ABB MEASUREMENT & ANALYTICS | COMMISSIONING INSTRUCTION

LLT100 Laser Level Transmitter
Commissioning guide

Commissioning guide for LLT100 laser level transmitter to provide practical advice and guidance on how to get the commissioning done quickly and easily.

Measurement made easy

—
LLT100

Purpose of this manual

This guide is built on practical experience to facilitate the commissioning of the LLT100 laser surface measurement. The LLT100 user manual contains all the necessary information, and the user must be familiar with it before using this manual.

This guide mainly provides practical advice and guidance on how to get the commissioning done quickly and easily. The document is divided into five sections. Features, safety, electrical connections, mounting, general mode, and easy setup are discussed in section 1. Measurements of solids are discussed in section 2, liquid measurements in section 3, specifications in section 4, and related documents in section 5.

Contents

1 Introduction

The LLT100 is a high performance laser level transmitter that accurately measures level, distance, and position over long ranges in industrial environments. The LLT100, using an eye-safe pulsed laser beam, features advanced timing and sophisticated signal processing for pinpoint accuracy.

1.1 Features

- Range up to 100 m (330 ft) for level of solids / 30 m (100 ft) for level of liquids / 200 m (660 ft) for positioning applications
- Narrow, easy-to-aim laser beam
- Measures solid surface even at wide angles
- Measures liquid levels even for clear liquids
- Robust aluminum or stainless steel enclosure
- Easy and intuitive setup / no calibration required
- Explosion proof class 1 / division 1 (zone 1)
- 2-wire power from the 4 to 20 mA loop
- HART communication

1.2 Health and Safety

⚠ WARNING

Bodily injury
Read the LLT100 Operating Instruction OI/LLT100-EN carefully before working with the product.
For personal and system safety, and for optimum performance, make sure that you thoroughly understand the contents before installing, using or maintaining this instrument.

NOTICE

- All servicing of the equipment is to be performed at factory by qualified service personnel only.
- No user / operator adjustments inside the LLT100 level transmitter are recommended by the manufacturer.

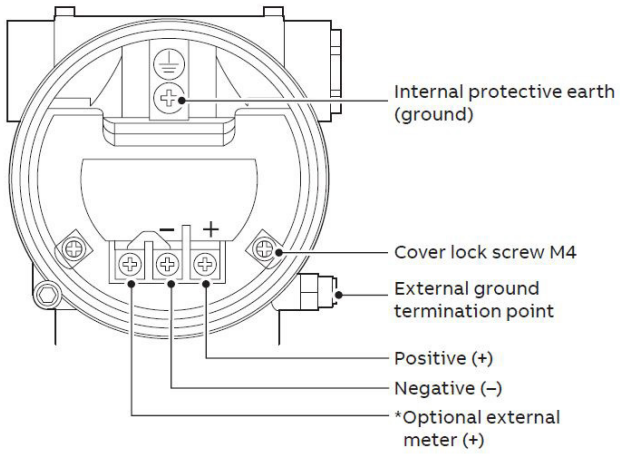
Product labels
Symbols that appear on this product are shown below::

Protective earth (ground) terminal.

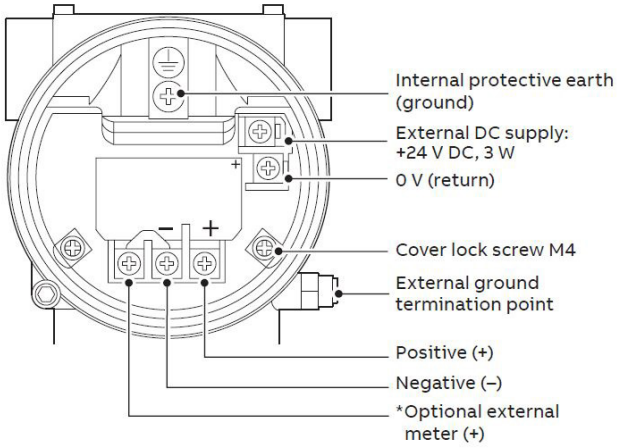
Direct current supply only.

1.3 Electrical Connection

HART terminal - 2 wires



HART terminal with heater option - 2 + 2 wires

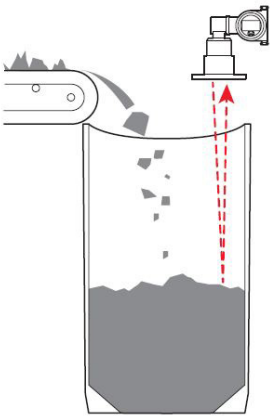


Attention – location of ground
The Ground symbols is used to identify protective earth conductor terminals.

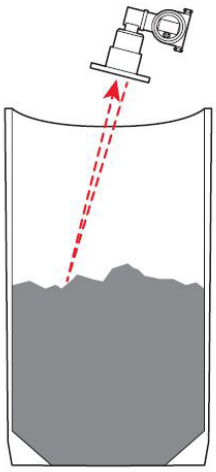
Attention – direct current

Use wires and cable glands rated 90 °C (194 °F) minimum.

1.4 Mounting

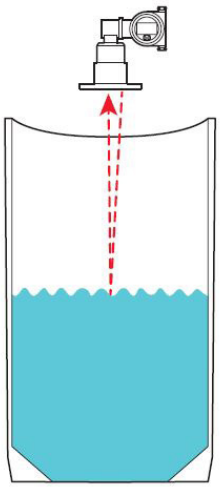


Install away from falling material for easiest configuration



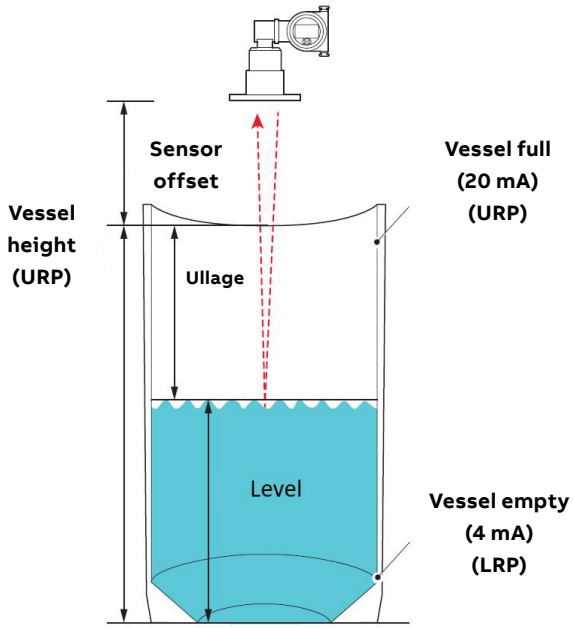
For solids laser beam can be aimed at any angle

Also typically applies to other scattering surfaces such as slurries and some turbulent liquids



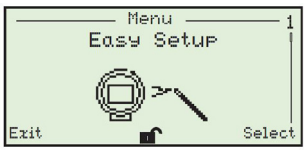
For typical liquid applications laser beam must be as perpendicular as possible, not exceeding 90° ± 5° to the surface

1.5 General Model



1.6 Easy Setup

1. Rotate the housing: unscrew the stop tang-screw by approximately 1 rotation (do not pull it out) before removing the housing. When the desired position is reached, re-tighten the stop tang-screw.
2. Connect the cables (15.5 to 42 V DC) to the LLT100 laser level transmitter – if using HART the minimum input voltage is 21 V DC.
3. Power on the transmitter.
4. Press the Right arrow key on the display and select your access level using the Up and Down arrow keys
5. Set the main parameters at the Easy Setup menu:



- Select the required language.
- Select the measurement mode: standard, clear liquid, positioning or dust / vapor.
- Enter the vessel height (URP).
- Set the sensor offset from the vessel top.
- Select the primary variable (PV) for the 4 to 20 mA output: level, ullage, volume.
- Choose the unit of the primary variable (PV): m, cm, mm, ft.
- Set the value for vessel empty (LRV).
- Set the value for vessel full (URV).
- Enable or disable the filling rate.
- Enter the Tag name

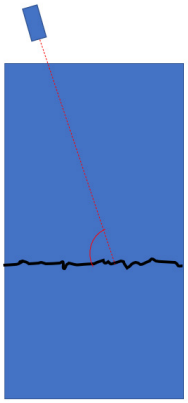
6. Once the settings are completed, press Exit to return to the Distance view.

Refer to Operating Instruction OI/LLT100-EN for detailed configuration / setup information.

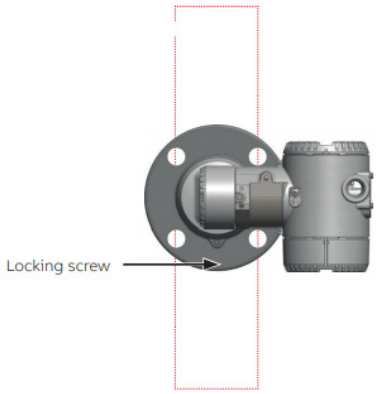
2 Solid Level Measurement

2.1 Installation

1. Using a visible laser pointer (pointing device as accessory), point the device/flange to the desired target and pay attention to any sources of error (dust, dust binding, material flow, etc.) The best reflection is obtained when the laser hits the surface to be measured at a 90° angle. The minimum angle required always depends on the application and the surface to be measured. However, <20° angles are to be avoided.



2. Check the cleanliness of the sensor optics, install the dust tube and purge ring. Select the correct installation position for the laser sensor. The beam is wider in the direction of the flange locking screw (fig. below). Install the gaskets and tighten the bolts to the “finger tension”.



3. Connect positive and negative terminals for the 4-20mA power loop, the terminals for the lens heater (optional), as well as the grounding terminal. Replace the transportation covers (red, yellow or orange plastic caps) with cable glands or plugs rated for the environment. Pay attention to the grounding!

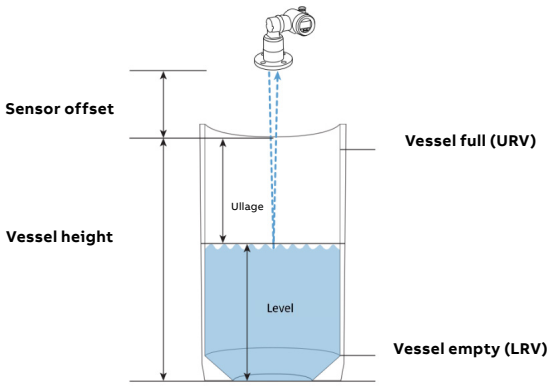
4. Connect power supply for the device.

2.2 Commissioning

1. Start commissioning from operator page 1 specification. Operator page 1 displays the desired process value (level = surface height, ullage = distance from top of the tank to surface) note values are based on e.g. given dimensions of the silo.

2. Operator page 3 will be built for commissioning. Choose 3 x9 display mode and choose level, ullage and amplitude to the lines. These are used to help with deployment.

3. Check the dimensions of the silo and the length of the nozzle = sensor offset.



4. Execute easy setup and fill in the data.
   - Language
   - Measurement mode, dust & vapor if process is dusty
   - Level unit
   - Vessel height (URP)
   - Sensor offset (nozzle length)
   - Output type for 4-20mA
   - Vessel empty LRV (4mA)
   - Vessel full URV (20mA)
   - Filling rate filter
   - Device TAG

5. Return to the main screen and select operator page 3. First, check the amplitude value. The value must always remain above 10 levels for reliable measurement. If the amplitude value is less than 10, the sensor will not receive sufficient reflection. First try to get a better signal by moving the sensor with the bolts loose. In general, problems with reflection are related to long and thin neck tubes or alignment problems, etc. Adequate reflection is a prerequisite for reliable measurement, and without proper reflection, it is not worth continuing to commission.

2 Solid Level Measurement

... 2.2 Commissioning

6. Once the amplitude value has been brought to an adequate level and ullage and level values are corresponding to the actual surface height, commissioning can continue. Next, tighten the sensor bolts and continuously observe the amplitude value. If the value collapses as a bolt is tightened, you need to tighten bolt from opposite side to bring reflection back.

7. The measurement is now operational and can be used to define filters if necessary.
   - Device setup menu includes filtering menu
   - Filling rate filters have separately configurable maximum filling and speed for the process. This filter can be used, for example, to eliminate interference that is well outside the possible rate of change.
   - No measurement period is the time a sensor can be without a reliable measurement result. If the filling rate and drain rate filter are not specified, the latest measurement result is frozen in case reflection is lost. If rate change filters are defined, the surface height is predicted based on the trend of previous measurement results.
   - Median filter is intended to eliminate interference in fast processes where rate change filters cannot be used. The filter specifies the number of measurements based on which the median value is calculated.
   - The damping filter can be used to filter for disturbances in slow processes e.g., a wave caused by a blender.

8. Typically, in silos, it is good to use rate filters and set the no measurement period large because their rate of change is relatively slow.

9. In feed cones and funnels, it is necessary to use the median filter and, if possible, also rate filters.

10. Select the filter parameters and the appropriate values for them. However, make sure that the filter does not make the measurement too slow.

11. Check the operation of the measurement and returns to previous paragraph in case operation is not as desired.

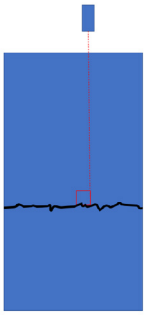
12. Finally, change device to the operator page 1 so that the process value can be displayed.

3 Liquid Level Measurement

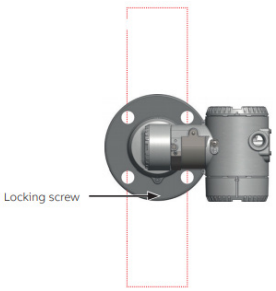
When measuring liquids, factors such as steam, foam and alignment are the most common problems. The effect of steam can be minimized with a nozzle and a tight connection from the nozzle to the sensor, so there is not so much steam going into the sealed tube (sealing the nozzle reduces the chimney effect). In some cases, neck tube insulation, a flushing flange or even an automatic valve is also possible if the process is particularly hostile, it is recommended that optics heating be used in applications where condensation occurs.

3.1 Installation

1. When measuring liquids, it is important that the sensor is at 90° angle to the liquid surface. The easiest way is to try to install everything horizontally, so that the necessary fine tuning can be done during the commissioning phase.



2. Check the cleanliness of the sensor optics, install the dust tube and purge ring flange. Select the correct installation position for the laser sensor. The laser beam is wider in the direction of the flange locking screw (figure below). Install the gasket and tighten the bolts to the “finger tension”.



3. Connect positive and negative terminals for the 4-20mA power loop, the terminals for the lens heater (optional), as well as the grounding terminal. Replace the transportation covers (red, yellow or orange plastic caps) with cable glands or plugs rated for the environment. Pay attention to the grounding!

4. Connect the power supply for the device.

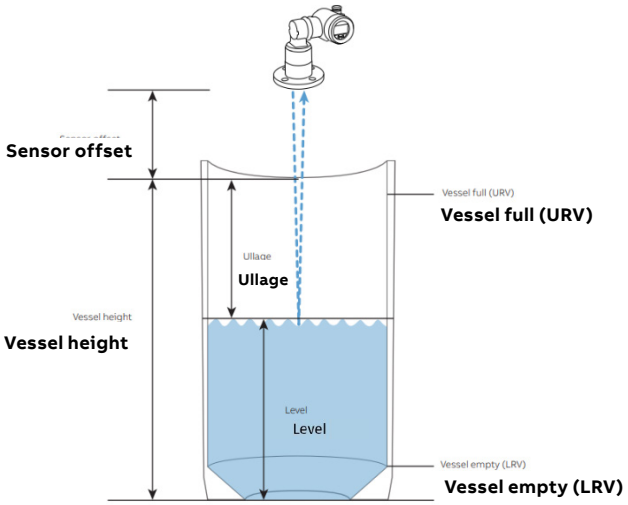
...3 Liquid Level Measurement

3.2 Commissioning

1. Start commissioning from operator page 1 specification. Operator page 1 displays the desired process value (level=surface height, ullage = distance from top of the tank to surface (note values are based on given silo dimensions).

2. Operator page 3 will be built for commissioning. Select 3x9 mode and choose level, ullage and amplitude for corresponding lines. These are used to help commissioning.

3. Check the dimensions of the silo and the length of the nozzle = sensor offset.



4. Execute easy setup menu and fill in the data
   - Language
   - Measurement mode, standard, clear liquid or dust and vapor
   - Level unit
   - Vessel height (URP)
   - Sensor offset (nozzle length)
   - Output type for 4-20mA
   - Vessel empty LRV (4mA)
   - Vessel full URV (20mA)
   - Filling rate filter
   - Device TAG

5. Return to the main screen and select operator page 3. First, check the amplitude value. Use the amplitude value to fine-tune the alignment and make sure the laser beam is as perpendicular to the surface as possible. To do so, first install it without the bolts. Then, look at the amplitude while slowly tilting the instrument in every direction. As you tilt it, you will see the amplitude changing. Take note of the maximum amplitude value that was reached during that experiment. Then, reinstall it with the bolts. The final amplitude value with the bolts tightened should be at least 90% of the max value reached earlier. In general, problems with reflection are related to long and thin neck tubes or problems alignment, etc. Adequate reflection is a prerequisite for reliable measurement and without proper reflection it is not worth continuing to commission.

6. Once the amplitude value has been brought to an adequate level and ullage and level values are corresponding to the actual surface height commissioning can be continued. Next, tighten the sensor bolts and observe the amplitude value. If the value collapses when tightening the bolt, tighten the counterparty bolt to bring amplitude back.

7. The measurement is now operational and can be used to define filters if necessary.
   - Device setup menu includes filtering menu
   - Filling rate and drain rate filters have separately configurable maximum filling and drain speed for the process. This filter can be used, for example, to eliminate interference that is well outside the possible rate of change.
   - No measurement period is the time a sensor can be without a reliable measurement result. If the filling rate and drain rate filter are not specified, the latest measurement result is frozen in case reflection is lost. If rate change filters are defined, the surface height is predicted based on the trend of previous measurement results.
   - Median filter is intended to eliminate interference in fast processes where rate change filters cannot be used. The filter specifies the number of measurements based on which the median value is calculated.
   - The damping filter can be used to filter for disturbances in slow processes e.g., a wave caused by a blender.

8. Typically, in large tanks/basins are good for rate filters. Remember to set the no measurement period quite large because their rate of change is relatively slow and is not limiting the parameter.

9. In wells, reactors, etc., it is necessary to use the median filter and, if possible, also rate filters.

10. Select the filter parameters and the appropriate values for them. However, make sure that the filter does not make the measurement too slow.

11. Check the operation of the measurement and return to the previous paragraph in the instruction if the operation is not as desired.

12. Finally, switch device to Operator page 1 so that the process value can be displayed.

Surface measurement has now been commissioned. If there is a malfunction in the measurement, etc. go back to the instruction and carry out the checks. If the amplitude is okay, check the filters, and if the amplitude is low, return to the very beginning of the instruction.

4 Specifications

Environmental conditions

- Operating temperature: –40 to 60°C (–40 to 140°F), up to 280°C (535°F) with cooling tube
- Altitude: Up to 2000 m (6561 ft.)
- Relative humidity: 0 to 100%
- Electrical equipment: Class III
- Pollution degree: 4 (IP66 / IP67 / Type 4X)
- Overvoltage: Category 1

Output

- Analog: 4 to 20 mA, NAMUR compliant
- Digital: HART 7 (multi-variable output)
- Communication: Local HMI, EDD / DTM, handheld

Power supply

- Powered from the loop: 4 to 20 mA, 15.5 to 42 V DC
- Heated lens option: 24 V DC (3W)

5 LLT100 Related Documents

Data sheet:
https://search.abb.com/library/Download.aspx?DocumentID=DS%2fLLT100-EN&LanguageCode=en&DocumentPartId=001&Action=Launch

Installation instructions:
https://search.abb.com/library/Download.aspx?DocumentID=I%2fLLT100%20Commissionning%20Instruction&LanguageCode=en&DocumentPartId=&Action=Launch

Operation:
https://search.abb.com/library/Download.aspx?DocumentID=OI%2fLLT100-EN&LanguageCode=en&DocumentPartId=&Action=Launch

Functional Safety Guide:
https://search.abb.com/library/Download.aspx?DocumentID=OS%2fLLT100-SIL_Safety_

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For more product information, visit:
www.abb.com/measurement

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