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.

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Disclaimer of Liability

While we have verified the contents of this manual for agreement with the instrumentation described, variations remain possible. Thus we cannot guarantee full agreement. The contents of this manual are regularly reviewed and corrections are included in subsequent editions. We welcome all suggestions for improvement.

Technical data subject to change.

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

Contact SMPI Technical Publications at the following address:

Technical Publications
Siemens Milltronics Process Instruments Inc.
1954 Technology Drive, P.O. Box 4225
Peterborough, Ontario, Canada, K9J 7B1
Email: techpubs.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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Special attention must be paid to warnings and notes highlighted from the rest of the text by grey boxes.

<table>
<thead>
<tr>
<th>In manual</th>
<th>On product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Earth (ground) Terminal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Protective Conductor Terminal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Label on product: yellow background.) WARNING: refer to accompanying documents (manual) for details.</td>
<td></td>
</tr>
</tbody>
</table>

FCC Conformity
US installations only: Federal Communications Commission (FCC) rules

WARNING: Changes or modifications not expressly approved by Siemens Milltronics 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 instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference to radio communications, in which case the user will be required to correct the interference at his own expense.

This symbol is used when there is no corresponding caution symbol on the product.
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 LR250.
- This manual applies to the SITRANS LR250 (HART) only.

This manual will help you set up your SITRANS LR250 for optimum performance. We always welcome suggestions and comments about manual content, design, and accessibility. Please direct your comments to techpubs.smpl@siemens.com.

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

Application Examples

The application examples used in this manual illustrate typical installations using SITRANS LR250 (see Appendix E: Application Examples on page 116). 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.

Technical Support

Support is available 24 hours a day.

To find your local Siemens Automation Office address, phone number and fax number go to:

www.siemens.com/automation/partner

- Click on the tab Contacts by Product then drill down to find your product group (+Process Automation > +Process Instrumentation > +Level Measuring Instruments).
- Select the team Technical Support. Click on Next.
- Click on the appropriate continent, then select the country followed by the city. Click on Next.

For on-line technical support go to:

www.siemens.com/automation/support-request

- Enter the device name (SITRANS LR250) or order number, then click on Search, and select the appropriate product type. Click on Next.
- You will be prompted to enter a keyword describing your issue. Then either browse the relevant documentation, or click on Next to email a detailed description of your issue to Siemens Technical Support staff.

Siemens A&D Technical Support Center: phone +49 180 50 50 222
fax +49 180 50 50 223+
### Abbreviations and Identifications

<table>
<thead>
<tr>
<th>Short form</th>
<th>Long Form</th>
<th>Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/D</td>
<td>Analog to digital</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CE / FM / CSA</td>
<td>Conformité Européenne / Factory Mutual / Canadian Standards Association</td>
<td>safety approval</td>
<td></td>
</tr>
<tr>
<td>Ci</td>
<td>Internal capacitance</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>D/A</td>
<td>Digital to analog</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAC</td>
<td>Digital Analog Converter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DCS</td>
<td>Distributed Control System</td>
<td>control room apparatus</td>
<td></td>
</tr>
<tr>
<td>dK</td>
<td>dielectric constant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FV</td>
<td>Full Vacuum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESD</td>
<td>Electrostatic Discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HART</td>
<td>Highway Addressable Remote Transducer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ii</td>
<td>Input current</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Io</td>
<td>Output current</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>IS</td>
<td>Intrinsically Safe</td>
<td>safety approval</td>
<td></td>
</tr>
<tr>
<td>Li</td>
<td>Internal inductance</td>
<td>mH</td>
<td></td>
</tr>
<tr>
<td>mH</td>
<td>milliHenry</td>
<td>$10^{-3}$</td>
<td>H</td>
</tr>
<tr>
<td>µF</td>
<td>microFarad</td>
<td>$10^{-6}$</td>
<td>F</td>
</tr>
<tr>
<td>µs</td>
<td>microsecond</td>
<td>$10^{-6}$</td>
<td>s</td>
</tr>
<tr>
<td>PED</td>
<td>Pressure Equipment Directive</td>
<td>safety approval</td>
<td></td>
</tr>
<tr>
<td>pF</td>
<td>pico Farads</td>
<td>$10^{-12}$</td>
<td>F</td>
</tr>
<tr>
<td>ppm</td>
<td>parts per million</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PV</td>
<td>Primary Variable</td>
<td>measured value</td>
<td></td>
</tr>
<tr>
<td>SV</td>
<td>Secondary Variable</td>
<td>equivalent value</td>
<td></td>
</tr>
<tr>
<td>TVT</td>
<td>Time Varying Threshold</td>
<td>sensitivity threshold</td>
<td></td>
</tr>
<tr>
<td>Ui</td>
<td>Input voltage</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Uo</td>
<td>Output voltage</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>
SITRANS LR250 Overview

SITRANS LR250 is a 2-wire 25 GHz pulse radar level transmitter for continuous monitoring of liquids and slurries in storage vessels including high pressure and high temperature, to a range of 20 m. (66ft). It is ideal for small vessels and low dielectric media.

The instrument consists of an electronic component coupled to a horn antenna and either a threaded or flange type process connection.

SITRANS LR250 supports HART communication protocol, and SIMATIC PDM software. Signals are processed using Process Intelligence which has been field-proven in over 500,000 applications worldwide (ultrasonic and radar).

Programming

SITRANS LR250 is very easy to install and configure via a graphical local user interface (LUI). You can modify the built-in parameters either locally via the Siemens infrared handheld programmer, or from a remote location via SIMATIC PDM.

Applications

- liquids and slurries
- bulk storage vessels
- simple process vessels

Approvals and Certificates

SITRANS LR250 is available with General Purpose approval, or for hazardous areas. For details see Approvals on page 8.

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

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

Power

- Maximum 30 V DC
- 4 to 20 mA
- Max startup current see Startup Behavior on page 115

Performance

Reference operating conditions according to IEC 60770-1
- ambient temperature +15 to +25 °C (+59 to +77 °F)
- humidity 45% to 75% relative humidity
- ambient pressure 860 to 1060 mbar g (86000 to 106000 N/m² g)

Measurement Accuracy (measured in accordance with IEC 60770-1)
- Maximum measured error = 5 mm (0.2") (including hysteresis and non-repeatability)

Frequency K-band

Max. measurement range 20 m (65.6 ft) except for 1.5" horn which has 10 m (32.8 ft)

Min. measurement range¹ 50 mm (1.97") from end of horn

¹ Minimum range is horn length + 50 mm. See Dimensions on page 10 and Flanged Horn on page 11.
Specifications

- Update time: minimum 1 second, depending on parameter settings
- Influence of ambient temperature: < 0.003%/K (average over full temperature range, referenced to maximum range)
- Dielectric constant of material measured:
  - Minimum $dK = 1.6$ (depending on antenna and application type)
- Memory:
  - non-volatile EEPROM
  - no battery required.

Interface

- Analog output:
  - signal range: 4 to 20 mA (± 0.02 mA accuracy) upper limit 20 to 23 mA adjustable
  - fail signal: 3.6 mA to 23 mA; or last value
  - load: Max. 600 Ω; for HART\(^1\) communication min. 230 Ω
- Communication: HART
  - Load: 230 to 600 Ω, 230 to 500 Ω when connecting a coupling module
  - Max. Line Length: multi-wire: ≤ 1500 m (4921 ft)
  - Protocol: HART, Version 5.1
- Configuration: Siemens SIMATIC PDM (PC), or Siemens Milltronics infrared hand-held programmer, or HART handheld communicator
- Display (local): graphic LCD, with bar graph representing level

Mechanical

- Process Connections:
  - threaded connection: 1.5" or 2" NPT (ASME 120.1), BSPT (EN 10226-1) or G (BS EN ISO 228-1)
  - flange connection: 2", 3", 4" (ANSI 150, 300#, 50, 80, 100 mm (PN16, 40, JIS 10K)
  - materials: 316 L stainless steel, optional Alloy N06022/2.4602 (C-22)

\(^1\) HART® is a registered trademark of HART Communication Foundation.

\(^2\) Display quality will be degraded in temperatures below –25 °C (–13 °F) and above +65 °C (+149 °F).
Specifications

Antenna:
- **horn**: standard 1.5’ (40mm), 2’ (50 mm), 3’ (80 mm), and 4’ (100 mm) horn, optional 100 mm (4”) horn extension
- **materials**: 316L stainless steel with PTFE emitter; optional Alloy N06022/2.4602 (C-22) with PTFE emitter

Enclosure
- **construction**: aluminum, polyester powder-coated
- **conduit entry**: 2 x M20x1.5, or 2 x ½” NPT
- **ingress protection**: Type 4X/NEMA 4X, Type 6/NEMA 6, IP 67, IP68 (see note below)

Weight
- **standard model**: < 3 kg (6.6 lb) 37.5 mm (1.5”) threaded connection with horn 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

**Notes:**
- Check Approvals on page 8, for the specific configuration you are about to use or install.
- Use appropriate conduit seals to maintain IP or NEMA rating.
## Specifications

### Process
- **temperature**: -40 to 150 °C (−40 to 302 °F)
  (at process connection with FKM O-ring)
- **pressure (vessel)**: Refer to *Process Pressure/Temperature derating curves* on page 110.

### Approvals

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>Approval Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>CSA, US/C, FM, CE</td>
<td></td>
</tr>
<tr>
<td>Radio</td>
<td>Europe (R&amp;TTE), FCC, Industry Canada</td>
<td></td>
</tr>
<tr>
<td>Hazardous</td>
<td>Intrinsically Safe (Europe)</td>
<td>ATEX II 1G, Ex ia IIC T4, ATEX II 1D, Ex tD A20 IP67 T90 °C</td>
</tr>
<tr>
<td></td>
<td>(International)</td>
<td>IECEx SIR 05.0031X, Ex ia IIC T4, Ex tD A20 IP67 T90 °C</td>
</tr>
<tr>
<td></td>
<td>(US/Canada)</td>
<td>FM/CSA: (barrier required)²</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class I, Div. 1, Groups A, B, C, D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class II, Div. 1, Groups E, F, G</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class III T4</td>
</tr>
<tr>
<td></td>
<td>Non-incendive (US/Canada)</td>
<td>FM/CSA³ Class I, Div. 2, Groups A, B, C, D T5</td>
</tr>
</tbody>
</table>

¹ The specifications apply to the standard horn 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 109, and *Process Pressure/ Temperature derating curves* on page 110.

² See *FM/CSA Intrinsically Safe connection drawing (North America only)* on page 25 for drawing number 23850853.

³ See *FM/CSA Non-incendive connection drawing (North America only)* on page 26 for drawing number 23850873.

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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
- Part Number: 7ML1930-1BK

Specifications
Dimensions

Threaded Horn Antenna with extension

Notes:
- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the Tag is available on our website at www.siemens.com/processautomation, on the product page for SITRANS LR250, under Process Connection Specifications.
- Signal amplitude increases with horn diameter, so use the largest practical size.
- Optional extensions can be installed between the flange and the antenna.
Horn dimensions

<table>
<thead>
<tr>
<th>Nominal Horn Size</th>
<th>Horn O.D.</th>
<th>Horn Height</th>
<th>Beam Width&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Measurement Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 mm (1.5&quot;)</td>
<td>39.8 mm (1.57&quot;)</td>
<td>100 mm (3.93&quot;)</td>
<td>19 degrees</td>
<td>10 m (32.8 ft)</td>
</tr>
<tr>
<td>50 mm (2&quot;)</td>
<td>47.8 mm (1.88&quot;)</td>
<td>131.5 mm (5.18&quot;)</td>
<td>15 degrees</td>
<td></td>
</tr>
<tr>
<td>80 mm (3&quot;)</td>
<td>74.8 mm (2.94&quot;)</td>
<td>164.5 mm (6.48&quot;)</td>
<td>10 degrees</td>
<td>20 m (65.6 ft)</td>
</tr>
<tr>
<td>100 mm (4&quot;)</td>
<td>94.8 mm (3.73&quot;)</td>
<td>219.5 mm (8.64&quot;)</td>
<td>8 degrees</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> – 3dB in the direction of the polarization axis (see Polarization reference point on page 17 for an illustration).

Flanged Horn

Notes:
- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the Tag is available on our website at www.siemens.com/processautomation, on the product page for SITRANS LR250, under Process Connection Specifications.
- Signal amplitude increases with horn diameter, so use the largest practical size.
- Optional extensions can be installed between the flange and the antenna.
Flange markings

The flange markings located around the outside edge of the flat-face flange identify the flange assembly on which the device is mounted. The flat-face flange identification is followed by identification of the welded assembly.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MMDDYYXXX</td>
<td>25556</td>
<td>2 150 316L/1.4404</td>
<td>DN80 16</td>
<td>316L/1.4404 or 316L/1.4435</td>
<td>A1B2C3</td>
<td>25546</td>
<td>A1B2C3</td>
</tr>
</tbody>
</table>
Specifications

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 Siemens Miltronics drawing identification.

Nominal size: the flange size followed by the hole pattern for a particular flange class. For example – a 2 inch ANSI B 16.5 150 lb class flange (North America) or – a DN 80 EN 1092-1 PN 16 class flange (Europe).

Material: the basic flange material (AISI or EU material designation). North American material codes are followed by European ones. For example, material designation 316L/1.4404.

Heat code: a flange material batch code identification.

<table>
<thead>
<tr>
<th>Flange size</th>
<th>Flange Class</th>
<th>Flange O.D.</th>
<th>Bolt Hole Circle Ø</th>
<th>Bolt Hole Ø</th>
<th>No. of Bolt Holes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2”</td>
<td>ANSI 150#</td>
<td>6.0”</td>
<td>4.75”</td>
<td>0.75”</td>
<td>4</td>
</tr>
<tr>
<td>3”</td>
<td>ANSI 150#</td>
<td>7.5”</td>
<td>6.0”</td>
<td>0.75”</td>
<td>4</td>
</tr>
<tr>
<td>4”</td>
<td>ANSI 150#</td>
<td>9.0”</td>
<td>7.50”</td>
<td>0.75”</td>
<td>8</td>
</tr>
<tr>
<td>2”</td>
<td>ANSI 300#</td>
<td>6.50”</td>
<td>5.00”</td>
<td>0.75”</td>
<td>8</td>
</tr>
<tr>
<td>3”</td>
<td>ANSI 300#</td>
<td>8.25”</td>
<td>6.62”</td>
<td>0.88”</td>
<td>8</td>
</tr>
<tr>
<td>4”</td>
<td>ANSI 300#</td>
<td>10.00”</td>
<td>7.88”</td>
<td>0.88”</td>
<td>8</td>
</tr>
<tr>
<td>DN 50</td>
<td>EN PN 16</td>
<td>165 mm</td>
<td>125 mm</td>
<td>18 mm</td>
<td>4</td>
</tr>
<tr>
<td>DN 80</td>
<td>EN PN 16</td>
<td>200 mm</td>
<td>160 mm</td>
<td>18 mm</td>
<td>8</td>
</tr>
<tr>
<td>DN 100</td>
<td>EN PN 16</td>
<td>220 mm</td>
<td>180 mm</td>
<td>18 mm</td>
<td>8</td>
</tr>
<tr>
<td>DN 50</td>
<td>EN PN 40</td>
<td>165 mm</td>
<td>125 mm</td>
<td>18 mm</td>
<td>4</td>
</tr>
<tr>
<td>DN 80</td>
<td>EN PN 40</td>
<td>200 mm</td>
<td>160 mm</td>
<td>18 mm</td>
<td>8</td>
</tr>
<tr>
<td>DN 100</td>
<td>EN PN 40</td>
<td>235 mm</td>
<td>190 mm</td>
<td>22 mm</td>
<td>8</td>
</tr>
<tr>
<td>50 mm</td>
<td>JIS 10K</td>
<td>155 mm</td>
<td>120 mm</td>
<td>19 mm</td>
<td>4</td>
</tr>
<tr>
<td>80 mm</td>
<td>JIS 10K</td>
<td>185 mm</td>
<td>150 mm</td>
<td>19 mm</td>
<td>8</td>
</tr>
<tr>
<td>100 mm</td>
<td>JIS 10K</td>
<td>210 mm</td>
<td>175 mm</td>
<td>19 mm</td>
<td>8</td>
</tr>
</tbody>
</table>

a. A 2” flange is designed to fit a 2” pipe: for actual flange dimensions see Flange O.D.
**Threaded Connection Markings**

Threaded connection markings are found on the flat face/faces of the process connection.

<table>
<thead>
<tr>
<th>Logo</th>
<th>Serial Number</th>
<th>Thread Size</th>
<th>Thread Series</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Logo" /></td>
<td>MMDDYYYYXX</td>
<td>1.5</td>
<td>NPT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BSP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>G/PF</td>
</tr>
</tbody>
</table>

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

WARNINGS:

• Installation shall only be performed by qualified personnel and in accordance with local governing regulations.
• SITRANS LR250 is to be used only in the manner outlined in this manual, otherwise protection provided by the device may be impaired.
• Never attempt to loosen, remove, or disassemble process connection or instrument housing while vessel contents are under pressure.
• This product is designated as a Pressure Accessory per Directive 97/23/EC and is not intended for use as a safety device.
• Materials of construction are chosen based on their chemical compatibility (or inertness) for general purposes. For exposure to specific environments, check with chemical compatibility charts before installing.
• The user is responsible for the selection of bolting and gasket materials which will fall within the limits of the flange and its intended use and which are suitable for the service conditions.
• Improper installation may result in loss of process pressure.

Notes:

• For European Union and member countries, installation must be according to ETSI EN 302372.
• Refer to the device nameplate for approval information.
• The Process Device Tag shall remain with the process pressure boundary assembly®. In the event the instrument package is replaced, the Process Device Tag shall be transferred to the replacement unit.
• SITRANS LR250 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 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.

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.
Mounting location

**Notes:**
- Correct location is key to a successful application.
- Avoid reflective interference from vessel walls and obstructions by following the guidelines below.

**Nozzle design**

- The end of the horn must protrude a minimum of 10 mm (0.4") to avoid false echoes being reflected from the nozzle.
- An antenna extension (100 mm/3.93") is available.

**Nozzle location**

**Notes:**
- Beam width depends on horn size: see below.
- For details on avoiding false echoes, see Auto False Echo Suppression on page 105.
- Keep emission cone free of interference from ladders, pipes, I-beams or filling streams.
- Make allowance for beam width to avoid interference with emission cone
- Avoid central locations on tall, narrow vessels.

---

**Min. clearance:** 10 mm (0.4")

**Beam width:**
- 1.5" horn = 19°
- 2" horn = 15°
- 3" horn = 10°
- 4" horn = 8°

---

Preferred

Undesirable
Nozzle location (continued)

- Provide easy access for viewing the display and programming via the hand programmer.
- Provide an environment suitable to the housing rating and materials of construction.
- Provide a sunshield if the instrument will be mounted in direct sunlight.

Orientation in a vessel with obstructions

Polarization reference point

For best results on a vessel with obstructions, or a stillpipe with openings, orient the front or back of the device toward the obstructions (see Mounting on a Stillpipe or Bypass Pipe on page 18 for an illustration.)
Mounting on a Stillpipe or Bypass Pipe

A stillpipe or bypass is used for products with a dK less than 3, or when vortex or extremely turbulent conditions exist. It can also be used to provide optimum signal conditions on foaming materials.

Stillpipe or Bypass Pipe requirements

An installation drawing number 23650689 is available on the product page of our website. Go to: www.siemens.com/LR250 and click on Downloads.

- The pipe diameter must be matched with the horn size. Use the largest horn size that will fit the stillpipe/bypass pipe (see Horn dimensions on page 11).
- Suitable pipe diameters: 40 mm (1.5") to 100 mm (4"). Not recommended: (152.4 mm/6" or 203.2 mm/8")
- One continuous length of metallic pipe is preferred, without joints. Joints: must be machined to (± 0.25 mm (± 0.010")) must have a welded connecting sleeve on the outside
- Bypass vent required at the upper end of the bypass
- Vent hole/stillpipe slot diameter/height less than 5 mm (0.19") if possible, to avoid affecting propagation.

Device orientation

Bypass Installation

- Align front or back of device with vents
- Vent hole diameter preferably < 5 mm (0.19")
- Optimum diameter 80 mm (3")

Stillpipe Installation

- Align front or back of device with stillpipe slots
- Preferably < 5 mm (0.19")

---

1. Bad joints create reflections.
2. To equalize pressure and keep the liquid level in the bypass constant with the liquid level in the vessel.
Installation Instructions

**Threaded Version**

1. Before inserting the device into its mounting connection, check to ensure the threads are matching, to avoid damaging them.
2. Simply screw the device into the process connection, and hand tighten, or use a wrench. A torque of 40 N m (30 ft.lbs) is recommended

**Flanged Version**

See Flanged Horn on page 11 and Flat Face Flange on page 12 for dimensions.
Wiring

Power

**WARNINGS:**
- The DC input terminals shall be supplied from a source providing electrical isolation between the input and output, in order to meet the applicable safety requirements of IEC 61010-1.
- All field wiring must have insulation suitable for rated voltages.

Connecting SITRANS LR250

**WARNINGS:**
- Check the nameplate on your instrument, to verify the approval rating.
- Use appropriate conduit seals to maintain IP or NEMA rating.
- Read *Instructions specific to hazardous area installations* on page 27.

**Notes:**
- Use twisted pair cable: AWG 22 to 14 (0.34 mm² to 2.5 mm²).
- Separate cables and conduits may be required to conform to standard instrumentation wiring practices or electrical codes.

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.

**Connecting HART**

**Typical PLC/ mA configuration with HART**

---

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

\(^2\) Depending on the system design, the power supply may be separate from the PLC, or integral to it.

\(^3\) Loop resistance (total of cable resistance plus 250 Ohm [resistor]) must be less than 550 Ohm for the device to function properly.
Wiring setups for hazardous area installations

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

1. Intrinsically Safe wiring

- For power demands see Loop Voltage versus Loop Resistance on page 114.
- For wiring requirements:
  - Europe/International: Follow local regulations.
  - US/Canada: Download FM/CSA Intrinsically Safe connection drawing (North America only) drawing number 23650653 from the product page of our website at: www.siemens.com/LR250 or see page 25.
- Approved dust-tight and water-tight conduit seals are required for outdoor NEMA 4X / type 4X / NEMA 6, IP67, IP68 locations. Recommended intrinsically safe barriers are listed under Passive Shunt Diode Barriers on page 23 and Active barriers (repeating barriers) on page 23.
- Refer to Instructions specific to hazardous area installations on page 27.

**Note:** Selecting a suitable PLC input module, power supply, or barrier 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.
Passive Shunt Diode Barriers

**Note:** A well regulated supply voltage is required.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTL</td>
<td>787SP+ (Dual Channel)</td>
</tr>
<tr>
<td>MTL</td>
<td>7787P+ (Dual Channel)</td>
</tr>
<tr>
<td>Stahl</td>
<td>9001/01-280-100-10 (Single Channel)</td>
</tr>
<tr>
<td>Stahl</td>
<td>9002/01-280-110-10 (Dual Channel)</td>
</tr>
</tbody>
</table>

How to select a passive barrier for SITRANS LR 250

To make sure that the barrier safety description is suitable for the LR 250 Intrinsically Safe (IS) input parameters, carry out the following calculations:

1. Determine the value for Re-e from the data sheet.
2. Calculate the total value for Rloop: by adding, for example, sense resistance, displays, and/or PLC inputs.
3. Calculate Rworking = Re-e + Rloop.
4. Determine the value of Vbarrier from the barrier data sheet (for example, voltage drops due to diodes).
5. Calculate Vworking = Vsupply – Vbarrier.

Use the values for Vworking and Rworking to confirm that operation is within the shaded area of the graph Loop Voltage versus Loop Resistance on page 114.

Active barriers (repeating barriers)

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTL</td>
<td>706</td>
</tr>
<tr>
<td>MTL</td>
<td>7206</td>
</tr>
<tr>
<td>Stahl</td>
<td>9001/51-280-110-14</td>
</tr>
<tr>
<td>Pepperl+Fuchs</td>
<td>KSD2-CiS-Ex</td>
</tr>
<tr>
<td>Pepperl+Fuchs</td>
<td>KFD2-STC3-Ex1</td>
</tr>
<tr>
<td>MTL</td>
<td>E02009 - verify</td>
</tr>
<tr>
<td>MTL</td>
<td>E02010</td>
</tr>
</tbody>
</table>
2. Non-incendive wiring (only for USA/Canada)

- For power demands see *Loop Voltage versus Loop Resistance* on page 114.
- For wiring requirements download *FM/CSA Non-incendive connection drawing (North America only)*/drawing number 23650673 from the product page of our website at: www.siemens.com/LR250, or see page 26.
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:
   \[ U_i = 30 \text{ VOLTS D.C.} \quad I_i = 120 \text{ mA} \quad P_i = 0.8 \text{W} \]
   \[ C_i = 15 \text{ nF} \quad L_i = 0.1 \text{ mH} \]

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.
### Appendix C: menu chart

**PRODUCT GROUP**

<table>
<thead>
<tr>
<th>Product Group</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONN CTLS.</td>
<td>Class I, Div. 2 (Safe) Non-Hazardous Location</td>
</tr>
<tr>
<td></td>
<td>Class I, Div. 2 Groups A, B, C, D Hazardous Location</td>
</tr>
</tbody>
</table>

**NOTES**

1. Installation shall be done in accordance with the NEC and CE part one.
2. Use approved water tight conduit fittings for outdoor applications.
3. For further information refer to the SITRANS LR 250 INSTRUCTION MANUAL.

**CONNECTION DRAWING**

- 1/2" NPT
- 24 V POWER SUPPLY
- METAL CONDUIT
- 2365067300
- 2365063700

**Drawn by:**

- S. NGUYEN
- T. LITTLE
- R. CLYSDALE

**Date:**

- 02 / NOV / 2005

**Rev:**

- 0

**Previous number:**

- 2365063700
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 06ATEX2358X

1. For use and assembly, refer to the main instructions.
2. The equipment is certified for use as Category 1GD equipment.
3. The equipment may be used with flammable gases and vapors with apparatus group IIC, IIB and IIA and temperature classes T1, T2, T3 and T4.
4. The equipment has a degree of ingress protection of IP67 and a temperature class of T90°C and may be used with flammable dusts.
5. The equipment is certified for use in an ambient temperature range of –40 °C to 80 °C.
6. The equipment has not been assessed as a safety related device (as referred to by Directive 94/9/EC Annex II, clause 1.5).
7. 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).
8. The equipment is non-repairable.
9. The certificate numbers have an 'X' suffix, which indicates that special conditions for safe use apply. Those installing or inspecting this equipment must have access to the certificates.
10. 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: for example, acidic liquids or gases that may attack metals, or solvents that may affect polymeric materials.
   - Suitable precautions: for example, establishing from the material's data sheet that it is resistant to specific chemicals.
Quick Start via local operation

SITRANS LR250 carries out its level measurement tasks according to settings made via parameters. The settings can be modified locally via the Local User Interface (LUI) which consists of an LCD display and a handheld programmer.

A Quick Start Wizard provides an easy 5-step guide to help you configure the device for a simple application. There are two ways to access the wizard:
- Quick Start Wizard via the handheld programmer on page 34
- Quick Start Wizard via SIMATIC PDM on page 38

For more complex setups see Appendix E: Application Examples on page 116, and for the complete range of parameters see Parameter Reference on page 53.

Activating SITRANS LR250

Note: Keep infrared devices such as laptops, cell phones, and PDAs, away from SITRANS LR250 to prevent inadvertent operation.

Power up the instrument. SITRANS LR250 automatically starts up in Measurement (RUN) mode. Press Mode to toggle between Measurement and Program Mode.

The LCD Display

Measurement mode (RUN mode)

Normal operation

1 – toggle indicator for linear units or %
2 – selected operation: level, space, or distance
3 – measured value (level or volume, space, or distance)
4 – units
5 – bar graph indicates level
6 – secondary region indicates on request1 electronics temperature, echo confidence, loop current, or distance
7 – text area displays status messages
8 – device status indicator

Fault present

7 – text area displays a fault code and an error message
8 – service required icon appears

1 In response to a key press request. For details, see Key functions in Measurement mode on page 30.
PROGRAM mode display

Navigation view

Parameter view

Edit view

Menu bar in navigation view

- A visible menu bar indicates the menu list is too long to display all items.
- The depth and relative position of the item band on the menu bar indicates the length of the menu list, and approximate position of the current item in the list.
- A deeper band indicates fewer items.
- A band halfway down the menu bar indicates the current item is halfway down the list.
### Handheld Programmer (Part No. 7ML1930-1BK)

The programmer is ordered separately.

![Handheld Programmer Keypad](image)

### Key functions in Measurement mode

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Updates the loop current.</td>
<td>New value is displayed in LCD secondary region.</td>
</tr>
<tr>
<td>6</td>
<td>Updates internal enclosure temperature reading.</td>
<td>New value is displayed in LCD secondary region.</td>
</tr>
<tr>
<td>8</td>
<td>Updates echo confidence value.</td>
<td>New value is displayed in LCD secondary region.</td>
</tr>
<tr>
<td></td>
<td>Updates distance measurement.</td>
<td>New value is displayed in LCD secondary region.</td>
</tr>
<tr>
<td><img src="image" alt="Mode" /></td>
<td>Mode opens PROGRAM mode.</td>
<td>Opens the menu level last displayed in this power cycle, unless power has been cycled since exiting PROGRAM mode or more than 10 minutes have elapsed since PROGRAM mode was used. Then top level menu will be displayed.</td>
</tr>
<tr>
<td><img src="image" alt="Right ARROW" /></td>
<td>Right ARROW opens PROGRAM mode.</td>
<td>Opens the top level menu.</td>
</tr>
<tr>
<td><img src="image" alt="Up or Down ARROW" /></td>
<td>Up or Down ARROW toggles between linear units and percent.</td>
<td>LCD displays measured value in either linear units or percent.</td>
</tr>
</tbody>
</table>
Programming SITRANS LR250

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

- See Operating via SIMATIC PDM on page 37 for remote operation.

Programming via the handheld programmer

Notes:
- The Quick Start wizard settings are inter-related and changes apply only after you click on Transfer at the end of step 5.
- Do not use the Quick Start wizard to modify individual parameter: see instead Parameter Reference on page 53.
- Initial Quick Start parameter values are not default values and do not necessarily reflect the current device configuration.
- SITRANS LR250 automatically returns to Measurement mode after a period of inactivity in PROGRAM mode (between 15 seconds and 10 minutes, depending on the menu level).

Parameter menus

Parameters are identified by name and organized into function groups, then arranged in a 5-level menu structure (see LCD menu structure on page 137).

Note: In Navigation mode ARROW keys move to the next menu item in the direction of the arrow.

1. QUICK START
2. SETUP
- 2.1. DEVICE
- 2.2. INPUT
  - 2.2.1. SENSOR CALIB.
  - 2.2.1.1. ANTENNA

Note: SITRANS LR250 automatically returns to Measurement mode after a period of inactivity in PROGRAM mode (between 15 seconds and 10 minutes, depending on the menu level).

1. Enter PROGRAM mode

- Point the programmer at the display (from a maximum distance of 600 mm [2 ft.]).
- Right ARROW activates PROGRAM mode and opens menu level 1.
- Mode opens the menu level last displayed in PROGRAM mode within the last 10 minutes, or menu level 1 if power has been cycled since then.
2. Navigating: key functions in Navigation mode

<table>
<thead>
<tr>
<th>Key</th>
<th>Name</th>
<th>Menu level</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔫 🔫</td>
<td>Up or Down ARROW</td>
<td>menu or parameter</td>
<td>Scroll to previous or next menu or parameter.</td>
</tr>
<tr>
<td>➩</td>
<td>Right ARROW</td>
<td>menu</td>
<td>Go to first parameter in the selected menu, or open next menu.</td>
</tr>
<tr>
<td>🍂</td>
<td>parameter</td>
<td>Open Edit mode.</td>
<td></td>
</tr>
<tr>
<td>🍁</td>
<td>Left ARROW</td>
<td>menu or parameter</td>
<td>Open parent menu.</td>
</tr>
<tr>
<td>🌟</td>
<td>Mode</td>
<td>menu or parameter</td>
<td>Change to MEASUREMENT mode.</td>
</tr>
<tr>
<td>🏡</td>
<td>Home</td>
<td>menu or parameter</td>
<td>Open top level menu: menu 1.</td>
</tr>
</tbody>
</table>

3. Editing in PROGRAM mode

Selecting a listed option

a. Navigate to the desired parameter.

b. Press Right ARROW ➩ to open parameter view.

c. Press Right ARROW ➩ again to open Edit mode. The current selection is highlighted. Scroll to a new selection.

d. Press Right ARROW ➩ to accept it. The LCD returns to parameter view and displays the new selection.

Changing a numeric value

a. Navigate to the desired parameter.

b. Press Right ARROW ➩ to open parameter view. The current value is displayed.

c. Press Right ARROW ➩ again to open Edit mode. The current value is highlighted.

d. Key in a new value.

e. Press Right ARROW ➩ to accept it. The LCD returns to parameter view and displays the new selection.
Key functions in Edit mode

<table>
<thead>
<tr>
<th>Key</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up or Down ARROW</td>
<td>Selecting options</td>
<td>Scrolls to item.</td>
</tr>
<tr>
<td>Numeric editing</td>
<td></td>
<td>- Increments or decrements digits - Toggles plus and minus sign</td>
</tr>
<tr>
<td>Right ARROW</td>
<td>Selecting options</td>
<td>- Accepts the data (writes the parameter) - Changes from Edit to Navigation mode</td>
</tr>
<tr>
<td>Numeric editing</td>
<td></td>
<td>- Moves cursor one space to the right - or with cursor on Enter sign, accepts the data and changes from Edit to Navigation mode</td>
</tr>
<tr>
<td>Left ARROW</td>
<td>Selecting options</td>
<td>Cancels Edit mode without changing the parameter</td>
</tr>
<tr>
<td>Numeric editing</td>
<td></td>
<td>- Moves cursor to plus/minus sign if this is the first key pressed - or moves cursor one space to the left.</td>
</tr>
<tr>
<td>Clear</td>
<td>Numeric editing</td>
<td>Erases the display.</td>
</tr>
<tr>
<td>Decimal point</td>
<td>Numeric editing</td>
<td>Enters a decimal point.</td>
</tr>
<tr>
<td>Plus or minus sign</td>
<td>Numeric editing</td>
<td>Changes the sign of the entered value.</td>
</tr>
<tr>
<td>0 to 9 Numerals</td>
<td>Numeric editing</td>
<td>Enters the corresponding character.</td>
</tr>
</tbody>
</table>

Requesting an Echo Profile

a. In PROGRAM mode, navigate to: LEVEL METER > DIAGNOSTICS > ECHO PROFILE (3.1)

b. Press Right ARROW to request a profile.

c. In the Profile screen, press Up ARROW to select the Transmit icon, and Right ARROW to update the profile.

d. Press Down ARROW to select the Exit icon, then Right ARROW to return to previous menu.
Quick Start Wizard via the handheld programmer

1. Quick Start
   a. Point the programmer at the display (from a maximum distance of 600 mm [2 ft.]), then press Right ARROW to activate PROGRAM mode and open menu level 1.
   b. Press Right ARROW twice to navigate to menu item 1.1 and open parameter view.
   c. Press Right ARROW to open Edit mode or Down ARROW to accept default values and move directly to the next item.
   d. To change a setting, scroll to the desired item or key in a new value.
   e. After modifying a value, press Right ARROW to accept it and press Down ARROW to move to the next item.
   f. Quick Start settings take effect only after you select Yes to Apply changes in step 1.7.

1.1. Material

<table>
<thead>
<tr>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIQUID</td>
</tr>
<tr>
<td>LIQUID LOW DK (low dielectric liquid)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Options</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLOW</td>
<td>0.1 m/minute</td>
</tr>
<tr>
<td>MED</td>
<td>1.0 m/minute</td>
</tr>
<tr>
<td>FAST</td>
<td>10.0 m/minute</td>
</tr>
</tbody>
</table>

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.

1.3. Sensor Units
Select the units for the Quick Start variables (high and low calibration point, and level, distance, or space)

<table>
<thead>
<tr>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>M, CM, MM, FT, IN</td>
</tr>
</tbody>
</table>
1.4. Operation

![Diagram of sensor with distance and calibration points]

**Operation types**

<table>
<thead>
<tr>
<th>Operation types</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO SERVICE</td>
<td>The SITRANS LR250 stops updating measurements and associated loop current. Last valid measurement is displayed.</td>
</tr>
<tr>
<td>LEVEL</td>
<td>Distance to material surface referenced from Low Calibration Point (process empty level).</td>
</tr>
<tr>
<td>SPACE</td>
<td>Distance to material surface referenced from High Calibration Point (process full level).</td>
</tr>
<tr>
<td>DISTANCE</td>
<td>Distance to material surface referenced from Sensor Reference Point.</td>
</tr>
</tbody>
</table>

**1.5. Low Calibration Point**

Distance from Sensor Reference to Low Calibration Point: usually process empty level. (See 1.4. Operation for an illustration.)

**Values**

Range: 0.0000 to 20.000 m

**1.6. High Calibration Point**

Distance from Sensor Reference to High Calibration Point: usually process full level. (See 1.4. Operation for an illustration.)

**Values**

Range: 0.0000 to 20.000 m

**1.7. Apply? (Apply changes)**

In order to save the Quick Start settings it is necessary to select Yes to apply changes.

**Options**

| YES, NO |

Display shows DONE when Quick Start is successfully completed.

Press Mode to return to Measurement mode. SITRANS LR250 is now ready to operate.

---

1. The point from which High and Low Calibration points are referenced: see Dimensions on page 10 and Flanged Horn on page 11.
**Level application example**

The application is a vessel that takes an average 3 hours to fill and 3 weeks to empty. The fill rate can be calculated as follows:

\[
\text{Fill rate} = \frac{15.5 \text{ m} - 1 \text{ m}}{180 \text{ min}} = 14.5 \text{ m}/180 \text{ min.} = 0.08 \text{ m/min.}
\]

**Auto False Echo Suppression**

If SITRANS LR250 displays a false high level, or the reading is fluctuating between the correct level and a false high level, you can use the Auto False Echo Suppression parameters to prevent false echo detection. See 2.2.5. TVT (Auto False Echo Suppression) setup for instructions.

**Quick Start Setting**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATERIAL LIQUID</td>
<td></td>
</tr>
<tr>
<td>RESPONSE RATE SLOW</td>
<td></td>
</tr>
<tr>
<td>UNITS m</td>
<td></td>
</tr>
<tr>
<td>OPERATION LEVEL</td>
<td></td>
</tr>
<tr>
<td>LOW CALIBRATION POINT 15.5 m</td>
<td></td>
</tr>
<tr>
<td>HIGH CALIBRATION POINT 1.0 m</td>
<td></td>
</tr>
<tr>
<td>APPLY? (CHANGES) YES</td>
<td></td>
</tr>
<tr>
<td>Save new settings.</td>
<td></td>
</tr>
</tbody>
</table>
Operating via SIMATIC PDM

Note: For a complete list of parameters with instructions, see Parameter Reference starting on page 53.

SIMATIC PDM is a software package used to commission and maintain SITRANS LR250 and other process devices. Please consult the operating instructions or online help for details on using SIMATIC PDM. (You can find more information at www.fielddevices.com: go to Products and Solutions > Products and Systems > Communications and Software > Process Device Manager.)

Functions in SIMATIC PDM

SIMATIC PDM monitors the process values, alarms and status signals of the device. It allows you to display, compare, adjust, verify, and simulate process device data.

For information on adjusting parameter values and viewing the results, see Changing parameter settings using SIMATIC PDM on page 46 and Parameters accessed via pull-down menus on page 46.

Features of SIMATIC PDM Rev. 6.0, SP2, HF1 (or higher)

The graphic interface in SITRANS LR 250 makes monitoring and adjustments easy.

- The graphic Quick Start Wizard provides an easy 5-step guide to help you configure the device for a simple application. See Quick Start Wizard via SIMATIC PDM on page 38 for instructions.
- See Online Display on page 47 to monitor process variables.
- See Echo profile saving on page 47 for easy echo profile comparison.
- See Trend Diagram (Level Trend over Time) on page 48 for Level trend monitoring.
- See Auto False Echo Suppression on page 48 and Manual TVT Shaper on page 50 on adjusting the TVT curve to avoid false echoes.

Device Description (DD)

Note: SITRANS LR250 requires the DD for SIMATIC PDM version 6.0 with SP2 and HF1, or higher.

You can locate the DD in Device Catalog, under Sensors/Level/Echo/Siemens Milltronics/ SITRANS LR250. Check the product page of our website at: www.siemens.com/LR250, under Downloads, to make sure you have the latest version of SIMATIC PDM, the most recent Service Pack (SP) and the most recent hot fix (HF). If you need to install a new DD see Configuring a new device on page 38.
Configuring a new device

Note: Clicking on Cancel during an upload from device to SIMATIC PDM will result in some parameters being updated.

1. Check that you have the most recent DD, and if necessary download it from the product page listed above. Save the files to your computer, and extract the zipped file to an easily accessed location. Launch SIMATIC PDM – Manager Device Catalog, browse to the unzipped DD file and select it.

2. Launch SIMATIC Manager and create a new project for LR250. Application Guides for setting up HART devices with SIMATIC PDM can be downloaded from the product page of our website at: www.siemens.com/LR250.

3. Open the Menu Device – Device Reset and click on OK to perform a reset to Factory Defaults.

4. After the reset is complete upload parameters to the PC/PG.

5. Calibrate the device.

Quick Start Wizard via SIMATIC PDM

The graphic Quick Start Wizard provides an easy 5-step guide to help you configure the device for a simple application.

Please consult the operating instructions or online help for details on using SIMATIC PDM. (Application Guides for setting up Siemens HART instruments with SIMATIC PDM are available on our website: www.siemens.com/processautomation.)

1. If you have not already done so, check that you have the most up-to-date Device Description (DD) for your instrument. (See Configuring a new device above.)

2. Launch SIMATIC Manager and create a new project for LR250. Application Guides for setting up HART and PROFIBUS PA devices with SIMATIC PDM can be downloaded from the product page of our website at: www.siemens.com/LR250.

3. Open the menu Device – Device Reset and click on OK to perform a reset to Factory Defaults.

4. After the reset is complete upload parameters to the PC/PG.

5. Calibrate the device via the Quick Start Wizard.
Quick Start Wizard steps

Notes:

- The Quick Start wizard settings are inter-related and changes apply only after you click on Transfer at the end of step 5.
- Do not use the Quick Start Wizard to modify individual parameters: see instead Parameter Reference on page 53.
- Initial Quick Start parameter values are not default values and do not necessarily reflect the current device configuration.
- Click on BACK to return and revise setting or Cancel to exit the Quick Start.

Launch SIMATIC PDM, open the menu Device – Quick Start and follow steps 1 to 5.

Step 1 – Identification

Note: The layout of the dialog boxes shown may vary according to the resolution setting for your computer monitor.

Click on NEXT to accept the default values. (Description, Message, and Installation Date fields can be left blank.)
Step 2 – Application Type

Select the application type (level or volume) and the material\(^1\), then click on NEXT.

![Application Type Diagram](image)

Step 3 – Vessel Shape

The vessel shapes shown are predefined.

To describe a more complex shape see Using Linearization via the Quick Start wizard on page 42.

Select the vessel shape, and click on NEXT.

![Vessel Shape Diagram](image)

---

\(^1\) See Application with Stillpipe on page 120 for a Low Dielectric Liquid application.
**Step 4 – Range**

Set the parameters, and click on **NEXT**.

**Step 5 – Summary**

Check parameter settings, and click on **BACK** to return and revise values, or **TRANSFER** to transfer values to the device.

The message **Quick Setup was successful** will appear. Click on **OK**, then click on **OK** again to synchronize with the device.
Using Linearization via the Quick Start wizard

You can use the linearization feature to define a more complex vessel shape and enter up to 32 level breakpoints where the corresponding volume is known. The values corresponding to 100% and 0% levels must be entered. The breakpoints can be ordered from top to bottom, or the reverse.

Example:

<table>
<thead>
<tr>
<th>Breakpoint number</th>
<th>Level value (m)</th>
<th>Volume value (l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>500</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>3000</td>
</tr>
<tr>
<td>4</td>
<td>19.5</td>
<td>8000</td>
</tr>
</tbody>
</table>

**Note:** values are for example purposes only.

Open the menu Device – Quick Start:

1. In Step 1 – Identification, press Next, to accept default values.
2. In Step 2 – Application Type, select a volume application, for example Volume in a vessel, and press Next.
3. In Step 3 – Vessel Shape, choose the vessel shape option Linearization Table and click on Linearization.
a. In the **Linearization** window click on the appropriate **Breakpoint** tab to open the dialog window.

![Linearization window](image)

b. Enter the desired level and volume values, and click on **OK**.

![Linearization values](image)

**Note:** **Reset** resets values to the values in the offline table.

c. In the **Step 3** window, click on **NEXT**.
4. In **Step 4 – Range Setup**, enter parameter values, and click on **NEXT**.

The message **Quick Setup was successful** will appear. Click on **OK**, then click on **OK** again to synchronize with the device.

5. In **Step 5 – Summary**, check parameter values. Click on **BACK** to return and revise values, or **TRANSFER** to transfer values to the device.
Configuring a stillpipe application

- Launch the Quick Start wizard and follow steps 1 to 2.
- In step 2, select Application Type – Level in a vessel with stillpipe, Material – Liquid Low dK, and set the stillpipe diameter as desired. The propagation factor is automatically updated according to the pipe diameter.

- Continue through steps 3 to 5 then click on Transfer to download settings to the device.

Calibrating LR250 via PDM

- See Quick Start Wizard via SIMATIC PDM on page 38 for configuration instructions for a simple application.
Changing parameter settings using SIMATIC PDM

**Notes:**
- For a complete list of parameters, see Parameter Reference on page 53.
- Clicking on Cancel during an upload from device to SIMATIC PDM will result in some parameters being updated.

1. Launch SIMATIC PDM, connect to SITRANS LR250, and upload data from the device.
2. Adjust parameter values in the parameter value field then press Enter. The status fields read Changed.
3. Open the Device menu, click on Download to device, then use File – Save, to save parameter settings. The status fields are cleared.

### Parameters accessed via pull-down menus

You have access to a number of functions via pull-down menus from the menu bar under Device or View.

For a complete list see Pull-down menus via SIMATIC PDM on page 53.
Online Display

To compare outputs in real time open the menu View – Display.

Echo profile saving

**Notes:**
- Double click on each axis and record the Xscale and Data Scale values, so that you can restore the default view by resetting to these values.
- You can save a profile or delete a saved profile.
- After saving a profile open menu View – Show echo profile.
**Trend Diagram (Level Trend over Time)**

**Notes:**
- Double click on each axis and record the Xscale and Data Scale values, so that you can restore the default view by resetting to these values.

Open the menu View – Trend

**Auto False Echo Suppression**

**Notes:**
- If possible adjust Auto False Echo Suppression parameters with an empty or almost empty vessel. There should be a minimum distance of 2 meters from the radar instrument to the material.
- Set Auto False Echo Suppression and Auto Suppression Range during startup, if possible.
- If the vessel contains an agitator, the agitator should be running.
- Before adjusting these parameters, rotate the instrument for best signal (lower false-echo amplitude).

SITRANS LR 250 first learns the echo profile. Then the learned profile, or part of it, is used to screen out false echoes. (See Auto False Echo Suppression on page 105 for a more detailed explanation.)
1. Determine **Auto Suppression Range** (the distance within which the learned TVT will replace the default TVT). Measure the actual distance from the antenna reference point to the material surface using a rope or tape measure, and make allowances for the actual location of the LR250. Subtract 0.5 m (20") from this distance, and use the resulting value.

2. Open the menu **Device – Auto False Echo Suppression**.

3. Enter the value for **Auto Suppression Range** and click on **Set Range**.

4. Click on **Learn**. While the new curve is being learned all buttons are inaccessible. Unless calculation is instantaneous, buttons will disappear till it is complete.

5. When buttons are visible, click on **Close**. Auto TVT is now on, and the learned TVT curve will be used.

6. To turn Auto False Echo Suppression off or on, reopen menu **Device – Auto False Echo Suppression** and click on **Off** or **On**.
Manual TVT Shaper

**Note:** Double click on each axis and record the Xscale and Data Scale values, so that you can restore the default view by resetting to these values.

This feature allows you to manually adjust the TVT curve to avoid false echoes caused by obstructions. (For an explanation see *Auto False Echo Suppression* on page 105.)

Open the menu **Device – TVT Shaper**

- Press **Measure** to refresh the echo profile and load the current TVT curve from the device.
- Change the position of the X cursor on the TVT curve using the **Point+** and **Point–** buttons: raise and lower the curve using **Offset+** and **Offset–**.
- Alternatively, enter values for **Point** and **Offset** directly into the dialog boxes.
- Press **Transfer to Device**.
Device Reset

Factory Defaults

Use Factory Defaults to reset all parameters excluding device addresses to the default settings.

1. Open the menu Device – Device Reset and click on OK to perform a reset to Factory Defaults.
2. After the reset is complete upload parameters to the PC/PG. (If you are performing a reset after replacing the device with a different instrument, do not upload parameters to the PC/PG).

Configuration Flag Reset

To reset the configuration flag to zero, open the menu Device – Configuration Flag Reset and execute a reset.

D/A (Digital/Analog) Trim

Allows you to trim the 4 mA and 20 mA points in order to calibrate the mA output.

Open the menu Device – D/A Trim. You will be prompted to attach a calibrated meter and enter the values at 4 mA and at 20 mA.

Simulate AO (Analog Output)

Allows you to input a simulated value in order to test the functioning of the mA connections during commissioning or maintenance of the device.

To simulate a user-defined mA value:

1. Open the menu Device – Simulate AO.
2. Select Other, enter the new value, and click on OK. The message ‘Field Device fixed at new value’ appears. Click on OK.
3. When you are ready to end simulation, select End and click on OK to return the device to the original output level.

Set Address

The default address for the device is 0. To reset the address via the handheld programmer see 5.1.Device Address on page 86.
Parameter Reference

Parameters are identified by name and organized into function groups. Menus arranged on up to five levels give access to associated features and options. (See LCD menu structure on page 137 for a chart.)

Parameters accessible via the handheld programmer are preceded by a number. Parameters not preceded by a number are accessible only via SIMATIC PDM.

Some parameters are accessible in SIMATIC PDM via pull-down menus. Where those parameters can also be accessed via the handheld programmer, they are found in the numbered list, and directions for SIMATIC PDM are given beside the individual parameter. Page references for further information can be found under Pull-down menus via SIMATIC PDM below.

Pull-down menus via SIMATIC PDM

<table>
<thead>
<tr>
<th>Device menus</th>
<th>View menus</th>
<th>page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication path</td>
<td>Display</td>
<td>47</td>
</tr>
<tr>
<td>Download to device</td>
<td>Identification</td>
<td>48</td>
</tr>
<tr>
<td>Upload to PC/PG</td>
<td>Trend</td>
<td>47</td>
</tr>
<tr>
<td>Update Diagnostic Status</td>
<td>Echo Profile</td>
<td>47</td>
</tr>
<tr>
<td>Quick Start</td>
<td>Show Echo Profile</td>
<td>47</td>
</tr>
<tr>
<td>Auto False Echo Suppression</td>
<td>Device Status</td>
<td>47</td>
</tr>
<tr>
<td>TVT shaper</td>
<td>Wear (powered days/poweron resets)</td>
<td>82</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Toolbar</td>
<td>-</td>
</tr>
<tr>
<td>Self test</td>
<td>Status bar</td>
<td>-</td>
</tr>
<tr>
<td>Device Reset</td>
<td>-</td>
<td>51</td>
</tr>
<tr>
<td>Configuration Flag Reset</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Select Analog Out</td>
<td>-</td>
<td>51</td>
</tr>
<tr>
<td>D/A Trim</td>
<td>-</td>
<td>51</td>
</tr>
<tr>
<td>Simulate AO</td>
<td>-</td>
<td>51</td>
</tr>
<tr>
<td>HART Communication</td>
<td>Update</td>
<td>-</td>
</tr>
</tbody>
</table>

Quick Start Wizard

The Quick Start wizard groups together all the settings you need to configure for a simple application. You can access it either via SIMATIC PDM, or via the handheld programmer.

- The Quick Start wizard is a complete package and the settings are inter-related.
- Do not use the Quick Start wizard to modify individual parameters.
- Because the settings are inter-related, the initial Quick Start parameter values are not default values.
- The initial Quick Start values do not necessarily reflect the current device configuration.
1. Quick Start

1.1. Material

<table>
<thead>
<tr>
<th>Options</th>
<th>LIQUID</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LIQUID LOW DK (low dielectric liquid)</td>
</tr>
</tbody>
</table>

1.2. Response Rate

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

<table>
<thead>
<tr>
<th>Options</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLOW</td>
<td>0.1 m/minute</td>
</tr>
<tr>
<td>MED</td>
<td>1.0 m/minute</td>
</tr>
<tr>
<td>FAST</td>
<td>10.0 m/minute</td>
</tr>
</tbody>
</table>

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.

1.3. Sensor Units

Select the units for the Quick Start variables (high and low calibration point, and level, distance, or space).

<table>
<thead>
<tr>
<th>Options</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>M, CM, MM, FT, IN</td>
<td></td>
</tr>
</tbody>
</table>

1.4. Operation

<table>
<thead>
<tr>
<th>Options</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO SERVICE</td>
<td>SITRANS LR250 stops updating measurements and associated loop current. Last valid measurement value is displayed.</td>
</tr>
<tr>
<td>LEVEL</td>
<td>Distance to material surface referenced from Low Calibration Point (process empty level).</td>
</tr>
<tr>
<td>SPACE</td>
<td>Distance to material surface referenced from High Calibration Point (process full level).</td>
</tr>
<tr>
<td>DISTANCE</td>
<td>Distance to material surface referenced from Sensor Reference Point.</td>
</tr>
</tbody>
</table>

Operation types

---

1. The point from which level measurement is referenced. For the reference point for each configuration see Dimensions on page 10 and Flanged Horn on page 11.
1.5. Low Calibration Point

*Distance from Sensor Reference to Low Calibration Point: usually process empty level. (See Operation types for an illustration.)*

| Parameters | Values | Range: 0.0000 to 20.000 m |

1.6. High Calibration Point

*Distance from Sensor Reference to High Calibration Point: usually process full level. (See Operation types for an illustration.)*

| Parameters | Values | Range: 0.0000 to 20.000 m |

When setting the High Calibration Point value, note that echoes are ignored within Near Range (2.2.1.11).

1.7. Apply? (Apply changes)

*In order to save the Quick Start settings it is necessary to select Yes and apply changes.*

| Options | YES, NO |

2. Setup

Notes:

- See Programming via the handheld programmer on page 31 or Operating via SIMATIC PDM on page 37 for instructions.
- Default settings in the parameter tables are indicated with an asterisk (*) unless explicitly stated.
- Values shown in the following tables can be entered via the handheld programmer.

2.1. Device

2.1.1. Software Revision

*Corresponds to the software or firmware that is embedded in the SITRANS LR250.*

2.1.2. Loader Revision

*Corresponds to the software used to update the SITRANS LR250.*

2.1.3. Hardware Revision

*Corresponds to the electronics hardware of the SITRANS LR250.*
2.2. Input

2.2.1. Sensor Calibration

Antenna

Factory set; not user-configurable. Identifies horn configuration and Near Range (blanking) distance is automatically adjusted to suit.

<table>
<thead>
<tr>
<th>Options (visible only via PDM)</th>
<th>Antenna</th>
<th>Available horn extensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5&quot; horn</td>
<td></td>
<td>100 mm</td>
</tr>
<tr>
<td>2&quot; horn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3&quot; horn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4&quot; horn</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Related parameters

2.2.1.1. Near Range: set to 50 mm from end of horn.

2.2.1.2. Material

Automatically configures the device to operate in the chosen application type, by changing one or more of the following parameters: 2.2.1.3. Propagation Factor, 2.2.4.1.2. Position, and/or 2.2.4.4.3. CLEF Range.

<table>
<thead>
<tr>
<th>Options</th>
<th>* LIQUID</th>
<th>LIQUID LOW DK (low dielectric liquid)</th>
</tr>
</thead>
</table>

Related parameters

2.2.1.3. Propagation Factor
2.2.4.1.2. Position
2.2.4.4.3. CLEF Range

You can configure each of the related parameters, to suit your particular application.
2.2.1.4. Sensor Units

Units the sensor is measuring in.

<table>
<thead>
<tr>
<th>Values</th>
<th>m, cm, mm, ft, in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>m</td>
</tr>
</tbody>
</table>

2.2.1.5. Operation

<table>
<thead>
<tr>
<th>Options</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO SERVICE</td>
<td>SITRANS LR250 stops updating measurements and associated loop current. Last valid measurement value is displayed.</td>
</tr>
<tr>
<td>* LEVEL</td>
<td>Distance to material surface referenced from Low Calibration Point (process empty level).</td>
</tr>
<tr>
<td>SPACE</td>
<td>Distance to material surface referenced from High Calibration Point (process full level).</td>
</tr>
<tr>
<td>DISTANCE</td>
<td>Distance to material surface referenced from Sensor Reference Point.</td>
</tr>
</tbody>
</table>

1. The point from which level measurement is referenced. For the reference point see for each configuration, see Dimensions on page 10 and Flanged Horn on page 11.
2.2.1.6. Low Calibration Pt.
Distance from Sensor Reference to Low Calibration Point (corresponding to Low Level Point). Units are defined in Sensor Units.

Values
Range: 0 to 20 m. Default 20.000 m

2.2.1.7. High Calibration Pt.
Distance from Sensor Reference to High Calibration Point (corresponding to High Level Point). Units are defined in Sensor Units. (See Operation types for an illustration.)

Values
Range: 0 to 20 m. Default 0.000 m

Related parameters
2.2.1.11. Near Range

When setting the High Calibration Point value, note that echoes are ignored within Near Range (2.2.1.11).

2.2.1.11. Near Range
The range in front of the device (measured from the sensor reference point) within which any echoes will be ignored, defined in sensor units. This is sometimes referred to as blanking or a dead zone. The factory setting is 50 mm past the end of the horn, and the range is dependent on the horn type.

<table>
<thead>
<tr>
<th>Factory Defaults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Values</td>
</tr>
<tr>
<td>Min. 1.5&quot; horn</td>
</tr>
<tr>
<td>Max. 4&quot; horn with 100 mm extension</td>
</tr>
</tbody>
</table>

1. The point from which level measurement is referenced. See Dimensions on page 10 and Flanged Horn on page 11.
2. The value produced by the echo processing which represents the distance from sensor reference point to the target.
2.2.1.12. Far Range

Allows the material level to drop below Low Calibration Point without generating a Loss of Echo (LOE) state. Unit is defined in Sensor units. See 2.2.1.6. Low Calibration Pt. for an illustration.

<table>
<thead>
<tr>
<th>Options</th>
<th>Range: Min. = Low Calibration Pt.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max. = 23 m (75.45 ft)</td>
</tr>
<tr>
<td></td>
<td>Default: Value for Low Calibration Pt. + 1 m (3.28 ft)</td>
</tr>
</tbody>
</table>

Use this feature if the measured surface can drop below the Low Cal. Point in normal operation.

2.2.1.13. Propagation Factor

Notes:
- When operating in a stillpipe, values for 2.2.4.4.3. CLEF Range, and for the propagation factor, should be set according to the pipe size. See the table below.
- For reliable results the horn size must be close to the pipe size.

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

<table>
<thead>
<tr>
<th>Nominal Pipe Size</th>
<th>40 mm (1.5&quot;)</th>
<th>50 mm (2&quot;)</th>
<th>80 mm (3&quot;)</th>
<th>100 mm (4&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propagation Factor</td>
<td>0.9628</td>
<td>0.990</td>
<td>0.991</td>
<td>0.9965</td>
</tr>
<tr>
<td>2.2.4.4.3. CLEF Range settings</td>
<td>Low Cal Pt. – 700 mm</td>
<td>Low Cal Pt. – 700 mm</td>
<td>Low Cal Pt. – 1000 mm</td>
<td>Low Cal Pt. – 1000 mm</td>
</tr>
</tbody>
</table>

a. Since pipe dimensions may vary slightly, the propagation factor may also vary.

2.2.1.19. Sensor Offset

A constant offset that can be added to Sensor value to compensate if the sensor has been changed. Units are defined in Sensor Units.

<table>
<thead>
<tr>
<th>Values</th>
<th>Default: 0 m</th>
</tr>
</thead>
</table>
### 2.2.2. Volume conversion

Carries out a volume conversion from a level value.

#### 2.2.2.1. Vessel Shape

Defines the vessel shape and allows the LR250 to calculate volume instead of level. If *None* is selected, no volume conversion is performed. Select the vessel shape matching the monitored vessel or reservoir.

<table>
<thead>
<tr>
<th>Vessel Shape</th>
<th>LCD DISPLAY/Description</th>
<th>Also required</th>
</tr>
</thead>
<tbody>
<tr>
<td>* None</td>
<td>NONE/No volume calculation required</td>
<td>N/A</td>
</tr>
<tr>
<td>CYLINDER/Flat end horizontal cylinder</td>
<td>maximum volume</td>
<td></td>
</tr>
<tr>
<td>SPHERE/Sphere</td>
<td>maximum volume</td>
<td></td>
</tr>
<tr>
<td>LINEAR/Upright, linear (flat bottom)</td>
<td>maximum volume</td>
<td></td>
</tr>
<tr>
<td>CONE/Conical or pyramidal bottom</td>
<td>maximum volume, dimension A</td>
<td></td>
</tr>
<tr>
<td>PARABOLIC BOT/Parabolic bottom</td>
<td>maximum volume, dimension A</td>
<td></td>
</tr>
<tr>
<td>HALF SPHERE/Half-sphere bottom</td>
<td>maximum volume, dimension A</td>
<td></td>
</tr>
</tbody>
</table>
### 2.2.3. Volume Breakpoints

#### 2.2.3.1. Maximum Volume

The maximum volume of the tank. Enter the vessel volume corresponding to High Calibration Point. For example, if your maximum vessel volume is 8000 L, enter a value of 8000. The units of volume are not entered, but are implied.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0.0000 to 99999</th>
<th>Default: 100.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related Parameters</td>
<td>Low Calibration Point</td>
<td>High Calibration Point</td>
</tr>
<tr>
<td></td>
<td>Vessel Shape</td>
<td></td>
</tr>
</tbody>
</table>

#### 2.2.3.2. Dimension A

The height of the vessel bottom in sensor units when the bottom is conical, pyramidal, parabolic, spherical, or flat-sloped. If the vessel is horizontal with parabolic ends, the depth of the end. See 2.2.2.1. Vessel Shape for an illustration.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0.0000 to 99999 mm</th>
<th>Default: 0.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related Parameters</td>
<td>Vessel Shape</td>
<td></td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Vessel Shape</th>
<th>LCD DISPLAY/ Description</th>
<th>Also required (cont’d) (cont’d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLAT SLOPED BOT/ Flat sloped bottom</td>
<td>maximum volume, dimension A</td>
<td></td>
</tr>
<tr>
<td>PARABOLIC ENDS/ Parabolic end horizontal cylinder</td>
<td>maximum volume, dimension A, dimension L</td>
<td></td>
</tr>
<tr>
<td>LINEAR TABLE/ Linearization table (level/volume breakpoints)</td>
<td>maximum volume, level breakpoints, volume breakpoints</td>
<td></td>
</tr>
</tbody>
</table>
2.2.3.3. Dimension L

Length of the cylindrical section of a horizontal parabolic end vessel, in sensor units. See 2.2.2.1. Vessel Shape for an illustration.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0.0000 to 99999 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 0.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Related Parameters</th>
<th>Vessel Shape</th>
</tr>
</thead>
</table>

2.2.3.4. Table 1-8

If your vessel shape is more complex than any of the preconfigured shapes, you can define the shape as a series of segments. A value is assigned to each level breakpoint and a corresponding value is assigned to each volume breakpoint. Level values are defined in sensor units. Volume units are defined by the user but are not explicitly stated in the SITRANS LR250.

<table>
<thead>
<tr>
<th>Level Values</th>
<th>Range: 0.0000 to 99999 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 0.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Volume Values</th>
<th>Range: 0.0000 to 99999</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 0.0</td>
</tr>
</tbody>
</table>

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

Breakpoints are grouped into four tables: Table 1-8, Table 9-16, Table 17-24, and Table 25-32.

Entering breakpoints via the hand-held programmer:

a. Go to the appropriate table for the particular breakpoint you wish to adjust: for example, go to Table 1-8 for breakpoint 1.
b. Under Table 1-8, go to 2.2.3.4.1. Level 1 to enter the level value for the breakpoint 1.
c. Under Table 1-8, go to 2.2.3.4.2. Vol 1 to enter the volume value for the breakpoint 1.
d. Repeat steps a to c, till values have been entered for all required breakpoints.

2.2.3.4.1. Level 1

a. Press Right ARROW to open Edit mode.
b. Enter level value and press Right ARROW to accept it.
c. Press Down ARROW to move to corresponding volume breakpoint.
2.2.3.4.2. Vol 1

a. Press Right ARROW to open Edit mode.
b. Enter volume value and press Right ARROW to accept it.
c. Press Down ARROW to move to next level breakpoint.

Example:

<table>
<thead>
<tr>
<th>Breakpoint Number</th>
<th>Level value (m)</th>
<th>Volume value (l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>500</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>3000</td>
</tr>
<tr>
<td>4</td>
<td>19.5</td>
<td>8000</td>
</tr>
</tbody>
</table>

**Note:** values are for example purposes only.

Entering breakpoints via PDM:

a. Level values are defined in Sensor Units. If you want to change the unit, go to Input > Sensor Calibration > Sensor Units and make a new selection.
b. Go to > Volume conversion and select Linearization Table option.
c. Go to > Volume breakpoints > Table 1-8 and enter values for level and volume breakpoints in table.
d. Repeat step c till values have been entered for all required breakpoints using other tables as required.

2.2.4. Echo Processing

2.2.4.1. Echo select

2.2.4.1.1. Algorithm

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

<table>
<thead>
<tr>
<th>Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>tF</td>
<td>True First echo</td>
</tr>
<tr>
<td>L</td>
<td>Largest echo</td>
</tr>
<tr>
<td>BLF</td>
<td>Best of Largest or First echo</td>
</tr>
</tbody>
</table>
2.2.4.1.2. Position

Defines where on the echo the distance measurement is determined. (See Echo Position Detection on page 105 for more detail.)

<table>
<thead>
<tr>
<th>Options</th>
<th>Related parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center</td>
<td>2.2.4.3. CLEF Range</td>
</tr>
<tr>
<td>* Hybrid (Center and CLEF)</td>
<td></td>
</tr>
<tr>
<td>CLEF (Constrained Leading Edge Fit)</td>
<td></td>
</tr>
</tbody>
</table>

If the vessel bottom is being reported as the level instead of the actual material level (at low level conditions), or if the dielectric constant of the liquid to be monitored is less than 3, we recommend setting Position to Hybrid and 2.2.4.3. CLEF Range to 0.5 m (1.64 ft).

2.2.4.1.3. Echo Threshold

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

<table>
<thead>
<tr>
<th>Values</th>
<th>Related Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range: 0 to 99</td>
<td>2.4.1. Fail-safe Timer</td>
</tr>
<tr>
<td>Default: 5</td>
<td></td>
</tr>
</tbody>
</table>

Use this feature when an incorrect material level is reported.
2.2.4.2. Sampling

Provides a method of checking the reliability of a new echo before accepting it as the valid reading, based on numbers of samples above or below the currently selected echo.

2.2.4.2.1. Echo Lock

Note: Ensure the agitator is always running while SITRANS LR250 is monitoring the vessel, to avoid stationary blade detection.

Selects the measurement verification process.

<table>
<thead>
<tr>
<th>Options</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lock Off</td>
<td>Range: 1 to 50</td>
</tr>
<tr>
<td>Maximum Verification</td>
<td>Default: 5</td>
</tr>
<tr>
<td>(not recommended for radar)</td>
<td></td>
</tr>
<tr>
<td>Material Agitator</td>
<td></td>
</tr>
<tr>
<td>Total Lock</td>
<td></td>
</tr>
<tr>
<td>(not recommended for radar)</td>
<td></td>
</tr>
</tbody>
</table>

Related parameters

2.2.7.2. Fill Rate
2.2.7.3. Empty rate
2.2.4.2.4. Sampling up
2.2.4.2.5. Sampling down
2.2.4.2.6. Window

For radar applications, Material Agitator is the most often-used setting, to avoid agitator blade detection.

2.2.4.2.4. Sampling up

Specifies the number of consecutive echoes that must appear above the echo currently selected, before the measurement is accepted as valid.

Values

| Range: 1 to 50 |
| Default: 5    |

2.2.4.2.5. Sampling down

Specifies the number of consecutive echoes that must appear below the echo currently selected, before the measurement is accepted as valid.

Values

| Range: 1 to 50 |
| Default: 2    |
2.2.4.2.6. Window

A "distance window" centered on the echo\(^1\), used to derive the reading. When a new measurement is in the window, the window is re-centered and the reading is calculated.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range: 0 to 20 m</td>
</tr>
<tr>
<td></td>
<td>Default: 0</td>
</tr>
</tbody>
</table>

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

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

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

2.2.4.3. Filtering

2.2.4.3.2. Damping Filter

The time constant for the damping filter. The damping filter smooths out the response to a sudden change in level. This is an exponential filter and the engineering unit is always in seconds. When a change occurs in the level, the reported measurement will be at 63.2% of the change in one time constant and will be at almost full change at the end of 5 time constants. See Damping on page 107 for more detail.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0 to 100.000 s</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 10.000 s</td>
</tr>
</tbody>
</table>

2.2.4.4. Tank Bottom Algorithm

2.2.4.4.3. CLEF Range

CLEF range is the level below which the CLEF setting for 2.2.4.1.2. Position will be used in preference to Hybrid.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0 to 20 m (0 to 65.6 ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 0.0 m</td>
</tr>
</tbody>
</table>

**Related parameters**

2.2.4.1.2. Position

We recommend setting 2.2.4.1.2. Position to Hybrid Algorithm and setting CLEF Range to 0.5 m (1.64 ft).

---

\(^1\) See *Echo Lock* on page 104 for more detail.
2.2.5. TVT (Auto False Echo Suppression) setup

First SITRANS LR250 learns the echo profile. Then the learned profile, or part of the learned profile, is used to screen out false echoes. See Before Auto False Echo Suppression on page 69 and After Auto False Echo Suppression on page 69 for examples.

2.2.5.1. TVT Hover Level

Defines how high the TVT (Time Varying Threshold) curve is placed above the noise floor of the echo profile, as a percentage of the difference between the peak of the largest echo in the profile and the noise floor. When SITRANS LR250 is located in the center of the vessel, the TVT hover level may be lowered to increase the confidence level of the largest echo. (For an illustration of the TVT curve see Before Auto False Echo Suppression on page 69)

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0 to 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 40%</td>
</tr>
</tbody>
</table>
2.2.5.6. Auto False Echo Suppression

Enables a 'learned' TVT curve to be used in place of the default TVT curve. (See Auto False Echo Suppression on page 105 for an explanation)

**Notes:**
- If possible adjust Auto False Echo Suppression parameters with an empty or almost empty vessel.
- Set Auto False Echo Suppression and Auto False Echo Range during startup, if possible.
- If the vessel contains an agitator, the agitator should be running.

<table>
<thead>
<tr>
<th>Options</th>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Default TVT curve will be used.</td>
<td></td>
</tr>
<tr>
<td>* ON</td>
<td>'Learned' TVT curve will be used.</td>
<td></td>
</tr>
<tr>
<td>LEARN</td>
<td>'Learn' the TVT curve.</td>
<td></td>
</tr>
</tbody>
</table>

a. Determine **Range** (the distance within which the learned TVT will replace the default TVT). Measure the actual distance from the antenna reference point to the material surface using a rope or tape measure, and make allowances for the actual location of the device.

b. Subtract 2 m (6.56 ft) from this distance, and use the resulting value.

**To use Auto False Echo Suppression via SIMATIC PDM:**

c. Open the menu **Device – Auto False Echo Suppression** and set Range. For more detail see **Auto False Echo Suppression** on page 48.

d. Select Learn. The device will automatically revert to On (Use Learned TVT) after a few seconds.

**To set Auto False Echo Suppression via the handheld programmer:**

c. Go to **2.2.5.7. Auto Suppression Range** and enter new value.

d. Press **RIGHT ARROW** to open Edit Mode

e. Select Learn. The device will automatically revert to On (Use Learned TVT) after a few seconds.

2.2.5.7. Auto Suppression Range

Defines the endpoint of the Learned TVT distance. Units are defined in sensor units.

| Values | Range: **0.00** to **20.00 m**  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: <strong>1.00 m</strong></td>
</tr>
</tbody>
</table>

a. Press **RIGHT ARROW** to open Edit mode.

b. Enter the new value and press **RIGHT ARROW** to accept it.

c. Set 2.2.5.6. Auto False Echo Suppression.
2.2.5.8. Shaper Mode

*Adjusts the TVT curve at a specified range.*

<table>
<thead>
<tr>
<th>Options</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ON</td>
</tr>
<tr>
<td>*</td>
<td>OFF</td>
</tr>
</tbody>
</table>

2.2.6. TVT shaper

*A breakpoint on the TVT curve, normalized to 0.*

2.2.6.1. Shaper 1-9

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: –50 to 50 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 0 dB</td>
</tr>
</tbody>
</table>
Parameters

2.2.6.2. Shaper 10-18

**Values**

<table>
<thead>
<tr>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>–50 to 50 dB</td>
<td>0 dB</td>
</tr>
</tbody>
</table>

2.2.6.3. Shaper 19-27

**Values**

<table>
<thead>
<tr>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>–50 to 50 dB</td>
<td>0 dB</td>
</tr>
</tbody>
</table>

2.2.6.4. Shaper 28-36

**Values**

<table>
<thead>
<tr>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>–50 to 50 dB</td>
<td>0 dB</td>
</tr>
</tbody>
</table>

2.2.6.5. Shaper 37-40

**Values**

<table>
<thead>
<tr>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>–50 to 50 dB</td>
<td>0 dB</td>
</tr>
</tbody>
</table>

2.2.7. Rate

2.2.7.1. Response Rate

**Note:** Changing Response Rate resets Fill Rate, Empty Rate, Filter Time Constant and Echo Lock.

*Sets the reaction speed of the device to measurement changes.*

<table>
<thead>
<tr>
<th>Related parameters</th>
<th>Response Rate</th>
<th>Fill Rate</th>
<th>Empty Rate</th>
<th>Filter Time Constant</th>
<th>Echo Lock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Options</td>
<td>slow</td>
<td>0.1 m/min.</td>
<td>0.1 m/min.</td>
<td>10 s</td>
<td>mat. agitator</td>
</tr>
<tr>
<td></td>
<td>medium</td>
<td>1 m/min.</td>
<td>1 m/min.</td>
<td>10 s</td>
<td>mat. agitator</td>
</tr>
<tr>
<td></td>
<td>fast</td>
<td>10 m/min.</td>
<td>10 m/min.</td>
<td>0 s</td>
<td>mat. agitator</td>
</tr>
</tbody>
</table>

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

Defines the maximum rate at which the reported sensor value is allowed to increase. Allows you to adjust the SITRANS LR250 response to increases in the actual material level. Fill Rate is automatically updated whenever Response Rate is altered.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: <strong>0 to 20 m / min.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Altered by</td>
<td>Response Rate</td>
</tr>
<tr>
<td>Related parameters</td>
<td>Sensor Units</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Options</th>
<th>Meters/Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow</td>
<td>0.1</td>
</tr>
<tr>
<td>Medium</td>
<td>1</td>
</tr>
<tr>
<td>Fast</td>
<td>10</td>
</tr>
</tbody>
</table>

2.2.7.3. Empty rate

Defines the maximum rate at which the reported sensor value is allowed to decrease. Adjusts the SITRANS LR250 response to decreases in the actual material level. Empty Rate is automatically updated whenever Response Rate is altered.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: <strong>0 to 20 m / min.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Altered by</td>
<td>Response Rate</td>
</tr>
<tr>
<td>Related</td>
<td>Sensor Units</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Options</th>
<th>Meters/Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow</td>
<td>0.1</td>
</tr>
<tr>
<td>Medium</td>
<td>1</td>
</tr>
<tr>
<td>Fast</td>
<td>10</td>
</tr>
</tbody>
</table>
2.2.8. Transducer Block (TB) Values (for diagnostic purposes)

2.2.8.2. Level Measurement
The value for level. Read Only.
In SIMATIC PDM, open the menu View – Display, and select the tab Display.

2.2.8.3. Space Measurement
The value for space. Read Only.
In SIMATIC PDM, open the menu View – Display, and select the tab Display.

2.2.8.4. Distance Measurement
The value for distance. Read Only.
In SIMATIC PDM, open the menu View – Display, and select the tab Display.

2.2.8.5. Volume Measurement
The value for volume. Read Only.
In SIMATIC PDM, open the menu View – Display, and select the tab Display.

2.3. Output

2.3.1. mA Output
2.3.1.1. mA Output Value
The loop current value in mA. Read Only except if the Manual option is chosen in mA Output function below (2.3.1.2).

<table>
<thead>
<tr>
<th>Values</th>
<th>User Entry only if Manual option is chosen in 2.3.1.2. Range: 3.6 mA to 22.6 mA</th>
</tr>
</thead>
</table>

2.3.1.2. mA Output Function
Alters the mA output/measurement function and allows the output to be set independently:

<table>
<thead>
<tr>
<th>Options</th>
<th>Manual</th>
<th>Level</th>
<th>Space</th>
<th>Distance</th>
<th>Volume</th>
</tr>
</thead>
</table>
### Notes:
- The mA Output Function is set independently from the setting in Operation. Set Operation first and then mA Output Function. (Operation resets mA Output Function to the same value.)
- The mA Output Function controls the primary value and the loop current for the SITRANS LR250. Use caution when changing the mA Output function when connected to a HART network.
- The mA Output Function also affects the secondary, tertiary and quaternary variables in a HART network.
- mA Output Function must be set to Manual before you can modify the mA Output Value (2.3.1.1). Remember to restore your previous setting after using mA Output Function.

#### 2.3.1.3. 4 mA Setpoint

Sets the process level corresponding to the 4 mA value. 4 mA always defaults to 0 and mA Output Function determines whether this is a Level, Space, Distance, or Volume measurement. Level and Space are measured as a percentage of the difference between High Calibration Point and Low Calibration Point. Distance is measured as a percentage of the Low Calibration Point.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0 to 20 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>0.00 m (set to value corresponding to 0% as defined by mA Output Function)</td>
</tr>
</tbody>
</table>

Enter the reading that is to correspond to a 4 mA output. Units are defined in Sensor units for Level, Space, or Distance. Units are unspecified for Volume.
2.3.1.4. 20 mA Setpoint

Sets the process level corresponding to the 20 mA value. 20 mA always defaults to 100%, and mA Output Function determines whether this is a Level, Space, or Distance measurement. Level and Space are measured as a percentage of the difference between High Calibration Point and Low Calibration Point. Distance is measured as a percentage of Low Calibration Point.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0 to 20 m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 20 m (set to value corresponding to 100% as defined by mA Output Function)</td>
</tr>
</tbody>
</table>

Enter the reading that is to correspond to a 20 mA output. Units are defined in Sensor units for Level, Space, or Distance. Units are unspecified for Volume.

2.3.1.5. Minimum mA limit

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

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 3.8 to 20.5 (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 3.8 (mA)</td>
</tr>
</tbody>
</table>

2.3.1.6. Maximum mA limit

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

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 3.8 to 20.5 (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 20.5 (mA)</td>
</tr>
</tbody>
</table>

2.3.1.7. 4 mA Output Trim

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

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 2.0 to 6.0 (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related parameters</td>
<td>20 mA Output Trim</td>
</tr>
</tbody>
</table>

Steps:
2. Set mA Output Value 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 4 mA Output Trim.
5. Restore mA Output Function to previous setting.
6. Confirm that the mA output is as expected.
2.3.1.8. 20 mA Output Trim

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

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Range: 18.0 to 24.0 (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related parameters</td>
<td>4 mA Output Trim</td>
</tr>
</tbody>
</table>

Steps:
2. Set mA Output Value 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 20 mA Output Trim.
5. Restore mA Output Function to previous setting.
6. Confirm that the mA output is as expected.

2.4. Fail-safe

2.4.1. Fail-safe Timer

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

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0.00 to 720 min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default: 100.0</td>
<td></td>
</tr>
</tbody>
</table>

Note: The last valid reading is maintained until the Fail-safe timer expires. After the timer expires, the reading is set based on Fail-safe Material Level (next page).

2.4.2. Fail-safe Material Level

The material level to be reported when the Fail-safe Timer expires.

<table>
<thead>
<tr>
<th>Options</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HI: Use 22.6 mA (max. mA Limit) as material level</td>
<td></td>
</tr>
<tr>
<td>LO: Use 3.6 mA (min. mA Limit) as material level</td>
<td></td>
</tr>
<tr>
<td>* HOLD: Level remains at last reading</td>
<td></td>
</tr>
<tr>
<td>VALUE: User-selected value (defined in Fail-safe Level below)</td>
<td></td>
</tr>
</tbody>
</table>

2.4.4. Fail-safe Level

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

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 3.6 mA to 22.6 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default: 22.6 mA</td>
<td></td>
</tr>
</tbody>
</table>

Note: Fail-safe Material Level must be set to VALUE to use this value.
3. Diagnostics

3.1. Echo Profile

Allows you to request the current echo profile either via the handheld programmer, or via SIMATIC PDM. (For more detail see Echo Processing on page 103.)

To request a profile via SIMATIC PDM:

a. Open the menu View – Echo Profile.
b. If desired, press Save.
c. To view the saved profile, open the menu View – Show Echo Profile.

To request a profile via the handheld programmer:

a. In PROGRAM mode, navigate to LEVEL METER > DIAGNOSTICS > ECHO PROFILE (3.1)
b. Press Right ARROW to request a profile.
c. In the Profile screen, press Up ARROW to select the Transmit icon, and Right ARROW to update the profile.
d. Press Down ARROW to select the Exit icon, then Right ARROW to return to previous menu.

3.14. Measured Values


Read Only. Displays (in degrees C) the current temperature on the circuit board recorded by the internal electronics.

3.14.2. Maximum Internal Temperature

Read Only. Displays (in degrees C) the maximum temperature recorded by the internal electronics. The high and low values are maintained over a power cycle.
3.14.3. Minimum Internal Temperature

Read Only. Displays (in degrees C) the minimum temperature recorded by the internal electronics. The high and low values are maintained over a power cycle.

3.15. Remaining Device Lifetime

**Note:** Performing a reset to Factory Defaults will reset all the Maintenance Schedule parameters to their factory defaults.

The Remaining Device/Sensor Lifetime parameters set up schedules for calibration and maintenance. The device will track itself based on operating hours, instead of a calendar-based schedule, and will monitor its predicted lifetime.

The maintenance warnings and alarms are communicated to the end user through status information. This information can be integrated into any Asset Management system. For optimal use, we recommend that you use SIMATIC PCS7 Asset Management Software in conjunction with SIMATIC PDM.

The device monitors the predicted lifetime of the device.

3.15.1. Total Device Operating Time

Read only. Displays the amount of time the device has been operating.

3.15.2. Remaining Device Lifetime

Read only. Total Expected Device Life less Total Device Operating Time.

3.15.3. Maintenance Required Limit

If the Total Expected Device Life less Total Device Operating Time is equal to or less than this limit, a Maintenance Required status is generated.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0 to 20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 0.164 years</td>
</tr>
</tbody>
</table>

In SIMATIC PDM, open the menu **Device – Maintenance**, click on **Remaining Device Lifetime**.

a) Enable **3.15.5. Maintenance Alert Activation**.

b) Modify limit values as required. Click **Write** to accept the changes.
3.15.4. Maintenance Demanded Limit

If the Total Expected Device Life less Total Device Operating Time is equal to or less than this limit, a Maintenance Demanded status is generated.

| Values                  | Range: 0 to 20 years                          | Default: 0.019 years |

In SIMATIC PDM, open the menu Device – Maintenance, click on Remaining Device Lifetime.

a) Enable 3.15.5. Maintenance Alert Activation.

b) Modify limit values as required. Click Write to accept the changes.

3.15.5. Maintenance Alert Activation

Select limits to be activated.

<table>
<thead>
<tr>
<th>Options</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warning Limit 1 (Maintenance Required Limit)</td>
<td>Warning Limit 2 (Maintenance Demanded Limit)</td>
</tr>
<tr>
<td>Warning Limits 1 and 2 (Maintenance Required and Maintenance Demanded Limits)</td>
<td>* OFF</td>
</tr>
</tbody>
</table>

To enable or disable Maintenance Alert Activation via PDM:

a) Open the menu Device – Maintenance, click on Remaining Device Lifetime.

b) Select either or both of Enable Maintenance Required Alert and Enable Maintenance Demanded Alert. Click Write to accept the changes.

3.15.6. Total Expected Device Life

The device tries to predict its overall lifetime. The factory default can be reset by the user.

| Values                  | Range: 0 to 20 years                          | Default: 10.00 years |

To modify the value via PDM, open the menu Device – Maintenance, click on Remaining Device Lifetime, enter the desired value then click Write to accept it.

3.15.7. Maintenance Status

Read only. Displays the status of the Maintenance Alerts.

<table>
<thead>
<tr>
<th>Options (view only)</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance Required Alert active</td>
<td></td>
</tr>
<tr>
<td>Maintenance Demanded Alert Active</td>
<td></td>
</tr>
</tbody>
</table>

Open the menu View – Display Status, click on the Maintenance tab and check the Device Lifetime Status window.
3.15.8. Acknowledge Status

Read only. Displays the status of the Maintenance Alerts that have been acknowledged.

<table>
<thead>
<tr>
<th>Options (view only)</th>
<th>Maintenance Required Alert acknowledged</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maintenance Demanded Alert acknowledged</td>
</tr>
</tbody>
</table>

Open the menu View – Display Status, click on the Maintenance tab and check the Device Lifetime Status window.

3.15.9. Acknowledge

Allows you to acknowledge either a Maintenance Required or a Maintenance Demanded alert.

To acknowledge an alert via PDM:

a) Open the menu View – Device Status and click on the tab Maintenance.

b) In the Device Lifetime section, click Acknowledge Warnings.

3.16. Remaining Sensor Lifetime

The device monitors the predicted lifetime of the sensor (the components exposed to the vessel environment).

3.16.1. Total Sensor Operating Time

Displays the amount of time the sensor has been operating.

Can be reset to zero via the handheld programmer (after performing a service.)

3.16.2. Remaining Sensor Lifetime

Read only. Total Expected Sensor Life less Total Sensor Operating Time.

3.16.3. Maintenance Required Limit

If the Total Expected Sensor Life less Total Sensor Operating Time is equal to or less than this limit, a Maintenance Required status is generated.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0 to 20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>0.164 years</td>
</tr>
</tbody>
</table>

To modify the value via PDM, open the menu Device – Maintenance and click on Remaining Device Lifetime.

a) Enable 3.16.5. Maintenance Alert Activation.

b) Modify limit values as required. Click Write to accept the changes.
3.16.4. Maintenance Demanded Limit

If the Total Expected Sensor Life less Total Sensor Operating Time is equal to or less than this limit, a Maintenance Demanded status is generated.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 to 20 years</td>
<td>0.019 years</td>
</tr>
</tbody>
</table>

To modify the value via PDM, open the menu Device – Maintenance and click on Remaining Device Lifetime.

a) Enable 3.16.5. Maintenance Alert Activation.

b) Modify limit values as required. Click Write to accept the changes.

3.16.5. Maintenance Alert Activation

Select limits to be activated.

<table>
<thead>
<tr>
<th>Options</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Warning Limit 1 (Maintenance Required Limit)</td>
</tr>
<tr>
<td></td>
<td>Warning Limit 2 (Maintenance Demanded Limit)</td>
</tr>
<tr>
<td></td>
<td>Warning Limits 1 and 2 (Maintenance Required and Maintenance Demanded Limits)</td>
</tr>
<tr>
<td></td>
<td>* OFF</td>
</tr>
</tbody>
</table>

To enable or disable Maintenance Alert Activation via PDM:

a) Open the menu Device – Maintenance, and click on Remaining Device Lifetime.

b) Select either or both of Enable Maintenance Required Alert and Enable Maintenance Demanded Alert. Click Write to accept the change.

3.16.6. Total Expected Sensor Life

The device tries to predict its overall lifetime. The factory default can be reset by the user.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 to 20 years</td>
<td>10.00 years</td>
</tr>
</tbody>
</table>

To modify the value via PDM, open the menu Device – Maintenance, click on Remaining Sensor Lifetime, enter the desired value then click Write.

3.16.7. Maintenance Status

Read only. Displays the status of the Maintenance Alerts.

<table>
<thead>
<tr>
<th>Options (view only)</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maintenance Required Alert active</td>
</tr>
<tr>
<td></td>
<td>Maintenance Demanded Alert Active</td>
</tr>
</tbody>
</table>

Open the menu View – Display Status, click on the Maintenance tab and check the Sensor Lifetime Status window.
3.16.8. Acknowledge Status

Read only. Displays the status of the Maintenance Alerts that have been acknowledged.

<table>
<thead>
<tr>
<th>Options (view only)</th>
<th>Maintenance Required Alert acknowledged</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maintenance Demanded Alert acknowledged</td>
</tr>
</tbody>
</table>

Open the menu View – Display Status, click on the Maintenance tab and check the Sensor Lifetime Status window.

3.16.9. Acknowledge

Allows you to acknowledge either a Maintenance Required or a Maintenance Demanded alert.

To acknowledge an alert via PDM:

a) Open the menu View – Device Status and click on the Maintenance tab.

b) In the Device Lifetime section click on Acknowledge Warning.

4. Service

4.1. Device Reset

Resets all parameter to factory defaults, with the following exceptions:

- The Lock and Unlock values are not reset.
- The learned TVT curve is not lost.

**Note:** Following a reset to factory defaults, complete reprogramming is required.

<table>
<thead>
<tr>
<th>Options</th>
<th>Idle or Done (Return to previous menu)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Factory Defaults</td>
</tr>
</tbody>
</table>

To perform a reset to factory defaults via SIMATIC PDM, open the menu Device – Device Reset and click on Factory Defaults.

4.2. Manufacture Date

The date of manufacture of the SITRANS LR250 (yy mm dd).

4.3. LCD Fast Mode

**Note:** Affects Measurement mode only: has no effect on Navigation mode.

Enables a faster rate of measurement from the device by disabling most of the display area. Only the bar graph will be refreshed when LCD Fast Mode is set to ON.

<table>
<thead>
<tr>
<th>Values</th>
<th>ON or OFF</th>
</tr>
</thead>
</table>
4.4. LCD Contrast

The factory setting is for optimum visibility at room temperature and in average light conditions. Extremes of temperature will lessen the contrast.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0 (High contrast) to 20 (Low contrast). Default: 4</th>
</tr>
</thead>
</table>

Adjust the value to improve visibility in different temperatures and luminosity

4.6. Powered Hours

Displays the number of hours the unit has been powered up since manufacture.

Open the menu View – Wear.

4.9. Power-on Resets

The number of power cycles that have occurred since manufacture.

Open the menu View – Wear.

4.11. Memory Test

Allows verification of the RAM, EEPROM, and Flash memory of the SITRANS LR250.

<table>
<thead>
<tr>
<th>LCD Display</th>
<th>IDLE</th>
<th>No test in progress.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BUSY</td>
<td>Test in progress.</td>
</tr>
<tr>
<td></td>
<td>PASS</td>
<td>Memory test successful.</td>
</tr>
<tr>
<td></td>
<td>FAIL</td>
<td>Test failed.</td>
</tr>
<tr>
<td></td>
<td>Err1</td>
<td>Test returned unexpected results.</td>
</tr>
<tr>
<td></td>
<td>P Oxcafe</td>
<td>Test passed with result data.</td>
</tr>
<tr>
<td></td>
<td>F Oxcafe</td>
<td>Test failed with result data.</td>
</tr>
</tbody>
</table>

| Handheld programmer entry | 1 to 9 | Any numeric key from 1 to 9 activates test. |

Press any numeric key from 1 to 9 to activate the test. The reading will display BUSY followed by the test result text.

4.16. Service Interval

Allows for scheduling of service inspections.

4.16.1. Time Last Serviced

Time elapsed since device was last serviced

Can be reset to zero via the handheld programmer (after performing a service.)
### 4.16.2. Remaining Lifetime

*Read only. Total Service Interval less Time Elapsed since last service.*

### 4.16.3. Maintenance Required Limit

*If the time remaining till next service is equal to or less than this limit, a Maintenance Required status is generated.*

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0 to 20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 0.164 years</td>
</tr>
</tbody>
</table>

### 4.16.4. Maintenance Demanded Limit

*If the time remaining till next service is equal to or less than this limit, a Maintenance Demanded status is generated.*

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0 to 20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 0.019 years</td>
</tr>
</tbody>
</table>

### 4.16.5. Alert Activation

*Select limits to be activated.*

<table>
<thead>
<tr>
<th>Values</th>
<th>Timer off</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On - no limits</td>
</tr>
<tr>
<td></td>
<td>On - limit 1</td>
</tr>
<tr>
<td></td>
<td>On - limits 1 and 2</td>
</tr>
<tr>
<td></td>
<td>On - limit 2</td>
</tr>
</tbody>
</table>

### 4.16.6. Service Interval

*Set time between scheduled service inspections*

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0 to 20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 1.0 year</td>
</tr>
</tbody>
</table>

### 4.16.7. Maintenance Status

*Read only. Displays the status of the Maintenance Alerts.*

<table>
<thead>
<tr>
<th>Options</th>
<th>Maintenance Required Alert active</th>
</tr>
</thead>
<tbody>
<tr>
<td>(view only)</td>
<td>Maintenance Demanded Alert Active</td>
</tr>
</tbody>
</table>

Open the menu **View – Display Status**, click on the **Maintenance** tab and check the **Service Schedule Status** window.
4.16.8. Acknowledge Status
Read only. Displays the status of the Maintenance Alerts that have been acknowledged.

<table>
<thead>
<tr>
<th>Options (view only)</th>
<th>Maintenance Required Alert acknowledged</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maintenance Demanded Alert acknowledged</td>
</tr>
</tbody>
</table>

Open the menu View – Display Status, click on the Maintenance tab and check the Service Schedule Status window.

4.16.9. Acknowledge
Allows you to acknowledge either a Maintenance Required or a Maintenance Demanded alert.

4.17. Calibration Interval
Allows for scheduling of calibrations.

4.17.1. Time Last Calibrated
Time elapsed since device was last calibrated.
Can be reset to zero via the handheld programmer (after performing a service.)

4.17.2. Remaining Lifetime
Read only. Total Calibration Interval less Time Elapsed since last calibration.

4.17.3. Maintenance Required Limit
If the time remaining till next calibration is equal to or less than this limit, a Maintenance Required status is generated.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0 to 20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 0.164 years</td>
</tr>
</tbody>
</table>

4.17.4. Maintenance Demanded Limit
If the time remaining till next calibration is equal to or less than this limit, a Maintenance Demanded status is generated.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0 to 20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 0.019 years</td>
</tr>
</tbody>
</table>
4.17.5. Alert Activation

*Select limits to be activated.*

<table>
<thead>
<tr>
<th>Values</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Timer off</td>
<td></td>
</tr>
<tr>
<td>On - no limits</td>
<td></td>
</tr>
<tr>
<td>On - limit 1</td>
<td></td>
</tr>
<tr>
<td>On - limits 1 and 2</td>
<td></td>
</tr>
<tr>
<td>On - limit 2</td>
<td></td>
</tr>
</tbody>
</table>

4.17.6. Total Calibration Interval

*Set time between scheduled calibrations.*

<table>
<thead>
<tr>
<th>Values</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>0 to 20 years</td>
</tr>
<tr>
<td>Default</td>
<td>1.0 year</td>
</tr>
</tbody>
</table>

4.17.7. Maintenance Status

*Read only. Displays the status of the Maintenance Alerts.*

<table>
<thead>
<tr>
<th>Options (view only)</th>
<th>Maintenance Required Alert active</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maintenance Demanded Alert Active</td>
</tr>
</tbody>
</table>

Open the menu View — Display Status, click on the Maintenance tab and check the Calibration Schedule Status window.

4.17.8. Acknowledge Status

*Read only. Displays the status of the Maintenance Alerts that have been acknowledged.*

<table>
<thead>
<tr>
<th>Options (view only)</th>
<th>Maintenance Required Alert acknowledged</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maintenance Demanded Alert acknowledged</td>
</tr>
</tbody>
</table>

Open the menu View — Display Status, click on the Maintenance tab and check the Calibration Schedule Status window.

4.17.9. Acknowledge

*Allows you to acknowledge either a Maintenance Required or a Maintenance Demanded alert.*
5. Communication

5.1. Device Address

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.

<table>
<thead>
<tr>
<th>Values</th>
<th>Range: 0 to 15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default: 0</td>
</tr>
</tbody>
</table>

To set the address via the handheld programmer:

- Press Right ARROW to activate PROGRAM mode and open menu level 1.
- Press Down ARROW repeatedly to navigate to COMMUNICATION (menu item 5).
- Press Right ARROW to display the parameter list.
- Scroll to DEVICE ADDRESS and press Right ARROW to open parameter view.
- Press Right ARROW to open Edit mode. Key in a new value and press Right ARROW to accept it.

5.2. Communication Control

**Note:** SITRANS LR250 can only reset this parameter via the handheld programmer.

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

<table>
<thead>
<tr>
<th>Options</th>
<th>Read Only</th>
<th>No changes are permitted via remote communications.</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Read Write</td>
<td>Changes are permitted.</td>
<td></td>
</tr>
<tr>
<td>Restricted</td>
<td>Sets the status to Read Only, with the potential for another HART device to change this via remote communications.</td>
<td></td>
</tr>
</tbody>
</table>
6. Security

6.1. Lock

**Note:** Do not lose this number value.

Prevents any changes to parameters via the hand-held programmer.

<table>
<thead>
<tr>
<th>Hand-held programmer Values</th>
<th>Range: 1 to 9999</th>
</tr>
</thead>
<tbody>
<tr>
<td>1954 (unlock value)</td>
<td>Off (enables local programming)</td>
</tr>
<tr>
<td>Any other value</td>
<td>On (disables local programming)</td>
</tr>
</tbody>
</table>

Note: This lock only applies only to the hand-held programmer: it does not lock through communications. A remote master can change configuration if 5.2 Communication Control is set to allow this.

To secure the programming lock: Key in any value other than the unlock value. Parameters are now locked and cannot be changed.

To unlock the device and enable hand-held programming changes: Key in the unlock value. Parameters are now unlocked and may be changed.

6.2. Unlock value

**Notes:**
- Default setting for 6.1 (Lock) is Unlocked.
- After a new value is stored in Unlock Value (6.2), that value will be recalled after a reset to Factory Defaults.
- Consult your Siemens Milltronics representative if you have forgotten the unlock value.

Stores the value to be entered in 6.1. Lock to unlock programming. If Lock is on, Unlock Value will not display the unlocked value.

<table>
<thead>
<tr>
<th>Hand-held programmer Values</th>
<th>Range: 1 to 9999</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory Default: 1954</td>
<td>Display when Lock is on</td>
</tr>
</tbody>
</table>

7. Language

Selects the language to be used on the LCD.

<table>
<thead>
<tr>
<th>Options</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>* English</td>
<td></td>
</tr>
<tr>
<td>German</td>
<td></td>
</tr>
<tr>
<td>French</td>
<td></td>
</tr>
<tr>
<td>Spanish</td>
<td></td>
</tr>
</tbody>
</table>
Appendix A: Alphabetical Parameter List

Note: Maintenance Parameters are not listed below. See Remaining Device Lifetime on page 77, Remaining Sensor Lifetime on page 79, Service Interval on page 82, and Calibration Interval on page 84 for those parameters.

<table>
<thead>
<tr>
<th>Parameter Name (Parameter Number)</th>
<th>Page Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mA Output Trim (2.3.1.8.)</td>
<td>75</td>
</tr>
<tr>
<td>20 mA Setpoint (2.3.1.4.)</td>
<td>74</td>
</tr>
<tr>
<td>4 mA Output Trim (2.3.1.7.)</td>
<td>74</td>
</tr>
<tr>
<td>4 mA Setpoint (2.3.1.3.)</td>
<td>73</td>
</tr>
<tr>
<td>Algorithm (2.2.4.1.1.)</td>
<td>63</td>
</tr>
<tr>
<td>Antenna ()</td>
<td>56</td>
</tr>
<tr>
<td>Auto False Echo Suppression (2.2.5.6.)</td>
<td>68</td>
</tr>
<tr>
<td>Auto Suppression Range (2.2.5.7.)</td>
<td>68</td>
</tr>
<tr>
<td>CLEF Range (2.2.4.3.)</td>
<td>66</td>
</tr>
<tr>
<td>Communication Control (5.2.)</td>
<td>86</td>
</tr>
<tr>
<td>Confidence (2.2.4.5.1.)</td>
<td>67</td>
</tr>
<tr>
<td>Current Internal Temperature (3.14.1.)</td>
<td>76</td>
</tr>
<tr>
<td>Damping Filter (2.2.4.3.2.)</td>
<td>66</td>
</tr>
<tr>
<td>Device Address (5.1.)</td>
<td>86</td>
</tr>
<tr>
<td>Device Reset (4.1.)</td>
<td>81</td>
</tr>
<tr>
<td>Dimension A (2.2.3.2.)</td>
<td>61</td>
</tr>
<tr>
<td>Dimension L (2.2.3.3.)</td>
<td>62</td>
</tr>
<tr>
<td>Distance Measurement (2.2.8.4.)</td>
<td>72</td>
</tr>
<tr>
<td>Echo Lock (2.2.4.2.1.)</td>
<td>65</td>
</tr>
<tr>
<td>Echo Profile (3.1.)</td>
<td>76</td>
</tr>
<tr>
<td>Echo Threshold (2.2.4.1.3.)</td>
<td>64</td>
</tr>
<tr>
<td>Empty rate (2.2.7.3.)</td>
<td>71</td>
</tr>
<tr>
<td>Fail-safe Level (2.4.4.)</td>
<td>75</td>
</tr>
<tr>
<td>Fail-safe Material Level (2.4.2.)</td>
<td>75</td>
</tr>
<tr>
<td>Fail-safe Timer (2.4.1.)</td>
<td>75</td>
</tr>
<tr>
<td>Far Range (2.2.1.12.)</td>
<td>59</td>
</tr>
<tr>
<td>Parameter Name (Parameter Number)</td>
<td>Page Number</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Fill Rate (2.2.7.2.)</td>
<td>71</td>
</tr>
<tr>
<td>Hardware Revision (2.1.3.)</td>
<td>55</td>
</tr>
<tr>
<td>High Calibration Pt. (2.2.1.7.)</td>
<td>58</td>
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<tr>
<td>Language (7.)</td>
<td>87</td>
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<td>82</td>
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<tr>
<td>LCD Fast Mode (4.3.)</td>
<td>81</td>
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<tr>
<td>Level Measurement (2.2.8.2.)</td>
<td>72</td>
</tr>
<tr>
<td>Loader Revision (2.1.2.)</td>
<td>55</td>
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<tr>
<td>Lock (6.1.)</td>
<td>87</td>
</tr>
<tr>
<td>Low Calibration Pt. (2.2.1.6.)</td>
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</tr>
<tr>
<td>mA Output Function (2.3.1.2.)</td>
<td>72</td>
</tr>
<tr>
<td>mA Output Value (2.3.1.1.)</td>
<td>72</td>
</tr>
<tr>
<td>Manufacture Date (4.2.)</td>
<td>81</td>
</tr>
<tr>
<td>Material (2.2.1.2.)</td>
<td>56</td>
</tr>
<tr>
<td>Maximum Internal Temperature (3.14.2.)</td>
<td>76</td>
</tr>
<tr>
<td>Maximum mA limit (2.3.1.6.)</td>
<td>74</td>
</tr>
<tr>
<td>Maximum Volume (2.2.3.1.)</td>
<td>61</td>
</tr>
<tr>
<td>Memory Test (4.11.)</td>
<td>82</td>
</tr>
<tr>
<td>Minimum Internal Temperature (3.14.3.)</td>
<td>77</td>
</tr>
<tr>
<td>Minimum mA limit (2.3.1.5.)</td>
<td>74</td>
</tr>
<tr>
<td>Near Range (2.2.1.11.)</td>
<td>58</td>
</tr>
<tr>
<td>Noise (2.2.4.5.)</td>
<td>67</td>
</tr>
<tr>
<td>Operation (2.2.1.5.)</td>
<td>57</td>
</tr>
<tr>
<td>Position (2.2.4.1.2.)</td>
<td>64</td>
</tr>
<tr>
<td>Powered Hours (4.6.)</td>
<td>82</td>
</tr>
<tr>
<td>Power-on Resets (4.9.)</td>
<td>82</td>
</tr>
<tr>
<td>Propagation Factor (2.2.1.13.)</td>
<td>59</td>
</tr>
<tr>
<td>Transducer Block (TB) Values (for diagnostic purposes)</td>
<td>72</td>
</tr>
<tr>
<td>Response Rate (2.2.7.1.)</td>
<td>70</td>
</tr>
<tr>
<td>Sensor Offset (2.2.1.9.)</td>
<td>59</td>
</tr>
<tr>
<td>Sensor Units (2.2.1.4.)</td>
<td>57</td>
</tr>
<tr>
<td>Software Revision (2.1.1.)</td>
<td>55</td>
</tr>
<tr>
<td>Space Measurement (2.2.8.3.)</td>
<td>72</td>
</tr>
<tr>
<td>Parameter Name (Parameter Number)</td>
<td>Page Number</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Strength (2.2.4.5.2.)</td>
<td>67</td>
</tr>
<tr>
<td>TVT Hover Level (2.2.5.1.)</td>
<td>67</td>
</tr>
<tr>
<td>Unlock value (6.2.)</td>
<td>87</td>
</tr>
<tr>
<td>Vessel Shape (2.2.2.1.)</td>
<td>60</td>
</tr>
<tr>
<td>Vol 1 (2.2.3.4.2.)</td>
<td>63</td>
</tr>
<tr>
<td>Volume Breakpoints (2.2.3.)</td>
<td>61</td>
</tr>
<tr>
<td>Volume Measurement (2.2.8.5.)</td>
<td>72</td>
</tr>
<tr>
<td>Window (2.2.4.2.6.)</td>
<td>66</td>
</tr>
</tbody>
</table>
Appendix B: 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 LR250, or contact your local Siemens Milltronics representative.

Specifically:

1. If you try to set a SITRANS LR250 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 [6.1] is set to the unlock value.)
   • The communications control parameter 5.2 must be set to **Read/Write** to allow you to write parameters to SITRANS LR250.

2. If you see unanticipated displays, for example:
   • PROGRAM mode displayed instead of Measurement 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 LR250. Any device with infrared capabilities (laptops, cell phones, PDAs) can cause interference which simulates a command to the SITRANS LR250, 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.
# Device Status Icons

<table>
<thead>
<tr>
<th>Icon</th>
<th>Priority Level</th>
<th>Meaning</th>
</tr>
</thead>
</table>
| ![Icon](image1) | 1 | • Maintenance alarm  
• Measurement values are not valid |
| ![Icon](image2) | 2 | • Maintenance warning: maintenance demanded immediately  
• Measured signal still valid |
| ![Icon](image3) | 3 | • Maintenance required  
• Measured signal still valid |
| ![Icon](image4) | 1 | • Process value has reached an alarm limit |
| ![Icon](image5) | 2 | • Process value has reached a warning limit |
| ![Icon](image6) | 3 | • Process value has reached a tolerance limit |
| ![Icon](image7) | 1 | • Configuration error  
• Device will not work because one or more parameters/components is incorrectly configured |
| ![Icon](image8) | 2 | • Configuration warning  
• Device can work but one or more parameters/components is incorrectly configured |
| ![Icon](image9) | 3 | • Configuration changed  
• Device parameterization not consistent with parameterization in project. Look for info text. |
| ![Icon](image10) | 1 | • Manual operation (local override)  
• Communication is good; device is in manual mode. |
| ![Icon](image11) | 2 | • Simulation or substitute value  
• Communication is good; device is in simulation mode or works with substitute values. |
| ![Icon](image12) | 3 | • Out of operation  
• Communication is good; device is out of action. |
### General Fault Codes

**Notes:**
- If more than one fault is present, the device status indicator and text for each fault alternate at 2 second intervals.
- Some faults cause the device to go to Failsafe mode (Fault 52). These are indicated with an asterisk (*).

<table>
<thead>
<tr>
<th>Code / Icon</th>
<th>Meaning</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>S: 0 *</td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td>S: 2 *</td>
<td>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.</td>
<td>Correct the power supply (resistance or voltage).</td>
</tr>
<tr>
<td>Code / Icon</td>
<td>Meaning</td>
<td>Corrective Action</td>
</tr>
<tr>
<td>-------------</td>
<td>---------</td>
<td>------------------</td>
</tr>
<tr>
<td>S: 3</td>
<td>Device is nearing its lifetime limit according to the value set in Maintenance Required Limit.</td>
<td>Replacement is recommended.</td>
</tr>
<tr>
<td>S: 4</td>
<td>Device is nearing its lifetime limit according to the value set in Maintenance Demanded Limit.</td>
<td>Replacement is recommended.</td>
</tr>
<tr>
<td>S: 6</td>
<td>Sensor is nearing its lifetime limit according to the value set in Maintenance Required Limit.</td>
<td>Replacement is recommended.</td>
</tr>
<tr>
<td>S: 7</td>
<td>Sensor is nearing its lifetime limit according to the value set in Maintenance Demanded Limit.</td>
<td>Replacement is recommended.</td>
</tr>
<tr>
<td>S: 8</td>
<td>Service interval as defined in Maintenance Required Limit has expired.</td>
<td>Perform service.</td>
</tr>
<tr>
<td>S: 9</td>
<td>Service interval as defined in Maintenance Demanded Limit has expired.</td>
<td>Perform service.</td>
</tr>
<tr>
<td>S: 11</td>
<td>Internal temperature sensor failure.</td>
<td>Repair required: contact your local Siemens representative.</td>
</tr>
<tr>
<td>S: 12</td>
<td>Internal temperature of device has exceeded specifications: it is operating outside its temperature range.</td>
<td>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.</td>
</tr>
</tbody>
</table>
### General Fault Codes (Continued)

<table>
<thead>
<tr>
<th>Code / Icon</th>
<th>Meaning</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>S: 17</td>
<td>Calibration interval as defined in Maintenance Required Limit has expired.</td>
<td>Perform calibration.</td>
</tr>
<tr>
<td>S: 18</td>
<td>Calibration interval as defined in Maintenance Demanded Limit has expired.</td>
<td>Perform calibration.</td>
</tr>
<tr>
<td>S: 28</td>
<td>Internal device failure caused by a RAM memory error.</td>
<td>Repair required: contact your local Siemens representative.</td>
</tr>
<tr>
<td>S: 29</td>
<td>EEPROM damaged.</td>
<td>Repair required: contact your local Siemens representative.</td>
</tr>
<tr>
<td>S: 31</td>
<td>Flash error.</td>
<td>Repair required: contact your local Siemens representative.</td>
</tr>
<tr>
<td>S: 33</td>
<td>Factory calibration for the internal temperature sensor has been lost.</td>
<td>Repair required: contact your local Siemens representative.</td>
</tr>
<tr>
<td>S: 34</td>
<td>Factory calibration for the device has been lost.</td>
<td>Repair required: contact your local Siemens representative.</td>
</tr>
<tr>
<td>S: 35</td>
<td>Factory calibration for the device has been lost.</td>
<td>Repair required: contact your local Siemens representative.</td>
</tr>
</tbody>
</table>
### General Fault Codes (Continued)

<table>
<thead>
<tr>
<th>Code / Icon</th>
<th>Meaning</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>S: 36</td>
<td>* Unable to start microwave module.</td>
<td>Reset power. If error persists, contact your local Siemens representative.</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Microwave" /></td>
<td></td>
</tr>
<tr>
<td>S: 37</td>
<td>* Measurement hardware problem.</td>
<td>Reset power. If error persists, contact your local Siemens representative.</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Measurement" /></td>
<td></td>
</tr>
<tr>
<td>S: 38</td>
<td>* Failure in the device electronics.</td>
<td>Reset power. If fault persists, contact your local Siemens representative: repair required.</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Device" /></td>
<td></td>
</tr>
<tr>
<td>S: 43</td>
<td>* Factory calibration for the radar receiver has been lost.</td>
<td>Repair required: contact your local Siemens representative.</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="雷達收發器" /></td>
<td></td>
</tr>
<tr>
<td>S: 44</td>
<td>* Factory calibration for the echo slope has been lost.</td>
<td>Repair required: contact your local Siemens representative.</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="斜坡" /></td>
<td></td>
</tr>
<tr>
<td>S: 45</td>
<td>* No valid boot program detected: firmware corrupt.</td>
<td>Repair required: contact your local Siemens representative.</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Boot Program" /></td>
<td></td>
</tr>
<tr>
<td>S: 48</td>
<td>* User configuration is invalid. One or more of parameters: Low Calibration Point, High Calibration Point, Volume breakpoints, and/or Auto False-Echo Suppression, are set to invalid values.</td>
<td>Reconfigure the unit. Ensure the difference between High Calibration Point and Low Calibration Point is not less than zero; check the breakpoints (only required if Volume Breakpoints is not set to 0).</td>
</tr>
<tr>
<td>Code / Icon</td>
<td>Meaning</td>
<td>Corrective Action</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>S: 49</td>
<td>* EEPROM corrupt.</td>
<td>Repair required: contact your local Siemens representative.</td>
</tr>
<tr>
<td>S: 50</td>
<td>* EEPROM corrupt.</td>
<td>Repair required: contact your local Siemens representative.</td>
</tr>
<tr>
<td>S: 51</td>
<td>* EEPROM corrupt.</td>
<td>Repair required: contact your local Siemens representative.</td>
</tr>
<tr>
<td>S: 52</td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td>S: 53</td>
<td>* Configuration lost: one or more parameter settings have been lost. This may occur after a firmware upgrade causes user parameters to be reset.</td>
<td>Restore user parameters using SIMATIC PDM.</td>
</tr>
</tbody>
</table>
## Operation Troubleshooting

Operating symptoms, probable causes, and resolutions.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Cause</th>
<th>Action</th>
</tr>
</thead>
</table>
| Display shows S: 0 LOE | level or target is out of range | • check specifications  
• check 2.2.16. Low Calibration Pt.  
• increase 2.2.4.5.1. Confidence |
| Display shows S: 0 LOE | material build-up on antenna | • clean the antenna  
• re-locate SITRANS LR250 |
| Display shows S: 0 LOE | location or aiming:  
• poor installation  
• flange not level | • check to ensure nozzle is vertical  
• use 2.2.5.6. Auto False Echo Suppression and check 2.2.5.7. Auto Suppression Range to ensure nozzle protrudes from end of nozzle. |
| Display shows S: 0 LOE | antenna malfunction:  
• temperature too high  
• physical damage  
• excessive foam  
• multiple echoes | • check 3.14.1. Current Internal Temperature  
• use foam deflector or stillpipe  
• relocate  
• use a defoamer  
• set 2.2.4.1.1. Algorithm to F (First echo) |
| Reading does not change, but the level does | SITRANS LR250 processing wrong echo, i.e. vessel wall, or structural member | • re-locate SITRANS LR250  
• check nozzle for internal burrs or welds  
• rotate instrument 90°  
• use 2.2.5.6. Auto False Echo Suppression and 2.2.5.7. Auto Suppression Range |
| Measurement is consistently off by a constant amount | • setting for 2.2.16. Low Calibration Pt. not correct  
• setting for 2.2.119. Sensor Offset not correct | • check distance from sensor reference point to 2.2.16. Low Calibration Pt.  
• check 2.2.119. Sensor Offset |
| 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 |
### Troubleshooting

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Cause</th>
<th>Action (Continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading erratic</td>
<td>echo confidence weak</td>
<td>• refer to 2.2.4.5.1. Confidence&lt;br&gt;• use 2.2.5.6. Auto False Echo Suppression and 2.2.5.7. Auto Suppression Range&lt;br&gt;• use foam deflector or stillpipe</td>
</tr>
<tr>
<td></td>
<td>liquid surface vortexed</td>
<td>• decrease 2.2.7.2. Fill Rate&lt;br&gt;• relocate instrument to side pipe&lt;br&gt;• increase confidence threshold in 2.2.4.1.3. Echo Threshold&lt;br&gt;• use foam deflector or stillpipe</td>
</tr>
<tr>
<td></td>
<td>material filling</td>
<td>• decrease 2.2.7.2. Fill Rate&lt;br&gt;• relocate instrument to side pipe&lt;br&gt;• increase confidence threshold in 2.2.4.1.3. Echo Threshold&lt;br&gt;• use foam deflector or stillpipe</td>
</tr>
<tr>
<td></td>
<td>reading response slow</td>
<td>• increase measurement response if possible&lt;br&gt;• relocate SITRANS LR250</td>
</tr>
<tr>
<td>Reads correctly but occasionally reads high when vessel is not full</td>
<td>2.2.7.2. Fill Rate setting incorrect</td>
<td>• clean the antenna&lt;br&gt;• use 2.2.5.6. Auto False Echo Suppression and 2.2.5.7. Auto Suppression Range</td>
</tr>
<tr>
<td></td>
<td>• detecting close range echo&lt;br&gt;• build up near top of vessel or nozzle&lt;br&gt;• nozzle problem</td>
<td>• clean the antenna&lt;br&gt;• use 2.2.5.6. Auto False Echo Suppression and 2.2.5.7. Auto Suppression Range</td>
</tr>
<tr>
<td>Level reading lower than material level</td>
<td>• material is within Near Range zone&lt;br&gt;• multiple echoes processed</td>
<td>• decrease 2.2.1.1. Near Range (minimum value depends on antenna type)&lt;br&gt;• raise SITRANS LR250&lt;br&gt;• ensure 2.2.4.1.1. Algorithm is set to F (First echo)&lt;br&gt;• vessel near empty and low dK material&lt;br&gt;• set 2.2.4.1.2. Position to Hybrid&lt;br&gt;• set 2.2.4.4.3. CLEF Range to 0.5 m</td>
</tr>
</tbody>
</table>
Appendix C: Maintenance

SITRANS LR250 requires no maintenance or cleaning under normal operating conditions.

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

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

Unit Repair and Excluded Liability

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

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

Principles of Operation

SITRANS LR250 is a 2-wire 25 GHz pulse radar level transmitter for continuous monitoring of liquids and 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 transit 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).

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 LR250 consists of an enclosed electronic circuit coupled to an antenna and process connection. The electronic circuit generates a radar signal (25 GHz) that is directed to the horn.

The signal is emitted from the horn, 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.

Echo Processing

Process Intelligence

The signal processing technology embedded in Siemens radar level devices is known as Process Intelligence.

Process intelligence provides high measurement reliability regardless of the dynamically changing conditions within the vessel being monitored. The embedded Process Intelligence dynamically adjusts to the constantly changing material surfaces within these vessels.

Process Intelligence is able to differentiate between the true microwave reflections from the surface of the material and unwanted reflections being returned from obstructions such as seam welds or supports within a vessel. The result is repeatable, fast and reliable measurement. This technology was developed as result of field data gained over some twenty years from more than 750,000 installations in many industries around the world.

---

1 The microwave output level is significantly less than that emitted from cellular phones.
Higher order mathematical techniques and algorithms are used to provide intelligent processing of microwave reflection profiles. This “knowledge based” technique produces superior performance and reliability.

**Time Varying Threshold (TVT) Curves**

A Time Varying Threshold (TVT) curve hovers above the echo profile to screen out unwanted reflections (false echoes).

In most cases the material echo is the only one which rises above the default TVT curve. In a vessel with obstructions a large false echo may rise above the default TVT. The Auto False Echo Suppression feature (see below) can be used to screen it out.

The device characterizes all echoes that rise above the TVT as potential good echoes. Each peak is assigned a rating based on its strength, area, height above the TVT, amongst other characteristics.

The true echo is selected based on the setting for the Echo selection algorithm (2.2.4.1.1. Algorithm). Options are true First Echo, Largest Echo, or best of Largest or First.

**Echo Lock**

If the echo selected by Algorithm is within the Echo Lock window, the window is centered about the echo, which is used to derive the measurement. In radar applications, two measurement verification options are used:

- **Lock Off:**
  SITRANS LR 250 responds immediately to a new selected echo (within the restrictions set by the Maximum Fill / Empty Rate), but measurement reliability is affected.

- **Material Agitator:**
  A new measurement outside the Echo Lock Window must meet the sampling criteria before the window will move to include it.

The other available options, Maximum Verification and Total Lock are not recommended for radar.
Echo Position Detection

The echo position algorithm (2.2.4.1.2. Position) determines which point on the echo will be used to calculate the precise time of flight, and calculates the range using the calibrated propagation velocity (adjusted by a propagation factor, if necessary).

The options are Center or CLEF (Constrained Leading Edge Fit). CLEF uses the leading edge of the echo. It can be used to compensate for materials with a low dK value, which may cause the vessel bottom to be reported as the level instead of the actual material level, in low level conditions. CLEF range is the level below which the CLEF algorithm will be used: above this level the Center algorithm is used.

Hybrid uses a combination of Center and CLEF, depending on the setting for CLEF range.

Auto False Echo Suppression

If an obstruction is causing a large echo before the material level echo, that echo will rise above the default TVT curve and may be selected as the true echo. Auto False-Echo Suppression modifies the TVT curve so that the false echo will not rise above the TVT curve.

When you use Auto False Echo Suppression, the device first learns the echo profile at that moment. A learned TVT curve follows the echo profile and rises above the false echo. You set Auto Suppression Range so that the learned profile replaces the default TVT curve up to a point past the obstruction. From that point on, the default TVT curve is used. The material level echo rises above this, and is selected as the true echo.

Example after Auto False Echo Suppression

---

1 Use Auto False Echo Suppression when the material level is substantially lower than process full level (ideally when the tank is empty or almost empty).
Measurement Range

Near Range

2.2.11. Near Range programs SITRANS LR250 to ignore the zone in front of the antenna. The default blanking distance is 50 mm (1.97”) from end of horn antenna.

Near Range allows you to increase the blanking value from its factory default. But 2.2.5.6. Auto False Echo Suppression is generally recommended in preference to extending the blanking distance from factory values.

Far Range

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.

Measurement Response

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

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

<table>
<thead>
<tr>
<th>2.2.7.2. Fill Rate</th>
<th>2.2.7.2. Fill Rate</th>
<th>2.2.4.2.1. Echo Lock</th>
<th>2.4.1. Fail-safe Timer (time in min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow</td>
<td>0.1 m/min</td>
<td>MATLAGITATOR</td>
<td>100</td>
</tr>
<tr>
<td>Medium</td>
<td>1 m/min</td>
<td>MATLAGITATOR</td>
<td>10</td>
</tr>
<tr>
<td>Fast</td>
<td>10 m/min</td>
<td>MATLAGITATOR</td>
<td>1</td>
</tr>
</tbody>
</table>
mA 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 LR250 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 Measurement 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 response rate (2.2.7.1).

If SITRANS LR250 is left in PROGRAM mode for 10 minutes without input, it automatically reverts to Measurement mode.

Damping

A damping filter smooths out the response to a sudden change in level. This is an exponential filter and the engineering unit is always in seconds. The setting can be modified in 2.2.4.3.2. Damping Filter.

Damping example

<table>
<thead>
<tr>
<th>Level (m)</th>
<th>Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>3.5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2.5</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>1.5</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

- input (level)
- smoothed output

time constant = 2 seconds
input (level) change = 2 m

In 5 time constants the output rises exponentially:
from 63.2% of the change in the first time constant, to almost 100% of the change by the end of the 5th time constant.
Loss of Echo (LOE)

A loss of echo (LOE) occurs when the calculated measurement is judged to be unreliable because the echo confidence value has dropped below the echo confidence threshold.

If the LOE condition persists beyond the time limit set in 2.4.1. Fail-safe Timer the LCD displays the Service Required icon, and the text region displays the fault code S: 0 and the text LOE.

If two faults are present at the same time, the fault code, error text, and error icon for each fault are displayed alternately. For example, Loss of Echo and Fail-safe High.

Fail-safe Mode

The purpose of the Fail-safe setting is to put the process into a safe mode of operation in the event of a fault or failure. The value to be reported in the event of a fault is selected so that a loss of power or loss of signal triggers the same response as an unsafe level.

Fail-safe Timer

Fail-safe Timer determines the time to elapse after the last valid reading before a Fail-safe state is activated. Fail-safe Material Level determines the level to be reported when the Fail-safe timer expires. Upon receiving a reliable echo, the loss of echo condition is aborted, the Service Required icon and error message are cleared, and the reading and mA output return to the current level.

Fail-safe value

When the 2.4.1. Fail-safe Timer expires, the material level to be reported is determined by 2.4.2. Fail-safe Material Level.

<table>
<thead>
<tr>
<th>Fail-safe Material Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI</td>
<td>Use Maximum mA Limit as material level</td>
</tr>
<tr>
<td>LO</td>
<td>Use Minimum mA Limit as material level</td>
</tr>
<tr>
<td>HOLD</td>
<td>Level remains at last reading</td>
</tr>
<tr>
<td>VALUE</td>
<td>User-selected value</td>
</tr>
</tbody>
</table>
Maximum Process Temperature Chart

**Note:** The chart below is for guidance only.

Where the chart does not apply, please use your own judgement regarding the use of SITRANS LR250. Parameter 3.14.1 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.

3.14.1 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 (3.14.1) to gauge the extent of change required to the installation in order to provide a reliable thermal-operating zone for the SITRANS LR250.

**WARNING:** Internal temperature must not exceed 80 °C (176 °F).
Process Pressure/Temperature derating curves

Notes:
- The Process Device Tag shall remain with the process pressure boundary assembly. In the event the instrument package is replaced, the Process Device Tag shall be transferred to the replacement unit.
- SITRANS LR 250 units are hydrostatically tested, meeting or exceeding the requirements of the ASME Boiler and Pressure Vessel Code and the European Pressure Equipment Directive.
- The serial numbers stamped in each process connection body (flange, threaded, or sanitary), provide a unique identification number indicating date of manufacture. Example: MMDDYY – XXX (where MM = month, DD = day, YY = year, and XXX = sequential unit produced)
- Further markings (space permitting) indicate flange configuration, size, pressure class, material, and material heat code.

WARNINGS:
- Never attempt to loosen, remove or disassemble process connection or instrument housing while vessel contents are under pressure.
- This product is designated as a Pressure Accessory per Directive 97/23/EC and is not intended for use as a safety device.
- Materials of construction are chosen based on their chemical compatibility (or inertness) for general purposes. For exposure to specific environments, check with chemical compatibility charts before installing.
- The user is responsible for the selection of bolting and gasket materials which will fall within the limits of the flange and its intended use and which are suitable for the service conditions.
- Improper installation may result in loss of process pressure and/or release of process fluids and/or gases.

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.
Horn Antenna or Wave Guide

1.5" and 2" Threaded Versions

- Process Connection Series:
  - 51209 or 51251 series fittings.
  - Ensure your instrument has the process identification Tag showing one of this series, and 25517 or 25555 stamped on threaded fitting.

---

2" (50 mm), 3" (80 mm) and 4" (100 mm) Flanged Versions: JIS 10 k

- Process Connection Series:
  - 51242 or 51252 series flange.
  - Ensure your instrument has the process identification Tag showing one of this series, and 25546, 25547, 25580 or 25581 stamped on flange.

---

**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" (50 mm), 3" (80 mm) and 4" (100 mm) Flanged Versions: PN16

Process Connection Series:
- 51242 or 51252 series flange.
- Ensure your instrument has the process identification tag showing one of this series, and 25546, 25547, 25580 or 25581 stamped on flange.

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

2" (50 mm), 3" (80 mm) and 4" (100 mm) Flanged Versions: PN40

Process Connection Series:
- 51242 or 51252 series flange.
- Ensure your instrument has the process identification tag showing one of this series, and 25546, 25547, 25580 or 25581 stamped on flange.

WARNING: Never attempt to loosen, remove or disassemble process connection or instrument housing while vessel contents are under pressure.
2" (50 mm), 3" (80 mm) and 4" (100 mm) Flanged Versions: 150 lb

Process Connection Series:
- 51242 or 51252 series flange.
- Ensure your instrument has the process identification Tag showing one of this series, and 25546, 25547, 25580 or 25581 stamped on flange.

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

2" (50 mm), 3" (80 mm) and 4" (100 mm) Flanged Versions: 300 lb

Process Connection Series:
- 51242 or 51252 series flange.
- Ensure your instrument has the process identification Tag showing one of this series, and 25546, 25547, 25580 or 25581 stamped on flange.

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

![Typical Connection Drawing](image)

Allowable operating area of SITRANS LR250

Loop Voltage versus Loop Resistance

![Loop Voltage versus Loop Resistance](image)
Startup Behavior

Notes:
• SITRANS LR250 is designed to start reliably with a power supply capable of delivering at least 25 mA.
• When connected to a power supply with a current limit of < 25 mA, the LR250 may not start reliably.

Typical Startup Current
## Appendix E: Application Examples

**Note:** In the applications illustrated below, values are for example purposes only.

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

Configure the basic settings using the Quick Start wizard parameters. (These parameters are inter-related, and changes take effect only after you select **YES** in step 7 to apply changes.)

In each example, after performing a Quick Start, navigate to the other required parameters (either via the handheld programmer, or via SIMATIC PDM) and enter the appropriate values.

### Liquid resin in storage vessel, level measurement

**Note:** Minimum distance from flange face to target is limited by 2.2.11. *Near Range.*

To obtain level measurement/4 to 20 mA output proportional to resin levels:

- Low Calibration Pt. = vessel bottom
- High Calibration Pt. = 0.5 m from sensor reference point.
- Max.fill/empty rate = 0.2 m/min.

In the event of a loss of echo:

SITRANS LR250 is to go into Fail-safe High after 2 minutes.

<table>
<thead>
<tr>
<th>Parameter type</th>
<th>Parameter No. and Name</th>
<th>Options/Values</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quick Start Wizard</td>
<td>1.1. Material</td>
<td>LIQUID</td>
<td></td>
</tr>
<tr>
<td>parameters</td>
<td>1.2. Response Rate</td>
<td>MED</td>
<td>Medium =1 m/minute</td>
</tr>
<tr>
<td>1.3. Sensor Units</td>
<td>M</td>
<td>meters</td>
<td></td>
</tr>
<tr>
<td>1.4. Operation</td>
<td>LEVEL</td>
<td>Level</td>
<td></td>
</tr>
<tr>
<td>1.5. Low Calibration Pt.</td>
<td>S</td>
<td>5 m</td>
<td></td>
</tr>
<tr>
<td>1.6. High Calibration Pt.</td>
<td>0.5</td>
<td>0.5 m</td>
<td></td>
</tr>
</tbody>
</table>
| 1.7. Apply? (Apply changes) | YES                         | Transfers Quick Start settings to device.
<table>
<thead>
<tr>
<th>Parameter type</th>
<th>Parameter No. and Name</th>
<th>Options/Values</th>
<th>Function (cont’d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent parameters</td>
<td>2.4.1. Fail-safe Timer</td>
<td>2</td>
<td>2 minutes</td>
</tr>
<tr>
<td></td>
<td>2.4.2. Fail-safe Material Level</td>
<td>HI</td>
<td>Failsafe level set to High</td>
</tr>
</tbody>
</table>

Return to Measurement: press Mode \( \text{Mode} \) to start normal operation.
Horizontal vessel with volume measurement

**Note:** The minimum distance from the flange face to the target is limited by 2.2.11. Near Range.

To obtain level measurement/4 to 20 mA output proportional to vessel volume in a chemical vessel:

- Low Calibration Point = vessel bottom (3.5 m from sensor ref. point)
- High Calibration Point = 0.5 m from sensor reference point.
- Max. fill/empty rate = 0.2 m/min.

Select vessel shape, Parabolic Ends, and enter values for A and L, to obtain a volume reading instead of level.

In the event of a loss of echo: SITRANS LR250 is to go into Fail-safe High after 2 minutes.

<table>
<thead>
<tr>
<th>Parameter type</th>
<th>Parameter No./Name</th>
<th>Options/Values</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quick Start Wizard parameters</td>
<td>1.1. Material</td>
<td>LIQUID</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.2. Response Rate</td>
<td>MED</td>
<td>Medium =1 m/minute</td>
</tr>
<tr>
<td></td>
<td>1.3. Sensor Units</td>
<td>M</td>
<td>meters</td>
</tr>
<tr>
<td></td>
<td>1.4. Operation</td>
<td>LEVEL</td>
<td>Level is reported as Volume when a vessel shape is selected.</td>
</tr>
<tr>
<td></td>
<td>1.5. Low Calibration Point</td>
<td>3.5</td>
<td>3.5 m</td>
</tr>
<tr>
<td></td>
<td>1.6. High Calibration Point</td>
<td>0.5</td>
<td>0.5 m</td>
</tr>
<tr>
<td></td>
<td>1.7. Apply? (Apply changes)</td>
<td>YES</td>
<td>Transfers Quick Start settings to device.</td>
</tr>
<tr>
<td>Parameter type</td>
<td>Parameter No./ Name</td>
<td>Options/Values</td>
<td>Function (cont’d)</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------</td>
<td>------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Independent parameters</td>
<td>2.2.2.1. Vessel Shape</td>
<td>Parabolic Ends (PDM) LINEAR (handheld)</td>
<td>Defines vessel shape.</td>
</tr>
<tr>
<td></td>
<td>2.2.3.1. Maximum Volume</td>
<td>8000</td>
<td>8000 liters</td>
</tr>
<tr>
<td></td>
<td>2.2.3.2. Dimension A</td>
<td>0.8</td>
<td>0.8 m</td>
</tr>
<tr>
<td></td>
<td>2.2.3.3. Dimension L</td>
<td>6</td>
<td>6 m</td>
</tr>
<tr>
<td></td>
<td>2.4.1. Fail-safe Timer</td>
<td>2</td>
<td>2 minutes</td>
</tr>
<tr>
<td></td>
<td>2.4.2. Fail-safe Material Level</td>
<td>HI</td>
<td>Failsafe level set to High</td>
</tr>
</tbody>
</table>

Return to Measurement: press Mode to start normal operation.
Application with Stillpipe

A stillpipe is recommended for products with a dK 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:
- 2.2.11. Near Range (Blanking) will be set at the factory. Check the Process Device Tag for specific values.
- Suitable pipe diameters are 40 mm (1.5”) to 100 mm (4”).
- The pipe diameter must be matched with the horn size. Use the largest horn size that will fit the stillpipe/bypass pipe (see Horn dimensions on page 11).
- See Mounting on a Stillpipe or Bypass Pipe on page 18 for installation guidelines.

This application is to obtain a level measurement and corresponding 4 to 20 mA output proportional to the oil level in a fuel storage vessel.

- Low Calibration Pt. is 5 m (16.5 ft) from the sensor reference point.
- High Calibration Pt. is 0.5 m (1.65 ft) from the sensor reference point.
- The stillpipe inside diameter is 50 mm (1.96”).
- The maximum rate of filling or emptying is about 0.1 m (4”)/min.

<table>
<thead>
<tr>
<th>Parameter type</th>
<th>Parameter</th>
<th>Options/Values</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quick Start Wizard</td>
<td>1.1. Material</td>
<td>LIQUID LOW DK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.2. Response Rate</td>
<td>MED</td>
<td>Medium =1 m/minute</td>
</tr>
<tr>
<td></td>
<td>1.3. Sensor Units</td>
<td>M</td>
<td>meters</td>
</tr>
<tr>
<td></td>
<td>1.4. Operation</td>
<td>LEVEL</td>
<td>Level is reported as Volume when a vessel shape is selected.</td>
</tr>
<tr>
<td></td>
<td>1.5. Low Calibration Point</td>
<td>5</td>
<td>5 m</td>
</tr>
<tr>
<td></td>
<td>1.6. High Calibration Point</td>
<td>0.5</td>
<td>0.5 m</td>
</tr>
<tr>
<td></td>
<td>1.7. Apply? (Apply changes)</td>
<td>YES</td>
<td>Transfers Quick Start settings to device.</td>
</tr>
</tbody>
</table>
2.2.1.13. Propagation Factor

<table>
<thead>
<tr>
<th>Nominal Pipe Size a</th>
<th>40 mm (1.5&quot;)</th>
<th>50 mm (2&quot;)</th>
<th>80 mm (3&quot;)</th>
<th>100 mm (4&quot;)</th>
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</thead>
<tbody>
<tr>
<td>Propagation Factor</td>
<td>0.9828</td>
<td>0.990</td>
<td>0.991</td>
<td>0.9965</td>
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</table>

2.2.4.4.3. CLEF Range

<table>
<thead>
<tr>
<th>Low Cal Pt. – 700 mm</th>
<th>Low Cal Pt. – 700 mm</th>
<th>Low Cal Pt. – 1000 mm</th>
<th>Low Cal Pt. – 1000 mm</th>
</tr>
</thead>
</table>

a. Since pipe dimensions may vary slightly, the propagation factor may also vary.
Appendix F: 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 LR250 can be configured over the HART network using either the HART Communicator 375 by Fisher-Rosemount, or a software package. The recommended software package is the SIMATIC Process Device Manager (PDM) by Siemens.

SIMATIC PDM

This software package is designed to permit easy configuration, monitoring, and troubleshooting of HART devices. The HART DD for SITRANS LR250 was written with SIMATIC PDM in mind and has been extensively tested with this software.

For more information, see Operating via SIMATIC PDM on page 37.

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 LR250. Older versions of the library will have to be updated in order to use all the features of SITRANS LR250.
HART Communicator 375 Menu Structure

**Note:** HART Communicator 375 is supported by SITRANS LR250 HART. The menu structure is aligned with the menu structure of SIMATIC PDM.

**QUICK START**
- MATERIAL
- RESPONSE RATE
- SENSOR UNITS
- OPERATION
- LOW CALIB. PT.
- HIGH CALIB. PT.
- APPLY?

**SETUP**
- DEVICE
  - SOFTWARE REV
  - LOADER REV
  - HARDWARE REV
- INPUT
  - SENSOR CALIB.
    - MATERIAL
    - SENSOR UNITS
    - OPERATION
    - LOW CALIB. PT.
    - HIGH CALIB. PT.
    - NEAR RANGE
    - FAR RANGE
    - PROPAG. FACTOR
    - SENSOR OFFSET
  - VOL CONVERSION
    - VESSEL SHAPE
  - VOLUME BREAKPT
    - MAX. VOLUME
    - DIMENSION A
    - DIMENSION L
    - TABLE 1 – 8 (Lev./Vol. Breakpoints 1-8)
    - TABLE 9 – 16 (Lev./Vol. Breakpoints 9-16)
    - TABLE 17 – 24 (Lev./Vol. Breakpoints 17-24)
    - TABLE 25 – 32 (Lev./Vol. Breakpoints 25-32)
- ECHO PROC.
  - ECHO SELECT
    - ALGORITHM
    - POSITION
    - ECHO THRESHOLD
  - SAMPLING
    - ECHO LOCK
    - UP SAMP.
    - DOWN SAMP.
    - WINDOW
  - FILTERING
    - DAMPING FILTER
  - TANK BOTTOM ALG
    - CLEF RANGE

Note: HART Communicator 375 is supported by SITRANS LR250 HART. The menu structure is aligned with the menu structure of SIMATIC PDM.
ECHO PROC (continued)

NOISE
CONFIDENCE
STRENGTH
NOISE AVERAGE

TVT SETUP
TVT HOVER LEVEL
AUTO ECHO SUPP
AUTO SUPP RANGE
SHAPER MODE

TVT SHAPER
SHAPER 1-9 (Shaper Points 1-9)
SHAPER 10-18 (Shaper Points 10-18)
SHAPER 19-27 (Shaper Points 19-27)
SHAPER 28-36 (Shaper Points 28-36)
SHAPER 37-40 (Shaper Points 37-40)

RATE
RESPONSE RATE
FILL RATE/min
EMPTY RATE/min

TB VALUES
READING MEAS.
LEVEL MEAS.
SPACE MEAS.
DISTANCE MEAS.
VOLUME MEAS.

OUTPUT
MA OUTPUT
MA OUTPUT VALUE
MA OUTPUT FUNC.
4 MA SETPOINT
20 MA SETPOINT
MIN. MA LIMIT
MAX. MA LIMIT
4 MA OUTPUT TRIM
20 MA OUTPUT TRIM

FAIL-SAFE
FAILSAFE TIMER
FAILSAFE MAT. LEVEL
FAILSAFE LEVEL

DIAGNOSTICS
ECHO PROFILE
MEAS. VALUES
CURR. INTERN. TEMP.
MAX. INTERN. TEMP.
MIN. INTERN TEMP.
REMAIN. DEV. LIFE
TOTAL OP--TIME
REMAIN. LIFETIME
MAINT REQ LIMIT
MAINT DEM LIMIT
ALERT ACTIVATION
TOTAL EXP. LIFE
REMAIN. DEV. LIFE (continued)
  MAINT STAT
  ACK STATUS
  ACK
REMAIN. SENS. LIFE
  SENS OP--TIME
  REMAIN. LIFETIME
  MAINT REQ LIMIT
  MAINT DEM LIMIT
  ALERT ACTIVATION
  TOTAL EXP. LIFE
  MAINT STAT
  ACK STATUS
  ACK

SERVICE
  DEVICE RESET
  MANUF. DATE
  LCD FAST MODE
  LCD CONTRAST
  POWERED HOURS
  POWERON RESETS
  MEM. TEST
  SERVICE INTERVAL
    TIME LAST SERV
    REMAIN LIFETIME
    MAINT REQ LIMIT
    MAINT DEM LIMIT
    ALERT ACTIVATION
    SERVICE INTERVAL
    MAINT STAT
    ACK STATUS
    ACK
CALIB. INTERVAL
  TIME LAST CAL.
  REMAIN LIFETIME
  MAINT REQ LIMIT
  MAINT DEM LIMIT
  ALERT ACTIVATION
  TOTAL CALIB.INTERVAL
  MAINT STAT
  ACK STATUS
  ACK

COMMUNICATION
  DEVICE ADDRESS
  COMM. CONTROL

SECURITY
  LOCK
  UNLOCK VALUE

LANGUAGE
Supported HART Commands

SITRANS LR 250 conforms to HART rev. 5 and supports the following:

Universal Commands
0, 1, 2, 3, 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

Device Specific Commands
Command 150  Read Echo Summary
Command 151  Read Echo Data Profile
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 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 178  Read Analog Special
Command 179  Write Analog Special
Command 182  Read Range Calibration
Command 183  Write Range Calibration
Command 186  Read Wear
Command 206  Read Confidence
Command 207  Write Confidence Threshold
Command 208  Read Local Display Commands
Command 209  Write Local Display Commands

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 G: Software Revision History

<table>
<thead>
<tr>
<th>Software Rev.</th>
<th>DD Rev.</th>
<th>Date</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00.03</td>
<td>1.00.03</td>
<td>02/25/2007</td>
<td>Initial release</td>
</tr>
</tbody>
</table>
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 width: the angle diametrically subtended by the one-half power limits (-3 dB) of the microwave 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 referred to 1 \(\mu\)V 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 Addressable Remote Transducer. 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.

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

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

---

\(^1\) 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 transit time.

**radar:** radar is an acronym for RAdio Detection And Ranging. 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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LCD menu structure
Appendix C: menu chart

LCD menu structure

Notes:
- In Navigation mode ARROW keys navigate the menu in the direction of the arrow.
- See Parameter Reference on page 53 for detailed information and instructions.

1. QUICK START
1.1 MATERIAL
1.2 RESPONSE RATE
1.3 SENSOR UNITS
1.4 OPERATION
1.5 LOW CALIB. PT.
1.6 HIGH CALIB. PT.
1.7 APPLY?

2. SETUP
2.1 DEVICE
2.1.1 SOFTWARE REV
2.1.2 LOADER REV
2.1.3 HARDWARE REV
2.2 INPUT
2.2.1 SENSOR CALIB.
2.2.1.1 MATERIAL
2.2.1.4 SENSOR UNITS
2.2.1.5 OPERATION
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2.2.1.7 HIGH CALIB. PT.
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2.2.1.12 FAR RANGE
2.2.1.13 PROPAG. FACTOR
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2.2.2 VOL CONVERSION
2.2.2.1 VESSEL SHAPE
2.2.3 VOLUME BREAKPT
2.2.3.1 MAX. VOLUME
2.2.3.2 DIMENSION A
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2.2.4.1 ECHO SELECT
2.2.4.1.1 ALGORITHM
2.2.4.1.2 POSITION
2.2.4.1.3 ECHO THRESHOLD
2.2.4.2 SAMPLING
2.2.4.2.1 ECHO LOCK
2.2.4.2.4 SAMPLING UP
2.2.4.2.5 SAMPLING DOWN
2.2.4.2.6 WINDOW

2.2.4.3 FILTERING
2.2.4.3.2 DAMPING FILTER
2.2.4.4 TANK BOTTOM ALG
2.2.4.4.3 CLEF RANGE
2.2.4.5 NOISE
2.2.4.5.1 CONFIDENCE
2.2.4.5.2 STRENGTH
2.2.4.5.3 NOISE AVERAGE
2.2.5 TVT SETUP
2.2.5.1 TVT HOVER LEVEL
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2.2.5.8 SHAPER MODE
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2.2.7.1 RESPONSE RATE
2.2.7.2 FILL RATE /MIN
2.2.7.3 EMPTY RATE /MIN
2.2.8 TB VALUES
2.2.8.2 LEVEL MEAS.
2.2.8.3 SPACE MEAS.
2.2.8.4 DISTANCE MEAS.
2.2.8.5 VOLUME MEAS.

2.3 OUTPUT
2.3.1 MA OUTPUT
2.3.1.1 MA OUTPUT VALUE
2.3.1.2 MA OUTPUT FUNC.
2.3.1.3 4 MA SETPOINT
2.3.1.4 20 MA SETPOINT
2.3.1.5 MIN. MA LIMIT
2.3.1.6 MAX. MA LIMIT
2.3.1.7 4 MA OUTPUT TRIM
2.3.1.8 20 MA OUTPUT TRIM

2.4 FAIL-SAFE
2.4.1 FAILSAFE TIMER
2.4.2 FAILSAFE MAT. LEVEL
2.4.4 FAILSAFE LEVEL

3. DIAGNOSTICS
3.1 ECHO PROFILE
3.14 MEAS. VALUES
3.14.1 CURR. INTERN. TEMP.
3.14.2 MAX. INTERN. TEMP.
3.14.3 MIN. INTERN TEMP.
3.15 REMAIN. DEV. LIFE
3.15.1 TOTAL OP.–TIME
3.15.2 REMAIN. LIFETIME

Notes:
- In Navigation mode ARROW keys navigate the menu in the direction of the arrow.
- See Parameter Reference on page 53 for detailed information and instructions.
3. DIAGNOSTICS (cont'd)
   3.15.3 MAINT REQ LIMIT
   3.15.4 MAINT DEM LIMIT
   3.15.5 ALERT ACTIVATION
   3.15.6 TOTAL EXP LIFE
   3.15.7 MAINT STAT
   3.15.8 ACK STATUS
   3.15.9 ACK

   3.16 REMAIN. SENS. LIFE
   3.16.1 SENS OP--TIME
   3.16.2 REMAIN. LIFETIME
   3.16.3 MAINT REQ LIMIT
   3.16.4 MAINT DEM LIMIT
   3.16.5 ALERT ACTIVATION
   3.16.6 TOTAL EXP LIFE
   3.16.7 MAINT STAT
   3.16.8 ACK STATUS
   3.16.9 ACK

4. SERVICE
   4.1 DEVICE RESET
   4.2 MANUF. DATE
   4.3 LCD FAST MODE
   4.4 LCD CONTRAST
   4.5 POWERED HOURS
   4.9 POWERON RESETS
   4.12 MEM. TEST
   4.17 SERVICE INTERVAL
      4.17.1 TIME LAST SERV
      4.17.2 REMAIN LIFETIME
      4.17.3 MAINT REQ LIMIT
      4.17.4 MAINT DEM LIMIT
      4.17.5 ALERT ACTIVATION
      4.17.6 SERVICE INTERVAL
      4.17.7 MAINT STAT
      4.17.8 ACK STATUS
      4.17.9 ACK
   4.18 CALIB. INTERVAL
      4.18.1 TIME LAST CAL
      4.18.2 REMAIN LIFETIME
      4.18.3 MAINT REQ LIMIT
      4.18.4 MAINT DEM LIMIT
      4.18.5 ALERT ACTIVATION
      4.18.6 TOTAL CALIB. INTRV
      4.18.7 MAINT STAT
      4.18.8 ACK STATUS
      4.18.9 ACK

5. COMMUNICATION
   5.1 DEVICE ADDRESS
   5.2 COMM. CONTROL

6. SECURITY
   6.1 LOCK
   6.2 UNLOCK VALUE

7. LANGUAGE