Radar Transmitters

SITRANS Probe LR

Quick Start Manual · 12/2013

SITRANS

SIEMENS

SITRANS Probe LR Quick Start Manual

English

This manual outlines the essential features and functions of SITRANS Probe LR. We strongly advise you to acquire the detailed version of the manual so you can use your instrument to its fullest potential. The complete manual can be downloaded from the Siemens website at: www.siemens.com/level. The printed manual is available from your local Siemens representative.

Questions about the contents of this manual can be directed to:

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

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.

⚠ **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.

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

English

SITRANS Probe LR

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

Notes:

- 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 Operating Instructions, 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.
- SITRANS Probe LR is to be used only in the manner outlined in this manual, otherwise protection provided by the equipment may be impaired
- This product is intended for use in industrial areas. Operation of this equipment in a residential area may cause interference to several frequency based communications..

SITRANS Probe LR 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.

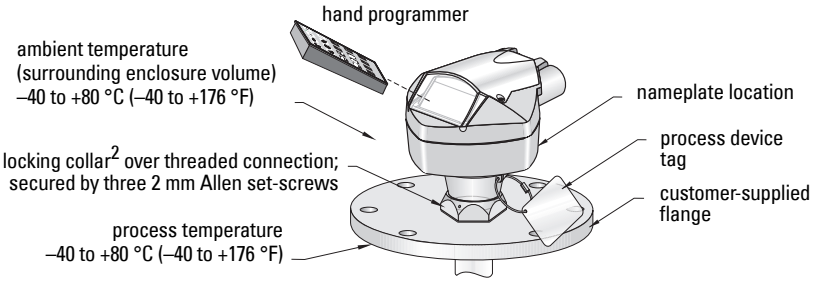
Communication is via HART[1], and signals are processed using Sonic Intelligence® .

Specifications

For a complete listing, see the full Operating Instructions for SITRANS Probe LR (see product page at: www.siemens.com/probelr). For Approvals information, please refer to the device nameplate.

Ambient/Operating Temperature

Note: Process temperature and pressure capabilities are dependent upon information on the process device tag. The reference drawing listed on the tag can be downloaded from the Siemens website. Go to the SITRANS Probe LR product page at: www.siemens.com/probelr.



1. HART® is a registered trademark of the HART Communication Foundation.
2. When the locking collar is secured, it prevents the enclosure rotating on the threaded connection.

Power

Nominal 24 V DC at max. 550 Ohm

- Maximum 30 V DC
- 4 to 20 mA

Approvals

• General	$CSA_{US/C}$, FM, CE, C-TICK		
• Radio	Europe (R&TTE), FCC, Industry Canada		
• Hazardous	Intrinsically Safe	(Europe)	ATEX II 1 G Ex ia IIC T4 Ga
		(US/Canada)	FM/CSA[1]: (barrier required) Class I, Div. 1, Groups A, B, C, D Class II, Div. 1, Groups E, F, G Class III T4
		(International)	IECEx SIR 13.0005X Ex ia IIC T4 Ga
		(Brazil)	INMETRO: DNV 12.0068 X Ex ia IIC T4 Ga IP67/IP68 -40 °C ≤ T a ≤ +80 °C DNV #OCP 0017 ABNT NBR IEC 60079-0:2008 e ABNT NBR IEC 60079-11:2009 e ABNT NBR IEC 60079-26:2008
	Non-incendive	(US)	FM[2]: Class I, Div. 2, Groups A, B, C, D T5
• Marine	Lloyd's Register of Shipping		
	ABS Type Approval		

Note: Approved dust-tight and water-tight conduit seals are required for outdoor Type 4X / NEMA 4X, Type 6 / NEMA 6, IP67, IP68 locations.

Note: EN61000-4-3 (CE EMC) testing was conducted on the SITRANS Probe LR while mounted in a metallic vessel.

Mechanical

• Process Connections:	threaded connection	1.5" NPT, BSP, or G (BS EN ISO 228-1)
• Antenna:	polypropylene rod	hermetically sealed construction

Process

- Temperature (at process connection): –40 to +80 °C (–40 to +176 °F)
- Pressure (vessel): maximum 3 bar, gauge (43.5 psi, gauge)

1. See *Wiring Drawing: Intrinsically Safe (FM)* on page 2 of Appendix A, for drawing number 23651611, or *Wiring Drawing: Intrinsically Safe (CSA)* on page 3 of Appendix A, for drawing number 23651621.
2. See *Wiring Drawing: Non-incendive (FM)* on page 1 of Appendix A, for drawing number 23650537.

Installation

! WARNINGS:

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

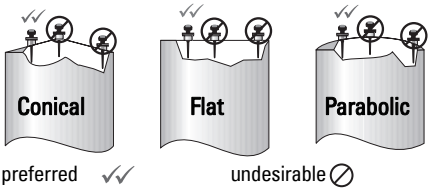
Mounting location

Recommendations

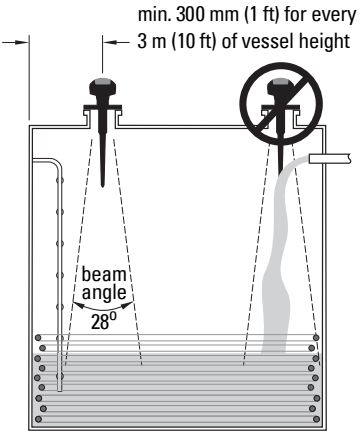
- Ensure ambient temperature is within –40 to +80 °C (–40 to +176 °F).
- Provide easy access for viewing the display and programming via the hand programmer.
- Ensure the environment is suitable to the housing rating and materials of construction.

Precautions

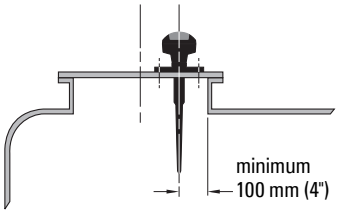
- Avoid proximity to high voltage or current wiring, high voltage or current contacts, and to variable frequency motor speed controllers.
- Avoid interference to the emission cone from obstructions or from the fill path.
- Avoid central locations on vessels.



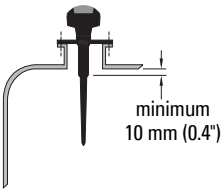
- Locate the antenna away from the side wall, to avoid interference from indirect echoes.
- Avoid interference from objects such as ladders or pipes, which can cause false echoes.
- Avoid interference from the fill path.



Mounting on a manhole cover



Mounting on a nozzle



To provide optimum signal conditions on a manhole cover, locate the antenna off-center relative to the cover, typically 100 mm (4") from the side of the manhole.

- 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.

Mounting instructions

- Before inserting SITRANS Probe LR into its mounting connection, check to ensure the threads are matching to avoid damaging them.
- Simply screw SITRANS Probe LR 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).
- To rotate the enclosure, use a 2 mm Allen key to loosen the three set-screws that secure the locking collar. Once the enclosure is positioned as desired, tighten the set-screws.

Wiring

Power

WARNINGS:

⚠ **DC terminals shall be supplied from an SELV [1] source in accordance with IEC-1010-1 Annex H.**

! **All field wiring must have insulation suitable for rated voltages.**

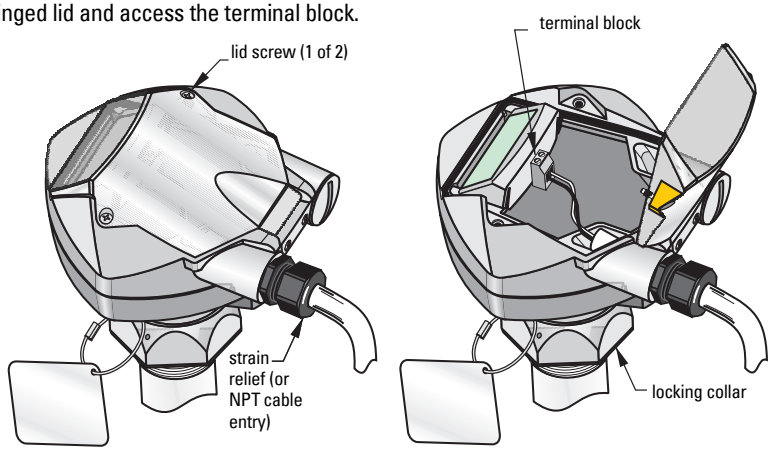
Connecting SITRANS Probe LR

Notes:

- For detailed wiring instructions, please refer to the full Operating Instructions.
- Use shielded, twisted pair cable (wire gauge AWG14 to AWG22).
- Separate cables and conduits[1] may be required to conform to standard instrumentation wiring practices, or electrical codes.
- The non-metallic enclosure does not provide a continuous ground path between conduit connections: use grounding type bushings and jumpers.

1. Safety Extra Low Voltage
2. If cable is routed through conduit, use only approved suitable-size hubs for waterproof application.

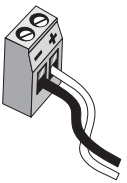
Unscrew the two lid screws to release the hinged lid and access the terminal block.



1. If you want to rotate the instrument on the process connection, use the 2 mm Allen key provided to loosen the 3 Allen set-screws securing the locking collar. Position the unit, and retighten the screws.

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

2. Strip the cable jacket for approximately 70 mm (2.75") from the end of the cable, and thread the wires through the strain relief[1].
3. Connect the wires to the terminals: the polarity is identified on the terminal block.
4. Tighten the gland to form a good seal.
   Close the lid and tighten screws: **please do not overtighten screws.** (Recommended torque is 1.1 to 1.7 N-m (10 to 15 in-lb) of torque)



Wiring setups for hazardous area installations

Always check the device nameplate and process device tag to verify the approval rating.

1. Intrinsically Safe wiring

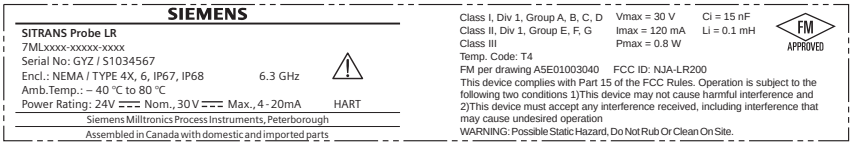
Device nameplate (ATEX/IECEX/INMETRO/C-TICK)

The ATEX certificate can be downloaded from the product page of our website at: www.siemens.com/probelr. Go to **Support > Approvals / Certificates.**

The IECEx certificate listed on the nameplate can be viewed on the IECEx website. Go to: http://iecex.iec.ch and click on **Ex Equipment Certificates of Conformity** then enter the certificate number IECEx SIR 13.0005X.

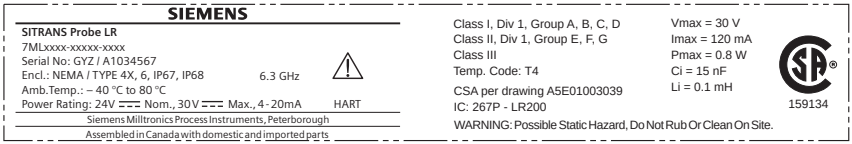
1. If cable is routed through conduit, use only approved suitable-size hubs for waterproof applications.

Device nameplate (FM)



FM Intrinsically Safe connection drawing number **A5E01003040** can be downloaded from the product page of our website at: www.siemens.com/probelr. Go to **Support > Installation Drawings > Level Measurement > Continuous - Radar.**

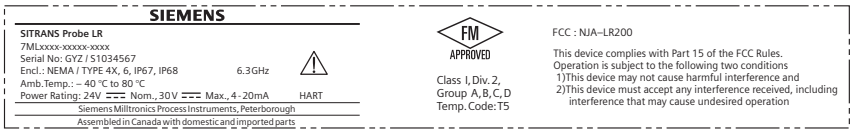
Device nameplate (CSA)



CSA Intrinsically Safe connection drawing number **A5E01003039** can be downloaded from the product page of our website at: www.siemens.com/probelr. Go to **Support > Installation Drawings > Level Measurement > Continuous - Radar.**

- For wiring requirements: follow local regulations.
- Approved dust-tight and water-tight conduit seals are required for outdoor Type 4X / NEMA 4X, Type 6 / NEMA 6, IP67, IP68 locations.
- Refer to *Instructions specific to hazardous area installations (Reference European ATEX Directive 94/9/EC, Annex II, 1/0/6)* on page 8.
- For power demands, see *Loop power* on page 4 of Appendix A.

2. Non-incendive wiring (FM US only)



FM Class 1, Div 2 connection drawing number **23650537** can be downloaded from the product page of our website at: www.siemens.com/probelr. Go to **Support > Installation Drawings > Level Measurement > Continuous - Radar.**

- For power demands, see *Loop power* on page 4 of Appendix A.

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 06ATEX2354X:

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:

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

    Aggressive substances: e.g. acidic liquids or gases that may attack metals, or solvents that may affect polymeric materials.

    Suitable precautions: e.g. regular checks as part of routine inspections or establishing from the material's data sheet that it is resistant to specific chemicals.
12. **Equipment Marking:**

    The equipment marking contains at least the information on the product label, shown under *Safety Guidelines* **on page 1**.

RUN Mode and PROGRAM Mode

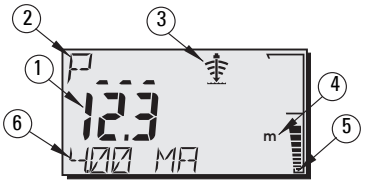
SITRANS Probe LR has two modes of operation: RUN and PROGRAM.

After you complete the installation procedures and power up SITRANS Probe LR, it starts in **RUN** mode and detects the material level. It returns the distance (in meters) to the material level referenced from Empty (process empty level). This is the default start-up display mode.

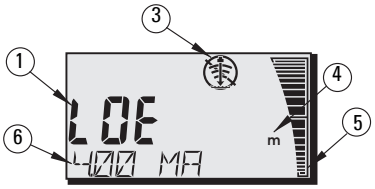
RUN Mode Display

Use the hand programmer to control the display.

Normal operation



Failsafe operation



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

2 – Secondary Reading (displays Parameter number for Auxiliary Reading)

3 – Echo status indicator: Reliable Echo or Unreliable Echo

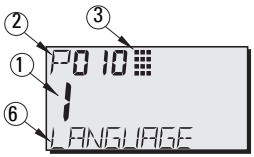
4 – Units or Percent

5 – Active bar graph represents material level

6 – Auxiliary Reading (depending on the parameter selected, it displays milliAmp value, distance, or echo 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 indicator. When a valid reading is received, the level reading display returns to normal operation.

PROGRAM Mode Display



1 – Primary Reading (displays parameter value)

2 – Secondary Reading (displays parameter number)

3 – Programming indicator

6 – Auxiliary Reading (displays parameter names for P001 to P010, if a language is selected. It displays the index value for indexed parameters, such as P054)

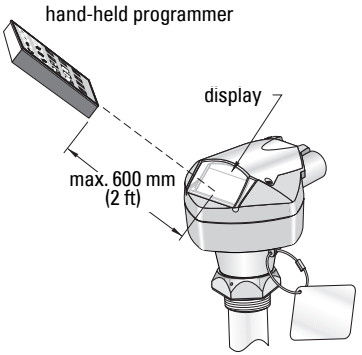
Programming

Note: Do not use the handheld programmer at the same time as SIMATIC PDM, or erratic operation may result.

- 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 hand programmer.
- For programming from a distance, use either a PC running SIMATIC[1] PDM or a HART handheld communicator.

Hand programmer.

For direct access to SITRANS Probe LR, point the programmer at the SITRANS Probe LR display and press the keys. (For detailed instructions, see the next page.)



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: (P000: Lock)

Value		Description
Value stored in P069	*	Lock off: programming permitted
other		Lock activated: no changes permitted

* Factory setting for P069 is 1954: after a new value is entered and accepted, it becomes the default setting.

Activating SITRANS Probe LR

Power up the instrument. SITRANS Probe LR starts in **RUN** mode.

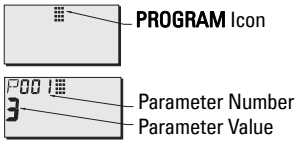
Notes:

- Keep infrared devices such as laptops, cell phones, and PDAs, away from SITRANS Probe LR to prevent inadvertent operation.
- 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. SIMATIC® is a registered trademark of Siemens AG.

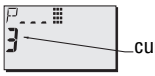
Accessing a parameter

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. (The current parameter value remains visible.)
4. Key in the desired parameter number followed by **ENTER**.

   For example: press 5 mA.
5. 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. (A remote master can still change configuration, if P799 is set to allow this.)
- Invalid entries will be rejected or limited.
- **CLEAR** c can be used to clear the field.

1. Key in the new value.
2. Press **ENTER** to set the value.

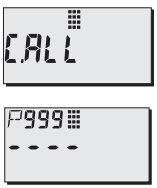
Parameter Reset to Factory Default

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

Master Reset (P999)

Returns all parameters except P000, P069, and P838 to default settings. (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**.
4. Press **CLEAR** c then **ENTER**, to Clear All and initiate reset. The LCD displays **C.ALL**.
5. Reset complete. (Reset takes several seconds to complete.)



Quick Setup: steps 1 to 9

Note: Factory settings are marked by an asterisk (*) in the tables.

1. Select language (P010: Language)

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

	ENGLISH	DEUTSCH	FRANÇAIS	ESPAÑOL
P000	LOCK	VERRIEGELG	VERROUIL	BLOQUEO
P001	OPERATION	BETRIEB	FONCTIONMT	FUNCIONAM.
P003	MEAS RESP	REAKTIONSZ	TEMPS REP.	TIEMPO R.
P004	ANTENNA	ANTENNE	ANTENNE	ANTENA
P005	UNITS	EINHEIT	UNITES	UNIDADES
P006	EMPTY	MESSBER.	VIDE	VACIO
P007	SPAN	MESSSPANNE	PLAGE	RANGO
P010	LANGUAGE	SPRACHE	LANGUE	IDIOMA

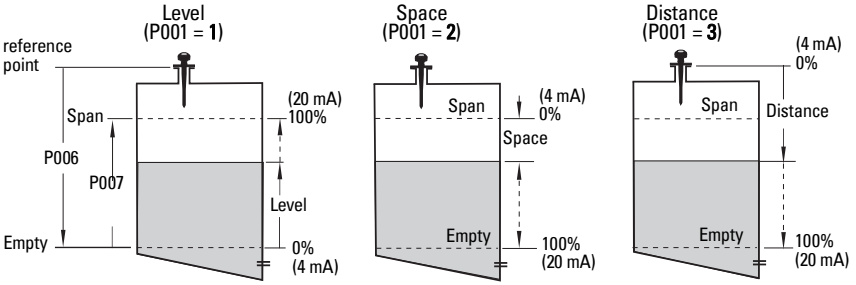
2. Set P001: Operation (measurement mode)

Notes:

- Setting P001 resets Span (P007), unless Span has previously been set to a different value.
- Changing P001 may reset Output Function (P201): this applies to HART only.

Value	1	*	**Level** returns distance to 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 distance to material level referenced from Span (process full level).
	3		**Distance** returns distance to material level from reference point.

mA Output with Level, Space, and Distance operation



3. Set P003: Measurement Response

Value	1	*	slow	0.1m/minute
	2		medium	1m/minute
	3		fast	10m/minute

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

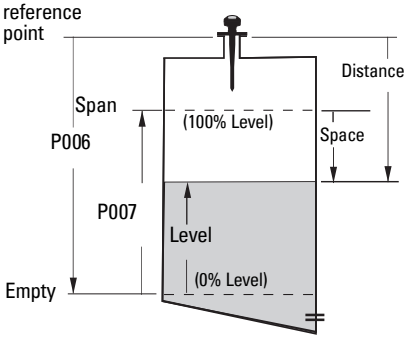
4. Select measurement units (P005)

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

(P004 - view only)

Value	240	*	rod antenna

5. (Set process empty level (P006: Empty)



Note:
Setting P006 resets Span, if it has not previously been set to a different value.

Value	Range	**0.0000 to 20.00 m (65.6 ft)**
	Default	**20.00 m (65.6 ft) max. range**

Empty can be set to any distance: not necessarily the bottom of the tank.

6. Set measurement range (P007: Span)

Value	Range	**0.0000 to 20.00 m (65.6 ft)**
	Default	**19.56 m (64.1 ft) (See note on next page.)**

Span can be set at any distance above Empty level.

Notes:
- The default setting for Span is based on Operation (P001) and Empty (P006). Span is set to Empty minus 110% of Blanking distance[1], unless Operation is set to **distance** (P001=3). In that case, Span is set to Empty distance.
- Always prevent the monitored surface from approaching within 0.3 m (1 ft) of the transducer face.

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

Value	Range:	**0.0000 to 20.00 m (65.6 ft)**
	*	**1.000 m (3.28 ft)**

8. Enable False Echo Suppression: set P837 (Auto False Echo Suppression.

Value	**0**		Off
	1	*	Use "learned" TVT
	2		"Learn"

Using P837 and P838 (perform this function at low tank levels)

Notes:
- P837 and P838 should be used together to adjust the TVT (Time Varying Threshold) curve.
- Use this function only if there is at least 2 m (6.5 ft) from the reference point to the material.
- Set P837 and P838 during start up, if possible.
- If the vessel contains an agitator, the agitator should be running.

1. Default setting for Blanking is 0.3 m (1 ft) plus shield length.

If SITRANS Probe LR displays an incorrect full level, or if the reading fluctuates between a false high level and a correct level, use 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[1].

P838 sets the distance within which SITRANS Probe LR will learn a new echo profile. P837 instructs the Probe LR to learn the echo profile at that moment, and use the learned profile instead of the default TVT curve.

a. Perform this function when the vessel is empty or nearly empty.
b. First rotate the instrument for best signal (lowest false echo amplitude).
c. Determine the distance from the reference point to the material level, and subtract 0.5 m (1.6 ft).
d. Select P838 and key in [distance to liquid level minus 0.5 m/1.6 ft], and press **ENTER**.
e. Select P837, then press **2** (Learn) and **ENTER**. P837 will automatically revert to **1** (use Learned TVT) after a few seconds.

9. Return to RUN

Press **PROGRAM** to return to **RUN** mode: setup is complete.

SITRANS Probe LR Communications: HART

Note: See *mA Output with Level, Space, and Distance operation* on page 12 for an illustration of the mA output with different modes of operation.

- You will need the full Operating Instructions[2] to acquire the list of applicable parameters.
- The HART Electronic Device Description (EDD) may be obtained from the HART Communication Foundation at www.hartcomm.org.
- We recommend that you use SIMATIC Process Device Manager (PDM) to program your instrument.

Maintenance

SITRANS Probe LR requires no maintenance or cleaning under normal operating conditions. If cleaning becomes necessary under severe operating conditions:

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

Unit Repair and Excluded Liability

For detailed information, please see the inside back cover.

1. For more details on Auto False Echo Suppression, please see the full Operating Instructions.
2. Operating Instructions can be downloaded from the product page of our website: www.siemens.com/probelr.