Instruction Manual · November 2005

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sitrans

LR 200 (HART)

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.

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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[1]: 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.
- This manual applies to the SITRANS LR 200 (HART) 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: http://pia.khe.siemens.com/index.asp?Nr=2181 and look under **Level Measurement/Level Measuring Instruments**.

1. This symbol is used when there is no corresponding caution symbol on the product.

! WARNING: Changes or modifications not expressly approved by Siemens Milltronics could void the user's authority to operate the equipment.

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 examples used in this manual illustrate typical installations using SITRANS LR 200. Because there is often a range of ways to approach an application, other configurations may also apply.

In all examples, substitute your own application details. If the examples do not apply to your application, check the applicable parameter reference for the available options.

Standard applications are found in the main body of the manual: for more specialized applications, please see *Appendix G: Special Applications*, page 109.

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		
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
FV	Full Vacuum		
ESD	Electrostatic Discharge		
HART	Highway Addressable Remote Transducer		
I_i	Input current		mA
I_o	Output current		mA
IS	Intrinsically Safe	safety approval	
L_i	Internal inductance		mH
LRV	**Lower Range Value**	value for process empty level	4 mA[1]
LSL	**Lower Sensor Limit**	below which no PV is anticipated	
mH	milliHenry	10^{-3}	Henry
µF	microFarad	10^{-6}	Farad
µs	microsecond	10^{-6}	Second
PED	Pressure Equipment Directive	safety approval	
pF	pico Farads	10^{-12}	Farad
ppm	parts per million		
PV	**Primary Variable**	measured value	
SELV	Safety extra low voltage		
SV	**Secondary Variable**	equivalent value	
TV	**Transmitter Variable**		
TVT	**Time Varying Threshold**	sensitivity threshold	
U_i	Input voltage		V
U_o	Output voltage		V
URV	**Upper Range Value**	value for process full level	20 mA[1]
USL	**Upper Sensor Limit**	above which no PV is anticipated	

1. 100% is most commonly set to 20 mA, and 0% to 4 mA: however, the settings can be reversed.

SITRANS LR 200

SITRANS LR 200 is a 2-wire loop-powered, continuous level measuring instrument that utilizes 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 HART[1]. Signals are processed using Sonic Intelligence® which has been field-proven in over 500,000 applications worldwide (ultrasonic and radar).

SITRANS LR 200 is available in numerous versions, several of which are approved for use in hazardous areas. The approval rating is shown on the device nameplate.

Application Type	LR 200 Version	Approval Rating	Valid for:	Wiring
Non-hazardous	**General Purpose**	$CSA_{US/C}$, FM, CE	N. America, Europe	See page 17
Hazardous	**Flameproof**	ATEX II 1/2 G, EEx dm ia IIC T4	Europe	See page 18
	Increased Safety	ATEX II 1/2 G, EEx em ia IIC T4	Europe	See page 19
	Explosion-proof	FM/CSA: Class I, Div. 1, Groups A, B, C, D Class II, Div. 1, Groups E, F, G Class III T4	US/Canada	See page 19
	Non-incendive	FM: Class I, Div. 2, Groups A, B, C, D T5	US	See page 20
	Intrinsically Safe (barrier required)	FM: Class I, Div. 1, Groups A, B, C, D Class II, Div. 1, Groups E, F, G Class III T4	US	See page 20
		ATEX II 1 G, EEx ia IIC T4	Europe	
		ANZEX Ex ia IIC T4 (Tamb = –40 to +80 °C) IP67	Australia	
		IECEX TSA 04.0020X T4	International	
		CSA: Class I, Div. 1, Groups A, B, C, D Class II, Div. 1, Groups E, F, G Class III T4	Canada	

1. HART® is a registered trademark of the HART Communication Foundation.

Process Connections

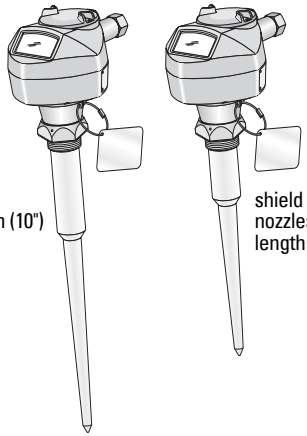
A wide range of process connections and antenna options is available to suit virtually any vessel configuration.

Applications

Notes:
- Please refer to device nameplate for approval information.
- SITRANS LR 200 is to be used only in the manner outlined in this manual, otherwise protection provided by the equipment may be impaired.

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
- slurries



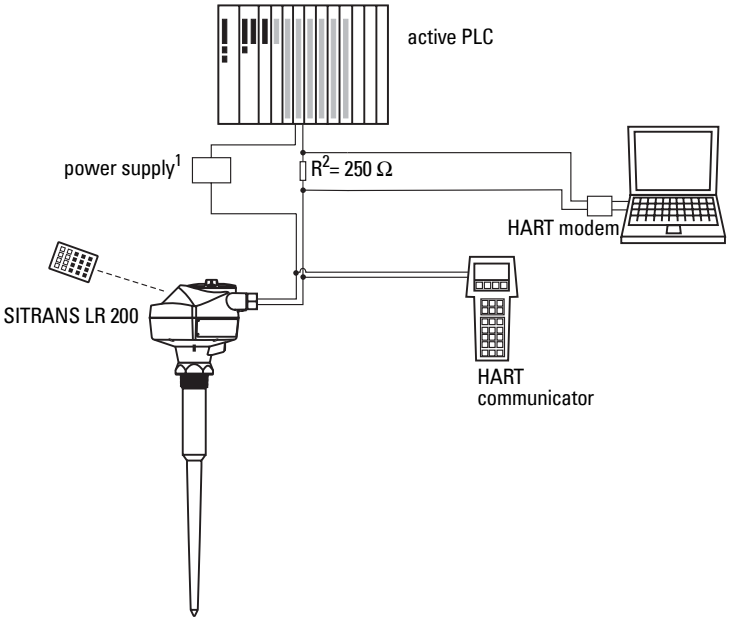
shield length 250 mm (10"): use for long nozzles of 250 mm (10") or less in length

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

SITRANS LR 200 System Implementation

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

Typical PLC/mA configuration with HART



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, via a PC using SIMATIC PDM, or via a HART Handheld Communicator.

SITRANS LR 200 Approvals and Certificates

Note: Please see *Approvals (verify against device nameplate)* on page 10 for an approvals listing.

1. Depending on the system design, the power supply may be separate from the PLC, or integral to it.
2. A 250 Ohm resistor may be required if the loop resistance is less than 250 Ohms.

Specifications

Note: 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

Power

General Purpose: Non-incendive[1]: Intrinsically Safe:	Nominal 24 V DC at max. 550 Ohm:
Flameproof: Increased Safety: Explosion-proof:	Nominal 24 V DC at max. 250 Ohm:

- Maximum 30 V DC
- 4 to 20 mA

Performance

Reference operating conditions according to IEC 60770-1

- ambient temperature +15 to +25 ^{o}C (+59 to +77 ^{o}F)
- humidity 45% to 75% relative humidity
- ambient pressure 860 to 1060 mbar g (86000 to 106000 N/m^2 g)

Measurement Accuracy (measured in accordance with IEC 60770-1)

- non-linearity (accuracy) the greater of: 10 mm (0.4"), or 0.10% of Span (including hysteresis and non-repeatability)
- non-repeatability 5 mm (included in non-linearity specification)
- deadband (resolution) 5 mm (included in non-linearity specification)

Analog Output Accuracy (measured in accordance with IEC 60770-1)

- non-linearity (accuracy) 0.125% of Span (including hysteresis and non-repeatability)
- non-repeatability 0.025% of Span (included in non-linearity specification)
- deadband (resolution) 0.0375% of Span (included in non-linearity specification)

1. FM Class I, Div. 2, Groups A, B, C, D, T5.

Frequency	5.8 GHz (6.3 GHz in N. America): refer to product nameplate for confirmation
Measurement range[1]	0.3 to 20 m (1 to 65 ft)
Update time	mA output and loop display is updated once per second
Blanking distance[2]	0.3 m (1 ft), plus the shield length (if any)
Influence of ambient temperature	0.006% / K
Dielectric constant	$\varepsilon_r > 3$ (for < 3 use waveguide antenna or stillpipe)

Memory:
- non-volatile EEPROM
- no battery required.

Interface

• HART	standard, integral to analog output
• configuration	Siemens SIMATIC PDM (PC), or HART handheld communicator, or Siemens Milltronics infrared hand-held programmer
• analog output	4–20 mA $\pm$ 0.02 mA accuracy (for detail, see non-linearity under *Analog Output Accuracy* on page 7)
• display (local)	multi-segment alphanumeric liquid crystal with bar graph (representing level)

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

1. For the reference point for each configuration, see *SITRANS LR 200 Dimensions* on page 15 for the standard version, or *Appendix H: Flanged Antenna Options*, page 113 onwards.
2. See *Near Blanking* on page 99 for more details.

Mechanical

Process Connections:

- threaded connection — 1.5" NPT, BSP, or G [BS EN ISO 228-1] (polypropylene rod antenna)
- flange connection — See *Dimensions: Flanges* on page 120.

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 H: Flanged Antenna Options* on page 113.
- horns/waveguide — see *Appendix H: Flanged Antenna Options* on page 113.

Enclosure

- construction — aluminum, polyester powder-coated
- conduit entry — 2 x M20x1.5, 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

Notes:

- Please check the ambient and operating temperatures under *Enclosure* on page 9, and *Approvals (verify against device nameplate)* on page 10; also check *Approvals (verify against device nameplate)* on page 10, 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).

Process

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

Approvals (verify against device nameplate)

- General $CSA_{US/C}$, FM, CE
- Radio Europe (R&TTE), FCC, Industry Canada
- Hazardous

Flameproof (Europe)		ATEX II 1/2 G, EEx dm ia IIC T4
Increased Safety (Europe)		ATEX II 1/2 G, EEx em ia IIC T4
Explosion proof (US/Canada)		FM/CSA: (barrier not required)[2] Class I, Div. 1, Groups A, B, C, D Class II, Div. 1, Groups E, F, G Class III T4
Non-incendive (US)		FM: (barrier not required)[3] Class I, Div. 2, Groups A, B, C, D T5
Intrinsically Safe: (Europe)		ATEX II 1 G, EEx ia IIC T4
	(US/Canada)	FM/CSA: (barrier required)[4] 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) IP67
	(International)	IECEX TSA 04.0020X T4

- Marine Lloyd's Register of Shipping
  ABS Type Approval

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 102, and *Process Pressure/Temperature derating curves* beginning on page 104.
2. See *Wiring drawing (Explosion-proof: FM/CSA)* on page 23 for drawing number 23650597.
3. See *Wiring drawing (Non-incendive: FM)* on page 24 for drawing number 23650537.
4. See *Wiring drawing (Intrinsically Safe: FM)* on page 25 for drawing number 23651611, and *Wiring drawing (Intrinsically Safe: CSA)* on page 26 for drawing number 23651621.

Installation

! **WARNINGS:**

- **This product can only function properly and safely if it is correctly transported, stored, installed, set up, operated and maintained.**
- **Please handle the device using the enclosure, not the antenna, to avoid damage.**

Note: Installation shall only be performed by qualified personnel and in accordance with local governing regulations.

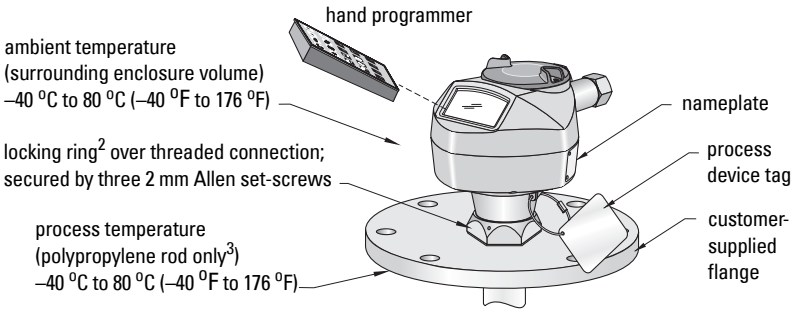
Mounting location

Recommendations:

- Ambient temperature within –40 to 80 °C (–40 to 176 °F)[1].
- Easy access for viewing the display and programming via the hand programmer.
- An environment suitable to the housing rating and materials of construction.
- Although the LCD has UV protection, use a sunshield if the instrument will be exposed to direct sunlight.

Precautions:

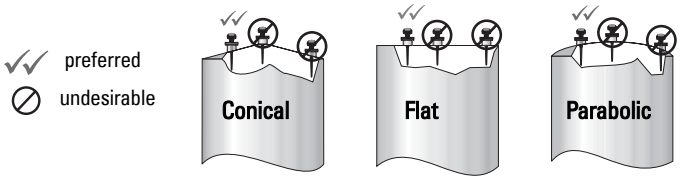
- Avoid interference to the emission cone from obstructions or from the fill path.
- Avoid central locations on vessels.



1. For more detail on maximum interface and process temperatures, see *Maximum Process Temperature Chart*, on page 102.
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 102, and the process pressure derating curves beginning on 104.

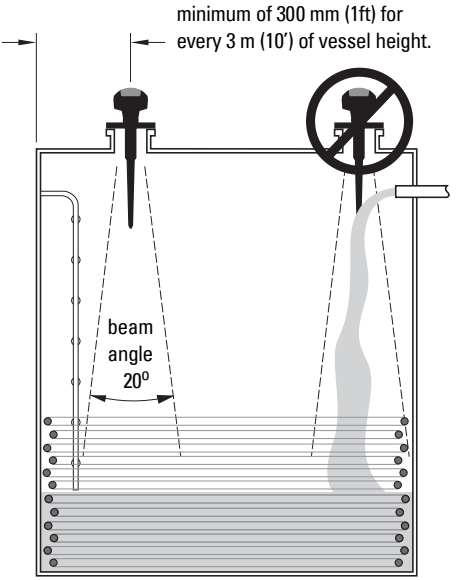
! WARNING: For vessels with conical or parabolic tops, avoid mounting the instrument at the centre. (The concavity of the top can focus echoes into the centre, giving false readings.)

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, which can cause false echoes.
- Make sure the beam angle does not intersect the fill path.



Notes:

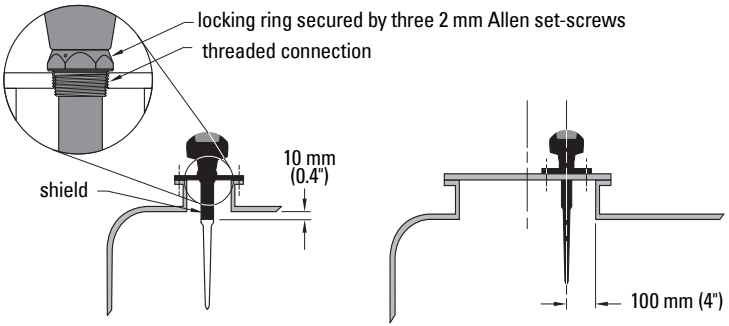
- Beam angle defined at –3dB boundary.
- For more detail on false echoes, see *Appendix F: Technical Reference* on page 97.

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.

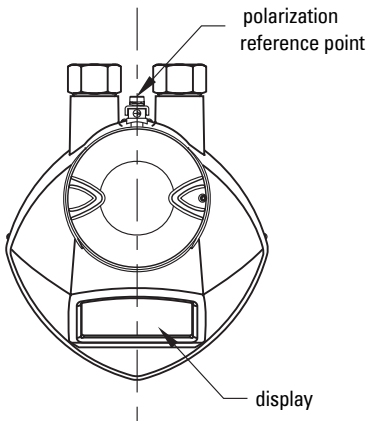
A manhole cover is typically a covered nozzle with a diameter 610 mm (24") or greater. To provide optimum signal conditions on a manhole cover, locate the antenna off-center, typically 100 mm (4") from the side.



Note: For details on other applications, see *Appendix G: Special Applications* on page 109.

Polarization reference point

For best results on a tank with obstructions, or a stillpipe with openings, orient the front or back of the device toward the obstructions (see *Mounting: Stillpipe or Bypass (Sidepipe)* on page 127 for an illustration.)



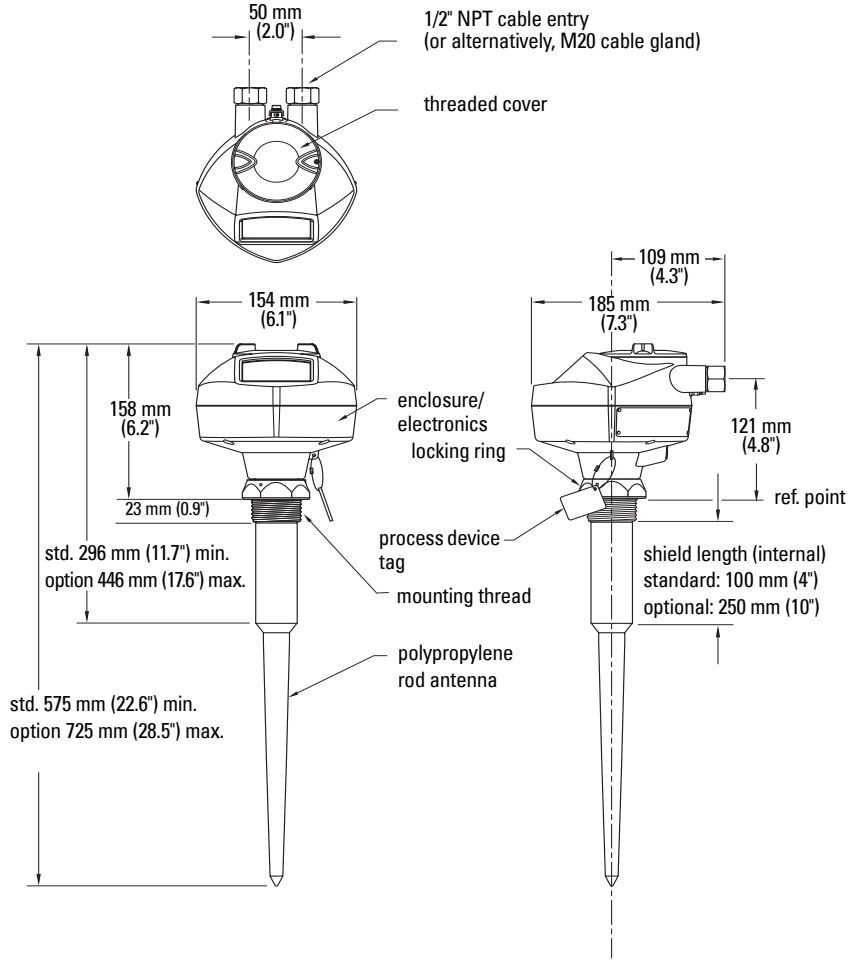
Mounting Instructions

Notes:
- The device can be rotated past 360° without damage.
- Do not rotate the enclosure after programming and vessel calibration, otherwise an error may occur, caused by a polarity shift of the transmit pulse.

1. Before inserting SITRANS LR 200 into its mounting connection, check to ensure the threads are matching, to avoid damaging them.
2. Simply screw SITRANS 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.

SITRANS LR 200 Dimensions



Notes

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.**

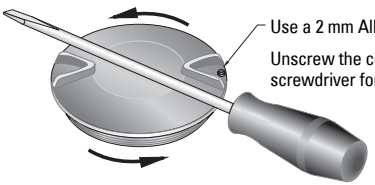
Connecting SITRANS LR 200

! **WARNINGS:**

- **Check the nameplate on your instrument, to verify the approval rating.**
- **Approved dust-tight and water-tight conduit seals are required for outdoor NEMA 4X / type 4X / NEMA 6, IP67, IP68 locations.**
- **Read *Instructions specific to hazardous area installations* on page 27.**

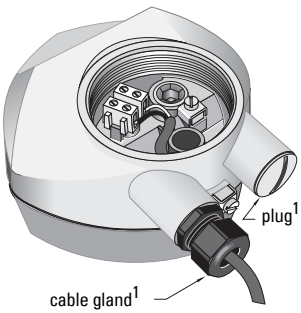
Notes:

- Use shielded, twisted pair cable: AWG 22 to 14 (0.34 mm^2 to 2.5 mm^2).
- Separate cables and conduits may be required to conform to standard instrumentation wiring practices or electrical codes.

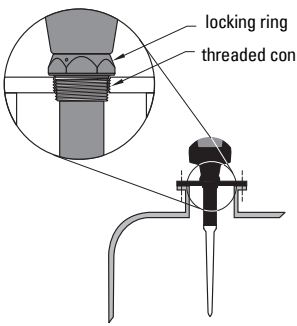


Use a 2 mm Allen key to loosen the lid-lock set screw.

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

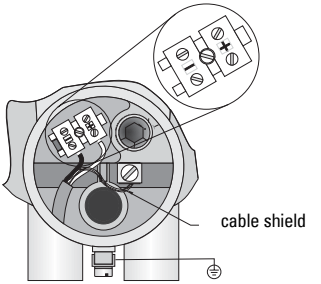


If you want to rotate the enclosure, use the 2 mm Allen key to loosen the locking ring.



1. Depending on the approval rating, glands and plugs may be supplied with your instrument.

1. Strip the cable jacket for approximately 70 mm (2.75") from the end of the cable, and thread the wires through the gland[1].
2. Connect the wires to the terminals as shown: the polarity is identified on the terminal block.
3. Ground the instrument according to local regulations.
4. Tighten the gland to form a good seal.



Wiring setups for hazardous area installations

There are five wiring options for hazardous area installations. In all cases, check the nameplate on your instrument, and confirm the approval rating.

1. Flameproof wiring method

Approval Rating	Valid for:
ATEX II 1/2 G, EEx dm ia IIC T4	Europe

- For power demands see *Curve 2 (Flameproof, Increased Safety, Explosion-proof)* on page 130.
- For wiring requirements follow local regulations.
- See also *Instructions specific to hazardous area installations* on page 27.

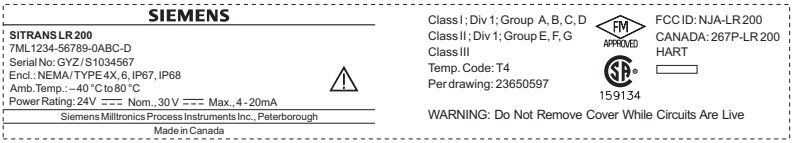
1. If cable is routed through conduit, use only approved suitable-size hubs for waterproof applications.

2. Increased safety wiring method

Approval Rating	Valid for:
ATEX II 1/2 G, EEx em ia IIC T4	Europe

- For power demands see *Curve 2 (Flameproof, Increased Safety, Explosion-proof)* on page 130.
- For wiring requirements follow local regulations.
- See also *Instructions specific to hazardous area installations* on page 27.

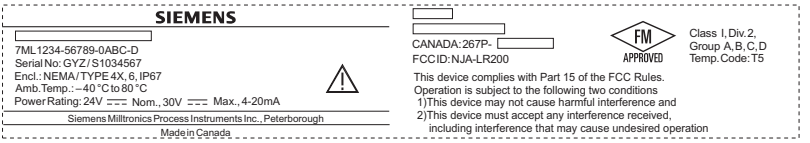
3. Explosion-proof wiring method



Approval Rating	Valid for:
FM/CSA: Class I, Div. 1, Groups A, B, C, D Class II, Div. 1, Groups E, F, G Class III T4	N. America

- For power demands see *Curve 2 (Flameproof, Increased Safety, Explosion-proof)* on page 130.
- For wiring requirements see *Wiring drawing (Explosion-proof: FM/CSA)* on page 23, for drawing number 23650597.

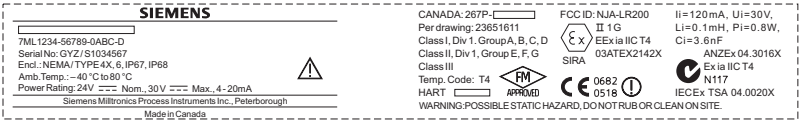
4. Non-incendive wiring

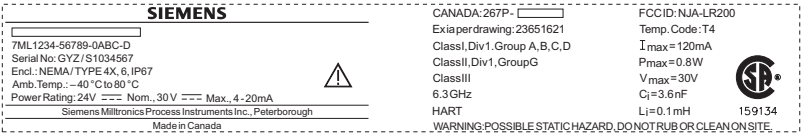


Approval Rating	Valid for:
FM: Class I, Div. 2, Groups A, B, C, D T5	N. America

- For power demands see *Curve 1 (General Purpose, Intrinsically Safe, Non-incendive)* on page 129.
- For wiring requirements see *Wiring drawing (Non-incendive: FM)* on page 24 for drawing number 23650537.

5. Intrinsically Safe wiring (barrier required[1])





Approval Rating	Valid for:
FM/CSA: Class I, Div. 1, Groups A, B, C, D Class II, Div. 1, Groups E, F, G Class III	US/Canada
ATEX II 1 G, EEx ia IIC T4	Europe
ANZEX Ex ia IIC T4 (Tamb = –40 to 80 °C) IP67	Australia
IECEX TSA 04.0020X	International

1. The barrier may be either external, or integral to the power supply.

- For power demands see *Curve 1 (General Purpose, Intrinsically Safe, Non-incendive)* on page 129.
- For wiring requirements:
  N. America: See *Wiring drawing (Intrinsically Safe: FM)* on page 25 for drawing number 23651611,
  or see *Wiring drawing (Intrinsically Safe: CSA)* on page 26 for drawing number 23651621.
  Europe: Follow local regulations.
  Australia: Follow local regulations.
  International: Follow local regulations.
- Approved dust-tight and water-tight conduit seals are required for outdoor NEMA 4X / type 4X / NEMA 6, IP67, IP68 locations.
- The maximum input voltage to the barrier must not exceed 250 V rms. Recommended intrinsically safe barriers are listed on page 21.
- Refer to *Instructions specific to hazardous area installations* on page 27.

EU Equivalency (barrier selection)

Any zener diode safety barrier, certified by an EU approved certification body to [EEx ia] IIC, its output voltage (U_0) not exceeding 30 V and its output current (I_0) limited by load resistance (R_0); such that $I_0 = U_0 / R_0$, does not exceed 120 mA.

IS Safety Barrier Selection

Selecting a suitable barrier or power supply requires knowledge about Intrinsic Safety and the application. It is the responsibility of the installer to ensure that the intrinsically safe installation complies with both the apparatus approval requirements and the relevant national code of practice.

How to select a passive barrier for SITRANS LR 200

1. Make sure that the barrier safety description is suitable for the LR 200 Intrinsically Safe (IS) input parameters.
2. Determine the maximum end-to-end resistance of the barrier (Re-e) from the data sheet.
3. Determine other loop resistance (Rloop): for example, sense resistance, displays, and/or PLC inputs.
4. Calculate Rworking = Re-e + Rloop.

(continued on next page)

5. Determine any non-linear voltage drops due to the barrier (Vbarrier) from the barrier data sheet (for example, voltage drops due to diodes).
6. Calculate Vworking = Vsupply – Vbarrier.
7. Using Vworking and Rworking, confirm that operation is within the shaded area of the graph *Curve 2 (Flameproof, Increased Safety, Explosion-proof)* on page 130.

Notes:
- The following list is not complete: there are many safety barriers on the market, which will work with the LR 200.
- The barriers listed below have all been tested and are functionally compatible with the LR 200.
- The barriers listed below are all HART compatible.

PLC Input Modules

Manufacturer	Part Number
Siemens	SM331 PCS7 HART Input Module

Passive Shunt Diode Barriers

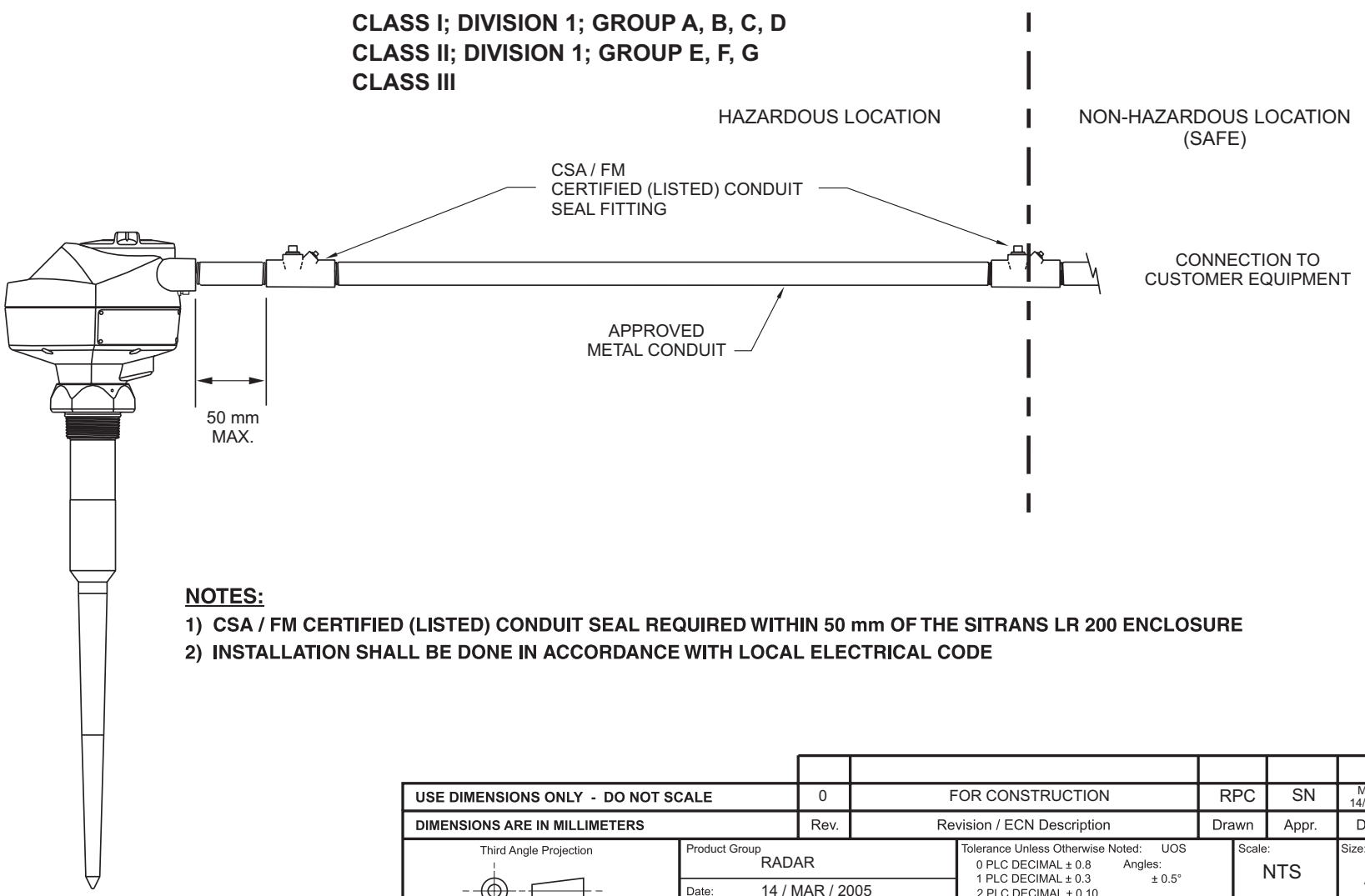
Note: A well regulated supply voltage is required.

Manufacturer	Part Number
MTL	787SP+ (Dual channel)
MTL	7787P+ (Dual channel)
Stahl	9001/01-280-100-10 (Single channel)
Stahl	9002/01-280-110-10 (Dual channel)

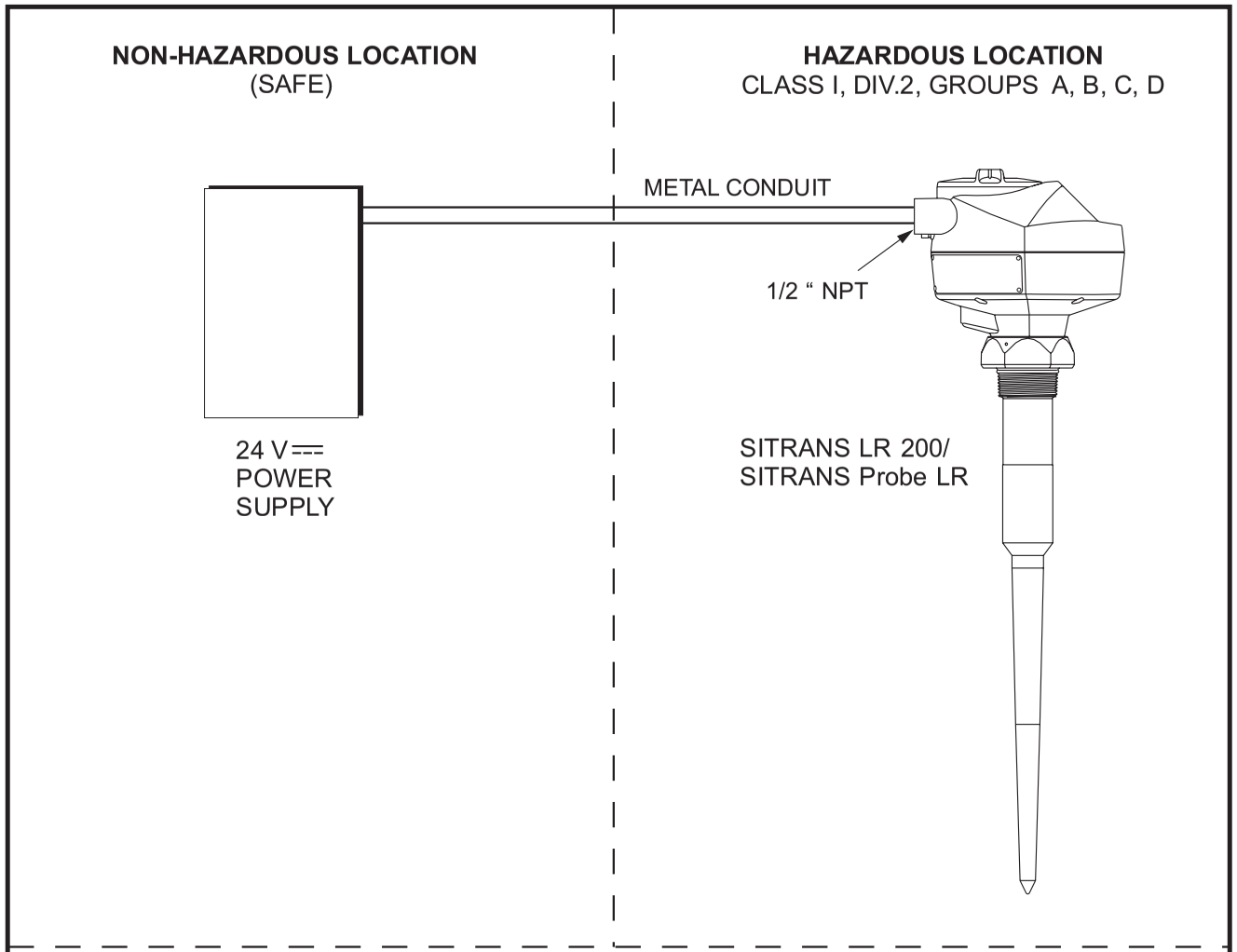
Active barriers (repeating barriers)

Manufacturer	Part Number
MTL	706
MTL	7206
Stahl	9001/51-280-110-14

Wiring drawing (Explosion-proof: FM/CSA)



Wiring drawing (Non-incendive: FM)



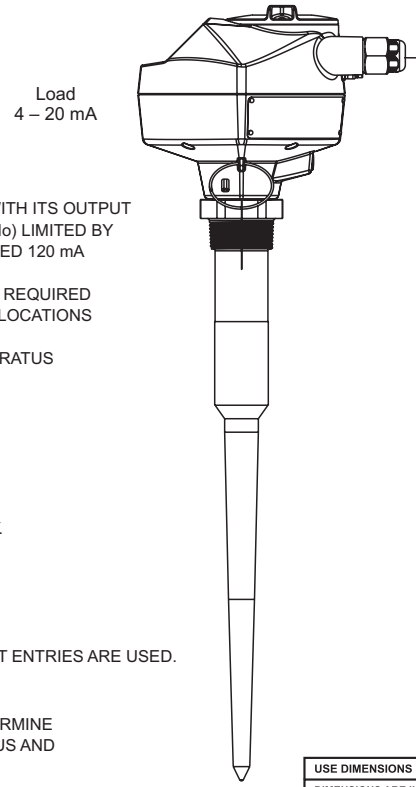
NOTES:

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

	Rev.	Revision / ECN Description	Drawn	Appr.	Date
	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					

Third Angle Projection	Product Group: RADAR	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
	Date: 05 / MAR / 2004			
	Drawn: R. CLYSDALE	TITLE: SITRANS LR 200 / PROBE LR CLASS I, Div. 2 CONNECTION DRAWING		
	Checked: T. LITTLE			
	Approved: S. NGUYEN			
FOR INTERNAL USE ONLY	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	

Wiring drawing (Intrinsically Safe: FM)



NOTES:

1. ANY CSA / FM INTRINSICALLY SAFE BARRIER / POWER SUPPLY, WITH ITS OUTPUT VOLTAGE (Uo) NOT EXCEEDING 30 V AND ITS OUTPUT CURRENT (Io) LIMITED BY LOAD RESISTANCE (Ro); SUCH THAT Io = Uo / Ro, DOES NOT EXCEED 120 mA

2. APPROVED DUST-TIGHT AND WATER-TIGHT CONDUIT SEALS ARE REQUIRED FOR CLASS II, DIV.1, Gr. E, F, G AND OUTDOOR NEMA 4X/TYPE 4X LOCATIONS

3. THE MAXIMUM VOLTAGE OF THE NON-INTRINSICALLY SAFE APPARATUS MUST NOT EXCEED 250 V rms.

4. UNDER THE ENTITY EVALUATION CONCEPT, THE LR 200 HAS THE FOLLOWING:
   Ui = 30 VOLTS D.C. Ii = 120 mA Pi = 0.8W
   Ci = 3.6 nF Li = 0.1 mH

5. SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

6. INSTALL PER NEC / CEC

7. USE SUPPLY WIRES RATED FOR 10 ° ABOVE.

8. EXTERNAL BONDING HUBS ARE REQUIRED WHEN BOTH CONDUIT ENTRIES ARE USED.

THE ENTITY EVALUATION CONCEPT IS A METHOD USED TO DETERMINE ACCEPTABLE COMBINATIONS OF INTRINSICALLY SAFE APPARATUS AND CONNECTED ASSOCIATED APPARATUS THAT HAVE NOT BEEN INVESTIGATED IN SUCH COMBINATION.

ENTITY CONCEPT DEFINITION: *THE ENTITY CONCEPT ALLOWS THE INTERCONNECTIONS OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN SUCH COMBINATIONS. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE AND CURRENT WITH INTRINSICALLY SAFE APPARATUS CAN RECEIVE AND REMAIN INTRINSICALLY SAFE, CONSIDERING FAULTS, MUST BE EQUAL OR GREATER THAN THE VOLTAGE (Uo) AND CURRENT (Io) LEVELS WHICH CAN BE DELIVERED BY THE ASSOCIATED APPARATUS, CONSIDERING FAULTS AND APPLICABLE FACTORS. IN ADDITION, THE MAX. UNPROTECTED CAPACITANCE (Ci) AND INDUCTANCE (Li) OF THE INTRINSICALLY SAFE APPARATUS, INCL. INTERCONNECTING WIRING, MUST BE EQUAL OR LESS THAN THE CAPACITANCE AND INDUCTANCE WHICH CAN BE SAFELY CONNECTED TO THE ASSOCIATED APPARATUS.*

	2	ADD NOTE 8 PER ECN 2003-0348	RPC	SN	NOV 07/2003
	1	ADD CSA/FM NOTE1, ADD NOTES 5, 6 AND 7, ADD VALUES IN NOTE 4 PER ECN 2003-0167	RPC	SN	APRIL 29/03
USE DIMENSIONS ONLY - DO NOT SCALE	0	FOR APPROVAL	BPS	IVZ	FEB 26/03
DIMENSIONS ARE IN MILLIMETERS	Rev.	Revision / ECN Description	Drawn	Appr.	Date

Third Angle Projection

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Product Group	RADAR
Date:	26 / FEB. / 03
Drawn:	BPS
Checked:	T. ADAM
Approved:	IVZ
Location:	PETERBOROUGH

Tolerance Unless Otherwise Noted: UOS
0 PLC DECIMAL ± 0.8 Angles: ± 0.5°
1 PLC DECIMAL ± 0.3
2 PLC DECIMAL ± 0.10

Scale: NTS Size: B

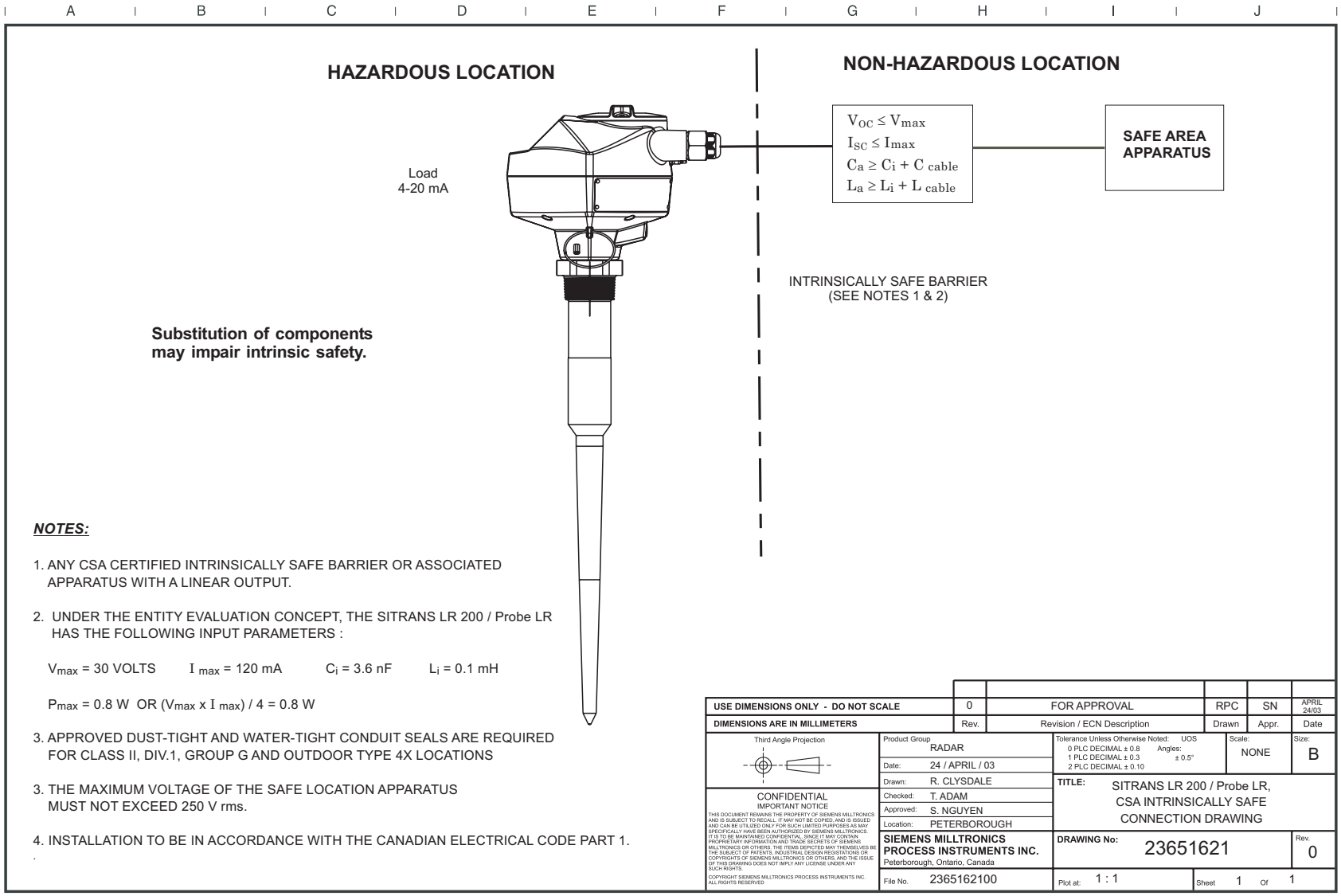
TITLE: SITRANS LR 200, INTRINSICALLY SAFE CONNECTION DIAGRAM

SIEMENS MILLTRONICS PROCESS INSTRUMENTS INC.
Peterborough, Ontario, Canada

DRAWING No: 23651611 Rev. 2

File No. 2365161102 Plot at: 1 : 1 Sheet 1 Of 1

Wiring drawing (Intrinsically Safe: CSA)



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.

1. **Equipment Marking**

    The equipment marking contains at least the information on the product nameplate.

LR 200 Version	Approval Rating	Nameplate
Flameproof	ATEX II 1/2 G, EEx dm ia IIC T4	See page 18
Increased Safety	ATEX II 1/2 G, EEx em ia IIC T4	See page 19
Explosion-proof	FM/CSA: Class I, Div. 1, Groups A, B, C, D Class II, Div. 1, Groups E, F, G Class III T4	See page 19
Non-incendive	FM: Class I, Div. 2, Groups A, B, C, D T5	See page 20
Intrinsically Safe	FM: Class I, Div. 1, Groups A, B, C, D Class II, Div. 1, Groups E, F, G Class III T4	See page 20
	ATEX II 1 G, EEx ia IIC T4	
	ANZEX Ex ia IIC T4 (Tamb = –40 to +80 °C) IP67	
	IECEX TSA 04.0020X T4	
	CSA: Class I, Div. 1, Groups A, B, C, D Class II, Div. 1, Groups E, F, G Class III T4	

Operating SITRANS LR 200

SITRANS LR 200 has two modes of operation: **RUN** and **PROGRAM**.

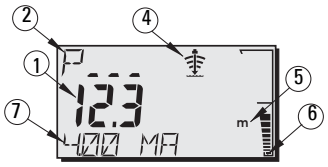
RUN Mode

SITRANS LR 200 automatically starts in **RUN** mode when power is applied, and detects the material level. The primary reading displays the material level (in meters) referenced from Empty (process empty level). This is the default start-up display mode.

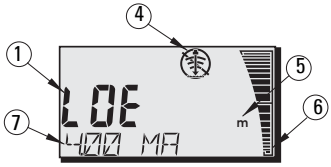
System status is displayed on the LCD, or on a remote communications terminal.

Display

Normal operation



Failsafe operation



1 – Primary Reading (displays level, distance, or volume, in either units or percent)

2 – Parameter for Auxiliary Reading[1]

4 – Echo status indicator: Reliable Echo or Unreliable Echo

5 – Units or Percent

6 – Active bar graph represents material level

7 – Auxiliary Reading (Depending on the parameter selected, it displays milliAmp value, distance, or confidence, with units where applicable.)

If the echo confidence drops below the echo confidence threshold, the failsafe timer starts running. When the timer expires, the letters **LOE** (Loss of Echo) alternate with the reading every two seconds, and the Reliable Echo indicator is replaced by the Unreliable Echo indicator. When a valid reading is received, the level reading display returns to normal operation.

1. Press to display the auxiliary reading field when in **RUN** mode.

Hand Programmer: function keys in RUN mode

Certain functions can be accessed directly from **RUN** mode by using specific keys.

Key	Run Mode
5 mA	mA output value displayed in auxiliary reading field.
6	Internal enclosure temperature displayed in auxiliary reading field.
P...	Parameter for auxiliary readings[1].
8	Displays the value representing Echo Confidence (P805).
%	Toggle between Units and % on reading display.
	Initiate and complete **PROGRAM** mode access.
	Distance displayed in auxiliary reading field.

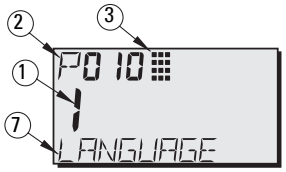
1. Press P... plus three-digit parameter number to set parameter to show in the auxiliary display.

PROGRAM Mode

Programming

- Set parameters to suit your specific application.
- Activate **PROGRAM** mode at any time, to change parameter values and set operating conditions.
- For local programming, use the Siemens Milltronics hand programmer.
- For programming from a distance, use either a PC running SIMATIC PDM, or a HART handheld communicator.

Display



1 – Primary Reading (displays parameter value)
2 – Secondary Reading (displays parameter number)
3 – Programming indicator
7 – Auxiliary Reading (displays parameter names for the Quick Start parameters, if a language is selected. It displays the index value for indexed parameters, such as P054.)

Hand Programmer: function keys in PROGRAM mode

Key	Programming Mode
0 to 9	Values
P...	Decimal point
Pxxx	Negative value
C	**CLEAR** value
%	**TOGGLE** between Units and % on parameter value
	End **PROGRAM** session and enable **RUN** mode
	Update echo quality parameters
	Parameter scroll-up
	Parameter scroll-down
	DISPLAY opens parameter fields
	ENTER the displayed value

Security

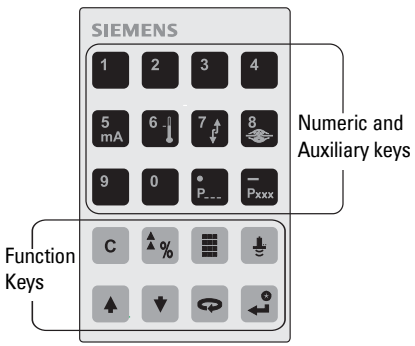
The Lock parameter, P000, secures SITRANS LR 200 against changes via the hand programmer. To enable programming, set P000 to the Unlocked Value stored in P069. To disable programming, enter a different value.

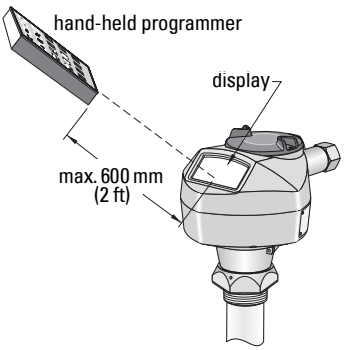
Note:
- A remote master can still change configuration, if P799 is set to allow this.

Hand programmer

Note: For detailed instructions on using the hand programmer, see the next page.

For direct access to SITRANS LR 200, point the hand programmer at the display (from a maximum distance of 600 mm [2 ft]), and press the keys.





Activating SITRANS LR 200

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

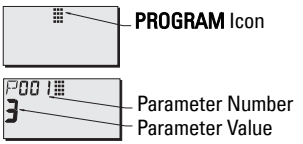
Power up the instrument. SITRANS LR 200 starts in **RUN** mode, and detects the material level. It displays the material level (in meters) referenced from Empty (process empty level). This is the default start-up mode.

Accessing a parameter

Notes:

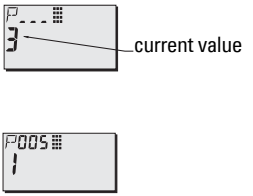
- Press **PROGRAM** then **DISPLAY** to access **PROGRAM** mode, and press **PROGRAM** to return to **RUN** mode.
- The following instructions apply when using the Hand Programmer.
- Do not use the Hand Programmer at the same time as SIMATIC PDM, or erratic operation may result.
- You do not need to key in initial zeros when entering a parameter number: for example, for P005, key in **5**.

1. Press **PROGRAM** then **DISPLAY**, to activate **PROGRAM** mode.



2. Either use the **ARROW** keys to scroll to a different parameter, or:
3. Press **DISPLAY** to open the Parameter Number field.
4. Key in the desired parameter number followed by **ENTER**.

   For example: press 5 mA.
   The LCD displays the new parameter number and value.



Changing a Parameter Value

Notes:
- Security must be disabled to enable programming: set P000 to the Unlocked Value stored in P069.
- Invalid entries will be rejected or limited.
- **CLEAR** [c] can be used to clear the field.

1. Use the **ARROW** keys [▲] [▼] to scroll to the parameter number, or press **DISPLAY** [⇔] and key in the parameter number followed by **ENTER** [↵].
2. Key in the new value.
3. Press **ENTER** [↵] to set the value.

Parameter Reset to Factory Default

1. Scroll to the parameter or enter its address.
2. Press **CLEAR** [c] then **ENTER** [↵]. The value returns to the default setting.

P999 Master Reset

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

Resets all parameters to their factory settings, with the following exceptions:

- *P000 and P069 are not reset.*
- *The learned TVT curve is not lost.*

1. Press **PROGRAM** [≡], then **DISPLAY** [⇔] to activate **PROGRAM** mode.
2. Press **DISPLAY** [⇔] to open parameter fields.
3. Key in **999**.

Press **CLEAR** [c] then **ENTER** [↵], to Clear All and initiate reset. The LCD displays **C.ALL**.

4. Reset complete. (Reset takes several seconds to complete.)

Using Units or Percent (%)

Many parameters can be viewed either as a percentage, or in measurement units (P005). View the parameter, then press **MODE** [▲%] to toggle between units and percentage.

Setup Steps (outline)

Set the Quick Start parameters between P001 and P010 (the main settings that apply to all applications and make the system operational). Then set P837 and 838 to ignore false echoes, and return to **RUN** mode.

1. Select a language option, or numeric, for the auxiliary reading (P010).
2. Select the measurement mode: level, space, or distance (P001).
3. Set the response time to level changes (P003).
4. Select units of measurement: m, cm, mm, ft, or in. (P005).
5. Set process empty level (Empty: P006).
6. Set the range to be measured (Span: P007).
7. To ignore false echoes before the material echo: set Auto False-Echo Suppression Distance P838.
8. Enable Auto False-Echo Suppression P837.
9. Return to **RUN** mode.

Setup Instructions

Notes:

- In **PROGRAM** mode, you can use the **ARROW** keys [▲] [▼] to scroll to a parameter number.
- The default parameter values are indicated by an asterisk (*) in the tables.

Using the hand programmer, set each parameter value to suit your application.

a. Press **PROGRAM** [▦], then **DISPLAY** [⇔], to activate **PROGRAM** Mode.

b. Either scroll to the desired parameter number, or press **DISPLAY** [⇔] again and key in the parameter number followed by **ENTER** [↵].

c. Key in the appropriate value for each parameter.

d. Press **ENTER** [↵] to set the value.

1. Select a language (P010: Language)

If a language is selected, parameter titles for the Quick Start parameters are displayed in the auxiliary reading field.

Parameter	Value		Description
P010	0	*	Numeric/None
	1		English
	2		German
	3		French
	4		Spanish

Parameter	Auxiliary reading
P000	LOCK
P001	OPERATION
P003	MEAS RESP
P004	ANTENNA
P005	UNITS
P006	EMPTY
P007	SPAN
P010	LANGUAGE

2. Select the measurement mode required for the application (P001: Operation)

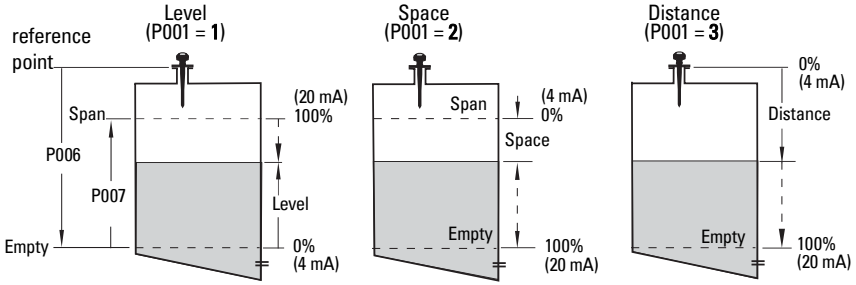
To measure how full the vessel is, select **Level**: the reading can be returned as level or as volume**:**

- for a level reading, ensure P050 is set to **0:** the reading returns the distance from process empty level (Empty) to the current level
- for a volume reading, select a vessel shape at P050, and set volume parameters 051 to 055 as required

To measure how much space remains in the vessel, select **Space**:

- **Space** returns a reading for the distance between current level and process full level (Span)

To measure the distance from the reference point[1] to the current level, select **Distance.**



Notes:

- Setting P001 resets Span (P007), unless Span has previously been set to a different value. Span is set to Empty distance minus 110% of Blanking[1], unless Operation is set to distance measurement (P001 = 3). In this case, Span is set to the same value as Empty (P006).
- Changing P001 may reset Output Function (P201).

Parameter	Values		Description
P001	**1**	*	**Level** returns material level referenced from Empty (process empty level). The reading is returned in volumetric units if parameters 050 to 055 are set to enable this.
	2		**Space** returns material level referenced from Span (process full level).
	3		**Distance** returns material level referenced from the reference point[1].

1. For the reference point for the standard model, see *SITRANS LR 200 Dimensions* on page 15. For other configurations, see *Appendix H: Flanged Antenna Options* on page 113 onwards.
2. See *Appendix F: Technical Reference* on page 97 for details.
3. For the reference point for the standard configuration, see page 15. For other configurations, see *Appendix H: Flanged Antenna Options* on page 113 onwards.

3. Set response time to filling/emptying rate (P003: Measurement Response)

Set P003 to a measurement response speed just faster than the maximum filling or emptying rate (whichever is greater).

Parameter	Values		Description		Parameters affected by P003
P003	**1**	*	slow	0.1m/minute	P070, P700, P701, P709, P711
	2		medium	1m/minute	
	3		fast	10m/minute	

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.

(For more detail on measurement response, see *Appendix F: Technical Reference* on page 97.)

(P004 Antenna Type: view only)

Value	240	antenna without PTFE extension
	241	rod + 50 mm PTFE extension
	242	rod + 100 mm PTFE extension

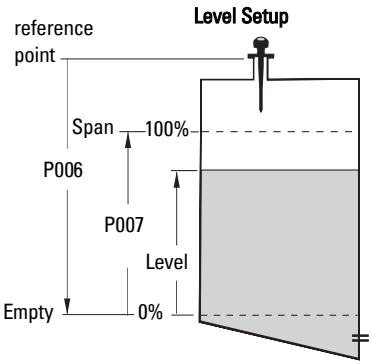
4. Select the measurement units required (P005: Units)

Parameter	Value		Description
P005	**1**	*	meters
	2		centimeters
	3		millimeters
	4		feet
	5		inches

5. Set process empty level (P006: Empty)

Value		
	Range	**0.0000 to 20.00**
	Default	**20.00 m (maximum range)**

Enter the distance from the antenna reference point[1] to process empty level (Empty), using units set in P005. Empty can be set to any distance: not necessarily the bottom of the vessel



Note:
- P006 and P007 are interlinked: see notes attached to P007.

6. Set the range to be measured (P007: Span)

Value		
	Range	**0.0000 to 20.00**
	Default	**19.56** (see note below)

Enter the distance between Empty (process empty level) and Span (process full level), in the units set in P005. Span can be set at any distance above Empty level.

Notes:
- Setting P006 resets Span, if it has not previously been set to a different value.
- The default setting for Span is based on Operation (P001) and Empty (P006). Span is set to Empty minus 110% of Blanking distance[2], unless Operation is set to **distance** (P001=3). In this case, Span is set to Empty distance.
- Always prevent the monitored surface from approaching within 0.3 m (1 ft) of the reference point, as this is the minimum distance detectable.

1. For the reference point for each configuration, see *SITRANS LR 200 Dimensions* on page 15 for the standard version, or *Appendix H: Flanged Antenna Options* on page 113 onwards.
2. 0.3 m (1 ft), plus the shield length (if any).

7. Minimize false reflections (P838: Auto False-Echo Suppression Distance)

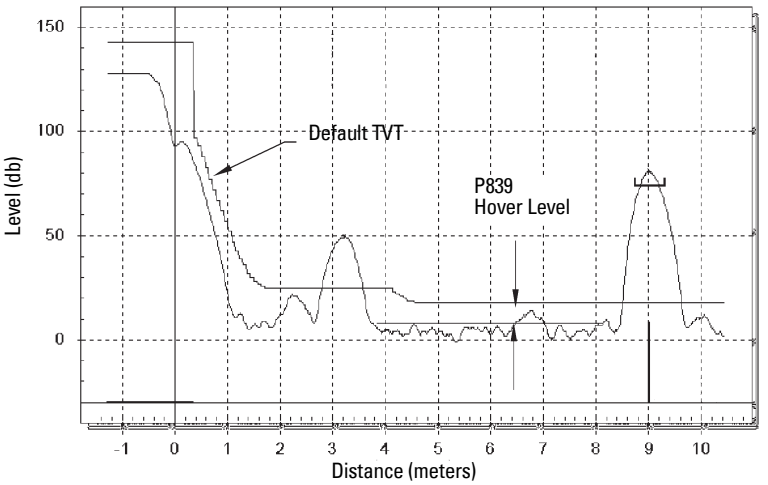
If SITRANS LR 200 displays an incorrect full level, or if the reading fluctuates between a false high level and a correct level, you can use the TVT (Time Varying Threshold)[1] shaper parameters P838 and P837 together to prevent false-echo detection. They elevate the TVT in this region and de-sensitize the receiver from any 'base noise' caused by internal antenna reflections, nozzle echoes, or other vessel false echoes.

Notes:
- Close all online windows before adjusting P837 and P838.
- This function works best when tank is empty or nearly empty: use it only if there is a minimum distance of 2 meters from the radar instrument to the material.
- Set P837 and P838 during start up, if possible.
- If the vessel contains an agitator, the agitator should be running.

Parameter	Values	
P838	Range:	**0.0000 to 20.00 (m)**
	*	**1.000**

Determine the actual distance from the antenna reference point to the material surface. Subtract 0.5 m from this distance and enter the result. Do this in combination with P837: see the Setup Instructions following P837.

Display before Auto False-Echo Suppression
(or when P837 = 0)



1. For more detail on Auto TVT adjustments, see *P837 Auto False-Echo Suppression* on page 73. See also *Appendix F: Technical Reference* on page 97.

8. Enable False-Echo Suppression (P837: Auto False-Echo Suppression[1])

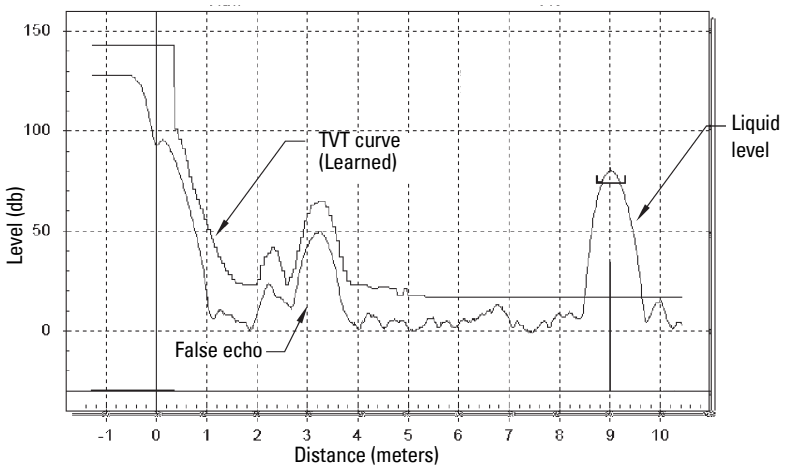
Use this feature to ignore false echoes before the material echo. Use P838 to set the Auto TVT distance first.

Parameter	Values		Description
P837	**0**		Off
	1	*	Use "learned" TVT
	2		"Learn"

Setup Auto False-Echo Suppression:

a. Perform this function when the vessel is empty or nearly empty.
a. First rotate the instrument for best signal (lowest false-echo amplitude)
b. Determine **distance** from radar instrument to material level.
c. Press **PROGRAM**, then **DISPLAY**.
d. Select P838 and key in [distance to liquid level minus 0.5m].
e. Select P837.
f. Press **2** and then press **ENTER**. P 837 will automatically revert to **1** (use Learned TVT) after a few seconds.

Example After Auto False-Echo Suppression



9. Press PROGRAM to return to RUN mode.

1. For more detail on Auto TVT adjustments, see *P837 Auto False-Echo Suppression* on page 73.

Additional Settings

- Convert readings to volume (P050 to P055)
- Stored unlock value (P069)
- Set Failsafe timer conditions (P070 TO P073)
- Control Analog Output (P201 to P215, and P911)
- Check installation records (P341 to P346)
- Calibrate sensor for unusual conditions (P652 to P655)
- Limit rate of change of reading (P700 to P701)
- Verify measurements (P709 to P713)
- Configure communications (P799)
- Control echo processing (P800 to P820)
- TVT curve adjustments - Auto False-Echo Suppression (P837 to P839)
- Software diagnostic tests (P900 to P901)
- Adjust measurements (P911 to P924)

For a full list of available parameters, see *Parameter Reference*, starting on page 46.

Notes

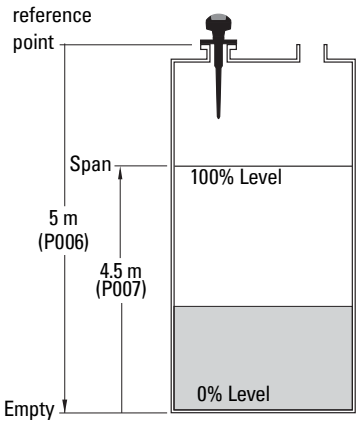
Application Examples

You can use these examples as setup references. Enter the values in the parameter tables to select the corresponding functions.

Example 1: Liquid resin in storage vessel, level measurement

Notes:

- The minimum distance from the flange face to the target is limited by near-blanking P800.
- Only set P837 if the product is at least 2 m (78") away from the flange face. If it is closer, leave P837 at **1** until the level drops and the distance increases beyond 2 m (78").



The application is to obtain a level measurement and corresponding 4 to 20 mA output proportional to resin levels in a storage vessel.

Process empty level (Empty) is the bottom of the tank, which is 5 m from the antenna flange face. Process full level (Span) is 4.5 m from the vessel bottom. The maximum rate of filling or emptying is about 0.2 m/min.

In the event of a loss of echo, SITRANS LR 200 is to go into Failsafe Hi after 2 minutes.

Parameter	Description	Value	Function
P001	mode of measurement	**1**	Level
P003	measurement response	**2**	1m/minute
P005	units	**1**	meters
P006	empty distance	**5**	5 m
P007	span	**4.5**	4.5 m
P070	Failsafe timer	**2**	2 minutes
P071	Failsafe mode	**1**	Hi
P838	Auto False-Echo Suppression Distance	[Distance [1] minus 0.5 m]	Sets length of learned TVT curve[2] to use
P837	Auto False-Echo Suppression	**2** then **1**	Enables the use of learned TVT curve[2].

1. Distance to product from reference point.
2. For more details on setting P837 and P838, see page 72 and page 73. For an explanation, see *Auto False-Echo Suppression* on page 99.

Return to **RUN**: press **PROGRAM** to start normal operation.

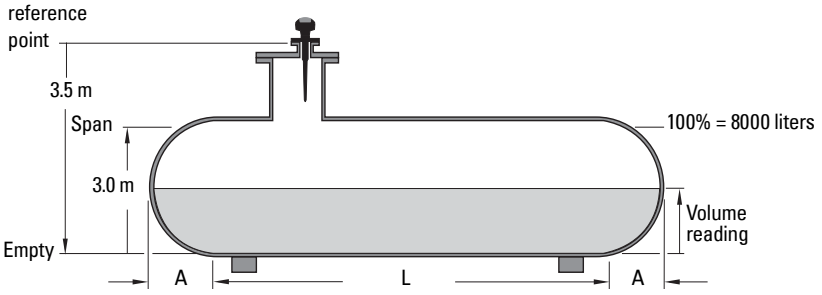
Example 2: Horizontal vessel with volume measurement

Notes:
- The minimum distance from the flange face to the target is limited by near-blanking P800.
- Only set P837 if the product is at least 2 m (78") away from the flange face. If it is closer, leave P837 at **1** until the level drops and the distance increases beyond 2m (78").

The application is to obtain a level measurement and corresponding 4 to 20 mA output proportional to vessel volume in a chemical vessel.

Process empty level (Empty) is the bottom of the tank, which is 3.5 m from the antenna flange face. Process full level (Span) is 3.0 m from the vessel bottom. The maximum rate of filling or emptying is about 0.2 m/min. Selecting tank shape 7 at P050, and entering values for A and L, will give a volume reading instead of level.

In the event of a loss of echo, SITRANS LR 200 is to go into Failsafe Hi after 2 minutes.



Parameter	Description	Values	Function
P001	mode of measurement	**1**	Volume replaces Level when a tank shape is selected at P050
P003	measurement response	**2**	1m/minute
P005	units	**1**	meters
P006	empty distance	**3.5**	3.5 m
P007	span	**3**	3 m
P050	vessel shape	**7**	parabolic ends
P051	maximum volume	**8000**	8000 liters
P052	vessel dimension A	**.8**	0.8 meters
P053	vessel dimension L	**6**	6 meters
P070	Failsafe timer	**2**	2 minutes
P071	Failsafe	**1**	Hi
P838	Auto False-Echo Suppression Distance	[Distance[1] minus 0.5 m]	Sets length of learned TVT curve[2] to use
P837	Auto False-Echo Suppression	**2** then **1**	Enables the use of learned TVT curve[2].

1. Distance to product from reference point.
2. For more details on setting P837 and P838, see page 72 and page 73. For an explanation, see *Auto False-Echo Suppression* on page 99.

Return to **RUN**: press **PROGRAM** to start normal operation.

Parameter Reference

Notes:
- Keep infrared devices such as laptops, cell phones, and PDAs, away from SITRANS LR 200 to prevent inadvertent operation.
- Do not use the Hand Programmer at the same time as SIMATIC PDM, or erratic operation may result.

SITRANS LR 200 is configured through its parameters, and the application determines the parameter values which are entered into the instrument.

Please check your value entries carefully before operating SITRANS LR 200, to ensure optimum performance.

Helpful Hints

- **Default** values are indicated with an asterisk (*) in the parameter tables, unless explicitly described.
- **Primary index** is an address: for example, P054.
- **Secondary index** is a sub-address that allows for multiple values on an indexed point, and allows indexed values from more than one parameter to be linked, for example, the breakpoints in P054 and P055.

To access a parameter and change a value (primary index):

1. Press **PROGRAM** then **DISPLAY** to activate **PROGRAM** Mode.
2. Either use the **ARROW** keys to scroll to each parameter number, or press **DISPLAY** again to access the parameter number field.and key in the parameter number followed by **ENTER**.
3. Key in the new value.
4. Press **ENTER**.

Note: Initial zeros in a parameter number do not have to be entered: for example, for P001, key in **1**.

To access a secondary index and change a value:

1. Select the parameter number, for example P054: the secondary index is displayed in the auxiliary reading.
2. Press **DISPLAY** twice[1] (the auxiliary reading field goes blank).
3. Key in the address of the desired index, or use the **ARROW** keys to scroll to the desired secondary index number.
4. Key in the new index value.
5. Press **ENTER**.

P000 Lock

Secures SITRANS LR 200 from parameter changes via the hand programmer.

Value	Unlocked Value (P069)	*	Unlocked: programming permitted[1]
	other		Locked: programming not permitted

1. The factory setting for P069 is 1954: after a new Unlocked value is entered and accepted, the new value becomes the default setting.

Note:
- This lock only applies to the hand programmer: it does not lock access through communications.
- A remote master can change configuration if P799 is set to allow this.

To secure the programming lock:

1. Key in **0,** and press **ENTER**.
2. Key in any value other than the Unlocked Value (P069).
3. Press **ENTER** to set the value: **PROGRAM** mode is now active for viewing only.

To unlock the instrument and enable programming changes:

1. Key in **0,** and press **ENTER**.
2. Key in the Unlocked Value (P069).
3. Press **ENTER** to set the value: **PROGRAM** mode is now active for programming.

1. At a parameter with a secondary index, pressing **DISPLAY** twice focusses the control on the secondary index.

P001 Operation

Note: Default values are indicated with an asterisk (*) in the parameter tables, unless explicitly described.

Sets the type of measurement required for the application. (This affects the local LCD only: the primary variable for HART is controlled by P201.)

To measure how full the vessel is, select **Level. T**he reading can be returned as level or as volume**:**

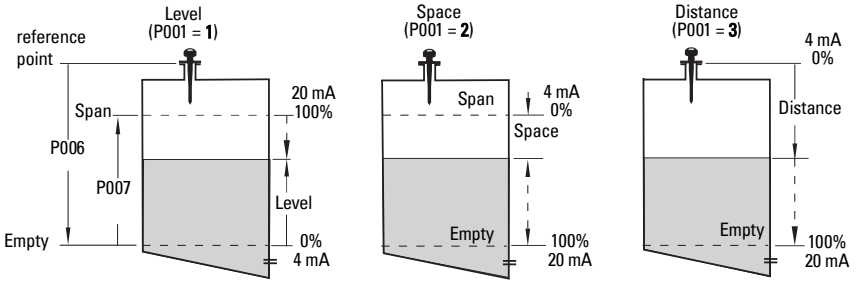
- for a level reading, ensure P050 is set to **0:** the reading returns the distance from process empty level (Empty) to the current level
- for a volume reading, select a vessel shape at P050, and set volume parameters 051 to 055 as required

To measure how much space remains in the vessel, select **Space**:

- **Space** returns a reading for the distance between current level and process full level (Span)

To measure the distance from the reference point[1] to the current level, select **Distance.**

Values	**0**		Instrument out of service.
	1	*	**Level** returns material level referenced from Empty (process empty level). The reading is returned in volumetric units if parameters 050 to 055 are set to enable this.
	2		**Space** returns material level referenced from Span (process full level).
	3		**Distance** returns material level reference from the reference point[1].



1. For the reference point for the standard model, see *SITRANS LR 200 Dimensions* on page 15. For other configurations, see *Appendix H: Flanged Antenna Options*, page 113 onwards.

Notes:

- Setting P001 resets Span (P007), unless Span has previously been set to a different value. Span is set to Empty distance minus 110% of Blanking[1] unless P001 is set to **3** (distance measurement). In this case it is set to the same value as Empty (P006).
- Changing P001 may reset Output Function (P201).

P003 Measurement Response

Sets the rate of response to level changes.

Related Parameters	P003			Failsafe Timer P070 (minutes)	Max. Measurement Response P700/P701	Damping Filter P709	Echo Verification P711
Values	**1**	*	slow	**100**	**0.1** m/minute	**10.0** s	**2**
	2		medium	**10**	**1** m/minute	**10.0** s	**2**
	3		fast	**1**	**10** m/minute	**1.0** s	**2**

Note: Changing P003 resets the following parameters: P070, P700, P701, P709, and P711.

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.

- **Echo Verification (P711):** discriminates between agitator blades in motion (spurious noise) and the target surface (true echo).
- **Failsafe timer (P070):** establishes the period from the time a loss of echo (LOE) starts until the Failsafe default (P071) is triggered. P070 takes precedence over P003.

P004 Antenna Type

Specifies the antenna type attached.

Values	**240**	*	antenna without PTFE extension
	241		rod + 50 mm PTFE extension
	242		rod + 100 mm PTFE extension

1. See *Near Blanking* on page 99 for more details.

P005 Units

Specifies measurement units used for dimensional values.

Values	**1**	*	meters
	2		centimeters
	3		millimeters
	4		feet
	5		inches

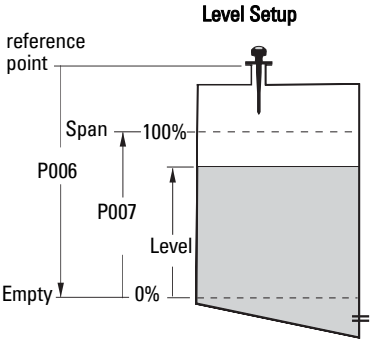
P006 Empty (process empty level)

Sets the distance from the reference point [1] to the process empty level, in units selected at P005.

Values	Range	**0.0000 to 20.00 (m)**
	Default	**20.00 m (max. range)**

Enter the distance from the reference point to Empty (process empty level), using units set in P005. Empty can be set to any distance: not necessarily the bottom of the vessel

Notes:
- Default setting is maximum range.
- P006 and P007 are interlinked: see note attached to P007.



1. For the reference point for the standard configuration, see *SITRANS LR 200 Dimensions* on page 15; for other configurations, see *Appendix H: Flanged Antenna Options*, page 113 onwards.

P007 Span (process full level)

Sets the range to be measured (referenced from Empty) in units selected at P005.

Values	Range	**0.0000 to 20.00 (m)**
	Default	**19.56** (see note below)

Enter the distance between Empty (process empty level) and Span (process full level), in units set in P005. Span can be set at any distance above Empty level.

Notes:

- Setting P006 will reset Span, if it has not previously been set to a different value.
- The default setting for Span is based on Operation (P001) and Empty (P006). Span is set to Empty minus 110% of Blanking[1] distance, unless Operation is set to **Distance** (P001 = 3). In this case, Span is set to Empty distance.
- Always prevent the monitored surface from approaching within 0.3 m (1 ft) of the reference point, as this is the minimum distance detectable.

P010 Language

Selects the language used for the auxiliary reading on the display.

Values	**0**	*	Numeric / None
	1		English
	2		German
	3		French
	4		Spanish

If a language is selected, parameter titles for the Quick Start parameters are displayed. (See the table on page 34 for the titles displayed.)

1. See *Near Blanking* on page 99 for details.

Volume (P050 to P055)

Note: Factory settings are indicated by an asterisk (*) in the parameter tables, unless explicitly described.

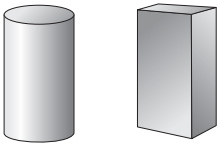
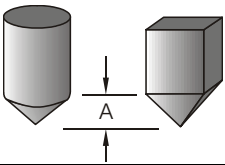
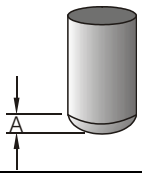
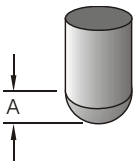
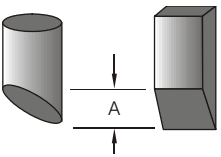
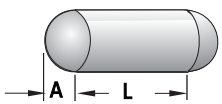
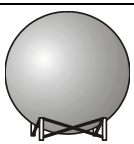
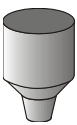
Set SITRANS LR 200 to calculate readings based on reservoir volume instead of level.

1. Operation must be set to Level (P001 = **1**).
2. Select a vessel shape matching the monitored vessel (P050).
3. If required, add dimensions A or L (as shown in the chart on page 53), using P052 and P053,
   or, if vessel shape 9 is selected, add level and volume breakpoints in P054 and P055.
4. Enter the value for the maximum vessel volume in P051.
5. Return to **RUN** mode: readings are now displayed in volumetric units. To select **PERCENT,** press [▲%]: the displayed volume reading will be a percentage of Maximum Volume.

P050 Vessel Shape

*Defines the vessel shape (see chart on next page) and allows SITRANS LR 200 to calculate volume instead of level. The default setting for P050 is **0** (volume calculation not required).*

Enter the value for the vessel shape matching the monitored vessel or reservoir (see chart on page 53).

P050 Value		Vessel Shape	Description	Also required
0	*	----	no volume calculation required	N/A
1			flat bottom	P051
2			conical or pyramidal bottom	P051, P052
3			parabolic bottom	P051, P052
4			spherical bottom	P051, P052
5			angled bottom	P051, P052
6			flat end cylinder	P051
7			parabolic end cylinder	P051, P052, P053
8			sphere	P051
9			universal linear level/volume breakpoints	P051, P054, P055

P051 Maximum Volume

For readings in volumetric units instead of percentage values, enter the vessel volume corresponding to Span (P007). Any volumetric units can be chosen, because the volume calculation is based on the maximum volume, and scaled according to the Vessel Shape (P050) value. If no value 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	P006 Empty P007 Span

Enter the vessel volume corresponding to Span (P007).

1. Key in the value. (For example, if maximum volume = 3650 m^3, key in 3650.)
2. Press **ENTER** .

If the value is too large for the LCD display, enter larger units.

Example:

If maximum volume = 267,500 gallons, key in **267.5** (thousands of gallons).

P052 Vessel Dimension A

*Dimension **A** as used for P050 Vessel Shapes 2, 3, 4, 5, or 7, in the chart on page 53).*

Values	Range: **0.0000 to 99999** in units (P005**)**
	Default: 0.0
Related Parameters	P050 Vessel Shape

Enter one of the following, using the units selected in P005:

- height of the vessel bottom if P050 = **2, 3, 4**, or **5**
- length of one end-section of the vessel if P050 = **7**

P053 Vessel Dimension L

*Dimension **L** as used in P050 Vessel Shape, in the chart on page 53).*

Values	Range**: 0.0000 to 99999** in units (P005)
	Default: 0.0
Related Parameters	P050 Vessel Shape

Enter the vessel length **L** (excluding both end sections) if P050 = **7.** Use the units selected in P005.

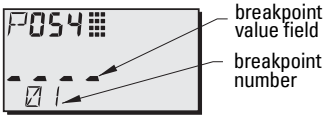
P054 Level Breakpoints

When the vessel shape is too complex for any of the preconfigured shapes, you can define the shape as a series of segments. In P054 you assign a level value to each breakpoint. In P055 you assign a corresponding volume value to each breakpoint.

Primary Index	P054
Secondary Index	Breakpoint number
Values	Range: **0.0000 to 99999** in units (P005)
	Default: 0.0
Related Parameters	P055 Volume Breakpoints

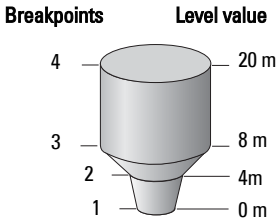
Enter up to 32 level breakpoints, where the corresponding volume is known. The 100% and 0% levels must be entered. The breakpoints can be ordered from top to bottom, or the reverse.

1. First set P050 to **9.**
2. Select P054.
3. The empty breakpoint value field appears, with the breakpoint number 01 in the auxiliary reading.



4. Key in the level value for breakpoint 1, and press **ENTER** [↵]. (Use units defined in P005.)
5. Press **DISPLAY** [⇔] twice to focus control on the secondary index.
6. Press the **UP ARROW** key [▲] to display 02 in the auxiliary reading.
7. Key in the level value for breakpoint 2, and press **ENTER** [↵]. (Use units defined in P005.)
8. Repeat steps 6 and 7 until level values have been entered for all the required breakpoints.

Example:



Breakpoint Number	Level breakpoint (P054)	Volume breakpoint (P055)
1	0	0
2	4	500
3	8	3000
4	20	8000

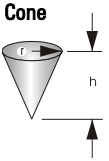
P055 Volume Breakpoints

Each segment defined by the level breakpoints (P054) requires a corresponding volume for SITRANS LR 200 to make the level-to-volume calculations.

Primary Index	P055
Secondary Index	Breakpoint number
Values	Range: **0.0000 to 99999** in units
	Default: **0.0000**
Related Parameters	P054 Volume Breakpoints

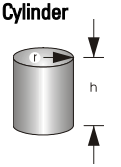
Typical volume calculations:

Cone



$V = (1/3)\pi r^2 h$

Cylinder



$V = \pi r^2 h$

Enter a volume for each breakpoint defined in P054. (See illustrated example for P054 on the previous page.)

1. First set P050 to **9.**
2. Select P055.
3. The empty breakpoint value field appears, with the breakpoint number 01 in the auxiliary reading.
4. Key in the volume for breakpoint 1, and press **ENTER** [↵]. (Any volumetric units can be used: see note to P051.)
5. Press **DISPLAY** [⇔] twice to focus control on the secondary index.
6. Press the **UP ARROW** key [▲] to display 02 in the auxiliary reading.
7. Key in the volume for breakpoint 2, and press **ENTER** [↵].
8. Repeat steps 5 and 6 until volume values have been entered for all the required breakpoints.

Lock (P069)

P069 Unlocked value

Stores the value to enter in Lock (P000) to unlock programming. If P000 is locked, P069 will not display the Unlocked value.

Values	Range	**1 to 9999**
	Factory setting	**1954**
	----	Display when P000 is locked

Notes:
- Default setting for P000 is unlocked.
- After a new value has been stored at P069, that value will be recalled after a master reset (P999).
- Consult your Siemens Milltronics representative, if you have forgotten the unlocked value.

Failsafe (P070 to P073)

Note: Factory settings are indicated by an asterisk (*) in the parameter tables, unless explicitly described.

P070 Failsafe Timer

Sets the time to elapse in minutes since the last valid reading, before Failsafe State activates.

Values	Range**: 0.00 to720 min.**
	Default: 100.0 (based on P003)

Note: The last valid reading is maintained until the Failsafe timer expires. After the timer expires, the reading is set based on P071.

P071 Failsafe Material Level

The material level to be reported when the Failsafe Timer expires.

Values	**1**		Use Maximum mA Limit (P213) as material level
	2		Use Minimum mA Limit (P212) as material level
	3	*	Level remains at last reading
	4		User-selected value (defined in P073)

1. Enter the value corresponding to the level you want reported when the Failsafe Timer expires.
2. Press **ENTER** .

P073 Failsafe level

Defines a user-defined level to report when the Failsafe timer expires.

Values	Range**: 3.6 mA to 22.6 mA**
	Default: 22.6 mA

Note: P071 must be set to **User-selected value (4)** to use this value.

mA Output (P201 to P215)

Note: Factory settings are indicated by an asterisk (*) in the parameter tables, unless explicitly described.

P201 mA Output Function

Alters the mA output/measurement relationship, and allows the output to be set independently from P001. If a HART master is connected, only the master can change the value.

Values	**0**		manual
	1	*	level
	2		space
	3		distance
	4		volume (only available if a tank shape has been selected at P050)

Notes:
- P201 is set independently from P001: set P001 first, as changing P001 will reset P201 to the same setting.
- P201 controls the primary value and the loop current for the HART common module and should not be changed if using HART.
- Selection also affects the secondary, tertiary, and quaternary variables for HART.
- P201 must be set to **0** (manual) before you can modify P911. Remember to restore the previous setting after using P911.

Independent mA Setpoint Parameters (P210 and P211)

Note: Factory settings are indicated by an asterisk (*) in the parameter tables, unless explicitly described.

P210 and P211 allow you to explicitly define the normal operating range. Use these features to reference the minimum and/or maximum mA output to any point in the measurement range.

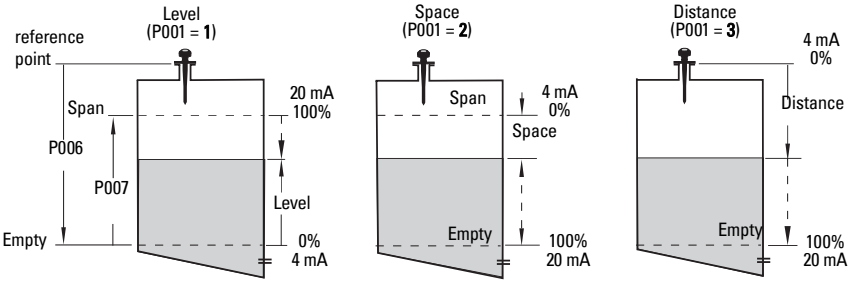
For HART, 4 mA and 20 mA represent the upper and lower range limits for the primary variable.

P201 (mA Function) Settings	Response for P210 and P211
Level, Space, or Distance	Key in the material level in Units (P005) or percent[1] of Span (P007) as referenced from Empty (P006).
Volume	Key in the volume in Maximum Volume (P051) units or as a percent[1] of Maximum Volume.

1. Ensure the % symbol is displayed before entering a % value.

P210 4 mA Setpoint (low output)

Sets the process level corresponding to the 4 mA value. 4 mA always defaults to ***0****, and P201 determines whether this is a Level, Space, Distance, or Volume measurement. Level and Space are measured as a percentage of Span; Distance is measured as a percentage of Empty.*



Values	Range: –**99999 to 99999.**
	Default: **0.000 m** (set to 0% as defined by P201: mA Output Function)
Related Parameters	P201: mA Output Function

Enter the reading that is to correspond to a 4 mA output. Use percent or units, depending on the setting for P051.

Note: P210 is used to set the 4 mA loop current for the HART common module.

P211 20 mA Setpoint (high output)

Sets the process level corresponding to the 20 mA value. 20 mA always defaults to 100%, and P201 determines whether this is a Level, Space, or Distance measurement. Level and Space are measured as a percentage of Span: Distance is measured as a percentage of Empty.

Values	Range: –**99999 to 99999.**
	Default: **19.56 m** (set to 100% as defined by P201: mA Output Function)
Related Parameters	P201: mA Output Function

Enter the reading that is to correspond to a 20 mA output, Use percent or units, depending on the setting for P051.

Note: P211 is used to set the 20 mA loop current for the HART common module.

mA Output Limit Parameters (P212 and P213)

Note: Factory settings are indicated by an asterisk (*) in the parameter tables, unless explicitly described.

P212 and P213 allow you to explicitly set a failsafe current outside the normal operating range.

P212 Minimum mA limit

Prevents the mA output from dropping below this minimum level for a measurement value. This does not restrict the Failsafe or manual settings.

Values	Range: **3.8 to 20.5 (mA)**
	Default: **3.8 (mA)**

P213 Maximum mA limit

Prevents the mA output from rising above this maximum level for a measurement value. This does not restrict the Failsafe or manual settings.

Values	Range: **3.8 to 20.5 (mA)**
	Default: **20.5 (mA)**

P214 4 mA Output Trim

Calibrates the 4 mA output. The mA output of the device is pre-calibrated; however, P214 can be used to trim remote displays or inputs.

Values	Range: **2.0 to 6.0 (mA)**
Related parameters	P215: 20 mA Output Trim

Steps:

1. Set Output Function (P201) to **0** (manual).
2. Set Output Value (P911) to **4 mA.**
3. Attach a calibrated meter and check the output at the terminals; record the remote reading in mA.
4. Enter this value in P214.
5. Restore P201 to previous setting.
6. Confirm that the mA output is as expected.

P215 20 mA Output Trim

Calibrates the 20 mA output. The mA output of the device is pre-calibrated; however, P215 can be used to trim remote displays or inputs.

Values	Range: **18.0 to 24.0 (mA)**
Related parameters	P214: mA Output Trim

Steps:

1. Set Output Function (P201) to **0** (manual).
2. Set Output Value (P911) to **20 mA.**
3. Attach a calibrated meter and check the output at the terminals; record the remote reading in mA.
4. Enter this value in P215.
5. Restore P201 to previous setting.
6. Confirm that the mA output is as expected.

Installation Records (P341 to P346)

Note: Factory settings are indicated by an asterisk (*) in the parameter tables, unless explicitly described.

P341 RUN Time

Displays the number of uninterrupted 24 hour periods that the device has been operating.

Values (view only)	Range: **0 to 99999** (days)
	Default: **0**
Related	P342: Power-on Resets

P341 is updated once a day.

- If power is cycled before 24 hours have passed, the run time will not be updated.
- If an instrument is powered down on a regular basis, P341 will not have an accurate value.

P342 Power-On Resets

The number of times power has been applied since the date of manufacture.

Values (view only)	Display: **0.0 to 99999**
	Default: **0**
Related	P341 RUN Time

This parameter is updated every time the instrument is reset or is powered up.

P343 Internal Temperature

Displays (in degrees C) either the current temperature on the circuit board, or the maximum or minimum temperature recorded by the internal sensor. The high and low values are maintained over a power cycle.

Values (view only)	Range	–50 °C to 150 °C
	1	Current temperature
	2	Maximum temperature
	3	Minimum temperature

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

P346 Serial Number

Displays the serial number of the instrument. The numbers stored in Index 2, followed by the numbers stored in Index 1, give you the complete serial number.

	Index 2	**Index 1**	
Values (view only)	Range: **00000 to 99999**	Range: **00000 to 99999**	
Example: **1503010**	**15**	**03**	**010**

Range Calibration (P652 to P655)

Note: Factory settings are indicated by an asterisk (*) in the parameter tables, unless explicitly described.

P652 Offset Correction

A fixed offset value that is added to the reading as a correction to the measurement.

Values	Range: **–99999 to 99999**
	Default**: 0.000**

P655 Propagation Factor

The value 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]).

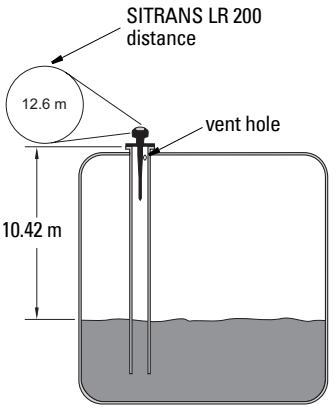
Example:

actual distance / SITRANS 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 15. For other configurations, see *Appendix H: Flanged Antenna Options*, page 113 onwards.

Rate (P700 and P701)

Note: Factory settings are indicated by an asterisk (*) in the parameter tables, unless explicitly described.

These parameters determine how material level changes are reported.

P700 Maximum Fill Rate

Allows you to further adjust the SITRANS LR 200 response to increases in the actual material level (or an advance to a higher Failsafe Material Level, P071). P700 is automatically updated whenever Measurement Response (P003) is altered.

Values	Range: **0.0000 to 99999** m / min.
	Factory setting: **0.1**
Altered by	P003 Measurement Response
Related	P005 Units P007 Span P071 Failsafe Material Level

Enter a value slightly greater than the maximum vessel-filling rate, in Units (P005) or percent of Span (P007) per minute.

P003 Value	Meters/Minute
1	0.1
2	1
3	10

P701 Maximum Empty Rate

Adjusts the SITRANS LR 200 response to decreases in the actual material level (or an advance to a lower Failsafe Material Level, P071). P701 is automatically updated whenever Measurement Response (P003) is altered.

Values	Range: **0.0000 to 99999** m / min.
	Factory setting: **0.1**
Altered by	P003 Measurement Response
Related	P005 Units P007 Span P071 Failsafe Material Level

Enter a value slightly greater than the vessel's maximum emptying rate, in Units (P005) or percent of Span (P007) per minute.

P003 Value	Meters/Minute
1	0.1
2	1
3	10

Measurement Verification (P709 to P713)

Note: Factory settings are indicated by an asterisk (*) in the parameter tables, unless explicitly described.

P709 Damping Filter

Stabilizes the reported level within the Echo Lock Window (P713) in the event of level fluctuations (for example, a rippling or splashing liquid surface). The value is in seconds, and depends on the number of seconds it takes the device to reach 63% of a step value change in reading.

Values	Range: **0 to 100** seconds (**0** = **off**)
	Default: **10.0** seconds
Altered by	P003 Measurement Response
Related	P007 Span P713 Echo Lock Window

The value is automatically altered when Measurement Response Speed (P003) changes. The higher the value entered, the greater the range of stabilized fluctuation.

P711 Echo Lock

Use this feature to select the measurement verification process.

Values	**0**		Off
	1		Maximum Verification
	2	*	Material Agitator
	3		Total Lock
Related	P700 Maximum Fill Rate P701 Maximum Empty Rate P712 Echo Lock Sampling P713 Echo Lock Window P820 Algorithm		

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

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

- When Maximum Verification or Material Agitator is selected, a new measurement outside the Echo Lock Window (P713) must meet the sampling criterion (P712).
- When Total Lock is selected, Echo Lock Window (P713) is pre-set to **0**.

SITRANS LR 200 continuously searches for the best echo according to the algorithm chosen (P820). If the selected echo is within the window, the window is then centered about the echo. If not, the window widens with each successive shot until the selected echo is within the window. The window then returns to its normal width.

When Echo Lock is Off, SITRANS LR 200 responds immediately to a new measurement, as restricted by the Maximum Fill / Empty Rate (P700 / P701). However, measurement reliability is affected.

P712 Echo Lock Sampling

The sampling criterion sets the number of consecutive echoes that must appear above or below the echo currently locked onto, before the measurements are validated as the new reading. (Echo Lock P711 must be set to **1** *or* **2***.*

Values	Range: **1:1 to 50:50**
	Format: **x:y** **x** = the number of **above** echoes **y** = the number of **below** echoes
Related	P711 Echo Lock

P711 default value		Description	P712 pre-set value
1		maximum verification	5:5
2	*	material agitator	5:2

Example:

- Set P711 to **2** (material agitator)
- The preset values for P712 in this case are **5:2**
- Result: a new reading will not be validated unless 5 consecutive measurements higher or 2 consecutive measurements lower than the current reading occur.

Note: Resetting P711 returns P712 to the respective pre-set values.

P713 Echo Lock Window

Adjusts the size of the Echo Lock Window. This value is automatically altered when Measurement Response (P003), Maximum Fill Rate (P700), or Maximum Empty Rate (P701), are altered.

Values	Range: **0.000 to 9999**
	Default: **0.000**
Altered by	P003 Measurement Response
Related Parameters	P005 Units P711 Echo Lock

The Echo Lock Window is a 'distance window[1]' centered on the echo used to derive the reading. When a new measurement falls within the window, the window is re-centered and the new reading calculated. Otherwise, the new measurement is verified by Echo Lock (P711) before the reading is updated.

1. Units are those set in P005.

When the value is **0**, the window is automatically calculated after each measurement. The value is fixed at **0** if Echo Lock (P711) is set to **3**.

- For slower Measurement Response values (P003), the window is narrow.
- For faster P003 values the window becomes progressively wider.

Note: The echo lock window is stored as standard samples, but displayed in units based on P005. Any value entered for P713 will be rounded to the nearest sample.

P752 HART address

Note: Accessible via the hand programmer only by keying in P752.

Sets the device address or poll ID on a HART network. Any address other than 0 will cause the output current to be a fixed value, and the current will not indicate the reading.

Values	Range	**0** to **15**

Communications (P799)

P799 Communications Control

Enables the read/write access to parameters via remote communications.

Values	**0**		Read only
	1	*	Read/write
	2		Restricted access – read only except for P799 which is read/write

Notes:
- P799 controls the access if you are using a HART master.
- P000 controls the lock access if you are using the Siemens Milltronics hand programmer.

Echo Processing (P800 to P807)

Note: Factory settings are indicated by an asterisk (*) in the parameter tables, unless explicitly described.

The following 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.

P800 Near Blanking [1]

Defines the distance from the reference point to be ignored by the transmitter/receiver.

Values	Range: **0.00 to 20** (m: selected in P005)
	Default: **0.400 m**
Related	P006 Empty P007 Span P838 Auto False-Echo Suppression Distance

To extend the blanking beyond the minimum default, enter a value in units.

P801 Range Extension

Allows the material level to drop below Empty (process empty level), without generating an LOE state.

Values	Range: **0 to 1000**%
	Default: **5.000** (% of Span)
Related	P006 Empty P007 Span P838 Auto False-Echo Suppression Distance

Use this feature if the surface monitored can drop below Empty level (P006) in normal operation. The value for P801 is added to Empty, and the sum can be greater than the range of the antenna. Range Extension can be increased (in Units or percent of Span) to a point where Empty plus Range Extension is greater than the distance from the flange face to the furthest surface to be monitored. The distance below empty is not blanked.

- Enter the value as a percentage of P006.
- For vessels with conical or parabolic bottoms, increase the value for P801 to ensure that an empty vessel reads Empty.

P804 Confidence Threshold

Determines which echoes are evaluated by software.

Values	Range: **0 to 99**
	Default: **5**
Related Parameters	P070 Failsafe Timer

P804 sets the minimum echo confidence that the echo must meet in order to prevent a Loss of Echo condition and the expiration of the Failsafe timer (P070). When Echo Confidence (P805) exceeds the Confidence Threshold, the echo is evaluated.

This feature is used when an incorrect material level is reported.

1. For more details, see *Near Blanking* on page 99.

P805 Echo Confidence

Measures echo reliability. It displays the echo confidence of the measurement echo from the last shot. P804 defines the minimum criterion for echo confidence.

Values (view only)	Display: **0 to 99**	
	Default: **0**	
	----	Shot not used
Related Parameters	P804 Confidence Threshold	

Press the measurement key [↓] to get a new reading that will update confidence values.

P806 Echo Strength

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

Values (view only)	Display: **–20 to 99**
	Default: **–15**

Press the measurement key [↓] to get a new reading that will update echo strength.

P807 Noise

Displays the average and peak 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.

Values (view only)	x = average (range: **–20 to 99**)
	y = peak (range: **–20 to 99**)
	Start up display[1]: **–15 . – 15 (x.y)**

1. The start up display, before a noise shot has been taken.

After a measurement, the values from the previous noise shot will be displayed. Press the measurement key [↓] to get a new reading that will update the noise profile.

Algorithm (P820)

Note: Factory settings are indicated by an asterisk (*) in the parameter tables, unless explicitly described.

P820 Algorithm

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

Values	**3**		**L**argest echo
	4		Reserved
	8		**b**est of **L**argest or **F**irst echo
	12	*	**F**irst echo

TVT (Time Varying Threshold) Adjustment Parameters (P831 to P839)

Note: Factory settings are indicated by an asterisk (*) in the parameter tables, unless explicitly described.

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.

The following 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.

P831 Manual TVT Shaper

Note: This parameter is for use only by Siemens Milltronics service personnel.

Turns the TVT Shaper ON or OFF.

P832 Manual TVT Shaper Adjust

Note: This parameter is for use only by Siemens Milltronics service personnel.

TVT (Time Varying Threshold) Adjustment Parameters (P837 to P839)

Note: Factory settings are indicated by an asterisk (*) in the parameter tables, unless explicitly described.

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.

The following 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.

P837 Auto False-Echo Suppression

Use P837 and P838 together, to set SITRANS LR 200 to ignore false echoes. Use P838 to set the Auto TVT distance first.

Notes:
- Close all online windows before adjusting P837 and P838.
- This function works best when the vessel is empty or nearly empty: use it only if there is a minimum distance of 2 meters from the radar instrument to the material.
- Set P837 and P838 during start up, if possible.
- If the vessel contains an agitator, the agitator should be running.

If SITRANS LR 200 displays a full level, or if the reading fluctuates between a false high level and a correct level, set P837 to elevate the TVT in this region and to de-sensitize the receiver from any 'base noise' caused by internal antenna reflections, nozzle echoes, or other vessel false echoes. (For examples of echo profiles before and after using this feature, see page 74.)

1. Rotate the instrument for best signal (lowest false-echo amplitude).
2. Set P 838 and then P837.

Values	**0**		Off
	1	*	Use **Learned TVT.** (See **Learned TVT curve** in *Example After Auto False-Echo Suppression* on page 75.)
	2		Learn

P838 Auto False-Echo Suppression Distance

Defines the range of Auto False-Echo Suppression (P837) to use for ignoring false echoes. (Units are defined in P005.)

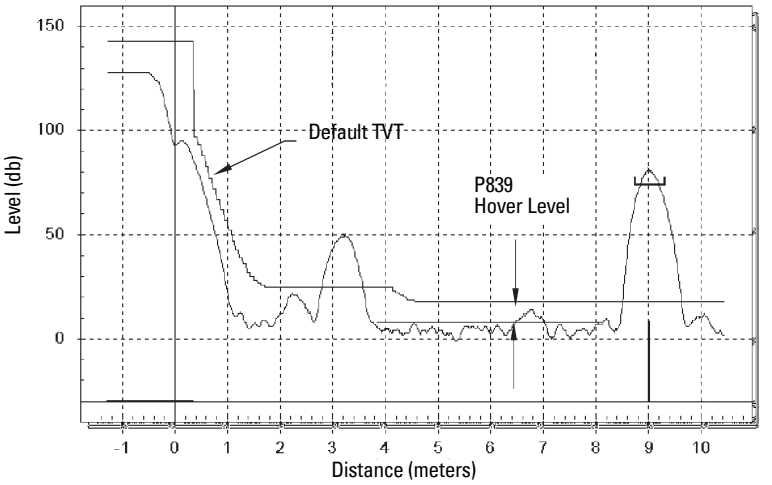
Values	Range: **0.000 to 20.00 m (maximum range)**
	Default:**1.000** m

Determine the actual distance from the antenna reference point to the material surface. Subtract 0.5 m from this distance, and enter the result.

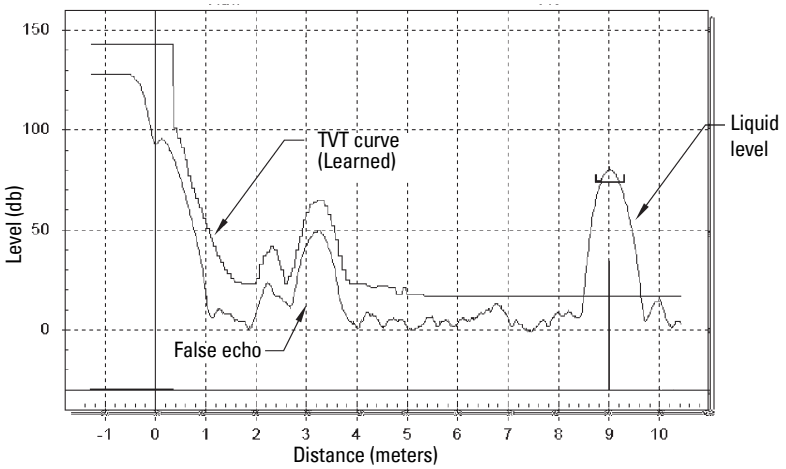
Set Up:

1. Perform this function when the vessel is empty or nearly empty.
2. Determine **distance** from radar instrument to liquid level.
3. Press **PROGRAM** then **DISPLAY**.
4. Select P838 and set [distance to liquid level minus 0.5m].
5. Select P837.
6. Press **2** and then press **ENTER**. P837 will revert to **1** (use Learned TVT) automatically after a few seconds.
7. Press **PROGRAM** to return to **RUN** mode.

Display before Auto False-Echo Suppression
(or when P837 = 0)



Example After Auto False-Echo Suppression



P839 TVT Hover Level

Defines (in percent) how high the TVT curve is placed above the profile, relative to the 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** %

Test (P900 to P924)

Note: Factory settings are indicated by an asterisk (*) in the parameter tables, unless explicitly described.

P900 Software Revision Number

Displays the software revision level.

Values (view only)	Range: **0.00** to **99.99**	
	1	Main code revision
	2	Primary boot revision
	3	Alternative boot revision
	3	Hardware stack revision
	Default	Determined by the software revisions installed

P901 Memory Test

Press **ENTER** to activate the test.

Values (view only)	**PASS**	Memory test successful
	F1	Fail RAM
	F2	Fail EEPROM
	F3	Fail FLASH

Measurement

P911 mA Output Value

Access this parameter to display the current value of the mA output.

Values (HART)	Range: **3.6 to 22.6 (mA)**	
	*	4 mA in HART fixed current mode

1. Set P201 to **0** (manual).
2. Enter a test value.

Note: P201 must be set to **0** to enable the test value to be entered at P911: be sure to restore P201 to the previous setting after the test!

P920 Reading Measurement

P920 corresponds to the final reading after all programming is applied. It is a copy of one of P921 to P924, depending on the setting for Operation (P001).

	Operation P001		Source Parameter for P920
	0	Off	– – – –
	1	Level	P921 if P050 = **0**, otherwise P924
	2	Space	P922
	3	Distance	P923
P920 Values (read only)	Range: **–99999** to **99999** (dimensional units, if volume has not been selected)		

P921 Material Measurement

Displays the distance between Empty /process empty level (P006) and the monitored surface, in Units (P005) or percent of Span (P007).

Values (view only)	Range: **–99999** to **99999**

P922 Space Measurement

Displays the distance between the monitored surface and Span / process full level (P007).

Values (view only)	Range: **–99999** to **99999**

P923 Distance Measurement

Displays the distance between the monitored surface and the reference point[1].

Values (view only)	Range: **–99999** to **99999**

1. For the reference point for the standard model, see *SITRANS LR 200 Dimensions* on page 15. For other configurations, see *Appendix H: Flanged Antenna Options*, page 113 onwards.

P924 Volume Measurement

The calculated vessel capacity in Maximum Volume (P051) or percent of Maximum Volume (volume calculation must be enabled at P050).

Values (view only)	Range: **–99999 to 99999**
Related Parameters	P051 Maximum Volume P050 Vessel Shape

Note: The display for P924 reads **- - - -**, when volume calculation is not enabled at P050 (P050 = 0).

P999 Master Reset

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

Resets all parameters to their factory settings, with the following exceptions:

- *P000 and P069 are not reset.*
- *The learned TVT curve is not lost.*

Use this feature after upgrading software:

1. Select P999.
2. Press **CLEAR** [c] then **ENTER** [↵] to Clear All and initiate reset.
3. Reset complete.
   (**Note:** Reset takes several seconds to complete.)

Appendix A: Alphabetical Parameter List

Parameter Name	Parameter Number	Page Number
20 mA Setpoint (high output)	211	60
20 mA Output Trim	215	62
4 mA Output Trim	214	61
4 mA Setpoint (low output)	210	60
Algorithm (Echo)	820	72
Antenna Type	004	49
Auto False-Echo Suppression	837	73
Auto False-Echo Suppression Distance	838	74
Level Breakpoints	054	55
Communications Control	799	69
Confidence Threshold	804	70
Damping Filter	709	66
Distance Measurement	923	77
Echo Confidence	805	71
Echo Lock	711	67
Echo Lock Sampling	712	68
Echo Lock Window	713	68
Echo Strength	806	71
Empty (process empty level)	006	50
Failsafe Level	073	58
Failsafe Material Level	071	58
Failsafe Timer	070	57
Internal Temperature	343	63
Language	010	51
Lock	000	47
mA Output Function	201	58
mA Output Value (HART/mA only)	911	76
Master Reset	999	78
Material Measurement	921	77
Maximum Empty Rate	701	66

Parameter Name	Parameter Number	Page Number
Maximum Fill Rate	700	65
Maximum mA limit	213	61
Maximum Volume	051	54
Measurement Response	003	49
Memory Test	901	76
Minimum mA limit	212	61
Near Blanking	800	70
Noise	807	71
Offset Correction	652	63
Operation	001	48
Power-on Resets	342	62
Propagation Factor	655	64
Range Extension	801	70
Reading Measurement	920	77
Serial Number	346	63
RUN Time	341	62
Software Revision Number	900	76
Space Measurement	922	77
Span (process full level)	007	51
Vessel Dimension A	052	54
Vessel Dimension L	053	54
Vessel Shape	050	52
TVT Hover Level	839	75
Units	005	50
Unlocked Value	069	57
Volume Breakpoints	055	56
Volume Measurement	924	78

Appendix B: Programming Chart

Parameter Number and Name	Value
P000 Lock	
P001 Operation	
P003 Measurement Response	
P004 Antenna Type	
P005 Units	
P006 Empty (process empty level)	
P007 Span (process full level)	
P010 Language	
P050 Vessel Shape	
P051 Maximum Volume	
P051 Maximum Volume	
P053 Vessel Dimension L	
P054 Level Breakpoints	
P055 Volume Breakpoints	
P069 Unlocked value	
P070 Failsafe Timer	
P071 Failsafe Material Level	
P073 Failsafe level	
P201 mA Output Function	
P210 4 mA Setpoint (low output)	
P211 20 mA Setpoint (high output)	
P214 4 mA Output Trim	
P215 20 mA Output Trim	
mA Output Limit Parameters (P212 and P213)	
P213 Maximum mA limit	
P341 RUN Time	
P342 Power-On Resets	
P343 Internal Temperature	

Parameter Number and Name	Value
P346 Serial Number	
P652 Offset Correction	
P655 Propagation FactorPropagation Factor	
P700 Maximum Fill Rate	
P701 Maximum Empty Rate	
P709 Damping Filter	
P711 Echo Lock	
P712 Echo Lock Sampling	
P713 Echo Lock Window	
P799 Communications Control	
P800 Near Blanking	
P801 Range Extension	
P804 Confidence Threshold	
P805 Echo Confidence	
P806 Echo Strength	
P807 Noise	
P820 Algorithm	
P837 Auto False-Echo Suppression	
P838 Auto False-Echo Suppression Distance	
P839 TVT Hover Level	
P900 Software Revision Number	
P901 Memory Test	
P911 mA Output Value	
P920 Reading Measurement	
P920 Reading Measurement	
P921 Material Measurement	
P922 Space Measurement	
P923 Distance Measurement	
P924 Volume Measurement	
P999 Master Reset	

Appendix C: HART Communications

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

SITRANS LR 200 can be configured over the HART network using either the HART Communicator 275 by Fisher-Rosemount, or a software package. There are a number of different software packages available. The recommended software package is the SIMATIC Process Device Manager (PDM) by Siemens.

HART Device Description (DD)

In order to configure a HART device, the configurator must have the HART Device Description for the instrument in question. HART DDs are controlled by the HART Communication Foundation. Please check with the HART Communication Foundation for the availability of the HART DD for SITRANS LR 200. Older versions of the library will have to be updated in order to use all the features of SITRANS LR 200.

HART Communicator 275:

Chart 1

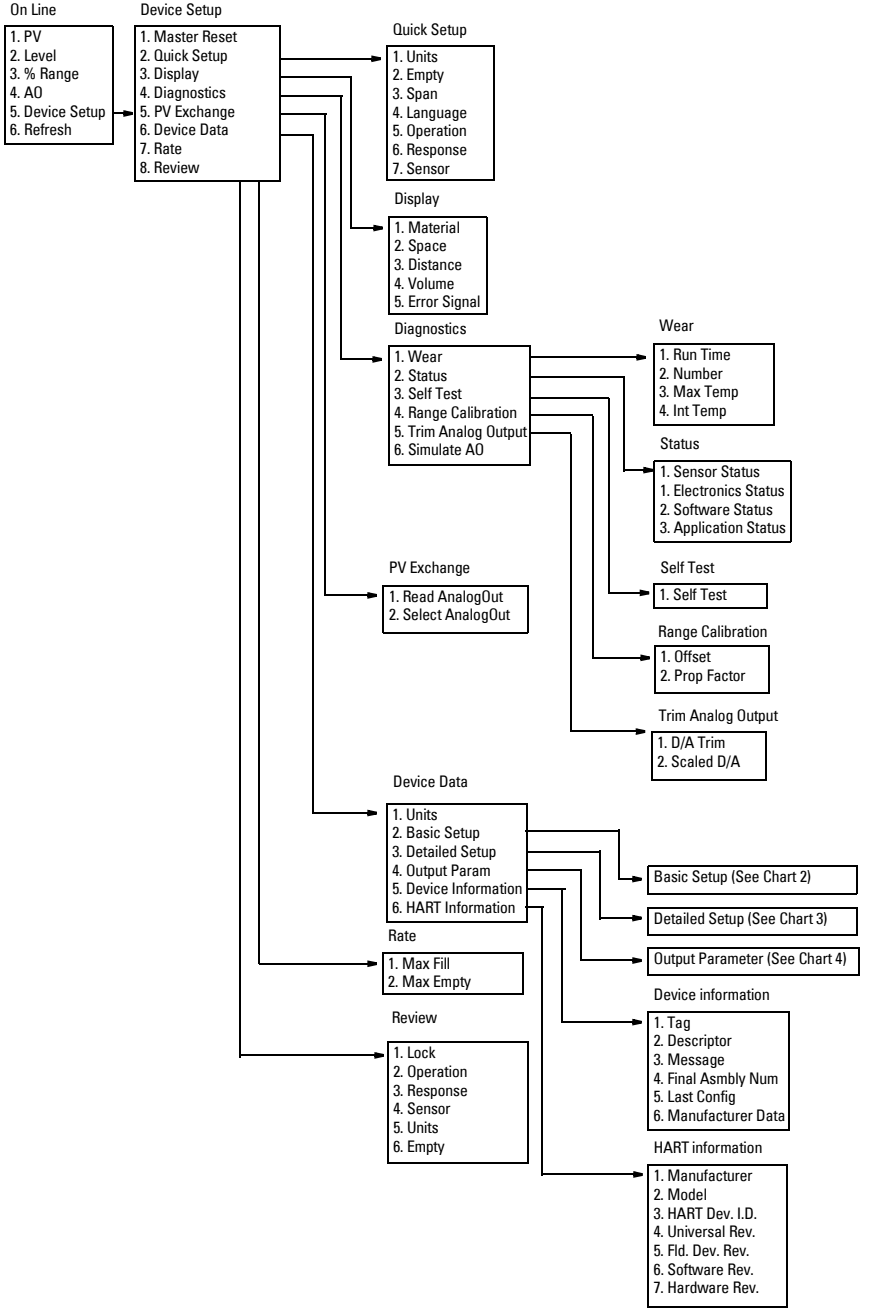


Chart 2

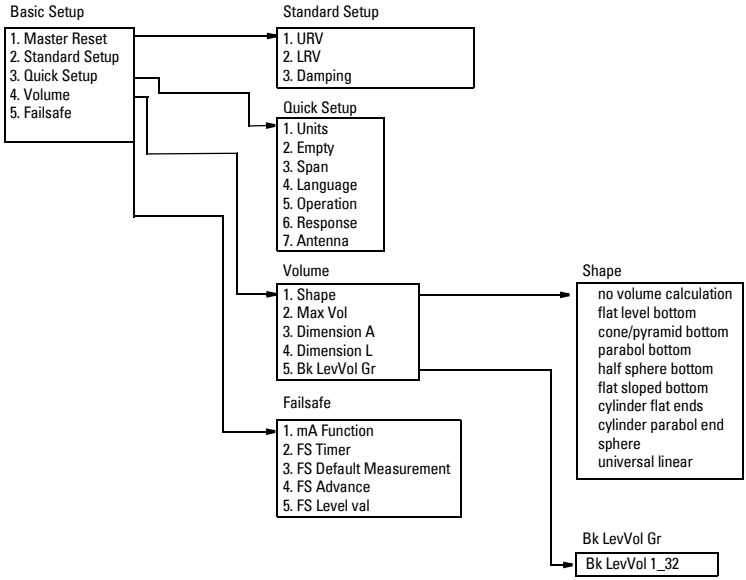


Chart 3

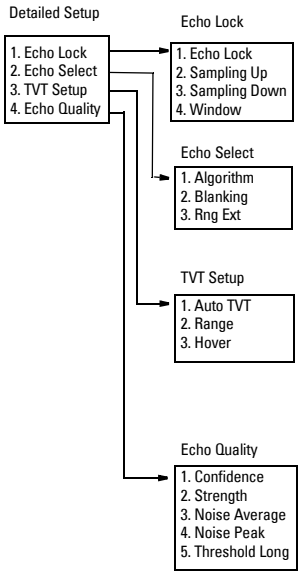
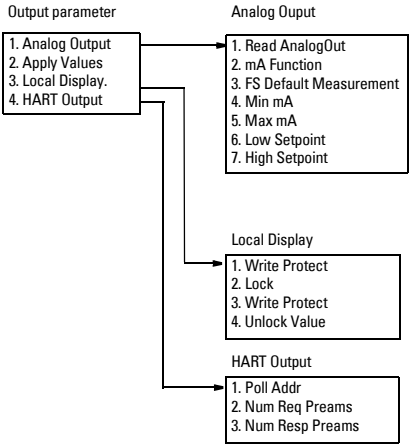


Chart 4



SIMATIC Process Device Manager (PDM)

This software package is designed to permit easy configuration, monitoring, and troubleshooting of HART devices. The HART DD for SITRANS LR 200 was written with SIMATIC PDM in mind and has been extensively tested with this software.

The Device Description for SIMATIC PDM may be downloaded from the product page of our website at: https://pia.khe.siemens.com/index.asp?Nr=7427, under **Downloads**.

All parameters accessible via the HART Communicator are also accessible via PDM. In addition, the Maintenance parameters listed below are accessible via PDM only.

Maintenance settings (accessible via PDM only)

Device Lifetime

Total Device Operating Time
Remaining Device Lifetime
Maintenance Required Limit
Maintenance Demanded Limit
Maintenance Alert Activation
Total Expected Device Life
Units
Maintenance Status
Acknowledge Status
Acknowledge

Sensor Lifetime
- Total Sensor Operating Time
- Remaining Sensor Lifetime
- Maintenance Required Limit
- Maintenance Demanded Limit
- Maintenance Alert Activation
- Total Expected Sensor Life
- Units
- Maintenance Status
- Acknowledge Status
- Acknowledge

Service Interval
- Time Elapsed Since Last Service
- Maintenance Required Limit
- Maintenance Demanded Limit
- Maintenance Alert Activation
- Total Service Interval
- Units
- Maintenance Status
- Acknowledge Status
- Acknowledge

Calibration Interval
- Time Elapsed Since Last Calibration
- Maintenance Required Limit
- Maintenance Demanded Limit
- Maintenance Alert Activation
- Total Calibration Interval
- Units
- Maintenance Status
- Acknowledge Status
- Acknowledge

Supported HART Commands:

SITRANS LR 200 conforms to HART rev. 5 and supports the following:

Universal Commands
0, 1, 2, 6, 7, 8, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22

Common Practice Commands
33, 34, 35, 36, 37, 38, 40,41, 42, 44, 45, 46, 48, 50, 51, 53, 54, 59, 110

Device Specific Commands

- Command 138 Read the user specific characteristics
- Command 139 Write the user specific characteristics
- Command 140 Perform Device Specific Configuration
- Command 160 Read Quick Setup
- Command 161 Write Quick Setup
- Command 162 Read Volume
- Command 163 Write Volume
- Command 164 Read Volume Breakpoint
- Command 165 Write Volume Breakpoint
- Command 166 Read Failsafe
- Command 167 Write Failsafe
- Command 168 Read Echo Data
- Command 169 Write Echo Data
- Command 170 Read Echo Lock
- Command 171 Write Echo Lock
- Command 172 Read TVT
- Command 173 Write TVT
- Command 174 Read TVT Shaper
- Command 175 Write TVT Shaper
- Command 176 Read Confidence
- Command 178 Read Analog Special
- Command 179 Write Analog Special
- Command 180 Read Local Display Commands
- Command 181 Write Local Display Commands
- Command 182 Read Range Calibration
- Command 183 Write Range Calibration
- Command 184 Read Serial Port Settings
- Command 185 Write Serial Port Setting
- Command 186 Read Wear

Universal and Common Practice Commands

For details on the Universal and Common Practice Commands, please contact the HART Communication Foundation.

Device Specific Commands

For a document containing the Device Specific Commands, please contact Siemens Milltronics at techpubs.smpi@siemens.com.

Appendix D: Troubleshooting

Communication Troubleshooting

Generally:

1. Check the following:
   - There is power at the instrument
   - The LCD shows the relevant data
   - The device can be programmed using the hand programmer
2. Verify that the wiring connections are correct.
3. 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 local Siemens Milltronics representative.

Specifically:

1. If you try to set a SITRANS LR 200 parameter via remote communications, but the parameter remains unchanged:
   - Some parameters can only be changed when the device is not scanning. Try putting the device in PROGRAM mode using the operating mode function.
   - Try setting the parameter from the keypad. (First make sure that the lock parameter [P000] is set to the value stored in P069.)
   - The communications control parameter P799 must be set to **1** to allow you to write parameters to SITRANS LR 200.
2. If you see unanticipated displays, for example:
   - PROGRAM mode displayed instead of RUN mode
   - the wrong parameter displayed in response to a command
   - a parameter displayed in response to no command

   make sure no infrared-capable device is close to SITRANS LR 200. Any device with infrared capabilities (laptops, cell phones, PDAs) can cause interference which simulates a command to the SITRANS LR 200, potentially causing it to switch modes or to change a parameter.
3. If the operation is erratic, make sure the Hand Programmer is not being used at the same time as SIMATIC PDM.

General Fault Codes

Note: Some faults cause the device to go to Failsafe mode (Fault 52). These are indicated with an asterisk (*).

Code		Meaning	Corrective Action
S:0	*	The device was unable to get a measurement within the Failsafe Timer period. Possible causes: faulty installation, antenna buildup, foaming/other adverse process conditions, invalid calibration range.	Ensure installation details are correct. Ensure no antenna buildup. Adjust process conditions to minimize foam or other adverse conditions. Correct range calibration. If fault persists, contact your local Siemens representative.
S:2	*	The device is operating in a low power condition that is outside its operating range. As a result, a valid measurement has not been taken for the failsafe timer period, and the device will be put into failsafe mode.	Correct the power supply (resistance or voltage).
S:3		Device is nearing its lifetime limit according to the value set in Maintenance Required Limit.	Replacement is recommended.
S:4		Device is nearing its lifetime limit according to the value set in Maintenance Demanded Limit.	Replacement is recommended.
S:6		Sensor is nearing its lifetime limit according to the value set in Maintenance Required Limit.	Replacement is recommended.
S:7		Sensor is nearing its lifetime limit according to the value set in Maintenance Demanded Limit.	Replacement is recommended.
S:8		Service interval as defined in Maintenance Required Limit has expired.	Perform service.
S:9		Service interval as defined in Maintenance Demanded Limit has expired.	Perform service.
S:11		Internal temperature sensor failure.	Repair required: contact your local Siemens representative.

Code		Meaning	Corrective Action (cont'd)
S:12		Internal temperature of device has exceeded specifications: it is operating outside its temperature range.	Relocate device and/or lower process temperature enough to cool device. Inspect for heat-related damage and contact your local Siemens representative if repair is required.
S:17		Calibration interval as defined in Maintenance Required Limit has expired.	Perform calibration.
S:18		Calibration interval as defined in Maintenance Demanded Limit has expired.	Perform calibration.
S:28	*	Internal device failure caused by a RAM memory error.	Repair required: contact your local Siemens representative.
S:29	*	EEPROM damaged.	Repair required: contact your local Siemens representative.
S:31	*	Flash error.	Repair required: contact your local Siemens representative.
S:33	*	Factory calibration for the internal temperature sensor has been lost.	Repair required: contact your local Siemens representative.
S:34	*	Factory calibration for the device has been lost.	Repair required: contact your local Siemens representative.
S:35	*	Factory calibration for the device has been lost.	Repair required: contact your local Siemens representative.
S:36	*	Unable to start microwave module.	Reset power. If error persists, contact your local Siemens representative.
S:37	*	Measurement hardware problem.	Reset power. If error persists, contact your local Siemens representative.

Code		Meaning	Corrective Action (cont'd)
S:38	*	Failure in the device electronics.	Reset power. If fault persists, contact your local Siemens representative: repair required.
S:43	*	Factory calibration for the radar receiver has been lost.	Repair required: contact your local Siemens representative.
S:44	*	Factory calibration for the echo slope has been lost.	Repair required: contact your local Siemens representative.
S:45	*	No valid boot program detected: firmware corrupt.	Repair required: contact your local Siemens representative.
S:48	*	User configuration is invalid. One or more of parameters: Span, Volume breakpoints, and/or Auto False-Echo Suppression, are set to invalid values.	Reconfigure the unit. Ensure Span (P007) is not set to **0**; check the breakpoints (only required if P050 is set to 9); do a P999 reset.
S:49	*	EEPROM corrupt.	Repair required: contact your local Siemens representative.
S:50	*	EEPROM corrupt.	Repair required: contact your local Siemens representative.
S:51	*	EEPROM corrupt.	Repair required: contact your local Siemens representative.
S:52		Failsafe is activated. Possible causes: 1) hardware failure; 2) memory failure; 3)Fault 48; 4) failsafe timer expired– possible causes: faulty installation, antenna buildup, foaming/ other adverse process conditions, invalid calibration range.	For 3) and 4) Correct configuration; ensure installation is correct; no antenna buildup; adjust process conditions to minimize foaming/ other adverse conditions; correct calibration range. If fault persists, or for 1) and 2), contact your local Siemens representative.
S:53	*	Configuration lost: one or more parameter settings have been lost. This may occur after a firmware upgrade causes user parameters to be reset.	Restore user parameters using SIMATIC PDM.

Operation Troubleshooting

Operating symptoms, probable causes, and resolutions.

Symptom	Cause	Action
Display flashes LOE and status symbol shows 	level or target is out of range	• check specifications • check P006 • increase range extension P805
Display flashes LOE and status symbol shows 	material build-up on antenna	• clean the antenna • upgrade to purged antenna • re-locate SITRANS LR 200
Display flashes LOE and status symbol shows 	location or aiming: • poor installation • flange not level	• check to ensure nozzle is vertical • use P837/P838 • check to ensure nozzle is clean and free of internal seams/welds
Display flashes LOE and status symbol shows 	antenna malfunction: • temperature too high • physical damage • excessive foam • multiple echoes	• check P343 • use foam deflector or stilling well • relocate • use a defoamer • set P820 to **12** (First echo)

Symptom	Cause	Action (cont'd)
Reading does not change, but the level does	SITRANS LR 200 processing wrong echo, i.e. vessel wall, or structural member	• re-locate SITRANS LR 200 • check nozzle for internal burrs or welds • rotate instrument 90^{o} • use P837/P838
Measurement is consistently off by a constant amount	P006 not correct P652 not correct	• check distance from flange face to zero level (P006) • check offset value (P652) or device tag
Screen blank	power error	• check nameplate rating against voltage supply • check power wiring or source
	too much load resistance	• change barrier type, or • remove something from the loop, or • increase supply voltage
Reading erratic	echo confidence weak	• refer to P805 • use P837/P838 • use foam deflector or stilling well
	liquid surface vortexed	• decrease measurement response P003 • relocate instrument to side pipe • increase confidence threshold P804
	material filling	• re-locate SITRANS LR 200
Reading response slow	P003 setting	• increase measurement response if possible

Symptom	Cause	Action (cont'd)
Reads correctly but occasionally reads high when vessel is not full	• detecting close range echo • build up near top of vessel or nozzle • wrong antenna choice for application • nozzle problem	• clean the antenna • shielded antenna required • see *Application Example: Stillpipe* on page 110 • use P837/P838
Level reading lower than material level	• material is within near blanking zone • vessel near empty and low ε_r material • multiple echoes processed	• decrease blanking P800: min. 0.4 m (1.3 ft) • raise SITRANS LR 200 • decrease range extension • ensure P820 is set to **12** (First echo)
	• nozzle too narrow for length	• see *Rod Extension Requirements* on page 124 • shielded antenna required
	• internal seam in nozzle	• inspect and remove seam • use P837/P838 • upgrade to shielded rod antenna

Appendix E: 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 F: 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 device transmits a signal and waits for the return echo. The transmit time is directly proportional to the distance from 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 levels inside a vessel. Electromagnetic waves are not attenuated by dust.

SITRANS LR 200 consists of an enclosed electronic component coupled to an antenna and process connection. The electronic component generates a radar signal (6.3 GHz in North America, 5.8 GHz elsewhere) 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 mA output.

Transceiver

The SITRANS LR 200 transceiver operates under one of three sets of pre-set conditions which affect the speed of the measurement response (P003).

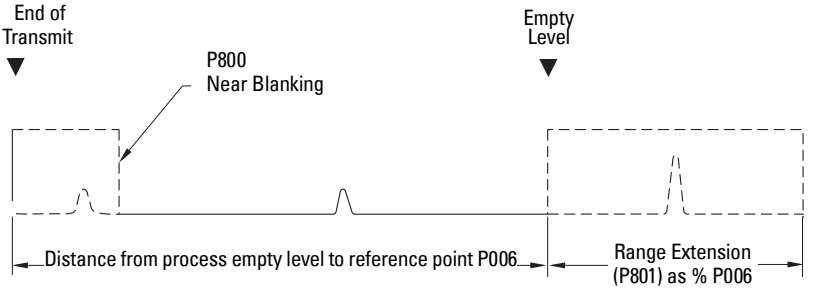
Measurement Response P003		Max. fill/empty rate P700/P701		Echo verification P711	Failsafe timer P070 (time in minutes)
1	*	0.1 m/min	slow	2	100
2		1 m/min	medium	2	10
3		10 m/min	fast	2	1

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

The measurement response limits the maximum rate at which the display and analog output respond to changes in measurement. P003 should be set to a measurement response just faster than the maximum filling or emptying rate (whichever is greater).

When the echoes are received, the relevant echo algorithm (P820) is applied to determine the true material echo.

Typical Receiver Signal



Loss of Echo (LOE)

A loss of echo (LOE) occurs when the calculated measurement is judged to be unreliable because the confidence value (P805) is less than the threshold value (P804).

If the LOE condition persists beyond the time limit set by the Failsafe timer (P070), the Reliable Echo indicator will be replaced by the Unreliable Echo indicator. The reading will alternate at two second intervals with the letters LOE.

Reliable Echo indicator  Unreliable Echo indicator  .

P070 determines the time to elapse after the last valid reading before a Failsafe state is activated. P071 determines the level to be reported when the Failsafe timer expires. Upon receiving a reliable echo, the loss of echo condition is aborted, the Reliable Echo indicator replaces the Unreliable Echo indicator, and the reading and mA output return to the current level.

Range Extension

In applications where the base of the vessel is conical or parabolic, a reliable echo may be available **below** the vessel empty distance, due to an indirect reflection path. Increasing the range extension to 30% or 40% can provide stable empty vessel readings.

Range extension is entered as a percentage of P006 (process empty level).

False-Echo Suppression

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 Blanking

Near Blanking programs SITRANS LR 200 to ignore the zone in front of the antenna. The default blanking distance is 0.3 m (1 ft), plus any shield length, from the reference point[1].

P800 allows you to increase the near blanking value from its factory setting. But Auto False-Echo Suppression (P837) is generally recommended in preference to extending the blanking distance from factory values.

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.

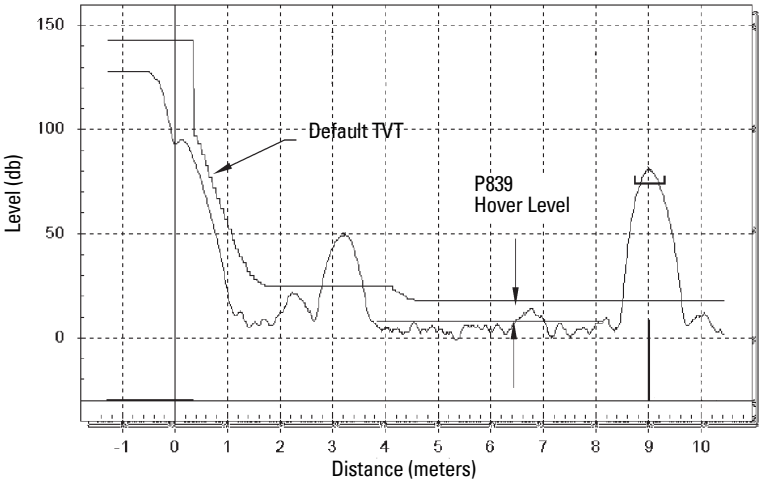
The default TVT curve hovers above the echo profile, and effectively screens out small false echoes. But if an obstruction is causing a large echo before the material level echo, that echo will rise above the default TVT curve. You can use Auto False-Echo Suppression to filter it out. If possible, rotate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

When you set P837 to **Learn**, the instrument learns the echo profile at that moment[2]. Then it uses the learned profile instead of the default TVT curve, for the distance set in P838. 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.

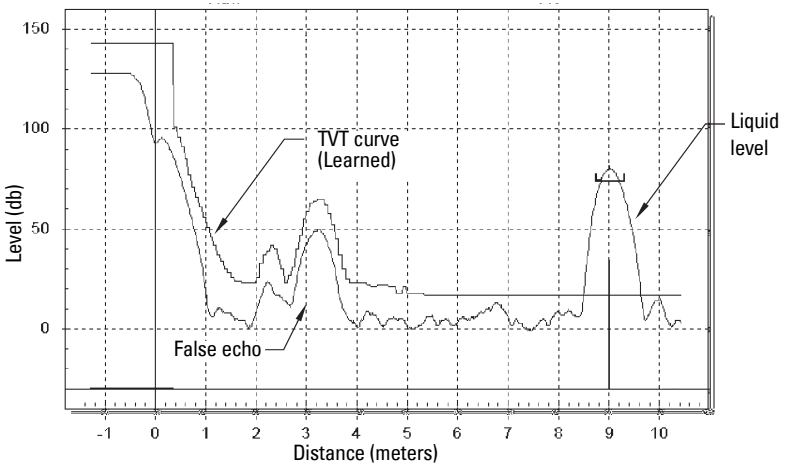
See page 100 for examples of the echo profile before and after using Auto False-Echo Suppression.

1. For the reference point for each configuration, see *SITRANS LR 200 Dimensions* on page 15 for the standard version, or *Appendix H: Flanged Antenna Options*, page 113 onwards.
2. Set P837 to 'Learn' when the material level is substantially lower than process full level (ideally when the tank is empty or almost empty).

Display before Auto False-Echo Suppression
(or when P837 = 0)



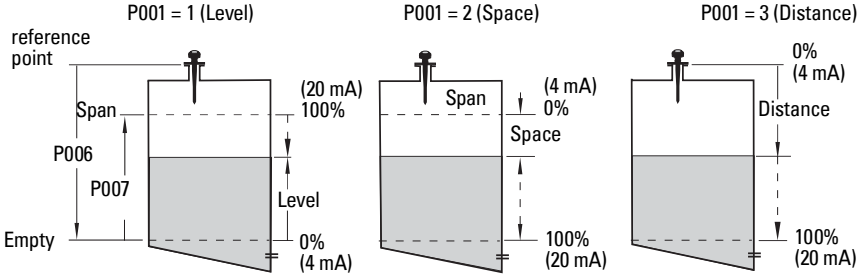
Example After Auto False-Echo Suppression



RUN/PROGRAM

Output

The mA output is proportional to the level, in the range 4 to 20 mA. Generally, the output is set so that the output for 0% is 4 mA, and the output for 100% is 20 mA. 0 and 100% are percentages of the full-scale reading (m, cm, mm, ft, in).



When SITRANS LR 200 is put into **PROGRAM** mode it stops responding to the process. It stores the most recent measurement, and holds the associated readings and mA signal output. The instrument reverts to the parameter last addressed during the previous program session.

When the instrument is returned to **RUN** mode, the transceiver resumes operation. The reading and mA output default to the last measurement taken. The reading and associated outputs migrate to the current process level at a rate controlled by the measurement response (P003).

If SITRANS LR 200 is left in **PROGRAM** mode for 10 minutes without input, it automatically reverts to **RUN** mode.

Failsafe

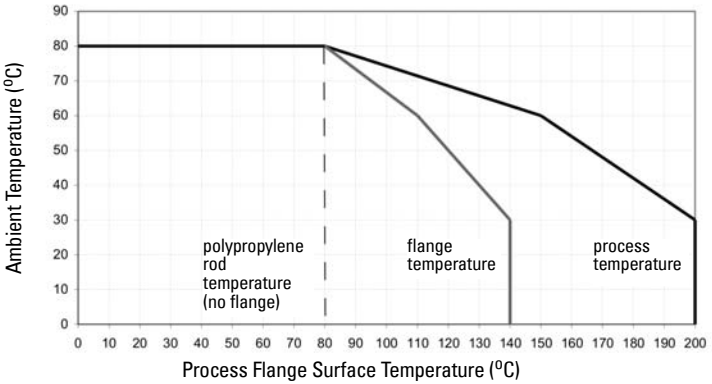
When the Failsafe timer (P070) expires, the material level to be reported is determined by P071 (Failsafe Material Level).

Failsafe Mode P071	
1 = HI	Use Maximum mA Limit (P213) as material level
2 = LO	Use Minimum mA Limit (P212) as material level
3 = HOLd	Level remains at last reading
4 = SEL	User-selected value (defined in P073)

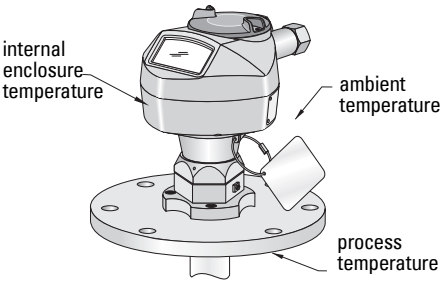
Maximum Process Temperature Chart

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 SITRANS 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. Parameter P343 is required to monitor the Internal Temperature. It gives you an excellent indication of how reliably the product will perform thermally when installed on your process vessel.

P343 also allows you to decide whether or not attention should be focussed on redesigning the installation. For example, if the internal temperature exceeds the maximum allowable limit, a sun shield or a longer nozzle may be required. Engineering will use this temperature reading (P343) to gauge the extent of change required to the installation in order to provide a reliable thermal-operating zone for the SITRANS LR 200.

! WARNING: Internal temperature must not exceed 80 ^{O}C (176 ^{O}F).

Process Pressure/Temperature derating curves

Notes:

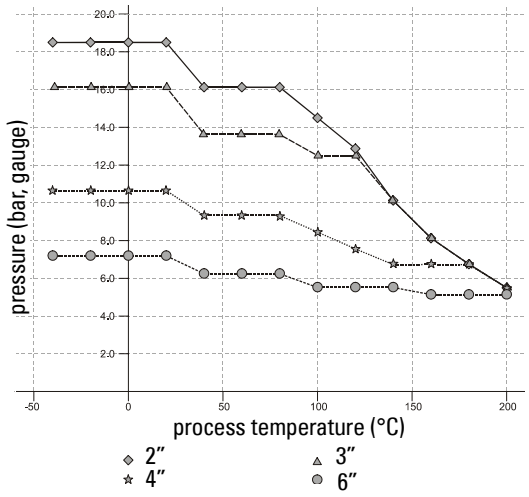
- These configurations are subject to revision: other options may be added.
- Process configuration numbers are not final.
- The Process Device Tag shall remain with the process pressure boundary assembly[1]. In the event the instrument package is replaced, the Process Device Tag shall be transferred 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 <u>not</u> 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. 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.

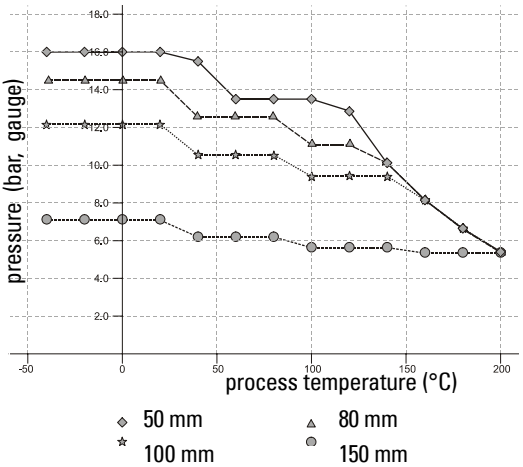
Rod Antenna ANSI Hole Pattern, 150#[1, 2]



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, PN16[1, 2,



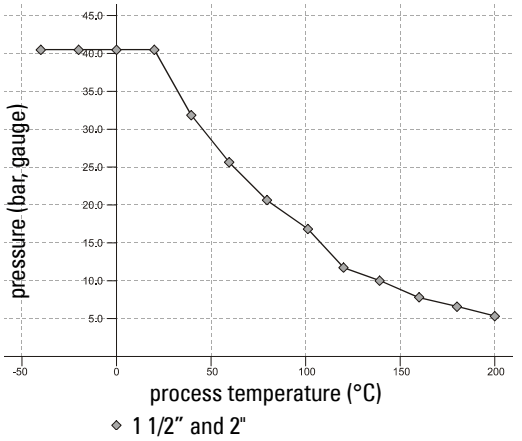
Process Configuration:

- 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.

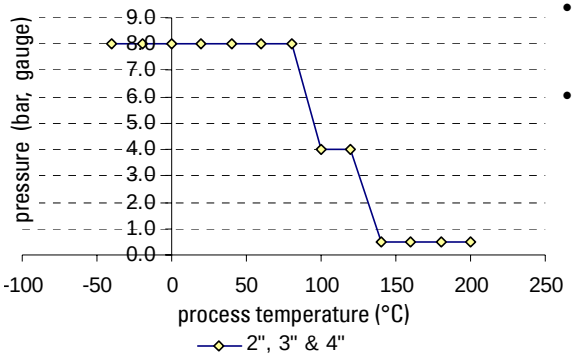
Rod Antenna Threaded Connection



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 Connection[1]



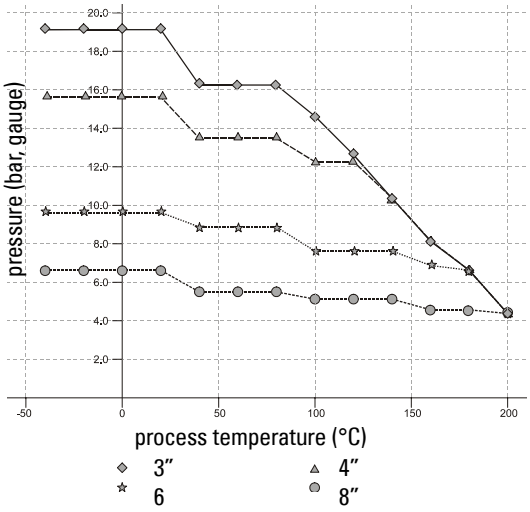
Process Connection Series:

- 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.

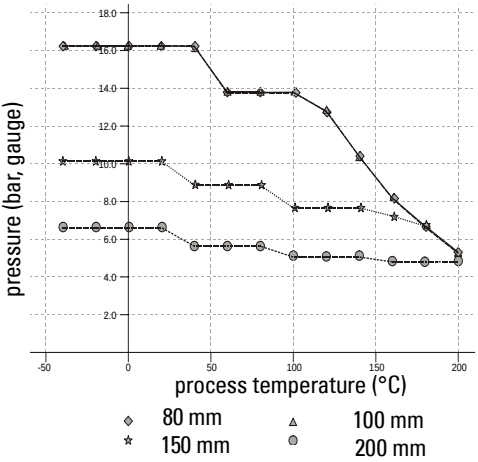
Horn Antenna or Wave Guide – ANSI Hole Pattern, 150#[1]



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, PN16[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.

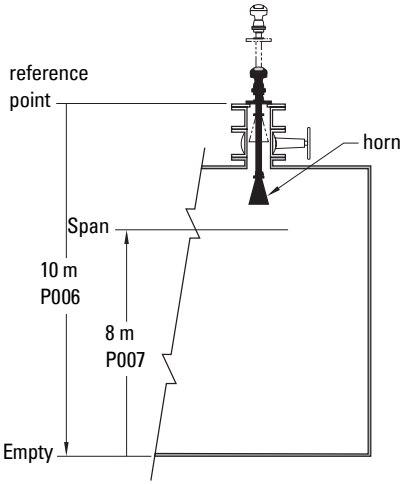
1. Customer to provide adequate bolting and flat-faced gasket to retain vessel pressure and provide sufficient sealing.
2. Customer to provide adequate bolting and flat-faced gasket to retain vessel pressure and provide sufficient sealing.

Notes

Appendix G: Special Applications

These more complex SITRANS LR 200 application examples can be used as setup references. The parameter value tables relate the values to the functions.

Example: Sliding Waveguide on Anaerobic Digesters



The raised position is for installation and maintenance. The lowered position is for operation. Program the instrument for operation in the lowered position.

This application is to obtain a level measurement and corresponding 4-20 mA output proportional to the sludge level on a digester. Process empty level (Empty) is the bottom of the digester, which is 10 m (33 ft) from the antenna flange face when the instrument is lowered to its normal operating position.

Process full level (Span) is 8 m (26.25 ft) from the bottom. The maximum rate of filling or emptying is about 0.1 m (4")/min.

Parameter	Enter		
P001	**1**	mode of measurement	= level
P003	**2**	measurement response	= 1 m/minute
P005	**1**	units	= meters
P006	**10**	empty distance	= 10 m
P007	**8**	span	= 8 m
P838[1]	**distance to material – 0.5 m**	auto false-echo suppression distance	
P837[2]	**2**	auto false-echo suppression	enable false-echo suppression

1. For more details on P837 and P838, see page 73.

2. Only set P837 if the product is at least 2 m (78") away from the flange face. If it is closer, leave P837 at **1** until the level drops and the distance increases beyond 2 m (78").

Return to **RUN**: to start normal operation, press **PROGRAM** .

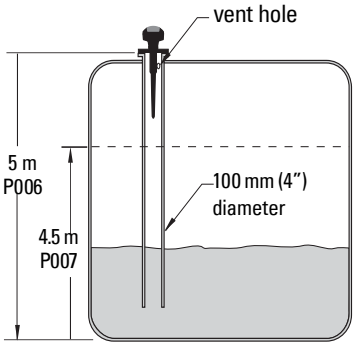
Application Example: Stillpipe

This is an alternative to the waveguide antenna option, used for products with an ε_r of less than 3, or if extremely turbulent or vortex conditions exist. This mounting arrangement 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.
- Blanking and P800 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 the chart on page 111 for typical P655 values.

This application is to obtain a level measurement and corresponding 4-20 mA 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.
- Empty level is 0 m/ft (bottom of tank).
- Full level (span) is 4.5 m (14.74 ft) from the bottom.
- The stillpipe inside diameter is 100 mm (4").
- The maximum rate of filling or emptying is about 0.1 m (4")/min.
- In the event of a loss of echo, SITRANS LR 200 is to go into Failsafe Hi after 2 minutes.



Parameter	Enter		
P001	**1**	mode of measurement	= level
P003	**2**	measurement response	= 1 m/minute
P005	**1**	units	= meters
P006	**5**	empty distance	= 5 m
P007	**4.5**	span	= 4.5 m
P655*	**0.955**	propagation factor	= 10 mm pipe I.D.

Parameter	Enter		
P838[1]	**distance to material – 0.5 m**	auto false-echo suppression distance	
P837[1, 2]	**2**	auto false-echo suppression	enable false-echo suppression

1. For more details on P837 and P838, see page 73.

2. Only set P837 if the product is at least 2 m (78″) away from the flange face. If it is closer, leave P837 at **1** until the level drops and the distance increases beyond 2 m (78″).

Return to **RUN**: to start normal operation, press **PROGRAM** .

Pipe Inside Diameter	P655 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

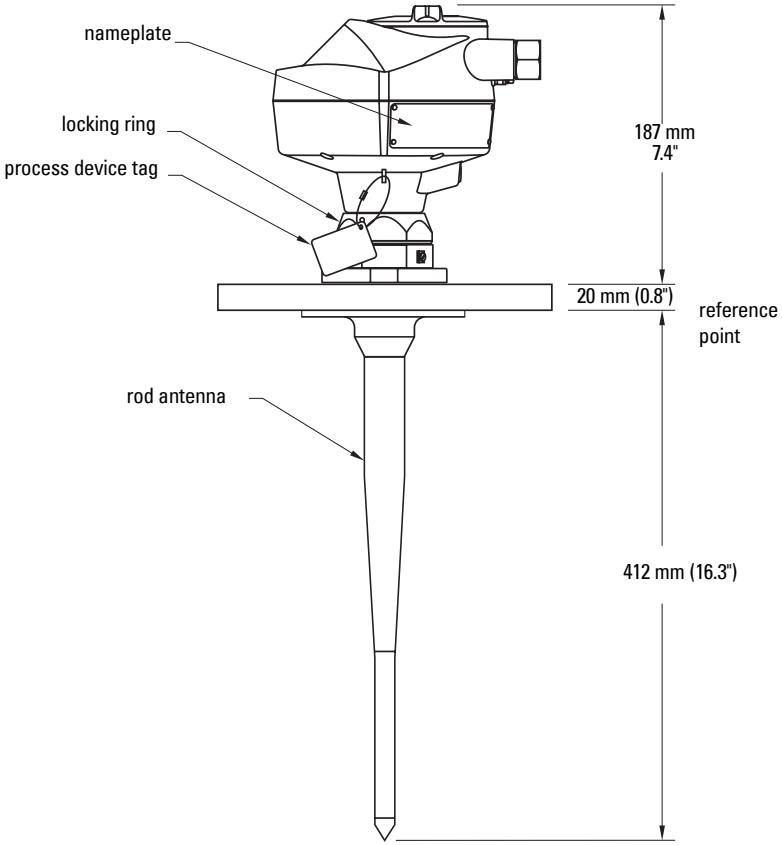
* These values are provided as a guideline only.

Notes

Appendix H: Flanged Antenna Options

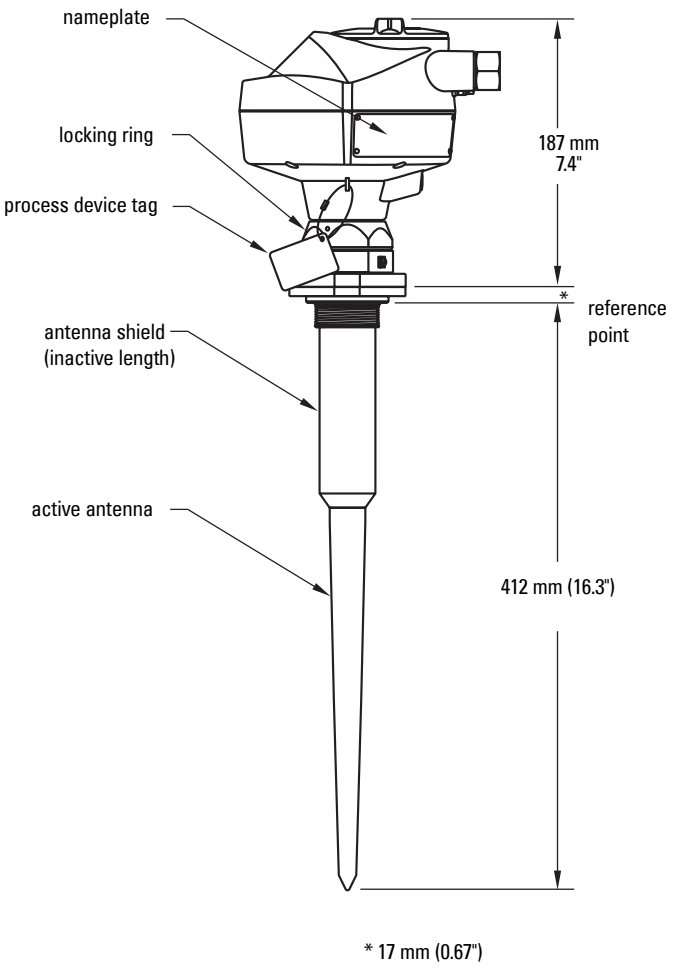
Dimensions: Rod Antenna

Note: For other flange dimensions and bolt hole sizing see *Dimensions: Flanges* **on page 120** and the table on page 121.



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.

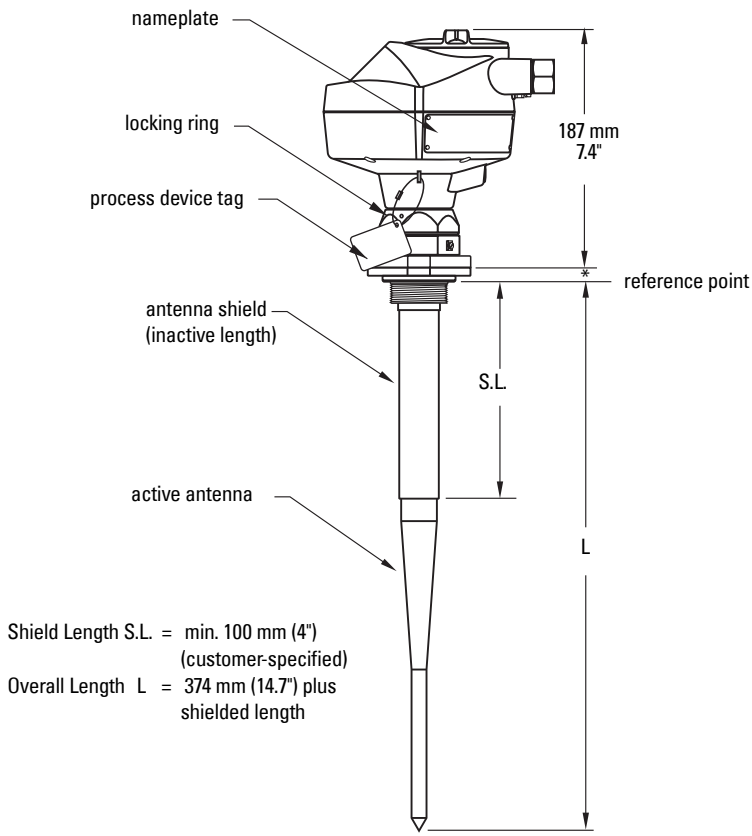
Dimensions: Threaded Rod



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: Shielded Rod



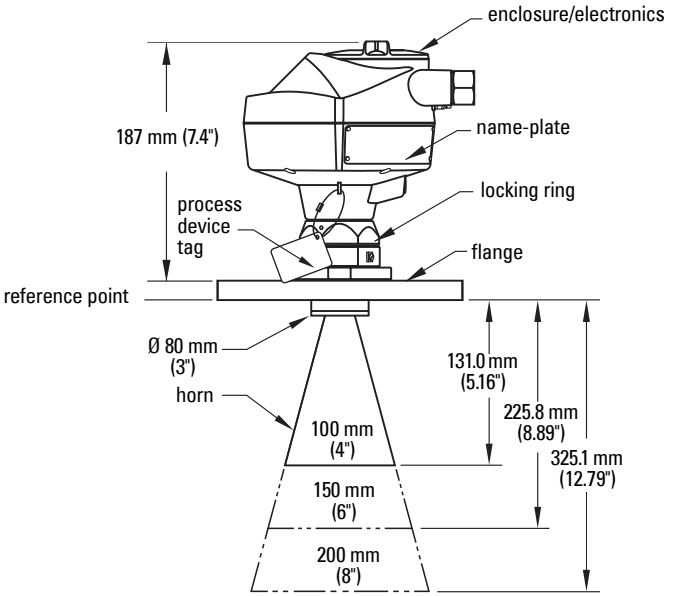
Note: Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available on our website at www.siemens.com/processautomation, on the product page for SITRANS LR 200, under Process Connection Specifications.

! 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: Horn

Notes:

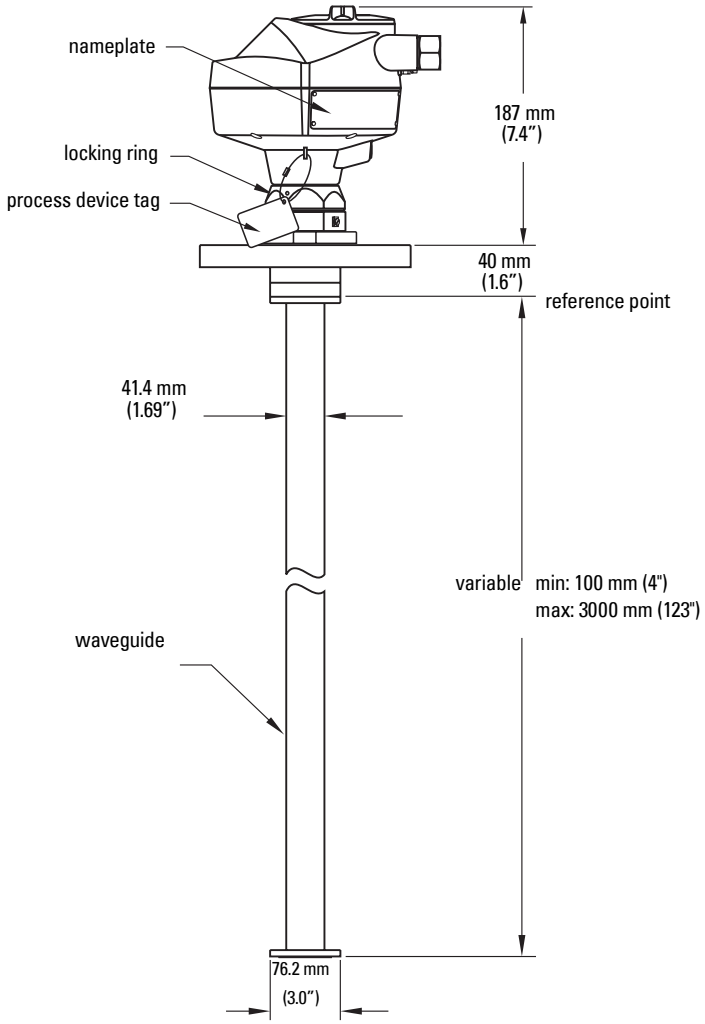
- For other flange dimensions and bolt hole sizing see *Dimensions: Flanges* on page 120 and the table on page 121.
- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available on our website at www.siemens.com/processautomation, on the product page for SITRANS LR 200, under Process Connection Specifications.
- Signal amplitude increases with horn diameter, so use the largest practical size.
- Optional waveguide extensions and/or purging[1] system can be installed between the flange and the antenna.



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

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.

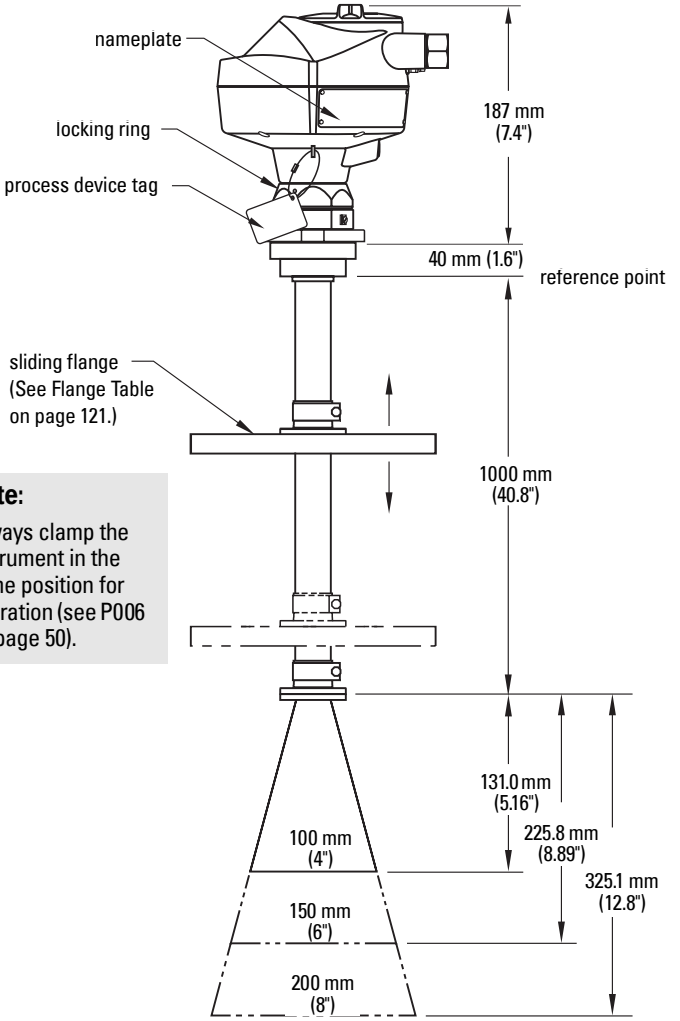
Dimensions: Waveguide



Notes:

- For other flange dimensions and bolt hole sizing see *Dimensions: Flanges* on page 120 and the table on page 121.
- You can connect a maximum of two waveguides together.
- 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 Specifications.

Dimensions: Sliding Waveguide Configuration



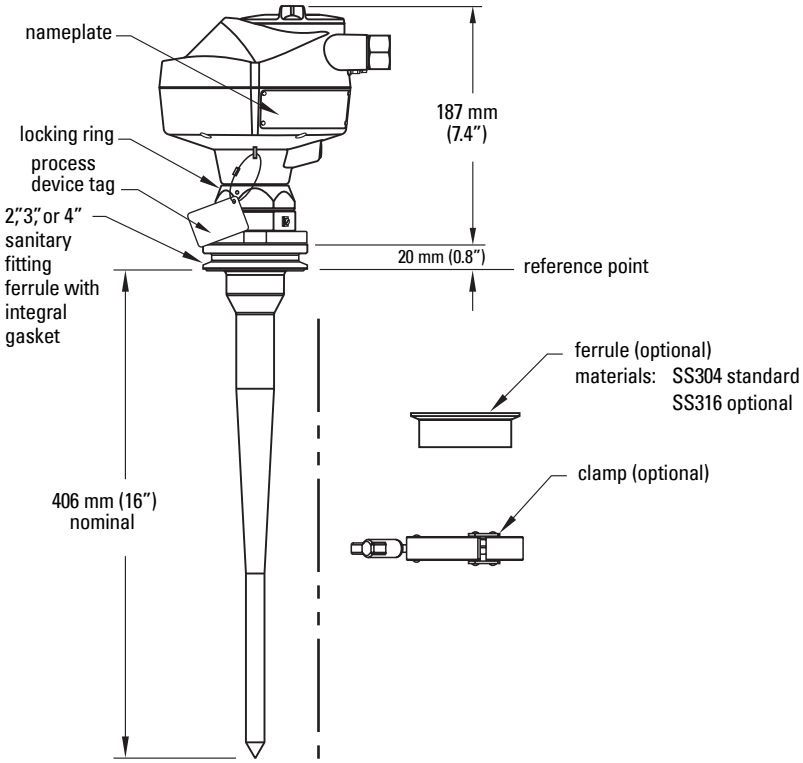
Note:

Always clamp the instrument in the same position for operation (see P006 on page 50).

Notes:

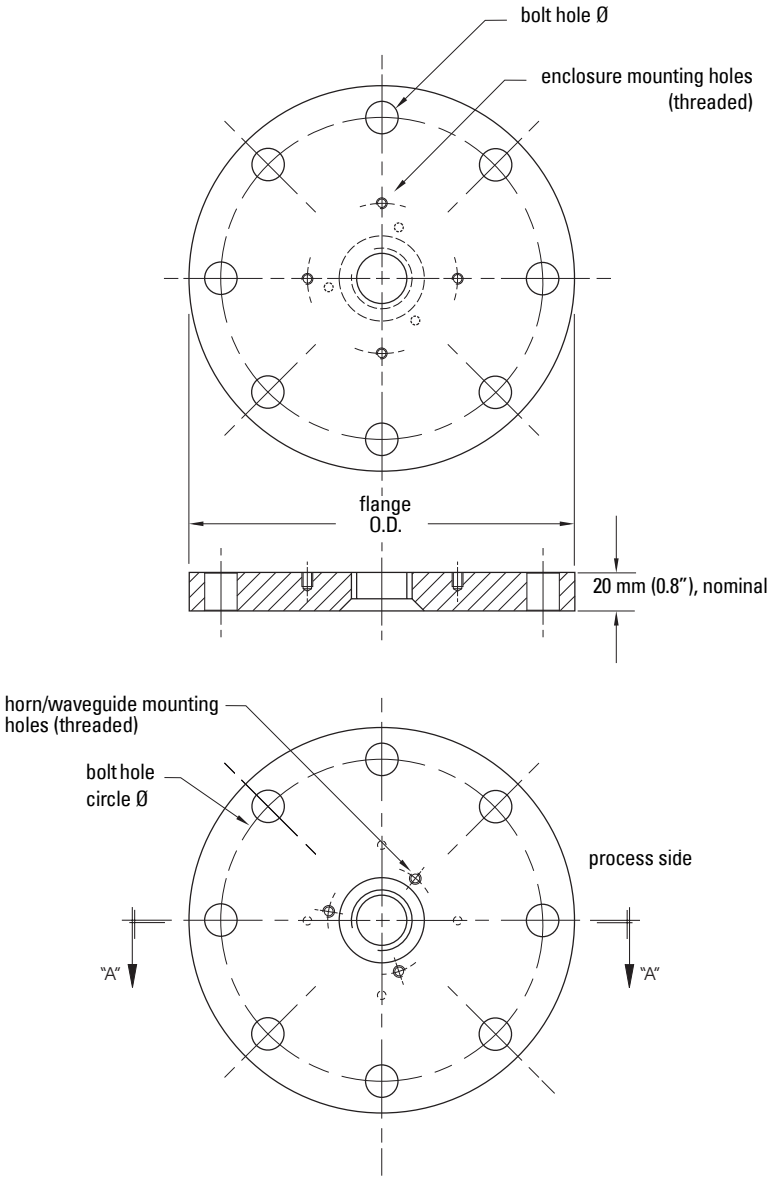
- For other flange dimensions and bolt hole sizing see *Dimensions: Flanges* on page 120 and the table on page 121.
- Maximum pressure 0.5 bar at 60° C (140° F) for sliding flange option.
- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference 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



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



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#[1]	6.50″	5.00″	.75″	4[1]
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

1. 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.

Flange marking

The flange markings are located around the outside edge of the flange.

	Serial No.	Logo	Flange Series	Nominal Size		Material	Heat Code
North American	MMDDYY XXX		22452	2	150	316/316L	A1B2C3
European	MMDDYY XXX		22452	DN80	16	1.4571	A1B2C3

Serial number: a unique number allotted to each flange, including the date of manufacture (mmddyy) followed by a number from 001 to 999.

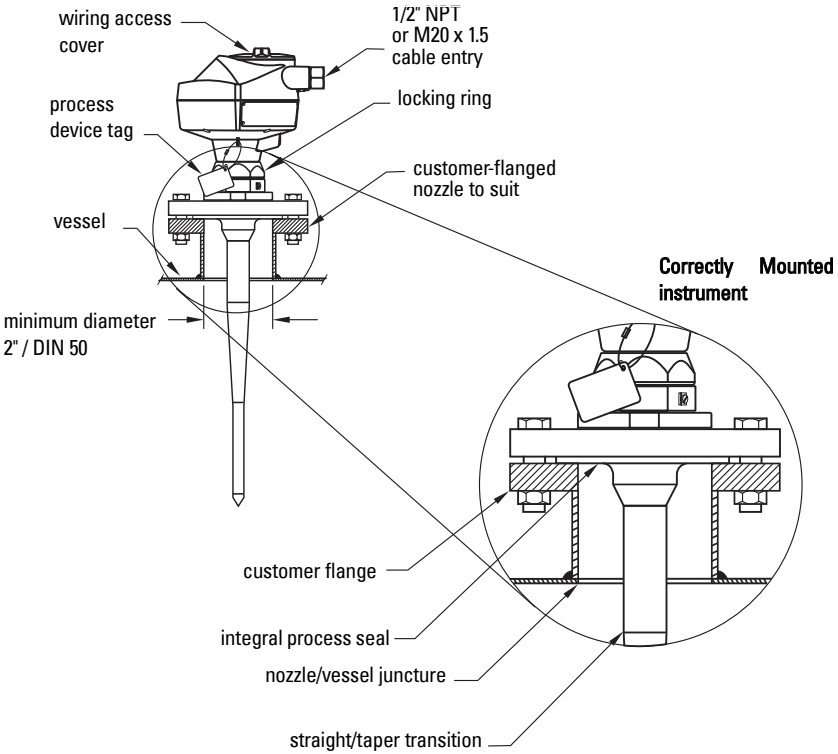
Flange series: the SMPI drawing identification.

Nominal size: a combination of the nominal pipe size and the hole pattern for a particular flange class. In the examples above, a 2 inch (or 80 mm) nominal pipe size is combined with the hole pattern corresponding toan ASME 150 lb class flange (or EN 1092-1 PN 16 class flange).

Material: the basic flange material (AISI or EU material designation).

Heat code: a flange material batch code identification.

Mounting



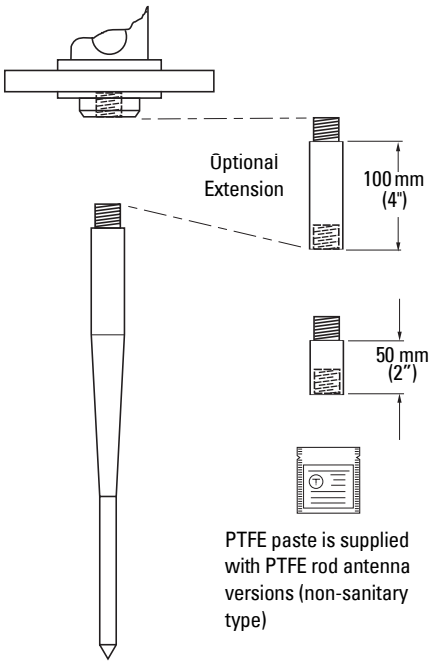
Notes:

- 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 124.

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

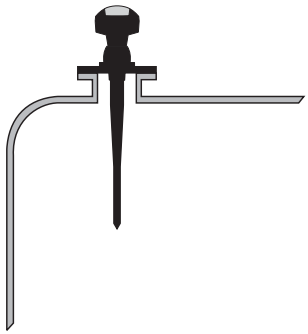
Nozzle I.D.	Nozzle Height mm (inches)*		
	<100 (4)	100 to 150 (4 to 6)	150 to 200 (6 to 8)
50 mm (2")	n/r	**	**
80 mm (3")	n/r	50 mm	100 mm
100 mm (4")	n/r	50 mm	100 mm
150 mm (6")	n/r	50 mm	100 mm
>150 mm (6")	n/r	n/r	n/r

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 Assembly



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.

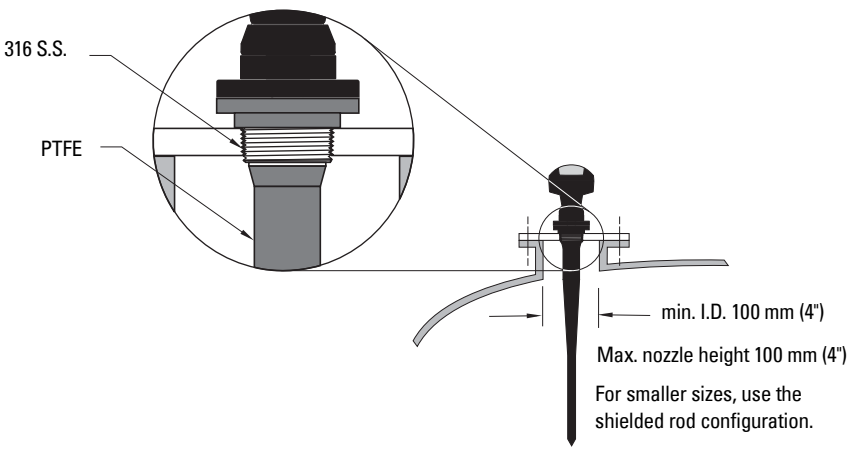
If you create a new nozzle for the radar instrument, the weld seams must be on the outside of the nozzle. Ensure that there are no seams or lips on the inside of the nozzle or you may get erratic readings.

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

Nozzles that are 200 mm (8") or larger in diameter provide excellent signal conditions. Under these conditions you can use the standard rod without extensions for nozzle lengths of up to 610 mm (24").

Mounting: Threaded Rod Antenna

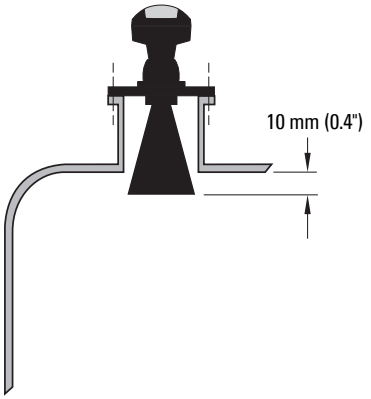
You can use 1.5" or 2" threaded process connections. There are three thread types: NPT, BSP, and G.



! 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.

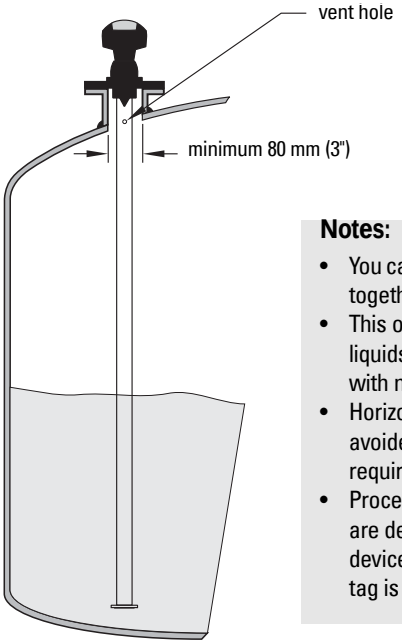
Mounting: Horn Antennas

The end of the horn 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 P655 on page 64 for the related propagation factor.



Notes:

- You can connect a maximum of two waveguides together.
- 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 Bypass (Sidepipe)

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

A horn antenna is preferred, but a rod antenna may also be used.

Pipe requirements

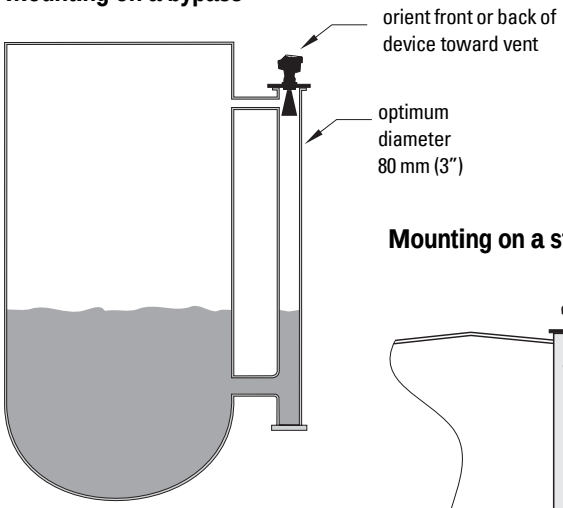
Diameter

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

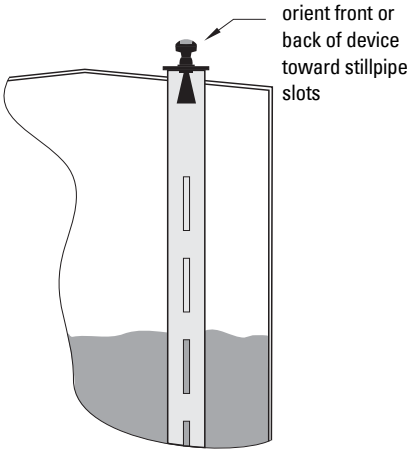
Smoothness

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.

Mounting on a bypass



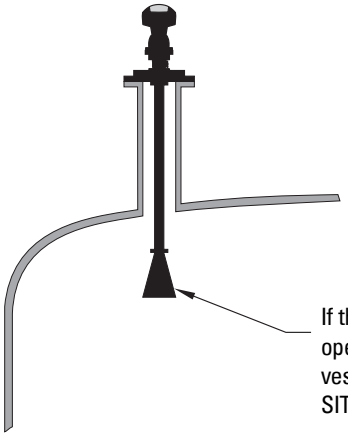
Mounting on a stillpipe



See P655 on page 64 for the related propagation factor.

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

Mounting: Horn with Waveguide Extensions



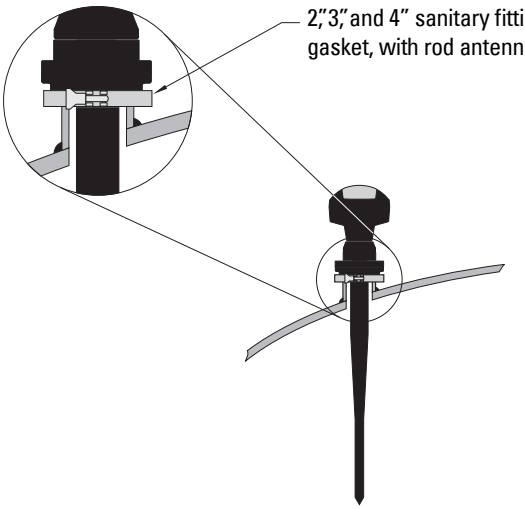
Use this combination if the nozzle is long and the diameter is small.

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

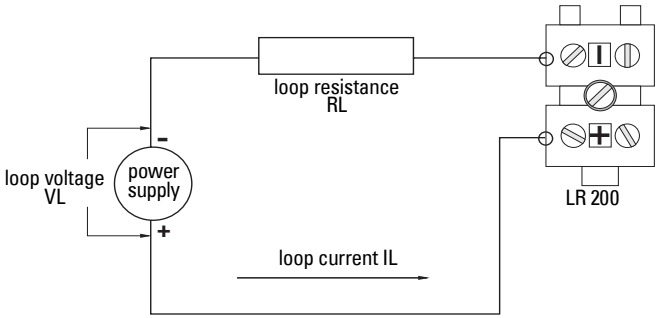


2",3," and 4" sanitary fitting ferrule with integral gasket, with rod antenna

Appendix J: Loop power

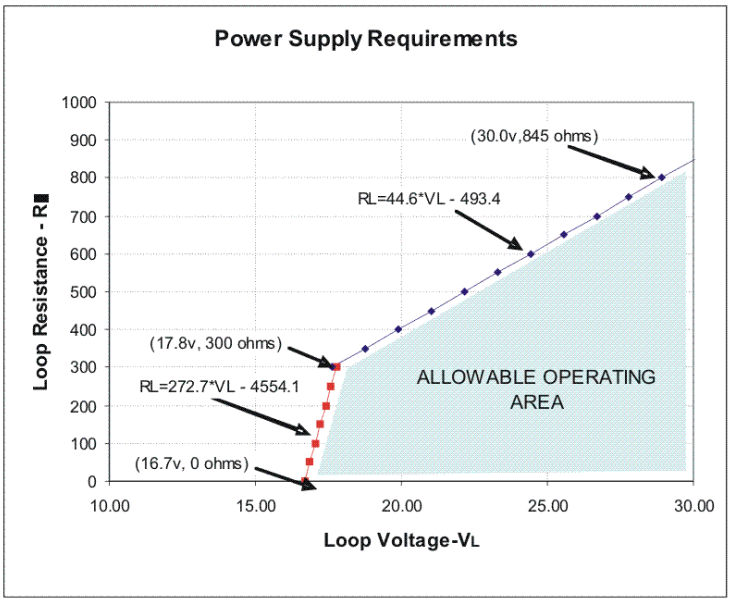
Typical Connection Drawing

Note: Loop voltage is the voltage at the terminals of the power supply (not the voltage at the terminals of the device).



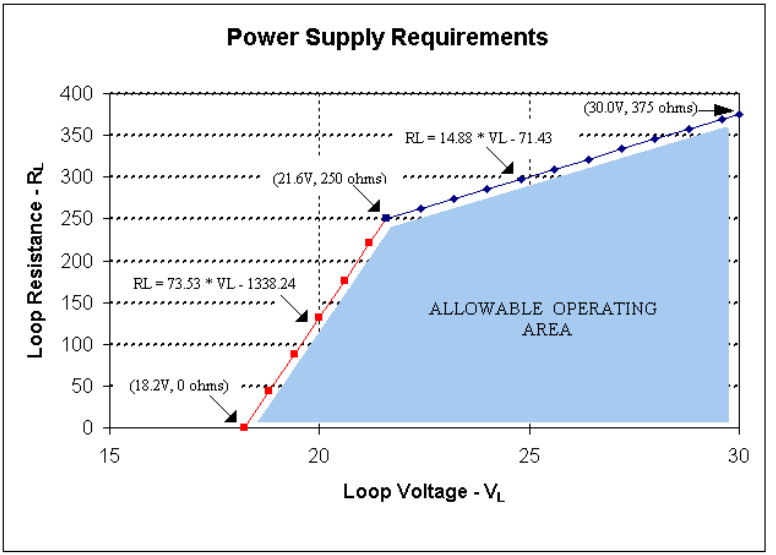
Curve 1 (General Purpose, Intrinsically Safe, Non-incendive)

Loop Voltage versus Loop Resistance



Curve 2 (Flameproof, Increased Safety, Explosion-proof)

Loop Voltage versus Loop Resistance



Appendix K: Software Revision History

Soft-ware Rev.	DD Rev.	Date	Changes
1.00	1.00	05/06/2003	• Initial Release
1.01		06/26/2003	• Factory calibration of antenna offset can now be saved.
1.02		10/16/2004	• Sporadic Fault 25 (electronic failure) messages reduced.
1.03	2.00	03/16/2005	• Cleaned up fault code issues. • Set HART status bit 4 (more status available) • MEASURE key works only on restricted set of parameters while in program mode. • Made corrections to language strings. • Corrected User Interface operation at –30 ^{0}C. • Fixed Fault 25 (electronic failure) caused by an RTM glitch on the RAMP_TH line. • PDM TVT profile was sometimes lacking a few bytes at the end. This is now fixed. • Added TVT Shaper to HART: P831 to cmd 172 and create cmd 174 for P832. • Improved mA output time at startup. • Product startup time reduced from about 30 seconds to about 10 seconds. • P838 now does not reset. • P831 and P832 TVT shaper added. • P054 and P054 breakpoints corrected for PDM.

Soft-ware Rev.	DD Rev.	Date	Changes (cont'd)
1.04	2.00	05/27/2004	• Fixed possible corruption of HART Status. • Prevent possible buffer overflows. • Fixed HART command 17 to correct status information. • Changes made to the program mode timer to avoid an immediate timeout followed by a switch to run mode when the device is switched into program mode via HART. • The **configuration changed** status can now be saved for the duration of a power cycle. • HART commands 170 and 171 modified to read and write P713. • Configuration status now being set for all required commands. • HART common practice and universal commands now return response codes. • When the full configuration is transferred to a unit, Span is reset to the default value. • HART command 225 now sets the manual Span flag when P007 is set. • Added new HART command 229 to provide a write for P799.
1.05		08/10/2004	• Corrected issue: P210 and P211 values (or HART values for URV/LRV) were not being preserved over a power cycle if operation was set to **distance** or **volume**.
2.03	2.03.01	10/05/2005	• Resolved issue that could cause peak to be selected below the TVT curve. • MP&F parameters added to product. • Fault system upgraded to use S# codes to match PROFIBUS products. • Increased number of breakpoints to 32. NOTE: Rev. 2.03 cannot be used with older hardware.

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 Permittivity. 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.

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.

HART: Highway **A**ddressable **R**emote **T**ransducer. An open communication protocol used to address field instruments.

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

i**nductance:** 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.

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

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.

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 humidity: the ratio of the actual amount of moisture in the atmosphere to the maximum amount of moisture the atmosphere could hold (which varies depending on the air temperature).

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 4 to 20 mA, 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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