

***miniTROLL***



**Operator's  
Manual**

**MODEL SSP-100**

**September 2001**

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# 1 INTRODUCTION



## IN THIS SECTION . . .

- Overview of the MiniTROLL Operator's Manual
- System Description
- System Features
- Checklist of Single MiniTROLL System Requirements

## OVERVIEW OF THE MINITROLL OPERATOR'S MANUAL

**Section 1: Introduction**

**Section 2: System Components** of single MiniTROLLs and networks

**Section 3: Getting Started** setting up a single MiniTROLL

**Section 4: Providing Power** for data collection and programming

**Section 5: Programming for Data Collection**

**Section 6: Field Installation** guidelines

**Section 7: Network Installation** recommendations

**Section 8: SDI-12 Operation**

**Section 9: Care & Maintenance**, including consumables

**Section 10: Warranty & Service**, How to Contact Us

## SYSTEM DESCRIPTION

Your new MiniTROLL is a compact, modular system for measuring temperature and pressure (water level, depth or drawdown) in natural

groundwater and surface water, as well as industrial, waste, and other installations. Components include the instrument body, a suite of vented cables for single instrument operation, vented T-boxes and non-vented cables for network operation, external power accessories, and consumable items.

### SYSTEM FEATURES

- 18.3 mm (0.72 in) diameter
- up to 1 megabyte flash data-storage memory
- fast data sampling (0.5 sec in linear tests)
- user-replaceable off-the-shelf batteries
- 16-bit A to D converter
- triple protection against moisture
- cable venting
- low-power HC11 microprocessor
- all 316 Stainless Steel body construction
- temperature-compensated pressure sensor
- temperature-compensated real-time clock
- multiple power options
- error-proof connector system
- SDI-12 or RS485 interface—or both
- easy-to-use Win-Situ™ 2000 software
- Optional Pocket-Situ™—Win-Situ for Pocket PC
- Standard, Advanced and Professional feature sets
- four measurement schedules, depending on model
- up to 16-test capacity

### SYSTEM SURFACE CONNECTORS

The lightweight, weather-resistant nylon connectors used throughout the MiniTROLL system are designed to make connections as simple as can be. Connector keying prevents misconnections. For example, vented cable (yellow or blue) cannot mate with non-vented (gray) network cable.



Each connector is protected by a dust cap. Replacements for worn or damaged dust caps are available from In-Situ Inc. or your local distributor.

### **TRIPLE MOISTURE PROTECTION**

A vented connector cap at the top of the MiniTROLL's submersible cable is fitted with a hydrophobic membrane that will not allow water droplets to pass into the cable. This replaceable cap contains indicating desiccant to protect the cable and electronics from condensation of water vapor. Additional desiccant in the MiniTROLL body provides further protection against moisture damage, but is not user-replaceable.

### **CHECKLIST: SINGLE MINITROLL SYSTEM**

The following are the minimum requirements for stand-alone (non-network) operation of a single MiniTROLL.



*For Network operation, refer to Section 7.*

### **FOR FIELD INSTALLATION & DATA COLLECTION**

- ✓ MiniTROLL
- ✓ Submersible cable
- ✓ Power source, any combination of
  - Internal batteries
  - Long-life disposable external battery pack
  - 6 VDC power supply, Computer Connection Cable and available AC line power source

### **FOR PROGRAMMING & DOWNLOADING DATA, ADD**

- ✓ Computer Connection Cable (*field or indoor use*) or Programming Cable (*indoor use only*). Both cables include an RS485/RS232 converter
- ✓ PC or laptop computer
- ✓ Win-Situ 2000 software



*For field use, Pocket-Situ and a Pocket PC with serial adapter cable are convenient additions.*

## 2 SYSTEM COMPONENTS



### IN THIS SECTION . . .

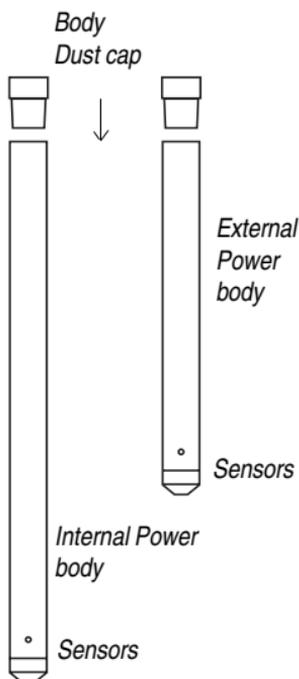
Component descriptions for single MiniTROLL systems and network systems. Components used in single-instrument installations are designated "S," while network components are designated "N." Some components are used in both configurations.

#### MINITROLL BODY [S, N]

The body includes a pressure sensor, temperature sensor, real-time clock, back-up capacitor, microprocessor, and 1MB data-storage memory. Body options include a choice of pressure ranges and internal or external power.

#### POWER OPTIONS

- **Internal Power**—This model is designed with extra length to accommodate two replaceable AA batteries (lithium or alkaline). The internal power is 3 VDC.
- **External Power**—This model has no internal power source; power is provided through separate power accessories.



*S = used in single MiniTROLL system; N = used in network system.*

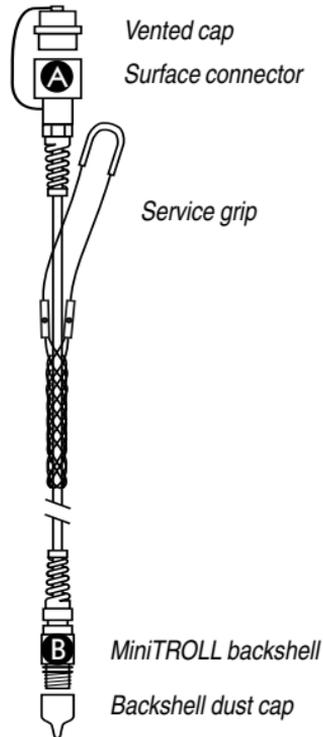
## SUBMERSIBLE CABLE [S, N]

Submersible cable includes the instrument's backshell and provides conductors for power and communication signals, a vent tube, strain relief, and a service grip to anchor the instrument securely. Available in standard and custom lengths of economical polyurethane or contaminant-resistant FEP\*.

The cable is vented to insure that atmospheric pressure is the reference pressure applied to the sensor diaphragm. For proper operation of PSIG sensors (gauged measurements), the cable should remain as straight as possible to avoid kinking or obstructing the internal vent tube.

### SURFACE CONNECTOR A

The nylon connector at the top of the submersible cable (when installed) mates with a variety of cables and accessories to provide (1) direct connection to an external battery pack, (2) direct connection to a network T-box, (3) connection to a communication cable with an AC line power input and DB-9 plug to a computer.



**CAUTION:** *The surface connector is weatherproof but not submersible.*

### Vented Connector Cap

The surface connector's vented cap includes a hydrophobic membrane that will not allow water droplets to pass into the cable, and a canister of desiccant that protects the cable and electronics from condensation. The indicating desiccant is blue when active. When the gel appears pink, the desiccant has adsorbed all the moisture it can hold. The entire vented cap is removable and replaceable.

\* FEP = fluorinated ethylene propylene, the generic equivalent of DuPont Teflon®.

**BACKSHELL [B]**

The backshell attaches directly to the MiniTROLL body. A soft dust cap protects the backshell's contact board and o-rings from damage when not attached to the instrument body.

**COMPUTER CONNECTION ACCESSORIES****COMPUTER CONNECTION ("COMM") CABLE [S]**

Vented polyurethane cable (1.8 m, 6 ft), connects the MiniTROLL's submersible cable to a PC or laptop computer to program the instrument for data collection, and download the collected data. Converts the MiniTROLL's RS485 signal to a standard RS232 signal for communication with a host computer. Includes a 2.5 mm external power jack to connect the instrument to 6 VDC external power.

**PROGRAMMING CABLE [S]**

Combines the functions of the submersible cable and computer connection cable for indoor use; connects the MiniTROLL directly to a PC for programming and downloading; includes RS485/RS232 converter and external power jack.

**NETWORK CABLES AND ACCESSORIES****NETWORK T-BOX, NTB-100 [N]**

A 4-function environmental enclosure that accommodates one MiniTROLL: (1) switches 12 VDC to 6 VDC to power the attached MiniTROLL, (2) incorporates three high-capacity capacitors to provide extra current in cases when all MiniTROLLs on the network "wake up" at the same time, (3) provides lightning suppression, and (4) provides cable venting. Used at end of network.

**NETWORK QUAD BOX, NTB-400 [N]**

A T-Box that accommodates up to 4 MiniTROLLs.

**NETWORK MID-LINE TAP BOX, MLT-100 [N]**

Environmental enclosure for connecting a MiniTROLL network to a PC, power, or telemetry from a point within the network.

**NETWORK COMMUNICATION CABLE [N]**

Non-vented PVC cable (1.8 m, 6 ft), connects a network of MiniTROLLs to a PC or laptop for programming and downloading. Includes an

*S = used in single MiniTROLL system; N = used in network system.*

RS485/RS232 converter, and can be wired to an external 12 VDC network power supply.

#### **SMART DEVICE NETWORK COMMUNICATION CABLE [N]**

Non-vented PVC cable (1.8 m, 6 ft), connects a network of MiniTROLLs to a "smart device" such as a modem or relay controller.

#### **NETWORK INTERCONNECT CABLE [N]**

Non-vented PVC cable (custom length), links MiniTROLLs and T-boxes into a network; connects the last T-box in a network to a network communication cable for programming and external 12 VDC input.

#### **NETWORK EXTENSION CABLE [N]**

Non-vented PVC cable (custom length), can be used to extend a length of network interconnect cable to cover a longer distance than originally planned on either side of a network T-box.

### **POWER COMPONENTS**

#### **INTERNAL POWER [S]**

3 VDC, supplied by two replaceable AA batteries. Powers 18 months of data collection or more, depending on measurement schedule; external battery pack or external power supply recommended for network installations.

To maintain contact between the cable and the internal circuitry, internal power models require the presence of AA batteries at all times, even when external power is being used.

#### **EXTENDED LIFE EXTERNAL BATTERY PACKS [S, N]**

Disposable 9 VDC alkaline battery pack attaches to the surface connector on the submersible cable. Accommodates long cable lengths (up to 610 m, 2000 ft). May be used as the MiniTROLL's exclusive power source, or to supplement internal power. When this power source is connected, the MiniTROLL will use the internal batteries (if present) at the same rate as the external battery pack, assuming they have the same voltage (the battery with the higher voltage will provide the primary power).

Two communication configurations are available:

- Vented Cap model—provides power for data collection but no communication capability

- Signal Pass-through model—can be used for programming and downloading as well as data collection

### **EXTERNAL POWER SUPPLY, 6 VDC [S]**

The MiniTROLL can run exclusively on power supplied from a 6 VDC line power supply connected to a 90-264 VAC input. When the 6 VDC line power is enabled, the MiniTROLL shuts down the battery regulator, thus preserving the internal batteries or external battery pack.

### **VENTED EXTERNAL POWER CABLE [S]**

Connects a single MiniTROLL directly to 6 VDC external power; no communication capability.

### **EXTERNAL POWER SUPPLIES, 12 VDC [N]**

Three regulated DC network power supplies are available:

- North American (120 VAC, 0° to 50° C)
- Universal (95-250 VAC, 0° to 40° C)
- Universal Environmental (100-120, 200-240 VAC, -10° to 60° C)

Alternatively, a 12 VDC automotive or marine battery may be used to power a MiniTROLL network.

## **SOFTWARE**

Win-Situ™ 2000 is easy-to-use software that lets you program the MiniTROLL for data collection. Supplied on CD and diskette, Win-Situ requires (at a minimum) a computer with a 486 processor, running Microsoft® Windows® 95, Windows 98, or Windows NT 4.0, Service Pack 4 or higher, a serial communications port, 16 megabytes of RAM, a hard disk, VGA compatible 640 x 480 display, and a Windows-compatible mouse or other pointing device.

Optional Pocket-Situ™ (Win-Situ 2000 for Pocket PC) is supplied on a Type 1 CompactFlash (CF) card for installation in the CF card slot of a hand-held mobile device running Windows CE 3.0, with a MIPS R4XXX processor (such as the Compaq® Aero® 1500 series) or StrongARM SA11XX processor (such as the Compaq iPAQ™ 3100 or 3600 series).

Complete information on using the software may be found in the *Win-Situ 2000 Operator's Manual*.

*S = used in single MiniTROLL system; N = used in network system.*

# 3 GETTING STARTED



## IN THIS SECTION . . .

Setting up a new MiniTROLL for stand-alone operation:

- Unpacking and inspection
- Attaching the submersible cable



*For Network operation, refer to Section 7.*

## UNPACKING AND INSPECTION

Your MiniTROLL was carefully inspected before shipping. Check for any physical damage sustained during shipment. Notify In-Situ and file a claim with the carriers involved if there is any such damage; do not attempt to operate the instrument. Accessories may be shipped separately and should also be inspected for physical damage and the fulfillment of your order.

Check the list of system requirements in Section 1 to be sure you have everything you need.

## A NOTE ON BATTERIES. . .

New internally powered MiniTROLLs arrive with factory-installed internal AA batteries. For guidelines on changing or replacing the batteries, please refer to the battery replacement instructions in the maintenance section of this operator's manual, page 31.

**SUBMERSIBLE CABLE INSTALLATION**

The MiniTROLL's submersible cable includes the instrument's backshell. Internal power is maintained by the presence of the backshell or the body dust cap.

Submersible cable

MiniTROLL  
backshell



1. Remove any protective dust caps from the backshell end of the submersible cable and from the MiniTROLL body.
2. Mate the backshell to the MiniTROLL body. The threads are standard, clockwise, right-hand threads.



**CAUTION:** Keep the body dust cap pressed into the back end of the MiniTROLL until you're ready to install the cable. This cap completes the battery contact to avoid resetting the real time clock.



**TIP:** Automatic device diagnostics require that you leave the cable connected to your MiniTROLL for at least 90 seconds each time you connect it.



**TIP:** If you have a programming cable, it may be connected instead of the submersible cable. After programming, remove the programming cable and attach the submersible cable for field installation.



**TIP:** Retain the soft backshell dust cap to protect the backshell's contact board from damage when not attached to the instrument body.

# 4

## PROVIDING POWER



### IN THIS SECTION . . .

- Summary of MiniTROLL power modes
- Connecting single, stand-alone MiniTROLLs to external power for programming and data collection



*For Network operation, refer to Section 7.*

### MINITROLL POWER MODES

The MiniTROLL operates in 3 power modes:

- internal power
- external battery pack
- external AC line power

These may be used separately or together in any combination.

### INTERNAL POWER

The internally powered MiniTROLL is designed with extra length to accommodate two AA batteries (lithium or alkaline). Internal power (3 VDC) is adequate for 18 months of data collection or more, depending on measurement schedules. An external battery pack or external power supply should be added for long-term monitoring and for networks.



**TIP:** *The software can display the approximate percentage of internal battery life remaining when the MiniTROLL is connected to a computer.*

**CONNECTING TO EXTERNAL POWER**

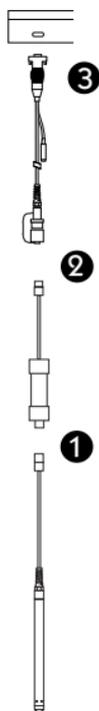


**CAUTION:** For proper operation, be sure batteries are always installed in the internally powered MiniTROLL, even when using external power.

**FOR PROGRAMMING & DATA COLLECTION**

**External Battery Pack with Signal Pass-Through**

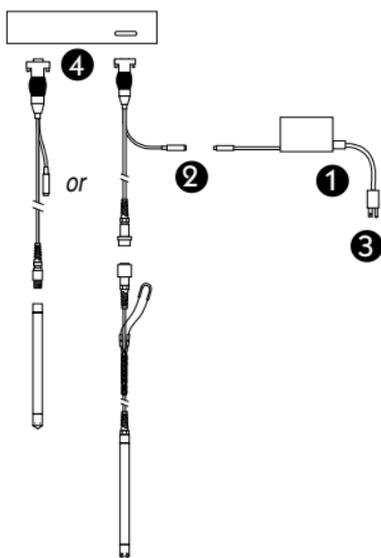
1. Connect the nylon connector at the bottom of the power pack to the surface connector on the submersible cable. Screw the dust caps together to prevent loss or damage.
2. Mate the nylon connector at the end of the battery pack cable to the nylon connector on computer connection cable.
3. For communications, plug the computer connection cable into an RS232 serial port.



**6 VDC Power Supply**

In-Situ's 6 VDC power supply connects to the 2.5 mm external power jack on computer connection cable, programming cable, or vented external power cable and is available with various AC line cords.

1. Connect an AC line cord to the power supply.
2. Connect the DC power plug to the external power jack on the computer connection cable or programming cable.
3. Plug the AC line cord into a 90-264 VAC line source.
4. For communications, plug the computer connection cable or programming cable into an RS232 serial port.

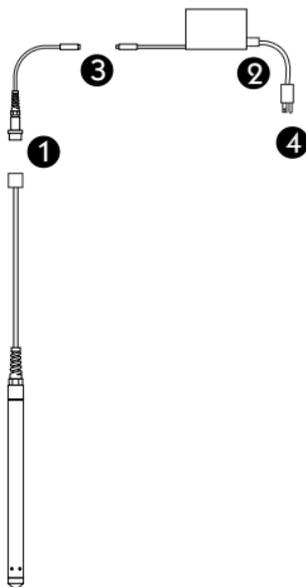


**FOR DATA COLLECTION ONLY—  
NO COMMUNICATION CAPABILITY****External Battery Pack with Vent Cap**

1. Connect the nylon connector at the bottom of the power pack to the surface connector on the submersible cable. Screw the dust caps together to prevent loss or damage.

**Vented External Power Cable**

1. Connect the nylon connector on the vented external power cable to the surface connector on the submersible cable. Screw the dust caps together to prevent loss or damage.
2. Connect the appropriate AC line cord to the 6 VDC external power supply.
3. Connect the DC power plug on the power supply to the external power jack on the vented external power cable.
4. Plug the AC line cord into a 90-264 VAC line source.



**TIP:** To communicate with the instrument, attach computer connection cable to the surface connector in place of the External Battery Pack with Vent Cap or the Vented External Power Cable.

# 5 PROGRAMMING FOR DATA COLLECTION



## IN THIS SECTION . . .

- Programming overview
- Connecting to the host computer
- Win-Situ at a glance
- Disconnecting

## PROGRAMMING OVERVIEW

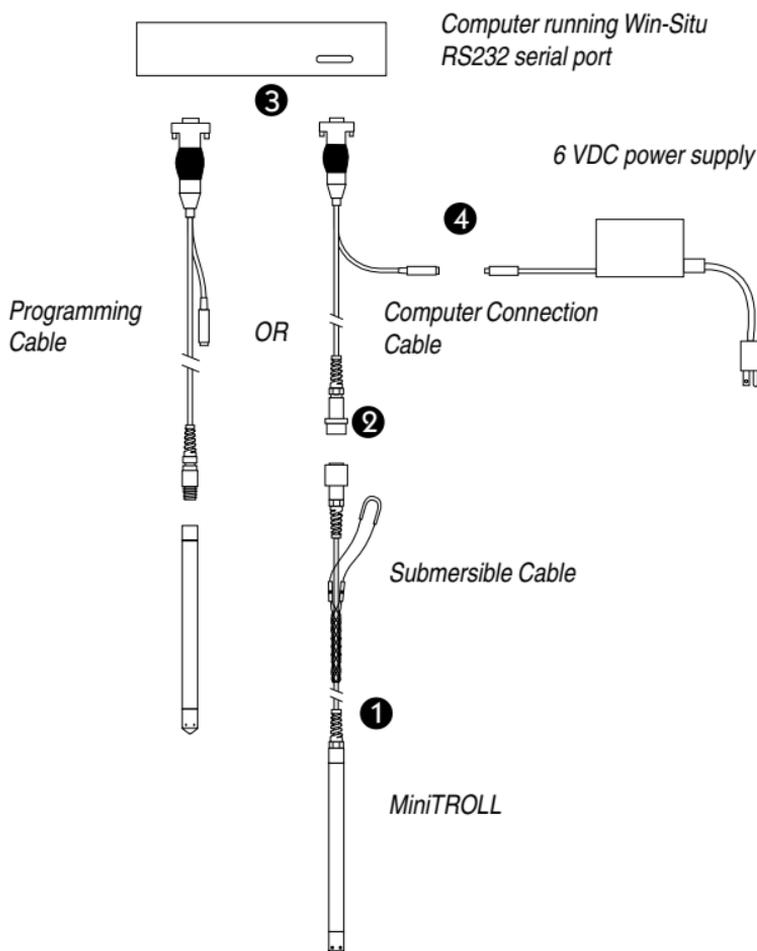
Programming the MiniTROLL for data collection is accomplished via a desktop, laptop, or pocket PC. Using your own PC and In-Situ's Win-Situ 2000 or Pocket-Situ software, you can set up many kinds of short-term tests and long-term monitoring schedules customized to your site and your specific data requirements.

## CONNECTING TO THE HOST COMPUTER

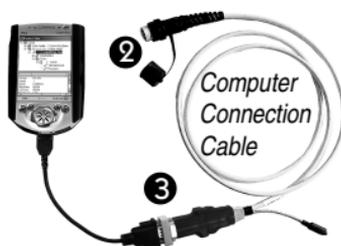
Three cable options for programming (and later downloading) a single MiniTROLL are shown on page 15. The programming cable is a convenient indoor alternative to the submersible-cable-and-computer-connection-cable combination. The Pocket PC has its own serial cable.



**TIP:** *The MiniTROLL communicates using RS485 communication protocols. Since the serial port on most PCs is RS232, the signal must be converted through an RS485/RS232 adapter in line between the MiniTROLL and the serial port. A converter is an integral part of the computer connection cable, the programming cable, and the network communication cable.*



1. Connect the submersible cable to the MiniTROLL. Or, for indoor use, connect the programming cable to the instrument.
2. Attach the computer connection cable to the surface connector at the end of the submersible cable.
3. Connect the computer connection or programming cable to the PC's RS232 serial port. Or plug the computer connection cable into the Compaq serial adapter cable, and connect to the com port on the Pocket PC.
4. To provide external power (optional for internally powered MiniTROLLs), connect a 6 VDC power supply to the external power jack and plug the AC line cord into a 90-264 VAC line source.



### WIN-SITU AT A GLANCE

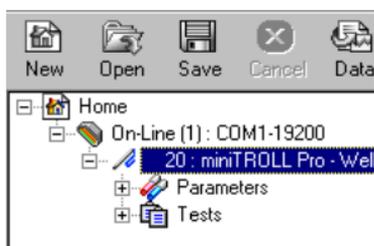
First, install Win-Situ: Insert the CD or diskette into the appropriate drive:

- CD: The install program will auto-run. Follow the on-screen steps.
- Diskette: Run A:\Setup from the Windows Start menu.

When installation is complete, start Win-Situ from the desktop shortcut.

## SET UP THE SITE

Win-Situ uses a "Navigation tree" to organize and display your instrument network. At the top is the "site" (computer), followed by one or more connections (COM ports), and then one or more devices (MiniTROLLs)



accessible through each COM port. When you start Win-Situ for the first time, a new, empty site called "Home" is displayed. A Wizard helps you add a connection to the site for your PC's COM port.

## FIND THE MINITROLL

If Win-Situ does not connect to the MiniTROLL automatically, double-click the new connection. Win-Situ will "find" the MiniTROLL and display it in the Navigation tree. Click to select it. Details on the instrument will be shown, along with buttons for the actions you can perform.



*If the MiniTROLL does not appear in the tree, there may be a communication problem. Check these items: (1) the hardware connections; (2) detach and re-attach the cable; (3) be sure the MiniTROLL has power.*

## CHECK THE CLOCK

Data collection schedules depend on the device clock. To set it, select **Edit**, then **Clock** and follow the instructions to synchronize to the host computer.

**1** Select the MiniTROLL

**2** Check the clock

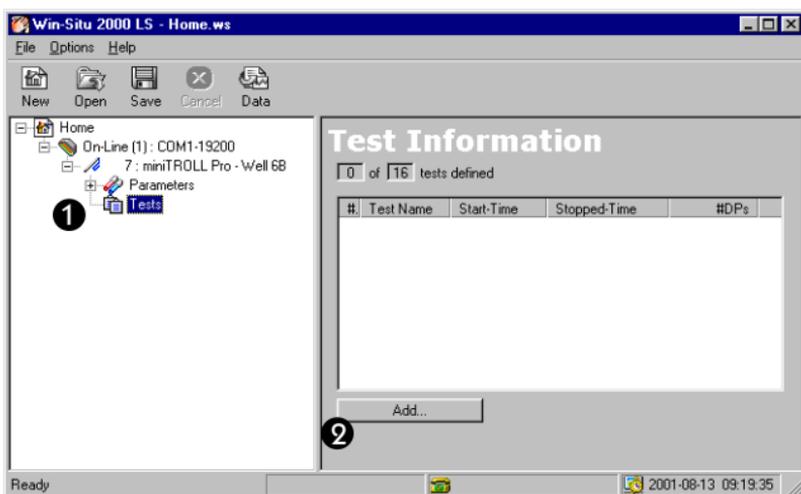
**3** Set the clock, if wrong

miniTROLL Pro	
Communication Type:	RS-485
Serial Number:	20
Name:	Well 12
Manufacture Date:	1999-11-18
Calibration Date:	1999-09-09
Hardware Version:	3.00
Firmware Version:	2.00
Storage Capacity:	970240 Bytes of 992768 Bytes Free (97% Free)
Battery Type:	Internal Lithium
Battery Installation Date:	2000-10-13
Battery Capacity:	100% remaining (3.0 V)
CPU Runtime (seconds):	21180.00

## ADD A TEST

Collecting a set of data with the MiniTROLL is called "running a test." To tell the instrument how to run the test—which parameters to measure, how often, when to start, etc.—you "add" a test to the device. Win-Situ's Test Wizard makes it easy.

1. Select the device's Tests node in the navigation tree.
2. Click **Add**. The Test Wizard will help you.



**TIP:** If you plan to use SDI-12 protocols to communicate with the MiniTROLL while a test is running, choose a test measurement interval of 3 seconds or longer. This will insure SDI-12 data transmission operates smoothly.

## DISCONNECTING

After the MiniTROLL is programmed to collect data, you're ready to

- disconnect the comm cable (or remove the programming cable and attach the submersible cable)
- cap the surface connector
- install the instrument in its field location. See Section 6.



**CAUTION:** Be sure to attach the submersible cable after removing the programming cable. This maintains pressure on the batteries and keeps the clock running, ensuring the instrument doesn't lose the test start time. A capacitor keeps the clock running for up to 60 minutes without pressure on the batteries. If power is removed for more than 60 minutes, the clock will reset, and any tests programmed to start during that time will not start. If the MiniTROLL tries to take a data point while power is disconnected, the test will stop (ABEND).

# 6 FIELD INSTALLATION



## IN THIS SECTION . . .

- Positioning the MiniTROLL on-site, securing the cable
- Stabilization time
- Installation tips and checklist

## POSITION THE MINITROLL

Lower the MiniTROLL gently to approximately the desired depth.

Position the instrument below the lowest anticipated water level, but not so low that its range might be

exceeded at the highest anticipated level.

Range	Usable Depth		
	kPa	PSI	Meters
103.4	15	11	35
206.8	30	21	69
689.5	100	70	231
2068	300	210	692
3447	500	352	1153



**TIP:** Be sure the MiniTROLL is communicating properly before field installation.

## CHECK THE INSTRUMENT'S DEPTH

At this point, if convenient, you can use computer connection cable to connect the MiniTROLL to a PC, start Win-Situ, and take a reading. If the

instrument is at the desired depth, secure it in position as suggested below. If not, reposition the MiniTROLL as necessary.

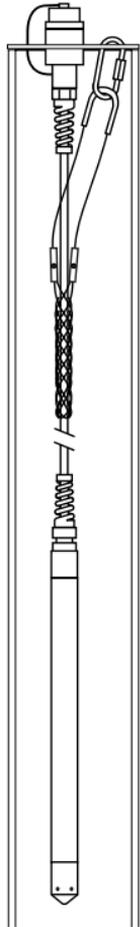
### SECURE THE CABLE

The cable has a handy device called a service grip near the surface end. You can slide it along the cable to the desired position by compressing it. When you pull on it, it tightens and stops sliding. You may need to pull on both ends of the service grip to properly tighten it and keep it from slipping.

Use the loop of the service grip to anchor the cable to a convenient stationary object. It works well with In-Situ's "well dock" installation ring. Simply insert the loop into the locking clip on the well dock, and position the assembly on the top of a well.

### INSTALLATION TIPS

- Never let a probe "free fall" down a well. The resulting shock wave when it hits the water surface can damage the strain gauge (the "waterhammer" effect).
- It is always wise to check the level of water above the probe, then move it and read again to be sure that the probe is giving a reasonable reading and showing change. It might not be located where you think it is — for example, it could be wedged against the casing with a loop of cable hanging below it. A probe in such a position might become dislodged and move during the test, giving a false change in level. *A secure placement is critical to accurate measurements.*
- Do not allow the cable (and its internal vent tube) to kink or bend. If the vent tube is obstructed, water level measurements can be adversely affected. The recommended minimum bend radius is 12.7 mm (½ in) or greater.



**CAUTION:** The surface connector is weatherproof but not submersible. To protect it from damage, keep it above water level. Be sure to keep the cap on (except when attached to another cable or accessory) to provide venting and protection against moisture.

**STABILIZATION TIME**

Allow the MiniTROLL to stabilize to the water conditions for *about an hour* before starting a test. A generous stabilization time is always desirable, especially in long-term tests. Even though the cable is shielded, temperature stabilization, stretching, and unkinking can cause apparent changes in the probe reading. If you expect to monitor water levels to the accuracy of the probe, it's worth allowing the extra time for the probe to stabilize to the test environment.

**INSTALLATION CHECKLIST**

- ✓ Programmed?
- ✓ Power provided?
- ✓ Surface connector capped?
- ✓ Instrument at the proper depth? within its operating temperature & pressure range? cable secured?

**OPTIONAL INSTALLATION ACCESSORIES**

- Well Dock or other anchor point to attach the service grip on the downhole cable
- Well cap to protect the surface connector, external battery pack if used
- Cable weight
- Non-vented backshell for use with PSIA sensors without cable



*For further information:*

*Providing Power, Section 4  
Programming for Data Collection, Section 5  
Network Installation, Section 7*

# 7 NETWORK INSTALLATION



## IN THIS SECTION . . .

- Network system requirements
- Network component descriptions
- Installation procedures for a MiniTROLL network

## SYSTEM REQUIREMENTS: MINITROLL NETWORK

A network of MiniTROLLs requires the following components:

### FOR FIELD INSTALLATION & OPERATION

- MiniTROLLs: up to 32
- Submersible Cables: one per instrument
- Network T-Boxes: one per instrument
- Network Interconnect Cables (*variable length*): one per T-Box
- Network Communication Cable (for external power input)
- Network power source: 12 VDC power supply and available AC line power source; or a 12 VDC automotive or marine battery



**CAUTION:** *The total length of all cable in a network must not exceed 1219 m (4000 ft). When calculating this total include all Network Interconnect Cable, all Submersible Cable, and all Network Extension Cable (if used).*

### FOR PROGRAMMING & DOWNLOADING DATA, ADD

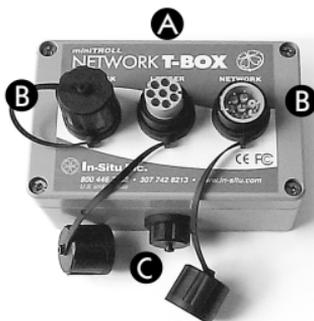
- PC, laptop, or Pocket PC
- Win-Situ 2000 or Pocket-Situ software

## NETWORK COMPONENTS

### NETWORK T-BOXES

Each T-box has:

- A one connector for MiniTROLL submersible cable (center)
  - B two connectors for network interconnect cables (left and right)
  - C vent port with dust cap containing hydrophobic membrane and desiccant
- an internal DC to DC converter to change externally-supplied 12 VDC to 6 VDC to power the attached MiniTROLL
  - three capacitors to provide extra current in cases when all instruments on the network “wake up” at the same time
  - lightning suppression



**TIP:** A Network Quad Box can accommodate up to 4 MiniTROLLs.

### NETWORK CABLES

Computer network cable is designed to lie flat on the ground or to be installed in on-site conduit. It is not submersible, not weight-bearing, not vented. Venting is provided by network T-boxes. Gray network cable does not mate with yellow or blue vented cables.

### INSTALLATION PROCEDURE

1. Install individual MiniTROLLs, on submersible cable, in their field monitoring sites.
2. Attach a T-box (center connector) to the surface connector of each MiniTROLL's submersible cable. Protective enclosures are recommended for complete water-resistance.
3. Connect the T-boxes using Network Interconnect Cable.
4. Connect Network Communication Cable to the interconnect cable on the last T-box in the network.



**TIP:** Network Extension Cable may be used to extend a length of Network Interconnect Cable to cover a longer distance than originally planned on either side of a T-box.

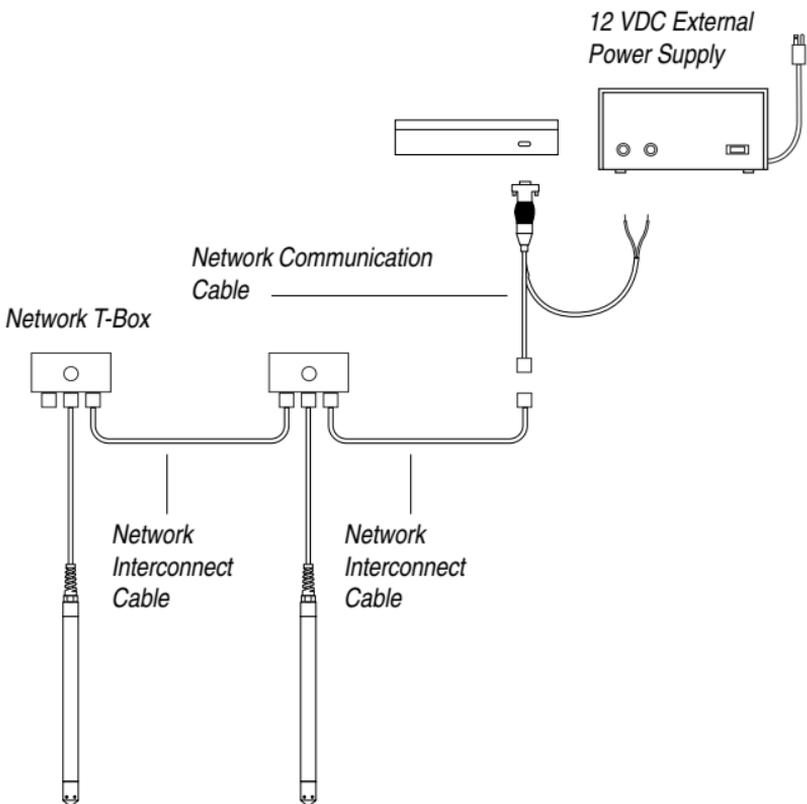
- To power the network, wire a 12 VDC network power supply to the Network Communication Cable (red=12V, black=ground). Alternatively, any 12 VDC automotive or marine battery may be used.



**TIP:** External power may be applied at a network mid-point using a Network Mid-Line Tap Box, rather than at the end with a Network T-Box. The Mid-Line Tap Box has 3 connectors for network interconnect cable; power is applied via the center connector.

### GUIDELINES & PRECAUTIONS

- In order to provide full power across the network interconnect cables with a small gauge wire, a higher voltage is required for a lower current (and to allow for voltage drops within the cable). The DC to DC converter in each T-box changes the 12 VDC to 6 VDC to power the attached MiniTROLL.
- Remove and replace the vented cap on the T-box vent when the indicating desiccant appears pink. Replacement dust caps and connector o-rings are also available.
- Screw the dust caps together to prevent loss or damage.



# 8

## SDI-12 OPERATION



SDI-12 is a serial digital interface that operates at 1200 baud. In-Situ's SDI-12 Adapter enables processing of the MiniTROLL's pressure and temperature measurements by an SDI-12 data recorder.

### SDI-12 REQUIREMENTS

- SDI-12 ready MiniTROLL (firmware 3.01 or higher)
- SDI-12 Adapter
- SDI-12 data recorder (customer-supplied)

### WIRING

Connect the 3 pigtails from the SDI-12 converter to the terminal block of an SDI-12 data recorder (or to an SDI-12 network) as follows.

- serial data line (white)
- ground line (black)
- 12-volt supply line (red).

The data recorder or an external power supply may provide power (9.6 - 16 V) to the 12V line. The shield should be terminated (grounded) at the data recorder.



### MINITROLL INSTALLATION

1. Install the MiniTROLL as usual.
2. Attach the surface connector on the MiniTROLL's submersible cable to the matching connector on the SDI-12 Adapter. A protective enclosure is recommended for complete water-resistance.



**CAUTION:** For proper operation, be sure batteries are always installed in the internally powered MiniTROLL, even when using external power.

## MAKING SDI-12 MEASUREMENTS

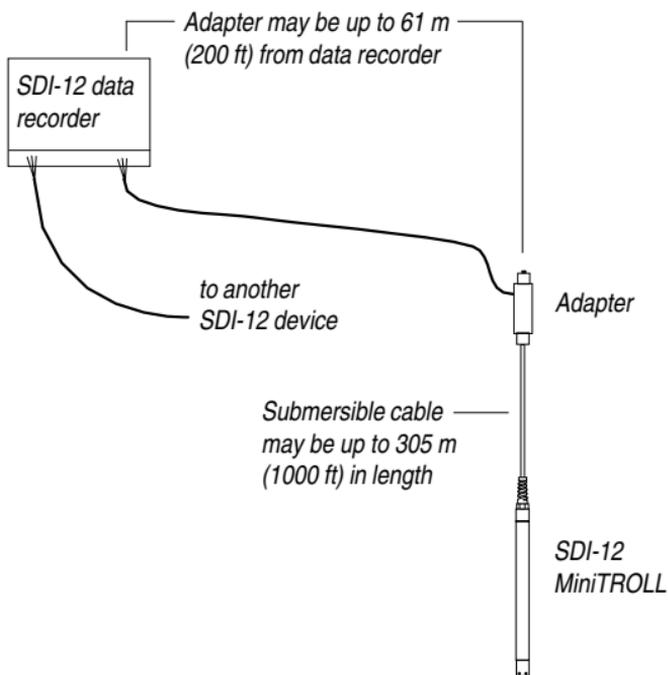
The SDI-12 MiniTROLL supports all SDI-12 Version 1.3 commands (listed on page 27). Data recorders that support SDI-12 Version 1.3 can usually send standard commands to an SDI-12 “sensor” like the MiniTROLL automatically. Additional information may be found in an SDI-12 reference, such as that listed at the end of this section. Or consult your SDI-12 data recorder documentation.

## SENSOR IDENTIFICATION

In response to the “send identification” command, the MiniTROLL will respond as follows:

013 IN-SITU SSP10030114252

013 Sensor address  
 IN-SITU Manufacturer (In-Situ Inc.)  
 SSP100301 Sensor (MiniTROLL) model  
 14 Firmware version  
 252 Serial number



**SENSOR DEFAULTS**

The MiniTROLL leaves the factory with the following settings:

Sensor address:	0
Pressure units:	psi
Temperature units:	degrees Celsius

When measuring both pressure and temperature, pressure is reported first. The SDI-12 MiniTROLL supports software-changeable addresses.

**REDUNDANT LOGGING (WIN-SITU AND SDI-12)**

If your MiniTROLL supports internal logging, the instrument is capable of running tests (programmed in Win-Situ) while participating in an SDI-12 network; however Win-Situ cannot communicate with the MiniTROLL while it is transmitting SDI-12 data, and conversely, the instrument cannot receive or respond to SDI-12 commands while connected to a PC serial port.

This “redundant logging” feature means

- if the SDI-12 recorder somehow “loses” data, the MiniTROLL data can be retrieved using Win-Situ.
- \* if the SDI-12 recorder ceases to function due to power loss, the MiniTROLL will continue to collect new data using its own internal batteries and clock.



**TIP:** Depending on the SDI-12 data recorder used, rapid sample schedules during a test may result in SDI-12 “retries.”

**REFERENCE**

SDI-12, A Serial-Digital Interface Standard for Microprocessor-Based Sensors, version 1.3. SDI-12 Support Group, Logan, Utah, April 7, 2000. Available at [www.sdi-12.org](http://www.sdi-12.org).

**SDI-12 V 1.3 Command Set**

<b>NAME</b>	<b>COMMAND</b>	<b>RESPONSE</b>
Break	Continuous spacing for at least 12 milliseconds	None
Acknowledge Active	a!	a<CR><LF>
Send Identification	a!	allccccccmmmmmm vvvxx...xx<CR><LF>
Change Address	aAb!	b<CR><LF>
Address Query	?!	a<CR><LF>
Start Measurement*	aM!	atttn<CR><LF>
Start Measurement and Request CRC*	aMC!	atttn<CR><LF>
Send Data	aD0! . . . aD9!	a<values><CR><LF> or a<values><CRC><CR><LF>
Additional Measurements*	aM1! . . . aM9!	atttn<CR><LF>
Additional Measurements and Request CRC*	aMC1! ... aMC9!	atttn<CR><LF>
Start Verification*	aV!	atttn<CR><LF>
Start Concurrent Measurement	aC!	atttnn<CR><LF>
Start Concurrent Measurement and Request CRC	aCC!	atttnn<CR><LF>
Additional Concurrent Measurements	aC1! . . . aC9!	atttnn<CR><LF>
Additional Concurrent Measurements and Request CRC	aCC1! ... aCC9!	atttnn<CR><LF>
Continuous Measurements	aR0! ... aR9!	a<values><CR><LF> (same as the D commands)
Continuous Measurements and Request CRC	aRC0! ... aRC9!	<values><CRC><CR><LF> (same as the D commands)

\* This command may result in a service request.

a	Sensor address
!	Command terminator
<CR><LF>	Response terminator
ttn	Time (seconds) until measurement is ready
n, nn	Number of measurement values

# 9 CARE & MAINTENANCE



## IN THIS SECTION . . .

- Operating considerations
- General maintenance
- Battery replacement
- Consumables

## OPERATING CONSIDERATIONS

The MiniTROLL has been designed to withstand harsh field conditions. However, as with any electronic instrument, it can be permanently damaged if used outside its operating specifications.

### TEMPERATURE

Operating Temperature	-5°C to 50°C (23°F to 122°F)
Storage Temperature	
with Alkaline Battery	-20°C to 54°C (-4°F to 129°F)
with Lithium Battery	-30°C to 60°C (-22°F to 140°F)
without Battery	-55°C to 125°C (-70°F to 257°F)

### PRESSURE

Pressure Range	Max. Pressure	Burst Pressure
11 m, 35 ft (103.4 kPa, 15 psi)	3X range	5X range
21 m, 69 ft (206.8 kPa, 30 psi)	2X range	3X range
70 m, 231 ft (689.5 kPa, 100 psi)	2X range	3X range
210 m, 692 ft (2068 kPa, 300 psi)	2X range	3X range
352 m, 1153 ft (3447 kPa, 500 psi)	2X range	3X range

## CALIBRATION

The MiniTROLL's accuracy can be adversely affected by improper care and handling, lightning strikes and similar surges, exceeding operating temperature and pressure limits, physical damage or abuse. Contact In-Situ Customer Service for information on periodic check-ups and recalibration. Annual factory recalibration is recommended.

## GENERAL MAINTENANCE

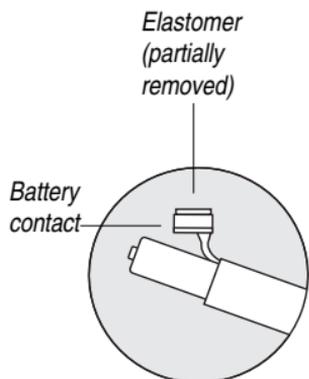
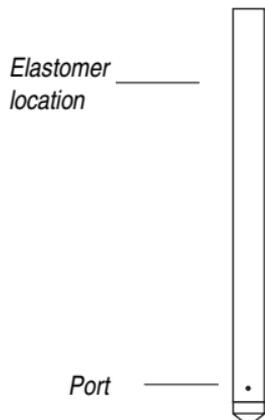
### FRONT END

If the ports in the front end become clogged with silt or mud, clean them gently with a squeeze of water from a wash bottle, or swish the instrument in a bucket of clean water. To avoid damage to the pressure sensor diaphragm, *do not insert any object into the holes.*

### ELASTOMER

An elastomeric connector ("elastomer" for short) in the back of the MiniTROLL body transmits signals from the sensor to the cable. The elastomer sits in a groove in the battery contact. Each time the cable is attached or detached, the elastomer undergoes abrasion from contact with the backshell. A new elastomer appears shiny gold; the traces are clean and sharp. With use the elastomer darkens; the traces gradually bend and compress; they may break and separate from the backing.

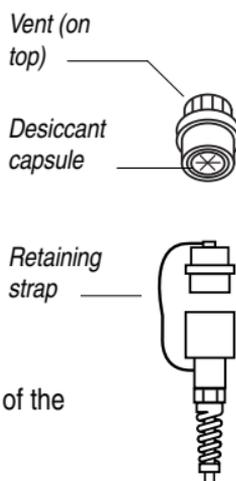
We recommend you inspect the elastomer regularly for evidence of wear and deterioration. It should last for at least 50 attachments/removals of the cable. When it begins to look worn, remove it from the battery contact with tweezers or your fingers, and replace it with a new one. Replacement elastomers are available from In-Situ Inc.



**VENT CAP DESICCANT**

The indicating silica gel desiccant in the MiniTROLL's surface connector cap appears blue when active. When the gel turns pink in color, the desiccant has adsorbed all the moisture it can hold. The entire cap should be removed and replaced.

- To remove a cap: Pull the retaining strap out of the slot on the connector body. Dispose of the used cap properly.
- To attach a cap: Insert the retaining strap into the slot on the connector body. Screw the cap to the connector.
- Protect new caps from moisture until ready to use.

**VENT TUBE**

The MiniTROLL's PSIG pressure sensor is designed to be minimally sensitive to barometric pressure changes. A vent tube in the cable assures that atmospheric pressure is the reference pressure to the sensor diaphragm. *The vent tube should not be blocked, kinked, or otherwise obstructed.* If it is, not only will barometric pressure appear in measurements, but large, varying errors will be introduced due to thermal expansion and contraction of air within the vent tube and probe body.

The recommended minimum bend radius is 12.7 mm (½ in) or greater.

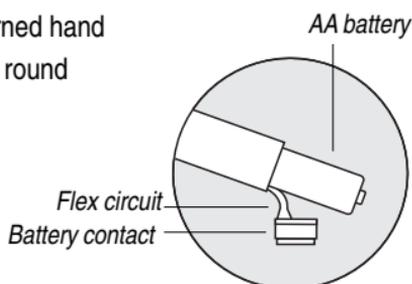
**BACKSHELL**

Keep the contact board at the quick-connect end of the submersible cable clean and free of dirt, grit, moisture, fingerprints, and the like, as contaminants will adversely affect the electronics. Always use the soft protective backshell dust cap when the submersible cable is not attached to a MiniTROLL. Replace the backshell o-rings if they appear cracked or worn.

**REPLACING THE INTERNAL BATTERIES**

Replace the batteries in internally powered MiniTROLLs as follows:

1. Remove the dust cap or backshell.
2. Invert the body over your upturned hand and tap or shake to loosen the round battery contact and move it toward the open end of the tube. Grasp the battery contact (with your fingers or needlenose pliers) and pull **gently** if it doesn't slide out on its own.



The battery contact is attached to a flexible circuit that extends no more than 20 mm (3/4 in) beyond the end of the body.



**CAUTION:** *The flex circuit is a ribbonlike strip that extends from the battery contact through the MiniTROLL body to the circuit board in the sensor end. Treat it with care when installing and removing batteries.*

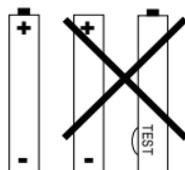
*DON'T tug on it to get the batteries out. It's an electronic circuit, not a battery removal device. Let it slide out on its own only as far as necessary to remove and replace the batteries.*

*DON'T twist it. The battery diagram should face the batteries.*

*DON'T bend the battery contact backwards. It should remain at a 90° angle to the flex circuit.*

3. Remove the used batteries.
4. Insert the new batteries according to the diagram on the inside of the flex circuit.
5. Firmly push the battery contact back into the MiniTROLL body. A good way to do this is to slide the top battery out slightly, then press the battery contact and the batteries into the body together.
6. Replace the backshell or dust cap.
7. Edit the Device to update the battery replacement information.

**Note:** Replacement AA batteries are available from In-Situ Inc., or from an electronics supply store. Note that some rechargeable AA batteries lack “bumps” at the + end. These batteries **will not work** in the MiniTROLL. Batteries with the self-test feature are not recommended due to tightness of fit.



**EXTERNAL BATTERY PACK MAINTENANCE**

Discard and replace the entire pack when the batteries are exhausted.

**CONSUMABLES**

A variety of replaceable items are available for operation and maintenance of your MiniTROLL system. The following is a partial list. Contact your In-Situ sales representative or your local distributor for prices and ordering information.

**Vented Cap with Hydrophobic Membrane & Indicating Desiccant**

Desiccant is blue when active; remove and replace the entire cap when the desiccant appears pink. Replacement caps come in two varieties:

For cable connectors (single cap or 5-pack)

For network boxes & battery pack with vented cap (single cap or 5-pack)

A pack of 10 desiccant capsules (no caps) with o-rings is also available.

**Internal Batteries**

Lithium AA batteries (2)

Alkaline AA batteries (2)

**External Battery Packs**

Battery pack with vented cap

Battery pack with signal pass-through

**Body & Backshell Dust Caps & O-Rings**

MiniTROLL backshell dust cap (5)

MiniTROLL body dust cap (5)

MiniTROLL backshell o-ring (4)

**Nylon Connector Dust Caps & O-Rings**

Replace dust caps that no longer seal, o-rings that appear cracked or worn.

Male dust cap for female nylon connector

Female dust cap for male nylon connector

O-ring for male nylon connector

O-ring for nylon connector socket insert

**Miscellaneous**

Elastomeric connector (single)

Elastomeric connector kit (5-pack with tweezers)

Fuse (3A, 120 VAC) for 12 VDC network power supply

Preventive maintenance/Recalibration service

# 10 WARRANTY & SERVICE



## **WARRANTY PROVISIONS**

In-Situ Inc. warrants all products sold, excluding batteries sold with such products, against defects in materials and workmanship under normal operating conditions. Consult the separate warranty for specific warranties that may apply.

## **SERIAL NUMBER**

The serial number is engraved on the body of the MiniTROLL. It is also programmed into the instrument and displayed when the instrument is connected to a computer running Win-Situ. We recommend that owners keep a separate record of this number. Should your MiniTROLL be lost or stolen, the serial number is often necessary for tracing and recovery, as well as any insurance claims. If necessary, In-Situ maintains complete records of original owner's names and serial numbers.

## **TO OBTAIN REPAIR SERVICE (U.S. AND CANADA)**

If you suspect that your MiniTROLL is malfunctioning and repair is required, you can help assure efficient servicing by following these guidelines:

1. Call In-Situ Customer Service toll-free at 1-800-446-7488 or 1-307-742-8213.

2. Be prepared to describe in detail the exact nature (symptoms) of the problem, including how the instrument was being used and the conditions noted at the time of the malfunction.
3. If service personnel determine that service is required, they will assign an RMA (return material authorization) number.
4. Write a description of the problem for service personnel, indicating whether the malfunction occurs intermittently or constantly. Save printouts or other materials that illustrate the problem.
5. Clean the MiniTROLL and cable. Decontaminate thoroughly if it has been used in a toxic or hazardous environment.
6. Pack your MiniTROLL in its original shipping box, if possible. Include your write-up of the symptoms, a statement certifying that the TROLL has been decontaminated, and any supporting information.
7. Send the package, shipping prepaid, to

In-Situ, Inc.  
Customer Service  
ATTN: RMA #            (assigned no. here)  
210 South 3rd Street  
Laramie, WY 82070

The warranty does not cover damage during transit. In-Situ recommends the customer insure all shipments. Warranty repairs will be shipped back prepaid.

## **HOW TO CONTACT US**

### **SHIPPING ADDRESS**

In-Situ, Inc.  
210 South Third St.  
Laramie, Wyoming 82070  
USA

### **CUSTOMER SERVICE**

800 446 7488  
Toll-free 24 hours a day in the U.S. and Canada

*Phone:* 307 742 8213  
*Fax:* 307 721 7598  
*Internet:* [www.in-situ.com](http://www.in-situ.com)

# 11 SPECIFICATIONS



## Physical

Materials	316 stainless steel, Viton®
Dimensions	
Internal Power model	295.9 mm (11.65 in) long, 18.3 mm (0.72 in) O.D.
External Power model	197.4 mm (7.77 in) long, 18.3 mm (0.72 in) O.D.
Weight (includes backshell)	
Internal Power model	0.31 kg (0.68 lb), with batteries
External Power model	0.22 kg (0.48 lb)
Wetted Materials	316 stainless steel, Viton®, nylon
Operating Temperature	-5°C to 50°C (23°F to 122°F)
Storage Temperature	
with Alkaline Battery	-20°C to 54°C (-4°F to 129°F)
with Lithium Battery	-30°C to 60°C (-22°F to 140°F)
without Battery	-55°C to 125°C (-70°F to 257°F)

## Signals

Voltage	
Internal Battery	3 VDC nominal
External Battery	3 VDC nominal
External Power	6 VDC nominal
Communications	RS485

**Pressure Sensor**

Type	Silicon strain-gauge pressure sensor		
Temperature Compensation	-5°C to 50°C (23°F to 122°F)		
Water Level Range	Pressure Range	Performance Accuracy*	Max. (Burst) Pressure
0-11 m (35 ft)	0-103.4 kPa (15 psi)	0.2% full scale	3X (5X) range
0-21 m (69 ft)	0-206.8 kPa (30 psi)	0.1% full scale	2X (3X) range
0-70 m (231 ft)	0-689.5 kPa (100 psi)	0.08% full scale	2X (3X) range
0-211 m (692 ft)	0-2068 kPa (300 psi)	0.08% full scale	2X (3X) range
0-352 m (1153 ft)	0-3447 kPa (500 psi)	0.08% full scale	2X (3X) range

\* Includes precision, repeatability, overpressure, and temperature to 3 sigma (3 standard deviations = 99.7% of reported values lie within stated accuracy)

**Temperature Sensor**

Type	Silicon temperature sensor
Range	-5°C to 50°C (23°F to 122°F)
Accuracy	±0.25°C

**Estimated Battery Lifetime**

Battery type	Maximum readings**		Life (years) at 20-min interval**
	1-sec interval	Over 18 mo	
Internal (Alkaline)	990,000	201,000	1.5 yr
Internal (Lithium)	1,200,000	449,000	2.0 yr
External (9V Alkaline)			
610 m (2000 ft) cable	520,000		0.7 yr
457 m (1500 ft) cable	2,100,000		2.7 yr
335 m (1100 ft) cable	4,100,000		5.1 yr
183 m (600 ft) cable	5,200,000		6.1 yr
up to 30 m (100 ft) cable	6,200,000		7.0 yr

\*\* 20°C, downloading every 220,000 readings

**Other**

Resolution	16-bit A-D converter
Fastest linear sampling rate	500 milliseconds
Fastest log sampling	300 milliseconds
Processor	Motorola HC11
Real-time clock accuracy	± 4 min/yr over full operating temperature range; ± 2 min/yr from 0°C to 40°C
Memory type/size	1 megabyte flash data storage
Memory capacity	220,000 readings (pressure/temperature pairs)
Filter	316 stainless steel mesh
Desiccant	0.75 g silica gel
Thermal stabilization time	30 min - 1 hr to within 0.1% full scale 1.5 - 2 hr to within 0.05% full scale
Barometric equilibration time	5 min to within 0.05% full scale for 304.8 m (1000 ft) cable