



Measurement Products

Level measurement

Proven level technologies providing reliable measurement solutions for process and utility applications

Power and productivity
for a better world™



Expertise in technology

More than a century of experience

To operate any process efficiently, it is essential to measure, actuate, record and control. In selecting ABB you are choosing a partner who is offering the best measurement solution for your needs, enabling maximum return on your investment. When investing in ABB's measurement products and solutions you are receiving the best technology, reliability and service in the business.

Research and development is a vital source of ABB's technology leadership. ABB constantly builds on the foundation of existing technologies for new applications, and continues to develop the breakthrough technologies needed to meet the challenges of the future. ABB and its heritage companies have been leaders in innovation and technology for more than 100 years. We are proud to include the K-TEK level product line in the ABB family of measurement solutions.

Aztec

Bailey

BOMEM

Bush Beach Engineering
Limited

**FISCHER
PORTER** 

Hartmann & Braun *K-TEK*

Kent

Pressductor®

 **SENSYCON**

Schoppe & Faeser *Taylor*

TBI-Bailey



TOTALFLOW
MEASUREMENT & CONTROL SYSTEMS

Comprehensive measurement solutions

Serving any industry

ABB measurement products provide world-class measurement solutions for any industry, utility or municipality. Latest innovations deliver technological solutions to make it easier for you to run your plant. ABB's measurement products are based on common technology, providing a common look and feel and method of operation. This results in products that are easy to configure, easy to integrate, and easy to maintain.

ABB's measurement products portfolio:

- Analytical measurements
- Flow measurement
- Natural gas measurement
- Valve automation
- Pressure measurement
- Temperature measurement
- Recorders and controllers
- Level measurement
- Device management
- Force measurement
- Service

1 Water and waste water | 2 Power and industrial steam | 3 Chemical and petrochemical | 4 Oil and gas | 5 Pulp and paper | 6 Minerals | 7 Metals | 8 Food and beverage | 9 Pharmaceuticals

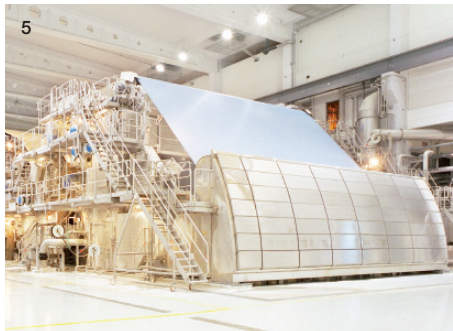




ABB offers the most complete level measurement product line in the world



Level measurement is a critical process parameter used in a variety of commercial and industrial applications around the world. ABB has the proven technology to provide solutions for the most difficult level applications for both liquids and solids.

From tall grain silos to high pressure boilers and process vessels, ABB offers a wide breadth of level technologies, certifications and approvals to meet the needs of the most demanding applications.

With the recent acquisition of K-TEK, a market leader in level detection, and ABB's existing hydrostatic level product lines, ABB now offers the most complete level measurement product line in the world.

Whether an application requires a cutting-edge solution, such as the non-contact laser or ultrasonic level transmitter, or ultra high pressure magnetic level gauges, transmitters and switches, ABB has the right technology for liquid or solids level detection needs.

ABB provides reliable level solutions – no matter how difficult the application may be.

- Precision engineered instruments built to specific customer requirements
- SIL2/3 certified transmitters
- Products that are easy to commission and calibrate, saving time and expense during a startup
- Largest selection of agency approved level switch technologies in the market
- Measurement solutions for both liquid and solids level applications

Measure two fluids in the same vessel? Absolutely.

On and offshore oil and gas production facilities have some of the most challenging level measurement applications in the exploration industry. High pressure separators, for example, contain two separate fluids in the same vessel – as when oil floats on top of water. Both fluid levels need to be measured on a continuous basis without disrupting the operation of the oil and gas processing plant. To accurately accomplish this, a technology with interface capabilities is required.



The ABB solution

The KM26 magnetic level gauge and AT200 magnetostrictive level transmitter utilize precision engineered floats that are specifically designed to float with half their volume in the upper fluid and half in the lower fluid. When accurate specifications of the fluids are provided, interface density differences as low as 0.04 specific gravity can be accurately measured. Since the vessel contents are totally contained within the float chamber, the same magnetic level float can be used to actuate limit switches or continuous level transmitting devices without disturbing existing piping or vessels. Installation and modification can be administered while the platform is on-line. This allows for easy integration of leveling technology into the distributed control systems (DCS).

Other suitable technologies for the oil and gas industry

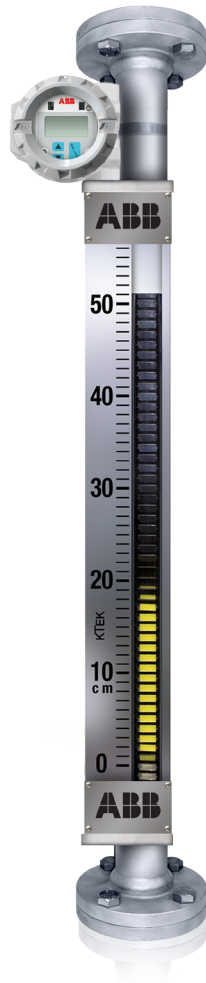
- MT series guided wave radar level transmitters
- MW05 MagWave level system
- AT series magnetostrictive level transmitters
- Vibrating fork level switches
- Gauge and differential pressure level transmitters
- LM7100 LevelMaster liquid level sensor

KM26 magnetic level gauge installed on a separator



“Smart“ level gauge beyond the sight glass

In today’s global chemical industry, process optimization and waste reduction is crucial. Continuous and point level measurement instrumentation provide the accuracy and reliability needed by chemical manufacturers worldwide. From radar and magnetostrictive, to non-contact ultrasonic and laser technologies, ABB has the solution for the toughest level application.



The ABB solution

The KM26 magnetic level gauge provides safe, reliable liquid level measurement with the added ability of optional transmitters and switches to make the KM26 a truly “smart“ level gauge. With limited leak paths, no glass in contact with the process and ultra high pressure and temperature ratings, the magnetic level gauge addresses many of the traditional challenges faced by older technology sight glass gauges. ASME code manufacturing standards ensure long lasting performance with little or no maintenance.

Other suitable technologies for the chemical industry

- MT series guided wave radar level transmitters
- AT series magnetostrictive level transmitters
- RS80 vibrating fork level switch
- Gauge and differential pressure level transmitters

KM26/AT200 installed on a chemical storage tank



A new level of safety for the refining industry

In the hazardous refining industry environment, plant operators require reliable level measurement solutions to manage high pressure and temperature applications. Because of the inherent danger found in refineries, critical issues of overflow prevention and maintaining level measurement accuracy is crucial. Instrumentation designed for Safety Instrumented Systems (SIS) are ideal to maintain the margin of safety and reliability required. Only ABB offers certified guided wave radar and magnetostrictive level transmitters to the exacting IEC 61508 safety standard.



The ABB solution

The ABB MT series of guided wave radars and AT series of magnetostrictive transmitters are the only level transmitters in the world to be IEC 61508 certified for operation in SIL2 (Safety Integrity Level 2) environments and are SIL3 approved with redundancy. The guided wave radar's self-monitoring capability continually checks for any faults that could cause device failures or false indications, and the magnetostrictive transmitter's strong electrical return pulse provides highly reliable measurements. These two technologies offer the best in safety and reliable communication, even in the harshest environments.

Other suitable technologies for the refining industry

- KM26 magnetic level gauge
- RS80 vibrating fork level switches
- TX thermal dispersion level/flow switches
- Gauge and differential pressure level transmitters

The only level transmitters to receive IEC 61508 certification for operation in SIL2 environments



The power to improve plant efficiency

The ability to produce safe, efficient power is essential to a modern society. ABB offers advanced level measurement technologies for both liquids and solids that accurately and consistently provide process level measurement and control in power plant environments. In an effort to improve plant heat-rate and overall system efficiencies, power generating facilities around the globe are rapidly upgrading antiquated level instruments with ABB technology. Power plants often have high pressure and temperature applications where accuracy is critical.



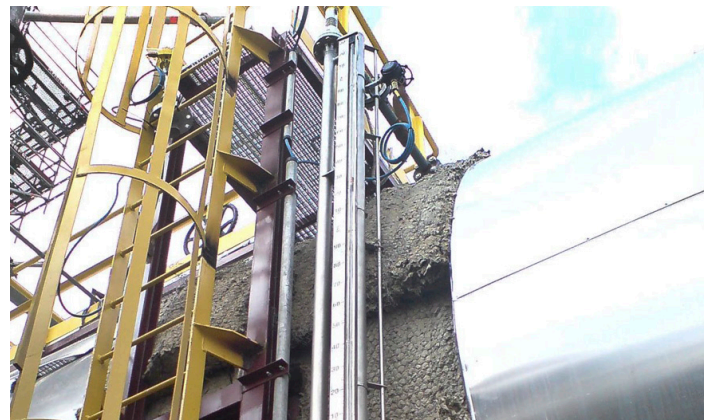
The ABB solution

The K-TEK MagWave dual chamber redundant level system has a proven record of improving feedwater heater reliability in power plants around the world. The MagWave combines a highly visible magnetic level indicator with the precise level measurement of a guided wave radar transmitter. Featuring a single probe transmitter in a standard 1.5 inch secondary chamber, the MagWave provides the measurement capabilities of a coaxial probe without the potential for fouling. Redundant level control can be achieved by adding a magnetostrictive transmitter or switch to the float chamber.

Other suitable technologies for the power industry

- KM26 magnetic level gauge
- AT series magnetostrictive level transmitters
- MT series guided wave radar level transmitters
- Gauge and differential pressure level transmitters

MW05 MagWave level system installed at a solar power plant



A level solution for open channel flow measurement

Reliable water level measurement in the treatment unit of any industrial plant or utilities can present challenges to level measurement instrumentation. Often the chemical and physical properties of the processed water can change drastically with composition from different acids, flocculants, surfactants or other water treatment processes. These constant changes in water makeup prevent many traditional level technologies from working accurately. Also, traditional contact level methods often mandate the usage of special metals or coatings. Customer preferences are shifting to non-contact level measurement. With global privatization of the water industry, highly accurate measurements and solutions will continue to be required.

The ABB solution

ABB's non-contact ultrasonic level transmitters and transducers provide the accuracy needed for surface foam conditions of many water and wastewater industry applications. Along with traditional level measurement, ultrasonic technology has sophisticated electronics and software that allow for flow measurement of flumes or weirs.

Other suitable technologies for the water and wastewater industries

- LM80 laser level transmitter
- KCAP series RF capacitance switches
- SP60 vibrating fork level switch



K10C ultrasonic transducer installed at a wastewater facility.



Pioneering new process controls for sustainability

Safety and process control are among the primary concerns when working in a mining environment. The variety of different level applications in mining requires unique, proven technologies. ABB offers a comprehensive selection of level measurement technologies and products used in the mining industry for both liquids and solids.

The ABB solution

Inventory levels in ore passes, which can reach up to 200 ft./60 m in depth with only 16 ft./5 m diameter, represent one of the most difficult and extreme level applications in an underground mine. The harsh environment and physical constraints of the ore passes prevent the use of most level technologies. The ABB family of laser level transmitters, LM200 and LM80, provide the solution. The LM200's focused, near infrared laser beam can effectively reach the bottom of the narrow ore pass, providing continuous level measurement to ensure production efficiency and safety. The LM80 provides unique and reliable level measurement solution for a variety of mining level measurement applications such as crusher level control, inventory measurement in silos, bins and detection of plugged chutes.

Other suitable technologies for the mining industry

- Vibrating fork level switches
- AT series magnetostrictive level transmitters
- Ultrasonic transmitters
- Blocked chute detection



LM80 laser installed on ore surge bin





Level Switch Technologies

Level switches, both mechanical and electronic, are an important part of a well designed process level control system. Their ability to accurately and repeatedly detect level is crucial and is often the last warning before a major upset or catastrophic failure. The ability to offer the best switch technology for a given application sets ABB apart from other manufacturers.

ABB level switches are categorized into two groups: magnetic/float based and electronic. Both groups offer inherent features and benefits that provide the proven reliability required by our global customers.

ABB level switch technologies

- Buoyancy
- Magnetically-coupled
- Thermal dispersion
- Vibrating fork
- RF Capacitance
- Rotary paddle
- Ultrasonic



Field Indicators & Controllers

As a comprehensive provider of level measurement products, ABB offers a variety of indicators and controllers that complement field instrumentation to provide customers with total level solutions. When a complete level measurement system is designed with the right combination of field indicators and controllers, the highest degree of level detection and control can be achieved.

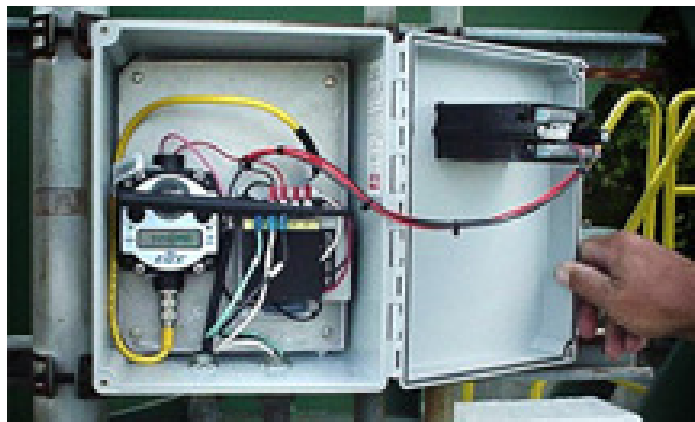
ABB field indicators and controllers for level

- Quad channel controllers
- Wireless communication transmitter
- Loop powered digital indicator
- Digital process monitors
- External relays

TX thermal dispersion installed for a flow/level application



WT8000 wireless communication transmitter node at base of caustic tank





Gauge and differential pressure level transmitters

The chemical processing industry has a variety of extreme level measurement challenges such as open and closed tank applications in hazardous areas where the process media is highly corrosive, viscous or has a tendency to crystallize or solidify.

The ABB solution

The 2600T series gauge and differential pressure transmitters are an ideal solution for these types of level applications. With standard all-welded diaphragm seal construction, the 2600T provides lasting reliable measurement even in vacuum, high temperature conditions. A wide variety of system fill fluids allow ABB 2600T transmitters to operate with process media temperature ranging from -100°C/-150°F or up to 375°C/700°F. With HART, PROFIBUS, FOUNDATION Fieldbus and wireless HART connectivity, the 2600T can be connected to any host. When safety is paramount, the 2600T is the right choice. Certified to IEC61508 for SIS loops up to SIL3 (1002D), the 2600T will add performance and reliability to any Safety level measurement system. A complete range of process connections, such as tees, wafer, flange mounting, threaded union, welded bushing, pulp and paper connections, sanitary and aseptic connections in compliance with 3-A sanitary standards allowing a trouble-free application fit. An extensive range of wetted process materials provides long lasting reliability for even the most difficult applications. Exotic materials, including Hastelloy C-2000, Super Duplex, Inconel 625 in addition to reliable treatments such as gold plating, anti-abrasion, anti-stick Diaflex and Teflon coated wetted parts are available. ABB can also offer special seals to meet individual process requirements.

266T differential pressure transmitter installed for a digester level application



Liquid level sensors for tank level measurement

The LevelMaster combines the industry's most innovative hardware and software to address the unique custody-measurement and operational needs of tank-level management. The LevelMaster provides not only an accurate level gauge, but also an accurate measurement of the oil and water interface, for trustworthy oil sales.

Unlike other level-sensing technologies, LevelMaster provides precise levels without having to continuously adjust for changes in the unpredictable properties of storage tank liquids. LevelMaster floats can measure oil, water and emulsion levels up to 25 ft./7.6 m deep, with a standard relative accuracy of 0.1 in./2.5 mm or optional high precision relative accuracy of 0.05 in./1.25 mm. Floats can be installed to measure only the top surface level (single float) or both surface and interface levels (dual floats). In addition to measuring the liquid levels, an RTD measures the liquid temperature at the load line.

LevelMaster installed on oil tank batteries










Reliable level solutions

A comprehensive offering by industry

Magnetic Level Gauges	Magnetostrictive Level Transmitters	Guided Wave Radar Level Transmitters	Laser Level Transmitters	Ultrasonic Level Transmitters & Switches	Magnetic Level Gauge Switches	Buoyancy Level Switches
KM26	AT100 AT200 AT500 AT600	MT5000 MT5100 MT5200	LM80 LM200 SS140XP	KSONIK/III KSONIK MICRO KSONIK MICRO LP Transducers	MS30/MS40 MS41 PS35/45	LS Series MS10/MS50 MS8D/MS8F
						

Industries	Magnetic Level Gauges	Magnetostrictive Level Transmitters	Guided Wave Radar Level Transmitters	Laser Level Transmitters	Ultrasonic Level Transmitters & Switches	Magnetic Level Gauge Switches	Buoyancy Level Switches
Oil and gas	X	X	X		X	X	X
Refining	X	X	X		X	X	
Chemical	X	X	X	X	X	X	
Power generation	X	X	X	X	X	X	X
Pharmaceutical & biotech	X	X	X	X	X	X	
Transportation (railcars)		X					
Food & beverage	X	X	X	X	X	X	
Wastewater	X	X	X	X	X	X	
Mining		X	X	X	X		
Rock, sand and gravel				X	X		
Pulp & paper	X	X	X	X	X	X	
Marine		X	X				
Agriculture		X	X	X	X		
Steel		X	X	X	X		
Defense/military		X			X		
Plastics		X	X	X	X		

Thermal Dispersion Level Switches	Vibrating Fork Level Switches	Specialty Level Switches	Field Indicators & Controllers	RF Level Controls	Gauge and Differential Pressure Level Transmitters	Liquid Level Sensors
TX TS	RS85 GP50/SP60	A22, CP2 AT200VP AT500MD Chute Master ST95	KVIEW10/100 DPM100 LPM200 IR/PP10	KCAP300/400 A75 A02	2600T Series	LevelMaster 7100
						
X	X	X	X	X	X	X
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Measurement Products - Measurement Made Easy

Guided Wave Radar Level Transmitters K-TEK Products

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Introduction

A new level of safety for hazardous industry environments



ABB's MT series Guided Wave Radar Level Transmitters are the only level transmitters in the world to be IEC 61508 certified for operation in SIL2 and SIL3 environments.

The guided wave radar's self-monitoring capability continually checks for any faults that could cause device failures or false indications. The device features a graphic display incorporated into an all digital electronics module. Using this new format ABB has been able to add waveform screens to the modular electronics along with easy to follow multiple choice setup menus. These menus can be changed to many different languages for easy commissioning throughout the world. Pulses of microwave energy are directed to the product surface using a rigid rod or flexible cable type probe. This assembly has no moving parts and no loss of energy due to beam divergence.

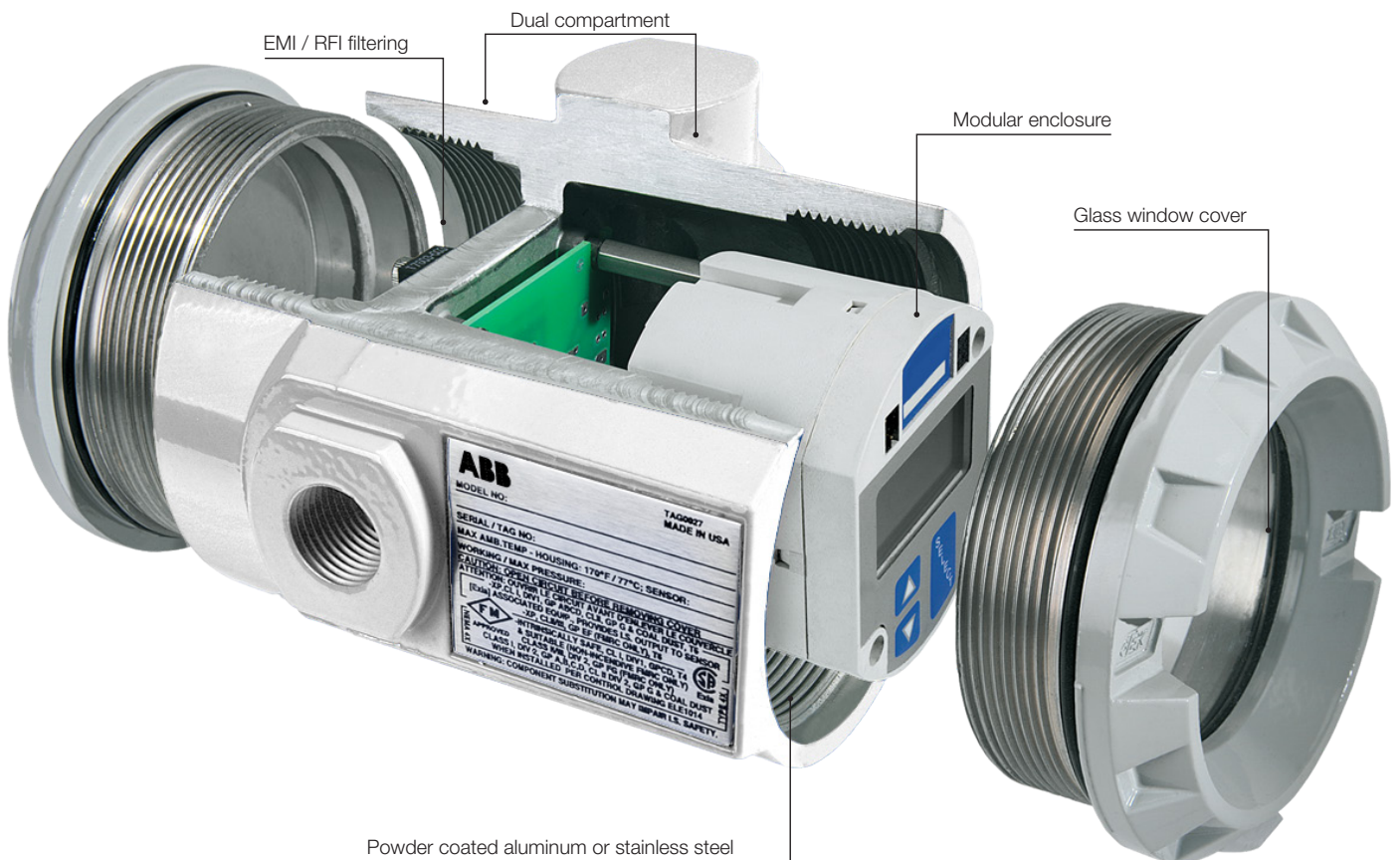
Customer benefits

- Microwaves are unaffected by temperature, pressure, specific gravity and vapors
- Easy to install
- No moving parts
- Ignores light continuous coatings
- Good for vacuum service
- No beam angle to be concerned about like through-air radar or ultrasonic transmitters
- More direct energy return – more consistent signal
- No complicated setup, no computer or programmer required
- Built-in waveform screen (Scope Trace)

Principle of operation

Stable readings in the most challenging environments

ABB's ability to provide engineered solutions for tough applications allows an engineer to specify the best coupler and probe design and material for the application. ABB can supply specialized couplers, rods, cables and probe-end connections. These components can be supplied in stainless steel, Hastelloy C276, Hastelloy B, Titanium, Tantalum, Monel 400 or Inconel 625.

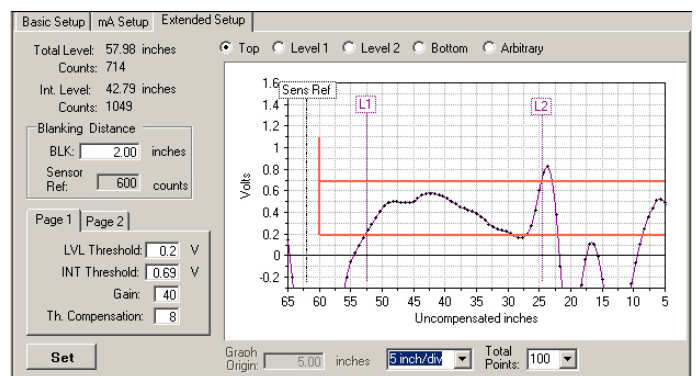




Time of flight

Guided wave radar uses the time domain reflectometry measurement principle.

- Microwave pulses are created and propagated down the probe or cable of the device.
- When the microwave pulse makes contact with a change in dielectric a reflection is created.
- ABB's radar sends and receives 64,000 pulses per second and provides two output readings in that time. The higher the dielectric of the material, the greater amount of energy reflected back to the transmitter.
- Using the time of flight principle, we measure the distance to the surface and back and then divide by two.

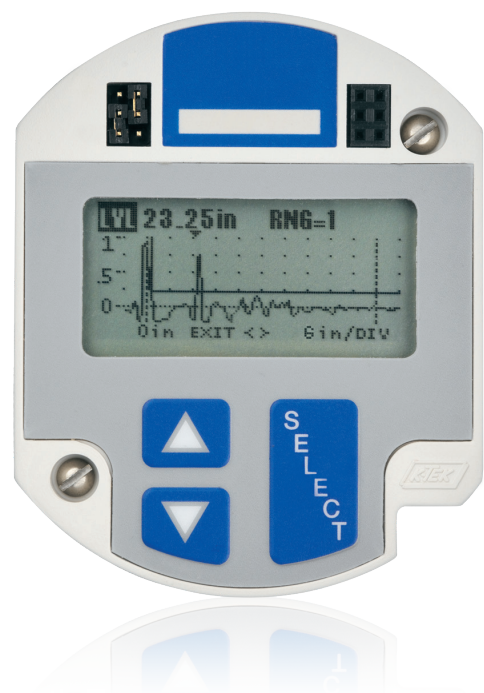


Graphic Display

The MT5000 series guided wave radar transmitters feature a graphic display incorporated into an all digital electronics module. Using this new format ABB has been able to add waveform screens to the modular electronics along with easy to follow multiple choice setup menus. These menus can be changed to many different languages for easy commissioning throughout the world. Pulses of microwave energy are directed to the product surface using a rigid rod or flexible cable type probe. This assembly has no moving parts and no loss of energy due to beam divergence. The waveform display allows engineers and technicians to view measurements in real-time and has onboard diagnostics.

Electronics

- HART Protocol
- Foundation Fieldbus
- Modbus



Industries and applications

The leader in level detection

Typical industries:

- Oil and gas production
- Refining
- Pharmaceutical and biotech
- Power generation
- Pulp and paper
- Iron and steel
- Chemicals
- Food and beverage
- Marine




Typical applications:

- Storage vessels
- Horizontal cylinders
- Open atmosphere sumps
- Cooling tower basin, flume and flumes
- Precipitator / fly ash
- Feedwater heaters
- Oil and gas separators
- Mud tanks
- Crude or hydrocarbon condensate tanks
- Process water tanks
- Crude oil storage tanks
- Chemical storage vessels
- Blending tanks
- Hydrocarbon storage vessels
- Fuel oil storage
- Sump or lift station
- Caustic tank
- Reactor vessels
- Ammonia storage
- Service water storage
- Demineralization tanks
- Makeup water storage
- Condensate storage
- Condenser sump or hotwell
- Deaerator
- Steam boiler drums
- Boiler blowdown tanks
- Flash tanks



Specifications

Radar level detection for liquids and solids

	MT5000	MT5100	MT5200
			
Process measurement	Liquid level	Liquid level, liquid / liquid interface level	Bulk solid level / Low dielectric applications
Features	<ul style="list-style-type: none"> Reliable level measurement over varied process conditions Standardization reduces inventory and training requirements Modular electronics 	<ul style="list-style-type: none"> Provides both lower and upper level fluid indications Flooded or non-flooded chambers Transmission of interface and upper fluid signals with the use of the optional RI100 repeat indicator Detection of the presence of a rag layer (patent pending) Weak interface signal detection 	<ul style="list-style-type: none"> Unaffected by dust No moving parts Unaffected by feed flow
Graphic display	Field selectable units in feet, inches, millimeters, centimeters, meters, or percentage and return signal waveform screens		
Housing	Dual compartment power, coated aluminum (standard) or stainless steel		
Power	13.5 - 36 VDC standard; 9-32 VDC foundation fieldbus; 10-18 VDC Modbus		
Output	Single 4-20 mA, HART, foundation fieldbus, MODBUS (RTU or ASCII)		
Resolution	+/- 0.0625 inches / 1.6 millimeters		
Process connection	3/4 inch NPT standard		
Menu languages	English, French, Russian, Italian, Spanish, Portuguese, Chinese (Mandarin)		
Accuracy	± 0.2 in / 5 mm	± 0.2 in / 5 mm upper level ± 1.0 in / 25 mm interface level	± 0.2 in / 5 mm direct measurement ± 1.0 in / 25 mm ULD mode
Approvals	Factory mutual (FM), Canadian standards association (CSA), GOST (Russian), ATEX, IEC, SIL2 and SIL3, INMETRO and NEPSI		
Measuring range	2 to 200 ft / 0.6 to 60.9 m	2 to 65 ft / 0.6 to 19.8 m	2 to 50 ft / 0.6 to 15.2 m
Sensor materials	316SS, Monel, Hastelloy C276 and B3, Titanium		316SS, Monel
Process pressure	Up to 5000 PSI / 344 bar		Up to 3000 PSI / 207 bar
Process temperature	Up to 800°F / 427°C		Up to 400°F / 204°C
Process dielectric constant	1.4 - 100 +	Upper fluid 1.6 - 5 Lower fluid 15 - 100+	Directly 3 < ULD Mode 1.3 - 3
Process viscosity maximum	1500 cp		N/A
Miscellaneous specifications	2000 PSI @ 635°F 138 bar @ 335°C, steam service	Secondary 4-20 mA output via RI100 repeat indicator	Bulk density 50 lb / ft ³ cable loading 10,000 lbs

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LST400

Ultrasonic level / open channel flow transmitter

Measurement made easy



Reduced installation cost

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

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

Wide range of applicability

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

LST400

Ultrasonic level / open channel flow transmitter

The LST400

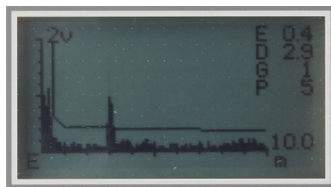
The LST400 is an ultrasonic level transmitter capable of measuring liquid level or solid applications up to 15 m (50 ft.) or flow rates in all types of open channel flow applications. The transmitter has a single 4 to 20 mA DC analog output with HART 7 and five (5) relay outputs. A transducer is fitted to the top of a silo or tank, facing down towards the material being measured.

The transmitter's microprocessor simultaneously fires an electronic pulse 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 surface of the material, 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 level of the product. Powerful software removes false echoes from the signal and electronic filters remove ambient noise.

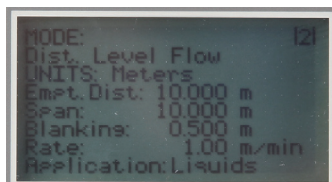
Save time on installation

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

- HART provides you with digital communication over existing plant infrastructure, really 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 get access to.



- The easy to use menu makes configuration a simple 1 minute task. All the settings required to start is in 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 automatically adjusting 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 the best 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 standard with 5 relays, open channel flow, AC and DC power, HART communication, and all sensors work with the standard LST400 transmitter.

Easy-access installation terminals

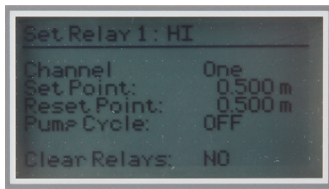
Easy access to the terminations ensures rapid and cost-effective installation. The wall-/pipe-mount version has been designed to ensure that cable connection is simple and convenient. Ingress protection of the electronics section is retained even when the terminal compartment cover is opened.



Fig.1: Terminal access on the LST400

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 requires no special skills 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 3 pumps being cycled. 3 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.

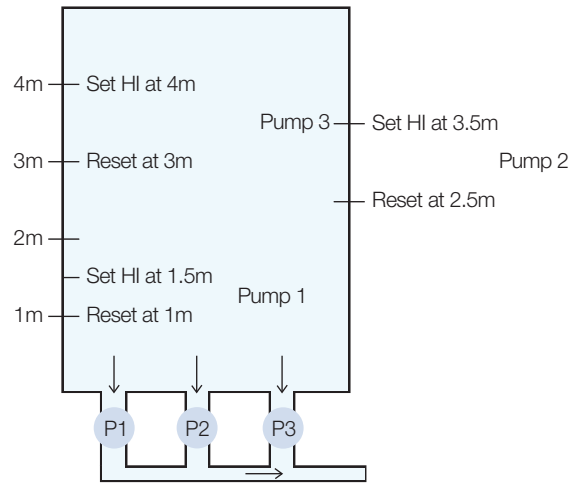


Fig. 2: Example of a pump cycling system

First In First Out(FIFO)

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

Rotate Pump Cycling

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

LST400

Ultrasonic level / open channel flow transmitter

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, 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

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

When using DC power, 24VDC PWR-IN

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

Relays

There are 5 relays on LST400, 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

4-20mA (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.

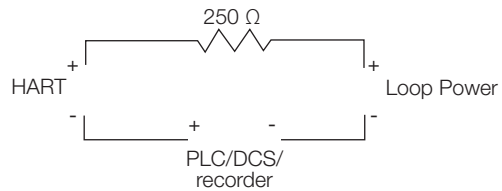
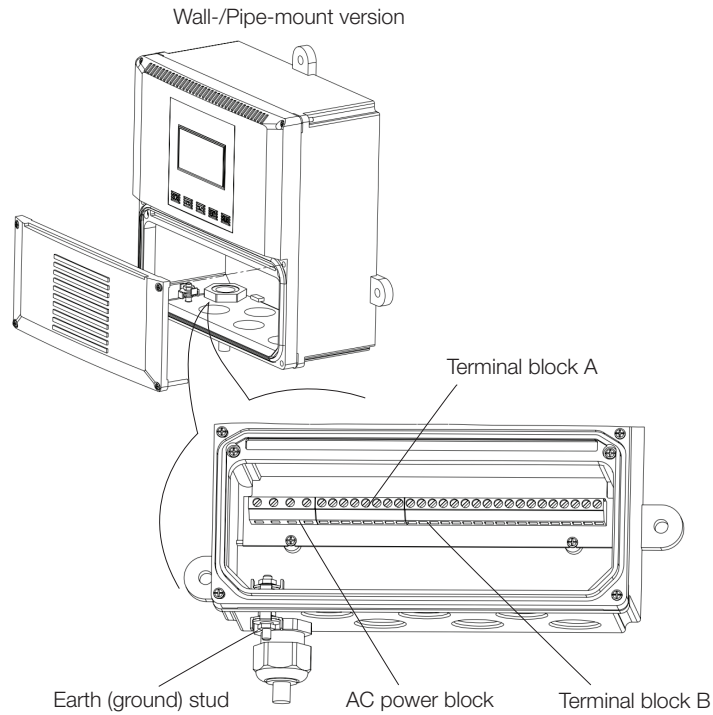


Fig. 3: Standard analog output connection diagram

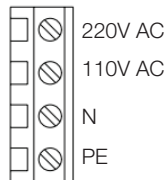
LST400

Ultrasonic level / open channel flow transmitter

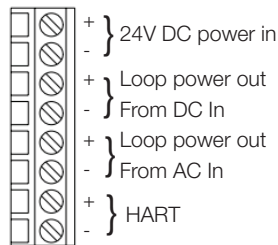
Terminal connections



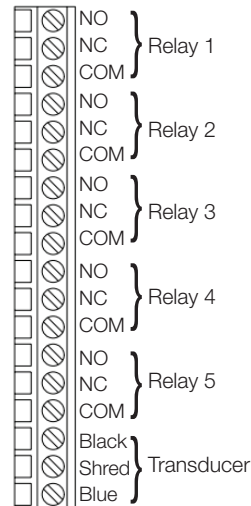
AC power block



Terminal block A



Terminal block B



Specification

General

Inputs

One level transducer with integrated temperature sensor

Range

0.5m to 15m

Accuracy

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

Repeatability

0.15% full span

Temperature compensation

NTC 10k Ω 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 1-6 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 8A, 115/230V AC, 8A DC

Analog output

Output ranges

4 to 20mA

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

Accuracy

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

Resolution

0.1% at 10mA, 0.05% at 20mA

Maximum load resistance

750 Ω at 20mA

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

Dimensions 192mm high x 230mm wide x 94mm deep

(7.56 in. high x 9.06 in. wide x 3.7 in. deep)

Weight 1kg (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 240V AC $\pm 15\%$, 50/60 Hz, 5VA

20 to 30V 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

LST400

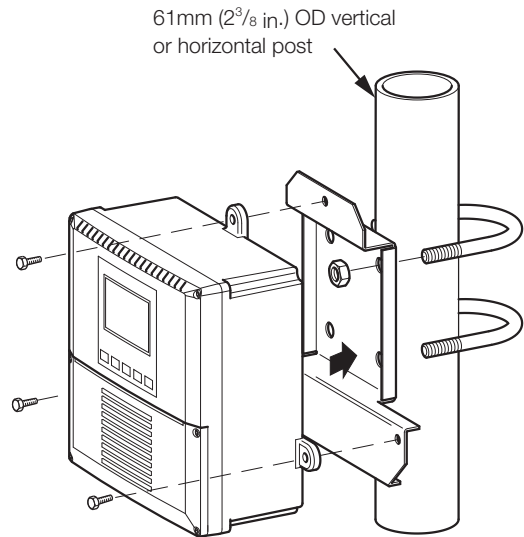
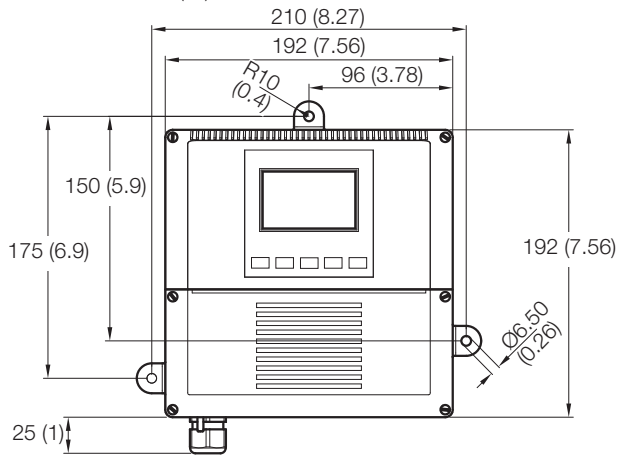
Ultrasonic level / open channel flow transmitter

Sensor specifications

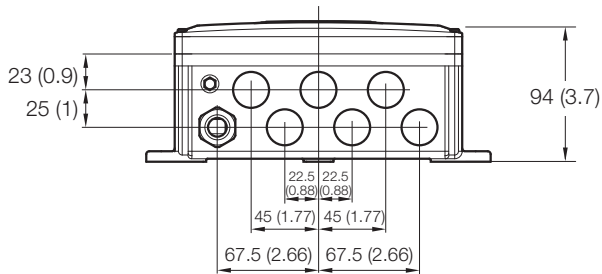
Type	S15	F15	C15
Model			
Design	For use on liquids and bulk solids up to 8m. Suitable for potable and waste water applications	For use in bulk solid level measurement up to 15m range. Foam face improves acoustic matching for better performance on solids.	Corrosion resistant housing ideal for chemically aggressive environments
Measurement range	0.5 to 15m	0.5 to 15m	0.5 to 15m
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	41kHz	41kHz	41kHz
Process temperature limits	-40°C to 90°C	-40°C to 90°C	-40°C to 90°C

Dimensions

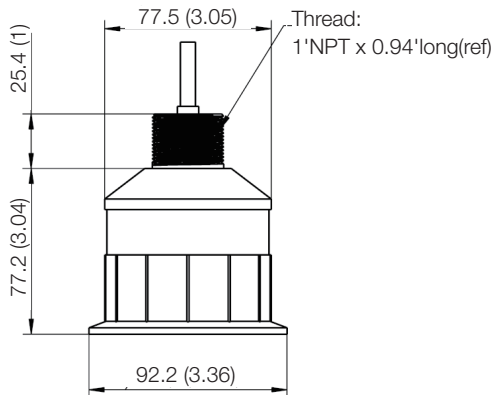
Dimensions in mm (in.)



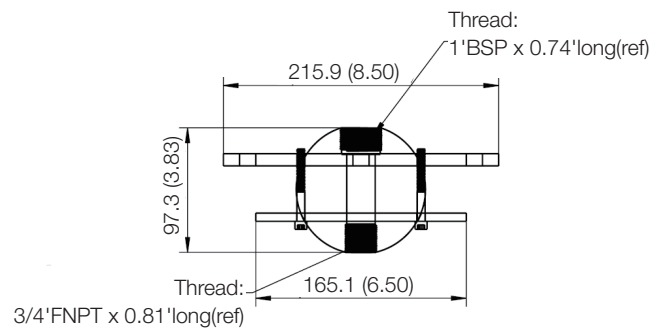
Pipe-mount detail



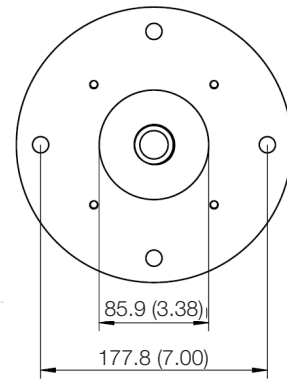
Wall-/Pipe-mount version



Sensor



Aiming kit



LST400

Ultrasonic level / open channel flow transmitter

Ordering information

Basic ordering information for LST400

Some updates to the product options. The product code stays the same, only options are added. Also 1 new sensor is added. Here they are:

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

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
Signal cable length								
Without signal cable	SC0							
10m (approx. 30ft.)	SC2							
20m (approx. 66ft.)	SC4							
30m (approx. 98ft.)	SC6							
40m (approx. 131ft.)	SC8							
50m (approx. 164ft.)	SCA							
Sensor options								
Aiming kit		SEK						
Flange Options								
Flange, 3 in. ANSI / ASME connection, PVC								FA3
Flange, 4 in. ANSI / ASME connection, PVC								FA4
Flange, 6 in. ANSI / ASME connection, PVC								FA6
Flange, 80 mm connection, PVC								FD3
Flange, 100 mm connection, PVC								FD4
Flange, 150 mm connection, PVC								FD6
Bracket Shape / Material								
For pipe mounting / Stainless steel								B2
Device Identification Plate								
Adhesive label with TAG no.								TC
Certificates								
Inspection certificate for calibration with test report								CR
Shipping Certificates								
Certificate of origin								GS1
Attested certificate of origin								GS2
Documentation Language								
English								M5
Chinese								M6

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Sales



Service

TS

Thermal Dispersion Switch

Thermal Dispersion flow/level/ temperature switch sanitary K-TEK Products



Features

- For Liquids or Small Granular Solids
- One Switch for Gas or Liquid Flow, Liquid Level, Interface Level or Temperature
- No Moving Parts
- Designed to 3A Standards
- 316L Stainless Steel All Welded Construction Standard
- Explosion Proof
- Temperature Range -50 to 350°F / -46 to 177°C Standard
- Pressure to 500 psig / 34.5 bar Standard

Options

- Electropolished Wetted Parts
- Extended Sensor
- Remote Mounting
- Ceramic Glass to Metal Feedthrough Provides Secondary Pressure Boundry

SPECIFICATIONS

Sensor

Materials of Construction	316L Stainless Steel 240 Grit Polish Standard
Response Time	No Flow to Flow: From 3 Seconds; Flow to No Flow: From 8 Seconds Level: $\pm 1/8"$; Temperature from 1 Second
Operating Temperature	-50 to 350°F / -46 to 177°C Standard
Operating Pressure	Full Vacuum to 500 psig / 34.5 bar Standard
Repeatability	Flow: 0.5% of maximum flow rating at Constant Conditions Standard Level: $\pm 1/8"$; Temperature: $\pm 1^\circ\text{C}$
Process Connection	1-1/2" Tri-Clamp Sanitary Fitting for Short Leg Tee Mounting
Insertion Length	Options: 2" Tri-Clamp, Flanges, Customer Specified Connections 1.8" / 45.7mm Standard Option: 1.2" / 30.5mm Insertion Length; Customer Specified Insertion Length

Electronics

Housing	Powder Coated Aluminum Standard Optional: Dual Compartment Aluminum; Dual Compartment 316L SS
Operating Temperature	-50 to 140°F / -46 to 60°C Ambient Standard Option: Remote Mounting of Electronics Up to 2000 ft. / 609 meters
Power Input	90-132 VAC, 50/60 Hz, 5.5 watts max Standard Options: 24 VDC, 24 VAC, 208-240 VAC
Relay Output	DPDT 8 amps @ 250 VAC
Conduit Entry	3/4" FNPT Standard
Approvals	CL I, Div I, GP A,B,C,D; CL I, Div II, GP E,F,G; Div III, DIP, NEMA or Type 4X FM: T3A @ Ta = 60C CSA: T3C @ Ta = 60C (For A, A1 and S housing options) GOST Russia, GOST Kazakhstan: 1ExdIICT3
Shipping Weight	5 lbs standard

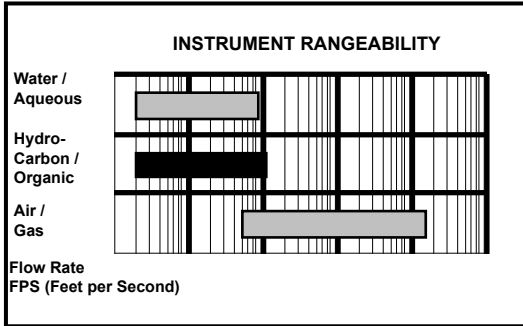
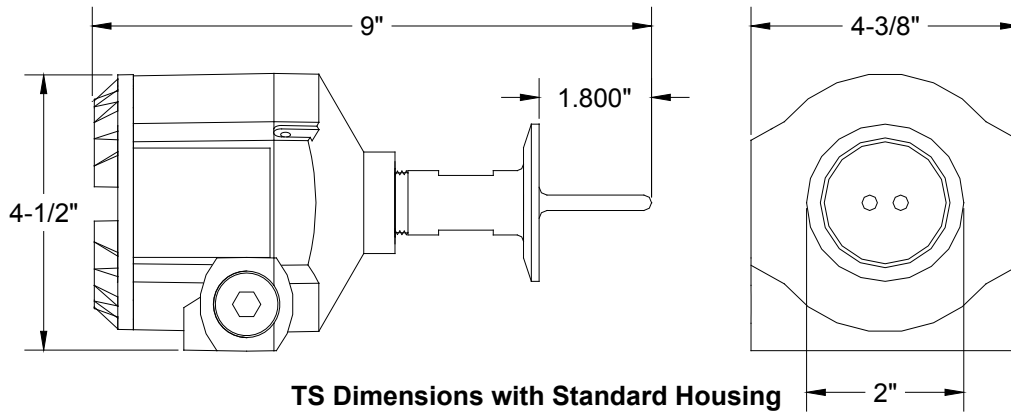


ORDERING INFORMATION:

TS / a / b / c / d / e / f / g / h :

/a Housing			
A1	Single Compartment Aluminum Housing Standard		
A1W	Single Compartment Aluminum Housing with glass window cover		
A	Dual Compartment Aluminum Housing		
AW	Dual Compartment Aluminum Housing with Glass Viewing Window		
S	Dual Compartment 316L Stainless Steel Housing		
SW	Dual Compartment 316L Stainless Steel Housing with Glass Viewing Window		
/b Material Type			
S6	316L Stainless Steel 240 Grit Mechanical Polish Standard		
EP	316L Stainless Steel 240 Grit and Electropolish		
/c A) Process Connection			
1005	1" / 1-1/2" Tri-Clamp Standard	500 psig @ 70°F / 34 bar @ 21°C	300 psig @ 250°F / 20 bar @ 121°C
2005	2" Tri-Clamp	450 psig @ 70°F / 31 bar @ 21°C	300 psig @ 250°F / 20 bar @ 121°C
/d Insertion Length			
1.8	1.8" / 45.7 mm Insertion Length Standard		
1.2	1.2" / 30.5 mm Insertion Length		
Length	Customer Specified Length in Inches or Millimeters (1.2" / 30.5 mm minimum)		
/e Power Input			
1	90-132 VAC Standard		
2	24 VDC or VAC (22.8 - 28.8 VDC; 20 VAC - 25 VAC)		
3	200-240 VAC		
/f Process Temperature			
H0	-50 to 350°F / -46 to 177°C Standard		
/g Approvals			
X	Not FM or CSA Approved		
FMX	Factory Mutual Research Corp. (FMRC) Explosion Proof Standard		
CSX	CSA Canadian Standard Association Explosion Proof		
GR	GOST Russia		
GK	GOST Kazakhstan		
/h Options (leave blank if no options required)			
DS	Dual Switch Point Electronics with Millivolt Output		
RJxxxx	Remote Electronics with PVC Cable (200°F / 93.3°C) Specify cable length "xxxx" ft. (Max. Length 2000 ft. / 609 m)		
RFxxxx	Remote Electronics with Teflon® (registered trademark of DuPont) Cable (350°F / 177°C) Specify cable length "xxxx" ft. (Max. Length 2000 ft. / 609 m)		
HS	5 Pin Hermetic Feed-through (not offered with Titanium)		





VOLUMETRIC (GPM OR CFM) TO VELOCITY (FPS)
Conversion Chart

LINE SIZE	1/8"	1/4"	3/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"
Liquid Multiplier	5.65	3.08	1.68	1.06	0.602	0.371	0.215	0.158
Gas Multiplier	42.19	23.06	12.57	7.909	4.5	2.776	1.61	1.18
Line Size	2"	2-1/2"	3"	3-1/2"	4"	5"	6"	8"
Liquid Multiplier	0.0956	0.067	0.0434	0.0325	0.0252	0.016	0.0111	0.006
Gas Multiplier	0.7161	0.519	0.3248	0.2427	0.1884	0.12	0.083	0.048
Line Size	10"	12"	14"	16"	18"	20"	24"	
Liquid Multiplier	0.00407	0.00287	0.00237	0.001815	0.001434	0.001154	0.000798	
Gas Multiplier	0.0304	0.0209	0.0177	0.0136	0.0107	0.00863	0.00597	

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GP50

Vibrating fork level switch

KTEK products

Measurement made easy



Features

- Accepts universal input voltage
- Acceptable for most bulk materials
- Modular & simple design
- Maintenance free
- No calibration required
- Self-cleaning
- Robust fork design with patented piezo crystal sensing element

Options

- Mounting plate/flange
- Extensions to 156 in./3962 mm
- General purpose indicator light

The Model GP50 is a vibrating level switch that detects the absence or presence of dry bulk solids in bins, silos or hoppers. The GP50 provides a contact output indicating a high or low level alarm. Typical Products include lime, styrofoam, flour and plastic pellets. The GP50 can detect products with densities as low as 1.3 pcf (20 kg/m³).


The GP50 is a compact and robust design, suitable for top or side mounting. The constant vibration of the fork tines provides self-cleaning characteristics for products that do not coat or cake. The unique design of the fork and crystal assembly eliminates false level readings.

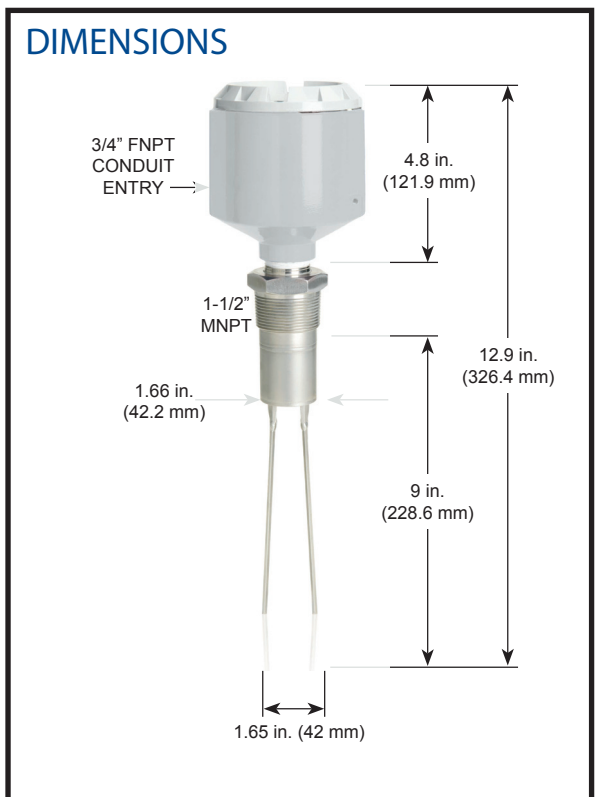
The GP50 sends a signal from the electronic circuitry to excite a patented piezo element in the probe. This causes the fork to vibrate at a frequency of 125 Hz. If the fork is covered by material, the change in vibration is detected by the circuitry which causes the relay to change state after a one second delay. When the fork is free from material, full vibration resumes and the relay reverts to its normal condition.

APPLICATIONS

The Model GP50 can be used in products that do not have heavy build up on forks. The Model GP50 can handle dense materials such as cement (80 pcf) to extremely light products like styrene (2 pcf). A wide range of applications are also found in dry food processing.

SPECIFICATIONS

Enclosure	Single Compartment Cast Aluminum, Powder Coated
Electrical Connection	(2) 3/4 in. FNPT Connections
Power Supply	Universal Input Voltage: 19 - 253 VAC, 50/60 Hz, 19 - 60 VDC
Fork Material	316 Stainless Steel
Material Specification	Granular bulk solids and powders that do not cake or coat; Minimum density 1.3 pcf (20 kg/m ³); maximum grain size 0.40 in (10mm)
Process Connection	1-1/2 in MNPT
Temperature Range	Sensor: -13 to 302°F / -25 to 150°C Electronics: -13 to 140°F / -25 to 60°C
Output	1 ea SPDT Relay, Maximum Contact Ratings: AC: 253 VAC, 4 A, 500 VA, Resistive DC: 253 VDC, 4 A, 60 W Switch Status Display via Integral LED Signal Delay: Probe free to covered: 1 second Probe covered to free: 1 to 2 seconds Sensitivity: Adjustable in 2 levels
Pressure	Maximum 232 psi / 16 bar
Classification	General Purpose 

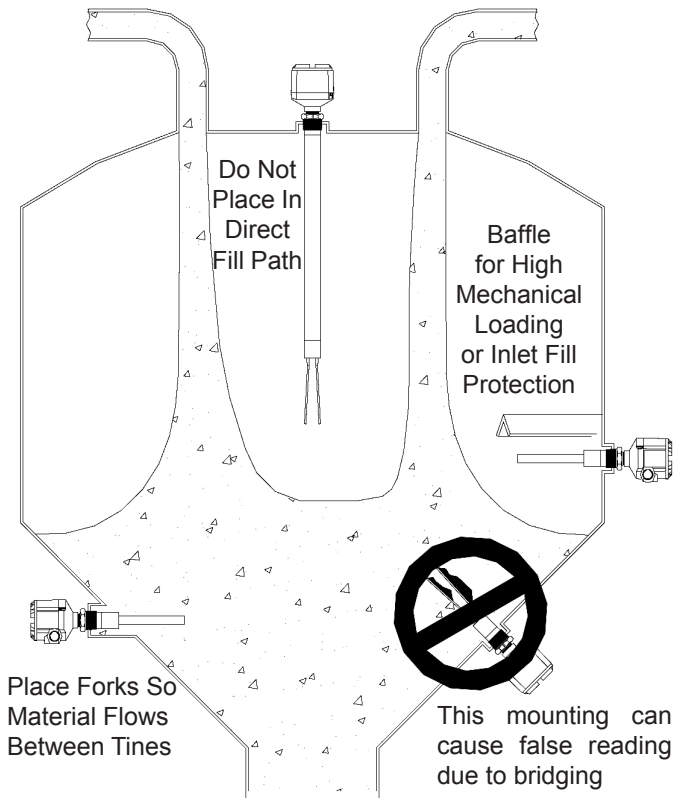


ORDERING INFORMATION

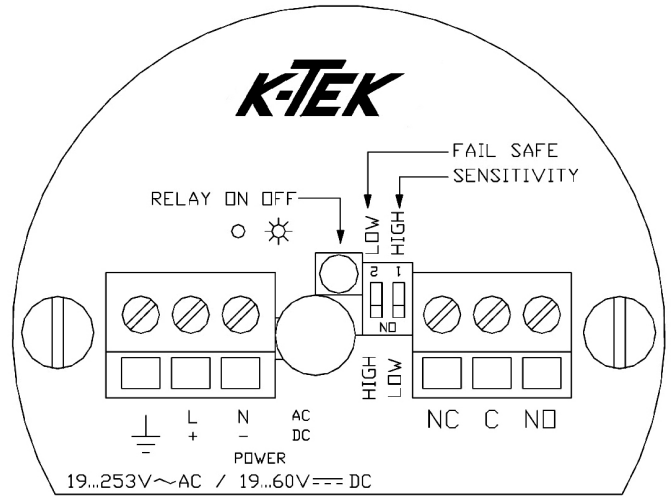
GP50/a/b/c/d:

Notes:	1. Accessories must be ordered separately.
/a Insertion Length	
X	Standard length 9 in. / 229 mm
Lxxx	Custom Length; xxx from 10 - 156 in. / 254 to 3962 mm
/b Process Connection	
P	1.5 MNPT (Standard)
WP	Welded Flange, 2" minimum; (Specify Type & Size from SLG-0001-1 Flange Guide)
FL	Flange Shipped Loose with 1-1/2" FNPT Process Connection Drilled & Tapped; 2" minimum; (Specify Type & Size from SLG-0001-1 Flange Guide)
Tnn	Tri-Clamp; Specify 'nn' as follow: 20 = 2.0", 25 = 2.5" up to 6"
/c Approvals	
X	None (Housing is FM Approved)
/d Options	
X	None
L2	120 VAC - Indicating Lamp (General Purposes Only)
L3	240 VAC - Indicating Lamp (General Purposes Only)
R	Remote Housing (20 ft. / 6.1m) max.

GENERAL INSTALLATION GUIDELINES

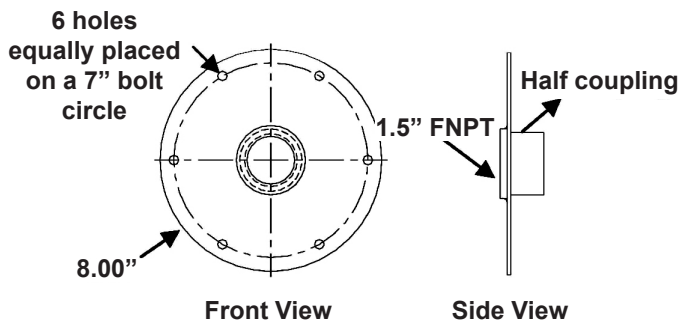


WIRING CONNECTIONS



DS/GP50-EN Rev. J 04.2014

MP6 MOUNTING PLATE DETAIL REQUIRED FOR PADDLE SWITCH REPLACEMENT



For more information, please contact:

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Note

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LM80

Laser level transmitter

Measurement made easy

Intermediate range
level products



Level measurement made easy

- Maintenance free, non-contact continuous level transmitter
- No calibration required
- Continuous level monitoring for granular solid materials and opaque liquids
- Measures solids and opaque liquids at any angle
- Built-in laser pointer for accurate alignment in narrow or tall vessels
- Auto-ranging to measure all levels
- Available non condensing heated optics prevent condensation issues

A convenient solution

- Rugged and robust powder coated aluminum or stainless steel enclosures can be used in any environment
- CSA, ATEX and IECEx potentially explosive atmosphere ratings
- Easy to install and configure without filling or emptying the vessel
- 4-20 mA and dual relay outputs

High performance

- Less than 0.3° beam divergence for precision targeting
- No false echoes
- Range up to 100 m (330 ft.) for level applications and up to 150 m (490 ft.) for positioning applications.
- Three updates per second
- Can penetrate moderate dust

Many different materials

- Measures all clearly visible surfaces irrespective of texture, granularity, slope and / or color
- Measures any opaque liquid level independent of dielectric constant or other physical properties
- Accurately measures to the surface of mineral ores, grains, and synthetic materials
- Examples include: gold and metal ores, coal, corn, rice, coffee, plastic pellets, oils and fuels

Many different vessels

- Works in all types of storage vessels including silos, tanks, feed chutes, bunkers and hoppers
- Can measure through narrow gaps
- Reads to the bottom of silos and tanks

Options and accessories

- Stainless steel dust tubes and cooling tubes
- Stainless steel 4 and 6 inch universal mounting plates sized for ANSI 150 and DIN PN10 flanges
- Stainless steel raised face ANSI and DIN Flanges
- 4" Triclover fittings
- Handheld configuration device (LCD2)

LM80

Laser level sensor

Overview

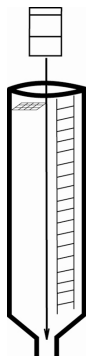
The laser level transmitter (LM80) is a non-contact, level measuring instrument designed for granular solid materials and opaque liquids. Based on pulsed laser technology, the LM80 embodies speed and accuracy in a single, easy to use and install product. The characteristic narrow beam divergence of the laser permits direct aiming to the target surface without interference from structure or falling material. With both continuous 4-20 mA and single point relay outputs, the LM80 can operate as a process control transmitter while simultaneously providing high and low alarms. Whether measuring a few meters into the confined space of a crusher, or to the bottom of the tallest silo, the LM80 with its laser pointer and long range is the plug-and-play solution to level measurement.

Level measurement with laser technology

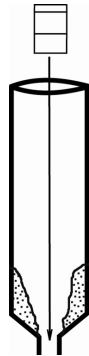
The LM80 uses a high speed laser pulse to measure distance. The laser light is emitted towards the surface and some of it reflects back to the instrument where it is detected by a sensitive optical receiver. The time it takes for the light to travel to the surface and back to the instrument is directly proportional to the distance between the instrument and the surface. Using a time-of-flight calculation, and knowing the height of the vessel, the LM80 accurately measures the distance to the target surface using the equations below:

$$\text{Distance} = \frac{\text{speed of light} \times \text{time-of-flight}}{2}$$
$$\text{Level} = \text{height} - \text{distance}$$

The unique characteristics of laser light give the LM80 significant performance advantages over other technologies. The narrow, long range beam can measure both near and far distances while the optical wavelength makes it easy to evaluate applications. If you can see the surface clearly, the LM80 can measure the level.



Easy measurement in Silos with an internal structure and/or buildup



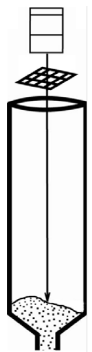
Level silos and bins. Ideal for pellets, grain, coffee, coal, dry bulk solids, opaque liquids and powders



Measures surfaces at any angle.



Non-contact, level measurement through obstacles such as protective grids etc



Range guide

The LM80 is mounted on top of a storage vessel aiming downwards towards the surface. Using the visible laser pointer, the position and angle of the LM80 can be adjusted so that the instrument measures all the way to the bottom of the vessel. Settings such as: the distances for the 4-20 mA output; and the relay switching points, can be entered into the instrument either before installation, or in situ using the laser configuration (LCD2) accessory. Another recommended accessory is the stainless steel dust tube (P801) which keeps the optical system of the LM80 clean for long periods.

Range explained

The LM80 is able to measure the level in tall silos because of the inherent long distance capability of laser technology. The laser has a natural advantage because it gets strong, clear signals from most types of granular solid materials. As the laser beam doesn't spread out and lose strength as it travels, there is little signal loss with increased distance.

Auto-ranging

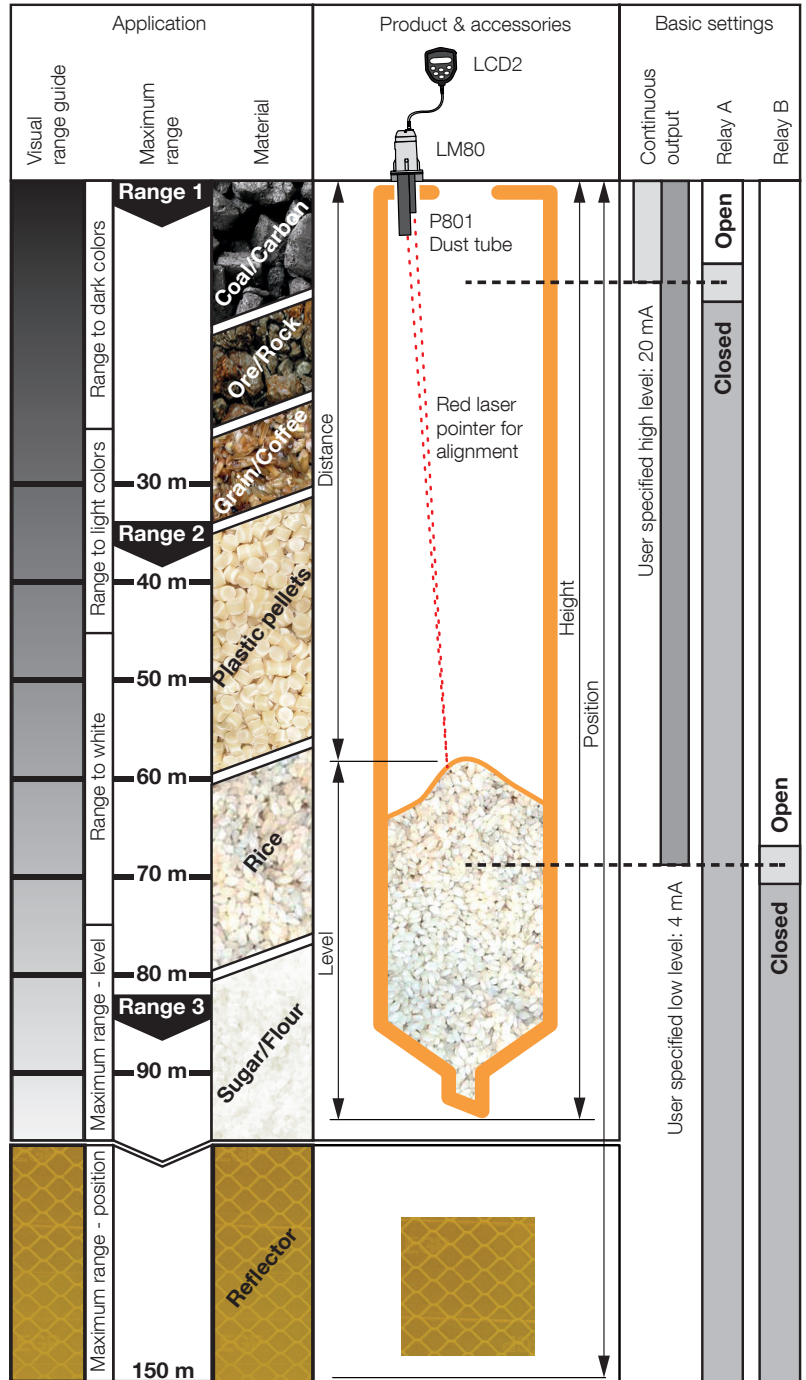
Auto-ranging is a hardware feature which increases the range of the internal timing circuitry of the LM80. It does this in response to the 4-20mA or relay set points that are entered by the user. If these settings are less than 35 m (114.8 ft) then automatic "Range 1" is used. Between 35 m (114.8 ft) and 85 m (278.9 ft), automatic "Range 2" is selected. As the LM80 switches between these ranges there is no loss of accuracy, only a slight reduction in measuring speed.

Ultimate range

The ultimate limit of range for the LM80 depends on the reflectivity of the material being measured, not on the height of the vessel. Dark colored materials can be measured over a shorter range than light colored materials. Using the chart on the left, a visual comparison between the graded "Visual range guide" strip and the surface to be measured tells you what range is practically possible.

Positioning range

When the LM80 is used for positioning applications with a reflective target it can measure to a maximum distance of 150 m (500 ft).



LM80

Laser level sensor

Specifications

Measurements	
Range	0.5 m (1.5 ft) to 30 m (100 ft) - dark colored surfaces 0.5 m (1.5 ft) to 100 m (150 ft) - light colored surfaces 0.5 m (1.5 ft) to 150 m (500 ft) - reflective targets in positioning applications
Resolution	±10 mm (0.4 in)
Accuracy	±30 mm (1.2 in)
Update rate	3 readings per second (maximum), 1 reading per minute (minimum)
Operating temperature	-40 °C to +60 °C (-40 °F to +140 °F) -40 °C to +45 °C (-40 °F to +113 °F) with non-condensing option (heated lens option (AC and SC)) Note: While the initial (cold start) accuracy of the LM80 will be within specifications, a settling period of approximately 15 minutes is recommended to allow the electronics to warm up and the internal temperature to stabilize.
Survival temperature	-40 °C to +80 °C / -40 °F to +176 °F
Pressure	1 bar
Outputs	
Analog	4-20 mA, NAMUR compliant non-isolated and self powered
Digital (Relay)	2 SPST relays: 0.5 A at 120 VAC, 0.25 A at 250 VAC, 1 A at 24 VDC, 0.5 A at 60 VDC
Communication	Standard male DB9 connector - RS232 for testing, troubleshooting and configuration 19200 baud, 8 data bits, 1 stop bit, no parity, no flow control
Power supply	
Voltage	24 V DC typical (18 to 32 V DC)
Current	0.4 A peak, 0.2 A continuous 0.52 A peak, 0.32 A continuous with non-condensing optics
Mechanical	
Base plate diameter	Flange - 140 mm (5.51 in) Triclover - 120 mm (4.72 in)
Length	Flange - 172 mm (6.77 in) Triclover - 166 mm (6.54 in)
Weight	Aluminum enclosure - 1.6 kg (3.53 lbs) Aluminum enclosure with triclover - 2.2 kg (4.85 lbs) 316 Stainless steel enclosure - 4.2 kg (9.26 lbs)
Enclosure material	Powder coated aluminum standard, 316 stainless steel option
O-ring seal material	Buna-N (Nitrile Rubber)
Mounting / process connection	Flange - 4 holes, 8.5 mm (0.33 in) diameter on 120 mm (4.72 in) diameter circle Triclover - 316 Stainless steel plate with seal groove

Optical	
Total optical aperture	90 mm (3 in)
Measuring laser lens diameter	25 mm (1 in)
Receiver lens diameter	50 mm (1.97 in)
Lens material	Acrylic
Lens impact resistance	Impact tested at 4 joule
Beam divergence	$\Delta < 0.3^\circ$
Beam spot diameter	$2R \tan\left(\frac{\Delta}{2}\right)$
	Where R is the range to the target and Δ is the beam divergence
Beam direction	$90^\circ \pm 1^\circ$ from mounting flange
Laser	
Measuring laser	905 nm near infrared pulsed semiconductor laser 12 mW average power output 20 W peak power output
Pointing laser	635 nm red semiconductor laser 3 mW continuous
Measuring laser life expectancy	25 years typical MTBF
Measuring laser safety	Always on IEC60825-1 class 1M laser A class 1M laser is safe for all conditions of use except when passed through magnifying optics. This means the maximum permissible exposure cannot be exceeded when viewing the laser with the naked eye without the aid of magnifying optics.
 Pointing laser safety	Intermittent IEC60825-1 class 3R laser Laser comes on at power up for 2 minutes, it can be turned back on for commissioning using the LCD2 communications and configuration device. A class 3R laser is considered safe if handled carefully, with restricted beam viewing. With a class 3R laser the maximum permissible exposure can be exceeded when viewing the laser with the naked eye, but with a low risk of injury.
	
Purge	
Purge air flow	Must be oil free dry air recommended flow between 0.5 and 4 l/minute maximum pressure 5.5 bar (80 psi)
Purge fitting	1/8 NPT
Environmental	
Enclosure rating	IP66/Nema 4X (Dust proof, can be washed down with high pressure hose)
Gas rating	This equipment can be used in flammable gases or vapor hazardous locations.






Documentation for LM80 laser level transmitter is available for download from www.abb.com/level

LM80

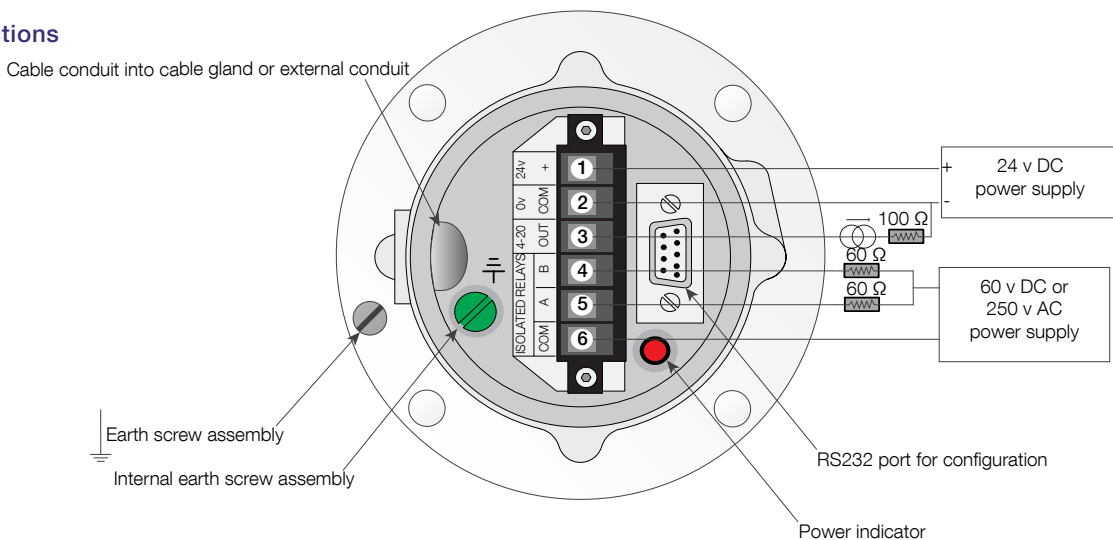
Laser level sensor

Approvals

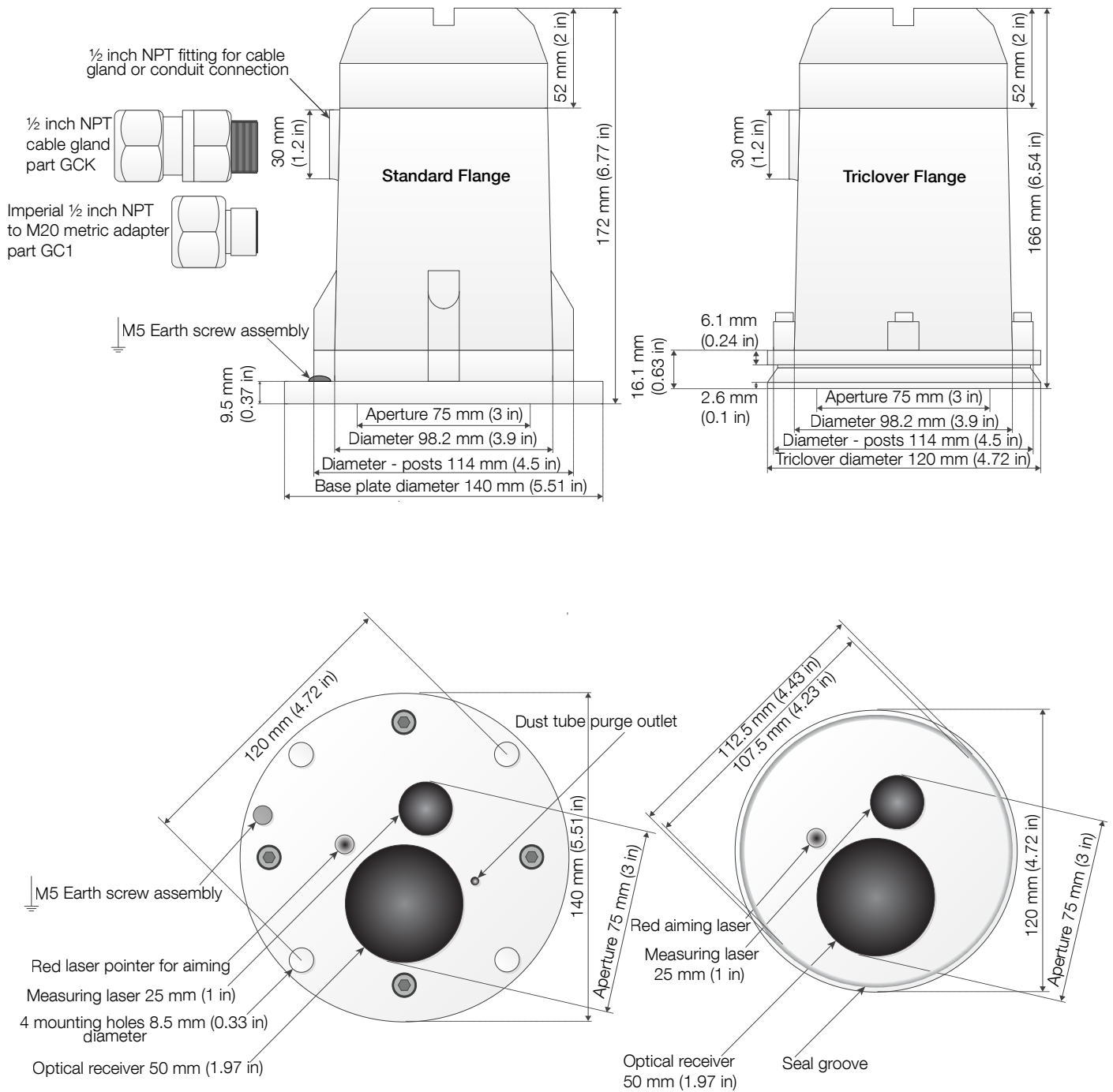
The instrument is certified with the following environmental safety ratings which must not be exceeded. Copies of instrument certifications are available on request.

<p>CE</p> 	<p>Quality standard: ISO9001:2008 ATEX directive 94/9/EC Electromagnetic compatibility directive 2004/108/EC Low voltage directive 2006/95/EC CE marking directive 93/68/EEC</p>	<p>Harmonized standards applied: EN 60079-0:2012, EN 60079-15:2010 EN 60079-28:2007, EN 60079-31:2009 EN/IEC 61326-1 electrical equipment for measurement, control and laboratory use - EMC requirements EN/IEC 60825-1 safety of laser products - part 1: equipment classification, requirements and user's guide</p>
<p>ATEX, IECEx</p> 	<p>Notified body: SIRA Certification service, Rake Lane, Eccleston, Chester, CH4 9JN, England II 3G Ex nA nC IIC T4 Gc Sira 07ATEX4179X II 3G Ex op is IIC T4 Gc Sira 07ATEX9180X II 2D Ex tb IIIC T85°C Db IECEx SIR 12.0120X -40°C to +60°C (-40°F to +140°F) -40°C to +45°C (-40°F to +113°F) with non-condensing option (heated lens option (AC and SC))</p>	
<p>CSA</p> 	<p>Class I, Division 2, Groups A, B, C and D; Class II and III, Groups E, F and G; T4A; Ex nA nC IIC T4; Ex tb IIIC T85°C; Class I, Zone 2, AEx nA nC IIC T4, AEx opis IIC T4 Gc; Class II, AEx tb IIIC T85°C, Type 4X enclosure -40°C to +60°C (-40°F to +140°F) -40°C to +45°C (-40°F to +113°F) with non-condensing option (heated lens option (AC and SC))</p>	
<p>FM</p> 	<p>Non-Incendive for Class I, Division 2, Groups A, B, C, and D; Dust-Ignitionproof Class II and III, Groups E, G, and F; Non-sparking with Enclosed Break Contacts for Class I, Zone 2, AEx nA nC Group IIC; and as Protection by enclosure for Class III AEx tb IIIC T85 hazardous (classified) location; indoor/outdoor location Type 4X/IP66.</p>	
<p>GOST-R (pending)</p> 	<p>2ExnAnCTTCT4</p>	

Electrical connections



Dimensions



LM80 Laser level sensor

Accessories



Dust tube (P801)	
Base plate diameter	140 mm (5.51 in) mounts on LM80 standard flange
Length	257.2 mm (10.125 in)
Material	304 Stainless steel
Gasket material	Black neoprene rubber durometer rating shore 60A
Function	Static air space prevents dust buildup, can be purged

Cooling tube (P802)	
Base plate diameter	140 mm (5.51 in) mounts on LM80 standard flange
Mounting plate diameter	140 mm (5.51 in) compatible with LM80 mounting accessories
Length	260.4 mm (10.25 in)
Material	304 Stainless steel
Function	Offset from hot process interface to allow convection cooling, can be purged

Mounting plates		
Nominal diameter	4 in / DN 100	6 in / DN 150
Part number	P804	P806
Outer diameter	228 mm (8.96 in)	284 mm (11.18 in)
Mounting bolt pattern	Dual pattern ANSI/DIN ANSI class 150 : 8 bolts, size 5/8 in, bolt circle 7.5 in DIN PN 10 : 8 bolts, size 18 mm, bolt circle 180 mm	Dual pattern ANSI/DIN ANSI class 150 : 8 bolts, size 3/4 in, bolt circle 9.5 in DIN PN 10 : 8 bolts, size 22 mm, bolt circle 240 mm
Material	304 Stainless steel	
Pressure rating	No pressure rating, atmospheric pressure only	

Mounting flanges				
Nominal diameter	4 in raised face	6 in raised face	DN 100	DN 150
Part number	F804	F806	F810	F815
Outer diameter	9 in	11 in	220 mm	285 mm
Mounting bolt pattern	ANSI class 150 8 bolts, size 5/8 in Bolt circle 7.5 in	ANSI class 150 8 bolts, size 3/4 in Bolt circle 9.5 in	PN 10 8 bolts, size 18 mm Bolt circle 180 mm	PN 10 8 bolts, size 22 mm Bolt circle 240 mm
Material	304 Stainless steel			
Pressure rating	No pressure rating, atmospheric pressure only			

Adjustable swivel flange (S800)	
Outer diameter	180 mm (7.1 in)
Mounting bolt pattern	4 bolt holes, 8.5 mm (0.33 in) diameter, bolt circle 160 mm (6.29 in)
Height	25.4 mm (1 in)
Tilt angle for aiming	Continuously adjustable from 0° to 6°
Material	Aluminum

Adjustable pivot bracket (A800)	
Outer diameter / width	160 mm (6.3 in)
Opening diameter	90 mm (3.54 in)
Mounting plate thickness	4.76 mm (0.19 in)
Mounting bolt	HHCS screw 5/16-18, bolt hole 8.33 mm (0.33 in)
Height of pivot	25.4 mm (1 in)
Tilt angle for aiming	Continuously adjustable over 180°
Material	304 Stainless steel

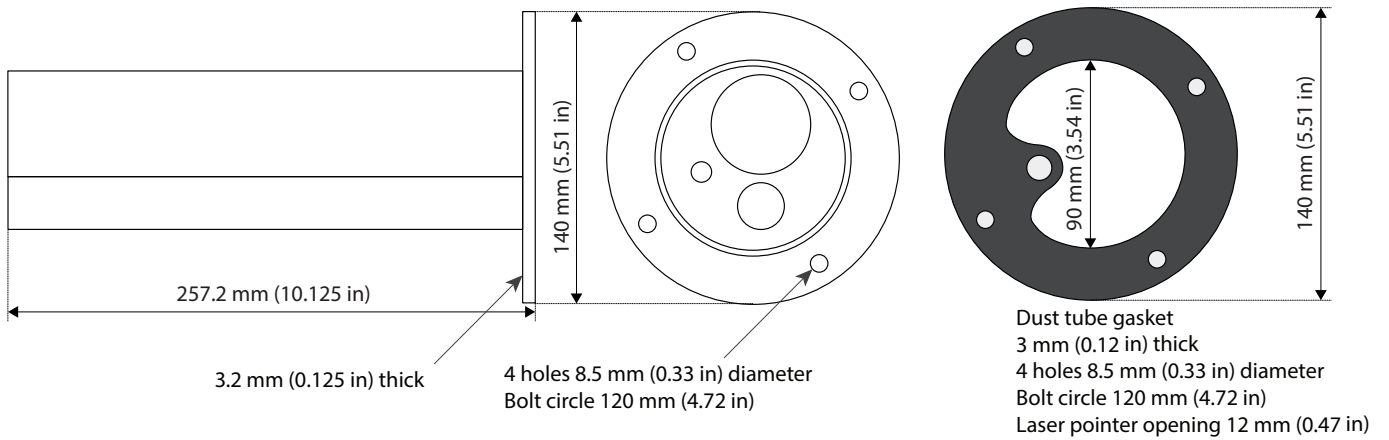
LM80

Laser level sensor

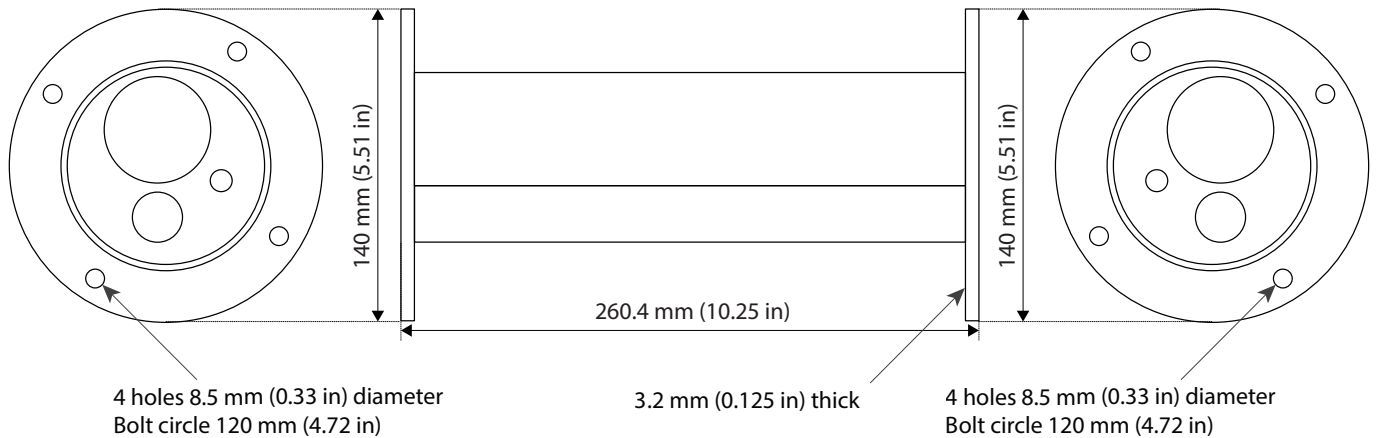
High pressure sight glass (HPSG)	
Window diameter	101.6 mm (4 in)
Outer diameter	152.4 mm (6 in)
Spray ring	Open channel, 1/8 NPT fitting for purge or cleaning fluid injection
Thickness	12.7 mm (0.5 in)
Material	316 Stainless steel
Pressure rating	10 bar (150 psi)
Temperature rating	230 °C (450 °F)
Communication/configuration device and local display (LCD2)	
Protocol	RS232 ASCII menus
Connector	Standard female DB9
Interface	Monochrome LCD display / 6 button keypad
Size	Width 55 mm (2.17 in), Height 97 mm (3.82 in), thickness 32.5 mm (1.28 in)
Material	Plastic enclosure
Cable length	150 cm (59 in)
Warning	Not rated for dust or gas / cannot be used in hazardous area
RS232 to USB cable (USBR)	
Function	Connect to standard PC for configuration
Description	Made up of two cables that work together: Standard DB9 female to female null modem RS232 cable Standard male DB9 to full size type B female USB
Cable length	Null modem DB9 cable 305 cm (120 in) DB9 to USB cable 45 cm (17.7 in)
Recommended software	Windows: PuTTY free open source terminal emulator Mac OS X: Terminal built in terminal emulator
Warning	Not rated for dust or gas / cannot be used in hazardous area
Reflector (REFL)	
Function	Reflective panel for positioning applications up to 150 m
Size	90 cm x 90 cm (36 in x 36 in)
Material	Aluminum with reflective paint
Cable glands (GCK)	
Description	Set of 2 Ex cable glands with 1/2 in. NPT thread, size 0 / 8 mm and size 00 / 12 mm
Metric adaptor (GC1)	
Description	Exd/e Flameproof imperial to metric adapter, 1/2 inch NPT to M20
Function	Enables use of metric M20 threaded conduits or cable glands with LM80
Battery pack (BPK)	
Function	Provide stand-alone power to LM80 for mobility and demonstration purposes
Battery	2 standard 9 volt batteries
Height	97.5 mm (3.84 in)
Diameter	110 mm (4.33 in)
Connector	Standard male DB9 compatible with LCD2 and USBR
Demo Kit	
Description	Rugged carrying case with LM80, dust tube, LCD2 and battery pack

Accessory dimensions

Dust tube (P801)



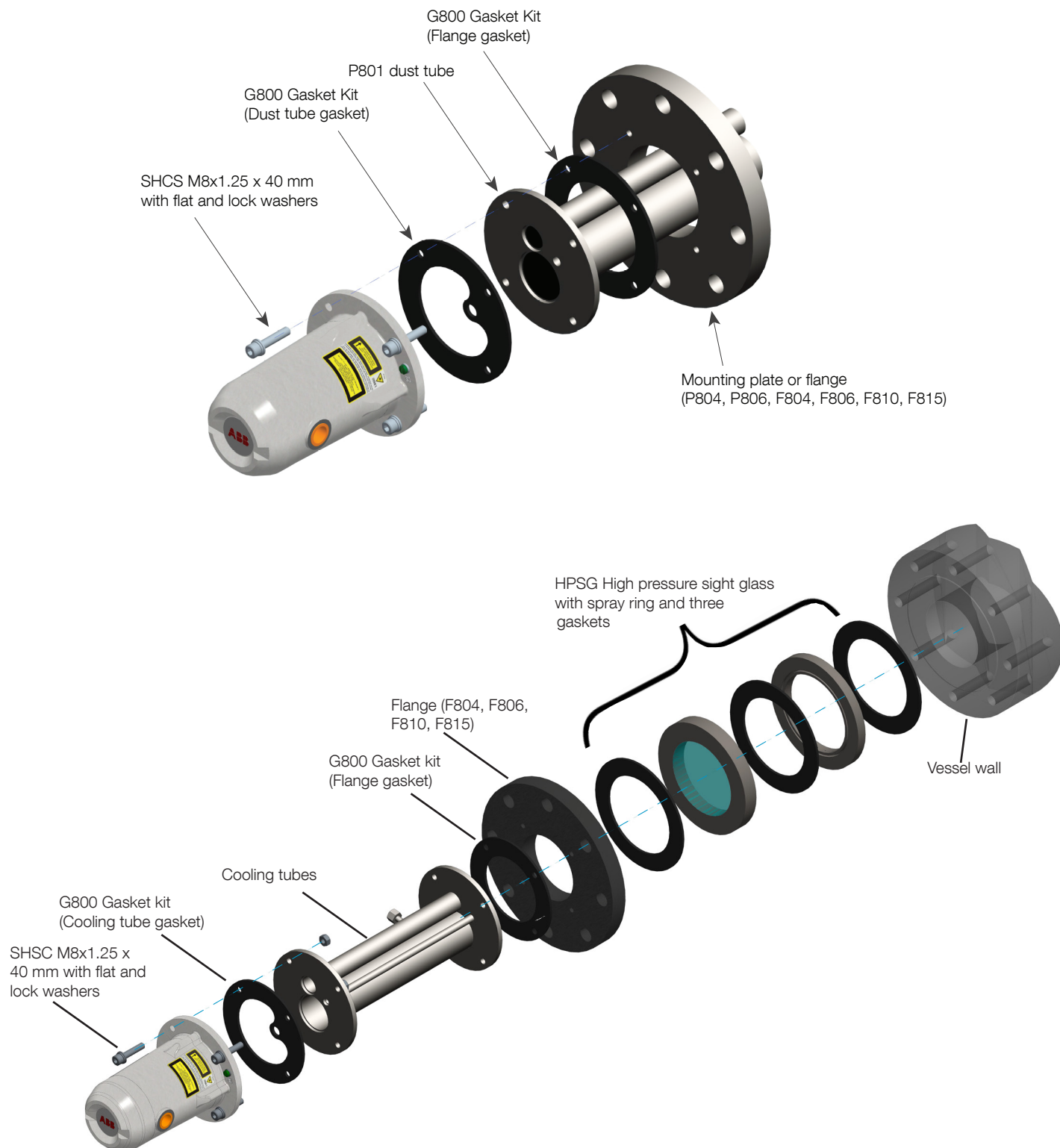
Cooling tube (P802)



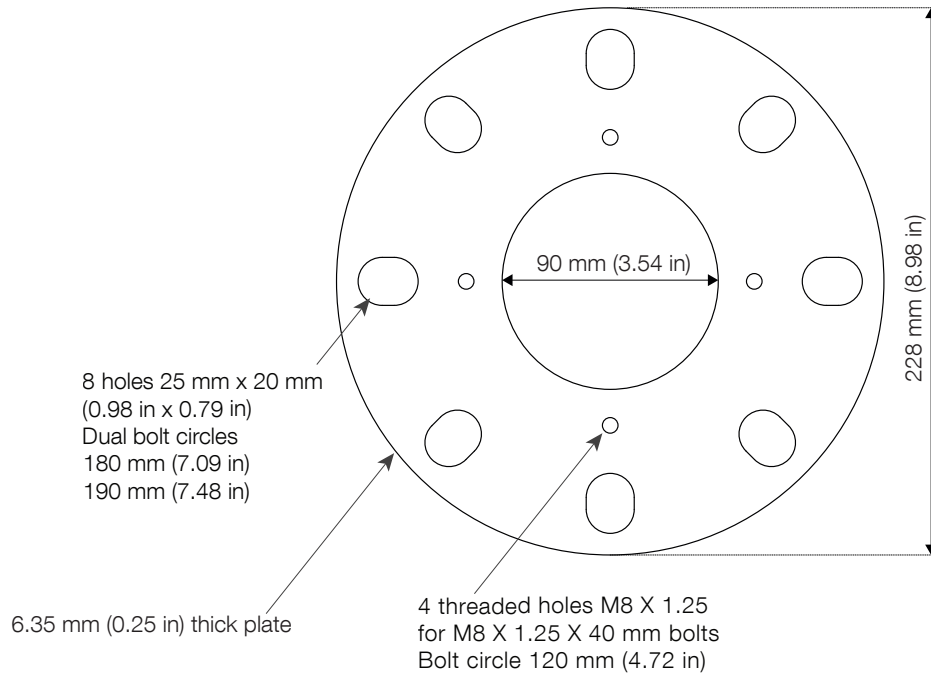
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Laser level sensor

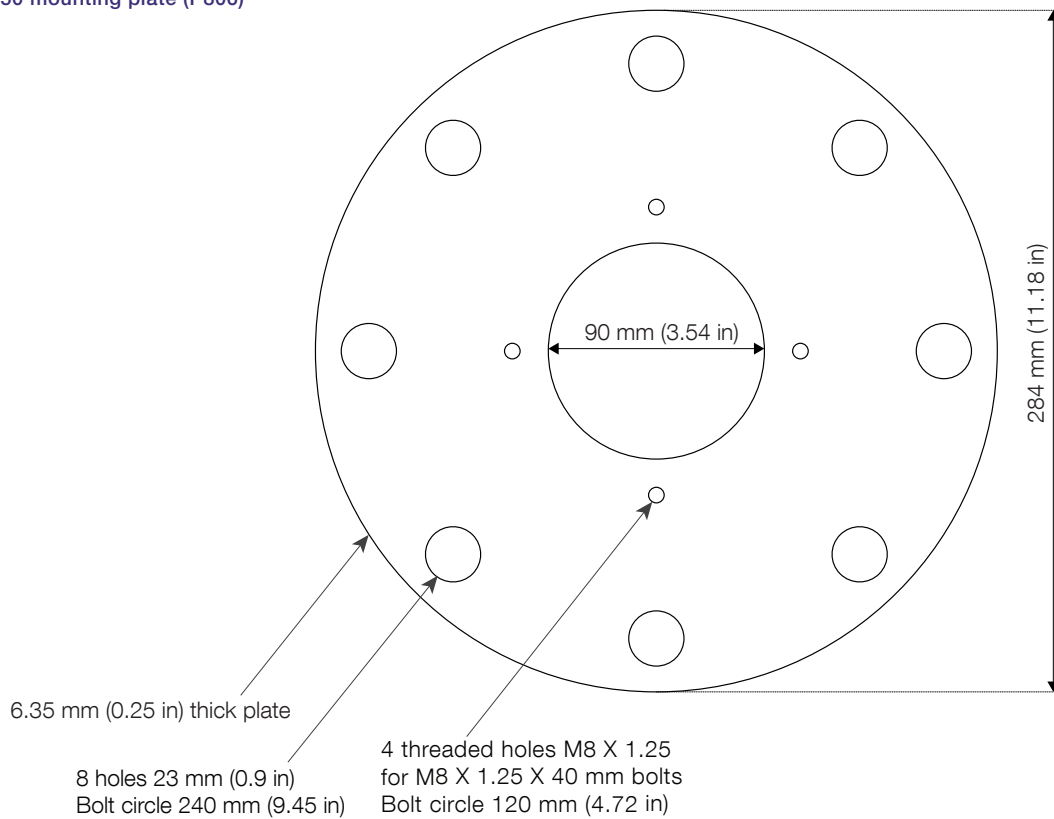
Mounting accessories



4 inch/DIN 100 mounting plate (P804)



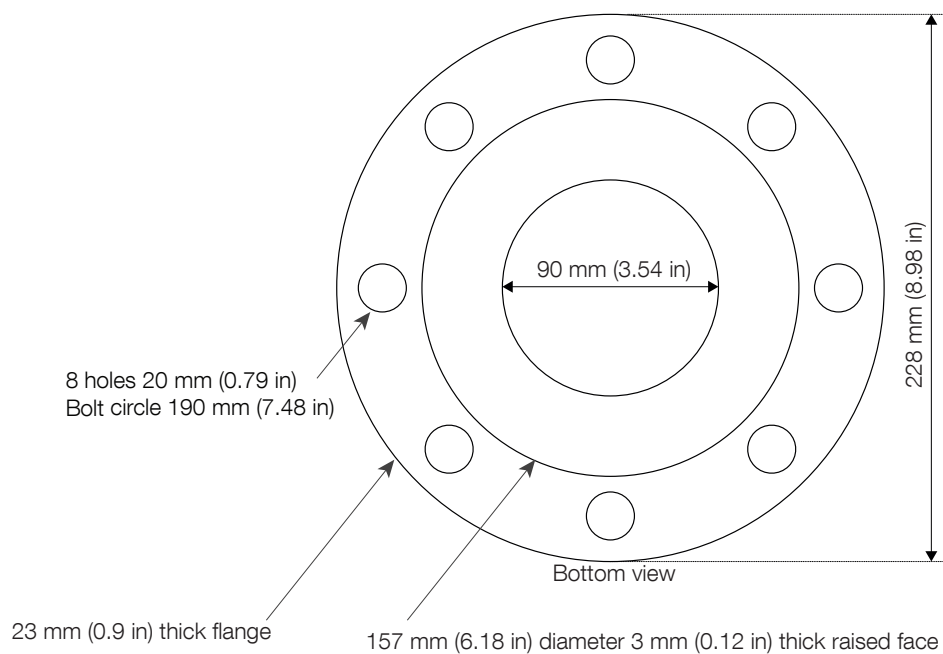
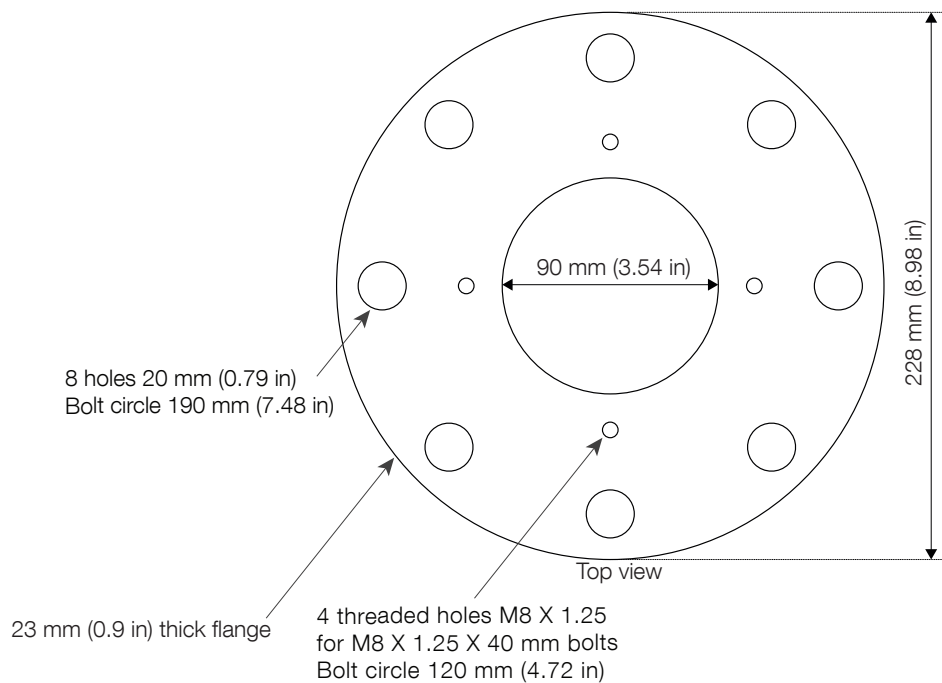
6 inch/DIN 150 mounting plate (P806)



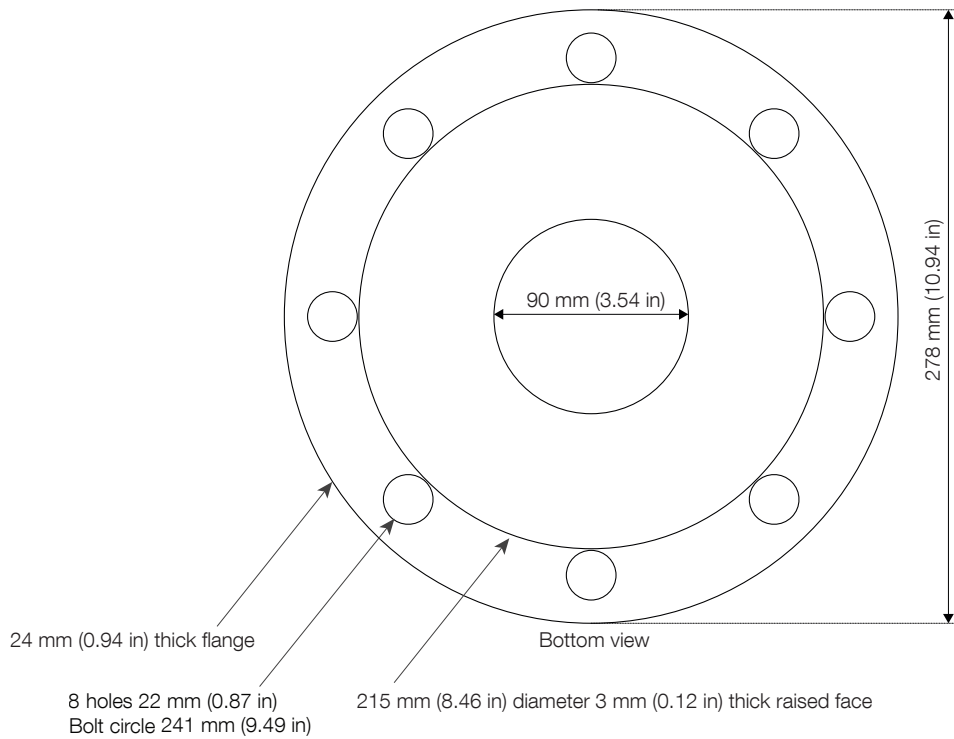
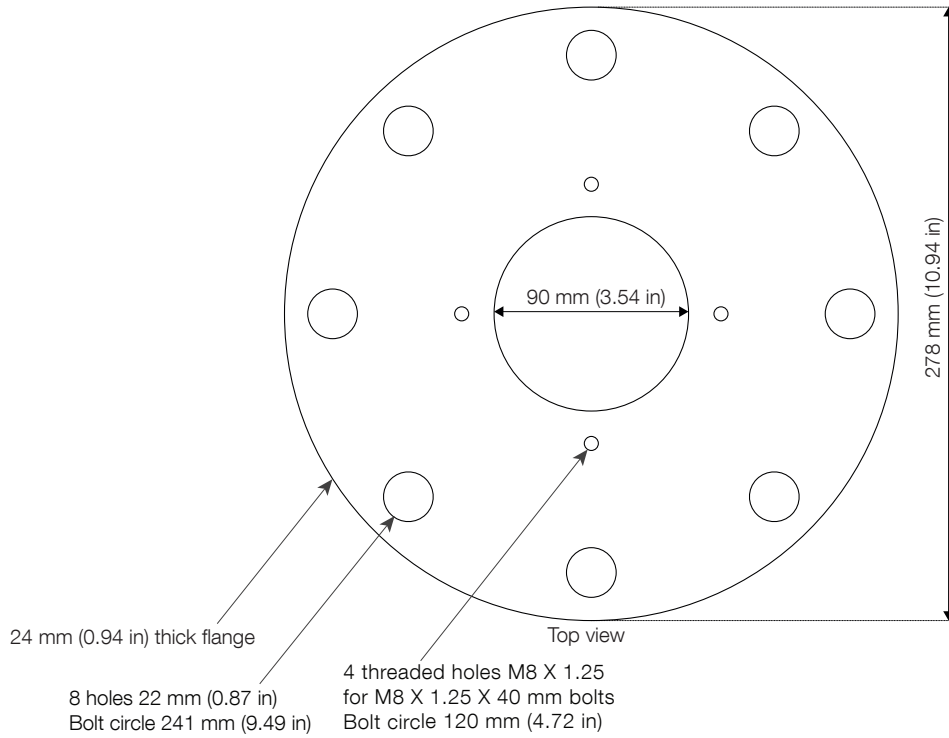
LM80

Laser level sensor

4 inch raised face mounting flange (F804)



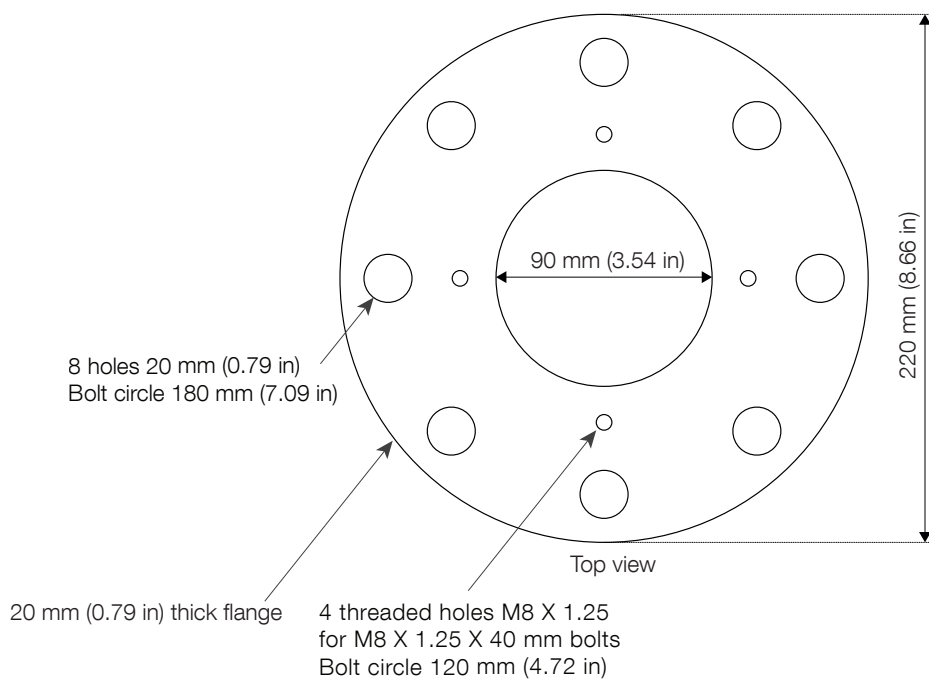
6 inch raised face mounting flange (F806)



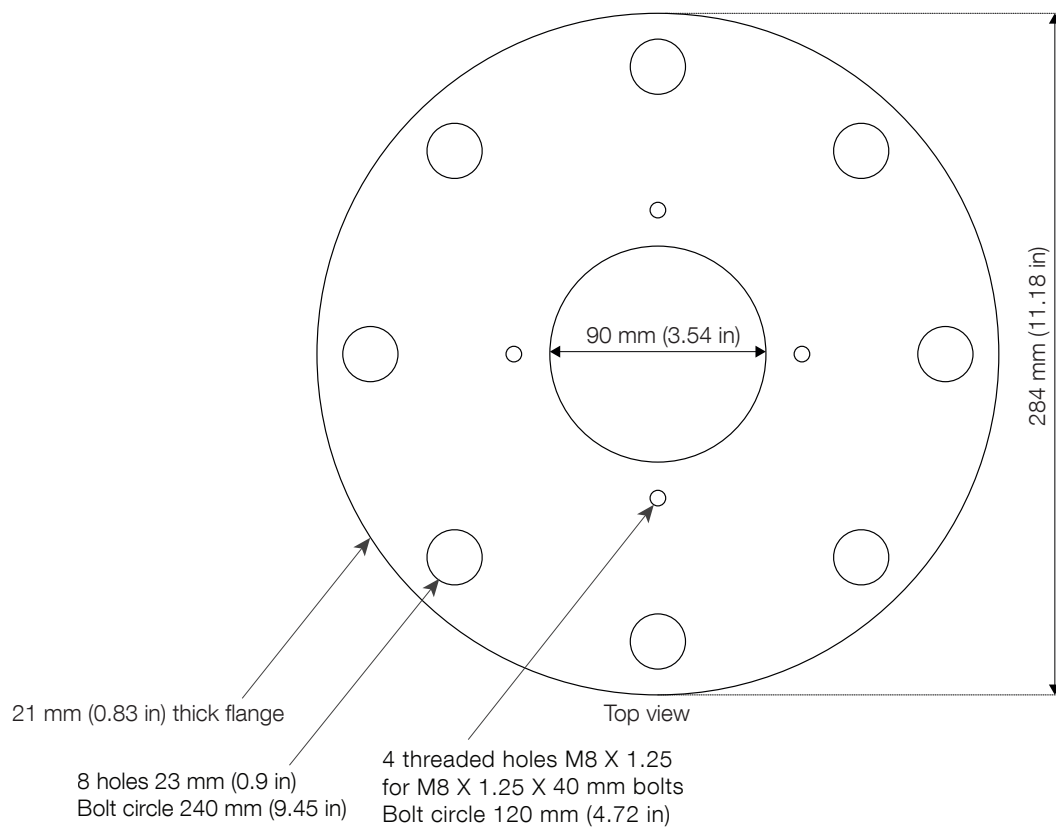
LM80

Laser level sensor

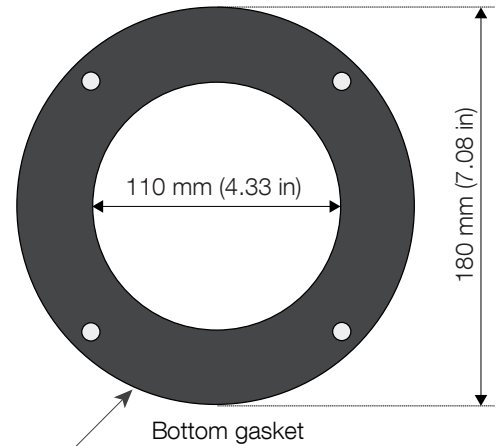
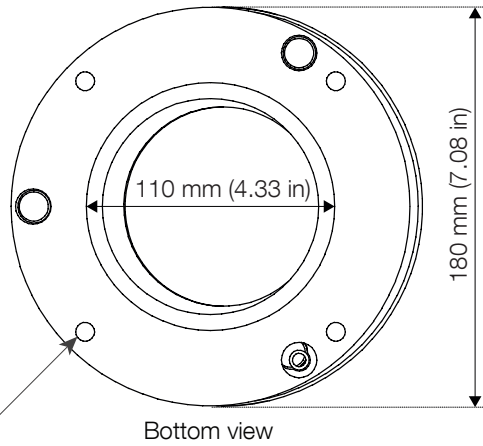
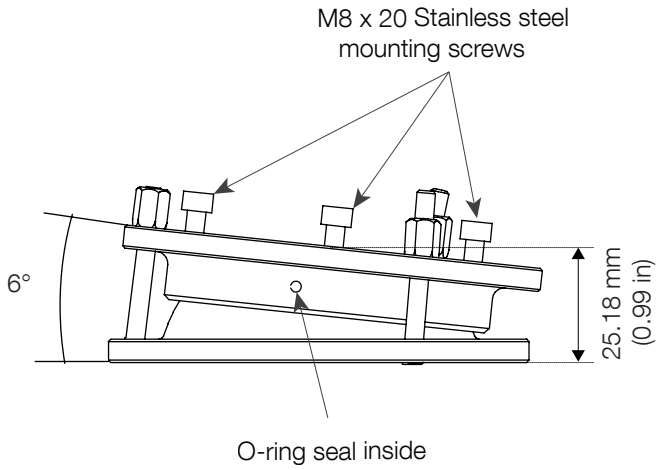
DIN 100 mounting flange (F810)



DIN 150 mounting flange (F815)

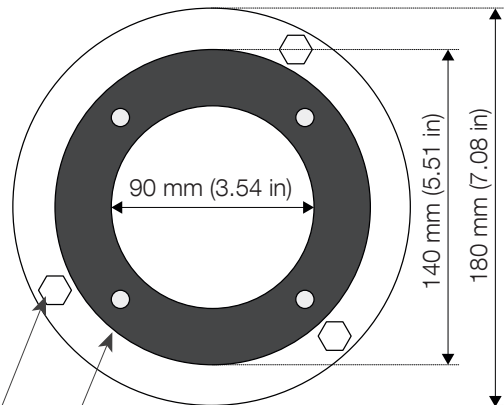


Swivel flange (S800)



4 holes 8.5 mm (0.33 in) diameter
Bolt circle 160 mm (6.29 in)

3 mm (0.12 in) thick



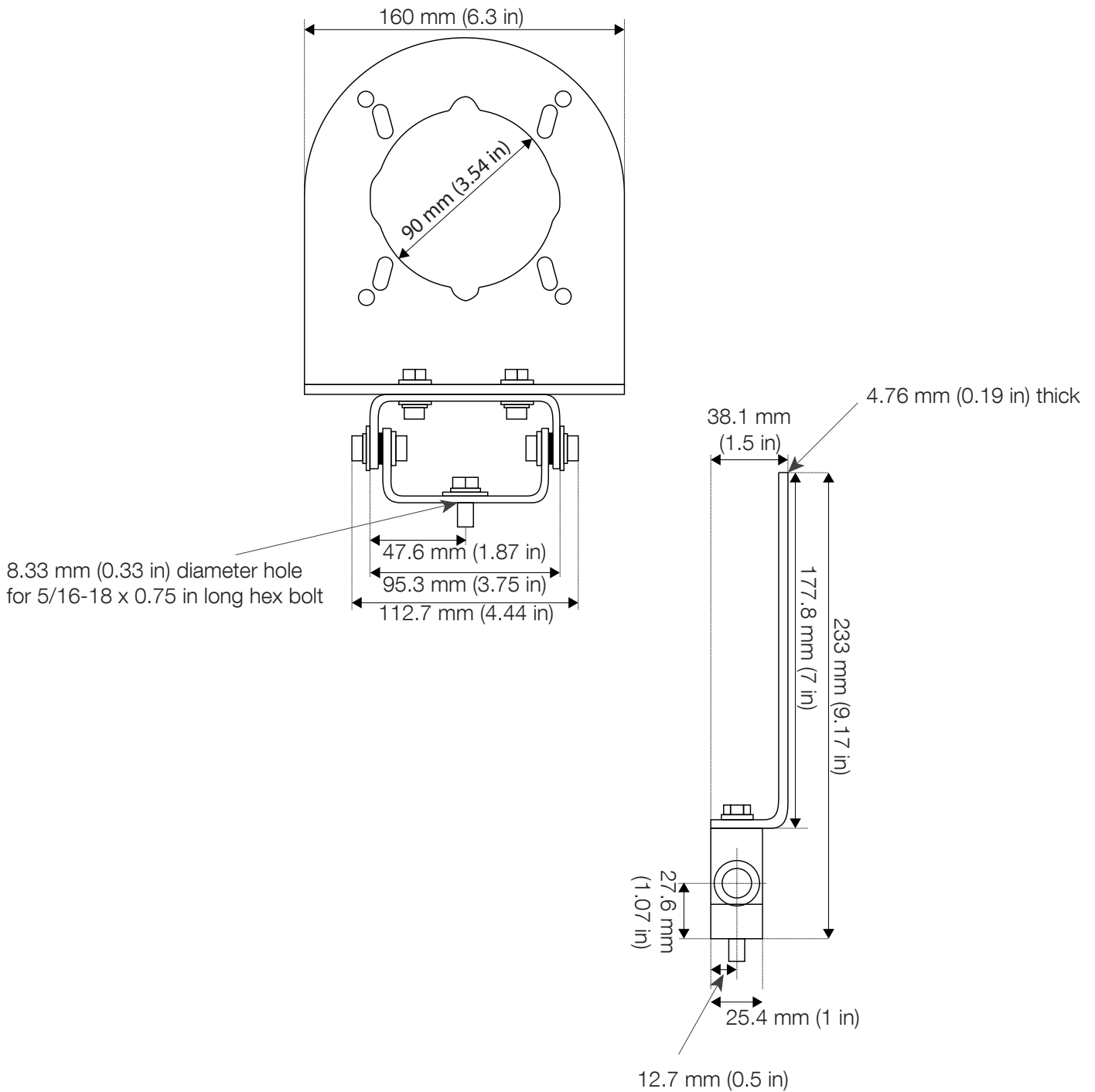
Angular adjustment bolts

3 mm (0.12 in) thick gasket
4 holes 8.5 mm (0.33 in) diameter
Bolt circle 120 mm (4.72 in)

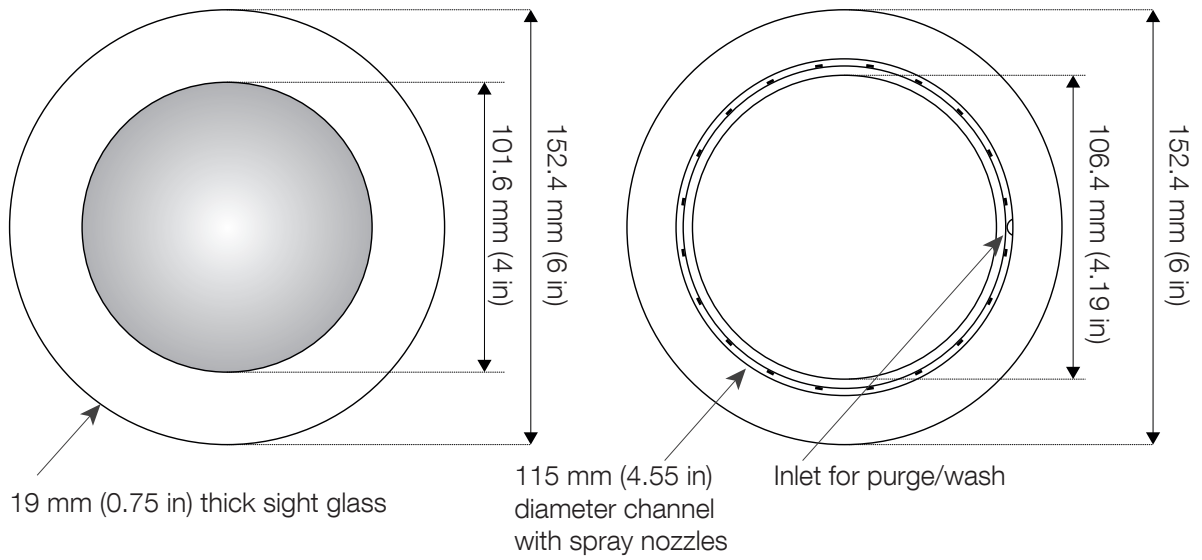
LM80

Laser level sensor

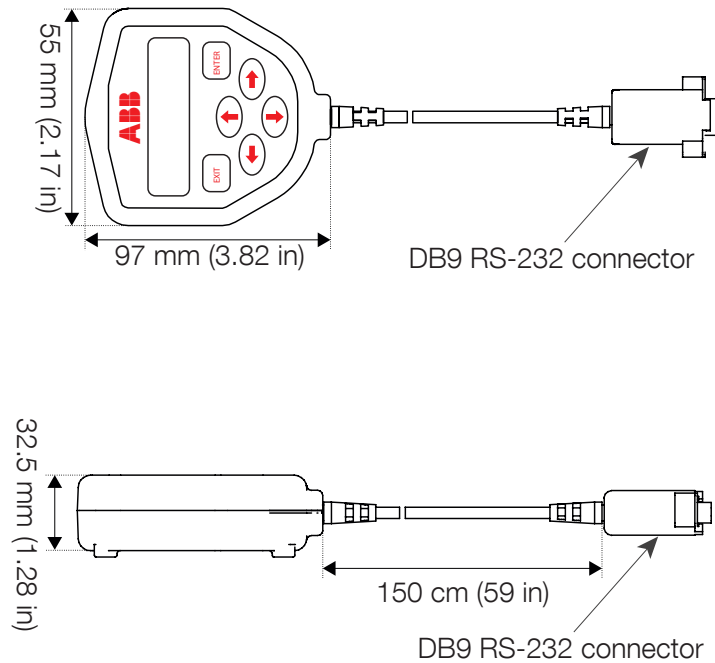
Adjustable pivot bracket (A800)



Miscellaneous Accessories
 High pressure sight glass (HPSG)



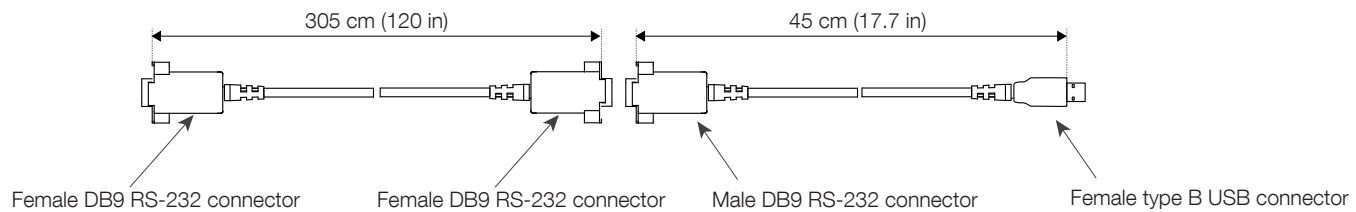
Communication/configuration device and local display (LCD2)



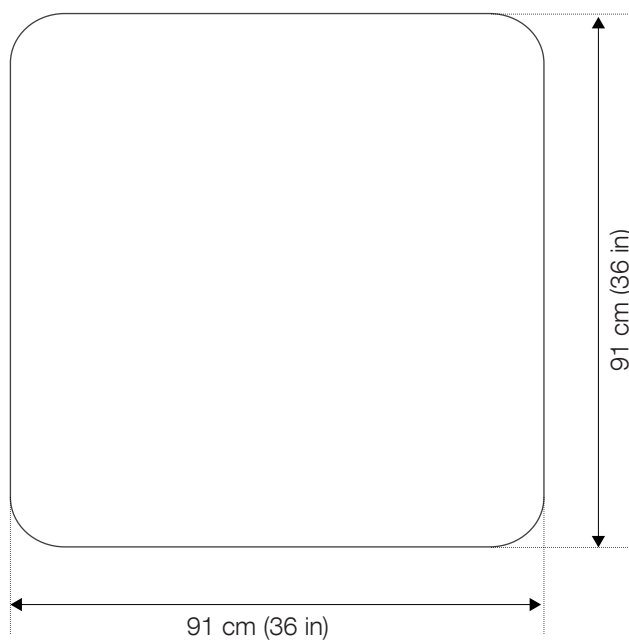
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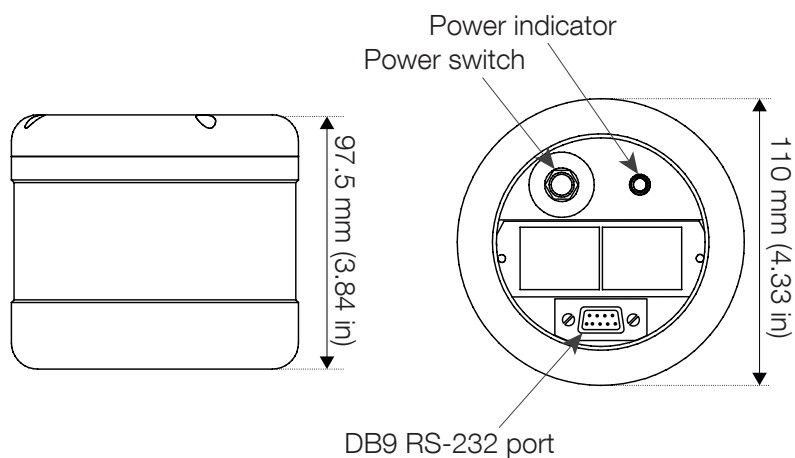
RS232 to USB cable (USBR)



Reflector (REFL)



Battery pack (BPK)



Ordering Information

Laser level transmitter	A	B	C	D	E
Unit options					
Powder coated aluminum	A				
Powder coated aluminum with non condensing optics	AC				
Powder coated aluminum with 304 stainless steel dust tube	AP801				
Powder coated aluminum with non condensing optics and stainless steel dust tube	ACP801				
Powder coated aluminum with 304 stainless steel cooling tube	AP802				
Powder coated aluminum with non condensing optics and stainless cooling tube	ACP802				
Powder coated aluminum, non condensing optics and 4 in stainless triclover fitting	ACT804				
Aluminum positioning unit 150 m / 492 ft, dust tube, reflector & adjustable mounting	AP150				
Aluminum positioning unit and accessories with non condensing optics	ACP150				
316 Stainless steel	S				
316 Stainless steel with non condensing optics	SC				
316 Stainless steel with 304 stainless steel dust tube	SP801				
316 Stainless steel with non condensing optics and stainless steel dust tube	SCP801				
316 Stainless steel with 304 stainless steel cooling tube	SP802				
316 Stainless steel with non condensing optics and stainless cooling tube	SCP802				
Stainless positioning unit 150 m / 492 ft, dust tube, reflector & adjustable mounting	SP150				
Stainless positioning unit and accessories with non condensing optics	SCP150				
Approvals					
North America (Canada, USA) cCSAus Class 1 Div 2		CSA			
Factory Mutual FMus Class 1 Div 2		FM			
ATEX non sparking		ATEX			
IECEX non sparking		IECEX			
Metrology certification for Russia		RMET			
GOST-R non sparking and metrology certification for Russia		GR			
Extended warranty					
Extended warranty for 3 extra years - provides a total of 5 years warranty				EW	
Replacement warranty - provides customer with new replacement unit instead of repair				RW	
Accessories					
304 Stainless steel 4 in. / DN 100 mounting plate, bolt pattern as per class 150 and DN 100 / PN 10, no pressure rating					P804
304 Stainless steel 6 in. / DN 150 mounting plate, bolt pattern as per class 150 and DN 150 / PN 10, no pressure rating					P806
304 Stainless steel 4 in. raised face flange, bolt pattern as per class 150, no pressure rating					F804
304 Stainless steel 6 in. raised face flange, bolt pattern as per class 150, no pressure rating					F806
304 Stainless steel DN 100 flange, bolt pattern as per DN 100 / PN 10, no pressure rating					F810
304 Stainless steel DN 150 flange, bolt pattern as per DN 150 / PN 10, no pressure rating					F815
304 Stainless steel adjustable pivot mounting bracket					A800
Aluminum swivel mount flange					S800
High pressure sight glass with spray ring cleaning system for high pressure/temperature applications					HPSG
Communication/configuration device and local display					LCD2
RS232 to USB cable for configuring LM80 using laptop or desktop computer					USBR
Set of 2 Ex cable glands with 1/2 in. NPT thread; size 0 / 8 mm and size 00 / 12 mm					GCK
Exd/e Flameproof imperial to metric adapter, 1/2 inch NPT to M20					GC1
Reflector plate 36 in. x 36 in. / 90 cm x 90 cm, for positioning applications					REFL
Battery pack for demo and mobility purposes					BPK
Gasket kit - contains 1 dust tube gasket and 1 flange gasket					G800
Swivel Flange Gasket kit - contains 1 swivel flange gasket					G801

LM80

Laser level sensor



Software menu system

Communication with the LM80 takes place via the RS232 port located in the terminal compartment. Connect a computer with a standard USB port using the USBR cable and a terminal emulation programme such as PuTTY, or the handheld Communication Device (LCD2) directly to this port. Power up the LM80 and press the “EXIT” or “ENTER” button on the LCD2, or the PC’s “Spacebar” to enter the menu system.

The LM80 has advanced settings for more difficult applications. If the surface is unstable then the output can be smoothed by the rolling average “Buffer”. If material occasionally falls into the

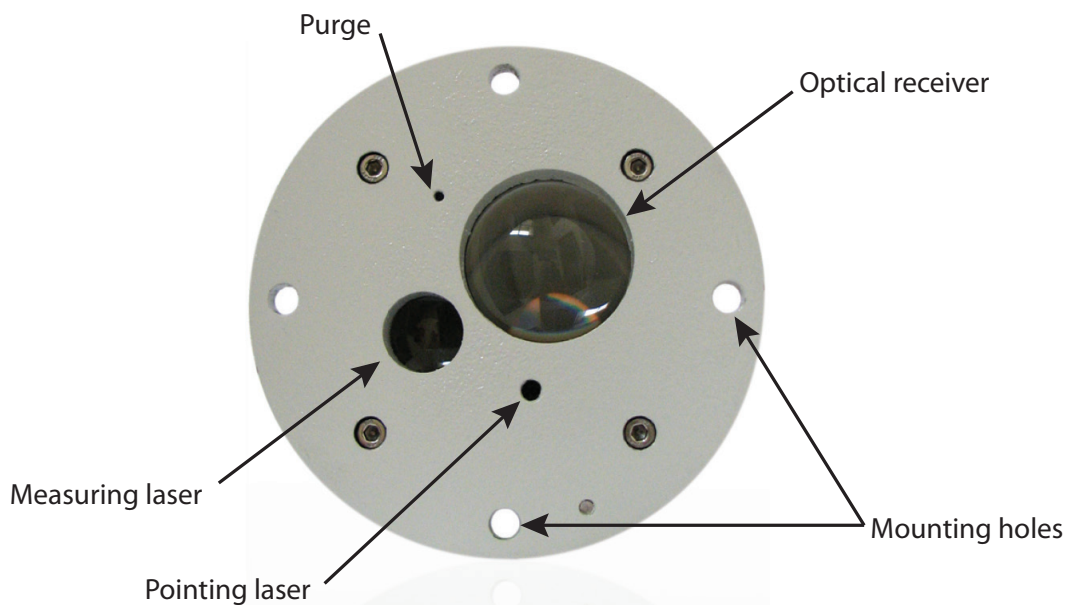
beam then the erroneous result can be removed and the correct level maintained by using the “Keep” setting. If the LM80 is being used in a dusty environment the incorrect readings can be eliminated using the “Dust” settings.

There are controls for the visible pointer, for the maximum range, for offsets, test facilities for the 4-20 mA and relay outputs, a choice of Metric or Imperial measuring units and settings for fail-safe conditions based on the NAMUR standards.

Menu item	Values / Options	LCD2	Description
Running mode	Distance measured and 4-20 mA current output displayed.		
4-20 mA Settings	A group of settings and options related to the 4-20 mA analog output.		
4 mA setpoint	0.00 m (ft) to max range	Yes	Sets the distance at which the analog output reads 4 mA
20 mA setpoint	0.00 m (ft) to max range	Yes	Sets the distance at which the analog output reads 20 mA
Fail-safe output	3.6 mA, 21.00 mA, last mA reading	Yes	Select the fail-safe 4-20 mA analog value to be output if there is no signal
Safety time (Fail-safe delay)	0 sec to 450 sec	Yes	Enter the time that the signal is lost before the fail-safe condition is output
4-20 mA test	4.00 mA, 12.00 mA, 20.00 mA	Yes	Select a value to output on the analog channel for test purposes
4-20 mA trim	4 mA reading 20 mA reading	No	This function recalibrates the laser transmitter current output loop based on the readings entered at 4 mA and 20 mA
Relay settings	A group of settings and actions related to the relay outputs		
Relay A open	0.00 m (ft) to max range	Yes	Sets the distance at which the relay opens
Relay A closed	0.00 m (ft) to max range	Yes	Sets the distance at which the relay closes
Relay A test	open, closed	Yes	Toggles between relay open and relay closed
Relay B open	0.00 m (ft) to max range	Yes	Sets the distance at which the relay opens
Relay B closed	0.00 m (ft) to max range	Yes	Sets the distance at which the relay closes
Relay B test	open, closed	Yes	Toggles between relay open and relay closed
Application settings	A group of settings for filtering, smoothing and adjusting to application conditions		
Program	Standard, Light dust, Heavy dust, Position, Custom	Yes	Select predefined settings for selected application Use custom program for user defined application settings
Laser pointer	on off	No	Switch from service only mode (off - pointer comes on for 2 minutes at power up) to always on mode. All new LM80s are shipped set to off.
Range Blank	0.00 m (ft) to max range	No	If signal is lost this range is output instead of the fail safe setting
Resolution	High Low	No	High resolution is the normal setting, low resolution can be used for faster response at the expense of device resolution
Measuring units	meters, feet	Yes	Select measuring units; either meters or feet
Datum trim	-1.00 m (-3.28 ft) to 1.00 m (+3.28 ft)	Yes	Adjusts the zero datum point of the instrument. Factory default is from the front face of the flange (0.00 m).
Setpoint limit	0.00 m (ft) to ~150 m (~500 ft)	No	Adjusts the maximum range of the device. The firmware allows up to 2980 m but the hardware is only capable of about 150 m (500 ft).
Smoothing	Settings to adjust the filtering and smoothing of the output for the custom program		
Pause	0 sec to 255 sec	No	Sets the time between reading updates
Buffer	1 to 25	No	Sets the size of the rolling average buffer
Keep	1 to buffer	No	Sets the number of readings to keep in the averaging buffer, readings are removed starting with the shortest readings
Fill rate	0, 0.001 to 20000.000 units per minute	No	Sets the fastest filling speed expected, if zero the setting is not used. Otherwise, any sudden rise in level is smoothed by this setting.
Empty rate	0, 0.001 to 20000.000 units per minute	No	Sets the fastest emptying speed expected, if zero the setting is not used. Otherwise, any sudden drop in level is smoothed by this setting.
Environment	Normal Dust	No	"Normal" for most applications, uses fixed gain "Dust" uses variable gain to compensate for dusty conditions, is used in conjunction with fill rate

LM80

Laser level sensor



Red laser pointer

The LM80 ships with a visible red laser pointer (Class 3R) to enable easy and accurate alignment. Through the menu system, the pointer can be set to “On” or “Off”. When set to “Off” the pointer will only shine for 2 minutes at power on and when the unit is in the menu system. When set to “On”, the pointer will shine continuously when the unit is in the menu system. After exiting the menu system, the aiming pointer will flash to indicate that the unit is taking measurements in operational mode. The LM80 always ships from the factory with the pointer set to “Off”.

Mounting

The LM80 produces a narrow, straight measuring laser beam. The unit should be mounted facing towards the area to be measured with no obstacles directly in the beam path. Avoid mounting the instrument close to a stream of material that may fall in front of it. The LM80 has four 8.5 mm (0.33 in) diameter mounting holes on a 120 mm (4.72 in) bolt circle. The instrument can be bolted directly onto a flange or bracket. The LM80 may receive stronger signals in subdued lighting and dark conditions than it does in direct sunlight. Check the operation over the full range of conditions to be measured after installing.

Grounding

It is recommended to use a AWG 16 or 1.5 mm² wire for earth connection. For best results use a size 10 earth lug with a copper body terminal per ASTM B-152, and tin plating per MIL-T-10727, and a manufacturer AMP part No. 34112 or No. 34109. The earth wire terminated with the recommended earth lug must be connected to the designated terminal for this purpose. The internal and the external earth screws are made of stainless steel.

Cables, wiring and routing

Always use shielded cables for power supply and signal. It is recommended to use a AWG16 or 1.5 mm² multi-core cable. The number of cores will depend upon the outputs required from the LM80. For a 4-20mA output, use a twisted pair shielded cable. Do not install the LM80 or route the signal cables in close proximity to high voltage electrical cables.



Dust management

In applications where dust may be present (even in very small quantities) it is recommended that the P801 dust tube accessory be used. The dust tube is a simple and effective device, designed to prevent dust settling on the lenses by creating a static airspace. When abundant dust is present the dust tube can additionally be purged with dry oil free air to further reduce any dust settling on the lens.

There are a number of advanced settings to improve performance when dust is present. The “Dust” setting in the “Environment” menu increases the dust penetration capabilities of the laser. In applications where the vessel may be loaded in batches and intermittent clouds of dust appear, a “Fill rate” may be entered to slow down the rate of response of the instrument.

LM80

Laser level sensor

Standard precautions

The LM80 is designed to withstand many industrial environmental conditions. However, a few precautions will ensure reliable operation of the unit for extended periods of time:

- Do not drop the instrument.
- Do not open the terminal compartment lid when an explosive dust or gas atmosphere may be present.
- Do not connect to the RS232 port when an explosive dust or gas atmosphere may be present.
- Do not expose the internal electronics to water or dirt.
- Do not install or connect with the power on.
- Use appropriate insulated lugs or ferrules for connections to the terminal block and grounding screws
- The flat stainless steel washer must be incorporated between the enclosure body and the lug to prevent corrosion from occurring.
- External transient protection of up to 40 % (44 V) of the maximum supply voltage ($32 \text{ V} \times 1.4 \leq 44 \text{ V}$) should be incorporated in the power supply line to the equipment when used in hazardous areas.
- Always keep the terminal compartment lid seal clean and lightly lubricated with Vaseline® Petroleum Jelly.
- Ensure that the terminal compartment lid is tight after connections have been made.
- If using cable glands, only use glands that have been suitably certified by a notified body for cable entry into the enclosure. If in doubt use cable glands supplied by ABB.
- Ensure that the cable glands are tight after connecting the external cable.
- Do not install conduit so that it can drain into the LM80 terminal compartment
- Remove dirt from the lenses with a clean, damp cloth only.
- Do not point the instrument at the sun.
- Avoid aiming the LM80 directly into the fill path of the vessel.
- For liquids always mount the laser to aim perpendicular to the liquid surface.

Notes

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3KXL312002R1001



Sales



Service

AT100

Magnetostrictive Level Transmitter

KTEK Products

Measurement made easy



Features

- SIL2 certified IEC 61508*
- High accuracy: .01% of full scale
- Superior piezo ceramic sensor (Patent # 5,473,245)
- Local indication with LCD display
- Never requires re-calibration: set it & forget it
- Dual compartment housing with separate field terminal compartment
- Loop powered to 75 ft./22 m probe length
- Total and/or interface level measurement
- Pressure to 3000 psig/207 bar, Std. 1800 psig/124.1 bar
- Temperature range: -320 to 800° F (-196 to 427°C) with options
- Field replaceable/upgradable electronics module
- Built in RFI/EMI filter
- Digital communications

Options

- Two level indications
- Temperature indications
- Foundation Fieldbus output
- Honeywell DE output
- Glass viewing window
- 316L stainless steel enclosure
- 20 point strapping table

SPECIFICATIONS

Electronic Transmitter

Housing type	Explosion Proof Powdered Coated Cast Aluminum or Stainless Steel, Dual Compartment
Electrical Connection	1/2" FNPT or M20
Repeatability	0.005% of full scale or 0.015", whichever is greater
Non-Linearity	0.01% of full scale or 0.035", whichever is greater
Accuracy	0.01% of full scale or 0.050", whichever is greater
Supply Voltage	13.5 to 36 VDC - Loop Powered; 9 to 32 VDC - Foundation Fieldbus
Reverse Polarity Protection	Diode in series with loop
Output/Communications	Standard 4-20 mA DC Loop HART protocol (standard) Foundation Fieldbus (optional) <ul style="list-style-type: none"> • ITK 5.1.0 Compliant • 5 AI and 1 PID blocks • 12.5 mA Quiescent Current Draw • LAS Capable
Damping	Honeywell DE (optional)
Burnout	Field adjustable by means of pushbuttons. Range: 0.1 to 36 seconds
Temperature	Jumper selectable upscale (21 mA) or downscale (3.6 mA)
Humidity	-40 to 170°F (-40 to 77°C) Ambient 0 to 100% R.H., non-condensing



* Transmitters equipped with 4-20mA/HART module option only
* Refer to "Ordering Information", Section F

Sensor Tube

	Standard	Options
Material	316L SS	Alloy 20, HSC-276, Teflon® (a registered trademark of DuPont) Jacketed 316L SS, Electro-Polish
Process Temp.	-320 to 250°F (-196 to 121°C)	800°F (427°C)
Max. Press.	1800 psig @ 300°F (124.1 bar @ 149°C)	3000 psig (206.8bar)
Probe Length	1 to 30 feet (304.8mm to 9.14m)	75 ft (22.3m)
Mounting	3/4 in MNPT compression fitting	Loose and welded flanges, plugs and tri-clamp fittings

Approvals:



FM Factory Mutual Research Corporation
XP / I / 1 / ABCD / T6; DIP / II, III / 1 / EFG / T6¹
IS / I / 1 / ABCD / T4 - ELE0001 and ELE1036^{2,3}
NI / I / 2 / ABCD / T4
TYPE 4X



CSA Canadian Standards Association
XP / I / 1 / ABCD / T6; DIP / II, III / 1 / EFG / T6¹
IS / I / 1 / ABCD / T4 - ELE0001²
NI / I / 2 / ABCD / T4
TYPE 4X



ATEX
FP: **ITS08ATEX15869X**¹
II 1/2 G/D Ex d IIC T6
Ex tD 20/A21 IP6X T80°C
IS: **ITS08ATEX15866X**^{2,3}
II 1/2 GD Ex ia IIC T4 (-40°C ≤ Tamb ≤ 66°C)
Ex iaD 20/21 IP6X T80°C (-40°C ≤ Tamb ≤ 66°C)



GOST Russia
FP: 1ExdIICT6¹
IS: 0ExiaIICT6²
Ingress protection: IP67
Sanitary Hygienic Certificate



IEC International Electromechanical Commission
IS: **IECEX ITS 08.0032X**^{2,3}
Ex ia IIC T4
Ex iaD 20/21 IP6X T80°C
FP: **IECEX ITS 08.0035**¹
II 1/2G/D Ex d IIC T6
Ex tD A21 IP6X T80°C



Chinese Approvals Available
when purchased through
K-TEK (Tianjin) Level Co. LTD.
TEDA-Tianjin, China +86 (22) 598 13078

- Notes:**
1. Excludes Probe F1 and SW3 options.
 2. Excludes RI (secondary analog output) & Honeywell DE options.
 3. Fieldbus & FISCO

IEC61508 CERTIFIED

Safety

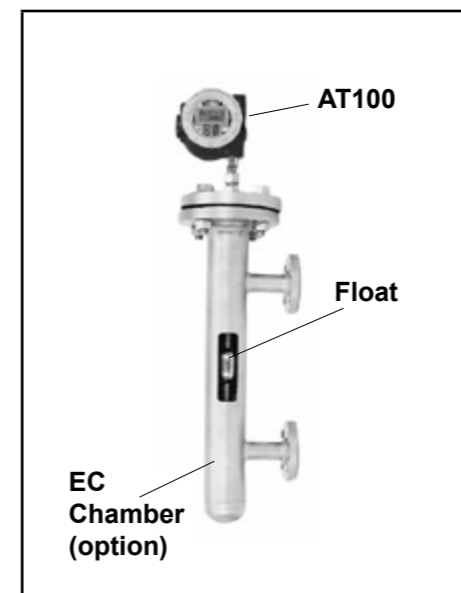


Third Party Certified Safety Integrity Level (SIL 2) data (FMEDA analysis) for Safety Instrumented Systems engineering is available.

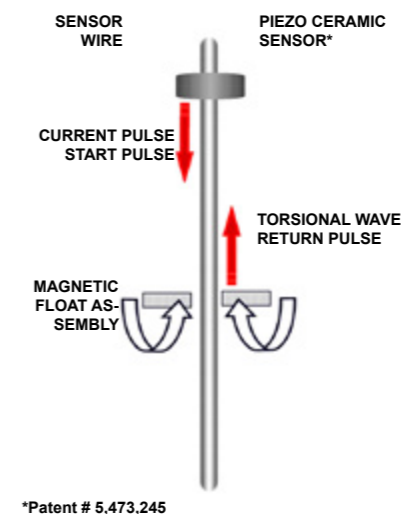
PRINCIPLE OF OPERATION:

The AT100 is based upon the magnetostrictive principle. The sensing tube contains a wire which is pulsed at fixed time intervals creating a magnetic field around the wire. The interaction of the magnetic field around the wire and the magnetic float causes a torsional stress wave to be induced in the wire. This torsion propagates along the wire at a known velocity, from the position of the magnetic float and toward both ends of the wire. A patented piezo ceramic sensing element placed in the transmitter assembly converts the received mechanical torsion into an electrical return pulse. The microprocessor-based electronics measures the elapsed time between the start and return pulses and converts it into a position measurement which is proportional to the level of the float.

AT100 Components

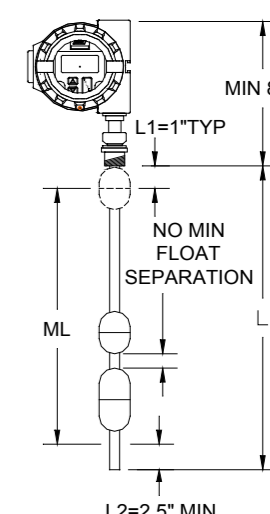


Principle of Operation



*Patent # 5,473,245

AT100 Dimensions



ORDERING INFORMATION

AT100/a/b/c/d/ef/g/h/l/j/k:

Example: AT100/S6/LW/A/R1/H0/M4A/X/FM/CF/F1B/48"

/a Probe Material

- S6** 316L Stainless Steel Standard
- A2** Alloy 20
- HC** Hastelloy C-276 (1/2" OD SW1 Probe without Sensor Well)
- TF** PFA Jacket (1/16" thick) over 316L SS (Max 350°F (177°C) & 50 psig (3.4bar))

/b Transmitter Configuration

- L** Standard Local Transmitter
- LW** Standard Local Transmitter with Window Cover
- T** Local Transmitter with Top Access or Readout
- TW** Local Transmitter with Top Access or Readout and Window Cover
- C** Offset Transmitter with Vapor Seal for Service Below Ambient
- CW** Offset Transmitter with Vapor Seal for Service Below Ambient and Window Cover

/c Transmitter Housing

- A** Standard Dual Compartment Aluminum Housing
- S** Dual Compartment 316L Stainless Steel Housing

/d Probe Type

- R1** Standard Rigid Probe, 5/8" OD
Notes: 1. 30 ft. (9.14m) maximum probe length
2. 1400 psig (96.5bar) @ 800°F (427°C)
3. 1600 psig (110.3bar) @ 700°F (371°C)
4. 1800 psig (124.1bar) @ 300°F (149°C)
- F1** Flexible Teflon® (a registered trademark of DuPont) Sensor Inserted into 1" OD Segmented Sensor Well
Notes: 1. Only available with /S6, /A2, /HC options.
2. 75 ft. (22.86 m) maximum probe length.
3. 300 psig (20.7bar) maximum & 170°F (77°C) maximum.
4. Specify maximum segment length, 10ft. (3.05m) standard.
5. Not suitable for explosion proof service.
6. Suitable for intrinsically safe installation.
7. Not suitable for cryogenic applications.
- HP** High Pressure Rigid Probe, 5/8" OD
Notes: 1. Not available with /TF probe material option.
2. 30 ft. (9.14m) maximum probe length.
3. 3000 psig (206.8 bar) maximum.
4. Not available with /H3 Process Temperature Option.
- SW1** 1/2" OD Rigid Probe for Insertion Into 5/8" OD x 0.049" Wall Sensor Well
Notes: 1. Specify and order sensor well separately.
2. 20 ft. (6.10m) maximum probe length.
3. Not available with /H3 Process Temperature Option.
- SW2** 5/8" OD Rigid Probe for Insertion Into 3/4" Sch. 40 or 80 Sensor Well
Notes: 1. Specify and order sensor well separately.
2. 30 ft. (9.14m) maximum probe length.
- SW3** 1/2" OD Flexible Probe for Insertion Into 5/8" OD x 0.49" wall Sensor Well
Notes: 1. Max 300°F (149°C) @ 1 hour Clean.
2. 15 ft. (4.57m) maximum probe length.
3. Available with /S6 probe material only.
4. Not suitable for explosion proof service.
5. Probe is not hermetically sealed. For use in conditioned (non-condensing) indoor locations only.
6. Only available with H0 process temperature option.

/e Process Temperature Options

- H0** < 170°F (77°C) Maximum; Top of transmitter is 8" (200mm) above process connection
 - H1** < 250°F (121°C) Maximum; Top of transmitter is 16" (406mm) above process connection
 - H2** < 450°F (232°C) Maximum; Top of transmitter is 26" (660mm) above process connection
 - H3** < 800°F (427°C) Maximum; Top of transmitter is 26" (660 mm) above process connection
- Note: 15 ft. (4.57m) maximum probe length.

ORDERING INFORMATION (continued)

/f Electronic Module

- X** None
- HART Protocol:** **M4A** One Level, LCD Indicator & SIL 2 rated 4-20 mA Output
M4B Two Levels, LCD Indicator & SIL 2 rated 4-20 mA Output
M4AS One Level, LCD Indicator & SIL 2 rated 4-20 mA Output & 20 point Strapping Table
M4BS Two Levels, LCD Indicator & SIL 2 rated 4-20 mA Output & 20 point Strapping Table
M5A One Level, One temperature point, LCD indicator, and Communications
M5B Two Levels, One temperature point, LCD indicator, and Communications

- Foundation** **M4AF** One Level & LCD Indicator
- Fieldbus Protocol:** **M4BF** Two Levels & LCD Indicator
M4AFS One Level & LCD Indicator & 20 point Strapping Table
M4BFS One Level & LCD Indicator & 20 point Strapping Table

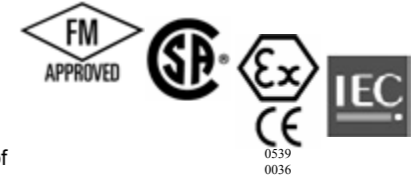
- Honeywell DE Protocol:** **M4AD** One Level & LCD Indicator
M4BD Two Levels & LCD Indicator

/g Second Analog Output (Not SIL Rated)

- X** None
- RI** Second electronic module with 1 ea. Analog output and LCD indication
Notes: 1. Only for use with HART Protocol equipped electronics modules
2. The RI100 is only approved as an Explosion Proof device
3. Analog output field selectable to any of the two levels or temperature
4. Housing type will be same as primary transmitter housing (/c above)

/h Approvals^{1,2}

- FM** Factory Mutual
- CSA** Canadian Standards Association
- CEX** ATEX Flameproof
- CEI** ATEX I.S.
- IEI** International Electromechanical Commission I.S.
- IEX** International Electromechanical Commission Flameproof
- GR** GOST Russia



- Notes: 1. All Explosion Proof Approvals exclude Probe F1 and SW3.
- 2. All Intrinsically Safe Approvals exclude RI (secondary analog output) & Honeywell DE options.

/i Process Connection

- X** None (use with /SW1, /SW2 and /SW3 probe types)
- CF** Standard adjustable compression fitting 3/4" MNPT (1"MNPT with /F1 probe type)
- FL** Flange or plug (shipped loose) with FNPT thread for use with compression fitting (specify type, material and rating from SLG-0001-1 Flange Designation Chart)
- WP** Flange or Plug welded to the sensor tube without compression fitting (specify type, material and rating from SLG-0001-1 Flange Designation Chart)

/j Float Type

- X** None (Use this selection with /SW1, /SW2, & /SW3 probe types)
- Fnn** Selection from Standard Float Chart (SLG-0003-1) or specify /FXX for custom float

/k Insertion Length

- L** Specify inserted length from process connection to end of probe in inches or millimeters or meters
Consult factory for ML, L1 & L2. There is an unusable range of 2.5 inches minimum (12" for /F1) at the bottom of the sensing tube (which can be reduced depending upon float dimensions).
The unusable range at the top of the sensor tube will be affected by the float dimensions.

NOTE: Consult factory for special application requirements.

Available Accessories:

M20 ISO FITTING: M20 Female Electrical Connection (**MM** - Brass or **MMS** - Stainless Steel)
For fastest response to inquiries provide a completed AT100 Application Data Sheet of the Serial Number of an existing AT100.



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A02

RF capacitance level switch

KTEK products

Measurement made easy



Features

- Remote mounting up to 50 ft.
- Built-in static protection
- DPDT relay
- Ambient temperatures up to 185°F/85°C
- Explosion-proof enclosure
- 0 to 30 second time delay
- Temperature compensation
- Switching capacitance of 0.2 picofarads

Options

- Wide band differential control
- Extended lower bushing
- Flanged process connections
- Epoxy coated aluminum enclosure

Applications

Dry Bulk Applications

- High or low level alarm
- Plugged chute detection
- Fly ash hopper level
- Pellets
- Granules
- Powders
- Chips
- Flakes


Liquid Applications

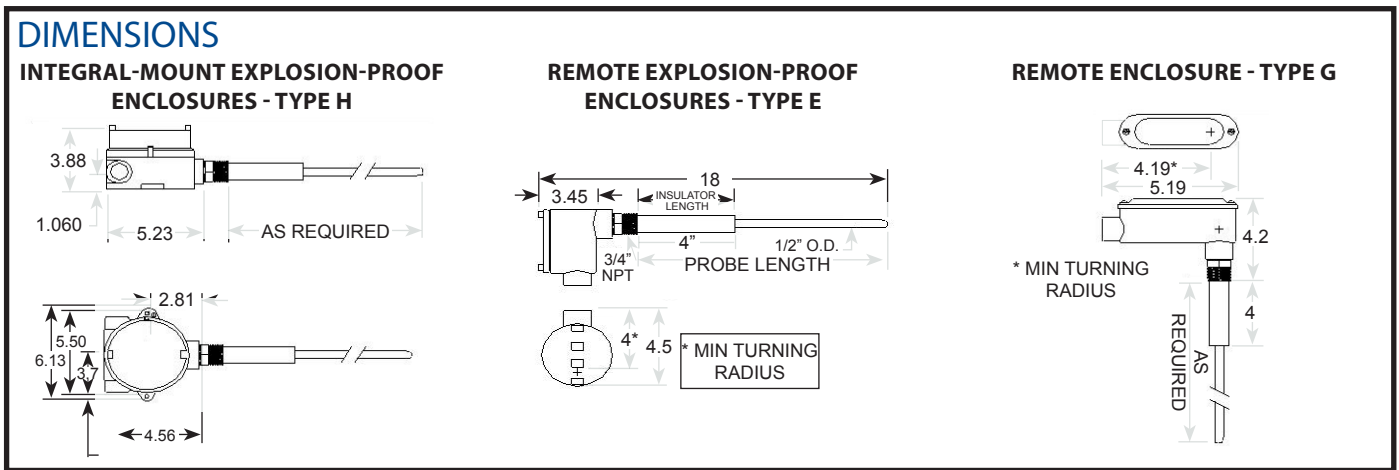
- High or low level alarm
- Interface
- Slurries
- Flow/no flow
- Liquid/foam interface
- Foams
- Conductive products
- Non-conductive products
- Organic
- Inorganic

Special Applications

- High temperature
- Corrosive environments
- High pressure
- Special probe materials

SPECIFICATIONS

Environmental	
Housing type	Explosion Proof, Polyurethane Enamel Coated, Copper Free Aluminum
Temperature	Electronics: -40 to 185° F / -40 to 85°C
Dielectric	Ideal: 2 or greater with standard probe; Consult factory for probe selection on lower dielectric applications.
Electrical	
Input Power	95-130 VAC, 50-60 Hz, 2 Watts; 180-260 VAC, 50-60 Hz; 24 VDC +/- 5%
Relay Contact Rating	Resistive: 5 Amp, 250 VAC; 5 Amp, 30 VDC; Inductive: 1/10 HP 125, 250 VAC
Sensitivity	With an initial load of 30 pF an increase of 0.2pF can be detected
Static Protection	Maximum Surge Current: 100 amps; Clamp Voltage: 75 volts
Process Connection	3/4" NPT Unless Otherwise Stated
Approvals	<div style="display: flex; align-items: center;">  Factory Mutual XP-DIP-AIS / I,II,III / 1 / BCDEFG with all probes except type 5, S, U DIP-AIS / II, III / 1 / EFG with probe type 5, S, U NEMA 4 </div>



ORDERING INFORMATION

A02/a/b/c/d/e:			
/a	Operating Voltage		
A	120 VAC		
B	240 VAC		
D	12 and 24 VDC		
/b	Probe Type	Operating Temperature	Operating Pressure
1	316SS Probe / 4" *Delrin® Lower Bushing	A	A
2	316SS Probe / 4" *Teflon® Lower Bushing	C	A
5	Fly Ash Probe / 8" 316SS Inactive Sheath	D	B
6	Bare probe / 13" 316SS Weight	A	D
8	CPVC Covered Cable / 13" Nylon Weight	A	D
N	*Teflon® Covered Cable / 13" *Teflon® Weight	C	D
B	Macroprobe (3/4" OD Probe *Delrin® Bushing)	A	A
T	Macroprobe (3/4" OD Probe *Teflon® Bushing)	C	A
K	Quick Release Clamp Probe / 4" *Teflon® Bushing	A	A
L	Quick Release Clamp Probe / *Teflon® Sheathed Probe	A	A
R	*Teflon® Sheathed Probe / 316SS Mounting Nipple	C	A
S	*Teflon® Sheathed Probe / *Teflon® Mounting Nipple	C	D
U	Flush Mount Detector – Aluminum / *Delrin® Bushing	A	D
W	Concentric Shield 304SS / *Teflon® Sheathed Probe	A	A
X	*Teflon® Sheathed Probe / 316SS Inactive Sheath	A	A
*Registered Trademark of DuPont			
/c	Probe Length		
xxx	Rigid Probe in Inches; Cable Probe in Feet		
/d	Options		
O	No Options		
C	Epoxy Coating Aluminum Enclosure		
F	Flanged Connection (Specify Loose or Welded, SLG-0001-1)		
L	Stainless Steel Tags		
Z	Any special option not included in above description. Includes but not limited to: Extended Lower Bushing, 10 amp DPDT Relay (24 VDC version only), (Not FM approved) or Remote-Mount Connector Cable		
/e	Enclosure		
H	Explosion Proof		
G	Remote NEMA 4		
E	Remote Explosion Proof		
Z	Special, Explain		
Note: Electrical enclosure is type H when remote mounted electronics are selected.			

Operating Temperature Codes		Operating Pressure Codes	
A	-40 to 185°F / -40 to 85°C	A	1500 psi @ 77°F / 103 bar @ 25°C
B	-40 to 320°F / -40 to 160°C	B	Static Head Only (Consult Factory)
C	-40 to 450°F / -40 to 230°C	C	150 psi / 10.3 bar
D	200 to 1400°F / 95 to 760°C	D	100 psi / 7 bar

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Sales



Service

LS Series Mechanical Level Switch Buoyancy Level Switch

Liquid point-level detection
switch
K-TEK Products

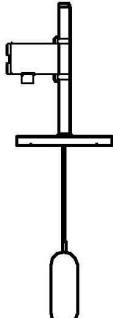

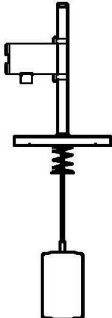

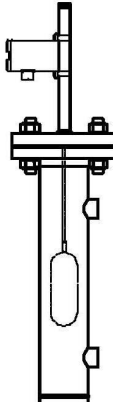
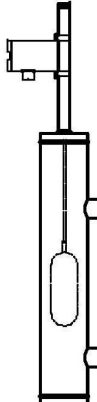
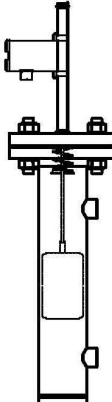
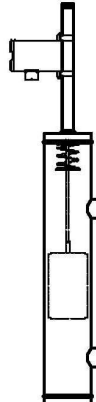


Features

- Rugged and robust chamber design for demanding applications
- One step switch point adjust
- Precision fabricated floats and displacers
- Compact switching mechanism eliminates bulky housing and traditional bias springs
- Easily retrofitted to most competitor models
- Eight standard designs and six compact switching mechanisms

LS Series

ABB's LS Series Mechanical Level Switches are the most rugged and durable liquid point-level detection products in the industrial marketplace today. **ABB** innovations such as the one-step switch point adjust and the hermetically sealed/dual compartment switching mechanism have eliminated the need for bulky housing covers that are associated with cracking, moisture ingress, high temperature fatigue, and ultimately switch failure. This configuration guide contains general guidelines and ordering data that will assist you in selecting the best float or displacer operated switch for your specific fluid level application. These switches are available in flanged or sealed chambers or as insertion models. ABB has over 100 configurations available.

 <p>LS 500 FLANGED TOP MOUNT FLOAT</p>	 <p>LS 510 MNPT TOP MOUNT FLOAT</p>	 <p>LS 550 FLANGED TOP MOUNT DISPLACER</p>	 <p>LS 560 MNPT TOP MOUNT DISPLACER</p>
 <p>LS 600 FLANGED CHAMBER FLOAT</p>	 <p>LS 700 SEALED CHAMBER FLOAT</p>	 <p>LS 800 FLANGED CHAMBER DISPLACER</p>	 <p>LS 900 SEALED CHAMBER DISPLACER</p>

General

- Over 10,000 global installations in applications ranging from condensate to CO₂ to crude oil
- Easily retrofitted to most competitor models
- Designed to handle specific gravities as low as 0.25, temperatures as high as 1000° F (538° C), and pressures up to 4500 psi (310 bar)
- Choose from eight (8) standard designs and six (6) different switching mechanisms
- Worldwide delivery
- Five year manufacturer warranty

Chambers

- Choices for chamber material include: Carbon Steel, 316 Stainless Steel, Duplex Stainless Steel, Hastelloy C-276, Hastelloy B-3, and P11 and P91 Chrome Molly Steel.
- Flanged models have standard slip-on “top access connection” flanges. Weld-neck flanges are optional.
- Designed to guidelines of ASME B31.1 and B31.3
- All welders and fabrication procedures are qualified and maintained per ASME
- Certification to NACE MRO175 and MRO103 is available

Sensing Elements

- Each float and displacer is precision fabricated to indicate true fluid level.
- Choices for float and displacer materials include: 316 Stainless Steel, Hastelloy C-276, and Titanium (Grades 2 and 5). Ceramic is also available for displacers.

Process Connections

- A wide variety of process connection types include: Flanges (slip-on, weld-neck), Socket Weld, and Threaded (NPT)
- Available flange ratings and sizes include: ASME, DIN, HG, and most International and customer specified flange types

Switching Mechanisms

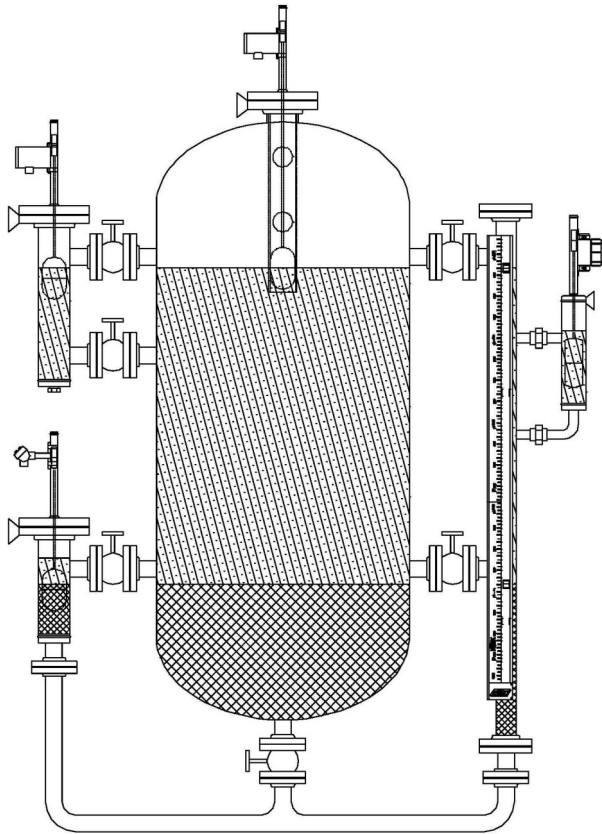
- All stainless steel housing construction with NEMA 4X ratings
- Temperature ratings available from -320°F (-190°C) to 1000°F (538°C)
- Choices for switching mechanism types include: Reed, Cam Action, and Pneumatic
- Available switching mechanisms are hermetically sealed, standard open contacts, or pneumatic contacts
- Agency Listings for most switches include: FM, CSA, and ATEX

Options

- Custom Calibration and Switch Point
- High Temperature and Cryogenic Insulation
- Steam Tube and Electrical Heat Tracing
- Vent, Drain, and Process Isolation Valves
- Stilling Wells and Support Tubes for Turbulent Conditions

Quality Certifications

- ABB is the only level gauge manufacturer in North America to hold the following certifications: ASME (U, S, and UM Stamps), PED, and National Boiler Certification



**A
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OIL AND GAS

- Separator levels

PETROCHEMICAL

- Catalytic Cracker
- Distillation
- Fractionation
- Hydrotreater/Reformer
- Coker
- Flare Knockout Tank

POWER

- Fuel Storage
- Steam Turbine Drip Legs
- Hotwell Condenser
- Feed Water Heaters
- Demineralization Tanks
- Ash Precipitator/Scrubber
- Steam Drum Level
- Lube Oil Systems

CHEMICAL & OTHER

- Storage & Batch Tank Level
- High Level Alarm Safety Shutdown
- Water/Wastewater Treatment Tanks
- Pulp Processing Tanks
- Lube Oil Tanks
- Sump Control

LS Series Description and Operation Basics

The LS Series is a single or multi point, fluid-level switch. The device consists of a float (or displacer) with an attached magnet and a switch post to house the moving magnet and to support the switch mechanism. The switch post is mounted on either a top entry process connection or to the top of a mechanical cage or chamber. Process connections are typically flanges, NPT, or socket weld connections. Chambers have connections on the side and/or bottom to attach to the side of a tank. Movement of the float (or displacer) is typically limited to the range required to activate the switch mechanism at a specified level.

The LS Series can be a float or displacer operated, magnetically coupled level switch. As the fluid level in the vessel rises or falls, the position of the float or displacer changes with it. Magnets inside the switch post, attached to the float or displacer, move with the changing level as well. A switch mechanism, attached to the exterior of the switch post, detects movement of the magnet past its location, and transfers the contact positions. Use of the LS Series instead of the conventional “bulky housing” cage switch allows easy access to the switch mechanism and there are no seals or diaphragms to wear out. Installation of isolation valves on the inlet and outlet of the chamber allows removal of the entire unit without draining the vessel.

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Switching Mechanism Comparison

The ABB standard switching mechanism is a magnetically actuated double pole double throw (DPDT) switch. ABB offers a variety of magnetically actuated switch mechanisms (reed, cam-action and pneumatic style) with SPDT, DPDT, or pneumatic outputs. When a ABB switch mechanism (single or multiple) is mounted on a LS Series mechanical switch, it can sense a high or low level within a vessel. The unique magnetic coupling action eliminates the need for seals, diaphragm springs, or torque tubes because there is no physical contact with the process. The switch configuration also has no process connections which ensures complete isolation from the process. The 360° adjustable switch mechanism does not require the removal of the conventional bulky cover and can be easily positioned at the desired switch point. The compact, maintenance free design, requires no periodic cleaning or operational checks and contains hermetically sealed contacts that ensure high reliability and extended product life.

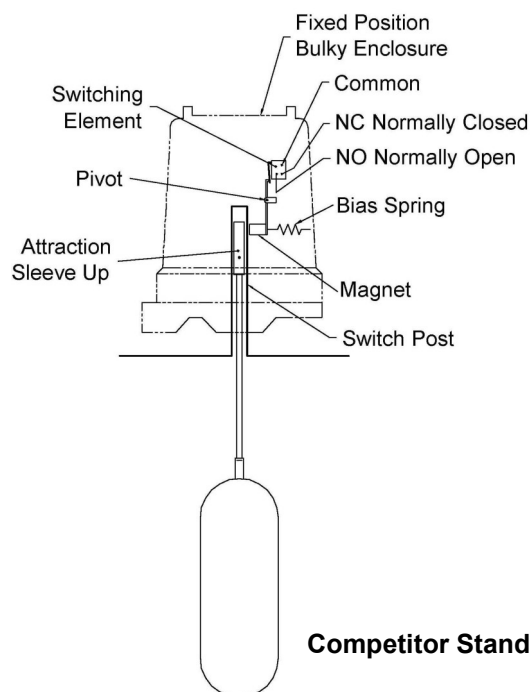
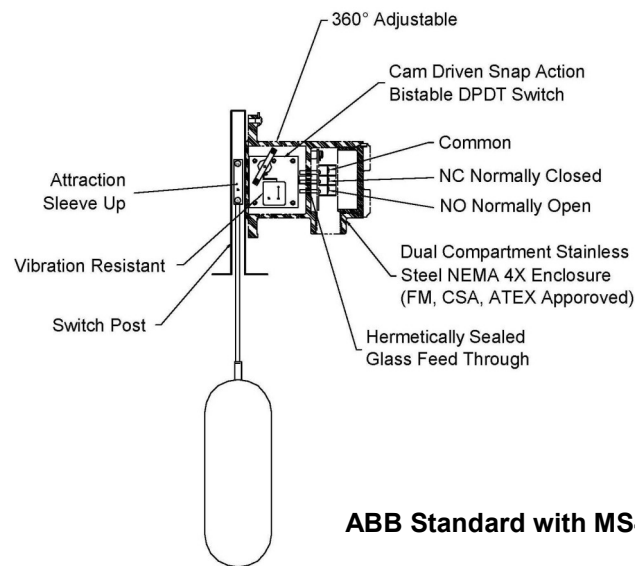


ABB uses high quality design, ASTM materials and ASME construction to provide a significantly higher standard product than our competition. With ABB products, a customer never needs to worry if they are getting a good design—all standard products meet the following criteria as a minimum.

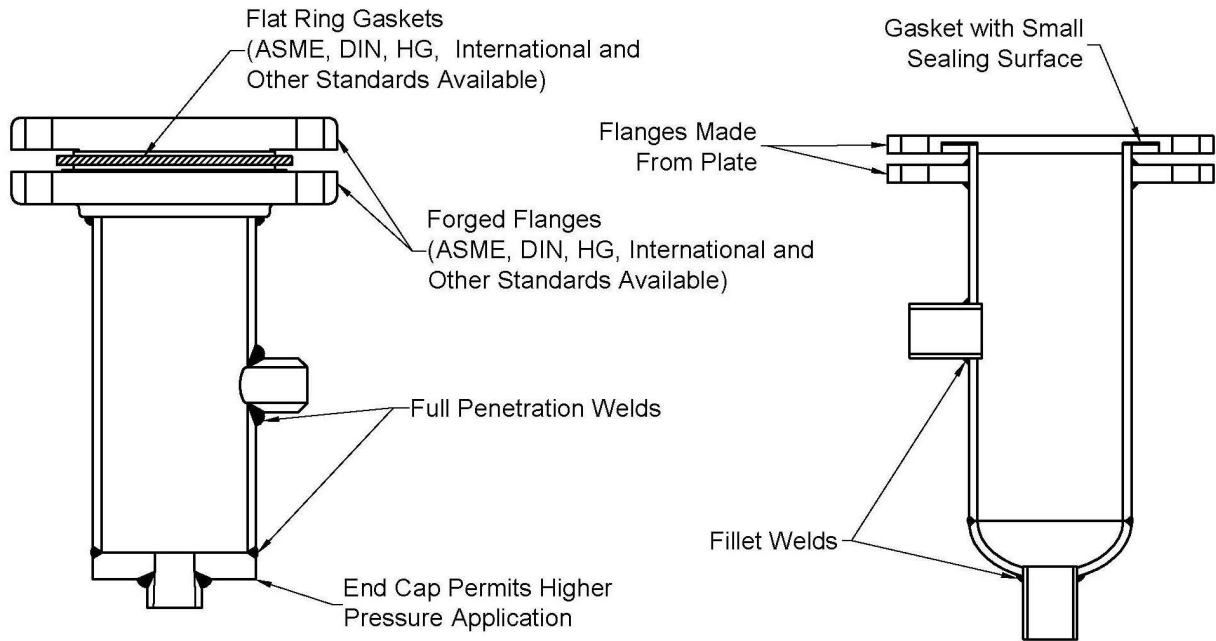


ABB Standard Chamber

Other Manufacturer's Chamber

ABB is the **only** North American level instrument company holding ASME, PED and National Boiler certifications. Any LS Series can be manufactured to following certifications and/or most customer specific supplied standards



U # 26,831 Manufacturer of Pressure Vessels
 UM #26,832 Manufacturer of Miniature of Pressure Vessels
 S #26,830 Manufacturer and Assembly of Power Boilers
 B31.1 Power Piping
 B31.3 Process Piping



Pressure Equipment Directive (97/23/EC)
 #DGR-0036-QS-166-02

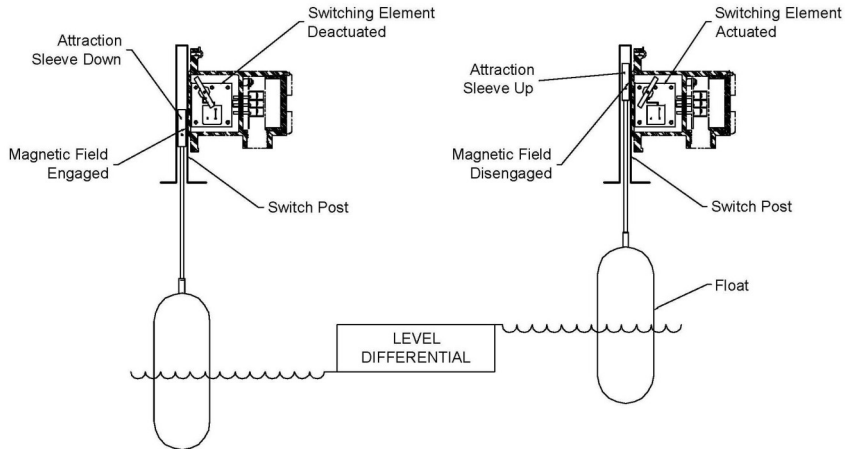


Authorized to apply the 'NB' mark and register boilers, pressure vessels, or other pressure retaining items with the National Board in accordance with its provisions. Scope of Authorization is in reference to ASME Stamps S and U.

Float Operated Level Switches Model Series 500, 510, 600, 700

The float rides on the process fluid and tracks with the liquid level movement. As the fluid level in the vessel (or external cage) rises or falls, the position of the float changes. Magnets attached to a float guide rod (located inside the sensing tube) also move with the changing level. A switch mechanism (electrical or pneumatic) attached to the exterior of the sensing tube is actuated by a rising level and de-actuated by a falling level.

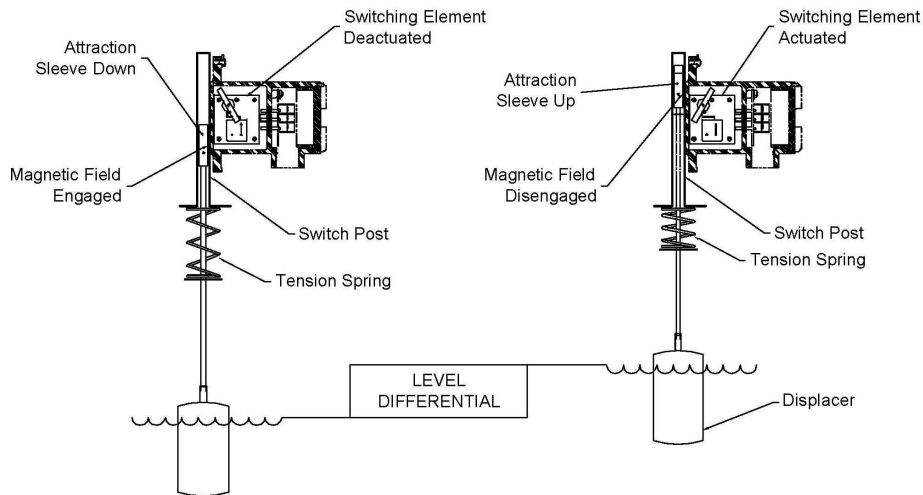
Floats can utilize multiple switching mechanisms. Consult the factory for special float switching arrangements.



Displacer Operated Level Switches Model Series 550, 560, 800, 900

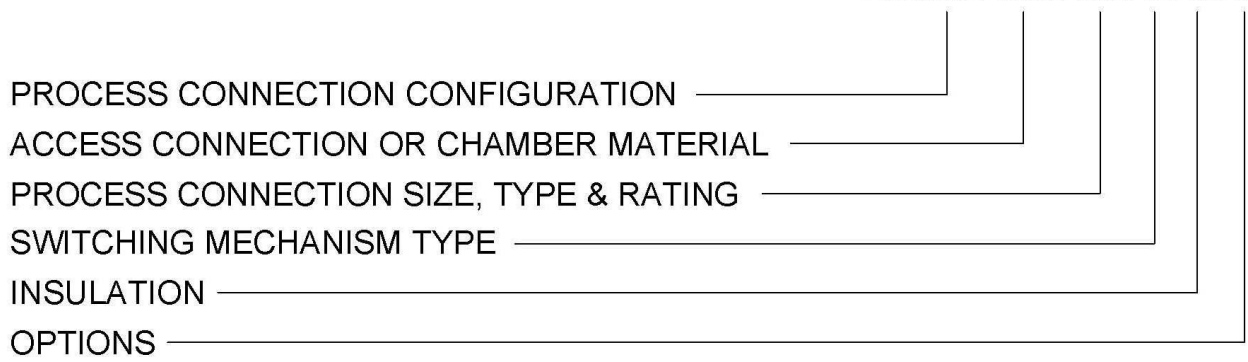
Displacer switches offer an alternative means of fluid level measurement different from the traditional float device. While a float follows the liquid level, a displacer remains partially or completely submerged. The buoyancy of the displacer is increased as it becomes covered by more liquid. Therefore, when the displacer weight drops below the spring tension (rising level), the switch mechanism is actuated. Hence, when the displacer weight increases to that greater than the spring tension (falling level), the switch mechanism is de-actuated.

Displacer switches can be utilized in some high pressure and low specific gravity applications where float designs are cost prohibitive or impossible to implement.



Model Number Format

a / b / c / d / e / f
 LS xxx / xxx / xx / x / x / x



How to Order:

- Step 1:** */a/* Select **Process Connection Configuration**
 Choose a mechanical level switch model series based on maximum working pressure, maximum temperature and minimum specific gravity.
- Step 2:** */b/* Select **Access Connection or Chamber Material**
- Step 3:** */c/* Select **Process Connection Size, Type & Rating**
- Step 4:** */d/* Select **Switching Mechanism Type**
- Step 5:** */e/* Select **Insulation**
- Step 6:** */f/* Select **Options**

Series LS 500/510

Model Number Selection: Step 1

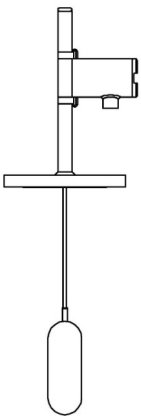
Top Mount Float Series

Model Number Formats

Series LS 5xx - Top Mounted Float					
50x - Flanged Process Connection			Example Application Data: Pressure 26bar, Temperature 225°C, S.G. .68, 4" Flanged Process Connection, 32 3/8" Pneumatic Switch Point Location		
Example: LS502/CST/SR43/F/IP/SP=32 3/8in.					
Model (Series) (a)	Access Connection Material (b)	Access Connection Size, Type & Rating (c)	Switching Mechanism Type (d)	Insulation (e)	Options (f)
502	CST	SR43	F	IP	SP=32 3/8"

Step 1:

/a/ Select **PROCESS CONNECTION CONFIGURATION**



50x Flanged



51x NPT

Note: For both the 50x and 51x, use the table below to select model series.

Top Mount Float Series

Model Series	Pressure at Indicated Temperature				Float Mat'l Code	Minimum S.G.
	100° F (psig)	37.7° C (bar)	450° F (psig)	232° C (bar)		
5x1	225	15.5	207	14.3	T2	.4
5x2	500	34.5	460	31.7	S6	.68
5x3	750	51.7	690	47.6	S6	.52

Float Materials: 316 SS (S6) is the standard. The following materials and others are available. Hastelloy C276; Titanium Gr2 and Titanium Gr5. Construction materials are determined by application specifics (i.e. temperature, pressure and specific gravity).

Consult ABB factory for other materials and process conditions not listed.

Series LS 550/560

Model Number Selection: Step 1

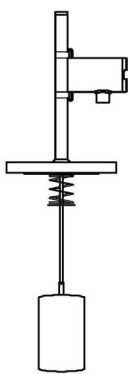
Top Mount Displacer Series

Model Number Formats

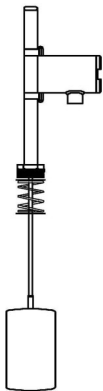
Series LS 5xx - Top Mounted Displacer					
56x - Threaded Process Connection		Example Application Data: Pressure: 17 bar, Temperature: 35°C, S.G.: 0.76, 1.5" NPT Process Connection, Switch Point Location 20 3/4"			
Example: LS562/SS6/P15/E/X/SP=20 3/4in.					
Model (Series) (a)	Access Connection Material (b)	Access Connection Size, Type & Rating (c)	Switching Mechanism Type (d)	Insulation (e)	Options (f)
562	SS6	P15	E	X	SP=20 3/4"

Step 1:

/a/ Select **PROCESS CONNECTION CONFIGURATION**



55x Flanged



56x NPT

Note: For both the 55x and 56x, use the table below to select model series.

Top Mount Displacer Series

Model Series	Pressure at Indicated Temperature				Displacer Mat'l	Minimum S.G.
	100° F (psig)	37.7° C (bar)	450° F (psig)	232° C (bar)		
5x1	1000	68.9	750	51.7	S6	.6
5x2	275	19.0	182	12.5	S6	.6

Displacer Materials: 316 SS (S6) is the standard. The following materials and others are available. Hastelloy C276; Titanium Gr2, Titanium Gr5 and Porcelain. Construction materials are determined by application specifics (i.e. temperature, pressure and specific gravity).

Consult ABB factory for other materials and process conditions not listed.

Step 2:

/b/ ACCESS CONNECTION MATERIAL

- CST** CARBON STEEL (STANDARD)
- SS6** 316 SS
- DUP** DUPLEX STAINLESS STEEL
- HSB** HASTELLOY B-3
- HSC** HASTELLOY C-276
- P11** P11 1.25%CHROME, MOLYBDENUM STEEL
- P91** P91 9% CHROME, MOLYBDENUM STEEL
- O** CUSTOM¹¹

Step 3:

/c/ ACCESS CONNECTION SIZE TYPE & RATING¹

SEE TABLES 3 & 4 (p46-49)
IN APPENDIX

- O** CUSTOM¹⁰

Step 4:⁴

/d/ SWITCHING MECHANISM TYPE²

1 AMP SPDT REED SWITCH

- A** MS30
- B** MS30EX

NOTE: TYPE A & B NOT COMPATIBLE WITH 55X/56X SERIES

10AMP DPDT CAM ACTION SWITCH

- C** MS40
- D** MS40/EX
- E** MS41 HERM SEALED (STANDARD)

PNEUMATIC SWITCH

- F** PS35
- G** PS45

Step 5:⁴

/e/ INSULATION³

- X** NO INSULATION
- IF** INSULATION FLANGE - RATED UP TO **900°F (482°C) MAX**
- IP** INSULATION PAD - ALL SERVICES $\geq 180^\circ\text{F}$ (**82°C**) PNEUMATIC SWITCHES ONLY ALL SERVICES $\geq 300^\circ\text{F}$ (**149°C**) ELECTRIC SWITCHES ONLY
- O** CUSTOM¹⁰

Step 6:^{4,7}

/f/ OPTIONS

- X** NO OPTIONS
- IL** INSERTION LENGTH
- CX** CUSTOM CALIBRATION⁵
- SW** STILLING WELL⁸
- ST** SUPPORT TUBE⁸
- IM** INTERFACE LEVEL MEASUREMENT⁹
- O** CUSTOM¹⁰
- SP** SWITCH POINT LOCATION⁶

NOTE: REFERENCE MODEL NUMBER SELECTION NOTES ON THE FOLLOWING PAGE

NOTES:

1. See Flange Pressure Rating Table in Appendix. Information in these tables is taken from ASME Standards. DIN, HG, or other International Flange Types require factory consultation.
2. See Switching Mechanisms and Housings on page 38-39. See Switch Mechanism Product Data Sheets for specifications.
3. See Insulation Descriptions on page 40; Insulation Flange (IF) is recommended for personnel safety.
4. Multiple Options: Separate multiple options with semi-colon (;) Example: ...x/B = 2-11/16 in; SW =17".....
5. CX - Custom Calibration: C + "B" or "C" for required dimension (not "B" and "C") and engineering units (mm, in, cm) Example: x / CB=2-11/16 in; See "Calibration Dimensions."
6. Customer to specify switch point location to nearest 1/8" or specify CX
7. Only applicable if retrofitting Top Insertion Model into existing Chamber. See Figure 1 below. Customer to specify existing Chamber Length (P) and Chamber ID.
8. See Stilling Well (SW) and Support Tubes (ST) descriptions below in Figure 2 and on page 42.
9. Interface Level Measurement (IM) requires special consideration. Consult factory for details.
10. For options and selections not listed, write requirements after model number. Contact the ABB factory for price and availability.

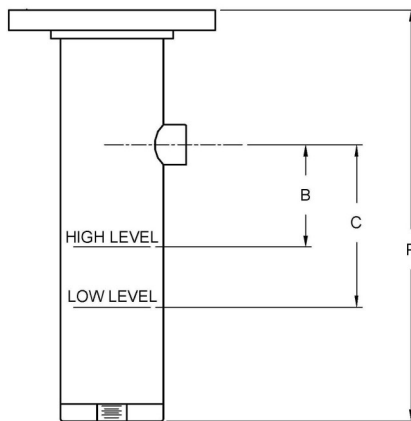


Figure 1

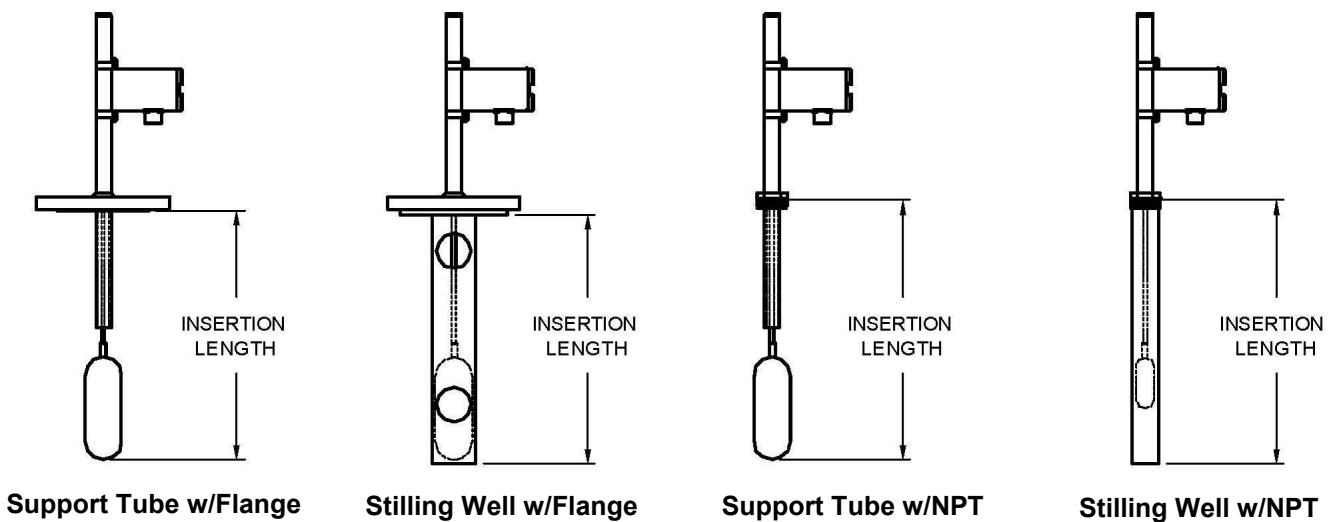


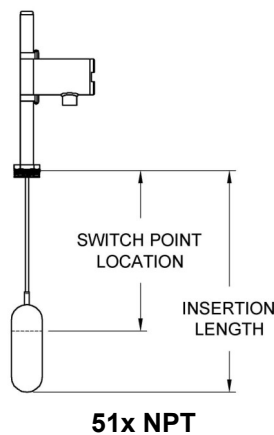
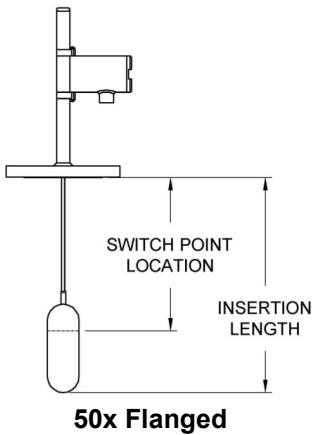
Figure 2

Calibration Dimensions for LS 500/510/550/560 Series

Dimensions in this catalog are for reference only. They may be changed without notice. Contact the factory for certified drawings for a particular model number.

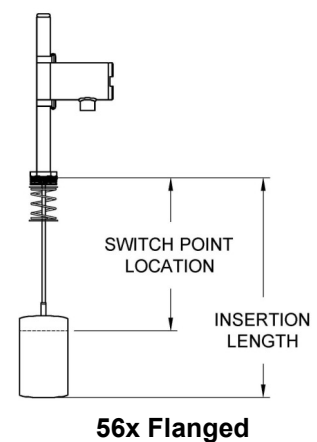
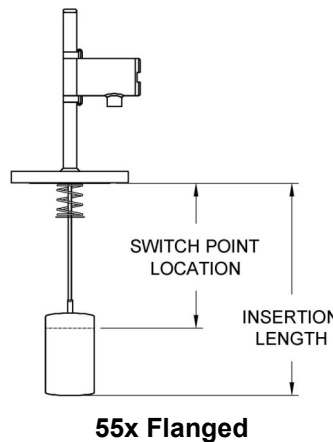
Note: It is important to consider the installation configuration when selecting the process connection. Be sure that the float will fit through the process connection, or that the vessel has access to attach the float from inside the vessel after instrument installation.

500/510 Series (Float)						
Model	Float Size	Minimum Opening Size	Minimum Insertion		Maximum Insertion	
			in	mm	in	mm
5x1	TBD	TBD	4-1/4	108	48	1219
5x2	TBD	TBD	4-1/2	114	48	1219
5x3	TBD	TBD	4-1/4	108	48	1219



Note: For longer Insertion Length, consult ABB factory.

550/560 Series (Displacer)			
Model	Displacer Size	Maximum Insertion Length	
		in	mm
5x1	TBD	48	1219
5x2	TBD	48	1219



Note: For longer Insertion Length, consult ABB factory.

Series LS 600

Model Number Selection: Step 1

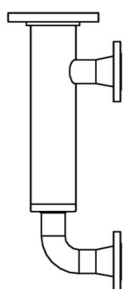
Flanged Chamber Float Series

Model Number Formats

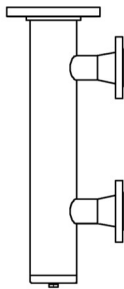
Series LS 6xx - Flanged Chamber Float					
61x - Side/Side Process Connections			Example Application Data: Pressure 52bar, Temperature 230°C, S.G. 0.61, 2" Flange Process Connection, Pneumatic Output , 3/4" Vent Valve		
Example: LS614/CST/N3F0W9/N74-WR26/F/IH2;IF/VV; C=300mm					
Model (Series) (a)	Chamber Material (b)	Process Connection Size, Type & Rating (c)	Switching Mechanism Type (d)	Insulation (e)	Options (f)
614	CST	N3F0W9/N74-WR26	F	IH2;IF	VV; C=300mm

Step 1:

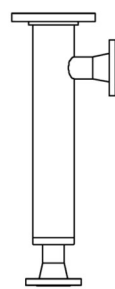
/a/ Select **PROCESS CONNECTION CONFIGURATION**



61x Side/Side



62x Side/Side/Drain



63x Side/Bottom

Carbon Steel Chamber (A106 GrB)

Model Series	Pressure at Indicated Temperature								Float Mat'l Code	Minimum S.G.
	100° F (psig)	37.7° C (bar)	450° F (psig)	232° C (bar)	750° F (psig)	399° C (bar)	1000°F (psig)	538°C (bar)		
6x1	285	19.7	185	12.8	95	6.6	23	1.6	TBD	0.44
6x2	500	34.5	460	31.7	389	26.8	354	24.3	TBD	0.60
6x3	740	51.0	622	42.9	505	34.8	418	28.8	TBD	0.44
6x4	990	68.2	822	56.6	778	53.6	676	46.6	TBD	0.61
6x5	285	19.7	185	12.8	95	6.6	23	1.6	TBD	0.38
6x6	285	19.7	185	12.8	95	6.6	23	1.6	TBD	0.64
6x7	350	24.1	322	22.2	272	18.8	247	17.1	TBD	0.60
6x8	740	51.0	622	42.9	389	26.8	281	19.3	TBD	0.65
6x9	1250	86.2	1150	79.3	TBD	TBD	TBD	TBD	TBD	0.77

Float materials: 316 SS (S6) is the standard. The following materials and others are available. Hastelloy C276; Titanium Gr2 and Titanium Gr5. Construction materials are determined by application specifics (i.e. temperature, pressure and specific gravity).

Consult ABB factory for other chamber materials and process conditions not listed.

Stainless Steel Chamber (316SS)

Model Series	Pressure at Indicated Temperature								Float Mat'l Code	Minimum S.G.
	100° F (psig)	37.7° C (bar)	450° F (psig)	232° C (bar)	750° F (psig)	399° C (bar)	1000°F (psig)	538°C (bar)		
6x1	275	19.0	182	12.5	95	6.6	27	1.8	TBD	0.44
6x2	500	34.5	460	31.7	389	26.8	354	24.6	TBD	0.60
6x3	720	49.6	497	34.3	425	29.3	287	19.4	TBD	0.44
6x4	1000	68.9	920	63.4	778	53.6	708	48.9	TBD	0.61
6x5	275	19.0	182	12.5	95	6.6	27	1.8	TBD	0.38
6x6	275	19.0	182	12.5	95	6.6	27	1.8	TBD	0.64
6x7	350	24.1	322	22.2	272	18.8	247	16.9	TBD	0.60
6x8	720	49.6	497	34.3	425	29.3	287	19.6	TBD	0.65
6x9	1250	86.2	992	68.4	TBD	TBD	TBD	TBD	TBD	0.77

Series LS 600

Model Number Selection: Steps 2 - 6

Step 2:

/b/ CHAMBER MATERIAL

CST	CARBON STEEL (STANDARD)
SS6	316 SS
DUP	DUPLEX STAINLESS STEEL
HSB	HASTELLOY B-3
HSC	HASTELLOY C-276
P11	P11 1.25%CHROME, MOLYBDENUM STEEL
P91	P91 9% CHROME, MOLYBDENUM STEEL
O	CUSTOM ¹¹

Step 3:

/c/ PROCESS CONNECTION SIZE TYPE & RATING^{1,9, 10}

SEE TABLES 3 & 4 (p46-49)
IN APPENDIX

O CUSTOM¹²

Step 4:⁴

/d/ SWITCHING MECHANISM TYPE²

1 AMP SPDT REED SWITCH

A MS30
B MS30EX

10AMP DPDT CAM ACTION SWITCH

C MS40
D MS40/EX
E MS41 HERM SEALED
(STANDARD)

PNEUMATIC SWITCH

F PS35
G PS45

Step 5:⁴

/e/ INSULATION³

X	NO INSULATION
IP	INSULATION PAD - ALL SERVICES $\geq 180^{\circ}\text{F}$ (82°C) PNEUMATIC SWITCHES ONLY
IH1	ELECTRIC SWITCHES ONLY HIGH TEMP. INSULATION; FLOAT CHAMBER ONLY; 1/2"THICK, 250°F (121°C) MAX
IH1D	HIGH TEMP. INSULATION; FLOAT CHAMBER & VENT/ DRAIN FLANGES; 1/2"THICK, 250°F (121°C) MAX
IH2	HIGH TEMP. INSULATION; FLOAT CHAMBER ONLY; 1"THICK, 500°F (260°C) MAX
IH2D	HIGH TEMP. INSULATION; FLOAT CHAMBER & VENT/ DRAIN FLANGES; 1"THICK, 500°F (260°C) MAX
IH3	HIGH TEMP. INSULATION; FLOAT CHAMBER ONLY; 2"THICK, 900°F (482°C) MAX
IH3D	HIGH TEMP. INSULATION; FLOAT CHAMBER & VENT/ DRAIN FLANGES; 2"THICK, 900°F (482°C) MAX
IF	INSULATION FLANGE - RATED UP TO 900°F (482°C) MAX
IL1	CRYOGENIC INSULATION; 2"THICK; SINGLE LAYER; -100°F (-73°C) MINIMUM
IL2	CRYOGENIC INSULATION; 3" THICK; DOUBLE LAYER; -200°F (-129°C) MINIMUM
IL3	CRYOGENIC INSULATION; 4" THICK; DOUBLE LAYER; -320°F (-196°C) MINIMUM
O	CUSTOM ¹²

Step 6:⁴

/h/ OPTIONS

X	NO OPTIONS
CX	CUSTOM CALIBRATION ⁵
LX	CUSTOM CHAMBER LENGTH ⁶
VV	VENT VALVE ⁷
DV	DRAIN VALVE ⁷
IV	ISOLATION VALVE ⁷
IM	INTERFACE LEVEL MEASUREMENT ⁸
TT1	STEAM TRACE TUBING
ET1xx	ELECTRIC TRACING; CLASS 1, DIV 2, GP BCD; 221°F (105°C) MAX , FIXED SET POINT CONTROL ¹¹
ET2x	ELECTRIC TRACING; CLASS 1, DIV 2, GP BCD; 400°F (204°C) MAX , ADJUSTABLE SETPOINT CONTROL ¹¹
ET3x	ELECTRIC TRACING; CLASS 1, DIV 2, GP BCD; 800°F (427°C) MAX , ADJUSTABLE SETPOINT CONTROL ¹¹
G	GUSSETS ON PROCESS CONNECTION (HIGH VIBRATION APPLICATIONS)
O	CUSTOM ¹²

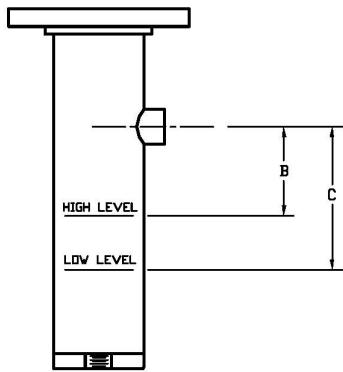
NOTE: REFERENCE MODEL NUMBER
SELECTION NOTES ON THE
FOLLOWING PAGE

NOTES:

1. See Flange Pressure Rating Table in Appendix. Information in these tables is taken from ASME Standards. DIN, HG, or other International Flange Types require factory consultation.
2. See Switching Mechanisms and Housings on page 38-39. See Switch Mechanism Product Data Sheets for specifications.
3. See Insulation Descriptions on page 40; Insulation Jackets (IH) & Insulation Flange Covers are recommended for personnel safety.
4. Multiple Options: Separate multiple options with semi-colon (;) Example: ...x/B = 2-11/16 in; H = 287mm;
5. CX - Custom Calibration: C + "B" or "C" for required dimension (not "B" and "C") and engineering units (mm, in, cm) Example: x / CB=2-11/16 in; See "Calibration Dimensions."
6. LX - Custom Length: L + "D" or "H" for required dimension (not "D" and "H") and engineering units (mm, in, cm) Example: x / LH = 287mm; See "Dimension Tables."
7. See Valve Description on Page 41. Vent Valve (VV), Drain Valve (DV), Isolation Valves (IV) Customer to specify valve type and size.
8. Interface Level Measurement (IM) requires special consideration. Consult factory for details.
9. For Available Process Connections, see Tables 3 and 4 (p46-49) in Appendix.
10. Chamber Access Flange Types will be the same as Process Connections. If Process Connections are not flanges, Raised Face Slip-ons will be the standard (unless otherwise specified). Use option "O" if flange type differs from process connection.
11. Specify power supply 1) 110, 2) 220, 3) 277 OR 4) 440 VAC) (ex. ET21= ET2 with 110VAC power supply). For ET1xx series only, specify setpoint A) 35°, B) 45°, C) 60°, D) 90° or E) 185°F (1.7°, 7.2°, 15.6°, 32.2°, or 85°C) (ex. ET11A = ET1 with 110VAC power supply and a setpoint of 35°F)
12. For options and selections not listed, write requirements after model number. Contact the ABB factory for price and availability.

Calibration Dimensions for LS 600 series

1. "B" is the distance that the switch trips on rising level at the specified S.G.
2. "C" is the distance that the switch resets on falling level at the specified S.G.
3. The "B" dimension is the default switch calibration setting.
4. The "C" dimension will vary depending on the particular switch unit specified.
5. If a different "B" or the "C" dimension is required, it should be stated as shown under Options.
6. Calibration accuracy is +/- 1/4" (6mm)



600 Series 6x1		
S.G.	"B"	"C"
.54	2-11/16"	3-3/4"
.60	3-3/16"	4-1/8"
.70	3-3/4"	4-9/16"
.80	4-3/16"	4-7/8"
.90	4-9/16"	5-1/8"
1.0	4-13/16"	5-3/8"

600 Series 6x2		
S.G.	"B"	"C"
.64	2-9/16"	3-1/2"
.70	3"	3-3/4"
.80	3-1/2"	4-3/16"
.90	3-15/16"	4-1/2"
1.0	4-1/4"	4-3/4"
1.1	4-1/2"	5"

600 Series 6x3		
S.G.	"B"	"C"
.50	2-9/16"	3-3/8"
.60	3-5/8"	4-1/16"
.70	4-1/8"	4-7/16"
.80	4-7/16"	4-3/4"
.90	4-11/16"	4-15/16"
1.1	4-7/8"	5-1/8"

600 Series 6x4		
S.G.	"B"	"C"
.61	2-1/2"	3-1/4"
.70	3-7/16"	3-13/16"
.80	3-7/8"	4-3/16"
.90	4-1/4"	4-1/2"
1.0	4-1/2"	4-11/16"
1.1	4-11/16"	4-7/8"

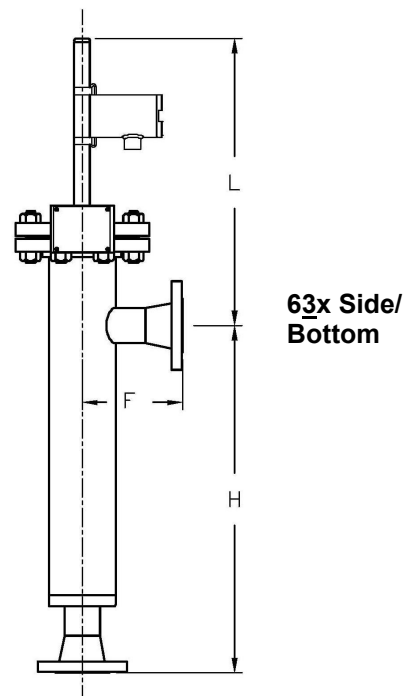
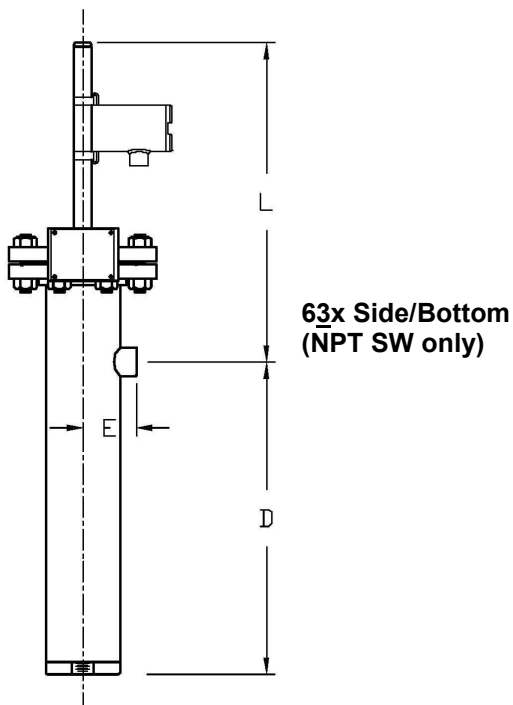
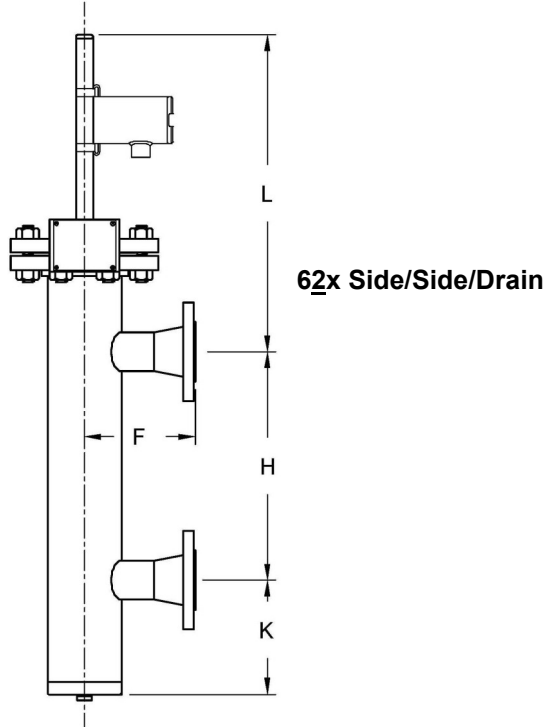
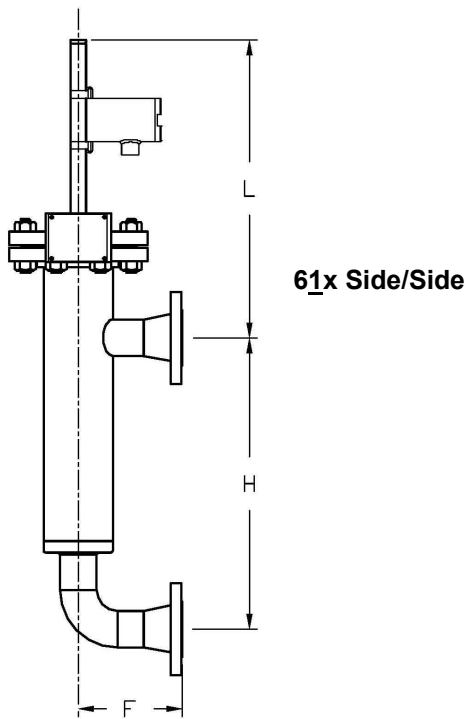
600 Series 6x5		
S.G.	"B"	"C"
.38	3-1/4"	4-1/16"
.40	3-13/16"	4-3/8"
.50	5-1/16"	5-5/16"
.60	5-11/16"	5-7/8"
.70	6-1/16"	6-1/4"
.80	6-3/8"	6-9/16"

600 Series 6x6; 6x7		
S.G.	"B"	"C"
.65	2-1/16"	3-7/16"
.70	2-3/8"	3-5/8"
.80	2-3/4"	3-7/8"
.90	3-1/8"	4-1/16"
1.0	3-3/8"	4-1/4"
1.1	3-9/16"	4-3/8"

600 Series 6x8; 6x9		
S.G.	"B"	"C"
.93	2-5/8"	3-1/2"
1.0	3"	3-3/4"
1.1	3-7/16"	4-1/16"
1.2	3-3/4"	4-3/8"
1.3	4"	4-9/16"
1.4	4-1/4"	4-13/16"

Chamber Dimensions for LS 600 series

- See Tables on page 19 for dimensions for selected process connection size.
- Drawings not to scale.



Dimension Tables

1" Process Connection Dimension Table

	D*		E*		F		H		K		L	
	Inches	mm	Inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
6x1	10-1/2	267	3-11/16	94	TBD	TBD	14	356	TBD	TBD	TBD	TBD
6x2												
6x3	10-3/8	264	4-3/4	121	TBD	TBD	14	356	TBD	TBD	TBD	TBD
6x4												
6x5	12-5/8	321	5-3/4	146	TBD	TBD	16	406	TBD	TBD	TBD	TBD
6x6	9	229	3-3/16	81	TBD	TBD	14	356	TBD	TBD	TBD	TBD
6x7												
6x8	10-1/2	267	3-11/16	94	TBD	TBD	14	356	TBD	TBD	TBD	TBD

* These dimensions apply to Model 63x Side/Bottom with Threaded or Socket "Flange Type" only (see p18)

1-1/2" Process Connection Dimension Table

	D*		E*		F		H		K		L	
	Inches	mm	Inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
6x1	10-9/16	268	3-3/4	95	TBD	TBD	14	356	TBD	TBD	TBD	TBD
6x2												
6x3	10-7/16	265	4-13/16	122	TBD	TBD	14	356	TBD	TBD	TBD	TBD
6x4												
6x5	12-11/16	322	5-13/16	148	TBD	TBD	16	406	TBD	TBD	TBD	TBD
6x6	9	229	3-1/4	83	TBD	TBD	14	356	TBD	TBD	TBD	TBD
6x7												
6x8	10-9/16	268	3-3/4	95	TBD	TBD	14	356	TBD	TBD	TBD	TBD

* These dimensions apply to Model 63x Side/Bottom with Threaded or Socket "Flange Type" only (see p18)

2" Process Connection Dimension Table

	D*		E*		F		H		K		L	
	Inches	mm	Inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
6x1	10-11/16	271	3-7/8	98	TBD	TBD	14	356	TBD	TBD	TBD	TBD
6x2												
6x3	10-9/16	268	4-15/16	125	TBD	TBD	14	356	TBD	TBD	TBD	TBD
6x4												
6x5	12-13/16	325	5-15/16	151	TBD	TBD	16	406	TBD	TBD	TBD	TBD
6x6	-- NA--	-- NA--	--NA--	-- NA--	TBD	TBD	14	356	TBD	TBD	TBD	TBD
6x7												
6x8	10-11/16	271	3-7/8	98	TBD	TBD	14	356	TBD	TBD	TBD	TBD

* These dimensions apply to Model 63x Side/Bottom with Threaded or Socket "Flange Type" only (see p18)

Series LS 700

Model Number Selection: Step 1

Sealed Chamber Float Series

Model Number Format

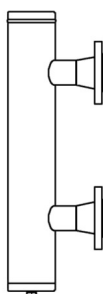
Series LS 7xx - Sealed Chamber Float					
Series LS 73x - Side/Bottom Process Connections			Example Application Data: Pressure 27bar, Temperature 35°C, S.G. 0.5, 1" Process Connection		
Example:LS738/SS6/C1W3/SC13/B/X/LH=315mm					
Model (Series) (a)	Chamber Material (b)	Process Connection Size, Type & Rating (c)	Switching Mechanism Type (d)	Insulation (e)	Options (f)
738	SS6	C1W3/SC13	B	X	LH=315mm

Step 1:

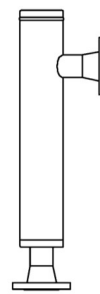
/a/ Select **PROCESS CONNECTION CONFIGURATION**



71x Side/Side



72x Side/Side/Drain



73x Side/Bottom

Carbon Steel Chamber (A106 GrB)

Model Series	Pressure at Indicated Temperature								Float Mat'l Code	Minimum S.G.
	100° F (psig)	37.7° C (bar)	450° F (psig)	232° C (bar)	750° F (psig)	399° C (bar)	1000°F (psig)	538°C (bar)		
7x1	225	15.5	207	14.3	175	12.1	159	11.0	TBD	.37
7x2	300	20.7	276	19.0	233	16.1	212	14.6	TBD	.54
7x3	500	34.5	460	31.7	389	26.8	354	24.4	TBD	.64
7x4	1250	86.2	1150	79.3	972	67.0	884	60.9	TBD	.93
7x5	750	51.7	690	47.6	584	40.3	531	36.6	TBD	.5
7x6	1000	68.9	920	63.4	778	53.6	708	48.8	TBD	.63
7x7	1000	68.9	920	63.4	778	53.6	708	48.8	TBD	.61
7x8	450	31.0	414	28.5	350	24.1	318	21.9	TBD	.38
7x9	350	24.1	322	22.2	272	18.8	247	17.1	TBD	.65

Float materials: 316 SS (S6) is the standard. The following materials and others are available. Hastelloy C276; Titanium Gr2 and Titanium Gr5. Construction materials are determined by application specifics (i.e. temperature, pressure and specific gravity).

Stainless Steel Chamber (316SS)

Model Series	Pressure at Indicated Temperature								Float Mat'l Code	Minimum S.G.
	100° F (psig)	37.7° C (bar)	450° F (psig)	232° C (bar)	750° F (psig)	399° C (bar)	1000°F (psig)	538°C (bar)		
7x1	225	15.5	207	14.3	175	12.1	159	11.0	TBD	.37
7x2	300	20.7	276	19.0	233	16.1	212	14.6	TBD	.54
7x3	500	34.5	460	31.7	389	26.8	354	24.4	TBD	.64
7x4	1250	86.2	1052	72.5	972	67.0	847	58.4	TBD	.93
7x5	750	51.7	690	47.6	584	40.3	531	36.6	TBD	.5
7x6	1000	68.9	838	57.8	778	53.6	677	46.6	TBD	.63
7x7	1000	68.9	838	57.8	778	53.6	677	46.6	TBD	.61
7x8	450	31.0	414	28.5	350	24.1	318	21.9	TBD	.38
7x9	350	24.1	322	22.2	272	18.8	247	17.1	TBD	.65

Consult ABB factory for other chamber materials and process conditions not listed.

Series LS 700

Model Number Selection: Steps 2 - 6

Step 2:

/b/ CHAMBER MATERIAL

- CST** CARBON STEEL (STANDARD)
- SS6** 316 SS
- DUP** DUPLEX STAINLESS STEEL
- HSB** HASTELLOY B-3
- HSC** HASTELLOY C-276
- P11** P11 1.25%CHROME, MOLYBDENUM STEEL
- P91** P91 9% CHROME, MOLYBDENUM STEEL
- O** CUSTOM¹¹

Step 3:

/c/ PROCESS CONNECTION SIZE TYPE & RATING^{1,9}

SEE TABLES 3 & 4 (p46-49)
IN APPENDIX

- O** CUSTOM¹¹

Step 4:⁴

/d/ SWITCHING MECHANISM TYPE²

- 1 AMP SPDT REED SWITCH**
- A MS30**
- B MS30EX**
- 10AMP DPDT CAM ACTION SWITCH**
- C MS40**
- D MS40/EX**
- E MS41 HERM SEALED (STANDARD)**
- PNEUMATIC SWITCH**
- F PS35**
- G PS45**

Step 5:⁴

/e/ INSULATION³

- X** NO INSULATION
- IP** INSULATION PAD - ALL SERVICES $\geq 180^{\circ}\text{F}$ (82°C) PNEUMATIC SWITCHES ONLY ALL SERVICES $\geq 300^{\circ}\text{F}$ (149°C) ELECTRIC SWITCHES ONLY
- IH1** HIGH TEMP. INSULATION; FLOAT CHAMBER ONLY; 1/2"THICK, **250°F (121°C) MAX**
- IH1D** HIGH TEMP. INSULATION; FLOAT CHAMBER & VENT/ DRAIN FLANGES; 1/2"THICK, **250°F (121°C) MAX**
- IH2** HIGH TEMP. INSULATION; FLOAT CHAMBER ONLY; 1"THICK, **500°F (260°C) MAX**
- IH2D** HIGH TEMP. INSULATION; FLOAT CHAMBER & VENT/ DRAIN FLANGES; 1"THICK, **500°F (260°C) MAX**
- IH3** HIGH TEMP. INSULATION; FLOAT CHAMBER ONLY; 2"THICK, **900°F (482°C) MAX**
- IH3D** HIGH TEMP. INSULATION; FLOAT CHAMBER & VENT/ DRAIN FLANGES; 2"THICK, **900°F (482°C) MAX**
- IL1** CRYOGENIC INSULATION; 2"THICK; SINGLE LAYER; **-100°F (-73°C) MINIMUM**
- IL2** CRYOGENIC INSULATION; 3" THICK; DOUBLE LAYER; **-200°F (-129°C) MINIMUM**
- IL3** CRYOGENIC INSULATION; 4" THICK; DOUBLE LAYER; **-320°F (-196°C) MINIMUM**
- O** CUSTOM¹¹

Step 6:⁴

/h/ OPTIONS

- X** NO OPTIONS
- CX** CUSTOM CALIBRATION⁵
- LX** CUSTOM CHAMBER LENGTH⁶
- VV** VENT VALVE⁷
- DV** DRAIN VALVE⁷
- IV** ISOLATION VALVE⁷
- IM** INTERFACE LEVEL MEASUREMENT⁸
- TT1** STEAM TRACE TUBING
- ET1xx** ELECTRIC TRACING; CLASS 1, DIV 2, GP BCD; **221°F(105°C) MAX**, FIXED SET POINT CONTROL¹⁰
- ET2x** ELECTRIC TRACING; CLASS 1, DIV 2, GP BCD; **400°F(204°C) MAX**, ADJUSTABLE SETPOINT CONTROL¹⁰
- ET3x** ELECTRIC TRACING; CLASS 1, DIV 2, GP BCD; **800°F (427°C) MAX**, ADJUSTABLE SETPOINT CONTROL¹⁰
- G** GUSSETS ON PROCESS CONNECTION (HIGH VIBRATION APPLICATIONS)
- O** CUSTOM¹¹

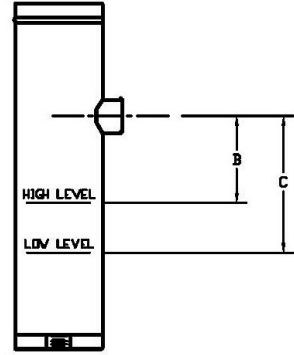
NOTE: REFERENCE MODEL NUMBER SELECTION NOTES ON THE FOLLOWING PAGE

NOTES:

1. See Flange Pressure Rating Table in Appendix. Information in these tables is taken from ASME Standards. DIN, HG, or other International Flange Types require factory consultation.
2. See Switching Mechanisms and Housings on page 38-39. See Switch Mechanism Product Data Sheets for specifications.
3. See Insulation Descriptions on page 40; Insulation Jackets (IH) & Insulation Flange Covers (IF) are recommended for personnel safety.
4. Multiple Options: Separate multiple options with semi-colon (;) Example: ...x/B = 2-11/16 in; H = 287mm;
5. CX - Custom Calibration: C + "B" or "C" for required dimension (not "B" and "C") and engineering units (mm, in, cm) Example: x / CB=2-11/16 in; See "Calibration Dimensions."
6. LX - Custom Length: L + "D" or "H" for required dimension (not "D" and "H") and engineering units (mm, in, cm) Example: x / LH = 287mm; See "Dimension Tables."
7. See Valve Description on Page 41. Vent Valve (VV), Drain Valve (DV), Isolation Valves (IV) Customer to specify valve type and size.
8. Interface Level Measurement (IM) requires special consideration. Consult factory for details.
9. For Available Process Connections, see Tables 3 and 4 (p46-49) in Appendix.
10. Specify power supply 1) 110, 2) 220, 3) 277 & 4) 440 VAC (ex. ET21= ET2 with 110VAC power supply). For ET1xx series only, specify setpoint A) 35°, B) 45°, C) 60°, D) 90° or E) 185°F (1.7°, 7.2°, 15.6°, 32.2°, or 85°C) (ex. ET11A = ET1 with 110VAC power supply and a setpoint of 35°F)
11. For options and selections not listed, write requirements after model number. Contact the ABB factory for price and availability.

Calibration Dimensions for LS 700 series

1. "B" is the distance that the switch trips on rising level at the specified S.G.
2. "C" is the distance that the switch resets on falling level at the specified S.G.
3. The "B" dimension is the default switch calibration setting.
4. The "C" dimension will vary depending on the particular switch unit specified.
5. If a different "B" or the "C" dimension is required, it should be stated as shown under Options.
6. Calibration accuracy is +/- 1/4" (6mm)



700 Series 7x1		
S.G.	"B"	"C"
0.37	2-5/16"	3-1/2"
0.40	3"	3-3/4"
0.50	3-15/16"	4-3/8"
0.60	4-3/8"	4-3/4"
0.70	4-3/4"	5-1/16"
0.80	4-15/16"	5-1/4"

700 Series 7x2		
S.G.	"B"	"C"
0.54	2-11/16"	3-3/4"
0.60	3-3/16"	4-1/8"
0.70	3-3/4"	4-9/16"
0.80	4-3/16"	4-7/8"
0.90	4-9/16"	5-1/8"
1.0	4-13/16"	5-3/8"

700 Series 7x3		
S.G.	"B"	"C"
0.64	2-9/16"	3-1/2"
0.70	3"	3-3/4"
0.80	3-1/2"	4-13/16"
0.90	3-15/16"	4-1/2"
1.0	4-1/4"	4-3/4"
1.1	4-1/2"	5"

700 Series 7x4		
S.G.	"B"	"C"
0.93	2-5/8"	3-1/2"
1.0	3"	3-3/4"
1.1	3-7/16"	4-1/16"
1.2	3-3/4"	4-3/8"
1.3	4"	4-9/16"
1.4	4-1/4"	4-13/16"

700 Series 7x5		
S.G.	"B"	"C"
0.50	2-9/16"	3-3/8"
0.60	3-5/8"	4-1/16"
0.70	4-1/8"	4-7/16"
0.80	4-7/16"	4-3/4"
0.90	4-11/16"	4-15/16"
1.0	4-7/8"	5-1/8"

700 Series 7x6		
S.G.	"B"	"C"
0.63	2-5/8"	3-3/4"
0.70	3-7/16"	4-1/16"
0.80	3-7/8"	4-3/8"
0.90	4-3/16"	4-9/16"
1.0	4-7/16"	4-3/4"
1.1	4-5/8"	4-7/8"

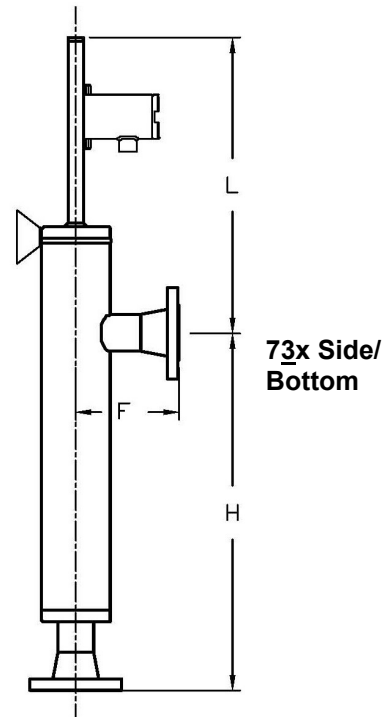
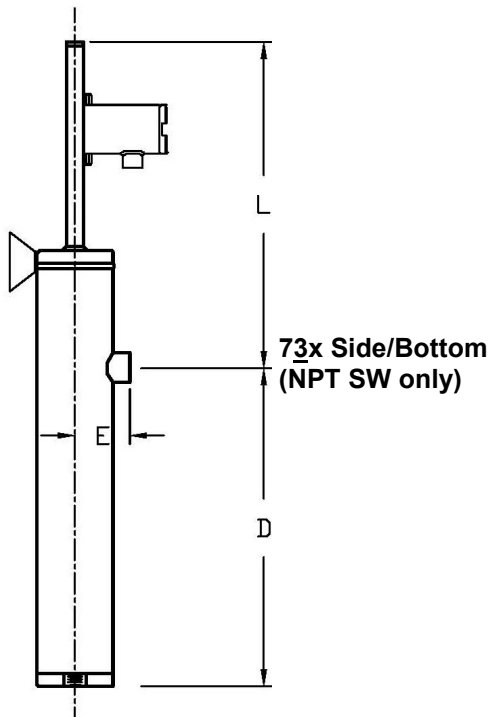
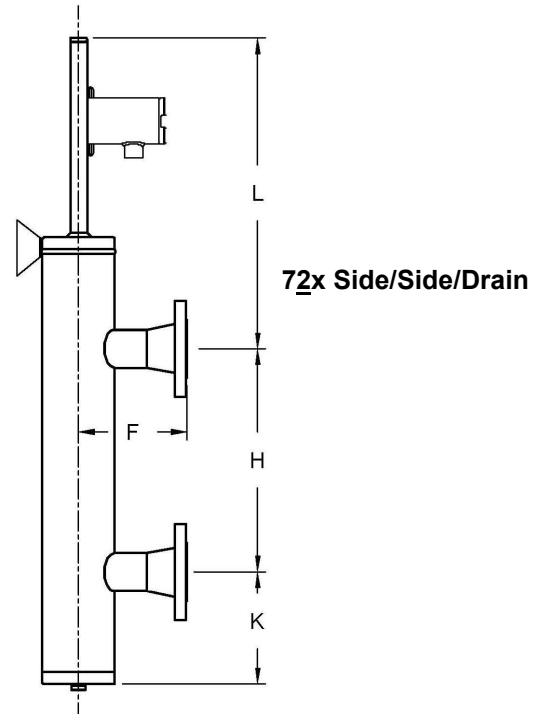
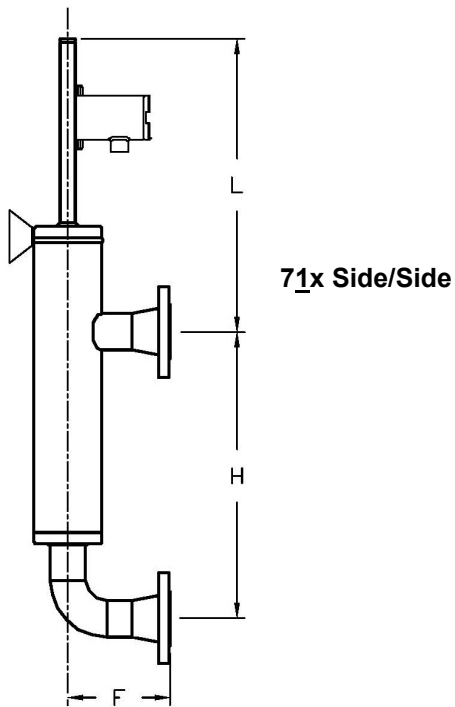
700 Series 7x7		
S.G.	"B"	"C"
0.61	2-1/2"	3-1/4"
0.7	3-7/16"	3-13/16"
0.8	3-15/16"	4-3/16"
0.9	4-1/4"	4-1/2"
1.0	4-1/2"	4-3/4"
1.1	4-11/16"	4-7/8"

700 Series 7x8		
S.G.	"B"	"C"
0.38	3-1/4"	4-1/16"
0.40	3-13/16"	4-3/8"
0.50	5-1/16"	5-5/16"
0.60	5-11/16"	5-7/8"
0.70	6-1/16"	6-1/4"
0.80	6-3/8"	6-9/16"

700 Series 7x9		
S.G.	"B"	"C"
0.65	2-1/16"	3-7/16"
0.70	2-3/8"	3-5/8"
0.80	2-3/4"	3-7/8"
0.90	3-1/8"	4-1/16"
1.0	3-3/8"	4-1/4"
1.1	3-9/16"	4-3/8"

Chamber Dimensions for LS 700 series

- See Tables on page 25 for dimensions for selected process connection size.
- Drawings not to scale.



Dimension Tables

1" Process Connection Dimension Table

	D*		E*		F		H		K		L	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
7x1	10-3/8	264	4-3/4	121	TBD	TBD	14	356	TBD	TBD	TBD	TBD
7x2	10-1/2	267	3-11/16	94	TBD	TBD	14	356	TBD	TBD	TBD	TBD
7x3												
7x4												
7x5	10-3/8	264	4-3/4	121	TBD	TBD	14	356	TBD	TBD	TBD	TBD
7x6												
7x7												
7x8	12-5/8	321	5-3/4	146	TBD	TBD	16	406	TBD	TBD	TBD	TBD
7x9	9	229	3-3/16	81	TBD	TBD	14	356	TBD	TBD	TBD	TBD

* These dimensions apply to Model 63x Side/Bottom with Threaded or Socket "Flange Type" only (see p.24)

1-1/2" Process Connection Dimension Table

	D*		E*		F		H		K		L	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
7x1	10-7/16	265	4-13-16	122	TBD	TBD	14	356	TBD	TBD	TBD	TBD
7x2												
7x3	10-9/16	268	3-3/4	95	TBD	TBD	14	356	TBD	TBD	TBD	TBD
7x4												
7x5	10-7/16	265	4-13/16	122	TBD	TBD	14	356	TBD	TBD	TBD	TBD
7x6	10-7/16	265	4-13/16	122	TBD	TBD	14	356	TBD	TBD	TBD	TBD
7x7												
7x8	12-11/16	322	5-13/16	147	TBD	TBD	16	406	TBD	TBD	TBD	TBD

* These dimensions apply to Model 63x Side/Bottom with Threaded or Socket "Flange Type" only (see p.24)

2" Process Connection Dimension Table

	D*		E*		F		H		K		L	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
7x1	10-9/16	269	4-15/16	126	TBD	TBD	14	356	TBD	TBD	TBD	TBD
7x2												
7x3	10-11/16	273	3-7/8	99	TBD	TBD	14	356	TBD	TBD	TBD	TBD
7x4												
7x5	10-9/16	269	4-15/16	126	TBD	TBD	14	356	TBD	TBD	TBD	TBD
7x6	10-9/16	269	4-15/16	126	TBD	TBD	14	356	TBD	TBD	TBD	TBD
7x7												
7x8	12-13/16	326	5-15/16	151	TBD	TBD	16	406	TBD	TBD	TBD	TBD

* These dimensions apply to Model 63x Side/Bottom with Threaded or Socket "Flange Type" only (see p.24)

Series LS 800

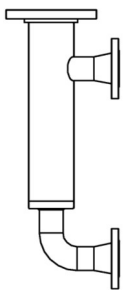
Model Number Selection: Step 1

Flanged Chamber Displacer Series

Model Number Formats

Series LS 8xx - Flanged Chamber Displacer					
82x - Side / Side/ Drain Process Connections			Example Application Data: Pressure 150bar, Temperature 35°C, S.G. 0.5, 3" Flange Process Connection		
Example: LS824/SS6/GEGE/SJ315/D/IH2D/CB=2-11/16"					
Model (Series) (a)	Chamber Material (b)	Process Connection Size, Type & Rating (c)	Switching Mechanism Type (d)	Insulation (e)	Options (f)
824	SS6	GEGE/SJ315	D	IH2D	CB=2-11/16"

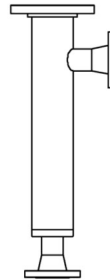
Step 1:



81x Side/Side



82x Side/Side/Drain



83x Side/Bottom

Carbon Steel Chamber (A106 GrB)

Model Series	Pressure at Indicated Temperature				Float Mat'l Code	Minimum S.G.
	100° F (psig)	37.7° C (bar)	450° F (psig)	232° C (bar)		
8x1	285	19.7	185	12.8	S6	.4
8x2	740	51.0	618	42.6	S6	.4
8x3	1480	102.0	1235	85.2	S6	.4
8x4	3376	232.8	3083	212.6	S6	.4

Standard displacer units are not available above 450°F (232°C)

Stainless Steel Chamber (316SS)

Model Series	Pressure at Indicated Temperature				Float Mat'l Code	Minimum S.G.
	100° F (psig)	37.7° C (bar)	450° F (psig)	232° C (bar)		
8x1	275	19.0	182	12.5	S6	.4
8x2	720	49.6	497	34.3	S6	.4
8x3	1440	99.3	992	68.4	S6	.4
8x4	3600	248.2	2480	171.0	S6	.4

Standard displacer units are not available above 450°F (232°C)

Displacer Materials: 316 SS (S6) is the standard. The following materials and others are available. Hastelloy C276; Titanium Gr2, Titanium Gr5 and Porcelain. Construction materials are determined by application specifics (i.e. temperature, pressure and specific gravity).

Consult ABB factory for other chamber materials and process conditions not listed.

Step 2:

/b/ CHAMBER MATERIAL

- CST** CARBON STEEL (STANDARD)
- SS6** 316 SS
- DUP** DUPLEX STAINLESS STEEL
- HSB** HASTELLOY B-3
- HSC** HASTELLOY C-276
- P11** P11 1.25%CHROME, MOLYBDENUM STEEL
- P91** P91 9% CHROME, MOLYBDENUM STEEL
- O** CUSTOM¹¹

Step 3:

/c/ PROCESS CONNECTION SIZE TYPE & RATING^{1,9, 10}

SEE TABLES 3 & 4 (p46-49) IN APPENDIX

- O** CUSTOM¹²

Step 4:⁴

/d/ SWITCHING MECHANISM TYPE²

10 AMP DPDT CAM ACTION SWITCH

- C** MS40
- D** MS40/EX
- E** MS41 HERM SEALED (STANDARD)

PNEUMATIC SWITCH

- F** PS35
- G** PS45

Step 5:⁴

/e/ INSULATION³

- X** NO INSULATION
- IP** INSULATION PAD - ALL SERVICES **≥180°F (82°C)** PNEUMATIC SWITCHES ONLY ALL SERVICES **≥300°F (149°C)** ELECTRIC SWITCHES ONLY
- IH1** HIGH TEMP. INSULATION; FLOAT CHAMBER ONLY; 1/2"THICK, **250°F (121°C) MAX**
- IH1D** HIGH TEMP. INSULATION; FLOAT CHAMBER & VENT/ DRAIN FLANGES; 1/2"THICK, **250°F (121°C) MAX**
- IH2** HIGH TEMP. INSULATION; FLOAT CHAMBER ONLY; 1"THICK, **500°F (260°C) MAX**
- IH2D** HIGH TEMP. INSULATION; FLOAT CHAMBER & VENT/ DRAIN FLANGES; 1"THICK, **500°F (260°C) MAX**
- IH3** HIGH TEMP. INSULATION; FLOAT CHAMBER ONLY; 2"THICK, **900°F (482°C) MAX**
- IH3D** HIGH TEMP. INSULATION; FLOAT CHAMBER & VENT/ DRAIN FLANGES; 2"THICK, **900°F (482°C) MAX**
- IF** INSULATION FLANGE - RATED UP TO **900°F (482°C) MAX**
- IL1** CRYOGENIC INSULATION; 2"THICK; SINGLE LAYER; **-100°F (-73°C) MINIMUM**
- IL2** CRYOGENIC INSULATION; 3" THICK; DOUBLE LAYER; **-200°F (-129°C) MINIMUM**
- IL3** CRYOGENIC INSULATION; 4" THICK; DOUBLE LAYER; **-320°F (-196°C) MINIMUM**
- O** CUSTOM¹²

Step 6:⁴

/h/ OPTIONS

- X** NO OPTIONS
- CX** CUSTOM CALIBRATION⁵
- LX** CUSTOM CHAMBER LENGTH⁶
- VV** VENT VALVE⁷
- DV** DRAIN VALVE⁷
- IV** ISOLATION VALVE⁷
- IM** INTERFACE LEVEL MEASUREMENT⁸
- TT1** STEAM TRACE TUBING
- ET1xx** ELECTRIC TRACING; CLASS 1, DIV 2, GP BCD; **221°F(105°C) MAX**, FIXED SET POINT CONTROL¹¹
- ET2x** ELECTRIC TRACING; CLASS 1, DIV 2, GP BCD; **400°F (204°C) MAX**, ADJUSTABLE SETPOINT CONTROL¹¹
- ET3x** ELECTRIC TRACING; CLASS 1, DIV 2, GP BCD; **800°F (427°C) MAX**, ADJUSTABLE SETPOINT CONTROL¹¹
- G** GUSSETS ON PROCESS CONNECTION (HIGH VIBRATION APPLICATIONS)
- O** CUSTOM¹²

NOTE: REFERENCE MODEL NUMBER SELECTION NOTES ON THE FOLLOWING PAGE

NOTES:

1. See Flange Pressure Rating Table in Appendix. Information in these tables is taken from ASME Standards. DIN, HG, or other International Flange Types require factory consultation.
2. See Switching Mechanisms and Housings on page 38-39. See Switch Mechanism Product Data Sheets for specifications.
3. See Insulation Descriptions on page 40; Insulation Jackets (IH) & Insulation Flange Covers are recommended for personnel safety.
4. Multiple Options: Separate multiple options with semi-colon (;) Example: ...x/B = 2-11/16 in; H = 287mm;
5. CX - Custom Calibration: C + "B" or "C" for required dimension (not "B" and "C") and engineering units (mm, in, cm) Example: ... x / CB=2-11/16 in; See "Calibration Dimensions."
6. LX - Custom Length: L + "D" or "H" for required dimension (not "D" and "H") and engineering units (mm, in, cm) Example: ... x / LH = 287mm; See "Dimension Tables."
7. See Valve Description on Page 41. Vent Valve (VV), Drain Valve (DV), Isolation Valves (IV) Customer to specify valve type and size.
8. Interface Level Measurement (IM) requires special consideration. Consult factory for details.
9. For Available Process Connections, see Tables 3 and 4 (p46-49) in Appendix.
10. Chamber Access Flange Types will be the same as Process Connections. If Process Connections are not flanges, Raised Face Slip-Ons will be the standard (unless otherwise specified).
11. Specify power supply 1) 110, 2) 220, 3) 277 or 4) 440 VAC) (ex. ET21= ET2 with 110VAC power supply). For ET1xx series only, specify setpoint A) 35°, B) 45°, C) 60°, D) 90° or E) 185°F (1.7°, 7.2°, 15.6°, 32.2°, or 85°C) (ex. ET11A = ET1 with 110VAC power supply and a setpoint of 35°F)
12. For options and selections not listed, write requirements after model number. Contact the ABB factory for price and availability.

Calibration Dimensions for LS 800 series

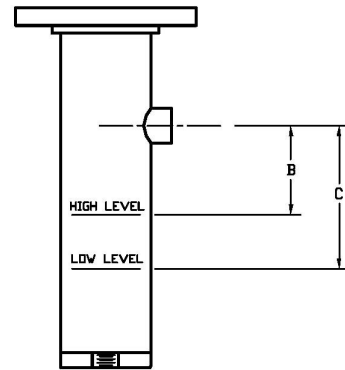
1. "B" is the distance that the switch trips on rising level at the specified S.G.
2. "C" is the distance that the switch resets on falling level at the specified S.G.
3. The "B" dimension is the default switch calibration setting.
4. The "C" dimension will vary depending on the particular switch unit specified.
5. If a different "B" or the "C" dimension is required, it should be stated as shown under Options.
6. Calibration accuracy is +/- 1/4" (6mm)

800 Series 8x1		
S.G.	"B"	"C"
0.40	1-3/8"	4-7/16"
0.50	2-7/16"	5"
0.60	3-1/8"	5-5/16"
0.70	3-11/16"	5-9/16"
0.80	4-1/16"	5-3/4"
0.90	4-15/16"	5-15/16"

800 Series 8x2		
S.G.	"B"	"C"
0.40	1-3/8"	4-7/16"
0.50	2-7/16"	5"
0.60	3-1/8"	5-5/16"
0.70	3-11/16"	5-9/16"
0.80	4-1/16"	5-3/4"
0.90	4-15/16"	5-15/16"

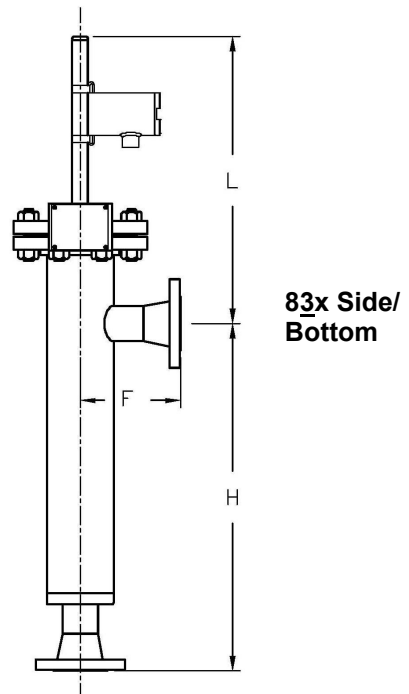
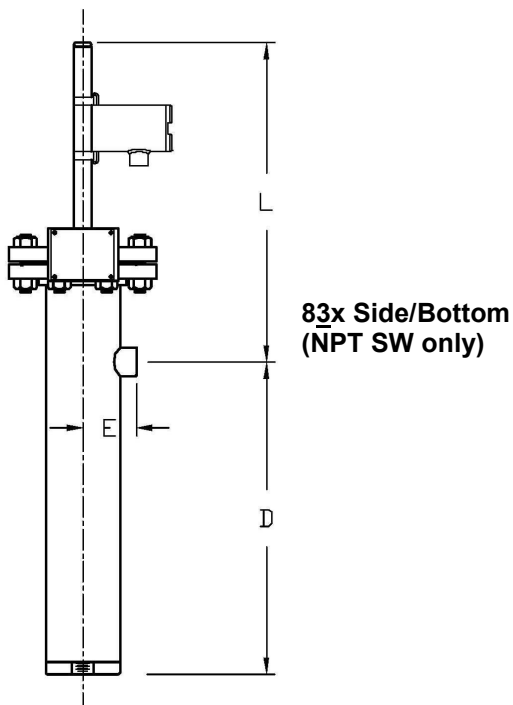
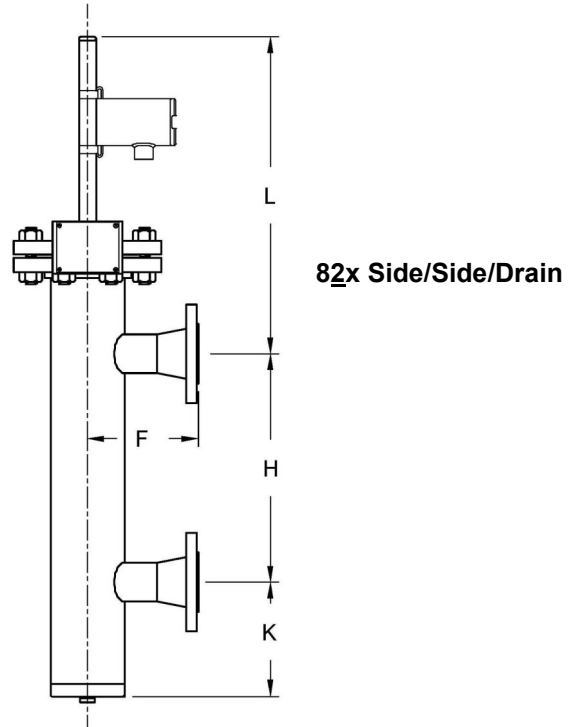
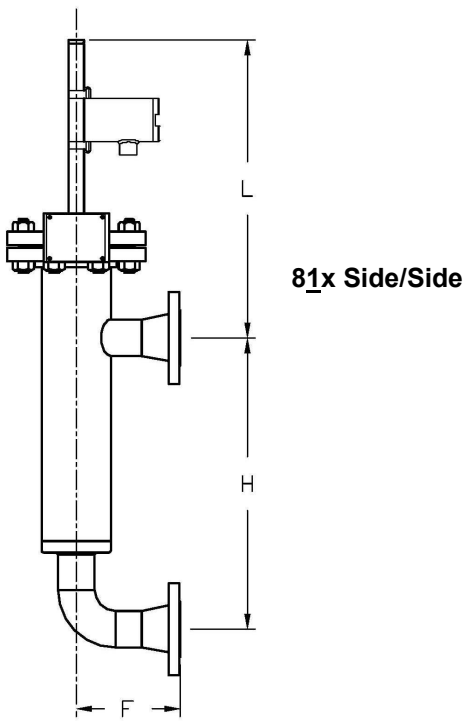
800 Series 8x3		
S.G.	"B"	"C"
0.40	1-3/8"	4-7/16"
0.50	2-7/16"	5"
0.60	3-1/8"	5-5/16"
0.70	3-11/16"	5-9/16"
0.80	4-1/16"	5-3/4"
0.90	4-15/16"	5-15/16"

800 Series 8x4		
S.G.	"B"	"C"
0.40	2-15/16"	5-1/4"
0.50	3-3/4"	5-5/8"
0.60	4-5/16"	5-15/16"
0.70	4-11/16"	6-1/8"
0.80	5"	6-1/4"
0.90	5-3/16"	6-3/8"



Chamber Dimensions for LS 800 series

- See Tables on page 31 for dimensions for selected process connection size.
- Drawings not to scale.



Dimension Tables

1" Process Connection Dimension Table

	D*		E*		F		H		K		L	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
8x1	13	330	3-3/16	81	TBD	TBD	16	406	TBD	TBD	TBD	TBD
8x2												
8x3												
8x4	11-1/2	292	3-11/16	94	TBD	TBD	16	406	TBD	TBD	TBD	TBD
8x5	12-3/4	324	3-15/16	100	TBD	TBD	16	406	TBD	TBD	TBD	TBD

* These dimensions apply to Model 63x Side/Bottom with Threaded or Socket "Flange Type" only (see p.30)

1-1/2" Process Connection Dimension Table

	D*		E*		F		H		K		L	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
8x1	13	330	3-1/4	82	TBD	TBD	16	406	TBD	TBD	TBD	TBD
8x2												
8x3												
8x4	11-9/16	294	3-3/4	95	TBD	TBD	16	406	TBD	TBD	TBD	TBD
8x5	12-7/8	327	4-1/16	103	TBD	TBD	16	406	TBD	TBD	TBD	TBD

* These dimensions apply to Model 63x Side/Bottom with Threaded or Socket "Flange Type" only (see p.30)

2" Process Connection Dimension Table

	D*		E*		F		H		K		L	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
8x1	/	/	/	/	TBD	TBD	16	406	TBD	TBD	TBD	TBD
8x2												
8x3												
8x4	11-11/16	297	3-7/8	98	TBD	TBD	16	406	TBD	TBD	TBD	TBD
8x5	13-1/4	337	4-7/16	113	TBD	TBD	16	406	TBD	TBD	TBD	TBD

* These dimensions apply to Model 63x Side/Bottom with Threaded or Socket "Flange Type" only (see p.30)

Sealed Chamber Displacer Series

Model Number Formats

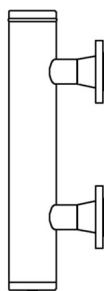
Series LS 9xx - Flanged Chamber Displacer					
91x - Side / Side/ Process Connections			Example Application Data: Pressure 1233psig, Temperature 122°F, S.G.0.46, 2" MNPT Thread		
Example: LS911/CST/N3W7/SJ26/E/IH1/L=21"					
Model (Series) (a)	Chamber Material (b)	Process Connection Size, Type & Rating (c)	Switching Mechanism Type (d)	Insulation (e)	Options (f)
911	CST	N3W7/SJ26	E	IH1	L=21"

Step 1:

/a/ Select **PROCESS CONNECTION CONFIGURATION**.



91x Side/Side



92x Side/Side/Drain



93x Side/Bottom

Carbon Steel Chamber (A106 GrB)

Model Series	Pressure at Indicated Temperature				Float Mat'l Code	Minimum S.G.
	100° F (psig)	37.7° C (bar)	450° F (psig)	232° C (bar)		
9x1	1480	102.0	1380	95.1	S6	.4
9x2	1435	98.9	1380	95.1	S6	.4
9x3	3376	232.8	3376	232.8	S6	.4

Standard displacer units are not available above 450°F (232°C)

Stainless Steel Chamber (316SS)

Model Series	Pressure at Indicated Temperature				Float Mat'l Code	Minimum S.G.
	100° F (psig)	37.7° C (bar)	450° F (psig)	232° C (bar)		
9x1	1480	102.0	1241	85.6	S6	.4
9x2	1480	102.0	1052	72.5	S6	.4
9x3	3601	248.3	2476	170.7	S6	.4

Standard displacer units are not available above 450°F (232°C)

Displacer Materials: 316 SS (S6) is the standard. The following materials and others are available. Hastelloy C276; Titanium Gr2, Titanium Gr5 and Porcelain. Construction materials are determined by application specifics (i.e. temperature, pressure and specific gravity).

Consult ABB factory for other chamber materials and process conditions not listed.

Series LS 900

Model Number Selection: Steps 2 - 6

Step 2:

/b/ CHAMBER MATERIAL

CST	CARBON STEEL (STANDARD)
SS6	316 SS
DUP	DUPLEX STAINLESS STEEL
HSB	HASTELLOY B-3
HSC	HASTELLOY C-276
P11	P11 1.25%CHROME, MOLYBDENUM STEEL
P91	P91 9% CHROME, MOLYBDENUM STEEL
O	CUSTOM ¹¹

Step 3:

/c/ PROCESS CONNECTION SIZE TYPE & RATING^{1,9}

SEE TABLES 3 & 4 (p46-49)
IN APPENDIX

O CUSTOM¹¹

Step 4:⁴

/d/ SWITCHING MECHANISM TYPE²

10AMP DPDT CAM ACTION SWITCH

C	MS40
D	MS40/EX
E	MS41 HERM SEALED (STANDARD)

PNEUMATIC SWITCH

F	PS35
G	PS45

Step 5:⁴

/e/ INSULATION³

X	NO INSULATION
IP	INSULATION PAD - ALL SERVICES $\geq 180^{\circ}\text{F}$ (82°C) PNEUMATIC SWITCHES ONLY
	ALL SERVICES $\geq 300^{\circ}\text{F}$ (149°C) ELECTRIC SWITCHES ONLY
IH1	HIGH TEMP. INSULATION; FLOAT CHAMBER ONLY; 1/2"THICK, 250°F (121°C) MAX
IH1D	HIGH TEMP. INSULATION; FLOAT CHAMBER & VENT/ DRAIN FLANGES; 1/2"THICK, 250°F (121°C) MAX
IH2	HIGH TEMP. INSULATION; FLOAT CHAMBER ONLY; 1"THICK, 500°F (260°C) MAX
IH2D	HIGH TEMP. INSULATION; FLOAT CHAMBER & VENT/ DRAIN FLANGES; 1"THICK, 500°F (260°C) MAX
IH3	HIGH TEMP. INSULATION; FLOAT CHAMBER ONLY; 2"THICK, 900°F (482°C) MAX
IH3D	HIGH TEMP. INSULATION; FLOAT CHAMBER & VENT/ DRAIN FLANGES; 2"THICK, 900°F (482°C) MAX
IL1	CRYOGENIC INSULATION; 2"THICK; SINGLE LAYER; -100°F (-73°C) MINIMUM
IL2	CRYOGENIC INSULATION; 3" THICK; DOUBLE LAYER; -200°F (-129°C) MINIMUM
IL3	CRYOGENIC INSULATION; 4" THICK; DOUBLE LAYER; -320°F (-196°C) MINIMUM
O	CUSTOM ¹¹

Step 6:⁴

/h/ OPTIONS

X	NO OPTIONS
CX	CUSTOM CALIBRATION ⁵
LX	CUSTOM CHAMBER LENGTH ⁶
VV	VENT VALVE ⁷
DV	DRAIN VALVE ⁷
IV	ISOLATION VALVE ⁷
IM	INTERFACE LEVEL MEASUREMENT ⁸
TT1	STEAM TRACE TUBING
ET1xx	ELECTRIC TRACING; CLASS 1, DIV 2, GP BCD; 221°F (105°C) MAX , FIXED SET POINT CONTROL ¹⁰
ET2x	ELECTRIC TRACING; CLASS 1, DIV 2, GP BCD; 400°F (204°C) MAX , ADJUSTABLE SETPOINT CONTROL ¹⁰
ET3x	ELECTRIC TRACING; CLASS 1, DIV 2, GP BCD; 800°F (427°C) MAX , ADJUSTABLE SETPOINT CONTROL ¹⁰
G	GUSSETS ON PROCESS CONNECTION (HIGH VIBRATION APPLICATIONS)
O	CUSTOM ¹¹

NOTE: REFERENCE MODEL NUMBER
SELECTION NOTES ON THE
FOLLOWING PAGE

NOTES:

1. See Flange Pressure Rating Table in Appendix. Information in these tables is taken from ASME Standards. DIN, HG, or other International Flange Types require factory consultation.
2. See Switching Mechanisms and Housings on page 38 and 39. See Switch Mechanism Product Data Sheets for specifications.
3. See Insulation Descriptions on page 40; Insulation Jackets (IH) & Insulation Flange Covers (IF) are recommended for personnel safety.
4. Multiple Options: Separate multiple options with semi-colon (;) Example: ...x/B = 2-11/16 in; H = 287mm;
5. CX - Custom Calibration: C + "B" or "C" for required dimension (not "B" and "C") and engineering units (mm, in, cm) Example: x / CB=2-11/16 in; See "Calibration Dimensions."
6. LX - Custom Length: L + "D" or "H" for required dimension (not "D" and "H") and engineering units (mm, in, cm) Example: x / LH = 287mm; See "Dimension Tables."
7. See Valve Description on Page 41. Vent Valve (VV), Drain Valve (DV), Isolation Valves (IV) Customer to specify valve type and size.
8. Interface Level Measurement (IM) requires special consideration. Consult factory for details.
9. For Available Process Connections, see Tables 3 and 4 (p46-49) in Appendix.
10. Specify power supply 1) 110, 2) 220, 3) 277 or 4) 440 VAC) (ex. ET21= ET2 with 110VAC power supply). For ET1xx series only, specify setpoint A) 35°, B) 45°, C) 60°, D) 90° or E) 185°F (1.7°, 7.2°, 15.6°, 32.2°, or 85°C) (ex. ET11A = ET1 with 110VAC power supply and a setpoint of 35°F)
11. For options and selections not listed, write requirements after model number. Contact the ABB factory for price and availability.

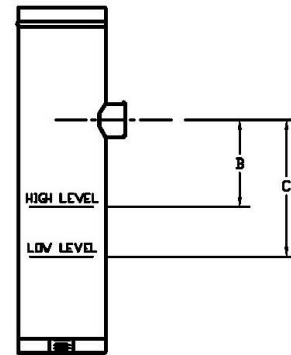
Calibration Dimensions for LS 900 series

1. "B" is the distance that the switch trips on rising level at the specified S.G.
2. "C" is the distance that the switch resets on falling level at the specified S.G.
3. The "B" dimension is the default switch calibration setting.
4. The "C" dimension will vary depending on the particular switch unit specified.
5. If a different "B" or the "C" dimension is required, it should be stated as shown under Options.
6. Calibration accuracy is +/- 1/4" (6mm)

900 Series 9x1		
S.G.	"B"	"C"
0.40	1-3/8"	4-7/16"
0.50	2-7/16"	5"
0.60	3-1/8"	5-5/16"
0.70	3-11/16"	5-9/16"
0.80	4-1/16"	5-3/4"
0.90	4-15/16"	5-15/16"

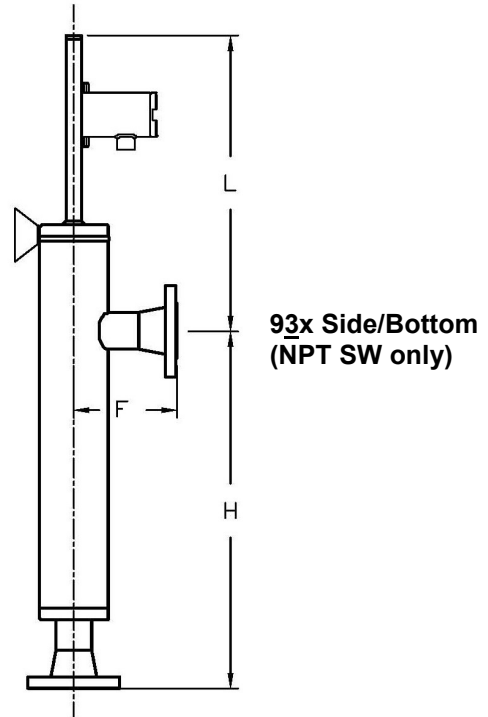
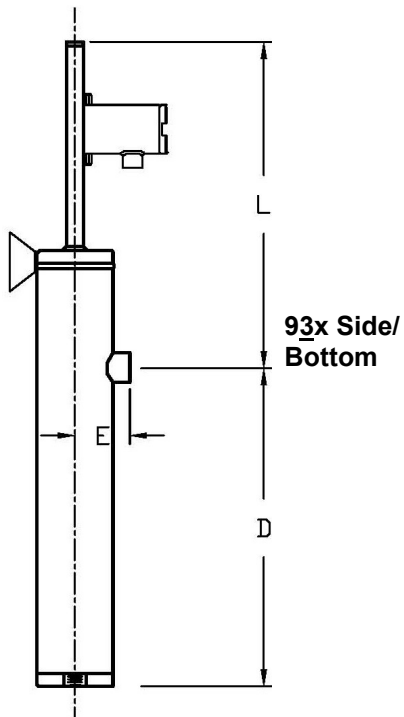
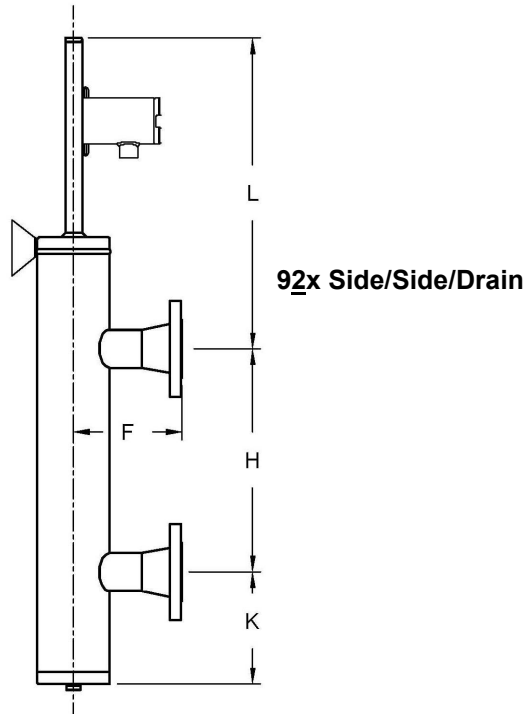
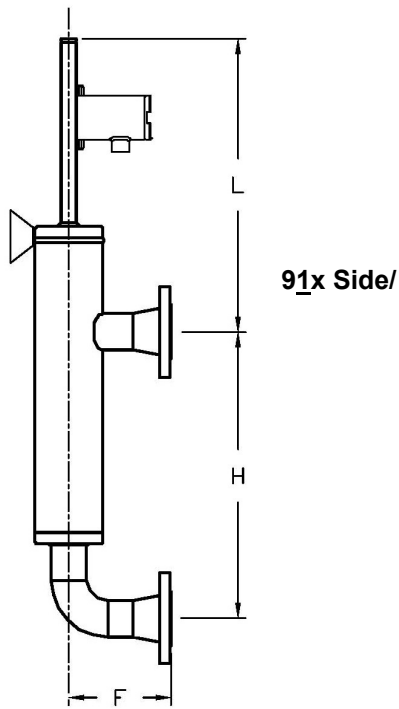
900 Series 9x2		
S.G.	"B"	"C"
0.40	1-3/8"	4-7/16"
0.50	2-7/16"	5"
0.60	3-1/8"	5-5/16"
0.70	3-11/16"	5-9/16"
0.80	4-1/16"	5-3/4"
0.90	4-15/16"	5-15/16"

900 Series 9x3		
S.G.	"B"	"C"
0.40	2-15/16"	5-1/4"
0.50	3-3/4"	5-5/8"
0.60	4-5/16"	5-15/16"
0.70	4-11/16"	6-1/8"
0.80	5"	6-1/4"
0.90	5-3/16"	6-3/8"



Chamber Dimensions for LS 900 series

- See Tables on page 37 for dimensions for selected process connection size.
- Drawings not to scale.



Dimension Tables

1" Process Connection Dimension Table

	D*		E*		F		H		K		L	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
9x1	13	330	3-3/16	81	TBD	TBD	16	406	TBD	TBD	TBD	TBD
9x2	11-1/2	292	3-11/16	94	TBD	TBD	16	406	TBD	TBD	TBD	TBD
9x3	12-3/4	324	3-15/16	100	TBD	TBD	16	406	TBD	TBD	TBD	TBD

* These dimensions apply to Model 63x Side/Bottom with Threaded or Socket "Flange Type" only (see p.36)

1-1/2" Process Connection Dimension Table

	D*		E*		F		H		K		L	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
9x1	13	330	3-1/4	82	TBD	TBD	16	406	TBD	TBD	TBD	TBD
9x2	11-9/16	294	3-3/4	95	TBD	TBD	16	406	TBD	TBD	TBD	TBD
9x3	12-7/8	327	4-1/16	103	TBD	TBD	16	406	TBD	TBD	TBD	TBD

* These dimensions apply to Model 63x Side/Bottom with Threaded or Socket "Flange Type" only (see p.36)

2" Process Connection Dimension Table

	D*		E*		F		H		K		L	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
9x1					TBD	TBD	16	406	TBD	TBD	TBD	TBD
9x2	11-11/16	297	3-7/8	99	TBD	TBD	16	406	TBD	TBD	TBD	TBD
9x3	13-1/4	337	4-7/16	113	TBD	TBD	16	406	TBD	TBD	TBD	TBD

* These dimensions apply to Model 63x Side/Bottom with Threaded or Socket "Flange Type" only (see p.36)

The switch point of LS Series level switches is dependent upon the specific gravity of the process fluid and other factors. As specific gravity decreases, the distance between the centerline of the upper process connection and the fluid level at which the switch transfers decreases. This is due to the additional amount of fluid required to make the float buoyant at the lower specific gravity. This means that actual fluid levels at the switch transfer point vary with specific gravity.

The function of the LS Series level switch depends upon the movement of a magnet assembly within the switch post to activate an external switch. In order to begin moving up with rising fluid level, a small amount of static friction must be overcome. To facilitate this additional force, the floats are designed with reserve buoyancy to provide force for movement and to provide buoyancy with decreases in specific gravity. This reserve buoyancy is in the form of the amount of float that is above the fluid level. In order for the reserve buoyancy to be useful, it must be located where fluid may actually reach it. As a standard, we design the floats so that the top is even with the centerline of the upper process connection when the magnet assembly is all the way to the top of the sensor tube. This allows standardization of all chambers for manufacturing. The fluid level at switching is then a function of the specific gravity and the float selected.

Dead-band of a magnetically operated switch is the distance a magnet must travel to transfer from one state to another. Switch transfer dead-band is a function of the type of switch selected and the strength of the magnetic field. The reed switch variety have only a small dead-band, while the cam actuated switches have larger dead-bands. Because the dead-band is different for each switch type, we set LS Series switches to either the High (rising fluid (standard)) or the Low (falling fluid) reference point on the LS Series sensor tube per the customer's requirements. The operation of the switch in the opposite direction is the dead-band distance. The location of the on/off points for each type of switch is consistent for that type, and is therefore known and placed on the sensor tube at the reference point on the sensor tube.

The LS Series is constructed such that sufficient over-travel past the switch point occurs to ensure proper operation no matter what switch type is used. This allowed over-travel increases the distance from the centerline of the upper process connection to the fluid level at the high switch point. This value is fixed at 11/16" for existing switch requirements. A difference of 13/16" between the high and low reference points has also been established due to existing switch requirements. Therefore, the high switch point is determined by the 11/16" over-travel plus the length of the float above the fluid level at the specific gravity specified. The low switch point is determined by the 11/16" over-travel plus the 13/16" difference between the reference points and the length of the float above the fluid level at the specific gravity specified.

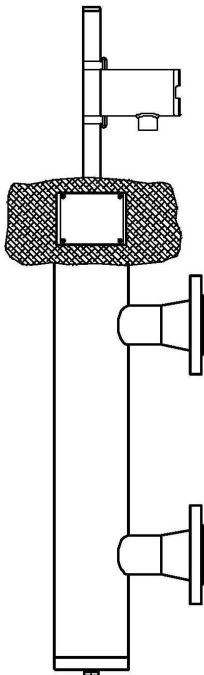
The following "magnetically activated" switching mechanisms in Table 1 are available and ready for use with the LS Series Switches. This table provides details on specific switching mechanism applicability. All switching mechanisms are available with the European CE mark. Consult the KTEK factory for certification/documentation. In high corrosive applications, ABB recommends the use of stainless steel housings over aluminum enclosures. Please see product data sheets on the KTEK website at www.ktekcorp.com for the latest specifications and approvals.

Table 1

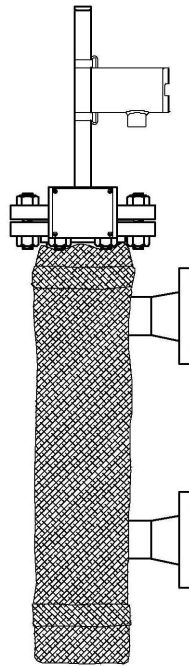
Model #	Agency Approvals	Enclosure			Switching Mechanism						Application		
		Type	Ratings	Electrical Connection	Type	Ratings	Min Process Temp	Max Process Temp	Dead-band	Contacts	High Temp	Vibration	High Corrosion
MS30	FM, CSA	Hermetically Sealed	NEMA 4x	1/2" MNPT	Reed	AC/DC 1amp	-40°F (-40°C)	300°F (149°C); 600°F (316°C) with IP option	1/8"	SPDT	●		
MS30/EX	FM, CSA	Hermetically Sealed, Explosion Proof	NEMA 4x	1/2" FNPT	Reed	AC/DC 1amp	-40°F (-40°C)	300°F (149°C); 600°F (316°C) with IP option	1/8"	SPDT	●		
MS40	FM, CSA	Stainless Steel	NEMA 4x	1/2" FNPT	Cam Driven, Snap Action	AC:10amp DC: 2.6 amp	-60°F (-51°C)	300°F (149°C); 600°F (316°C) with IP option	7/8"	DPDT	●	●	●
MS40/EX	FM, CSA	Stainless Steel, Explosion Proof	NEMA 4x	3/4" FNPT	Cam Driven, Snap Action	AC:10amp DC:1/2 amp	-60°F (-51°C)	300°F (149°C); 600°F (316°C) with IP option	13/16"	DPDT	●	●	●
MS41	FM, CSA, ATEX	Stainless Steel, Dual Compartment, Hermetically Sealed, Explosion Proof	NEMA 4x	1/2" FNPT	Cam Driven, Snap Action	AC: 10amp DC: 2.6 amp	-320°F (-195°C) with option	300°F (149°C); 1000°F (538°C) with IP option	15/16"	DPDT	●	●	●
PS35	Non-electric	Stainless Steel	NEMA 4x	1/8" MNPT port	Pneumatic	15 to 100 psig	0°F (-18°C)	180°F (82°C); 450°F (232°C) with IP option	1"	Pneumatic Signal			●
PS45	Non-electric	Stainless Steel	NEMA 4x	1/8" MNPT port	Pneumatic	1 to 100 psig	0°F (-18°C)	180°F (82°C); 450°F (232°C) with IP option	15/16"	Pneumatic Signal			●

Mechanical Level Switches

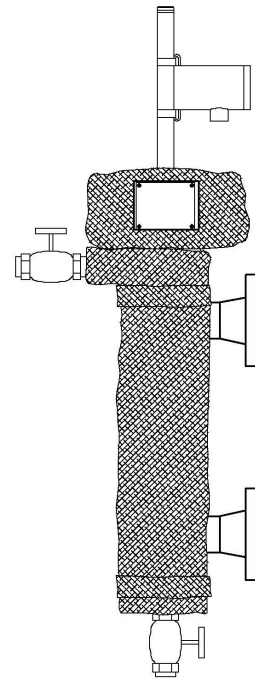
Options/Insulation



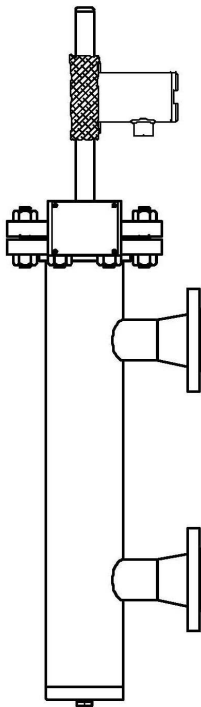
IF
INSULATION FLANGE- RATED UP
TO 900°F (482°C) MAX



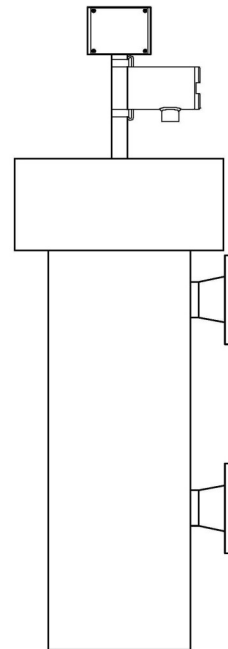
IHx
INSULATION JACKET HIGH
TEMPERATURE - RATED
UP TO 900°F (482°C) MAX



IHxD
INSULATION WRAP INCLUDES
JACKET, FLANGE, VALVES AND
PROCESS CONNECTIONS
RATED UP TO 900°F (482°C) MAX



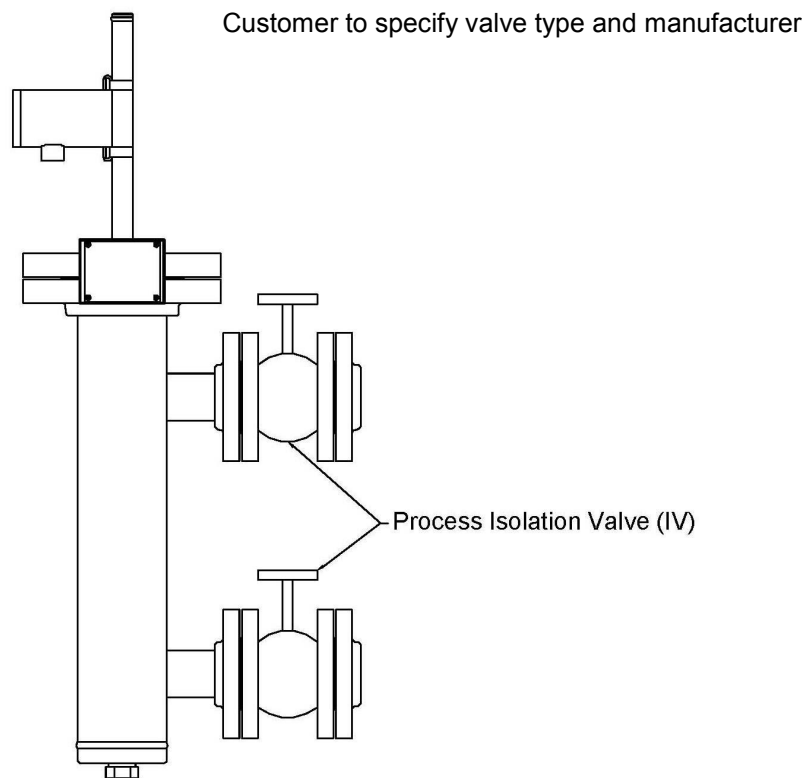
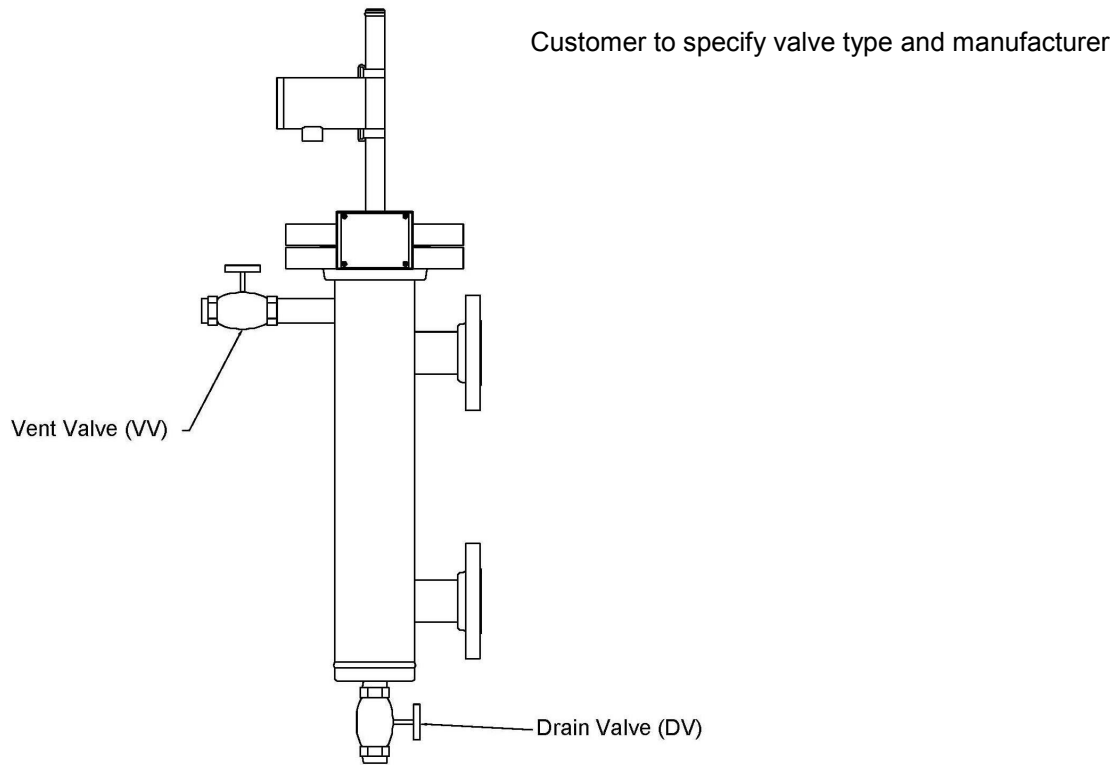
IP
INSULATION PAD -ALL SERVICES $\geq 180^{\circ}\text{F}$
(82°C) PNEUMATIC SWITCHES ONLY
ALL SERVICES $\geq 300^{\circ}\text{F}$ (149°C) ELECTRIC
SWITCHES ONLY



ILx
INSULATION -
CRYOGENIC SERVICES
RATED DOWN TO -320°F (-196°C) MIN

NOTE: KTEK recommends for Process Temperatures $\geq 150^{\circ}\text{F}$ (66°C) the use of **IHx**, **IF** or **IHxD** for personnel safety.

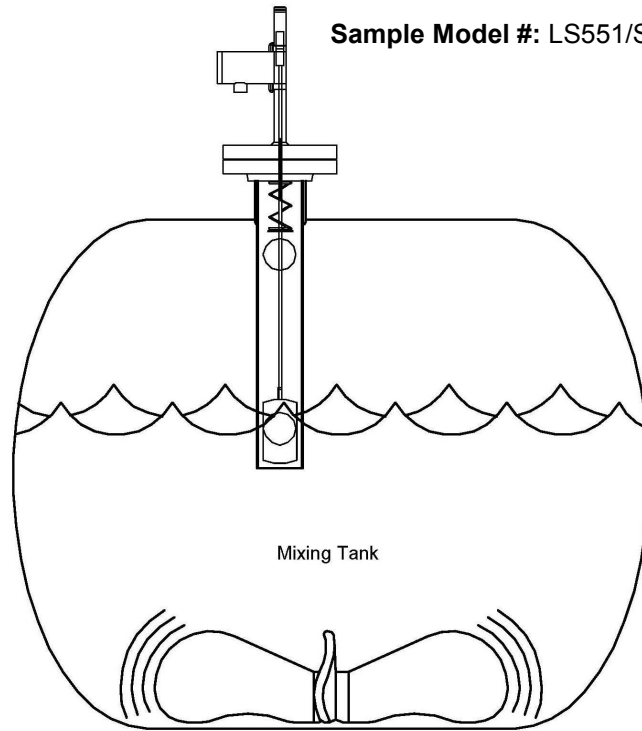
NOTE: Consult ABB factory for overall physical dimensions of cryogenic units.



Mechanical Level Switches

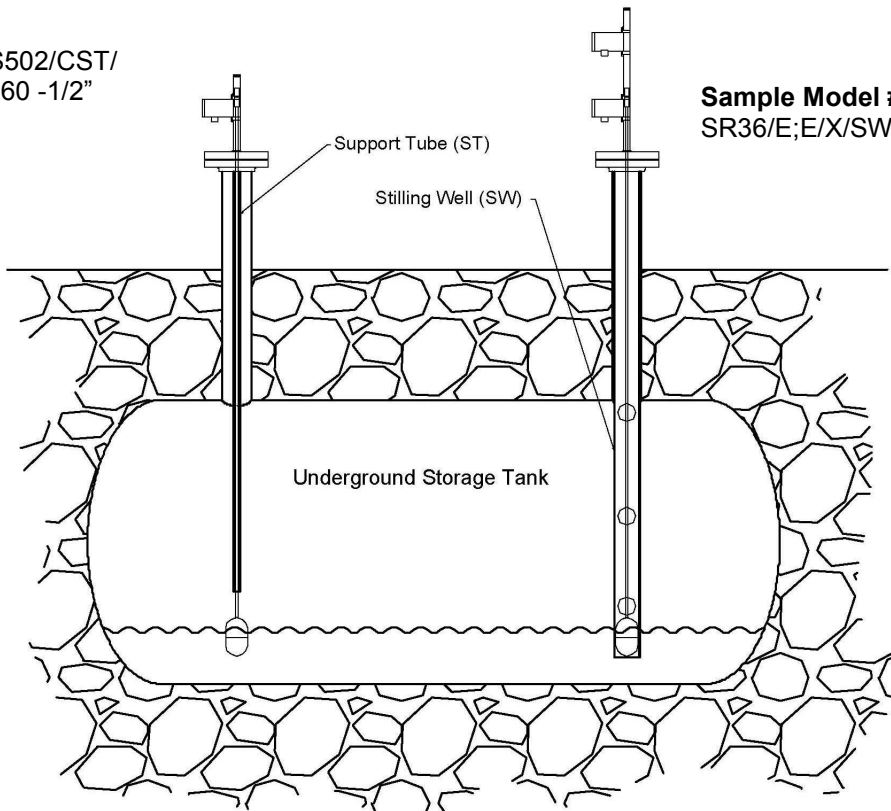
Options/Stilling Wells

NOTE: Stilling Well (SW) dimensions are determined by customer application. ABB recommends the use of Stilling Wells (SW) or Existing Chambers (CAGES) on all Top Mount Units ≥ 24 " insertion length. Consult factory on the use of Support Tubes (ST). See illustrations below.



Sample Model #: LS551/SS6/SR41/E/X/SW; SP=17-1/4"

Sample Model #: LS502/CST/
WR256/E/X/ST; SP=60 -1/2"



Sample Model #: LS501/SS6/
SR36/E;E/X/SW; SP1=56",

Table 1 Typical Pressure for Various Materials

A106B CARBON STEEL

Pipe Size	Pipe Schedule	100°F (38°C)	200°F (93°C)	300°F (149°C)	400°F (204°C)	500°F (260°C)	600°F (316°C)	650°F (343°C)	700°F (371°C)	750°F (399°C)
1"	40	2857	2857	2857	2857	2857	2857	2857	2743	2476
	80	3950	3950	3950	3950	3950	3950	3950	3792	3423
	160	5757	5757	5757	5757	5757	5757	5757	5526	4989
1-1/2"	40	2116	2116	2116	2116	2116	2116	2116	2032	1834
	80	2983	2983	2983	2983	2983	2983	2983	2864	2585
	160	4331	4331	4331	4331	4331	4331	4331	4157	3753
2"	40	1783	1783	1783	1783	1783	1783	1783	1712	1545
	80	2575	2575	2575	2575	2575	2575	2575	2472	2232
	160	4217	4217	4217	4217	4217	4217	4217	4049	3655
3"	40	1693	1693	1693	1693	1693	1693	1693	1625	1467
	80	2394	2394	2394	2394	2394	2394	2394	2298	2074
	160	3600	3600	3600	3600	3600	3600	3600	3456	3120
4"	40	1435	1435	1435	1435	1435	1435	1435	1378	1244
	80	2075	2075	2075	2075	2075	2075	2075	1992	1798
	160	3376	3376	3376	3376	3376	3376	3376	3241	2926
5"	40	1258	1258	1258	1258	1258	1258	1258	1208	1090
	80	1857	1857	1857	1857	1857	1857	1857	1783	1610
	160	3201	3201	3201	3201	3201	3201	3201	3073	2774
6"	40	1143	1143	1143	1143	1143	1143	1143	1098	991
	80	1794	1794	1794	1794	1794	1794	1794	1722	1554
	160	3083	3083	3083	3083	3083	3083	3083	2960	2672
8"	40	1006	1006	1006	1006	1006	1006	1006	966	872
	80	1586	1586	1586	1586	1586	1586	1586	1523	1375
	160	2976	2976	2976	2976	2976	2976	2976	2857	2579
10"	40	913	913	913	913	913	913	913	876	791
	80	1509	1509	1509	1509	1509	1509	1509	1448	1308
	160	2950	2950	2950	2950	2950	2950	2950	2832	2557

Ratings are given for standard seamless pipe sizes at temperatures from 100°F (38°C) to 750°F(399°C). All ratings are in psig and are based on ANSI/ASME B31.1.

Table 1 (continued)**A312-TP316/316SS**

Pipe Size	Pipe Schedule	100°F (38°C)	200°F (93°C)	300°F (149°C)	400°F (204°C)	500°F (260°C)	600°F (316°C)	650°F (343°C)	700°F (371°C)	750°F (399°C)
1"	40	3048	2629	2362	2171	2019	1924	1867	1824	1810
	80	4213	3634	3265	3002	2791	2659	2580	2528	2501
	160	6140	5296	4759	4375	4068	3876	3761	3684	3646
1-1/2"	40	2257	1947	1750	1608	1496	1425	1383	1354	1340
	80	3182	2744	2466	2267	2108	2009	1949	1909	1889
	160	4619	3984	3580	3291	3060	2916	2829	2772	2743
2"	40	1902	1640	1474	1355	1260	1201	1165	1141	1129
	80	2747	2369	2129	1957	1820	1734	1682	1648	1631
	160	4499	3880	3486	3205	2980	2840	2755	2699	2671
3"	40	1806	1558	1400	1287	1196	1140	1106	1084	1072
	80	2553	2202	1979	1819	1691	1612	1564	1532	1516
	160	3840	3312	2976	2736	2544	2424	2352	2304	2280
4"	40	1531	1321	1187	1091	1014	967	938	919	909
	80	2213	1909	1715	1577	1466	1397	1355	1328	1314
	160	3601	3106	2791	2566	2386	2273	2206	2161	2138
5"	40	1342	1158	1040	956	889	847	822	805	797
	80	1981	1709	1535	1411	1312	1250	1213	1189	1176
	160	3414	2945	2646	2433	2262	2155	2091	2049	2027
6"	40	1219	1052	945	869	808	770	747	732	724
	80	1913	1650	1483	1363	1267	1208	1172	1148	1136
	160	3289	2836	2549	2343	2179	2076	2014	1973	1953
8"	40	1073	926	832	765	711	678	657	644	637
	80	1692	1459	1311	1205	1121	1068	1036	1015	1005
	160	3175	2738	2460	2262	2103	2004	1944	1905	1885
10"	40	974	840	755	694	645	615	596	584	578
	80	1609	1388	1247	1147	1066	1016	986	966	956
	160	3147	2714	2439	2242	2085	1986	1927	1880	1868

Ratings are given for standard seamless pipe sizes at temperatures from 100°F (38°C) to 750°F (399°C). All ratings are in psig and are based on ANSI/ASME B31.1.

Table 2

A105 CARBON STEEL

Class	100°F (38°C)	200°F (93°C)	300°F (149°C)	400°F (204°C)	500°F (260°C)	600°F (316°C)	650°F (343°C)	700°F (371°C)	750°F (399°C)
150#	285	260	230	200	170	140	125	110	95
300#	740	680	655	635	605	570	550	530	505
600#	1480	1360	1310	1265	1205	1135	1100	1060	1015
900#	2220	2035	1965	1900	1810	1705	1650	1590	1520
1500#	3705	3395	3270	3170	3015	2840	2745	2655	2535
2500#	6170	5655	5450	5280	5025	4730	4575	4425	4230

A182-F316/316L STAINLESS STEEL

Class	100°F (38°C)	200°F (93°C)	300°F (149°C)	400°F (204°C)	500°F (260°C)	600°F (316°C)	650°F (343°C)	700°F (371°C)	750°F (399°C)
150#	275	235	215	195	170	140	125	110	95
300#	720	620	560	515	480	450	440	435	425
600#	1440	1240	1120	1025	955	900	885	870	855
900#	2160	1860	1680	1540	1435	1355	1325	1305	1280
1500#	3600	3095	2795	2570	2390	2255	2210	2170	2135
2500#	6000	5160	4660	4280	3980	3760	3680	3620	3560

B574 HASTELLOY-C

Class	100°F (38°C)	200°F (93°C)	300°F (149°C)	400°F (204°C)	500°F (260°C)	600°F (316°C)	650°F (343°C)	700°F (371°C)	750°F (399°C)
150#	290	260	230	200	170	140	125	110	95
300#	750	750	730	700	665	605	590	570	530
600#	1500	1500	1455	1395	1330	1210	1175	1135	1065
900#	2250	2250	2185	2095	1995	1815	1765	1705	1595
1500#	3750	3750	3640	3490	3325	3025	2940	2840	2660
2500#	6250	6250	6070	5820	5540	5040	4905	4730	4430

B462 ALLOY-20

Class	100°F (38°C)	200°F (93°C)	300°F (149°C)	400°F (204°C)	500°F (260°C)	600°F (316°C)	650°F (343°C)	700°F (371°C)	750°F (399°C)
150#	290	260	230	200	170	140	125	110	95
300#	750	740	710	680	655	605	590	570	530
600#	1500	1485	1420	1365	1310	1210	1175	1135	1065
900#	2250	2225	2130	2045	1965	1815	1765	1705	1595
1500#	3750	3710	3550	3410	3275	3025	2940	2840	2660
2500#	6250	6180	5920	5680	5460	5040	4905	4730	4430

A182-F12 CHROME MOLY STEEL

Class	100°F (38°C)	200°F (93°C)	300°F (149°C)	400°F (204°C)	500°F (260°C)	600°F (316°C)	650°F (343°C)	700°F (371°C)	750°F (399°C)
150#	290	260	230	200	170	140	125	110	95
300#	750	735	700	670	645	605	590	570	530
600#	1500	1470	1400	1335	1290	1210	1175	1135	1065
900#	2250	2210	2100	2005	1940	1815	1765	1705	1595
1500#	3750	3680	3495	3345	3230	3025	2940	2840	2660
2500#	6250	6135	5830	5570	5385	5040	4905	4730	4430

Note: All pressures given in psig. Flange size does not affect pressure rating. Pressure rating is based on flange class only. All ratings are based on ASME B16.5.-2003, DIN, HG, or other international flange types available but require factory consultation

Table 3: Schematic Illustration of Available Connections

C0	C0L	C0E	C1	C1L	C2	FE	F0E
F0	F1	F2	F3	F3E	F4	GE	G
G1	G4	L	N0E	N0	N2E	N2	N3E
N3	N6	SW	SWE	X	T0	T2	T3
T4	T5	T6	T7	T9	W0	W1	W2
W3	W4	W5	W6	W7	W9	W10	

Note: Please see Option Code Table on page 47

Table 3 (Continued)

Description of Option Codes															
C0	FNPT Coupling	SW	Socket Weld Flange ¹												
C0E	FNPT Coupling Connected Via Extruded Outlet ²	SWE	Socket Weld Flange Connected Via Extruded Outlet ²												
C0L	Thread-o-let (Min SCH 40 Chamber)	T0	Butt Welded Dome Pipe Cap												
C1	Socket Weld Coupling	T2	T0 with FNPT Coupling and Plug												
C1L	Sock-o-let (Min SCH 40 Chamber)	T3	T0 with Socket Weld Coupling												
C2	C0 with plug	T4	T0 with FNPT Coupling												
FE	Weld Neck Flange Connected Via Extruded Outlet ²	T5	T0 with Nipple, for Socket Welding (Flat end)												
F0	Weld Neck Flange ¹	T6	T0 with Nipple, for Butt Welding (37.5° Beveled end)												
F0E	FE with pipe between chamber and Weld Neck Flange	T7	T0 with Nipple, MNPT												
F1	Weld Neck Flange with Weld-o-let (Min SCH 40 Chamber)	T9	T0 With Nipple and Flange												
F2	Weld Neck Flange with Weld-o-let and Concentric Reducer (Min SCH 40 Chamber)	W0	Welded Flat Pipe Cap with Float Stop Spring												
F3	Weld Neck Flange with Concentric Reducer	W1	W0 with FNPT ³ ; 1/2" FNPT standard												
F3E	Weld Neck Flange with Concentric Reducer Connected Via Extruded Outlet ²	W2	W0 with Plug ⁵ ; 1/2" Standard												
F4	Weld Neck Flange with Butt Weld Tee	W3	W0 with Socket Weld Coupling												
GE	Slip-On Flange Connected Via Extruded Outlet ²	W4	W0 with FNPT Coupling												
G	Slip-On Flange ¹	W5	W0 with Nipple, for Socket Welding (Flat end)												
G1	Slip-On Flange with Weld-O Let and Pipe Nipple	W6	W0 with Nipple, for Butt Welding (37.5° Beveled end)												
G4	Slip-On Flange with Butt Weld Tee and Pipe Nipple	W7	W0 with Nipple, MNPT												
L	Stub End with Loose (Lap Joint) Flange	W9	W0 with Nipple and Flange ⁶												
N0E	Branch Nipple for Socket Weld (Flat end) Connected Via Extruded Outlet ²	W10	W0 with Socket Weld Bore ⁴ ; 1/2" SW Standard												
N0	Branch Nipple for Socket Weld (Flat end)	X	No Connection												
N2	Branch Nipple for Butt Welding (37.5° Beveled end)														
N2E	Branch Nipple for Butt Welding (37.5° Beveled end) Connected Via Extruded Outlet ²														
N3	MNPT Branch Nipple														
N3E	MNPT Branch Nipple Connected Via Extruded Outlet ²														
N6	Weld-o-let (Min SCH 40 Chamber)														
<p>Notes:</p> <p>1: Extruded outlet can be utilized as follows</p> <table border="0"> <thead> <tr> <th></th> <th><u>FLANGES & NIPPLES</u></th> <th><u>COUPLING SIZES</u></th> </tr> </thead> <tbody> <tr> <td>Stainless Steel:</td> <td>Sch. 10 chambers with 1", 1-1/2" & 2" connections Sch. 40 chambers with 1-1/2" & 2" connections²</td> <td>3/4", 1", 1-1/4" 1-1/4"</td> </tr> <tr> <td>Alloy20:</td> <td>Sch. 10 chambers with 1-1/2" & 2" connections</td> <td>1-1/4"</td> </tr> <tr> <td>Hastelloy:</td> <td>Sch. 10 chambers with 1-1/2" & 2" connections</td> <td>1-1/4"</td> </tr> </tbody> </table> <p>2: Cannot extrude SCH 40 seamless pipe 3: 1/2" FNPT Standard; Optional FN7 (3/4") or FN1 (1"). Specify after option. (i.e.: W1FN7) 4: 1/2" SW Standard; Optional SW7 (3/4"). Specify after option. (i.e.: W10SW7) 5: 1/2" plug Standard; see Table 4 (Page 49) for additional sizes. 6: Select T9 or W9 when chamber configuration is top side/ bottom bottom.</p>					<u>FLANGES & NIPPLES</u>	<u>COUPLING SIZES</u>	Stainless Steel:	Sch. 10 chambers with 1", 1-1/2" & 2" connections Sch. 40 chambers with 1-1/2" & 2" connections ²	3/4", 1", 1-1/4" 1-1/4"	Alloy20:	Sch. 10 chambers with 1-1/2" & 2" connections	1-1/4"	Hastelloy:	Sch. 10 chambers with 1-1/2" & 2" connections	1-1/4"
	<u>FLANGES & NIPPLES</u>	<u>COUPLING SIZES</u>													
Stainless Steel:	Sch. 10 chambers with 1", 1-1/2" & 2" connections Sch. 40 chambers with 1-1/2" & 2" connections ²	3/4", 1", 1-1/4" 1-1/4"													
Alloy20:	Sch. 10 chambers with 1-1/2" & 2" connections	1-1/4"													
Hastelloy:	Sch. 10 chambers with 1-1/2" & 2" connections	1-1/4"													

Table 4

Flanged Connections											
Size	Pressure Rating	Loose Flange	Slip On Flanges				Socket Weld Flanges	Weld Neck Flanges			
			Raised Face	RTJ	Tongue & Groove	Male/Female	Raised Face	Raised Face	RTJ	Tongue & Groove	Male/Female
1/2"	150#	L51	SR51	SJ51	ST51	SM51	SWR51	WR51	WJ51	WT51	WM51
1/2"	300#	L53	SR53	SJ53	ST53	SM53	SWR53	WR53	WJ53	WT53	WM53
1/2"	600#	L56	SR56	SJ56	ST56	SM56	SWR56	WR56	WJ56	WT56	WM56
1/2"	1500#	L515	SR515	SJ515	ST515	SM515	SWR515	WR515	WJ515	WT515	WM515
3/4"	150#	L71	SR71	SJ71	ST71	SM71	SWR71	WR71	WJ71	WT71	WM71
3/4"	300#	L73	SR73	SJ73	ST73	SM73	SWR73	WR73	WJ73	WT73	WM73
3/4"	600#	L76	SR76	SJ76	ST76	SM76	SWR76	WR76	WJ76	WT76	WM76
3/4"	1500#	L715	SR715	SJ715	ST715	SM715	SWR715	WR715	WJ715	WT715	WM715
1"	150#	L11	SR11	SJ11	ST11	SM11	SWR11	WR11	WJ11	WT11	WM11
1"	300#	L13	SR13	SJ13	ST13	SM13	SWR13	WR13	WJ13	WT13	WM13
1"	600#	L16	SR16	SJ16	ST16	SM16	SWR16	WR16	WJ16	WT16	WM16
1"	1500#	L115	SR115	SJ115	ST115	SM115	SWR115	WR115	WJ115	WT115	WM115
1-1/2"	150#	L151	SR151	SJ151	ST151	SM151	SWR151	WR151	WJ151	WT151	WM151
1-1/2"	300#	L153	SR153	SJ153	ST153	SM153	SWR153	WR153	WJ153	WT153	WM153
1-1/2"	600#	L156	SR156	SJ156	ST156	SM156	SWR156	WR156	WJ156	WT156	WM156
1-1/2"	1500#	L1515	SR1515	SJ1515	ST1515	SM1515	SWR1515	WR1515	WJ1515	WT1515	WM1515
2"	150#	L21	SR21	SJ21	ST21	SM21	SWR21	WR21	WJ21	WT21	WM21
2"	300#	L23	SR23	SJ23	ST23	SM23	SWR23	WR23	WJ23	WT23	WM23
2"	600#	L26	SR26	SJ26	ST26	SM26	SWR26	WR26	WJ26	WT26	WM26
2"	1500#	L215	SR215	SJ215	ST215	SM215	SWR215	WR215	WJ215	WT215	WM215
2-1/2"	150#	L251	SR251	SJ251	ST251	SM251	SWR251	WR251	WJ251	WT251	WM251
2-1/2"	300#	L253	SR253	SJ253	ST253	SM253	SWR253	WR253	WJ253	WT253	WM253
2-1/2"	600#	L256	SR256	SJ256	ST256	SM256	SWR256	WR256	WJ256	WT256	WM256
2-1/2"	1500#	L2515	SR2515	SJ2515	ST2515	SM2515	SWR2515	WR2515	WJ2515	WT2515	WM2515
3"	150#	L31	SR31	SJ31	ST31	SM31	SWR31	WR31	WJ31	WT31	WM31
3"	300#	L33	SR33	SJ33	ST33	SM33	SWR33	WR33	WJ33	WT33	WM33
3"	600#	L36	SR36	SJ36	ST36	SM36	SWR36	WR36	WJ36	WT36	WM36
3"	900#	L39	SR39	SJ39	ST39	SM39	SWR39	WR39	WJ39	WT39	WM39
3"	1500#	L315	SR315	SJ315	ST315	SM315	SWR315	WR315	WJ315	WT315	WM315
4"	150#	L41	SR41	SJ41	ST41	SM41	SWR41	WR41	WJ41	WQT41	WM41
4"	300#	L43	SR43	SJ43	ST43	SM43	SWR43	WR43	WJ43	WT43	WM43

1. Extruded Outlets are full bore up to a maximum of 2". See Note 1 on Page 47.
2. 1/2" to 2 1/2" flanges use 1500# if 900# is specified.
3. Flat face flanges can be supplied with the (SF or WF) designator. (i.e. for a 1/2" 150# flat face flange, please specify SF51 or WF51)

Table 4 (continued)

Nipples: Sch 40 Std.			Plugs:1/2 std.		Threaded Couplings:			Socket Weld Couplings:		
1/2"	Sch.40	N54	1/2"	P5	1/2"	3000#	C53	1/2"	3000#	SC53
1/2"	Sch.80	N58	3/4"	P7	3/4"	3000#	C73	3/4"	3000#	SC73
1/2"	Sch.160	N51	1"	P1	1"	3000#	C13	1"	3000#	SC13
3/4"	Sch.40	N74	2"	P2						
3/4"	Sch.80	N78	3"	P3						
3/4"	Sch.160	N71	4"	P4						
			6"	P6						
1"	Sch.40	N14								
1"	Sch.80	N18								
1"	Sch.160	N11								

Screw-On Caps			Sock-o-lets			Thread -o- lets:		
2"	3000#	S23	1/2"	3000#	S05	1/2"	3000#	T053
2-1/2"	3000#	S253	3/4"	3000#	S07	3/4"	3000#	T073
3"	3000#	S33	1"	3000#	S10	1"	3000#	T103
4"	3000#	S43	1-1/2"	3000#	S15	1-1/2"	3000#	T153
			2"	3000#	S20	2"	3000#	T203
						1/2"	6000#	T056
						3/4"	6000#	T076
						1"	6000#	T106
						1-1/2"	6000#	T156
						2"	6000#	T206

Hex Head Access Connection Codes (NPT Top Mount 510/560 series only)			
1"	3000#	P1	1" MNPT
1-1/2"	3000#	P15	1-1/2" MNPT
2"	3000#	P2	2" MNPT

Table 5

Pressure			
To Convert From:	To:	Use this formula:	
Bar	Pounds per Square Inch (psi)	bar	x 14.504 = psi
KiloPascals (kPa)	Pounds per Square Inch (psi)	kPa	x 0.145 = psi
MegaPascals (Mpa)	Pounds per Square Inch (psi)	Mpa	x 145 = psi
Kilograms per cm ² (kg/cm ²)	Pounds per Square Inch (psi)	kg/cm ²	x 14.223 = psi
Pounds per Square Inch (psi)	Bar	psi	÷ 14.504 = bar
Pounds per Square Inch (psi)	Kilo Pascals (kPa)	psi	÷ 0.0145 = kPa
Pounds per Square Inch (psi)	Mega Pascals (Mpa)	psi	÷ 145 = Mpa
Pounds per Square Inch (psi)	Kilograms per cm ² (kg/cm ²)	psi	÷ 14.223 = kg/cm ²
Specific Gravity			
To Convert From:	To:	Use this formula:	
Kilograms per meter ³ (kg/m ³)	Specific Gravity (SG)	kg/m ³	x 0.001 = SG
Pounds per foot ³ (lb/ft ³)	Specific Gravity (SG)	lb/ft ³	÷ 62.4 = SG
Degrees API	Specific Gravity (SG)	141.5	÷ (API + 131.5) = SG
Specific Gravity (SG)	Kilograms per meter ³ (kg/m ³)	SG	x 1000 = kg/m ³
Specific Gravity (SG)	Pounds per foot ³ (lb/ft ³)	SG	x 62.4 = lb/ft ³
Specific Gravity (SG)	Degrees API	(141.5 ÷ SG)	- 131.5 = API
Length			
To Convert From:	To:	Use this formula:	
millimeters (mm)	inches (in)	mm	÷ 25.4 = in
meters (m)	feet (ft)	m	x 3.281 = ft
inches (in)	millimeters (mm)	in	x 25.4 = mm
feet (ft)	meters (m)	ft	÷ 3.281 = m
Temperature			
To Convert From:	To:	Use this formula:	
Degrees Fahrenheit (°F)	Degrees Centigrade (°C)	(°F - 32)	÷ 1.8 = °C
Degrees Centigrade (°C)	Degrees Fahrenheit (°F)	(°C x 1.8)	+ 32 = °F
Fluid Flow Rates			
To Convert From:	To:	Use this formula:	
Feet per Second (FPS)	Gallons per Minute (GPM)	FPS x 448.83	x A1 = GPM
Kilograms per Hour (kg/H)	Gallons per Minute (GPM)	(kg/H ÷ kg/m ³)	x 4.403 = GPM
Meters per Second (m/s)	Gallons per Minute (GPM)	m/s x A2	x 15852 = GPM
Cubic meters per Hour (m ³ /H)	Gallons per Minute (GPM)	m ³ /H	÷ 4.4 = GPM
Gallons per Minuter (GPM)	Feet per Second (FPS)	GPM	÷ (448.83 x A1) = FPS
Gallons per Minuter (GPM)	Kilograms per Hour (kg/H)	GPM x kg/m ³	÷ 4.403 = kg/H
Gallons per Minuter (GPM)	Meters per Second (m/s)	GPM	÷ (A2 x 15852) = m/s
Gallons per Minuter (GPM)	Cubic meters per Hour (m ³ /H)	GPM	÷ 4.4 = m ³ /H
Variables			
A1 = Area of pipe in square feet (ft ²)			
A2 = Area of pipe in square meters (m ²)			
kg/m ³ = Specific gravity in kilograms/cubic meter			

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