Appendix 4

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└→ Level TROLL® Comparison | Recommended Systems
   └→ Level TROLL® 300 | **Level TROLL® 500** | Level TROLL® 700 | **BaroTROLL®**

*Baro***TROLL**®

NEW!

*Baro***TROLL**®

The *BaroTROLL*® is a low-cost, self-contained logger that measures barometric pressure. It contains highly precise barometric and temperature sensors, a data logger, and internal power in a 18.3mm (0.72 in) diameter housing. Our low-owered system practically eliminates the need to change batteries and guarantees long-term operation. Alternatively, the unit can be powered with external power. System integration is a snap with built-in RS-485/232 **Modbus**, **SDI-12**, and **4-20mA** communications.

The *BaroTROLL*® is typically used in conjunction with one or more of the non-vented *Level TROLL*® instruments to compensate for changes in water level due to barometric fluctuations. Readings from the *BaroTROLL*® can be automatically subtracted from data collected by a *Level TROLL*®. Due to its small size, it can be installed at the surface or inside the well casing--even in 25mm (1 in) wells! Built entirely from rugged titanium and welded to eliminate o-ring seals, you can have total confidence in harsh environments.

Product Details

Specifications

Cables and Accessories

Recommended Systems

Brochure

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Manual

Applications:

- Barometric pressure monitoring
- Temperature monitoring
- Atmospheric research

Features & Benefits:

- **Barometric pressure, temperature & data logging in a 18.3mm (0.72 in) OD** -- Fits in a 25mm (1 in) well.
- **Ultra-rugged, all-titanium design** -- Perfect for corrosive sites.
- **TIG-welded seals** -- Prevents flooding of instrument.
- **Ultra-low power system guarantees 5 years or 2-million readings** -- Forget about changing batteries or running out of power.
- **Uses external battery or line power** -- Never run out of power.
- **Sealed Twist-Lock hanger** -- 100% reliability
- **Easy-to-use Win-Situ® software** -- Get the data you need fast! Large, sizable display that's easy to see from a distance.
- **Extremely accurate sensors** -- Record minute changes in barometric pressure and temperature.
- **Data saved by sites not files** -- Collect and save information by site automatically. No need to transfer data later.
- **Easy-to-read memory and battery gauges** -- Know exactly how much power is left.
- **Modbus, SDI-12, and 4-20mA** -- Provides for easy connections to existing and online systems.
- **Specify start and stop times for logging** -- Collect the data you need up to the date you want and no more.

- **User-friendly Wizards guide every step** -- Reduces complicated steps and the need for tedious manuals.
- **-20 to 80C temperature range** -- Use for research and applications with higher temperatures.
- **100,000 data points of memory (1 MB)** -- Reduces the interval between data collection.
- **CE and FCC approved** -- Prevents susceptibility to outside emission interference and transient electrical surges.
- **Ability to "undelete" files from the unit** -- Retrieves accidentally deleted data.

Specifications

General

Operating temperature range	-20 to 80C
Dimensions	18.3 mm (0.72 in) OD, 21.6cm (8.5 in) long
Weight (includes backshell)	0.197 kg (0.43 lb)
Output options	Modbus (RS-485/232), SDI-12, 4-20mA
Housing material	Titanium
Nose cone material	Black Delrin®

Power

Internal battery	3.6V Lithium
Typical life*	5 yrs or 2-million readings
External power	8-36VDC
	*Whichever comes first. See battery guide for details.

Logging

Memory / data points**	1 MB / 100,000+
Logging Rate	User selectable from 1 min -- 49 days
Modbus	2 per sec
SDI-12	2 per sec
4-20 mA Update Rate	2 per sec
Measurement Types	Linear
	**data record = time and date plus one single parameter logged

Barometric Sensor

	Silicon strain gauge
Type	Non-vented
Material	Titanium
Accuracy***, FS	+/-0.05% (at 15C)
FS = Full Scale	+/-0.1% (-5 to 50C)
	+/-0.25% (-20 to -5 & 50 to 80C)
	*** Accuracy with 4-20mA output option: +/-0.25% typical
Resolution	0.005% FS or better
Range	Non-vented: 0 to 1.14 bar (0 to 16.5 psi)
Units of Measure - Pressure	psi, KPa, bar, mbar, mmHg, cmH_2O, inH_2O

Temperature Sensor

Material	Silicon
Accuracy	+/-0.1C
Resolution	0.01C or better
Range	-20 to 80C (-4 to 176F)

Warranty: The BaroTROLL comes with a one-year warranty.

Minimum System Requirements: 400MHz Pentium® II, 128MB RAM, 100MB free disk space, Internet Explorer® 6.01 or higher, and Windows® 2000 Professional SP2 or better, or Windows XP Professional SP2 or better, or Windows Vista®, CD ROM Drive, Serial or USB port.

Download In-Situ® Modbus Networking Specifications | www.modbus.org

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Pentium is a registered trademark of Intel.
Windows, Internet Explorer, and Windows Vista are registered trademarks of Microsoft Corporation, USA and other countries.

Contact Us

Level **TROLL**® *300*

Simple,
Powerful, *Easy*
level monitoring

NEW!

Level **TROLL**® *300*

Introducing the **NEW Level TROLL® 300**... Simple, Powerful, Easy water level monitoring.

The **Level TROLL® 300** is an absolute (non-vented) instrument for monitoring and recording changes in water level, pressure and temperature. The **Level TROLL® 300** eliminate problems commonly found in the industry while also providing the accuracy, reliability and ease of use needed for long-term water level monitoring. Its 20.8mm (0.82") diameter 316L stainless steel housing allow the instrument to be confidently deployed in a 25mm (1") well. Enhanced electronic and sensor design provide long-term accuracy with internal memory of 50,000 data points and options of internal or external power allowing deployment for years. The new Twist-Lock connector eliminates worries of lost data and or communication failure while procedural and data errors are reduced through easy to use Windows®-based software. The **Level TROLL® 300** provides the confidence needed to perform highly accurate water level studies with a complete and integrated solution.

Product Details

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The **Level TROLL® 300** system is of primary interest to those who deploy instrumentation for the monitoring and recording of long-term water level changes in either monitoring wells or in open surface water. The **Level TROLL® 300** instrument comes standard with the ability to communicate via **Modbus, 4-20mA, SDI-12** and **RS-485/232**. Pressure sensor accuracy has been verified to meet or exceed 0.1% of full-scale operation, while maintaining one of the smallest sensor diameters in the industry. The new instrument incorporates a fully sealed power cell, warranted to operate for a minimum of 5 years or 1,000,000 readings, whichever comes first, eliminating worry of system flooding while also giving confidence in long-term deployment. Long-term deployment is further assured with optional external power accessories. The **Level TROLL® 300** can be deployed with either suspension wire or direct read cable using the In-Situ® Twist-Lock connector. The system was extensively tested to provide sure attachment to the communication and deployment cable, thus eliminating worry of communication failure or error. Additionally, an optional external barometer (**BaroTROLL®**) is available for use with the **Level TROLL® 300** , with seamless integration of barometric pressure compensation performed through In-Situ®'s new **Baro Merge**™ software.

12 reasons to choose the Level TROLL® 300

1. In-Situ® Reliability and Ruggedness at a great price!
2. Easy to install and easier to operate
3. Power it your way–Internal Battery only, Optional External Battery pack, or External Power
4. Every Level TROLL® 300 has built-in MODBUS/RS485, SDI-12, and 4-20mA communications–no special adapters required!
5. No ceramic sensors that can compromise your data by drifting
6. Completely sealed instrument with removable nosecone

7. Error proofed data download– no way to burn out the internal battery during data downloads
8. Kevlar® fiber reinforced direct reading cable available at ANY length up to 1200m (4000ft)
9. Industry leading Win-Situ® software included at no charge with every Level TROLL® 300
10. Compatible with the In-Situ® RuggedReader® and Win-Situ® Mobile software for reliable field operation and data retrieval
11. SCADA Ready and Telemetry Ready–no confusing proprietary communication protocol!
12. 100% Compatible with all In-Situ® TROLL® accessories

Applications:

- Long-term well monitoring
- Dewatering, Tanks
- Stream
- Lake and Reservoir monitoring
- Flow measurements
- Landfill & industrial water monitoring
- Combined sewer overflow (CSO)
- Mine sites
- and more!

- Not suitable for long-term deployment in saltwater or corrosive environments.

Features & Benefits:

- **Rugged, 316L Stainless Steel** – Perfect for Long-term well monitoring, Dewatering, Lake and Reservoir monitoring, Aquaculture, Agriculture, and Landfill monitoring.
- **Accurate Stainless Steel Sensors** – Stainless Steel sensors reduce the potential for drift, which is inherent to ceramic sensors.
- **TIG-welded seals** – Prevents flooding of instrument.
- **Ultra-low power system guarantees 5 years or 1-million readings** – Forget changing batteries or running out of power.
- **Uses external battery or line power** – no worries about running out of power.
- **RS-485 MODBUS, SDI-12, and 4-20mA** – SCADA ready - provides for easy connections to existing and online systems
- **Twist-Lock connectors that "lock" tight** – 100% reliability
- **Can be used with suspension wire** – More economical than direct read cable
- **Can be used with In-Situ®'s new Twist-Lock cables** – Save time and money by downloading data from the top of the well.
- **Extend cables by simply adding additional segments** – maximizes your investment and maintain flexibility with your unit.
- **Easiest ever Win-Situ® software** – get the data you need fast! Large display that's easy to see from a distance
- **Linear logging** – perfect for long-term monitoring
- **Fast Linear logging** – perfect for specialized tests
- **Event Test Logging pause logging feature** – Pause logging when removing a unit. Reinstall and restart where you left off!
- **Specify start and stop times for logging** – collect the data you need up to the date you want and no more
- **Ability to "undelete" files from the unit** – no worries of accidentally deleting your data.
- **Data saved by sites not files** – collect and save information by site automatically. No need to transfer data to a different format.
- **Easy-to-read memory and battery gauges** – know exactly how much power is left
- **Submersible pressure ranges up to 210m / cable length up to 1200m** – measure to the depth you need.
- **FCC and CE emission tested** – prevents susceptibility to outside emission interference and transient electrical surges
- **Model number, serial number, pressure range and manufacturing information printed on side of the unit** – know the details of the unit without opening the software. Reduces accidental over pressuring

Click here for more details on the Level TROLL®

Specifications

General

Operating temperature range	-20° to 80°C (-4° to 176°F)
Dimensions	20.8 mm (0.82 in) OD, 22.9cm (9 in) long
Weight (includes hanger)	0.24 kg (0.54 lb)
Output options	Modbus (RS-485/232), SDI-12, 4-20mA
Housing material	316L Stainless Steel
Nose cone material	Black Delrin®

Power

Internal battery	3.6V Lithium
Typical life*	5 yrs or 1-million readings
External power	8-36VDC
	*Whichever comes first. See battery guide for details.

Logging

Memory / data points**	1 MB / 50,000+
Logging Rate	User selectable from 1 sec -- 49 days
Modbus	0.5 sec
SDI-12	0.5 sec
Measurement Types	Linear, Fast Linear, Event
	**data point = time and data plus one parameter logged

Level Sensor

	Silicon strain gauge
Type	Vented
Material	316L Stainless Steel
Accuracy, FS	+/-0.1% or better (0° to 50°C (32° - 122°F))
Resolution	0.01% FS or better
Range	Non-Vented:

- 10.9 m, 35.8 ft (206.8 kPa, 30 psi)
- 60.1 m, 197.3 ft (689.5 kPa, 100 psi)
- 200 m, 658.7 ft (2068 kPa, 300 psi)

Temperature Sensor

Material	Silicon
Accuracy	+/-0.3°C
Resolution	0.1C or better
Range	0° to 50°C (32° to 122°F) - temperature compensated

TROLL® Hangers and Twist-Lock Cables

Connector	Twist-Lock for direct read or stripped & tinned cable
Number of conductors	6
Internal Conductor Material	Polypropylene
Diameter 6.7mm (0.265 in)	Break strength 127 kg (280 lbs)
Bend Radius	2X diameter of cable = 13.72mm / 0.54 in

Cable Types:

FEP (Generic Teflon®) coated steel cable for hanging
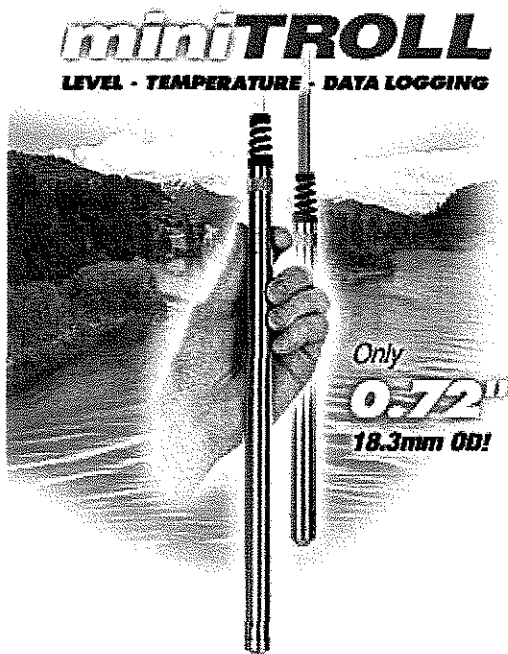Direct read non-vented Polyurethane or Halogen-Free Polyurethane

Minimum System Requirements: 400MHz Pentium® II, 128MB RAM, 100MB free disk space, Internet Explorer® 5.0 or higher, and Windows® 2000 Professional SP2 or better.

Download In-Situ® Modbus Networking Specifications | www.modbus.org

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└─→ miniTROLL®

miniTROLL

LEVEL · TEMPERATURE · DATA LOGGING

Only **0.72"**
18.3mm OD!

Parameters Measured

- Level
- Temperature
- Open channel flow (using pressure)
- Barometric Pressure (BaroTROLL® only)

The Professional Standard for water level monitoring

The miniTROLL® is the world's most advanced data logging probe. It is completely self-contained and features an internal data logger with a pressure/level and a temperature sensor . It is used by water professiosnals around the world to collect real-time information for analysis of both short- and long-term water level trends.

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miniTROLL® Versions
Advanced | Professional

Features:

- Smallest diameter at only 0.72 inches (18.3mm)
- Powerful onboard data logger - up to 1MB (440,000 data points)
- Linear, linear average, logarithmic, and event logging modes
- User-replaceable AA batteries - no need to return to the factory!
- High quality vented Quick-Connect cable (FEP or Polyurethane) - Fully detachable!
- Ultimate 4-way level compensation including auto barometric compensation
- Vented cable, Direct-Read cables OR suspension by low-cost wire
- Networking and telemetry capable
- Accuracy certified to NIST-traceable standards
- Multiple product versions - select the features you need
- Always upgradeable!

See why water professionals choose it short-term or long-term water monitoring!

The
Professional
Standard

All in one design
Rugged construction
Easiest to use
Extreme Accuracy
NIST-traceability
Long-lasting power
Quick-Connect cables and backshells
BaroTROLL®
Installation
Telemetry
Software / Handhelds Pocket PC's
Accessories
Multiple product versions

Did you know?
You can deploy the *miniTROLL®* with or without cable using a stainless steel backshell.

All-in-One Design

The miniTROLL® is the ultimate tool for short and long-term water level monitoring. It boasts the smallest diameter at only 18.3mm (0.72") and contains everything needed to monitor and record water level and temperature data!

- Smallest diameter at only 18.3mm (0.72")
- Rugged Industrial 316-Stainless Steel design
- Integrated Quick-Connect cable - fully detachable

EVERYTHING NEEDED IS IN ONE UNIT!]

- Sensors
- *Data Logger*
- Clock
- Power

Rugged Construction

The miniTROLL® is the ultimate tool for short and long-term water level monitoring. It boasts the smallest diameter at only 18.3mm (0.72") and contains everything needed to monitor and record water level and temperature data!
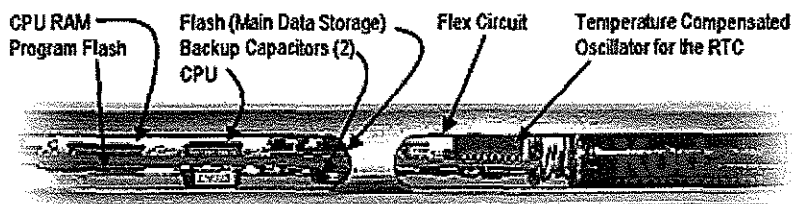
miniTROLL® System Components

The main body of the miniTROLL® has unique features not found with competitor products. We will break the probe into three areas:

1. Sensor/Analog Electronics (Front)
2. Digital Electronics (Middle)
3. Power Management/Battery Compartment/Connector (Back)

Electronics

- Internal data logging
- High accuracy real-time-clock
- *±2 min/year over the operating temperature range.*
- Field Upgradeable Product Upgrades
- Networking and Smart Data Retrieval
- File System allowing Multiple Test Storage

CPU RAM — Flash (Main Data Storage) — Flex Circuit — Temperature Compensated
Program Flash — Backup Capacitors (2) — Oscillator for the RTC
CPU

Powerful data logging with 1MB of memory

A powerful internal data logger is the key to real-time profiling and long-term monitoring.

- Up to 16 tests scheduled to run or stored
- Linear, Linear Average, Event and Log testing modes
- 0.5 second to 7 day user-selectable sampling rates
- Downloads only new data
- Non-volatile memory
- Up to 220,000 data points (level & temperature) based on version

Comes standard with surge and lightening protection!

Sensors

- Pressure/Level & Temperature sensors
- Cavity less than 1 mm from the fluid ports to the surface of the pressure sensor
- Factory serviceable nose and debris screen

Optional NPT Adapter
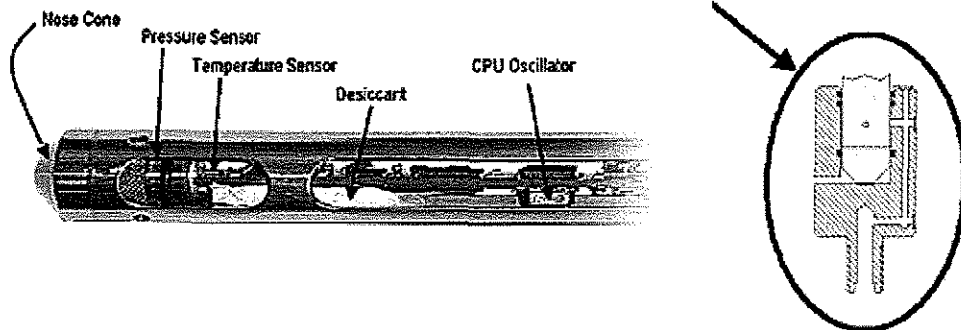
Easiest to use

In-Situ® instruments are famous for their ease-of-use and the miniTROLL® is no exception. With intuitive Windows®-based Win-Situ® software you will be able to operate the miniTROLL® right out of the box. We have designed the software to be intuitive, with Wizards to step you through every operation. The miniTROLL® puts our 25 years of experience into a field-proven tool, used by water professionals in virtually every profession.

- User Replaceable Batteries! **(No need to return to the factory)**
- Built-in Barometric Compensation options
- More Options!! - Gauged (vented) and Absolute (non-vented) options
- Direct-Read and Wire Suspension Options
- No need to merge data sets for temperature and pressure
- Powerful and Easy to Use Software
- Upgradable via the Internet
- Version Upgradable - even downhole!
- Water-tight Pocket PC and Windows® interface
- 24/7 Customer Service

Extreme Accuracy
Do you demand accuracy and precision?

- All units pass extensive environmental testing
- Temperature Accuracy: ± 0.25°C over entire range
- Resolution: 16-bit A-D converter
- Pressure Accuracy: ±0.1% over full pressure and temperature range, or 0.05% @ 15°C

Level readings are compensated for:
- Temperature from -5 to 50°C
- Fluid Density
- Gravitational Acceleration
- Barometric pressure (with vented cable)

Accurate *Data*

media isolated silicon strain gauge

Silicon temperature sensor
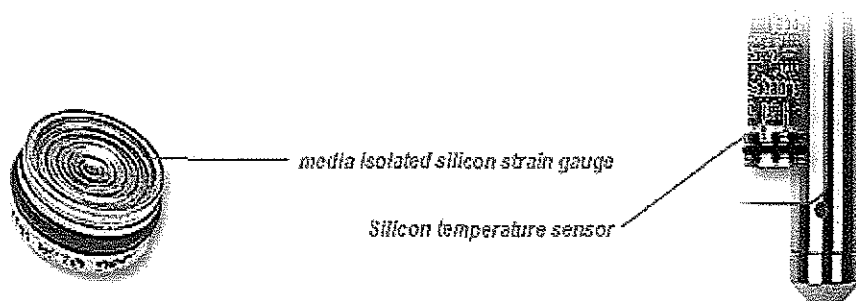
Sensor Options
- Pressure Only
- Temperature Only
- Temperature and Pressure
- Gauged or Absolute (Vented or Non-vented respectively
- All probes are fully temperature compensated
- 15, 30, 100, 300 and 500-psi (0-351m, 0-1152 ft)

NIST-traceable

Our Customers and their clients demand **accuracy** and **precision**. The miniTROLL® has been extensively tested against competing units in every operating environment known. The result? The miniTROLL® is considerably more accurate. Our published specifications are very conservative and reflect our high regard for the integrity of data in all environmental conditions, not just the lab. We stand behind our accuracy by providing a **calibration report** with every miniTROLL®.

A discussion our competition would rather not have

Some competitors do not include an calibration report. Why? Their accuracy is simply an average of poor accuracy readings (see chart below). They can honestly say their Full Scale specification is good due to the "cancellation" of the negative and positive errors or an average of the pressure readings over temperature. You decide-- have a look at a graph below that shows unbiased data from an environmental test between the miniTROLL® and a competitor. Even though the written specifications are similar, environmental testing shows there is a substantial difference. WHICH instrument would you trust with YOUR readings? In many cases the accuracy of our instruments will be much greater than our specifications, giving you assurance that you have chosen the right tool for the job.

MiniTROLL vs. Competitor A
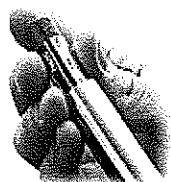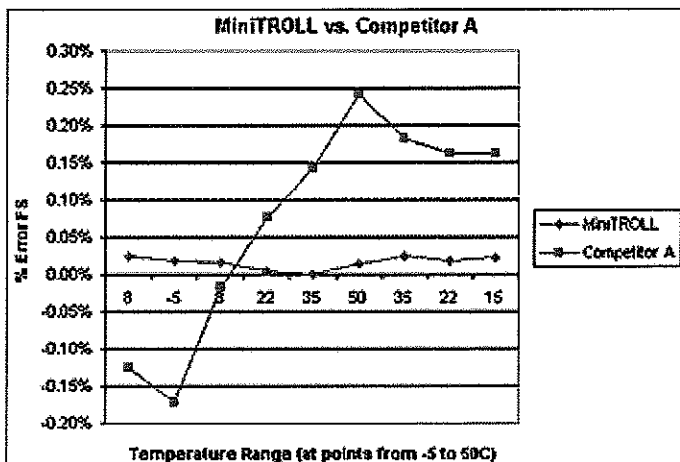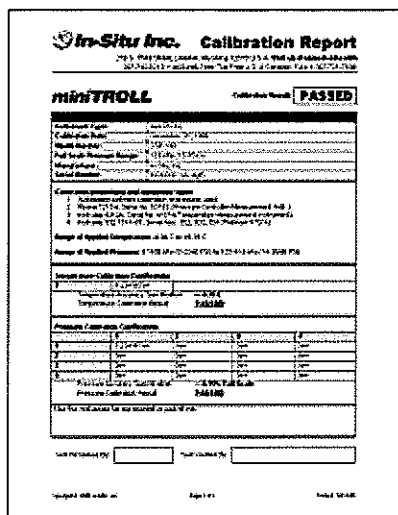
Long-Lasting Power
- **User replaceable, commercially available AA batteries**
- Up to 2 years of power!
- Internal and/or external power operation
- Two additional patents pending

Replaceable Energy Cells
Elastomer Holder
Quick-Connection End
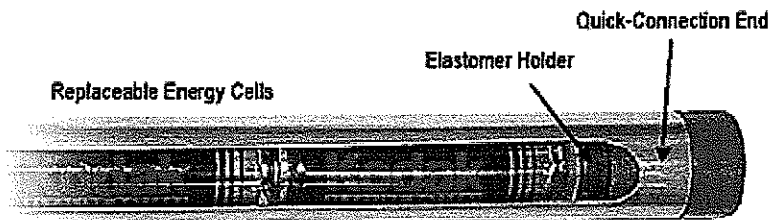
Quick-Connect Cables and Backshells

The miniTROLL® is exceptionally easy to use. It has been designed from the ground up with conveniences that you will appreciate.

- Revolutionary Quick-Connect cables
- Patented design (US Patent 6,305,944)

Quick-Connect Cable is offered in 3 types:

- Polyethylene - non-vented (Black)
- Polyurethane - vented (Yellow)
- FEP (Teflon®) - vented (Blue)
- Teflon®-coated stainless steel wire

Teflon-coated stainless steel wire
Polyethylene
Polyurethane
FEP (Teflon equivalent)
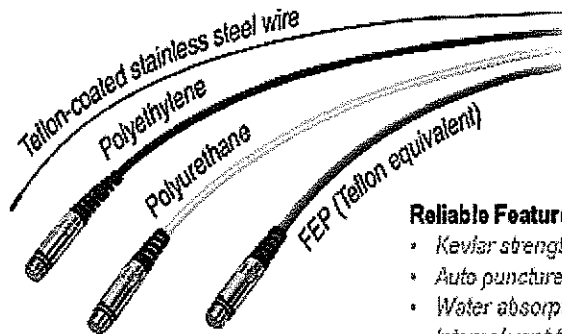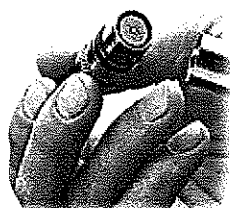
Reliable Features:
- Kevlar strength members
- Auto puncture seal
- Water absorption tape
- Internal vent tube

Sealed Backshells
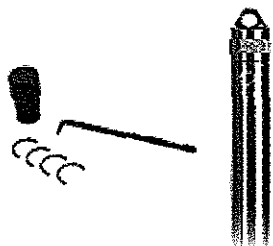
The miniTROLL® can also be suspended by **low-cost wire** using a **non-vented backshell** and battery retainer kit.

BaroTROLL®

"BaroTROLL®" is a **low-cost barometric smart-probe that compensates for barometric pressure for non-vented units**. This device complements the non-gauged (absolute) versions of the current In-Situ® TROLL® product line by allowing up-hole placement of an inexpensive barometric logger. Ambient barometric data compensation is easily achieved through a new 1-step software enhancement in the included Win-Situ® software.

- *Low-cost*
- 100,000 data points
- Temperature compensated

Installation
Installation is easy--just place it in water!

The miniTROLL® is easy to setup and install for:

- Long-term monitoring
- Short-term aquifer studies

- **View data real-time!**

- Download data with a PC, laptop or iPAQ Pocket PC OR, Transmit data by Telemetry!

Win-Situ® Software
- Integrated graphing and reporting
- Powerful REAL-TIME display - graph or meter views
- Full support for TROLL® 9000 and miniTROLL®
- Instant "one-button" export to MS Excel®!
- New Quick-Calibration Wizard for TROLL® 9000
- View up to 4 graphs simultaneously - select primary and secondary axis
- Customize your view - zoom tool, full or split screen, unit selection and more!
- Included FREE with purchase of Multi-Parameter TROLL® 9000 or miniTROLL®
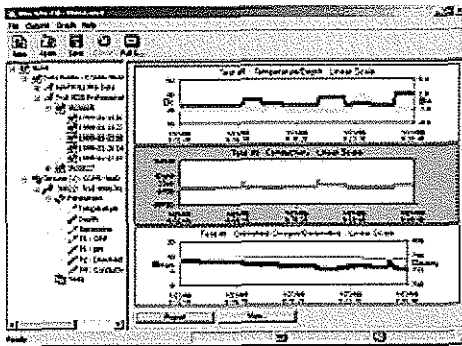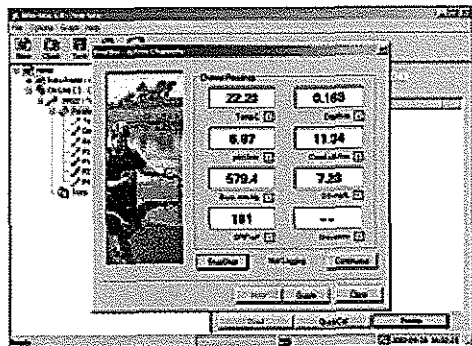
Win-Situ® software screen shots -- Real-time "profiling" readings / Graph view

Pocket-Situ -- Pocket PC Software from In-Situ®
Say goodbye to that expensive and heavy handheld unit and say hello to new Pocket-Situ running on the RuggedReader®! View and download data real-time, start and stop logging operations or take voice notes, manage your schedule, save contacts, and more.

RuggedReader
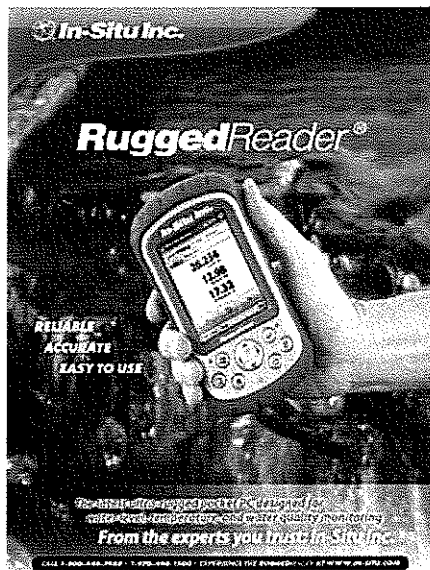
- Powerful instrument controller
- All of the features of Win-Situ®
- View data in Graph OR Meter format
- View data real-time!
- Download data, calibrate sensors, setup logging
- It's also a fully functional PDA
- Store contacts, make schedules
- Use Pocket Word, Excel®, play games, etc.

Accessories

In designing the MP TROLL® 9000, as well as in our ongoing product support, we incorporate a philosophy of providing features that our customers will use and appreciate. Our options simply give you the choice of the right tool for the job. The MP TROLL® 9000 is also field-upgradeable (even downhole!), should the job requirements change. Here are some of the many optional additions to your toolkit.
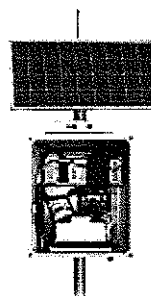
Networking

Multiple unit installations are a snap using T-Boxes or Quad-Boxes. Create networks of up to 32 TROLL® 9000s. Saves money!
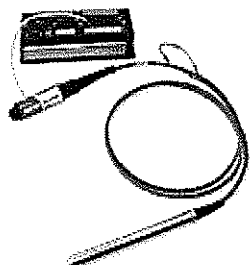
External power

Need more power? The miniTROLL® can be used with external power. In this case, the internal battery will be used as backup.
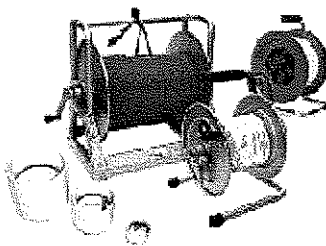
Telemetry Systems

Telemetry systems make long-distance communications easy. Modem, cellphone/modem and radio telemetry options are available with solar or line power.

SDI-12

Now available with optional SDI-12 output. Connects to popular 3rd-party data loggers.

Reels, Well Docks and caps

Reels are available in three sizes in steel or ABS plastic. Well Docks make well installations a snap. A real asset!

Locking Well Caps

Protect your investment with these rugged, lockable well caps. Caps are vented for your convenience. Try with well docks!
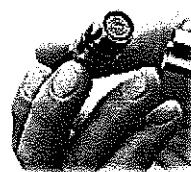
Non-vented backshell

Use the miniTROLL® with or without vented cable by attaching a stainless steel backshell.

Desiccants

High humidity? Try a MAXUM high-capacity desiccant. Screws right onto the cable!

Cables

Patented design

Vented or non-vented Quick-Connect cables. Available in polyethylene, polyurethane or

FEP (Teflon®).

Excellent Value - Add the features Up, Try it Today!

The answer is simple: The miniTROLL® combines powerful functionality and In-Situ® reliability with affordable versions. Sure, there are many competitive products. When you add up features & benefits, which unit comes out ahead? How important is your data?

▷ Affordable, Reliable and very Easy-to-use, the miniTROLL® is being used by water professionals to collect precise information for analysis of both short- and long-term water level trends.

Versions
Choose the version best suited to your needs.

Versions	Advanced	Professional
Level / Pressure Sensor	X	X
Temperature Sensor		X
Barometric Pressure Sensor		
SDI-12 Communications	Optional	Optional
Temperature compensation	X	X
Barometric compensation	X	X
Fluid density compensation	X	X
Internal Data logging	X	X
Memory (data points)	80,000	220,000
Number of tests stored	2	16
Linear tests	X	X
Linear average tests	X	X
Event tests	X	X
Log tests		X
Min sampling rate (sec)	0.5	0.5
SDI-12 Min samp. rate (sec)	2	2
Telemetry capability	X	X
Networking capability		X
Download speed	2X	3X
Downloads only new data	X	X
Upgradeable	X	

Specifications

Specifications	Internal Power	External Power
General:		
Dimensions	18.3 mm (0.72 in) OD, 295.9 mm (11.65 in) long	18.3 mm (0.72 in) OD, 197.4 mm (7.77 in) long
Weight (includes backshell)	0.31 kg (0.68 lb) with batteries	0.22 kg (0.48 lb)
Wetted materials	316 stainless steel, Viton®, FEP* or polyurethane (cable), both models	
Sensors:	Pressure Sensor	Temperature Sensor
Operating principle	integrated silicon strain-gauge pressure sensor	silicon temperature sensor
Ranges / Accuracies	■ 3.5 m, 11.5 ft (34.4 kPa, 5 psi) / ±0.1% over full temperature, 0.05% @ 15°C ■ 11 m, 35 ft (103.4 kPa, 15 psi) / ±0.1% over full temperature, 0.05% @ 15°C ■ 21 m, 69 ft (206.8 kPa, 30 psi) / ±0.1% over full temperature, 0.05% @ 15°C ■ 70 m, 231 ft (689.5 kPa, 100 psi) / ±0.1% over full temperature, 0.05% @ 15°C ■ 211 m, 692 ft (2068 kPa, 300 psi) / ±0.1% over full temperature ■ Higher ranges also available. Call for information.	-5°C to 50°C (23°F to 122°F) / ±0.25°C
Pressure rating	2x range/3x burst (11 m = 3x range/5x burst)	NA
Operating temperature	-5°C to 50°C (23°F to 122°F)	-5°C to 50°C (23°F to 122°F)
Other:		
Measurement schedules	- Linear (500 millisecond minimum) - Linear average - Logarithmic (300 millisecond minimum) - Event	

Resolution	16-bit A-D convertor: 0.00531% FS / 1 mm for a 21m (206.8 kPa/30 psi) sensor
Processor	Motorola HC11
Real-time clock accuracy	±4 min/yr over operating temp. range: ±2 min/yr from 0°C to 40°C
Memory	1 megabyte flash data storage= 220,000 pressure & temperature readings (440,000 total)
Filter	316 stainless steel
Desiccant	0.75 g silica gel
Thermal stabilization time	30 min to 1hr to within 0.1% of full scale, 1.5 to 2 hr to within 0.05% of full scale
Barometric equilibration time	5 min to within 0.05% of full scale for 304.8 m (1000 ft) of cable

TERMS OF INTEREST

Gauged (vented) Option. Automatically compensates for atmospheric changes:

Vent to atmosphere. Why? - Forces on both sides of the pressure transducer are equalized, providing a more accurate reading relative to ambient atmospheric pressure.

Compensate for Barometric Changes. Why? - As barometric pressure changes, water in an enclosed aquifer will rise and fall in response to the change. This phenomenon will introduce a margin of error in your readings if not compensated and primarily affects tests conducted in enclosed aquifers.

All of the electronics and sensors are completely self contained in the Gauged miniTROLL® version. *This configuration is exceptionally durable and made to withstand years of exposure to harsh downhole conditions.* By using a tool with everything you need built in, it Increases Accuracy, and Reduces Time and Effort to merge barometric data reading corrections to get "True" water levels.

Absolute (non-vented) Option:

No Need to Compensate for barometric changes in some tests. Why? - When monitoring an open body of water, or a pressurized water column, there is no need to compensate for barometric pressure. In the open body of water, the affects of the change in barometric pressure are insignificant, relative to even the high accuracy recorded by the miniTROLL®. When monitoring a pressurized water column, changes to outside atmospheric pressure will usually be of no significance to your test.

All of the electronics and sensors are completely self contained in the Absolute (non-vented) miniTROLL® version. The Absolute miniTROLL® may be suspended by either a stainless steel wire or direct-read cable option. *This configuration is exceptionally durable and made to withstand years of exposure to harsh downhole conditions.* By using a tool with everything you need built in, it Increases Accuracy and Reliability.

Direct readings

Don't need to remove unit from well to get readings. Why? - In many cases you will not want to disturb the transducer once you have started to take readings downhole. The Reliable, Watertight and Easy to Use direct-read cable option for the miniTROLL® allows you to see everything the miniTROLL® is detecting and recording with a simple twist of a connector at the wellhead. By utilizing the direct-read cable option to examine either real-time or recorded downhole data, your miniTROLL® will remain in the exact same place as when you first positioned it. Your data will be far more accurate. Here are some more reasons to use the simple direct-read option for the miniTROLL®:

- Readings may be offset upon reinstallment
- Unit may be contaminated and unwise to handle
- More chances for unit to snag in well
- Difficult to reposition
- Easy to collect data
- Can connect to telemetry systems / 3rd-party data loggers / Online / Automation

Wire Suspension (non-direct reading)

In some cases, you will want to suspend your Absolute (non-vented) miniTROLL® by a thin stainless steel wire. You will want to employ this method when:

- Least Cost is an issue
- Very High Security is an issue
- Well contamination may prevent introduction of poly or FEP downhole cable.
- Longer term monitoring is being employed
- Atmospheric compensation is not an issue

Need more information? Take a look at the spec sheets