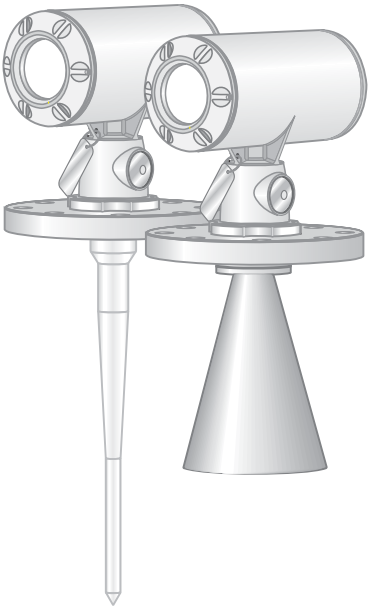
Instruction Manual • September 2003



sitrans

LR 300

SIEMENS

Safety Guidelines

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

Qualified Personnel

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

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

Note: Always use product in accordance with specifications.

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Technical Publications
Siemens Milltronics Process Instruments Inc.
1954 Technology Drive, P.O. Box 4225
Peterborough, Ontario, Canada, K9J 7B1
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Table of Contents

Safety Notes

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

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

CAUTION: means that failure to observe the necessary precautions can result in considerable material damage.

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

Safety marking symbols

	Alternating Current
	Direct Current
	Earth (ground) Terminal
	Protective Conductor Terminal
	Frame or Chassis Terminal

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 Siemens Milltronics instrument.
- This manual applies to SITRANS LR 300 only.

This manual will help you set up your SITRANS LR 300 for optimum performance. We always welcome suggestions and comments about manual content, design, and accessibility.

Please direct your comments to techpubs@siemens-milltronics.com. For the complete library of Siemens Milltronics manuals, go to www.siemens-milltronics.com

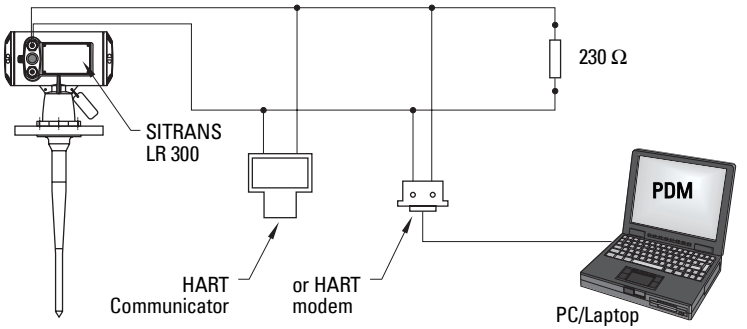
Note: SITRANS LR 300 is to be used only in the manner outlined in this manual, otherwise protection provided by the equipment may be impaired

SITRANS LR 300 is a versatile process level-monitoring instrument using advanced pulse radar techniques. The unit consists of an electronic component coupled to the antenna and process connection.

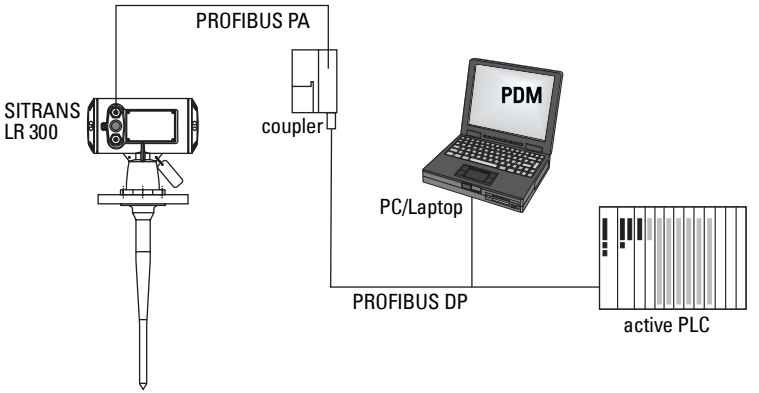
SITRANS LR 300 Communications

The standard SITRANS LR 300 supports Modbus[1], and HART[2] or PROFIBUS[3] PA.

Sample configuration using HART



Sample configuration using PROFIBUS PA



1. Modbus® is a registered trademark of Groupe Schneider.
2. HART® is a registered trademark of the HART Communication Foundation.
3. PROFIBUS® is a registered trademark of PROFIBUS International (PI).

SIMATIC PDM (Process Device Manager)

This software package is designed to permit easy configuration, monitoring, and troubleshooting of HART devices. The HART DD for SITRANS LR 300 was written with SIMATIC PDM in mind and has been extensively tested with this software.

You can download the Device Descriptor for SIMATIC PDM from our website: www.siemens-milltronics.com, on the SITRANS LR 300 product page, under **Downloads.**

SITRANS LR 300 Applications

- liquids, slurries
- process temperatures up to 200 °C (392 °F)
- vacuum and pressurized vessels

! WARNINGS:

- **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.**

SITRANS LR 300 Approvals and Certificates

- general and radio
- hazardous

Notes:

- See **Approvals** on page 7 for an approvals listing.
- **IMPORTANT: All specifications are subject to change without notice.**

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

Specifications

SITRANS LR 300

Power

- 24–230 Vac, ±15%, 40–70Hz, 28 VA (11W)

or

- 24–230 Vdc, ±15%, (9W)

Notes:

- Safety feature limits the inrush current during start up.
- This instrument features a universal power supply. AC or DC voltage may be applied to the same terminals.
- Power consumption will vary according to voltage. Please see **Appendix V, Typical Power Consumption,** on page 103.

Normal start up takes about 2 seconds to power up the unit. If something (such as hesitation in plugging in the unit) causes a rapid power fluctuation, the unit will shut down for 10 seconds to ensure the inrush current will not exceed specified limits.

Fuse

- FU1 & FU2, Fast Acting Ceramic Bussmann ABC fuse, 1 Amp. 250V.

Interface

- HART: standard, integral to analog output
- PROFIBUS PA: optional (when PROFIBUS PA is selected, the analog output is not available)
- analog output: optically-isolated 4–20 mA into 450 Ω max. ± 0.02 mA accuracy
- serial interface[1]: isolated[2] RS-485 (refer to RS-485 specifications)
- programmer link: infrared receiver (refer to Programmer specifications on page 7)
- display (local): backlit, alphanumeric, and multi-graphic liquid crystal for readout and entry

1. This port is used to communicate through Modbus.
2. Although the RS-485 is isolated, its inputs are electrically clamped to earth ground: see page 32 for more detail.

Performance[1]

- frequency: 5.8 GHz (U.S.A. 6.3 GHz)
- accuracy at 20° C: ±15mm from 0.4m to 10m
  ± 0.15% from 10m to 20m
- temperature drift: <±0.25% of range from –40 to 60° C (–40 to 140° F)
- measuring range: 0.4m to 20m (minimum range may be extended or maximum range reduced, depending on the specific antenna system installed)
- repeatability: ± 2mm for range < 3m
  ± 3mm for range < 5m
  ± 5mm for range < 10m
  ± 10mm for range < 20m
- Fail-Safe: mA and "reading" programmable **high**, **low**, or **hold**, upon Loss of Echo (LOE) condition

Mechanical

Process Connections: (Please refer to **Appendix IV** on page 98 for pressure/temperature limitations.)

- flat-faced flanges: 316 stainless steel
  ANSI #150/#300 2", 3", 4", 6", 8"
  DIN PN16/PN25/PN40 50mm, 80mm, 100mm, 150mm, 200mm
  JIS 10K 50mm, 80mm, 100mm, 150mm, 200mm
- threaded connection: 316 stainless steel, 1-1/2" or 2"
  NPT, BSP, or G
- sanitary connection: 316 stainless steel, 2", 3", or 4" tri-clamp

Antennas:

- dielectric rod: PTFE
  length 41cm (16.3"), including integral gasket
- horn: 316 stainless steel
  diameters 100mm (4"), 150mm (6"), 200mm (8")
  emitter cone, PTFE
  waveguide extensions optional
- waveguide: 316 stainless steel
  emitter cone PTFE

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

Note: See **Appendix III, Ambient/Operating Temperature Specification** on page 97, and **Approvals** on page 7, for the specific configuration you are about to use or install.

1. Reference conditions.

Sanitary Antennas (FDA approved materials):

- dielectric rod: one piece UHMW-PE; optional PTFE
  2",3",4" tri-clamp connection
- horn: 304 stainless steel
  horn with integral 4" tri-clamp connection
  PTFE emitter

Enclosure (electronic):

- construction: aluminum, epoxy-coated; or 316 stainless steel
- conduit: 2 x 1/2" NPT or M 20 x 1.5 entry
- ingress protection: Type 4X / NEMA 4X, Type 6 / NEMA 6, IP 67: (see note below)

Weight:

- 7.5 kg (16.5 lb) with 2"/150 psi flange (aluminum); 13.6 kg (30 lb) stainless steel
- weight will vary with flange size and rating

Environmental:

- location: indoor/outdoor
- altitude: 2000m max.
- ambient temperature: –40 to 60° C (–40 to 140° F)[1]
- relative humidity: suitable for outdoor
- installation category: II
- pollution degree: 4

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

Notes:

- See **Appendix III, Ambient/Operating Temperature Specification** on page 97, and **Approvals** on page 7, for the specific configuration you are about to use or install.
- The use of approved watertight hubs/glands is required for Type 4X / NEMA 4X, Type 6 / NEMA 6, IP 67 (outdoor applications).

1. See Appendix III (Ambient/Operating Temperature Specification) on page 97, and Approvals on page 7

Process

- material dielectric: $\varepsilon_r > 1.8$
  for $\varepsilon_r < 3$, you should use a waveguide antenna or stillpipe (see Mounting: Waveguide Antenna on page 27, or Mounting: Stillpipe or Sidepipe on page 28)
- temperature: UHMW-PE –40 to 80°C (–40 to 176°F)
  PTFE –40 to 200°C (–40 to 392°F)[1]
- pressure (vessel): dependent on process connection type and temperature (refer to **Appendix IV** on page 98 for charts, or obtain the reference drawing listed on the device process tag)

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

Approvals (verify against device nameplate)

- General: CSA $_{US/C}$, FM, CE, 3A Sanitary
- Radio: Europe, Industry Canada, FCC
- Hazardous:

  Europe; EEx de IIC T6
  ATEX II 1/2G, EEx de IIC T6 or EEx d IIC T6
  ATEX II 1/2G, EEx de [ia] IIC T6

  US; Class I, Div. 1, Gr. A,B,C,D (Class I, Zone 1, IIC T6)
  Class II, Div. 1, Gr. E,F,G
  Class III

  Canada; Class I, Div. 1, Gr. A,B,C,D (Class I, Zone 1, IIC T6)
  Class II, Div. 1, Gr. E,F,G
  Class III

- Lloyd's Register of Shipping, categories ENV1, ENV2, ENV3, ENV5

Notes:
- See **Appendix III, Ambient/Operating Temperature Specification**, on page 97, and **Approvals** on this page, for the specific configuration you are about to use or install.
- For instructions relating to ATEX-approved instruments, please see **Appendix VIII: hazardous area installations** on page 128.

Programmer (remote keypad)

Intrinsically Safe Programmer (I.S.) Model for hazardous locations: (battery is non-replaceable)

- enclosure: 67 mm w x 100 mm h x 25 mm d (2.6" w x 4" h x 1" d)
- approval: EEx ia IIC T4, SIRA certificate Ex002030
- ambient temperature: –20 to 40° C (–5 to 104° F)
- interface: proprietary infrared pulse signal
- power: 3V lithium battery
- weight: 150 g (0.3 lb)
- color: black

Note: See **Appendix III, Ambient/Operating Temperature Specification**, on page 97, and **Approvals** on page 7, for the specific configuration you are about to use or install.

Installation

Notes:

- Installation shall only be performed by qualified personnel and in accordance with local governing regulations.
- This product is susceptible to electrostatic shock. Follow proper grounding procedures.
- Do not use a Ground Fault Interrupt (G.FI.) with SITRANS LR 300. The ground path is used for filtering purposes in conjunction with the universal power supply.

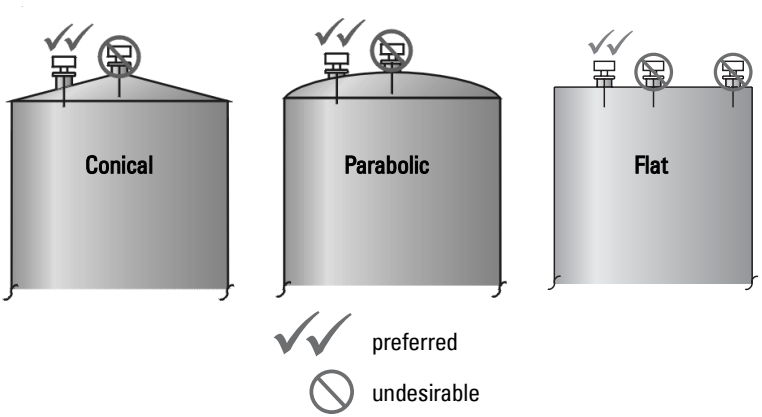
! WARNINGS:

- **Changes or modifications not expressly approved by Siemens Milltronics Process Instruments Inc. could void the user's authority to operate the equipment.**
- **This product is designated as a Pressure Accessory per Directive 97/ 23 / EC and is not intended for use as a safety device.**
- **Improper installation may result in loss of process pressure.**

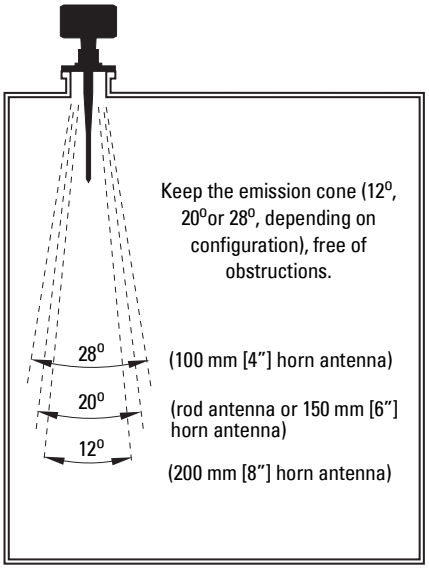
Mounting Location

- Do not mount in direct sunlight without the use of a sun shield. Refer to **Appendix III, Ambient/Operating Temperature Specification**, on page 97

Note: Avoid mounting the unit at the centre: there is a greater likelihood of false readings.



Beam Spreading



Due to the polarization effect of the microwave signal related to the wall of the vessel, we recommend locating SITRANS LR 300 a minimum of 30 cm (1') away from the sidewall for every 3 m (10') of vessel height.

Polarization Effect

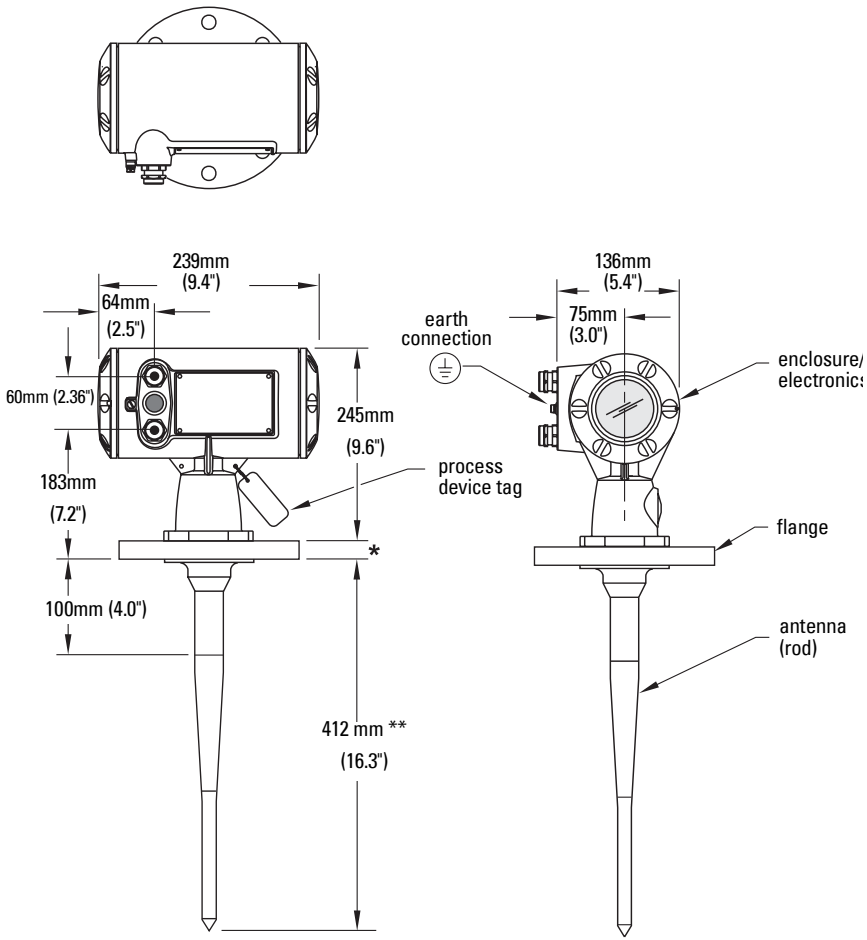
Mounting the unit too close to a wall may cause echoes to disappear at specific levels due to wave cancellation. A strong false reflection from an internal tank obstruction can be reduced or eliminated by rotating the unit to reduce this polarization effect.

False Reflections

Flat obstructions and struts perpendicular to the emission cone cause large false reflections. They reflect the radar signal with high amplitude. Round profile interfering surfaces diffuse reflections of the radar signals and cause false reflections with low amplitude.

Minimize false reflections first by rotating the instrument for best signal (lowest false echo amplitude). Then use the TVT shaper parameters (P831, 832, 837 and 838) to prevent false echo detection.

Dimensions: SITRANS LR 300 with Rod Antenna



* Flange thickness 25mm (1") nominal.

** Standard length, 50mm and 100mm (2″ and 4") extensions available.

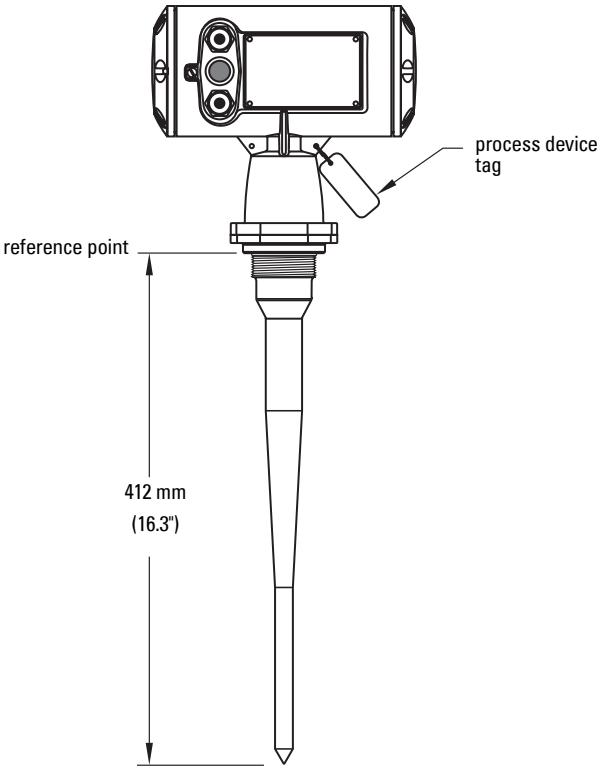
Note: Please see next page for notes on process temperature and pressure capabilities, as well as enclosure recommendations.

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

Notes:

- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available upon request.
- For information on temperature and pressure ratings, see **Appendix IV** on page 98.
- The use of approved watertight hubs/glands is required for Type 4X / NEMA 4X, Type 6 / NEMA 6, IP 67 (outdoor applications)
- 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.

Dimensions: Threaded Rod

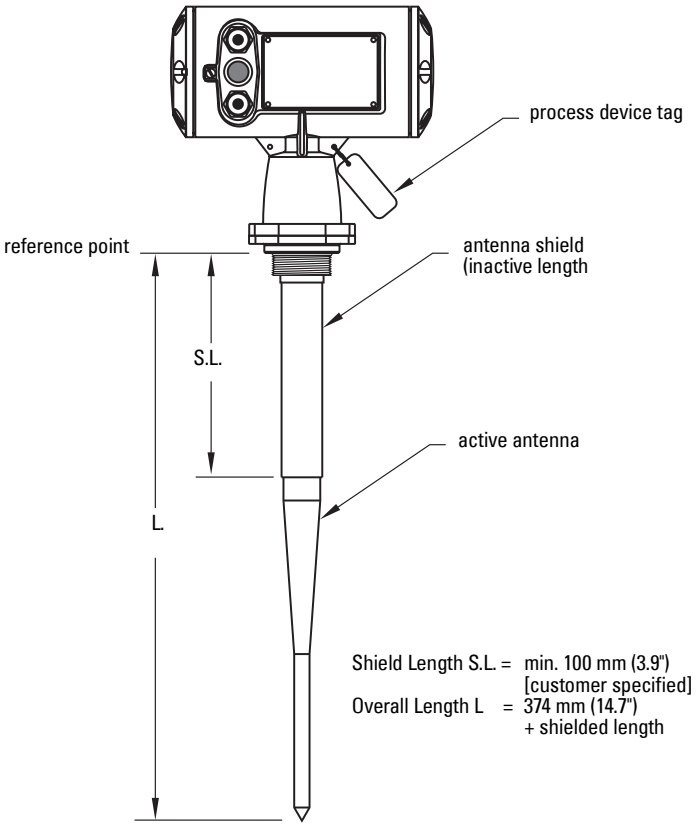


Notes:

- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available upon request.
- 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.

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

Dimensions: Shielded Rod

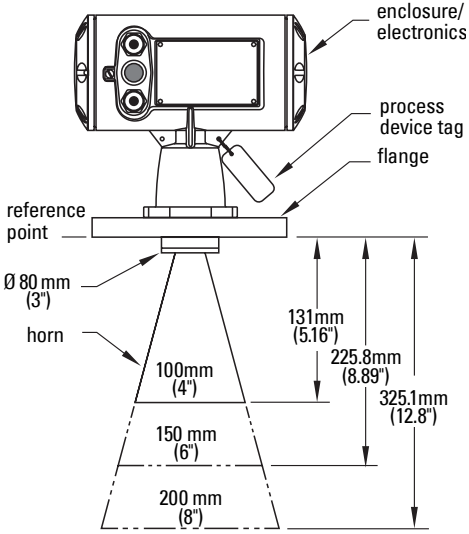


Notes:

- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available upon request.
- 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.

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

Dimensions: Horn



Nominal Horn Size	Horn O.D.	Horn Height	Beam Angle
100mm (4″)	95.3mm (3.75″)	131.0mm (5.16″)	28 degrees
150mm (6″)	146.0mm (5.75″)	225.8mm (8.89″)	20 degrees
200mm (8″)	199.4mm (7.85″)	325.1mm (12.8″)	12 degrees

Notes:

- Signal amplitude increases with horn diameter, so use the largest practical size.
- Optional waveguide extensions and/or purging system * can be installed between the flange and the antenna.

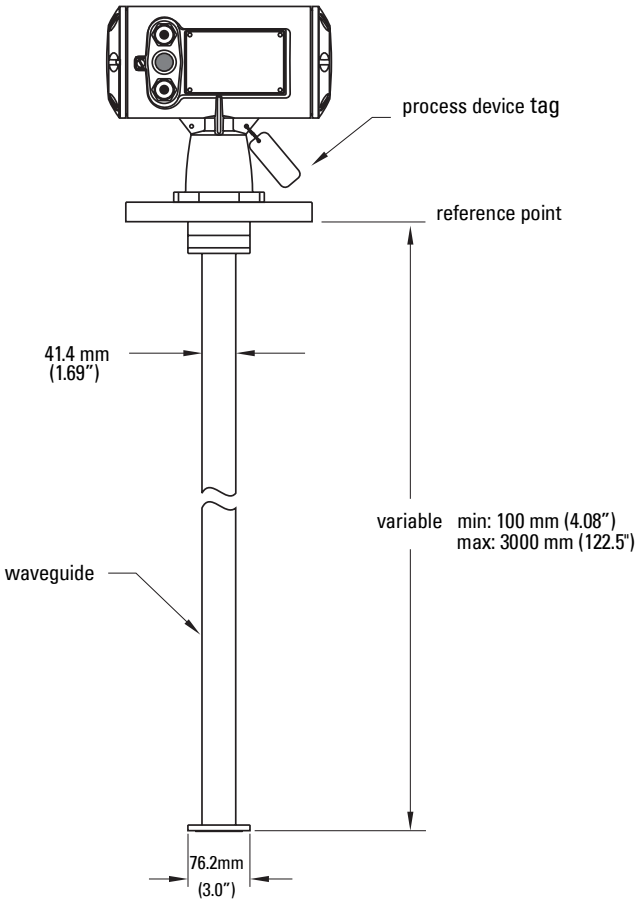
* A purging system is an option available for this antenna type. This provides an inlet on the flange where cooling air or cleaning fluid may be supplied. The air or liquid passes through the flange and exits the inside of the horn to clean the antenna system.

Notes:

- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available upon request.
- 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.

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

Dimensions: Waveguide

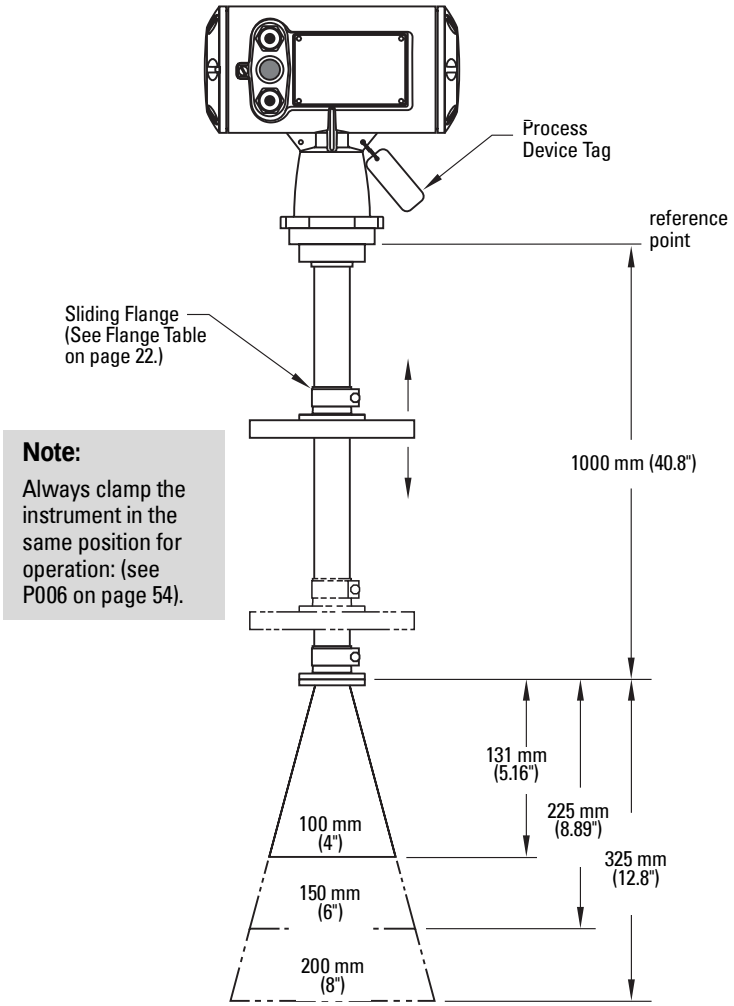


Notes:

- You can connect a maximum of two waveguides together.
- This option is recommended only for clean liquids on vessels without agitators or turbulence.
- Horizontal stress on this antenna must be avoided, otherwise mechanical support may be required.
- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available upon request.
- 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

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

Dimensions: Sliding Waveguide Configuration



Note:
Always clamp the instrument in the same position for operation: (see P006 on page 54).

Note: Please see next page for notes on process temperature and pressure capabilities, as well as enclosure recommendations.

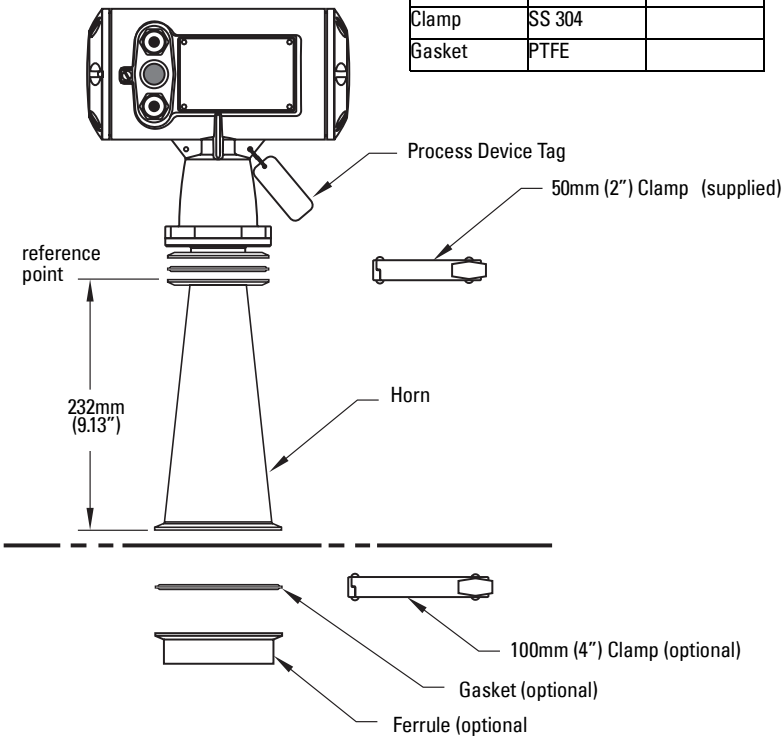
! WARNING: The user is responsible for the selection of bolting and gasket materials which will fall within the limits of the flange and its intended use and which are suitable for the service conditions.

Notes:

- Maximum pressure 0.5 bar at 60° C (140° F) for sliding flange option.
- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available upon request.
- 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

Dimensions: Sanitary Horn

Materials	Standard	Optional
Horn	SS 304	
Ferrule	SS 304	SS 316
Clamp	SS 304	
Gasket	PTFE	

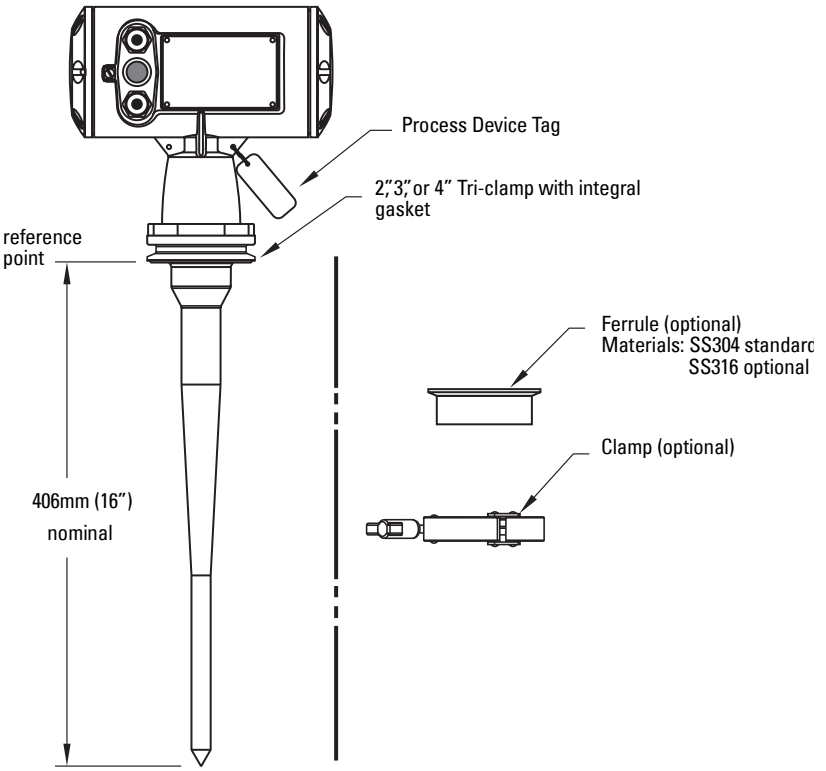


Notes:

- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available upon request.
- 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.

! WARNING: Improper installation may result in loss of process pressure.

Dimensions: Sanitary Rod



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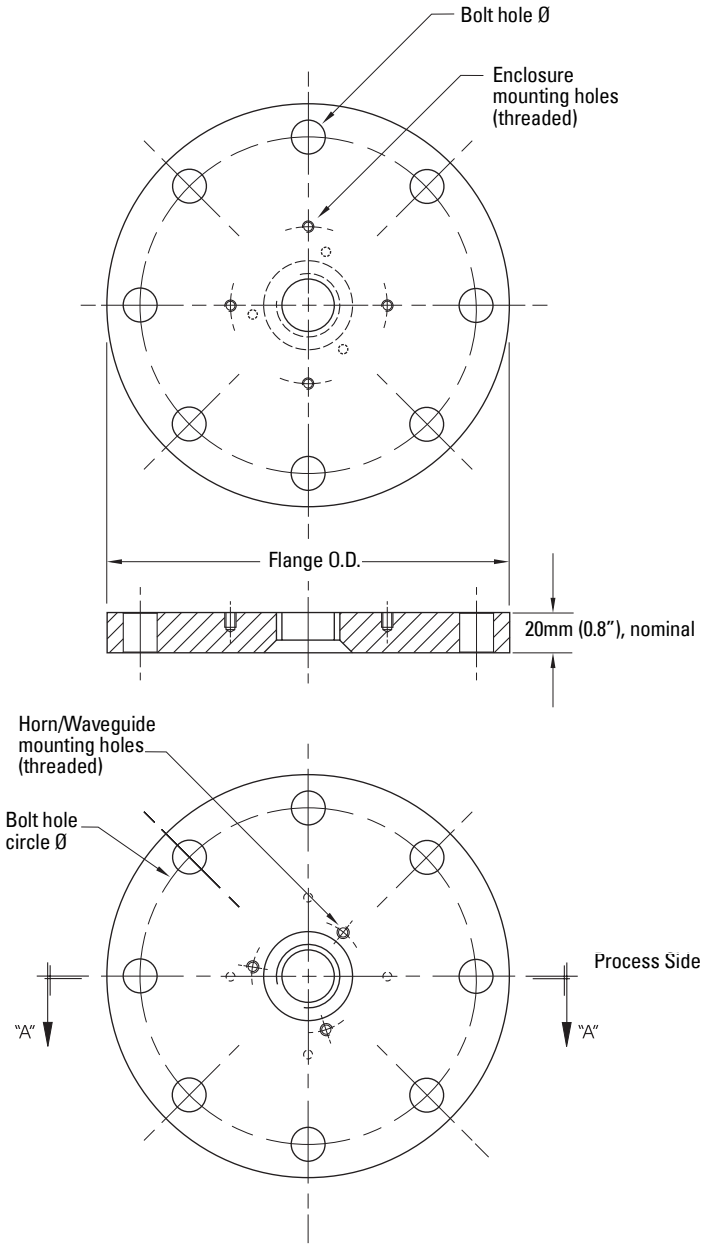
- Process temperature and pressure capabilities are dependent upon information on the process device tag. Reference drawing listed on the tag is available upon request.
- The Process Device Tag shall remain with the process pressure boundary assembly. In the event the instrument package is replaced, the Process Device Tag shall be transferred to the replacement unit.

! WARNING: Improper installation may result in loss of process pressure.

Dimensions: Flanges



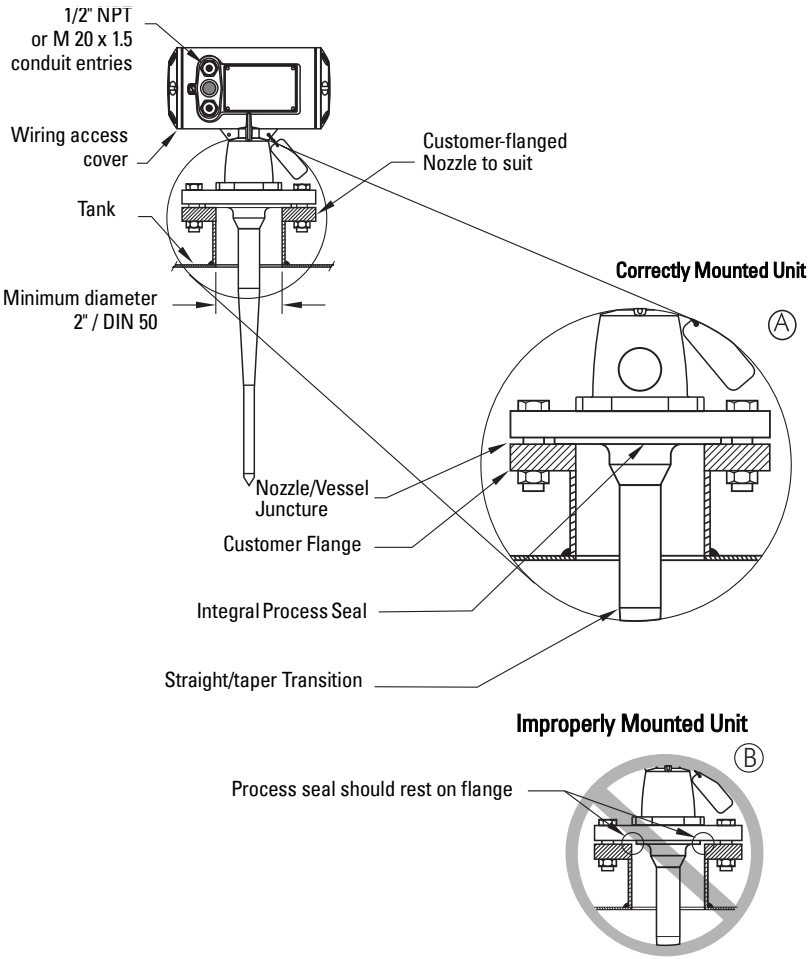
See chart on page 22 for further details on flange sizes.

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

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

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

Mounting



* Refer to the Rod Extension Requirements table on page 24.

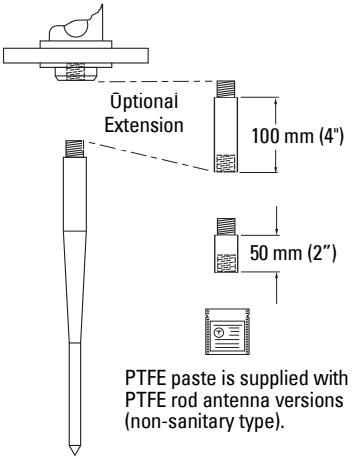
Notes:

- The Integral process seal MUST rest on the customer flange. See detail (A) showing a correctly mounted unit.
- The straight/taper transition of the rod should extend past the nozzle/vessel opening. Add extensions as required*.

WARNINGS:

- **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.**
- **For pressure applications, it will be necessary to use PTFE tape, or other appropriate thread sealing compound, and to tighten the process connection beyond hand-tight.**
- **Improper installation may result in loss of process pressure.**

Rod Assembly



Notes:

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

Rod Extension Requirements

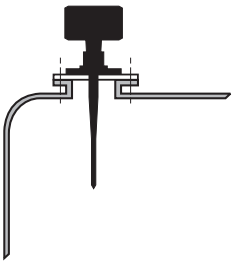
Nozzle I.D.	Nozzle Height mm (inches)*		
	<100 (4)	100 to 150 (4 to 6)	150 to 200 (6 to 8)
50mm (2")	n/r	**	**
80mm (3")	n/r	50mm	100mm
100mm (4")	n/r	50mm	100mm
150mm (6")	n/r	50mm	100mm
>150mm (6")	n/r	n/r	n/r

n/r extension not required

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

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

Mounting: Rod Assembly



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

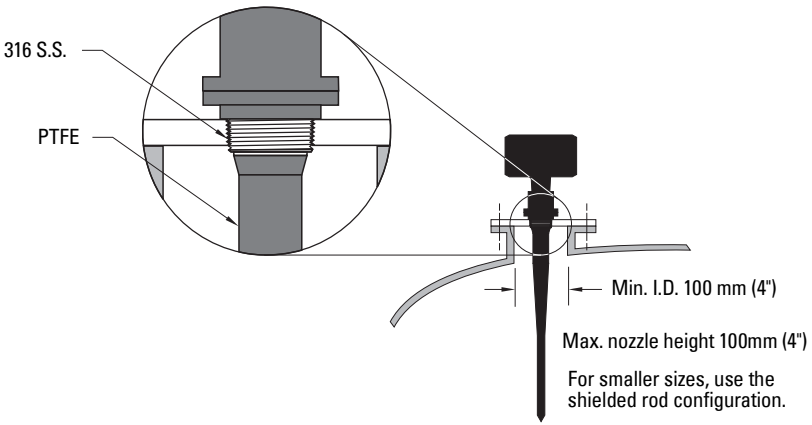
If you create a new nozzle for the radar unit, the weld seams must be on the outside of the nozzle. Ensure that there are no seams or lips on the inside of the nozzle or you may get erratic readings.

If the mounting illustrated on page 25 is not suitable due to the minimum blanking requirements, consider the shielded rod or horn antenna options.

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

Mounting: Threaded Rod Antenna

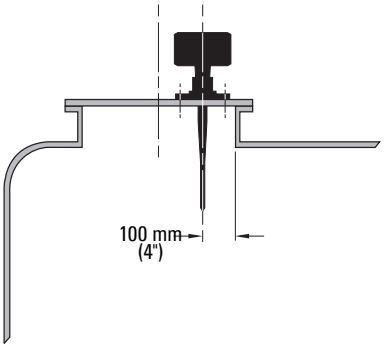
You can use 1.5" or 2" threaded process connections. There are three thread types: NPT, BSP, and G.



! WARNINGS:

- **Improper installation may result in loss of process pressure.**
- **For pressure applications, it will be necessary to use PTFE tape or other appropriate thread sealing compound, and to tighten the process connection beyond hand-tight.**

Mounting: Manhole Covers

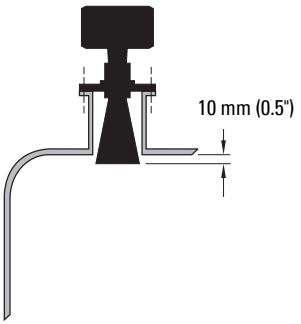


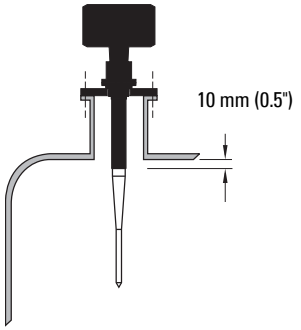
A manhole cover is typically a nozzle that is 610mm (24") or greater in diameter, with a cover.

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

Mounting: Horn Antennas or Shielded Rod

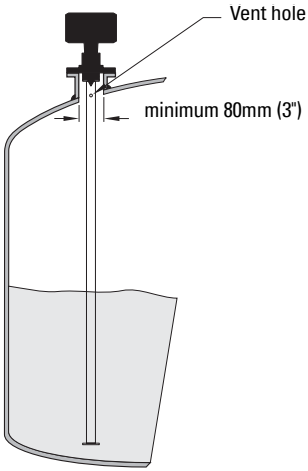
The end of the horn, or the end of the shield section, should protrude a minimum of 10mm (0.5") to avoid interference with the nozzle.





Mounting: Waveguide Antenna

This option is recommended for products with ε_r lower than 3. See P655 on page 63 for the related propagation factor.



Notes:

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

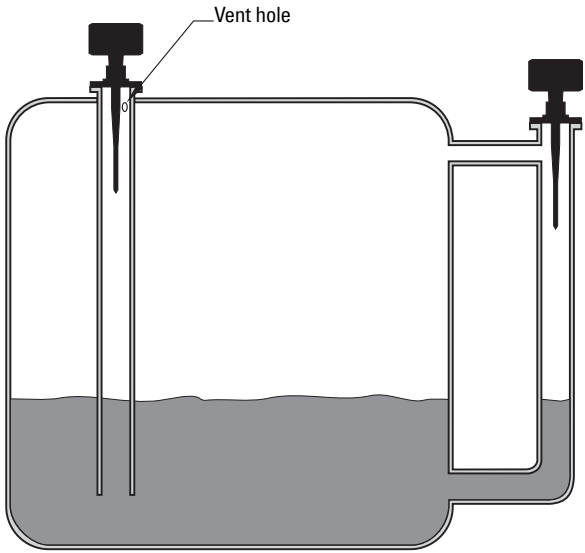
Mounting: Stillpipe or Sidepipe

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

Suitable pipe diameters are 50mm (2") to 250mm (10"). A rod antenna or a horn antenna may be used.

Smoothness

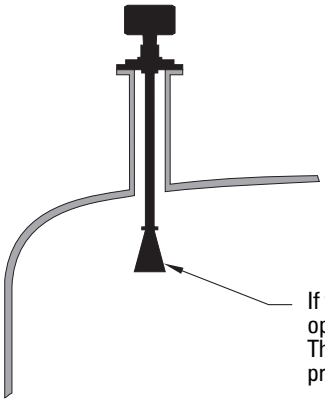
One continuous length of metallic pipe is preferred, without joints. If joints are unavoidable, you must machine them to close tolerances (± 0.25mm [± 0.010"]) and weld a connecting sleeve on the outside.



See P655 on page 63 for the related propagation factor.

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

Mounting: Horn with Waveguide Extensions



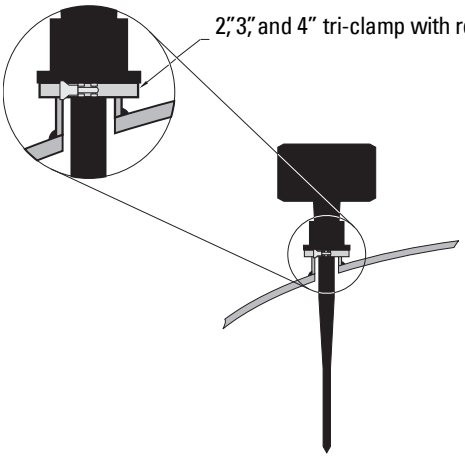
Use this combination if the nozzle is long and the diameter is small.

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

Waveguide extensions are available in custom lengths.

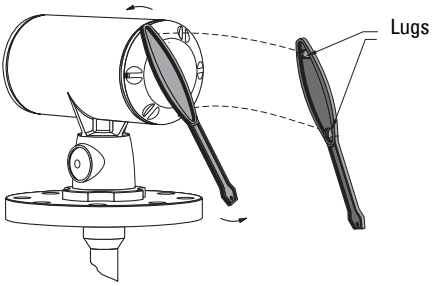
If the horn diameter is too large for the nozzle opening, you need to insert it from inside the vessel. The horn must be connected to the SITRANS LR 300 process flange.

Mounting: Sanitary Rod Antenna



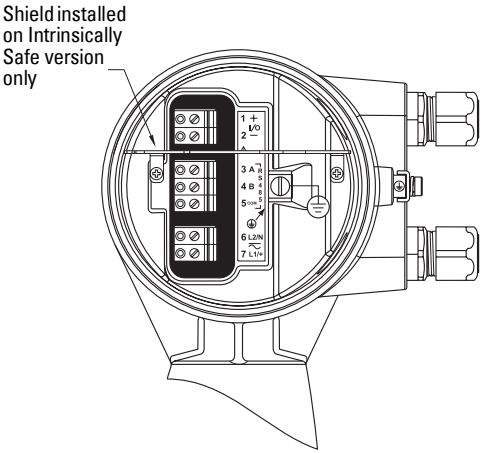
Interconnection

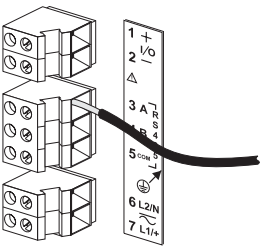
A special wrench is provided to open the SITRANS LR 300 enclosure. The two lugs on the wrench fit into the indentations in the back cover of the enclosure.



SITRANS LR 300 Terminal Block

Two options are available. The Intrinsically Safe mAmp Output Version has a shield installed: the standard version does not.





Wiring access is from the side of the terminal block.

Wiring requirements:

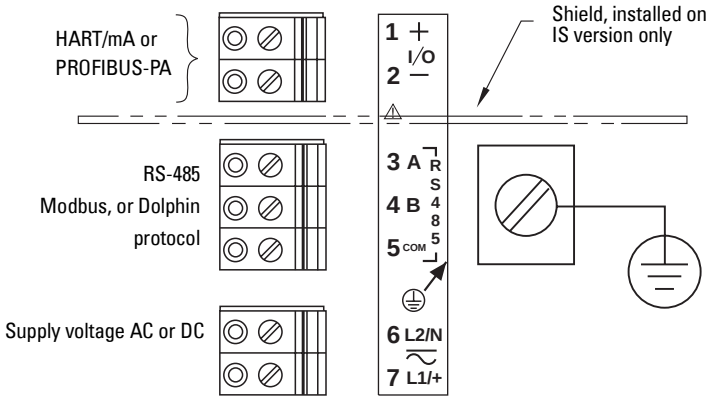
- Increased safety, EEx e version: solid 4
  flexible stranded 2.5
- General safety or hazardous EEx d version: rigid 0.2 to 4
  flexible stranded 0.2 to 2.5
  AWG 24 to 12

Notes:

- The recommended torque on the terminal clamping screws is 0.5 – 0.6 Nm.
- Connect the shielding of instrument cables to ground at one end only.

WARNING: Avoid static discharge to terminals.

SITRANS LR 300 Wiring



Notes

- Installation shall only be performed by qualified personnel and in accordance with local governing regulations.
- The equipment must be protected by a 15 A fuse or circuit breaker in the building installation.
- The circuit breaker or switch in the building installation, marked as the disconnect switch, shall be in close proximity to the equipment and within easy reach of the operator.
- Do not use a Ground Fault Interrupt (G.F.I.) with SITRANS LR 300. The ground path is used for filtering purposes in conjunction with the universal power supply.
- All Input/Output wiring must be shielded for CE compliance, except for supply voltage.
- Wiring requirements:

Increased safety, EEx de version:	use solid 4, flexible stranded 2.5
General safety or hazardous EEx d version:	use rigid 0.2 to 4 flexible stranded 0.2 to 2.5 AWG 24 to 12

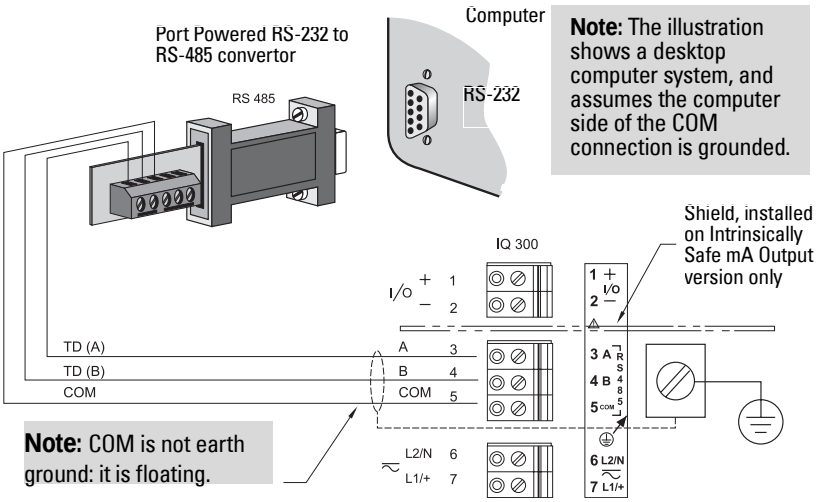
- The input parameters for the PROFIBUS PA version of the equipment certified as EEX de [ia] IIC T6 meet the requirements for FISCO field apparatus as described in IEC 60079-27.

! WARNINGS:

- **All field wiring must have insulation suitable for the rated voltage.**
- **Avoid static discharge to terminals.**

Communications Installation

Port 1: RS-485



Notes:

- The RS-485 is isolated with respect to earth ground, but its inputs (A,B, COM) are electrically clamped to earth ground to protect them against electrical transients.
- Before making any connections, measure the common on the cable with respect to the earth ground that the instrument is connected to, and make sure COM is within ± 3 V dc with respect to earth ground.
- If you are connecting the converter to a portable notebook computer, the COM of the notebook is normally isolated. To prevent damage to the RS-485 port, one end of this COM connection must be grounded.

! WARNING: Avoid static discharge to terminals.

PC Connection

To connect the device to a computer requires the use of a RS-485 to RS-232 converter. Siemens Milltronics offers a converter that is powered by the RS-232 port on the computer (part number 7ML1830-1HA).

Port Configuration

See Communication Parameters on page 68.

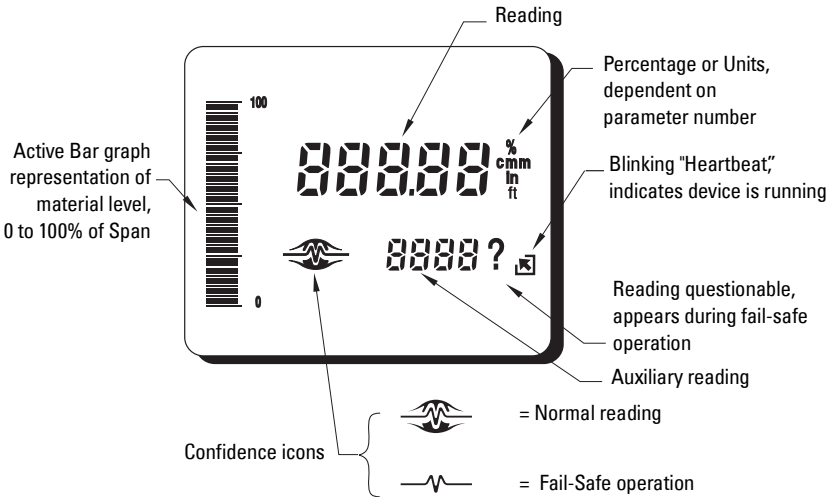
Start Up

Overview

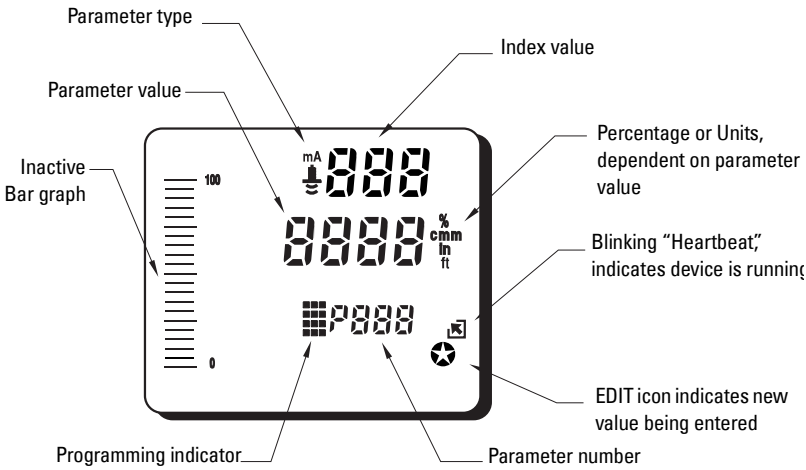
SITRANS LR 300 has two modes of operation: **RUN** and **PROGRAM**.

After you have completed the installation procedures and powered up SITRANS LR 300, the unit starts in **RUN** mode and detects the distance from the instrument flange to the target in meters. This is the default start-up display mode.

RUN Mode Display



PROGRAM Mode Display

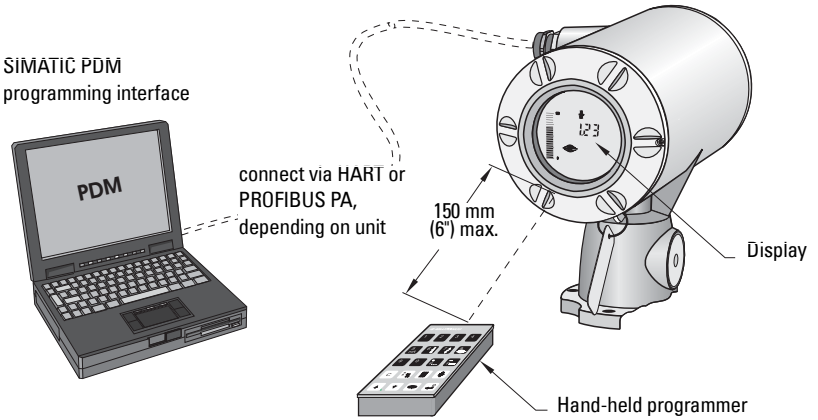


Programming

PROGRAM mode has two states: **EDIT** and **DISPLAY**. In **DISPLAY** state, the parameter number, parameter type, and parameter value are being displayed. In **EDIT** state, the **EDIT** icon is also visible, indicating that the device is accepting input into the current field.

You can activate the **PROGRAM** mode at any time and set parameters to suit the application and/or user preferences. Programming can be carried out locally using the hand programmer or remotely through one of the communication channels: SIMATIC PDM, HART Master, or PROFIBUS Master.

The instruction examples in this manual use icons from the hand programmer.



SIMATIC PDM, HART Master, or PROFIBUS Master

SIMATIC PDM is a user interface program designed to configure SITRANS LR 300 from a laptop or a desktop PC, using HART or PROFIBUS PA. Using SIMATIC PDM, you can modify parameter values in real time, view process values in graphic form on screen, view profiles, and generate instrument configuration reports.

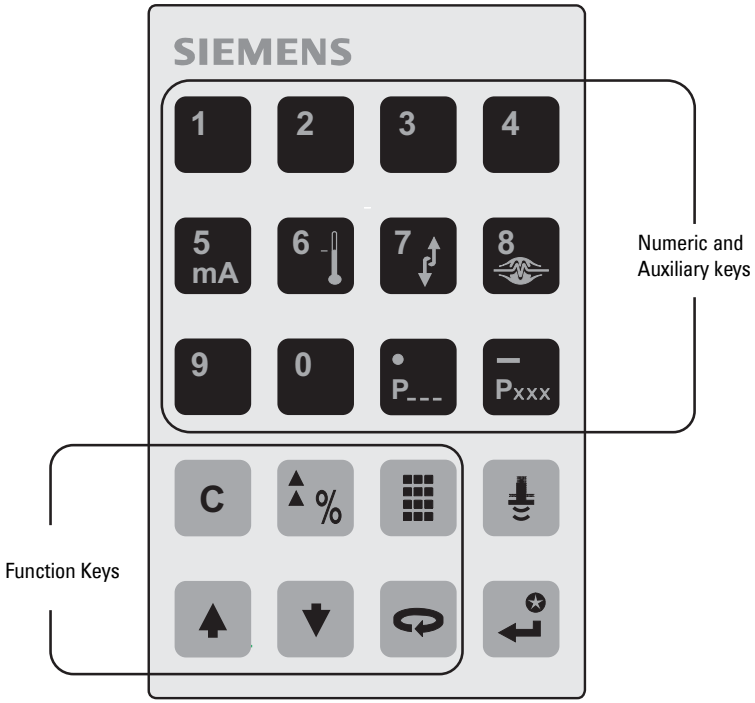
SIMATIC PDM is purchased separately. Please contact your Siemens representative.

Hand Programmer

The programmer is a sturdy, hand-held, programming unit offering immediate access to the configuration parameters. Point the programmer at the lower portion of the SITRANS LR 300 display window (from a maximum distance of 15cm [6"]) and press the buttons in the required sequence.

Local Programming

The hand programmer is used for local programming sequences. Please make sure you hold the programmer close to the unit (within 15cm [6"]), and point it directly at the bottom of the display to activate the programming options.



Key	Programming Mode	Run Mode
0 to 9	Values	
5 mA		mA output value displayed in auxiliary reading field
6		Internal enclosure temperature displayed in auxiliary reading field (P343).
P...	Decimal point	Parameter for auxiliary readings*
Pxxx	Negative value	
C	Clear value	
%	Toggle between Units and % on parameter value	Toggle between Units and % on reading display
	End **PROGRAM** session and enable **RUN** mode	Initiate and complete **PROGRAM** mode access
	Update echo quality parameters	Distance displayed in auxiliary reading field.
	Parameter scroll-up	
	Parameter scroll-down	
	Toggle fields	
	Enter the displayed value	

* Pressing P... plus three-digit parameter number, sets parameter to show in the auxiliary display.

Accessing PROGRAM Mode

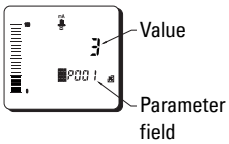
PROGRAM mode has two states: **EDIT** and **DISPLAY**. In **DISPLAY** state, the parameter number, parameter type, and parameter value are being displayed. In **EDIT** state, the **EDIT** icon indicates that the unit is accepting input into the current field. The icon remains visible until the **ENTER** key has been pressed, and the new value is accepted.

Note: Values shown are for demonstration purposes only.

1. The unit starts in **RUN** mode and readings correspond to existing settings.

2. Press the **PROGRAM** key to activate the **PROGRAM** mode. (The number fields go blank.)

3. Press the **TOGGLE** key to display parameter fields. Initial program starts at P000.



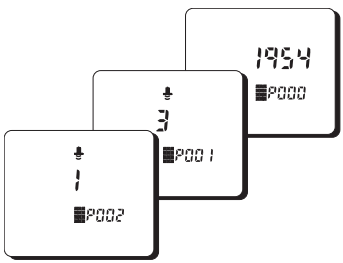
Accessing a Parameter

The parameter settings configure the units to a specific use. Press the **PROGRAM** key followed by the **TOGGLE** key: then choose **Scroll Access** or **Direct Address** to access a parameter.

Scroll Access

In **PROGRAM** mode, you can scroll through the parameters sequentially and in either direction until you reach the required parameter. [P000 to P999]

1. Press **ARROW** keys to scroll up or down.



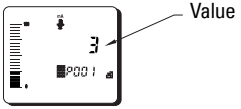
Direct Address

In **PROGRAM** mode, you can access a parameter directly by entering its number.

1. Press the **PROGRAM** key followed by the **TOGGLE** key to display the Parameter Number field.

2. Press the **TOGGLE** key to open the Parameter Number field. The Parameter Number field goes blank and the **EDIT** icon appears.

3. Key in the desired parameter number. Example: 0 0 1 . The new parameter number and value appear.



Note: You can enter parameter numbers below 100 without leading zeros. Enter the number followed by the ENTER key. Example: To access P005, press 5 mA .

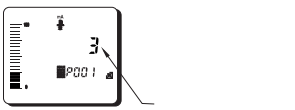
Modifying a Parameter Value

Once a parameter is accessed, you can set or modify its values.

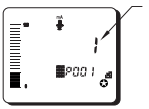
Notes:
- Security must be disabled. To disable security, set P000 to 1954.
- Values shown are for demonstration purposes only.
- Invalid entries will be rejected or limited.

Changing Parameter Values

1. Select the parameter to modify.



2. Key in the new value. Example: press 1 . The new value and the EDIT icon appear.



3. Press the **ENTER** key to set the value. The **EDIT** icon disappears.

Note: The **CANCEL** key c can be used to clear the field.

Resetting a Parameter to Factory Setting

1. Scroll to the parameter or enter its address.

2. Press the **CANCEL** key [c]. The value field goes blank and the **EDIT** icon appears.

3. Press the **ENTER** key [↵]. The value returns to factory default and the **EDIT** icon disappears.

Accessing RUN Mode

1. In **PROGRAM** mode, press the **PROGRAM** key [≡]. The screen may go blank for a moment.
   SITRANS LR 300 returns to **RUN** mode.

Quick Start Programming

1. Configure all parameters to their factory settings by performing a master reset via Parameter 999 (see page 78).
2. Set the following parameters for a Quick Start: (see page 52).

   - (P001) mode of measurement
   - (P002) process material
   - (P003) measurement response
   - (P004) antenna configuration
   - (P005) units
   - (P006) empty distance
   - (P007) span
   - (P837) Auto False Echo Suppression
   - (P838) Auto False Echo Suppression Distance

Numerous other program parameters can be changed subsequently, or during another programming session. Please see Parameter Descriptions, starting on page 51, for a list of available parameters.

3. After you have completed programming, press the **PROGRAM** key [≡] to return to **RUN** mode.

Notes:

Operation

Overview

SITRANS LR 300 is an advanced level-measuring device for liquids and slurries. Using advanced pulse radar technology, the device calculates material level by emitting a series of radar pulses and then analyzing their reflections.

The device consists of an enclosed electronic component mounted to a flanged antenna component. The electronic component generates a 5.8 GHz (U.S.A. 6.3 GHz) radar signal that is directed to the antenna, waveguide, or horn.

The radar signal is emitted axially from the antenna and propagates along this axis in a defined conical beam decreasing in strength at a rate proportional to the square of the change in distance.

The radar pulse detects the interface between the dielectric constant of the atmosphere and that of the material being measured. Electro-magnetic wave propagation is not sensitive to temperature and atmospheric conditions, or to variations in the medium.

Pulses are transmitted from the antenna at a fixed repetition rate. The reflected echoes are received and digitally converted to an echo profile. The profile is analyzed to determine the distance from the material surface to the flange face. This distance is used as a basis for the display of material level and mA output.

Transceiver

The SITRANS LR 300 transceiver operates under one of five sets of pre-set conditions (P003).

Measurement Response parameter P003	Max. fill/empty rate P700/P701		Echo verification P711	Fail-Safe timer P070
1	0.1 m/min	slow	2	100
2	1 m/min		2	10
3	10 m/min		2	1
4	100 m/min		0	0.1
5	1000 m/min	fast	0	0

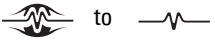
When the echoes are received, the relevant echo algorithm (P820) is applied to determine the true material echo.

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

Loss of Echo (LOE)

A loss of echo (LOE) occurs when the calculated measurement is judged to be unreliable because the confidence (P805) is less than the threshold (P804). Refer to **Operation Troubleshooting** on page 88.

If the LOE condition persists beyond the time limit set by the Fail-Safe timer (P070), the Confidence icon will change from full to partial:



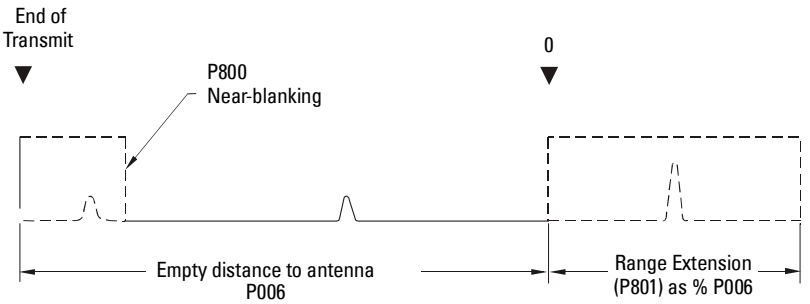
The response to LOE is set by P072 and P219. They determine whether the reading and mA output will be immediately forced to the Fail-Safe default (P071 and P219). Upon receiving a reliable echo, the loss of echo condition is aborted, the Confidence icon returns to full, and the reading and mA output return to the current level at the rate set by P072.

Blanking or Auto False Echo Suppression

Near-blanking (P800) is set to ignore the zone in front of the antenna where false echoes can appear during the receive cycle. They are often created by internal impediments like a ladder rung, and are usually indicated by an incorrect high level reading. False echoes can be overcome by increasing the near-blanking value from its factory setting.

Auto False Echo Suppression (P837) is recommended in preference to extending the blanking distance from factory values.

Typical Receiver Signal



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

Range extension is entered as a percentage of P006.

Analog Output

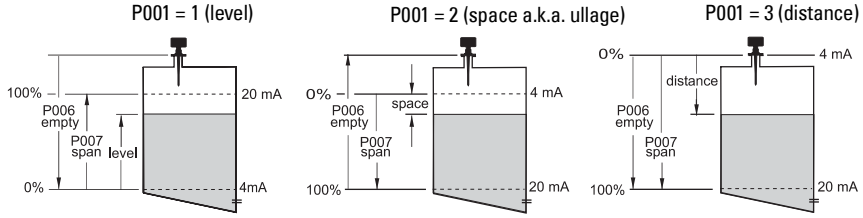
SITRANS LR 300 can be programmed to provide an analog output of 4 to 20 mA, for proportional or inverse span. For details, see **Independent mA Setpoint Parameters (P210 and P211)**, on page 60.

Programming

When the unit is put into **PROGRAM** mode, the analog output level holds its prior value unless the mA output function is the common output or HART is the communication protocol.

Run

The analog output responds in the following manner:



0 and 100% are percentage of full-scale reading (m, cm, mm, ft, in).

Volume

To program the unit for volume, set:

- operation (P001) to level **1** (see page 52)
- tank shape (P050) to a value other than **0** (see page 54)
- other volume parameters (P051 to P053) as required

To program the unit for ullage, set:

- operation (P001) to space **2** (see page 52)
- tank shape (P050) to a value other than **0** (see page 54)
- other volume parameters (P051 to P053) as required

Fail-Safe

When the Fail-Safe timer (P070) expires, the mA output responds as follows:

Fail-Safe Mode (071)	Status (4 - 20)	Status (20 - 4)
1 = high	22	2
2 = low	2	22
3 = hold	hold	hold

RUN/PROGRAM

When you select **PROGRAM** mode, SITRANS LR 300 stops responding to the process. It stores the most recent measurement, and holds the associated readings and mA signal output. The unit reverts to the parameter last addressed during the previous program session.

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

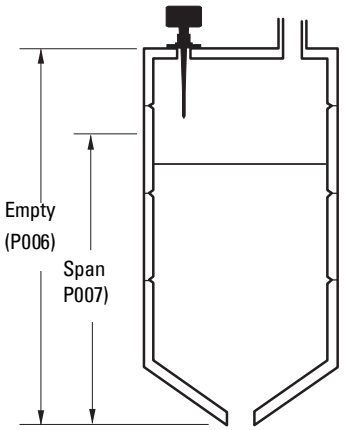
If SITRANS LR 300 is left in **PROGRAM** mode for 10 minutes without input, it automatically reverts to **RUN** mode.

Application Examples

These SITRANS LR 300 application examples can be used as set-up references. The parameter value tables relate the values to the functions.

Application Example: Asphalt in Storage Tank

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



The application is to obtain a level measurement and corresponding 4-20 mA output proportional to asphalt levels in a storage tank.

The bottom of the antenna flange is 5m from the tank bottom. The empty level is 0m (bottom) and the full level (span) is 4.5m from the bottom. The maximum rate of filling or emptying is about 0.1m/min. In the event of a loss of echo, SITRANS LR 300 is to go into Fail-Save Hi after 2 minutes.

Asphalt build-up on the rod antenna does not affect performance.

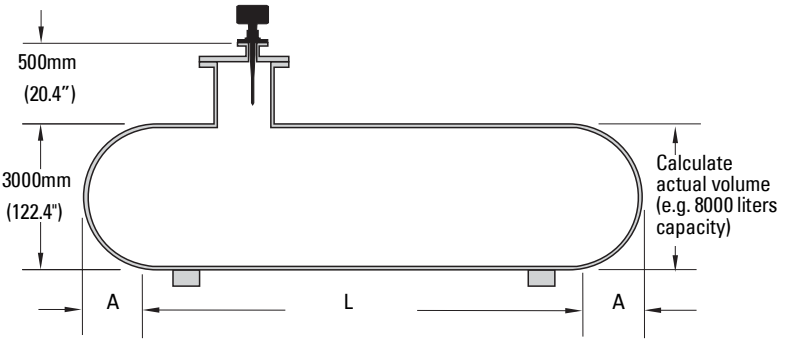
Parameter	Enter		
P999	**----**	master reset	
P001	**1**	mode of measurement	= level
P002	**1**	material	= liquid
P003	**2**	measurement response	= 1m/minute
P004	**240**	antenna	= factory
P005	**1**	units	= meters
P006	**5**	empty distance	= 5m
P007	**4.5**	span	= 4.5m
P070	**2**	Fail-Safe timer	= 2 minutes
P071	**1**	Fail-Safe	= Hi
P820	**8**	algorithm	= Blf (best of Largest or First)
P830	**7**	TVT type	= factory
P837/838 (Note above)	**2 & 1**	Auto False Echo Suppression	

Run: To start normal operation, press the **PROGRAM** key.

Application Example: Horizontal Tank with Volume

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

The application is to obtain a level measurement and corresponding 4-20 mA output proportional to vessel volume in a chemical tank. The bottom of the antenna flange is 3.5m from the tank bottom. The empty level is 0m (bottom) and the full level (span) is 3.0m from the bottom. The maximum rate of filling or emptying is about 0.1 m/min. In the event of a loss of echo, SITRANS LR 300 is to go into Fail-Safe Hi after 2 minutes.



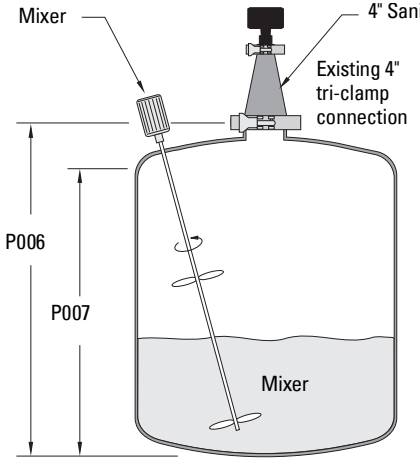
Parameter	Enter		
P999	**----**	master reset	
P001	**1**	mode of measurement	= level
P002	**1**	material	= liquid
P003	**2**	measurement response	= 1m/minute
P004	**240**	antenna	= factory
P005	**1**	units	= meters
P006	**3.5**	empty distance	= 3.5m
P007	**3**	span	= 3m
P050	**7**	tank shape	= parabolic ends
P051	**8000**	maximum volume	= liters
P052	**.8**	tank dimension A	= 0.8 meters
P053	**6**	tank dimension L	= 6 meters
P070	**2**	Fail-Safe timer	= 2 minutes
P071	**1**	Fail-Safe	= Hi
P820	**12**	algorithm	= First echo
P837/838 (Note above)	**2 & 1**	Auto False Echo Suppression	

Run: To start normal operation, press the **PROGRAM** key [▤].

Application Example: Juice Batch Tank with Sanitary Horn Antenna

Notes:

- The minimum distance from the flange face to the target is limited by near-blanking P800.
- Only set P837 if the product is at least 2m (78") away from the flange face. If it is closer, leave P837 at **1** until the level drops and the distance increases beyond 2m (78").
- Choose **First only** (P820 = **12**) if SITRANS LR 300 is in the center. Otherwise, keep it at **8 (bLF)**.
- Sanitary Antenna Options: The one-piece antenna/process seal provides an excellent mounting method, even on non-sanitary installations.



This application is to obtain a level measurement and corresponding 4-20 mA output proportional to the juice level on a batch process tank.

The bottom of the horn is 5m from the tank bottom. The empty level is 0m (bottom) and the full level (span) is 4.5m from the bottom. The maximum rate of filling or emptying is about 0.5m/min.

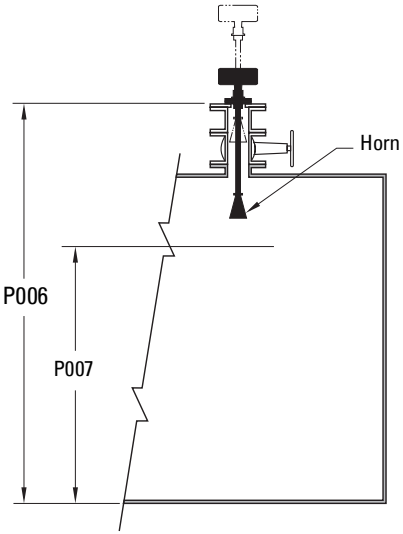
In the event of a loss of echo, SITRANS LR 300 is to go into Fail-

Parameter	Enter		
P999	**----**	master reset	
P001	**1**	mode of measurement	= level
P002	**1**	material	= liquid
P003	**2**	measurement response	= 1m/min.
P004	**240**	antenna	= factory
P005	**1**	units	= meters
P006	**5**	empty distance	= 5m
P007	**4.5**	span	= 4.5m
P070	**2**	Fail-Safe timer	= 2 minutes
P071	**1**	Fail-Safe	= Hi
P820	**12**	algorithm	= First Echo
P830	**7**	TVT type	= factory
P837/838 (Note above)	**2 & 1**	Auto False Echo Suppression	

Run: To start normal operation, press the **PROGRAM** key [≡] .

Application Example: Sliding Waveguide on Anaerobic Digesters

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



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

This application is to obtain a level measurement and corresponding 4-20 mA output proportional to the sludge level on a digester. The bottom of the SITRANS LR 300 mounting flange is 10m from the bottom of the digester when SITRANS LR 300 is lowered to its normal operating position.

The empty level is 0m (bottom) and the full level (span) is 8m from the bottom. The maximum rate of filling or emptying is about 0.1m/min.

Parameter	Enter		
P999	**----**	master reset	
P001	**1**	mode of measurement	= level
P002	**1**	material	= liquid
P003	**2**	measurement response	= 1m/minute
P004	**240**	antenna	= factory
P005	**1**	units	= meters
P006	**10**	empty distance	= 10m
P007	**8**	span	= 8m
P820	**8**	algorithm	= bLF (best of Largest or First)
P830	**7**	TVT type	= factory
P837/838 (Note above)	**2 & 1**	Auto False Echo Suppression	

Run: To start normal operation, press the **PROGRAM** key [▤].

Application Example: Stillpipe or By-pass Pipe

This is an alternative to the waveguide antenna option, used for products with an ε_r of less than 3, or if extremely turbulent or vortex conditions exist.

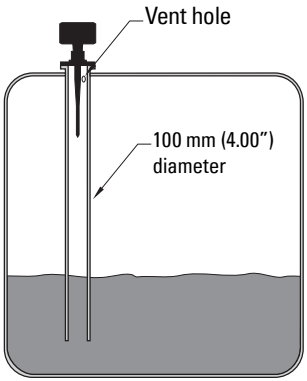
Notes:
- For $\varepsilon_r < 3$, the lower 40 cm of vessel level may not be measurable.
- Only set P837 if the product is at least 2 m (78") away from the flange face. If it is closer, leave P837 at **1** until the level drops and the distance increases beyond 2m (78").

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

The bottom of the SITRANS LR 300 flange is 5 m from the tank bottom. The empty level is 0m (bottom) and the full level (span) is 4.5 m from the bottom. The stillpipe inside diameter is precisely 4.00 inches. The maximum rate of filling or emptying is about 0.1m/min.

In the event of a loss of echo, SITRANS LR 300 is to go into Fail-Safe Hi after 2 minutes.

This mounting arrangement also provides optimum signal conditions on foaming materials.



Suitable pipe diameters are 50 mm (2") to 250 mm (10"): (see page 50 for typical P655 values).

Set the parameters below in the order shown: (see notes 1 and 2 on next page for more details).

Parameter	Enter		
P999	**----**	master reset	
P001	**1**	mode of measurement	= level
P002	**1**	material	= liquid
P003	**2**	measurement response	= 1m/minute
P004	**240**	antenna	= factory
P005	**1**	units	= meters
P006	**5**	empty distance	= 5 m
P007	**4.5**	span	= 4.5 m
P655 (see page 50)	**0.955**	propagation factor	= 10 mm (4") pipe
P800	**0.1**	near blanking	= 0.1 m
P820	**12**	algorithm	= First echo
P837/838 (Note above)	**2 & 1**	Auto False Echo Suppression	
P839	**80**	Auto TVT Hover Level	= 80%

Run: To start normal operation, press the **PROGRAM** key [≡].

Pipe Inside Diameter	P655 Value (Typical)*
50mm (2″)	0.827
80mm (3″)	0.915
100mm (4″)	0.955
150mm (6″)	0.980
200mm (8″)	0.990

* These values are provided as a guideline.

1. As a result of the extremely high signal to noise ratio experienced in pipe propagation, the blanking may be set to 0.1 m (4"). Normally, a minimum distance of 0.25 m (10") may be achieved.
2. Increase Hover level (P839) to 80% to de-sensitize the instrument concerning deposits or pipe imperfections.

Parameter Descriptions

The parameters are the programmable features of SITRANS LR 300. Adjust the value settings on the parameters to configure the unit.

The parameter tables show the values you need to enter in **bold** type, followed by additional information when necessary. The pre-set values are the factory settings, which may need alteration for specific applications.

Press the **PROGRAM** key followed by the **TOGGLE** key twice to open the parameter fields.

P000 Lock

Secures SITRANS LR 300 from changes.

Value	**1954**	Lock off: programming permitted
	other	Lock activated: programming secured

Enter **000** to access the parameter, then enter any value other than **1954** to secure the programming lock. Press **ENTER** to set the value. The **PROGRAM** mode is now active for viewing only. To unlock, access this parameter and enter **1954.**

Notes:

- This lock only applies to LCD/ hand programmer.
- A remote master can change configuration if P799 is set to allow this.

! WARNING: Use this lock as backup security only. It uses a fixed value which can be discovered by unauthorized personnel.

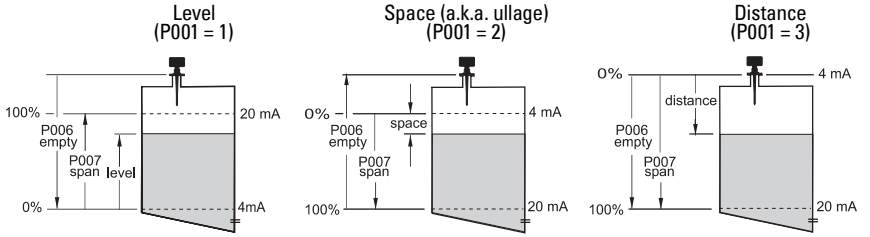
Quick Start Parameters (P001 to P007)

Parameters P001 to P007 are the main settings that apply to all applications and make the system operational.

P001 Operation (F = 3)

Sets the display variable for the local LCD only. (The primary variable for the HART/ PROFIBUS Master is controlled by P201.)

Values	1	Level: material level referenced to empty distance (P006)
	2	Space: space to material level referenced from span (P007)
	3	Distance: distance to target referenced from the flange face



Note: P050 sets SITRANS LR 300 to calculate readings based on reservoir volume.

P002 Material

Identifies the material being monitored.

Values	1	Liquids or slurries

P003 Measurement Response (F = 2)

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

	Measurement Response P700/P701			Echo Verification P711	Fail-Safe Timer P070
Values	1	0.1m/minute	slow	2	100
	2	1m/minute	↕	2	10
	3	10m/minute		2	1
	4	100m/minute		0	0.1
	5	1000m/minute	fast	0	0

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

If SITRANS LR 300 does not keep step with the rate of level change, select a faster rate. If the reading bounces around an average value, select a slower rate. In general, slower response time is associated with greater reliability. Noisy applications or those with agitators tend to be more manageable at slower response rates, as these make use of filtering, echo verification, and longer Fail-Safe delay.

- **echo verification:** discriminates between agitator blades in motion (spurious noise) and the target surface (true echo).
- **Fail-Safe timer:** establishes the period from the time a loss of echo (LOE) starts until the Fail-Safe default (P071) is triggered. The P003 pre-set timer value can be overridden by P070.

P004 Antenna (F = 240)

Identifies antenna configuration.

Values	240	factory setting for all antenna types
	241	rod + 50mm PTFE extension
	242	rod + 100mm PTFE extension

P005 Units (F = 1)

Specifies units for programming and measurement.

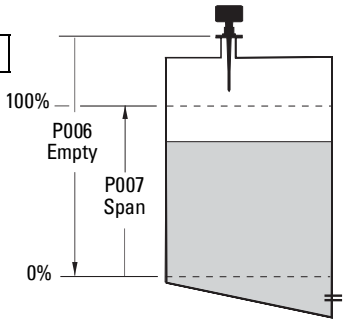
Values	1	meters
	2	centimeters
	3	millimeters
	4	feet
	5	inches

P006 Empty (F = 10m)

Sets the distance in units (see P005) from flange face to empty level.

Values	-----	# units set in P005

Empty level can be set at any distance desired, not just actual empty.



P007 Span (F = 10m)

Sets the distance from empty (P006) to full / 100% level.

Values	-----	# units set in P005

Full level can be set at any measurement above the empty level.

Note: After these start-up parameters are configured, set Parameters P837 and P838.

Volume Parameters (P050 to P055)

Set SITRANS LR 300 to calculate readings based on reservoir volume rather than level.

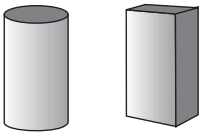
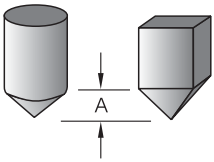
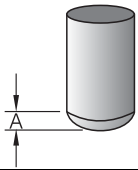
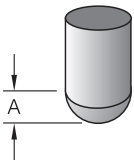
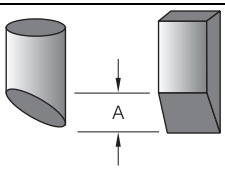
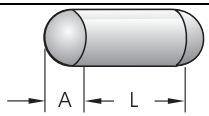
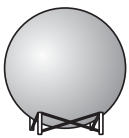
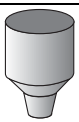
P050 Tank Shape (F = 0)

Enter the Tank Shape value that matches the monitored vessel or reservoir. (See chart on next page.)

When Operation is **LEVEL** (P001 = **1**), liquid (material) volume is calculated. When Operation is **SPACE** (P001 = **2**), remaining vessel capacity is calculated

In the **RUN** mode, readings are displayed in volumetric units. (See **Maximum Volume [P051]** on page 56.) When **percent** is selected, the displayed volume reading is a percentage of Maximum Volume.

Note: Parameters P052 and P053 set tank dimensions A and L.

P050 Value	Tank Shape	Description	Additional Volume Parameters required
0	----	volume calculation not required (factory disabled)	N/A
1		flat bottom	P051
2		conical or pyramidal bottom	P051, P052
3		parabolic bottom	P051, P052
4		spherical bottom	P051, P052
5		angled bottom	P051, P052
6		flat ends	P051
7		parabolic ends	P051, P052, P053
8		sphere	P051
9		universal linear level/volume breakpoints	P051, P054, P055

P051 Maximum Volume (F = 100 i.e. 100%)

For readings in volumetric units (rather than percent), enter the vessel volume between Empty (P006) and Span (P007).

Values	Range: **0.0000 to 99999**
Related Parameters	P006 Empty P007 Span

The units of measurement for this reading are non-dimensional. The volume is calculated from the empty position to the maximum position and is scaled according to the Tank Shape (P050) value. This allows the use of any volume units required.

Example:

1. If maximum volume = 3650m^3, enter **3650**.
   or
2. If maximum volume = 267500 gallons, enter **26750** (gallons x 10).
3. Enter the volume of the tank at full (Factory Setting = 100).

P052 Tank Dimension A (F = – – – –)

Dimension A is used in the tank shape parameter (P050) on page 54.

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

If P050 = 2,3,4, or 5, enter the height of the tank bottom.
If P050 = 7, enter the length **A** of one end-section of the tank. (See chart **Tank Shape** on page 55.)

Note: Enter the dimension in units chosen in P005.

P053 Tank Dimension L (F = – – – –)

Dimension L is used in the tank shape parameter (P050) on page 54.

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

If P050 = 7, enter the tank length **L** (excluding both end sections). (See chart **Tank Shape** on page 55.)

Note: Enter the dimension in units chosen in P005.

P054 Breakpoint Levels (F = – – – –)

When the tank shape is too complex for any of the pre-configured shapes, you can specify the volume based on segment.

Secondary Index	Breakpoint
Values	Range: **0.0000 to 99999** in units
Related Parameters	P055 Volume Breakpoints (Universal Volume Calculation)

Enter up to 32 level breakpoints (where volume is known) if P050 = 9.

Entering a Level Breakpoint
1. Open parameter P054.
2. Enter a breakpoint in measurement units.
3. Match each breakpoint to the same index value for P055.

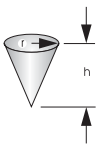
P055 Volume Breakpoints (Universal Volume Calculation) (F = – – – –)

Each segment defined by the level breakpoints (P055) requires a volume to allow SITRANS LR 300 to make the level-to-volume calculations.

Secondary Index	Breakpoint
Values	Range: **0.0000 to 99999** in units
	Pre-set: **0.0000**
Related Parameters	P054 Volume Breakpoints (Universal Volume Calculation)

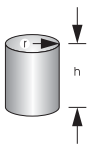
Typical volume calculations:

Cone



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

Cylinder



$V = \pi r^2 h$

Entering a Volume Breakpoint
1. Open parameter P055.
2. For each index enter a volume.
3. Match each volume to the same index value for P054.

Display and Reading Parameters (P060 to P063)

P060 Decimal Position (F = 2)

Defines the maximum number of decimal places used on the LCD.

Values (Level measurement only)	0	no digits after the decimal point
	1	1 digit after the decimal point
	2	2 digits after the decimal point
	3	3 digits after the decimal point

In **RUN** mode, the decimal position is adjusted to prevent the number of digits from exceeding the display capabilities. To keep the decimal place from shifting, reduce the number of decimal places to that shown at 100%.

For example, if 100% = 15m, use two decimal places for readings of 15.00 or parts thereof (e.g. 12.25).

P062 Offset Reading (F = 0.0000)

Adds the specified value to the reading displayed, usually to reference the reading to sea level or to another datum level.

Values (Level measurement only)	Range: **-999 to 99999**
	Pre-set: 0.0000

The operation of the device is not affected by the Offset Reading. This value is used for display only. All control measurements are still referenced to empty.

P063 Minimum Reading (F = 0.0000)

Adjusts the minimum reading the product will show. This is useful on conical or parabolic tanks to prevent negative values on the display.

Values (Level measurement only)	Range: **-999 to 99999**
	Pre-set: 0.0000

P063 is only applied after P062 Offset Reading and then only if reading displays level/ volume (P001=1).

The milliAmp output is not affected.

Fail-Safe Parameters (P070 to P072)

P070 Fail-Safe Timer

Sets the time delay, in minutes, before going into Fail-Safe mode.

Values	Range**: 0.0000 to 99999**
	Pre-set: Refer to Table for P003 on page 53.

P071 Fail-Safe Material Level (F = 3)

Selects the default measurement in the event that the Fail-Safe timer expires. (See also P219.)

Values	1	High: maximum span value
	2	Low: minimum span value
	3	Hold: hold current value

P072 Fail-Safe Level Advance (F = 1)

Sets the speed at which SITRANS LR 300 advances and returns to the Fail-Safe Material Level.

Values	1	Restricted (pre-set): unit advances to/from the Fail-Safe Material level as set by P003, P700, or P701.
	2	Immediate: Fail-Safe Material Level is assumed at once.
	3	Fast Back: Fail-Safe Level Advance is restricted. Returns to new measured material level at once.
Related parameter	P219 mA Output Fail-Safe	

mA Output Parameters (P201 to P219)

P201 mA Output Function (F = 1)

Alters the mA output/measurement relationship. Set independently from P001. This determines the primary variable for HART/PROFIBUS PA, and should not be changed if using HART.

Values	**0**	manual
	1	level
	2	space
	3	distance
	4	volume
	9	controlled by HART or Modbus

Selection can be done locally, or from the Master, using the Primary Variable exchange.

Note:
- Ensure the master is off-line with the device when changing this value locally. Changes will affect the mAmp Output directly, and can cause serious problems if under automatic control.
- Selection also affects the secondary, tertiary, and quaternary variables.
- **0 (manual)** setting is required to utilize P911. Remember to change back to previous setting after P911 usage.

Independent mA Setpoint Parameters (P210 and P211)

Use these features as a reference for calculating the minimum and/or maximum mA output to any point in the measurement range.

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

Note: **Ensure the % symbol is displayed before entering a % value.**

P201 (mA Function) Settings	Response
Level, Space, or Distance	Enter the material level in Units (P005) or percent of Span (P007) as referenced to Empty (P006).
Volume	Enter the volume in Maximum Volume (P051) units, or as a percent of Maximum Volume.

P210 4 mA Setpoint Parameter

Used to set the process level that corresponds to the 4 mA value. 4 mA always defaults to 0, and P201 determines whether this is a level, space, or distance measurement.

P211 20 mA Setpoint Parameter

Used to set the process level that corresponds to the 20 mA value. 20 mA always defaults to 100%, and P201 determines whether this is a level, space, or distance measurement.

P212 mA Output Minimum Limit

Note: HART Communications may not function below 3.6 mA.

Values 0 to 22.00

P213 mA Output Maximum Limit

Note: HART Communications may not function below 3.6 mA.

Values 0 to 22.00

P214 4 mA Output Trim

Used to calibrate the mA output for 4 mA. The device mA output is pre-calibrated; however, this parameter can be used to trim remote displays or inputs.

Values	Range: **0 to 22.00.** Display P911
Related Parameters	P215 20 mA Output Trim

Steps:

1. Set P201 to **0** (manual).
2. Set P911 to **4 mA**.
3. Record remote reading in mA.
4. Enter this value in P214.
5. Set P201 to previous setting.

P215 20 mA Output Trim

Used to calibrate the output for 20 mA. The device mA output is pre-calibrated; however, this parameter can be used to trim remote displays or inputs.

Values	Range: **0 to 22.00. Display P911.**
Related Parameters	P214 4 mA Output Trim

Steps:

1. Set P201 to **0** (manual).
2. Set P911 to **20 mA**.
3. Record remote reading in mA. Attach calibrated meter.
4. Enter this value in P215.
5. Set P201 to previous setting.

P219 mA Output Fail-Safe

Used to set the mA Fail-Safe operation, independent of the Fail-Safe Material Level (P071).

Values	**0**	Off (pre-set)	mA output responds to Fail-Safe Material Level
	1	HI	produces P213 (mA Output Maximum Limit)
	2	LO	produces P212 (mA Output Minimum Limit)
	3	HOLd	last known value is held until normal operation resumes

Installation Records Parameters (P340 to P346)

P340 Manufacture and Calibration Dates

Displays the year and month (yy-mm) for the following indexes:

Index	Data
01	manufacture date
02	calibration date
03	user date 1

Note: User date can only be set remotely by a HART/PROFIBUS master.

P341 Run Time

Shows the accumulated number of days SITRANS LR 300 has been operating.

Values (view only)	Display: **0.0 to 99999 (**days)

P342 Power-On Resets

A counter that increments every time power is applied to the unit following an interruption.

P343 Internal Temperature

*See **Appendix III, (Ambient/Operating Temperature Specification)** on 97 for more details.*

	Index	Temperature
3 Values	**1**	Current Internal Enclosure Temperature
	2	Maximum Recorded Internal Enclosure Temperature
	3	Minimum Internal Enclosure Temperature

Note: Internal Enclosure Temperature will always be higher than ambient.

P346 Serial Number

Displays the serial number of the unit.

Range Calibration Parameter (P655)

P655 Propagation Factor (F = 1)

Compensates for the change in the microwave velocity as compared with propagation in free space, when propagation is within a stillpipe (metal).

Values	Range: **0.0000 to 1.0000**
	Pre-set: **1**

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

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

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

The propagation factor is constant for a given pipe diameter, or can be determined by comparing the radar distance reading to the actual process material distance (measured from the face of the SITRANS LR 300 flange).

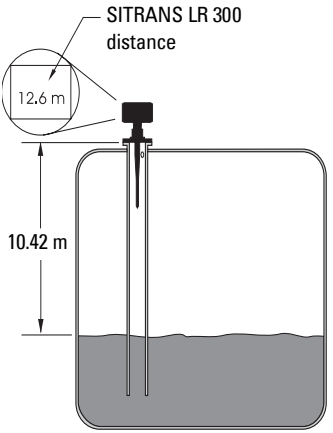
Example:

$$\frac{\text{actual distance}}{\text{SITRANS LR 300 distance}} = \text{p.f. (propagation factor)}$$

Using the readings shown:

$$\frac{10.42\text{m}}{12.6\text{m}} = 0.827$$

Enter the propagation factor: **0.827**



Rate Parameters (P700 and P701)

These parameters determine how material level changes are reported.

P700 Maximum Fill Rate

Adjusts the SITRANS LR 300 response to increases in the actual material level (or an advance to a higher Fail-Safe Material Level, P071).

Values Altered by Related Parameters	Range: **0.0000 to 99999** (stored in meters)
	P003 Measurement Response
	P005 Units P007 Span P071 Fail-Safe Material Level

Enter a value slightly greater than the maximum vessel-filling rate. This value, in Units (P005) or % of Span (P007) per minute, is automatically altered when Maximum Process Speed (P003) is altered.

P003 Value	Meters/Minute
1	0.1
2	1
3	10
4	100
5	1000

P701 Maximum Empty Rate

Adjusts the SITRANS LR 300 response to decreases in the actual material level (or an advance to a lower Fail-Safe Material Level, P071).

Values	Range: **0.0000 to 99999** (stored in meters)
Altered by	P003 Measurement Response
Related Parameters	P005 Units P007 Span P071 Fail-Safe Material Level

Enter a value slightly greater than the vessel's maximum emptying rate. This value, in Units (P005) or % of Span (P007) per minute, is automatically altered when Measurement Response Speed (P003) is altered.

P003 Value	Meters/Minute
1	0.1
2	1
3	10
4	100
5	1000

Measurement Verification Parameters (P709 to P713)

P709 Damping Filter

Stabilizes the reported level due to level fluctuations (such as a rippling or splashing liquid surface) within the Echo Lock Window (P713). The value is in seconds, and depends on the number of seconds it takes the device to reach 63.2% of a step value change in reading.

Values	Range: **0 to 100** (0= off)
Related Parameters	P007 Span P713 Echo Lock Window

P711 Echo Lock (F = 2)

Selects the measurement verification process.

Values	**0**	off
	1	maximum verification
	2	material agitator
	3	total lock
(P711) Related Parameters	P700 Maximum Fill Rate P701 Maximum Empty Rate P712 Echo Lock Sampling P713 Echo Lock Window P820 Algorithm	

If a material agitator (mixer) is used in the vessel monitored, set Echo Lock to **1** (maximum verification) or **2** (material agitator) to avoid agitator blade detection. To avoid stationary blade detection, ensure the agitator is always running while SITRANS LR 300 is monitoring the vessel.

When set for **1** (maximum verification) or **2** (material agitator), a new measurement outside of the Echo Lock Window (P713) must meet the sampling criterion (P712).

For **3** (total lock), Echo Lock Window (P713) is pre-set to **0** (zero). SITRANS LR 300 continuously searches for the best echo according to the algorithm chosen (P820). If the selected echo is within the window, the window is then centered about the echo. If not, the window widens with each successive shot until the selected echo is within the window. The window then returns to its normal width.

When Echo Lock is **0** (off), SITRANS LR 300 responds immediately to a new measurement, within the constraints set by the Max Fill/Empty Rate (P700/P701). However, measurement reliability is affected.

P712 Echo Lock Sampling

Sets the number of consecutive echoes appearing above or below the echo currently locked onto. Sampling ratio must occur before the measurements are validated as the new reading (for Echo Lock P711 values: **1** *or* **2***).*

Values	Range: **1:1 to 99:99**
	Format: xx:yy xx = the number of **above** echoes yy = the number of **below** echoes
Related Parameter	P711 Echo Lock

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

Example Settings:

- P711 = 2: material agitator
- P712 = 5:2

Example Results:

- A new reading will not be validated unless 5 consecutive measurements higher or 2 consecutive measurements lower than the current reading occur.

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

P713 Echo Lock Window (F = 0.0000)

Adjusts the new measurement changes permitted before the Echo Lock is applied.

Values	Range: **0.0000 to 99999**
	Pre-set: 0.0000
Altered by	P711 Echo Lock
Related Parameters	P005 Units

The Echo Lock Window is a "distance window" (Units, P005) centered on the echo and used to derive the reading. When a new measurement is in the window, the window is re-centered and the new reading calculated. Otherwise, the new measurement is verified by Echo Lock (P711) before the reading is updated.

Communications Parameters (P750 and P752)

P750 Ident Number Section (F = 0)

Directs the device to use either the manufacturer-specific (Siemens Milltronics) identification number, or the profile-specific ident number (Class 1 master using Profile 3.00 level gsd file).

Values	**0**	Manufacturer Specific identification number
	1	Profile Specific Ident Number

P752 PROFIBUS PA / HART address

Allocates the fieldbus ID or address for the device.

Values for PROFIBUS PA	Range: **1** to **126**
	Default: **126**
Values for HART	Range: **0** to **16**
	Default: **0**

Serial Communication Parameters (P770 to P799)

These parameters control the RS-485 port. If you are using the Modbus protocol, use P799 to set SITRANS LR 300 to read-only or read-write. The Modbus Register Map is on page 79.

P770 Serial Protocol (F = 1)

Sets the communications protocol used on the RS-485 port.

Values	**0**	Communications disabled
	1	Dolphin Protocol
	2	Modbus ASCII slave serial protocol
	3	Modbus RTU slave serial protocol

Dolphin protocol is a proprietary protocol, for Siemens Milltronics use only.

Modbus is an open protocol. Please see www.modbus.org for more information.

P771 Bus Address (for Modbus) (F = 1)

Allocates the unique identifier of SITRANS LR 300 on the network for the RS-485 port.

Values	Range: **0 to 99999**
	Pre-set: 1

For devices connected with a serial Modbus slave protocol, this parameter is a number from 1-247. The network administrator must ensure that all devices on the network have unique addresses. Do not use the value **0** (zero) for Modbus communications because this is the broadcast address and is inappropriate for a slave device.

P772 Baud Rate (F = 9.6)

Sets the communication rate with the master device.

Values	**4.8**	4800 baud
	9.6	9600 baud
	19.2	19,200 baud
	38.4	38,400 baud

This specifies the rate of communication in Kbaud. Any value may be entered, but only the values shown are supported. The baud rate should reflect the speed of the connected hardware and protocol used. For updating software, you must use 9600 baud.

P773 Parity (F = 0)

Sets the serial port parity for the RS-485 port.

Values	**0**	No Parity (default)
	1	Odd Parity
	2	Even Parity

Notes:

- Ensure that the communications parameters are identical between the SITRANS LR 300 and all connected devices.
- If 7 data bits are chosen for Modbus ASCII, then parity must be set to either **1** (odd) or **2** (even), and not to **0** (no parity)

P774 Data Bits and Stop Bits

There are eight data bits and one stop bit.

P799 Communications Control (F = 1)

This parameter determines the read/write access to parameters via remote communication. Index 1 controls serial communications via the RS-485 port, (Modbus only). Index 2 controls PROFIBUS PA or HART.

Index	Values	Description
01	0	Read only
	1	Read/write
	2	Restricted access – read only except for P799 which is read/write
02	0	Read only
	1	Read/write
	2	Restricted access – read only except for P799 which is read/write

To change an index value:

1. Press **TOGGLE** to open the secondary index field: (you may need to press **TOGGLE** twice, depending on your start point). The index fields are empty and read – –.
2. Press the **ARROW** keys to scroll to the required index (or type in the address).
3. Key in the index value required, and press **ENTER** to set the value.

Notes:

- P799 is independent of P000. Even if P000 is locked, a communications master can write to any parameter if P799=**1**, or can write to P799 if P799=**2.**
- P000 controls the lock access if you are using the Siemens Milltronics keypad hand programmer, but it has no effect on Modbus.
- Press **PROGRAM** to toggle between **RUN** and **PROGRAM** mode.
- Press **TOGGLE** twice to open parameter fields.

Echo Processing Parameters (P800 to P807)

P800 Near Blanking (F = 0.4m)

*Sets the amount of blanking as measured from the flange face and extending into the measurement range. See **Blanking** on page 42.*

Values	Range: **0 to 99999**
	Pre-set: 0.4m
Related parameter	P837 Auto False Echo Suppression

Enter the value in units as set in P005.

P801 Range Extension (F = 5%)

Sets the amount of range extension as measured from the empty distance (P006) and extending beyond the measurement range. See ***Blanking*** *on page 42.*

Values	Range: **0 to 99%**
	Pre-set: 5%

Enter the value as a percentage of P006. The distance below empty is not blanked.

For tanks with conical or parabolic bottoms, increase this parameter to ensure that an empty tank reads empty.

P804 Confidence Threshold (F = 5)

Sets the minimum echo confidence that the echo must meet in order to prevent a loss of echo condition and the expiration of the Fail-Safe timer (P070).

Values	Range: **0 to 99**
	Pre-set: **5**
Related Parameters	P070 Fail-Safe Timer

P805 Echo Confidence

Measures echo reliability.

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

Values (view only)	Display: **0 to 99**
Related Parameters	P804 Confidence Threshold

P806 Echo Strength

Displays the strength of the selected echo, in dB above 1 µV rms.

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

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

P807 Noise

Displays the average and peak ambient noise (in dB above 1 µV #see P806 RMS) being processed.

Press the measurement key [↓] to get a noise reading. The noise level is a combination of transient noise and electrical noise (receiving circuitry).

Values (view only)	x = average (–20 to 99)
	y = peak (–20 to 99)

Algorithm Parameter (P820)

P820 Algorithm (F = 8)

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

Values	**3**	L = **L**argest only
	8	bLF = best of **L**argest or **F**irst
	12	**F** = **F**irst only

Select **8 (bLF)** for most applications and all mounting locations except the center of the vessel. Select **12 (F)** for the center of the vessel mounting location and for still pipes and waveguide antennas used as stillpipes. Select **3 (L)** only when the vessel level will remain at low levels.

TVT (Time Varying Threshold) Adjustment Parameters (P830 to P841)

The following parameters are for authorized Siemens Milltronics Service personnel or technicians familiar with Siemens Milltronics echo processing techniques. SIMATIC PDM should be used to view the echo profile before attempting to modify these parameters.

P830 TVT Type

Value	**7**	Smooth TVT

P831 TVT Shaper

*Turns the TVT Shaper **ON** or **OFF**:*

Values	**0**	off
	1	on
Related Parameters	P832 TVT Shaper Adjust	

Turn the TVT Shaper **ON** before using P832, and afterwards turn the TVT Shaper **ON** and **OFF** while monitoring the effect to pick up the true echo.

P832 TVT Shaper Adjust

Allows manual adjustment of the TVT curve.

Values	Range: –**50 to 50**
	Pre-set: **0**
Related Parameters	P831 TVT Shaper

Use this feature to bias the shape of the TVT curve to avoid crossing false echoes from fixed objects.

Adjust this parameter while viewing the echo profile with SIMATIC PDM. Refer to the SIMATIC PDM online help for details. The TVT curve is divided into 40 breakpoints, which you can access via the index field. Each breakpoint is normalized to a value of 0, as displayed in the parameter value field. By changing the breakpoint value up or down, the intensity of the bias applied to that breakpoint of the curve is changed accordingly. By changing the value of adjacent breakpoints, the effective bias to the shaper can be broadened to suit the desired correction. If you are experiencing more than one false echo, you can apply additional shaping can along different points of the curve. Apply shaping sparingly in order to avoid missing the true echo.

To change a breakpoint:

1. Confirm that P831, TVT shaper, is **ON (1)**.
2. Go to P832.
3. Press **TOGGLE** to open the secondary index field.
4. Press **ARROW** keys to scroll through the 40 points, (or type in the desired point).
5. Enter the value from –50 to 50.
6. Press **ENTER** to set the value.

Notes:

- Press **PROGRAM** to toggle between **RUN** and **PROGRAM** mode.
- Press **TOGGLE** twice to open parameter fields.

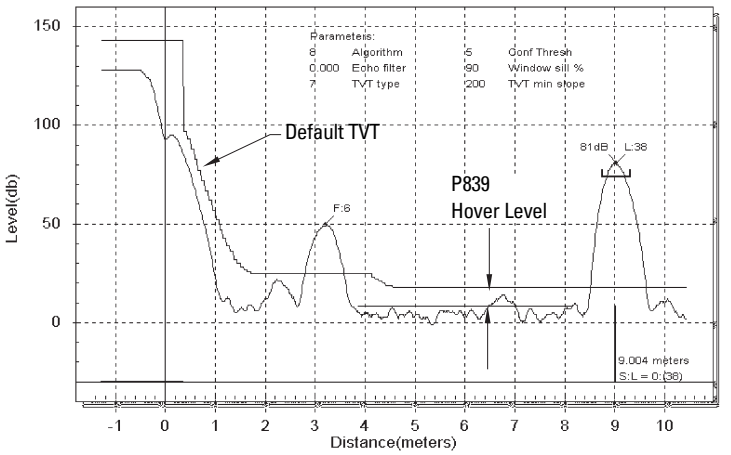
P837 Auto False Echo Suppression (F = 1)[1]

Use P837 and P838 during start up, if possible. It works ideally if the tank is empty or at low levels. Only use this function if there is a minimum 2m distance from the radar unit to the material. The agitator should be running, if the vessel contains an agitator.

Use this feature to adjust the TVT Curve

height to ignore false echoes on the Echo Profile by placing the TVT above the current signal. Use P838 to set the Auto TVT length.

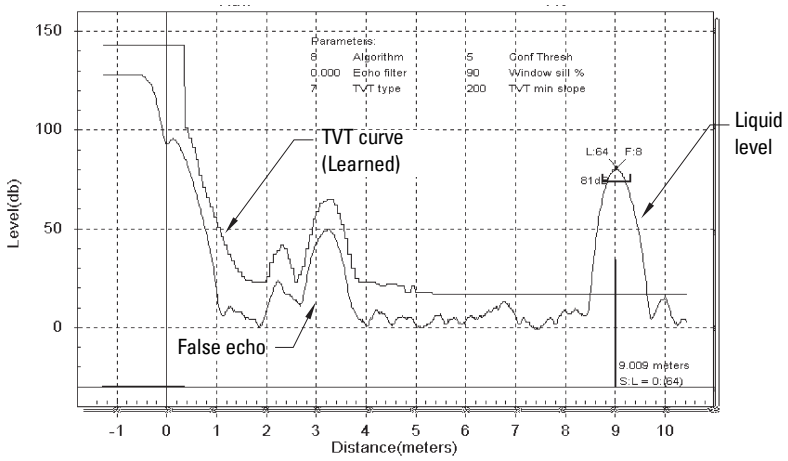
Echo Profile before Auto False Echo Suppression (or when P837 = 0)



Parameters

1. P837 will be preset to **1** by the factory. This is done to accommodate internal antenna reflections.

Echo Profile After Auto False Echo Suppression



If SITRANS LR 300 displays a full level, or if the reading fluctuates between a high level and a correct level, set this parameter to elevate the TVT in this region and to de-sensitize the receiver from any 'base noise' caused by internal antenna reflections and/or nozzle echoes.

Entry:

0 = Off (not used).
1 = Use Learned TVT. (See Learned TVT Curve, in Example: After False Echo Suppression, above.)
2 = Learn.

Set Up:

1. Perform this function at low tank levels.
2. Determine **distance** from radar unit to liquid level.
3. Select P838 and set [distance to liquid level minus 0.5m].
4. Select P837.
5. Press **2** and then press **ENTER** [↵]. P 837 will revert to **1** (use Learned TVT) automatically after a few seconds.

Notes:

- Press **PROGRAM** [≡] to toggle between **RUN** and **PROGRAM** mode.
- Press **TOGGLE** [⇄] twice to open parameter fields.

P838 Auto False Echo Suppression Distance (F = 1.0m)

Defines the endpoint of the Learned TVT distance. Set this parameter with P837, as above.

P839 TVT Hover Level (F = 40)

Defines (in %) how high the TVT is placed above the profile, with respect to the largest echo. When SITRANS LR 300 is located in the center of the vessel, this parameter may be reduced to prevent multiple echo detections.

P841 Number of Shots (F = 5)

Defines the number of profiles used for averaging before the processing and output are determined. Increasing this value provides slower response times

Test Parameters (P900 to P999)

P900 Software Revision

Displays the software revision level.

	Index	
Values (view only)	**1**	Software
	2	Boot revision
	3	Downloader revision
	4	Hardware release

P901 Memory

Tests the memory.

Test is initiated by scrolling to the parameter or repeated by pressing the **ENTER** key [↵].

	PASS	
Values (view only)	**1**	normal
		consult Siemens Milltronics

P911 mA Output Value

Displays the current value of the mA output in MilliAmps.

Values	Range: **4.00 to 20.00**

When P201 is set to **0** (manual), a test value can be entered and the displayed value transmitted to the output. Be sure to switch P201 back to the desired function after the test!

P920 Reading Measurement

*Displays the reading measurement that the unit is programmed for in **RUN** mode (P001, operation).*

Values (view only)	units showing Level/Space/Distance

P921 Material Measurement

Displays the reading measurement as though the unit were programmed to read Level (P001 = 1).

P922 Space Measurement

Displays the reading measurement as though the unit were programmed to read Space (P001 = 2).

P923 Distance Measurement

Displays the reading measurement as though the unit were programmed to read Distance (P001 = 3).

P924 Volume Measurement

The calculated vessel capacity in Maximum Volume (P051) or % of Maximum Volume.

Values	Range: **0.0000 to 99999**
Related Parameters	P051 Maximum Volume

P927 Distance Measurement (0%)

The distance between the surface and the flange face.

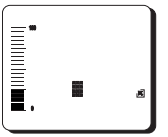
Values	Range: **0.0000 to 99999 in units or % of Empty**
Related Parameters	P005 Units P006 Empty

Use P923 unless the distance information is required in percent.

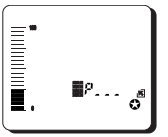
P999 Master Reset

Resets parameters to their factory setting.

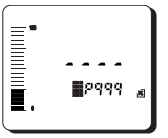
1. Press the **PROGRAM** key [≡] to activate the PROGRAM mode.



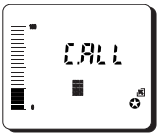
2. Press the **TOGGLE** key [⇔] twice to access parameter fields.



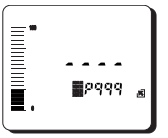
3. Key in **999**.



4. Press the **CANCEL** key [c] then press the **ENTER** key [↵] to Clear All and initiate reset.



5. Reset complete.
   Note: Reset takes several seconds to complete.



Modbus Register Map

The memory map of the IQ-300 occupies the Modbus holding registers (R40,001 and up). This map is used when the protocol is Modbus RTU slave or Modbus ASCII slave.

Register Map for Most Common Data

Legend	
Type	The type of data held in the group of registers.
Start	The first register to hold the referenced data.
Data Type	The possible values of the data in the register. See Data Types on page for more information.
Description	The type of data held in the individual registers.
#R	The number of registers used for the referenced data.
Read/Write	Indicates whether the register is readable, writeable, or both.

SITRANS LR 300 is designed to make it easy for master devices to get useful information via Modbus. The chart below gives an overview of the different sections. A more detailed explanation of each section follows.

Type	Description	Start	#R [1]	Data Type	Read/ Write
ID	Siemens Milltronics Product Code	40,064	1	3	R
Point Data	Reading (1)	41,010	1	-20,000 to 20,000	R
	Volume (1)	41,020	1	-20,000 to 20,000	R
I/O Data	mA Output	41,110	1	400 to 2,000	R/W
Parameter Values	Parameter Access	43,997 to 44,999		Depends on Parameter	R/W

1. Maximum registers shown, fewer may be used depending on options installed.

Product ID (R40,064)

This value identifies the Siemens Milltronics device type. For SITRANS LR 300, the value is 3.

Point Data (R41,010 – R41,031)

Measurement point data contain the current instrument readings. These are the values shown for the reading measurement, (level, distance, or volume, according to the setting for P001); and for the volume measurement, (volume). Please see page 52 for more details on P001.

The available registers are:

Data	Registers	Parameter
Reading	41,010	P920
Volume	41,020	P924

The reading is expressed as a percentage of full scale, multiplied by 100:

Reading	Value
0	0.00%
5000	50.00%
7564	75.64%
20,000	200.00%

Input/Output

SITRANS LR 300 has one mA output.

mA Output (R41,110)

The mA output is scaled from 400 to 2,000 (4 to 20 mA multiplied by 100). Displayed in P911.

Parameter Access (R43,997 – R46,999)

Parameter values are given as integers in the range of registers from R44,000 to R44,999. The last three numbers of the register correspond to the parameter number.

Parameter Register #	Parameter #
44,000	P000
44,001	P001
44,002	P002
…	…
44,999	P999

The parameters are usually all read/write. However, before a parameter can be read or written to, the format (where decimal place is) and the indexes must be defined.

Notes:
- Parameter P999 is read only.
- Parameter P999 (Master Reset) cannot be used via Modbus.
- See **Data Types** on page 83 for a description of the different types of data associated with different parameters.

Format Word (R43,997)

Format Word is an unsigned integer that contains a value that represents a certain decimal offset.

The decimal offset indicates how the remote system must interpret the integer value that is stored in the parameter access register. The following table shows how different parameter values can be shown based on a register value (integer) of **1234**.

Decimal	Offset	Example
0	0	1,234
1	-1	12,340
2	-2	123,400
3	-3	1,234,000
4	-4	12,340,000
5	-5	123,400,000
6	+1	123.4
7	+2	12.34
8	+3	1.234
9	Percent	12.34%

Examples of using the Format Word for both the index values and the decimal offset value are shown below:

Format	Decimal
0	0
3	3 right
8	3 left
9	percent

Primary Index (R43,999) and Secondary Index (R43,998)

Many parameters are indexed. There are two possible indexes, a primary index and a secondary index. A secondary index is a sub-address of the primary index.

If there is not an index, enter a value of **1**.

Reading Parameters

1. Write the primary index value into R43,999.

   This is a value between 1 and 40 that specifies the primary index on the parameter. This value is normally 1.

2. Write the secondary index value into R43,998.

   This is a value between 1 and 40 that specifies the secondary index on the parameter. This value is normally 1.

3. Write the desired format value into R43,997.

4. Read the value from the appropriate parameter register.

Types of values are:

- **Numeric Values** on page 83.
- **Split Values** on page 83.
- **Text Messages** on page 84.

A value of 22,222 indicates that an error has occurred. Specify a different format type and try again.

Writing Parameters

The method of writing parameters is similar to the method of reading them. Become familiar with **Reading Parameters**, (above), before attempting to write any parameters.

Writing parameter values to SITRANS LR 300:

1. Write the primary index value into R43,999.
2. Write the secondary index value into R43,998.
3. Write the desired format value into R43,997.
4. Write the value to the appropriate parameter register.

Data Types

The SITRANS LR 300 parameters do not always use integers to hold values. For the convenience of the programmer, those values are converted to and from a 16-bit integer number. This section describes the conversion process.

Numeric Values

Numeric parameter values are the most common. For example, parameter P920 (Reading) returns a number that represents the current reading (either level or volume, depending on the IQ-300 configuration).

Numeric values are requested or set in units or percent of span, and may be specified using a number of decimal places.

Numeric values must be in the range –20,000 to +20,000 to be valid. If a parameter is requested and its value is more than +20,000, the number 32,767 is returned; if it is less than –20,000, the number –32,768 is returned. If this overflow happens, decrease the number of decimal places.

If a parameter cannot be expressed in terms of percent of span, or has no meaningful value, the number 22,222 is returned. Try requesting the parameter in units, or refer to the Parameter Description section on page 51 for an explanation of the format and use of the requested parameter.

Split Values

Certain parameters are actually a pair of numbers separated by a colon, using this format: **xx:yy**.

One example is P712 (Echo Lock Sampling) where:

xx = the number of above echoes
yy = the number of below echoes

The number which corresponds to xx:yy, for either reading or setting a parameter, is determined by the following formula:

For storing to the device:

value = (xx + 128) x 256 + (yy + 128)

For reading from the device:

xx = (value / 256) – 128

yy = (value % 256) – 128

where % is the modulus operator.

The modulus can be computed by following these steps:

$value_1$ = value / 256

$value_2$ = remainder of $value_1$

$value_3$ = $value_2$ x 256

yy = $value_3$ – 128

It may simplify the calculation to note:

xx = (most significant byte of value) – 128

yy = (least significant byte of value) – 128

Text Messages

If a device parameter returns a text message, that message is converted to an integer and is then provided in the register. The numbers are shown in the following table:

Number	Text Message as displayed on LCD
22222	Invalid value
30000	Off
30001	On
30002	≡≡≡≡
30003	[ ]]] (parameter does not exist)
30004	Err
30005	Err1
30006	Open
30007	Short

Number	Text Message as displayed on LCD
30008	Pass
30009	Fail
30010	Hold
30011	Lo
30012	Hi
30013	De
30014	En
30015	**----** (parameter has not been set)
-32768	Value is less than –20,000
32767	Value is greater than 20,000

Error Handling

Errors can be traced to two general sources:

1. There is an error in transmission.

or

2. The host tries to do something that is not a valid action.

In the first case, SITRANS LR 300 does not respond and the master waits for a **Response Time Out** error, which causes the master to re-send the message.

In the second case, it depends on what the host tries to do. In general, SITRANS LR 300 will not give an error to the host request. Various actions and the expected outcome are as follows:

- If the host reads an invalid register, the host will get an undetermined value back.
- If the host writes an invalid register (a non-existing parameter or a read only parameter), the value will be ignored and no error response will be made. However, the current value will not reflect the desired new value.

- If the host writes a read only register, then the value will be ignored and no error response will be made. However, the current value will not reflect the desired new value.
- If P799 is read-only, then the value will be ignored and no error response will be made. However, the current value will not reflect the desired new value.
- If the host attempts to write one or more registers that are out of range, an exception response code 2 or 3 is generated depending on whether the start address is valid.
- If the host used an unsupported function code, an exception response code of 01 should be generated. However, this is not guaranteed and there may be no response.

Modbus Responses

When polled by a Modbus Master, a slave device will do one of the following:

1. Echo back the command with the correct response (see the Modbus specification for more details). This is the normal response.
2. Not reply. This means that something went wrong with the transmission of the message.
3. Return an Exception Code. This reflects an error in the message.

SITRANS LR 300 uses the following exception codes:

Code	Name	Meaning
01	Illegal Function	The function code received in the query is not an allowable action for the slave.
02	Illegal Data Address	The data address received in the query is not an allowable address for the slave.
03	Illegal Data Value	A value contained in the query data field is not an allowable value for the slave.

Troubleshooting

Communication Troubleshooting

Generally:

1. Check the following:
   - There is power at the unit
   - The LCD shows the relevant data
   - The device can be programmed using the hand programmer
2. Check the wiring pin-outs and verify that the connection is correct.
3. Verify that values in set-up parameters P770 to P773 match the settings in the computer communicating with the unit.
4. Check that the port you are using on the computer is correct. Sometimes trying a different Modbus driver will solve the problem. An easy stand-alone driver called ModScan32 is available from Win-Tech at www.win-tech.com. We have found that this driver is useful to test communications.

Specifically:

If you try to set a SITRANS LR 300 parameter via remote communications, but the parameter remains unchanged:

- Some parameters can only be changed when the device is not scanning. Try putting the device in program mode using the operating mode function.
- Try setting the parameter from the keypad. (First make sure that the lock parameter [P000] is set to **1954**.)
- The communications control parameter P799 must be set to **1** to be able to write parameters to SITRANS LR 300.

Operation Troubleshooting

Operating symptoms, probable causes, and resolutions.

Symptom	Cause	Action
display reads 	level or target is out of range	• check specifications • check P006 • increase range extension P805
display reads 	material build-up on antenna	• clean • upgrade to purged antenna • re-locate SITRANS LR 300
display reads 	location or aiming: • poor installation • flange not level	• check to ensure nozzle is vertical • use P837 • check to ensure nozzle is clean and free of internal seams/welds
display reads 	antenna malfunction: • temperature too high • physical damage • excessive foam • multiple echoes	• check P343 • use foam deflector or stilling well • relocate • use a defoamer • set P820 to **12** (First echo)
Reading does not change, but the level does	SITRANS LR 300 processing wrong echo, i.e. vessel wall, or structural member	• re-locate SITRANS LR 300 • check nozzle for internal burrs or welds • rotate unit 90° • use P837
Measurement is consistently off by a constant amount	P006 not correct P652 not correct	• Check distance from Flange face to zero level (P006) • Check offset value (P652) or device tag
Screen blank	power error	• check nameplate rating against voltage supply • check power wiring or source

Symptom	Cause	Action
Reading erratic	echo confidence weak	• refer to P805 • use P837 • use foam deflector or stilling well
	liquid surface vortexed	• decrease measurement response P003 • relocate unit to side pipe • increase confidence threshold P804
	material filling	• re-locate SITRANS LR 300
Reading response slow	P003 setting	• increase response if possible
Reads correctly but occasionally reads high when vessel is not full	• detecting close range echo • build up near top of tank or nozzle • water or other high ε_r material in antenna threads • wrong antenna choice for application • nozzle problem	• clean • rod extensions may be required • See **Application Example: Stillpipe or By-pass Pipe** on page 49 • use P837/P838 • upgrade to shielded rod antenna
Level reading lower than material level	• material is within near blanking zone • tank near empty and low ε_r material • multiple echoes processed	• decrease blanking P800 (min. 0.4 m) • raise SITRANS LR 300 • decrease range extension • set P820 to 12 (First echo)
	• nozzle too narrow for length	• See **Rod Extension Requirements** on page 24 • Upgrade to Shielded Rod Antenna
	• Internal seam in nozzle	• Inspect and remove seam • Use P837 • upgrade to shielded rod antenna

Maintenance

SITRANS LR 300 requires no maintenance or cleaning under normal operating conditions.

Note: Under severe operating conditions, the antenna may require periodic cleaning.

Appendix I

Alphabetical Parameter List

Parameter Name	Parameter Number	Page Number
20 mA Output Trim	215	62
4 mA Output Trim	214	61
Algorithm	820	72
Antenna	004	53
Auto False Echo Suppression	837	74
Auto False Echo Suppression Distance	838	76
Baud Rate	772	69
Breakpoint Levels	054	57
Bus Address (Modbus)	771	69
Communications Control	799	70
Confidence Threshold	804	71
Damping Filter	709	65
Data Bits and Stop Bits	774	69
Decimal Position	060	58
Distance Measurement	923	77
Distance Measurement (%)	927	77
Echo Confidence	805	71
Echo Lock	711	66
Echo Lock Sampling	712	67
Echo Lock Window	713	67
Echo Strength	806	71
Empty	006	54
Fail-Safe Level Advance	072	59
Fail-Safe Timer	070	59
Fail-Safe Material Level	071	59
Ident Number Section	750	68
Internal Temperature	343	63
Lock	000	51
mA Output Fail-Safe	219	62
mA Output Function	201	60
mA Output Maximum Limit	213	61
mA Output Minimum Limit	212	61

Parameter Name	Parameter Number	Page Number
mA Output Value	911	76
4 mA Output Trim	214	61
20 mA Output Trim	215	62
Manufacture and Calibration Dates	340	62
Master Reset	999	78
Material	002	52
Material Measurement	921	77
Maximum Empty Rate	701	65
Maximum Fill Rate	700	64
Maximum Volume	051	56
Measurement Response	003	53
Memory	901	76
Minimum Reading	063	58
Near Blanking	800	70
Noise	807	71
Number of Shots	841	76
Offset Reading	062	58
Operation	001	52
Parity	773	69
Power On Resets	342	63
PROFIBUS PA / HART address	752	68
Propagation Factor	655	63
Range Extension	801	71
Reading Measurement	920	77
Run Time	341	63
Serial Number	346	63
Serial Protocol	770	68
Software Revision	900	76
Space Measurement	922	77
Span	007	54
Tank Dimension 'A'	052	56
Tank Dimension 'L'	053	56
Tank Shape	050	54
TVT Hover Level	839	76
TVT Shaper	831	72
TVT Shaper Adjust	832	72

Parameter Name	Parameter Number	Page Number
TVT Type	830	72
Units	005	53
Volume Breakpoints	055	57
Volume Measurement	924	77

Appendix II

Programming Chart

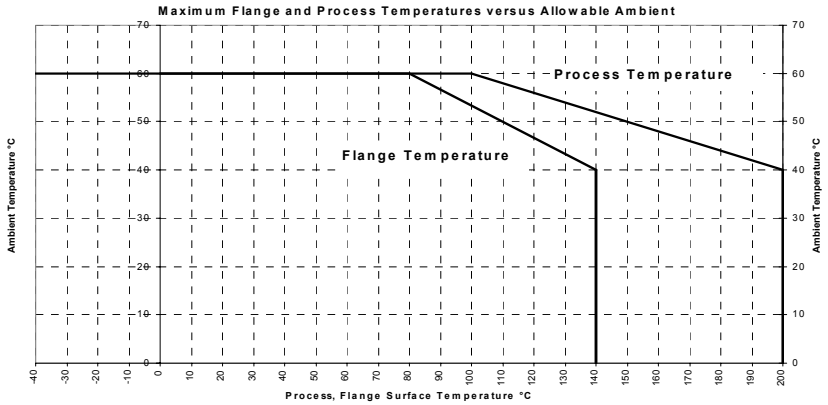
Number	Parameter Name	Value
001	Operation	
002	Material	
003	Measurement Response	
004	Antenna	
005	Units	
006	Empty	
007	Span	
050	Tank Shape	
051	Max Volume	
052	Tank Dimension 'A'	
053	Tank Dimension 'L'	
054	Breakpoint Level	
055	Volume Breakpoints	
060	Decimal Position	
062	Offset Reading	
063	Minimum Reading	
070	Fail-Safe Timer	
071	Fail-Safe Material Level	
072	Fail-Safe Level Advance	
201	mA Output Function	
212	mA Output Minimum Limit	
213	mA Output Maximum Limit	
214	4 mA Output Trim	
215	20 mA Output Trim	
219	mA Output Fail-Safe	
340	Manufacture and Calibration Dates	
341	Run Time	
342	Power On Resets	
343	Internal Temperature	
346	Serial Number	
655	Propagation Factor	

Number	Parameter Name	Value
700	Maximum Fill Rate	
701	Maximum Empty Rate	
709	Damping Filter	
711	Echo Lock	
712	Echo Lock Sampling	
713	Echo Lock Window	
750	Ident Number Section	
752	PROFIBUS PA / HART address	
770	Serial Protocol	
771	Bus Address (Modbus)	
772	Baud Rate	
773	Parity	
774	Data Bits and Stop Bits	
799	Communications Control	
800	Near Blanking	
801	Range Extension	
804	Confidence Threshold	
805	Echo Confidence	
806	Echo Strength	
807	Noise	
820	Algorithm	
830	TVT Type	
831	TVT Shaper	
832	TVT Shaper Adjust	
837	Auto False Echo Suppression	
838	Auto False Echo Suppression Distance	
839	TVT Hover Level	
841	Number of Shots	
900	Software Revision	
901	Memory	
911	mA Output Value	
920	Reading Measurement	
921	Material Measurement	
922	Space Measurement	

Number	Parameter Name	Value
923	Distance Measurement	
924	Volume Measurement	
927	Distance Measurement (%)	

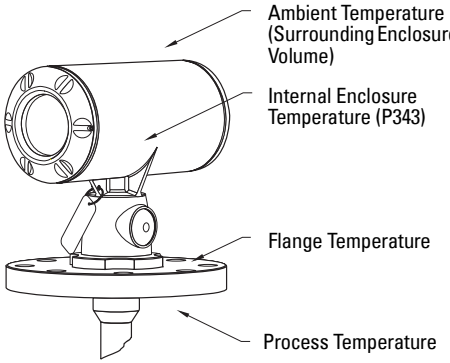
Appendix III

Ambient/Operating Temperature Specification



The chart above is provided for guidance only.

- The chart does not represent every possible process connection arrangement. For example, it will NOT apply if you are mounting SITRANS LR 300 on a nozzle greater than 8" nominal, or directly on a metallic tank surface.
- The chart does not take into consideration heating from direct sunshine exposure.



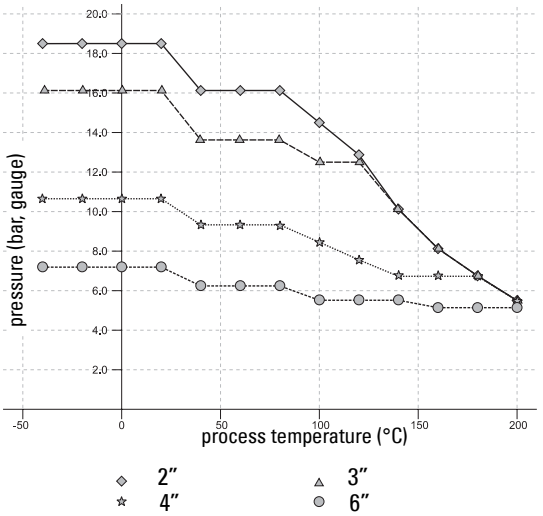
Where the chart does not apply, please use your own judgement regarding the use of SITRANS LR 300. Parameter P343 is required to monitor the Internal Temperature. It gives you an excellent indication of how reliably the product will perform thermally when installed on your process vessel. The maximum allowable internal temperature (P343) is 81^{o} C.

P343 also allows you to decide whether or not attention should be focussed on redesigning the installation. For example, if the internal temperature exceeds the maximum allowable limit, a sun shield or a longer nozzle may be required. Engineering will use this temperature reading (P343) to gauge the extent of change required to the installation in order to provide a reliable thermal-operating zone for SITRANS LR 300.

Appendix IV

Process Pressure/Temperature de-Rating

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



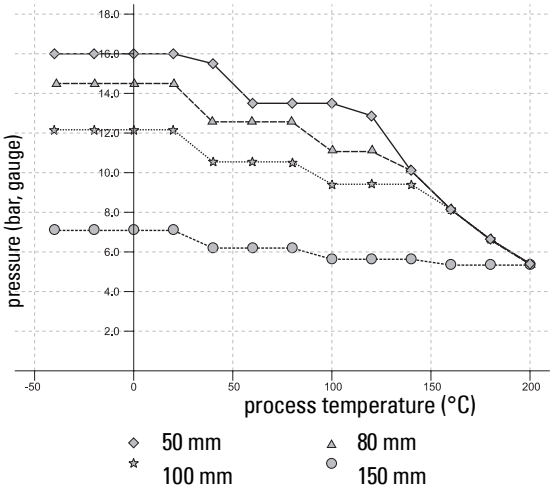
Process Configuration:

- 51003 with flange series 22452.
- Flange will be stamped 22452. Process connection tag will have the series identified as 51003.
- Reference drawing number is shown on the process device tag. This drawing can be obtained on request.

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

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

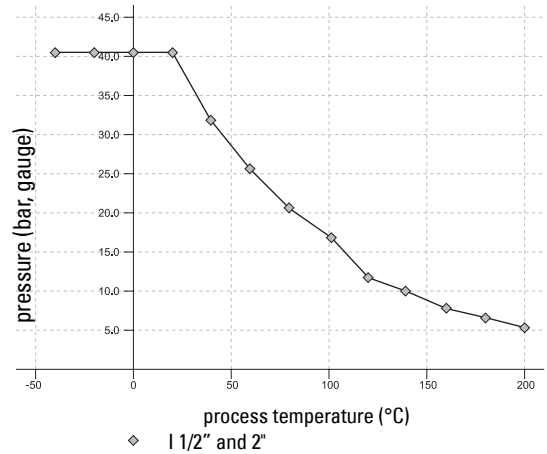
Rod Antenna DN Hole Pattern, PN16[1, 2]



Process Configuration:

- 51003 with flange series 22452.
- Flange will be stamped 22452. Process connection tag will have the series identified as 51003.
- Reference drawing number is shown on the process device tag. This drawing can be obtained on request.

Rod Antenna Threaded Connection



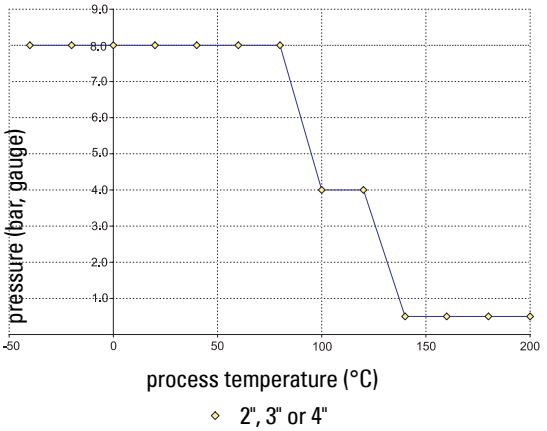
Process Connection Series:

- 51002, 51004, 51005
- Ensure the unit has a process connection identification tag showing one of this series.
- Reference drawing number is shown on the process device tag. This drawing can be obtained on request.

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

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

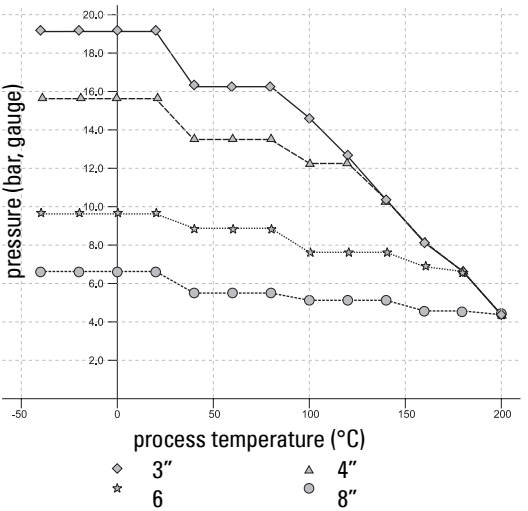
Rod Antenna Sanitary Connection[1]



Process Connection Series:

- 51010
- Ensure unit has the process identification tag showing this series number.
- Reference drawing number is shown on the process device tag. This drawing can be obtained on request.

Horn Antenna or Wave Guide – ANSI Hole Pattern, 150#[2]



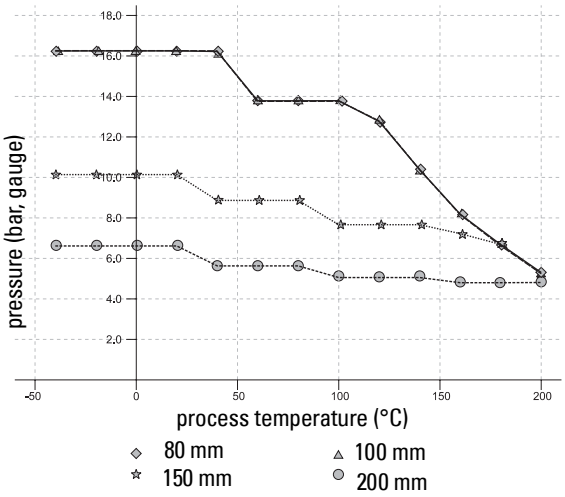
Process Connection Series:

- 51006 to 51012 with 22452 series flange.
- Ensure your unit has the process identification tag showing one of this series, and 22452 stamped on flange.
- Reference drawing number is shown on the process device tag. This drawing can be obtained on request.

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

1. UHMW-PE antennas are rated to a maximum of 80°C (176°F) of continuous duty; however, they can be used for periods of up to 3 hours at temperatures up to 120°C (248°F) at 1 bar pressure.
2. Customer to provide adequate bolting and flat-faced gasket to retain vessel pressure and provide sufficient sealing.

Horn Antenna or Wave Guide DN Hole Pattern, PN16[1]



Process Connection Series:

- 51006 to 51012 with 22452 series flange.
- Ensure your unit has the process identification tag showing one of this series, and 22452 stamped on flang
- Reference drawing number shown on the process devic tag. This drawing can be obtained on request.

! WARNINGS:

- **This product is designated as a Pressure Accessory per Directive 97/ 23 / EC and is <u>not</u> intended for use as a safety device.**
- **Materials of construction are chosen based on their chemical compatibility (or inertness) for general purposes. For exposure to specific environments, check with chemical compatibility charts before installing.**
- **The user is responsible for the selection of bolting and gasket materials which will fall within the limits of the flange and its intended use and which are suitable for the service conditions.**
- **Improper installation may result in loss of process pressure.**

Note: Please see next page for important information regarding the Process Device Tag and other markings.

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

Notes:

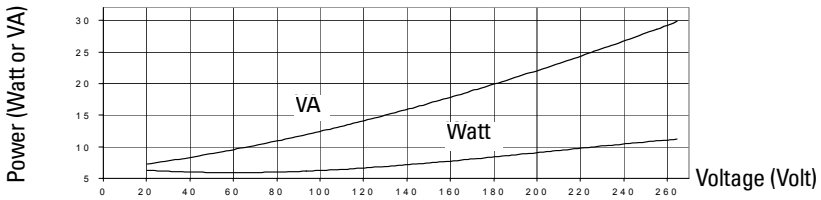
- The Process Device Tag shall remain with the process pressure boundary assembly. In the event the instrument package is replaced, the Process Device Tag shall be transferred to the replacement unit.
- All SITRANS LR 300 units are hydrostatically tested, meeting or exceeding the requirements of the 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
  MM = month
  DD = day
  YY = year
  XXX= sequential unit produced
  Further markings (space permitting) indicate flange configuration, size, pressure class, material and material heat code.

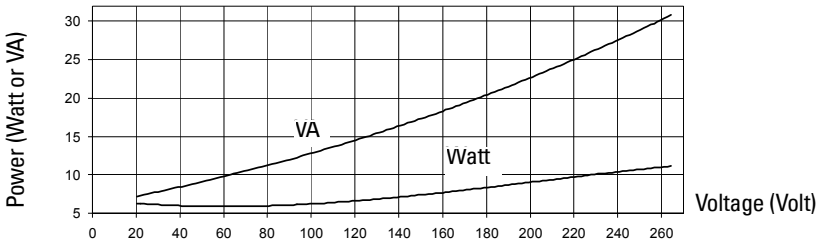
Appendix V

Typical Power Consumption

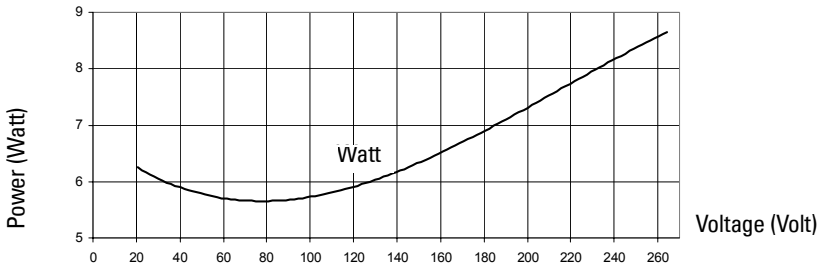
SITRANS LR 300 Typical Consumption with 50Hz AC Input Supply



SITRANS LR 300 Typical Consumption with 60Hz AC Input Supply



SITRANS LR 300 Typical Consumption with DC Input Supply



Appendix VI: HART

HART Communications for SITRANS LR 300

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

The IQ-300 can be configured over the HART network using either the HART Communicator 275 by Fisher-Rosemount, or a software package. There are a number of different software packages available, and SITRANS LR 300 should work well with any of them. The recommended software package is the SIMATIC Process Device Manager (PDM) by Siemens.

HART Device Descriptor (DD)

In order to configure a HART device, the configurator must have the HART Device Descriptor for the unit in question. HART DD's are controlled by the HART Communication Foundation. The HART DD for SITRANS LR 300 was released in 2001. Older versions of the software may need to be upgraded to include this DD.

SIMATIC Process Device Manager (PDM)

This software package is designed to permit easy configuration, monitoring and troubleshooting of HART and PROFIBUS PA devices. The HART DD for SITRANS LR 300 was written with SIMATIC PDM in mind and has been extensively tested with this software.

PDM has two different DD's for SITRANS LR 300. One is located in the HCF library, and provides basic functions. The other is located under the Sensor directory, and is a modified DD that lets you take full advantage of the advanced features of PDM.

The most up-to-date version of the special DD for SITRANS LR 300 designed for PDM, can be downloaded from the LR 300 product page on our web site at www.siemens-milltronics.com.

HART Communicator 275:

Chart 1

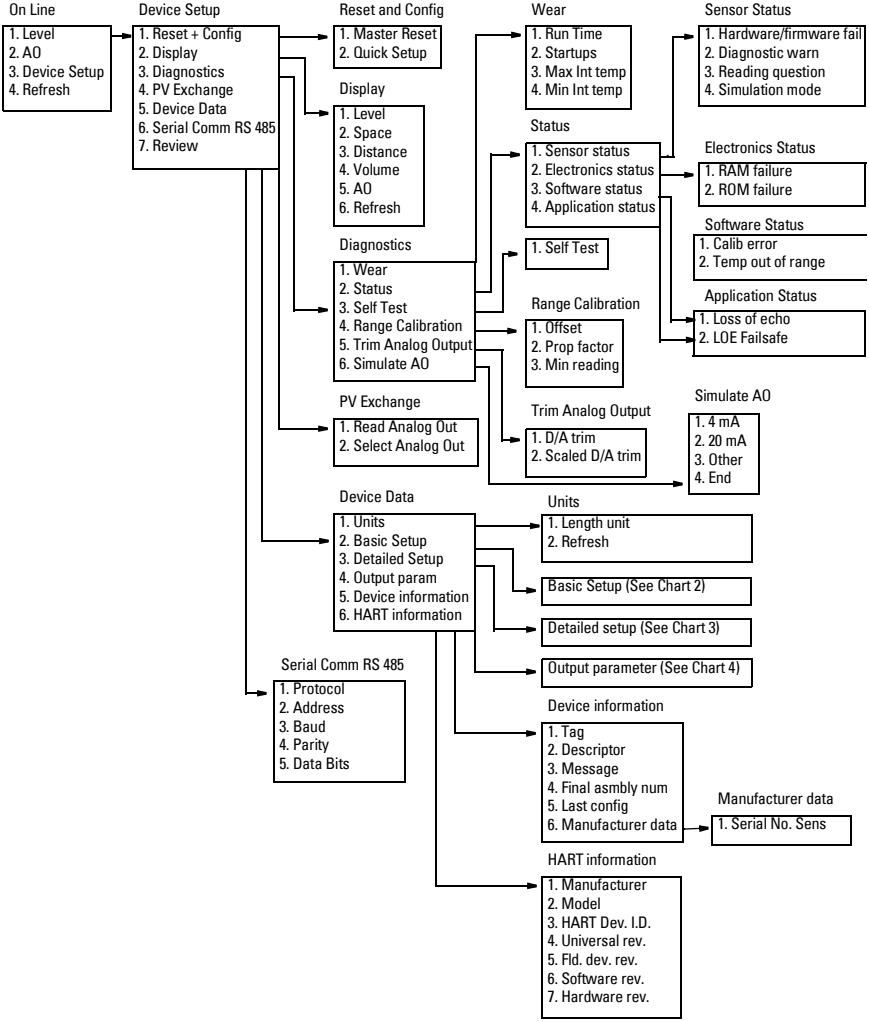


Chart 2

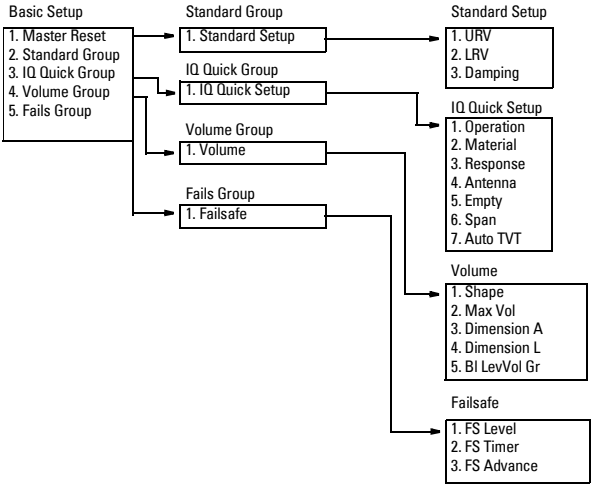

Basic Setup
1. Master Reset
2. Standard Group
3. IQ Quick Group
4. Volume Group
5. Fails Group
Standard Group
1. Standard Setup
IQ Quick Group
1. IQ Quick Setup
Volume Group
1. Volume
Fails Group
1. Failsafe
Standard Setup
1. URV
2. LRV
3. Damping
IQ Quick Setup
1. Operation
2. Material
3. Response
4. Antenna
5. Empty
6. Span
7. Auto TVT
Volume
1. Shape
2. Max Vol
3. Dimension A
4. Dimension L
5. BI LevVol Gr
Failsafe
1. FS Level
2. FS Timer
3. FS Advance

Chart 3

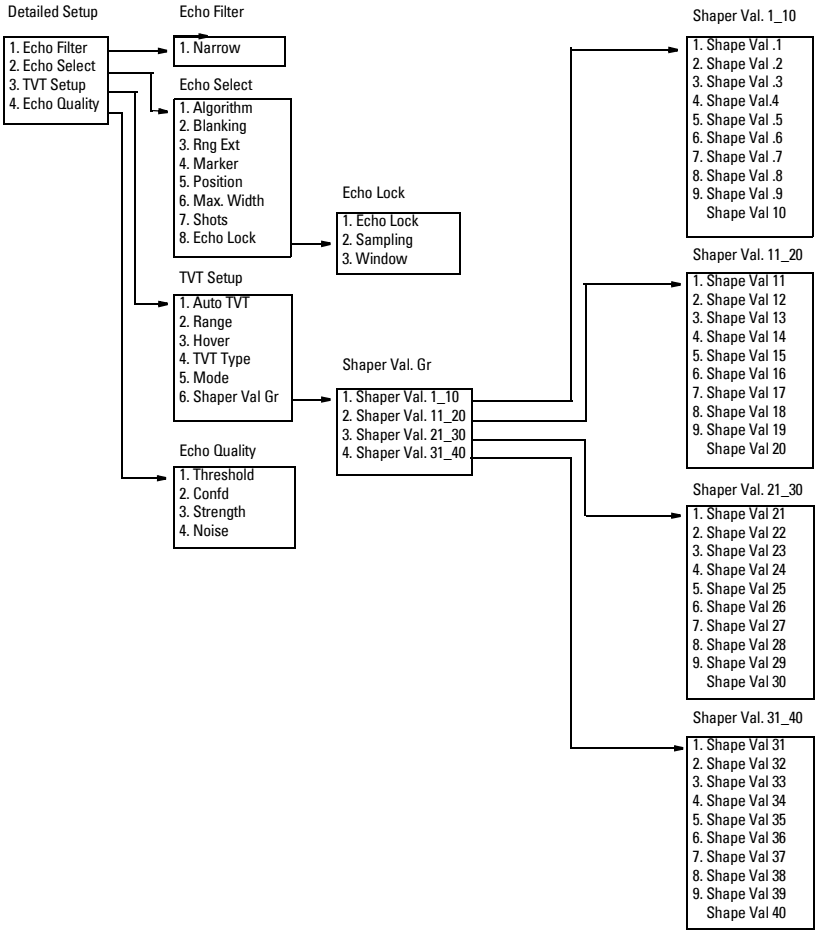
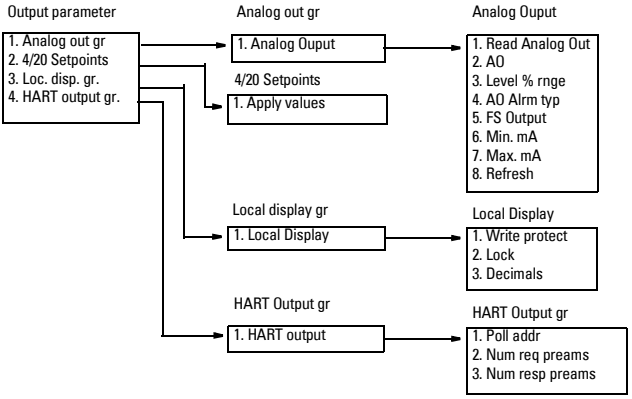

Detailed Setup
1. Echo Filter
2. Echo Select
3. TVT Setup
4. Echo Quality
Echo Filter
1. Narrow
Echo Select
1. Algorithm
2. Blanking
3. Rng Ext
4. Marker
5. Position
6. Max. Width
7. Shots
8. Echo Lock
Echo Lock
1. Echo Lock
2. Sampling
3. Window
TVT Setup
1. Auto TVT
2. Range
3. Hover
4. TVT Type
5. Mode
6. Shaper Val Gr
Shaper Val. Gr
1. Shaper Val. 1_10
2. Shaper Val. 11_20
3. Shaper Val. 21_30
4. Shaper Val. 31_40
Echo Quality
1. Threshold
2. Confd
3. Strength
4. Noise
Shaper Val. 1_10
1. Shape Val .1
2. Shape Val .2
3. Shape Val .3
4. Shape Val.4
5. Shape Val .5
6. Shape Val .6
7. Shape Val .7
8. Shape Val .8
9. Shape Val .9
Shape Val 10
Shaper Val. 11_20
1. Shape Val 11
2. Shape Val 12
3. Shape Val 13
4. Shape Val 14
5. Shape Val 15
6. Shape Val 16
7. Shape Val 17
8. Shape Val 18
9. Shape Val 19
Shape Val 20
Shaper Val. 21_30
1. Shape Val 21
2. Shape Val 22
3. Shape Val 23
4. Shape Val 24
5. Shape Val 25
6. Shape Val 26
7. Shape Val 27
8. Shape Val 28
9. Shape Val 29
Shape Val 30
Shaper Val. 31_40
1. Shape Val 31
2. Shape Val 32
3. Shape Val 33
4. Shape Val 34
5. Shape Val 35
6. Shape Val 36
7. Shape Val 37
8. Shape Val 38
9. Shape Val 39
Shape Val 40

Chart 4


Output parameter
1. Analog out gr
2. 4/20 Setpoints
3. Loc. disp. gr.
4. HART output gr.
Analog out gr
1. Analog Ouput
4/20 Setpoints
1. Apply values
Local display gr
1. Local Display
HART Output gr
1. HART output
Analog Ouput
1. Read Analog Out
2. AO
3. Level % rnge
4. AO Alrm typ
5. FS Output
6. Min. mA
7. Max. mA
8. Refresh
Local Display
1. Write protect
2. Lock
3. Decimals
HART Output gr
1. Poll addr
2. Num req preams
3. Num resp preams

Supported HART Commands:

SITRANS LR 300 conforms to HART rev. 5 and supports the following:

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

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

Device Specific Commands

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

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

Appendix VII: PROFIBUS PA

Note: The following instructions assume that the user is familiar with PROFIBUS PA.

PROFIBUS PA Communications for SITRANS LR 300

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

SITRANS LR 300 is a Class A, Profile Version 3.0, PA device. It supports Class 1 Master for cyclic data exchange, and Class 2 for acyclic services: (see page 111 for details).

SITRANS LR 300 can be configured using a software package. There are a number of different software packages available and SITRANS LR 300 should work well with any one of them. We recommend SIMATIC Process Device Manager (PDM) by Siemens. (You can find more information at www.fielddevices.com: go to Product Solutions > Products and Systems > Software).

Device Descriptor

In order to use Process **Device Manager (PDM)** with PROFIBUS PA, you will need the Device Descriptor for SITRANS LR 300, which will be included with new versions of PDM.

You can locate the Device Descriptor in **Device Catalog**, under **Sensors/Level/Echo/ Siemens Milltronics**. If you do not see **SITRANS LR 300** under Siemens Milltronics, you can download the Device Descriptor for SIMATIC PDM from our website: www.siemens-milltronics.com, on the SITRANS LR 300 product page, under **Downloads.**

The GSD file

The GSD file **SM_05E0.GSD** can be obtained from Siemens Milltronics at our Web site: www.siemens-milltronics.com. (See page 114, **To configure and use PROFIBUS PA with an S7-300/ 400 PLC**, for more details.)

Bus address (Device Address)

Values	Range: 0 to 126
	Pre-set: 126

- This value can be set via P752, or over the network. (After changing the value, turn the unit off and back on again in order for the change to take effect.)

Bus Termination

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

Power Demands

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

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

Current I_S < 128 mA, voltage U_0 < 15 V

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

The number of devices which can be connected to a bus line is determined by finding the combined maximum current consumption of all the connected devices (10 mA for SITRANS LR 300). Plan to allow a current reserve for safety.

Cyclic versus Acyclic Data

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

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

Cyclic Data

When you configure SITRANS LR 300 on the PROFIBUS PA bus, there are 4 slots available for modules.

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

Slot 0 always transmits **Level** information; slot 1 always **Space information**; slot 2 always **Distance** information, and slot 3 always **Volume** information. If you do not wish to have data transmitted, then you must use a **Free Place** module in that slot.

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

The 4 function blocks **(Level, Space, Distance, Volume)** return 5 bytes of data each:

	Floating Point				Status
Level	byte 1	byte 2	byte 3	byte 4	byte 5
Space	byte 6	byte 7	byte 8	byte 9	byte10
Distance	byte 11	byte 12	byte 13	byte 14	byte 15
Volume	byte 16	byte 17	byte 18	byte 19	byte 20

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

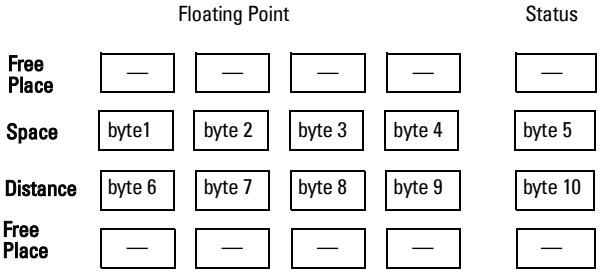
The 5th byte is the status word and the list of possible values is given in the chart on page 113.

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

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

	Floating Point				Status
Free Place	—	—	—	—	—
Free Place	—	—	—	—	—
Distance	byte1	byte 2	byte 3	byte 4	byte 5
Volume	byte 6	byte 7	byte 8	byte 9	byte 10

Example 2:



Status Word

Values in hex notation	Description
0x80	Data is GOOD.
0x4C	Initial value when the unit is first started up, before a valid reading is taken.[1]
0x44	The data displayed is uncertain: it is the last usable data recorded before an LOE state occurred.
0x10	The Failsafe timer has expired: this could be caused by LOE or by a sensor malfunction: value is BAD.
0x04	There is an error in the configuration of the function blocks in PROFIBUS PA[2].
0X1E	The function block has been placed out of service. (You will see this only if you read status word via acyclic services, after placing the function block out of service[3].)
0X60	The function block has been placed in simulation mode, using PDM.
0x8E	Value is GOOD, but above HI Alarm value in associated Analog Input block.
0x8A	Value is GOOD, but above HI warning value.
0x8D	Value is GOOD, but below LO Alarm value.
0x89	Value is GOOD, but below LO warning value.
0xC4	Bad configuration: value is BAD.
0XDE	AI block out of service: value is BAD.

1. At this time the LCD screen display shows **----**.
2. This could happen when a firmware download has been done, but a system reset (P999) has not been done. This could also happen if the function blocks are not configured properly using PDM or acyclic services.
3. A function block is placed out of service when a Free Place module is selected to fill the slot occupied by that function block.

Diagnostics

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

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

Acyclic Data

SITRANS LR 300 supports up to three simultaneous connections by a class 2 Master (C2 connection). It does not support Master class 1 (C1 connection). A list of all acyclic data, including address (slot and index), format, range of values, start value, and attributes, can be found at **Directory** on page 119.

Configuration Example:

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

1. Import the GSD file **SM_05E0.GSD** from the Siemens Milltronics Web site: www.siemens-milltronics.com into Step 7 software.
2. Add the SITRANS LR 300 "rack": click and drag the SITRANS LR 300 folder from the hardware catalog.
3. Fill the rack with desired modules, by dragging and dropping them from the hardware catalog.
4. After configuring PROFIBUS PA in steps 2 and 3, download it to the PLC.
5. Add code to the PLC program to read data consistently using the SFC14.

PROFIBUS Level Device Design

The device follows the profile block model and includes a physical block, a level transducer block and four analog input function blocks.

Profile 3.0 Class A Design

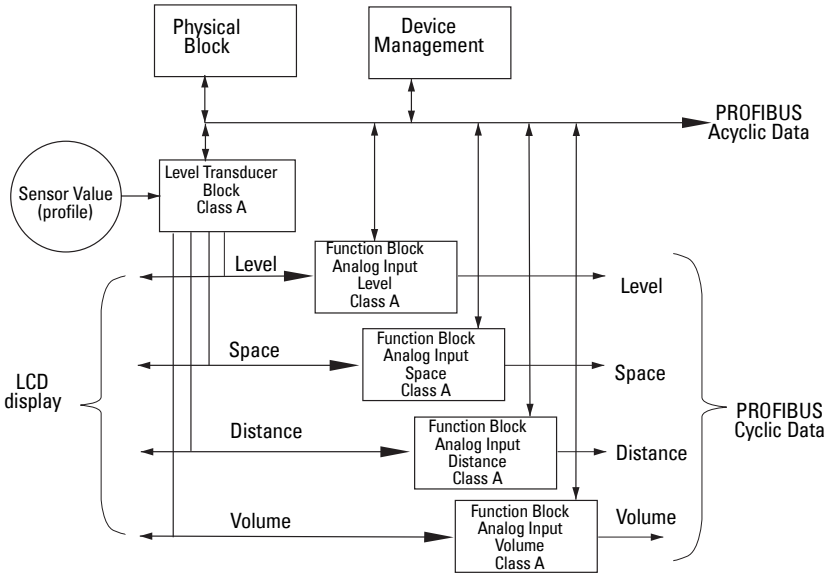
The device is implemented as a Profile 3.0, Class A PA device. The Profile model is used, but in order to program the level transducer block, you have to use some device-specific parameters in addition to the standard profile parameters.

The Transducer Block (TB) implements some of the Class B parameters, but not all.

The outputs from the TB are the Level, Space, Distance and Volume values as calculated by the device (P921, P922, P927 & P924). The output to the function blocks (FB's) is always in percent, except for Distance which is always in meters. The analog input FB's can then convert the percent values into any units desired.

Block Model

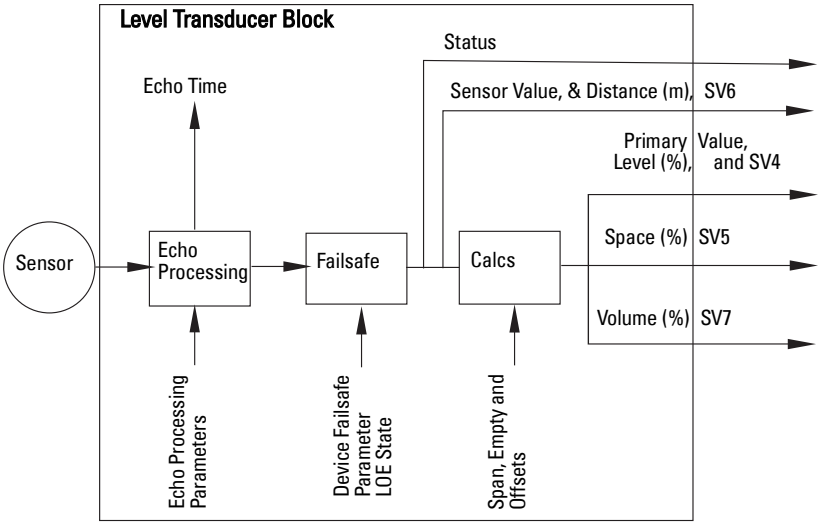
The device is implemented with one Physical Block (PB1), one Transducer Block (TB1) and four Function Blocks (FB1, FB2, FB3, FB4).



Note: the LCD display values are not the same as the Analog Input (AI) block outputs. The AI block can perform any conversion to a value, which may be in different units from the LCD.

Transducer Block - Level

The Transducer Block meets Profile 3.0 class A requirements. The main OUT values of the TB block used by the AI function blocks are the four Secondary Values (SV4, SV5, SV6 and SV7).

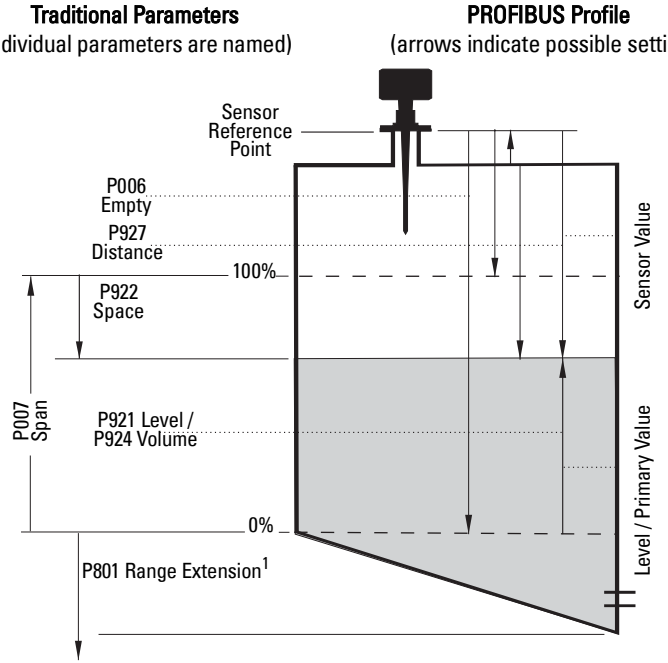


The Primary Value (PV) and Level parameters from the profile are the same value as the Secondary Value (SV) 4, and these are all in percent.

The Sensor Value parameter is the same as SV6 and represents the distance in meters.

Parameter Structure

The diagram below shows a level application and the parameters involved.



Sensor Value

The value produced by the echo processing, which represents the distance from the Sensor Reference Point to the target.

Sensor Unit

Units for Sensor Value, calibration points and other sensor-related parameters.

Level, Primary Value

The level as a percentage of Span (P007): (units are%).

Level, Primary Value Unit

Always%.

Sensor Reference Point

The point to which all of the above parameters are referenced, which is the flange face.

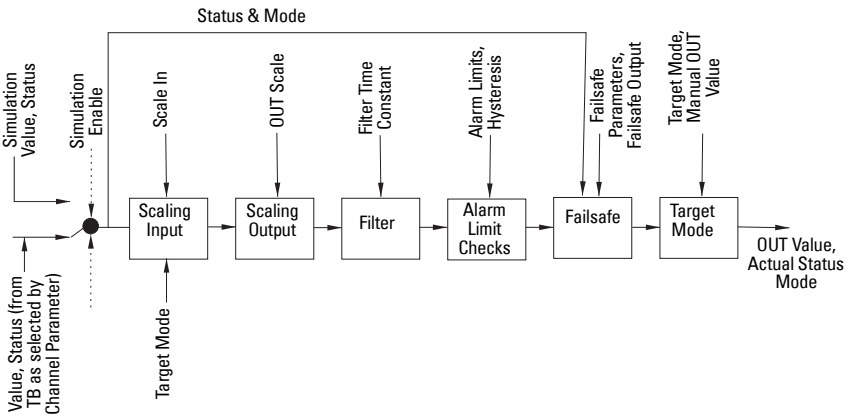
1. Range extension can be set beyond the tank bottom.

Function Blocks – Analog Input

The Analog Input (AI) function blocks produce the device outputs for PROFIBUS. They utilize the outputs from the Level TB (PV, SV1, SV2, … SVn) and then apply any required scaling and quality checks. There are four AI blocks, which each use one of the TB outputs and modify it to produce the Level, Space, Distance and Volume OUT values.

Note: These AI OUTs are not the same as the TB outputs available to the LCD.:

Analog Input Function Block



The input to the function block is one of the four Secondary Values, (SV4, SV5, SV6 and SV7) of the Transducer Block Level. This input is fixed for each of the AI blocks. The channel parameter is not utilized and the user cannot determine the input value to the block.

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

Linear conversion:

The scaling blocks can provide a linear conversion to any desired units.

1. The input value is normalized (Scaling Input)
2. The scaling output is applied.
3. This value is filtered using a first order filter based on a time constant provided by the user.
4. The value is checked against the user parameterized warning and alarm limits. (There is an upper and lower warning limit and an upper and lower alarm limit. The unit of the limits corresponds to the unit of the output range. A hysteresis parameter prevents toggling in the Status field of the OUT value.)

5. The Failsafe is checked against the status value from the TB OUT, or from the simulation input status. Failsafe can modify the OUT value to the Failsafe Out value, or to some high/low limit based on the status.
6. The target mode block allows the entire AI block to be overridden by a Manual Out value.
7. The OUT VALUE parameter is the value for the cyclic data transfer.

Device Management

Directory

Slot, Index	Description	Data Type	Handler
1,0	Directory Header 1- ID 1 -Rev. Number 1 -Num Dir Objects 9 -Num Dir Entries 1 -First Composite List Dir 1 -Num Composite List Dir	Record	Directory Handler
1,1	Composite List Directory Index Offset Num 1 4 1 (1 PB, at offset 4) 1 5 1 (1 TB, at offset 5) 1 6 4 (4 FBs, at offset 6) Composite Directory Slot Index Num 0 0x6b 0x7f PB 1 0x3d 130 TB 1 16 44 FB 1 2 16 44 FB 2 3 16 44 FB 3 4 16 44 FB 4		

Physical Block 1

This is the only physical block for the device.

	Relative Index	Name	Internal Product Parameter or Constant Value	Description	Data Type & size
	0	BLOCK OBJECT		Refer to Sections 3.4 & 3.7.2 in Profi. Spec.	Record
	1	ST_REV		Static revision – incremented by configuration device	Uint16, eeprom
	2	TAG_DESC	E781- PAR_HART_LONG_TAG	Tag Name for device, supplied by the master	String [32] eeprom
	3	STRATEGY	PAR_PROFI_STRATEGY		Uint16
	4	ALERT_KEY	PAR_PROFI_ALERT_KEY		Uint8
	5	TARGET_MODE		Target mode for block	Uint8
	6	MODE_BLK		3 bytes actual, permitted, normal Bits 7– out of service 6–init. Manual, not class a/b 5- local override, not class A 4- manual 3- automatic 2- cascade, not class a/b 1-Remote cascade 0- remote output not a/b	Record
	7	ALARM_SUM		Summary of alarms	Record
	8	SOFTWARE_REVISION	P900-1, PAR_SOFTWARE_REV	Software rev.	String, 16
	9	HARDWARE_REVISION	P900-2, PAR_SOFTWARE_REV	Hardware board stack	String, 16
	10	DEVICE_ MAN _ID	0x58	Manufacturer ID	Uint16
	11	DEVICE_ID	"IQ300"	ID indicating IQ300	String, 16
	12	DEVICE_SER_NUM	PAR_SERIAL_NUMBER_BATCH (Drops first 5 characters of serial number)	Serial number	String, 16
	13	DIAGNOSIS	PAR_DIAGNOSTIC_STATE Point 1	Diagnostic – see Page 72, 3.11.4	Uint8, 4 bytes in total
	14	DIAGNOSIS_EXTENSION	PAR_DIAGNOSTIC_STATE Point 2	Device specific diagnostics, Failsafe, LOE, short, stack overflow	
Not used	15				
Not used	16				
	17	DEVICE_CERTIFICATION	Based on Item number		
	18	WRITE_LOCKING	P000, P799	Controls write access, 0 – no writes, 2457 – writes allowed	Uint16

	Relative Index	Name	Internal Product Parameter or Constant Value	Description	Data Type & size
	19	FACTORY_RESET	Similar to Master Remote Master Reset	If 1 written – sets all param to factory 2506 – warmstart 2712 – reset bus	Uint16
	20	DESCRIPTOR	PAR_PROFI_PB_DISCRIPTOR		String, 32
	21	DEVICE_MESSAGE	PAR_PROFI_PB_MESSAGE		String, 32
	22	DEVICE_INSTALL_DATE	PAR_PROFI_INSTALL_DATE		String, 16
Not used	23	LOCAL_OP_ENA		Local operation 0 – no allowed 1 – enabled Interfaces to P799	Uint8
	24	IDENT_NUMBER_SELECTR	PAR_PROFI_PB_IDENT_NUM_SEL	See specification	Uint8

Transducer Block 1

This is the only transducer block for the device.

	Relative Index	Name	Internal Product Parameter or Constant Value	Description	Data Type & size
	0- 7		Same as PB		
	8	PRIMARY VALUE	P921- PAR_MATERIAL_READING In percent Units.	Current level output in percent of span	DS33 Record
	9	PRIMARY VALUE UNITS	PERCENT	always percent	Uint16
	10	LEVEL	P921- PAR_MATERIAL_READING In percent Units.	Current level output in percent of span	Float
	11	LEVEL_UNIT	PERCENT	always percent	Uint16
	12	SENSOR_VALUE	PAR_XDUCER_TARGET_LIN	Distance in Meters from sensor reference point to target	Float
	13	SENSOR_UNIT	METERS	Units for sensor value is always Meters	Uint16
Not used	14	SECONDARY VALUE 1			
Not used	15	SECONDARY VALUE 1 UNIT			
Not used	16	SECONDARY VALUE 2			
Not used	17	SECONDARY VALUE 2 UNIT			
Not used	18	SENSOR_OFFSET		*This does not conform to Profile 3.0* Class B	Float
	19	CAL_TYPE	Calibration Type is always 0 for Radar units		Uint8

	Relative Index	Name	Internal Product Parameter or Constant Value	Description	Data Type & size
	20	CAL_POINT_LO	PAR_TB_SENSOR_CAL index [1,1]		Float
	21	CAL_POINT_HI	PAR_TB_SENSOR_CAL index [1,2]		Float
	22	LEVEL_LO	PAR_TB_LEVEL index [1,1]		Float
	23	LEVEL_HI	PAR_TB_LEVEL index [1,2]		Float
Not used	24	LEVEL_OFFSET		This does not conform to Profile 3.0 **Class B**	Float
Not used	25	LIN_TYPE		This does not conform to Profile 3.0 Class B	Uint8
Not used	26	LIN_DIAMETER		This does not conform to Profile 3.0 Class B	Float
Not used	27	LIN_VOLUME		This does not conform to Profile 3.0 Class B	Float
	28	SENSOR_HIGH_LIMIT	PAR_TB_SENSOR_LIMITS Index [1,1]		Float
	29	SENSOR_LOW_LIMIT	PAR_TB_SENSOR_LIMITS Index [1,2]		Float
Not used	30	MAX_SENSOR_VALUE			Float
Not used	31	MIN_SENSOR_VALUE			Float
Not used	32	TEMPERATURE			Float
Not used	33	TEMPERATURE UNIT			Float
Not used	34	MAX TEMPERATURE			Float
Not used	35	MIN TEMPERATURE			Float
Not used	36	TAB_ENTRY			
Not used	37	TAB X Y VALUE			
Not used	38	TAB MIN VALUE			
Not used	39	TAB MAX VALUE			
Not used	40	TAB OP CODE			
Not used	41	TAB STATUS			
Not used	42	TAB ACTUAL NUMBER			

	Relative Index	Name	Internal Product Parameter or Constant Value	Description	Data Type & size
Reser-viced	43..52				
	53	SECONDARY_VALUE_3	Level Out value in percent		DS33-OUT VALUE record
	54	SECONDARY_VALUE_3_UNITS	Level Out value units Always Percent		DS33-OUT VALUE record
	55	SECONDARY_VALUE_4	Space Out value in percent		DS33-OUT VALUE record
	56	SECONDARY_VALUE_4_UNITS	Space Out value units Always percent		DS33-OUT VALUE record
	57	SECONDARY_VALUE_5	Distance Out value in Meters		DS33-OUT VALUE record
	58	SECONDARY_VALUE_5_UNITS	Distance Out value units Always Meters		DS33-OUT VALUE record
	59	SECONDARY_VALUE_6	Volume Out value in percent		DS33-OUT VALUE record
	60	SECONDARY_VALUE_6_UNITS	Volume Out value units Always percent		DS33-OUT VALUE record
Not Used	61				
Not Used	62				
Not Used	63				
Not Used	64				
	65	Quick Start Parameter Group 1	PAR_OPERATION PAR_SUBSTANCE PAR_EMPTY_DISTANCE PAR_FOLF_TIME_CONSTANT		
	66	Quick Start Parameter Group 2	PAR_RESPONSE PAR_ANTENNA PAR_SPAN		
	67	Volume Setup	PAR_TANK_SHAPE; PAR_MAX_VOLUME; PAR_TANK_DIMENSION_A PAR_TANK_DIMENSION_L		
	68	Failsafe Setup	PAR_FAIL_SAFE_TIMER PAR_FAIL_SAFE_MATERIAL PAR_FAIL_SAFE_ADVANCE		

	Relative Index	Name	Internal Product Parameter or Constant Value	Description	Data Type & size
	69	Echo Data	PAR_NEAR_BLANKING; PAR_RANGE_EXTENSION PAR_ALGORITHM PAR_WINDOW_SILL_SET PAR_ECHO_POSITION		
	70	Echo Lock	PAR_ECHO_LOCK PAR_ECHO_LOCK_UP PAR_ECHO_LOCK_DOWN PAR_ECHO_LOCK_WINDOW PAR_NARROW_ECHO_FILTER PAR_NUMBER_LONG_SHOTS		
	71	Auto TVT	PAR_AUTO_NEAR_TVT_MODE PAR_AUTO_NEAR_TVT_RANGE PAR_TVT_HOVER		
	72	TVT Parameters	PAR_TVT_TYPE PAR_TVT_SHAPER_MODE PAR_CONF_THRESH_SL		
	73	Confidence Parameters	PAR_CONF_SL PAR_ECHO_STRENGTH PAR_NOISE_AVERAGE (read Only)		
	74	Serial Port	PAR_SERIAL_PROTOCOL PAR_SERIAL_ADDR PAR_SERIAL_BAUD PAR_SERIAL_PARITY PAR_SERIAL_DATA_BITS		
	75	Range Calibration	PAR_OFFSET_ADJUSTMENT PAR_MWAVE_VELOCITY_MULT PAR_MINIMUM_READING		
	76	Local Display	PAR_LOCK PAR_DECIMAL_POSITION		
	77	Volume Breakpoint	PAR_BREAKPOINT_LEVEL PAR_BREAKPOINT_VOLUME Points 1-3		
	78	Volume Breakpoint	PAR_BREAKPOINT_LEVEL PAR_BREAKPOINT_VOLUME Points 4-6		
	79	Volume Breakpoint	PAR_BREAKPOINT_LEVEL PAR_BREAKPOINT_VOLUME Points 7-9		
	80	Volume Breakpoint	PAR_BREAKPOINT_LEVEL PAR_BREAKPOINT_VOLUME Points 10-12		
	81	Volume Breakpoint	PAR_BREAKPOINT_LEVEL PAR_BREAKPOINT_VOLUME Points 13-15		
	82	Volume Breakpoint	PAR_BREAKPOINT_LEVEL PAR_BREAKPOINT_VOLUME Points 16-18		
	83	Volume Breakpoint	PAR_BREAKPOINT_LEVEL PAR_BREAKPOINT_VOLUME Points 19-21		

	Relative Index	Name	Internal Product Parameter or Constant Value	Description	Data Type & size
	84	Volume Breakpoint	PAR_BREAKPOINT_LEVEL PAR_BREAKPOINT_VOLUME Points 22-24		
	85	Volume Breakpoint	PAR_BREAKPOINT_LEVEL PAR_BREAKPOINT_VOLUME Points 25-27		
	86	Volume Breakpoint	PAR_BREAKPOINT_LEVEL PAR_BREAKPOINT_VOLUME Points 28-30		
	87	Volume Breakpoint	PAR_BREAKPOINT_LEVEL PAR_BREAKPOINT_VOLUME Points 31-32		
	88	TVT Breakpoints	PAR_TVT_SHAPER Points 1-10		
	89	TVT Breakpoints	PAR_TVT_SHAPER Points 11-20		
	90	TVT Breakpoints	PAR_TVT_SHAPER Points 21-30		
	91	TVT Breakpoints	PAR_TVT_SHAPER Points 31-40		
	92	Echo Profile Summary	Minimum Y axis Value in dB Maximum Y axis Value in dB (empty) X axis start value X axis Max value X axis step value between echo profile data values X axis step value between TVT profile data values	Summary information of Echo Profile. Must be read prior to slots 93-128	
	93-120	Echo Profile	Echo Profile data points Each slot contains 20 data points as Uint8		
	121-128	TVT Profile	TVT Profile data points Each slot contains 20 data points as Uint8		

Function Block 1 - Level

The first analog input function block produces the level value.

	Relative Index	Name	Number	Description	Data Type & size
	0-7		See PB descriptions		
	8	Batch	PAR_PROFI_FB_BATCH_ID PAR_PROFI_FB_BATCH_RUP PAR_PROFI_FB_BATCH_OPERATION PAR_PROFI_FB_BATCH_PHASE		
	9				
	10	OUT	Level Out Value & status	Level reading value	DS33 Record

	Relative Index	Name	Number	Description	Data Type & size
	11	PV_SCALE	PAR_PROFI_FB_PV_EU index [1,2] PAR_PROFI_FB_PV_EU index [1,1]	Scaled to percent	Array, float
	12	OUT_SCALE	PAR_PROFI_FB_SCALE_EU index[1,2] PAR_PROFI_FB_SCALE_EU index[1,1] PAR_PROFI_FB_SCALE_UNITS index[1,1] PAR_PROFI_FB_SCALE_DECIMALS index[1,1]	Scaling values record	Record
Not Used	13	LIN_TYPE		This does not conform to Profile 3.0 Class B	Uint8
	14	CHANNEL	Always mapped to TB1 Secondary Value 3	Map to TB (always 1)	Uint16
Not Used	15				
	16	PV_FTIME	PAR_PROFI_FB_PVTIME –index [1,1]	Filter time	Float
	17	FSAFE_TYPE	PAR_PROFI_FB_FAILSAFE_TYPE –index [1,1]		Uint8
	18	FSAFE_VALUE	PAR_PROFI_FB_FAILSAFE_VALUE –index [1,1]		Float
	19	ALARM_HYS	PAR_PROFI_FB_ALARM_LIMITS – index [1,1]		Float
	21	HI_HI_LIM	PAR_PROFI_FB_ALARM_LIMITS – index [1,2]		Float
	23	HI_LIM	PAR_PROFI_FB_ALARM_LIMITS – index [1,3]		Float
	25	LO_LIM	PAR_PROFI_FB_ALARM_LIMITS – index [1,4]		Float
Not Used	26				
	27	LO_LO_LIM	PAR_PROFI_FB_ALARM_LIMITS – index [1,5]		Float
Not Used	30	HI_HI_ALM			Record
Not Used	31	HI_ALM			Record
Not Used	32	LO_ALM			record
Not Used	33	LO_LO_ALM			Record
	34	SIMULATE	Not stored. Out of reset, simulation is always disabled.	Simulation value, status and state	Record
Not Used	35	OUT_UNITS_TEXT			String

Function Block 2 - Space

The second analog input function block produces the Space value. This is the same layout as AI 1, but the internal parameters reference primary index 2 for all internal parameters. (Example: index [1,1], [1,2] becomes [2,1] and [2,2].)

Function Block 3 - Distance

The third analog input function block produces the Distance value. This is the same layout as AI 1, but the internal parameters reference primary index 3 for all internal parameters. (Example: index [1,1], [1,2] becomes [3,1] and [3,2].)

Function Block 4 - Volume

The forth analog input function block produces the Volume value. This is the same layout as AI 1, but the internal parameters reference primary index 4 for all internal parameters. (Example: index [1,1], [1,2] becomes [4,1] and [4,2].)

Appendix VIII: hazardous area installations

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 01ATEX1282 or SIRA 01ATEX2276:

1. For use and assembly, refer to the main instructions.
2. The equipment is certified for use as Category 1G/2G equipment.
   The 1G certification covers the use of the equipment antenna or wave-guide in a zone 0 environment at ambient temperatures of –40°C to +60°C and atmospheric pressure up to the process flange. The 2G certification covers the remainder of the equipment for use in a zone 1 environment.
3. The equipment may be used with flammable gases and vapors with apparatus group IIC and temperature class T6.
4. The equipment is certified for use in an ambient temperature range of–40°C to 60°C.
5. The equipment has not been assessed as a safety related device (as referred to by Directive 94/9/EC Annex II, clause 1.5).
6. Installation and inspection of this equipment shall be carried out by suitably trained personnel in accordance with the applicable code of practice (EN 60079-14 and EN 60079-17 in Europe).
7. Repair of this equipment shall be carried out by suitably trained personnel in accordance with the applicable code of practice (e.g. EN 60079-19 within Europe).
8. Components to be incorporated into or used as replacements in the equipment shall be fitted by suitably trained personnel in accordance with the manufacturer's documentation.
9. The equipment has been tested in accordance with MIL Standard D0160B for the following vibration levels:

   Frequency range 15–54Hz, 0.010 inch displacement
   Frequency range 54–2000 Hz, 1.5 g of acceleration.

   These were randomly cycled for a period of 2 hours.

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

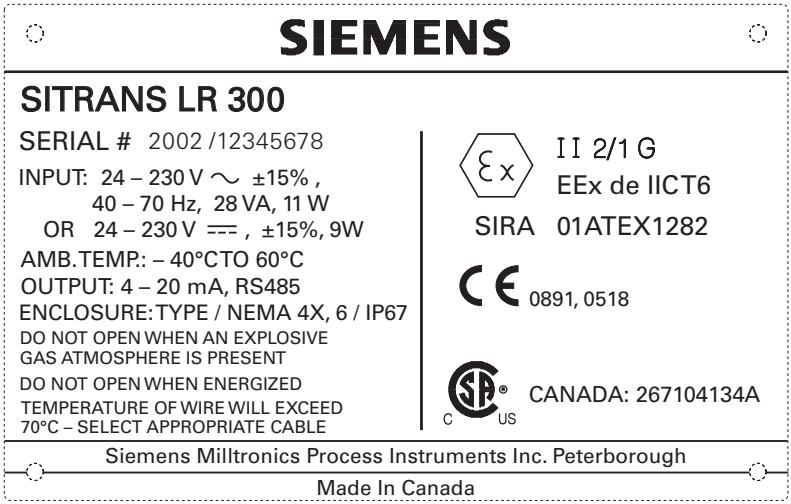
    Aluminum alloy A-356 T6 (aluminum enclosure option)
    Stainless steel CF8M (stainless steel enclosure option)
    Stycast[1] 2651-40FR encapsulant, catalyst II
    Stycast LA-9823-76 epoxy cement
    Tempered glass (window)

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

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

11. Equipment Marking

The equipment marking contains at least the following information:



1. Stycast® is a registered trademark of the National Starch and Chemical Company.

SIEMENS

SITRANS LR 300

SERIAL # 2002 / 12345678

INPUT : 24 – 230 V ~, ±15%,
40 – 70 Hz, 28 VA, 11 W,
OR 24 – 230 V ⎓, ±15%, 9W
Um = 250 V ~

I.S. CONNECTIONS 1 & 2 : U_i = 17.5 V;
I_i = 380 mA; P_i = 5.32 W; C_i = 0; L_i = 0

AMB. TEMP: – 40°C TO 60°C

OUTPUT: PROFIBUS PA, RS485

ENCLOSURE: TYPE / NEMA 4X, 6 / IP67

DO NOT OPEN WHEN AN EXPLOSIVE GAS ATMOSPHERE IS PRESENT

II 2(1)/1 G
EEx de [ia]IIC T6

SIRA 01ATEX2276

0891, 0518

CANADA: 267104134A

DO NOT OPEN WHEN ENERGIZED

TEMPERATURE OF WIRE WILL EXCEED 70°C -- SELECT APPROPRIATE CABLE

Siemens Milltronics Process Instruments Inc. Peterborough

Made In Canada

SIEMENS

SITRANS LR 300

SERIAL # 2002 / 12345678

INPUT : 24 – 230 V ~, ±15%,
40 – 70 Hz, 28 VA, 11 W,
OR 24 – 230 V ⎓, ±15%, 9W

I.S. CONNECTIONS 1 & 2 : U_o = 23.1 V;
I_o = 117 mA; P_o = 676 mW;
C_o = 140 nF; L_o = 3 mH

AMB. TEMP.: – 40°C TO 60°C

OUTPUT: mA / HART, RS485

ENCLOSURE: TYPE / NEMA 4X, 6 / IP67

II 2(1)/1 G
EEx de [ia] IIC T6

SIRA 01ATEX2276

0891, 0518

CANADA: 267104134A

DO NOT OPEN WHEN ENERGIZED

TEMPERATURE OF WIRE WILL EXCEED 70°C -- SELECT APPROPRIATE CABLE

DO NOT OPEN WHEN AN EXPLOSIVE GAS ATMOSPHERE IS PRESENT

Siemens Milltronics Process Instruments Inc. Peterborough

Made In Canada

Index

www.siemens-milltronics.com

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

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