LST300
Compact ultrasonic level transmitter

The most powerful ultrasonic level transmitter in a compact form

Measurement made easy
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   (Zone 0/20), and cFMus division 1, Zone 0/20 ......................................................... 54
   Meter design for NEPSI intrinsic safety, ATEX/IECEx intrinsic safety
   (Zone 0/20), and cFMus division 1, Zone 0/20 ......................................................... 55

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1 Introduction

Liquid level measurement has never been easier.

LST300 is the most advanced compact level instrument available. With class leading accuracy and specification typically only found in expensive remote sensor units, LST300 changes the way the world looks at compact ultrasonic transmitters.

LST300 features high temperature range, corrosion resistant design, metal housing, intrinsic safety, advanced diagnostics, false echo filtering and even real time on-screen graphic echo view. The LST300 can be installed in areas where compact instruments were never an option.

LST300 solves many liquid level challenges in liquid storage tanks and liquid processes in a wide range of industries, including:

- Water and wastewater
- Chemical and petrochemical
- Power
- Paper and pulp
- Mining and metals
- Food and beverage
2 Safety

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.

This product 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 this 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.

Information and symbols on the product must be observed. They may not be removed and must be fully legible at all times.

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)
• To measure volumetric flow (indirectly using distance measurement and tank dimensions)
• To measure the volume (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 chapter 8 “Specification”)

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

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.

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.

Operator liability
Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given. Any deviation from these instructions will transfer the complete liability to the user.

Technical limit values
Particular attention must be paid to the limit values listed in the sections relating to ex relevant specifications (refer to chapter 8, “Ex relevant specifications”):
• The data for the signal inputs and outputs of the transmitter
• The permissible temperature data and limit values
Plates and symbols

Safety, warning and note symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![DANGER]</td>
<td>Serious damage to health / risk to life&lt;br&gt;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.</td>
</tr>
<tr>
<td>![DANGER]</td>
<td>Serious damage to health / risk to life&lt;br&gt;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.</td>
</tr>
<tr>
<td>![WARNING]</td>
<td>Body injury&lt;br&gt;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.</td>
</tr>
<tr>
<td>![WARNING]</td>
<td>Body injury&lt;br&gt;This symbol, in conjunction with the signal word “WARNING”, indicates a potential electrical hazard. Failure to observe this safety information may result in death or severe injury.</td>
</tr>
<tr>
<td>![CAUTION]</td>
<td>Minor Injuries&lt;br&gt;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.</td>
</tr>
<tr>
<td>![NOTICE]</td>
<td>Property damage&lt;br&gt;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.</td>
</tr>
<tr>
<td>![IMPORTANT]</td>
<td>IMPORTANT (NOTE)&lt;br&gt;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.</td>
</tr>
</tbody>
</table>
IMPORTANT (NOTE)
The name plates shown here are only examples. The name plates attached to the device may be different to what you see here.

Figure 1  Product labels for LST300

1 Model number  
2 Serial number for identification by the manufacturer  
3 Order number  
4 Power supply  
5 Ambient temperature  
6 Measuring range  
7 Protection type according to EN 60529  
8 Year / Month of manufacture  
9 Alarm sign (read the instruction before using it)  
10 Ex mark (example)  
11 CE mark  
12 Tag number  

B Certification plate  
C Tag plate  
D Wired-On plate
3 Mounting

Installation safety instructions
Details of any damage that has occurred in transit must be recorded on the transportation documents. All claims for damages must be submitted to the shipper without delay and before installation.

Installation requirements
An LST300 level transmitter can be installed in many applications you need. 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.

Dimensions

Figure 2 Transmitter with 1.5 inch thread
**Direct mounting variations**

The LST300 transmitter can also be mounted directly on a tank using either a nut or a sleeve.

**Direct installation using a nut**

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 LST300 transmitter, insert the transmitter through the hole and secure from inside the tank using the nut.

**Direct installation using a sleeve**

1. Select a sleeve that is compatible with NPT or BSP thread. The LST300 transmitter’s thread size is 1.5 in. (for the 75 KHz version) or 2 in. (for the 50 KHz version).
2. Fit a seal to the LST300 transmitter and screw the transmitter into the sleeve by hand.

**Note**

Tighten the transmitter hand-tight only. Do not use tools.
Mounting with L-shape bracket

Figure 6  Wall mounting with L-shape bracket

Figure 7  L-shape bracket

Figure 8  Floor mounting with L-shape bracket

Figure 9  Floor mounting support
Mounting with extendable bracket

Figure 10  Wall mounting with extendable bracket

Figure 11  Extendable portion

Figure 12  Floor mounting with extendable bracket
Mounting with flanges

Figure 13  Mounting with ANSI B16.5 flange with 1.5” and 2” NPTF thread

Figure 14  Mounting with DIN2527 flange with 1.5” and 2” NPTF thread

### ANSI B16.5 class 150 blind flanges

<table>
<thead>
<tr>
<th>Nominal pipe size</th>
<th>Outside diameter (O)</th>
<th>Thickness (T)</th>
<th>Raised face diameter (R)</th>
<th>Number of holes</th>
<th>Diameter of bolt holes</th>
<th>Bolt circle diameter (C)</th>
<th>Approximate weight (lbs)</th>
<th>Thread P</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>7.5</td>
<td>0.94</td>
<td>5</td>
<td>4</td>
<td>0.75</td>
<td>6</td>
<td>9</td>
<td>1.5” or 2” NPTF THREAD</td>
</tr>
<tr>
<td>4</td>
<td>9.0</td>
<td>0.94</td>
<td>6.19</td>
<td>8</td>
<td>0.75</td>
<td>7.5</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>11</td>
<td>1.00</td>
<td>8.5</td>
<td>8</td>
<td>0.88</td>
<td>9.5</td>
<td>26</td>
<td></td>
</tr>
</tbody>
</table>

Table 1  Types of ANSI B16.5 class flanges for option

The dimensions are in inches.

### DIN2527.PN16.Shape B

<table>
<thead>
<tr>
<th>Rated diameter</th>
<th>Flange Screws</th>
<th>Weight of flange (7.8 Kg/dm²)</th>
<th>Thread P</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>b</td>
<td>k</td>
<td>Number</td>
</tr>
<tr>
<td>---------------</td>
<td>---</td>
<td>---</td>
<td>---------</td>
</tr>
<tr>
<td>80</td>
<td>200</td>
<td>20</td>
<td>160</td>
</tr>
<tr>
<td>100</td>
<td>220</td>
<td>20</td>
<td>180</td>
</tr>
<tr>
<td>150</td>
<td>285</td>
<td>22</td>
<td>240</td>
</tr>
</tbody>
</table>

Table 2  Types of DIN2527 flanges for option

The dimensions are in mm.
Beam angle reference

LST300 shall be mounted in a proper position with no big blocks, e.g. filling point or wall within the beam angle area.

### C06 Sensor

<table>
<thead>
<tr>
<th>Beam Angle 7°</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>vessel depth</td>
<td>beam width</td>
<td></td>
</tr>
<tr>
<td>m</td>
<td>(ft)</td>
<td>mm</td>
</tr>
<tr>
<td>0.5</td>
<td>1.6</td>
<td>30.7</td>
</tr>
<tr>
<td>1</td>
<td>3.3</td>
<td>61.5</td>
</tr>
<tr>
<td>2</td>
<td>6.6</td>
<td>123</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>184</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>245</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>307</td>
</tr>
<tr>
<td>6</td>
<td>20</td>
<td>368</td>
</tr>
</tbody>
</table>

![Figure 15](image1)

Transducer perpendicular to liquid level.

![Figure 16](image2)

This is INCORRECT as the filling point is obscuring the LST300's line of sight.

This is CORRECT as the filling point is NOT obscuring the LST300's line of sight.

### C10 Sensor

<table>
<thead>
<tr>
<th>Beam Angle 5°</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>vessel depth</td>
<td>beam width</td>
<td></td>
</tr>
<tr>
<td>m</td>
<td>(ft)</td>
<td>mm</td>
</tr>
<tr>
<td>0.5</td>
<td>1.6</td>
<td>21.9</td>
</tr>
<tr>
<td>1</td>
<td>3.3</td>
<td>43.8</td>
</tr>
<tr>
<td>2</td>
<td>6.6</td>
<td>87.5</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>131</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>175</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>218.5</td>
</tr>
<tr>
<td>6</td>
<td>20</td>
<td>262.5</td>
</tr>
<tr>
<td>7</td>
<td>23</td>
<td>306</td>
</tr>
<tr>
<td>8</td>
<td>26</td>
<td>350</td>
</tr>
<tr>
<td>9</td>
<td>29.5</td>
<td>394</td>
</tr>
<tr>
<td>10</td>
<td>33</td>
<td>438</td>
</tr>
</tbody>
</table>
Standing off installations

In case of Standing off pipe is needed, to max. reduce the blanking distance impact or to better adjust to the set up, it is recommended to use PE or PVC pipe, with a 45degree angle in the end.

Figure 17

NOTICE

In case a standing off pipe is used for process connection, make sure the diameter of the pipe D is larger than 120mm and L/D <= 3.
4 Electrical connections

Before installation, ensure the LST300 is not plugged in to any power supply.

Installation engineers must statically discharge themselves or use a wrist strap before connecting cables to LST300.

Check the LST300 power supply to ensure that it does not exceed the permitted range (12 to 42 V DC).

When the terminal cover of the LST300 is open, protect the inside of the transmitter against the ingress of dust and moisture.

**WARNING – BODY INJURY**

**Not recommend for hot plugging power**

The LST300 does not recommend hot plugging power (4 to 20 mA with HART).

Shut down the power supply before connecting the LST300 to the power supply.

Le LST300 ne recommande pas la puissance chaude de bouchage (4 - 20 mA avec Hart).

Arrêtez l'alimentation avant de connecter le LST300 à l'alimentation.

**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.

LST300 connections have ESD 4 kV protection for contact and 8 kV for air in accordance with IEC 61000-4-2. ABB strongly recommends using a wrist strap or to discharge electrostatic charge before connecting cables to the LST300.

---

**Cable connection area**

The electrical wiring is fitted to the LST300 using a 1/2-14 NPT or a M20 x 1.5 cable gland. To ensure the transmitter’s NEMA 4X and IP 66/67 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 or M20 x 1.5 female thread).

**DANGER – SERIOUS DAMAGE TO HEALTH / RISK TO LIFE**

When installing the LST300 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.

**IMPORTANT (NOTE)**

The red plugs must be removed when the transmitter is installed in a hazardous area. They are not explosion-proof certified products.
**Figure 19 Termination introduction**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Positive polarity of power supply (+)</td>
</tr>
<tr>
<td>b</td>
<td>Negative polarity of power supply (-)</td>
</tr>
<tr>
<td>c</td>
<td>Extend meter, shorted with negative polarity for normal use (Ext)</td>
</tr>
</tbody>
</table>

**DC power supply**

The LST300 operates from a DC power supply that is connected to the terminals shown in Fig. 15.
- Open the blind cover first to connect the cable.
- The power supply voltage is 12 to 42 V DC without surge protection, and 14 to 42 V with surge protection when the - and Ext Meter terminals are shorted.
- It is recommended to use twisted pair cables for better resistance to electrical disturbance.

**Analog output**

LST300 has a 4 to 20 mA analog output to transmit measurements and alarms.
- The 4 to 20 mA output and power supply input share the same wires.
- The output current is the process variable during normal conditions. It can also be a fixed value as a failsafe or to indicate alarm conditions.
- The current output range of a valid signal is 4 to 20 mA.
- The Low Alarm value is configurable in the range of 3.5 mA to 3.6 mA.
- The High Alarm value is configurable in the range of 21 mA to 22.6 mA.
- The refresh frequency of the 4 to 20 mA output is 0.2 second.

**HART communications**

The HART protocol is used for digital communication between a process control system / PC, a handheld terminal, and LST300. It can be used to send all device and measuring point parameters from the transmitter to the process control system or PC. Conversely, it also provides a means of reconfiguring the transmitter. Digital communication utilizes an alternating current superimposed on the analog output (4 to 20 mA) that does not affect any meters connected to the output.
- The HART communication shares the cable with the power supply. No additional wires are required.
- An extra resistor is needed for HART communication. The minimum value of resistor is 250 ohm. The resistor in power line causes voltage drop, and should be considered to ensure the power supply to the LST300 remains above the minimum rated input voltage.
- The baud rate of the HART communication is 1200.

**Grounding**

The LST300 requires a ground connection to the terminal as shown in Fig. 16.
- The LST300 provides two connectors for ground (PE). An effective ground connection is needed for optimum EMC protection.
- All grounding must comply with anti-explosion regulations if the LST300 transmitter is to be used in hazardous environments (Zone 1 Div 1 and Zone 1 Div 2).
Terminal connections

Figure 20 Electrical connection – HART version

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power supply</td>
</tr>
<tr>
<td>2</td>
<td>Remote display</td>
</tr>
<tr>
<td>3</td>
<td>Handheld terminal</td>
</tr>
<tr>
<td>4</td>
<td>External ground connection</td>
</tr>
<tr>
<td>5</td>
<td>Internal ground connection</td>
</tr>
<tr>
<td>6</td>
<td>Cable entry</td>
</tr>
</tbody>
</table>

**WARNING**

Explosion-proof transmitter must be either repaired by the manufacturer or approved by a certified expert following repair work. Observe the relevant safety precautions before, during and after repair work.

Émetteur-déflagrant doit être soit réparé par le fabricant ou approuvé par un expert agréé suite à des travaux de réparation. Respectez les précautions de sécurité nécessaires avant, pendant et après les travaux de réparation.
Wiring

Wire the transmitter as follows:

1. Remove the cap from one of the two electrical connection ports located at both sides in the upper part of the transmitter housing.

2. If needed, fit various adaptors and bushings to the ½ inch internal NPT threads of the connection ports to comply with plant wiring (conduit) standards.

3. Remove the housing cover of field terminals, side. However, in an explosion-proof installation, do not remove the transmitter covers when power is applied to the unit.

4. Run wiring through the open port. Connect the positive lead to the + terminal and the negative lead to the – terminal.

**IMPORTANT (NOTE)**

Do not connect the power across the test terminals, which could damage the test diode in the test connection.

5. Plug and seal the electrical ports. Make sure that when the installation is completed, these openings are properly sealed against entry of rain and corrosive vapors and gases.

6. If applicable, install wiring with a drip loop. Arrange the drip loop so that the bottom is lower than the conduit connection and the transmitter housing.

7. Put back the housing cover, turn it to seat O-ring into the housing, and then continue to manually tighten the cover until it contacts the housing metal-to-metal.
5 Commissioning

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.

For a detailed description of these menus and parameters, see section “Parameter descriptions”.

1 Log on to the LST300 at the Standard or Advanced level.

![Menu](image)

2 Select Easy Setup in the main menu.

![Menu](image)

3 Select a language in the “Easy Setup” menu and press select.

![Menu](image)

4 Select an option of Operation Mode in the “Easy Setup” menu and press select.

![Menu](image)

### 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 (12 to 42 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.

![Figure 21](image)
The options available are Level, Flow and Volume.

5 Configure Empty Distance and press \( \text{Configure} \).

Note
Empty Distance is the distance from the face of the sensor to the bottom of the tank. In Level mode, Empty Distance indicates the distance from the sensor where the tank is empty.

6 Configure Span and press \( \text{Configure} \).

Note
Span is the distance from the bottom of the tank to the top of the tank. In Level mode, Span indicates the tank full position.

7 Configure Blanking and press \( \text{Configure} \).

Note
Blanking is the area close to the transmitter where meaningful measurements cannot be made. The default value depends on the product specification. Adjusting Blanking is optional.

8 Configure Max Change Rate.

Note
Max Change Rate indicates the maximum change rate of measuring distance or level.
6 Configuration

Operation

The LCD display is provided with optional capacitive control buttons. When this option is selected, device control through the glass of the closed cover is enabled.

The default instrument offers standard push buttons.

**IMPORTANT (NOTE)**
When the capacitive control button option is selected, the transmitter automatically calibrates the buttons on a regular basis. If the cover should be opened during operation, the button sensitivity is increased at first. As a result, operating errors may occur. The button sensitivity returns to normal during the next automatic calibration.

Menu navigation

![LCD indicator](image)

- **Control buttons**
  - **Meaning**
  - **Exit** Exit the menu
  - **Back** Go back to the upper level menu
  - **Cancel** Cancel a parameter entry
  - **Next** Select the next position for entering numerical and alphanumeric values

![Menu levels](image)

**Menu levels**

Two levels exist under the process display.

- **Information level**
  - **Diagnostics**
  - **Operator Page 1 ... 3**
  - **Autoscroll**
  - **Signals View**

- **Configuration level**
  - **Easy Setup**
  - **Device Info**
  - **Device Setup**
  - **Display**
  - **Input/Output**
  - **Process Alarm**
  - **Communication**
  - **Diagnostics**
  - **Calibrate**

![Process display](image)

**Process display**

- **Present process values**
- **Symbol indicating button function**
- **Symbol indicating “Parameterization protected”**

**IMPORTANT (NOTE)**

For a detailed description of the individual parameters and menus on the configuration level, refer to section “Overview of parameters on the configuration level” and section “Parameter descriptions”.

![Figure 23](image)

**Figure 23 Menu levels**

- **Process display** Display process data
- **Information level** Access diagnostics and operator pages
- **Configuration level** Configure the device

![Figure 24](image)

**Figure 24 Process display**

- **Present process values**
- **Symbol indicating button function**
- **Symbol indicating “Parameterization protected”**
The process display appears when the device is switched on. It shows information about the device and the present process values.

The way in which the present process values (1) are shown can be adjusted at the configuration level.

**Description of symbols**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>Call up information level. When Autoscroll mode is enabled, a ▼ symbol appears here and the operator pages are automatically displayed one after the other.</td>
</tr>
<tr>
<td>▲</td>
<td>Call up configuration level.</td>
</tr>
<tr>
<td>🔌</td>
<td>The device is protected against changes to the parameter settings.</td>
</tr>
<tr>
<td>Q</td>
<td>Display of the current flowrate</td>
</tr>
<tr>
<td>Σ⁺</td>
<td>Totalizer status in forward direction</td>
</tr>
<tr>
<td>Σ⁻</td>
<td>Totalizer status in reverse direction</td>
</tr>
</tbody>
</table>

**Switching to the information level (operator menu)**

On the information level, the operator menu can be used to display diagnostic information and select which operator pages to display.

1. Press ☐ to switch to the information level.

![Process Display](image)

2. Press ▲ or ▼ to select a submenu.

![Operator Menu](image)

3. Press ☐ to confirm your selection.

**Menu** | **Description**
---|---
| 📚 / Operator Menu | Select the "Diagnostics" submenu. See also chapter 7 "Diagnostic Messages". |
| Operator Page 1 | Select the operator page to be displayed |
| Operator Page 2 | Select the operator page to be displayed |
| Operator Page 3 | Select the operator page to be displayed |
| Operator Page 4 | Select the operator page to be displayed |

**Error messages on the LCD display**

In case of an error, a message consisting of an icon and text appears at the bottom of the process display. The displayed text indicates where the error has occurred.

![Error Message](image)

The error messages are divided into the following four groups:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>✗</td>
<td>Error / Failure</td>
</tr>
<tr>
<td>🔦</td>
<td>Functional check</td>
</tr>
<tr>
<td>🔴</td>
<td>Out of specification</td>
</tr>
<tr>
<td>🔒</td>
<td>Maintenance required</td>
</tr>
</tbody>
</table>

Additionally, an error message indicates one of the following areas where the error has occurred:

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronics</td>
<td>Error / Alarm of the electronics.</td>
</tr>
<tr>
<td>Sensor</td>
<td>Error / Alarm of the flow meter sensor</td>
</tr>
<tr>
<td>Status</td>
<td>Alarm due to the present device status</td>
</tr>
<tr>
<td>Operation</td>
<td>Error / Alarm due to the present operating conditions</td>
</tr>
</tbody>
</table>

**Invoking the error description**

1. Press ☐ to switch to the information level.

![Process Display](image)
2 Press or to select the “Diagnostics” submenu.

3 Press to confirm your selection.

The first line indicates where the error has occurred. The second line shows the unique error number. The next lines show a brief description of the error and its remedy information.

**IMPORTANT (NOTE)**
Refer to chapter 7 “Diagnostic Messages” for a detailed description of the errors and remedy information.

Switching to the configuration level parameterization
The device parameters can be displayed and changed on the configuration level.

1 Press to switch to the information level.

2 Press or to select an access level.

3 Press to confirm your selection.

**IMPORTANT (NOTE)**
There are four access levels as follows:
- At the “Read Only” level all entries are disabled. Parameters are read only and cannot be modified.
- At the “Standard” level you can edit all parameters except for those written in italics.
- At the “Advanced” level all parameters can be modified.
- The Service menu is reserved to the customer service. Passwords can be defined for the “Standard” and “Advanced” levels. There are no factory default passwords. Password can be edited or reset once you have logged on to the corresponding access level. To reset to the “No password defined” state, select “-” as the password.

4 Enter the corresponding password (see section “Selecting and changing parameters”).

**Note**
There is no factory default password. You can switch to the configuration level without entering a password.

**Note**
The selected access level remains active for 3 minutes. Within this time period, you can toggle between the process display and the configuration level without re-entering the password.

5 Press to switch to the information level. The LCD display now indicates the first menu item at the configuration level.

6 Press or to select a menu.

7 Press to confirm your selection.

**Selecting and changing parameters**

**Selecting a parameter value**
1 Select the parameter you want to set in the menu.

2 Press to see the list of available parameter values. The parameter value that is currently set is highlighted.
Setting a numerical parameter

1. Select the parameter you want to set in the menu.

2. Press \[ \text{Edit} \] for parameter editing. The currently selected position is highlighted.

3. Press \[ \text{OK} \] to select the decimal position to be changed.

4. Press \[ \text{or } \text{OK} \] to select the required level.

5. Press \[ \text{OK} \] to select the next position.

6. If necessary, select and set other decimal positions using the same procedure as described in steps 3 and 4.

7. Press \[ \text{OK} \] to confirm your setting.

Setting an alphanumeric parameter

1. Select the parameter you want to set in the menu.

2. Press \[ \text{Edit} \] for parameter editing. The currently selected position is highlighted.

3. Press \[ \text{OK} \] to select the alphanumeric position to be changed.

4. Press \[ \text{or } \text{OK} \] to select the required character.

5. Press \[ \text{OK} \] to select the next position.

6. If necessary, select and set other alphanumeric positions using the same procedure as described in steps 3 and 4.

7. Press \[ \text{OK} \] to confirm your setting.

Exiting the setup

Values are mandatory for some menu items. Exit a menu without parameter change as follows:

1. Press \[ \text{OK} \] repeatedly till the cursor is moved to the right. Once the cursor reaches the end position, “Cancel” is displayed in the lower right.

2. Press \[ \text{OK} \] to terminate editing and exit the menu item. Or press \[ \text{OK} \] to return to the start.

IMPORTANT (NOTE)
The LCD display automatically returns to the process display three minutes after the last button is actuated.

Overview of parameters at the configuration level

IMPORTANT (NOTE)
This overview of parameters shows all the menus and parameters available on the device. Depending on the device version and configuration, some menus and parameters may not be visible.

The displayed menu vary in different operation modes. In this section, menus displayed only in some operation modes are marked with numbers in brackets. The numbers represent the operation modes as follows:

- Level
- Flow
- Volume

Refer to section “Menu levels” for a list of operation modes these numbers represent.
1) Distance Alarm Limit and Level Alarm Limit will be displayed based on present PV in Level Mode.

2) Distance = 100%, Distance = 0% and Level = 100%, Level = 0% will be displayed based on present PV in Level Mode.
## Parameter descriptions

### Menu: Easy Setup

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>English, Chinese</td>
<td>Menu language. Only two languages are available. New languages can be downloaded.</td>
</tr>
<tr>
<td>Operation Mode</td>
<td>Level Mode, Flow Mode, Volume Mode</td>
<td>Select an operation mode</td>
</tr>
<tr>
<td>Empty Distance</td>
<td>350 to 12000 mm (50 kHz) 250 to 7200 mm (75 kHz)</td>
<td>Distance from sensor to the bottom of the measurement range</td>
</tr>
<tr>
<td>Span</td>
<td>0 to 12000 mm (50 kHz) 0 to 7200 mm (75 kHz)</td>
<td>Measurement span</td>
</tr>
<tr>
<td>Blanking</td>
<td>350 to 12000 mm (50 kHz) 250 to 7000 mm (75 kHz)</td>
<td>Distance from sensor where no measurement is possible</td>
</tr>
<tr>
<td>Max Change Rate</td>
<td>0 to 720 m/h</td>
<td>Maximum rate the level can change</td>
</tr>
</tbody>
</table>

### Menu: Device Info

**IMPORTANT (NOTE)**
This menu is used only to display the device parameters. The parameters are displayed independently of the configured access level, but cannot be changed.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Device Version</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor Type</td>
<td>C10 (50 kHz) C06 (75 kHz)</td>
<td>Device sensor frequency</td>
</tr>
<tr>
<td>Product Code</td>
<td>-</td>
<td>Product code</td>
</tr>
<tr>
<td>Serial No.</td>
<td>-</td>
<td>Product serial number</td>
</tr>
<tr>
<td>Calibration Date</td>
<td>-</td>
<td>Product calibration date</td>
</tr>
<tr>
<td>Calibration Location</td>
<td>-</td>
<td>Product calibration location</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>-</td>
<td>Manufacturer name</td>
</tr>
<tr>
<td>Street</td>
<td>-</td>
<td>Manufacturer street name</td>
</tr>
<tr>
<td>City</td>
<td>-</td>
<td>Manufacturer city name</td>
</tr>
<tr>
<td>Phone</td>
<td>-</td>
<td>Manufacturer phone number</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitter Firmware Version</td>
<td>-</td>
<td>Firmware revision of the field device</td>
</tr>
<tr>
<td>Transmitter Hardware Version</td>
<td>-</td>
<td>Electronics hardware revision of the field device</td>
</tr>
<tr>
<td>Transmitter Bootloader Version</td>
<td>-</td>
<td>Software revision of the electronics board bootloader</td>
</tr>
<tr>
<td>Sensor Firmware Version</td>
<td>-</td>
<td>Firmware revision of the sensor</td>
</tr>
<tr>
<td>Sensor Hardware Version</td>
<td>-</td>
<td>Electronics hardware revision of the sensor</td>
</tr>
<tr>
<td>Sensor Bootloader Version</td>
<td>-</td>
<td>Software revision of the sensor board bootloader</td>
</tr>
</tbody>
</table>
### Menu: Device Setup

<table>
<thead>
<tr>
<th>Menu / Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Device Setup</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit Setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm Limits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process Value Setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totalizer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu / Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Device Setup / Access Control</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard Password</td>
<td>alphanumeric</td>
<td>Set the password for the “Standard” access level</td>
</tr>
<tr>
<td>Advanced Password</td>
<td>alphanumeric</td>
<td>Set the password for the “Advanced” access level</td>
</tr>
<tr>
<td>Read Only Switch</td>
<td>-</td>
<td>Display the switch settings for hardware write protection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu / Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Device Setup / Basic Setting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empty Distance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Span</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blanking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max Change Rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max Power Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min Power Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Echo Selection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reset to Factory Default</td>
<td>-</td>
<td>Reset configuration to default according to the present access level</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu / Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Device Setup / Unit Setting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit Length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit Flow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit Totalizer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Menu / Parameter</td>
<td>Value range</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Unit Volume</td>
<td>m³</td>
<td>ft³</td>
</tr>
<tr>
<td>Unit Temperature</td>
<td>Kevin</td>
<td>Celsius</td>
</tr>
<tr>
<td>Unit Change Rate</td>
<td>m/s, m/h</td>
<td>inch/min</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu / Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Setup / Alarm Limits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance High Alarm Limits</td>
<td>0 to 12000 mm</td>
<td></td>
</tr>
<tr>
<td>Distance Low Alarm Limits</td>
<td>0 to 12000 mm</td>
<td></td>
</tr>
<tr>
<td>Level High Alarm Limits</td>
<td>0 to 12000 mm</td>
<td></td>
</tr>
<tr>
<td>Level Low Alarm Limits</td>
<td>0 to 12000 mm</td>
<td></td>
</tr>
<tr>
<td>Flow High Alarm Limits</td>
<td>0 to 9999990000.0 m³/h</td>
<td></td>
</tr>
<tr>
<td>Flow Low Alarm Limits</td>
<td>0 to 9999990000.0 m³/h</td>
<td></td>
</tr>
<tr>
<td>Volume Low Alarm Limits</td>
<td>0 to 9999990000.0 m³</td>
<td></td>
</tr>
<tr>
<td>Volume Low Alarm Limits</td>
<td>0 to 9999990000.0 m³</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu / Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Setup / Process Value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level Mode</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Flow Mode</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Volume Mode</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Device Setup / Process Value / Level Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level Mode PV</td>
<td>Distance Level</td>
<td></td>
</tr>
<tr>
<td>Level Mode SV</td>
<td>Temperature Distance Level</td>
<td></td>
</tr>
<tr>
<td>Level Mode TV</td>
<td>Temperature Distance Level</td>
<td></td>
</tr>
<tr>
<td>Level Mode QV</td>
<td>Temperature Distance Level</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu / Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Setup / Process Value / Flow Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow Mode PV</td>
<td>Flow</td>
<td></td>
</tr>
<tr>
<td>Flow Mode SV</td>
<td>Temperature Distance Flow</td>
<td>Interval totalizer Overall totalizer</td>
</tr>
<tr>
<td>Flow Mode TV</td>
<td>Temperature Distance Flow</td>
<td>Interval totalizer Overall totalizer</td>
</tr>
<tr>
<td>Flow Mode QV</td>
<td>Temperature Distance Flow</td>
<td>Interval totalizer Overall totalizer</td>
</tr>
</tbody>
</table>
### Menu / Parameter

<table>
<thead>
<tr>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Device Setup / Process Value / Volume Mode</strong></td>
<td></td>
</tr>
<tr>
<td>Volume Mode PV</td>
<td>Volume</td>
</tr>
<tr>
<td>Volume Mode SV</td>
<td>Temperature Distance Volume</td>
</tr>
<tr>
<td>Volume Mode TV</td>
<td>Temperature Distance Volume</td>
</tr>
<tr>
<td>Volume Mode QV</td>
<td>Temperature Distance Volume</td>
</tr>
</tbody>
</table>

### Menu / Parameter

<table>
<thead>
<tr>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Device Setup / Totalizer</strong></td>
<td></td>
</tr>
<tr>
<td>Interval Overflow Num</td>
<td>Read Only</td>
</tr>
<tr>
<td>Interval Totalizer</td>
<td>Display Only</td>
</tr>
<tr>
<td>Overall Overflow Num</td>
<td>Display Only</td>
</tr>
<tr>
<td>Overall Totalizer</td>
<td>Display Only</td>
</tr>
<tr>
<td>Overflow Threshold</td>
<td>10E+9 10E+8 10E+7 10E+6 10E+5</td>
</tr>
<tr>
<td>Reset Interval Totalizer</td>
<td>-</td>
</tr>
<tr>
<td>Enable Totalizer</td>
<td>-</td>
</tr>
</tbody>
</table>

### Menu: Display

<table>
<thead>
<tr>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Display</strong></td>
<td></td>
</tr>
<tr>
<td>Language</td>
<td>English, Chinese</td>
</tr>
<tr>
<td>Contrast</td>
<td>0 to 100</td>
</tr>
<tr>
<td>Operator Pages</td>
<td></td>
</tr>
<tr>
<td>Autoscroll</td>
<td>Disable, Enable</td>
</tr>
<tr>
<td>Length Format</td>
<td>0_DP 1_DP 2_DP 3_DP</td>
</tr>
<tr>
<td>Flowrate Format</td>
<td>0_DP 1_DP 2_DP 3_DP</td>
</tr>
<tr>
<td>Volume Format</td>
<td>0_DP 1_DP 2_DP 3_DP</td>
</tr>
<tr>
<td>Temperature Format</td>
<td>0_DP 1_DP</td>
</tr>
<tr>
<td>Date/Time Format</td>
<td>DD-MM-YYYY MM-DD-YYYY YYYY-MM-YYYY</td>
</tr>
<tr>
<td>Display Test</td>
<td></td>
</tr>
</tbody>
</table>
## Menu / Parameter | Value range | Description
--- | --- | ---
**Display / Operator Pages**

### Operator Page 1

- Display Mode
  - Off
  - 1*6_A
  - 1*6_B
  - 1*6_BAR
  - 1*9
  - 1*9_BAR
  - 2*9
  - 2*9_BAR
  - 3*9
  - Graph
  - Configure each operator page

### Operator Page 2

### Operator Page 3

### Operator Page 4

---

**Menu / Parameter | Value range | Description**

### Display / Operator Pages / Operator Page 1

1st Line
- MAIN_OPERATOR_VIEW_SIGNAL_1
- MAIN_OPERATOR_VIEW_SIGNAL_2
- MAIN_OPERATOR_VIEW_SIGNAL_3
...  
- MAIN_OPERATOR_VIEW_SIGNAL_20  
- Configure each line

2nd Line
- Configure each line

3rd Line
- Configure each line

4th Line
- Configure each line

Bar Graph
- Configure each line

### Display / Operator Pages / Operator Page 2/3/4

1st Line
- Configure each line

2nd Line
- Configure each line

3rd Line
- Configure each line

4th Line
- Configure each line

Bar Graph
- Configure each line

---

**Menu: Input/Output**

**Menu / Parameter | Value range | Description**

### Input/Output

- Current Output
  - Configure each line

---

**Menu / Parameter | Value range | Description**

### Input/Output / Current Output

- Distance I=100%
  - 350 to 12000 mm (50 kHz)
  - 250 to 7200 mm (75 kHz)
  - In this menu the distance value for which the current output is to indicate its 100 % value (20 mA) is entered. The menu is only displayed when the distance is output at the current output.

- Distance I=0%
  - 350 to 12000 mm (50 kHz)
  - 250 to 7200 mm (75 kHz)
  - In this menu the distance value for which the current output is to indicate its 0 % value (4 mA) is entered. The menu is only displayed when the distance is output at the current output.

- Level I=100%
  - 0 to 12000 mm (50 kHz)
  - 0 to 7200 mm (75 kHz)
  - In this menu the level value for which the current output is to indicate its 100 % value (20 mA) is entered. The menu is only displayed when the level is output at the current output.
### Menu / Parameter | Value range | Description
--- | --- | ---
**Level I=0%**<br>0 to 12000 mm (50 kHz)<br>0 to 7200 mm (75 kHz) | In this menu the level value for which the current output is to indicate its 0 % value (4 mA) is entered. The menu is only displayed when the level is output at the current output.  
**Flow I=100%**<br>0 to 9999990000.0 m³/h | In this menu the flow value for which the current output is to indicate its 100 % value (20 mA) is entered. The menu is only displayed when the flow is output at the current output.  
**Flow I=0%**<br>0 to 9999990000.0 m³/h | In this menu the flow value for which the current output is to indicate its 0 % value (4 mA) is entered. The menu is only displayed when the flow is output at the current output.  
**Volume I=100%**<br>0 to 9999990000.0 m³ | In this menu the volume flow rate value for which the current output is to indicate its 100 % value (20 mA) is entered. The menu is only displayed when the volume flow rate is output at the current output.  
**Volume I=0%**<br>0 to 9999990000.0 m³ | In this menu the volume flow rate value for which the current output is to indicate its 0 % value (4 mA) is entered. The menu is only displayed when the volume flow rate is output at the current output.  
**Iout for Alarm**<br>Alarm HI<br>Alarm Low | Select the status of the current output in error condition.  
The output “low” or “high” current is set in the subsequent menu.  
Default setting: “Low Alarm”  
**Low Alarm**<br>Max 3.6000<br>Min 3.5000 | Unit: mA  
Select the current for Low Alarm  
**High Alarm**<br>Max 22.600<br>Min 21.000 | Unit: mA  
Select the current for High Alarm

### Menu: Process Alarm

| Menu / Parameter | Value range | Description
--- | --- | ---
**Process Alarm**<br>Diagnostic History | - | Display of the alarm history  
**Clear History** | Execute | Clear the alarm list  
**Group Masking** | | Alarm messages are divided into groups. If masking is activated for a group (ON), no alarm occurs.

### Menu / Parameter | Value range | Description
--- | --- | ---
**Process Alarm / Group Masking**<br>Maintenance Required | Disable, Enable | -  
**Function Check** | Disable, Enable | -  
**Out Of Specification** | Disable, Enable | -

### Menu: Communication

| Menu / Parameter | Value range | Description
--- | --- | ---
**Communication**<br>HART |  | -

### Menu / Parameter | Value range | Description
--- | --- | ---
**Communication / HART**<br>Device Address | Max 15<br>Min 0 | Select the HART device address.  
The HART protocol has provisions for creating a bus with up to 15 devices (1 to 15). If an address greater than 0 is set, the device operates in Multidrop mode, i.e., the current output is fixed at 4 mA and there is only HART communication over the current output.  
**Tag**<br>8 characters, uppercase only, no special characters | Enter a HART TAG number as the unique identifier for the device  
**Descriptor**<br>16 characters, uppercase only, no special characters | Enter a HART descriptor  
**Message**<br>32 characters alphanumeric | Display of the alphanumeric TAG number  
**Manuf. ID**<br>26.000 | Display of the HART manufacturer ID  
ABB = 26
### Menu / Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Type</td>
<td>161.00</td>
<td>Display of the HART device type LST300 = 161</td>
</tr>
<tr>
<td>Device ID</td>
<td>1.0000</td>
<td>Display of the HART device ID</td>
</tr>
</tbody>
</table>

### Diagnostics

<table>
<thead>
<tr>
<th>Menu / Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diagnostics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal Waveform</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>True Echo Detection</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Status Monitor</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Simulation</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Device Run Time</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Diagnostics / True Echo Detection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start Tank Profiling</td>
<td>-</td>
<td>Start tank profiling</td>
</tr>
<tr>
<td>Select True Echo</td>
<td>1 to 5</td>
<td>Select true echo number</td>
</tr>
<tr>
<td>Disable Tank Profiling</td>
<td>-</td>
<td>Disable tank profiling</td>
</tr>
<tr>
<td>Tank Profiling Status</td>
<td>Idle, Initialize, Pulsing, Processing, Finish</td>
<td>Present tank profiling status</td>
</tr>
<tr>
<td>Threshold Start</td>
<td>Max 2500.0 mV</td>
<td>The voltage of the threshold at the first threshold point. This point is where the blanking distance ends.</td>
</tr>
<tr>
<td></td>
<td>Min 0.0000 mV</td>
<td></td>
</tr>
<tr>
<td>Threshold Middle</td>
<td>Max 2500.0 mV</td>
<td>The voltage of the threshold at the middle threshold point</td>
</tr>
<tr>
<td></td>
<td>Min 0.0000 mV</td>
<td></td>
</tr>
<tr>
<td>Threshold End</td>
<td>Max 2500.0 mV</td>
<td>The voltage of the threshold at the last threshold point. This point is at the Empty Distance.</td>
</tr>
<tr>
<td></td>
<td>Min 0.0000 mV</td>
<td></td>
</tr>
<tr>
<td><strong>Diagnostics / Status Monitor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gain</td>
<td>Display only</td>
<td>The Gain value of the sensor in the last measurement</td>
</tr>
<tr>
<td>Pulse Number</td>
<td>Display only</td>
<td>The Number of pulses of the sensor in the last measurement</td>
</tr>
<tr>
<td>Power Mode</td>
<td>Display only</td>
<td>The Power Mode of the sensor in the last measurement</td>
</tr>
<tr>
<td>Power Change Ratio</td>
<td>Display only</td>
<td>The number of power changes in the last minute</td>
</tr>
<tr>
<td>Echo Number</td>
<td>Display only</td>
<td>The number of echoes in the last measurement</td>
</tr>
<tr>
<td>Present Blanking</td>
<td>Display only</td>
<td>Present blanking value</td>
</tr>
<tr>
<td>Current Output</td>
<td>Display only</td>
<td>The analog output in mA</td>
</tr>
<tr>
<td>Signal Level</td>
<td>Display only</td>
<td>Average size in mV of all echoes that crossed the threshold in the last measurement</td>
</tr>
<tr>
<td>Max Signal Level</td>
<td>Display only</td>
<td>Maximum signal level in mV in the last measurement</td>
</tr>
<tr>
<td>Noise Level</td>
<td>Display only</td>
<td>Average size in mV of all echoes that did not cross the threshold in the last measurement</td>
</tr>
<tr>
<td>Max Noise Level</td>
<td>Display only</td>
<td>Maximum noise level in mV in the last measurement</td>
</tr>
<tr>
<td>Signal Noise Ratio</td>
<td>Display only</td>
<td>Ratio of signal to noise</td>
</tr>
<tr>
<td>Sensor Temperature</td>
<td>Display only</td>
<td>The temperature as measured by the internal temperature sensor</td>
</tr>
<tr>
<td>Temperature Too Low</td>
<td>Display only</td>
<td>Alarm for temperature too low</td>
</tr>
<tr>
<td>Temperature Too High</td>
<td>Display only</td>
<td>Alarm for temperature too high</td>
</tr>
<tr>
<td>Beyond Empty Distance</td>
<td>Display only</td>
<td>Alarm for distance beyond empty distance</td>
</tr>
<tr>
<td>Almost Full</td>
<td>Display only</td>
<td>Alarm for distance close to blanking</td>
</tr>
<tr>
<td>Echo Too large</td>
<td>Display only</td>
<td>Alarm for echo too large</td>
</tr>
<tr>
<td>Echo Too Small</td>
<td>Display only</td>
<td>Alarm for echo too small</td>
</tr>
<tr>
<td>Lost Echo</td>
<td>Display only</td>
<td>Alarm for single echo lost</td>
</tr>
<tr>
<td>Lost Signal</td>
<td>Display only</td>
<td>Alarm for echo lost</td>
</tr>
<tr>
<td>Noise Alarm</td>
<td>Display only</td>
<td>Alarm for noise</td>
</tr>
</tbody>
</table>
### Menu: Diagnostics / Simulation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Simulation Mode</td>
<td>Simulation off</td>
<td>Select data simulation mode</td>
</tr>
<tr>
<td></td>
<td>Distance sim</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature sim</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level sim</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Volume sim</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flow sim</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PV% sim</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Current out sim</td>
<td></td>
</tr>
<tr>
<td>Distance</td>
<td>0 to 12000 mm</td>
<td>Distance in simulation</td>
</tr>
<tr>
<td>Level</td>
<td>1000 to 12000 mm</td>
<td>Level in simulation</td>
</tr>
<tr>
<td>Flow</td>
<td>0 to 9999999000.0 m³/h</td>
<td>Flow in simulation</td>
</tr>
<tr>
<td>Volume</td>
<td>0 to 9999999000.0 m³</td>
<td>Volume in simulation</td>
</tr>
<tr>
<td>Temperature</td>
<td>-100 to 100 °C</td>
<td>Temperature in simulation</td>
</tr>
<tr>
<td>Current Output</td>
<td>3.5 to 22.6 mA</td>
<td>Current in simulation</td>
</tr>
<tr>
<td>PV%</td>
<td>0 to 100</td>
<td>PV% in simulation</td>
</tr>
<tr>
<td>Alarm Simulation</td>
<td>See section “Alarm Simulation”</td>
<td>-</td>
</tr>
</tbody>
</table>

### Diagnostics / Device Run Time

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interval Run Time</td>
<td>Display only</td>
<td>Device interval run time in second</td>
</tr>
<tr>
<td>Total Run Time</td>
<td>Display only</td>
<td>Device total run time in second</td>
</tr>
<tr>
<td>Reset Interval Time</td>
<td>Display only</td>
<td>Reset device interval run time</td>
</tr>
<tr>
<td>Maintenance Time</td>
<td>Display only</td>
<td>Remaining maintenance time in day</td>
</tr>
</tbody>
</table>

### Menu: Calibrate

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibration</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Linearization</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Temperature Sensor</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Ultrasonic sensor</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Dry</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Wet</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

### Calibrate / Calibration / Temperature Sensor

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Sensor</td>
<td>Default Temp (20 °C)</td>
<td>Temperature source selection</td>
</tr>
<tr>
<td></td>
<td>Inner Temp</td>
<td></td>
</tr>
<tr>
<td></td>
<td>External Temp</td>
<td></td>
</tr>
<tr>
<td>Temperature Offset</td>
<td>-100 to 100 °C</td>
<td>Temperature offset</td>
</tr>
<tr>
<td>External Temperature</td>
<td>-100 to 100 °C</td>
<td>External temperature</td>
</tr>
</tbody>
</table>

### Calibrate / Calibration / Dry

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Sensor Point</td>
<td>0 to 12000 mm</td>
<td>Lower sensor point for level calibration</td>
</tr>
<tr>
<td>Upper Sensor Point</td>
<td>0 to 12000 mm</td>
<td>Upper sensor point for level calibration</td>
</tr>
<tr>
<td>Lower Level Point</td>
<td>0 to 12000 mm</td>
<td>Lower level point for level calibration</td>
</tr>
<tr>
<td>Upper Level Point</td>
<td>0 to 12000 mm</td>
<td>Upper level point for level calibration</td>
</tr>
<tr>
<td>Menu / Parameter</td>
<td>Value range</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------------</td>
<td>--------------------------------------------------------------</td>
</tr>
<tr>
<td>Calibrate / Calibration / Dry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Sensor Point</td>
<td>0 to 12000 mm</td>
<td>Lower sensor point for level calibration</td>
</tr>
<tr>
<td>Upper Sensor Point</td>
<td>0 to 12000 mm</td>
<td>Upper sensor point for level calibration</td>
</tr>
<tr>
<td>Lower Level Point</td>
<td>0 to 12000 mm</td>
<td>Lower level point for level calibration</td>
</tr>
<tr>
<td>Upper Level Point</td>
<td>0 to 12000 mm</td>
<td>Upper level point for level calibration</td>
</tr>
<tr>
<td>Calibrate / Calibration / Wet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Sensor Point</td>
<td>Display Only</td>
<td>Result lower sensor point for level calibration</td>
</tr>
<tr>
<td>Upper Sensor Point</td>
<td>Display Only</td>
<td>Result upper sensor point for level calibration</td>
</tr>
<tr>
<td>Lower Level Point</td>
<td>0 to 12000 mm</td>
<td>Lower level point for level calibration</td>
</tr>
<tr>
<td>Upper Level Point</td>
<td>0 to 12000 mm</td>
<td>Upper level point for level calibration</td>
</tr>
<tr>
<td>Wet Calibrate Lower</td>
<td>-</td>
<td>Wet calibrate lower sensor point</td>
</tr>
<tr>
<td>Wet Calibrate Upper</td>
<td>-</td>
<td>Wet calibrate upper sensor point</td>
</tr>
<tr>
<td>Calibrate / Linearization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linearization Table</td>
<td>-</td>
<td>Linearization Table configuration interface</td>
</tr>
<tr>
<td>Active Table</td>
<td>Disable, Enable</td>
<td>Enable or disable the linearization table</td>
</tr>
<tr>
<td>Max Flow</td>
<td>0 to 9999990000.0 m³/h</td>
<td>The maximum flow value of the channel</td>
</tr>
<tr>
<td>Max Volume</td>
<td>0 to 9999990000.0 m³</td>
<td>The maximum volume of the vessel</td>
</tr>
</tbody>
</table>

**Menu: Service**
Refer to the service manual for more details.

**Alarm Simulation**

Device with HART protocol

<table>
<thead>
<tr>
<th>Software SWxxxxxxxxxxx</th>
<th>Software version</th>
<th>Type of changes</th>
<th>Operating Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>00.00.01</td>
<td>Original</td>
<td>OI/LST300-EN Rev. B</td>
</tr>
</tbody>
</table>


7 Advanced functions

Signal waveform

The signal waveform function is used to analyze the process conditions, optimize installation and visualize false echoes for further processing. The signal waveform is available on the Through The Glass (TTG) version of LST300, but can also be accessed via Enhanced Device Description (EDD) on handheld configurators such as ABB DHH800, or on a computer using the Device Type Manager (DTM).

In the instructions below, the signal waveform on the LST300 HMI interface is shown as an example.

Accessing the waveform display

1. Log on to the LST300 at the **Standard** or **Advanced** level.

2. Select **Diagnostics** from the main menu.

3. Select **Waveform** from the “Diagnostics” submenu.

![Signal waveform display](image)

**Signal waveform display**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Current process values</td>
</tr>
<tr>
<td>2</td>
<td>Blanking distance line — All signals to the left of this line are ignored</td>
</tr>
<tr>
<td>3</td>
<td>Waveform x-axis offset — Used to scroll along the axis when zoomed</td>
</tr>
<tr>
<td>4</td>
<td>True Echo Index — Indicates which echo is used when True Echo Detection is used</td>
</tr>
<tr>
<td>5</td>
<td>Echo signal example</td>
</tr>
<tr>
<td>6</td>
<td>Threshold — All signals below this line are ignored and considered noise</td>
</tr>
<tr>
<td>7</td>
<td>Waveform zoom level — Used to see more details</td>
</tr>
</tbody>
</table>

The signal waveform can be selected from the “Diagnostics” menu. It shows information about the last measured signal and the current process values. The zoom function allows access to more details in a specific region.

**Description of symbols**

- ![Symbol](image)
  - **Description**: Return to the “Diagnostics” menu

- ![Symbol](image)
  - **Description**: Scroll to the next parameter

- ![Symbol](image)
  - **Description**: Enter the True Echo Index selection menu

**Selecting parameters to display**

In the signal waveform display, select the live information to display as follows:

1. Press ![Symbol](image) to switch until the current process values box in the top left is highlighted.
2 Press \( \downarrow \) or \( \uparrow \) to scroll through the different process values.

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ins</td>
<td>The instant distance measured during the last measurement. This corresponds to the distance of the echo shown in the waveform.</td>
</tr>
<tr>
<td>Tem</td>
<td>The measured process temperature.</td>
</tr>
<tr>
<td>Sig</td>
<td>The size of the echo as shown in the waveform (in mV)</td>
</tr>
</tbody>
</table>

Selecting True Echo Index (TEI)

The True Echo Index is used together with the True Echo Detection function. Information on applying this function is shown in Section of this document.

1 Press \( \downarrow \) to switch until the current process values box in the top left is highlighted.

2 Press \( \downarrow \) to enter the “True Echo Index” menu.

3 Press \( \downarrow \) to select the position to be changed.

4 Press \( \downarrow \) or \( \uparrow \) to scroll through the different process values.

5 Press \( \downarrow \) to confirm your selection.

Changing waveform zoom

1 Press \( \downarrow \) to switch until the waveform zoom level box in the bottom right is highlighted.

2 Press \( \downarrow \) to zoom in and view more details.

3 Press \( \downarrow \) to zoom out to have a wider view of the measurement range.

4 After zooming in, press \( \downarrow \) or \( \uparrow \) to scroll back to the original or other zoom view levels.

Scrolling the x-axis

1 When zoomed in, press \( \downarrow \) to switch until the waveform x-axis offset box in the bottom left is highlighted.

2 Press \( \downarrow \) to scroll to the right to be further from the sensor and closer to the maximum measurement range.

3 Press \( \downarrow \) to scroll to the left to be closer to the sensor and further from the maximum measurement range.
True Echo Detection

Accessing the True Echo Detection menu

1. Log on to the LST300 at the Standard or Advanced level.

2. Select Diagnostics from the main menu.

3. Select True Echo Detection from the “Diagnostics” submenu.

Configuring True Echo Detection

1. Install LST300 following the instructions in chapter 2 “Mounting”. Avoid as many obstructions as possible and ensure the transmitter has clear line of sight to the target liquid surface.

   IMPORTANT (NOTE)
   The best way to ensure the correct echo is measured is a good installation with clear line of sight. The True Echo Filtering function is used optimally when obstructions cannot easily be avoided, such as submerged pumps and agitators.

2. Ensure the tank is empty enough for all obstructions to be visible. Any obstructions that are submerged cannot be detected.

3. Navigate to the “True Echo Detection” menu, as explained in section “Accessing the True Echo Detection menu”.

4. Select Start Tank Profiling from the “True Echo Detection” submenu.

5. Select OK to start Tank Profiling.

   IMPORTANT (NOTE)
   Tank profiling may take up to 2 minutes to complete. During this time no measurement values are used as output.

6. After two minutes, select Tank Profiling Status to check whether the Tank Profiling is complete. The status should be Finish.

7. Navigate to the signal waveform display as explained in section “Accessing the waveform display”.
**IMPORTANT (NOTE)**

It is assumed in the following steps that the signal waveform display is used. If the signal waveform display is not available, the same function can be performed by checking the process display window to verify the measurement, and changing the True Echo Index as shown in section “Selecting the True Echo Index (TEI)”.

1. **Ins 6.250m**: Shows Instant Distance of the selected echo is 6.250 m
2. **TEI 3**: shows echo number 3 is selected as the true echo

**8** In the waveform display, check whether the result of Tank Profiling is as expected. In this example **Echo 3** is selected and the Instant Distance is **6.250 m**. If this is the correct target, no further setup is required.

**IMPORTANT (NOTE)**

Some echoes may appear small, but can cause false measurements under certain conditions. LST300 compensates for all possible conditions, and therefore may create false echo windows when it does not look necessary in the current measurement.

**9** As an example, Echo number 2 is assumed as the desired echo in this step. Follow the steps in section “Selecting the True Echo Index (TEI)” to change the True Echo Index to 2.

**10** Check whether the result is as expected. The Instant Distance is shown as **4.100 m** in this example.

1. **Ins 4.100m**: Shows Instant Distance of the selected echo is 6.250 m
2. **TEI 2**: shows echo number 2 is selected as the true echo

**11** To disable the True Echo Detection function, select **Disable Echo Detection** from the “True Echo Detection” menu and click **OK**.

**IMPORTANT (NOTE)**

Tank profiling data is lost when the Tank Profiling function is disabled.

**Volume**

Volume output is used in situations where a volume output is desired, instead of the level. LST300 has 32 points allowing the operator to plot a volume to level chart. This chart is usually provided by the tank manufacturer. It is also possible to calculate custom tank volumes using dimensions from drawings.

Common tank shapes include:
- Flat base tanks
- Cone base tanks
- Half sphere base tanks
- Sloped base tanks
- Horizontal cylinder tanks
- Tanks with angles between sections
Example tank
In this example, a cylindrical tank with a cone base is configured. This is a simple shape to configure, containing only 3 points and linear sections in between.

![Cylindrical tank with cone base](image)

Figure 26 Cylindrical tank with cone base

Figure 27 Linearization curve of cylindrical tanks with cone base

Configure the level settings
1. Log on to the LST300 at the Standard or Advanced level.
2. Select Easy Setup from the main menu.
3. Select Volume as the Operate Mode and then press Next.
4. Select Empty Distance to configure the distance from the face of the sensor to the bottom of the tank.
   In Level mode, Empty Distance indicates the tank is empty. In this example the sensor is assumed as 0.25 m above the top of the tank.
5. Press Next to confirm the Empty Distance configuration.
6. Configure Span to configure the distance from the bottom of the tank to the top of the tank.
   In Level mode, Span indicates the tank full position. This is the 3.00 m as shown in figure 22 “Cylindrical tank with cone base”.
7. Press Next to confirm the Span configuration.
Configure the volume unit
1 Select **Calibrate** from the main menu.

2 Select **Units Config** from the “Diagnostics” submenu.

3 Select **Volume Unit** from the “Unit Config” submenu.

4 Configure the **Volume Unit** as required (liter is used in this example) and then press **Next**.

Configure the linearization table
1 Select **Calibrate** from the main menu.

2 Select **Linearization** from the “Calibrate” submenu.

3 Set **Max Volume** from the “Linearization” submenu.

   In this example, 1832 liters is set as the maximum volume (unit already set in section “Configuring the volume unit”).

4 Enter the **Linearization Table** from the “Linearization” submenu.
5 Press \( \text{Insert} \) to select the position to be changed to the linearization point number. The first point to update in this example is point 00.

6 Press \( \text{Insert} \) to change the position to \( \text{Lev} \).

7 Use \( \text{Browse} \) to enter the editing menu.

8 Set the level for point 00 in the editing menu. In this example level 0.000 m is set.

9 Use \( \text{Browse} \) to select \( \text{OK} \) and return to the “Linearization Table” menu.

10 Press \( \text{Insert} \) to change the position to \( \% \) for point 00.

11 Use \( \text{Insert} \) to enter the editing menu.

12 Set the level for point 00 in the editing menu. In this example a percentage of 0% is set for point 00.

13 Use \( \text{Insert} \) to select \( \text{OK} \) and return to the “Linearization Table” menu.

14 Repeat steps 5 to 13 for linearization point 01 and 02 according to the data in the table below:

<table>
<thead>
<tr>
<th>Point</th>
<th>Level</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>0.000 m</td>
<td>0.00</td>
</tr>
<tr>
<td>01</td>
<td>1.000 m</td>
<td>14.30</td>
</tr>
<tr>
<td>02</td>
<td>3.000 m</td>
<td>100</td>
</tr>
</tbody>
</table>

### Open channel flow

The LST300 open channel flow function calculates the flowrate in an open channel by measuring level and converting it to a flowrate using standard equations. The automated calculation of parameters can only be done using DTM or EDD. Alternatively the calculation can be done offline, and the setup can be done in the field on the HMI using the pre-calculated maximum flow value and linearization table.

The open channel flow is not calculated directly. A linearization table and the maximum flowrate are calculated and downloaded to the device using DTM or EDD. Then this linearization table is used on the device to calculate the flowrate.

LST300 supports the following 12 channels:
- Rectangular thin plate weir
- Triangular notch thin plate weir
- Rectangular broad crested weir
- Rectangular throated flume
- Trapezoidal throated flume
- U throated flume
- Round nose horizontal broad crested weir
- Parshall flume
- Palmer bowlus flume
- Round pipe
- Leopold lagco flume
- Cut throat flume

Any custom or special channels with available linearization transfer curve can also be configured manually.
Open channel flow on DTM

1. Click Configuration > Device Setup > Basic Setting.

2. Select Flow in the Operate Mode field and click Set.

3. Click Configuration > Open Channel Flow > Open Channel Selection.

4. Select a value from the Channel Shape box and click Apply. The Triangular Notch Thin Plate Weir is selected here as an example.

5. The parameters and an image for the selected channel shape are displayed.

6. Complete the parameters and click Calculate.

7. The maximum flowrate is calculated and displayed at the top of the interface.

Note
The max flowrate calculation must be executed before the linearization table generation, to prevent an incorrect linearization table.
8 Click **Generate** to generate the linearization table for this channel shape.

9 The linearization table is displayed below.

10 Click **Store user curve to device** to store the linearization table to the device.

11 Click **Calibration > Linearization > Linearization** to confirm the setting.

12 Click **Load user curve from device** and select *Enable* in the **Linearization Status** field to active the open channel flow function.
Open channel flow on EDD

1. Click Configuration > Device Setup > Basic Setting.

2. Select Flow in the Operate Mode field and click SEND.

3. Click Configuration > Open Channel Flow.

4. Select a value from the Channel Shape box and click SEND. The Triangular Notch Thin Plate Weir is selected here as an example.

5. The parameters and an image for this channel shape are displayed.

6. Edit the parameters and click Calculate Max Flowrate.

7. The maximum flowrate is calculated and displayed. The maximum flowrate is downloaded to device automatically.

Note
The max flowrate calculation must be executed before the linearization table generation, to prevent an incorrect linearization table.

8. Click Generate Linearization Table to generate the linearization table for this channel shape.

9. Click Configuration > Open Channel Flow > Linearization to confirm the linearization.
Calibration

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

Ultrasonic level calibration
There are two types of errors: offset and gradient.

Offset error
The error at a 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.

\[
y = mx + c
\]

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.

\[
y = mx + c
\]

The speed of sound is linear, enabling calibration to be performed using only two known points. This provides sufficient information to calibrate LST300.

Calibration can be performed in position 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.

There are two kinds of calibration for LST300. One is for wet calibration and the other is for dry calibration.

Dry calibration
Dry calibration can be done when we have two known target levels available, and have the actual measurements at those known points from LST300.

Before starting the calibration procedure, gather the required measurements that will be used as inputs to the dry calibration function.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Sensor Point</td>
<td>LST300 measurement for the level position closest to the bottom of the tank</td>
</tr>
<tr>
<td>Upper Sensor Point</td>
<td>LST300 measurement for the level position closest to the top of the tank</td>
</tr>
<tr>
<td>Lower Level Point</td>
<td>The expected level value at the level position closest to the bottom of the tank</td>
</tr>
<tr>
<td>Upper Level Point</td>
<td>The expected level value at the level position closest to the top of the tank</td>
</tr>
</tbody>
</table>

As shown in the above figures, values in the following table are used as an example.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Sensor Point</td>
<td>0.410 m is measured</td>
</tr>
<tr>
<td>Upper Sensor Point</td>
<td>2.990 m is measured</td>
</tr>
<tr>
<td>Lower Level Point</td>
<td>0.400 m is expected</td>
</tr>
<tr>
<td>Upper Level Point</td>
<td>3.000 m is expected</td>
</tr>
</tbody>
</table>
Dry calibration procedure

1. Log on to the LST300 at the Standard or Advanced level.

2. Select Calibrate from the main menu.

3. Select Calibration from the “Calibrate” submenu.

4. Select Dry from the “Calibration” submenu.

5. Configure the four parameters in this menu using the data already obtained earlier in section “Dry calibration”. The level dry calibration is immediately active on the LST300.

Wet calibration

Wet calibration can be done in position, and the measurement is performed directly from the calibration menu. No measurement is required prior to calibration. It is however required that the level can be adjusted to the calibration positions while performing the calibration.

Wet calibration procedure

1. Follow the steps 1 to 3 in section “Dry calibration procedure” to navigate to the “Calibration” submenu.

2. Select Wet from the “Calibration” submenu.

3. Ensure the LST300 is measuring the upper calibration point, by ensuring the conditions as indicated in figure 26 “Upper calibration point measured”.

4. Configure the Upper Level Point as the known value of the level at a position close to the top of the tank.
5 Select **Wet Calibrate Upper** to perform a sensor measurement of the upper calibration point, and then click **OK**.

6 Confirm the measurement in the **Upper Sensor Point** set.

7 Ensure the LST300 is measuring the lower calibration point, by ensuring the conditions as indicated in figure 27 “Lower calibration point measured”.

8 Select **Wet Calibrate Lower** to perform a sensor measurement of the lower calibration point, and then click **OK**.

9 Confirm the measurement in the **Lower Sensor Point** set. The level wet calibration is immediately active on the LST300.
8 Diagnostic messages

The LST300 provides several diagnostic messages that can be viewed from the menu. The diagnostic messages provide insight into the state of the current process and is valuable for application troubleshooting.

Table 3 details each diagnostic message together with possible causes and remedial actions.

<table>
<thead>
<tr>
<th>Error no. / Range</th>
<th>Text on the LCD display</th>
<th>Cause</th>
<th>Remedy / Spare part</th>
</tr>
</thead>
<tbody>
<tr>
<td>F104.004 Process</td>
<td>Primary variable exceeds limit</td>
<td>Primary variable exceeds limit</td>
<td>Confirm the process variable and take action for limit exceeding.</td>
</tr>
<tr>
<td>F105.010 Process</td>
<td>Primary Variable is exceeds range</td>
<td>Primary variable exceeds range</td>
<td>Confirm Primary Variable and take action for range exceeding.</td>
</tr>
<tr>
<td>F113.016 Electronics</td>
<td>Sensor board failure Restart device. If failure, contact ABB service</td>
<td>Sensor board failure</td>
<td>Re-start the device. If this fails to solve the problem, contact ABB Level Support at <a href="http://www.abb.com/level">http://www.abb.com/level</a>.</td>
</tr>
<tr>
<td>C117.017 Electronics</td>
<td>Sensor board write memory error. Restart device. If failure, contact ABB service</td>
<td>Sensor board write memory failure</td>
<td>Re-start the device. If this fails to solve the problem, contact ABB Level Support at <a href="http://www.abb.com/level">http://www.abb.com/level</a>.</td>
</tr>
<tr>
<td>C118.023 Electronics</td>
<td>Electronics board write memory error. Restart device. If failure, contact ABB service</td>
<td>Electronics board write memory failure</td>
<td>Re-start the device. If this fails to solve the problem, contact ABB Level Support at <a href="http://www.abb.com/level">http://www.abb.com/level</a>.</td>
</tr>
<tr>
<td>M024.031 Operation</td>
<td>Incorrect voltage for device Check power supply</td>
<td>Incorrect voltage for proper device operation</td>
<td>Check power supply.</td>
</tr>
<tr>
<td>S022.032 Process</td>
<td>Environment temperature exceed Measurement may be invalid. Check temperature</td>
<td>Environmental conditions exceed acceptable device operating conditions</td>
<td>Measurement reading may be invalid. Rectify improper environmental conditions.</td>
</tr>
<tr>
<td>C098.035 Configuration</td>
<td>Measurement data simulate Confirm device should be in simulation mode</td>
<td>One or more measurement values are in simulation mode</td>
<td>Confirm measurement values should be in simulation mode.</td>
</tr>
<tr>
<td>F106.038 Electronics</td>
<td>Current output circuit failure Restart device. If failure, contact ABB service</td>
<td>Current output circuit has failed</td>
<td>Re-start the device. If this fails to solve the problem, replace the electronics board.</td>
</tr>
<tr>
<td>F121.039 Electronics</td>
<td>Electronics board failure Restart device. If failure, contact ABB service</td>
<td>Electronics board failure</td>
<td>Re-start the device. If this fails to solve the problem, contact ABB Level Support at <a href="http://www.abb.com/level">http://www.abb.com/level</a>.</td>
</tr>
<tr>
<td>F116.040 Process</td>
<td>Sensor initialized data get error Restart device. If failure, contact ABB service</td>
<td>Sensor board configuration data cannot got.</td>
<td>Re-start the device. If this fails to solve the problem, contact ABB Level Support at <a href="http://www.abb.com/level">http://www.abb.com/level</a>.</td>
</tr>
<tr>
<td>M020.041 Operation</td>
<td>NV replace error Restart device. If failure, contact ABB service</td>
<td>An error occurred during a NV Replace effort</td>
<td>Re-start the device. If this fails to solve the problem, contact ABB Level Support at <a href="http://www.abb.com/level">http://www.abb.com/level</a>.</td>
</tr>
<tr>
<td>S096.042 Process</td>
<td>Current is in saturation level</td>
<td>Current is in saturation level</td>
<td>Monitor process conditions.</td>
</tr>
</tbody>
</table>
9 Ex relevant specifications

Meter design for general purpose, Ex protection code Y0

IMPORTANT (NOTE)
For applications in US and Canada, when the temperature under rated conditions is higher than 60 °C at the entry point or 60 °C at the branching point of conductors, accessories such as cable, gland or conductors in conduit with minimum temperature specification of 60 °C must be selected.

IMPORTANT (NOTE)
The devices may only be operated in explosive areas if the housing covers have been fully closed.

⚠️ WARNING
Static hazard clean only with a damp cloth.
Avertissement – Danger statique Nettoyez uniquement avec un chiffon humide.

IMPORTANT (NOTE)
“Y0” digit means general purpose.

Supply power terminals
UB = 12 to 42 V DC

Operation temperature ranges
- The ambient operating temperature range of the LST300 is between -40 °C and 85 °C (-40 °F and 185 °F).
- Pollution degree 3 (refer to IEC 60664-1) must not be exceeded for the macro environment of the device. The device conforms to degree of protection IP66 / IP67. If the device is installed as intended, this requirement is met by the housing as standard.

Meter design for NEPSI non sparking, ATEX/IECEx energy limited (Zone 2/22), cFMus division 2, Zone 2/22

Meter design for NEPSI Non Sparking, Ex protection code is C5.

Meter design for ATEX/IECEx energy limited (Zone 2/22), Ex protection code is E5.

Meter design for cFMus, division 2, Zone 2/22, Ex protection code is F3.

IMPORTANT (NOTE)
For applications in US and Canada, when the temperature under rated conditions is higher than 60 °C at the entry point or 60 °C at the branching point of conductors, accessories such as cable, gland or conductors in conduit with minimum temperature specification of 60 °C must be selected.

IMPORTANT (NOTE)
The devices may only be operated in explosive areas if the housing covers have been fully closed.

⚠️ WARNING
Static hazard clean only with a damp cloth.
Avertissement – Danger statique Nettoyez uniquement avec un chiffon humide.

IMPORTANT (NOTE)
“C5” digit means that customers choose NESPI Non Sparking method of protection on the product. Dedicated check box is to be marked by the manufacturer.

IMPORTANT (NOTE)
“E5” digit means that customers choose ATEX or IECEx Non Sparking method of protection on the product. Dedicated check box is to be marked by the manufacturer.

IMPORTANT (NOTE)
“F3” digit means that customers choose FM US or FM C Non Incendive method of protection on the product. Dedicated check box is to be marked by the manufacturer.

NEPSI approval design for China
Ex nA IIC T6...T4 Gc DIP A22 T, 85°C
For electrical parameters, refer to cert, GYJXXXXXX

EC type-examination certificate FM15ATEX0064X
Designation:
II 3 G Ex nA IIC T6...T4 Gc - II 3 D Ex tc IIIC T85°C
For electrical parameters, refer to cert, FM15ATEX0064X

Certificate of conformity IECEx FME 15.0010X
Designation:
Ex nA IIC T6...T4 Gc - Ex tc IIIC T85°C
For electrical parameters, refer to cert, IECEx FME 15.0010X

FM approval design for the USA and Canada
CL I, ZONE 2 AEx/Ex nA IIC T6...T4
CL I/DIV 2/GP ABCD
NI CL I/DIV 2/GP ABCD
DIP CL II, III/DIV 2/GP EFG

Supply power terminals
Um = 42 V DC

Operation temperature ranges
- Ambient operating temperature between -40 °C and 85 °C (-40 °F and 185 °F)
- Dependence on the temperature class as detailed in the tables below
The devices must be installed in a protected environment in accordance with the specific conditions on the test certificate.

Pollution degree 3 (refer to IEC 60664-1) must not be exceeded for the macro environment of the device. The device conforms to degree of protection IP66 / IP67. If the device is installed as intended, this requirement is met by the housing as standard.

When connected to the line supply, the electrical circuits must not exceed overvoltage category III. When not connected to the line supply, the electrical circuits must not exceed overvoltage category II.

**Entity parameters for L2 display**

<table>
<thead>
<tr>
<th>Temperature class – Gas</th>
<th>Temperature class – Dust</th>
<th>Ambient temperature limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4</td>
<td>T135 °C</td>
<td>-40 to 60 °C</td>
</tr>
<tr>
<td>T4</td>
<td>T135 °C</td>
<td>-40 to 60 °C</td>
</tr>
<tr>
<td>T5</td>
<td>T100 °C</td>
<td>-40 to 56 °C</td>
</tr>
<tr>
<td>T6</td>
<td>T85 °C</td>
<td>-40 to 44 °C</td>
</tr>
</tbody>
</table>

**Entity parameters for L7 display**

<table>
<thead>
<tr>
<th>Temperature class – Gas</th>
<th>Temperature class – Dust</th>
<th>Ambient temperature limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4</td>
<td>T135 °C</td>
<td>-40 to 85 °C</td>
</tr>
<tr>
<td>T4</td>
<td>T135 °C</td>
<td>-40 to 70 °C</td>
</tr>
<tr>
<td>T5</td>
<td>T100 °C</td>
<td>-40 to 40 °C</td>
</tr>
<tr>
<td>T6</td>
<td>T85 °C</td>
<td>-40 to 40 °C</td>
</tr>
</tbody>
</table>

**Entity parameters for L0 display**

<table>
<thead>
<tr>
<th>Temperature class – Gas</th>
<th>Temperature class – Dust</th>
<th>Ambient temperature limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4</td>
<td>T135 °C</td>
<td>-40 to 85 °C</td>
</tr>
<tr>
<td>T4</td>
<td>T135 °C</td>
<td>-40 to 70 °C</td>
</tr>
<tr>
<td>T5</td>
<td>T100 °C</td>
<td>-40 to 56 °C</td>
</tr>
<tr>
<td>T6</td>
<td>T85 °C</td>
<td>-40 to 44 °C</td>
</tr>
</tbody>
</table>

**IMPORTANT (NOTE)**
The devices may only be operated in explosive areas if the housing covers have been fully closed.

**WARNING**
Static hazard clean only with a damp cloth.

Avertissement – Danger statique Nettoyez uniquement avec un chiffon humide.

**IMPORTANT (NOTE)**
“C6” digit means that customers choose NEPSI Intrinsically Safe method of protection on the product. Dedicated check box is to be marked by the manufacturer.

**IMPORTANT (NOTE)**
“E6” digit means that customers choose ATEX or IECEx Intrinsically Safe method of protection on the product. Dedicated check box is to be marked by the manufacturer.

**IMPORTANT (NOTE)**
“F4” digit means that customers choose FM US or FM C Intrinsically Safe method of protection on the product. Dedicated check box is to be marked by the manufacturer.

**NEPSI approval design for China**
Ex ia IIC T6...T4 Ga Ex iaD 20 T85° C
For electrical parameters, refer to cert, GYJXXXXXXX

**EC type-examination certificate FM15ATEX0063X**
Designation:
II 1 G Ex ia IIC T6...T4 Ga - II 1 D Ex ia IIIC T85° C
For electrical parameters, refer to cert, FM15ATEX0063X

**Certificate of conformity IECEx FME 15. 0010X**
Designation:
Ex ia IIC T6...T4 Ga - Ex ia IIIC T85° C
For electrical parameters, refer to cert, IECEx FME 15.0010X

**FM approval design for the USA and Canada**
IS/Sec. Intrinsique (Entity) CL I
ZONE 0 AEx/Ex ia IIC T6...T4
CL I/DIV 1/6P ABCD IS - CL II,III DIV 1/GP EFG
IS Control Drawing number: 3KXL065035U0009

**Supply power terminals**
Refer to the tables below

**Operation temperature ranges**
- Ambient operating temperature between -40 °C and 85 °C (-40 °F and 185 °F)
- Dependence on the temperature class as detailed in the tables below
### Entity parameters for L2 display

<table>
<thead>
<tr>
<th>Temperature class – Gas</th>
<th>Temperature class – Dust</th>
<th>Ambient temperature limitation</th>
<th>Input Current limit</th>
<th>Voltage limit</th>
<th>Power limit</th>
<th>Ci</th>
<th>Li</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4</td>
<td>T135 °C</td>
<td>-40 to 60 °C</td>
<td>100 mA</td>
<td>30 V</td>
<td>0.75 W</td>
<td>17 nF</td>
<td>10 uH</td>
</tr>
<tr>
<td>T4</td>
<td>T135 °C</td>
<td>-40 to 60 °C</td>
<td>160 mA</td>
<td>30 V</td>
<td>1 W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>T100 °C</td>
<td>-40 to 56 °C</td>
<td>100 mA</td>
<td>30 V</td>
<td>1.4 W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T6</td>
<td>T85 °C</td>
<td>-40 to 44 °C</td>
<td>50 mA</td>
<td>30 V</td>
<td>0.4 W</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Entity parameters for L7 display

<table>
<thead>
<tr>
<th>Temperature class – Gas</th>
<th>Temperature class – Dust</th>
<th>Ambient temperature limitation</th>
<th>Input Current limit</th>
<th>Voltage limit</th>
<th>Power limit</th>
<th>Ci</th>
<th>Li</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4</td>
<td>T135 °C</td>
<td>-40 to 85 °C</td>
<td>100 mA</td>
<td>30 V</td>
<td>0.75 W</td>
<td>13 nF</td>
<td>10 uH</td>
</tr>
<tr>
<td>T4</td>
<td>T135 °C</td>
<td>-40 to 70 °C</td>
<td>160 mA</td>
<td>30 V</td>
<td>1 W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>T100 °C</td>
<td>-40 to 40 °C</td>
<td>100 mA</td>
<td>30 V</td>
<td>1.4 W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T6</td>
<td>T85 °C</td>
<td>-40 to 40 °C</td>
<td>50 mA</td>
<td>30 V</td>
<td>0.4 W</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Entity parameters for L0 display

<table>
<thead>
<tr>
<th>Temperature class – Gas</th>
<th>Temperature class – Dust</th>
<th>Ambient temperature limitation</th>
<th>Input Current limit</th>
<th>Voltage limit</th>
<th>Power limit</th>
<th>Ci</th>
<th>Li</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4</td>
<td>T135 °C</td>
<td>-40 to 85 °C</td>
<td>100 mA</td>
<td>30 V</td>
<td>0.75 W</td>
<td>17 nF</td>
<td>10 uH</td>
</tr>
<tr>
<td>T4</td>
<td>T135 °C</td>
<td>-40 to 70 °C</td>
<td>160 mA</td>
<td>30 V</td>
<td>1 W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>T100 °C</td>
<td>-40 to 56 °C</td>
<td>100 mA</td>
<td>30 V</td>
<td>1.4 W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T6</td>
<td>T85 °C</td>
<td>-40 to 44 °C</td>
<td>50 mA</td>
<td>30 V</td>
<td>0.4 W</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The devices must be installed in a protected environment in accordance with the specific conditions on the test certificate.

Pollution degree 3 (refer to IEC 60664-1) must not be exceeded for the macro environment of the device. The device conforms to degree of protection IP66 / IP67. If the device is installed as intended, this requirement is met by the housing as standard.

When connected to the line supply, the electrical circuits must not exceed overvoltage category III. When not connected to the line supply, the electrical circuits must not exceed overvoltage category II.

**IMPORTANT (NOTE)**

For applications in US and Canada, when the temperature under rated conditions is higher than 60 °C at the entry point or 60 °C at the branching point of conductors, accessories such as cable, gland or conductors in conduit with minimum temperature specification of 60 °C must be selected.

**IMPORTANT (NOTE)**

The devices may only be operated in explosive areas if the housing covers have been fully closed.

### Meter design for NEPSI intrinsic safety, ATEX/IECEx intrinsic safety (Zone 0 /20), and cFMus division 1, Zone 0/20

Meter design for NEPSI combined C5 + C6, Ex protection code is C7.

Meter design for ATEX/IECEx combined E5 + E6, Ex protection code is E7.

Meter design for cFMus, combined F3 + F4, Ex protection code is F8.

**IMPORTANT (NOTE)**

"C7" digit means that customers choose NEPSI Non Sparking or Intrinsically Safe method of protection on the product.

Dedicated check box is to be marked by the manufacturer or customers.

**IMPORTANT (NOTE)**

"E7" digit means that customers choose ATEX or IECEx Non Sparking or Intrinsically Safe method of protection on the product.

Dedicated check box is to be marked by the manufacturer or customers.

**WARNING**

Static hazard clean only with a damp cloth.

Avertissement – Danger statique Nettoyez uniquement avec un chiffon humide.
IMPORTANT (NOTE)
“F8” digit means that customers choose FM US or FM C Non
incendive or Intrinsically Safe method of protection on the
product.
Dedicated check box is to be marked by the manufacturer or
customers.

IMPORTANT (NOTE) – Note for transmitter with combined
approval
Before installation of the transmitter, customers should
permanently mark their chosen Protection Concept on the
safety label. The transmitter can only be used according to this
Protection Concept for the whole life.
If two or more types of protection box (on the safety label) are
permanently marked, the transmitter must be removed from
hazardous classified locations.
The selected Type of Protection is allowed to be changed only
by the manufacturer after a new satisfactory assessment.

NEPSI approval design for China (Non Sparking)
For detailed information, refer to section “Meter design for
NEPSI non sparking, ATEX/IECEx energy limited (Zone 2 /22),
cFMus division 2, Zone 2/22”.

NEPSI approval design for China (Intrinsically Safe)
GYJXXXXXX
For detailed information, refer to section “Meter design for
NEPSI intrinsic safety, ATEX/IECEx intrinsic safety (Zone 0 /20),
and cFMus division 1, Zone 0/20”.

EC type-examination certificate FM15ATEX0064X
Designation:
II 3 G Ex nA IIC T6...T4 Gc - II 3 D Ex tc IIIC T85°C
For electrical parameters, refer to cert, FM15ATEX0064X

For detailed information, refer to section “Meter design for
NEPSI non sparking, ATEX/IECEx energy limited (Zone 2 /22),
cFMus division 2, Zone 2/22”.

Certificate of conformity IECEx FME 15. 0010X
Designation:
Ex ia IIC T6...T4 Ga - Ex ia IIIIC T85° C
For electrical parameters, refer to cert, IECEx FME 15.0010X

For detailed information, refer to section “Meter design for
NEPSI intrinsic safety, ATEX/IECEx intrinsic safety (Zone 0 /20),
and cFMus division 1, Zone 0/20”.

FM approval design for the USA and Canada (Non Incendive)
CL I, ZONE 2 AEx/Ex nA IIC T6...T4
CL I/DIV 2/GP ABCD
NI CL I/DIV 2/GP ABCD
DIP CL II, III/DIV 2/GP EFG

For detailed information, refer to section “Meter design for
NEPSI non sparking, ATEX/IECEx energy limited (Zone 2 /22),
cFMus division 2, Zone 2/22”.

FM approval design for the USA and Canada (Intrinsically
Safe)
IS/Sec. Intrinseque (Entity) CL I
ZONE 0 AEx/Ex ia IIC T6...T4
CL I/DIV 1/GP ABCD IS - CL II,III DIV 1/GP EFG
IS Control Drawing number: 3KXL065035U0009

For detailed information, refer to section “Meter design for
NEPSI intrinsic safety, ATEX/IECEx intrinsic safety (Zone 0 /20),
and cFMus division 1, Zone 0/20”.

EC type-examination certificate FM15ATEX0063X
Designation:
II 1 G Ex ia IIC T6...T4 Ga - II 1 D Ex ia IIIIC T85° C
For electrical parameters, refer to cert, FM15ATEX0063X

For detailed information, refer to section “Meter design for
NEPSI intrinsic safety, ATEX/IECEx intrinsic safety (Zone 0 /20),
and cFMus division 1, Zone 0/20”.
10 Specification

Measurement

Measurement range
C06 sensor: 0.25 to 6 m (10” to 20 ft)
C10 sensor: 0.35 to 10 m (14” to 32 ft)

Beam angle (@ -3dB, full angle)
C06 sensor: 7°
C10 sensor: 5°

Accuracy
±2 mm (0.08”) or 0.2 % of full span (the larger of the two)

Repeatability
±0.2 % of measurement range

Mechanical data

Housing material
Metal parts: Aluminum alloy
Plastic parts: PVDF

Dimensions
Length: 136 mm (5.3”)
Width: 100 mm (3.9”) (excluding glands)
Height: 266 mm (10.4”)

Weight
2 kg (4.4 lbs)

Cable entry type
Two options:
1/2 in. threaded bore for cable gland, directly on housing:
Supplied with 1 x 1/2 in. NPT cable gland
M20 x 1.5 threaded bore for cable gland, directly on housing:
Supplied with M20 x 1.5 cable gland

Electrical data

Terminals
Three connections for wire cross sections of up to 2.5 mm2 (14 AWG) as connection points for power supply and communication purposes

Grounding
Internal and external ground terminals are provided for 6 mm2 (10 AWG) wire cross sections

Power supply
The transmitter operates from 16 to 42 V DC with no load and is protected against reversed polarity (additional loads enable operation above 42 V DC).
During use in Exia zones and in other intrinsically safe applications, the power supply must not exceed 30 V DC.

Ripple
Max. 2.2 mV RMS over a 500 Ω load as per HART specifications

Load limitations
Total measurement circuit resistance at 4 to 20 mA and HART:

\[ R(\text{kΩ}) = \frac{22 \text{ mA}}{\text{Voltage supply - Minimum operating voltage (V DC)}} \]

A minimum resistance of 250 Ω is required for HART communication.

Analog output
Two-Wire output: 4 to 20 mA related to level / volume / flow, full compensation for temperature effects

Displays (option)

Integrated LCD display (code L7)
Widescreen LCD display, 128 x 64 pixels, 52.5 x 27.2 mm (2.06 x 1.07 in.) dot matrix
Four keys for device configuration and management
Easy setup for quick commissioning
Customized visualizations which users can select
Totalized and actual value flow indication
Temperature and diagnostics message display, and configuration settings

Integrated LCD display with TTG operation (code L2)
Same specifications as the integrated LCD display (code L7) An innovative Through-The-Glass (TTG) keypad which can be used to activate the device configuration and management menus without having to remove the transmitter housing cover
TTG keys protected against accidental activation
Hazardous area approvals

cFMus
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, Zone 0 AEx/Ex ia IIC T6...T4
IS Control Drawing number: 3KXL065035U0009

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, Zone 2, AEx/Ex nA IIC T6...T4

ATEX/IECEx
Intrinsic Safety type of protection:
II 1 G Ex ia IIC T6...T4 Ga - II 1 D Ex ia IIC T85° C
For electrical parameters, refer to cert, FM15ATEX0063X
Ex ia IIC T6...T4 Ga - Ex ia IIC T85° C
For electrical parameters, refer to cert, IECEx FME 15.0010X

Non Incendive type of protection:
II 3 G Ex nA IIC T6...T4 Gc - II 3 D Ex tc IIC T85°C
For electrical parameters, refer to cert, FM15ATEX0064X
Ex nA IIC T6...T4 Gc - Ex tc IIC T85°C
For electrical parameters, refer to cert, IECEx FME 15.0010X

NEPSI
Intrinsic Safety type of protection:
Ex ia IIC T6...T4 Ga - Ex iaD 20 T85° C
For electrical parameters, refer to cert, GYJXXXXXX

Non Incendive type of protection:
Ex nA IIC T6...T4 Gc - DIP A22 TA85°C
For electrical parameters, refer to cert, GYJXX.XXXX

Environmental data

Electromagnetic compatibility (EMC)
Meets requirements of EN 61326
Overvoltage strength (with surge protection): 2 kV (according to IEC 61000-4-5)

Temperature
-40 to 85 °C (-40 to 185 °F), according to EN 60068-2-14, 1 K/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 EN 60068-2-64)

Climate class
DIN EN 60068-2-38 (Test Z/AD) DIN/IEC 68 T2-30Db
Note