

ABB MEASUREMENT & ANALYTICS | DATA SHEET

# Ultrasonic level **LST400**

## Open channel flow transmitter



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# Measurement made easy

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## Reduced installation cost

- Easy access terminations
- Integrated echo display makes for easy troubleshooting

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## High functionality on standard product

- 4 to 20 mA output with HART 7
- 5 configurable relays / 8 A
- Configurable as open channel flow meter
- Preconfigured flow curves for most common channels
- 21 Point linearizer for calibration of non-linear vessels
- Pump control and cycling
- Automatic variable gain & power for difficult applications
- Integrated analytical software

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## Wide range of applicability

- Water and wastewater
- Power
- Mining and metals
- Food and beverage
- Pharmaceutical
- Paper and pulp

## Overview

### The LST400

The LST400 is an ultrasonic level transmitter capable of measuring liquid level or solid applications up to 15 m (approx. 50 ft) or flow rates in all types of open channel flow applications. The transmitter has a single 4 to 20 mA DC analog output with HART 7 and five relay outputs. A transducer is fitted to the top of a silo or tank, facing down towards the material being measured.

The transmitter's microprocessor simultaneously fires an electronic pulse to the transducer and starts a timer. The transducer converts this electronic pulse to an acoustic pulse, which is directed toward the surface of the material being measured. When the acoustic pulse contacts the material surface, energy is reflected back to the transducer, which converts this reflected energy back to an electronic pulse. This pulse is sent back to the microprocessor, which stops the timer and determines the 'time of flight' of the signal. By combining the speed of sound through air and the 'time of flight' of the pulse, the microprocessor accurately determines the product level. Powerful software removes false echoes from the signal and electronic filters remove ambient noise.

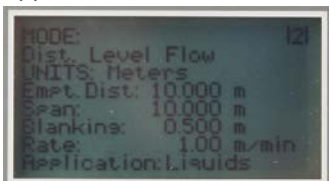
### Save time on installation

LST400 comes with HART digital communication and with an easy to use graphic display as standard.

- HART provides you with digital communication over existing plant infrastructure, significantly simplifying configuration and installation.
- The integrated graphic echo display makes troubleshooting easy. The echo screen shows the echo and diagnostic information that most instruments require specialized software and a computer to access.



- The easy to use menu makes configuration a simple 1 minute task. All the settings required to start are on the first page of the menu, requiring no further setup for the majority of applications.



### Works in the most difficult conditions

LST400 has an advanced algorithm which automatically adjusts the instrument to work in the most difficult conditions.

- LST400 can vary pulse size for optimal performance at short and long distances.
- Pulse length can be adapted, to ensure pulses can travel through the air even in the presence of dust.
- The receiver gain can be increased to make sure the smallest of echoes can be detected easily.

LST400 automatically adjusts these settings, ensuring optimum performance can be achieved in all conditions.

### High functionality as standard

Instead of the usual range of options available on ultrasonic sensors, LST400 includes everything you need in one. It comes with five relays, open channel flow, AC and DC power, and HART communication as standard. All sensors work with the standard LST400 transmitter.

### Easy-access installation terminals

Easy access to the terminals ensures rapid and cost-effective installation. The wall / pipe-mount version has been designed to ensure that cable connection is simple and convenient. Ingress protection of the electronics section is retained even when the terminal compartment cover is opened.



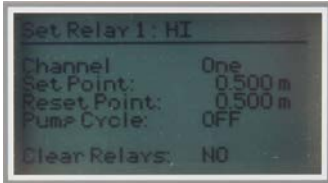
Figure 1 Terminal access on the LST400



## Overview

### Pump control using relays

LST400 has five relays as standard, eliminating the need for controllers in basic control applications. Pump control is easy to configure, and no special skills are required to program pump control functions.



When it is important to keep the loads to the pump balanced we can use pump cycling. If the same pump always switches on first and then switches off last, it will carry a much larger load than any of the other pumps. This will mean earlier need for maintenance on this first pump. At the same time the other pumps will be underutilized. LST400 has two different modes to ensure the running time of the pumps is balanced. These are referred to as First In First Out (FIFO) and Rotate Pump Cycling.

#### Example

In the following example we can see a system of three pumps being cycled. Three pumps are set up with the same Set and Reset settings, the only difference being the cycling mode. In this example we can see how the pumps behave at each point and how the work load is balanced between the pumps.

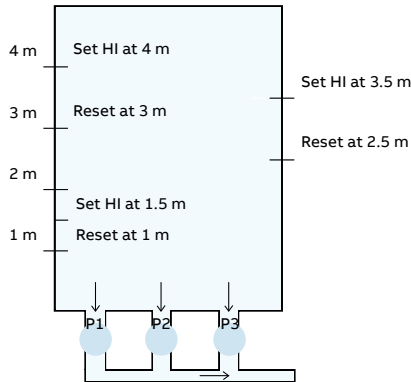


Figure 2 Example of a pump cycling system

First In First Out (FIFO)									
	Level	P1	P2	P3		Level	P1	P2	P3
Seq.1	1.3 m	x	x	x	Seq.6	2.2 m	x	x	√
Seq.2	2.2 m	√	x	x	Seq.7	0.8 m	x	x	x
Seq.3	3.6 m	√	√	x	Seq.8	1.8 m	√	x	x
Seq.4	4.3 m	√	√	√	Seq.9	0.8 m	x	x	x
Seq.5	2.8 m	x	√	√	Seq.10	1.8 m	x	√	x

Rotate Pump Cycling									
	Level	P1	P2	P3		Level	P1	P2	P3
Seq.1	1.3 m	x	x	x	Seq.6	2.2 m	√	x	x
Seq.2	2.2 m	√	x	x	Seq.7	0.8 m	x	x	x
Seq.3	3.6 m	√	√	x	Seq.8	1.8 m	x	√	x
Seq.4	4.3 m	√	√	√	Seq.9	0.8 m	x	x	x
Seq.5	2.8 m	√	√	x	Seq.10	1.8 m	x	x	√

### Open channel flow

In the water industry we often encounter open channels. Open channels are an effective way to distribute water. Using a man-made structure with an open surface, water can flow freely relying only on the force of gravity. There are no pumps used and no pressure applied. Over many years, studies have been done to experimentally establish the relationship between level and the flow through an open channel. It is therefore possible to use a level meter to measure the flow through this channel by measuring the level and using the preconfigured relationship. This conversion is performed by using the 21-point linearization function on the LST400. LST400 is preconfigured with the most common weirs and flumes and has the capability to program custom channels.

The most important setup needed in the instrument is the shape of the channel. An Empty Distance and a Span is also configured of this along with the calculated Maximum Flow value is then used to accurately calculate the flow at any point along the span.



## Terminal connections

### Power

The LST400 can be powered using either AC power or 24 V DC power. When using AC power, connect power to either 220 V or 110 V, Neutral to N and Ground to PE.

When using DC power, use 24 V DC PWR-IN.

In both power modes, make sure to have PE connected to ground.

### Relays

There are five relays on the LST400. The connectors are marked Relay 1, Relay 2, Relay 3, Relay 4 and Relay 5.

The relay connections are marked as NO (Normally Open), NC (Normally Closed) and COM (Common).

### Transducer

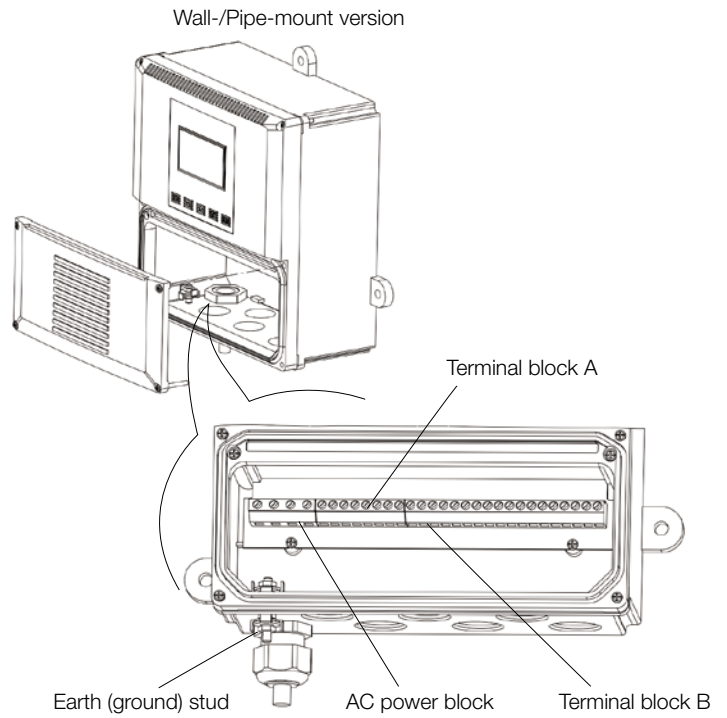
The black wire is the temperature sensor signal.

The shield is the common ground used for both temperature and signal line.

The blue wire is the measurement signal.

### Analog output

4 to 20 mA (labeled HART) is loop powered. There is no power on this port unless it is supplied. A resistor is needed to allow current to flow through the loop.



Loop power can be provided from

- 'LoopPwr from AC-IN'. Can be used to supply power to the current output if the AC power source is used. The power supplied here is isolated.
- 'LoopPwr from DC-IN'. Can be used to supply power to the current output if the DC power source is used. The power supplied here is not isolated.
- External loop power can also be used when using the instrument on an existing HART network.

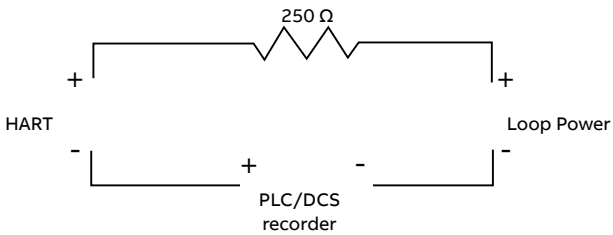
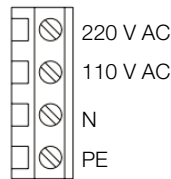
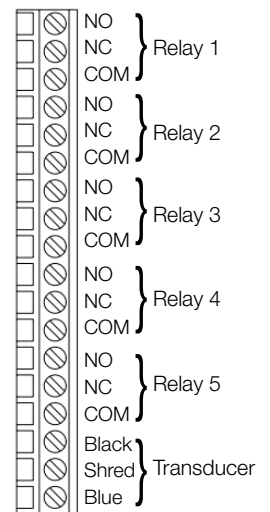


Figure 3 Standard analog output connection diagram

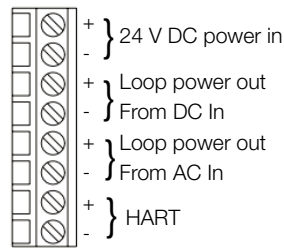
#### AC power block



#### Terminal block B



#### Terminal block A



## Specification

### General

#### Inputs

One level transducer with integrated temperature sensor

#### Range

0.5 m to 15 m

#### Accuracy

0.25% full span with temperature compensation or 3 mm (0.11 in) (whichever is greater)

#### Repeatability

0.15 % full span

#### Temperature compensation

NTC 10 k $\Omega$  thermistor

Range -40 to 80 °C (-40 to 176 °F)

#### Measurement modes

Level

Distance

Linearized level (21-point linearizer)

Open channel flow with preconfigured flow curves for most common channels

#### Rate of change

0.03 to 65 ft / minute; 0.01 to 20 m / minute

### Display

#### Type

128 x 64 dot graphic display

#### Energy-saving function

Backlit LCD configurable as ON or Auto-Off after one to six minutes

### Relay output

#### Number of relays

Five supplied as standard

#### Set point adjustment

Configurable as high/low set point

#### Hysteresis

Configurable as reset point

#### Cycling options

Programmable for First in First Out (FIFO) or Cycle Mode

#### Relay contacts

Single-pole changeover

Rating 8 A, 115/230 V AC, 8 A DC

### Analog output

#### Ranges

4 to 20 mA

Analog output programmable to select 3.6 mA, 4 mA, 20 mA, 21 mA or hold last value in case of system failure.

#### Accuracy

$\pm 0.25$  % FSD,  $\pm 0.5$  % of reading (whichever is greater)

#### Resolution

0.1 % at 10 mA, 0.05 % at 20 mA

#### Maximum load resistance

750  $\Omega$  at 20 mA

#### Communications

HART 7 as standard

### Access to functions

#### Direct keypad access

Measurement, maintenance, configuration, diagnostics and service functions.

Performed without external equipment or internal jumpers.

### Mechanical data

#### Wall / Pipe-mount versions transmitter

IP65 / NEMA 4X, Glass Loaded Polycarbonate

Size (W x D x H)

230 x 94 x 192 mm (9.06 x 3.70 x 7.56 in)

Weight 1 kg (2.2 lb)

#### Cable Entry Types

7 x knockouts suitable for M20 or 1/2" NPT cable glands

Supplied with 5 x M20 or 5 x 1/2" NPT cable glands

### Power supply

#### Voltage requirements

110 V AC or 240 V AC  $\pm 15$  %, 50/60 Hz, 5 VA

20 to 30 V DC, 4 VA

#### Environmental data

Operating temperature limits

-20 to 65 °C (-4 to 149 °F)

#### Storage temperature limits

-25 to 75 °C (-13 to 167 °F)

### EMC

#### Emissions and immunity

Meets requirements of EN61326-3 (for an industrial environment)

### Approvals, certification and safety

#### CE Mark




EMC Directive 2006/95/EC (IEC 61010-1)

LV Directives 2004/108/EC (IEC 61326-3 for an industrial environment)

#### General safety

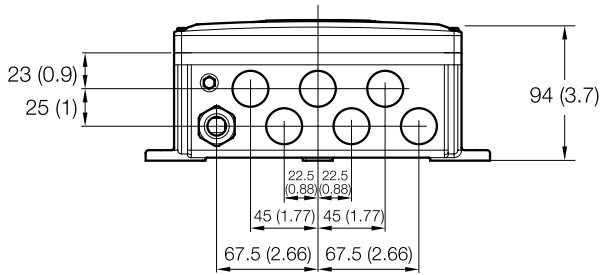
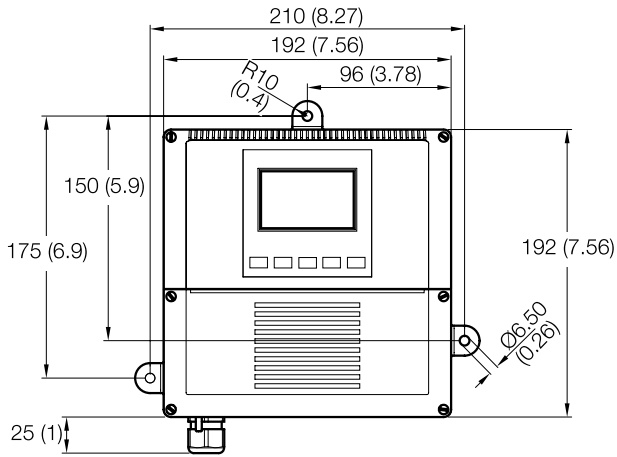
EN61010-1

## Sensor specifications

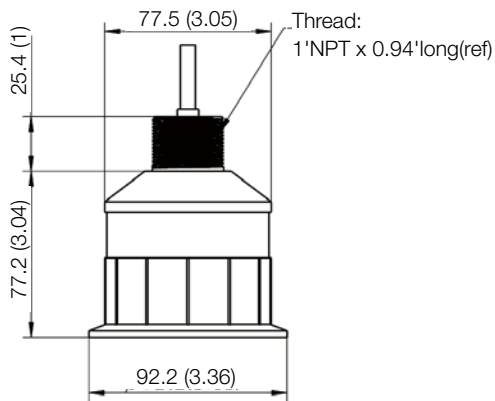
Type	S15	F15	C15
			
Model			
Design	For use on liquids and bulk solids up to 8 m (approx. 26 ft). Suitable for potable and waste water applications.	For use in bulk solid level measurement up to a range of 15 m (approx. 49 ft). Foam face improves acoustic matching for better performance on solids.	Corrosion resistant housing ideal for chemically aggressive environments.
Measurement range	0.5 to 15.0 m (1.6 to 49.2 ft)	0.5 to 15.0 m (1.6 to 49.2 ft)	0.5 to 15.0 m (1.6 to 49.2 ft)
Acoustic window material	Glass reinforced epoxy	Glass reinforced epoxy	PVDF
Housing material	Glass filled polyester	Glass filled polyester	PVDF
Beamwidth (@ -3 dB)	7°	7°	7°
Operating frequency	41 kHz	41 kHz	41 kHz
Process temperature limits	-40 °C to 90 °C	-40 °C to 90 °C	-40 °C to 90 °C

# Dimensions

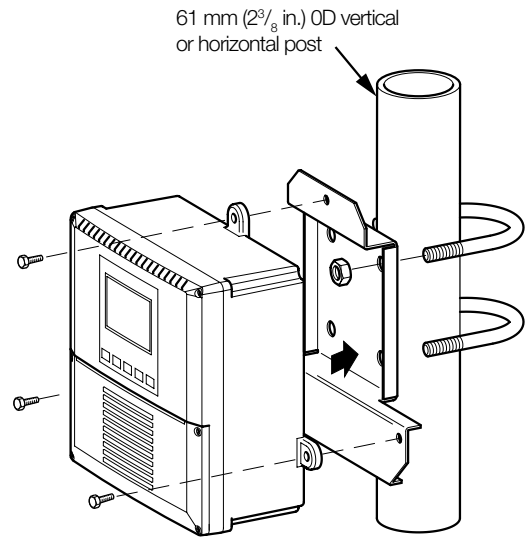
Dimensions in mm (in.)



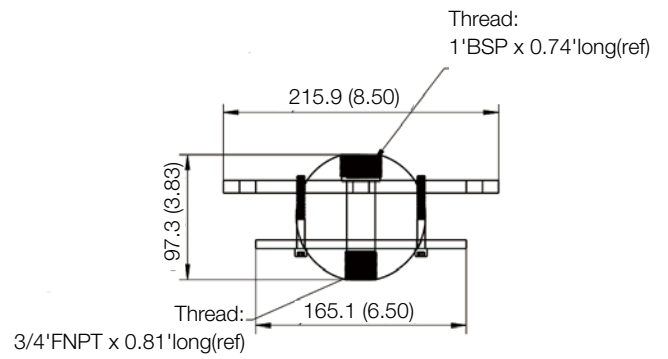
Wall-/Pipe-mount version



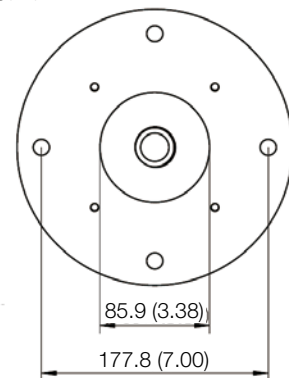
Sensor



Pipe-mount detail



Aiming kit





## Ordering information

### Basic ordering information for LST400

Some updates to the product options. The product code stays the same, only options are added. Also one new sensor is added. Here they are:

<b>LST400</b>	X	X	X	X	X	X
<b>Explosion protection certification</b>						
General Purpose	Y0					
<b>Sensor type and range</b>						
Standard transducer ,15 m (approx. 49 ft) range		S15				
Foam face transducer , 15 m (approx. 49 ft) range, for solids		F15				
Corrosion resistant transducer, 15 m (approx. 49 ft) range		C15				
No transducer		Y00				
<b>Process connection type</b>						
1 in, NPT, 0.94 in, long			N1			
<b>Housing material / cable glands</b>						
Polycarbonate / 2 pieces. Metric, M20 x 1.5, cable glands mounted				P3		
Polycarbonate / 2 pieces. 1/2 in. NPT threads, cable glands mounted				P6		
<b>Power supply</b>						
115 to 230 V AC or 24 V DC					A1	
<b>Out signal</b>						
HART digital communication and 4 to 20 mA						H1

## Additional ordering information

### Additional ordering information for LST400

Add one or more codes after basic ordering information to select all required options

	X	X	X	X	X	X	X	X
<b>Signal cable length</b>								
Without signal cable	SC0							
10 m (approx. 30 ft)	SC2							
20 m (approx. 66 ft)	SC4							
30 m (approx. 98 ft)	SC6							
40 m (approx. 131 ft)	SC8							
40 m (approx. 131 ft)	SCA							
<b>Sensor options</b>								
Aiming kit		SEK						
<b>Sensor options</b>								
Flange, 76 mm (3 in) ANSI / ASME connection, PVC			FA3					
Flange, 102 mm (4 in) ANSI / ASME connection, PVC			FA4					
Flange, 152 mm (6 in) ANSI / ASME connection, PVC			FA6					
Flange, 80 mm (3.1 in) connection, PVC			FD3					
Flange, 100 mm (3.9 in) connection, PVC			FD4					
Flange, 150 mm (5.9 in) connection, PVC			FD6					
<b>Bracket Shape / Material</b>								
For pipe mounting / Stainless steel				B2				
<b>Device Identification Plate</b>								
Adhesive label with TAG no.					TC			
<b>Certificates</b>								
Inspection certificate for calibration with test report						CR		
<b>Shipping Certificates</b>								
Certificate of origin							GS1	
Attested certificate of origin							GS2	
<b>Documentation Language</b>								
English								M5
Chinese								M6



Sales



Service



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