User Guide

Levelogger Series Software Version 4

November 10, 2011

Solinst ®

Levelogger ®
Model 3001

1 Introduction

This User Guide focuses on the current Levelogger Series, which includes:

- Levelogger Edge
- Barologger Edge
- Levelogger Junior
- LTC Levelogger Junior
- Rainlogger

Software Version 4 is also compatible with Levelogger Gold and Barologger Gold dataloggers. For details on setting up the Levelogger Gold and Barologger Gold, see Section 5.9. It is also compatible with the Leveloader data transfer device, which has a separate User Guide.

This Windows based software provides many convenient features. You can view and program datalogger settings, begin logging sessions, monitor real-time readings, download data, manage data files, perform data compensations, and save and export data files. Depending on the type of datalogger, there will be differences in programming options. See below for a summary of the differences:

Datalogger Programming Options			
Datalogger Type	**Sampling Options**	**Memory Capacity**	**Battery Life**
Levelogger Edge	Linear (0.125 second to 99 hours), Compressed Linear, Event-Based, Schedule, Repeat Schedule, Real-Time View , Future Start/Stop	40,000 sets of readings or up to 120,000 Compressed. Slate or Continuous Mode (see note)	10 years based on 1 reading per minute
Barologger Edge	Linear (0.125 second to 99 hours), Compressed Linear, Event-Based, Schedule, Repeat Schedule, Real-Time View, Future Start/Stop	40,000 sets of readings or up to 120,000 Compressed. Slate or Continuous Mode (see note)	10 years based on 1 reading per minute
Levelogger Junior	Linear (0.5 second to 99 hours), Real-Time View	32,000 sets of readings in Slate Mode	5 years based on 1 reading per minute
LTC Levelogger Junior	Linear (5 seconds to 99 hours), Real-Time View	16,000 sets of readings in Slate Mode	5 years based on 1 reading every 5 minutes
Rainlogger	Linear (5 minutes to 99 hours), 5 Minute Maximum Rainfall (Intensity)	Up to 40,000 tips. Slate Mode	10 years based on 2 parameters logged every 10 minutes
Levelogger Gold	Linear (0.5 second to 99 hours), Event-based, Schedule, Real-Time View, Future Start/Stop	40,000 sets of readings, Slate or Continuous Mode.	10 years based on 1 reading per minute
Barologger Gold	Linear (0.5 second to 99 hours), Event-based, Schedule, Real-Time View, Future Start/Stop	40,000 sets of readings, Slate or Continuous Mode.	10 years based on 1 reading per minute

Table 1-1
Levelogger Programming Options

1.1 Levelogger Series

1.1.1 Levelogger Edge

The Levelogger Edge is an absolute (non-vented) datalogger, which measures groundwater and surface water levels and temperature. Water levels are displayed as temperature compensated pressure readings, and can be barometrically compensated with the aid of a Barologger Edge.

Levelogger Edge Technical Specifications	
Level Sensor:	Piezoresistive Silicon with Hastelloy Sensor
Ranges:	15, 30, 65, 100, 300 ft. (5, 10, 20, 30, 100 m)
Accuracy (Typical):	± 0.05% FS
Resolution:	24 Bit Resolution
Normalization:	Automatic Temperature Compensation
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Temp. Sensor Accuracy:	± 0.05ºC
Temp. Sensor Resolution:	0.003ºC
Temp. Comp. Range:	0ºC to 50ºC
Battery Life:	10 years (based on 1 reading/minute)
Clock Accuracy:	± 1 minute/year (-20ºC to 80ºC)
Operating Temperature:	-20ºC to 80ºC
Maximum # Readings:	40,000 (up to 120,000 using data compression)
Memory:	FRAM, Continuous or Slate mode
Communication Speed:	9600 bps, 38,400 bps with USB optical reader
Com Interface:	Optical Infra-red: USB, RS-232, SDI-12
Size:	7/8" x 6.25" (22 mm x 159 mm)
Weight:	129 grams (4.5 oz.)
Corrosion Resistance:	Titanium based PVD coated body and superior corrosion resistant Hastelloy sensor
Other Wetted Materials:	Delrin®, Viton®, 316L Stainless Steel
Sampling Modes:	Linear, Event & User-Selectable Schedule with Repeat Mode, Future Start, Future Stop, Real-Time View
Measurement Rates:	0.125 second to 99 hours
Barometric Compensation:	High accuracy, air-only, Barologger Edge

LT Edge Models	Accuracy
F15, M5	± 0.05% FS
F30, M10	± 0.05% FS
F65, M20	± 0.05% FS
F100, M30	± 0.05% FS
F300, M100	± 0.05% FS

! NOTE

To use the Levelogger Edge with Software Version 4.0.1, ensure you are using version 3.002 firmware.

! NOTE

The Model number refers to the depth of submergence below water level that the pressure sensor can withstand. i.e.: The Levelogger Edge, which is available in F15 (M5), F30 (M10), F65 (M20), F100 (M30) and F300 (M100) ranges has actual water level ranges of 16.40 ft (5 meters), 32.80 ft (10 meters), 65.60 ft (20 meters), 98.40 ft (30 meters) and 328.0 ft (100 meters), respectively.

1.1.2 Barologger Edge

The Barologger Edge uses algorithms based on air pressure only. It measures and logs changes in atmospheric pressure, which are then used to compensate water level readings recorded by a Levelogger Edge.

Barologger Edge Technical Specifications	
Level Sensor:	Piezoresistive Silicon with Hastelloy Sensor
Accuracy (Typical):	± 0.05 kPa
Resolution:	24 Bit Resolution
Normalization:	Automatic Temperature Compensation
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Temp. Sensor Accuracy:	± 0.05ºC
Temp. Sensor Resolution:	0.003ºC
Temp. Comp. Range:	-10ºC to 50ºC
Battery Life:	10 years (based on 1 reading/minute)
Clock Accuracy:	±1 minute/year (-20ºC to 80ºC)
Operating Temperature:	-20ºC to 80ºC
Maximum # Readings:	40,000 (120,000 using data compression)
Memory:	FRAM, Continuous or Slate mode
Communication Speed:	9600 bps, 38,400 bps with USB optical reader
Com Interface:	Optical Infra-red: USB, RS-232, SDI-12
Size:	7/8" x 6.25" (22 mm x 159 mm)
Weight:	129 grams (4.5 oz.)
Corrosion Resistance:	Titanium based PVD coated body and superior corrosion resistant Hastelloy sensor
Other Wetted Materials:	Delrin®, Viton®, 316L Stainless Steel
Sampling Modes:	Linear, Event & User-Selectable Schedule with Repeat Mode, Future Start, Future Stop, Real-Time View
Measurement Rates:	0.125 second to 99 hours

Barologger Edge Models	Accuracy
Air Only	± 0.05 kPa

1.1.3 Levelogger Junior

The Levelogger Junior provides an inexpensive alternative for measuring groundwater and surface water levels and temperature.

Levelogger Junior Technical Specifications	
Level Sensor:	Piezoresistive Silicon in 316L Stainless Steel
Ranges:	15, 30 ft. (5, 10 m)
Accuracy (typical):	± 0.1% FS
Resolution:	0.03% FS
Normalization:	Automatic Temperature Compensation
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Accuracy:	± 0.1ºC FS
Resolution:	± 0.1ºC
Temp Compensation Range:	10ºC to 40ºC
Battery life:	5 years (based on 1 reading/minute)
Clock Accuracy:	± 1 minute / year
Operating Temperature:	-20ºC to 80ºC
Memory:	Non-volatile EEPROM, FRAM back-up, Slate mode only
Maximum # Readings	32,000 (no data compression)
Com Interface:	Optical Infra-red: USB, RS-232, SDI-12
Communication Speed:	9600 bps
Size:	7/8" x 5.5 " (22 mm x 140 mm)
Weight:	154 g (5.4 oz)
Wetted Materials:	Delrin®, Viton®, 316L Stainless Steel
Sampling Mode:	Linear, Future Start, Real Time View
Measurement Rates:	0.5 seconds to 99 hours
Altitude Input:	-980 to 16,400 ft. (-300 to 5,000 m)
Barometric Compensation:	High accuracy, air-only, Barologger

LT Models	Full Scale (FS)	Accuracy (Typ)	Resolution
F15, M5	16.4 ft., 5 m	± 0.020 ft., 0.6 cm	0.028% FS
F30, M10	32.8 ft., 10 m	± 0.032 ft., 1.0 cm	0.021% FS

> **⚠ NOTE**
>
> To use the Levelogger Junior with Software Version 4.0.1, ensure you are using version 2.006 firmware.

1.1.4 LTC Levelogger Junior

The LTC Levelogger Junior provides an inexpensive and convenient method to measure level, temperature and conductivity all in one probe.

LTC Levelogger Junior Technical Specifications	
Level Sensor:	Piezoresistive Silicon with Hastelloy Sensor
Ranges:	30, 100 ft. (10, 30 m)
Accuracy (typical):	± 0.1% FS
Resolution:	0.03% FS
Normalization:	Automatic Temperature Compensation
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Accuracy:	± 0.1ºC
Resolution:	0.1ºC
Temp Compensation Range:	10ºC to 40ºC
Conductivity Sensor:	4-Electrode Platinum
Full Range:	0 to 80,000 µS/cm
Calibrated Range:	500 to 50,000 µS/cm
Accuracy:	± 2% of reading
Resolution:	± 0.01% FS
Normalization:	Specific Conductance normalized to 25ºC for full range
User Calibration Points:	1413, 5000, 12,880 µS
Battery Life:	5 years (based on 1 reading/ 5 minutes)
Clock Accuracy:	± 1 minute / year
Operating Temperature:	-20ºC - 80ºC
Memory:	Non-volatile EEPROM, FRAM back-up, Slate mode only
Maximum Readings:	16,000
Communication Speed:	9600 bps
Com Interface:	Optical Infrared: USB, RS-232, SDI-12
Size:	7/8" x 7.5" (22 mm x 190 mm)
Weight:	200 g (7.05 oz.)
Wetted Materials:	Delrin®, Viton®, 316L Stainless Steel, Platinum
Sampling Mode:	Linear, Future Start, Real Time View
Measurement Rates:	5 seconds to 99 hours
Altitude Input:	-980 to 16,400 ft. (-300 to 5,000 m)
Barometric Compensation:	High accuracy, air-only, Barologger

LTC Models	Full Scale (FS)	Accuracy (Typ)	Resolution
F30, M10	32.8 ft., 10 m	± 0.032 ft., 1.0 cm	0.021% FS
F100, M30	98.4 ft., 30 m	± 0.128 ft., 1.5 cm	0.021% FS

1.1.5 Rainlogger

The Rainlogger is designed for use with most standard tipping-bucket rain gauges with a reed switch output. It measures total rainfall per sampling period and a five-minute maximum rainfall (intensity). You can add rainfall data to your Levelogger network.

Rainlogger Technical Specifications	
Battery Life:	10 years (logging two parameters/10 minutes)
Clock Accuracy:	± 1 minute/year
Operating Temperature:	-20˚C to 80˚C
Resolution:	0.004 to 0.008" (0.1 to 0.2 mm) (dependent on rain gauge type)
Maximum # Readings:	Up to 40,000 tips
Memory:	Non-volatile EEPROM, FRAM back-up, Slate mode only
Communication:	Optical infra-red: USB, RS-232, SDI-12
Measurement:	Recorded number of Tips multiplied by the Calibration Factor of the Tipping Bucket selected
Logging Mode:	Linear (Total Rainfall per sampling period), 5-Minute Maximum Rainfall
Sampling Rate:	5 minutes to 99 hours
Size:	7/8" x 7" (22 mm x 175 m)
Weight:	4.8 oz (135 grams)
Materials:	316 Stainless Steel, Delrin®, Viton®

1.1.6 Leveloader

The Leveloader is a data transfer device for use with all versions of Leveloggers. It can be used to download, store, and transfer data from Levelogger to PC, as well as, save settings files for transfer to a Levelogger. Also allows real-time viewing of Levelogger readings. The Leveloader is used with Levelogger Software, see separate Leveloader User Guide.

1.1.7 Levelogger Gold

The Levelogger Gold is an absolute (non-vented) datalogger, which measures groundwater and surface water levels and temperature. Water levels are displayed as temperature compensated pressure readings, and can be barometrically compensated with the aid of a Barologger.

Levelogger Gold Technical Specifications	
Level Sensor:	Piezoresistive Silicon in 316L Stainless Steel
Accuracy (Typical):	0.05% FS
Ranges:	15, 30, 65, 100, 300 ft. (5, 10, 20, 30, 100 m)
Resolution:	0.002 to 0.0006% FS
Normalization:	Automatic Temp Compensation
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Temp. Sensor Accuracy:	± 0.05°C
Temp. Sensor Resolution:	0.003°C
Temp. Comp. Range:	10ºC to +40°C
Battery Life:	10 Years - based on one reading/min
Clock Accuracy:	± 1 minute/year
Operating Temperature:	-20°C to 80°C
Maximum # Readings:	40,000 of level and temperature
Memory:	EEPROM Slate, Continuous, and redundant backup of last 1200 readings
Communication:	Optical Infra-red: USB, RS-232, SDI-12
Communication Speed:	9600 bps
Size:	7/8" x 6" (22 mm x 154 mm)
Weight:	6.3 oz (179 grams)
Corrosion Resistance:	Zirconium Nitride (ZrN) Coating
Other Wetted Materials:	316L Stainless Steel, Delrin®, Viton®
Sampling Modes:	Linear, Event & User-Selectable with 30 separate line items
Measurement Rates:	0.5 sec to 99 hrs
Barometric Compensation:	High accuracy, air-only, Barologger Gold

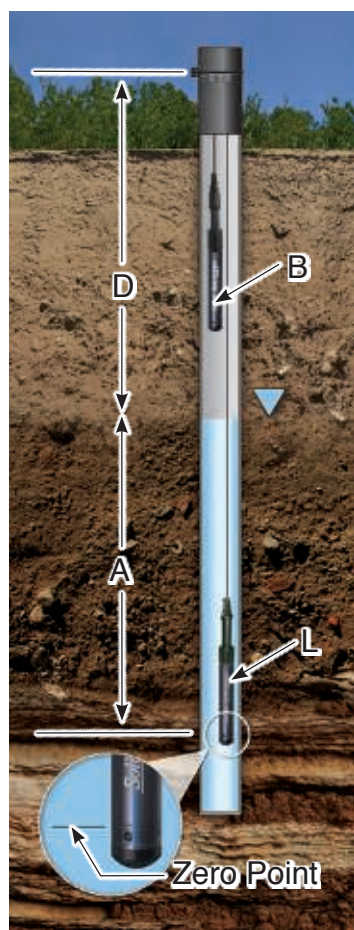| LT Models	Full Scale (FS)	Accuracy (Typ)	Resolution
F15, M5	16.4 ft., 5 m	± 0.010 ft., 0.3 cm	0.001% FS
F30, M10	32.8 ft., 10 m	± 0.016 ft., 0.5 cm	0.0006% FS
F65, M20	65.6 ft., 20 m	± 0.032 ft., 1 cm	0.0006% FS
F100, M30	98.4 ft., 30 m	± 0.064 ft., 1.5 cm	0.0006% FS
F300, M100	328.1 ft., 100 m	± 0.164 ft., 5 cm	0.0006% FS

1.1.8 Barologger Gold

The Barologger Gold uses algorithms based on air pressure only. It measures and logs changes in atmospheric pressure, which are then used to compensate water level readings recorded by a Levelogger.

Barologger Gold Technical Specifications	
Level Sensor:	Piezoresistive Silicon in 316L Stainless Steel
Accuracy (Typical):	0.05% FS
Resolution:	0.002% FS
Normalization:	Automatic Temp Compensation
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Temp. Sensor Accuracy:	± 0.05°C
Temp. Sensor Resolution:	0.003°C
Temp. Comp. Range:	10°C to +40°C
Battery Life:	10 Years - based on one reading/min
Clock Accuracy:	± 1 minute/year
Operating Temperature:	-20°C to 80°C
Maximum # Readings:	40,000 of pressure and temperature
Memory:	EEPROM Slate, Continuous, and redundant backup of last 1200 readings
Communication:	Optical Infra-red: USB, RS-232, SDI-12
Communication Speed:	9600 bps
Size:	7/8" x 6" (22 mm x 154 mm)
Weight:	6.3 oz (179 grams)
Corrosion Resistance:	Zirconium Nitride (ZrN) Coating
Other Wetted Materials:	316L Stainless Steel, Delrin®, Viton®
Sampling Modes:	Linear, Event & User-Selectable with 30 separate line items
Measurement Rates:	0.5 sec to 99 hrs

LT Models	Full Scale (FS)	Accuracy (Typ)	Resolution
Barologger	Air Only	± 0.003 ft., 0.1 cm	0.002% FS

! NOTE

To use the Barologger Gold with Software Version 4.0.1, ensure you are using version 2.006 firmware.

A = L - B

Figure 1-1
Levelogger Measurement Fundamentals

> **⚠ NOTE**
>
> Leveloggers measure the pressure of air plus water column above their sensor (zero point). To adjust the level readings after data collection, for example to water level depths below top of casing **(D)**, refer to the Manual Data Adjustment options within the software Data Compensation Wizard.

> **⚠ NOTE**
>
> The Levelogger Gold and current Levelogger Junior and LTC Levelogger Junior models convert pressure readings to the water level equivalent above the datalogger's pressure zero point of 950 cm (31.17 ft). The Levelogger Edge has no zero point offset. As such, water level data will appear different, although measuring the same pressure.

1.2 Measurement Parameters

1.2.1 Level

All Leveloggers measure total (absolute) pressure. When submerged, the Levelogger is recording the combination of barometric pressure and water pressure. The actual pressure of just water **(A)** above the sensor is obtained by subtracting barometric pressure **(B)** from the total pressure **(L)** (see Figure 1-1).

The best method to compensate for barometric pressure is to employ a Barologger above the water level, to obtain records of barometric pressure. The Levelogger Software includes a Data Compensation Wizard, which guides you through the automated process of barometric compensation. Manual methods can be employed to determine the absolute water level using barometric records collected on-site or available from a local weather station (i.e. airport). Water level readings from Leveloggers are automatically temperature-compensated.

A = Actual water column height

B = Barometric pressure

L = Levelogger total pressure readings

D = Depth to water level, below reference datum

1.2.1.1 Pressure Calibration

The Levelogger Edge is calibrated against a range of set reference points to an accuracy of 3 decimal places. The units of pressure are in pounds per square inch. The conversion factor for pounds per square inch relates to pressure as follows:

$$1 \text{ pound per square inch} \begin{aligned} &= 0.0689476 \text{ bar} \\ &= 0.703070 \text{ m} \\ &= 703.070 \text{ kg/m}^2 \\ &= 6.895 \text{ kPa} \\ &= 2.31 \text{ ft. } H_2 0 @ 4°C. \end{aligned}$$

During the calibration procedure, the Levelogger is fully submerged in a highly accurate water bath. The bath is set to 5°C and allowed to stabilize. The pressure is then calibrated to six separate pressure points covering the entire range of pressure for that particular Levelogger to check for any non-linearity. The process is repeated again at 35°C to check for temperature effects. Once done, the Levelogger is approved after all specifications for accuracy, precision, stability and hysteresis have been met. The Levelogger should be calibrated for the lifetime of the instrument, as long as it is used within its specified range.

1.2.2 Barometric Pressure

The Barologger is designed for use in air only. It has a specific range and firmware algorithms based on air pressure rather than water pressure. This makes the Barologger less accurate if used in water, but more accurate if used as intended in air. Using a Barologger is the most accurate and convenient method of obtaining atmospheric pressure and air temperature measurements, which are then synchronized to the Levelogger. The Data Compensation Wizard in the Levelogger Software simplifies the adjustment of the level measurements for barometric pressure changes, by using the synchronized data from all Leveloggers on site and the site Barologger.

1.2.3 Temperature

Leveloggers record temperature compensated water levels. Groundwater and surface water temperature measurements are particularly important in situations where temperatures may fluctuate significantly, and when temperature is used in determining liquid level, viscosity and hydraulic conductivity. Temperature monitoring is vital in the calculation of certain temperature dependent contaminant reaction rates. A Platinum Resistance Temperature Detector is used to accurately compensate for temperature changes within the range of 0 to +50°C for the Levelogger Edge or -10°C to +50°C for the Barologger Edge (10°C to +40°C for the Levelogger Junior models). The Levelogger will record temperature in its thermal range of -20 to +80°C, but outside the range, compensation will be less accurate.

1.2.4 Conductivity

The LTC Levelogger Junior provides the added feature of electrical conductivity measurement. It measures the actual conductivity at the current temperature. Conductivity measurement is particularly useful in monitoring saltwater intrusion, surface water infiltration and mixing, as well as the monitoring of certain pollutants and contaminant parameters. Conductivity is measured via a platinum 4-electrode sensor, which produces highly stable and consistent readings. Conductivity calibration is performed by using a liquid solution with a known conductivity value and the Calibration Wizard in the Levelogger Windows Software. The Data Compensation Wizard allows you to convert conductivity readings to Specific Conductance (at 25°C) or Salinity.

1.2.4.1 Calibration of the Conductivity Sensor

The conductivity sensor of the LTC Levelogger Junior is a highly sensitive device requiring regular calibration by the user. The conductivity calibration frequency is dependent on the water quality of the Levelogger's monitoring environment. To determine whether an LTC Levelogger Junior should be recalibrated, test the unit in a solution with a known electrical conductivity value at a reference temperature. In Real Time View, observe current readings by using the Read Now function. If this reading varies from the known Specific Conductance of the solution by greater than 2% of the Full Scale of Conductivity measurement, the unit should be recalibrated using the Conductivity Calibration Wizard procedure outlined in Section 6. As a minimum, calibrate your LTC Levelogger Junior at least twice a year. Ensure that a conductivity calibration is performed when the LTC Levelogger Junior is being set up for its initial use and after long periods of dry storage.

1.2.5 Total Rainfall

The Solinst Rainlogger is designed to count the tips of an external tipping-bucket rain gauge within a user defined sample interval and output the total rainfall over that sample interval, as well as intensity.

1.3 Software Communication

Levelogger Software is Windows based, and is therefore used with a desktop or laptop PC. Dataloggers connect to a laptop or desktop PC with an Optical Reader cable. The Optical Reader cable uses an infrared data reader/port connected to the datalogger and a USB or RS232 (Serial) Com Port to transfer information between the datalogger and computer.

If you are programming dataloggers in the office, or have deployed your datalogger using a wireline or cord, an Optical Reader is most commonly used for communication with a PC (see Figure 1-2).

If a datalogger is deployed in the field using a Direct Read Cable, a PC Interface Cable is used for communication with the PC, without removing it from the well (see Figure 1-3).

Optical Reader

Figure 1-2 Levelogger Connected to a PC Using an Optical Reader

PC Interface Cable

Datalogger Down Well

Figure 1-3
Levelogger and Direct Read Cable Connected to PC Using a PC Interface Cable

1.3.1 Backwards Compatibility

The Levelogger Edge is not backwards compatible with previous versions of Levelogger Software. Only Levelogger Software Version 4 can be used to program the Levelogger Edge and Barologger Edge.

Levelogger Junior, LTC Levelogger Junior, Rainlogger, and Leveloader are compatible with Levelogger Software Version 4.0.1. If used with previous software versions, they will not have some of the features gained with the release of Version 4.0.1 Software. The Levelogger Gold and Barologger Gold are also compatible with Version 4.0.1 Software, and previous versions.

To use your Leveloggers with Version 4.0.1 Software, ensure your firmware is upgraded to the following versions:

Datalogger	Firmware Version
Levelogger Edge	3.002
Barologger Edge	3.002
Levelogger Junior	2.006
LTC Levelogger Junior	2.002
Rainlogger	1.004
Leveloader	1.300
Levelogger Gold	2.006
Barologger Gold	2.006

For more information on previous software versions, visit www.solinst.com to view the **Levelogger Compatibility Matrix**, located on the Downloads page.

! NOTE

It is always recommended to use the most recent version of software.

! NOTE

For more information, visit www.solinst.com to view the Levelogger Compatibility Matrix, which is located on the Downloads page.

2 System Requirements

The minimal hardware and software requirements for software installation and operation are:

Hardware	Software
Memory: 32 MB or more	OS: Windows XP, Vista, or 7
Display: VGA: 800 x 600 pixels, 256 colour	
Ports: USB or RS-232 Serial Port	

Communication Port Setting for Levelogger Communications:

Bits per second	9600
Data bits	8
Stop bits	1
Flow control	None

3 Software Installation

Web Download

Download the newest version of Levelogger Software by visiting
www.solinst.com/Downloads/

CD Installation

1) Insert the software CD provided.

2) If the installer does not automatically start, to activate the software install click on the 'setup.exe' file located on the software CD.

3) The Software Installation Wizard will guide you through the remaining installation process. Figure 3-1 shows the Levelogger Installation Wizard.

4) Restart the computer after installation is completed. Default Directory is C:\Program Files\Solinst\Levelogger4_0
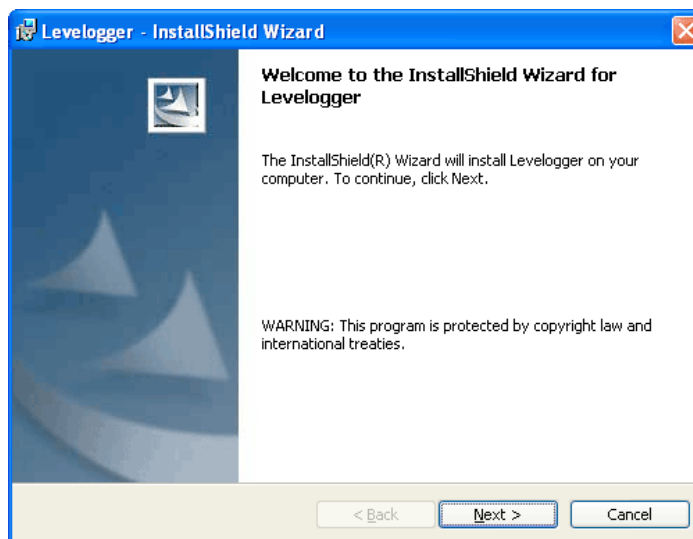
Figure 3-1 Software Installation Wizard

4 Startup, Configurations and Settings

4.1 Startup

If using a USB port, plug in the USB cable before starting the Levelogger Software. If plugging in the USB device for the first time, the driver for the device will have to be installed, see Section 4.1.3 for USB driver installation instructions.

To start the Levelogger Software, click [icon], or click the Start button and select:

Programs > Solinst > Levelogger 4 > Levelogger 4.0.1

Once the program is started, you can set up the parameters for the Software.

4.1.1 Software/Firmware Update Checks

Each time the software is opened, it automatically checks for software updates. If there is an update, "Software Update Available" will appear in the top right of the menu bar. When you click the message, it will open a webpage where you can download the software update.

The Software also checks for firmware updates once you have retrieved settings from a connected Levelogger (see Section 5)."Firmware Update Available" will appear in the top right menu bar. Clicking the message will open a webpage where you can download the firmware update. See Section 12 for firmware update instructions.

4.1.2 Communicating with a USB Port

USB port communication requires the installation of USB driver software and the setting up of a virtual com port. If communicating via a USB port, the user will either:

1)   Connect a Levelogger Optical Reader or PC Interface Cable to the USB port

2)   Use a USB to RS232 Adapter

If 1) during the installation of Levelogger Software, the **Virtual Com Port Driver** will be installed automatically. The Levelogger Software Installation Wizard also copies a folder to the Levelogger folder containing all the Solinst USB drivers. When you plug in the Solinst USB device, check the com port designation after installing the device (see Section 4.2.1).

If 2) Solinst strongly recommends the use of either Keyspan™ or IO Gear™ USB to RS232 Serial Adapters. These adapters have a sufficiently large buffer to accommodate the size of data bundle and bit transfer rate of the Levelogger. Follow the manufacturer's USB Driver and Com port setup installations found on the CD accompanying the adapter.

If you have installed another brand-name adapter, but cannot communicate with the Levelogger, in most cases the problem is that the adapter does not have a large enough internal memory buffer. The minimum buffer size should be 96 bytes.

⚠ NOTE

Your PC must have an internet connection to check for software and firmware updates.

You can also check for updates using the Help menu.

⚠ NOTES

To check the Com port assigned to a USB device after installation, open the Device Manager. Expand "Ports (COM & LPT)" to show the Com Port that has been assigned. To change the assigned Port, see Section 4.2.1.

You may have to restart your computer after adding a new USB device, before that port will be detected by the Levelogger Software

4.1.3 Installing USB Drivers for Levelogger 4 Software

Levelogger Software Version 4.0.1, for use with Solinst USB Optical Reader, PC Interface Cable and Leveloader, comes equipped with USB drivers for: Windows XP, Vista, and 7.

4.1.3.1 USB Installation for Windows XP

1) Plug the USB device into the computer, and Windows will automatically detect the connected device. This will begin the 'Found New Hardware Wizard'.

2) The 'Wizard' will give the option to connect to Windows Update to search for software components, select: 'No, not at this time'.

3) Click 'Install from a list or specific location', then click the 'Next' Button. (Figure 4-1).

Figure 4-1 Found New Hardware Wizard Window

4) Select the installation option, 'Include this location in the search' (Figure 4-2), then click the 'Browse' Button to search for the appropriate directory:

C:\Program Files\Solinst\Levelogger4_0\USB Drivers
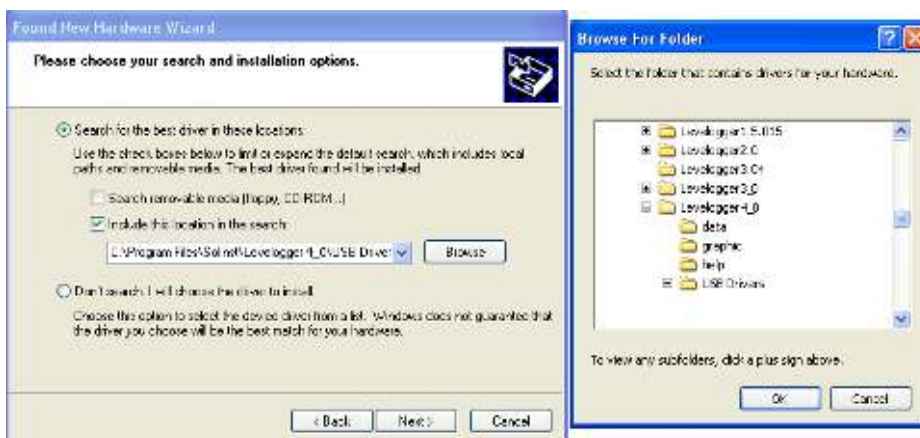
Figure 4-2 Found New Hardware Window and Figure 4-3 Browse for Folder Window
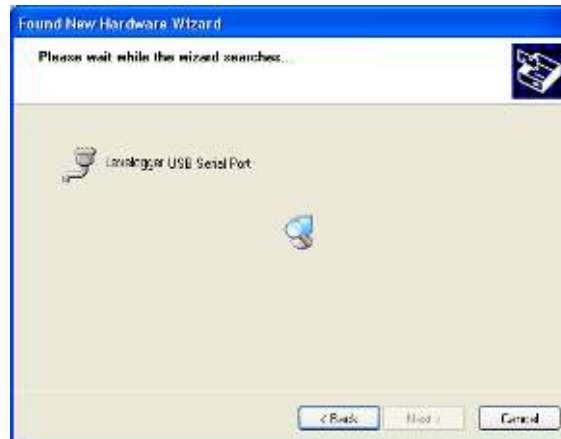
Figure 4-4 Found New Hardware Search Window

5) A warning message will then prompt that the software has not passed the Windows Logo Test. Select 'Continue Anyway' (Figure 4-5). This will complete the installation process. A system restart may be required. Repeat the steps if the installation fails the first time.

Figure 4-5 Hardware Installation Window

Figure 4-6 Found New Hardware Completed Window

> ⚠ **NOTE**
>
> These instructions are for use with Vista 32 bit Operating Systems.

> ⚠ **NOTE**
>
> After plugging in the USB device, if the Found New Hardware Wizard does not automatically appear, proceed to the Manual USB Installation instructions in Section 4.1.4.

4.1.3.2 USB Installation for Windows Vista

1) Plug in the USB device, the system will automatically detect the connected unit and start the 'Found New Hardware' Wizard.

2) From the provided list select "Locate and install driver software (recommended)".

Figure 4-7 Found New Hardware Window

3) On the next screen select, "I don't have the disc. Show me other options."
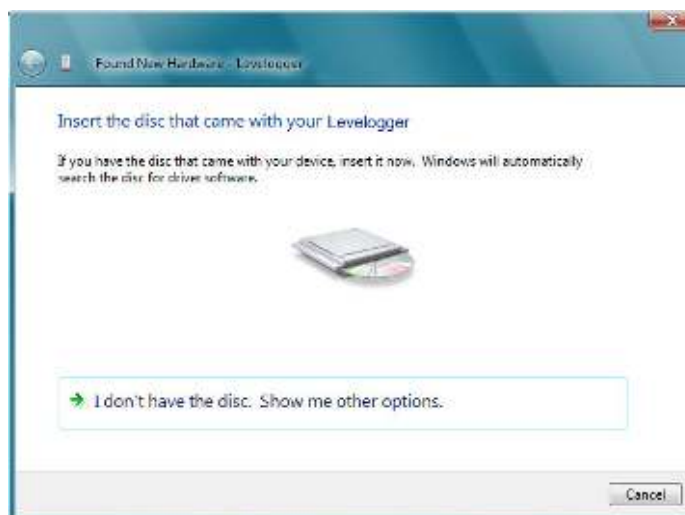
Figure 4-8 Found New Hardware - USB Serial Port Window

4) On the next screen select, "Browse my computer for driver software (advanced)" option.
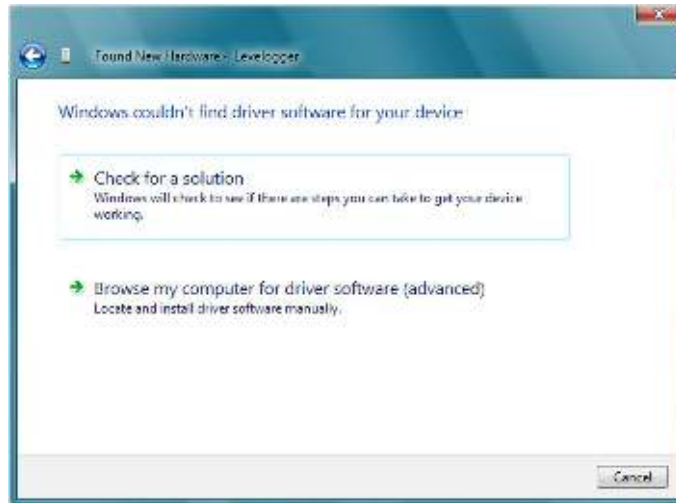
Figure 4-9 Found New Hardware Browse Window

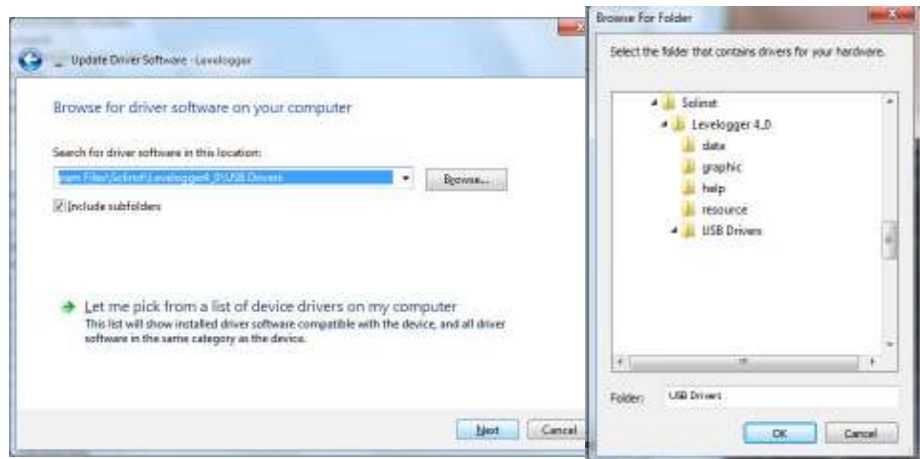5) Select the Browse button and point the navigation window to the provided USB drivers located within the Levelogger4_0 folder. The default destination is:

C:\Program Files\Solinst\Levelogger4_0\USB Drivers

The selected pathway will be provided within the window, select Next on the wizard to complete the installation.
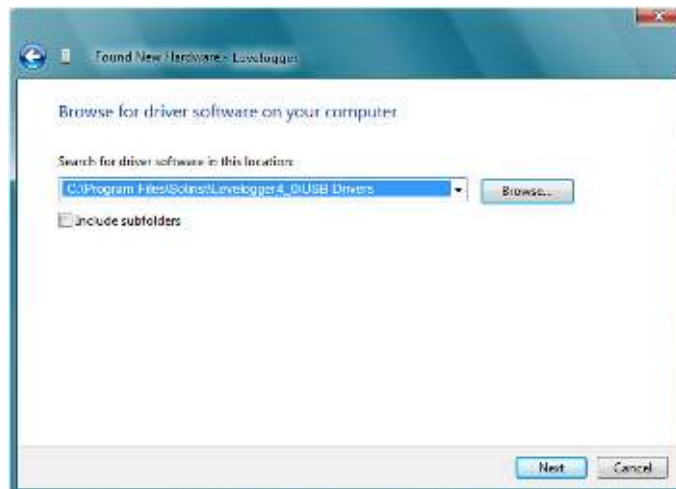
Figure 4-10 Search for Driver Software Window

6) Once the installation completes, a system restart may be required. If the found new hardware wizard prompts again, please repeat steps 1-6.

4.1.3.3 USB Installation for Windows 7

1) Plug the USB Device into the PC. The system will automatically detect the connected unit. Windows 7 should automatically install the driver for the device.

2) If no driver is automatically found, then the following steps should be taken.

3) Press the Windows start button to bring up the start menu, select "Control Panel", then "Hardware and Sound", then "Device Manager".

4) Under "Other Devices" there will be a device shown with a yellow warning symbol. Right click on this device, and select "Update Driver Software".
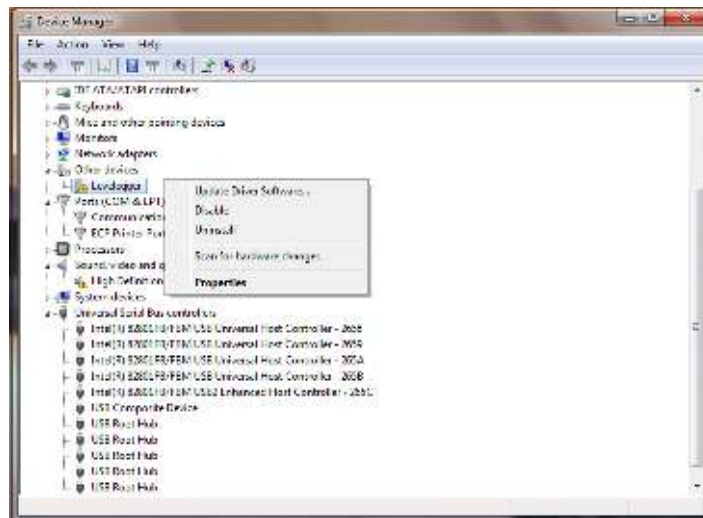
Figure 4-11 Windows 7 Device Manager

5) Select "Browse my computer for driver software".
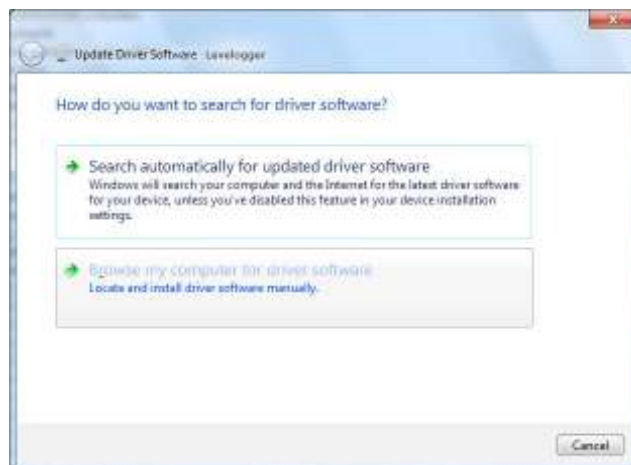
Figure 4-12 Update Driver Software

Figure 4-13 Browse for Driver Software

6) Click the Browse button and point the navigation window to the provided USB drivers located within the Levelogger4_0 folder. Default destination is:

   C:\Program Files\Solinst\Levelogger4_0\USB Drivers

7) Select Next. A window may appear stating "Windows can't verify the publisher of this driver software", select "Install this driver software anyway".
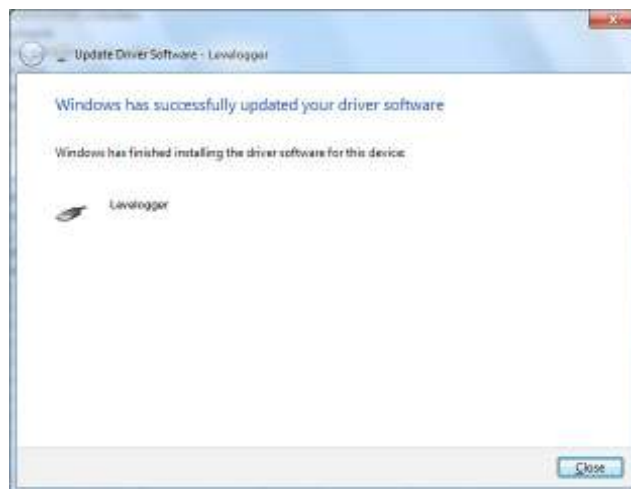

Figure 4-14 Update Complete

8) Windows will confirm when the installation is complete. Press Close to close the window, then go back to the "Device Manager".
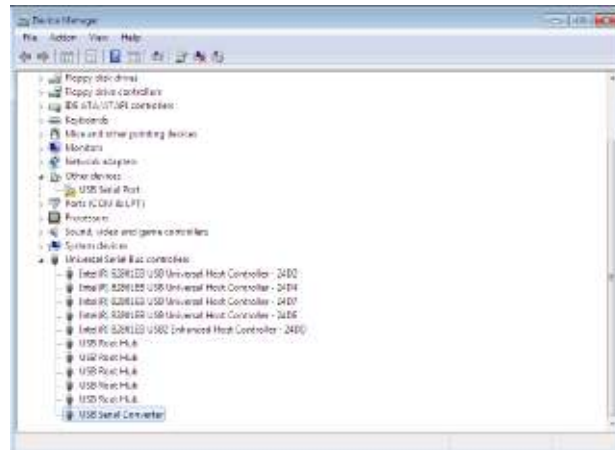
Figure 4-15 Update Serial Port

9) You will repeat steps 4-8 to update the USB Serial Port. This will now be shown under "Other Devices" with a yellow warning symbol.

10) Once this installation is complete, a window will confirm the COM port assigned to the device.

4.1.4 Manual USB Installation

If your device is plugged in and the Found New Hardware Wizard fails to start, then follow these steps:

1) Open the Device Manager. Typically this is found through the path:
Start > Control Panel > System > Hardware > Device Manager

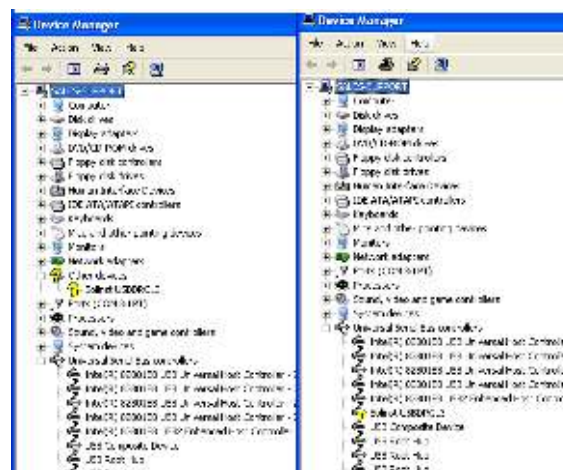Once the Device Manager is open, a version of the following list(s) will appear:

Figure 4-16 Device Manager

2) Identify the Solinst device from the list. The device will be categorized under "Other Devices" or "Universal Serial Bus Controllers".

3) Highlight the device in the list and right click. You will see an option to "Update the driver". This will start the "Hardware Update Wizard". Now follow the instructions for your specific Windows version.

4.2 Configuration and Settings

4.2.1 Com Port Designation Set Up

After installing a USB device, should the Com Port number assigned to the device conflict with your existing devices, it is possible to change the Com Port designation number:

1) Click Start > Settings > Control Panel
2) Click Systems to open the System Properties
3) Click the Hardware tab and click 'Device Manager'
4) Double Click the Ports Icon and select the 'USB Serial Port'
5) Right click and select Properties
6) Click the 'Port Settings' tab and click 'Advanced'
7) Select the Com Port Number and click 'OK'

Note: the path to the "Port Settings" tab may be different for each Windows operating system. The above is just a guideline.

4.2.2 Data Directory

The program will save data downloaded to the following default directory: <C:\Program Files\Solinst\Levelogger4_0\Data> unless otherwise specified in the Default Directory field of the Application Settings window (Figure 4-17).

Click the Configuration menu at the top of the program window, select Application Settings and input or navigate to a different folder destination. After completing the Application Settings, click the OK button to confirm and save the settings.

Figure 4-17 Application Setting Window

4.2.3 File Name Settings

From the Application Settings window in the Configuration menu, you can set what information will be included in your default file names of downloaded data (see Figure 4-17). You can include Start Date, Stop Date, Serial Number, and Location. Check-off the information you would like included.

After completing the Application Settings, click the OK button to confirm and save the settings.

5 Levelogger Edge Series Setup

After you start the Levelogger Software, the main Levelogger Software window will appear, with the Datalogger Settings tab open.
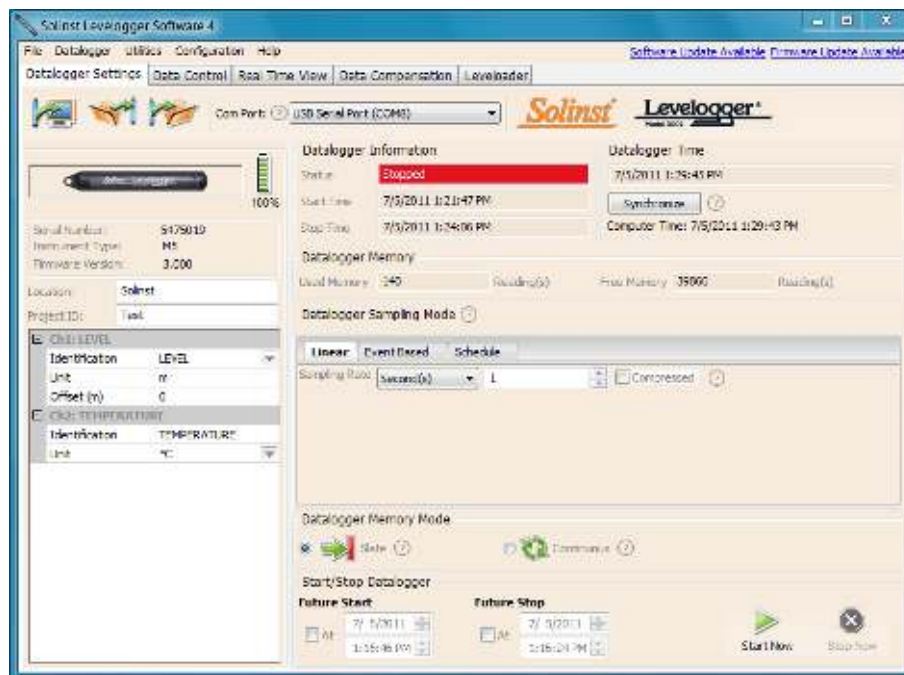

Figure 5-1 Datalogger Settings Tab

Select the appropriate COM or USB Port for the connected communications device from the centre drop-down menu.

Click 🖥 to retrieve the current settings from the connected datalogger.

5.1 Datalogger Settings

After you have retrieved the settings of the connected datalogger, the Datalogger Settings tab will identify the Instrument Type, Serial Number, Firmware Version, Project ID, Location, and the Channel Settings.

- **Instrument Type**: will display the model of the attached datalogger, i.e.: F100/M30, Barologger, Rainlogger.
- **Serial Number:** the unique serial number of the attached datalogger will be displayed.
- **Firmware Version**: shows the firmware version of the attached datalogger.
- **Project ID:** input your own identification system. The Project ID is limited to 32 characters.
- **Location**: input specific site / location information. The location is limited to 32 characters.

5.1.1 Setting Up Channel Information

In the lower left portion of the Datalogger Settings tab is the area for setting channel parameters (level, temperature, conductivity, rainfall). The software will detect the available channels when the datalogger settings are retrieved.

5.1.1.1 Level Channel (Ch1)

- **Identification** describes the measurement parameter of the channel and has already been configured as 'LEVEL'. The channel can be re-named to suit each project. The channel monitors water column equivalent pressure. The Identification field will be the channel heading, data column heading and graph line name when viewing the data Identification is limited to 32 characters.

- **Unit** refers to the channel's unit of measurement. There are six options when using a Levelogger Edge, m (default), cm, ft, kPa, mbar, and psi. When using a Barologger Edge, the options are kPa (default), mbar, and psi.

- **Offset** refers to an adjustment, such as the distance between the tip of the Levelogger and the monitoring well cap or static water level. It is recommended that the value of 0.00 be used for as this keeps all subsequent readings relative to the tip of the Levelogger. The reference range is -1000 to 16,400 ft or -300 m to 5000 m.

Figure 5-2 Levelogger Edge Channel Setup

The Levelogger Junior and LTC Levelogger Junior also have inputs for:

- **Altitude** in feet or meters above sea level, at which the logger is actually deployed, is input in the altitude field.   You can enter an elevation between -1000 ft below sea level and 16,400 ft (or -300 m and 5000 m) above sea level. The readings will then be automatically compensated for elevation.

- **Density** is used to adjust the range of the Levelogger based on the sample fluid density. The range for the density adjustment is from 0.9 kg/L to 1.1 kg/L.

5.1.1.2 Temperature Channel (Ch2)

- **Identification** describes the measurement parameter of the channel and has already been configured as 'TEMPERATURE'. The channel can be re-named to suit each project. The Identification field will be the channel heading, data column heading and graph line name when viewing the data. Identification is limited to 32 characters.

- **Unit** refers to the channel's unit of measurement. For the Levelogger and Barologger Edge, the temperature channel can be set to °C (default) or °F.

5.1.1.3 Conductivity Channel (Ch3)

- **Identification** describes the measurement parameter of the channel and has already been configured as 'CONDUCTIVITY'. The channel can be re-named to suit each project. The Identification field will be the channel heading, data column heading and graph line name when viewing the data. Identification is limited to 32 characters.
- **Unit** refers to the channel's unit of measurement. There are two units of measure available for the user to select: mS/cm or µS/cm.
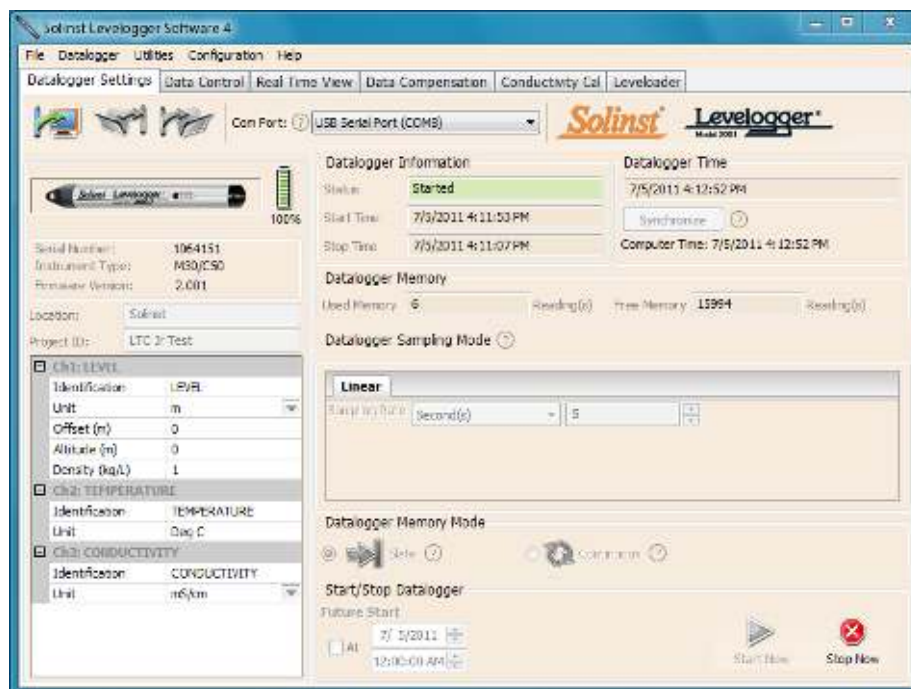

Figure 5-3 Conductivity Channel Setup

5.1.1.4 Rainlogger

There are two channels of measurement for the Rainlogger, **'RainFall'** and **'MaxRainFall'**.

The **'RainFall'** Channel will provide the total rainfall within the sample interval. It does so by multiplying the number of tips within the interval by the tipping bucket's calibration factor.

- **Identification** describes the measurement parameter of the channel and has already been configured as 'RainFall'. The channel can be re-named to suit each project. The Identification field will be the channel heading, data column heading and graph line name when viewing the data. Identification is limited to 32 characters.
- **Units** refers to the channel's unit of measurement. There are two units of measure available for the user to select: mm or in.
- **The Rainfall Cal Constant** field allows you to enter the calibration factor for the tipping bucket you will be using. The calibration factor is the amount of rainfall depth (mm, in) per tip. The calibration factor should be indicated on a label on the tipping bucket device or in the manufacturer's documentation. Input the calibration factor in mm or inches.

In the **'MaxRainFall'**, the readings are of maximum 5 minute peak intensity within a minimum 15 minute sampling interval. This rainfall intensity value is derived by subdividing the sample interval into 5 minute sub-intervals and temporarily recording the number of tips in each 5 minute sub-interval. The Peak intensity reading is calculated by multiplying the number of tips in the 5 minute interval with the largest number of tips by 12 and presenting peak intensity/hr.

- **Identification** describes the measurement parameter of the channel and has already been configured as 'MaxRainFall'. The channel can be re-named to suit each project. The Identification field will be the channel heading, data column heading and graph line name when viewing the data. Identification is limited to 32 characters.
- **Units** refers to the channel's unit of measurement. There are two units of measure available for the user to select: mm/hr or in/hr.
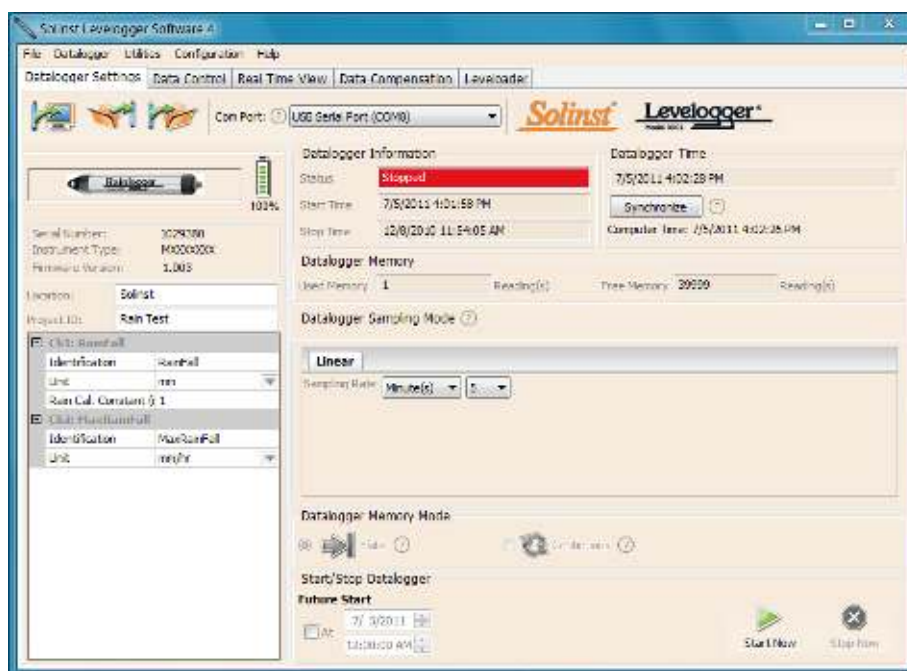
Figure 5-4 Rainlogger Channel Setup

5.2 Datalogger Information

The Datalogger Information section shows the Status of the attached datalogger (i.e.: Started, Stopped, Future Start) and the Start Time and Stop Time of the datalogger. When a Future Start and/or Stop time is set (see Section 5.8), the Start Time and Stop Time fields will fill in. The fields will update each time the datalogger is stopped and started.
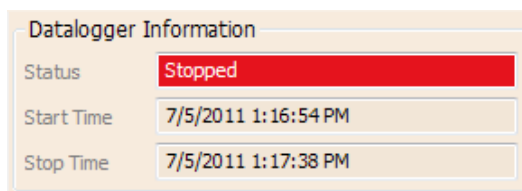

Figure 5-5 Datalogger Information

5.3 Datalogger Memory

The Datalogger Memory section shows the amount of memory used, and the amount of memory remaining (number of readings).

Figure 5-6 Datalogger Memory Remaining

If the Data Compression option is selected (see Section 5.7), the amount of free memory shown is approximated as a visual status bar.
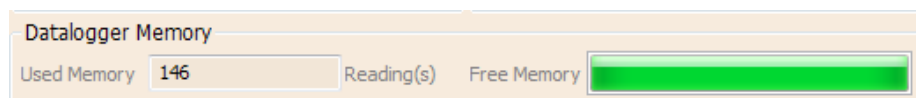

Figure 5-7 Datalogger Compressed Memory

5.4 Datalogger Time

The Datalogger Time section provides the controls for setting the datalogger clock. If you want to synchronize the datalogger's clock to the computer clock, click Synchronize to set the time in the datalogger.

If you start the datalogger without synchronizing the clock and the time difference between the datalogger and the PC is more than 3 seconds, the software will give you a message asking 'Do you want to synchronize the time?'. Click Yes to synchronize the clock.

It can be very useful to synchronize the clocks of all the Leveloggers and Barologgers when it comes to Barometric Compensation.
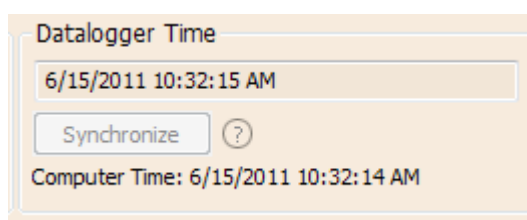

Figure 5-8 Datalogger Time

5.5 Datalogger Sampling Mode

The Datalogger Sampling Mode section allows you to choose the sampling measurement type. Options are Linear, Event Based and Schedule.

Linear refers to a set time interval between collection of readings. Sample Rate can be any number from 0.125 seconds to 99 hours for the Levelogger Edge. There is a data compression option available for the Levelogger Edge. This increases the memory capacity of the Levelogger Edge from 40,000 readings to up to a maximum of 120,000. Check the Data Compression box to allow data compression.

Data Compression works by only saving data changes in memory. For example, if you have linear sampling set to record each second, and your water level varies a little for 60 seconds, the memory will only record incremental values for the 60 seconds. When your data is exported, it will display all 60 intervals with the corresponding level data.
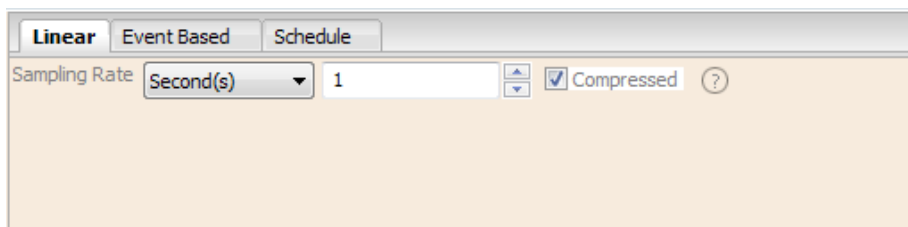
Figure 5-9 Linear Sampling Setup

Event Based sample collection is the most memory efficient means of data collection. In Event mode, the Levelogger will activate every sampling interval defined and check if readings have changed by the selected threshold (Change) from the last recorded reading.

For the Levelogger Edge, 'LEVEL' or 'TEMPERATURE' is the selected parameter where change is monitored. The Levelogger will record a new reading only if the specified change in the parameter has occurred.

A default reading will also be stored in the datalogger memory, every 24 hours from the last recording, if no "event" occurs.

Figure 5-10 Event-Based Sampling Setup

Schedule Sampling allows you to select a logarithmic style sampling schedule adapted to the needs of each application.

Schedule Sampling is set by using the plus and minus buttons to add or subtract line items in the Schedule window. The maximum number of line items in a schedule is 30, each with its own sampling interval of seconds, minutes or hours and duration of seconds, minutes, hours, days or weeks. A 'Pause' interval can also be selected, which stops the Levelogger from recording for the specified duration.

Running totals of the number of readings still available, from the total possible 40,000 or 120,000, and the run time to date are shown. If the number of readings selected exceeds the Leveloggers memory capacity an error message appears.
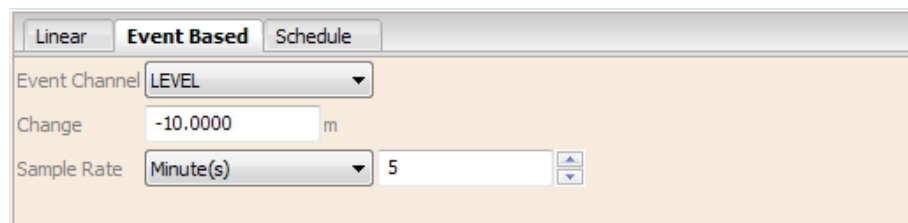
By checking 'Repeat', the Levelogger will continue to run through the schedule until its memory is full, or it is stopped.

Figure 5-11 Schedule Sampling Setup

5.6 Datalogger Memory Mode

Memory Mode Selection will be grayed-out if not in Linear sampling mode. When using a Levelogger in Linear Mode, there is a choice of **Continuous** Logging (wrap around) or **Slate** Logging .

Compressed Linear, Event-based and Schedule sampling modes can only use the Slate Mode option.

In Continuous Logging the new log is started at the end of any previous log and continues logging, eventually recording over the first logged data. As one of the download options is to 'Append Data', Continuous Logging can be a preferred choice when logging long-term.

In Slate Logging the new log is also started at the end of any previous log, but will stop recording after 40,000 readings (or up to 120,000 readings), so that the beginning of the current log will not be written over.

Figure 5-12 Datalogger Memory Mode

NOTE

A schedule can be saved and applied to other Leveloggers, or a Leveloader, by saving the Levelogger Settings file (see Section 5.7).

NOTE

Continuous Memory Mode is only available for Levelogger Edge and Levelogger Gold units using Linear Sampling.

5.7 Saving and Retrieving Levelogger Settings Files

To store settings as defaults, click ![icon]. It will store the settings of the Levelogger into an *.lls file as a series of defaults. The *.lls file will save the Project ID, Location, Sample Mode, Sample Rate, Channel ID, Unit, and Offset.

To retrieve settings from defaults, click ![icon] from a selected *.lls file. This is particularly useful if programming several Leveloggers with similar identical settings. Keep in mind that Project ID and Location identification information will be identical and should be distinguished from logger to logger or monitoring point to point.

5.8 Starting and Stopping the Datalogger

Starting the Datalogger

There are two ways to start logging: **Start Now** or by programming a **Future Start** time.

To start logging immediately, do not fill in a Future Start time and click, ![icon]. It should say Start Now below the icon to indicate an immediate start. Any changed settings will automatically be applied to the datalogger, and it will start logging. Datalogger Status will change from Stopped to Started.

After the datalogger is started, and begins collecting readings, the Start icon will be greyed out, and only the Stop icon and Future Stop settings will be active.
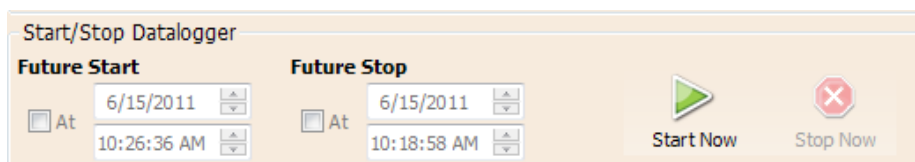
Figure 5-13 Starting the Datalogger Immediately

Check **Future Start** 'At' to set logging to start at a later date and/or time. This Start mode is referred to as Future Start in the Status field. Click ![icon] to apply the Future Start time and any changes to the datalogger settings.

When the Future Start time is reached, the datalogger will start logging and the Status will change from Future Start to Started.
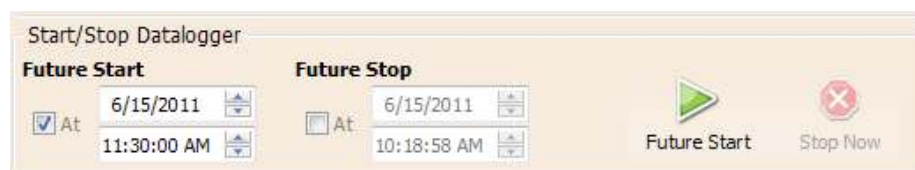

Figure 5-14 Future Start Setting

Stopping the Datalogger

There are two ways to stop logging: Stop Now or at a programmed Future Stop time for the Levelogger Edge and Barologger Edge.

To stop the datalogger immediately when it is logging, click ⊗ , (it should say Stop Now below the icon).

The Levelogger can be stopped at any time before it reaches the maximum reading capacity. **Starting again begins a new recording session and clears previously stored data readings.**
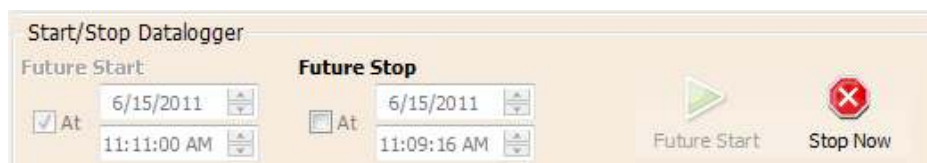
Figure 5-15 Stopping the Datalogger Immediately

To program a **Future Stop** time for your datalogger, check Future Stop 'At' and fill in the desired stop time. The Future Stop time will be applied to the datalogger once ▷ is selected for an immediate or future start.

You can also program a Future Stop time after you have started the datalogger, by checking Future Stop 'At' and filling in the desired stop time. Select ⊗ to apply the Future Stop time (it should say Future Stop below the icon). The Stop Time should be shown in the Datalogger Status section.
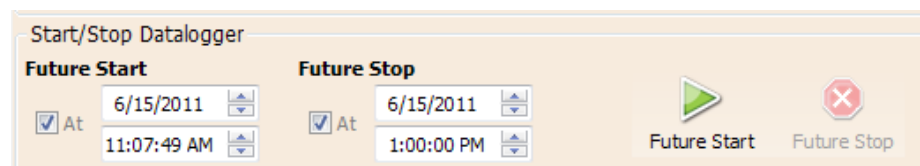
Figure 5-16 Future Stop Setting

It is critical to note that when Leveloggers log data in Slate mode, it means they will record data until stopped or their memory is full. When the memory fills, the datalogger will stop recording. For this reason, it is important to determine, based on your start time and sampling rate, the date and time at which the memory will be full and the datalogger will stop recording. Levelogger Edge units record in Slate mode if Event, Schedule, or Compressed logging, but in standard Linear mode they can be set to Slate or to Continuous logging.

5.9 Levelogger Gold Setup

This Section briefly describes the Levelogger Gold and Barologger Gold setup.
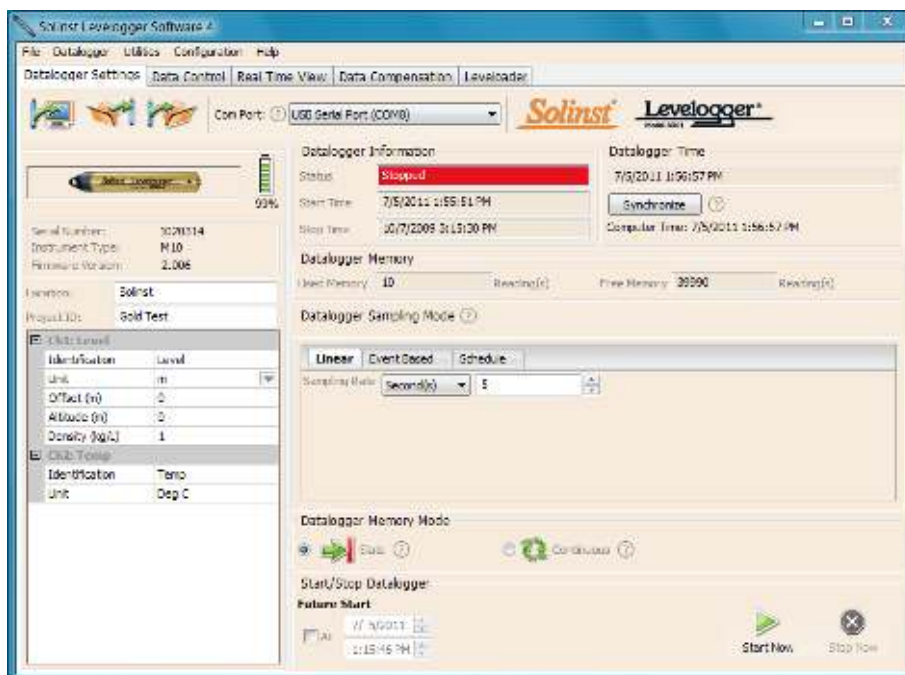
Figure 5-17 Levelogger Gold Settings

Select the appropriate COM or USB Port for the connected communications device from the centre drop-down menu.

Click [icon] to retrieve the current settings from the connected datalogger.

Channel Information

Level Channel (Ch1)

- **Identification** describes the measurement parameter of the channel and has already been configured as 'LEVEL'. The channel can be renamed to suit each project. The channel monitors water column equivalent pressure. The Identification field will be the channel heading, data column heading and graph line name when viewing the data. The Identification is limited to 32 characters.
- **Units** refers to the channel's units of measurement. There are three units of measure available for the user to select: cm, m or ft. When the user changes the unit, the value of the range and altitude will change according to the Unit Conversion formula. Note that when a metric unit is used, the unit of altitude is meters. When feet are the level channel units, feet are the units of altitude.

- **Offset** refers to an offset correction, such as the distance between the tip of the Levelogger and the monitoring well cap or static water level. It is recommended that the value of 0.00 be used for offset as this keeps all subsequent readings relative to the tip of the Levelogger. The offset range for Levelogger Gold and Barologger Gold units is -1000 to 16400 ft or -300 m to 5000 m.

- **Altitude** in feet or meters above sea level, at which the logger is actually deployed, is input in the altitude field. Water column equivalent pressure decreases with altitude at a rate of approximately 1.2:1000 in the lower atmosphere below 5000 m. You can compensate for this by entering an elevation between -1000 ft below sea level and 16,400 ft (or -300 m and 5000 m) above sea level. The readings will then be automatically compensated for elevation.

- **Density Adjustment** is used to adjust the range of the Levelogger based on the sample fluid density. The range for the density adjustment is from 0.9 kg/L to 1.1 kg/L.

Temperature Channel (Ch2)

- **Identification** describes the measurement parameter of the channel and has already been configured as 'TEMPERATURE'. The channel can be re-named to suit each project. The Identification field will be the channel heading, data column heading and graph line name when viewing the data. Identification is limited to 32 characters.

- **Unit** refers to the channel's unit of measurement. The Levelogger Gold and Barologger Gold measure in °C only.

Sample and Memory Modes

Sample Mode, allows you to choose the sampling measurement type. Options are Linear, Event-based and Schedule.

- **Linear** refers to a set time interval between collection of readings. Sample Rate can be any number from 0.5 seconds to 99 hours. The Levelogger Gold and Barologger Gold can store 40,000 readings of level and temperature.

- **Event Based** sample collection is the most memory efficient means of data collection. In Event mode, the Levelogger will activate every sampling interval defined and check if readings have changed by the selected threshold (Change) from the last recorded reading. For the Levelogger Gold, 'LEVEL' or 'TEMPERATURE' is the selected parameter where change is monitored. The Levelogger will record a new reading only if the specified change in the parameter has occurred.

- **Schedule Sampling** allows you to select a logarithmic style sampling schedule adapted to the needs of each application. Schedule Sampling is set by using the plus and minus buttons to add or subtract line items in the Schedule window. The maximum number of line items in a schedule is 30, each with its own sampling interval of seconds, minutes or hours and duration of seconds, minutes, hours, days or weeks.

! NOTE

In Event-based sampling mode, the Levelogger Gold has a total memory of 25,000 readings of level and temperature

! NOTE

An important reminder for Event-based sampling is that, although actual memory usage in stable water level conditions may be relatively small, battery power consumption is partially a function of the sample reading rate. Therefore, a small sample reading interval will consume battery power at a higher rate whether readings are stored or not.

Memory Mode selection will be grayed-out if not in Linear Mode sampling. When using a Levelogger Gold in Linear Mode, there is a choice of **Continuous** logging (wrap around) or **Slate** logging. In Continuous logging the new log is started at the end of any previous log and continues logging, eventually recording over the first logged data. As one of the download options is to 'Append Data', Continuous logging can be a preferred choice when logging long-term. In Slate logging the new log is also started at the end of any previous log, but will stop recording after 40,000 readings, so that the beginning of the current log will not be written over.

Starting and Stopping the Levelogger

There are two ways to start logging: **Start Now** or by programming a **Future Start** time.

To start logging immediately, do not fill in a Future Start time and click, . It should say Start Now below the icon to indicate an immediate start. Any changed settings will automatically be applied to the datalogger, and it will start logging. Datalogger Status will change from Stopped to Started.

After the datalogger is started, and begins collecting readings, the Start icon will be greyed out, and only the Stop icon and Future Stop settings will be active.

Check **Future Start** 'At' to set logging to start at a later date and/or time. This Start mode is referred to as Future Start in the Status field. Click to apply the Future Start time and any changes to the datalogger settings.

When the Future Start time is reached, the datalogger will start logging and the Status will change from Future Start to Started.

To stop the datalogger immediately when it is logging, click , (it should say Stop Now below the icon).

The Levelogger can be stopped at any time before it reaches the maximum reading capacity. **Starting again begins a new recording session and clears previously stored data readings.**

It is critical to note that when Leveloggers log data in Slate mode, it means they will record data until stopped or their memory is full. When the memory fills, the datalogger will stop recording. For this reason, it is important to determine, based on your start time and sampling rate, the date and time at which the memory will be full and the datalogger will stop recording. Levelogger Gold units record in Slate mode if Event, Schedule, or Compressed logging, but in standard Linear mode they can be set to Slate or to Continuous logging.

Figure 6-1
LTC Levelogger Junior

6 Conductivity Calibration

The LTC Levelogger Junior conductivity sensor must be calibrated for reliable conductivity measurements. Calibrate for conductivity at the start of each new monitoring project or at a minimum each new monitoring season (twice a year).

Calibrating the LTC Levelogger Junior again directly after the monitoring project or season will provide information on the degree of conductivity deviation during the project or season. If necessary, readings can be corrected for any conductivity deviation in a spreadsheet program after the data has been exported.

The process of conductivity calibration is performed automatically by use of the Calibration Wizard. You place the LTC Levelogger Junior in a specified calibration solution and follow the steps provided by the wizard. Conductivity calibration solutions are available from Solinst or any laboratory supply outlet.

The LTC Levelogger Junior has an 80,000 µS/cm conductivity range and a calibrated range from 500 to 50,000 µS/cm. It can be calibrated at up to 3 calibration standard points:

- 1,413 µS/cm
- 5,000 µS/cm
- 12,880 µS/cm

The solution(s) must be between 10°C and 30°C during actual calibration. Temperature should remain stable during the 10 - 20 seconds it takes to perform each calibration.

Ensure that the calibration solution covers the entire sensor cell and the logger is agitated to release entrapped air bubbles.
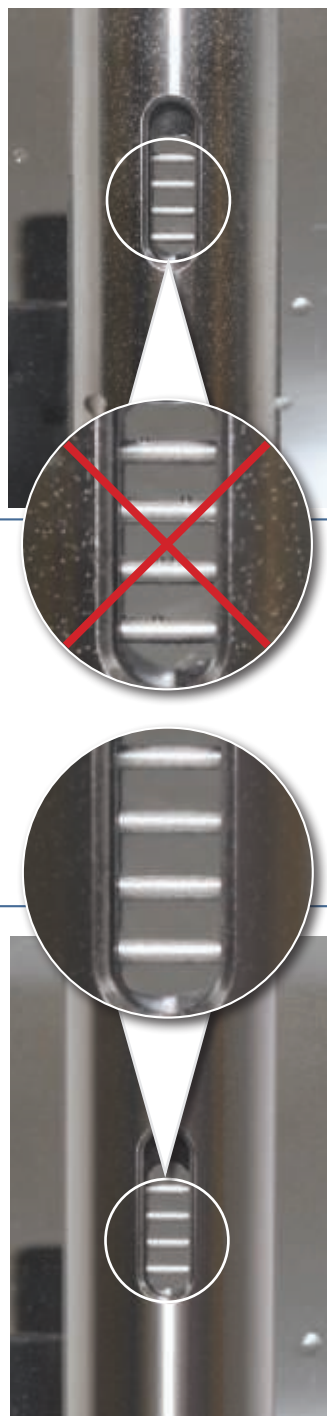
Start the Calibration Wizard by clicking the Conductivity Cal tab and retrieve the settings from the attached LTC Levelogger Junior by clicking [icon].

Stop the LTC Levelogger Junior by clicking [icon].

The wizard will guide you through the calibration process. You can exit the wizard after any step to cancel the calibration session.

Introduction: The LTC Levelogger Junior must be connected to the computer with an Optical Reader during the entire calibration process and **must be in the stopped mode**. Ensure you use fresh calibration solution and allow thermal equilibration of the solution during the process. Also ensure no air bubbles are present on the sensor and that the pins are clean.
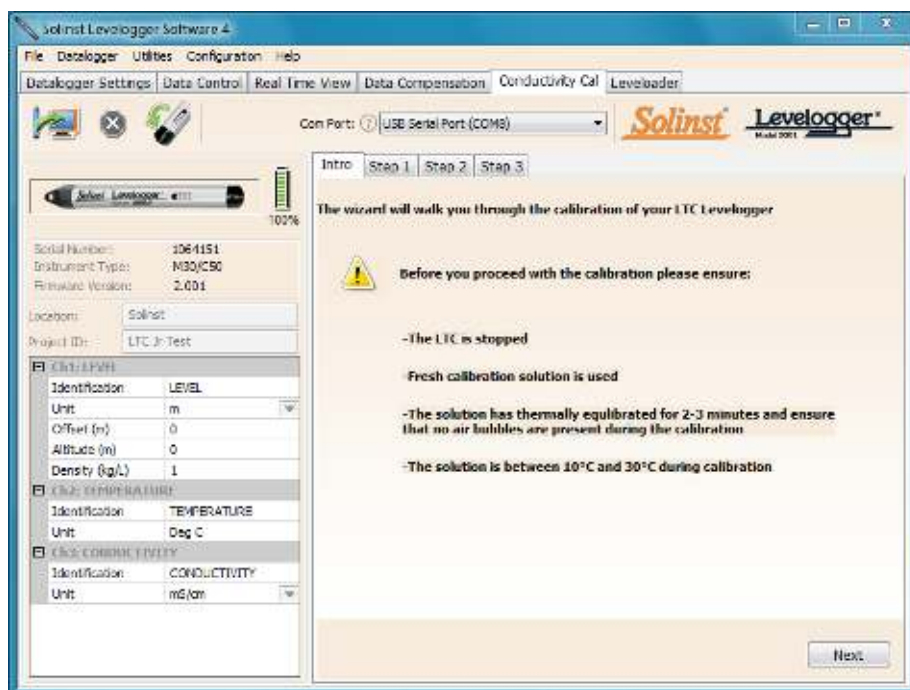
Figure 6-2 LTC Levelogger Junior Calibration Wizard Introduction

1) **Setting the Temperature Coefficient:** The default setting for the Temperature Coefficient is 2.00. If the conductivity solution you are using to calibrate the LTC Levelogger Junior states a different temperature coefficient on the label, please input that number into the Temperature Coefficient field.
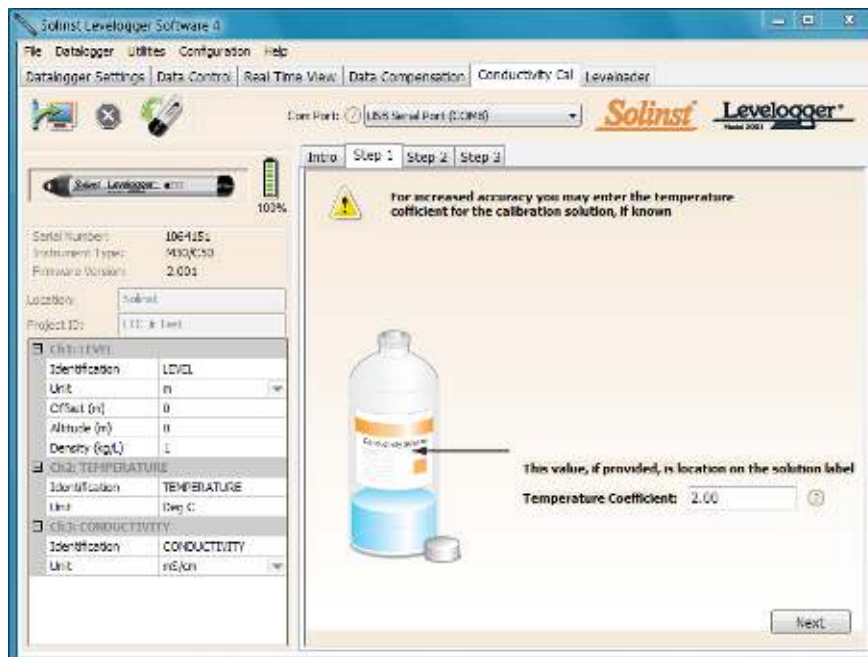
Figure 6-3 LTC Levelogger Junior Calibration Wizard Step 1

2) **Setup:** The Levelogger Software requires the user to choose the calibration solutions. You can choose up to three solutions for a multipoint calibration of the LTC Levelogger Junior. Ensure the solutions are ready in the calibration beaker or container. Start the calibration by selecting Next.
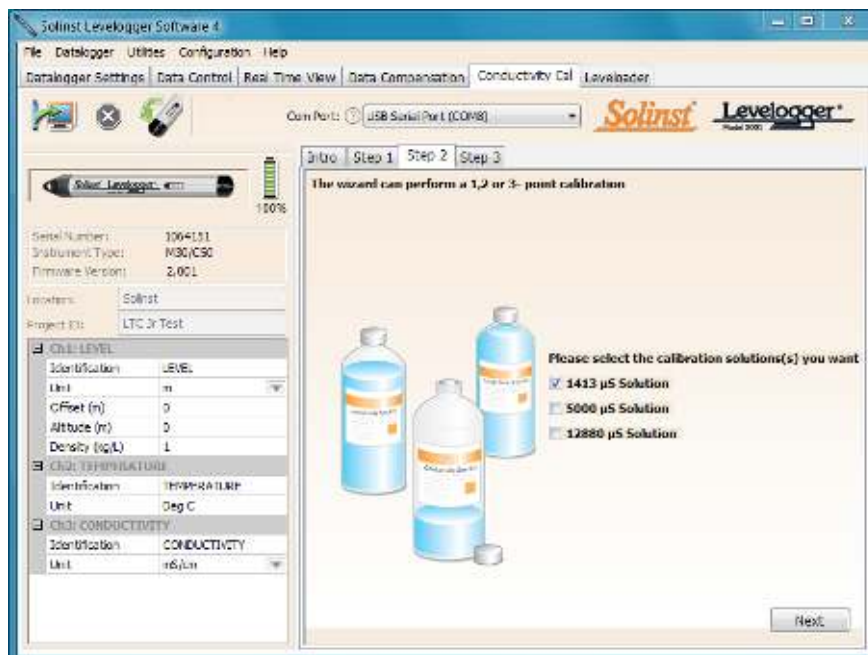
Figure 6-4 LTC Levelogger Junior Calibration Wizard Step 2

3) **LTC Levelogger Junior Rinsing Process:** Use DI water to rinse the LTC Levelogger Junior first and then rinse the LTC Levelogger Junior with the displayed calibration solution. Use fresh solution for calibration, and immerse the LTC Levelogger Junior. Lightly tap the Levelogger to remove any bubbles from the sensor. Allow 2-3 minutes, then select next to calibrate.
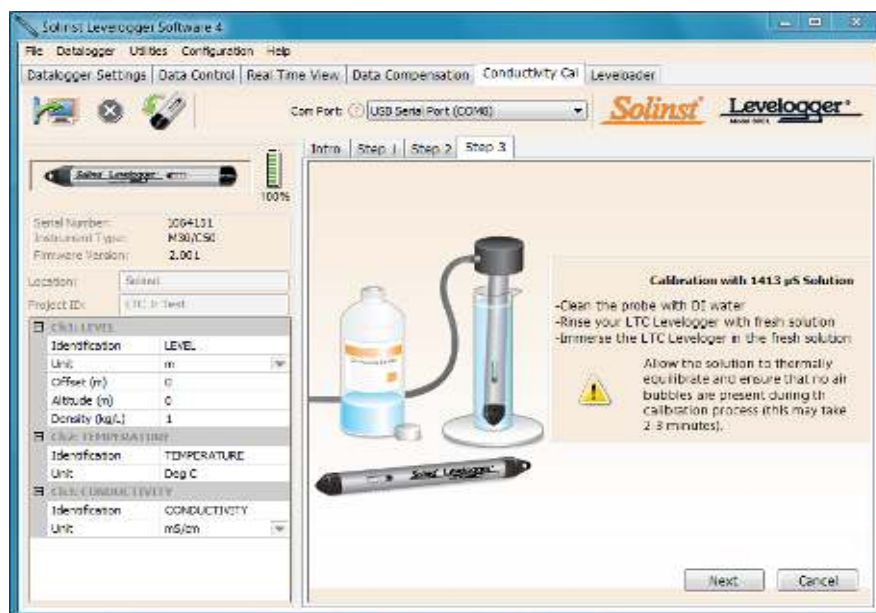
Figure 6-5 LTC Levelogger Junior Calibration Wizard Step 3
(example of window calibrating with 1413 µS/cm solution)

NOTE

Always remember to use fresh solution, remove all bubbles from the sensor pins, and allow for thermal equilibration of the sensor before proceeding.

NOTE

Once the calibration is complete for the first solution of a multipoint calibration, the Calibration Wizard will then go back to the beginning of Step 3 to start the rinsing process for the next solution selected.

Calibration: Since all standard calibration solutions state conductivity at a standard temperature of 25°C, the LTC Levelogger Junior can account for temperature differences between 15 - 30°C when you calibrate the unit. The LTC Levelogger Junior will compare the current temperature and conductivity readings against the temperature corrected standard solution. When a single-point calibration is successful the process is completed. If a failure does occur within the single-point calibration procedure, the LTC Levelogger Junior will default back to the last pre-calibrated state. When conducting a multipoint calibration, once the first calibration point is successful the process repeats itself to the next calibration point (back to the beginning of Step 3). If a failure does occur within the multi-point calibration procedure, the LTC Levelogger Junior will accept all of the successful calibration points and default back to the last pre-calibrated state for any failed ones.

Figure 6-6 LTC Levelogger Junior Calibration Successful

6.1 Restore Factory LTC Levelogger Junior Calibration

An LTC Levelogger Junior can be set back to original factory calibration settings for conductivity at any time, using this function. If you suspect that user calibrations are not working properly, you can restore the LTC Levelogger Junior to its original factory settings and then perform a "first-time" conductivity user calibration to maximize accuracy.

To execute this function, simply click the Restore Factory LTC Calibration button, with the LTC Levelogger Junior connected to the PC.

7 Data Control
(Downloading and Viewing Data)

Click the Data Control tab on the Main window. From the Data Control tab you can download data from a Levelogger, display data in tabular or graphic format, and save and export data files.

NOTE

When you click on a data point in the graph, the corresponding data point will be highlighted in the table. You can also highlight a section of data in the graph.
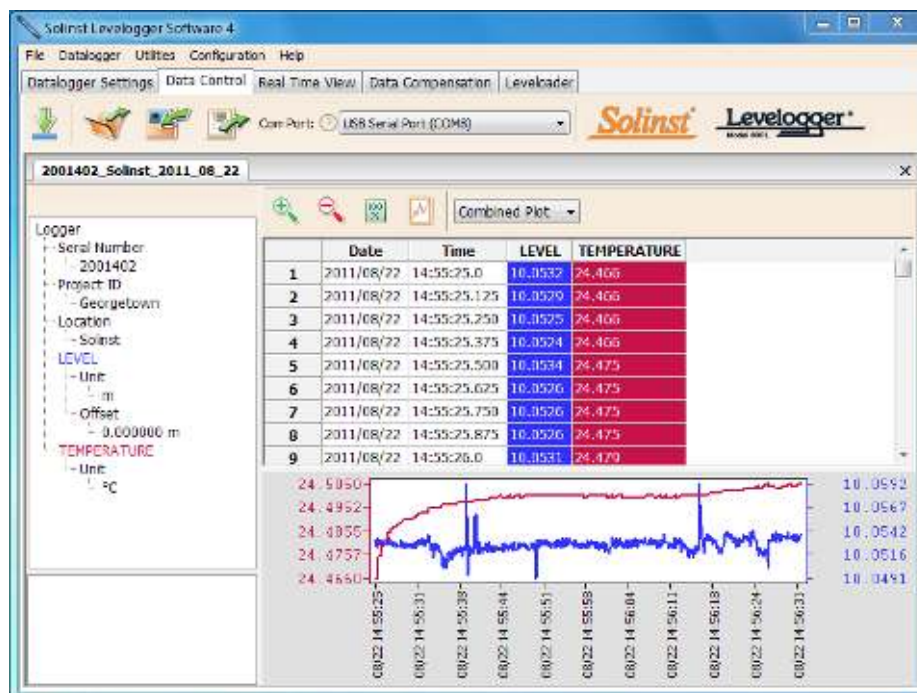
Figure 7-1 Data Control Tab

Click to open a *.xle or *.lev file. Multiple files can be opened at the same time and are available for viewing by clicking the File Name Tab on top of the data table. All the Levelogger settings and the channel information effective during data collection are shown on the left of the window. The bottom left section of the window will display the channel information of an opened compensated file (see Section 8).

7.1 Downloading Options and Saving Data Files

7.1.1 Default File Format

The default file type for Levelogger Software Version 4 and up is *.xle. Previous Levelogger Software used *.lev files as the default. The *.xle file type is a *.xml format, which allows for enhanced functionality. The *.xle files can be exported as *.xml files, which can be integrated into external database programs.

The *.lev files of previous Levelogger downloads are compatible with Levelogger Software Version 4 and up, however, *.xle files are not compatible with previous software versions. To ensure compatibility, all Levelogger Software versions allow data to be exported as *.csv files for use in external spreadsheet programs. See Section 7.3 for Export options.

7.1.2 Downloading Data

Click 🔽 from the Data Control tab to download data from a connected datalogger. There are four options for downloading data. They are: **All Data, Append Download, Partial Download and Recover Previous Log**.

If you select **All Data**, the program will download all the data from the current logging session of a datalogger into a *.xle file.

The default directory for saved data is in the 'Data' folder: <C:\Program\Files\Solinst\Levelogger4_0\Data>.

If you select **Append Download**, the program will append the data in an opened *.xle file from the datalogger. The opened *.xle file and the attached datalogger should have the same serial number and start time, otherwise an error will occur.
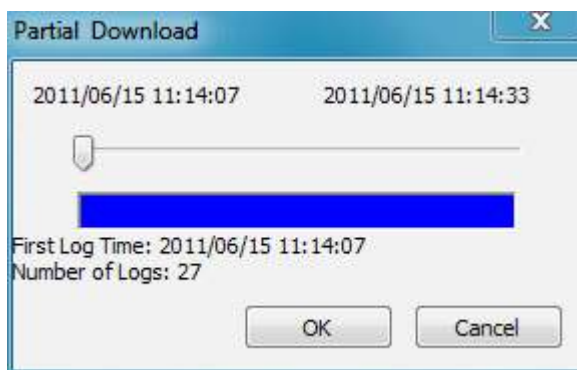
Figure 7-2 Partial Download Window

If you select **Partial Download**, a Partial Download Selection Window will open. The window shows the time stamp of the first and last reading in the logging session. Use the slider to select the time interval you would like data from. Once you click OK, all the data within that time will be downloaded to a *.xle file.

If you select **Recover Previous Log**, the software will try to recover the data from the previous log session and download the data to a *.xle file.

Once the data is downloaded from a Levelogger, it is automatically saved in a temporary file.

7.1.3 Saving Data

Click ![icon] to save the data in a specific *.xle file.

The default directory for saved data is in the 'Data' folder:
<C:\Program\Files\Solinst\Levelogger4_0\Data>.

However, the default directory for saved files can be changed by clicking the Configuration menu at the top of the program window, selecting 'Application Settings' and inputting or navigating to a different folder destination. If an error is experienced in saving your first data file such as depicted in Figure 7-3, you may not have file writing privileges to the default directory. It this case, create and set as the default file save folder, a new Levelogger data folder within the My Documents folder and attempt the file save procedure again.
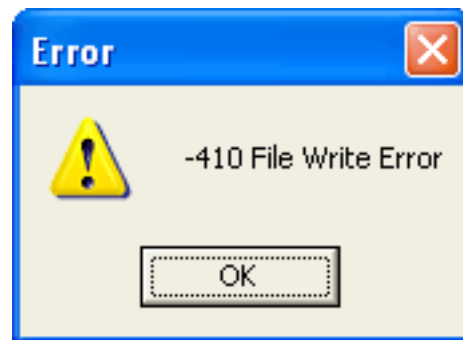
Figure 7-3 File Write Error Message

7.2 Graph Manipulation and Zoom Function

To perform the Zoom In function on the graph, click ![zoom in icon] .

To perform a Zoom Out function on the graph click ![zoom out icon] . Click ![100% icon] to undo all the zoom functions.

The Zoom functions can also be used for data selections in the graph.

Click ![graph icon] to open the Graph Option Dialog. The Graph Dialog is shown in Figure 7.4.
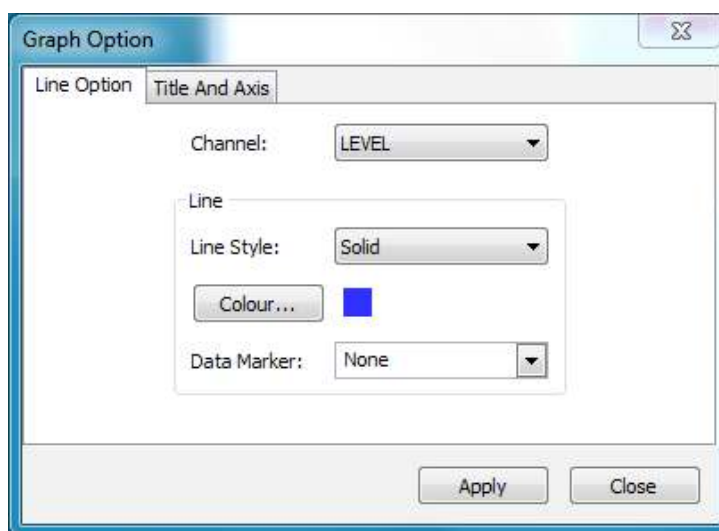
Figure 7-4 Line Option Window

The Line Option is used to adjust the style and colour of the line in the graph for each channel. The user can also select the shape of the data marker or remove the data marker.
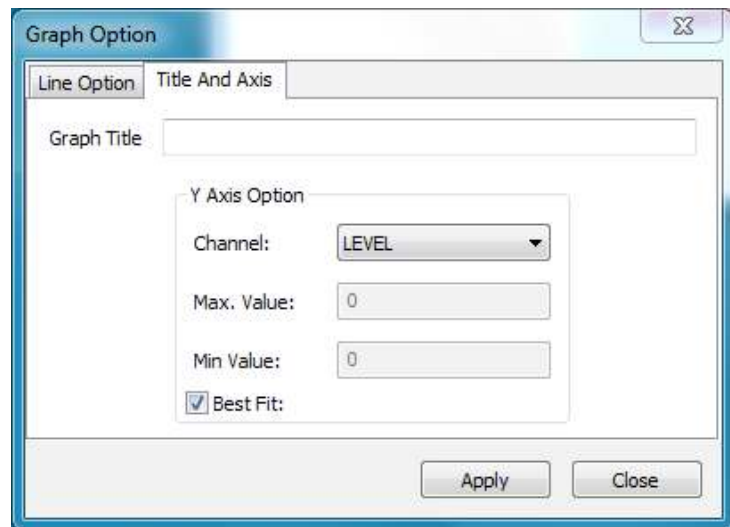
Figure 7-5 Title and Axis Option Window

The Title and Axis Option is used to enter the title of the graph and change the Y axis label or user selected scale. Check the Best Fit box to enable the software to determine the best fit scale. If the Best Fit box is not checked, the user has to enter a maximum and minimum value of the selected channel. The X axis is logging time.

There is the option to show Combined Plot graphs or Separated Plot graphs of the data. Choosing a Combined Plot will show the data from each of the channels in one graph. The Separated Plot option will show a separate graph for each data channel.
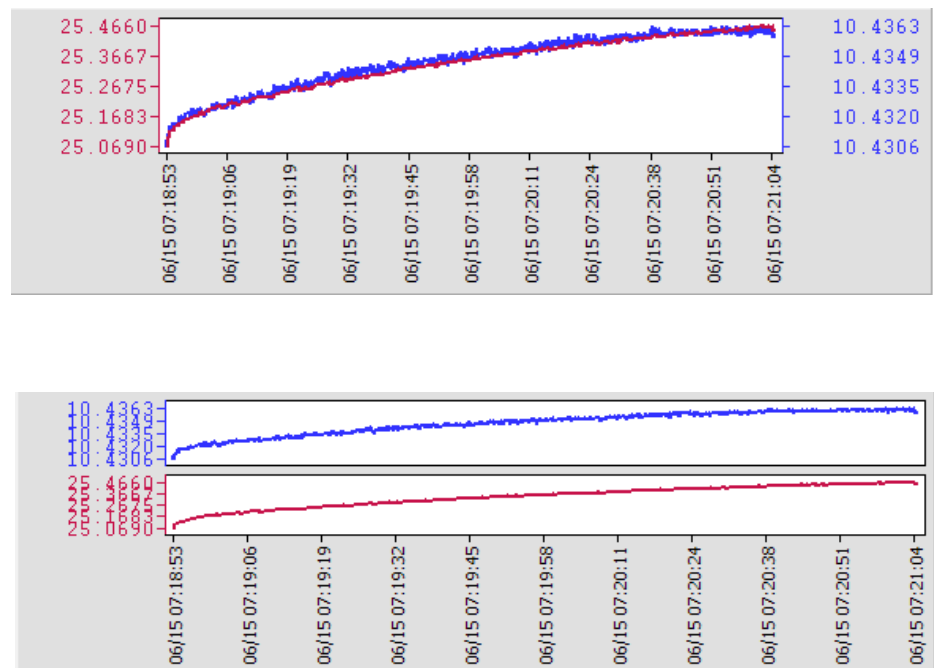
Figure 7-6 Combined and Separated Plot Graphs

There is also the option to view more than one graph at a time. Click and drag a File Name Tab and drop it when you see a shaded area on the window to open a separate graph of that data file. You can view any number of graphs at one time by re-sizing your window as required.
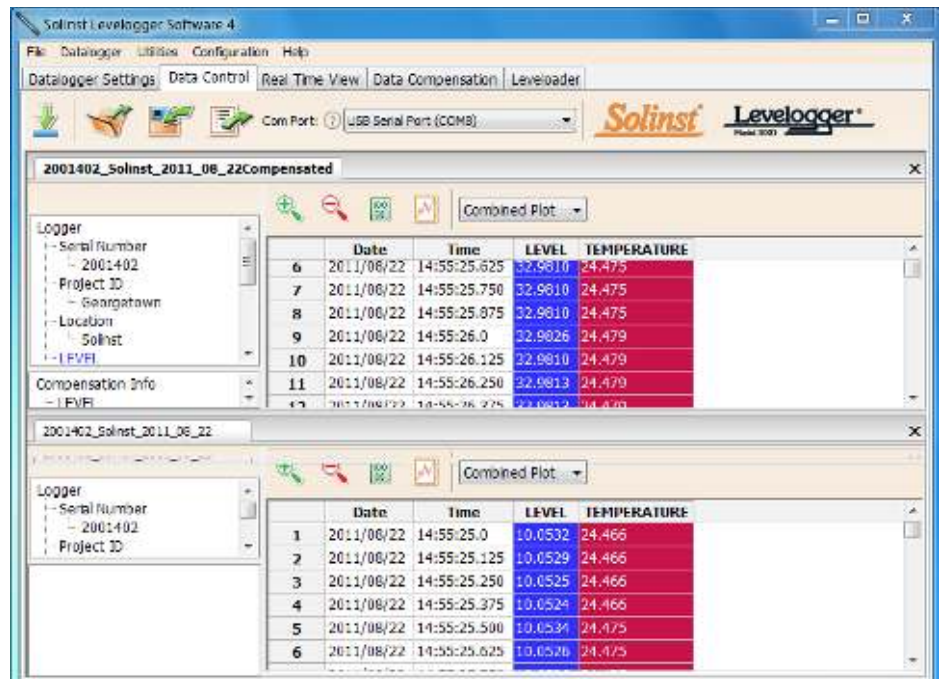
Figure 7-7 Viewing Two Graphs

7.3 File Export and Print Function

Data can be exported in *.csv (comma separated value) file format or *.xml (extensible markup language) file format by clicking File > Export > Data or

The *.csv and *.xml file formats are supported and can be imported by most spreadsheet and database programs.

Also, the data graph can be exported to a *.bmp file or a *.wmf file by clicking File > Export > Graph.

The Datalogger Settings, data table and data graph can be printed. Click File > Print Preview, to open the Print Preview window. Figure 7-8 shows the print preview of the Datalogger Settings. The Datalogger Settings are always on the first page of the document. The data graph is on the second page of the document and the rest of the document is the data table.

Click Print..., to open the print dialog. You can choose to print the entire document or just a selection. You can also click File > Print, to open the print dialog.
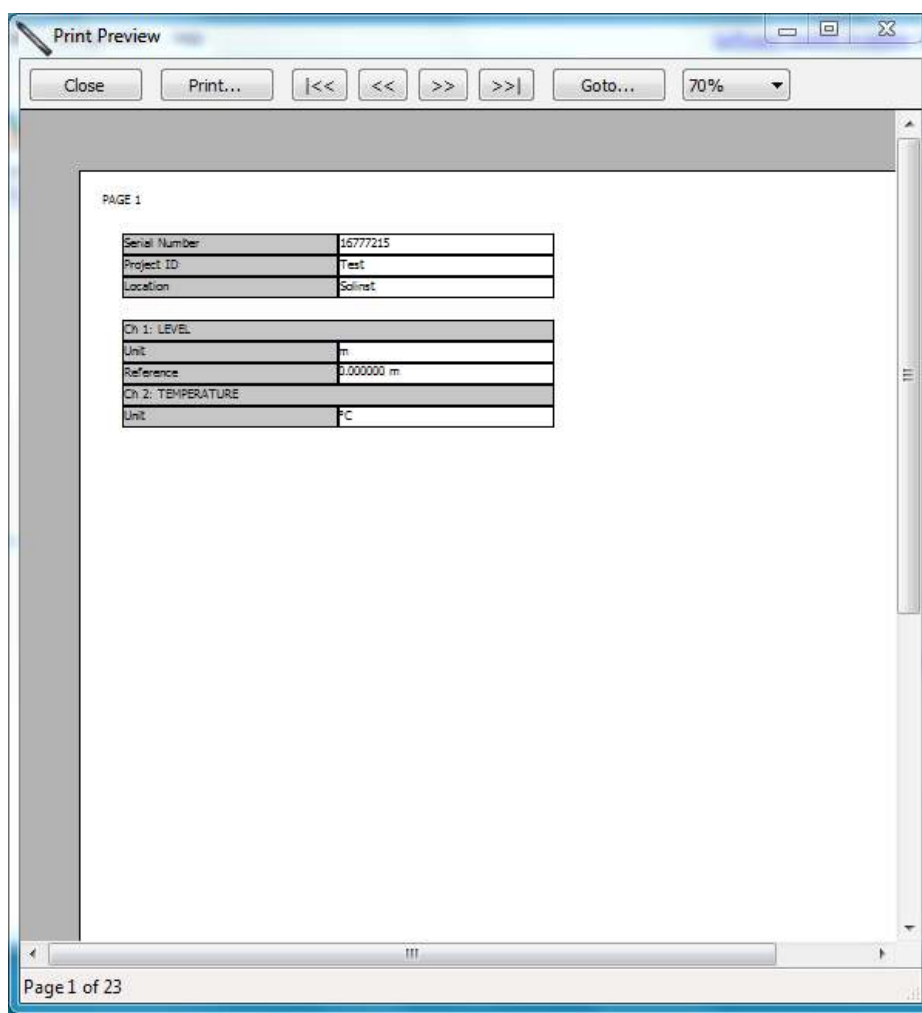
Figure 7-8 Print Preview Window

8 Data Compensation

Click the Data Compensation tab to open the Data Compensation Wizard.

In the first step of the wizard, check the Levelogger data file(s) you would like to compensate. Any files you have open in the Data Control tab will be on the list and checked off.

Use the directory on the left of the window or click ✔ to select any other Levelogger data files you would like to compensate, and ensure they are checked off. Select Next to continue.

Figure 8-1 Data Compensation Wizard - Step 1

There are eight Data Compensation options available: Barometric Compensation, Manual Data Adjustment, Unit Conversion, Offset, Altitude, Density Adjustment, Barometric Efficiency, and Conductivity Conversion. However, only the options available for your opened Levelogger file type will be active (e.g. Conductivity Conversion is only available for LTC Levelogger Junior files).

In this step, check the type(s) of compensation(s) you want to perform. Note, if multiple Levelogger files have been checked off in the first step, Barometric Compensation will be the only option available. All other options are only available when a single Levelogger file is selected for compensation.
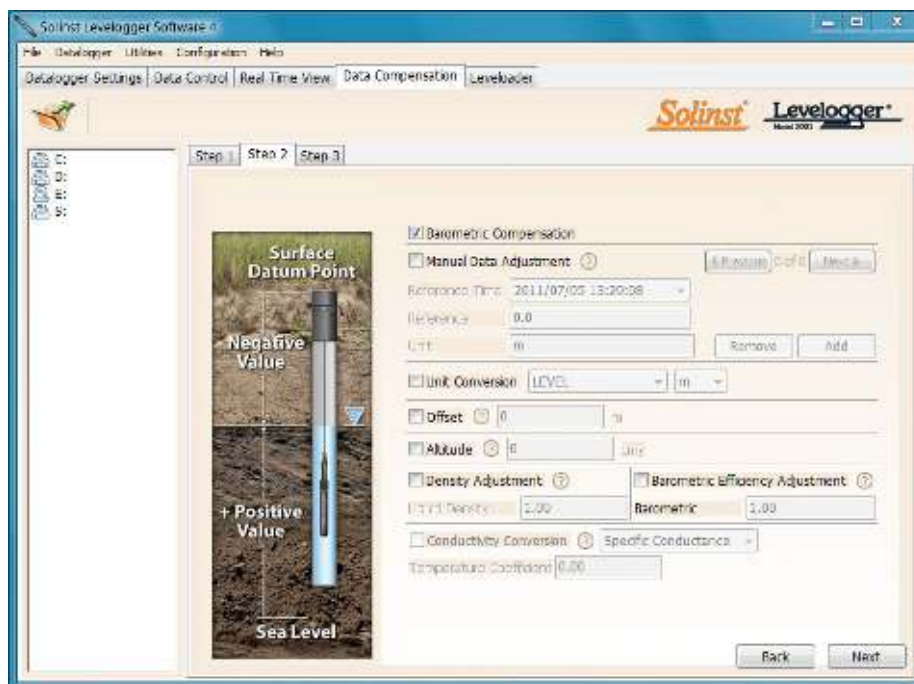
Figure 8-2 Data Compensation Wizard - Step 2

Barometric Compensation simply subtracts the barometric reading from the corresponding Levelogger reading(s). If there is an inconsistency of the time stamp between the Barometric file and the Levelogger file(s), a linear approximation on the barometric data will be performed, or an error may occur.

Manual Data Adjustment allows you to enter a manual water level measurement as a Datum Reference or field zero, which all Levelogger water level readings can then be adjusted to.

If the Datum is above water level (e.g. top of well casing), the datum must be input as a negative value. If the Datum is below water level (e.g. sea level), a positive value is input. The date and time of measurement of the Datum Reference must be recorded to complete the adjustment. This Reference Time must replace an actual reading in the Levelogger file, and is selected from the drop-down menu showing all time stamps in the Levelogger file.

⚠ NOTE

To perform a Manual Data Adjustment, only a single Levelogger file you want to adjust can be selected in Step 1.

You can make multiple adjustments to one data file by selecting 'Add' to enter another Datum Reference. All readings after this Reference Time, will be adjusted to this second Datum reference point. You can add as many adjustments to one Levelogger data file as you would like (as long as it doesn't exceed the total number of readings in that file).
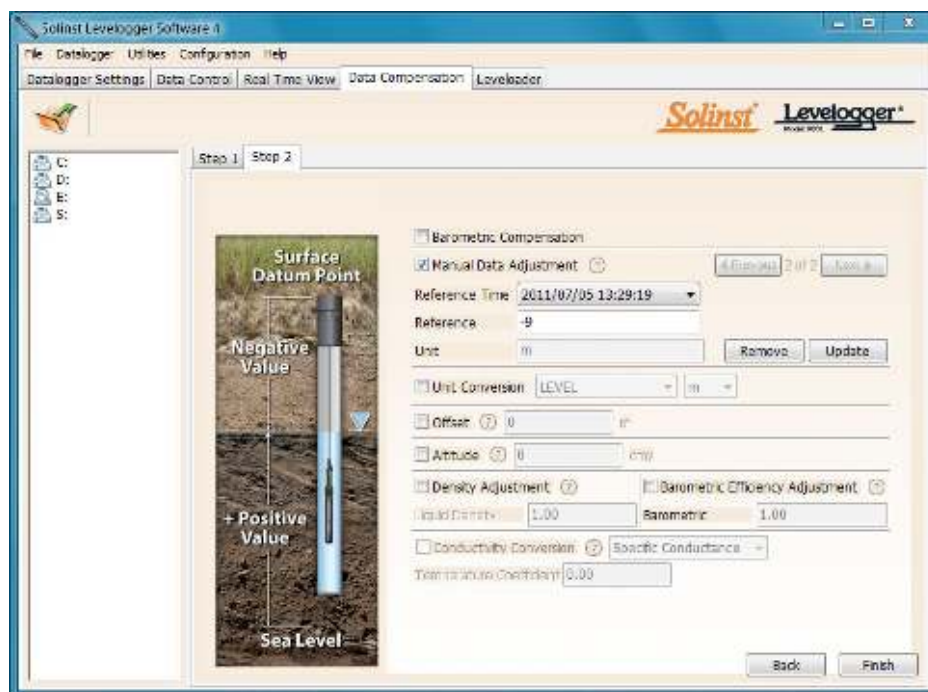
Figure 8-4 Manual Data Adjustment

Figure 8-3 Reference Datum

Unit Conversion allows you to convert water level readings in a Levelogger file to different units (m, cm, ft, kPa, bar, or psi), or temperature readings to °C or °F.

Offset allows you to enter any value, positive or negative, which will be added to each reading in the selected Levelogger file to offset by that amount.

Altitude is used to correct for elevation. Water column equivalent pressure decreases with altitude at a ratio of approximately 1.21/1000 in the lower atmosphere below 5000 m. You can compensate for this by entering an elevation between -1000 ft below sea level and 16,400 ft (or -300 m and 5000 m) above sea level.

Density Adjustment corrects the range of the level channel in the data file based on a user input adjustment of fluid density. The range of the density adjustment is from 0.9 kg/L to 1.1 kg/L.

Barometric Efficiency Adjustment is used to proportionally adjust Barologger data in relation to a particular Levelogger. Barometric efficiency is often expressed as a percentage or proportion. The input field is proportional and has a default value of 1.00. For more information about Barometric Efficiency, see Section 10.1.3. The barometric efficiency can be set from 0.01 to 3.00.

Conductivity Conversion allows you to convert raw Conductivity readings from an LTC Levelogger Junior, to Specific Conductivity (conductivity that is temperature compensated to the standard of 25°C). The Temperature Coefficient default for Specific Conductivity is 2.00. The Temperature Coefficient should not be adjusted, unless you know the value specific to the solution you are measuring. You can also convert Conductivity readings to Salinity values.

After you have selected the desired compensation(s), click next to select the Barologger file you want to use for Barometric Compensation, or if Barometric Compensation was not selected, click Finish or Finish and Open to complete the selected compensation(s).

If you selected Barometric Compensation in Step 2, the third step will be to select the Barometric file you want to use to compensate the selected Levelogger files. Click Finish or Finish and Open to complete the compensation(s).
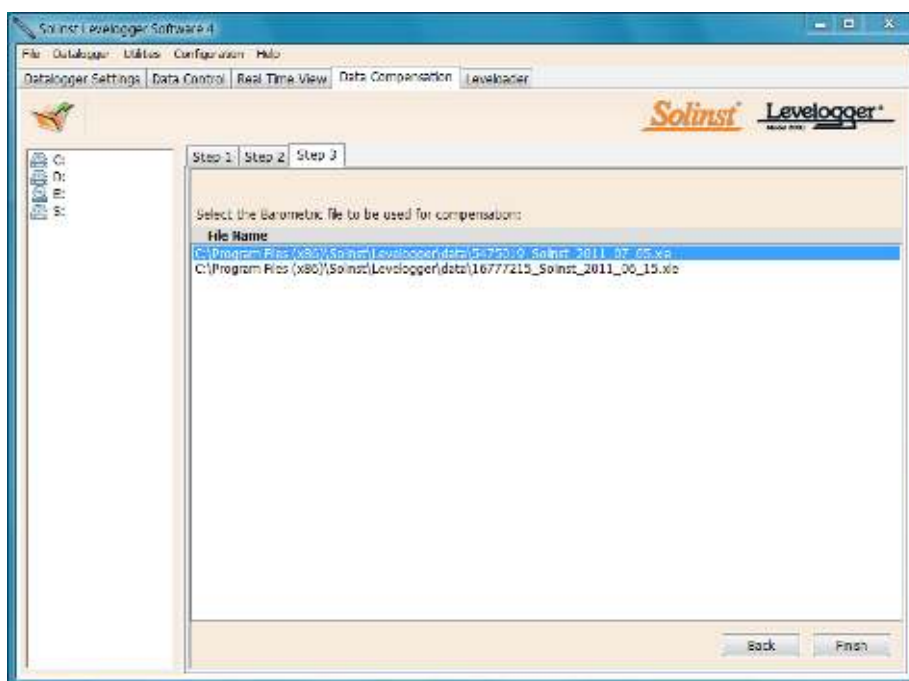
Figure 8-5 Data Compensation Wizard - Step 3

The compensated data will be saved in a new *.xle file. The default file name will be the <original Levelogger file name> with the word <compensated> added to the file name prefix. Alternatively, the user can name the compensated file. Do not change or delete the file extension. The compensated file can be opened from the Data Control tab, or if Finish and Open is selected, then the compensated file will automatically open in the Data Control tab. All data files are saved to the default location: <C:\Program Files\Solinst\Levelogger4_0\Data> .

Figure 8-6 Viewing Compensated Data

8.1 Manual Barometric Compensation

This section describes how to perform manual barometric compensation on Levelogger Edge data files when a Barologger was not dedicated as a barometric recorder.

For short term tests during which the barometric pressure varies insignificantly, the collection of continuous barometric data may be unnecessary. In this event, take a reading from an open air exposed Levelogger prior to running the short term test and record this level. This level represents the barometric pressure. Similarly, at the end of your test, take another barometric reading and record this measurement. After the submerged Levelogger data has been exported to a spreadsheet program compensate your submerged Levelogger data files for barometric pressure. If no appreciable change in barometric reading occurred, you may write in the first cell of a new column, a simple calculation that subtracts your barometric reading from the submerged data file, then copy and paste this calculation to all the cells in that new column. The new column will represent the barometrically compensated liquid level.

Barometric data can be collected on site using a recording barometer or from a local weather station. To accomplish an accurate manual barometric compensation, the atmospheric pressure station should not be greater than 20 miles (30 km) away and within an elevation change of 1000 ft (300 m). In addition, the date and time of the barometric data should cover the range of data collected by the Levelogger. If setting up the barometer, set the recording interval to that of the Levelogger sampling interval or some multiple of the Levelogger interval. To compensate submerged Levelogger data using barometric data collected from an on site barometric datalogger or a nearby weather station, these steps must be taken:

1) Export both the Levelogger data file and the barometric file to a spreadsheet.

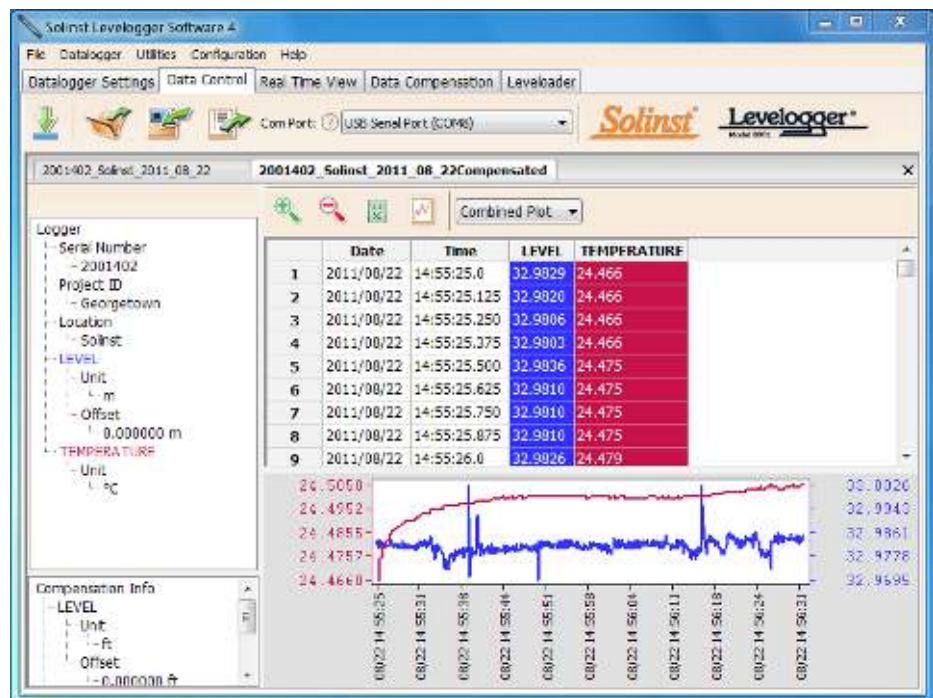2) In the spreadsheet, ensure both files are using the same units. If your Levelogger data was recorded in m, cm, or ft, convert the barometric data column from its barometric measurement units (typically atm, mm Hg, psi, mbar or kPa) to feet or meters of water column equivalent using the conversion factors in Table 8-1. (There is also the option to initially set up your Levelogger Edge to record in psi, kPa, or mbar, which could eliminate the need to convert data).

Table 8-1		
Common barometric units to water column equivalent conversions		
Barometric unit	**Water column equivalent (ft)**	**Water column equivalent (m)**
1 psi	2.3108	0.7043
1 atm	33.959	10.351
1 kPa	0.3352	0.1022
1 mm - Hg	0.04469	0.01362
1 in - Hg	1.1330	0.3453
1 mbar	0.03352	0.01022

Table 8-1 Common Barometric Units to Water column Equivalent Conversions

3) Once the units for each column are the same, subtract the barometric column from the Levelogger data to get the true net water level recorded by the Levelogger Edge.
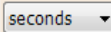
9 Real Time View

Click the Real Time View tab from the main software window (Figure 9-1). The purpose of this tab is to provide on-screen measurement as data is being recorded by the connected datalogger. The data is displayed in tabular and graphical format. All the channel information and Levelogger settings are displayed on the left of the window.

First, select a non-logged view rate [seconds ▾] [1 ⬍]. This rate can be set independently of the logging period of the Levelogger and does not interfere with any logging taking place in the Levelogger itself.

Checking, **Enable Manual Data Adjustment**, allows you to enter a datum/ field zero (e.g. depth to water level) to which the change in Real Time View level measurements are then adjusted against. This is only available when you are taking readings in m, cm, or ft.

Real Time View readings can be displayed as a graph or in tabular format. The same graphing options as the Data Control tab are available for Real Time View readings. Real Time View readings are being recorded within the Levelogger Software and prior to closing the window, they can be saved by exporting the data into a *.csv file, by choosing the file export option ▣➔ .

To start the current readings, click ▶ . Immediately the readings will be displayed.

To take a reading at any specific time, click the [Read Now] button and that reading will be added to the displayed data. To turn the Real Time View monitoring off, decide if you want to save the data as described above, and simply click ⊗ .

Figure 9-1 Real Time View Window

0.71"

Levelogger Edge
Measurement Line

0.59"

Levelogger Junior/LTC Junior
Measurement Line

0.56"

Levelogger Gold
Measurement Line
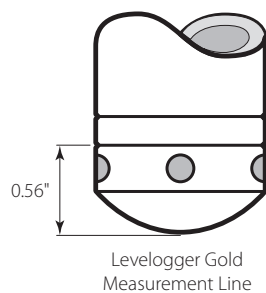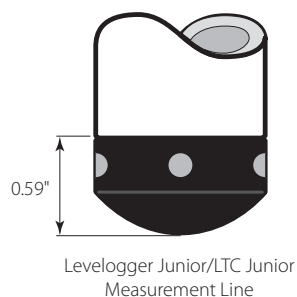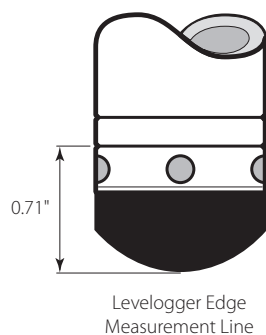
Figure 10-1

10 Installation and Maintenance of Leveloggers

10.1 Installation

Many options exist for installation of the Levelogger, but essentially these installation methods can be classified into two broad categories: free suspended or fixed installations.

1) In free suspended installations, the Levelogger is hung via suspension wire or Direct Read Cable from a well cap, or some fixed tie-off location, at the well head.

2) In fixed installations the Levelogger is fixed in place by a compression fitting, a clamping mechanism or simple metal straps.

It is recommended that the Levelogger be installed in a vertical orientation. However, inclined or horizontal installation is acceptable. The level sensor in the Levelogger is indicated by the machined line about the body of the logger just above the pressure access holes. The pressure transducer is oriented in a plane normal to the long axis of the body and detects pressure directed along the plane of the long axis (Figure 10-1). In vertical orientations, the sensor detects pressure above the pressure transducer line, where as in non-vertical orientations, the pressure zero point is proportional to the angle of inclination.

Care should be taken to avoid dropping the Levelogger against a hard surface. Leveloggers should always be installed with the installation cap on (if not using a Direct Read Cable), whether it is being suspended by it or not. This prevents unnecessary battery drainage and protects the optical eyes.

Make sure you properly estimate the maximum and minimum expected water levels during the monitoring period. You need to install your Levelogger so it remains submerged at all times, and ensure tha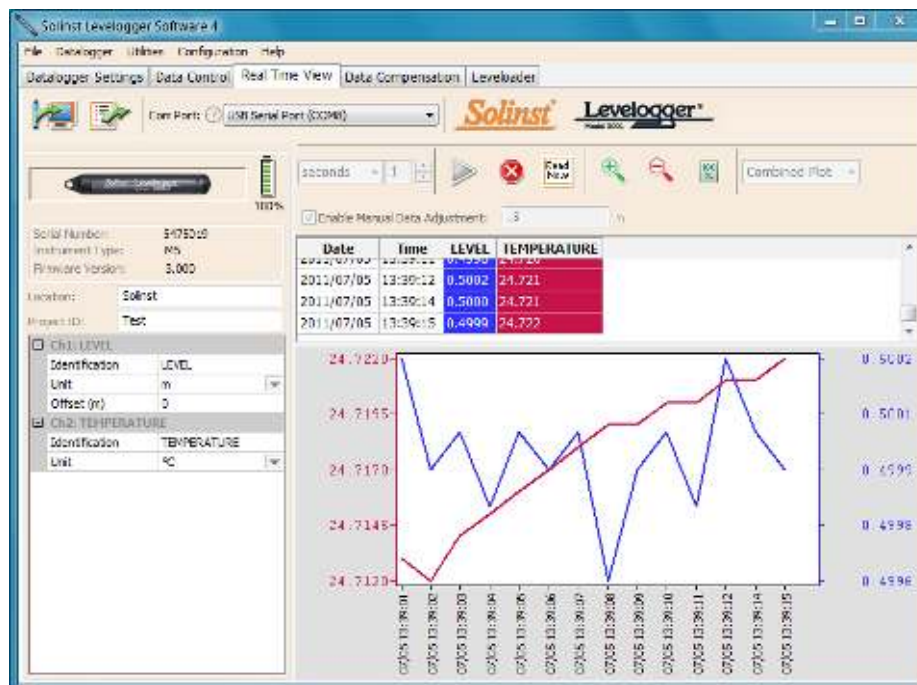t its maximum submergence depth throughout the monitoring period remains within its specified range. The pressure transducer can be damaged if the datalogger is over-pressurized by submergence greater than its level range. The Levelogger Edge is warranted to pressures up to 200% of its full scale level range (150% for the Levelogger Gold and Junior Models), however accuracy can not be guaranteed beyond its full scale.

Other important considerations when installing the Levelogger in pressurized or intermittently pressurized locations such as pressure vessels, pressurized pipes, pulse flow conditions, drop structures or near hydraulics works, is to keep in mind the potential effect of water or steam hammer and hydraulic jump. Water hammer is caused by an abrupt alteration of flow direction resulting in pressure surges. Steam hammer occurs when steam enters a cold pipe partially filled with water. The hammer effect has the potential to significantly increase hydraulic pressure possibly exposing the pressure sensor to pressures beyond its maximum rating. Hydraulic jump is a phenomenon that occurs when water is 'lifted' or 'ramped' by velocity or flow obstructions. Hydraulic jump causes turbulence and creates non-representative head conditions in the water column. Care should be taken to avoid logger installation at points susceptible to hydraulic jump.

Figure 10-2
Solinst 2" Locking Well Cap
for Wireline or Kevlar Cord
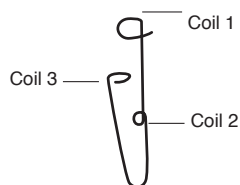
Diagram 1
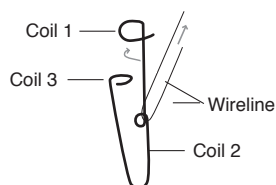
Diagram 2
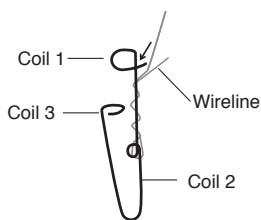
Diagram 3
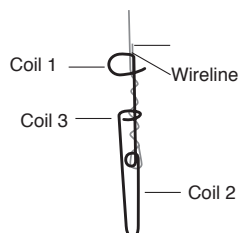
Diagram 4

Figure 10-3 Wireline Hook Installation

10.1.1 Free Suspended Installations

10.1.1.1 Suspension Wire/Rope Installation

When installing on a suspension wire or cord, the Levelogger is pre-programmed and started using the software. It is then deployed with the suspension wire or cord connected to the installation cap of the Levelogger to the underside of a well cap. The data is retrieved manually, by withdrawing the Levelogger, removing the installation cap and attaching an Optical Reader directly to the datalogger. Data is downloaded to a desktop or laptop PC or by using a Leveloader.

Solinst supplies stainless steel suspension wire assemblies including SS stranded wire and hooks available in a variety of lengths from 50 ft (15 m) to 500 ft (150 m), and Kevlar cord assemblies. Solinst also supplies the Model 3001 2" Well Cap Assembly from which the Levelogger can be suspended. An Adaptor for 4" wells also available (see Section 10.1.1.3).

This type of installation is applicable to both submerged and barometric record applications. Follow these steps to install the Levelogger using stranded cabling and hooks:

1) Loop the cable through the coil 2 of the hook assembly, then wind the looped strands several times around the hook shaft and pass through coil 1.

2) Pass coil 3 through the Well Cap eyelet or Levelogger/Barologger eyelet and snap coil 3 to the hook shaft.

3) If the Well Cap is not used then some secure tie-off point should be used or installed.

4) If installing a Barologger, ensure the suspension level is above the highest expected water level.

5) When retrieving data and/or reprogramming the Levelogger, extract it from the monitoring location, unthread the installation cap, interrogate and re-suspend the unit rechecking the security of the wireline clamps each time.
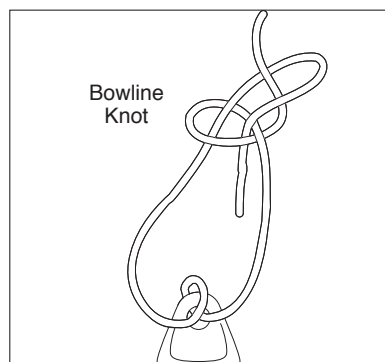
Figure 10-4 Bowline Knot Used to Connect Kevlar Cord to the Levelogger

Single Well Cap Option

Dual Well Cap Option

Figure 10-5
Solinst 2" Locking Well Caps for
Direct Read Cable Installation

Figure 10-6
Solinst Direct Read Cable

10.1.1.2 Direct Read Cable Assembly Installation

When installing using a Direct Read Cable Assembly, the Levelogger can be deployed before it is programmed and started with the software. The Levelogger is installed using a Direct Read Cable to a Direct Read Wellhead, where a PC Interface Cable is connected allowing the Levelogger to communicate with a desktop or laptop PC, or a Leveloader.

The Direct Read Cable system is composed of the ordered length of Direct Read Cable, the Model 3001 Well Cap Assembly (see Section 10.1.1.3) and the PC Interface Cable. The Direct Read cable threads to the Levelogger, while the socket at the opposite end of the Direct Read Cable fits into the specially designed Well Cap insert. The PC Interface Cable connects to the Direct Read socket at surface and to either a USB or RS232 port on the PC. While use of the Model 3001 Well Cap is recommended and convenient, it is optional as long as a satisfactorily secure alternative tie-off point is found for the Direct Read Cable. Follow these steps to install a Direct Read Cable Assembly to the Levelogger:

1. Remove the installation cap from the Levelogger, align and connect the optical socket (two glass 'eyes' using the alignment pin) of the Direct Read cable to the Levelogger by threading the coupling onto the Levelogger tightly.

2. The Levelogger and optical socket will fit through the hole in the Well Cap insert.

3. Remove the protective cap from the non-optical socket at the wellhead end of the Direct Read Cable, seat the socket in the Well Cap Insert and align and thread it to the round socket of the PC Interface Cable.

4. Connect the USB or RS232 socket of the PC Interface Cable to the USB or RS232 Com Port on your PC.

5. The two plugged holes in the Well Cap can be opened to provide an access port for a Barologger, as well as a water level meter probe.

> When removing a Direct Read Cable from a Levelogger, ensure you only twist the coupling. To avoid possible damage, do not twist the strain relief on the Direct Read Cable.

Strain
Relief

Coupling

Figure 10-7 Proper way to remove a Direct Read Cable from a Levelogger

10.1.1.3 Model 3001 Well Cap Assembly

The Model 3001 Well Cap Assembly is designed to fit 2" wells, and provides options for installing Leveloggers with wireline, Kevlar cord, or using a Direct Read Cable.

The well cap base provides a tight friction fit onto the well casing. The cap is secured to the base with a twist lock. For further security, a 3/8" (9.5 mm) shackle diameter lock can be used. The Well Cap is vented to allow for the equalization of barometric pressure in the well. Users can choose to permanently secure the PVC Well Cap to the well casing, using three screw points on the inner shoulder of the Well Cap Base.

For wireline or Kevlar cord suspension, simply use the suspension hook on the underside of the insert to secure the Levelogger to the Well Cap (*see* Section 10.1.1.1). To install using a Direct Read Cable, lower the Levelogger with the Direct Read Cable through one opening in the insert (*see* Section 10.1.1.2).

> **! NOTE**
>
> The insert has openings to hold two Direct Read Cables in the same well. If only one Direct Read Cable is used, the other hole provides access for Solinst Water Level Meters.

Figure 10-8 Model 3001 Well Cap Assembly (#110099)

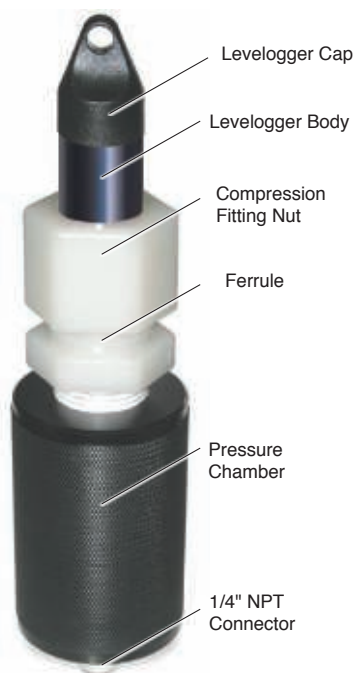Figure 10-9 If installing Leveloggers in a 4" well, a reducer assembly is available. (#110235)

Figure 10-10
7/8″ Nylon Compression Fitting with
1/4" NPT Connector

- Levelogger Cap
- Levelogger Body
- Compression Fitting Nut
- Ferrule
- Pressure Chamber
- 1/4" NPT Connector

10.1.2 Fixed Installations

10.1.2.1 Artesian Monitoring

Monitoring of artesian conditions in which the piezometric surface is above ground surface or more particularly above the top of well casing elevation using Leveloggers can be quite straight forward.

Continuous artesian conditions infer that the piezometric surface never drops below the level the ground surface or particularly the top of casing elevation and the casing is sealed with a sealed wellhead. In this case, where freezing is not a concern, the Levelogger need only be installed on the wellhead itself by means of a large compression fitting with a 1/4" NPT connector, as illustrated in Figure 10-10. Solinst can supply a 7/8" nylon compression fitting for this purpose. First, a 1/4" NPT hole is tapped into the wellhead. The user slides the Levelogger into the compression fitting, leaving about 1/4 of the logger body exposed above the fitting. The compression fitting nut is tightened around the Levelogger. The 1/4" NPT connector on the bottom of the pressure chamber of the fitting threads into the hole in the sealed wellhead. The user can communicate with the logger simply by removing the logger cap and attaching the optical reader. Ensure that the logger and sealed wellhead are enclosed within an outer protective well cap or enclosure. This method should only be used in low pressure conditions (less than 30 psi or 66 ft (20 m) of water column).

When conducting artesian monitoring with Leveloggers a number of considerations must be kept in mind. First, ensure that the maximum hydraulic pressure the Levelogger will encounter within the well at its installation point will not exceed the hydraulic range of the logger. Second, artesian conditions do not preclude the necessity for barometric compensation of Levelogger data. Artesian conditions are caused by aquacludes forming confined aquifers. Confined aquifers, while not acted on by barometric pressure to the same extent as unconfined aquifers, are typically subject to barometric pressure at some barometric efficiency (See Section 10.1.3.1). Finally, bear in mind that the total pressure and subsequent water column equivalent depth measured by the Levelogger after barometric compensation may not represent the actual water level within the artesian well. Sealed intermittent artesian wells can be pressurized when artesian, but can also be de-pressurized when non artesian. The Levelogger's reading after barometric compensation represent the height of the piezometric surface.

10.1.2.2 Vacuum Monitoring

Vacuum monitoring is usually conducted by first installing pressure transducers such as the Levelogger in monitoring wells and then shutting-in or sealing those wells to the atmosphere with pressure sealed wellheads. Air is pumped out from an extraction well amongst the cluster or matrix of monitoring wells, theoretically dropping air pressure in the vicinity of the extraction well. For short-term tests in which data is not required during the extraction event, the Leveloggers can be programmed and simply suspended from hooks or eyelets on the underside of the sealed wellheads, the test run and the data collected at the end of the test by extraction and downloading of the loggers. However, if ongoing data from the Leveloggers is required during the extraction event, the loggers must be installed in a manner similar to the artesian monitoring scenarios described previously in this section. Leveloggers or Barologgers can be used to monitor the drop in pressure.
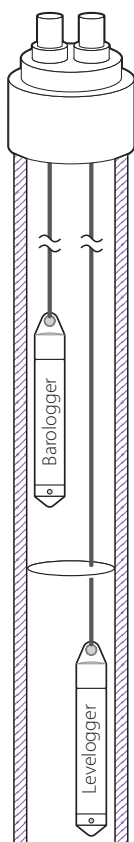
Figure 10-11 Levelogger and Barologger in Well

> **!** **NOTE**
>
> The Barologger Edge should not be used to monitor water, as the internal mathematics for temperature compensation are based on air rather than water.

10.1.3 Barologger Installation

The Barologger is a Levelogger with a small range adequate to monitor the fluctuations that occur in barometric pressure. The Barologger's readings are used to barometrically compensate Levelogger readings. As a rule of thumb, a Barologger can be used to compensate all the Leveloggers in a 20 mile (30 km) radius and/or with every 1000 ft. (300 m) change in elevation.

To monitor barometric pressure correctly, the Barologger should never be submerged. In well installations, it is recommended that the Barologger be suspended in one of the monitored wells above the high water point (the well must be vented). For best reading accuracy, the Barologger should be installed in a similar thermal environment to that of the Levelogger. In groundwater wells, the Barologger should be suspended beyond the frost line and deep enough to avoid large temperature fluctuations. In surface water applications, the Barologger is best deployed in a dry well – a well embedded in the bottom of the water body, but sealed at the base from water entry and vented to the atmosphere. If a dry well cannot be installed, the Barologger can be installed on a float in the stilling well. Further information on the Barologger and barometric pressure can be found in Section 8.1.

10.1.3.1 Barometric Efficiency

The influence of barometric pressure on a groundwater surface can follow three scenarios. In confined aquifers with capillary or vadose head space, increased atmospheric pressure can tighten the pore spaces in the overlying soil and produce a capillary effect as the water level rises in response to having nowhere else to go but up. Second, some deeper aquifer systems can be quite barometrically isolated from the relatively small change in level that barometric influences can produce. The third scenario occurs in an unconfined aquifer, with high barometric efficiency, in which a barometric pressure change results in an equivalent or highly proportional drop or rise in groundwater pressure. In essence, depending on the aquifer type and depth, increased barometric pressure can result in either increased, static or decreased water levels. Barometric efficiency, the relationship of a barometric change on groundwater pressure, in confined aquifers generally ranges from 20 to 75%, whereas in unconfined aquifers the efficiency can range from 80 - 100%.

A second important element of Barometric efficiency is time lag – the time differential between a unit change in barometric at the surface to the time of transmission of that change to the aquifer. Calculating general barometric efficiency should not be done on a single barometric event, but rather on a statistically significant number of events. As a result, it may take a month or more of submerged Levelogger and Barologger data to determine barometric efficiency and time lag. As Barometric pressure fluctuates over time in excess of 60 cm water column equivalent pressure and as barometric efficiency can be such an important factor in accurately monitoring groundwater levels, it is vital that barometric compensation of the Levelogger data be performed.

The absolute pressure method used in the Levelogger and Barologger provide the user with the data necessary to determine barometric efficiency and time lag. If a barometric efficiency value has been determined from the Levelogger and Barologger data, that value can be applied to Barologger data in the Compensation Wizard.

Wells puncturing an aquifer have a negligible to non-existent effect on directly transmitting barometric changes to the larger aquifer. Barometric pressure is transmitted through overlying layers. To obtain the best and most accurate long term water level readings from Leveloggers, the user must first understand how the Levelogger calculates a depth of water above the transducer and second whether barometric efficiency should be considered in barometric compensation.

Figure 10-12 Solinst Rainlogger

**3 Pin Rain
Gauge Connector**

Figure 10-13
The Tipping Bucket Rain Gauge Connector
of the Rainlogger

10.1.4 Rainlogger Installation

The Solinst Rainlogger (Figure 10-12) is designed to count the tips of an external tipping-bucket rain gauge within a user defined sample interval and output the total rainfall over that sample interval.

The waterproof housing is made of stainless steel. Direct exposure to rainfall should be avoided, and the Rainlogger should not be submerged.

The rain gauge connected to the Rainlogger is supplied by the customer and is a reed-switch type gauge most commonly known as a tipping-bucket rain gauge. The rain gauge connector is 3-pin (Figure 10-13) and connects to the 3-pin cable supplied with the Rainlogger. Longer cables up to 30 m (100 ft) can be supplied when the Rainlogger is ordered. The connector cable has 3 wires, however only two, the blue and brown wires, are connected to the tipping bucket device. As the tipping bucket is just an electrical switch, it does not usually matter to which terminal on the tipping bucket the blue or brown wire is connected. Refer to the tipping bucket manufacturer's instructions. Longer, exposed cables should be protected from rodents and vandalism by cable armoring or installation within electrical conduit.

Figure 10-14 Rainlogger Connected to Tipping Bucket

10.1.5 Installation in Extreme Environments

10.1.5.1 Freezing or High Temperature Conditions

Levelogger installation at submerged depths that may be at risk of freezing during the monitoring session is not recommended without taking adequate precautions to avoid transducer damage. When water freezes it expands approximately 9% by volume. A 9% expansion can equate to extreme pressure as demonstrated in Example 10.1. Therefore, solid freezing has the potential to damage the pressure transducer, which is rated to withstand up to 200% (150% for the Levelogger Gold and Junior Models) of its depth fluctuation range. Pressures beyond this threshold may damage the transducer. With certain precautions, the Levelogger can be used in freezing liquid environments. If monitoring shallow water bodies or groundwater zones susceptible to freezing, the easiest way to avoid transducer damage is to lower the transducer to a point in the water column below the frost line or ice formation depth. In water bodies such as shallow streams, wetlands or ponds where freezing may penetrate to the bottom, install the Levelogger in a vented stilling well imbedded into the bottom of the water body beyond the frost line. In cases where the above noted precautions cannot be taken and the Levelogger must be installed in the freezing zone, it is recommended that the logger be placed inside two elongated silicon, rubber or latex balloons, the balloons can be filled with a non-toxic, non-corrosive anti-freeze solution and sealed (Figure 10-15). Place the balloons in a section of perforated, 1.25" (30 mm) ID pipe and install the logger in the monitored water. The antifreeze solution will protect the Levelogger from ice expansion at the pressure transducer, yet transmit any pressure fluctuations that occur. Please note that a similar installation protection can be used when the Levelogger is monitoring liquids which are incompatible with its wetted materials. The operating temperature range for Leveloggers is -20° - 80°C (-4° - 180°F). At the opposite end of the thermal scale, exposing the Levelogger to temperatures beyond 80°C may damage the thermistor and otherwise affect the Levelogger.

Figure 10-15
Installation in Freezing Liquid
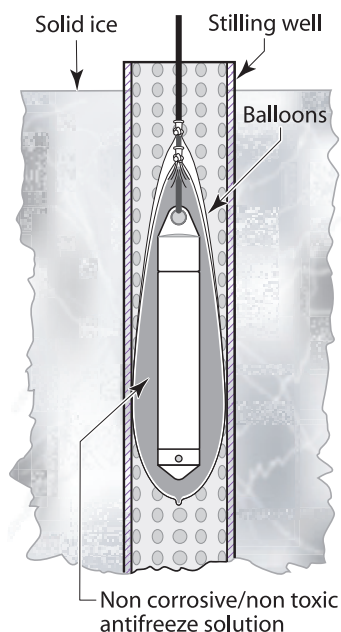
Example 10.1 Solid Freezing Effects

The pressure exerted by the physical expansion or ice crystallization process on a retaining or enclosing contact surface is related to the temperature gradient over which the process occurs. For example, liquid freezing at -22°C, can create expansion pressures of 22 kg/cm² or 313 psi or the equivalent of 721 ft or 220 m water column depth.

10.1.5.2 Marine or Brackish Installations

When installing the Levelogger in salt or brackish water or in a liquid having a specific gravity (density) different than fresh water, the density difference is compensated for by inputting the density of the monitored fluid in the Datalogger Settings window (see Section 5.1). Also, see Section 8 for details in compensating the Levelogger for fluid density differences.

The Levelogger Edge can be used for monitoring in salt or brackish water. However, long term use of the first generation stainless steel body LTC Levelogger or LT Levelogger, or LTC and LT Levelogger Junior in salt or brackish water is not recommended, as the salt or other pollutants may cause pitting which can lead to perforation of the Levelogger's casing. To minimize this effect, regularly lift the Levelogger from the liquid; within seconds a thin protective layer will be formed by oxidation. Again, this precaution applies to the first generation stainless steel LTC and LT Leveloggers or LTC and LT Levelogger Junior. If using an LT Levelogger or Levelogger Junior in a continuous salt/brackish monitoring scenario, the stainless steel body of the datalogger can be protected in a manner similar to the freezing protection method described in Section 10.1.5.1. The Levelogger can be placed in balloons and the balloons filled with non-corrosive/ non-toxic fluid. As pressure changes, the fluid encasing the loggers will transmit the pressure differential to the datalogger's pressure transducer. Care must be taken in the selection of the balloon material or filling fluid such that the balloon material prevents diffusion of salts across the concentration gradient or that the filling fluid is comprised of polymeric molecules too large to diffuse out of the balloon material.

10.2 Levelogger Maintenance

Levelogger maintenance consists of cleaning the outside casing, the circulation holes and the optical infrared eyes. The required frequency of cleaning is dependent on several aspects of the monitored water quality. In freshwater with good to excellent water quality, the Levelogger cleaning requirements will be very minimal; amounting to a seasonal or even annual maintenance inspection. In most cases cleaning can be accomplished by rinsing the Levelogger and using mild, non-residual, non-abrasive household cleaners using a very soft-plastic, bristled, pipe-cleaner type brush. Do not insert any object through the circulation holes at the sensor end of the Levelogger. In some cases simple cleaners are insufficient to properly clean the Levelogger. Several commonly occurring water conditions require specific maintenance methods, these include hard water, high suspended solids loading, biological or chemical fouling and salt or brackish water conditions.

Hard water monitoring can result in the precipitation of calcium and magnesium deposits on the pressure transducer as well as other components of the Levelogger. These deposits can be safely dissolved using a diluted solution (typically ≤ 10% strength) of acetic or phosphoric acid. Commercially available products for dissolving hard water scaling are also available and can be used if designed for household use. Some industrial strength hard water scaling removers are much higher strength and are not recommended for cleaning the Levelogger.

High suspended solids load may block the circulation ports or clog the internal pressure cell of the Levelogger. The potential clogging effect of solids deposition can be minimized by placing the Levelogger in zones of flow. To remove solids build up, rinse the Levelogger under a low flow of tap water until particles have been washed away.

Bacteriological or chemical fouling can be an important consideration in many ground and surface water monitoring projects. Sessile bacteria will often utilize installed instrumentation as an attachment substrate. Chemical deposit can be the result of electrical charge differential between the instrumentation of the monitored liquid or the result of biological or algal activity. Both forms of fouling can result in difficult to remove deposits on the Levelogger transducer, the conductivity wires and the Levelogger casing. To remove fouling use a diluted (≤ 10%) solution of sulfuric acid. Persistent material may require soaking for several hours.

11 Diagnostics Utility

The Levelogger Diagnostics Utility can be used for troubleshooting Leveloggers and obtaining information about that Levelogger that can assist the Solinst Technical Support representative to identify and fix any problems you may encounter with your Levelogger. The Diagnostics Utility can be launched from the Utilities menu at the top of the software. The utility can be used to run a self-test, do a Memory Dump and create and email reports.

11.1 Run Diagnostics

The Run Diagnostics function reads the following information from the Levelogger:

1) Serial Number
2) Model Number
3) Firmware Version
4) Battery Voltage
5) Charge Level
6) Current Level Reading
7) Current Temperature Reading
8) Max/Min Pressure Reading
9) Max/Min Temperature Reading
10) Max/Min Conductivity Reading
11) Total Number of Logs

This information can be used to identify firmware, battery and/or temperature/pressure sensor problems. This function also performs a series of self-tests on the Levelogger to check for problems with the battery, memory, and pressure/temperature sensors. If any of these tests fail then a report should be created and emailed to Solinst Technical Support. To execute this function simply click the 'Run Diagnostics' button.
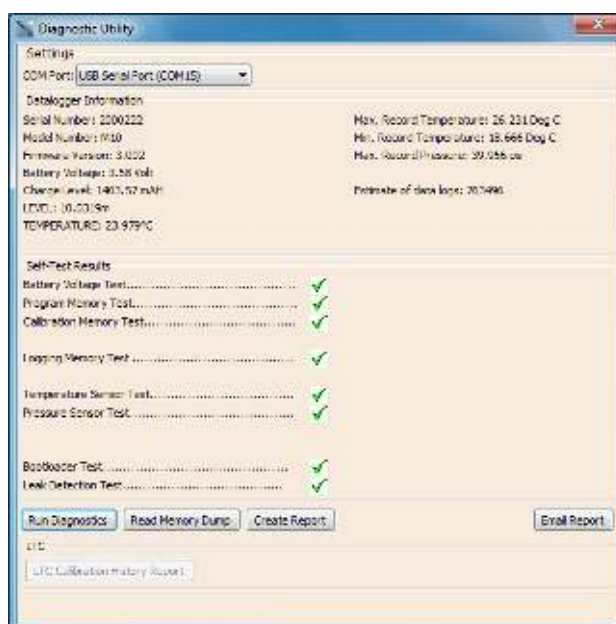

Figure 11-1 Run Diagnostics

11.2 Read Memory Dump

This function creates a complete dump of the Levelogger's memory, which can then be sent to Solinst Technical Support for analyzing.

To execute this function simply click the Read Memory Dump button. Performing a memory dump will create a *.xle file of the data to save.

Figure 11-2 Read Memory Dump

11.3 Create Report

This function simply creates a text file containing the information obtained from the Run Diagnostics function. When you click the Create Report button, a window will pop up asking you to fill out your company information. Simply fill this out and the resulting report can be saved or sent to Solinst Technical Support for troubleshooting. If creating a report for an LTC Levelogger Junior, the LTC Calibration History Report will be included.
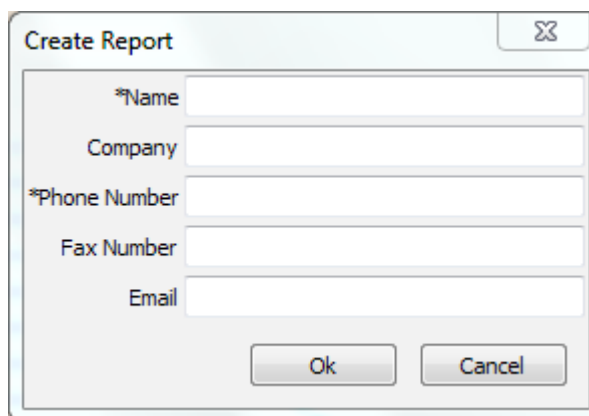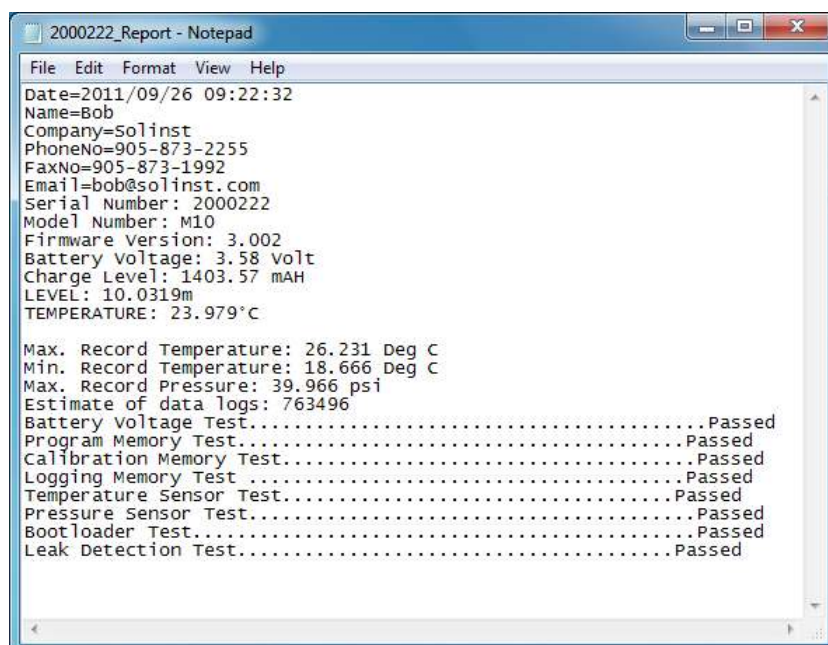

Figure 11-3 Customer Info Input Window

Figure 11-4 Report Example

11.4 Email Report

Clicking Email Report will guide you through the process of creating a Diagnostics Report, and it will automatically attach the report to an email to send to Solinst Technical Staff for troubleshooting. If you are emailing a report for an LTC Levelogger Junior, the LTC Calibration History Report will be included.

11.5 LTC Calibration History Report

This function creates a report of all previous user calibrations performed on the LTC Levelogger Junior. Use it to send a history report to Solinst for analysis if the LTC Levelogger Junior readings are irregular and/or the unit does not maintain its calibration. To execute this function simply click the LTC Calibration History Report button. This creates a text file that can be sent to Solinst Technical Support.
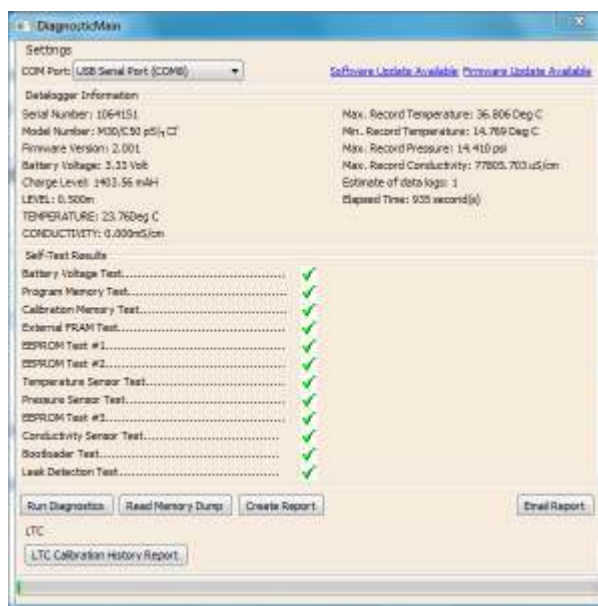

Figure 11-5 LTC Calibration History Report

11.6 Software/Firmware Updates

Each time the Diagnostic Utility is opened, it automatically checks for software updates. If there is an update, "Software Update Available" will appear in the top right of the window. When you click the message, a webpage will open, allowing you to download the software update.

The Utility also checks for firmware updates. "Firmware Update Available" will appear in the top right of the window. Clicking the message will open a webpage where you can download the firmware update. See Section 12 for firmware update instructions.

⚠ NOTE

Your Computer must have an internet connection to check for software and firmware updates.

You can also check for updates using the Help menu.

---

12 Firmware Upgrade Utility

The Firmware Upgrade Utility is used to upload new firmware files to a Levelogger. The zipped firmware file can be obtained from: http://www.solinst.com/Downloads/

Make sure to unzip the firmware file after you have downloaded it, so you can access the *.ssf file.

To upload new firmware to a Levelogger, follow these steps:

1) Open the Solinst Firmware Upgrade Utility from the Utilities menu in the main Levelogger Software. Pick the Com Port to which the Levelogger is connected and make sure the Baud Rate is set to 9600.

2) Click the 'Open' button, which should open a file dialog asking for the firmware file (*.ssf) to upload. Navigate to the directory where the firmware file was saved on your PC, then click on the file and click 'Open'.

3) Check the 'Firmware File Information' box to make sure that the opened file is the right one.

4) Click the 'Upload Firmware' button, to start the firmware upload process.

5) If a communication error occurs and is indicated in the Levelogger Information Window (Figure 12-1) either before the 'Verified Program Checksum' message or after the 'Program Information Section', then restart the upgrade process.

6) If, however, a communication error occurs between the 'Verified Program Checksum' and the 'Program Information Section' messages, then please contact Solinst. You will need to give the Levelogger Serial Number and explain the exact positioning of the error message.
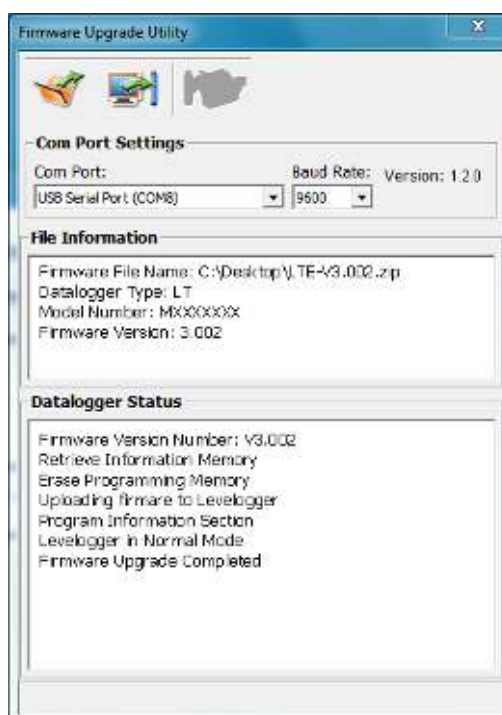

Figure 12-1
Firmware Upgrade Utility Window

13 Trouble Shooting

13.1 Problems During Installation of Levelogger Software

'Class not Registered' or 'DLL not found' or 'Access violation'

1) You may not have Administrator Rights to install the software in the Windows XP/Windows Vista/Windows 7 environment.

    - Ask your System Administrator for assistance.

2) Some files got corrupted during installation of the Levelogger software. Use 'Add/Remove Programs' to uninstall then re-install Levelogger software.

13.2 Error During Software Uninstall Process

The 'Add/Remove Program' cannot locate the Levelogger <setup.exe> file of the software or the link between the software and the 'Add/Remove Program' is damaged.

The record in the Registry Table must be removed:

1) Ask your System Administrator to remove this.

2) Refer to the following link from Microsoft Website for instructions: http://support.microsoft.com/default.aspx?scid=kb;en-us;247501

13.3 Problems During Installation of RS232 to USB Converter

Unable to install the RS232/USB converter from Keyspan or IO Gear

1) After plugging in the RS232/USB Converter, a Hardware Installation Wizard will open. Follow the instruction from the Wizard and make sure to select the RS232/USB Converter Driver from the Keyspan or IO Gear Installation CD.

2) If the Hardware Installation Wizard does not open after plugging in the RS232/USB Converter, follow the steps below to open the Hardware Installation Wizard:

    a. Select Control Panels
    b. Double click on System
    c. Select the Device Manager Tab
    d. Double click on Other devices
    e. Right click on USB Serial Converter
    f. Select Update Driver...

> **! NOTE**
>
> Solinst recommends Keyspan or IO Gear. For problems with converters from other manufacturers, please contact the manufacturer.

13.4 Data Has Been Erased Accidentally

If Levelogger has been restarted and old data has not been saved, go to Download Options and choose Data Recovery. It downloads the immediately previous log.

13.5 Error Messages During Use of Software

**'Communication Time Out' or 'Communication Error' or
'The Command that is sent to the Levelogger Edge is not defined'**

1) Try communicating with another Levelogger, Optical Reader or Direct Read Cable. The communication cable, Optical Reader or Levelogger may be damaged.

2) Clean the optical 'eyes' on the Levelogger and the cable, with a soft cloth.

3) Check that the communication cable is connected to the same Com Port that is chosen in the upper middle of the Main Window of the Levelogger software.

4) Check the Com port settings. They should be as follows:

   - Bits per second: 9600
   - Data bits: 8
   - Parity: None
   - Stop bits: 1
   - Flow control: None
     (This may have been set to Xon/Xoff – change it to None, Select [OK] and back out of this pathway.)

The route to view your Com port settings is as follows:

   a. Select Control Panels
   b. Double click on System
   c. Select the Device Manager Tab
   d. Double click on Ports
   e. Double click on Communications Port(s)
   f. Choose the Port Settings Tab

5) Try using a different computer, to see if this is the cause of the problem.

6) If using a laptop (especially in conjunction with a Direct Read Cable) your Com Port may not be powered adequately to receive/transmit data. Try using a desktop computer to test this, or contact Solinst to obtain a PC Interface Booster Cable.

7) If problem persists, contact Solinst.

'**Port Cannot Open**'

1) Ensure the correct Com Port is selected in the upper middle of the Main Window of the Levelogger software.

2) Check if some other software is using the same Com Port in the background. Shut that software down or choose another Com Port if available. Such background software may be anti-virus software or PDA software.

3) Make sure your Com Port has been enabled:
   a. Select Control Panels
   b. Double click on System
   c. Select the Device Manager Tab
   d. Double click on Ports
   e. Double click on Communications Port(s)
   f. Choose General
   g. Uncheck 'Disable in this hardware profile box'

4) If you are using a virtual Com Port, like a USB optical reader or USB/RS232 converter, refer to the 'Problems During Installation of RS232 to USB Converter' section to make sure they are installed properly.

'**File Create Error**' and '**File Write Error**'

1) If you do not have file-writing privileges to the Levelogger default data folder, change the folder as follows: in the Levelogger software, click 'Configuration' then 'Application Settings'. Under 'Default Directory', enter a new destination folder, to which you have file writing privileges, e.g. 'My Documents'. Follow the same procedure if you have the same problem when you export the data file in csv format.

2) Ask your System Administrator for assistance.

'**File Open Error**' and '**File Read Error**'

1) Shut down or disable any other software that is active and using the same file.

2) In Notepad or Wordpad, open the <*.xle> or <*.lls> file to check for corruptions in the file. How are the Levelogger files ended?

3) If problems persist contact Solinst for assistance.

'**Time Span Error, some data cannot be compensated**'

1) Find another barometric data file that has the same time stamp as the Levelogger.

2) Perform the compensation (a simple subtraction) in a spreadsheet program for any missing time stamps.

'A different type of Levelogger is detected'

Try clicking the Retrieve Settings icon again, or replace the Levelogger currently in the Optical Reader with the one that was previously being worked on, and complete the operation.

'The selected file is not a barometer'

Select a Barologger for the compensation process.

'Data Corrupted'

Contact Solinst for assistance. Use Levelogger Diagnostic Utility to do a memory dump and sent the dump file to Solinst for further analysis.

'Internal Error'

Contact Solinst for assistance.

'Fail to append data - A different Levelogger has been detected!' or 'Fail to append data - A different start time has been detected!' or 'Fail to append data - New data is not available in the Levelogger!'

The Levelogger software can only append data to a file that has the same serial number and start time as the connected Levelogger. Find the correct file, or use 'All Data' to download the complete file.

'Only Levelogger Gold/Edge supports this function'

The 'Append Data', 'Partial Download' and 'Data Recovery' functions are only supported by the Levelogger Gold/Edge loggers, not previous version Leveloggers.

'Schedule cannot be empty'

When using the 'Schedule' sampling option in a Levelogger Gold/Edge, the schedule must contain at least one item.

'Readings in schedule exceed the maximum'

The number of readings in a schedule should not result in more than 40,000 (or up to 120,000) individual readings.