

LST100

Ultrasonic level transmitter for upstream oil and gas

Accurately track and measure one of the most expensive consumable on a site – chemicals

Measurement made easy



Introduction

Keep track of chemical usage and stock

- No other instrument is able to monitor chemical levels effectively in such an easy-to-use, compact device. Track chemical usage and remotely monitor stock levels for chemicals in all sites, no matter how remote.

Safe for use at all sites in potentially explosive environments

- FM approved for use in Zone 2 or Div 2 applications without a barrier, or Zone 1 or Div 1 using the recommended intrinsic safety barrier.

Ultra-low power consumption for solar or battery

- The LST100 has ultra-low power consumption equivalent to a 4 to 20 mA instrument functioning constantly at 4 mA. Using 1 to 5 V output means low power consumption during all conditions.
- The LST100 is typically powered from a solar or battery power source. Its low power consumption ensures low cost of ownership.

For more information

Additional publications for the LST100 ultrasonic level transmitter are available for free download from www.abb.com/level or by scanning this code:



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1 Safety

1.1 General information and notes

Read these instructions carefully prior to installing and commissioning the device.

These instructions are an important part of the product and must be kept for future reference.

These instructions are intended as an overview and do not contain detailed information about all design variations of this product or every possible aspect of installation, operation and maintenance.

For additional information, or if specific problems occur that are not detailed in these instructions, contact the manufacturer.

The content of these instructions is neither part of any previous or existing agreement, promise or legal relationship, nor is it intended to change the same.

The LST100 is designed with state-of-the-art technology and is operationally safe. It left the factory pre-tested for safety and in perfect working order. The information in the manual must be observed and followed in order to maintain safe and optimal function throughout the period of operation.

Modifications and repairs to the product may be performed only if expressly permitted by these instructions or ABB technical support.

Observe all of the instructions and the safety and warning symbols to ensure optimum protection of personnel and the environment, as well as safe and fault-free operation of the device.

1.2 Intended use

This device is intended for the following uses:

- To measure distance to a liquid surface (directly, using time-of-flight through air).
- To measure the level of liquids in tanks (indirectly, using distance measurement and tank dimensions).
- Using these products as intended involves observing the following points:
 - Read and follow the instructions in this manual.
 - Observe the technical ratings (refer to Section 8, *Specifications*).

1.3 Improper use

The following are instances of improper use of the device:

- Measuring the level of bulk solids.
- Measuring in a medium other than air, for example in the presence of heavy gas vapors.
- Use as a climbing aid, for example for mounting purposes
- Use as a support for external loads, for example to support the tank, etc.
- Addition of material, for example by painting over the name plate or welding/soldering on parts.
- Removal of material, for example by spot drilling the housing.

1.4 Target groups and qualifications

Installation, commissioning and maintenance of the product may be performed only by trained specialist personnel who have been authorized by the plant operator to do so. The specialist personnel must have read and understood the manual and comply with its instructions.

The operators must strictly observe the applicable national regulations with regard to installation, function tests, repairs, and maintenance of electrical products.

1.5 Warranty provisions

Using the device in a manner that does not fall within the scope of its intended use, disregarding this manual, using under-qualified personnel, or making unauthorized alterations releases the manufacturer from liability for any resulting damage. This renders the manufacturer's warranty null and void.

1 Safety

1.6 Plates and symbols

1.6.1 Safety, warning and note symbols



DANGER – Serious damage to health / risk to life

This symbol, in conjunction with the signal word “DANGER”, indicates an imminent danger. Failure to observe this safety information will result in death or severe injury.



DANGER – Serious damage to health / risk to life

This symbol, in conjunction with the signal word “DANGER”, indicates an imminent electrical hazard. Failure to observe this safety information will result in death or severe injury.



WARNING – Bodily injury

This symbol, in conjunction with the signal word “WARNING”, indicates a potentially dangerous situation. Failure to observe this safety information may result in death or severe injury.



CAUTION – Minor injuries

This symbol, in conjunction with the signal word “CAUTION”, indicates a potentially dangerous situation. Failure to observe this safety information may result in minor or moderate injury. The symbol may also be used for property damage warnings.



NOTICE – Property damage

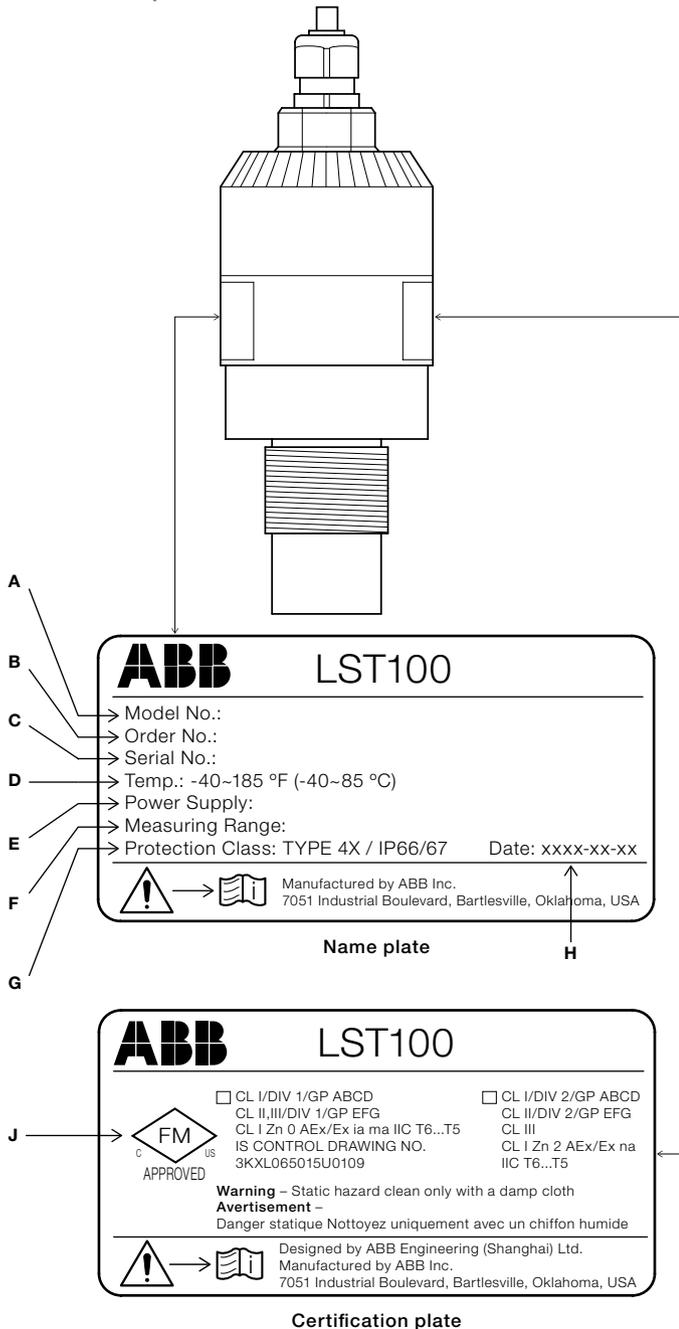
This symbol indicates a potentially damaging situation. Failure to observe this safety information may result in damage to or destruction of the product and / or other system components.



IMPORTANT (NOTE)

This symbol indicates operator tips, particularly useful information or important information about the product or its further uses. The signal word “IMPORTANT (NOTE)” does not indicate a dangerous or harmful situation.

1.6.2 Name plate



Name plate

- A** Model number (for more detailed information about the technical design, refer to the data sheet or the order confirmation).
- B** Order number
- C** Serial number for identification by the manufacturer
- D** Medium temperature
- E** Power supply
- F** Measuring range
- G** Protection class type
- H** Year/Month/Day of manufacture (YYY-MM-DD)

Certification plate

- J** Ex mark according to cFM and FMus (example)

Fig. 1.1: Product labels

2 Mounting

2.1 Installation requirements

An LST100 level transmitter can be installed almost anywhere in the tank. Consider the following installation conditions:

- Ensure the instrument is installed within recommended temperature and pressure ratings.
- The sensor must be installed as perpendicular as possible to the liquid surface being measured.
- Avoid installing the instrument in a location where vibration may be present during operation.
- Mount with a clear line-of-sight to the target surface.
- If installed in a cylindrically shaped vessel, ensure that the sensor is installed just above the lowest point in the tank. This allows measurements to be taken as the tank approaches empty.
- Use the mounting kit to raise the instrument above the highest point in the tank.
- Close the unit after wiring in order to maintain ingress protection.
- Loosen the cable gland when opening or closing the terminal cover, so as not to twist the cable inside the instrument.

2.2 Dimensions

Dimensions in mm (in.)

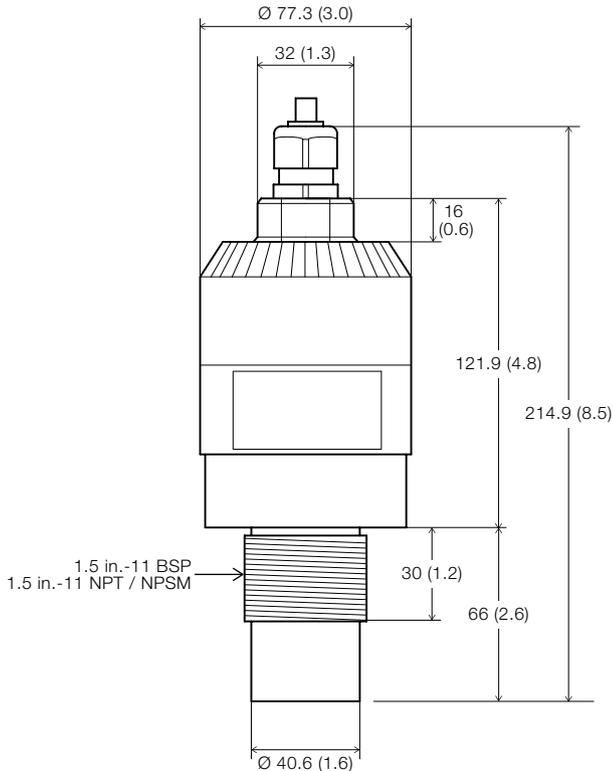


Fig. 2.1: Transmitter with 1.5 inch thread dimensions

Dimensions in mm (in.)

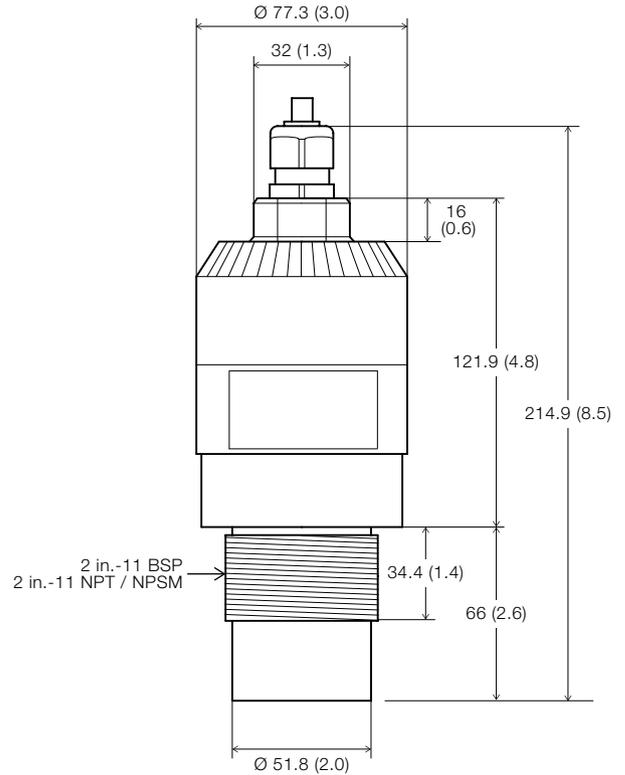


Fig. 2.2: Transmitter with 2 inch thread dimensions

Dimensions in mm (in.)

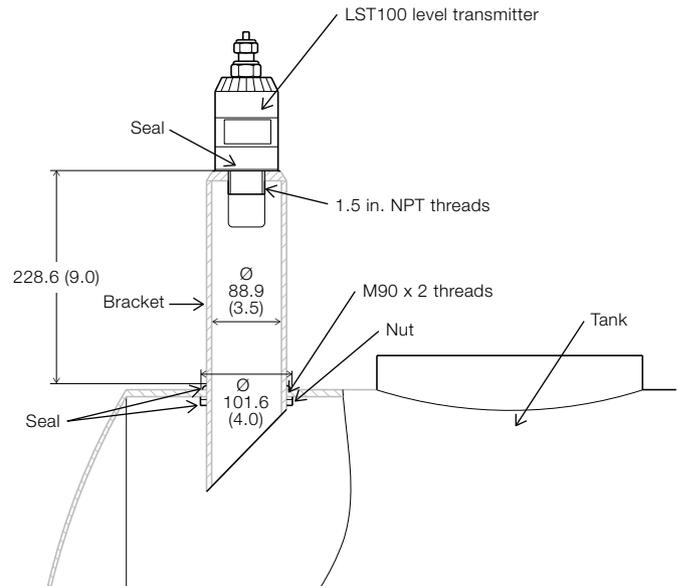


Fig. 2.3: Transmitter mounting bracket dimensions

2.3 Mounting on a tank using the mounting bracket

The mounting bracket can be used to reduce the effective dead zone of the instrument, enabling measurement all the way to the top of the tank. Install the bracket as follows:

1. Referring to Fig. 2.4, make a 92^{+3}_{-1} mm ($3.54^{+0.2}_{-0.1}$ in.) hole at the top of the tank using a hole puncher or other machining method. Locate the hole:
 - in an area with a minimum of 102 mm (4 in.) space all around to enable access.
 - at the highest point of the tank's surface to ensure the sensor is installed perpendicular to the liquid surface.

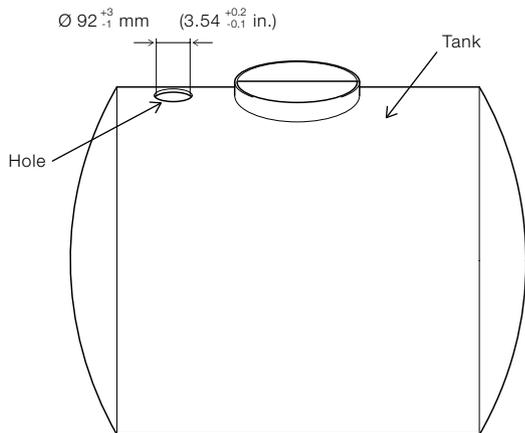


Fig. 2.4: Tank with a hole at the highest point of the tank's surface

2. Referring to Fig. 2.5, place a seal on the tank surface around the hole and insert the bracket through the seal and the hole. **Note:** the seal is used to prevent leakage from the environment into the tank.

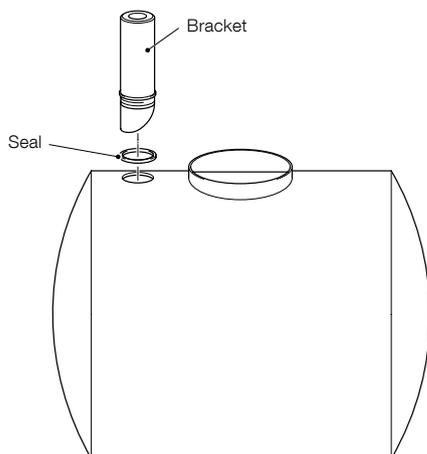


Fig. 2.5: Installing the mounting bracket on a tank with the seal

3. Referring to Fig. 2.6, fit a seal over the bottom of the bracket and fit the nut as shown. Tighten the nut to secure the bracket.

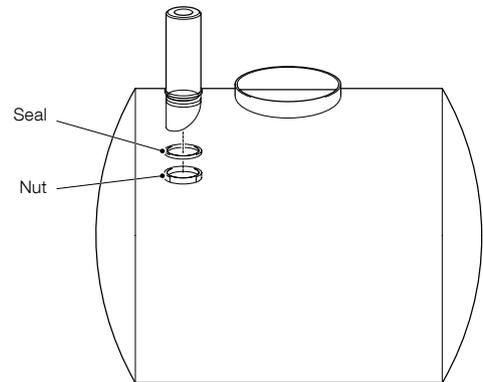


Fig. 2.6: Securing the mounting bracket to the tank using the nut

4. Referring to Fig. 2.7, fit a seal to the LST100 transmitter and screw the transmitter into the bracket by hand. **Note:** Tighten the transmitter hand-tight only – do not use tools. The seal is used to prevent leakage from the environment into the tank.

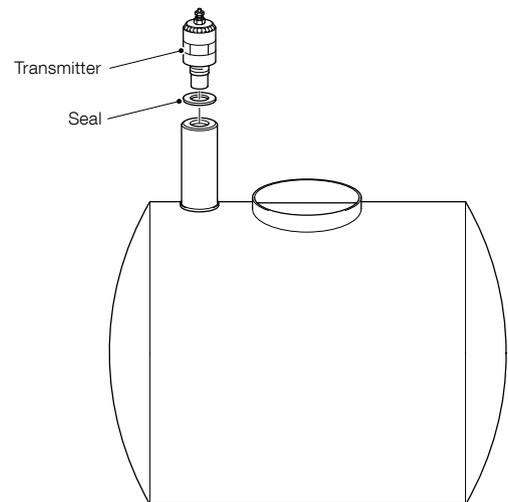


Fig. 2.7: Installing the LST100 transmitter on the mounting bracket using a seal



IMPORTANT (NOTE)

To ensure a tight seal, wrap PTFE-based tape on the threads of the LST100 transmitter.

2 Mounting

2.4 Other mounting variations

The LST100 transmitter can also be mounted directly on a tank using either a nut or a sleeve.

2.4.1 Direct installation using a nut

Referring to Fig. 2.8

1. Drill a 38 mm (1.5 in.) hole (for U5 process connection) or 50.8 mm (2 in.) hole (for U2 process connection) into the tank.
2. Fit a seal to the LST100 transmitter, insert the transmitter through the hole and secure from inside the tank using the nut.

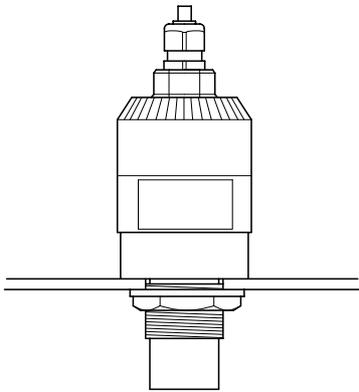


Fig. 2.8: Direct installation using a nut

2.4.2 Direct installation using a sleeve

Referring to Fig. 2.9

1. Select a sleeve that is compatible with NPT or BSP thread. The LST100 transmitter's thread size is 1.5 in. (for 20 ft. version) or 2 in. (for the 30 ft. version).
2. Fit a seal to the LST100 transmitter and screw the transmitter into the sleeve by hand. Note: Tighten the transmitter hand-tight only – do not use tools.

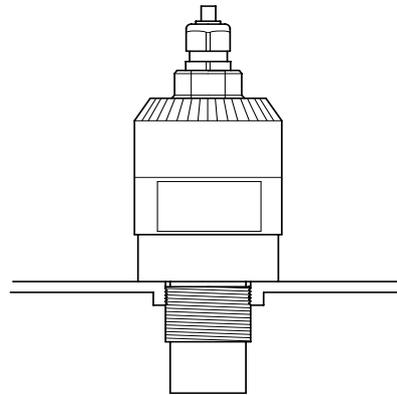


Fig. 2.9: Direct installation using a sleeve

3 Electrical connection

Before installation, ensure the LST100 is not plugged in to any power supply. The LST100 does not support hot plugging for all interfaces (1 to 5 V output, RS485). Installation engineers must statically discharge themselves or use a wrist strap before connecting cables to LST100.

Check the LST100 power supply to ensure that it does not exceed the permitted range (9 to 16 V DC).

When the terminal cover of the LST100 is open, protect the inside of the transmitter against the ingress of dust and moisture.



WARNING – Bodily injury

No support for hot plugging interface

The LST100 does not support hot plugging for all interfaces (1 to 5 V output, RS485). Disconnect the LST100 from the power supply before connecting cables.



NOTICE – Property damage

Material damage due to electrostatic discharge

- An open cover does not provide contact protection. Touching conductive components can damage electronic components (in some cases beyond repair) due to electrostatic discharge.
 - Do not touch conductive components.
 - LST100 connections have ESD 4 kV protection for contact and 8 kV for air in accordance with IEC 61000-4-ABB strongly recommends using a wrist strap or to discharge electrostatic charge before connecting cables to the LST100.
-

3.1 Cable connection area

The electrical wiring is fitted to the LST100 using a 1/2-14 NPT cable gland. To ensure the transmitter's NEMA 4X and IP 67 ingress protection rating is maintained, apply a suitable sealing compound to the cable gland threads before screwing the gland into the housing (1/2 in. NPT female thread).



DANGER – Serious damage to health / risk to life

When installing the LST100 measuring system in hazardous areas, all national standards and the specifications in the safety instructions must be complied with and the specified cable gland must be used.



NOTICE – Property damage

- Do not screw the terminal cover on with the cable gland tightened.
- Route a single cable only through the cable gland. Multiple cables will compromise the transmitter's ingress protection.
- After connecting the terminals, ensure the terminal cover is tightened.

Moisture damage prevention

- During installation of the single cable, include a drip loop in the cable and ensure the cable gland compression fitting is securely tightened.
-

3 Electrical connection

3.2 Signal cable connection

The LST100 is designed to operate from battery and solar power sources.

Installation notes:

- Use 7-core shielded cable for power supply and signal connections.
- Use twisted cable with a specific cross section and length. For longer lines, cable with a greater cross section is required.
- Use the cable shielding to make ground connections.

The signal cable is connected to the terminals shown in Fig. 3.1.



NOTICE – Property damage

Do not connect the shielding to different grounds at each end of the cable.

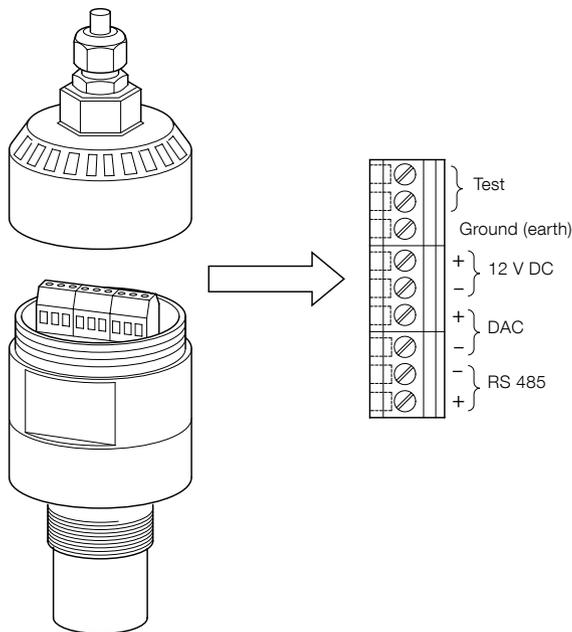


Fig. 3.1: LST 100 electrical terminals

3.2.1 DC power supply

The LST100 operates from a 12 V DC power supply that is connected to the terminals shown in Fig. 3.

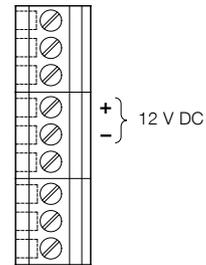


Fig. 3.2: 12 V DC power supply terminals

The power supply voltage is: 9 to 16 V DC.

- The minimum power capability of the battery and solar power supply is: 120 mW.

3.2.2 Analog output

LST100 has a 1 to 5 V analog output that is connected using the terminals shown in Fig. 3.3.

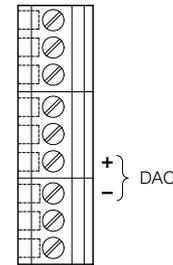


Fig. 3.3: Analog output terminals

The LST100 uses a 1 to 5 V analog output to display measurement results and alarm data.



IMPORTANT (NOTE)

Use twisted wire to improve resistance to interference.

The output voltage is the process variable during normal conditions. It can also be a fixed value as a failsafe or to indicate alarm conditions.

- The voltage output range of a valid signal is 0.97 to 5.2 V DC.
- A high alarm is defined as >5.4 V and a low alarm is defined as <0.95 V.
- The refresh frequency of the 1 to 5 V output is 1 second.

3.2.3 Digital communications

The LST100 is configured using RS485 digital communications. The RS485 connection is made to the terminals shown in Fig. 3.4.

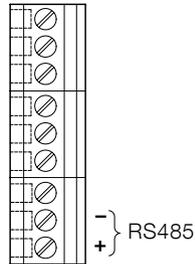


Fig. 3.4: RS485 communication terminals

The LST100 uses RS485 for digital communication. RS485 is an asynchronous, half duplex communication method that can transmit measurement results and alarm information from the LST100, and configuration and control commands to the LST100. The length of the cable used for digital communication is limited by the communication baud rate and FM approval requirements.

- The LST100 transmitter's RS485 port is designed for point-to-point communication and does not support network topology.
- The baud rate of the LST100 transmitter's RS485 communication is fixed at 9600 bps.
- The LST100 supports cable lengths of up to 30 m (100 ft).

3.2.4 Grounding

The LST100 requires a ground connection to the terminal shown in Fig. 3.5.

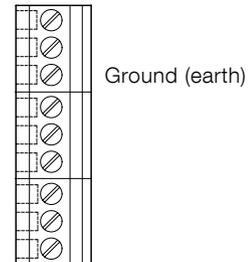


Fig. 3.5: The ground connection terminal

The LST100 provides one connector for ground (PE). An effective ground connection is needed for optimum EMC protection. The shielding of a shielded cable can be used for grounding.

All grounding must comply with anti-explosion regulations if the LST100 transmitter is to be used in hazardous environments (Zone 1 or Div 1 and Zone 2 or Div 2).

4 Commissioning

4.1 Preliminary checks prior to start-up

Before beginning the commissioning procedure, ensure:

- The power supply is OFF.
- The power supply is within the specified range (9 to 16 V DC).
- The pin assignment matches the connection diagram.
- The transmitter is correctly grounded.
- The transmitter is within temperature limits.
- The transmitter is installed in a location free of vibration.
- The terminal cover is sealed.

4.2 Preparing for digital communication

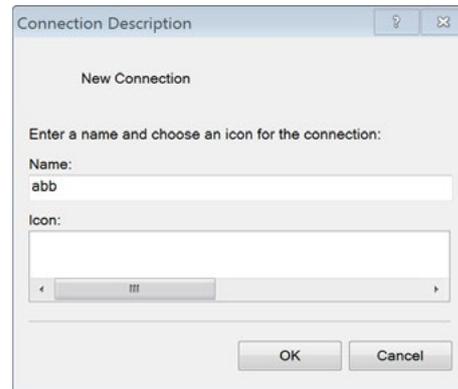
HyperTerminal must be installed on the computer used for configuration. HyperTerminal is included as a standard in all Windows versions up to Windows XP and is accessed from the Start menu, under Accessories, Communications.

HyperTerminal is not included in any version of Windows from Vista onwards. For Windows-based computers using Windows Vista or later, copy HyperTerminal from the flash drive that ships with the LST100 to any convenient location on the computer.

An RS485 connection to the computer is required for setup but most modern computers are not fitted with RS485 serial communication ports. The usual method of establishing an RS485 connection to a modern computer is by means of a readily available, RS485-to-USB modem. The modem's USB plug connects to the computer and the RS485 connections are connected directly to the LST100.

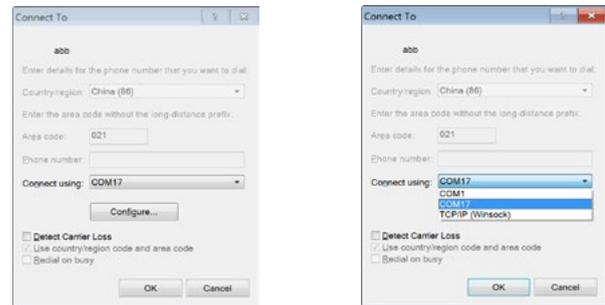
4.3 Configuring the digital communications

1. Open a HyperTerminal window. A Connection Description dialog is displayed:



2. Enter a name in the **Name** field and click **OK**. (It is not necessary to choose an icon).

A *Connect To* dialog is displayed:



3. Select a connection port from the **Connect using:** drop-down list and click **Configure....** (It is not necessary to check the option boxes).



IMPORTANT (NOTE)

Available ports vary. A desktop computer with a direct serial port will have a low number (for example, COM1 or COM2). A laptop with a USB converter will have a higher number (for example, COM7).

The Com port properties dialog is displayed:



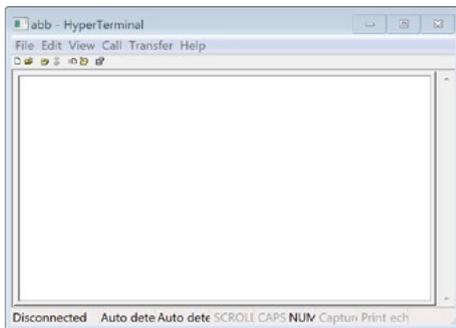
4. Select the following port settings and click **OK**.

Bits per second: 9600
 Data bits: 8
 Parity: Odd
 Stop bits: 1
 Flow control: None

The Connect To dialog is displayed:

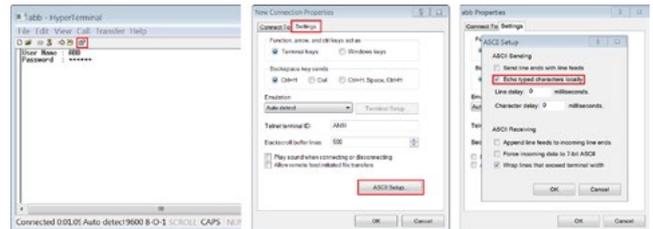


5. Click **OK** to exit connection configuration and return to the HyperTerminal window:



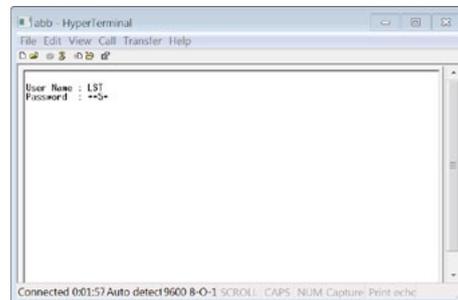
IMPORTANT (NOTE)
 Step 6 is optional.

6. Click the  icon (properties) on the top toolbar to display the connection properties dialog. Select the **Settings** tab and click **ASCII Setup...**. Check the **Echo typed characters locally** box and click **OK**, then click **OK** again to exit the connection properties dialog. Any characters typed in HyperTerminal are now echoed for easier visualization of input.

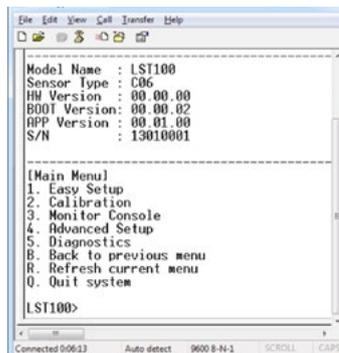


7. When prompted, input the user name and the password. The default logon information is:

User name: LST
 Password: 5159



Connection to the LST100 is established and the home screen of the transmitter is displayed.



4 Commissioning

4.4 Commissioning the unit

4.4.1 Factory settings

Three menu levels are available – Easy, User, and Advanced. All settings found in the Easy Setup menu are also available in the User setup. See Section 4.4.2, *Commissioning using the Easy Setup menu* for Easy Setup instructions.

The LST100 is delivered with default factory settings as shown in Table 4.1, Factory default settings.

Menu name	Number	Setting	Default value
Easy Setup	1	Operate Mode	Level
	2	Length Unit	feet
	3	Empty Distance	20.000 ft
	4	Span	19.150 ft
	5	Blanking	0.850 ft
	6	Max Rate of Change	1.500 ft
Calibration	1	Enable User Calibration	NO
	2	Measured Value of P1	0.003 ft
	3	Actual Value of P1	0.003 ft
	4	Measured Value of P2	0.003 ft
	5	Actual Value of P2	0.003 ft
	6	Enable Simulation	NO
	7	Simulated Voltage	1 mV
	8	Offset of 1000mV	1000 mV
	9	Offset of 5000mV	5000 mV
	Advanced Setup	1	Measure Interval
2		Temp. Compensation	YES
3		Temp. Unit	Fahrenheit
4		Temp. Offset	0.0 F
5		Min Power Level	Level_1
6		Max Power Level	Level_5
7		Invert Voltage	NO
8		Failsafe	LOW ALARM
9		Factory Reset	NO
10		User Password	*****

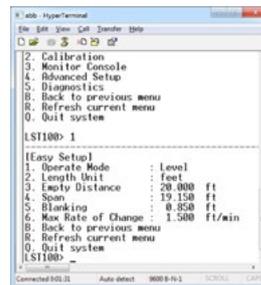
Table 4.1: Factory default settings

4.4.2 Commissioning using the Easy Setup menu

The most common configuration parameters are summarized in the Easy Setup menu. This menu provides the quickest way to configure the device. Use the Easy Setup menu to select dimensions, operating mode and engineering units.

For a detailed description of these menus and parameters, see Section 5.2, *Parameter descriptions*.

- Log on to the LST100 as described in Section 4.1 of this manual. On the welcome screen are 5 menus: Easy, Calibration, Monitor Console, Advanced Setup, and Diagnostics.
- Select 1 from the Main Menu to display the Easy Setup menu:



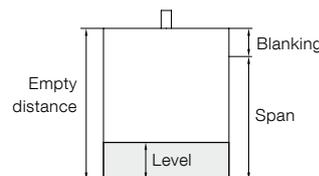
- On the Easy Setup menu, select 1 to configure *Operate Mode*. The options available are *Level* and *Distance*. Select the desired mode by entering the associated number. Click **Enter**.



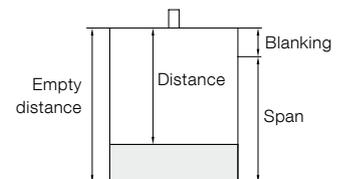
IMPORTANT (NOTE)

After setting a value, select R to refresh the menu with updated settings. Select B to return to the previous menu without refreshing the menu with updated settings.

Level (1) – the LST100 measures the distance from the bottom of the tank to the surface of the liquid.

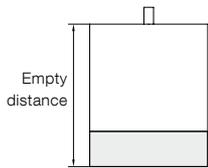


Distance (2) – the LST100 measures the distance from the transmitter to the surface of the liquid.

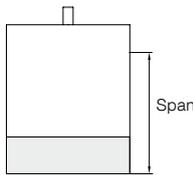


5 Configuration

- On the Easy Setup menu, select 2 to configure *Length Unit*. Two options are available, *Meters* and *Feet*. Select the preferred unit.
- On the Easy Setup menu, select 3 to configure *Empty Distance*. This is the distance (in units selected in step 4) from the face of the sensor to the bottom of the tank. In *Level* mode, *Empty Distance* indicates the tank is empty, or the 1V point.



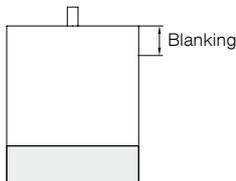
- On the Easy Setup menu, select 4 to configure *Span*. This is the distance from the bottom of the blanking distance of the sensor to the bottom of the tank. In *Level* mode, *Span* indicates the tank full position, or the 5V point.



IMPORTANT (NOTE)

Span cannot be adjusted beyond *Blanking*. The LST100 limits the *Span* value based on the *Blanking* distance set in step 7.

- On the Main menu, select 5 to configure *Blanking*. This is the area close to the transmitter where meaningful measurements cannot be made. The default value is according to the product specification. Adjusting *Blanking* is optional.



- On the Easy Setup menu, select 6 to configure *Max Rate of Change*. This is the maximum speed at which the level is allowed to change and provides filtering for any brief disturbances.

The LST100 uses RS485 communication protocol to enable configuration using a laptop computer.

5.1 Menu navigation

On the Main menu there are 8 selectable options. The first 5 are submenus and the last 3 are navigation options.

The submenus:

- Easy Setup* contains the most important parameters
- Calibration* contains all settings required to calibrate the measurement or the analog output
- Monitor Console* enables access to real time measurement and instrument status information
- Advanced Setup* contains more advanced parameters not required for common configuration
- Diagnostics* contains all alarms and diagnostic information

Navigation options:

Navigation options are displayed in all menu levels. The menu is not case sensitive and accepts upper or lower case input.

- Back to previous menu operation* return to previous menu
- Refresh current menu* the menu is refreshed with the newest value
- Quit* User is logged off and must log on again before being able to configure the instrument



After sending a command to the LST100, one of three responses are returned:

No.	Response status	Description
1	Invalid input	The input value is out of range.
2	Successful	Setting is successful.
3	This item is read only.	The item is read only and cannot be configured.

5 Configuration

5.2 Parameter descriptions

Menu summary					
Menu name	No.	Configure name	Setting range		Description
Easy Setup	1	Operate Mode	1: Level	2: Distance	Measurement mode
	2	Length Unit	1: Feet	2: Meters	Measurement length units
	3	Empty Distance	0.213 to 15.24 m (0.700 to 50.00 ft)		Distance from sensor to bottom of tank
	4	Span	0.213 to 15.24 m (0.700 to 50.00 ft)		Measurement span
	5	Blanking	0.001 to 15.24 m (0.003 to 50.00 ft)		Distance from sensor where no measurement is possible
	6	Max Rate of Change	0.001 to 15.24 m/minute (0.003 to 50.00 ft/minute)		Maximum rate the level can change in the process
Calibration	1	Enable User Calibration	1. No	Yes	Enable user calibration function
	2	Measured Value of P1	0.001 to 15.24 m (0.003 to 50.00 ft)		LST100 measured value of calibration point 1 (short range)
	3	Actual Value of P1	0.001 to 15.24 m (0.003 to 50.00 ft)		Actual distance to target for calibration point 1 (short range)
	4	Measured Value of P2	0.001 to 15.24 m (0.003 to 50.00 ft)		LST100 measured value of calibration point 2 (short range)
	5	Actual Value of P2	0.001 to 15.24 m (0.003 to 50.00 ft)		Actual distance to target for calibration point 2 (short range)
	6	Enable Simulation	1. No	Yes	Enable Simulation
	7	Simulated Voltage	1 to 5800 mV		Simulated Voltage used for output calibration
	8	Offset of 1000mV	500 to 1500 mV		Offset for 1000 mV
	9	Offset of 5000mV	4000 to 6000 mV		Offset for 5000 mV
Monitor Console	1	Level	Read Only		Output level value
	2	Instant	Read Only		Instant distance from target surface to bottom of tank
	3	Percentage	Read Only		Percentage of Span
	4	Voltage Output	Read Only		The voltage to output
	5	Refresh Automatically	1. No	Yes	Refresh automatically
Advanced Setup	1	Measure Interval	2 to 3600 s		Interval between measurements
	2	Temp. Compensation	1. No	Yes	Compensate for the speed of sound
	3	Temp. Unit	1. Fahrenheit	Celsius	Temperature unit
	4	Temp. Offset	-200 to 200		Offset for temperature sensor
	5	Min Power Level	1. Level_1 2. Level_2 3. Level_3 4. Level_4 5. Level_5		Minimum power used
	6	Max Power Level	1. Level_1 2. Level_2 3. Level_3 4. Level_4 5. Level_5		Maximum power used
	7	Invert Voltage	1. No	Yes	Invert voltage
	8	Failsafe	1. LOW ALARM 2. HIGH ALARM 3. HOLD MODE		Failsafe
	9	Factory Reset	1. No	Yes	Factory reset
	10	User Password	Read Only		

Menu summary

Menu name	No.	Configure name	Setting range	Description
Diagnostics	1	Temperature	Read Only	Indicate the current temperature
	2	Signal Level	Read Only	Indicate the average signal in last measurement
	3	Maximum Signal	Read Only	Indicate the maximum signal in last measurement
	4	Noise Level	Read Only	Indicate the average noise in last measurement
	5	Maximum Noise	Read Only	Indicate the maximum noise in last measurement
	6	Signal Noise Ratio	Read Only	Indicate the ratio of the signal size to the noise size
	7	Number of Echo	Read Only	Indicate the number of echoes in last measurement
	8	Current Pulse Number	Read Only	Indicate the number of pulses being transmitted
	9	Current Gain	Read Only	Indicate the current receiver gain
	10	Current Power Mode	Read Only	Indicate the high power or low power in use for pulsing
	11	Current Blanking	Read Only	Indicate the current blanking
	12	Number of Power Change	Read Only	Indicate the number of power change
	13	Alarm Level	Read Only	Indicate the the alarm level
	14	NV Status	Read Only	Indicate the NV statue
	15	NV Load Error	Read Only	Indicate the NV load error
	16	Power Down Alarm	Read Only	Indicate the power shut down, but device dosen't restart
	17	Almost Full	Read Only	Indicate the distance may be not able to measure
	18	Loss Signal	Read Only	Indicate the echo has lost for a long time
	19	Beyond Empty Dis.	Read Only	Indicate the distance is out of empty distance
	20	Loss Echo	Read Only	Indicate the echo is loss
	21	Echo Too Small	Read Only	Indicate the maximum signal is below value of echo too small
	22	Echo Too Large	Read Only	Indicate the maximum signal is above value of echo too large
	23	Temp. High	Read Only	Indicate the the temperature is too high
	24	Temp. Low	Read Only	Indicate the the temperature is too low
	25	Noise Alarm	Read Only	Indicate the the average noise is above noise threshold
	26	Clear NV Load Error	1. No Yes	

5 Configuration

5.3 Downloading and uploading configurations

To download a device configuration:

1. Log on to the LST100 using the following logon information:
User name: LSTCONFIG
Password: 5159



IMPORTANT (NOTE)

The password 5159 is the default user password.
• If the user password has been customized, use the updated password.

After successfully logging on, the LST100 responds with the current device configuration in the following format:

---Start of configuration file---

```
{  
>1=1\r  
>2=2\r  
>3=3\r  
>4=4\r  
>5=5\r  
...  
}
```

---End of configuration file---

2. Select the text shown in red above.
3. Copy the text and paste it into a text editor (for example, Notepad).
4. Save the file to a known location as a configuration backup or for upload to another device.

To upload a device configuration:

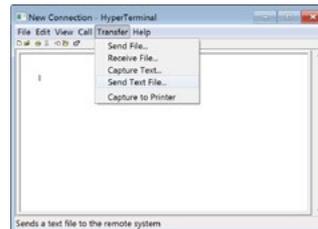
1. Log on to the LST100 using the following logon information:
User name: LSTCONFIG
Password: 5159



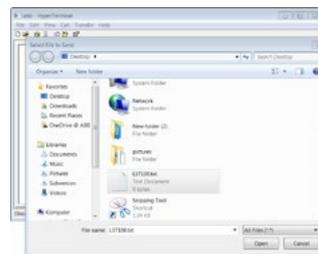
IMPORTANT (NOTE)

The password 5159 is the default user password.
• If the user password has been customized, use the updated password.

2. Select **Transfer** in the HyperTerminal toolbar and select **Send Text File...** to open the file explorer window.



3. In the file explorer window, browse to the configuration file saved at step 4 in the download instructions. Select the file and click Open. HyperTerminal sends the configuration to the LST100.



4. The LST100 responds with a status message indicating upload success or failure in the following format:

---Start of response message---

There is not nv error now.

<0>1=1\r

<0>2=2\r

<0>3=3\r

<0>4=4\r

<0>5=5\r

...

---End of response message---

5. Enter Q (or q) to exit the upload interface.

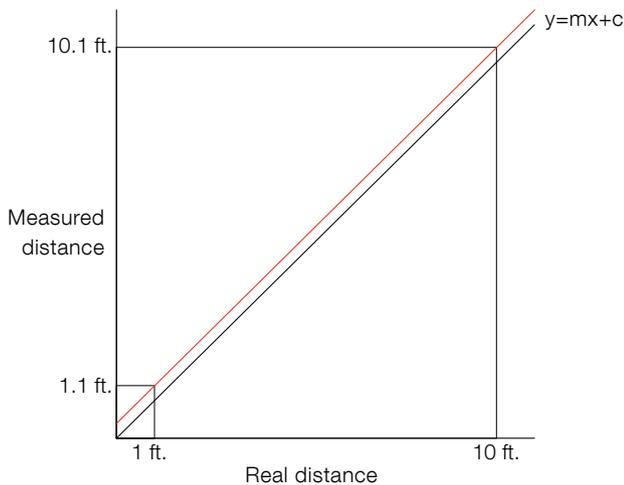
6 Calibration

An easy-to-use, 2-point calibration enables the best possible accuracy by calibrating the measurement to two known good points.

There are two types of errors: offset and gradient.

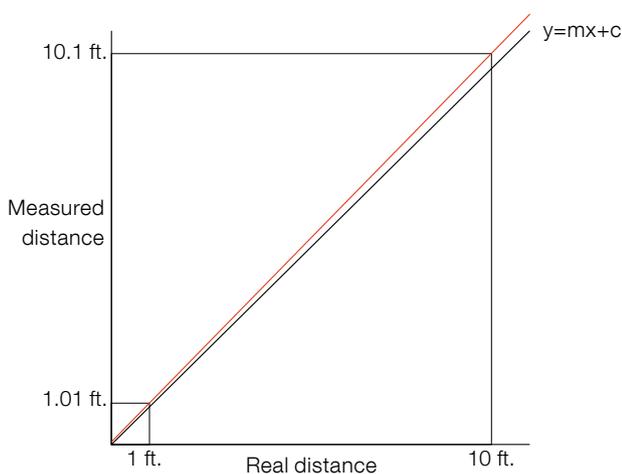
– Offset error

The error at close range is equal to the error at maximum range. In this case the “c” value in the equation $y=mx+c$ must be corrected.



– Gradient error

A small error at a close range becomes larger as the range increases. In this case the “m” value in the equation $y=mx+c$ must be corrected.



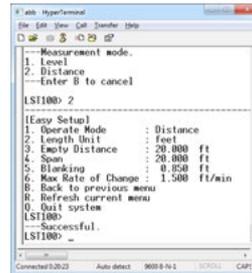
The speed of sound is linear, enabling calibration to be performed using only 2 known points. This provides sufficient information to calibrate LST100.

6.1 Calibration procedure

Calibration can be performed on site if the tank dimensions are known. This gives best results as it ensures the instrument is calibrated to the intended installation. Alternatively, the calibration can be performed before installation by pointing the sensor at a known target.

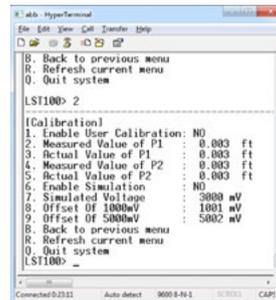
1. Log on to the LST100 as described in Section 4.3, *Configuring the digital communications*. The welcome screen is displayed.

2. Select **1. Easy Setup** from the main menu. Ensure that **Operate Mode** is set to **Distance**.



Enter **B** to return to the main menu.

3. Select **Calibration** from the main menu. Ensure that **Enable User Calibration** is set to **NO**. This disables any existing calibration to avoid errors in the new calibration.



Enter **B** to return to the main menu.

6 Calibration

- Ensure the LST100 is measuring the short range calibration point and select **3. Monitor Console** from the main menu.



Record the measured distance and the actual distance.



IMPORTANT (NOTE)

ABB recommends measuring the short range calibration point when the tank is nearly full.

- Ensure the LST100 is measuring the long range calibration point and select **3. Monitor Console** from the main menu. Record the measured distance and the actual distance.



IMPORTANT (NOTE)

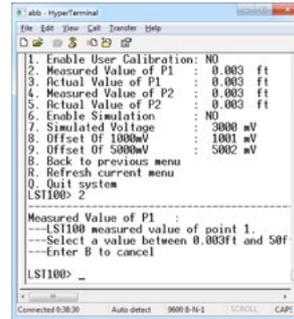
ABB recommends measuring the long range calibration point when the tank is empty.

Enter **B** to return to the main menu.

- Select **2. Calibration** from the main menu. Configure the following 4 parameters from the information noted in Steps 4 and 5:

- Measured value of P1: The measured short range distance noted at Step 4
- Actual value of P1: The actual short range distance noted at Step 4
- Measured value of P2: The measured long range distance noted at Step 4
- Actual value of P2: The actual long range distance noted at Step 4

- Set **Enable User Calibration** to **YES**. The calibration is now active on the LST100.



Enter **B** to return to the main menu.

- Select **3. Monitor Console** from the main menu. Check that the distance is within the LST100 transmitter's specified accuracy.



IMPORTANT (NOTE)

Step 9 is applicable only if **Operate Mode** was set to **Level** before calibration was performed.

- Select **1. User Setup** from the main menu and set **Operate Mode** to **Level** (if required).

7 Diagnostic messages

The LST100 provides several diagnostic messages that can be viewed from the menu. The diagnostic messages provide insight into the state of the current process and can be valuable when troubleshooting an application.

Table 7.1 details each diagnostic message together with possible causes and remedial actions.

Alarm number	Name on HyperTerminal	Cause	Remedy
1	Temperature	Current Temperature	
2	Signal Level	Average signal in last measurement	
3	Maximum Signal	Maximum signal in last measurement	
4	Noise Level	Average noise in last measurement	
5	Maximum Noise	Maximum noise in last measurement	
6	Signal Noise Ratio	The ratio of the signal size to the noise size	
7	Number of Echo	The number of echoes in last measurement	
8	Current Pulse Number	The number of pulses being transmitted	
9	Current Gain	The current receiver gain	
10	Current Power Mode	High power or low power in use for pulsing	
11	Current Blanking	The selected blanking, Blanking or Blanking for HP	
12	Number of Power Change	Number of changes to instrument pulsing and receiving power in the last minute	
13	Alarm Level	Device alarm level	
14	NV Status	Status of NV operations	
15	NV Load Error	1. The NV (nonvolatile memory) initialization has failed. 2. The firmware has been updated.	1. Set the Clear NV Load Error parameter to Yes to clear the nonvolatile memory. 2. Restart the LST100.
16	Power Down Alarm	Power supply is below the minimum of 9 V.	Ensure the power supply voltage is above 9 V.
17	Almost Full	The distance to the target surface is approaching the Blanking parameter value. Measurement has stopped and a Tank Full state is transmitted (5 V).	1. Increase the distance to the target surface. 2. Increase the value of the Blanking parameter.
18	Loss Signal	Loss Echo lasts for several minutes.	1. Reduce the distance to the target surface. 2. Contact ABB service.
19	Beyond Empty Dis.	The distance to the target surface is beyond the Empty Distance setting.	1. Reduce the distance to the target surface. 2. Increase the value of the Empty Distance parameter.
20	Loss Echo	The distance to the target surface is beyond the measurement range.	1. Reduce the distance to the target surface. 2. Ensure the LST100 is installed perpendicular to the target surface.
21	Echo Too Small	1. The distance to the target surface is approaching the measurement limit. 2. The Max Power Level setting in the User Setup menu is too low.	1. Reduce the distance to the target surface. 2. Increase the value of the Max Power Level parameter.
22	Echo Too Large	The Min Power Level setting in the User Setup menu is too high.	Decrease the value of the Max Power Level parameter.
23	Temp. High	The environment temperature is too high.	Check and decrease the environment temperature.
24	Temp. Low	The environment temperature is too low.	Check and increase the environment temperature.
25	Noise Alarm	The noise level is too high.	Decrease the value of the Max Power Level parameter.
26	Clear NV Load Error	Clear nonvolatile memory load error	

Table 7.1: Diagnostic messages

8 Specifications

Measurement

Range

0.85 to 20 ft / 1.15 to 30 ft

Beam angle (@ -3dB)

5° (20 ft version) / 7° (30 ft version)

Accuracy

±½ in. or 0.25 % of full span (largest of the two)

Repeatability

±0.25% of measurement range

Mechanical data

Housing material

PVDF

Dimensions

Height – 122 mm (4.8 in.) minimum (excluding glands)

Diameter – 78 mm (3.07 in.) – excluding glands

Weight

1.0 kg (2.2 lb)

Cable entry type

One ½ in. threaded bore for cable gland, directly on housing

Supplied with 1 x ½ in. NPT cable gland

Electrical Data

Terminals

9 terminals for power supply and communication purposes accommodating wire cross sections of up to 1 in. (14 AWG)

Power supply

3 terminals for power supply (PE/+/-): The LST100 operates from 9 to 16 V DC and is protected against reversed polarity

Analog output (1 to 5 V)

2 terminals for analog output (+/-): 1 to 5 V related to level, or full compensation for temperature effects

RS485 communication

2 terminals for RS485 communication (+/-): RS485 communication for setting parameters, monitoring measurement results and diagnostics messages

Option for connecting ground

2 terminals as a jumper switch for ground earth. Connecting the transducer to ground is optional and is done using this jumper.

Environmental data

Hazardous area approvals

Intrinsic Safety type of protection:

- Approval according to FM US and Canada
- IS Class 1 Div 1/GP ABCD- CL II/ DIV 1/ GP EFG, CL 1, Zone 1

Non Incendive type of protection:

- Approval according to FM US and Canada
- NI Class 1 Div 2/GP ABCD- DIP CL II/ DIV 2/ GP EFG, CL 1, Zone 2, AExnA IIC T6; IP66/67

Electromagnetic compatibility (EMC)

Meets requirements of EN 61326

Overvoltage strength (with surge protection): 2 kV (according to IEC 61000-4-5)

Temperature

-40 to 185 °F, according to EN 60068-2-14, 1K/min, 100 cycles

Humidity

Relative humidity: Up to 100 %

Condensation, icing: Not permissible

Pressure

Measurement functional from -4 to 44 psi (-0.25 to 3.0 bar)

Vibration resistance

Acceleration up to 1 g at frequencies of up to 2,000 Hz (according to IEC 60068-2-64)

Humid and dusty atmospheres (degree of protection)

LST100 is dust and sand-proof and protected against immersion effects as defined by EN 60529 (1989) to IP 66/67 or by NEMA 4X

Notes

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