User Guide
Levelogger Series

September 15, 2021

Solinst®

1 Introduction

This User Guide focuses on the current Levelogger 4.6.1 Software and Levelogger 5 Series of dataloggers, which includes:

- Levelogger 5
- Barologger 5
- Levelogger 5 Junior
- Levelogger 5 LTC
- Rainlogger 5

Levelogger Software 4.6.1 is also compatible with the Levelogger Edge Series of dataloggers.

Note: Levelogger Gold Series dataloggers are compatible with Levelogger Software 4.4.0. For full specifications on Gold Series dataloggers, see the Appendix.

In addition, Levelogger Software 4.6.1 is compatible with LevelVent 5 and AquaVent 5 vented dataloggers and the Solinst Readout Unit (SRU), which have separate User Guides.

Note: For further information about Solinst product compatibility, please refer to the Levelogger Series: Hardware Compatibility chart at www.solinst.com/downloads/

Levelogger Software is Windows® based and 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.

Solinst dataloggers can also be used with the Solinst Levelogger App, which shares most of the features of Solinst Levelogger Software, on your smart device. To use the Solinst Levelogger 5 App Interface, see the separate User Guide. Also, see separate instructions for use with the DataGrabber 5 simple USB data transfer device.

Note: Let Solinst keep you up-to-date with each new software and firmware release. Register your software at: www.solinst.com/Registration/ to receive these updates.

A significant physical difference between Levelogger 5 Series of dataloggers compared to all previous versions (including the Edge and Gold Series), is one large optical eye (lens) versus two smaller optical eyes and a connection pin at the communication interface.

Section 2 discusses the different hardware options to communicate with each type of datalogger. Section 10.1.1.2 discusses Direct Read Cable installation options.
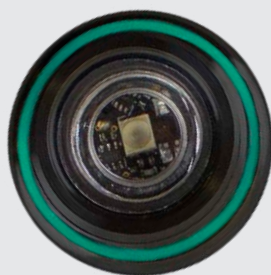
Levelogger 5 Optical Eye   Levelogger Edge Optical Eyes

1.1 Levelogger Series

1.1.1 Levelogger 5

The Levelogger 5 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 5.

Note: Solinst recommends using the most recent Levelogger 5 firmware version with the latest Levelogger Software version. See Section 2.3.

Levelogger 5 Technical Specifications	
Level Sensor:	Piezoresistive Silicon with Hastelloy® Sensor
Ranges:	5, 10, 20, 30, 100, 200 m
Accuracy	± 0.05% FS
Resolution::	0.001% FS, 0.0006% FS
Normalization:	Automatic Temperature Compensation
Temp. Comp. Range:	0ºC to 50ºC
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Temp. Sensor Accuracy:	± 0.05ºC
Temp. Sensor Resolution:	0.003ºC
Battery Life:	10 years (based on 1 reading/minute)
Clock Accuracy (typical):	± 1 minute/year (-40ºC to 80ºC)
Operating Temperature:	-20ºC to 80ºC
Maximum # Readings:	150,000 sets of readings
Memory:	Continuous or Slate mode
Communication Speed:	9600 bps, 57,000 bps with USB
Com Interface:	Optical high-speed: USB, SDI-12
Size:	22 mm x 160 mm (7/8" x 6.3")
Weight:	146 grams (5.2 oz.)
Corrosion Resistance:	Baked-on coating using polymerization technology (inside and out) and superior corrosion resistant Hastelloy pressure sensor
Wetted Materials:	Delrin®, Viton®, 316L Stainless Steel, Hastelloy, PFAS-free PTFE
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

Models	Full Scale	Accuracy	Resolution
M5	5 m (16.4 ft.)	± 0.3 cm (0.010 ft.)	0.001% FS
M10	10 m (32.8 ft.)	± 0.5 cm (0.016 ft.)	0.0006% FS
M20	20 m (65.6 ft.)	± 1 cm (0.032 ft.)	0.0006% FS
M30	30 m (98.4 ft.)	± 1.5 cm (0.064 ft.)	0.0006% FS
M100	100 m (328.1 ft.)	± 5 cm (0.164 ft.)	0.0006% FS
M200	200 m (656.2 ft.)	± 10 cm (0.328 ft.)	0.0006% FS

Note: The Model number refers to the depth of submergence below water level that the pressure sensor can withstand. i.e.: The Levelogger 5, which is available in M5, M10, M20, M30, M100, and M200 ranges has actual water level ranges of 5 m (16.40 ft), 10 m (32.80 ft), 20 m (65.60 ft), 30 m (98.40 ft), 100 m (328.0 ft), and 200 m (656.2 ft), respectively.

1.1.2 Barologger 5

The Barologger 5 uses algorithms based on air pressure only. It measures and logs changes in atmospheric pressure and temperature, which are then used to compensate water level readings recorded by a Levelogger.

Note: Solinst recommends using the most recent Barologger 5 firmware version with the latest Levelogger Software version. See Section 2.3.

Barologger 5 Technical Specifications	
Level Sensor:	Piezoresistive Silicon with Hastelloy Sensor
Accuracy:	± 0.05 kPa
Resolution:	0.002% FS
Normalization:	Automatic Temperature Compensation
Temp. Comp. Range:	-10ºC to 50ºC
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Temp. Sensor Accuracy:	± 0.05ºC
Temp. Sensor Resolution:	0.003ºC
Battery Life:	10 years (based on 1 reading/minute)
Clock Accuracy (typical):	±1 minute/year (-20ºC to 80ºC)
Operating Temperature:	-20ºC to 80ºC
Maximum # Readings:	150,000 sets of readings
Memory:	Continuous or Slate mode
Communication Speed:	9600 bps, 57,600 bps with USB
Com Interface:	Optical high-speed: USB, SDI-12
Size:	22 mm x 160 mm (7/8" x 6.3")
Weight:	146 grams (5.2 oz.)
Corrosion Resistance:	Baked-on coating using polymerization technology (inside and out) and superior corrosion resistant Hastelloy pressure sensor
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

Model	Full Scale (FS)	Accuracy	Resolution
Barologger	Air Only	±0.05 kPa	0.002% FS

1.1.3 Levelogger 5 Junior

The Levelogger 5 Junior provides an inexpensive alternative for measuring groundwater and surface water levels and temperature.

Note: Solinst recommends using the most recent Levelogger 5 Junior firmware version with the latest Levelogger Software version. See Section 2.3.

Levelogger 5 Junior Technical Specifications	
Level Sensor:	Piezoresistive Silicon with Hastelloy Sensor
Ranges:	5, 10 m
Accuracy:	± 0.1% FS
Resolution:	0.02% FS, 0.01% FS
Normalization:	Automatic Temperature Compensation
Temp Comp. Range:	0ºC to 40ºC
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Accuracy:	± 0.1ºC
Resolution:	0.1ºC
Battery life:	5 years (based on 1 reading/minute)
Clock Accuracy (typical):	± 1 minute / year (-20ºC to 80ºC)
Operating Temperature:	-20ºC to 80ºC
Memory:	Continuous or Slate mode
Maximum # Readings	75,000 sets of readings
Com Interface:	Optical high-speed: USB, SDI-12
Communication Speed:	9600 bps, 57,600 bps with USB
Size:	22 mm x 160 mm (7/8" x 6.3")
Weight:	145 grams (5.1 oz)
Wetted Materials:	Delrin, Viton, 316L Stainless Steel, Hastelloy
Sampling Mode:	Linear, Future Start, Real Time View
Measurement Rates:	0.5 seconds to 99 hours
Barometric Compensation:	High accuracy, air-only, Barologger

Models	Full Scale (FS)	Accuracy	Resolution
M5	5 m (16.4 ft.)	± 0.6 cm (0.020 ft.)	0.02% FS
M10	10 m (32.8 ft.)	± 1.0 cm (0.032 ft.)	0.01% FS

1.1.4 Levelogger 5 LTC

The Levelogger 5 LTC provides an accurate and convenient method to measure water level, temperature and conductivity all in one probe.

Note: Solinst recommends using the most recent Levelogger 5 LTC firmware version with the latest Levelogger Software version. See Section 2.3.

Levelogger 5 LTC Technical Specifications	
Level Sensor:	Piezoresistive Silicon Pressure Sensor
Ranges:	5, 10, 20, 30, 100, and 200 m
Accuracy:	± 0.05% FS
Resolution:	0.001% FS, 0.0006% FS
Normalization:	Automatic Temperature Compensation
Temp Comp. Range:	0ºC to 50ºC
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Accuracy:	± 0.05ºC
Resolution:	0.003ºC
Conductivity Sensor:	4-Electrode Platinum
Full Range:	0 to 100,000 µS/cm
Calibrated Range:	50 to 80,000 µS/cm
Accuracy:	±1% 5,000 µS/cm - 80,000 µS/cm; greater of ±2% or 15 µS/cm from 50 µS/cm - 5,000 µS/cm
Resolution:	± 0.1 µS/cm
Normalization:	Specific Conductance normalized to 25ºC for full range
User Calibration Points:	1413, 5000, 12,880, 80,000 µS
Battery Life:	8 years (based on 1 reading every 5 minutes)
Clock Accuracy (typical):	± 1 minute / year
Operating Temperature:	-20ºC to 80ºC
Memory:	Continuous or Slate Mode
Maximum Readings:	100,000 sets of readings
Communication Speed:	9600 bps, 57,600 bps with USB
Com Interface:	Optical high-speed: USB, SDI-12
Size:	22 mm x 208 mm (7/8" x 8.2")
Weight:	200 grams (7.1 oz)
Corrosion Resistance:	Baked-on coating using polymerization technology (inside and out) and superior corrosion resistant Hastelloy pressure sensor
Wetted Materials:	Delrin, Viton, 316L Stainless Steel, Hastelloy, Platinum, PFAS-free PTFE
Sampling Mode:	Linear, Event & User-Selectable Schedule with Repeat Mode, Future Start, Future Stop, Real Time View
Measurement Rates:	2 seconds to 99 hours
Barometric Compensation:	High accuracy, air-only, Barologger

Models	Full Scale	Accuracy	Resolution
M5 C80	5 m (16.4 ft.)	± 0.3 cm (0.010 ft.)	0.001% FS
M10 C80	10 m (32.8 ft.)	± 0.5 cm (0.016 ft.)	0.0006% FS
M20 C80	20 m (65.6 ft.)	± 1 cm (0.032 ft.)	0.0006% FS
M30 C80	30 m (98.4 ft.)	± 1.5 cm (0.064 ft.)	0.0006% FS
M100 C80	100 m (328.1 ft.)	± 5 cm (0.164 ft.)	0.0006% FS
M200 C80	200 m (656.2 ft.)	± 10 cm (0.328 ft.)	0.0006% FS

1.1.5 Rainlogger 5

The Rainlogger 5 is designed for use with most standard tipping-bucket rain gauges. It records each tip time from the tipping-bucket, and outputs the amount of rainfall per programmed time period based on rainfall calibration constant shown on the tipping-bucket.

Note: Solinst recommends using the most recent Rainlogger 5 firmware version with the latest Levelogger Software version. See Section 2.3.

Rainlogger 5 Technical Specifications	
Battery Life:	10 years (logging 2 parameters/10 minutes)
Clock Accuracy (typical):	± 1 minute/year
Operating Temperature:	-20˚C to 80˚C
Maximum # Readings:	Up to 100,000 tip times
Memory:	Continuous or Slate mode
Com Interface:	Optical high-speed: USB, SDI-12
Communication Speed:	9600 bps, 57,600 bps with USB
Measurement:	Records each tip by the tipping-bucket rain gauge and outputs the amount of rainfall
Sampling Mode:	Event Based, Future Start, Real TIme View
Size:	22 mm x 160 mm (7/8" x 6.3")
Weight:	50 grams (1.8 oz)
Materials:	ABS, Delrin, Viton

Tipping-Bucket
Connector Cable

1.1.6 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.

Note: Solinst recommends using the most recent Levelogger Edge firmware version with the latest Levelogger Software version. See Section 2.3.

Levelogger Edge Technical Specifications	
Level Sensor:	Piezoresistive Silicon with Hastelloy Sensor
Ranges:	5, 10, 20, 30, 100, 200 m
Accuracy:	± 0.05% FS
Resolution:	0.001% FS to 0.0006% FS
Normalization:	Automatic Temperature Compensation
Temp. Comp. Range:	0ºC to 50ºC
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Temp. Sensor Accuracy:	± 0.05ºC
Temp. Sensor Resolution:	0.003ºC
Battery Life:	10 years (based on 1 reading/minute)
Clock Accuracy (typical):	± 1 minute/year (-20ºC to 80ºC)
Operating Temperature:	-20ºC to 80ºC
Maximum # Readings:	40,000 sets of readings
Memory:	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:	22 mm x 159 mm (7/8" x 6.25")
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

Models	Full Scale	Accuracy	Resolution
M5	5 m (16.4 ft.)	± 0.3 cm (0.010 ft.)	0.001% FS
M10	10 m (32.8 ft.)	± 0.5 cm (0.016 ft.)	0.0006% FS
M20	20 m (65.6 ft.)	± 1 cm (0.032 ft.)	0.0006% FS
M30	30 m (98.4 ft.)	± 1.5 cm (0.064 ft.)	0.0006% FS
M100	100 m (328.1 ft.)	± 5 cm (0.164 ft.)	0.0006% FS
M200	200 m (656.2 ft.)	± 10 cm (0.328 ft.)	0.0006% FS

1.1.7 Barologger Edge

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

Note: Solinst recommends using the most recent Barologger Edge firmware version with the latest Levelogger Software version. See Section 2.3.

Barologger Edge Technical Specifications	
Level Sensor:	Piezoresistive Silicon with Hastelloy Sensor
Accuracy:	± 0.05 kPa
Resolution:	0.002% FS
Normalization:	Automatic Temperature Compensation
Temp. Comp. Range:	-10ºC to 50ºC
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Temp. Sensor Accuracy:	± 0.05ºC
Temp. Sensor Resolution:	0.003ºC
Battery Life:	10 years (based on 1 reading/minute)
Clock Accuracy (typical):	±1 minute/year (-20ºC to 80ºC)
Operating Temperature:	-20ºC to 80ºC
Maximum # Readings:	40,000 sets of readings
Memory:	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:	22 mm x 159 mm (7/8" x 6.25")
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

Model	Full Scale (FS)	Accuracy	Resolution
Barologger (M1.5)	Air Only	±0.05 kPa	0.002% FS

1.1.8 Levelogger Junior Edge

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

Note: Solinst recommends using the most recent Levelogger Junior Edge firmware version with the latest Levelogger Software version. See Section 2.3.

Levelogger Junior Edge Technical Specifications	
Level Sensor:	Piezoresistive Silicon with Hastelloy Sensor
Ranges:	5, 10 m
Accuracy:	± 0.1% FS
Resolution:	0.02% FS to 0.01% FS
Normalization:	Automatic Temperature Compensation
Temp Comp. Range:	0ºC to 40ºC
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Accuracy:	± 0.1ºC
Resolution:	0.1ºC
Battery life:	5 years (based on 1 reading/minute)
Clock Accuracy (typical):	± 1 minute / year (-20ºC to 80ºC)
Operating Temperature:	-20ºC to 80ºC
Memory:	Continuous or Slate mode
Maximum # Readings	40,000 sets of readings
Com Interface:	Optical Infra-red: USB, RS-232, SDI-12
Communication Speed:	9600 bps
Size:	22 mm x 142 mm (7/8" x 5.6")
Weight:	119 grams (4.2 oz)
Wetted Materials:	Delrin®, Viton®, 316L Stainless Steel, Hastelloy
Sampling Mode:	Linear, Future Start, Real Time View
Measurement Rates:	0.5 seconds to 99 hours
Barometric Compensation:	High accuracy, air-only, Barologger Edge

Models	Full Scale (FS)	Accuracy	Resolution
M5	5 m (16.4 ft.)	± 0.6 cm (0.020 ft.)	0.02% FS
M10	10 m (32.8 ft.)	± 1.0 cm (0.032 ft.)	0.01% FS

1.1.9 LTC Levelogger Edge

The LTC Levelogger Edge provides an accurate and convenient method to measure water level, temperature and conductivity all in one probe.

Note: Solinst recommends using the most recent LTC Levelogger Edge firmware version with the latest Levelogger Software version. See Section 2.3.

LTC Levelogger Edge Technical Specifications	
Level Sensor:	Piezoresistive Silicon with Hastelloy Sensor
Ranges:	15, 10, 20, 30, 100, and 200 m
Accuracy:	± 0.05% FS
Resolution:	0.001% FS to 0.0006% FS
Normalization:	Automatic Temperature Compensation
Temp Comp. Range:	0ºC to 50ºC
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Accuracy:	± 0.05ºC
Resolution:	0.003ºC
Conductivity Sensor:	4-Electrode Platinum
Full Range:	0 to 100,000 µS/cm
Calibrated Range:	50 to 80,000 µS/cm
Accuracy:	±1% 5,000 µS/cm - 80,000 µS/cm; greater of ±2% or 10 µS/cm from 50 µS/cm - 5,000 µS/cm
Resolution:	± 0.1 µS/cm
Normalization:	Specific Conductance normalized to 25ºC for full range
User Calibration Points:	1413, 5000, 12,880, 80,000 µS
Battery Life:	8 years (based on 1 reading every 5 minutes)
Clock Accuracy (typical):	± 1 minute / year
Operating Temperature:	-20ºC to 80ºC
Memory:	Continuous or Slate Mode
Maximum # Readings:	27,000 sets of readings
Communication Speed:	9600 bps, 38,400 bps with USB optical reader
Com Interface:	Optical Infrared: USB, RS-232, SDI-12
Size:	22 mm x 190 mm (7/8" x 7.5")
Weight:	200 g (7.05 oz.)
Corrosion Resistance:	Titanium ceramic PVD coated body and superior corrosion resistant Hastelloy pressure sensor
Other Wetted Materials:	Hastelloy, Delrin®, Viton®, Platinum
Sampling Mode:	Linear, Event & User-Selectable Schedule with Repeat Mode, Future Start, Future Stop, Real Time View
Measurement Rates:	2 seconds to 99 hours
Barometric Compensation:	High accuracy, air-only, Barologger

Models	Full Scale	Accuracy	Resolution
M5	5 m (16.4 ft.)	± 0.3 cm (0.010 ft.)	0.001% FS
M10	10 m (32.8 ft.)	± 0.5 cm (0.016 ft.)	0.0006% FS
M20	20 m (65.6 ft.)	± 1 cm (0.032 ft.)	0.0006% FS
M30	30 m (98.4 ft.)	± 1.5 cm (0.064 ft.)	0.0006% FS
M100	100 m (328.1 ft.)	± 5 cm (0.164 ft.)	0.0006% FS
M200	200 m (656.2 ft.)	± 10 cm (0.328 ft.)	0.0006% FS

1.1.10 Rainlogger Edge

The Rainlogger Edge is designed for use with most standard tipping-bucket rain gauges. It records each tip time from the tipping-bucket, and outputs the amount of rainfall per programmed time period (based on rainfall calibration constant).

Note: Solinst recommends using the most recent Rainlogger Edge firmware version with the latest Levelogger Software version. See Section 2.3.

Rainlogger Edge Technical Specifications	
Battery Life:	10 years (logging 2 parameters/10 minutes)
Clock Accuracy (typical):	± 1 minute/year
Operating Temperature:	-20˚C to 80˚C
Maximum # Readings:	Up to 60,000 tip times
Memory:	Continuous or Slate mode
Communication:	Optical infra-red: USB, RS-232, SDI-12
Measurement:	Records each tip by the tipping-bucket rain gauge and outputs the amount of rainfall
Sampling Mode:	Event Based, Future Start, Real TIme View
Size:	22 mm x 140 mm (7/8" x 5.5")
Weight:	44 grams (1.6 oz)
Materials:	ABS, Delrin®, Viton®

1.2 Measurement Parameters

1.2.1 Level
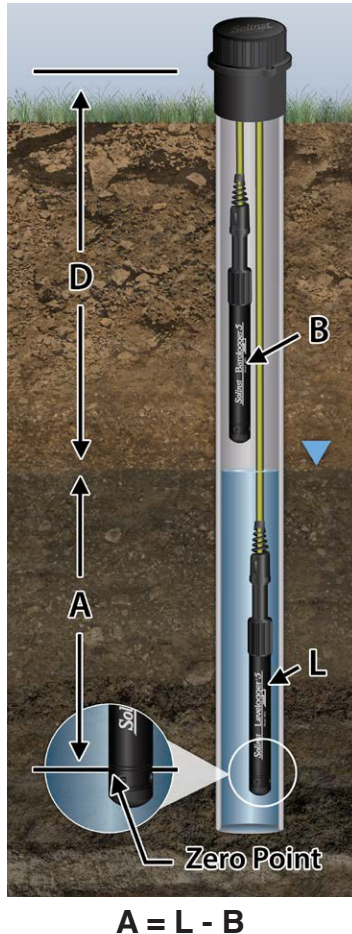
$$A = L - B$$

Figure 1-1
Levelogger Measurement Fundamentals

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 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

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 Advanced options within the software Data Wizard.

Note: The Levelogger Gold series convert pressure readings to the water level equivalent above the datalogger's pressure zero point of 950 cm (31.17 ft). The Levelogger 5 and Edge Series have no zero point offset. As such, water level data will appear different, although measuring the same amount of pressure (i.e. Levelogger 5 data will appear to be reading 950 cm (31.17 ft) higher than a Levelogger Gold). Barometric Compensation using the Data Wizard in Levelogger Software Version 4.4.0, automatically considers this zero point offset difference when compensating a mix of models.

1.2.1.1 Pressure Calibration

The Levelogger 5 is calibrated against a range of set reference points to an accuracy of 3 decimal places. During the calibration procedure, the Levelogger is fully submerged in a highly accurate water bath, until conditions are stable. The pressure is then calibrated to six separate pressure points covering the entire range of pressure to check for any non-linearity. The process is repeated again at two different temperatures 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 life-time of the instrument as long as it is used within its given technical specifications, in compatible monitoring environments with routine inspections, and is not physically, chemically or thermally damaged.

1.2.2 Barometric Pressure

The Barologger 5 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 Wizard in the Levelogger Software simplifies the adjustment of the level measurements for barometric pressure changes, by generating a compensated data file 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 where its accuracy is important 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 5 and Levelogger 5 LTC, -10°C to +50°C for the Barologger 5, and 0 to +40°C for the Levelogger 5 Junior. 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 Levelogger LTC models provide the added feature of electrical conductivity measurement; they measure the actual conductivity at the current temperature. Conductivity measurement is particularly useful in monitoring saltwater intrusion, surface water infiltration and mixing, as well as being an indicator 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 up to 4 specific calibration solution ranges, and the Calibration Wizard in the Levelogger Windows Software.

The Data Wizard allows you to convert conductivity readings to Specific Conductance (at 25°C), Salinity expressed in Practical Salinity Units (PSU), or TDS. A Practical Salinity Unit (PSU) is a dimensionless descriptor for the Practical Salinity Scale (PSS). The PSS defines salinity as the ratio of a water sample's conductivity to that of a standard KCL solution. The Data Wizard uses the equation given in the UNESCO Technical Paper "Algorithms for computation of fundamental properties of seawater", to convert Conductivity readings to Salinity. For more information, see: Fofonoff, N. P. and R.C. Millard, Jr. Algorithms for computation of fundamental properties of seawater, UNESCO, Tech. Pap. Mar. Sci.,44. The Data Wizard uses the known equation "TDS=keEC" to convert Conductivity readings to TDS, where TDS is expressed in mg/L or ppm and EC is the electrical conductivity in μS/cm at 25˚C. Correlation factor ke is between 0.55 - 0.8. For more information, see: Al Dahaan, S.A.M., Al-Ansari, N. and Knutsson, S. (2016) Influence of Groundwater Hypothetical Salts on Electrical Conductivity Total Dissolved Solids. Engineering, 8, 823-830. http://dx.doi.org/10.4236/eng.2016.811074

Note: For every degree change in temperature, there is approximately a 2% change in conductivity. To convert raw conductivity measurements to Specific Conductance measurements, you can use the following equation:

$$\text{Specific Conductance} = \text{Conductivity} / (1 + 0.02 * (\text{temp(C)} - 25))$$

You can also perform this calculation automatically using the Data Wizard.

1.2.4.1 Calibration of the Conductivity Sensor

The conductivity sensor of a LTC Levelogger 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 a LTC Levelogger should be re-calibrated, 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 the stated accuracy of the conductivity measurement, the unit should be re-calibrated using the Conductivity Calibration Wizard procedure outlined in Section 6. As a minimum, calibrate your LTC Levelogger at least twice a year. Ensure that a conductivity calibration is performed when the LTC Levelogger is being set up for its initial use and after long periods of dry storage.

1.2.5 Total Rainfall

Solinst Rainloggers are designed to record the number of tips of an external tipping-bucket rain gauge, and output the amount of rainfall per tip.

2 Communicating with Solinst Dataloggers

Levelogger Software is Windows based, and is therefore used with a desktop or laptop PC. Dataloggers connect to a PC with an Optical Reader or PC Interface Cable. The Optical Readers and PC Interface Cable use an optical data reader/port connected to the datalogger and a USB (or RS-232 Serial Com Port) to transfer information between the datalogger and computer.

Note: There is also the option to communicate with a DataGrabber 5 or Levelogger 5 App Interface (see separate User Guides).

2.1 Optical Readers

If you are programming **5 Series dataloggers** in the office, the Optical Reader most commonly used for communication with a PC is a **Desktop Reader 5**.

Desktop Reader 5

Desktop Reader 5

Figure 2-1 Levelogger 5 Connected to a PC Using a Desktop Reader 5

Note: Always plug in the USB device before starting the Software. See Section 4.1.2 for more information on communication with USB ports.

If you have deployed your Levelogger 5 in the field using wireline or cord (not on a L5 Direct Read Cable), a **Field Reader 5** is most commonly used for communication with a PC.

Field Reader 5

Field Reader 5

Figure 2-2 Levelogger 5 Connected to a PC Using a Field Reader 5

You can also use an older style Optical Reader with an **L5–Edge DRC Adaptor** to communicate with a 5 Series datalogger.

Note: The L5–Edge DRC Adaptor contains a small, long-lasting battery (not user-replaceable). The Adaptor should always be stored above freezing temperatures and with caps on to prevent unnecessary battery drainage and protect the optical eyes.

Note: The L5–Edge DRC Adaptor also allows the connection of a Levelogger 5 to an older style Direct Read Cable. See Section 10.1.1.2.

L5–Edge DRC Adaptor

Older Style
Optical Reader

Older Style
Optical Reader
and Adaptor
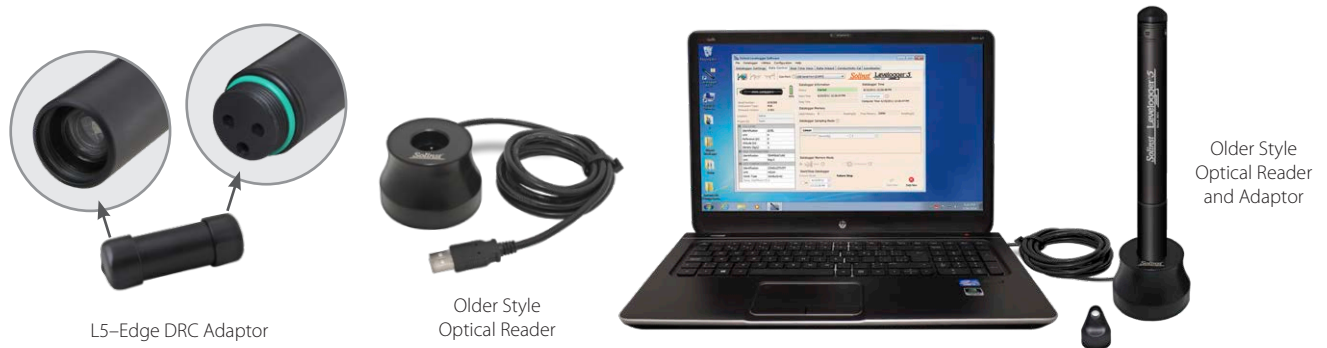
Figure 2-3 Levelogger 5 Connected to a PC Using an Older Style Optical Reader and L5–Edge DRC Adaptor

If you are programming an **Edge or Gold Series datalogger**, you will require an **Edge–L5 DRC Adaptor** to connect to a Desktop Reader 5 or Field Reader 5, or you can use an older style Optical Reader.

Note: The Edge–L5 DRC Adaptor contains a small, long-lasting battery (not user-replaceable). The Adaptor should always be stored above freezing temperatures and with caps on to prevent unnecessary battery drainage and protect the optical eyes.

Note: The Edge–L5 DRC Adaptor also allows the connection of a Levelogger Edge or Gold to a L5 Direct Read Cable. See Section 10.1.1.2.

Note: When connecting an Edge–L5 DRC Adaptor, only turn the coupling on the Adaptor and hold the datalogger still.

Edge–L5 DRC
Adaptor

Desktop Reader 5
and Adaptor

Figure 2-4 Levelogger Edge Connected to a PC Using an Edge–L5 DRC Adaptor and Desktop Reader 5

Edge–L5 DRC
Adaptor

Field Reader 5
and Adaptor

Figure 2-5 Levelogger Edge Connected to a PC Using an Edge–L5 DRC Adaptor and Field Reader 5

Older Style
Optical Reader

Figure 2-6 Levelogger Edge Connected to a PC Using an Older Style Optical Reader

2.2 PC Interface Cable

If a datalogger is deployed in the field using a L5 Direct Read Cable (or older style Direct Read Cable), a PC Interface Cable connects to the L5 Direct Read Cable for communication with the PC—no need to remove the datalogger from the well.

PC Interface Cable

Datalogger on a L5 Direct Read Cable Down Well

Figure 2-7 Datalogger and L5 Direct Read Cable Connected to PC Using a PC Interface Cable

Note: See Section 10.1.1.2 for more information on installations using Direct Read Cables.

2.3 Backwards Compatibility

The Levelogger 5 Series is not backwards compatible with previous versions of Levelogger Software. Only Levelogger Software Version 4.6.1 and up can be used to program the Levelogger 5, Barologger 5, Levelogger 5 Junior, Levelogger 5 LTC, and the Rainlogger 5.

Note: It is always recommended to use the most recent version of software and firmware.
Let Solinst keep you up-to-date with each new software and firmware release. Register your software at:
www.solinst.com/Registration/ **to receive these updates.**

Only Levelogger Software Version 4 and up can be used to program the Levelogger Edge and Barologger Edge. The Levelogger Junior Edge is only compatible with Levelogger Software Version 4.0.2 and up. The Rainlogger Edge is only compatible with Software Version 4.1.0 and up. The LTC Levelogger Edge is only compatible with 4.3.0 and up.

The Levelogger Gold, Barologger Gold, Levelogger Junior, LTC Levelogger Junior, and Rainlogger are compatible with Levelogger Software Version 4.4.0, as well as previous versions.

To use your Leveloggers with Version 4.6.1 Software, ensure your firmware is upgraded to the following versions (or higher):

Datalogger	Firmware Version
Levelogger 5	1.004
Barologger 5	1.004
Levelogger 5 Junior	1.004
Levelogger 5 LTC	1.004
Rainlogger 5	1.004
Levelogger Edge	3.004
Barologger Edge	3.004
Levelogger Junior Edge	3.004
LTC Levelogger Edge	1.003
Rainlogger Edge	3.001

For more information on previous software and firmware versions, visit www.solinst.com to view **3001 Levelogger Series: Hardware Compatibility**, located on the Downloads page.

3 System Requirements and Software Installation

3.1 System Requirements

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

Hardware	Software
Processor: 1 GHz or faster processor or SoC	OS: Windows 10
RAM: 1 GB for 32-bit or 2 GB for 64-bit	
Hard disk space: 128 MB	
Display: 800 x 600	
Ports: USB or RS-232	

The communication port setting for Levelogger communications is automatically set up when the Levelogger Software is installed:

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

3.2 Software Installation

Web Download

1) Download the newest version of Levelogger Software by visiting: https://www.solinst.com/downloads/

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

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_6
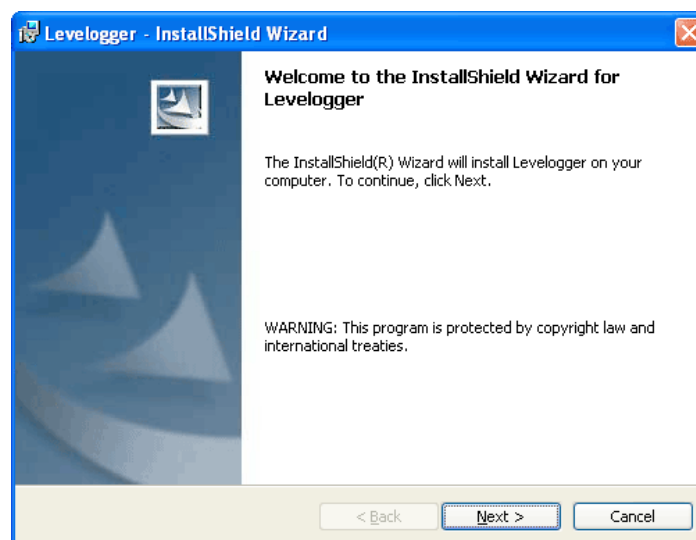
Figure 3-1 Software Installation Wizard

4 Startup, Configurations and Settings

4.1 Startup

When using a USB port, plug in the USB device (Desktop Reader 5, Field Reader 5,Optical Reader, or PC Interface Cable) before starting the Levelogger Software.

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

Programs > Solinst > Levelogger 4 > Levelogger 4.6.1

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 on-line 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 web page where you can download the software update.

Note: Your PC must have an Internet connection to check for software and firmware updates.

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 web page where you can download the firmware update. See Section 12 for firmware update instructions.

Note: You can also check for updates using the Help menu.

4.1.2 Communicating with a USB Port

There are two types of Solinst USB devices that you can use to communicate with Levelogger Software:

1) Older style Optical Readers (received before February 2018) and PC Interface Cables (received before July 2018) that sometimes require updating drivers. When connected to your PC, their details can be found within the Device Manager under the list of "Ports (COM & LPT)".

Note: to check the Com Port assigned to these USB devices 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 4.1.2.2.

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

2) The current style Desktop Reader 5, Field Reader 5, as well as older style Optical Readers (received after February 2018), and PC Interface Cables (received after July 2018) do not use drivers. When connected to your PC their details can be found within the Device Manager under the list of "Human Interface Devices" (HID).

4.1.2.1 HID-Compliant USB Devices

Current Desktop Reader 5, Field Reader 5, older style Optical Readers received after February 2018, and PC Interface Cables received after July 2018, will be displayed under the list of "Human Interface Devices". Simply connect the Optical Reader or PC Interface Cable to the USB port on your PC. When installed, a message stating that "a HID-compliant device has been recognized" typically appears.

4.1.2.2 Older Style USB Devices

For older style Optical Readers (received before February 2018) and PC Interface Cables (received before July 2018), USB port communication requires the installation of USB driver software and the setting up of a virtual Com Port.

Note: See previous versions of the Levelogger User Guide or the Solinst YouTube Channel, https://www.youtube.com/user/SolinstCanadaLtd, for instructions on manually installing the USB drivers, if required.

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 the device is installed.

Note: to check the Com Port assigned to these USB devices after installation, open the Device Manager. Expand "Ports (COM & LPT)" to show the Com Port that has been assigned.

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

Com Port Designation Set Up

After installing an older style 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 Configuration and Settings

4.2.1 Data Directory

Levelogger Software program will save data downloaded to the following default directory:
<C:\Program Files\Solinst\Levelogger4_6\Data>
Unless otherwise specified in the Default Directory field of the Application Settings window (Figure 4-1).

Click the Configuration menu at the top of the Levelogger Software 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.
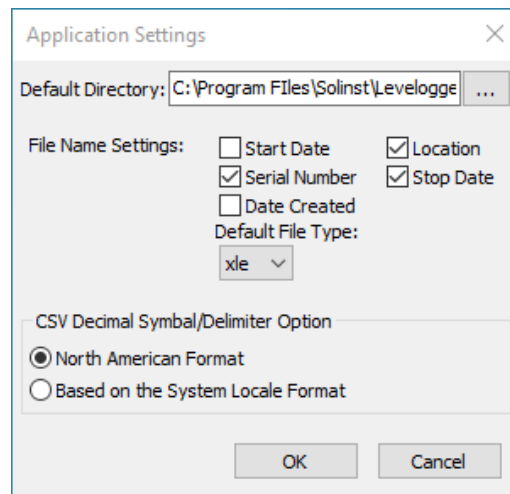
Figure 4-1 Application Setting Window

4.2.2 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 4-1). You can include Start Date, Stop Date, Date Created, 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.

4.2.3 Default File Type

From the Application Settings window in the Configuration menu, you can set what default file type you would like to use for downloaded, saved and exported data files. You can select between either *.xle (default) or *.lev file types (see Figure 4-1). For more information about the two file types, see Section 7.1.1.
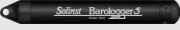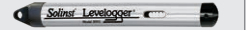
You also have the option to choose between North American Format for decimal separators (period symbol) or based on the System Locale Format, for exported *.csv files.

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

5 Levelogger Series Setup

Depending on the type of datalogger, there will be differences in programming options, memory, and battery life. See below for a summary of the differences:

Table 5–1: Levelogger Series Programming Options. Memory & Battery Life				
Datalogger Type	Sampling Options	Units of Measure	Memory Capacity	Battery Life
Levelogger 5 (Barologger 5)	Linear (0.125 second to 99 hours), Event Based, Schedule, Repeat Schedule, Real Time View, Future Start/Stop	Level: m (default), cm, ft, kPa, bar, and psi Baro: kPa (default), mbar, and psi. Temp: °C, °F	150,000 sets of readings in Slate or Continuous Mode	10 years based on 1 reading per minute
Levelogger 5 Junior	Linear (0.5 second to 99 hours), Real Time View, Future Start	Level: m (default), cm, ft, kPa, bar, and psi Temp: °C, °F	75,000 sets of readings in Slate or Continuous Mode	5 years based on 1 reading per minute
Levelogger 5 LTC	Linear (2 seconds to 99 hours), Event Based, Schedule, Repeat Schedule, Real Time View, Future Start/Stop	Level: m (default), cm, ft, kPa, bar, and psi Temp: °C, °F Cond: mS/cm, µS/cm	100,000 sets of readings in Slate or Continuous Mode	8 years based on 1 reading every 5 minutes
Rainlogger 5	Event Based (records tips from tipping-bucket rain gauge), Real Time View, Future Start	mm or in	Up to 100,000 tip time logs in Slate or Continuous Mode	10 years based on 2 parameters logged every 10 minutes
Levelogger Edge (Barologger Edge)	Linear (0.125 second to 99 hours), Event Based, Schedule, Repeat Schedule, Real Time View, Future Start/Stop	Level: m (default), cm, ft, kPa, bar, and psi Baro: kPa (default), mbar, and psi. Temp: °C, °F	40,000 sets of readings in Slate or Continuous Mode	10 years based on 1 reading per minute
Levelogger Junior Edge	Linear (0.5 second to 99 hours), Real Time View, Future Start	Level: m (default), cm, ft, kPa, bar, and psi Temp: °C, °F	40,000 sets of readings in Slate or Continuous Mode	5 years based on 1 reading per minute
LTC Levelogger Edge	Linear (2 seconds to 99 hours), Event Based, Schedule, Repeat Schedule, Real Time View, Future Start/Stop	Level: m (default), cm, ft, kPa, bar, and psi Temp: °C, °F Cond: mS/cm, µS/cm	27,000 sets of readings in Slate or Continuous Mode	8 years based on 1 reading every 5 minutes
Rainlogger Edge	Event Based (records tips from tipping-bucket rain gauge), Real Time View, Future Start	mm or in	Up to 60,000 tip time logs in Slate or Continuous Mode	10 years based on 2 parameters logged every 10 minutes
Levelogger Gold (Barologger Gold)	Linear (0.5 second to 99 hours), Event Based, Schedule, Real Time View, Future Start/Stop	Level: m (default), cm, ft, Temp: °C	40,000 sets of readings in Slate or Continuous Mode	10 years based on 1 reading per minute
Levelogger Junior	Linear (0.5 second to 99 hours), Real Time View, Future Start	Level: m (default), cm, ft, Temp: °C	32,000 sets of readings in Slate Mode	5 years based on 1 reading per minute
LTC Levelogger Junior	Linear (5 second to 99 hours), Real Time View, Future Start	Level: m (default), cm, ft, Temp: °C Cond: mS/cm, µS/cm	16,000 sets of readings in Slate Mode	5 years based on 1 reading every 5 minutes
Rainlogger	Event Based (records tips from tipping-bucket rain gauge), Real Time View, Future Start	mm or in	Up to 60,000 tip time logs in Slate Mode	10 years based on 2 parameters logged every 10 minutes

Note: Levelogger Gold Series dataloggers are compatible with Levelogger Software Version 4.4.0.

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

Note: Click on ⑦ icons to get an explanation of that software feature.
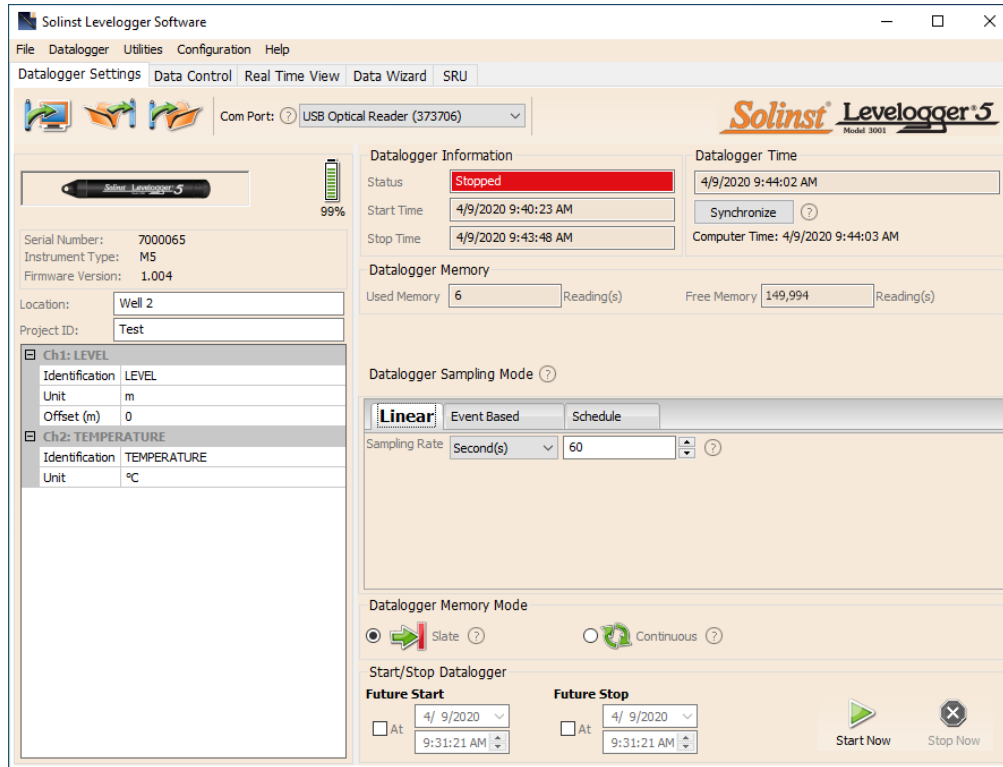

Figure 5-1 Datalogger Settings Tab

Select the appropriate Com 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, Battery Level and the Channel Settings.

- **Instrument Type**: will display the model of the attached datalogger, i.e.: 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.

Note: When first setting up a Barologger and Levelogger(s) that will be used for the same project, it is suggested to set them at the same sampling interval, and to use the Future Start and Stop options where possible. When the data sets have the same time stamps, and start and stop times, barometric compensation of the data will be most accurate. It is also useful to synchronize the clocks of the dataloggers. See Section 5.4.

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 Levelogger 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 (m is default). See Table 5-1 for options.

Note: Readings can be converted to other units using the Data Wizard.

Note: If you set your Levelogger to record in pressure units (kPa, bar, psi), you can not change the offset or enter an elevation value (in the Data Wizard). Only raw pressure readings will be provided.

- **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, as this keeps all subsequent readings relative to the tip of the Levelogger. The reference range is -300 m to 5000 m or -1000 to 16,400 ft.

Note: There is no Offset input option for the Barologger.

Note: Readings can be corrected or offset with respect to a specific reference elevation or datum for a much wider spectrum of numeric offsets as part of the Data Wizard.

⊟ Ch1: LEVEL	
Identification	LEVEL
Unit	m
Offset (m)	0
⊟ Ch2: TEMPERATURE	
Identification	TEMPERATURE
Unit	°C

Figure 5-2 Levelogger 5 Channel Setup

The Levelogger Gold, 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 -300 m below sea level and 5000 m (or -1000 ft and 16,400 ft) 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.

Note: For other dataloggers, data can be adjusted for altitude and density post data collection using the Solinst Levelogger Software Data Wizard.

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, the temperature channel can be set to °C (default) or °F (except Gold Series dataloggers).

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 when monitoring water conductivity.
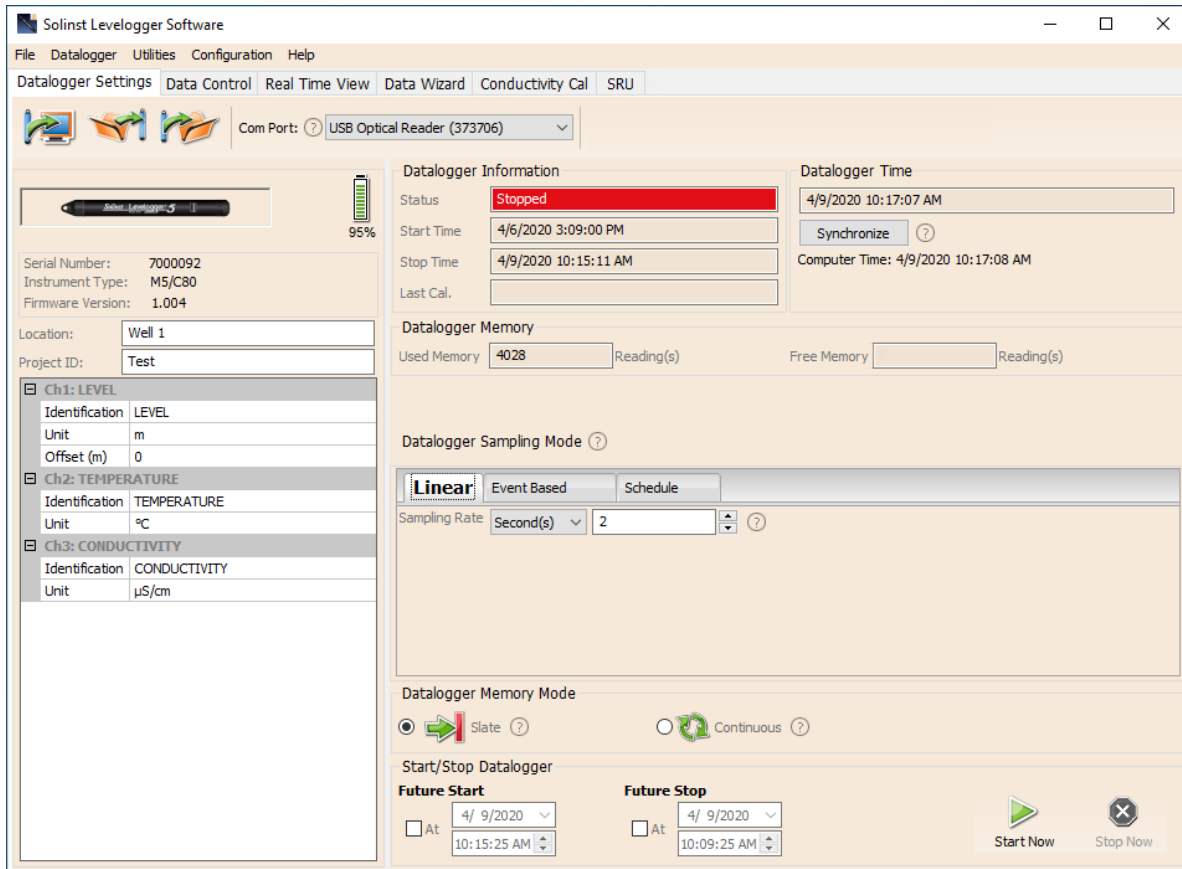
Figure 5-3 Conductivity Channel Setup

Note: For every degree change in temperature, there is approximately a 2% change in conductivity. To convert raw conductivity measurements to Specific Conductance measurements, you can use the following equation:

$$\text{Specific Conductance} = \text{Conductivity} / (1 + 0.02 * (\text{temp(C)} - 25))$$

You can also perform this calculation automatically using the Data Wizard.

Note: You can also convert Conductivity readings to Salinity (expressed in Practical Salinity Units (PSU)) using the Solinst Levelogger Software Data Wizard.

5.1.1.4 Rainloggers

There is one channel of measurement for a Rainlogger. The **RainFall** Channel records each tip time by the connected tipping-bucket and outputs the amount of rainfall per tip (input Rainfall Cal Constant).

- **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.
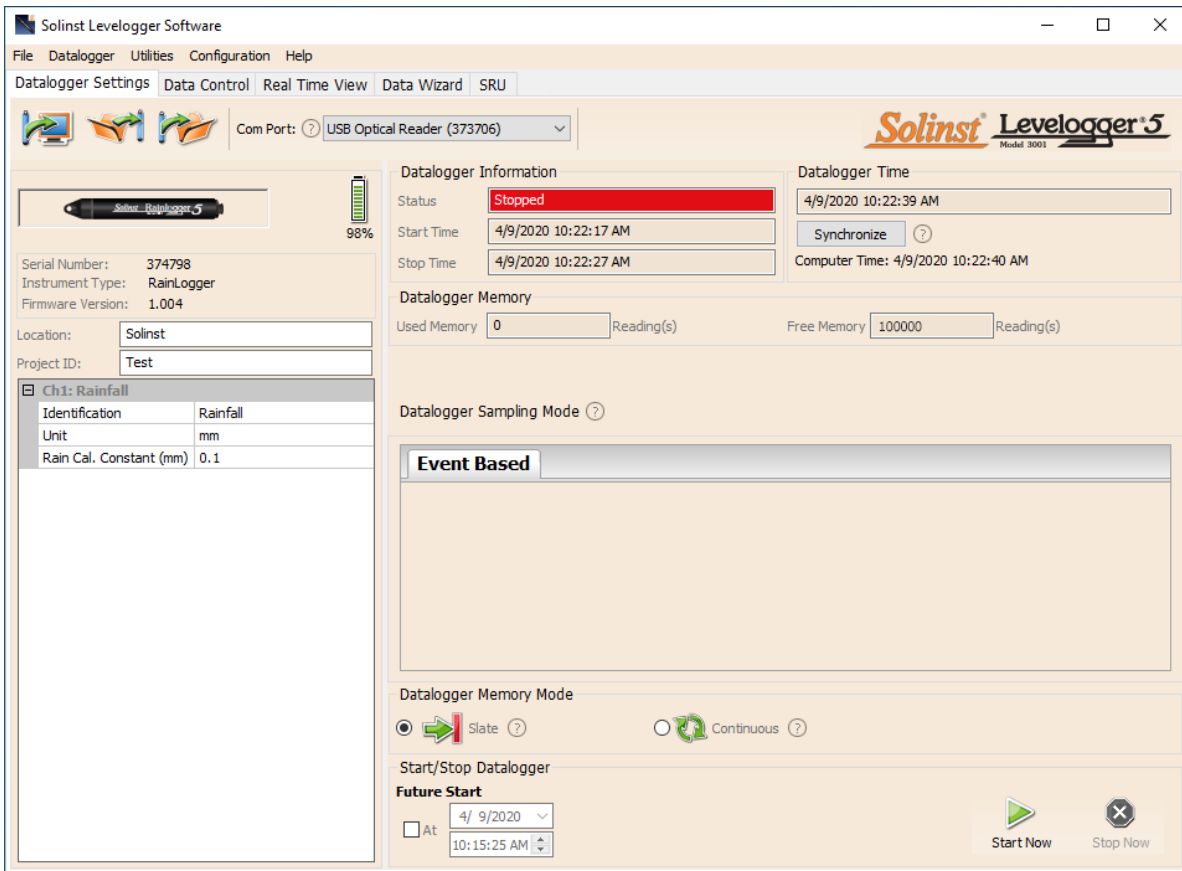

Figure 5-4 Rainlogger Channel Setup

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.
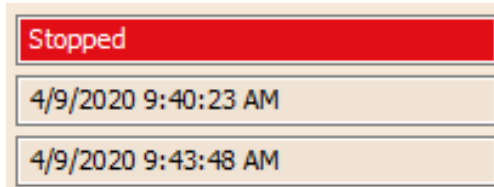

Figure 5-5 Datalogger Information

5.3 Datalogger Memory

The Datalogger Memory section shows the amount of memory used, and the amount of memory remaining (sets of readings).
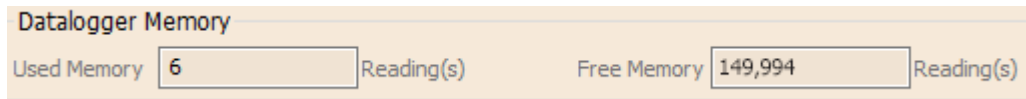
Figure 5-6 Datalogger Memory Remaining

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 Solinst 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 logger time to system time?'. Click Yes to synchronize the clock.

It can be very useful to synchronize the clocks of all the Solinst Leveloggers and Barologgers when it comes to Barometric Compensation, especially when being used in the same project.

To synchronize to a different time/time zone you first must adjust the computer time using the Windows Operating System Date and Time Settings menu. Then re-start the **Solinst Levelogger Software** and synchronize your Dataloggers to the new time.
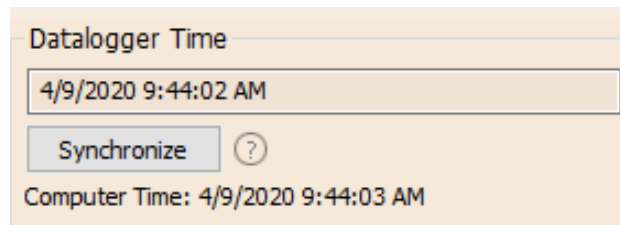

Figure 5-7 Datalogger Time

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.

Note: See Table 5-1 for model specific programming options.

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 5.

Note: Typical battery life of the Levelogger 5 is 10 Years, based on 1 reading per minute. More rapid readings will reduce the battery life. For example, if a Levelogger 5 is setup in Continuous Mode at a sampling rate of 1 second, the battery will be depleted in approximately 4 months.

Note: If a Levelogger 5 Junior or Levelogger 5 LTC is used at a sampling rate of 5 seconds, the battery will be depleted in approximately 2.4 months.
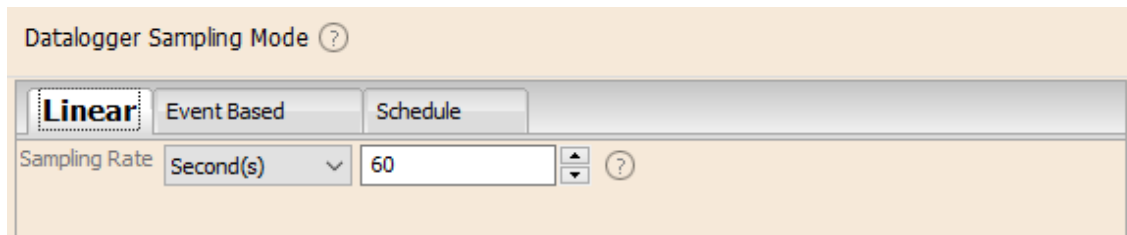

Figure 5-8 Linear Sampling Setup

Event Based sample collection is the most memory efficient means of data collection. In Event mode, the Levelogger will be activated at every defined 'Sample Rate' to check if readings have changed by the selected 'Change' from the last recorded reading.

For the Levelogger 5, 'LEVEL' or 'TEMPERATURE' is the selected parameter where change is monitored. You can also select 'CONDUCTIVITY' for the Levelogger 5 LTC. The Levelogger will record a new reading only if the specified change in the parameter has occurred, at the specific point in time, as defined by the 'Sample Rate'.

Note: In Event Based sampling mode, battery consumption is mainly a function of sampling rate. Therefore, with a smaller sampling interval, battery power will be used up quickly whether readings are stored or not.

Note: In Event Based sampling mode, the Levelogger 5 has a total memory of 60,000 sets of readings and the Levelogger 5 LTC has a total memory of 45,000 sets of readings.

Note: In Event Based sampling mode, the Levelogger Edge has a total memory of 24,000 sets of readings and the LTC Levelogger Edge has a total memory of 18,650 sets of readings. The Levelogger Gold has a total memory of 25,000 sets of readings.

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

Note: Rainloggers record in Event Based mode only. They record the tip times of a connected tipping-bucket.
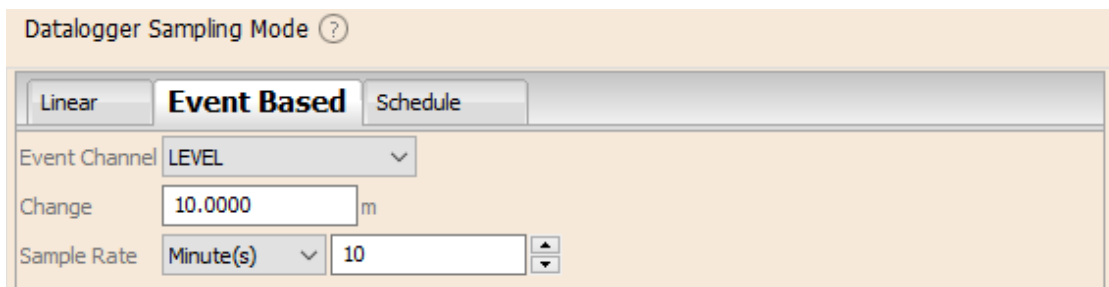

Figure 5-9 Event Based Sampling Setup

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, and the run time to date are shown. If the number of readings selected exceeds the Levelogger's 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.
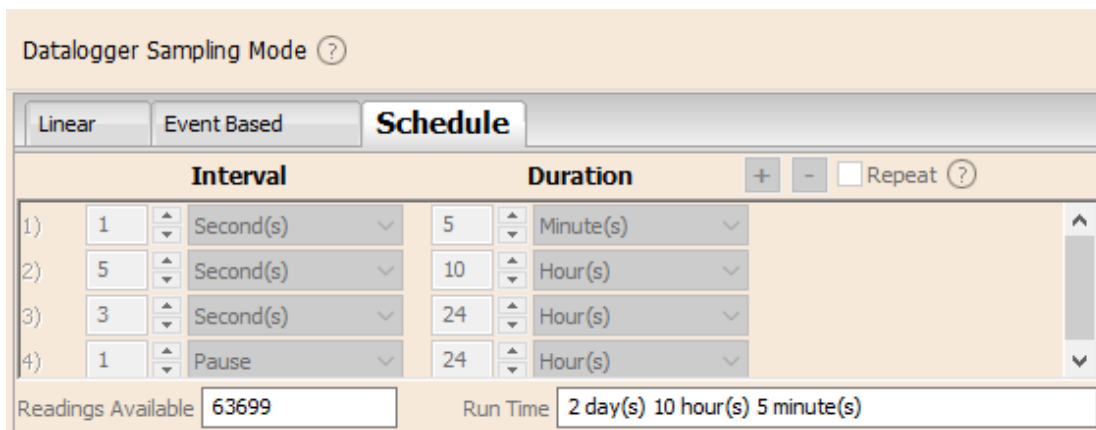

Figure 5-10 Schedule Sampling Setup

5.6 Datalogger Memory Mode

Datalogger Memory Mode selection will only appear when **Linear** sampling mode is selected. When in Linear Mode, there is a choice of **Continuous** Logging (wrap around) or **Slate** Logging .

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 (see Section 7.1.2).

In Slate Logging, the new log is also started at the end of any previous log, but will stop recording after the dataloggers memory is full (e.g. 150,000 sets of readings), so that the beginning of the current log will not be written over.
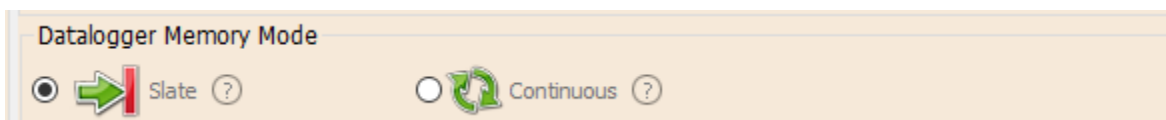

Figure 5-11 Datalogger Memory Mode

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 *.dtf file as a series of defaults. The *.dtf file will save the Project ID, Location, Sample Mode, Sample Rate, Channel ID, Unit, and Offset.

Note: Settings files created in Levelogger Software Version 3 or earlier (.lls or .sci files) can not be opened by Software Version 4.6 and up. These settings files will need to be re-created and saved in Levelogger Software Version 4.6 and up.

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

5.8 Starting and Stopping the Datalogger

Starting the Solinst Datalogger

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

To start logging immediately, do not click the Future Start box and click, ▷ . It should say Start Now below the icon to indicate an immediate start.
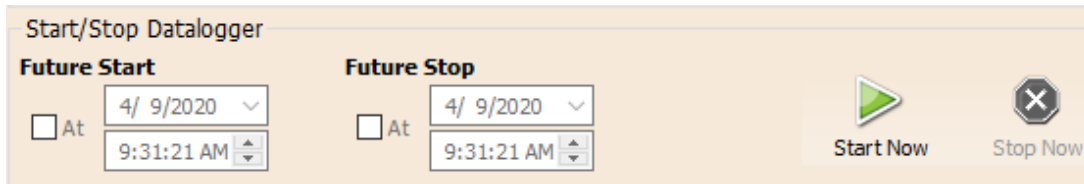

Figure 5-12 Starting the Datalogger Immediately

Before starting a Levelogger 5 Series datalogger, a pop-up window will indicate how much memory is available. **Selecting "Yes" ignores the message and starts the datalogger immediately** with the remaining available memory. Selecting "No" gives you the chance to access the Data Control tab to download and/or delete data files using the "Download and Delete Files" option, to free-up memory (see Section 7).
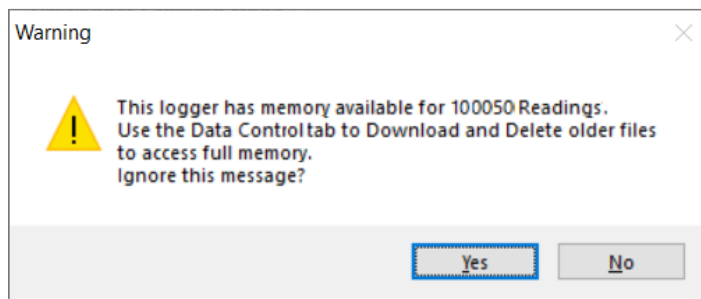

Figure 5-13 Remaining Memory Warning

Note: When using an Edge or Gold Series datalogger, remember to download any data on the datalogger before starting a new session. When starting a new logging session, any data from previous recording sessions will be erased.

After selecting "Yes" any changed settings will automatically be applied to the datalogger, and it will start logging. Datalogger Status will change from Stopped to Started.

Note: If a setting has been changed, it will be highlighted in yellow as a reminder before the datalogger is started. If a setting has been entered incorrectly, it will be highlighted in red. Changed settings are applied to the datalogger automatically when the Start icon is selected.

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.
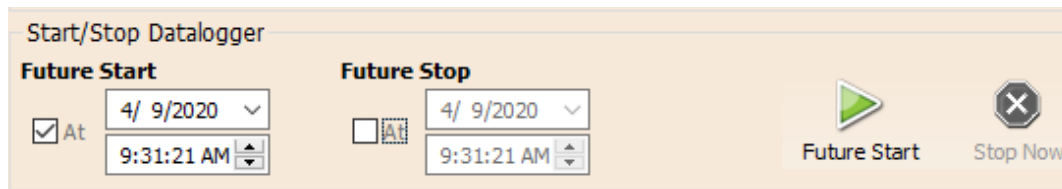
Figure 5-14 Future Start Setting

Note: Retrieve the Levelogger settings in order to refresh the status (i.e. when the status changes from Future Start to Started).

Note: Using a Future Start to synchronize all of your Loggers to start at the same time is recommended when deploying a Barologger to compensate a number of Leveloggers.

Stopping the Solinst Datalogger

There are two ways to stop logging: **Stop Now** or at a programmed **Future Stop** time.

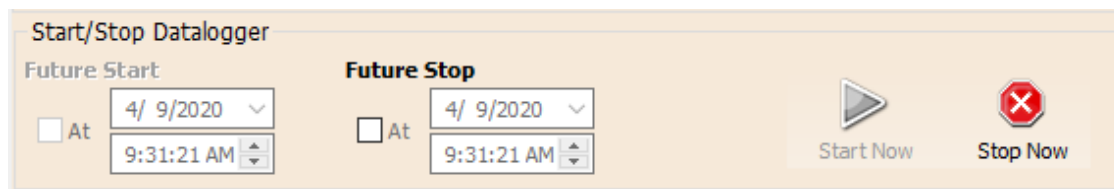**To stop the datalogger immediately** when it is logging, click , (it should say Stop Now below the icon).

Figure 5-15 Stopping the Datalogger Immediately

The Levelogger can be stopped at any time before it reaches the maximum reading capacity.

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.

Note: If you have set a Future Stop time, but wish to stop the datalogger immediately, uncheck the Future Stop 'At' box, and the Stop icon should say Stop Now. Click the icon to stop logging.
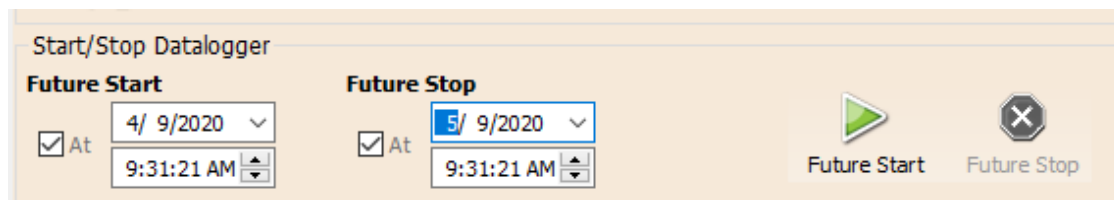

Figure 5-16 Future Stop Setting

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. 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 5 and Levelogger Edge units record in Slate mode if Event or Schedule logging, but in standard Linear mode they can be set to Slate or to Continuous logging.

6 Conductivity Calibration

The Levelogger 5 LTC, LTC Levelogger Edge and LTC Levelogger Junior conductivity sensors 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).

Levelogger 5 LTC

LTC Levelogger Edge

LTC Levelogger Junior

Figure 6-1 Levelogger 5 LTC, LTC Levelogger Edge, and LTC Levelogger Junior

Calibrating the LTC Levelogger 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 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 Levelogger 5 LTC and LTC Edge have a 100,000 µS/cm conductivity range and a calibrated range from 50 to 80,000 µS/cm. They can be calibrated to 4 calibration standard points:

- 1,413 µS/cm
- 5,000 µS/cm
- 12,880 µS/cm
- 80,000 µS/cm

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 to 3 calibration standard points:

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

If you know the approximate conductivity range of the water that you will be measuring, best accuracy when calibrating your unit is to select two calibration points—one above, and one below that range. If you are measuring in water less than 1,413 µS/cm or above 80,000 µS/cm (above 12,880 µS/cm for the LTC Levelogger Junior), use just one calibration solution.

The solution(s) and LTC 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. Use Real Time View to confirm that you have reached thermal equillibrium prior to calibration.

For best accuracy, it is recommended you use calibration solutions that have a temperature error of ±2% or better. You should also keep the solution as close to the stated temperature on the bottle as possible (i.e. 25°C). The closer you get to the temperature extremes of 10°C and 30°C, the less accurate your calibrations may be.

Note: Watch a step-by-step video of a 2-point conductivity calibration for the LTC Levelogger Edge.

https://www.solinst.com/products/dataloggers-and-telemetry/3001-levelogger-series/operating-instructions/user-guide/6-conductivity-calibration/6-conductivity-calibration.php

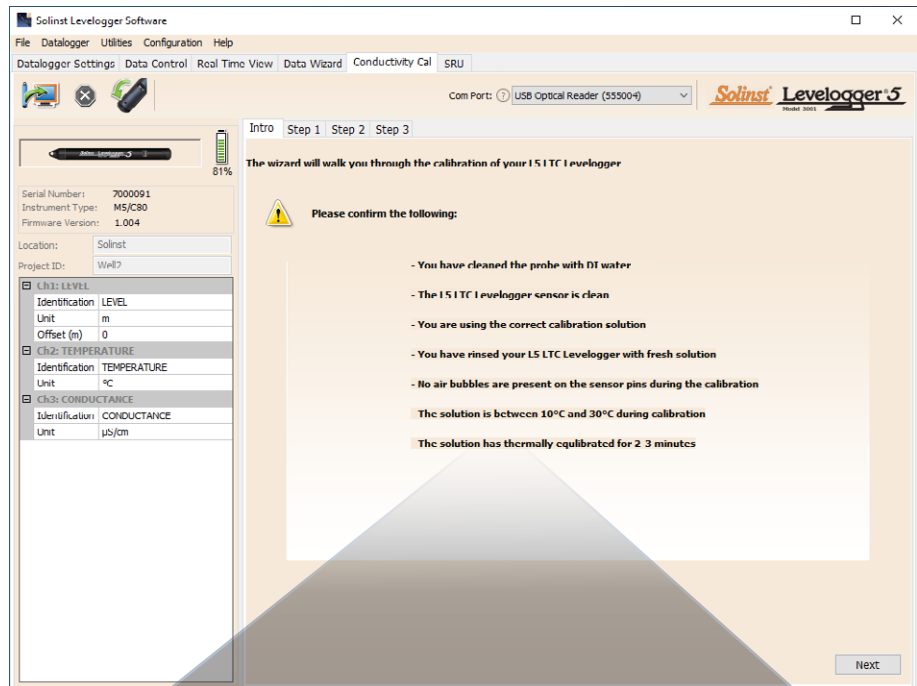Retrieve the settings from the attached LTC Levelogger by clicking .

Stop the LTC Levelogger by clicking .

Start the Solinst Levelogger Software Calibration Wizard by clicking the Conductivity Cal tab. The wizard will guide you through the calibration process. You can exit the wizard after any step to cancel the calibration session.

Introduction: The Solinst LTC Levelogger must be connected to the computer with an Optical Reader (Desktop Reader 5 or Field Reader 5) during the calibration 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. See Section 10.2 for recommended methods to clean the sensor pins. See Section 10.1.5.3 for protection against biofouling conditions.

Note: Ensure that the calibration solution covers the entire sensor cell and the logger is agitated to release entrapped air bubbles.

Figure 6-2 Levelogger Conductivity 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 states a different temperature coefficient on the label, please input that number into the Temperature Coefficient field.
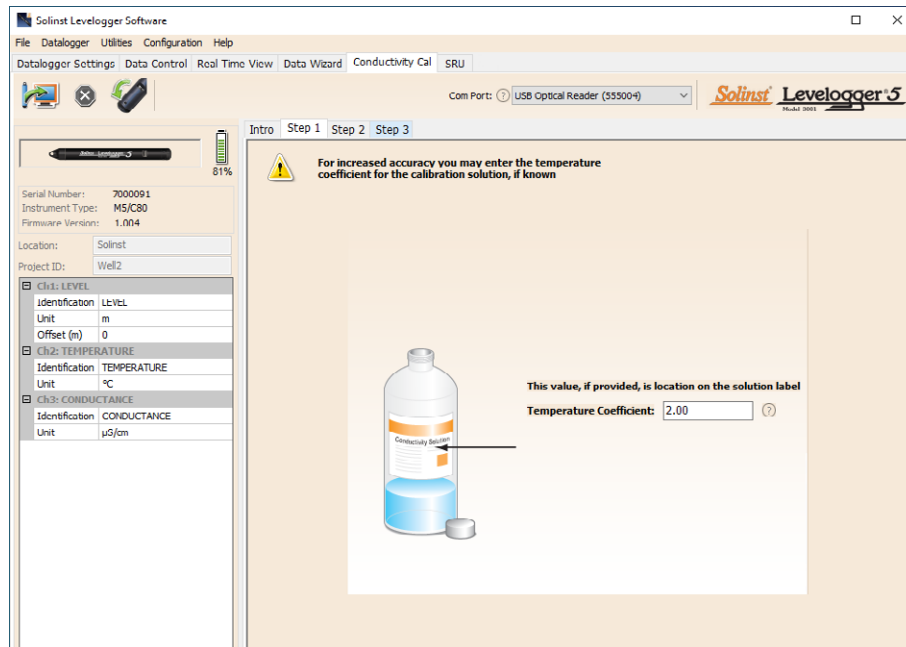
Figure 6-3 Levelogger Conductivity Calibration Wizard Step 1

2) **Setup:** The Levelogger Software requires the user to select the calibration solutions. You can choose up to four (three for the LTC Levelogger Junior) solutions for a multipoint calibration of the LTC Levelogger. Ensure the solutions are ready in the calibration beaker or container. Start the calibration by selecting Next.

Note: To obtain the highest accuracy, choose the calibration solution closest to your expected conductivity. Use a two point calibration for waters midway between two calibration solutions. Use a one point calibration for waters less than 1,413 µS/cm and above 80,000 uS/cm (12,880 uS/cm for the LTC Levelogger Junior).
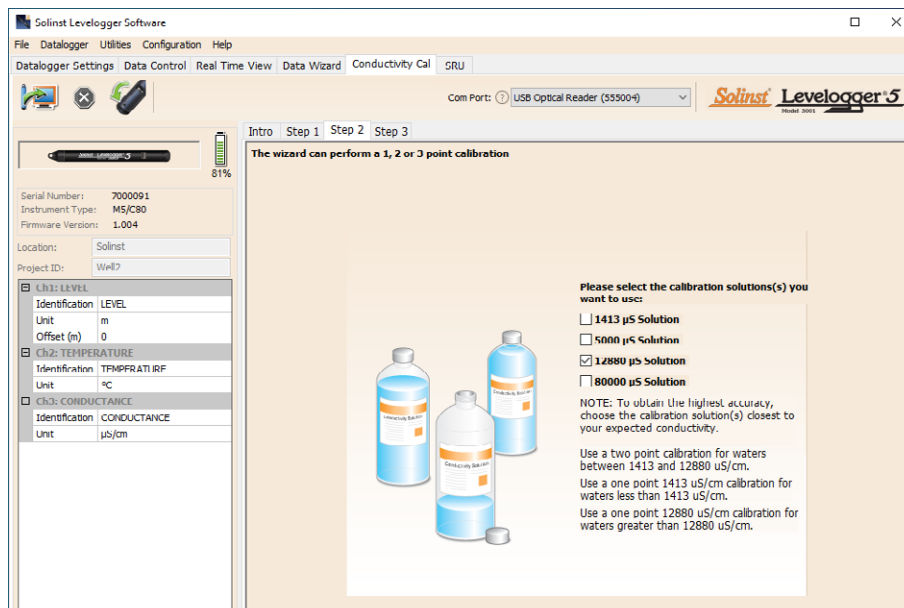

Figure 6-4 Levelogger Conductivity Calibration Wizard Step 2

3) **LTC Levelogger Rinsing Process:** Use DI water to rinse the LTC Levelogger first and then rinse the Levelogger with the displayed calibration solution. Use fresh solution for calibration, and immerse the LTC Levelogger. Lightly tap and stir the Solinst LTC Levelogger to remove any bubbles from the sensor. Allow 2-3 minutes to stabilize, then select next to calibrate.
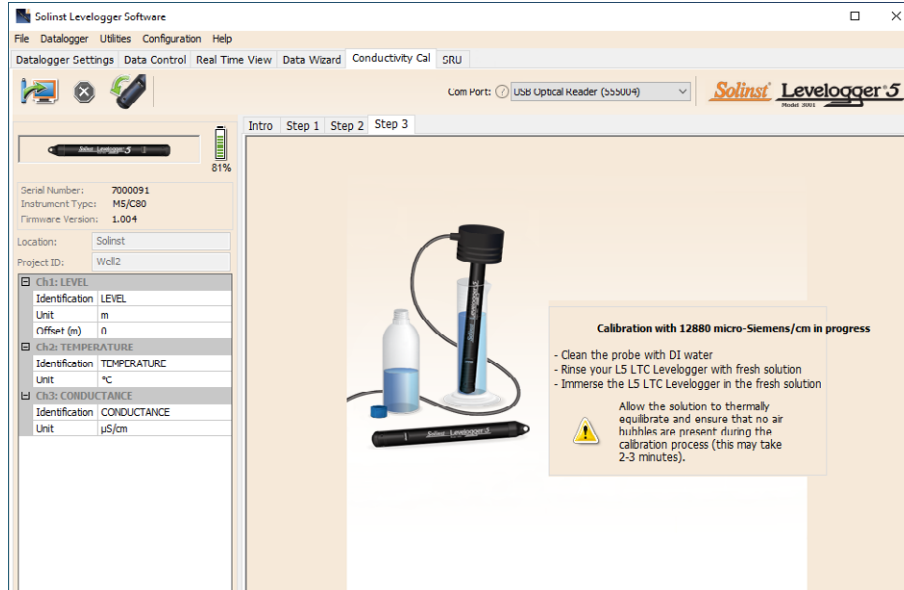
Figure 6-5 Levelogger Conductivity Calibration Wizard Step 3
(example of window calibrating with 12,880 µS/cm solution)

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

Calibration: Since most standard calibration solutions state conductivity at a standard temperature of 25°C, the LTC Levelogger will account for temperature differences between 10 to 30°C when you calibrate the unit. The LTC Levelogger will compare the current temperature and conductivity readings against the temperature corrected standard solution.

Figure 6-6 Levelogger Conductivity Calibration Successful

When a single-point calibration is successful, the process is complete. Once the calibration is complete for the first solution of a multipoint calibration, a message will appear stating that the calibration was successful. When you select 'Okay', the Calibration Wizard will go back to the beginning of Step 3 to start the rinsing process for the next solution selected. The calibration process will proceed automatically until completed for all solutions.
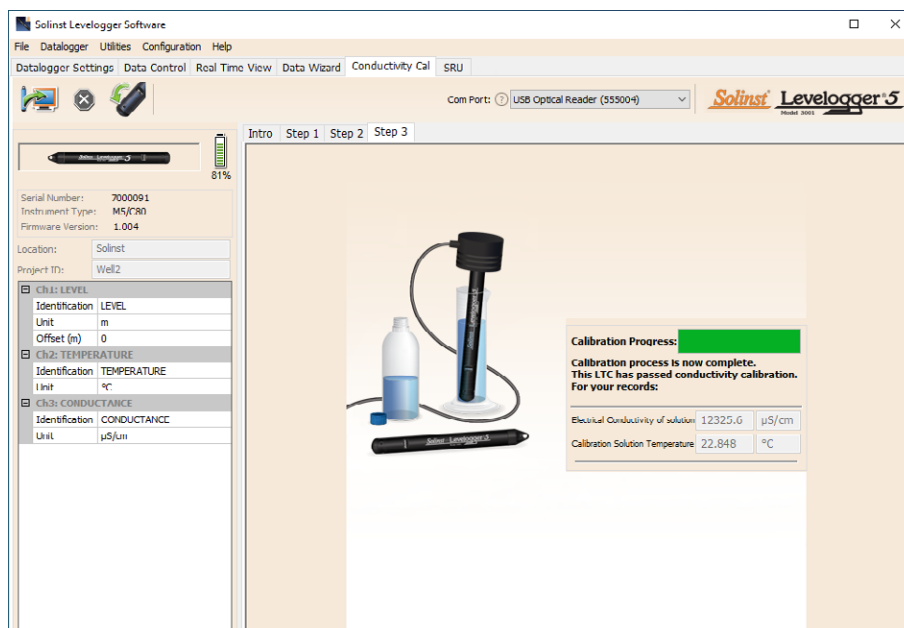
If a failure occurs at any point during calibration, a message will appear asking you to clean and check your probe, then start the calibration process over for that current solution by selecting 'Yes' (Figure 6-7). If performing a multipoint calibration, any previous successful calibration points will remain.
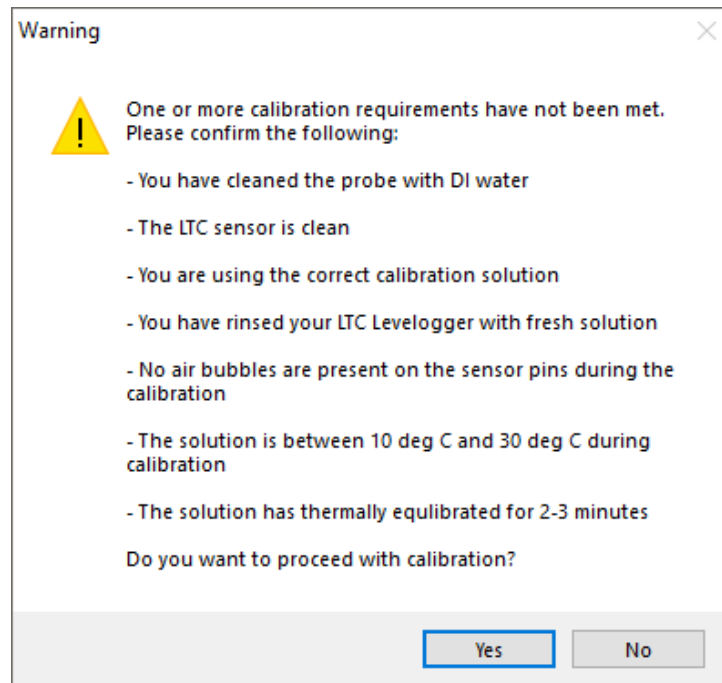
Figure 6-7 Levelogger Conductivity Calibration Warning 1

If a second failure occurs during calibration, a warning message will appear indicating that your probe may still be dirty, or damaged. This may occur if your Solinst LTC Levelogger conductivity sensor has been affected by dirt, mineral build-up, etc., so it no longer responds like it did when it was first factory calibrated. This step allows your sensor to be calibrated within a wider range of the standard solution value.
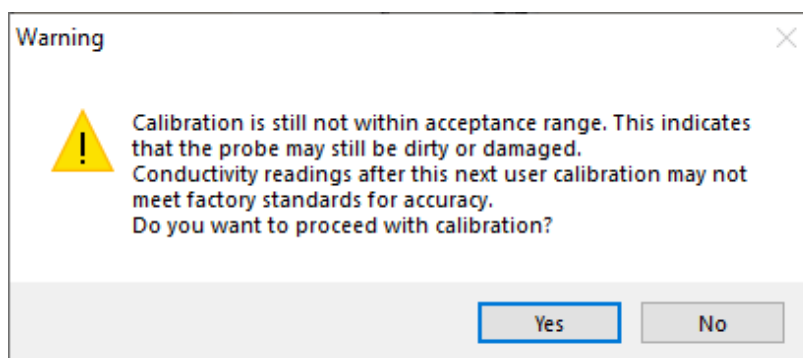
Figure 6-8 Levelogger Conductivity Calibration Warning 2

If you select 'Yes' to accept the larger tolerance, the calibration process will start over for that current solution (Figure 6-8). If performing a multipoint calibration, any previous successful calibration points will still remain. If you select 'No', the LTC Levelogger will default back to the last pre-calibrated state. You can retry the calibration using the normal tolerance range.

If a third calibration error occurs, or the results of the calibration are outside the error tolerance range, a warning message will appear asking you to contact Solinst for more options (Figure 6-9).
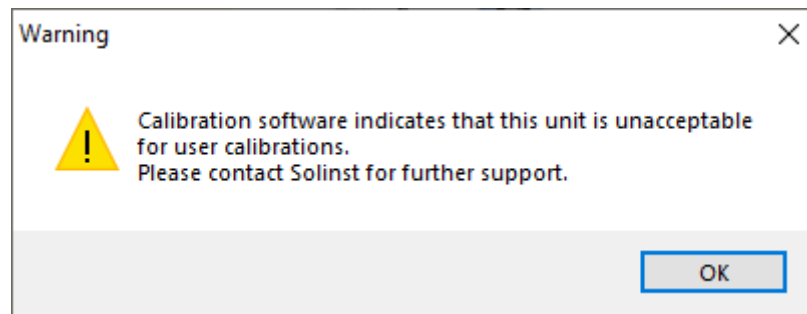
Figure 6-9 Levelogger Conductivity Calibration Warning 3

6.1 Restore Factory LTC Levelogger Calibration

A LTC Levelogger 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, or if you have mistakenly attempted a calibration in the wrong solution, you can restore the LTC Levelogger 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 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.
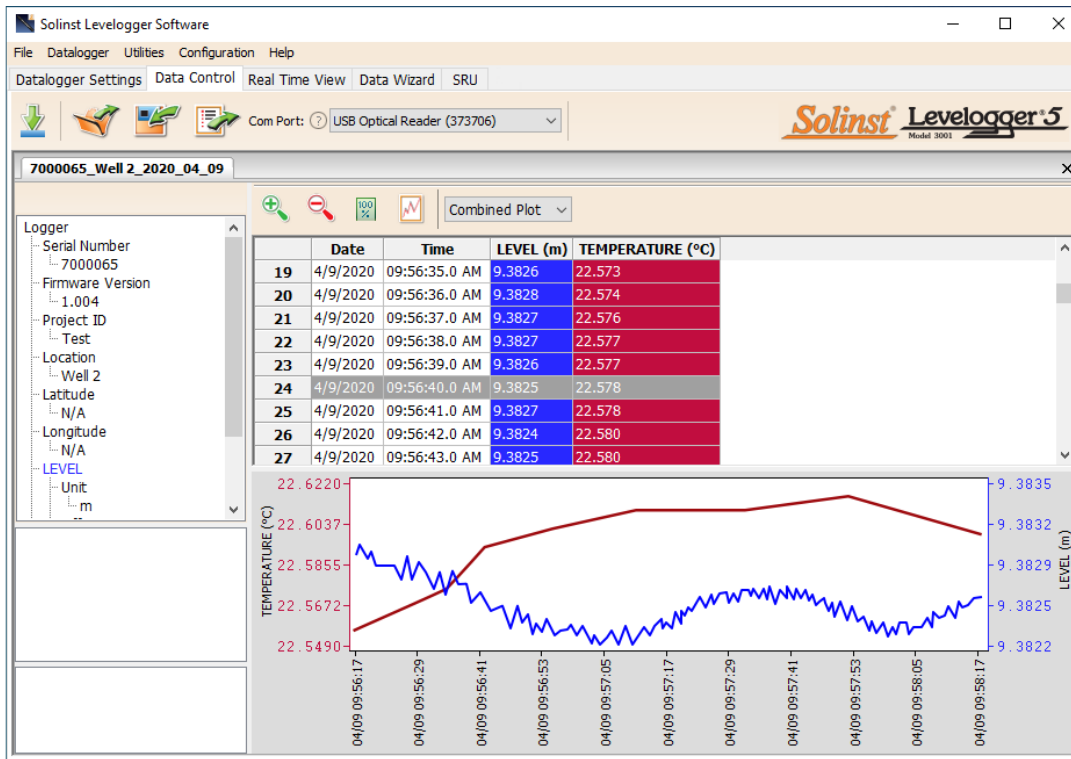
Figure 7-1 Data Control Tab

Click [icon] 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 top left of the window.

The bottom left sections of the window are used to display information after a data compensation has been performed. The middle section displays information from a Barologger, if a barometric compensation is performed, and the bottom section includes information from other conversions, such as offsets or conductivity conversions (see Section 8).

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. Simply left click on a row number, then hold and drag to include the row number of interest.
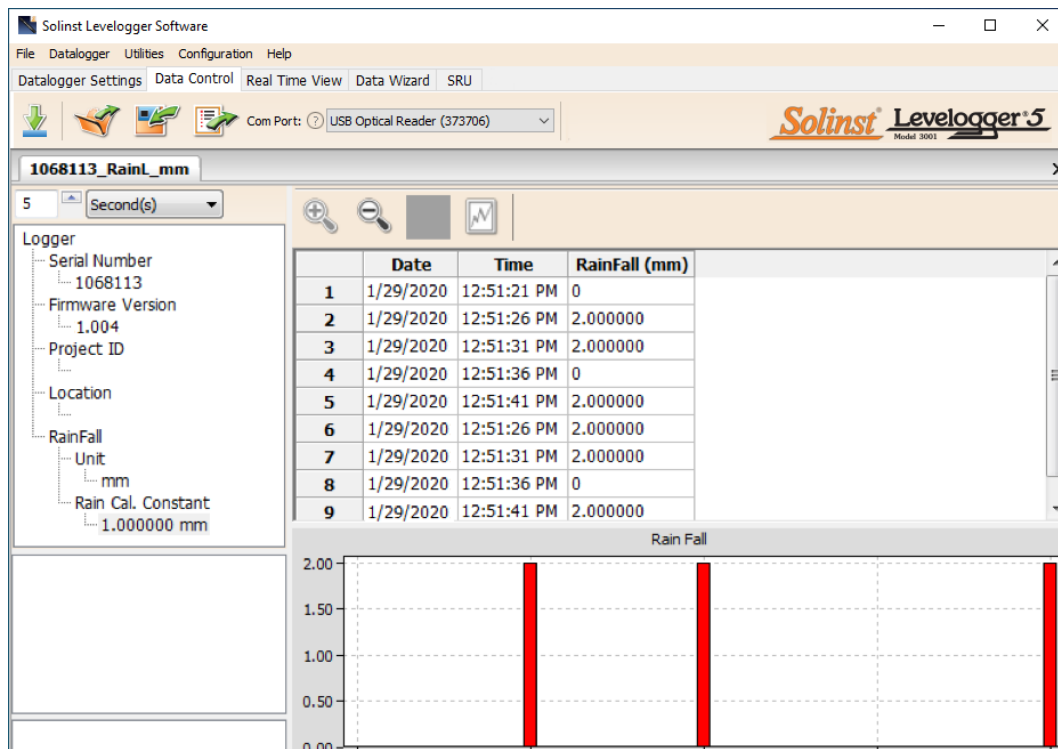
Figure 7-2 Rainlogger Data

When you view data downloaded from a Rainlogger, the RainFall data will be shown in a table and in a bar graph. A drop-down menu appears that allows you to select the time interval at which you would like the data shown, from 1 to 99 seconds, minutes, hours, days, or weeks (this acts like a zoom function). Figure 7-2 shows the data every 5 seconds from the start date and time.

Note: As there is only one channel of data for Rainloggers, there are no graphing options.

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, unless changed to *.lev in the Application Settings (see Section 4.2.4). 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.

Note: The default file type is *.xle, unless changed in the Application Settings (see Section 4.2.4).

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

Note: Before downloading data you must select the Com Port that the datalogger is connected to and retrieve the settings from the attached datalogger by clicking [icon] in Datalogger Settings tab.

Click [icon] from the Data Control tab to download data from a connected datalogger. There are four options for downloading data.

For Levelogger 5 Series dataloggers, they are: **All Data, Append Download, Partial Download and Download and Delete Files**.

For the Levelogger Edge and Gold Series dataloggers, 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_6\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.

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.
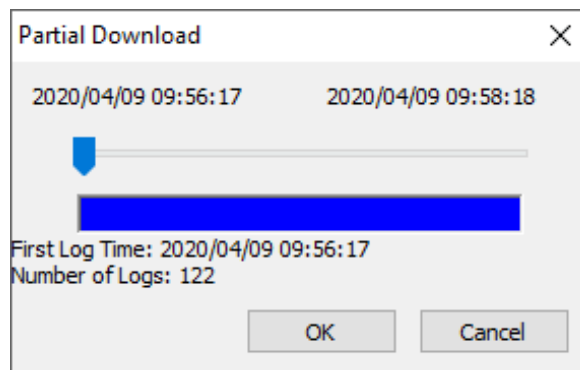
Figure 7-3 Partial Download Window

For Levelogger 5 Series dataloggers, if you select Download and Delete Files, the software will bring up a window with a list of logging sessions currently stored in the datalogger's memory. Select the files you want to download. Each logging session will be saved as a separate *.xle file.

To access the full memory, select Delete All Files and you will be prompted with a "Warning All Data in the logger will be erased! Continue?" Select Yes, or No, to proceed. (Selecting individual files for deletion, is not an option.) This will free-up memory before starting a Levelogger 5 Series datalogger (See Section 5.8).
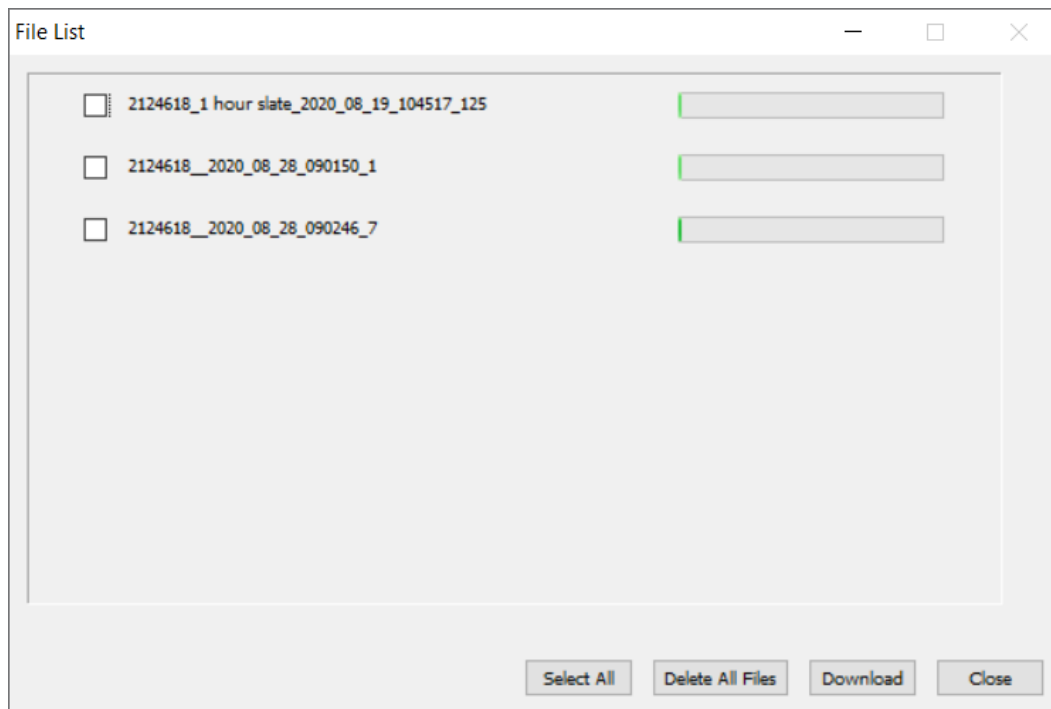
Figure 7-4 Download Files List

For Edge and Gold Series dataloggers, if you select **Recover Previous Log**, the software will try to recover the data from the previous logging 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 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_6\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 7-5, you may not have file writing privileges to the default directory. In 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.
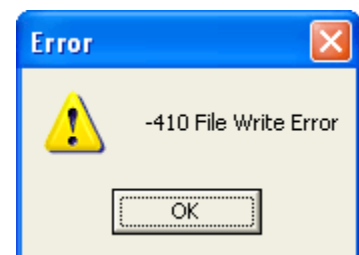
Figure 7-5 File Write Error Message

7.2 Graph Manipulation and Zoom Function

To perform the Zoom In function on the graph, click   .

To perform a Zoom Out function on the graph click   . Click   to undo all the zoom functions. The Zoom functions can also be used for data selections in the graph.

Note: Right click, and drag the mouse to scan the data graph.

Click   to open the Graph Option Dialog. The Graph Dialog is shown in Figure 7-6.

Note: As there is only one channel of data for Rainloggers, there are no graphing options.
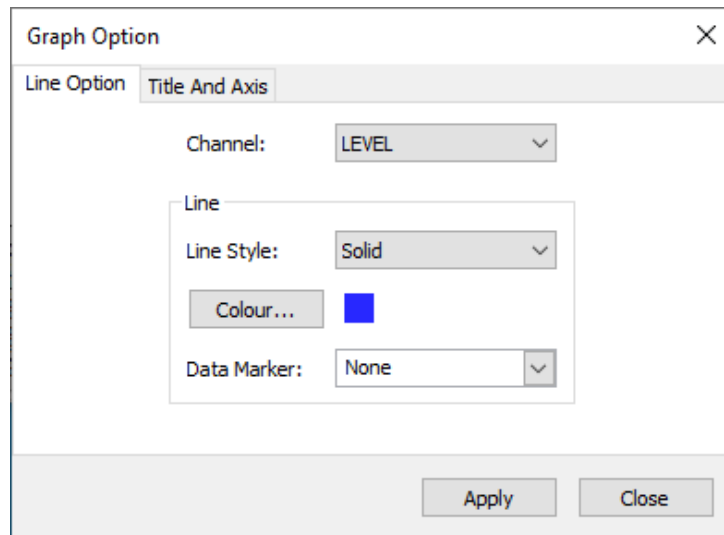
Figure 7-6 Line Option Window

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.
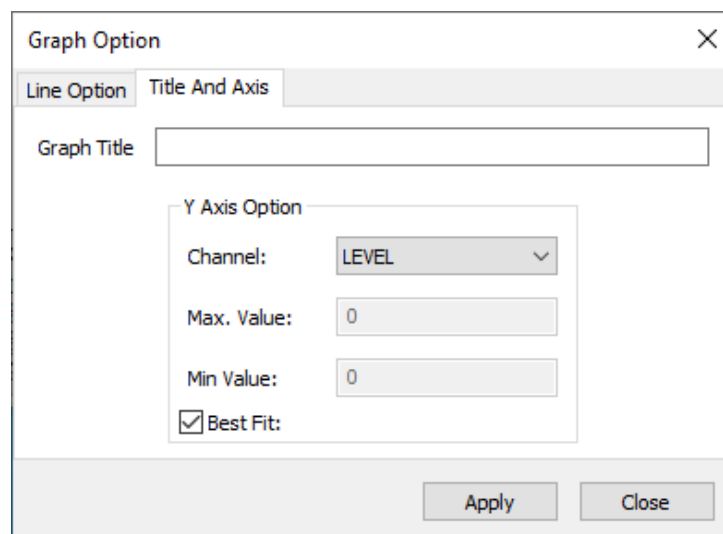
Figure 7-7 Title and Axis Option Window

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.
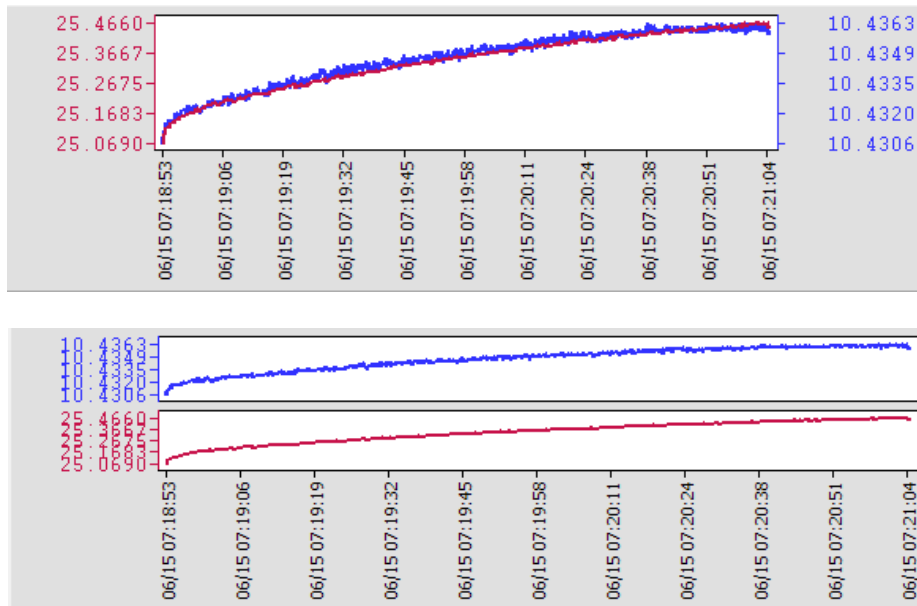
Figure 7-8 Combined and Separated Plot Graphs

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.
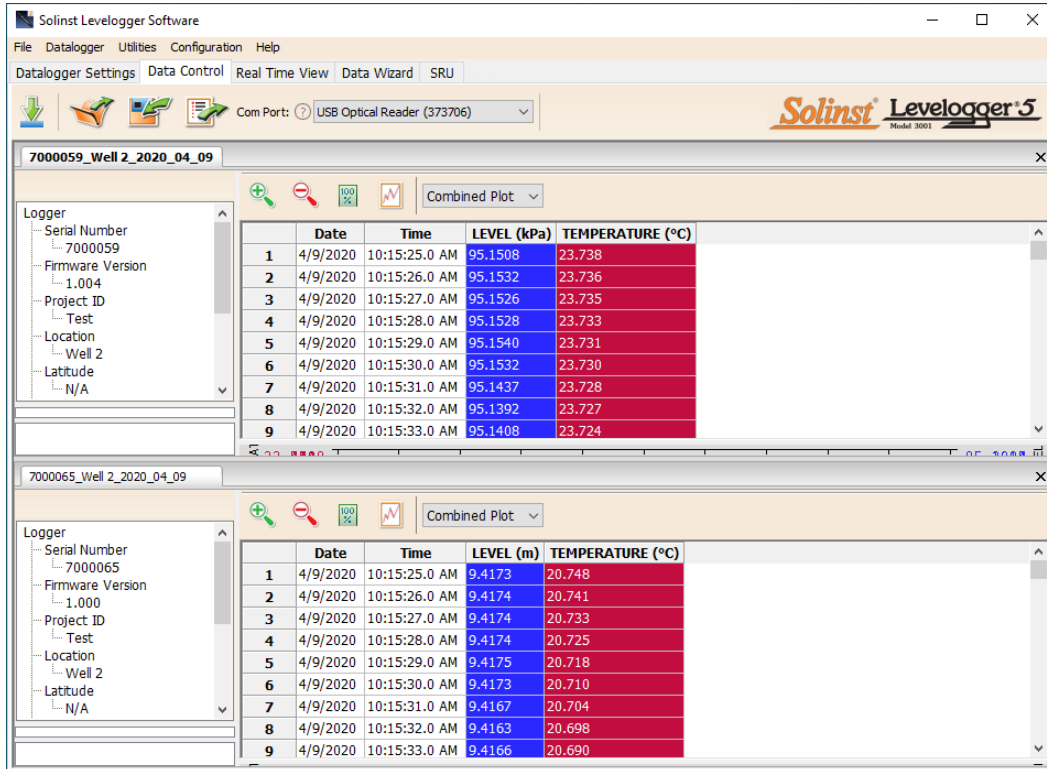
Figure 7-9 Viewing Two Graphs

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.

Note: You have the option to choose between North American Format for decimal separators (period symbol) or based on the System Locale Format, for exported *.csv files. See Section 4.2.4.

Also, the data graph can be exported to a *.bmp file or a *.png 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 7-10 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.
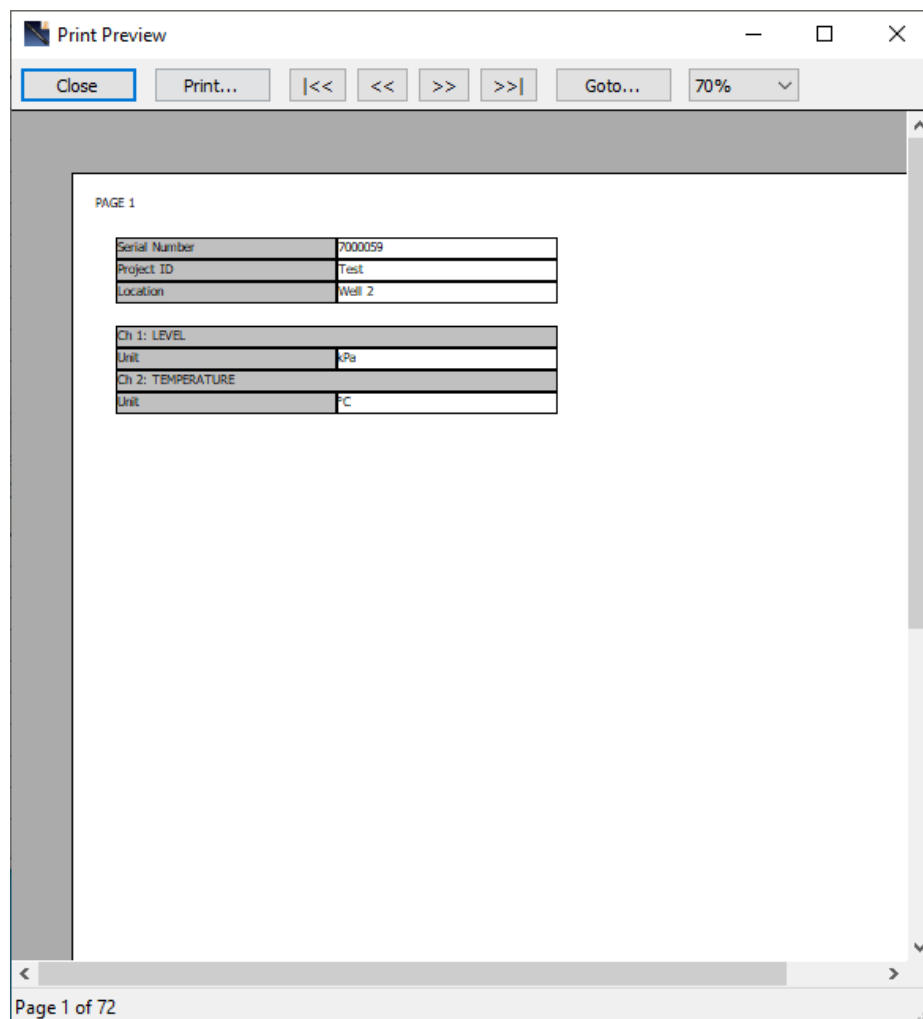
Figure 7-10 Print Preview Window

8 Data Compensation

Data Compensations, such as Barometric Compensation, Manual Data Adjustments and Parameter Adjustments can be performed automatically using the Levelogger Software Data Wizard, or manually, by exporting data to an external spreadsheet program.

8.1 Data Wizard

Open the Solinst Levelogger Software Data Wizard tab. The first step is to select your Data Compensation Path. The choices for Leveloggers are **Basic** or **Advanced**.

Choosing **Basic** allows you to do a simple Barometric Compensation of Levelogger data only.

The **Advanced** option allows you to perform Barometric Compensation, Manual Data Adjustments and Parameter Adjustments, including adjustments to Rainlogger data.

Barometric Compensation simply subtracts the barometric reading from the corresponding Levelogger reading(s), to give true water level measurements.

Note: Multiple datalogger files can be compensated at once.
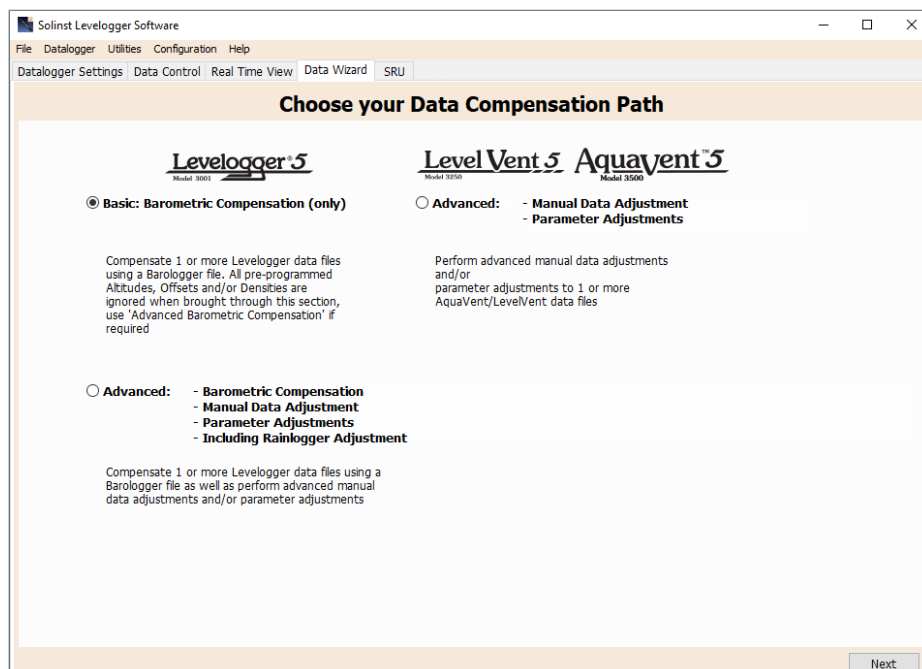
Figure 8-1 Data Wizard

Manual Data Adjustment allows you to enter a manual water level measurement or reference point as a field zero, which all Levelogger water level readings can then be adjusted to. There is the option to convert readings to Depth to Water Level measurements (e.g. from the top of a well casing to water level), or Elevation of Water Level measurements (e.g. above sea level).

Note: Manual Data Adjustment, and Parameter Adjustments are useful for correcting Levelogger data files to make data consistent across a project.

Parameter Adjustments allow you to change Levelogger, Barologger or Rainlogger data to different units of measurements, add an offset, correct data for elevation differences, convert conductivity to Salinity or Specific Conductance, adjust density, or adjust barometric efficiency. Only the options available for your opened datalogger file types will be active (e.g. Conductivity Conversion is only available for LTC Levelogger data files).

Note: Parameter Adjustments is the only option for compensating Rainlogger data.

Standard Adjustments:

- **Unit** conversion allows you to convert level readings in a Levelogger file to different units (m, cm, ft, kPa, bar or psi), a Barologger file to kPa, mbar, or psi, temperature readings to °C or °F, conductivity readings to µS/cm or mS/cm, or rainfall values to mm or inches.

- **Offset** allows you to enter any value, positive or negative, which will be added to each reading in the selected Levelogger file to be offset by that amount. It is recommended to stay with the default zero value, unless a known offset has been determined (e.g. to correct for pressure sensor drift. See Solinst Technical Bulletin: Understanding Pressure Sensor Accuracy, Precision, Resolution & Drift: https://www.solinst.com/onthelevel-news/water-level-monitoring/water-level-datalogging/understanding-pressure-sensor-accuracy-precision-resolution-drift/.

Note: If you set your Levelogger to record in pressure units (kPa, bar, psi), you can not change the offset or enter an elevation value (in the Data Wizard). Only raw pressure readings will be provided.

- **Elevation** is used to correct for altitude differences between Levelogger or Barologger locations. 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 -300 m below sea level and 5000 m (or -1000 ft and 16,400 ft) above sea level.

- **Conductivity Conversion** allows you to convert raw Conductivity readings from a LTC Levelogger to Specific Conductance (conductivity that is temperature compensated to the standard of 25°C). The Temperature Coefficient default for Specific Conductance 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 expressed in Practical Salinity Units (PSU), or TDS (See Section 1.2.4).

- **Rainfall Cal. Constant** allows you to enter a different rainfall calibration constant for a Rainlogger data file (amount of rainfall per tip of the tipping-bucket rain gauge).

Additional Adjustments:

Note: Additional Adjustments appear when ">>" is selected. These are application specific, for advanced users.

- **Density Adjustment** corrects the range of the level channel in the Levelogger 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** option uses the Barologger data to adjust the submerged Levelogger data, based on the type of aquifer it is monitoring. The barometric efficiency can be set from 0.01 to 3.00. For more information about Barometric Efficiency, see Section 10.1.3.1.

Note: Advanced compensation provides the option of performing one, two, or all three data compensation types, in any combination.

8.1.1 Basic Compensation

When you choose **Basic** compensation, the next step is to select the Barologger file you want to use for compensation, then select the Levelogger file(s) you want to compensate. You can only select one Barologger file to compensate multiple Levelogger files.

Note: One Barologger can be used to compensate all Leveloggers in a 30 km (20 mile) radius and/or with every 300 m (1000 ft) change in elevation.

For best accuracy, the Levelogger file(s) and Barologger file should have the same start time and logging interval. (The Future Start option in the Datalogger Settings tab is a convenient way to start all of your loggers at the same time.) 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.

Any files you have open in the Data Control tab will be listed.
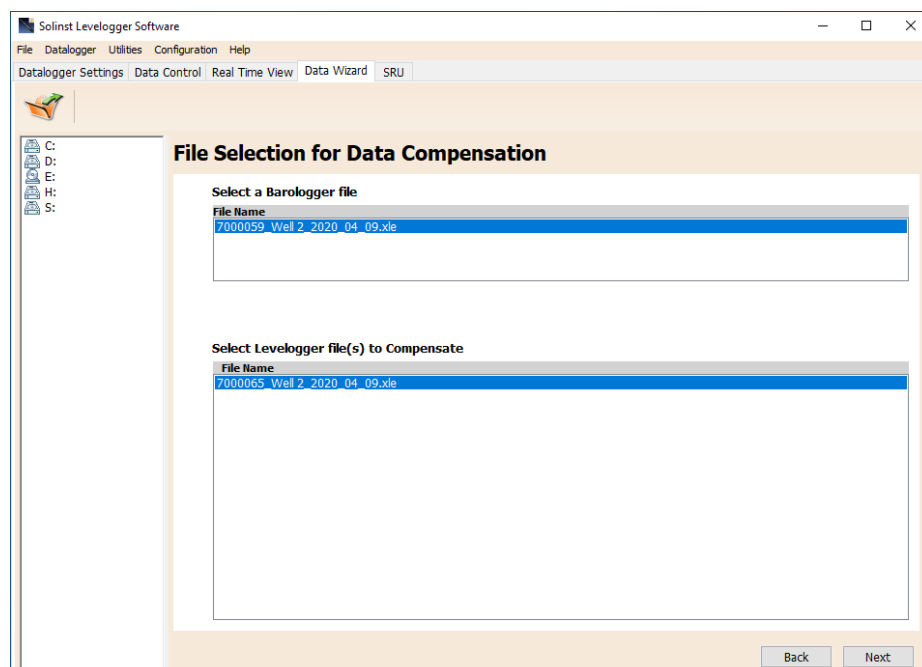
Figure 8-2 Selecting Files for Barometric Compensation

Use the directory on the left of the window or click to open any other Levelogger data files you would like to compensate. Ensure the files you want to compensate are highlighted in the list. **Both the Barologger file and Levelogger file(s) must be highlighted.** Do this by clicking the file name. To de-select a file, click it again. Multiple Levelogger files can be selected at once.

Note: Both a Barologger file and a Levelogger file must be selected to complete a Barometric Compensation.

Select Next to complete the compensation.

The compensated data will automatically 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 rename the compensated file by saving it in the Data Control tab. Do not change or delete the file extension. All data files are saved to the default location: <C:\Program Files\Solinst\Levelogger4_6\Data>.

Note: 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.

The next window will show the results of the compensation. If the compensation was unsuccessful, there will be an explanation in the Reason column (e.g. time stamp of Levelogger and Barologger files were not close enough to perform an accurate compensation). You can still view the compensated file in the Data Control tab by clicking 'Open' in the Action column. If the compensation is successful, select 'Open' to view the compensated file in the Data Control tab.

Figure 8-3 Barometric Compensation Results

From the Data Control tab, you can view the data, save the compensated file with a new filename and/or export the data (see Section 7).

All the original Levelogger settings and the channel information effective during data collection are shown on the top left of the window. The bottom left sections of the window are used to display the compensation information. The middle section displays information from the Barologger.
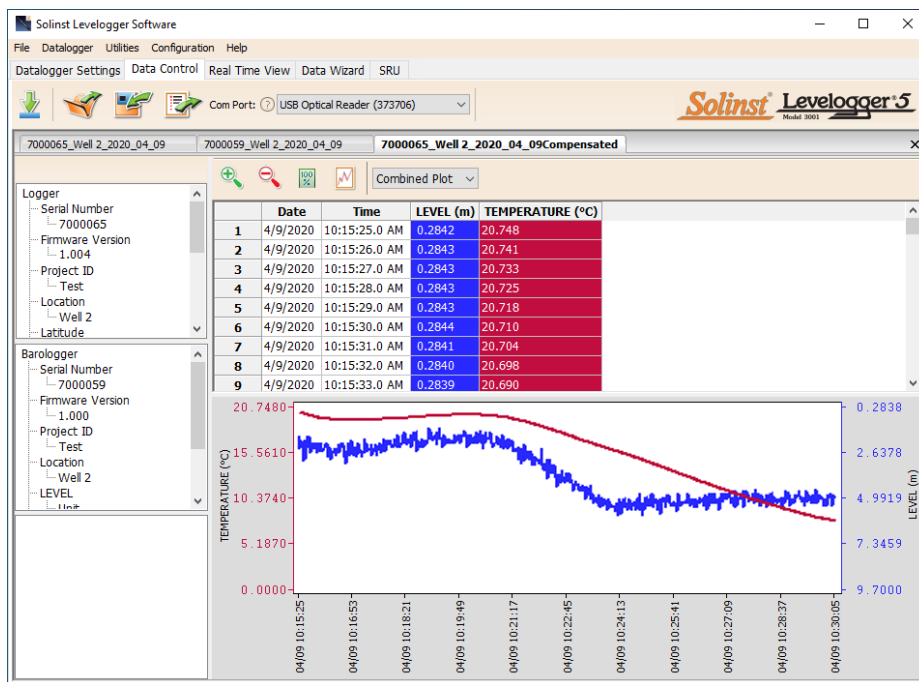
Figure 8-4 Viewing Compensated Files in the Data Control Tab

8.1.2 Advanced Compensation

When you select **Advanced** compensation, the Data Compensation Options window will open.
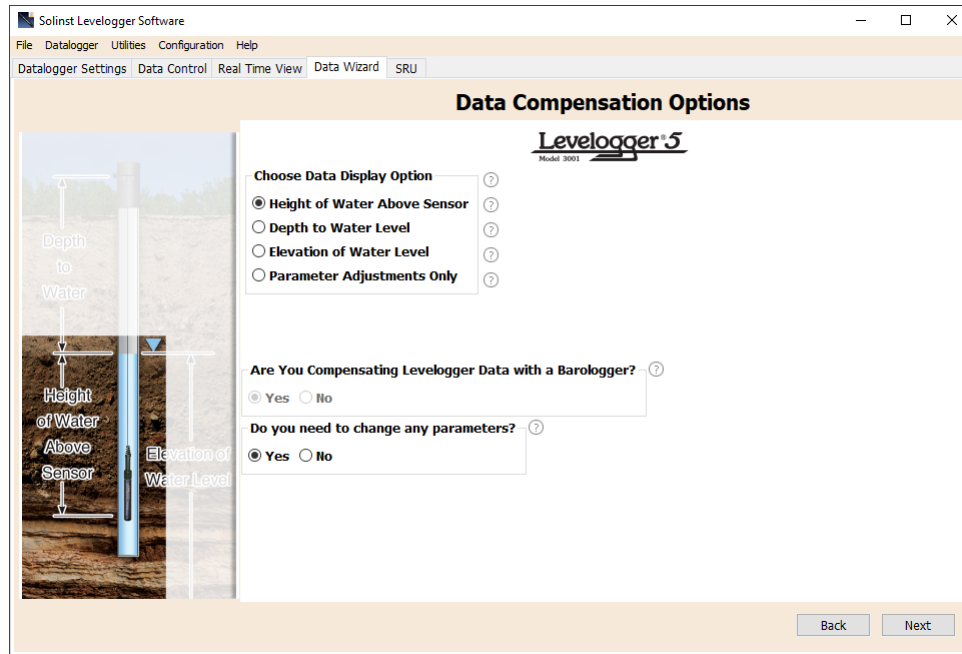
Figure 8-5 Advanced Data Compensation Options

First, you will select how you want your data displayed (Manual Data Adjustment):

- **Height of Water Above Sensor** is the default display option. Select this option to perform a Barometric Compensation and/or Parameter Adjustments to one or more data files, while keeping the sensor diaphragm (zero point) as the reference point.
- **Depth to Water Level** adjusts water level data to represent depth to water level readings (from the top of a well casing or other reference point) by entering a field zero, such as a manual depth to water level measurement. Adjustments can be made to one or more data files.
- **Elevation of Water Level** adjusts water level data to represent elevation of water level readings (above sea level or other reference point) by entering a measuring point elevation, and a field zero, such as a staff gauge measurement from that point. Adjustments can be made to one or more data files.
- **Parameter Adjustments Only** allows you to adjust one or more data files to different units, elevation, etc., while keeping the sensor diaphragm (zero point) as the reference point for Leveloggers. It also allows you to change Rainlogger data file parameters.

    Note: Parameter Adjustments Only, is the only option for compensating Rainlogger data.

Next, you will select Yes or No to **Barometrically Compensating** the data (will not be active if you selected Parameter Adjustments Only).

Next, you will select Yes or No to performing any **Parameter Adjustments** on the data files (will not be active if you selected Parameter Adjustments Only).

Click Next, after you have selected all of your Data Compensation options.

In the next window, you will choose the Levelogger file(s), Rainlogger file(s), and Barologger file(s) you would like to use in the compensation. Any files you have open in the Data Control tab will be listed.

Use the directory on the left of the window or click ![icon] to open any other data files you would like to compensate. Ensure the files you want to compensate are highlighted in the list. **If doing a Barometric Compensation, ensure the Barologger file is highlighted.** Do this by clicking the file name. To de-select a file, click again. Select Next to continue.

Note: See Section 8.1.1 for more information on selecting files for Barometric compensation.
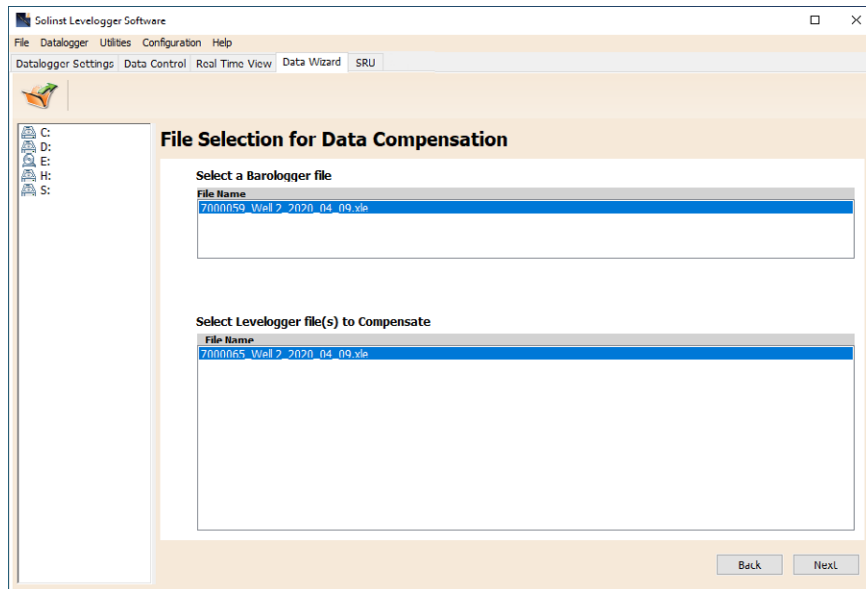
Figure 8-6 Selecting Files for Compensation

If you have selected yes to **Parameter Adjustments**, or selected the **Parameter Adjustments Only** option, in the next window you will enter these. **You can expand the window by clicking ">>" to show additional adjustment options.** If you did not select to change any parameters, this window will not be shown.

Note: When adjusting Units for Levelogger files or Rainlogger files, If you select apply to all, the same unit change will be applied to all of the files being compensated at that time.
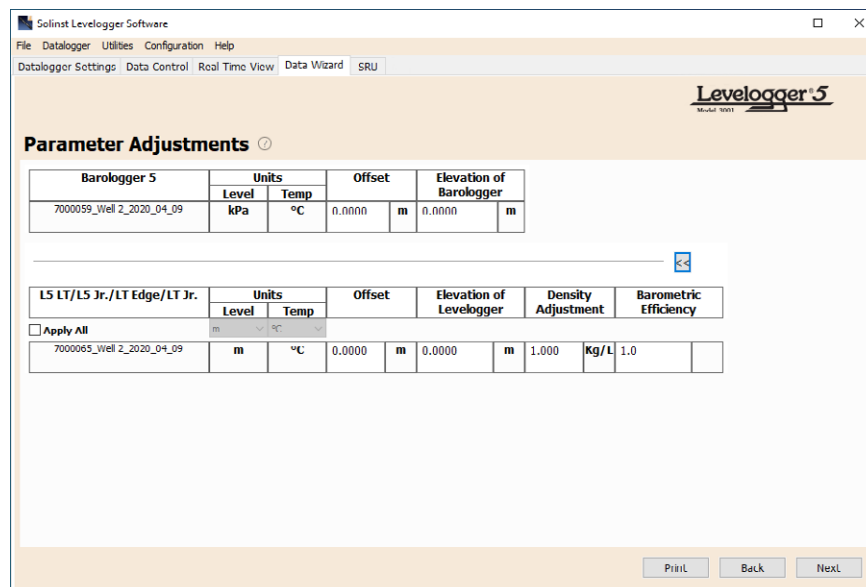
Figure 8-7 Parameter Adjustments

Next, for each selected Levelogger file, you will enter the Field Zero(s) you would like to use to manually adjust your Levelogger data. (If you have selected **Height of Water Above the Sensor or Parameter Adjustments Only**, this window will not be shown.)

For **Depth to Water Level** adjustments, enter a **Field Zero (A)**. If the static water level is below your Field Zero measurement, the Field Zero is input as a positive value (e.g. a manual water level meter measurement taken from the top of a well casing. See Example 8.1). If the static water level is above your Field Zero, the Field Zero is input as a negative value (such as in an artesian condition).

The Time the Field Zero measurement was taken must replace an actual reading in the Levelogger file. This is selected from the drop-down menu showing all time stamps in the Levelogger file. Click 'Add' to apply the adjustment. If you need to change a Field Zero, click 'Update' after any edits.

Note: The date and time of measurement of the Field Zero must be recorded to complete the adjustment. The Field Zero must replace an actual reading the Levelogger file. I.e. take a manual measurement immediately after starting the Levelogger, and note that time.
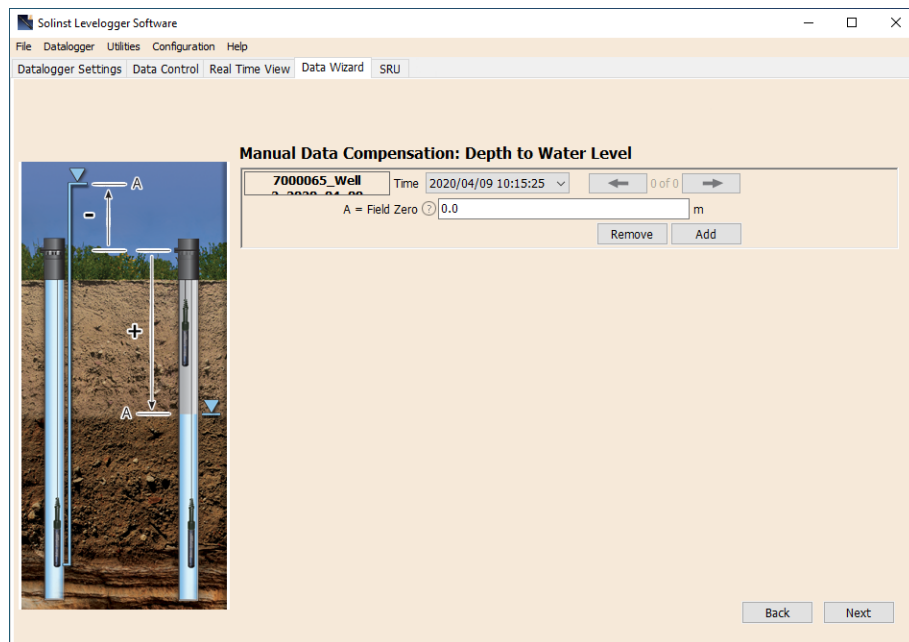
Figure 8-8 Manual Data Adjustment - Depth to Water Level
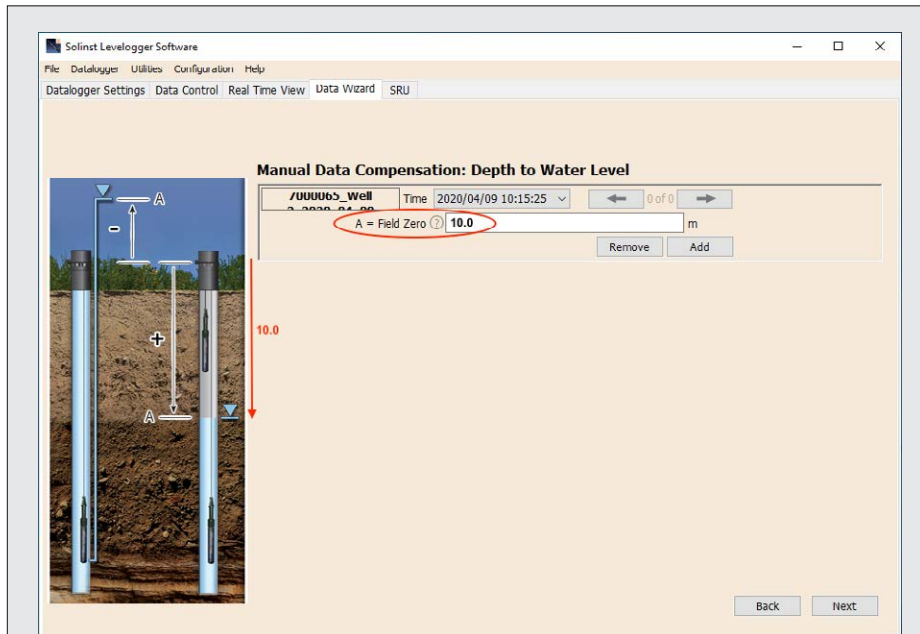
Example 8.1 Depth to Water Level Adjustment

When using a manual depth to water measurement taken from the top of a well casing as a Field Zero, enter it as a positive value (e.g. 10 m).

In your adjusted data file, your readings will increase in value as the water level decreases. This is because the depth to static water level from the top of the well casing is increasing. The adjusted readings will decrease in value as the static water level rises.

Original Levelogger Data (barometrically compensated height of water above sensor)	8.75 m	8.50 m	8.75 m	9.0 m	9.25 m
Adjusted Levelogger Data (depth to water)	(A) 10.0 m	10.25 m	10.0 m	9.75 m	9.50 m

For **Elevation of Water Level** adjustments, enter a **Measuring Point Elevation (A)** and a **Field Zero (B)** from that Measuring Point.

If the static water level is below your Measuring Point, the Field Zero is input as a positive value (e.g. if you are using a manual depth to water measurement as a Field Zero, from the top of a well casing as the Measuring Point).

If the static water level is above your Measuring Point, the Field Zero is input as a negative value (such as a flowing artesian condition in a sealed wellhead). The Measuring Point elevation may also be entered as a negative value.
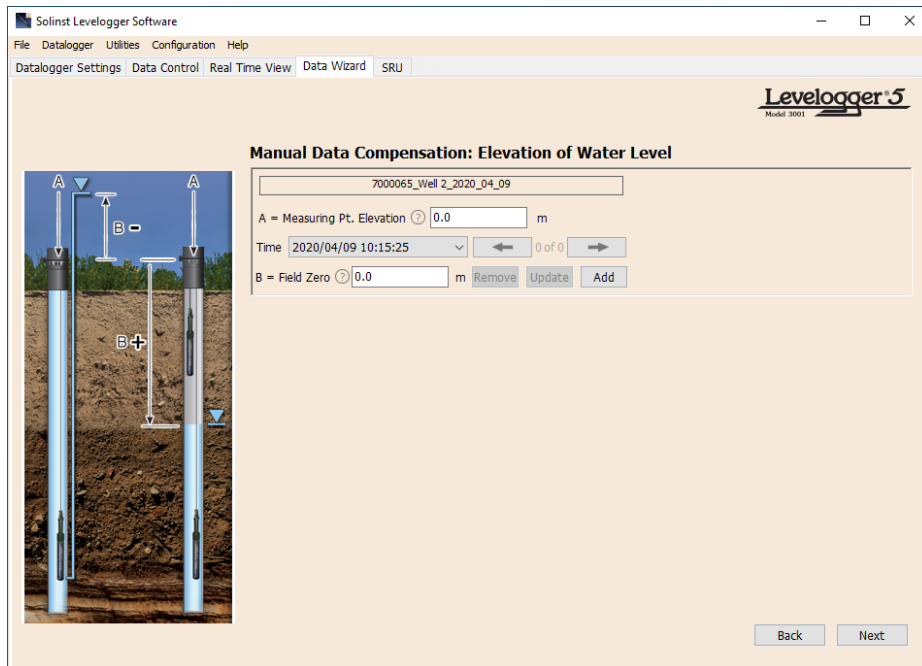
Figure 8-9 Manual Data Adjustment - Elevation of Water Level

The Time the Field Zero measurement was taken, 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. Click 'Add' to apply the adjustment. If you need to change a Field Zero, click 'Update' after any edits.

Note: The date and time of measurement of the Field Zero must be recorded to complete the adjustment. The Field Zero must replace an actual reading the Levelogger file. I.e. take a manual measurement immediately after starting the Levelogger, and note that time.

You can make multiple adjustments to one data file by selecting 'Add' again to enter another Field Zero. All readings after this Time, will be adjusted to this second measurement. 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).

Select Next to complete the compensation.

The compensated data will automatically 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 rename the compensated file by saving it in the Data Control tab. Do not change or delete the file extension. All data files are saved to the default location: <C:\Program Files\Solinst\Levelogger4_6\Data>.

Note: 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.

The next window will show the results of the compensation. If the compensation was unsuccessful, there will be an explanation in the Reason column (e.g. time stamp of Levelogger and Barologger files were not close enough to perform an accurate compensation). You can still view the compensated file in the Data Control tab, by clicking 'Open' in the Action column. If the compensation is successful, select 'Open', to view the compensated data file in the Data Control tab.
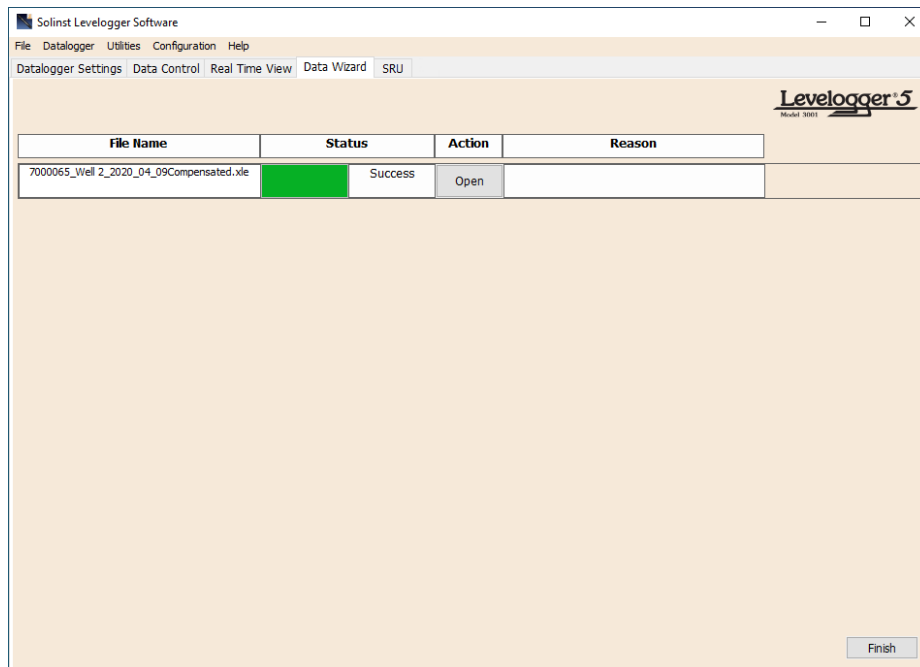
Figure 8-10 Advanced Data Compensation Results

From the Data Control tab, you can view the data, save the compensated file with a new filename and/or export the data (see Section 7).

All the original Levelogger settings and the channel information effective during data collection are shown on the top left of the window. The bottom left sections of the window are used to display the compensation information. The middle section displays information from the Barologger, and the bottom section includes information about manual data and parameter adjustments.
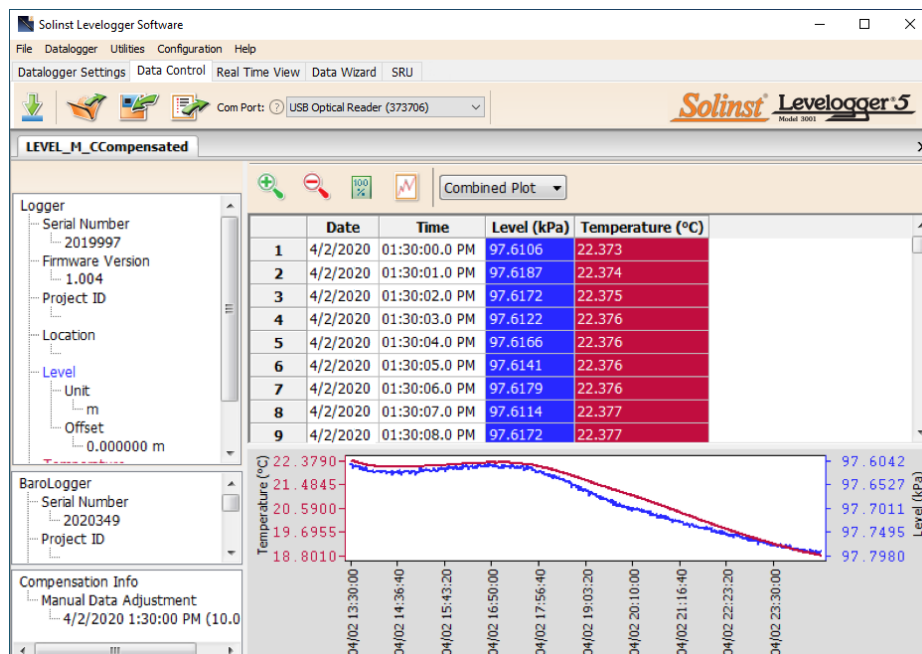
Figure 8-11 Viewing Compensated Files in the Data Control Tab

8.2 Manual Barometric Compensation

This section describes how to perform manual barometric compensation on Levelogger 5, Levelogger 5 Junior, Levelogger 5 LTC, Levelogger Edge, Levelogger Junior Edge, and LTC Levelogger Edge data files when a Barologger was not dedicated as a barometric recorder.

Note: For Manual Barometric Compensation instructions for the Levelogger Gold and Levelogger Junior, visit: www.solinst.com and see the Levelogger Software Version 3.4.1 User Guide in the Downloads section.

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.

Note: When analyzing barometric data it is important to keep in mind that storm events commonly reduce total atmospheric pressure by about 1.7% from pre-existing high pressure conditions. 1.7% converts to approximately 0.2 m or 0.6 ft of water level equivalent barometric fluctuation.

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 30 km (20 miles) away). 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.

Note: It is important to remember that weather station barometric data will often contain an offset or normalization (i.e. normalization to sea level). Manual data conversation and barometric compensation should account for any variation of the normalization or offset used between the barometric data sourced and Solinst Leveloggers.

Note: See our Technical Bulletin: Barometric Compensation and the Importance of Barometric Data, for more information on incorporating elevation differences in your compensation.

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 to record in psi, kPa, or bar. This makes compensation using other atmospheric pressure devices easier.)

Note: You can also convert the Levelogger 5 data units to match the Barometric units using the Data Wizard.

Common barometric units to water column equivalent conversions		
Barometric unit	**Water column equivalent (ft)**	**Water column equivalent (m)**
1 psi	2.30666	0.703070
1 kPa	0.334553	0.101972
1 mbar	0.0334553	0.0101972

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.

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.

Note: Datalogger settings can not be changed in the Real Time tab. Changes must be made in the Datalogger Settings tab. The changes are applied when the Real Time readings are started. ▶

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 ▽ 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 ⊗ .

Note: You can also view Real Time readings from a Rainlogger 5, Rainlogger Edge, or a Rainlogger using firmware version 2.000 or higher.
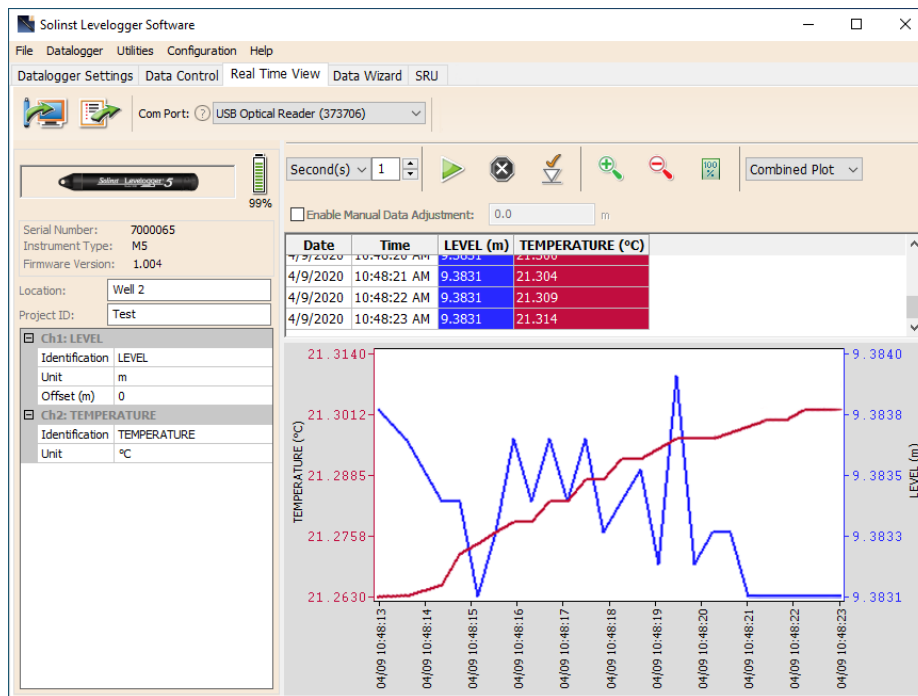
Figure 9-1 Real Time View Window

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/cord 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, simple metal straps, etc.
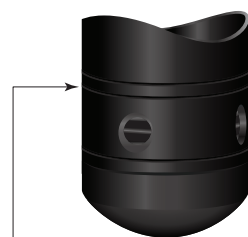
Levelogger 5/
Levelogger 5 LTC/
Levelogger Edge/
LTC Levelogger Edge
Measurement Line
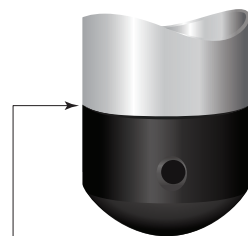
Levelogger 5 Junior/
Levelogger Junior Edge
/LTC Levelogger Junior
Measurement Line
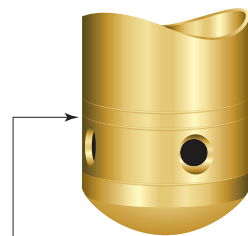
Levelogger Gold
Measurement Line

Figure 10-1

Most Leveloggers are installed in a vertical orientation. However, inclined or horizontal installation is acceptable. The level sensor in the Levelogger is indicated by the machined line around 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). The sensor detects total pressure above the pressure transducer line.

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 eye(s).

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 that its maximum submergence depth throughout the monitoring period remains within its specified range.

Note: When installing in a borehole, measure the total depth to ensure the Levelogger does not touch the bottom (avoid submergence in sediment).

The pressure transducer can be damaged if the datalogger is over-pressurized by submergence greater than its level range. The Levelogger 5, Levelogger 5 Junior, Levelogger 5 LTC, Levelogger Edge, Levelogger Junior Edge, and LTC Levelogger Edge are warranted to pressures up to 200% of their full scale level range (150% for the Levelogger Gold, Levelogger Junior and LTC Levelogger 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.

10.1.1 Free Suspended Installations

10.1.1.1 Suspension Wire/Cord 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.

Figure 10-2 Solinst 2" Locking Well Cap for Wireline or Kevlar Cord

The data is retrieved manually, by withdrawing the Levelogger, removing the installation cap and attaching a Field Reader 5 or Desktop Reader 5 (see Section 2). This type of installation is applicable to both submerged and barometric applications.

Note: There is also the option to communicate with a DataGrabber 5 or Levelogger 5 App Interface (see separate User Guides).

Before deployment, to ensure a water-tight seal, tighten the installation cap onto the Levelogger until there is no green o-ring visible.

Figure 10-3 Proper Installation Cap Connection

Note: The o-ring on the optical end of the Levelogger should be inspected regularly and replaced as required. See Section 10.2.

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

Coil 1
Coil 3
Coil 2

Diagram 1

Coil 1
Coil 3
Wireline
Coil 2

Diagram 2

Coil 1
Coil 3
Wireline
Coil 2

Diagram 3

Coil 1
Wireline
Coil 3
Coil 2
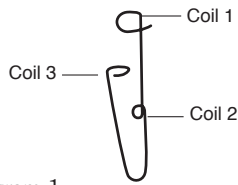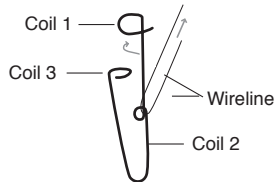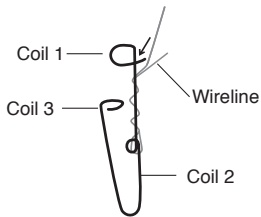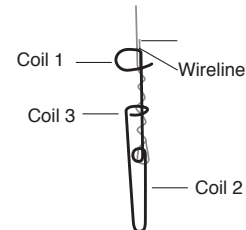
Diagram 4

Figure 10-4 Wireline Hook Installation

Follow these steps to install the Levelogger using **stainless steel wire 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, un-thread the installation cap, interrogate and re-suspend the unit rechecking the security of the wireline clamps each time.

The wireline is a multi-stranded 304 Stainless Steel wire with a break strength of about 40 lbs.

Bowline Knot

Figure 10-5 Kevlar Cord
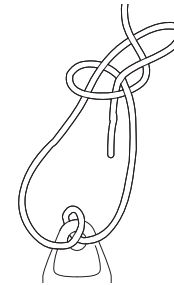
Figure 10-6 Bowline Knot Used to Connect Kevlar Cord to the Levelogger

It is recommended that the **Kevlar cord** be connected to the Levelogger and well cap using a bowline knot (see Figure 10-6). The Kevlar cord is comprised of multiple Kevlar strands braided with black polyester, and has break strength of 150 lbs. Kevlar is very suitable for underwater applications in freshwater and marine environments, as the material resists rusting.

10.1.1.2 Direct Read Cable Assembly Installation

When using a Direct Read Cable, the Solinst Levelogger can be deployed before it is programmed and started with the software. The Direct Read Cable threads to the Levelogger, while the surface connector at the opposite end of the Direct Read Cable fits into the specially designed Well Cap insert. The PC Interface Cable connects to the surface connector, allowing the Levelogger to communicate with a laptop PC (see Section 2). While use of the Model 3001 Well Cap Assembly (see Section 10.1.1.3) is recommended and convenient, it is optional as long as a satisfactorily secure alternative tie off point is found for the Direct Read Cable.

Single Well Cap Option   Dual Well Cap Option

Figure 10-7 Solinst 2" Locking Well Caps for Direct Read Cable Installation

Note: There is also the option to communicate with a DataGrabber 5 or Levelogger 5 App Interface (see separate User Guides).

Solinst supplies L5 Direct Read Cable assemblies in lengths up to 1500 ft. The cable has a durable, flexible, abrasion-resistant polyurethane jacket.

PC Interface Cable

30.46 mm
(1.200")

21.5 mm
(0.810")

3.2 mm
(1/8")

Direct Read Cable

22.23 mm
(0.875")

Figure 10-8
L5 Direct Read Cable Dimensions

Figure 10-9
Levelogger 5 Connected to L5 Direct Read Cable

Figure 10-10
Levelogger 5 Connected to Older Style
Direct Read Cable Using an L5–Edge DRC Adaptor

Levelogger 5 Series dataloggers can be used with L5 Direct Read Cables, as well as the older style Direct Read Cables (used with Edge and Gold Series dataloggers). To use the older style Direct Read Cables, an L5–Edge DRC Adaptor is required.

Note: When connecting an older style Direct Read Cable to an L5–Edge DRC Adaptor, only turn the coupling on the Direct Read Cable and hold the Adaptor still.

Note: The L5–Edge DRC Adaptor contains a small, long-lasting battery (not user-replaceable). The Adaptor should always be stored above freezing temperatures and with caps on to prevent unnecessary battery drainage and protect the optical eyes.

Levelogger Edge and Gold Series dataloggers can be used with L5 Direct Read Cables, as well as the older style Direct Read Cables. To use L5 Direct Read Cables, an Edge–L5 DRC Adaptor is required.

Note: The Edge–L5 DRC Adaptor contains a small, long-lasting battery (not user-replaceable). The Adaptor should always be stored above freezing temperatures and with caps on to prevent unnecessary battery drainage and protect the optical eyes.

Note: When connecting an Edge–L5 DRC Adaptor, only turn the coupling on the Adaptor and hold the datalogger still. Hold the Adaptor still while threading on the Direct Read Cable coupling.

Figure 10-11
Levelogger Edge Connected to L5 Direct Read Cable
Using an Edge–L5 DRC Adaptor

Figure 10-12
Levelogger Edge Connected to Older Style
Direct Read Cable

Note: The dimensions of an older style Direct Read Cable are the same as the L5 Direct Read Cable.

Follow these steps to install a Direct Read Cable assembly to a Levelogger 5:

1) Remove the installation cap from the Levelogger, align the optical socket of the L5 Direct Read Cable with the Levelogger and threading the coupling onto the Levelogger tightly (while holding the datalogger still). If using an Adaptor, thread the Adaptor onto the Levelogger first, then thread the Direct Read Cable coupling onto the Adaptor (while holding the Adaptor still).

Note: The o-ring on the optical end of the Levelogger should be inspected regularly and replaced as required. See Section 10.2.

> To ensure a water-tight seal, when connecting a Direct Read Cable or Aaptor, tighten the coupling onto the Levelogger until there is no green o-ring visible.

Figure 10-13 Proper Direct Read Cable Connection

2) The Levelogger (and Adaptor) and Direct Read Cable will fit through the hole in the Well Cap insert.
3) The surface connector of the Direct Read Cable will seat in the Well Cap insert.
4) 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 (or Adaptor), ensure you only twist the coupling. To avoid possible damage, do not twist the strain relief on the Direct Read Cable.

Figure 10-14 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 9.5 mm (3/8") 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.

Note: The insert has openings to hold two Direct Read Cables in the same well, plus a third hole (0.7" ID) to fit a Water Level Meter probe for manual field measurements.

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).

Figure 10-15 Model 3001 Well Cap Assembly (#110099).
If installing Leveloggers in a 4" well, a reducer adaptor is available. (#110235)

A Support Hanger Bracket is available for use with the Well Cap Assembly. When installed, it provides an option for supporting and organizing down well cables or cords, or for coiling extra Direct Read Cable if the full length is not required. It is inserted through the top of the well cap base and hangs from the shoulder.

Note: There are three holes in the top of the Support Hanger Bracket that can be used to secure it in the well cap base with screws.

Figure 10-16 Support Hanger Bracket (#112764)

10.1.2 Fixed Installations

10.1.2.1 Flowing Artesian Monitoring

Monitoring of flowing artesian conditions using Leveloggers can be quite straight forward. Continuous artesian conditions infer that the piezometric surface never drops below the level of the ground surface, or particularly the top of casing elevation, and the casing is sealed with a wellhead. In this case, where freezing is not a concern, the Levelogger need only be installed on the wellhead itself by means of an Artesian Well Fitting Assembly, as illustrated in Figure 10-17. This same fitting allows the use of a Direct Read Cable to install the Levelogger at depth in a well, for cases when the piezometric surface falls below top of casing. See separate installation instructions.

Figure 10-17 Artesian Well Fitting Assembly

Note: The Artesian Well Fitting Assembly is not recommended for pressures in excess of 30 psi (20 m (66 ft)) of water column).

When conducting artesian monitoring with Leveloggers, a number of issues should be considered. First, ensure that the maximum hydraulic pressure the datalogger will encounter at its installation point, will not exceed the specified range of the datalogger. 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 10-18 Levelogger and Barologger in Well

10.1.3 Barologger Installation

The Solinst 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 30 km (20 mile) radius and/or with every 300 m (1000 ft) change in elevation.

Note: The Barologger should not be used to monitor water, as the internal mathematics for temperature compensation are based on air rather than water.

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 8.2.

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 Data 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.

10.1.4 Rainlogger Installation

Solinst Rainloggers (Figure 10-19) are designed to log the tip times of an external tipping-bucket rain gauge, and output the amount of rainfall per tip.

The Rainlogger 5 and Edge housings are made of ABS, while the Rainlogger housing is made of stainless steel. Direct exposure to rainfall should be avoided, and Rainloggers should not be submerged. The Rainlogger 5 and Edge ABS housings provide extra electrostatic discharge (ESD) protection.

The rain gauge connected to the Rainlogger is supplied by the customer. The Rainlogger rain gauge connector (Figure 10-20) connects to the 2 m (6.5 ft.) cable supplied with the Rainlogger. The Rainlogger 5 and Edge use different connector cables than the older Rainlogger, which can not be interchanged. The connector cables have two wires, which are connected to the tipping-bucket by splicing to the tipping-bucket cable. As the tipping-bucket is just an electrical switch, for most models, the wires can be connected to either cable wire. Refer to the manufacturer's operating instructions. Longer, exposed cables should be protected from rodents and vandalism by cable armoring or installation within electrical conduit.

Note: The Rainlogger 5 and Edge use a different connector cable than the older Rainlogger, and they can not be interchanged.

Figure 10-19 Solinst Rainloggers

Rain Gauge
Connector

Figure 10-20
The Tipping-bucket Rain Gauge Connector
of the Rainlogger 5

Figure 10-21 Rainlogger 5 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 water 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 pressure transducer. As such, care should be taken when choosing the appropriate pressure transducer range for your application.
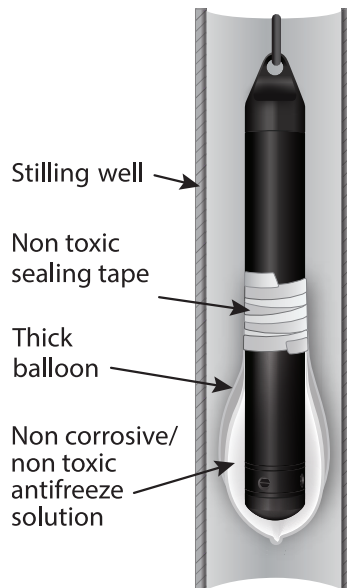
Stilling well

Non toxic sealing tape

Thick balloon

Non corrosive/ non toxic antifreeze solution

Figure 10-22
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, i.e. the speed at which freezing occurs. For example, liquid freezing at -22°C, can create expansion pressures of 22 kg/cm² or 313 psi or the equivalent of 220 m or 721 ft water column depth.

With precautions, the Solinst 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.

Note: Although precautions can be taken, placing a Levelogger in a situation where the water may freeze solid can permanently damage the sensor.

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 10-22). Place the balloons in a section of perforated, 30 mm (1.25") 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. However, it should be noted that even if these precautions are taken, there is still the risk that placing a Levelogger in a situation where the water may freeze solid can permanently damage the sensor (see Example 10.1).

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° to 80°C (-4° to 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.

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 for the LTC Levelogger Junior and the Levelogger Gold Series (see Section 5.1). Also, see Section 8 for details in compensating the Levelogger 5, Levelogger 5 Junior, Levelogger 5 LTC, Levelogger Edge, Levelogger Junior Edge, and LTC Levelogger Edge for fluid density differences.

The Levelogger 5, Levelogger 5 LTC, Levelogger Edge and LTC Levelogger Edge can be used for monitoring in salt or brackish water. However, long term use of the stainless steel body Levelogger 5 Junior, Levelogger Junior Edge, LTC Levelogger Junior, Levelogger Junior and first generation LTC and LT Leveloggers 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 Levelogger 5 Junior, Levelogger Junior Edge, LTC Levelogger Junior, Levelogger Junior, and first generation LTC and LT Leveloggers.

If using these dataloggers in a continuous salt/brackish water 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.

10.1.5.3 Biofouling Conditions

Biofouling is the unwanted buildup of microorganisms, plants, algae, or organisms such as barnacles and muscles on a wetted surface. When a Levelogger is deployed for an extended period of time, especially in a saltwater environment, there is the risk of biofouling. Biofouling on the pressure sensor and conductivity cell can compromise the accuracy of the measurements.

A Solinst Biofoul Screen can be used to protect the Levelogger from biofouling. The copper-coiled Delrin screen naturally reduces biofouling, and lengthens the time a Levelogger can be deployed before maintenance is required. The Biofoul Screen simply slips onto the sensor end of the Levelogger where it is held in place with its compression fitting. It adds about 19 mm (3/4") to the length of the Levelogger. It allows water to freely enter the conductivity cell, as well as the pressure transducer inlets. It is replaced as required.

Figure 10-24 Solinst Biofoul Screen for the Levelogger

Figure 10-23 Biofoul Screen Dimensions

10.2 Levelogger Maintenance

Levelogger maintenance consists of inspecting and replacing o-rings, and cleaning the outside casing, the circulation holes and the optical *eye(s)*. 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.

Note: To clean the optical eye(s) on a Levelogger, use a clean, soft cloth or cotton swab to gently wipe away any debris and dry the eye(s). Avoid soap or cleaners, as it may leave a residue. Compressed air may also be used to clear away any debris.

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 groundwater 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.

Note: The Levelogger installation cap should be left on when you are soaking a Levelogger.

Cleaning LTC Levelogger sensor pins is recommended before calibrating the unit prior to starting a project. The pins of the LTC Levelogger sensor are platinum-coated, therefore they should not be roughly cleaned or touched with any metal. They can be cleaned with a soft bristle brush, Q-tip, or cloth. Almost any acid solution can be selected to clean the sensor, provided it is highly diluted (generally less than 10% acid). The "soaking" time should be monitored and kept to a minimum.

There are o-rings on Levelogger optical ends, which are designed to prevent leaks. Depending on your application, you may be unscrewing the caps and/or direct read cables from the Levelogger optical end more frequently. This could result in damage to the o-rings. These **o-rings should be inspected regularly and replaced as required** (contact Solinst for replacements).

Figure 10-25 Levelogger O-ring Damage

Figure 10-26 Replacing Levelogger O-rings

To remove the old o-ring, use your fingers to push the o-ring up and roll it off the Levelogger. Use your fingers (no sharp tools) to install the new o-ring. Do not use any grease or silicone lubricant to help install the o-ring. Use a small amount of water if required, then wipe dry.

Note: It is important to ensure the installation cap or a Direct Read Cable is attached to the Levelogger during storage to prevent unnecessary battery drain and to protect the optical eye(s).

Before storing Leveloggers for any extended period, they should be stopped from recording, cleaned as described previously, and stored in non-freezing conditions with the cap on to protect the optical eyes and to prevent unnecessary battery drainage.

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/conductivity sensor problems. This function also performs a series of self-tests on the Levelogger to check for problems with the battery, memory, pressure/temperature/conductivity sensors. If a LTC Levelogger fails the Conductivity Sensor Test, this could mean that you have not calibrated your LTC in a while (~1 year). It is recommended that you perform a conductivity calibration, then 'Run Diagnostics' again. 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.

Note: If a LTC Levelogger fails the Conductivity Sensor Test, this could mean that you have not calibrated your LTC in a while (~1 year). It is recommended that you perform a conductivity calibration, then 'Run Diagnostics' again.
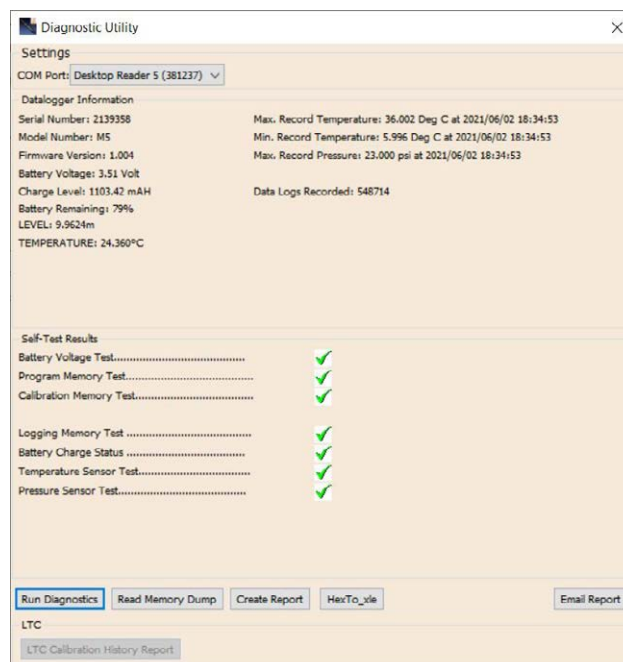

Figure 11-1 Run Diagnostics

11.2 Read Memory Dump

This function creates a complete dump of the datalogger's memory, which can then be sent to Solinst Technical Support for analyzing, or converted to an *.xle file that you can open in the Data Control tab.

Note: It is recommended that, before attempting to use this function, you use the 'Create Report' function to send a report to the Solinst Technical Support.

To execute this function simply click the Read Memory Dump button. Performing a memory dump will create *.hex files of the data which are saved on your PC.
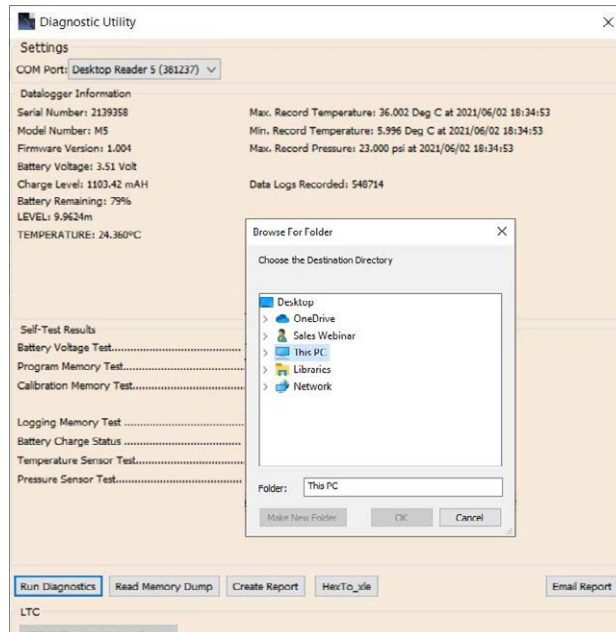

Figure 11-2 Read Memory Dump

11.2.1 File Conversion (hex to xle)

This function converts the *.hex files that were created and saved with the Read Memory Dump function, to *.xle files that you can open in the Data Control tab, or send to Solinst for technical support. A list of the files created will be displayed.
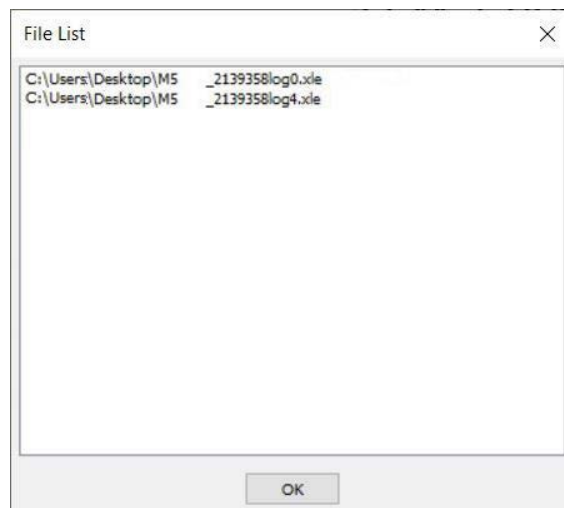
Figure 11-3 Hex To _xle File Conversion List

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 a LTC Levelogger, the LTC Calibration History Report will be included.

Note: The 'Email Report' option automatically creates a report and attaches it to an email to send to Solinst—all in one step.

Figure 11-4 Customer Info Input Window

Figure 11-5 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 a LTC Levelogger, 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. Use it to send a history report to Solinst for analysis if the LTC Levelogger 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.
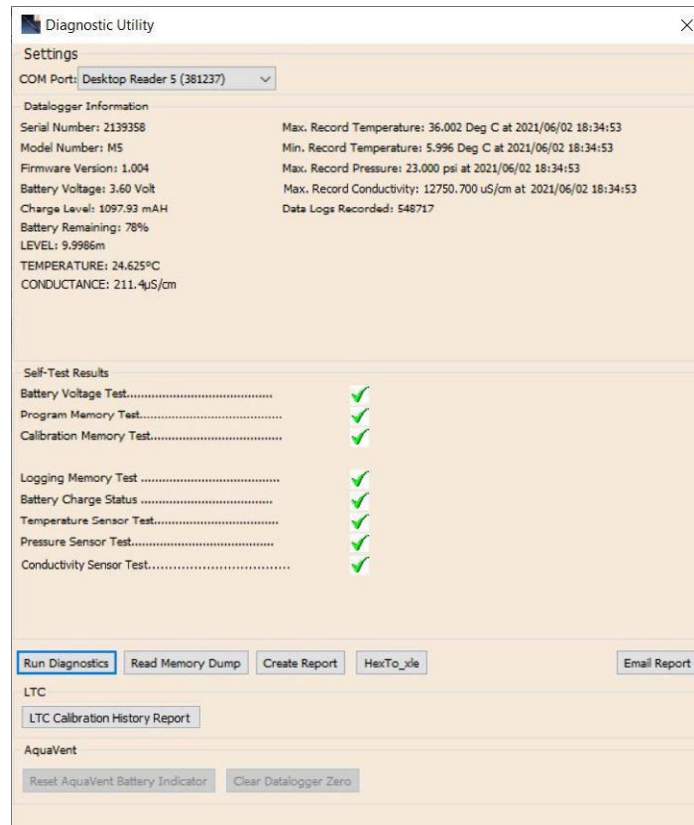
Figure 11-6 LTC Calibration History Report

11.6 Software/Firmware Updates

Each time the Diagnostic Utility is opened, it automatically checks on-line 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 web page 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 web page 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.

Note: You can also check for updates using the Help menu.

12 Firmware Upgrade Utility

Note: To check for firmware updates using Levelogger Software, retrieve settings from the connected datalogger (see Section 5). "Firmware Update Available" will appear in the top right menu bar if there is an update available. Clicking the message will open a web page where you can download the firmware update. You can also use the Software's Help menu.

Note: It is important that the communication between the PC and the Levelogger is not interrupted during a firmware/calibration upload so make sure to close any other running programs, including screen savers, and do not disconnect the Levelogger before the upload is finished.

Note: Solinst recommends using an Optical Reader (Desktop Reader 5 or Field Reader 5) to connect your Levelogger to the PC during a firmware upgrade to avoid any interruptions during the extended communication period.

The Firmware Upgrade Utility is used to upload new firmware files to a Levelogger. The zipped firmware file can be obtained from: https://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.

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 '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 'Datalogger Status' box either before or after the "Verifying Firmware" and "Loading Firmware to Datalogger" messages, then restart the upgrade process.

6) If, however, a communication error occurs between the "Verifying Firmware" and the "Loading Firmware to Datalogger" messages, then please contact Solinst. You will need to give the datalogger Serial Number and explain the exact positioning of the error message.
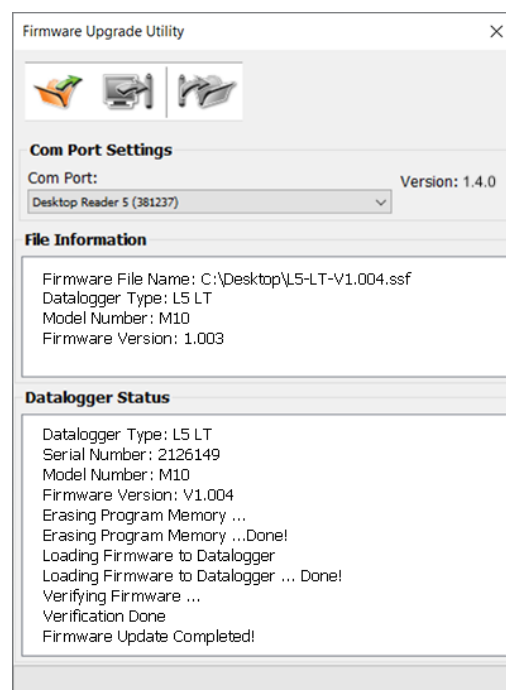
Figure 12-1 Firmware Upgrade Utility Window

13 Troubleshooting

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 10 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 the latest version of Levelogger Software downloaded from the Solinst website Downloads section.

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 Data Has Been Erased Accidentally

For Levelogger Edge and Gold Series dataloggers, if the datalogger has been restarted and old data has not been saved, go to Download Options and choose Recover Previous Log.

13.4 Error Messages During Use of Software

**'Communication Time Out' or 'Communication Error' or
'The Command that is sent to the Levelogger 5/Edge is not defined'**

1) Try communicating with another Levelogger, Desktop Reader 5, Field Reader 5, or Direct Read Cable. The communication cables or Levelogger may be damaged.
2) Clean the optical eye(s) 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.

7) If problem persists, contact Solinst.

'Port Cannot Open'

1) If using a USB device, ensure you plugged it in before starting the Levelogger Software.

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

3) If the correct Com Port is not available, a USB Driver installation or update may be required.

4) 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.

5) Make sure your Com Port has been enabled:

      a. Select Control Panel

      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'

'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 connected 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 5/Edge/Gold supports this function'

The 'Append Data', 'Partial Download' and 'Download Files/Data Recovery' functions are only supported by the Levelogger 5/Edge/Gold loggers, not previous version Leveloggers.

'Schedule cannot be empty'

When using the 'Schedule' sampling option, 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 150,000 individual readings.

Appendix

Levelogger Gold Series

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
Ranges:	5, 10, 20, 30, 100 m
Accuracy:	0.05% FS
Resolution:	0.001% FS to 0.0006% FS
Normalization:	Automatic Temperature Compensation
Temp. Comp. Range:	10°C to 40°C
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Temp. Sensor Accuracy:	± 0.05°C
Temp. Sensor Resolution:	0.003°C
Battery Life:	10 Years - based on one reading/min
Clock Accuracy (typical):	± 1 minute/year
Operating Temperature:	-20°C to 80°C
Maximum # Readings:	40,000 of level and temperature
Memory:	Slate and Continuous
Communication:	Optical Infra-red: USB, RS-232, SDI-12
Communication Speed:	9600 bps
Size:	22 mm x 154 mm (7/8" x 6")
Weight:	179 grams (6.3 oz)
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, Future Start, Future Stop, Real Time View
Measurement Rates:	0.5 sec to 99 hrs
Barometric Compensation:	High accuracy, air-only, Barologger Gold

Models	Full Scale	Accuracy	Resolution
M5	5 m (16.4 ft.)	± 0.3 cm (0.010 ft.)	0.001% FS
M10	10 m (32.8 ft.)	± 0.5 cm (0.016 ft.)	0.0006% FS
M20	20 m (65.6 ft.)	± 1 cm (0.032 ft.)	0.0006% FS
M30	30 m (98.4 ft.)	± 1.5 cm (0.064 ft.)	0.0006% FS
M100	100 m (328.1 ft.)	± 5 cm (0.164 ft.)	0.0006% FS
M200	200 m (656.2 ft.)	± 10 cm (0.328 ft.)	0.0006% FS

Note: Solinst recommends using the most recent Levelogger Gold firmware version with Levelogger Software Version 4.4.0 . See Section 2.3. Contact Solinst if you need to upgrade your firmware from version 1.016 or lower.

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.

Note: Solinst recommends using the most recent Barologger Gold firmware version with Levelogger Software Version 4.4.0. See Section 2.3.

Barologger Gold Technical Specifications	
Level Sensor:	Piezoresistive Silicon in 316L Stainless Steel
Accuracy:	0.05% FS
Resolution:	0.002% FS
Normalization:	Automatic Temperature Compensation
Temp. Comp. Range:	0°C to 40°C
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Temp. Sensor Accuracy:	± 0.05°C
Temp. Sensor Resolution:	0.003°C
Battery Life:	10 Years - based on one reading/min
Clock Accuracy (typical):	± 1 minute/year
Operating Temperature:	-20°C to 80°C
Maximum # Readings:	40,000 of pressure and temperature
Memory:	Slate and Continuous,
Communication:	Optical Infra-red: USB, RS-232, SDI-12
Communication Speed:	9600 bps
Size:	22 mm x 154 mm (7/8" x 6")
Weight:	179 grams (6.3 oz)
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, Future Start, Future Stop, Real Time View
Measurement Rates:	0.5 sec to 99 hrs

Model	Full Scale (FS)	Accuracy	Resolution
Barologger (M1.5)	Air Only	±0.05 kPa	0.002% FS

Levelogger Junior

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

Note: Solinst recommends using the most recent Levelogger Junior firmware version with Levelogger Software Version 4.4.0.. See Section 2.3.

Levelogger Junior Technical Specifications	
Level Sensor:	Piezoresistive Silicon in 316L Stainless Steel
Ranges:	5, 10 m
Accuracy:	± 0.1% FS
Resolution:	0.028% FS to 0.021% FS
Normalization:	Automatic Temperature Compensation
Temp Comp. Range:	10ºC to 40ºC
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Accuracy:	± 0.1ºC
Resolution:	0.1ºC
Battery life:	5 years (based on 1 reading/minute)
Clock Accuracy (typical):	± 1 minute / year
Operating Temperature:	-20ºC to 80ºC
Memory:	Slate mode
Maximum # Readings	32,000 (no data compression)
Com Interface:	Optical Infra-red: USB, RS-232, SDI-12
Communication Speed:	9600 bps
Size:	22 mm x 140 mm (7/8" x 5.5 ")
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:	-300 to 5,000 m (-980 to 16,400 ft)
Barometric Compensation:	High accuracy, air-only, Barologger Gold

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

Note: The Levelogger Junior looks very similar to the newer Levelogger Junior Edge. To determine the difference, look at the serial number on the body of the Levelogger. If the fourth number in the serial number is 1, it is a Levelogger Junior. If the fourth number is a 2, it is a Levelogger Junior Edge.

LTC Levelogger Junior

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

Note: Solinst recommends using the most recent LTC Levelogger Junior firmware version withwith Levelogger Software Version 4.4.0.. See Section 2.3.

LTC Levelogger Junior Technical Specifications	
Level Sensor:	Piezoresistive Silicon with Hastelloy Sensor
Ranges:	30, 100 ft. (10, 30 m)
Accuracy:	± 0.1% FS
Resolution:	0.021% FS
Normalization:	Automatic Temperature Compensation
Temp Comp. Range:	10ºC to 40ºC
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Accuracy:	± 0.1ºC
Resolution:	0.1ºC
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 or 20 µS/cm
Resolution:	1 µS
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 (typical):	± 1 minute / year
Operating Temperature:	-20ºC to 80ºC
Memory:	Slate mode
Maximum Readings:	16,000
Communication Speed:	9600 bps
Com Interface:	Optical Infrared: USB, RS-232, SDI-12
Size:	22 mm x 190 mm (7/8" x 7.5")
Weight:	200 g (7.05 oz.)
Wetted Materials:	Hastelloy, Delrin®, Viton®, 316L Stainless Steel, Platinum
Sampling Mode:	Linear, Future Start, Real Time View
Measurement Rates:	5 seconds to 99 hours
Altitude Input:	-300 to 5,000 m (-980 to 16,400 ft)
Barometric Compensation:	High accuracy, air-only, Barologger

LTC Models	Full Scale (FS)	Accuracy	Resolution
F30, M10 C50	32.8 ft., 10 m	± 0.032 ft., 1.0 cm	0.021% FS
F100, M30 C50	98.4 ft., 30 m	± 0.098 ft., 3 cm	0.021% FS

Rainlogger

The Rainlogger is designed for use with most standard tipping-bucket rain gauges. It records each tip time from the tipping-bucket, and outputs the amount of rainfall per programmed time period (based on rainfall calibration constant).

Note: Solinst recommends using the most recent Rainlogger firmware version with Levelogger Software Version 4.4.0. See Section 2.3. If using a firmware version prior to version 2.000, the Rainlogger will function differently (See previous Levelogger User Guide).

Rainlogger Technical Specifications	
Battery Life:	10 years (logging 2 parameters/10 minutes)
Clock Accuracy (typical):	± 1 minute/year
Operating Temperature:	-20˚C to 80˚C
Maximum # Readings:	Up to 60,000 tip times
Memory:	Slate mode
Communication:	Optical infra-red: USB, RS-232, SDI-12
Measurement:	Records each tip by the tipping-bucket rain gauge and outputs the amount of rainfall
Sampling Mode:	Event Based, Future Start, Real TIme View
Size:	22 mm x 175 m (7/8" x 7")
Weight:	135 grams (4.8 oz)
Materials:	316L Stainless Steel, Delrin®, Viton®

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