

SIMPLE, POWERFUL, RELIABLE WATER LEVEL MONITORING

Level **TROLL**®

From the Level Experts: In-Situ® Inc.

Level **TROLL**® 100

**IN-SITU RELIABILITY
AT OUR LOWEST PRICE!**



Level **TROLL**® 300

**RUGGED AND DURABLE
WITH FLEXIBLE COMMUNICATIONS!**



Level **TROLL**® 500

**TOTAL CONFIDENCE IN ALL APPLICATIONS,
EVEN MARINE ENVIRONMENTS!**



Level **TROLL**® 700

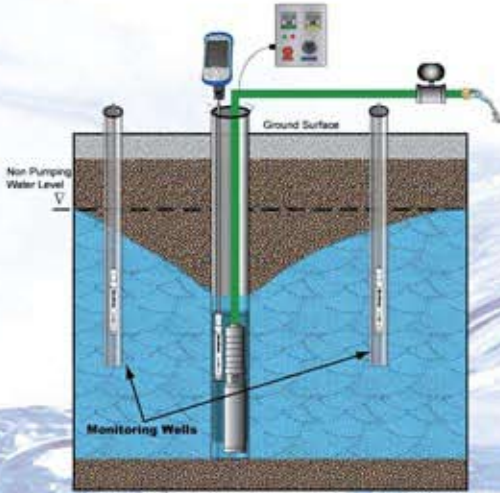
**THE PROFESSIONAL'S CHOICE FOR
HIGH-ACCURACY WATER LEVEL MONITORING!**



**Full Spectrum of Functionality and Price Options
Low-Power System with Guaranteed Battery Life
Superior Accuracy and Performance
FREE 24/7 Technical Support – Always!**

Level TROLL® Applications

Aquifer Characterization (Slug and Pumping Tests)



Slug Test – Estimate hydraulic conductivity (K) in minutes as opposed to hours for a pump test. This method requires the depression or elevation of static water in a well, and the measurement of time it takes to equilibrate. This is done by inserting a slug into the well causing the water level to rise or by removing a slug causing the water level to fall. Time is measured until the level returns to its original static position. The most common log types used are logarithmic or fast linear.

Pumping Test (step) – A well is pumped at different rates for short periods of time, and the aquifers response or drawdown is measured in a monitoring well to determine well efficiency and final pump rate for a constant rate pump test. The most common log types used are logarithmic in the pumping well and fast linear in the monitoring well.

Pumping Test (constant rate) – Also known as a yield test, a constant rate pump test is typically performed after a step test. Pump tests deliver a more accurate hydraulic conductivity value (K) compared to slug tests. The pumping well is pumped at a constant rate for 24+ hours, and level data is collected in monitoring wells to determine the storage coefficient (S), radius of influence and other hydrologic parameters. The most common log types used are logarithmic or step linear.

For Detailed Application Notes

visit the downloads section at www.in-situ.com

Long-Term Monitoring & Resource Management

Long-Term Ground Water Monitoring – Develop historical data on ground water aquifers to determine water influences and usages for residential planning, water rate billing, contamination plume direction, ground water/surface water interaction, seasonal water demand, and other related issues. One or more monitoring wells are equipped with vented water level instruments. Each well will typically be measured for base-line water levels and temperature. The most common log type used is linear, typically at 15-minute intervals or longer.

Lake and Reservoir Monitoring – Track water levels over extended periods of time to determine yearly demand and supply. Water level instrumentation is normally placed in a slotted PVC pipe or stilling well and vented to atmosphere. The most common log types used are linear and event.

Flood and Storm Surge Monitoring – Gather data on flood events and their environmental impact. Instruments are placed in a stream, floodplain or area of interest and secured to prevent loss in a flood event. Absolute or non-vented instrumentation is often used due to concerns of flooding. **Absolute pressure sensor data must be post corrected for barometric changes for accurate level data.** The most common log types used are linear and event.

Storm Water Monitoring – Collect data on amount and rate of storm water runoff to assess recharge rate into ground water aquifers and to monitor the impact of ground water/surface water interaction. Vented or gauged instruments are mounted in outfall basins, storm sewers or ground water wells near recharge area. The most common log types used are linear and event.

Estuary Level and Tide Monitoring – Gather and report tidal changes and water level elevations in coastal areas. Instruments are mounted on fixed structures in PVC pipe or stilling wells and vented to atmosphere. The most common log type used is linear average. For maximum accuracy, tide gauge systems should compensate for water density.

Wetlands Monitoring – Monitor long-term health and viability of coastal or inland marshes and wetlands. Vented or non-vented instruments are placed in a slotted and screened PVC pipe. **Absolute pressure sensor data must be post corrected for barometric changes for accurate level data.** The most common log types used are linear and event.

River and Stream Gauging – Determine and track water level over extended periods of time and track impact of discharge, rainfall and runoff. The level instrumentation is usually placed in a slotted PVC pipe or stilling well with a vented cable. The most common log types used are linear and event.

River Crest Stage Gauging – Determine and track high water levels or flood crest of streams and rivers. Absolute instrumentation is secured to a fixed structure, such as a bridge piling. **Absolute pressure sensor data must be post corrected for barometric changes for accurate level data.** The most common log types used are linear and event.



Ground water monitoring in a coastal zone using Level TROLL® 700 and RuggedReader®



Stream gauging using Level TROLL® 500 and RuggedReader®

Level TROLL® Applications

Specialty Applications

Dewatering – Monitor the removal of water when pumping a riverbed, construction site, mine, quarry or water well. Vented or non-vented instruments are placed in the appropriate areas to monitor the water level. The most common log type used is linear.

Dual-Phase Extraction – Monitor ground water levels in a sealed well during remediation of contaminated soil. The most common log type used is linear.

Landfill Monitoring – Determine the highest measured ground water level and rainfall/recharge relationships. Landfill design engineers and regulatory agencies use this data to determine landfill expansion feasibility and design requirements. The most common log types used are linear and event.

Municipal and Process Monitoring – Monitor water levels in an established water system by attaching the logging instrument directly to a SCADA or PLC system. The most common log type used is linear. **Level TROLL instruments (300, 500, 700) feature Modbus (RS485), SDI-12 and 4-20mA outputs and can be connected directly to a telemetry, SCADA or PLC system without any special adaptors.**



Monitoring recharge rate in an aquifer storage and recovery (ASR) project using Level TROLL 700

Recommended System by Application

Application	Level TROLL® 100 (Acetal alloy)	Level TROLL® 300 (316 SS)	Level TROLL® 500 (Titanium)	Level TROLL® 700 (Titanium)	Recommended cable type
Aquifer characterization			O	X	Vented
Economical, long-term monitoring in fresh water	O	X			Suspension wire
High-accuracy, long-term monitoring in brackish, saltwater or fresh water			X	O	Vented
Lake and reservoir monitoring		O	X	O	Vented or non-vented
Storm water monitoring			X	O	Vented
Tide/harbor fluctuations monitoring			O	X	Vented
Wetlands/estuaries monitoring	O		X	O	Vented or non-vented
River and stream gauging		O	X	O	Vented or non-vented
Crest stage gauging	O	X	O	O	Non-vented or suspension wire
Flood and storm surge monitoring	O	X	O	O	Non-vented or suspension wire
Dewatering		O	X	O	Vented or non-vented
Landfill monitoring	O	X	O	O	Non-vented
Municipal and process monitoring (SCADA integration)		O	X	O	Vented or non-vented
Real-time monitoring via telemetry		O	X	O	Vented or non-vented

X = Recommended by In-Situ Inc. O = Can also be used

For Detailed Technical Notes
visit the downloads section at www.in-situ.com

CALL 1-800-446-7488 • 1-970-498-1500 • EXPERIENCE THE LEVEL TROLL AT WWW.IN-SITU.COM

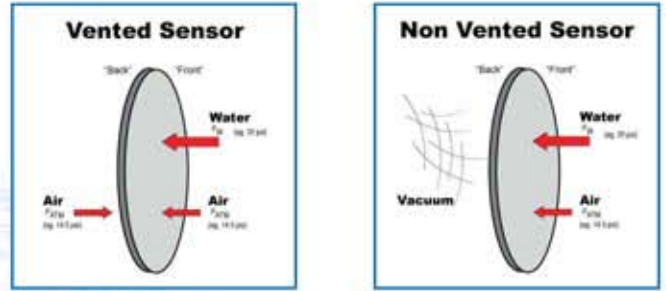
Level TROLL® Measurement Types

Absolute (Non-Vented) vs. Gauged (Vented)

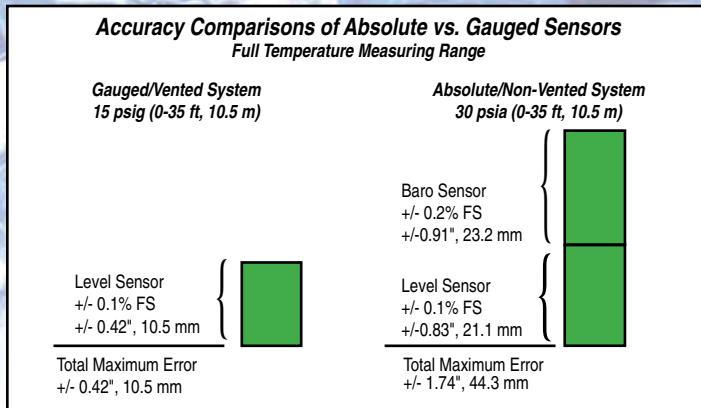
Definition and Background

Absolute (non-vented) sensors respond to atmospheric pressure and pressure head of water above the sensor. Its measurements are read in psia (pounds per square inch absolute) relative to zero pressure. **PSIA sensors must be compensated for atmospheric pressure using a Baro TROLL®.**

Gauged (vented) sensors allows atmospheric pressure to be applied to the back of the pressure sensor, canceling out the effect of external atmospheric pressure fluctuations. Measurements are in psig (pounds per square inch gauged) relative to atmospheric pressure. **PSIG sensors must be deployed on vented cable with desiccant.**



Accuracy Considerations: Total Cumulative Error



Gauged sensors eliminate the effect of varying atmospheric pressure on the measurement and the need for post-logging data compensation. **Gauged systems are the most accurate.**

Absolute sensors will work for all applications, provided that a barometric record is kept and data is post corrected.

All In-Situ® Level TROLL instruments are calibrated over the full pressure and temperature range of the instrument. Many other loggers on the market are calibrated at only 1 or 2 points.

Logging Types

Linear – Measurements are logged at a fixed interval of 1 minute or more; commonly used in long-term monitoring applications. (Log with any Level TROLL instrument.)

Fast Linear – Measurements are logged at a fixed interval of 1 minute or less. The linear sample interval is very fast and the duration of the log is short. Alternatively used in rapid drawdown pump, purging and slug tests. (Log with any Level TROLL instrument.)

Event – One parameter is checked for an event, and data is logged at a user-defined baseline rate in non-event conditions and at an increased user-defined rate when the event is occurring; used to catch events that are not predictable without logging unnecessary data, such as storm events. (Log with any Level TROLL instrument.)

Linear Average – Each logged measurement is the average of several fast measurement; used for applications such as tide gauging. (Level TROLL 700 only.)

Step Linear – Measurements are sampled and recorded on a user-defined schedule which may include multiple steps, each with a unique linear measurement interval and duration; most commonly used in pumping yield tests for high-capacity wells where the pumping rate remains constant. (Level TROLL 700 only.)

True Logarithmic – Measurements are logged on a logarithmically decaying schedule and gradually get further apart until they become linear; most commonly used in rapid drawdown pump, purging and slug tests. (Level TROLL 700 only.)

Win-Situ[®] 5 and Win-Situ[®] Mobile Software

Industry-leading Win-Situ software from In-Situ[®] is the communication platform used to set up, control and manage data from Level TROLL[®] instruments. The software has been designed to be powerful and easy-to-use. Win-Situ 5 software is included with the purchase of Level TROLL 300, 500 and 700 instruments. It's also included with the purchase of the Level TROLL[®] 100 Docking Station. Win-Situ Mobile software is included with the purchase of an In-Situ RuggedReader[®] handheld PC.

Win-Situ 5 Software Features

- Site data management
- Wizards to guide equipment setup
- Real-time indicators of instrument battery, memory and alarms
- Graphical interface
- Simple data export to Excel[®] and other analysis programs

* Win-Situ 5 requires: Microsoft[®] Windows[®] 2000 Professional SP4 or higher; Windows[®] XP Professional SP1 or higher; or Windows Vista[®]; and Internet Explorer[®] 6.01 or higher



Win-Situ Mobile Software Features

- The full power of Win-Situ 5 in a mobile format
- Set up logs and download data
- View real-time data numerically or graphically
- Operates on the powerful RuggedReader handheld PC, even in the toughest field conditions



Software Utilities

Win-Situ BaroMerge[™] – Simplifies post correction of data from absolute instruments using data from a Baro TROLL[®] or user-defined barometric readings.

Win-Situ Software Manager – Keeps your software and instrument firmware up-to-date by automatically checking for the latest versions on the In-Situ web site – eliminating the need to manually keep track of and download software and firmware updates. Free updates available at www.in-situ.com

Win-Situ Sync – Moves data and site files automatically between Win-Situ PC software and the RuggedReader handheld PC. This allows the rapid transfer of site and well information to field teams during monitoring projects.



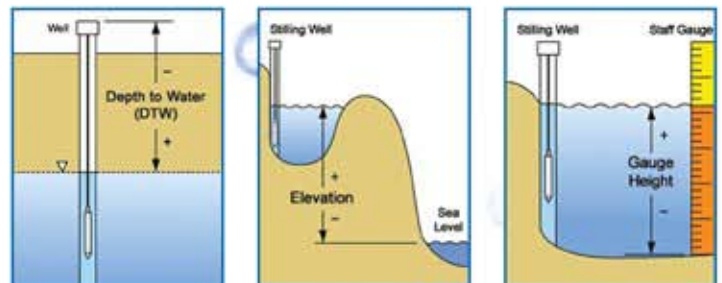
Setting Up a Water Level Reference

In addition to depth and pressure, water level measurements can be expressed in several ways. In-Situ offers multiple choices when setting a water level reference.

1. Depth to Water – Records the distance from the top of a well casing or other reference point down to the water surface. Logged readings increase as the water level decreases (i.e., as the water surface gets farther away from the reference point). This reference point measurement is commonly used to monitor drawdown in ground water wells.

2. Elevation – Relates the sensor measurements to mean sea level (MSL) or any other datum you choose. Logged readings increase as the water level increases. Elevation references are commonly used in surface water monitoring.

3. Gauge Height – Reports water level readings relative to a staff gauge. Useful for river and stream gauging.



Level **TROLL**[®] Instruments

Level, Pressure, Temperature and Data Logging

Level **TROLL** Advantages

GUARANTEED BATTERY LIFE

Only industry guarantee for battery life – 5 years or 2 million readings or free instrument replacement!

SUPERIOR ACCURACY AND PERFORMANCE

In-Situ[®] uses the newest sensor technologies. All instruments undergo an extensive full-scale calibration procedure for both pressure and temperature. A serialized calibration report comes with each instrument.

RUGGED AND RELIABLE

All Level TROLL sensors are designed for use in many applications. Deploy acetal alloy (100), 316 stainless steel (300) and titanium (500, 700) sensors into all types of environmental waters. For superior corrosion-resistance in brackish or saltwater, choose acetal alloy or titanium.

FLEXIBLE COMMUNICATIONS

The Level TROLL 300, 500 and 700 instruments feature Modbus (RS485), SDI-12 and 4-20mA outputs. Connect each of these units to a SCADA or PLC system without any special adaptors.

FREE 24/7 TECHNICAL SUPPORT – ALWAYS!

In-Situ's friendly Technical Support experts are always available to help! They will assist you with instrument setup, calibration, troubleshooting and application-related questions. Fast, friendly and always free of charge, technical answers are a phone call away!

Baro **TROLL**[®] Baro **TROLL**[®] 100

AUTO-COMPENSATION FOR BAROMETRIC PRESSURE CHANGES

Recommended for barometric correction of non-vented instruments

BaroMerge[™] software automatically post corrects data from In-Situ Level TROLLS

Level **TROLL**[®] 100

IN-SITU RELIABILITY AT OUR LOWEST PRICE!

Non-vented (absolute) instrument
Simple data download via docking station
Linear, fast linear and event testing
1.03" diameter acetal alloy body – Corrosion-resistant



Level **TROLL**[®] 300

RUGGED AND DURABLE WITH FLEXIBLE COMMUNICATIONS

Non-vented (absolute) instrument
Download data while deployed via direct read cable
Linear, fast linear and event testing
Standard outputs – Modbus (RS485), SDI-12 and 4-20mA
0.82" diameter stainless steel body



Level **TROLL**[®] 500

TOTAL CONFIDENCE IN ALL APPLICATIONS, EVEN MARINE ENVIRONMENTS!

Vented (gauged) or non-vented (absolute) instrument
Accuracy +/- 0.05% at 15°C
Linear, fast linear and event testing
Telemetry/SCADA ready – Modbus (RS485), SDI-12 and 4-20mA
0.72" diameter titanium body – Ideal for harsh environments



Level **TROLL**[®] 700

THE PROFESSIONAL'S CHOICE FOR HIGH-ACCURACY WATER LEVEL MONITORING!

Vented (gauged) or non-vented (absolute) instrument
Accuracy +/- 0.05% at 15°C
Telemetry/SCADA ready – Modbus (RS485), SDI-12 and 4-20mA
Professional logging types – Linear average, step linear and true logarithmic testing
Logs as quickly as 4x/second
0.72" diameter titanium body – Easily fits down a 1" well



VERSIONS	100	300	500	700
Operational Temp. Range	-20°C to 50°C	-20°C to 80°C	-20°C to 80°C	-20°C to 80°C
Storage Temperature	-40°C to 80°C	-40°C to 80°C	-40°C to 80°C	-40°C to 80°C
Diameter, OD	1.03" (26.2mm)	0.82" (20.82mm)	0.72" (18.3mm)	0.72" (18.3mm)
Length	5.5" (14.0cm)	9.0" (22.9cm)	8.5" (21.6cm)	8.5" (21.6cm)
Weight	6.0oz (170g)	0.54lb (0.24kg)	0.43lbs (0.197kg)	0.43lbs (0.197kg)
Output Options	USB or RS232 via docking station	Modbus (RS485) SDI-12, 4-20mA	Modbus (RS485) SDI-12, 4-20mA	Modbus (RS485) SDI-12, 4-20mA
Housing Material	Acetal Alloy	Stainless Steel	Titanium	Titanium
Nose Cone Material	Acetal Alloy	Black Delrin®	Black Delrin®	Black Delrin®
Internal Battery	3.6V lithium	3.6V lithium	3.6V lithium	3.6V lithium
Battery Life	5 yrs or 2M readings*	5 yrs or 2M readings*	5 yrs or 2M readings*	5 yrs or 2M readings*
Cable Connect	Wire Only	Direct Read or Wire	Direct Read or Wire	Direct Read or Wire
External Power	No	8-36VDC	8-36VDC	8-36VDC
Memory	0.5MB	1MB	2MB	4MB
Data Records**	32,000	50,000	100,000	350,000
Fastest Logging Rate	1 per sec	1 per sec	2 per sec	4 per sec
Fastest Output Rate				
Modbus	N/A	2 per sec	2 per sec	2 per sec
SDI-12	N/A	2 per sec	2 per sec	2 per sec
4-20 mA Update Rate	N/A	2 per sec	2 per sec	2 per sec
Measurement Types	Linear, Fast Linear, Event	Linear, Fast Linear, Event	Linear, Fast Linear, Event	Linear, Fast Linear, Linear Average, Step Linear, Event, and True Logarithmic
Pressure Sensor	Silicon strain gauge	Silicon strain gauge	Silicon strain gauge	Silicon strain gauge
Sensor Material	Ceramic	Stainless steel	Titanium	Titanium
Sensor Accuracy				
Full Scale	Typical +/-0.1% FS Maximum +/-0.3% FS	+/-0.1% @ 15°C +/- 0.1% over calibrated temperature range	+/-0.05% @ 15°C +/- 0.1% over calibrated temperature range	+/- 0.05% @ 15°C +/- 0.1% over calibrated temperature range
Sensor Resolution	+/- 0.01 or better	+/- 0.01% or better	+/- 0.005% or better	+/- 0.005% or better
Sensor Ranges Available	Non-Vented*** 0-30ft (0-9.0m) 0-100ft (0-30m) 0-250ft (0-76m)	Non-Vented*** (30 psia) 0-35ft (10.5m) (100 psia) 0-200ft (60m) (300 psia) 0-650ft (200m)	Non-Vented*** (30 psia) 0-35ft (10.5m) (100 psia) 0-200ft (60m) (300 psia) 0-650ft (200m) (500 psia) 0-1100ft (340m) Vented (5 psig) 0-11.5ft (3.5m) (15 psig) 0-35ft (11m) (30 psig) 0-70ft (21m) (100 psig) 0-230ft (70m) (300 psig) 0-700ft (210m) (500 psig) 0-1150ft (350m)	Non-Vented*** (30 psia) 0-35ft (10.5m) (100 psia) 0-200ft (60m) (300 psia) 0-650ft (200m) (500 psia) 0-1100ft (340m) Vented (5 psig) 0-11.5ft (3.5m) (15 psig) 0-35ft (11m) (30 psig) 0-70ft (21m) (100 psig) 0-230ft (70m) (300 psig) 0-700ft (210m) (500 psig) 0-1150ft (350m)
Burst Pressure	0-30ft: 60ft (18m) 0-100ft: 134ft (40.8m) 0-250ft: 368ft (112m)	Maximum 2X range Burst 3X range	Maximum 2X range Burst 3X range	Maximum 2X range Burst 3X range
Units of Measure – Pressure	Psi, kPa, bar, mbar, mmHg, inHg, cmH ₂ O, and inH ₂ O	Psi, kPa, bar, mbar, mmHg, inHg, cmH ₂ O, and inH ₂ O	Psi, kPa, bar, mbar, mmHg, inHg, cmH ₂ O, and inH ₂ O	Psi, kPa, bar, mbar, mmHg, inHg, cmH ₂ O, and inH ₂ O
Units of Measure – Level	m, mm, cm, in, ft	m, mm, cm, in, ft	m, mm, cm, in, ft	m, mm, cm, in, ft
Calibrated Temperature	0°C to 50°C	0°C to 50°C	-5°C to 50°C	-5°C to 50°C
Temperature Accuracy	+/- 0.3°C	+/- 0.3°C	+/- 0.1°C	+/- 0.1°C
Temperature Resolution	0.1°C	0.1°C	0.01°	0.01°
Units of Measure	Fahrenheit, Celsius	Fahrenheit, Celsius	Fahrenheit, Celsius	Fahrenheit, Celsius

* 1 reading = time and date plus all available parameters polled or logged from device ** Data records = one reading with time stamp
*** Recommended for Baro TROLL® and Baro TROLL® 100 for post correcting non-vented instruments



Telemetry

Flexible and economical TROLL® Link Telemetry Systems offer reliable data retrieval from remote locations. TROLL Link Telemetry Systems provide:

- **Satellite or cellular options** that guarantee communication from nearly any location.
- **Faster data access** at a lower total cost than other data retrieval methods.
- **Full compatibility** with Level TROLL® 300, 500, 700, Aqua TROLL® 200 or TROLL® 9500 instruments.
- **User-defined configuration options** for monitoring and alarming.
- **A solar-powered option** to eliminate on-site power supply.
- **Remote access to instruments** using Win-Situ® Plus software or the secure In-Situ® Data Center.



RuggedReader®

This ultra-rugged handheld PC ensures field-readiness with its waterproof, shockproof design. Collect, store, analyze and transfer data using the latest Microsoft® Windows® Mobile operating system and powerful Win-Situ® Mobile and Pocket-Situ 4 software.



TROLL® Com

TROLL Com offers either cable or direct connect options via USB or RS232. Establishes communication between the TROLL 300, 500 or 700 and a laptop, desktop or RuggedReader handheld PC. Access the Level TROLL® 100 using a docking station with either USB or RS232 connection.



Level TAPE

Choose from the economical Level TAPE 100 or the rugged Level TAPE 200 for accurate distance to water measurements in wells, bore holes and surface water applications. Scaled in feet or meters, with multiple lengths available.



Cables and Suspension Wire

- **Twist-Lock RuggedCable™**—Titanium connectors offer reliability and ease-of-use. Choose from either durable polyurethane or Teflon® (FEP) jacketed cables. Two-year warranty.
- **Titanium cable extender**—Twist-Lock connectors quickly join multiple lengths of RuggedCable for maximum flexibility on monitoring projects.
- **Stripped and tinned cables**—Directly connect to SCADA or PLC systems via 4-20mA, Modbus (RS485) or SDI-12—no adapters required.
- **Suspension wire**—Available in three standard lengths for deployment of absolute sensors.

Additional Accessories

Visit www.in-situ.com for a full range of accessories, including:

- **Well Caps**—Choose from a selection of locking well caps, vented well caps and well docks.
- **NPT Adaptor**—Install Level TROLL instrument into threaded process piping.
- **Desiccants**—Vented cables require desiccants and In-Situ offers a variety of options.

Warranty

The Level TROLL® comes with a one-year warranty. Extended warranties available: call or visit www.in-situ.com for information on our Assurance Plus service and warranty program.

CALL FOR INFO OR TO PURCHASE THE LEVEL TROLL TODAY



In-Situ Inc.
The Standard for Water Quality & Level

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