

**Ozarks Environmental and Water Resources Institute (OEWRI)  
Missouri State University (MSU)**

**Standard Operating Procedures for:  
Installation, Operation, and Maintenance of the Solinst  
Levelogger Gold and Barologger Gold (Model 3001)**

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## **1.0 INTRODUCTION**

### **1.1 Scope of the method**

#### **1.1.1 Method**

This document details the procedure for installation, operation and maintenance of the Solinst Levelogger Gold and Barologger Gold (Model 3001) series water level sensor and datalogger.

#### **1.1.2 Purpose**

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 Gold.

### **1.2 Definitions**

**1.2.1** Polyvinyl chloride (PVC): a common thermoplastic resin used in a variety of products.

**1.2.2** Universal Serial Bus (USB): Most widely used hardware interface for attaching peripherals to a computer.

## **2.0 EQUIPMENT AND SUPPLIES**

### **2.1 Installation Checklist**

- Levelogger
- Barologger
- Appropriate amount of 2" diameter schedule 40 PVC electrical conduit w/ elbows and couplings
- PVC primer and glue
- Locking well cap
- Appropriate length of wire to hang instruments
- Pipe brackets
- Concrete screws
- Concrete drill bit appropriate for screw diameter
- Hammer drill

## **3.0 INSTALLATION**

### **3.1 Site Location**

The preferred site for installation is at a bridge or other structure where the pipe can be mounted to concrete. Alternative sites may be used, but pipe housing must be securely mounted to withstand high flows.

### **3.2 Pipe Installation**

The PVC pipe should be mounted to concrete walls or piers using the appropriate sized brackets and concrete screws. Several 45 and 90 degree elbows, or sweeps, should be available if the pipe needs to be installed around corners. Couplings are needed to attach pipe ends together when “bell” ends are not available. Pipe is secured at all joints with PVC primer and glue.

### **3.3 Instrument Installation**

#### **3.3.1 Introduction**

The Levelogger and Barologger are to be installed using a free suspended installation method. For the free suspended installation method the instrument is hung by a suspension wire or reliable string. It should be anchored on the other end to support the weight of the unit.

Do not drop the Levelogger. The pressure transducer can be damaged. It can also be damaged if over pressurized (150%) above its recommended range. The unit can also be damaged by the effects of a steam hammer or hydraulic jump. Steam hammer is caused by pressure surges and hydraulic jumps occur when obstructions cause water to build and increase the velocity once it clears the obstacle. This can alter the readings at the installation site. If hydraulic jump occurs within the area care should be observed when determining the installation location.

#### **3.3.2 Free Suspension/Rope Installations**

When installing using a suspension wire or rope, the Levelogger is preprogrammed and started using the software. It is then deployed using a suspension wire or rope connected to the installation cap of the Levelogger to the underside of a well cap. The data is retrieved manually, by withdrawing the Levelogger, removing the installation cap and attaching an Optical Reader directly to the datalogger. Data is downloaded to a desktop or laptop PC. Follow these steps to install the Levelogger and Barologger.

- Secure the Levelogger to the rope by either tying a line to the Levelogger cap or use a suspension wire which can either be secured with a knot or by using a crimping tool to apply a crimp to the two lines once it's passed through the hole in the cap.
- Determine length of wire required for the specific site and adjust accordingly with scissors or wire cutters.
- If using the 2" capping device, secure the other end by either tying a knot in the line after it is passed through the hole located on the bottom portion of the device.
- If the capping device is not used then some secure tie off point should be emplaced. Make sure both ends are secure before installation.
- If installing a Barologger, ensure the suspension level is above the highest expected water level.
- When retrieving data and/or reprogramming the Levelogger, extract it from the monitoring location, unthread the installation cap, interrogate and resuspend the unit rechecking the security of the wireline clamps each time.

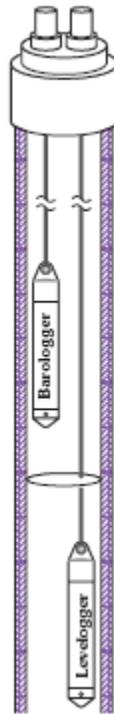


Figure 1. Free Suspended Installation Method

### **3.3.3 Barologger Installation**

The Barologger measures barometric pressure. The readings can be used to compensate Levelogger readings. The correct altitude (within 10m) must be determined or it will result in incorrect readings. A Barologger has the ability to compensate all Leveloggers within a 20 mile (30 km) radius. It can also be applicable to every 1,000 ft. (300 m) in elevation.

The Barologger shouldn't ever be submerged. The Barologger should be suspended above the high water point. In conditions where freezing is possible, the Barologger should be suspended below the frost line and deep enough to avoid large temperature fluctuations.

### **3.3.4 Extreme Temperature Conditions**

Leveloggers can be damaged by extreme temperatures. If water freezes solid it can damage the pressure transducer. With certain precautions, the Levelogger can be used in these environments.

- The transducer can be lowered below the frost line or ice formation depth.
- In shallow areas like streams, wetlands, or ponds; install the Levelogger in a vented stilling well imbedded into the bottom below the frost line.
- If the Levelogger has to be installed in the freezing zone, place the Levelogger inside two rubber or latex balloons. These can then be filled with a non-toxic, non-corrosive anti-freeze solution and sealed. Place the balloons in a section of perforated, 2" diameter schedule 40 PVC electrical conduit and install the logger. The antifreeze solution will protect the Levelogger from ice expansion at the pressure transducer, yet transmit any pressure fluctuations that occur.
- At the other end, exposing the Levelogger to temperatures beyond 80°C (180°F) can damage the thermistor and alter readings.

## **4.0 PRE-DEPLOYMENT**

### **4.1 Software**

To install Levelogger Gold software, follow these steps:

- When the Levelogger CD is inserted into the CD ROM drive the program will automatically detect the program. Otherwise download the software from [www.solinst.com/Downloads/](http://www.solinst.com/Downloads/) and save the file.
- Restart the computer after installation is completed.

## 4.2 USB Installation

Plug the USB device into the computer, and Windows will automatically detect the connected device and start the Hardware Installation Wizard. If your device is plugged in and the Found New Hardware Wizard fails to start, then follow these steps:

- Open the Device Manager.
- Identify the Solinst device from the list.
- Highlight the device in the list and right click. You will see an option to “Update the driver”. This will start the “Hardware Update Wizard”. Now follow the instructions for your specific Windows version.

## 4.3 Firmware

To upload new firmware to a Levellogger Gold, follow these steps:

- Open the Solinst Firmware Update Utility (LLGfirmwareUpdate.exe), which is located in the ‘Utility’ folder in the Levellogger folder. Pick the Com Port to which the Levellogger is connected and make sure the Baud Rate is set to 9600.
- Click the left most ‘Open’ button, which should open a file dialog asking for the firmware file (\*.ssf) to upload. Navigate to the directory where the firmware file is located then click on the file and click ‘Open’.
- Check the ‘Firmware File Information’ box to make sure that the opened file is the right one.
- Click the ‘Upload Firmware’ button, which is the second button from the left, to start the firmware upload process.
- If a communication error occurs and is indicated in the Levellogger Information Window either before the ‘Verified Program Checksum’ message or after the ‘Program Information Section’, then restart the upgrade process.
- If, a communication error occurs between the ‘Verified Program Checksum’ and the ‘Program Information Section’ messages, contact Solinst.

## 4.4 Startup, Configurations and Settings

### 4.4.1 Startup

To start the Levellogger PC Software, click the icon, or click the Start button and select: Programs > Solinst > Levellogger > Levellogger 3.4.0 (or higher).

#### **4.4.2 Communication Port Settings**

If using a USB port, plug in the USB cable before starting the Levelogger Software. The Com Port Setting required for this method is RS232 or the USB communication port, selected from the communication settings. Once the program begins, parameters can be established using the software.

In the “Com Port Selection” field, select the communication port that is connected to the Levelogger. The program automatically detects the available Com ports on your computer. USB port communication requires the installation of USB driver software and the setting up of a Virtual Com port. If using a USB port, you must either:

- Connect a Levelogger Optical Reader or PC Interface Cable to the USB port
- Use a USB to RS232 Adapter

#### **4.4.3 Com Port Designation Set Up:**

- Open the Device Manager
- Double Click the Ports Icon and select the ‘USB Serial Port’
- Right click and select Properties
- Click the ‘Port Settings’ tab and click ‘Advanced’
- Select the Com Port Number and click ‘OK’

#### **4.4.4 Data Directory**

The program will save data downloaded to the following default directory:

<C:\Program Files\Solinst\Levelogger3\_4\Data> unless otherwise specified in the Default Directory field of the Application Settings Window.

#### **4.4.5 Levelogger Settings**

Click the button with the green arrow (top left) to retrieve the current settings from a connected Levelogger.

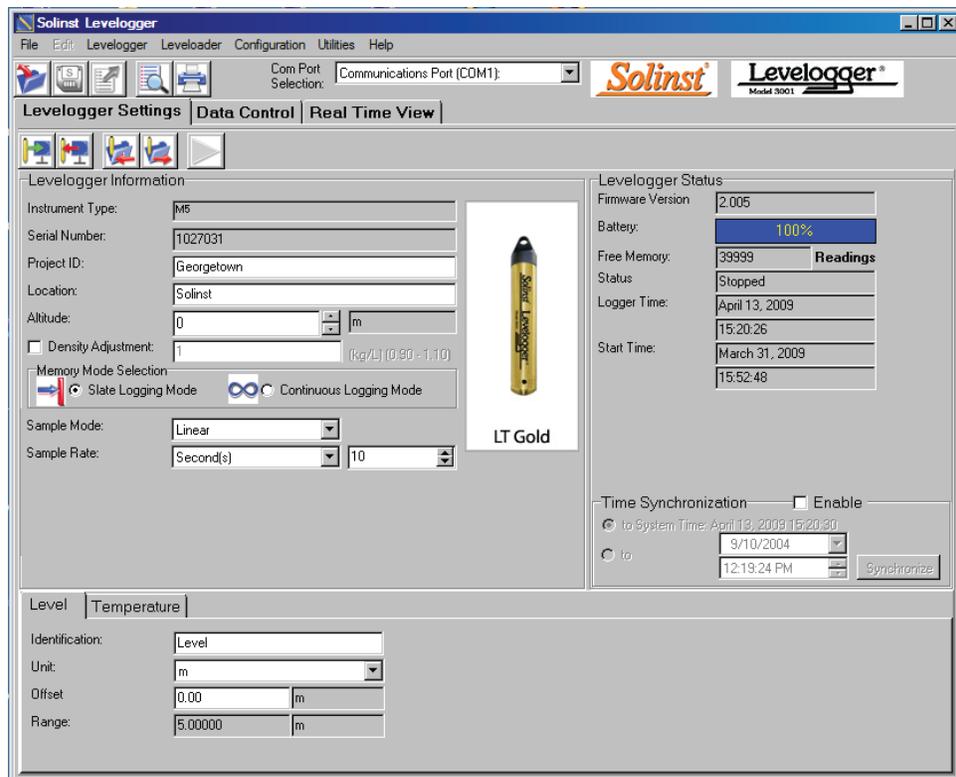


Figure 2. Levelogger Settings Window

- Fill in the pertinent information in the “Project ID” and “Location” fields. Each item is limited to 32 characters.
- Altitude should be specified as well in either feet or meters above sea level, where the logger is actually deployed.
- Offset should be set at “0.00” in order to keep readings relative to the tip of the logger. Although it can be altered to reflect the distance between the tip of the Levelogger and the monitoring well cap or static water level.
- Range refers to the water fluctuation range capability of the device, measured in meters.
- The Temperature tab, was pre-programmed by Solinst in °C and cannot be changed. Recommended range of the unit is (-20°C to 80°C).
- Conductivity (Figure 3) can be determined by selecting either mS/cm or µS/cm.
- The Temperature Coefficient field shown in the conductivity tab, allows you to choose the actual conductivity (‘Conductivity’) at the current temperature or select Specific Conductance (‘Spec. Cond.’) Do not change the measurement unless the specific values are determined of the solution in which you are measuring.

#### **4.4.6 Program Levellogger Settings**

If the Levellogger's clock has not been synchronized with a computer, click the "Enable" box on the mid-right side of the status screen (Figure 3). Input pertinent information. The settings for the logging session should be completed as this point, click the button with the red arrow to send all the settings to the Levellogger. Once complete the Levellogger can be started.

#### **4.4.7 Starting and Stopping the Levellogger**

When ready to begin click the green triangle button. The "Start Levellogger" window will open. To begin logging information immediately, choose "Now". Otherwise choose to start at a later date and/or time. After the Levellogger is operational, it will begin collecting readings according to the specified start time. The Start icon will change to a Stop icon. The session can be stopped before maximum readings are recorded. However, when a new session begins the Levellogger deletes all previous information.

When the Levelloggers in Slate mode, it means it will record data until stopped or until their memory is full. When this occurs it will stop recording. If using this method is important to determine when the information needs to be collected.

#### **4.4.8 Saving and Retrieving Levellogger Settings Files**

To store specified settings as defaults, click the blue folder with a right hand red arrow icon (Figure 3). The program will store the settings of the Levellogger into an \*.lls file. The \*.lls file will save the following settings: Project ID, Location, Sample Mode, Event Percent, Sample Rate, Altitude, Density, Channel ID, Unit and Offset.

In order to retrieve settings from a default setting, click on the blue folder containing a left hand arrow icon (Figure 3). Keep in mind that Project ID and Location identification information will be identical and should be distinguished from logger to logger or point to point.

## **5.0 DATA COLLECTION**

In order to download data, first click the "Data Control Tab" from the Main Window. From this window, the user can download data from a Levellogger, data can be displayed in either tabular or graphic forms, and also perform data compensations and export functions.

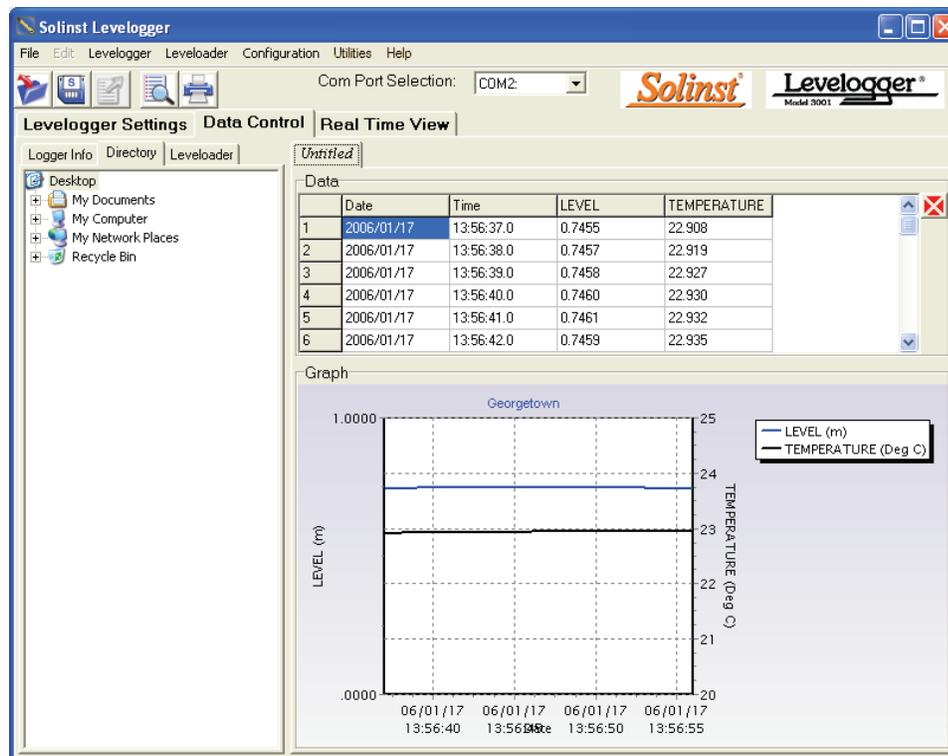


Figure 3. Data Control Window and Directory

## 5.1 Downloading Options

In order to download the information from the collection, click the blue folder with red downward arrow on the Data Control window (Figure 4). Select "All Data", the program will download all the data from the current logging session of a Levelogger as a \*.lev file.

## 5.2 Graph Manipulation and Zoom Function

To perform the Zoom In or out on the graph, click the plus or minus buttons (Figure 4). Multiple portions of the graph can be altered to the user's specifications, such as labels, markers, etc, by clicking on the "Graph Option". The Channel Selection Option allows for one to define each possible channel on the graph. Click the available options to select the required channels.

## 5.3 Data Compensation

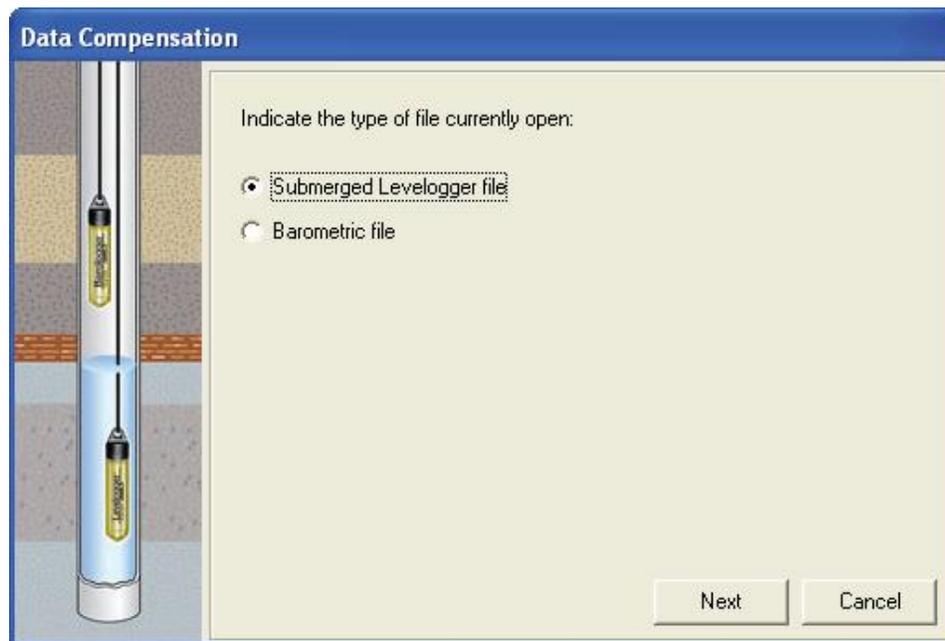


Figure 4. Data Compensation Window

Click the Data Compensation icon to open the Data Compensation Wizard. Identify the specific file. After the selection of the file type, click “Next” and the Data Compensation window (Figure 5) will open. There are four compensations to select from: Barometric Compensation, Manual Data Adjustment, Density Adjustment and Barometric Efficiency.

### 5.3.1 Barometric Compensation

Requires both the Barometric file and the submerged Levelogger files. In order to obtain a value subtract the barometric reading from the Levelogger reading.

### 5.3.2 Manual Data Adjustment

Allows the user to enter a manual water level measurement as a reference datum or field zero, which all Levelogger water level readings can then be adjusted to. If the value is greater it can be entered as a negative value. If the value is below water level, a positive value is recorded. The date and time must be recorded as well. The program determines the correction factor and adjusts all the data in the selected file.

### 5.3.3 Density Adjustment

Allows for the correction based on a user input adjustment of fluid density ranges if known.

### 5.3.4 Barometric Efficiency

Is often expressed as a percentage or proportion and has a default value of 1.00. However, it can be altered from 0.01 to 3.00. Both the default and altered settings can be saved as a \*.lev file. Do not change or delete the file extension.

## 5.4 Real Time View Window and File Export

In order to view the Real time information, click the Real Time View tab from the main software window and the current readings will be provided. The results can be displayed as a graph or in tabular format. If certain information is not required, it can be removed by unchecking the check box to the right of the data display. However, if it's not selected, the information will not be recorded. Information recorded can be saved by exporting the data into a \*.csv file, using choosing the file export option.

To begin the current readings, click the Start icon. To record information at a specific time, click the read now button. This reading will be added to the data set.

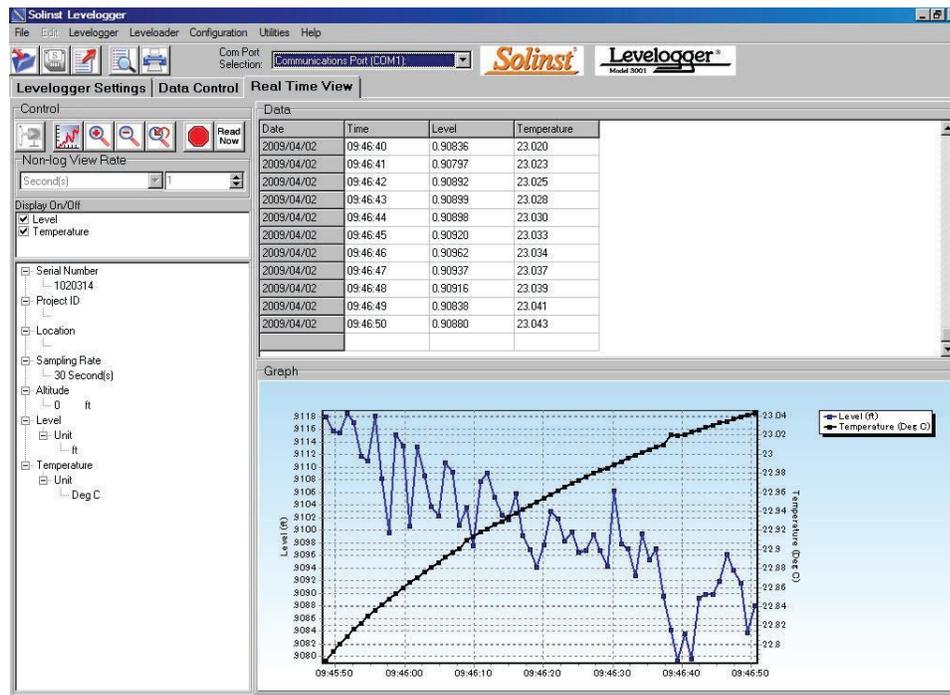


Figure 5. Real-Time Video Window

Data can be exported from the unit in a \*.csv (comma separated value) file format by clicking File> Export > Data. Which can be opened in Microsoft Excel.

## **6.0 MAINTENANCE**

### **6.1 Levelogger Maintenance**

Levelogger maintenance consists of cleaning the outside stainless steel casing, the circulation holes and the optical infrared eyes. Check the unit when collecting data. Cleaning consists of rinsing the Levelogger with a mild, non-abrasive household cleaner and 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. A number of conditions require specific maintenance protocols. These include conditions like hard water, high suspended solids loading, biological or chemical fouling and salt or brackish water conditions. Also it is imperative to check to the canister in which the unit is housed. The holes in the bottom should be free of debris and sedimentation. Check to make sure the unit is properly secured by the concrete anchors and is not loose.

### **6.2 Hard water conditions**

Calcium and magnesium have the potential to deposit on the pressure transducer as well as other components of the Levelogger. These deposits can be safely dissolved using a diluted solution (typically  $\leq 10\%$  strength) of acetic or phosphoric acid.

### **6.3 High suspended solids**

High suspended solids may block the circulation ports or clog the internal pressure cell of the Levelogger. Clogging can be minimized by placing the unit in an area of higher flow potential. In order to remove built up solids, rinse the Levelogger in a sink using a low water flow.

### **6.4 Bacteriological or chemical fouling**

Bacteriological or chemical fouling can be an important consideration to take into account with installation sites. Chemical deposits can be caused by either electrical charge created by the unit and surrounding material, or by certain chemical compositions. Both forms of fouling can result in difficult to remove deposits. To remove fouling use a diluted ( $\leq 10\%$ ) solution of sulfuric acid. Persistent material may require soaking for several hours.

## **7.0 MAINTENANCE CHECKLIST**

- Mild, non-residual, non-abrasive household cleaner.
- Soft-plastic, bristled, pipe-cleaner type brush.
- Acetic or Phosphoric Acid ( $\leq 10\%$ ) for hard water conditions.
- Water to rinse suspended solids from unit.
- Sulfuric Acid ( $\leq 10\%$ ) for Bacteriological or chemical fouling.

## **8.0 REFERENCES**

- Levellogger Series (Levellogger Gold, Barologger Gold, Levellogger Junior, LTC Levellogger Junior and Rainlogger) User Guide – Software Version 3.4.1. (2011). Solinst, Ontario, Canada.