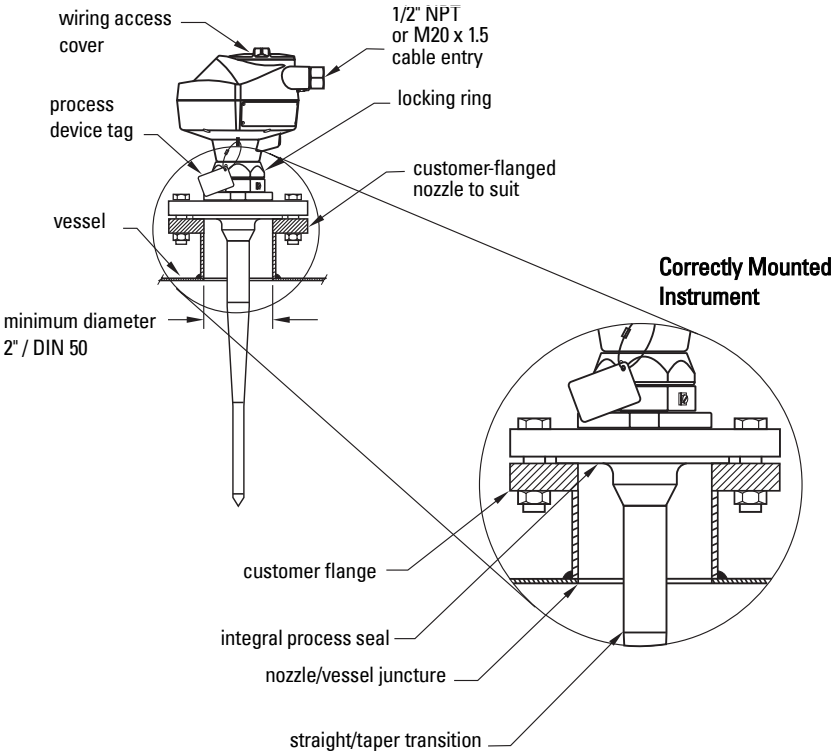


See chart on page 52 for further details on flange sizes.

Pipe size	Flange Size	Flange O.D.	Bolt Hole Circle Ø	Bolt Hole Ø	Number of Bolts
2″	ANSI 150#	6.0″	4.75″	.7″	4
3″	ANSI 150#	7.5″	6.0″	.75″	4
4″	ANSI 150#	9.0″	7.50″	.75″	8
6″	ANSI 150#	11.0″	9.50″	.88″	8
8″	ANSI 150#	13.5″	11.75″	.88″	8
2″	ANSI 300#**	6.50″	5.00″	.75″	4**
3″	ANSI 300#	8.25″	6.62″	.88″	8
4″	ANSI 300#	10.00″	7.88″	.88″	8
6″	ANSI 300#	12.50″	10.62″	.88″	12
8″	ANSI 300#	15.00″	13.00″	1.00″	12
50 mm	DIN PN 16	165 mm	125 mm	18 mm	4
80 mm	DIN PN 16	200 mm	160 mm	18 mm	8
100 mm	DIN PN 16	220 mm	180 mm	18 mm	8
150 mm	DIN PN 16	285 mm	240 mm	22 mm	8
200 mm	DIN PN 16	340 mm	295 mm	22 mm	12
200 mm	DIN PN 25	360 mm	310 mm	26 mm	12
50 mm	DIN PN 40	165 mm	125 mm	18 mm	4
80 mm	DIN PN 40	200 mm	160 mm	18 mm	8
100 mm	DIN PN 40	235 mm	190 mm	22 mm	8
150 mm	DIN PN 40	300 mm	250 mm	26 mm	8
200 mm	DIN PN 40	375 mm	320 mm	30 mm	12
50 mm	JIS 10K	155 mm	120 mm	19 mm	4
80 mm	JIS 10K	185 mm	150 mm	19 mm	8
100 mm	JIS 10K	210 mm	175 mm	19 mm	8
150 mm	JIS 10K	280 mm	240 mm	23 mm	8
200 mm	JIS 10K	330 mm	290 mm	23 mm	12

** Due to the limited space on this flange, SITRANS LR 200 can only use 4 of the standard 8 bolt holes of the 2″ ANSI #300 size.

Mounting PTFE Rod Antenna, FF Flange



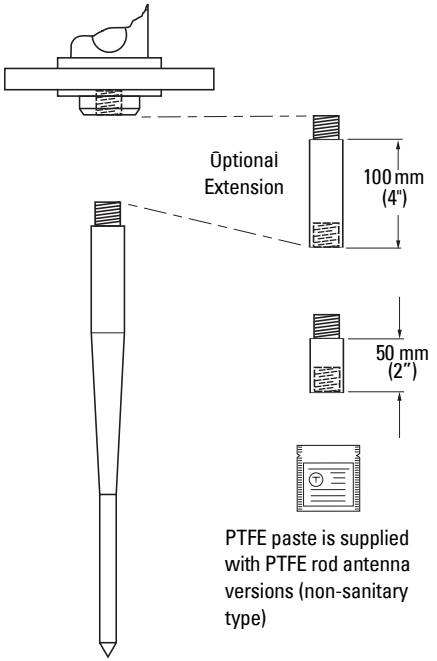
Notes:

- The integral process seal MUST rest on the customer flange. See the detail above, showing a correctly mounted instrument.
- The straight/taper transition of the rod should extend past the nozzle/vessel opening. Add extensions as required*.

* Refer to the *Rod Extension Requirements* table on page 54.

Rod Assembly

! WARNING: For pressure applications, it will be necessary to use PTFE tape or other appropriate thread sealing compound, and to tighten the process connection beyond hand-tight.



Notes:

- Water or process fluids must not enter the connecting threads: this could cause reflections at the connection, which will appear as false echoes.
- Apply a small amount of PTFE paste to the antenna threads before threading the antenna together, and tighten slowly. Ensure that the rod sections mate securely with no gaps. Do not apply too much PTFE paste or the parts will not mate securely.
- Do not use wrenches or pliers. Hand tighten only (except in pressure applications: see warning above).

Rod Extension Requirements

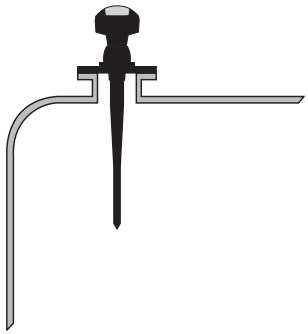
Nozzle I.D.	Nozzle Height mm (inches)*		
	<100 (4)	100 to 150 (4 to 6)	150 to 200 (6 to 8)
50 mm (2")	n/r	**	**
80 mm (3")	n/r	50 mm	100 mm
100 mm (4")	n/r	50 mm	100 mm
150 mm (6")	n/r	50 mm	100 mm
>150 mm (6")	n/r	n/r	n/r

n/r: extension not required

* Consult Siemens Milltronics for assistance with nozzle sizes not listed.

** Application not recommended for 50 mm (2") I.D. nozzles longer than 100 mm (4"). Shielded rod antennas are available for these applications.

Mounting: Rod Antenna



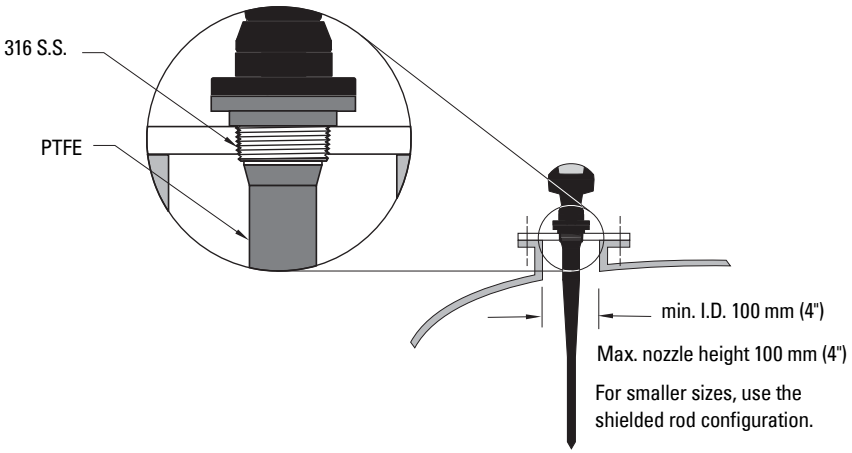
Ideally, the nozzle should be as short as possible. If your application requires a nozzle that exceeds our recommended maximum length, consider using a shielded rod configuration.

If you create a new nozzle for the radar instrument, the weld seams must be on the outside of the nozzle. Ensure that there are no seams or lips on the inside of the nozzle or you may get erratic readings.

If the mounting illustrated above is not suitable due to the minimum blanking requirements, consider the shielded rod or horn antenna options.

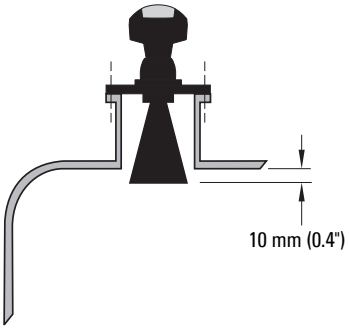
Mounting: Threaded Rod Antenna

You can use 1.5" or 2" threaded process connections. There are three thread types: NPT, BSP, and G.

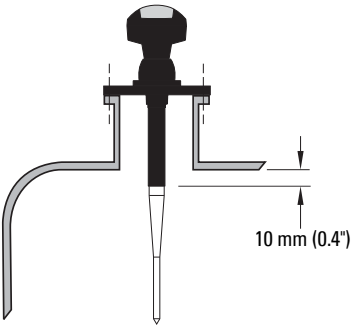


! WARNING: For pressure applications, it will be necessary to use PTFE tape or other appropriate thread sealing compound, and to tighten the process connection beyond hand-tight.

Mounting: Horn Antenna and Shielded Rod Antenna.



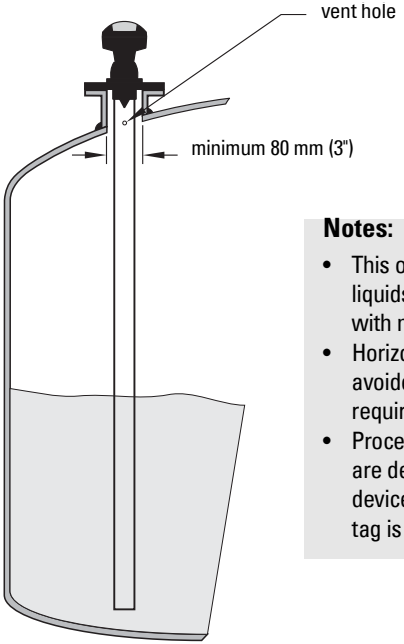
The end of the horn should protrude a minimum of 10 mm (0.4") to avoid interference with the nozzle.



The end of the shield should protrude a minimum of 10 mm (0.4") to avoid interference with the nozzle.

Mounting: Waveguide Antenna

This option is recommended for products with ε_r lower than 3. See *Propagation Factor* on page 97 for the related propagation factor.



Notes:

- This option is recommended only for clean liquids, and only on vessels without an agitator, with no turbulence.
- Horizontal stress on this antenna must be avoided, otherwise mechanical support may be required.
- Process temperature and pressure capabilities are dependent upon information on the process device tag. The reference drawing listed on the tag is available upon request.

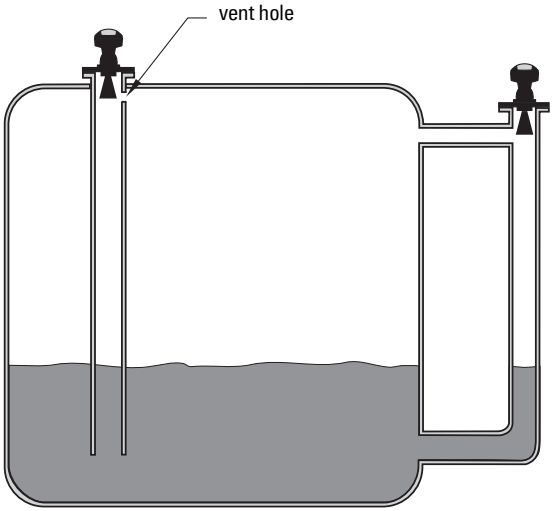
Mounting: Stillpipe or Sidepipe

This is an alternative to the waveguide antenna option, used for products with an ε_r less than 3 or for extremely turbulent or vortex conditions. This mounting arrangement can also be used to provide optimum signal conditions on foaming materials.

Suitable pipe diameters are 50 mm (2") to 250 mm (10"). Use a horn antenna for preference, but a rod antenna can also be used.

Smoothness

One continuous length of metallic pipe is preferred, without joints. If joints are unavoidable, you must machine them to close tolerances (± 0.25 mm [± 0.010"]) and weld a connecting sleeve on the outside.



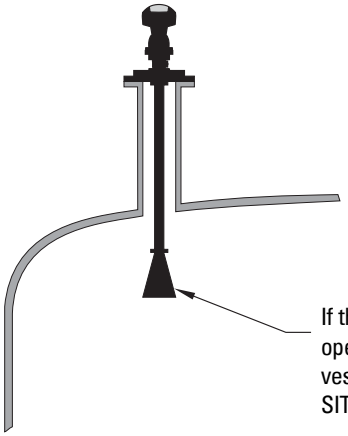
Suitable pipe diameters are 50 mm (2") to 250 mm (10").

A horn antenna is preferable, but a rod antenna can be used.

See *Propagation Factor* on page 97 for the related propagation factor.

Ensure there is a vent at the upper end of the side pipe to equalize pressure and keep the liquid-level in the pipe constant with the liquid-level in the vessel.

Mounting: Horn with Waveguide Extensions



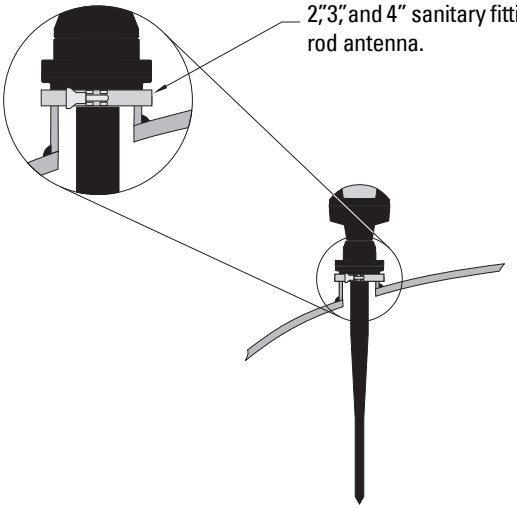
Use this combination if the nozzle is long and the diameter is small.

For example, if the nozzle is 100 mm (4") in diameter and 460 mm (18") in length), the rod antenna is not suitable due to nozzle interference.

Waveguide extensions are available in custom lengths.

If the horn diameter is too large for the nozzle opening, you need to insert it from inside the vessel. The horn must be connected to the SITRANS LR 200 process flange.

Mounting: Sanitary Rod Antenna



2",3",and 4" sanitary fitting ferrule, with rod antenna.

Appendix E: Special Applications

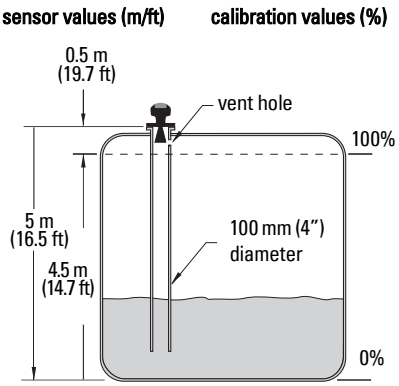
Application Example: Stillpipe

This mounting arrangement can be used for products with an ε_r of less than 3, or if extremely turbulent or vortex conditions exist. It can also be used to provide optimum signal conditions on foaming materials.

Notes:
- For $\varepsilon_r < 3$, the lower 400 mm of vessel level may not be measurable.
- Near Range will be set at the factory. Check the process device tag for specific values.
- Suitable pipe diameters are 50 mm (2") to 250 mm (10"): See chart on page 60 for typical values.

This application is to obtain a level measurement and corresponding output proportional to the oil level in a fuel storage vessel.

- The reference point of SITRANS LR 200 is 5 m (16.5 ft.) from the vessel bottom.
- Low Level Point is 0 m/ft. (bottom of tank).
- Low Calibration Point is 0%
- High Level Point is 4.5 m (14.7 ft.) from the bottom.
- High Calibration Point is 100%.
- The stillpipe inside diameter is 80 mm (3").
- Fill rate is about 0.1 m (4")/min.
- Empty rate is about 0.1 m (4")/min.
- In the event of a loss of echo, SITRANS LR 200 is to go into Failsafe Hi[1] after 2 minutes.



Parameter	Select/Enter	Hand Programmer Values
Response Rate	1 m/minute	2
Unit (Level)	meters	1
Low Level Point	0 (%)	0
Low Calibration Point	5 m	5
High Level Point	100 (%)	100
High Calibration Point	0.5 (m)	0.5
Propagation factor	0.915	0.915

1. For more detail, see *Failsafe Mode* on page 35.

Parameter	Select/Enter	Hand Programmer Values
Auto False Echo Suppression Distance	**distance to material minus 0.5 m**	**distance to material minus 0.5 m**
Auto False Echo Suppression	on	**2**

Press **Mode** to return to **RUN**: and start normal operation.

Pipe Inside Diameter	Propagation Factor Value (Typical)*
50 mm (2″)	0.827
80 mm (3″)	0.915
100 mm (4″)	0.955
150 mm (6″)	0.980
200 mm (8″)	0.990

* These values are provided as a guideline only.

Appendix F: programming via the hand programmer

Although the complete range of parameters is only accessible via PDM[1], you can access and adjust many of the parameters via the Siemens Milltronics infrared hand programmer.

- For the complete list of parameters, see *Appendix K: Parameter Descriptions* on page 85.
- *Appendix G: LCD menu structure* on page 65 gives a list of all parameters accessible via the hand programmer, preceded by the menu number.

Parameter Menu Structure

The parameters are organized into function groups, and arranged in a 4-level menu structure. For example:

1. Identification
1.2. Configuration
1.2.2. Remote Lock.

The LCD Display

Details on the LCD display are given in *Startup*, page 16 onwards.

Using the hand programmer

Note: For Quick Access to parameters via the hand programmer, press the mode key to activate PROGRAM mode, then key in the menu number.

Detailed instructions on using the hand programmer start on page 17, and on doing a Quick Setup start on page 21.

The following pages give details on how to programme some of the more complex SITRANS LR 200 parameters via the hand programmer.

Security

Local operation enable

Local Operation can be enabled or disabled via PDM. Go to **Identification > Device > Local Operation Enable** and select the desired setting.

1. Please see page 24 for *Remote operation via PROFIBUS PA*

Write locking

Write locking prevents any changes to parameters, either via PDM or the hand programmer, but still allows access to the device.

Values	**2547 (unlock value)**	**Off**	Enables parameter changes
	any other value	**On**	Disables parameter changes

1. Go to **Write Locking:**

   1. Identification Menu

   1. 3. Configuration

   1.3.5. Lock
2. Press **Right ARROW** [→] to open Edit mode.
3. Key in **2547** (unlock value) to enable parameter changes.
4. Press **Right ARROW** [→] again, to accept the change and return to Navigation mode.

Remote operation enable

Remote Operation can be enabled or disabled via the hand programmer.

Values	**0**	Remote operation enabled
	1	Remote operation disabled

To change the setting:

- Open **Identification** Menu, then scroll down to CONFIG.
- Press **Right ARROW** [→] to open the Config Menu, then scroll down to REMLOCK.

  1. Identification

  1.2. Configuration

  1.2.2. Remote Lock
- To enable programming, set REMLOCK to **0**. To disable programming, enter **1.**

How to do a Master Reset

Master Reset

Note: Following a Master Reset, complete reprogramming is required.

	1	Reset all parameters (except PROFIBUS address) to PROFIBUS PA profile default values
Values	**2506**	Warm Start: restart the device (this option is rarely used)
	2712	Reset PROFIBUS address to 126
	32768	Reset to manufacturer's default values (factory settings)[1]

Example: do a Profile reset

1. Go to **Reset:**

   1. Identification Menu

   1. 2. Configuration

   1.2.3. Reset

2. Press the **Right ARROW** key [→] to open Edit mode.
3. Key in **1 (Profile Reset)** to reset all parameters except PROFIBUS address.
4. Press the **Right ARROW** key [→] again, to accept the changes and return to Navigation mode.

Individual Parameter Reset

1. Press **Right ARROW** [→], then **CLEAR** [C], then **Right ARROW** [→].
2. The value returns to the default factory setting.

Fault Reset

Used to reset a fault message after an active fault has occurred and been corrected. A manual reset is required only for certain faults, identified by an asterisk (*) in the General Fault Code list on page 29.

To reset, key in the value of the fault code in question.

1. Go to **Reset Fault:**

   1. Identification Menu

   1. 2. Configuration

   1.2.4. Reset Fault

2. Press the **Right ARROW** key [→] to open Edit mode.
3. Key in the number of the Fault Code to reset the status to normal operation.
4. Press the **Right ARROW** key [→] again, to accept the change and return to Navigation mode.

---

1. Manufacturer's settings:
   AIFB Filter Time Constant = 10 s
   LTB values set for 0 - 20 m (Low and High Calibration points; Near Range and Far Range)

Device calibration

Only four settings are required for a Quick Setup: High Calibration Point, Low Calibration Point, High Level Point, and Low Level Point. (For an illustration, see *Calibration* on page 22.)

2.3. Sensor Calibration:

2.3.1. Sensor Units (default meters)
2.3.2. Calibration Type.

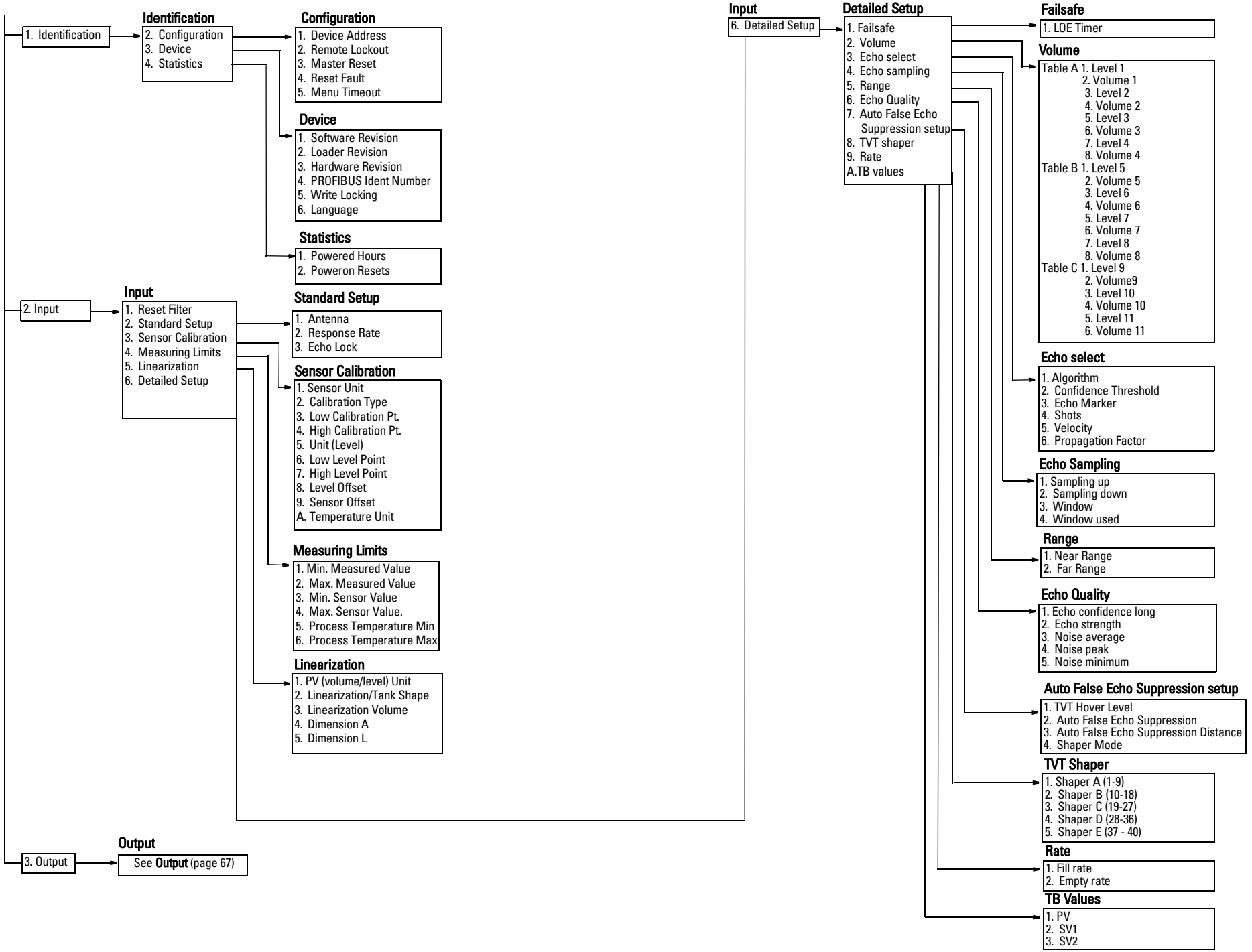
Values	**0**	*	"Dry" calibration
	1		"Wet" calibration (not recommended for SITRANS LR 200)

2.3.3. Low Calibration Pt.
2.3.4. High Calibration Pt.
2.3.5. Unit [Level] (default percent)
2.3.6. Low Level Point
2.3.7. High Level Point

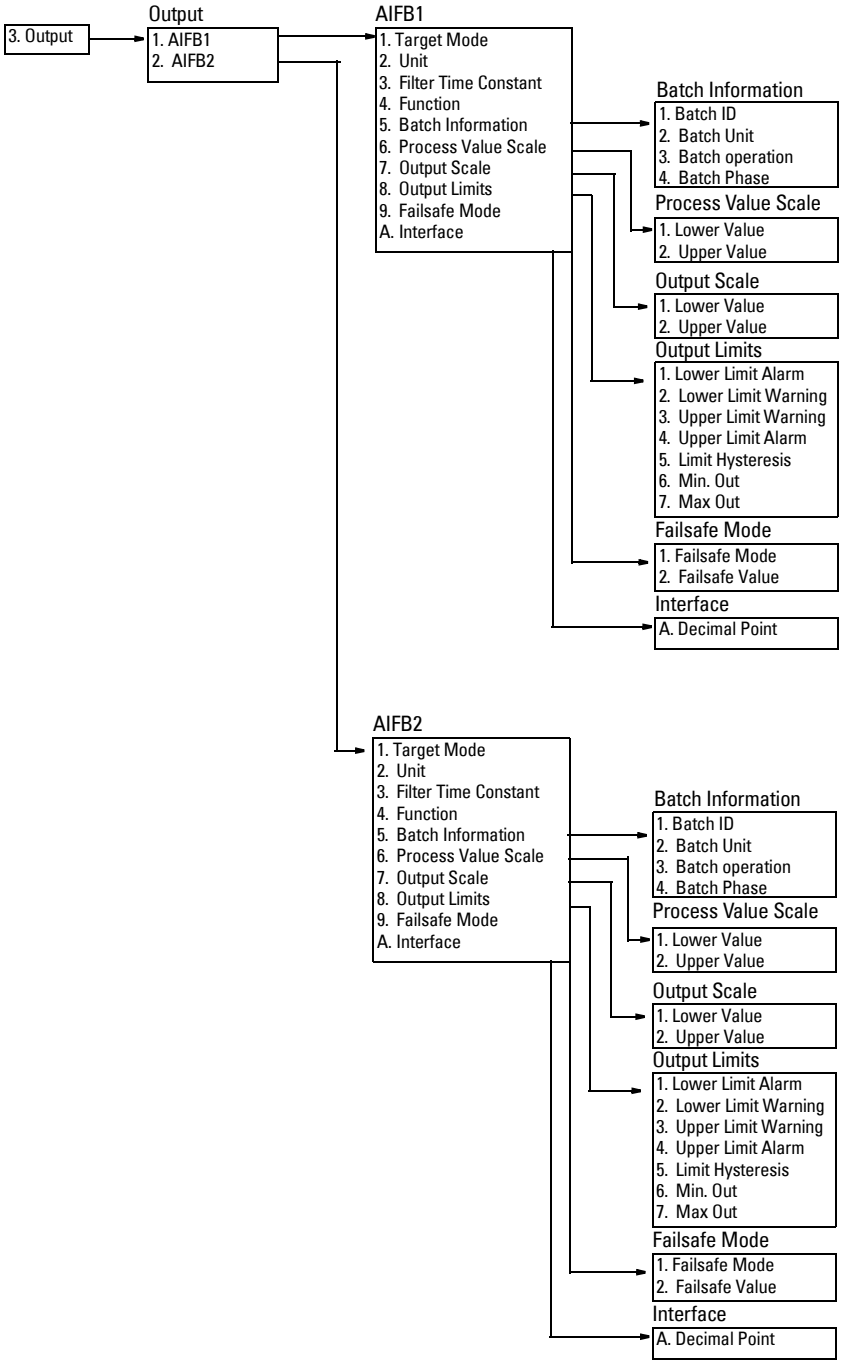
1. Go to **Calibration Type** and verify that "Dry" Calibration is selected.
2. Go to **Low Calibration Point** and enter the new value (default units are meters).
3. Go to **High Calibration Point** and enter the new value (default units are meters).
4. Go to **Low Level Point** and enter the corresponding value in percent (default is 0).
5. Go to **High Level Point** and enter the corresponding value in percent (default is 100).
6. SITRANS LR 200 is now ready to operate.

Appendix G: LCD menu structure

Appendix G: menu structure



SITRANS LR 200 (PROFIBUS PA) – INSTRUCTION MANUAL


3. Output
Output
1. AIFB1
2. AIFB2
AIFB1
1. Target Mode
2. Unit
3. Filter Time Constant
4. Function
5. Batch Information
6. Process Value Scale
7. Output Scale
8. Output Limits
9. Failsafe Mode
A. Interface
Batch Information
1. Batch ID
2. Batch Unit
3. Batch operation
4. Batch Phase
Process Value Scale
1. Lower Value
2. Upper Value
Output Scale
1. Lower Value
2. Upper Value
Output Limits
1. Lower Limit Alarm
2. Lower Limit Warning
3. Upper Limit Warning
4. Upper Limit Alarm
5. Limit Hysteresis
6. Min. Out
7. Max Out
Failsafe Mode
1. Failsafe Mode
2. Failsafe Value
Interface
A. Decimal Point
AIFB2
1. Target Mode
2. Unit
3. Filter Time Constant
4. Function
5. Batch Information
6. Process Value Scale
7. Output Scale
8. Output Limits
9. Failsafe Mode
A. Interface
Batch Information
1. Batch ID
2. Batch Unit
3. Batch operation
4. Batch Phase
Process Value Scale
1. Lower Value
2. Upper Value
Output Scale
1. Lower Value
2. Upper Value
Output Limits
1. Lower Limit Alarm
2. Lower Limit Warning
3. Upper Limit Warning
4. Upper Limit Alarm
5. Limit Hysteresis
6. Min. Out
7. Max Out
Failsafe Mode
1. Failsafe Mode
2. Failsafe Value
Interface
A. Decimal Point

Notes

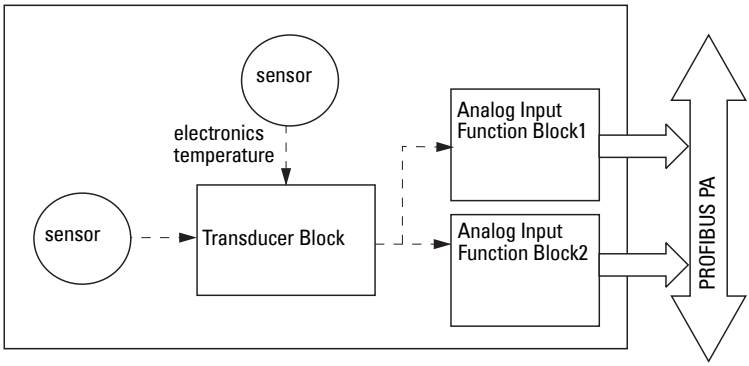
Appendix H: PROFIBUS PA Profile Structure

PROFIBUS Level Device Design

The device follows the profile block model and is implemented as a Profile 3.0, Class B, PA device. Standard profile parameters are used to program the level transducer block.

Block Model for recording and processing measured values

The functions of the device are divided into blocks for different areas of responsibility. They can be parameterized by acyclic data transfer via PDM.



The device is implemented with one Physical Block (PB1), one Level Transducer Block (LTB1), and two Analog Input Function Blocks (AIFB1 and AIFB2).

All data is viewed from the perspective of the DCS or PLC, so information from the sensor is an input.

Transducer Block (TB)

The Level Transducer Block (LTB) carries out adjustments to the sensor, such as level calibration and volume calibration. It supplies the outputs utilized by either or both of the AIFBs.

Analog Input Function Blocks AIFB1 and AIFB2

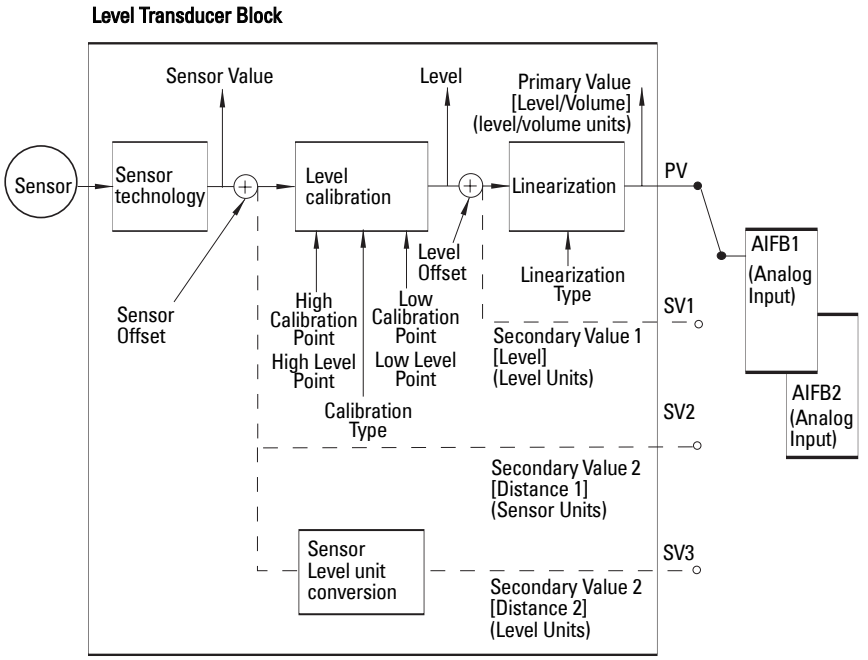
The two AIFBs are completely independent of each other. They utilize the output from the Level TB, and apply any required quality checks, scaling, and Failsafe operation selections.

The output of an Analog Input Function Block supplies the measured value and associated status information to PROFIBUS PA, via cyclic data transfer.

Description of the blocks

Transducer block function groups

The figure below shows the signal flow of measured values from the sensor through the Transducer block into the output value (Primary Value/ Level or Volume; Secondary Value 1 / Level; Secondary Value 2 /Distance 1; or Secondary Value 3 / Distance 2). The Level TB implements all of the basic parameters (see parameter diagram on page 71), including level to volume calculation, if that option has been selected.



How the LTB works:

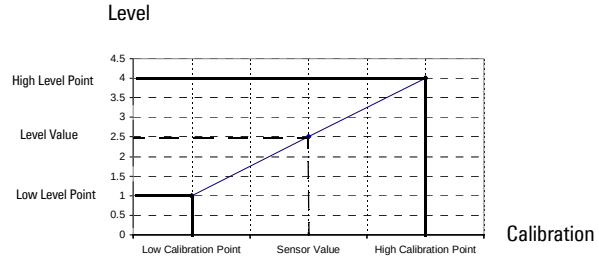
1. The sensor technology block selects the proper echo. For an explanation of sensor technology, please refer to *Appendix A: Technical Reference*, page 33 onwards.

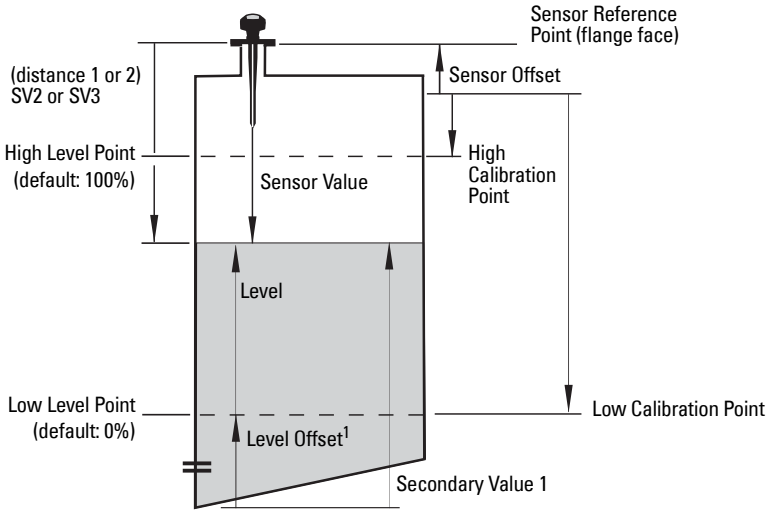
   The sensor value (in sensor units) is checked to see if it is within its measuring limits. If the limit is exceeded, this results in a **Bad** status and the error message **Failure in measurement**. The sensor value is stored in Sensor Value.

   The analog signal from the sensor is transformed into a digital signal.

   A Sensor Offset (default 0) provides compensation if necessary for changes in the sensor.

2. Level Calibration is a linear transfer function that converts a sensor value to a level value. The level value is used for volume calculation, if that function is enabled.





3. Then linearization can be carried out to accommodate complex tank shapes, or to provide level to volume conversion.
4. The LTB provides four possible outputs
   - Primary Value (PV) / Level or Volume
   - Secondary Value 1 (SV1) / Level
   - Secondary Value 2 (SV2) / Distance1 (sensor units)
     or
   - Secondary Value 3 (SV3) / Distance 2 (any level units, except %)

1. Level Offset (default 0) can compensate for specific tank configurations.

Electronics temperature

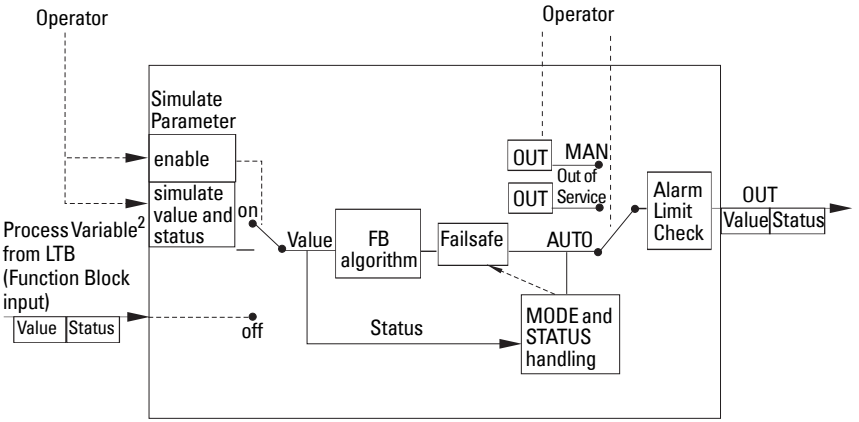
The transducer block also monitors the internal temperature of the device electronics. If the temperature exceeds permitted limits, it does not change the sensor value, but it does change the status.The permitted limits correspond to those of the permitted ambient temperature.

If a temperature limit is exceeded, the status changes. Peak indicators[1] allow you to check the maximum and minimum temperatures that have occurred.

Analog Input Function Blocks 1 and 2

The figure below shows how measured values are processed within the two Analog Input Function Blocks (**AIFB1** and **AIFB2**) to produce the device outputs, which are communicated via cyclic transfer to PROFIBUS PA, and displayed on the LCD.

Analog Input Function Block function groups (simulation, mode and status)



1. Open View menu, scroll down to Peak Values, and click on Temperature tab in the Peak Values window.
2. The output from the Level Transducer Block can be called the Primary Value (or Secondary Value). When it becomes the input to the AIFB, it is called the Process Variable.

How the AIFBs work

The Analog Input Function Blocks allow you to control modifications to the output value (PROFIBUS cyclic data).

Output Conversion

Values transmitted by the Level TB have a status attached. The decision on what to do with each value is made by the Analog Input Function Block.

Device/ Input Simulation

The input can be a simulated value instead of a TB OUT value. This allows the AI block to be tested independently of the characteristics of the environment.

Failsafe

- If the status of the Primary Value or Simulation Value is **bad**, the fault logic can output either the last usable measured value, or a given substitute value.

Device / Output Simulation

One of three settings can be selected:

Setting	description	Output value
AUTO	automatic	the automatically-recorded measured value
MAN	manual	a manually-set fixed simulation value
O/S	function block disabled	the preset safety value.

- The result is the output parameter (OUT).

AIFB execution steps:

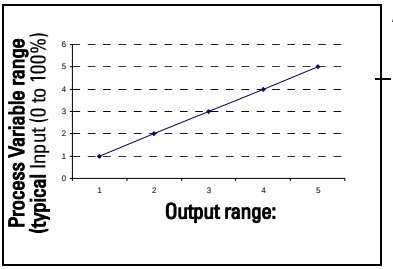
The AIFBs can provide a linear conversion to any desired units.

1. The input value is normalized (Scaling Input)

   Process Variable range applies to any of the four LTB values. (Units of the Process Variable scale are the same as the units used for the LTB output.) Output units together with Process Variable range determine how the LTB output is converted to whatever units the customer wants.

2. The scaling output is applied.

For example:



3. This value is filtered using a first order filter based on a time constant provided by the user.
4. The status of the Process Variable (input value) is checked. If the status is Bad, a Failsafe condition occurs. The output is determined by the Failsafe Mode of the block.
5. The target mode parameter allows the entire AI block to be overridden by a Manual Out value.
6. The value is checked against the user parameterized warning and alarm limits. (There is an upper and lower warning limit and an upper and lower alarm limit. The unit of the limits corresponds to the unit of the output range. A hysteresis parameter prevents toggling in the Status field of the OUT value.)
7. The OUT VALUE parameter is the value for the cyclic data transfer.

Appendix J: Asynchronous Communications Data Map

Directory

Slot	Index	Value	Description	Size (bytes)
			Directory Header	
		1	1 - Directory ID	
		1	1 - Revision Number	
1	0	3	3 - Number of entries	
		8	8 - Directory Entries	
		1	1 - First Composite List	
		3	3 - Num Composite Lists	
			List Directory	
			Entry Index No. of blocks	
	1	0x01040001	1 4 1 (1 PB, at Index 4)	4
	2	0x02050002	2 5 2 (2 TBs, at Index 5)	4
	3	0x03070002	3 7 2 (2 FBs, at Index 7)	4
1			Directory	
			Slot Index No. of parameters	
	4	0x00100053	0 16 83 Physical Block	4
	5	0x0064001C	0 100 30 (Internal Use Only)	4
	6	0x014D008A	1 77 138 Transducer Block	4
	7	0x0110002F	1 16 47 AIFB	4
	8	0x0210002F	2 16 47 AIFB	4

Physical Block 1

This is the only physical block for the device.

Relative Index	Name	Access	Structure	Type
0	Block Object	r	Reserved	UNSIGNED_INTEGER (1)
			Block Object	INTEGER (1)
			Parent Class	INTEGER (1)
			Class	INTEGER (1)
			DD Reference	UNSIGNED_INTEGER(4)
			DD Revision	UNSIGNED_INTEGER(2)
			Profile	INTEGER (2)
			Profile Revision	INTEGER (2)
			Execution Time	UNSIGNED_INTEGER (1)
			Number of Parameters	UNSIGNED_INTEGER(2)
			Address of View 1	UNSIGNED_INTEGER(2)
			Number of views	UNSIGNED_INTEGER(1)

Relative Index	Name	Access	Structure	Type (cont'd)
1	ST REV	r	Value	UNSIGNED_INTEGER(2)
2	Tag	r/w	Value	ASCII(32)
3	Strategy	r/w	Value	UNSIGNED_INTEGER(2)
4	Alert Key	r/w	Value	UNSIGNED_INTEGER (1)
5	Target Mode	r/w	Value	UNSIGNED_INTEGER (1)
6	Mode Block	r	Actual Mode	UNSIGNED_INTEGER (1)
			Permitted Modes	UNSIGNED_INTEGER (1)
			Normal Mode	UNSIGNED_INTEGER (1)
7	Alarm Summary	r	Current States	UNSIGNED_INTEGER (1)
			Unacknowledged	UNSIGNED_INTEGER (1)
			Unreported	UNSIGNED_INTEGER (1)
			Disabled	UNSIGNED_INTEGER (1)
8	Software Revision	r	Value	ASCII(16)
9	Hardware Revision	r	Value	ASCII(16)
10	Manufacturer ID	r	Value	UNSIGNED_INTEGER (2)
11	Device ID	r	Value	ASCII(16)
12	Serial Number	r	Value	ASCII(16)
13	Diagnosis	r	Value	UNSIGNED_INTEGER (4)
14	Diagnosis Extension	r	Value	BYTE (6)
15	Diagnosis Mask	r	Value	UNSIGNED_INTEGER (4)
16	Diagnosis Ext Mask	r	Value	BYTE (6)
17	Certification	r	Value	ASCII(32)
18	Write Locking	r/w	Value	UNSIGNED_INTEGER(2)
19	Factory Reset	r/w	Value	UNSIGNED_INTEGER(2)
20	Descriptor	r/w	Value	ASCII(32)
21	Device Message	r/w	Value	ASCII(32)
22	Installation Date	r/w	Value	ASCII(16)
23	Local Operation Enable	r/w	Value	UNSIGNED_INTEGER (1)
24	Ident Number Selector	r/w	Value	UNSIGNED_INTEGER (1)
25	HW Write Protect	r	Value	UNSIGNED_INTEGER (1)
40	Diagnosis Simulation	r/w	Enable	UNSIGNED_INTEGER (1)
			Simulation	UNSIGNED_INTEGER (4)
41				UNSIGNED_INTEGER (1)
42	Order Number	r		ASCII (48)
43	Language	r/w		UNSIGNED_INTEGER (1)
44	Reserved			
45	Reserved			

Relative Index	Name	Access	Structure	Type (cont'd)
46	Device Wear	r	Powered Hours	UNSIGNED_INTEGER (4)
			Poweron Resets	UNSIGNED_INTEGER (2)
47	Reserved			
48	Reserved			
49	Date of Birth	r	Value	ASCII (16)
50	Powered Seconds	r	Value	UNSIGNED_INTEGER (4)
51	Boot Revision	r	Value	ASCII (16)
52	Reset Fault	w	Value	UNSIGNED_INTEGER (2)
82	Profibus Address	r/w		
83	View Object	r	Value	BYTE(17)

Analog Input Function Blocks: AIFB1 and AIFB2

Each of the two Analog Input Function Blocks can be set up to return **Level**, **Distance**, or **Volume**. Within the function blocks, the values are scaled according to the user requirement.

Relative Index	Name	Access	Structure	Type
0	Block Object	r	Reserved	UNSIGNED_INTEGER (1)
			Block Object	INTEGER (1)
			Parent Class	INTEGER (1)
			Class	INTEGER (1)
			DD Reference	UNSIGNED_INTEGER(4)
			DD Revision	UNSIGNED_INTEGER(2)
			Profile	INTEGER (2)
			Profile Revision	INTEGER (2)
			Execution time	UNSIGNED_INTEGER (1)
			Number of Parameters	UNSIGNED_INTEGER(2)
			Address of View 1	UNSIGNED_INTEGER(2)
			Number of views	UNSIGNED_INTEGER(1)
1	ST REV	r	Value	UNSIGNED_INTEGER(2)
2	Tag	r/w	Value	ASCII(32)
3	Strategy	r/w	Value	UNSIGNED_INTEGER(2)
4	Alert Key	r/w	Value	UNSIGNED_INTEGER (1)
5	Target Mode	r/w	Value	UNSIGNED_INTEGER (1)
6	Mode Block	r	Actual Mode	UNSIGNED_INTEGER (1)
			Permitted Modes	UNSIGNED_INTEGER (1)
			Normal Mode	UNSIGNED_INTEGER (1)

Relative Index	Name	Access	Structure	Type (cont'd)
7	Alarm Summary	r/w	Current States	UNSIGNED_INTEGER (1)
			Unacknowledged	UNSIGNED_INTEGER (1)
			Unreported	UNSIGNED_INTEGER (1)
			Disabled	UNSIGNED_INTEGER (1)
8	Batch Information	r/w	Batch ID	UNSIGNED_INTEGER(4)
			Batch RUP	UNSIGNED_INTEGER (2)
			Batch Operation	UNSIGNED_INTEGER(2)
			Batch Phase	UNSIGNED_INTEGER(2)
10	OUT	r/w	Value	FLOAT
			Status	UNSIGNED_INTEGER (1)
11	PV Range	r/w	Upper	FLOAT
			Lower	FLOAT
12	Output Scale	r/w	Upper	FLOAT
			Lower	FLOAT
			Units	UNSIGNED_INTEGER(2)
			Decimals	INTEGER (1)
13	Linearization	r/w	Value	UNSIGNED_INTEGER (1)
14	Channel/Function	r/w	Value	UNSIGNED_INTEGER(2)
16	Filter Time Constant	r/w	Value	FLOAT
17	Failsafe Mode	r/w	Value	INTEGER (1)
18	Failsafe Value	r/w	Value	FLOAT
19	Alarm Hysteresis	r/w	Value	FLOAT
21	Hi Hi Alarm Limit	r/w	Value	FLOAT
23	Hi Alarm Limit	r/w	Value	FLOAT
25	Lo Alarm Limit	r/w	Value	FLOAT
27	Lo Lo Alarm Limit	r/w	Value	FLOAT
30	Hi Hi State (Not Used)	r		UNSIGNED_INTEGER (1)
31	Hi State (Not Used)	r		UNSIGNED_INTEGER(1)
32	Lo State (Not Used)	r		UNSIGNED_INTEGER(1)
33	Lo Lo State (Not Used)	r		UNSIGNED_INTEGER(1)

Relative Index	Name	Access	Structure	Type (cont'd)
34	Simulation	r/w	Status	UNSIGNED_INTEGER(1)
			Value	FLOAT
			Enable	UNSIGNED_INTEGER(1)
35	Out Unit Text			ASCII(16)
45	Max Out Value	r/w		FLOAT
46	Min Out Value	r/w		FLOAT
60	fbViewObject	r	Value	BYTE(18)

Transducer Block (Level)

This is the main transducer block for the device. (A second block is for internal use only.)

Relative Index	Name	Access	Structure	Type
0	Block Object	r	Reserved	UNSIGNED_INTEGER (1)
			Block Object	INTEGER (1)
			Parent Class	INTEGER (1)
			Class	INTEGER (1)
			DD Reference	UNSIGNED_INTEGER(4)
			DD Revision	UNSIGNED_INTEGER(2)
			Profile	INTEGER (2)
			Profile Revision	INTEGER (2)
			Execution Time	UNSIGNED_INTEGER (1)
			Number of Parameters	UNSIGNED_INTEGER(2)
			Address of View 1	UNSIGNED_INTEGER(2)
			Number of views	UNSIGNED_INTEGER(1)
1	ST REV	r	Value	UNSIGNED_INTEGER(2)
2	Tag	r/w	Value	ASCII(32)
3	Strategy	r/w	Value	UNSIGNED_INTEGER(2)
4	Alert Key	r/w	Value	UNSIGNED_INTEGER (1)
5	Target Mode	r/w	Value	UNSIGNED_INTEGER (1)
6	Mode Block	r	Actual Mode	UNSIGNED_INTEGER (1)
		r/w	Permitted Modes	UNSIGNED_INTEGER (1)
		r/w	Normal Mode	UNSIGNED_INTEGER (1)
7	Alarm Summary	r/w	Current States	UNSIGNED_INTEGER (1)
			Unacknowledged	UNSIGNED_INTEGER (1)
			Unreported	UNSIGNED_INTEGER (1)
			Disabled	UNSIGNED_INTEGER (1)

Relative Index	Name	Access	Structure	Type (cont'd)
8	PV	r	Value	FLOAT
			Status	INTEGER (1)
9	PV Units	r/w	Value	INTEGER (2)
10	Level	r	Value	FLOAT
11	Level Units	r/w	Value	UNSIGNED_INTEGER (2)
12	Sensor Value	r	Value	FLOAT
13	Sensor Units	r/w	Value	INTEGER (2)
14	SV1	r	Value	FLOAT
			Status	INTEGER (1)
15	SV1 Units	r/w	Value	INTEGER (2)
16	SV2	r	Value	FLOAT
			Status	INTEGER (1)
17	SV2 Units	r/w	Value	INTEGER (2)
18	Sensor Offset	r/w	Value	FLOAT
19	Calibration Type	r/w	Value	UNSIGNED_INTEGER (1)
20	Cal Lo	r/w	Value	FLOAT
21	Cal Hi	r/w	Value	FLOAT
22	Level Lo	r/w	Value	FLOAT
23	Level Hi	r/w	Value	FLOAT
24	Level Offset	r/w	Value	FLOAT
25	Linearization Type	r/w	Value	INTEGER (1)
26	Diameter	r/w	Value	FLOAT
27	Max Volume	r/w	Value	FLOAT
28	Sensor Hi Limit	r	Value	FLOAT
29	Sensor Lo Limit	r	Value	FLOAT
30	Max Sensor Value	r/w	Value	FLOAT
31	Min Sensor Value	r/w	Value	FLOAT
32	Temperature	r	Value	FLOAT
33	Temperature Units	r/w	Value	INTEGER (2)
34	Max Tempera-ture	r/w	Value	FLOAT

Relative Index	Name	Access	Structure	Type (cont'd)
35	Min Temperature	r/w	Value	FLOAT
53	SV3	r/w	Value	FLOAT
53		r/w	Status	UNSIGNED_INTEGER (1)
54	SV3 Units	r/w	Value	UNSIGNED_INTEGER (2)
65	Basic setup	r/w	Transducer	INTEGER (2)
			Algorithm	INTEGER (1)
			Response Rate	INTEGER (1)
66		r/w	Lock	INTEGER (1)
			Window Sill	UNSIGNED_INTEGER (1)
67	TVT Hover	r/w		INTEGER (1)
68	Confidence Threshold	r/w		UNSIGNED_INTEGER (1)
69	Echo Information	r	Echo Confidence	UNSIGNED_INTEGER (1)
			Echo Strength	UNSIGNED_INTEGER (1)
			Average Noise	INTEGER (1)
70		r	Peak Noise	INTEGER (1)
			Min Noise	INTEGER (1)
72	LOE Timeout	r/w		FLOAT
73	Rate Limits	r/w	Fill Rate Limit	FLOAT
73		r/w	Empty Rate Limit	FLOAT
74	Reserved	r		
75	Reserved	r/w		FLOAT
76	Simulation	r/w	Fixed	FLOAT
			Min Value	FLOAT
			Max Value	FLOAT
			Number of Steps	UNSIGNED_INTEGER (2)
			Step Size	UNSIGNED_INTEGER (2)
			Mode	INTEGER (1)
77	Auto TVT	r/w	Mode	INTEGER (1)
			Range	FLOAT
78	Reserved	r		FLOAT
78	Reserved	r		FLOAT
79	Number of shots	r/w	Value	INTEGER (1)
80	Reserved	r/w		INTEGER (1)

Relative Index	Name	Access	Structure	Type (cont'd)
81	XY1	r/w	X	FLOAT
			Y	FLOAT
82	XY2	r/w	X	FLOAT
			Y	FLOAT
83	XY3	r/w	X	FLOAT
			Y	FLOAT
84	XY4	r/w	X	FLOAT
			Y	FLOAT
85	XY5	r/w	X	FLOAT
			Y	FLOAT
86	XY6	r/w	X	FLOAT
			Y	FLOAT
87	XY7	r/w	X	FLOAT
			Y	FLOAT
88	XY8	r/w	X	FLOAT
			Y	FLOAT
89	XY9	r/w	X	FLOAT
			Y	FLOAT
90	XY10	r/w	X	FLOAT
			Y	FLOAT
91	XY11	r/w	X	FLOAT
			Y	FLOAT
92- 129			Reserved	
130	Velocity	r		FLOAT
131	Propagation Factor	r/w		FLOAT
132	Tank shape	r/w	Dim A	FLOAT
			Dim L	FLOAT
133	TVT Shaper Mode	r/w		INTEGER (1)
134	Shaper Array	r/w	Point 1	INTEGER (1)
			Point 2	INTEGER (1)
			Point 3	INTEGER (1)
			Point 4	INTEGER (1)
			Point 5	INTEGER (1)
			Point 6	INTEGER (1)

Relative Index	Name	Access	Structure	Type (cont'd)
134 (cont'd)	Shaper Array (cont'd)	r/w (cont'd)	Point 7	INTEGER (1)
			Point 8	INTEGER (1)
			Point 9	INTEGER (1)
			Point 10	INTEGER (1)
			Point 11	INTEGER (1)
			Point 12	INTEGER (1)
			Point 13	INTEGER (1)
			Point 14	INTEGER (1)
			Point 15	INTEGER (1)
			Point 16	INTEGER (1)
			Point 17	INTEGER (1)
			Point 18	INTEGER (1)
			Point 19	INTEGER (1)
			Point 20	INTEGER (1)
			Point 21	INTEGER (1)
			Point 22	INTEGER (1)
			Point 23	INTEGER (1)
			Point 24	INTEGER (1)
			Point 25	INTEGER (1)
			Point 26	INTEGER (1)
			Point 27	INTEGER (1)
			Point 28	INTEGER (1)
			Point 29	INTEGER (1)
			Point 30	INTEGER (1)
			Point 31	INTEGER (1)
			Point 32	INTEGER (1)
			Point 33	INTEGER (1)
			Point 34	INTEGER (1)
			Point 35	INTEGER (1)
			Point 36	INTEGER (1)
			Point 37	INTEGER (1)
			Point 38	INTEGER (1)
			Point 39	INTEGER (1)
			Point 40	INTEGER (1)
135	Lock Counters	r/w	Lock Down	UNSIGNED_INTEGER (1)
			Lock Up	UNSIGNED_INTEGER (1)

Relative Index	Name	Access	Structure	Type (cont'd)
136	Lock Window	r/w	Value	FLOAT
137	Reserved			
138	Echo Window Used	r	Value	FLOAT
139	Measuring Range	r/w	Upper limit	FLOAT
			Lower Limit	FLOAT
160	tbViewObject			

Appendix K: Parameter Descriptions

SITRANS LR 200 (PROFIBUS PA): parameter menus

The parameters are grouped in menus according to function. Submenus, arranged on four levels, give access to associated features and options.

Some menus are accessible in PDM only via pull-down menus: in those cases, directions are given beside the individual parameter.

Not all menus are accessible via the hand programmer. Menus that are accessible via the hand programmer are preceded by a number (applicable only to the hand programmer).

Notes:
- For Quick Access to parameters via the hand programmer, press the mode key to activate PROGRAM mode, then key in the menu number. (For more details, see *The hand programmer* on page 17.)
- Values shown in the tables below can be entered via the hand programmer.

1. Identification

Operation Unit

Tag

Text that can be used in any way, for example as a unique label for a field device in the plant.

Description

Text that is associated with the Field Device. This text can be used by the user in any way. There is no specific recommended use.

Message

Text that is associated with the Fleld Device. This text can be used by the user in any way. There is no specific recommended use.

1.2. Configuration

1.2.1. Address (default 126)

The unique address of the device on the network (also called PROFIBUS address).

Values	**0 - 126**

Open the menu **Device – Set Address**.

1.2.2. Remote operation enable

Enables or disables programming via the network and PDM.

Values	**0**	Remote operation enabled
	1	Remote operation disabled

1.2.3. Master Reset

Note: Following a Master Reset, complete reprogramming is required.

Values	**1**	Reset all parameters (except PROFIBUS address) to PROFIBUS PA profile default values
	2506	Warm Start: restart the device (this option is rarely used)
	2712	Reset PROFIBUS address to 126
	32768	Reset to manufacturer's default values (factory settings)

1.2.4. Reset Fault

Resets the Fault message after an active fault has occurred and been corrected. This is required only for faults listed as requiring a manual reset in the General Fault Code list (see page 29).

To reset, key in the value of the fault code in question.

1.2.5. Menu Timer

Determines the length of time (in seconds) the device will stay in PROGRAM mode without any key presses occurring.

1.3. Device

Manufacturer

References a specific manufacturer, usually the name of the company responsible for the manufacture of this Field Device.

Product designation

Uniquely identifies the Field Device when combined with the Manufacturer Identification and Device Type. This variable cannot be modified by the Host user.

Device Serial Num

Uniquely identifies the Field Device. This variable cannot be modified by the Host.

Order No.

The order number for this device.

Date of birth

Date of manufacture.

1.3.1. Software Revision

Corresponds to the software or firmware that is embedded in the Field Device.

1.3.2. Loader Revision

Corresponds to the software used to update the Field Device.

1.3.3. Hardware Revision

Corresponds to the electronics hardware of the Field Device.

Profile Revision

PROFIBUS PA Profile standard that this device conforms to.

Static Revision No.

The revision level of the static data associated with the Physical Block. The Static Revision No. is updated whenever a standard profile configuration parameter is changed.

1.3.4. PROFIBUS Ident Number

Identifies the device on the network. The Ident Number must match that in the GSD file (the GSD file provides information on the device to the master).

Values	**0**	Profile-specific (uses generic device DD and profile GSD for class B device)
	1	Manufacturer-specific (uses SMPI DD and GSD file, which identifies the LR 200 [PROFIBUS PA]).

Installation Date

Date on which the device was installed. The user must enter the date.

Local Operation Enable

Enables/disables programming the device via the hand programmer.When disabled, the user still has access to the mode control of the two Analog Input Function Blocks.

1.3.5. Write Locking

Prevents any changes to parameters via PDM or the hand programmer.

Values	**2547 (unlock value)**	Off (enables programming)
	any other value	On (disables programming)

Open the menu **Device – Write Locking**, and select On or Off.

1.3.6. Language

Selects the language to be used on the LCD.

Values	**0**	English
	1	German
	2	French
	3	Spanish
	4	Italian

1.4. Statistics[1]

1.4.1. Powered Hours

Number of hours the unit has been powered up since manufacture.

1.4.2. Poweron Resets

The number of power cycles that have occurred since manufacture.

2. Input

Static Revision Number

The revision level of the static data associated with the Transducer Block, updated whenever a standard profile configuration parameter is changed.

Class

Indicates the Level Transducer Block as per PROFIBUS PA PRofile specifications.

2.1. Reset Filter

Resets the rate filter.

Value	**1**	the sensor value immediately goes to the target distance

2.2. Standard Setup

2.2.1. Antenna

Identifies antenna configuration.

Values	**240**	rod antenna
	241	rod + 50 mm extension
	242	rod + 100 mm extension
	243	rod + 150 mm extension

1. To find Statistics in PDM, open **View** menu and scroll down to **Wear**.

2.2.2. Response Rate

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

Related parameters	Response Rate			LOE Timer[1] (minutes)	Fill Rate	Empty Rate	Echo Lock[2]	
Values	1	*	slow	100	0.1 m/minute	0.1 m/minute	2	material agitator
	2		medium	10	1 m/minute	1 m/minute		
	3		fast	1	10 m/minute	10 m/minute		

Note: Changing Response Rate resets the following parameters: LOE Timer, Fill Rate, Empty Rate, and Echo Lock.

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

2.2.3. Echo Lock

Note: Ensure the agitator is always running while SITRANS LR 200 is monitoring the vessel, to avoid stationary blade detection.

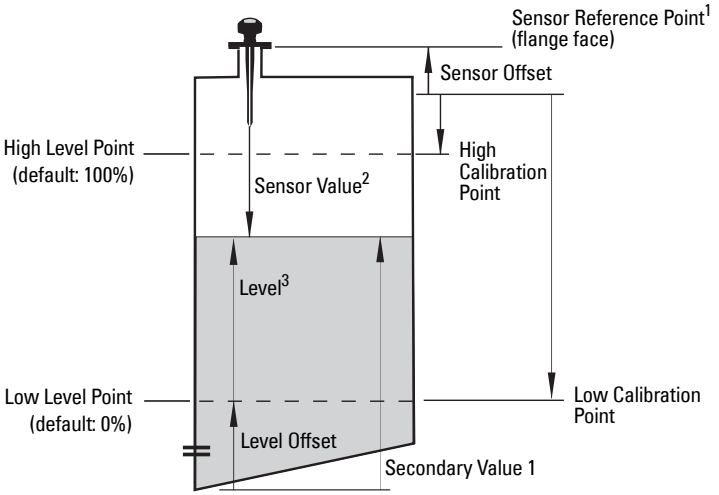
Selects the measurement verification process.

Values	0		Off
	1		Maximum Verification
	2	*	Material Agitator
	3		Total Lock
Related parameters	Maximum Fill Rate Maximum Empty Rate Echo Lock Sampling Echo Lock Window Algorithm		

If a material agitator or mixer is used in the monitored vessel, Echo Lock should be set for Maximum Verification or Material Agitator to avoid agitator blade detection.

1. For more detail, see *LOE Timer* on page 34.
2. For more detail, see *Echo Lock* on page 34.

2.3. Sensor Calibration



2.3.1. Sensor Units

Whatever units the sensor is measuring in.

2.3.2. Calibration Type

In "Dry" calibration, the user enters all four calibration values: High and Low Level Points, and High and Low Calibration Points.

Values	**0**	*	"Dry" calibration
	1		"Wet" calibration (not recommended for SITRANS LR 200)

2.3.3. Low Calibration Pt.

Distance from Sensor Reference to Low Calibration Point (corresponding to Low Level Point). Unit is defined in Sensor units. (In PDM, go to Device menu > Sensor Calibration, then click on More Information, to see an illustration.)

2.3.4. High Calibration Pt.

Distance from Sensor Reference to HIgh Calibration Point (corresponding to High Level Point). Unit is defined in Sensor units. (In PDM, go to Device menu > Sensor Calibration, then click on More Information, to see an illustration.)

1. Sensor Reference Point: the point to which all of the above parameters are referenced, which is the flange face.
2. Sensor Value: the value produced by the echo processing, which represents the distance from the Sensor Reference Point to the target.
3. Level Value: the level measured in level units.

2.3.5. Unit (Level)

Selected engineering units for Level (PV).

- Referenced from Low Level Point (plus level offset, if any)
- Default %
- Can be any linear measurement

2.3.6. Low Level Point

The level when the material is at Low Calibration Point. The unit is defined in Level units. (In PDM, go to ***Device menu > Sensor Calibration****, then click on* ***More Information*** *to see an illustration.)*

2.3.7. High Level Point

The level when the material is at High Calibration Point. The unit is defined in Level units. (In PDM, go to ***Device menu > Sensor Calibration****, then click on* ***More Information*** *to see an illustration.)*

2.3.8. Level Offset

A constant offset that is added to Level to form either PV (Level or Volume) output. The unit is defined in Level units.

2.3.9. Sensor Offset (default 0)

The offset from the Sensor's reference point to the tank's reference point: a constant offset added to the Sensor value. The unit is defined in Sensor Units.

Compensates, for example if the sensor head is changed.

2.3.A. Temperature Units

Selects the engineering unit to be displayed with the value representing temperature.

2.4. Measuring Limits

2.4.1. Min. Measured Value[1]

The minimum recorded Sensor value, defined in Sensor units.

2.4.2. Max. Measured Value[1]

The maximum recorded Sensor value, defined in Sensor units.

2.4.3. Min. Sensor Value

Defines the minimum usable value for the measuring range (physical limit of the sensor) in Sensor units.

2.4.4. Max. Sensor Value

Defines the maximum usable value for the measuring range (physical limit of the sensor) in Sensor units.

1. In PDM, open View menu, scroll down to Peak Values, and click Sensor tab.

2.4.5. Process Temperature Min.

The minimum recorded temperature of the internal electronics.

Open the menu **View – Peak Values** and select the tab **Temperature.** If necessary, click on the reset button, and download to the device.

2.4.6. Process Temperature Max.

The maximum recorded temperature of the internal electronics.

Open the menu **View – Peak Values** and select the tab **Temperature.** If necessary, click on the **Reset** button, and download to the device.

2.5. Linearization

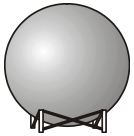
Carries out a volume conversion from a level value.

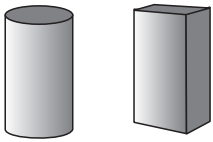
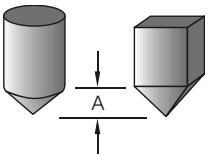
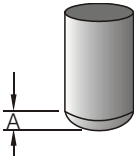
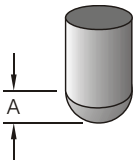
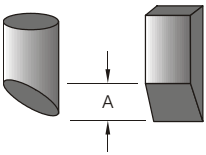
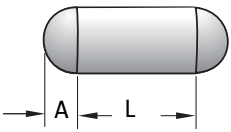
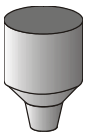
2.5.1. PV (volume/level) Units

Select units for either volume or level.

2.5.2. Linearization Type/Vessel Shape

Defines the vessel shape and allows the LR 200 to calculate volume instead of level. If "none" is selected, no volume conversion is performed. Select the vessel shape matching the monitored vessel or reservoir.

	Vessel Shape	Description	Also required
*	----	no volume calculation required	N/A
20		flat end horizontal cylinder	linearization volume
21		sphere	linearization volume

	Vessel Shape	Description	Also required
240		upright, linear (flat bottom)	linearization volume
241		conical or pyramidal bottom	linearization volume, dimension A
242		parabolic bottom	linearization volume, dimension A
243		half-sphere bottom	linearization volume, dimension A
244		flat sloped bottom	linearization volume, dimension A
245		parabolic end horizontal cylinder	linearization volume, dimension A, dimension L
247		linearization table (level/volume breakpoints)	linearization volume, level breakpoints, volume breakpoints

2.5.3. Linearization Volume

The maximum volume of the tank. Units are defined in Primary Value units. For readings in volumetric units instead of percentage values, enter the vessel volume corresponding to High Calibration Point. Any volumetric units can be chosen, because the volume calculation is based on the maximum volume, and scaled according to the vessel shape selected. If no vessel shape is entered, the default is 100, and the reading will be a percentage value.

Values	Range: **0.0000 to 99999**
	Default: 100.0
Related Parameters	Low Calibration Point High Calibration Point

2.5.4. Dimension A

The height of the vessel bottom (in level units) when the bottom is conical, pyramidal, parabolic, spherical, flat sloped, cylindrical, or spherical. See page 93 for an illustration.

Values	Range: **0.0000 to 99999** in units (P005**)**
	Default: 0.0
Related Parameters	Vessel Shape

2.5.5. Dimension L

Length of the cylindrical section of a horizontal parabolic end tank, in level units. See page 93 for an illustration.

Values	Range**: 0.0000 to 99999** in units (P005)
	Default: 0.0
Related Parameters	Vessel Shape

2.6. Detailed Setup

2.6.1. Failsafe

2.6.1.1. LOE (Loss of Echo) Timer

Amount of time, in minutes, that a Loss of Echo must persist, before the device goes into Failsafe mode. See page 35 for more details.

Values	Range**: 0.00 to 720** (minutes)
	Default:10

2.6.2. Volume

When the vessel shape is too complex for any of the preconfigured shapes, you can define the shape as a series of segments. First assign a value to each level breakpoint., then assign a corresponding value to each volume breakpoint. (Volume values can be percent or volumetric; level values can be percent or linear.)

Level Values	Range: **0.0000 to 99999** (%, ft, m, in, cm, mm, gal, L, imp. gal: see PDM for more)
	Default: 0.0
Volume Values	Range: **0.0000 to 99999** (% or volumetric units)
	Default: 0.0

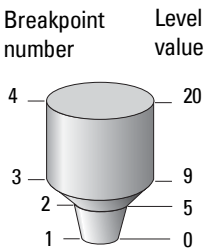
Enter up to 11 level breakpoints, where the corresponding volume is known. The values corresponding to 100% and 0% levels must be entered. The breakpoints can be ordered from top to bottom, or the reverse. Breakpoints are grouped into 3 tables:

2.6.2.1. Table A (1 - 4)
2.6.2.2. Table B (5 - 8)
2.6.2.3. Table C (9 -11)

Entering breakpoints in PDM:

a. First go to **Linearization > PV (volume/level) units**, and select the desired volume units.
b. The default for level values is percent: if you want to select units instead, go to **Input > Sensor Calibration > Unit (level),** and select the desired unit.
c. Go to **> Linearization/Tank Shape**, and select **Linearization table** option**.**
d. Go to **Detailed Setup > Volume > Table 1 - 4**.
e. In **Level 1**, enter a level value for breakpoint 1.
f. In **Volume 1**, enter the corresponding volume value for breakpoint 1.
g. Repeat steps **c** and **d** (using **Tables 5 - 8** and **9 - 11** if required), until values have been entered for all the required breakpoints.

Example:



Breakpoint Number	Level value (m)	Volume value (l)
1	0	0
2	5	500
3	9	3000
4	20	8000

Note: values are for example purposes only.

2.6.3. Echo select

2.6.3.1. Algorithm

Selects the algorithm to be applied to the echo profile to extract the true echo.

Values	**12**	*	**F**	**F**irst echo
	3		**L**	**L**argest echo (reserved for SMPI service personnel)
	8		**bLF**	**b**est of **L**argest or **F**irst echo (reserved for SMPI service personnel)

2.6.3.2. Confidence Threshold

Sets the minimum echo confidence that the echo must meet in order to prevent a Loss of Echo condition and the expiration of the LOE timer. When Echo Confidence exceeds the Confidence Threshold, the echo is evaluated.

Values	Range: **0 to 99**
	Default: **5**
Related Parameters	LOE Timer

Use this feature when an incorrect material level is reported.

2.6.3.3. Echo Marker

The point on the selected echo from which the measured value is taken.

2.6.3.4. Shots

The number of echo profile samples averaged to produce a measurement.

2.6.3.5. Velocity

Effective propagation velocity in m/s.

2.6.3.6. Propagation Factor

Compensates for the change in microwave velocity from propagation in free space.The value is used to compensate for changes in microwave velocity due to propagation within a metal stillpipe, instead of in free space.

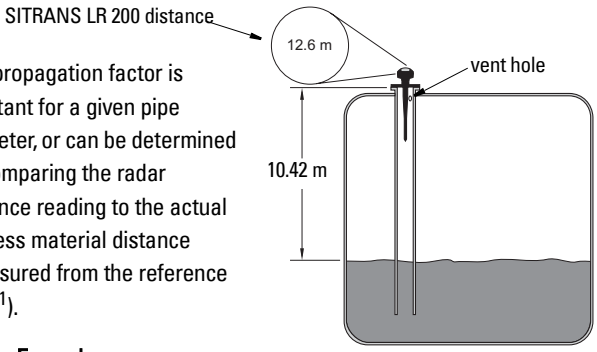
Values	Range: **0.3000 to 1.5000**
	Default: **1.000**

Pipe Size (I.D.)	Propagation Factor
50 mm (2")	0.827
80 mm (3")	0.915
100 mm (4")	0.955
150 mm (6")	0.980
200 mm (8")	0.990

Contact your Siemens Milltronics representative for other sizes and propagation factor numbers.

Note: For waveguide antennas used as stillpipes, the propagation factor value is shown on the process device tag.

The propagation factor is constant for a given pipe diameter, or can be determined by comparing the radar distance reading to the actual process material distance (measured from the reference point[1]).



Example:

actual distance / LR 200 distance = p.f. (propagation factor)

Using the readings shown:

10.42m / 12.6m = 0.827

Enter the propagation factor: **0.827**

1. For the reference point for the standard model, see *SITRANS LR 200 Dimensions* on page 13. For other configurations, see *Appendix D: Flange Adapter Versions*, page 44 onwards.

2.6.4. Echo Sampling

2.6.4.1. Sampling up[1]

Once echo is outside the window, a specified number of consecutive echoes must appear above the echo locked onto, before measurement is accepted as valid.

2.6.4.2. Sampling down[1]

Once echo is outside the window, a specified number of consecutive echoes must appear below the echo locked onto, before measurement is accepted as valid.

2.6.4.3. Window[1]

A "distance window" centered on the echo, used to derive the reading. When a new measurement is in the window, the window is re-centered and the reading is calculated (see ***Display before Auto False Echo Suppression,*** *page 101 for an illustration).*

When the value is 0, the window is automatically calculated after each measurement.

- For slower Measurement Response values, the window is narrow.
- For faster Measurement Response values, the window becomes progressively wider.

Note: The echo lock window is stored as standard sample, but displayed in the engineering units selected to display level. Any value entered for the echo lock window will be rounded to the nearest sample.

2.6.4.4. Window Used[1]

2.6.5. Range

2.6.5.1. Near Range (LOW RANGE)

The range in front of the device (measured from the reference point[2]) within which any echoes will be ignored. (This is sometimes referred to as "Blanking" or "Dead Zone".)

Values	Range: **0** to **20 m**
	Default: **0.4 m**

1. This parameter is for use only by Siemens Milltronics service technicians.
2. For the standard configuration reference point, see *SITRANS LR 200 Dimensions* on page 13. For other configurations, see *Appendix D: Flange Adapter Versions*, page 44 onwards.

2.6.5.2. Far Range (HI RANGE)

Note: Far Range can extend beyond the bottom of the tank.

Maximum distance from the reference point[2], within which an echo should be considered valid.

Values	Range: **0** to **20 m**
	Default: **Low Calibration Point**

Echo Profile

Echo Confidence

Measures echo reliability. It displays the echo confidence of the measurement echo from the last shot. Confidence Threshold defines the minimum criterion for echo confidence.

Values (view only)	**0 to 99**	
	----	Shot not used
Related Parameters	Confidence Threshold	

Open the menu **View – Profile.**

Echo Strength

Displays the absolute strength (in dB above 1 µV rms) of the echo selected as the measurement echo.

Values (view only)	**–20 to 99**

Open the menu **View – Profile.**

Noise Average

Displays the average ambient noise (in dB above 1 µV rms) of a noise profile, as x.y. Noise level is a combination of transient noise and receiving circuitry. After a measurement, the values from the previous noise shot will be displayed.

Open the menu **View – Noise**.

Noise Peak

Displays the peak ambient noise (in dB above 1 µV rms).

Open the menu **View – Noise**.

Noise Minimum

Displays the minimum ambient noise (in dB above 1 µV rms).

Open the menu **View – Noise**.

2.6.6. TVT (Auto False Echo Suppression) setup

Note: The Auto False Echo Suppression parameters are for authorized Siemens Milltronics Service personnel or technicians familiar with Siemens Milltronics echo processing techniques. View the echo profile first, before attempting to modify these parameters.

First SITRANS LR 200 learns the echo profile. Then the learned profile, or part of the learned profile, is used to screen out false echoes.

2.6.6.1. TVT Hover Level[1]

Defines in percent how high the TVT (Time Varying Threshold) curve is placed above the echo profile, with respect to largest echo. When SITRANS LR 200 is located in the center of the vessel, lower this parameter to prevent multiple echo detections.

Values	Range: **0** to **100%**
	Default: **40**%

2.6.6.6. Auto False Echo Suppression[1]

Enables a 'learned' TVT curve to be used in place of the default TVT curve.

Use this feature to ignore false echoes before the material echo. Set Range (Auto False Echo Suppression Distance) first.

Values	**0**	Off
	1	Enable Auto False Echo Suppression
	2	"Learn" the TVT curve

a. Rotate the instrument for best signal (lower false-echo amplitude).
b. Go to **Range**, and set the value (see details below).
c. Open the menu **Device – Auto False Echo Suppression** and select the option to change it.
d. Select **Learn.** The device will automatically revert to On (Use Learned TVT) after a few seconds.

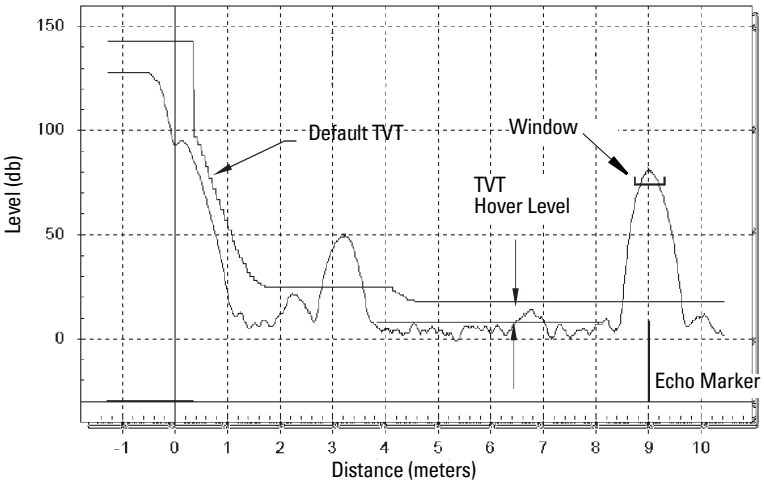
2.6.6.7. Range (Auto False Echo Suppression Distance)

Defines the endpoint of the Learned TVT distance.

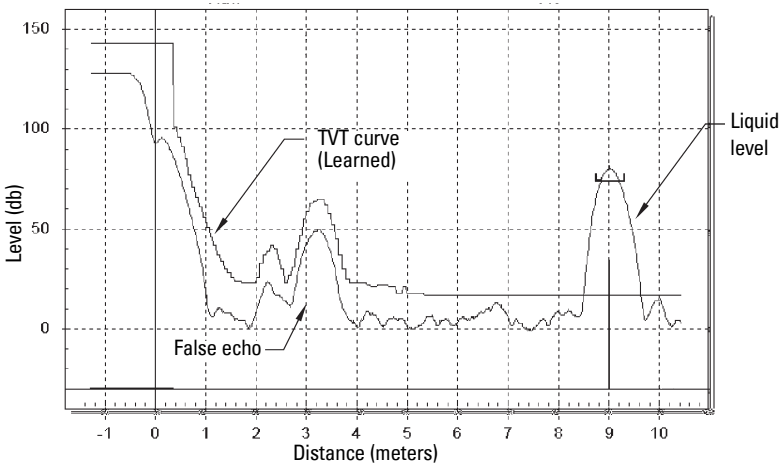
a. Go to **Input > Detailed Setup > TVT Setup > Range.**
b. Determine the actual distance from the antenna reference point to the material surface.
c. Subtract 0.5 m (20") from this distance, and enter the result.

1. For an illustration, see *Display before Auto False Echo Suppression* and *Example after Auto False Echo Suppression*, page 101.

Display before Auto False Echo Suppression



Example after Auto False Echo Suppression



2.6.6.8. Shaper Mode

Adjusts the TVT curve at a specified range.

2.6.7. TVT shaper

A breakpoint on the TVT curve, normalized to 0.

2.6.7.1. Shaper A (1-9)
2.6.7.2. Shaper B (10-18)
2.6.7.3. Shaper C (19-27)
2.6.7.4. Shaper D (28-36)
2.6.7.5. Shaper E (37 - 40)

2.6.8. Rate

2.6.8.1. Fill Rate

Defines the maximum rate at which the reported sensor value is allowed to increase.Allows you to further adjust the LR 200 response to increases in the actual material level (or an advance to a higher Failsafe Material Level, P071). Fill Rate is automatically updated whenever Response Rate is altered.

Values	Range: **0.0000 to 99999** m / min.
	Factory setting: **0.1**
Altered by	Response Rate
Related	Unit (Level) High Level Point

Enter a value slightly greater than the maximum vessel-filling rate, in Sensor Units per minute.

Hand Programmer Value	Meters/Minute
1	0.1
2	1
3	10

2.6.8.2. Empty rate

Defines the maximum rate at which the reported sensor value is allowed to decrease.Adjusts the LR 200 response to decreases in the actual material level. Empty Rate is automatically updated whenever Response Rate is altered.

Values	Range: **0.0000 to 99999** m / min.
	Factory setting: **0.1**
Altered by	Response Rate
Related	Units (Level) High Level Point

Enter a value slightly greater than the vessel's maximum emptying rate, in Sensor Units per minute.

Hand Programmer Value	Meters/Minute
1	0.1
2	1
3	10

2.6.9. Transducer Block (TB) Values (for diagnostic purposes)

2.6.9.1. PV

The value for level, or volume (if volume conversion is selected).

Open the menu **View – Display,** and select the tab **Measure Valued (Secondary Values)**.

2.6.9.2. SV1

The value for level.

Open the menu **View – Display,** and select the tab **Measure Valued (Secondary Values)**.

2.6.9.3. SV2

The value for distance.

Open the menu **View – Display,** and select the tab **Measure Valued (Secondary Values)**.

3. Output

3.1. AIFB1

Static Revision No.

The revision level of the static data associated with Analog Input Function Block 1. The Static Revision No. is updated whenever a standard profile configuration parameter is changed.

3.1.1. Target Mode

Used to request an operating mode from the Function Block.

Values	**128**	Out of Service (O/S)
	16	Manual Mode (MAN)
	8	Automatic Mode (AUTO)

Open the menu **Device – Simulation,** go to **Function Block – AIFB1** or **2,** click on the tab **Simulation Output**, and select a target mode. Then click on the tab **Simulation (Measured Value)**, and enable or disable **Simulation**.

3.1.2. Unit

Engineering unit to be displayed with the output value.

3.1.3. Filter Time Constant

The time constant for the damping filter. The engineering unit is always in seconds. (This is an exponential filter: when a change occurs at the input, the output will be at 63.2% of the change in one time constant, and will be at full change after 5 time constants.)

3.1.4. Function

Used to select between the different level block outputs (Volume/Level, Level, Distance in Sensor units, Distance in Level units).

3.1.5. Batch Information

These 4 parameters are intended to be used in Batch Applications conforming to IEC 61512 Part 1 (ISA S88). Other applications do not require these values, which are only stored in the Function Block.

3.1.5.1. Batch ID

Identifies a certain batch to allow assignment of equipment-related information (for example faults, alarms) to the batch.

3.1.5.2. Batch Unit

Identifies the active Control Recipe Unit Procedure or the related Unit (for example, reactor, centrifuge, drier).

3.1.5.3. Batch operation

Identifies the active Control Recipe Operation.

3.1.5.4. Batch Phase

Identifies the active Control Recipe Phase.

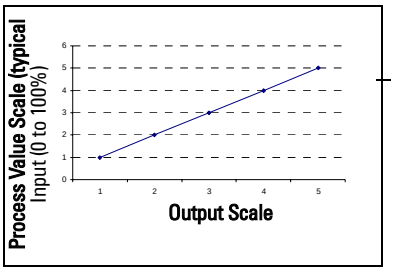
3.1.6. Process Value Scale

3.1.6.1. Lower Value

Defines the operational lower range value of the input value (Process Value Scale) in engineering units. Process Value Scale normalizes the input value to a customer-defined range.

3.1.6.2. Upper Value

Defines the operational upper range value of the input value (Process Value Scale) in engineering units. Process Value Scale normalizes the input value to a customer-defined range.



3.1.7. Output Scale

Scales the Process Variable. The function block parameter OUT SCALE contains the values of the lower limit and upper limit effective range.

3.1.7.1. Lower Value

Defines the operational lower range value of the output value in engineering units.

3.1.7.2. Upper Value

Defines the operational upper range value of the output value in engineering units.

3.1.8. Output Limits

3.1.8.1. Lower Limit Alarm

The setting for the lower alarm limit in engineering units.

3.1.8.2. Lower Limit Warning

The setting for the lower warning limit in engineering units.

3.1.8.3. Upper Limit Warning

The setting for the upper warning limit in engineering units.

3.1.8.4. Upper Limit Alarm

The setting for the upper alarm limit in engineering units

3.1.8.5. Limit Hysteresis

Hysteresis is used to adjust the sensitivity of the trigger for alarm messages. It is used to compensate when a process variable fluctuates around the same value as a limit. A high level alarm occurs when a value exceeds an upper limit. The alarm's status remains true until the value drops below the limit minus the alarm hysteresis. The directions are reversed for low limit detection.

Enter a value for the hysteresis here, to be used for all warnings and alarms. The units are the same as the output value scale.

3.1.8.6. Min Out

Min Out is a minimum peak indicator for the AIFB output values.

3.1.8.7. Max Out

Max Out is a maximum peak indicator for the AIFB output values.

3.1.9. Failsafe Mode

3.1.9.1. Failsafe Mode

Failsafe Mode occurs if the status of the input value is bad, or if the device has been put into Failsafe mode using Simulation. One of three options can be selected for the material level to be reported when the LOE timer expires.

Hand Programmer Values		Material level to be reported
0		Default value used as output value.
1	*	Store last valid output value.
2		Calculated output value is incorrect.

3.1.9.2. Failsafe Value

*(Accessible in PDM only after **0** is selected in Failsafe Mode).*

User-defined default value for the OUT parameter, if sensor or sensor electronic fault is detected. Units are the same as the OUT value.

3.1.A. Human Interface

3.1.A.1. Decimal Point

The number of digits to display after the decimal point. (The LCD is limited to displaying three decimal places.)

Out unit text

If the code list does not contain a desired unit for the OUT parameter, (see General Requirement) you can write the specific text in this parameter.

3.2. AIFB2

(See AIFB1: the parameters for AIFB2 are identical.)

Appendix L: hazardous area installations

- Wiring details
- Instructions specific to hazardous area installations

Wiring Details

Intrinsically Safe Model

FM/CSA (See page 111 for reference drawing 23650529, also available from the product page of our website: www.siemens.com/processautomation.)

Under the entity evaluation concept, SITRANS LR 200 has the following characteristics:

(input voltage) U_i	= 24 V
(input current) I_i	= 250 mA
(input power) P_i	= 1.2 W
(internal capacitance) Ci	= 0
(internal inductance) Li	= 0

Entity Concept:

The Entity Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criteria for interconnection is that the voltage and current which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal to or greater than the output voltage (Uo) and output current (Io) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (Ci) and Inductance (Li) of the intrinsically safe apparatus, including interconnecting wiring, must be equal to or less than the capacitance and inductance which can be safely connected to associated apparatus.

Under the FISCO evaluation concept, SITRANS LR 200 has the following characteristics:

(input voltage) U_i	= 17.5 V
(input current) I_i	= 380 mA
(input power) P_i	= 5.32 W
(internal capacitance) Ci	= 0
(internal inductance) Li	= 0

FISCO-Concept

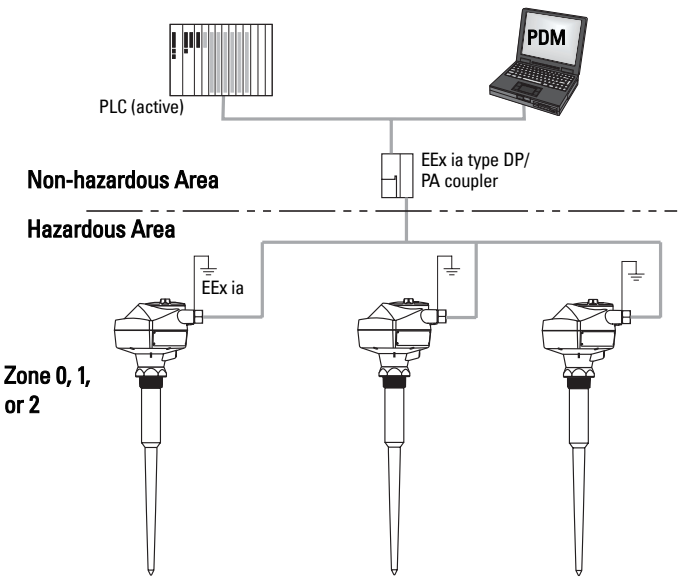
Note: For complete details and instructions regarding the FISCO Concept, see page 111 for drawing number 23650529, also available from the product page of our website: www.siemens.com/processautomation.

The FISCO Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criteria for interconnection is that the voltage (Ui or Vmax), the current (Ii, or Imax) and the power (Pi, or Pmax) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal to or greater than the voltage (Uo or Voc or Vi), the current (Io or Isc or Ii), and the power (Po or Pmax) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (Ci) and inductance (Li) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 µH respectively.

In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system. The allowed voltage Uo (or Voc or Vt) of the associated apparatus is limited to the range of 14V dc to 24V dc. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50 µA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

FM/CSA

- Approved dust-tight and water-tight conduit seals are required for outdoor NEMA 4X / type 4X / NEMA 6, IP67, IP68 locations.
- The maximum voltage of the non-intrinsically safe apparatus must not exceed 250 V rms.



EU Equivalency

Any zener diode safety barrier, certified by an EU approved certification body to [EEx ia] IIC, its output voltage (Uo) not exceeding 24 V and its output current (Io) limited by load resistance (Ro); such that Io = Uo / Ro, does not exceed 250 mA.

Notes

- The installation must comply with national requirements.
- The safe area is unspecified except that it must not be supplied from nor contain, under normal or abnormal conditions, a source of potential with respect to earth in excess of 250 V rms or 250 V DC.

Product Nameplate

SIEMENS

SITRANS LR 200
7ML1234-56789-0ABC-D
Serial No: GYZ/S1034567
Encl.: NEMA/TYPE 4X, 6, IP67, IP68
Amb.Temp.: –40 °C to 80 °C
Power Rating: 30V ⎓ Max., 10.5 mA

Siemens Milltronics Process Instruments Inc., Peterborough

Made in Canada

PROFIBUS PA 5.8 GHz

Fisco:	Entity:
U_i=17.5 V,	U_i=24 V,
I_i=380 mA,	I_i=250 mA,
P_i=5.32W,	P_i=1.2W,
C_i=0,	C_i=0,
L_i=0.1mH	L_i=0.1mH

ANZEx 05.3005X
Ex ia IIC T4
N117
IECEx TSA 05.0009X
0682
II 1G
EExiaIICT4
SIRA 03ATEX2142X
0518

WARNING: Possible static hazard, do not rub or clean on site.

FM/CSA Intrinsically Safe connection drawing

Note: Reference drawing 23650529 is available from the product page of our website: www.siemens.com/processautomation.

FISCO-Concept

The FISCO Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criteria for interconnection is that the voltage (U_i or V_{max}), the current (I_i, or I_{max}) and the power (P_i, or P_{max}) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (U_o or V_{oc} or V_i), the current (I_o or I_{sc} or I_i) and the power (P_o or P_{max}) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (C_i) and inductance (L_i) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 µH respectively.

In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system. The allowed voltage U_o (or V_{oc} or V_t) of the associated apparatus is limited to the range of 14V dc to 24V dc. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50 µA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices needs to have the parameters in the following range:

loop resistance R*:	15	...	150 Ω / km
inductance per unit length L*:	0,4	...	1 mH / km
capacitance per unit length C*:	80	...	200 nF / km

$C^* = C^*_{line/line} + 0.5\ C^*_{line/screen}$, if both lines are floating or
$C^* = C^*_{line/line} + C^*_{line/screen}$, if the screen is connected to one line

Maximum allowed cable length:	CLASS I, ZONE 0 ia	CLASS I, ZONE 1 ib
Length of spur cable:	≤ 30 m	≤ 30 m
Length of trunk cable:	≤ 1 km	≤ 5 km
Total length (sum of trunk and spur cables)	≤ 1 km	≤ 5 km
Length of splice	≤ 1 m	≤ 1 m

At each end of the trunk cable an approved infallible line termination with the following parameters is suitable:
R = 90 ...100Ω
C = 0 ... 2.2 µF.

One of the allowed terminations might already be integrated in the associated apparatus.

The number of passive devices connected to the bus segment is not limited due to I.S. reasons. If the above rules are respected, up to the specified total length, the inductance and capacitance of the cable will not impair the intrinsic safety or the installation.

USE DIMENSIONS ONLY - DO NOT SCALE	0	FOR CONSTRUCTION	RPC	SN	FEB 16/2004
DIMENSIONS ARE IN INCHES	Rev.	Revision / ECN Description	Drawn	Appr.	Date

Third Angle Projection

Product Group: RADAR
Date: 16 / FEB / 2004
Drawn: R. CLYSDALE
Checked: E. DeSIMONE
Approved: S. NGUYEN
Location: PETERBOROUGH

Tolerance Unless Otherwise Noted: UOS
1 Place Decimal ± 0.03
2 Place Decimal ± 0.01
3 Place Decimal ± 0.002
Angles: ± 0.5°

Scale: NTS
Size: A

TITLE: SITRANS LR 200 / Probe LR
PROFIBUS PA
CONNECTION DRAWING

FOR INTERNAL USE ONLY

SIEMENS MILLTRONICS PROCESS INSTRUMENTS INC.
Peterborough, Ontario, Canada

DRAWING No: 23650529
Rev. 0

File No. 2365052900
Plot at: 1 : 1
Sheet 1 Of 4

The number of passive devices connected to the bus segment is not limited due to I.S. reasons. If the above rules are respected, up to the specified total length, the inductance and capacitance of the cable will not impair the intrinsic safety or the installation.

Notes:

INTRINSICALLY SAFE **CLASS I, II, III DIV. 1, GROUPS A, B, C, D, E, F, G**
CLASS I, ZONE 0/1 GROUPS IIB / IIC

1. Approved apparatus must be installed in accordance with manufacturer instructions.
2. Approved associated apparatus must meet the following requirements:
   U_o or V_{oc} or $V_t \leq U_i$ (V_{max}) and I_o or I_{sc} or $I_t \leq I_i$ (I_{max}) and P_o or $P_{max} \leq P_i$ (P_{max})
3. The maximum non-hazardous area voltage must not exceed 250 V.
4. In the USA the installation must be in accordance with the National Electrical Code NFPA 70, Article 504, resp. Article 505 and ANSI/ISA-Rp 12.6 (except chapter 5). In Canada observe the Canadian Electrical Code.
5. Multiple earthing of screen is allowed only, if high integrity equipotential system is realized between the points of bonding.
6. WARNING: Substitution of components may impair intrinsic safety.

FM applications: NONINCENDIVE, CLASS I, II, III DIV. 2, GROUPS A, B, C, D, E, F, G

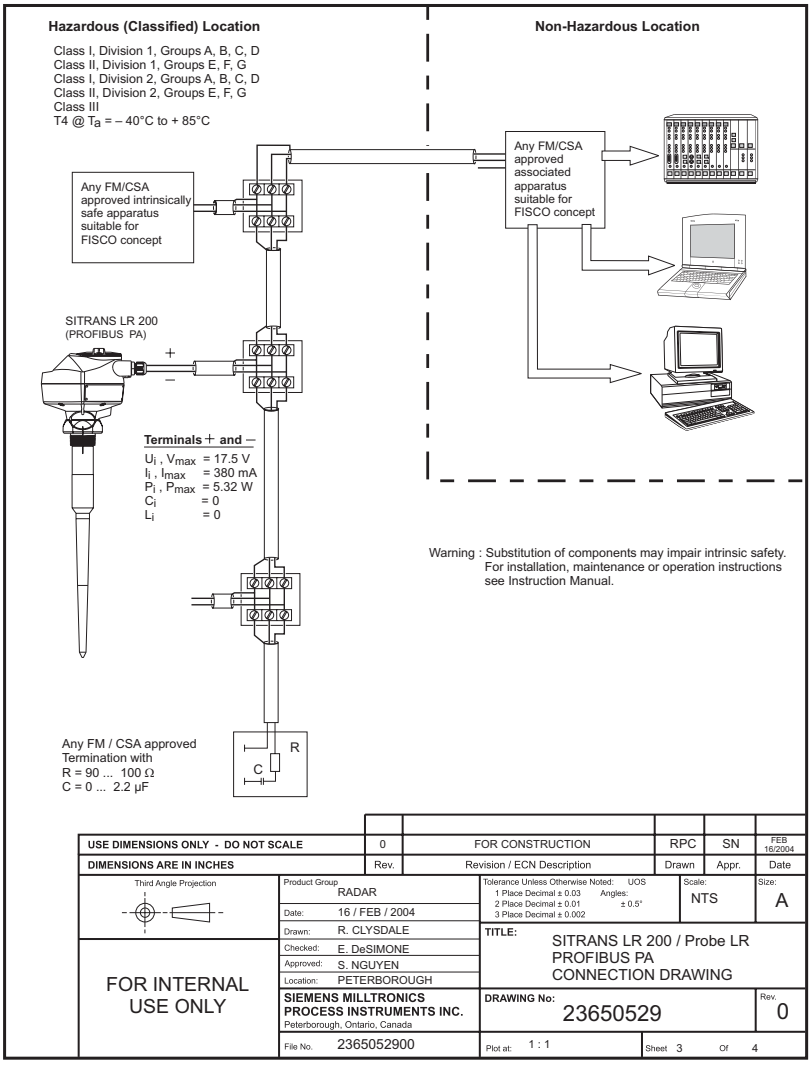
CSA applications: suitable for CLASS I, II, III, DIV. 2, GROUPS A, B, C, D, E, F, G

1. Intrinsic safety barrier not required. Max. supply voltage 30 V.
2. WARNING: Explosion Hazard - do not disconnect equipment unless power has been switched off or the area is known to be Non- Hazardous.
3. WARNING: Substitution of components may impair suitability for Class I, Division 2.

USE DIMENSIONS ONLY - DO NOT SCALE	0	FOR CONSTRUCTION	RPC	SN	FEB 16/2004
DIMENSIONS ARE IN INCHES	Rev.	Revision / ECN Description	Drawn	Appr.	Date

Third Angle Projection

Product Group: RADAR	Tolerance Unless Otherwise Noted: UOS 1 Place Decimal ± 0.03 Angles: 2 Place Decimal ± 0.01 ± 0.5° 3 Place Decimal ± 0.002	Scale: NTS	Size: A
Date: 16 / FEB / 2004			
Drawn: R. CLYSDALE	TITLE: SITRANS LR 200 / Probe LR PROFIBUS PA CONNECTION DRAWING		
Checked: E. DeSIMONE			
Approved: S. NGUYEN			
Location: PETERBOROUGH			
FOR INTERNAL USE ONLY			
SIEMENS MILLTRONICS PROCESS INSTRUMENTS INC. Peterborough, Ontario, Canada	DRAWING No: 23650529		Rev. 0
File No. 2365052900	Plot at: 1 : 1	Sheet 2 Of 4	



USE DIMENSIONS ONLY - DO NOT SCALE	0	FOR CONSTRUCTION	RPC	SN	FEB 16/2004
DIMENSIONS ARE IN INCHES	Rev.	Revision / ECN Description	Drawn	Appr.	Date

Third Angle Projection

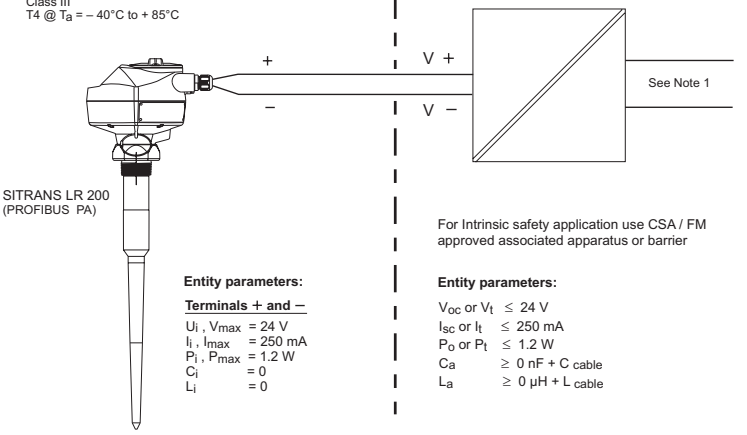
Product Group: RADAR	Tolerance Unless Otherwise Noted: UOS 1 Place Decimal ± 0.03 Angles: 2 Place Decimal ± 0.01 ± 0.5° 3 Place Decimal ± 0.002	Scale: NTS	Size: A
Date: 16 / FEB / 2004			
Drawn: R. CLYSDALE	TITLE: SITRANS LR 200 / Probe LR PROFIBUS PA CONNECTION DRAWING		
Checked: E. DeSIMONE			
Approved: S. NGUYEN			
Location: PETERBOROUGH			
FOR INTERNAL USE ONLY			
SIEMENS MILLTRONICS PROCESS INSTRUMENTS INC. Peterborough, Ontario, Canada	DRAWING No: 23650529		Rev. 0
File No. 2365052900	Plot at: 1 : 1	Sheet 3 Of 4	

Hazardous (Classified) Location

Class I, Division 1, Groups A, B, C, D
Class II, Division 1, Groups E, F, G
Class I, Division 2, Groups A, B, C, D
Class II, Division 2, Groups E, F, G
Class III
T4 @ T_a = – 40°C to + 85°C

Non-Hazardous Location

Intrinsic safety barrier



Entity parameters:

Terminals + and –

U_i , V_{max} = 24 V
I_i , I_{max} = 250 mA
P_i , P_{max} = 1.2 W
C_i = 0
L_i = 0

For Intrinsic safety application use CSA / FM approved associated apparatus or barrier

Entity parameters:

V_{oc} or V_t ≤ 24 V
I_{sc} or I_t ≤ 250 mA
P_o or P_t ≤ 1.2 W
C_a ≥ 0 nF + C_{cable}
L_a ≥ 0 µH + L_{cable}

Notes:

1. The non-intrinsically safe terminals (power rail) must not be connected to any device which uses or generates more than 250 Vrms or dc unless it has been determined that the voltage has been adequately isolated.
2. In the USA the installation must meet the requirements of the National Electrical Code, NFPA 70. article 504 resp. article 505 and ANSI / ISA RP 12.6 . In Canada observe the Canadian Electrical Code.
3. Multiple earthing of screen is allowed only, if high integrity equipotential system is realized between the points of bonding.

Warning : Substitution of components may impair intrinsic safety. For installation, maintenance or operation instructions, see Instruction Manual.

USE DIMENSIONS ONLY - DO NOT SCALE	0	FOR CONSTRUCTION	RPC	SN	FEB 16/2004
DIMENSIONS ARE IN INCHES	Rev.	Revision / ECN Description	Drawn	Appr.	Date

Third Angle Projection

Product Group: RADAR
Date: 16 / FEB / 2004
Drawn: R. CLYSDALE
Checked: E. DeSIMONE
Approved: S. NGUYEN
Location: PETERBOROUGH

Tolerance Unless Otherwise Noted: UOS
1 Place Decimal ± 0.03 Angles:
2 Place Decimal ± 0.01 ± 0.5"
3 Place Decimal ± 0.002

Scale: NTS
Size: A

TITLE: SITRANS LR 200 / Probe LR
PROFIBUS PA
CONNECTION DRAWING

FOR INTERNAL USE ONLY

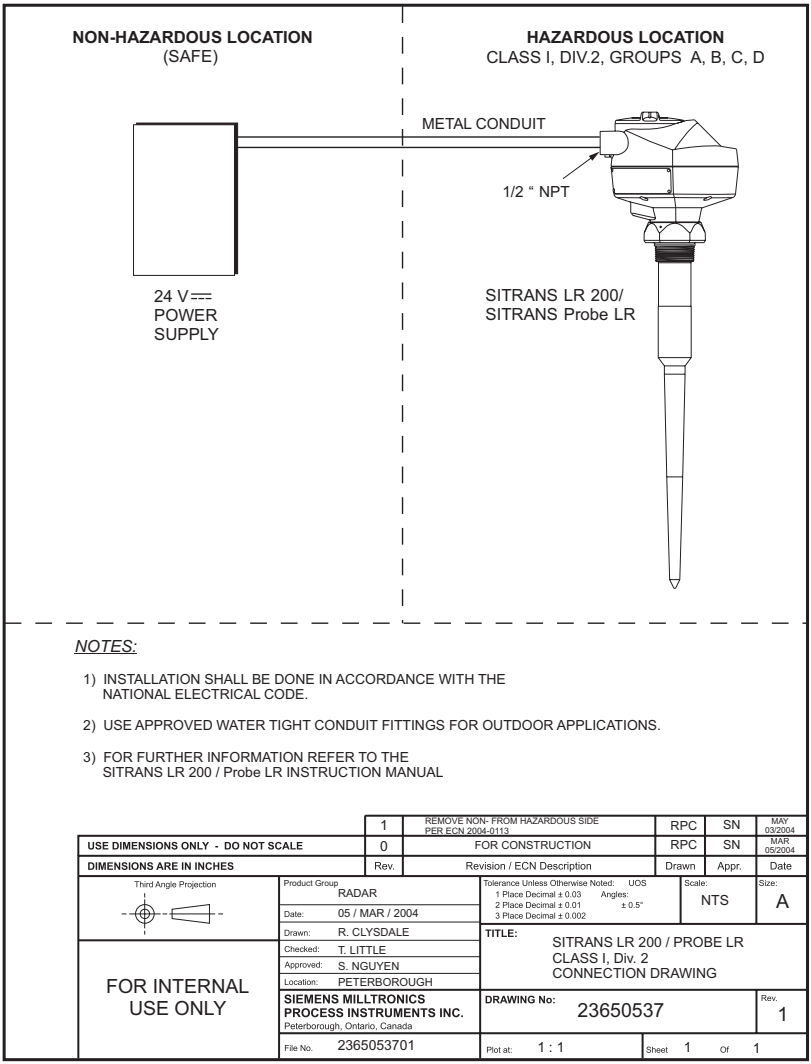
SIEMENS MILLTRONICS PROCESS INSTRUMENTS INC.
Peterborough, Ontario, Canada

DRAWING No: 23650529
Rev. 0

File No. 2365052900
Plot at: 1 : 1
Sheet 4 Of 4

FM Class 1, Div. 2 connection drawing

Note: Reference drawing 23650537 is available from the product page of our website: www.siemens.com/processautomation.



NOTES:

1) INSTALLATION SHALL BE DONE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE.

2) USE APPROVED WATER TIGHT CONDUIT FITTINGS FOR OUTDOOR APPLICATIONS.

3) FOR FURTHER INFORMATION REFER TO THE SITRANS LR 200 / Probe LR INSTRUCTION MANUAL

	1	REMOVE NON- FROM HAZARDOUS SIDE PER ECN 2004-0113	RPC	SN	MAY 03/2004
USE DIMENSIONS ONLY - DO NOT SCALE	0	FOR CONSTRUCTION	RPC	SN	MAR 05/2004
DIMENSIONS ARE IN INCHES	Rev.	Revision / ECN Description	Drawn	Appr.	Date

Third Angle Projection	Product Group: RADAR	Tolerance Unless Otherwise Noted: UOS 1 Place Decimal ± 0.03 Angles: 2 Place Decimal ± 0.01 ± 0.5° 3 Place Decimal ± 0.002	Scale: NTS	Size: A
	Date: 05 / MAR / 2004	TITLE: SITRANS LR 200 / PROBE LR CLASS I, Div. 2 CONNECTION DRAWING		
	Drawn: R. CLYSDALE			
	Checked: T. LITTLE			
FOR INTERNAL USE ONLY	Approved: S. NGUYEN			
	Location: PETERBOROUGH			
	SIEMENS MILLTRONICS PROCESS INSTRUMENTS INC. Peterborough, Ontario, Canada	DRAWING No: 23650537		Rev. 1
	File No. 2365053701	Plot at: 1 : 1	Sheet 1 Of 1	

Instructions specific to hazardous area installations

(Reference European ATEX Directive 94/9/EC, Annex II, 1/0/6)

The following instructions apply to equipment covered by certificate number SIRA 03ATEX2142X:

1. For use and assembly, refer to the main instructions.
2. The equipment is certified for use as Category 1G equipment.
3. The equipment may be used with flammable gases and vapors with apparatus group IIC and temperature class T4.
4. The equipment is certified for use in an ambient temperature range of –40 ×C to 80 ×C.
5. The equipment has not been assessed as a safety related device (as referred to by Directive 94/9/EC Annex II, clause 1.5).
6. Installation and inspection of this equipment shall be carried out by suitably trained personnel in accordance with the applicable code of practice (EN 60079-14 and EN 60079-17 in Europe).
7. Repair of this equipment shall be carried out by suitably trained personnel in accordance with the applicable code of practice (e.g. EN 60079-19 within Europe).
8. Components to be incorporated into or used as replacements in the equipment shall be fitted by suitably trained personnel in accordance with the manufacturer's documentation.
9. It is the responsibility of the user to ensure that manual override is possible in order to shut down the equipment and protective systems incorporated within automatic processes which deviate from the intended operating conditions, provided that this does not compromise safety.
10. The 'X' suffix to the certificate number relates to the following special conditions for safe use:
    a. Parts of the enclosure may be non-conducting and may generate an ignition-capable level of electrostatic charge under certain extreme conditions. The user should ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a build-up of electrostatic charge on non-conducting surfaces.
    b. As either Aluminum, Magnesium, Titanium or Zirconium may be used at the accessible surface of the equipment. In the event of rare incidents, ignition sources due to impact and friction sparks could occur. This shall be considered when the SITRANS LR 200 is being installed in locations that specifically require group II, category 1G equipment.

11. The certification of this equipment relies upon the following materials used in its construction:

    Aluminum alloy ANSI ref. A380.0 (aluminum enclosure option)
    Valox 365 (injection moulded plastic enclosure option)
    Ultem 1010 (window on plastic enclosure option)
    Stycast 2651-40FR encapsulant, catalyst II

    The detailed composition of Aluminum A380.0 as used in the metal enclosure (threaded lid option only) is as follows:

    Si – 8.5%, Fe – 1.3%, Cu – 3.5%, Mn – 0.5%, Mg – 0.1%, Ni – 0.1%, Zn – 3%, Sn – 0.35%, others – 0.5%, Al - balance

    If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised.

    Aggressive substances: e.g. acidic liquids or gases that may attack metals, or solvents that may affect polymeric materials.
    Suitable precautions: e.g. regular checks as part of routine inspections or establishing from the material's data sheet that it is resistant to specific chemicals.

12. Equipment Marking

    The equipment marking contains at least the information on the product nameplate, shown on page 110.

Notes

Glossary

accuracy: degree of conformity of a measure to a standard or a true value.

agitator: mechanical apparatus for mixing or aerating. A device for creating turbulence.

algorithm: a prescribed set of well-defined rules or processes for the solution of a problem in a finite number of steps.

ambient temperature: the temperature of the surrounding air that comes in contact with the enclosure of the device.

antenna: an aerial which sends out and receives a signal in a specific direction. There are four basic types of antenna in radar level measurement, horn, parabolic, rod, and waveguide.

attenuation: a term used to denote a decrease in signal magnitude in transmission from one point to another. Attenuation may be expressed as a scalar ratio of the input magnitude to the output magnitude or in decibels.

Auto False-Echo Suppression: a technique used to adjust the level of a TVT curve to avoid the reading of false echoes. (See TVT.)

Auto False-Echo Suppression Distance: defines the endpoint of the TVT distance. (See TVT.) This is used in conjunction with auto false echo suppression.

beam angle: the angle diametrically subtended by the one-half power limits (-3 dB) of the sound beam.

beam spreading: the divergence of a beam as it travels through a medium.

blanking: a blind zone extending away from the reference point plus any additional shield length.The instrument is programmed to ignore this zone.

capacitance: the property of a system of conductors and dielectrics that permits the storage of electricity when potential differences exist between the conductors. Its value is expressed as the ratio of a quantity of electricity to a potential difference, and the unit is a Farad.

confidence: describes the quality of an echo. HIgher values represent higher quality. Confidence threshold defines the minimum value.

damping: term applied to the performance of an instrument to denote the manner in which the measurement settles to its steady indication after a change in the value of the level.

dB (decibel): a unit used to measure the amplitude of signals.

derating: to decrease a rating suitable for normal conditions according to guidelines specified for different conditions.

dielectric: a nonconductor of direct electric current.[1]

dielectric constant (DK): the ability of a dielectric to store electrical potential energy under the influence of an electric field. Also known as Relative Permitivity. An increase in the dielectric constant is directly proportional to an increase in signal amplitude. The value is usually given relative to a vacuum /dry air: the dielectric constant of air is 1[1].

echo: a signal that has been reflected with sufficient magnitude and delay to be perceived in some manner as a signal distinct from that directly transmitted. Echoes are frequently measured in decibels relative to the directly transmitted signal.

echo confidence: the recognition of the validity of the echo. A measure of echo reliability.

Echo Lock Window: a window centered on an echo in order to locate and display the echo's position and true reading. Echoes outside the window are not immediately processed.

Echo Marker: a marker that points to the processed echo.

Echo Processing: the process by which the radar unit determines echoes.

Echo Strength: describes the strength of the selected echo in dB above 1 μV rms.

Echo Profile: a graphical display of a processed echo.

false echo: any echo which is not the echo from the desired target. Generally, false echoes are created by vessel obstructions.

1. Many conductive liquids/electrolytes exhibit dielectric properties; the relative dielectric constant of water is 80.

frequency: the number of periods occurring per unit time. Frequency may be stated in cycles per second.

hertz (Hz): unit of frequency, one cycle per second. 1 Gigahertz (GHz) is equal to 10^9 Hz.

horn antenna: a conical, horn-shaped antenna which focuses microwave signals. The larger the horn diameter, the more focused the radar beam.

inductance: the property of an electric circuit by virtue of which a varying current induces an electromotive force in that circuit or in a neighboring circuit. The unit is a Henry.

microwaves: the term for the electromagnetic frequencies occupying the portion of the radio frequency spectrum from 1 GHz to 300 GHz.

multiple echoes: secondary echoes that appear as double, triple, or quadruple echoes in the distance from the target echo.

Near Blanking: see Blanking

nozzle: a length of pipe mounted onto a vessel that supports the flange.

parameters: in programming, variables that are given constant values for specific purposes or processes.

polarization: the property of a radiated electromagnetic wave describing the time-varying direction and amplitude of the electric field vector.

polarization error: the error arising from the transmission or reception of an electromagnetic wave having a polarization other than that intended for the system.

PROFIBUS PA: one of the PROFIBUS family of protocols, specifically tailored for the needs of process industries (PA = Process Automation).

propagation factor (pf): where the maximum velocity is 1.0, pf is a value that represents a reduction in propagation velocity as a result of the wave travelling through a pipe or medium.

pulse radar: a radar type that directly measures distance using short microwave pulses. Distance is determined by the return transmit time.

radar: radar is an acronym for **RA**dio **D**etection **A**nd **R**anging. A device that radiates electromagnetic waves and utilizes the reflection of such waves from distant objects to determine their existence or position.

range: distance between a transmitter and a target.

range extension: the distance below the zero percent or empty point in a vessel.

relative permittivity: see dielectric constant.

repeatability: the closeness of agreement among repeated measurements of the same variable under the same conditions.

shot: one transmit pulse or measurement.

speed of light: the speed of electromagnetic waves (including microwave and light in free space. Light speed is a constant 299,792,458 meters per second.

stillpipe: a pipe that is mounted inside a vessel parallel to the vessel wall, and is open to the vessel at the bottom.

stilling-well: see **stillpipe**.

two wire radar: a low-energy radar. Can be loop powered, analog, intrinsically safe, or a digital (BUS) transmitter.

TVT (time varying threshold): a time-varying curve that determines the threshold level above which echoes are determined to be valid.

waveguide antenna: a hollow, metallic tube that transmits a microwave signal to the product target.

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