LEVEL SCOUT

OPERATIONS MANUAL

C O N T E N T S

1.0 PRODUCT DESCRIPTION

The Level Scout is a submersible pressure transducer with data logging capabilities that also measures temperature.

Key features include:

- Embedded datalogger and level sensor in one instrument
- Pressure accuracy of +/- 0.05% FS TEB (Total Error Band) for most pressure ranges
- Integrated temperature measurement up to +/- 0.2 °C accuracy
- Field upgradeable firmware
- Quick-disconnect cable assembly with in-line vent filter
- Level ranges to 692 feet (211 m) of H_2O
- Networkable RS-485 interface for long cable runs
- On-board surge protection
- User-selectable measurement units
- Replaceable batteries that have an estimated 3-year life
- Linear, Linear Average, Logarithmic and Event based logging modes built in
- Small diameter (0.75 inches, 19 mm) easily fits in a 1 inch well
- Stainless steel or Titanium construction
- Optional RS-485 to SDI-12 converter for connectivity to 3rd party SDI-12 devices

The Level Scout combines a highly accurate pressure sensor assembly with power conservative microcomputer circuitry. Internal batteries power the electronics providing years of data logging using linear, linear averaging, event triggered, and logarithmic sampling modes. The batteries are easily field-replaceable via a quick-disconnect cable.

The Level Scout firmware can be upgraded in the field as new features and capabilities are released. The Level Scout features a networkable RS-485 communications interface utilizing the SDI-12 protocol. The unit is supplied with sophisticated yet easy to use Windows based applications software, Data Scout Advanced and Data Scout, for use with a laptop or desktop computer and Data Scout Mobile for use with a handheld PC to facilitate the following functions:

- Logging set-up and initialization
- Tabular and graphical data display
- Extraction of logged data
- Real time data sampling

All versions of Data Scout software and Level Scout firmware upgrades are available for free download at www.ysi.com.

2.0 INSTALLATION AND SETUP

This chapter will provide a detailed description of how to setup and install the Level Scout. Note that a Quick Start Guide is provided with each Level Scout. This card provides an abbreviated set of instructions for operating the Level Scout immediately.

2.1 INITIAL INSPECTION

Carefully unpack the instrument and accessories from the shipping container and inspect for damage. If any parts or materials are missing or damaged, contact YSI Customer Service at 800-897-4151   (+1 937 767-7241) or your local YSI Representative.

2.2 CONNECTING YOUR TRANSDUCER

2.2.1 CABLE ATTACHMENT

Depending on the Level Scout's pressure format (absolute or vented gauge) and communications needs, there are two deployment accessories that may be used: the field cable or the suspension wire. The field cable includes power and communications conductors as well as a reference pressure vent tube. It should be used with **all** vented Level Scouts. The field cable may be optionally used with absolute Level Scouts, especially in installations where direct data readout is desired. When using the field cable with an absolute pressure Level Scout, the cable vent tube or vent patch must still be protected from moisture migration.

The suspension wire is intended for use **only** with the Absolute Level Scouts. It provides a low cost suspension solution for deployments where direct data readout is not required.

The following procedure explains how to connect the filed cable to a Level Scout:

- Inspect the two o-rings on the open, battery end of the transducer to ensure they are clean and not damaged.

- Remove the battery insulator strip from the Level Scout.

- Look inside the cable end of the connectors to view how the two sections mate together. The two keys in the transducer and cable are two different sizes. This is important to note to ensure proper alignment (figure 2.1).
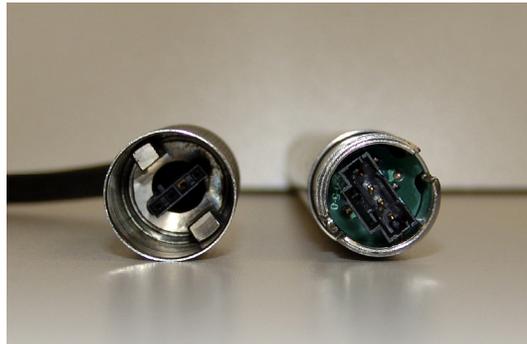
Figure 2.1

- Insert the transducer housing into the cable retaining nut. Hold the transducer assembly in one hand and the cable in the other near the retaining nut (figure 2.2).

Figure 2.2

YSI Incorporated

- While applying slight pressure, push the two parts together and slowly rotate the transducer assembly until the keys align. When the keys align, the housing will slip into the retaining nut assembly an additional one inch and the transducer will no longer rotate while the user is holding the cable.

- Now that the keys are aligned and seated, grasp the transducer in one hand and the retaining nut in the other. While applying slight pressure, push the two parts together and screw the retaining nut onto the transducer housing. Continue threading the parts together until they are fully mated, leaving no visible gap where the retaining nut meets the transducer housing.

2.2.2 PC – SERIAL COMMUNICATIONS CONNECTION

The field cable incorporates an innovative vent filter that provides lifetime moisture protection for vented Level Scouts. A GORE-TEX®-like plug prevents water droplets from entering the filter while allowing air to pass freely to the internal silica gel desiccant. The 316 SS housed filter also provides surge protection and utilizes a compact electrical connector.

There are two options for the communication cable, the 778 or the 779 adapters.

The 778 adapter provides connection from the field cable to a modem, PDA, or computer, and includes built-in conversion to RS-232C and USB as well as a DC input connector. When using the 778, you will be prompted to install drivers from the Information and Support CD that was included with your Level Scout.

For SDI-12 output, use the 778 or 779 with a 772 adapter. Additional, the 779 incorporates a DC input connector and requires additional converters for RS-232C (model 771) or USB (model 771 and 773) communication.

See figure 2.3 for a diagram of all the communication adapter options.

If using a universal cable assembly, figure 2.4, the RS-485 communications interface to the Level Scout is terminated in a 9-pin male D-shell connector. This connector is intended to work directly with the Level Scout communication adapters 771 (RS-232), 772 (SDI-12), and 773 (USB).

If using a 771 RS-485 to RS-232 adapter, ensure the RS-485 end of the adapter is pointed toward the transducer and the RS-232 labeled end is connected to your PC or USB adapter.

> Note: See Appendix A for wiring information of the discontinued, universal cable 9-pin D-shell and for connection information for model 772 RS-485 to SDI-12 converter.

773

USB
RS-232C

RS-485
232/USB
778

772
SDI-12
RS-485

RS-232C
RS-485
771

770

779

Field
Cable

Suspension
Wire

Figure 2.3

Optional External Power Source

level scout

Dessicant   Cable Hanger

RS485/RS232 Converter

To PC Serial Port
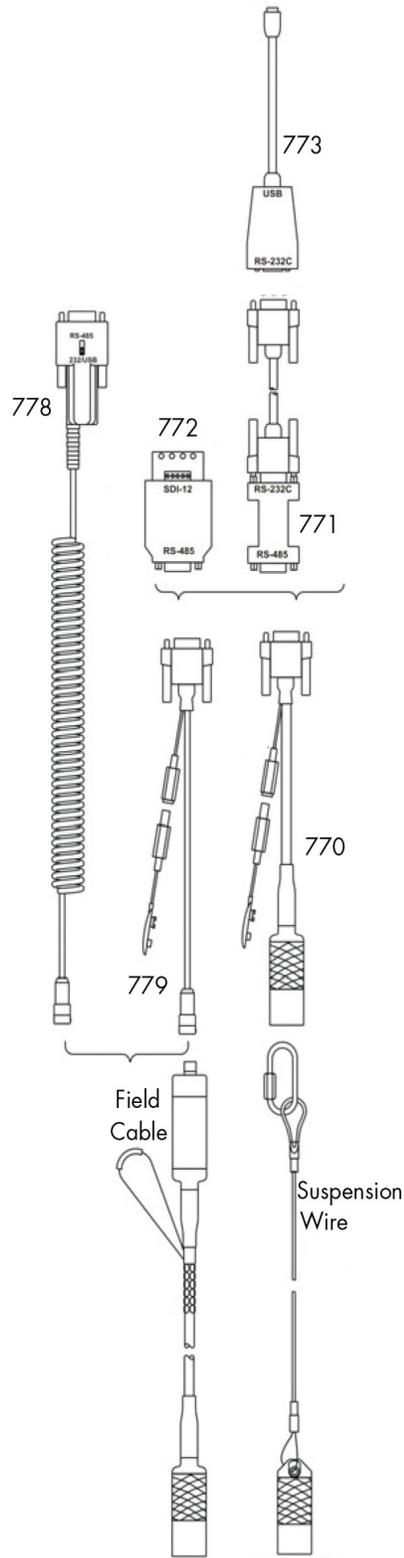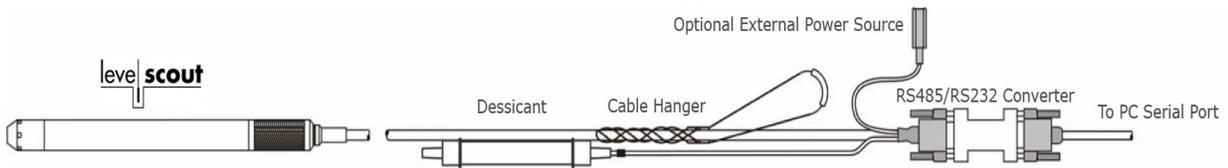
Figure 2.4

2.2.3 POWER AND BATTERY CONNECTIONS

The Level Scout is designed to operate for long periods of time via internal battery power or optionally with external power sources. The Level Scout is shipped with new industrial alkaline batteries installed that will power the transducer for over three years of normal operation.

The cable assembly includes a convenient power connection jack that can be used to provide external power to the Level Scout. It is shipped with a mating connector that has a standard 9V DC battery connection which should be used for data extraction **only**. To use external power to conserve the internal batteries, attach a suitable long life battery to the provided connector or install a power supply in its place. Ensure any external power sources comply with the power supply requirements listed in the specifications section of this manual.

> *Warning*
>
> The Level Scout is designed to reset its internal microprocessor should it detect a short across the external power leads. To prevent unintended resets of the Level Scout, ensure that the external power leads are not allowed to short to each other or a common conductor (such as a metal surface). Similar resets of the Level Scout can occur if an external power source is used that sources a near 0.0 VDC potential. This can occur if an external battery is used that lacks proper output voltage such as when it has been fully discharged. *If the external battery is fully discharged and attached, it will cause all internal logging to stop.*

2.3 LEVEL SCOUT SOFTWARE

Included with the Level Scout are three (3) separate software programs, all provided free of charge. All three programs allow the user to communicate to and configure the Level Scout, setup logging tests, view live data, setup alarms and broadcasts, and download data from the Level Scout.

- **Data Scout Advanced** can be used on a PC or laptop running Windows® 98, ME, NT, 2000 or XP. In addition to the tasks listed about, Data Scout Advanced allows the user to merge data from two separate files. This can be useful when utilizing a BaroScout to compensate absolute transducers for barometric pressure. Data Scout Advanced will also allow the user to display data in graphical format and change the reporting units of previously logged tests. Data Scout Advanced is described in this manual. A more detailed Data Scout Advanced manual is located on the CD that was shipped with the Level Scout.

- **Data Scout** can be used on a PC or laptop running Windows® 98SE, 2000 or XP with version 1.1 of .NET™CLR installed (Common Language Runtime, installed with the installation of Data Scout). Data Scout is a simpler version of Data Scout Advanced. For instructions on how to use Data Scout, please refer to the Data Scout manual located on the CD that was shipped with the Level Scout.

- **Data Scout Mobile** can be used with a handheld PC running Windows® Mobile 2003/2005, at least 1 CF card slot (required for CF serial port adapter), and a CF RS-232 port adapter with 9-pin, D-shell connector. Handheld devices confirmed to run Data Scout Mobile include HP IPAQ® 4700, IPAQ 2795, and Trimble Recon®. The operation of Data Scout Mobile is identical to Data Scout. For instruction on how to use Data Scout Mobile, please refer to the Data Scout manual located on the CD that was shipped with the Level Scout.

2.3.1 LOADING DATA SCOUT ADVANCED ONTO A PC

A copy of Data Scout Advanced can be found on the CD that was shipped with the Level Scout. The following instructions outline the Data Scout Advanced installation process.

- Insert the information and support CD in the computer.

- Navigate to the CD drive.

- Double click on the DSAdvIns.exe file. This will load the Windows® SETUP program, which guides the user through the remainder of the installation process.

- After installation, Data Scout Advanced can be executed via the Windows® Start menu by selecting Start | Programs | Data Scout Advanced | DSAdv.

2.4 INTERNAL CLOCK SYNCHRONIZATION

When received from the YSI, the Level Scout's internal clock will be set to Eastern Standard Time. The internal clock can be quickly and easily synchronized to the local time using the Data Scout Advanced date/time synchronize function as explained in section 3.3 and 4.2 of this manual.

2.5 GENERAL FIELD INSTALLATION

The cable assembly for the Level Scout was shipped with a cable hanger pre-installed. This cable hanger provides a simple method to secure the cable at the top of the installation.

Always carefully lower the transducer into the liquid, penetrating the liquid surface slowly. Avoid dropping the unit into the water as the sudden impact with the water surface can permanently damage the transducer.

The Level Scout is calibrated for operation in a vertical, upright position with the cable extending up. Although it may be operated in any orientation, anything other than this vertical position will result in a slight zero offset in the measured data. If the transducer will be operated in a known, non-vertical orientation this zero offset error may be easily calibrated out as described in section 4.5. Note that the threaded hole on the end of the Level Scout closed-face nose piece offers a convenient method to attach a weight to help ensure vertical orientation. However, avoid inserting any foreign object into this hole that may damage the sensitive diaphragm the nose cone is protecting.

2.6 DESICCANT FILTER

Field cables have an in-line vent filter that do not require replacement. It is designed to provide the vent tube lifetime protection from moisture migration.

The universal field cable (older style cable) is shipped with a desiccant filter installed on the end of the vent tube. When installing the Level Scout, ensure a desiccant filter is attached to the cable vent tube. Failure to use a desiccant could result in moisture migration down the cable vent tube. This can cause measurement offset errors (from water drops in the vent tube) or premature failure of the transducer, which would not be covered by warranty. **When using the desiccant filter, remember to remove the filter's protective cap prior to collecting data.** This will allow air into the desiccant filter. The vent filter is designed to last for at least one (1) year in humid conditions before needing replacement.

When using the universal cable assembly with an absolute pressure Level Scout, the vent tube must still be protected from moisture migration but it is not critical for air to flow through the vent tube. In this situation the protective cap may be left on the desiccant filter or alternately the vent tube may be capped to minimize maintenance requirements.

When using the desiccant filter, ensure a proper maintenance/replacement schedule is followed as described in section 4.6 of this manual.

2.7 CABLE PROTECTION

When working with the transducer cable, such as when lowering the transducer into a well, make sure the cable does not drag over sharp edges which could nick or cut the cable outer jacket. A cut in the outer jacket will provide a path for water to migrate into the transducer electronics causing permanent damage.

The field cables are quite flexible. Care needs to be taken to ensure that when bending the cable to suit the installation, the vent tube does not become crimped inside the cable. To avoid this crimping, **do not bend the cable tighter than a radius of 1 inch.**

Many users require a compression fitting or strain relief to secure the cable as it enters a junction box. Care needs to be taken that the fitting is not over-tightened to the extent that it damages the cable or crushes the internal vent tube.

Crimping the vent tube from tight bends or crushing can result in measurement offset errors since the reference pressure port of the Level Scout's internal transducer would be blocked. This will prevent the reference from 'breathing' as a result of atmospheric or temperature related pressure changes.

3.0 OPERATION USING DATA SCOUT ADVANCED

This chapter will describe the basics of Data Scout Advanced operation so the user can fully utilize the Level Scout. Refer to the separate Data Scout Advanced manual if more detailed information is needed. See section 2.3.1 for software installation instructions.

3.1 INITIAL SETUP AND CONFIGURATION

3.1.1 FIRST TIME DATA SCOUT ADVANCED USE

Open Data Scout Advanced on the PC. The first time Data Scout Advanced is initiated there will be a warning that states it has an empty site network (referred to as a 'Site Net') as shown in figure 3.1. This is normal and simply indicates that Data Scout Advanced has no prior history of the transducers attached to the PC.
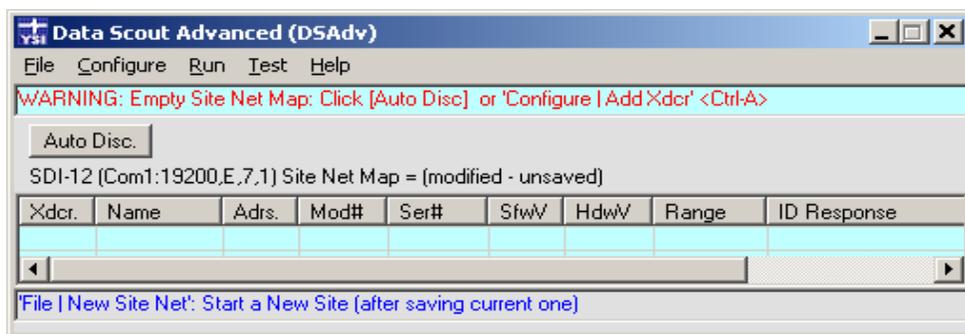
Figure 3.1

To configure Data Scout Advanced to communicate with the Level Scout, perform the following steps:

- Click **Configure**, and then **Xducer Site Network** from the drop-down menu. This will open the **Xducer Site Net Parameters** dialog form (figure 3.2).

- In the Protocol frame, select **SDI-12**. When SDI-12 protocol is selected, the **Baud** rate pull-down list will default to **19200** which matches the factory default of the Level Scout. If the baud rate of the Level Scout has been changed, select the Data Scout Advanced baud rate that matches the configuration in the Level Scout. In the **Port** pull-down list, select the PC COM port that the Level Scout is attached to. Normally, the other check boxes (**Echo Used** and **Modem Used**) will remain unchecked. If you have been communicating to an SDI-12 device, like EcoNet, the Baud rate in the Level Scout has likely been set to 1200 so you should set the DS Adv baud rate to 1200 in order to communicate to the Level Scout.

- Click **OK** to apply these settings and return to the main Data Scout Advanced menu.
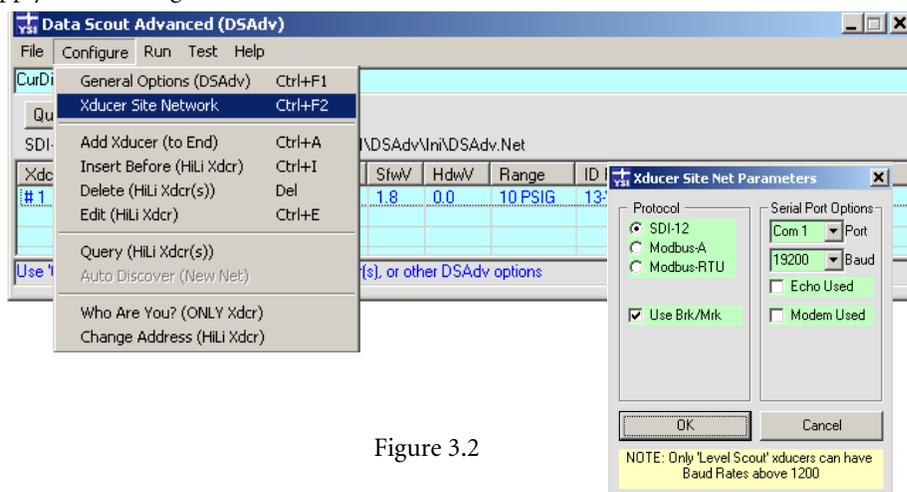
Figure 3.2

- Now that the PC communications settings have been made, click the **Auto Disc**. button to initiate a search for attached transducers. Data Scout Advanced will indicate the status as it searches through all SDI-12 addresses (0-9, A-Z, a-z) on the network for attached transducers. Note that the default unit address for each Level Scout is 0 (zero) when it is shipped from the factory.

> ***Tip***
> Once Data Scout Advanced finds all attached transducers, click the **Stop** button to terminate the search for additional transducers.

3.1.2 RESTART OF DATA SCOUT ADVANCED

If Data Scout Advanced had been previously executed, a memory of the last session will be stored on the PC. When Data Scout Advanced is restarted, it will default to the previous session's communications settings (protocol, baud rate, and port). Likewise, Data Scout Advanced will assume that the attached transducers from the previous session are still attached. Note that at this point the **Auto Disc**. button will change to the **Query** button. Use the **Query** button to make sure that the transducers are still connected (figure 3.3). If a previously installed transducer has been replaced by a different transducer, Data Scout Advanced will identify the newly installed transducer and update the Site Net to reflect information for this new transducer**.**
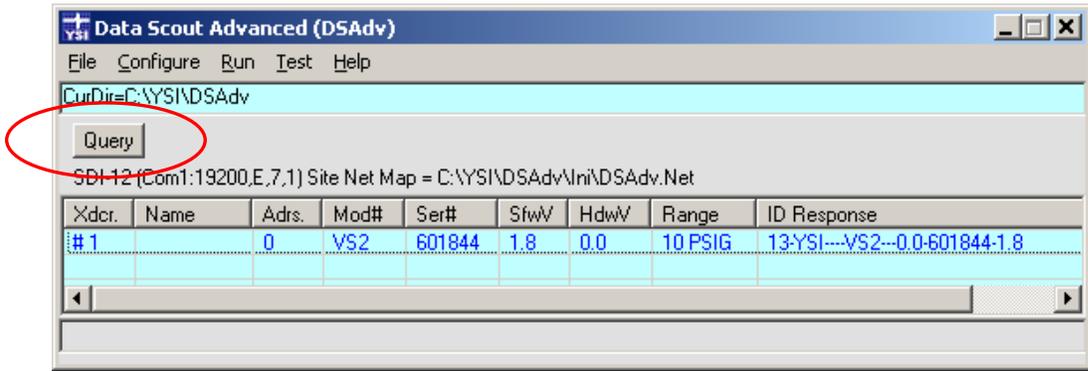
Figure 3.3

To clear the Data Scout Advanced history from the previous session, select **File** and **New Site Net**. This will return the display to the **Auto Disc**. state with no transducers listed. To open an existing named site net, select **File**, then **Open Site Net**.

3.1.3 VIEWING LIVE DATA

Once Data Scout Advanced has discovered the attached Level Scouts, it is ready to acquire live data. This live data is captured in what is referred to as the **Run** window. To launch the Run window, select the **Run** drop down menu and then select either **All Xducers** or **HiLi Xducer(s)** as shown in figure 3.4. Selecting **All Xducers** launches a Run window with data for all identified transducers in the main screen. Selecting **HiLi Xducer(s)** will launch the Run window for only the selected (highlighted) transducers in the Site Net. The following sections describe the Run window controls related to acquiring, displaying, and optionally recording live data.
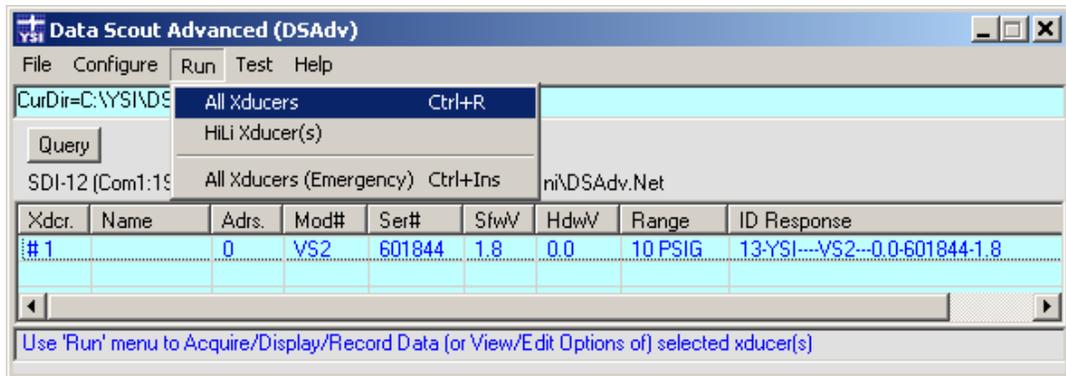
Figure 3.4

> ***Tip***
> The measurement fields acquired and displayed from the attached Level Scout(s) can be changed by selecting the **Acquire** menu item from the **Run** window. Measurement fields listed at the bottom of the drop-down menu may be checked or unchecked as desired.

3.1.4 ACQUIRE DATA CONTROLS

The fields contained within the Acquire frame (figure 3.5), are used to control live data acquisition with the transducers in the current Run screen. These controls operate as follows:

- The leftmost text box in the Acquire frame is an indicator of data acquisition status. The box shows the total number of completed (and partial) live data scans acquired. The fractional part of this number is actually a sub-scan digit representing acquisition of different measurement parameters for each scan. The background color of the box is *white* when Acquire is off, *green* when Acquire is running, and *yellow* when Acquire is waiting during an idle period between scans. This box is normally a display only field, but if clicked when acquisition is off, it clears the accumulated scan count in the box.

- Clicking the **On** button will start continuous data acquisition from the attached transducers at the update rate shown in the **Period** (in seconds) box. The acquired data will be displayed in the Run window data table and/or trend plot, depending on the selected display options. Note that if the value in the Period frame requests a rate faster than is possible for the number of active transducers and the measurement options, Data Scout Advanced will acquire at its fastest possible rate for that configuration. The default Period of '0' will result in Data Scout Advanced acquiring data as fast as possible. To set a specific update period, click the green **Period** text box and enter the desired sample rate in seconds.

- Clicking the **Off** button will stop active data acquisition.

- Clicking the **1** button when acquisition is off will result in only a single data set being acquired from each transducer. The values from this single data set will be displayed in the Run window data table and/or trend plot, depending on the selected display options.
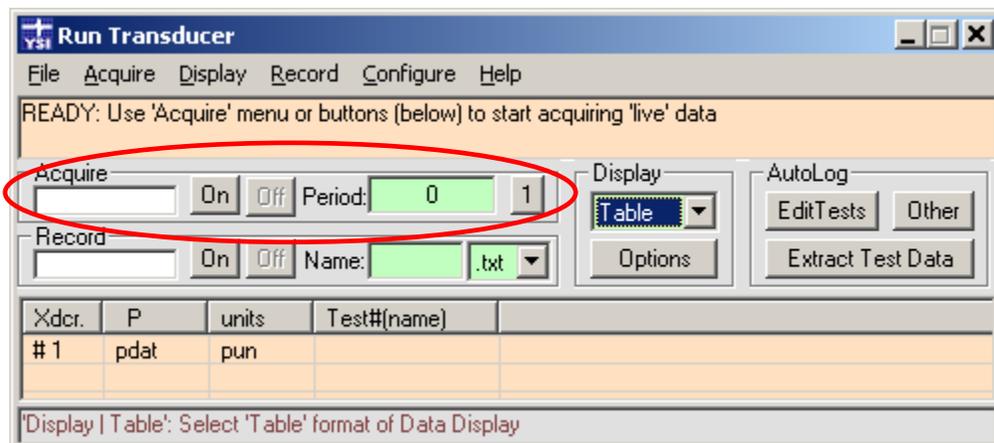
Figure 3.5

3.1.5 RECORD FRAME CONTROLS

The controls contained within the **Record** frame (figure 3.6) are used to configure the recording of live data to the PC's hard drive. Data recording takes place only as live data acquisition occurs as described in the preceding section. If live data is not running, data can not be recorded. Configuration for data recording can occur at any time whether data is being acquired or not. The controls are as follows:

Figure 3.6

- The frame in the left most position of the Record frame reflects the elapsed recording time in seconds. The box background color is *white* if Record is off, *yellow* if Record is on but not currently recording any scans, and *green* if Record is writing acquired scans to the hard drive. This timer is reset to 0.0 every time recording is turned on.

- The **On** button starts data recording using the specified file name and file type. The data/time stamp added to the base file name makes the recorded data file name unique.

- The **Off** button disables data recording and closes the current data file.

- The **Name** text box contains the base file name for storage of recorded data. This value can be changed by clicking in the text box and typing the desired base file name. Note that the complete file name used by Data Scout Advanced will be:

*base_file_name*_yyyy-mm-dd_hh-mm-ss.txt   (or .csv)

The yyyy-mm-dd_hh-mm-ss time stamp used as part of the file name reflects the date and time when the recording was started. Assuming the standard installation directories were used, the recorded data files will be stored in folder C:\YSI\DSAdv\Dat

- The File type pull-down list is located adjacent to the file base name text box. The two file type options are formatted text file (.txt) or a comma separated variable format (.csv).

> *Tip*
> The .csv file type should be used if the goal is to import the logged data into a spreadsheet application. The Playback feature of Data Scout Advanced can also be used at any time to convert a file written in one format into the other format.

3.1.6 DISPLAY FRAME CONTROLS

The **Display** frame (figure 3.7) determines the appearance the acquired data in the Run window. The **Display** type pull-down list allows the user to select if the data will be displayed as tabular data, graphical trend plot, or both.

Figure 3.7

The **Options** button in the Display frame opens the **Display Options** window (figure 3.8) used to control various aspects of the Run window's appearance and behavior during live data acquisition or during the extraction of AutoLog data. The controls within this window used during live data acquisition are described below. The controls in this window related to AutoLog data are explained later in this chapter (sections 3.2.2, 3.2.3, and 3.2.4).

3.1.7 LIVE DISPLAY OPTIONS CONTROLS

When viewing live data, the **View/Edit AutoLog and Plot Display Options** window can be used to alter the scaling, appearance, and general behavior of the live trend plot (figure 3.8).
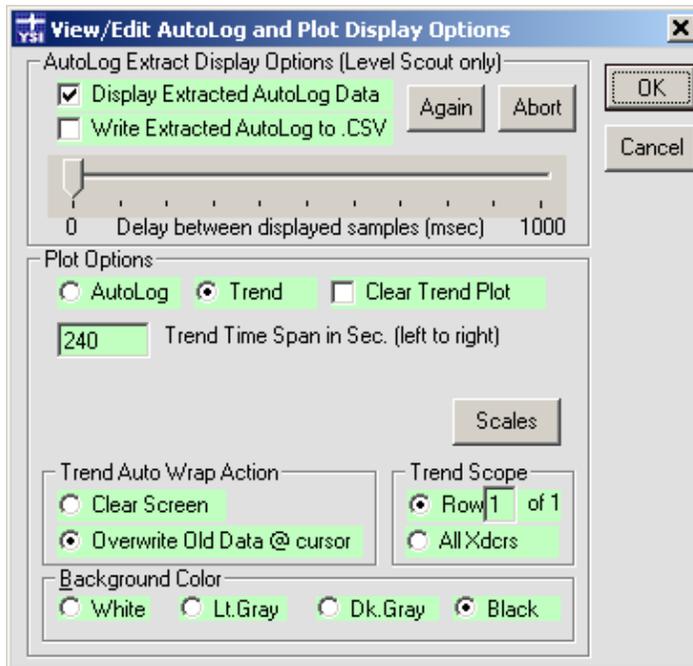
Figure 3.8

The **Plot Options** frame controls are as follows when live Trend data display is selected:

- Clicking the **Clear Trend Plot** check box will result in the clearing of the current trend plot area after the **OK** button is pressed.

- The **Trend Time Span** field allows the user to specify the time frame covered by the trend plot. This will be the plot X-axis width.

- Selecting the **Scales** button opens a control window with inputs to determine the vertical scaling of all plotted data values. Minimum and maximum values for each vertical axis can be controlled for best viewing of the data of interest. Once these scales are changed, re-selecting the **Plot** display type will restore the original scales.

- The **Trend Auto Wrap Action** frame controls how the Trend graph behaves once the trend has reached the right most limit of the plot area. Selecting **Clear Screen** will result in the contents of the trend plot area being cleared when the Trend Time Span is reached. A new trend plot will then be restarted at the left side of a blank plot area. Selecting **Overwrite Old Data @ cursor** will result in the plot restarting at the left most limit of the screen but it will not clear the existing plot data as it wraps around.

- The **Trend Scope** frame allows for control of which transducers are displayed in the trend plot area. Users may select that the trend plot displays live trend data for a single transducer or all transducers in the current Run window.

- The **Background Color** control allows for customization of the plot background for different viewing preferences.

3.1.8 OTHER LIVE DATA OPTIONS

Data Scout Advanced allows for the tabular and graphical display of up to seven live data items from the Level Scout. The user can control which live data items are acquired from the Level Scout and displayed by selecting the **Acquire** menu from the Run window menu bar. This will provide the ability to enable or disable seven different measurements that may be extracted from the unit.

3.1.9 CONFIGURING AUTOLOG TESTS

The Level Scout transducer is capable of performing a series of autonomous logging tests which are referred to as AutoLog tests. These tests can be configured to acquire data over extended periods of time. Data Scout Advanced contains several configuration forms described below which are used to easily configure the Level Scout for these AutoLog tests.

The AutoLog functions generally focus on only one transducer at a time, therefore, select a particular transducer before selecting one of the Autolog functions. A single transducer can be selected by clicking its row in the **Xdcr.** column on the left side of the Run window.

3.1.10 AUTOLOG EDIT TESTS FRAME CONTROLS
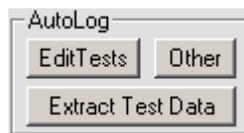
Figure 3.9

Clicking the **Edit Tests** button (figure 3.9) in the AutoLog frame of the Run window opens the **Test Configuration Editor** window (figure 3.10). Before opening this window, Data Scout Advanced queries the attached Level Scout to determine the configuration and status of its sixteen internal test profiles. This configuration information is displayed within the AutoLog configuration windows

to reflect the unit's current state. The various components of the AutoLog configuration window are described in detail in the following sections.

The frame labeled **Summary of Existing Tests** contains a tab for each of the sixteen internal Level Scout test configurations. The number on the tab reflects the internal test number. A color-coded symbol next to the test number on the page select tab provides a quick visual of the status of each test. The possible test statuses are as follows:

Done - The red icon indicates that the test profile has completed and the can be extracted.

Active - The green icon indicates that the test profile is currently running in the Level Scout. Note that already logged data scans may be extracted while the test profile continues to run.

Pending - The yellow icon indicates that a test profile has been configured and is scheduled to start. The Level Scout is waiting for the requested start time before changing the test profile status to **Active.**

Idle - The black icon indicates that a test has been partially defined.

Vacant - Indicates that the test profile is undefined and available for use.
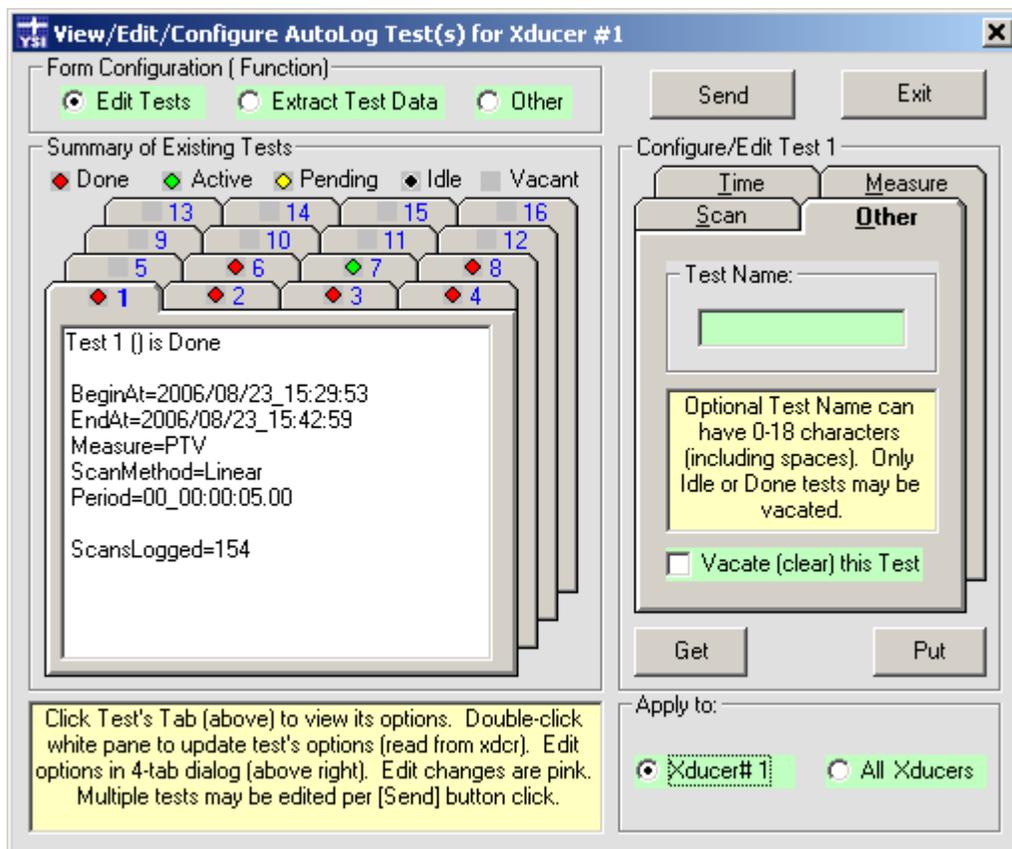
Figure 3.10

Clicking on a test configuration tab will bring it to the foreground of the summary frame. The text box field contained in the test configuration tab contains summary information for that test profile.   This summary information is for display purposes only and may not be edited in this field.   The majority of this summary information is displayed in a user friendly format in the **Configure/Edit** frame found on the right side of the form.

The frame labeled **Configure/Edit Test X** provides an easy to use method for displaying and editing the test profile controls. By clicking on different test configuration tabs, the contents of the **Configure/Edit** frame will update to reflect the test configuration for that selected test. There are four configuration tabs used to configure a test; **Time**, **Measure**, **Scan**, and **Other**. These tabs are used to both display the configurations of an existing test profile and to edit the configurations for a new test profile.

The **Time** tab is used to display or edit the times a test profile will start and end (figure 3.11). When editing a test profile, Data Scout Advanced will allow the user to specify the start and end times in either absolute time or relative time. If relative times are used, Data Scout Advanced will transparently convert those requested relative start and stop times into absolute times at the time the test profile is sent to the Level Scout. Note that the calculated times are relative to the time the configuration is sent to the Level Scout, not the time the relative settings were entered. If the test end time is specified in relative time, the requested end time will be relative to the test start time. If the user would like a test to acquire data forever, select an end time of **None**. When test profile information is displayed, it will always be displayed in absolute time format.
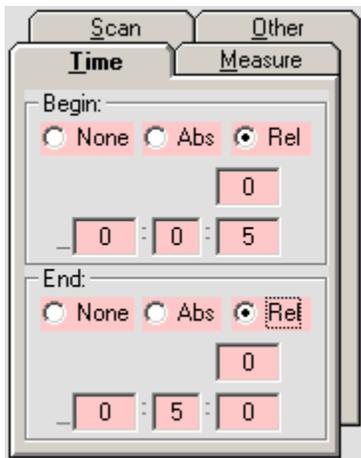
Figure 3.11

The **Measure** tab(figure 3.12) is used to display or edit the parameters that will be measured during a test. Possible measurements for each test configuration include pressure, temperature, PCB-temperature (only available on Level Scout with 4MB memory option), and supply voltage. A check next to the measurement type indicates that data will be collected for that parameter.
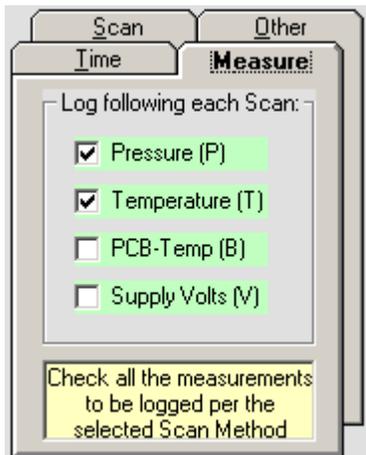
Figure 3.12

The **Temperature** measurement is based on the temperature of the pressure sensor. This is the temperature that is used for the pressure calculation and thermal correction algorithms. This measurement is useful for understanding the temperatures the pressure transducer is exposed to. Accuracy of this measurement is ± 1.0 ° C.

PCB-Temp is a high-accuracy temperature measurement that is available on the high memory Level Scout only (model VS4, VT4, AS4 and AT4). The sensor for this measurement is located on the Level Scout's circuit board, near the pressure sensor. Accuracy of this measurement is ± 0.2° C.

The **Supply Volts** measurement provides an indication of the Level Scout's internal battery voltage level. When using alkaline batteries, the battery voltage will decay linearly with battery use. Note that not all battery technologies behave in this linear decay manner. The Level Scout can operate from battery power as long as the reported battery voltages remain above 1.5 volts. Applying external power to the Level Scout will result in a slight increase in the reported internal battery voltage of approximately 0.2 volts.

The **Scan** tab (figure 3.13) is used to display or configure the sampling method used for the selected test profile. Select one of the four possible sampling methods (described below) from the **Method** pull down list.
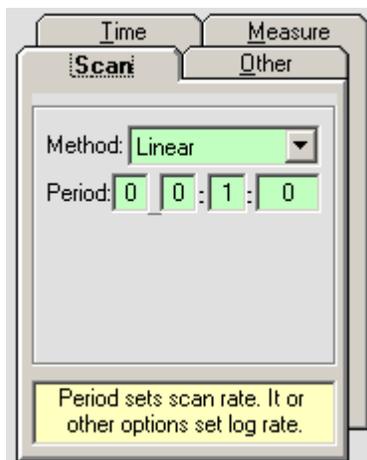
Figure 3.13

- **Linear** - Data is sampled at a constant, linear defined rate. The period between scans needs to be specified in Days:Hours:Minutes:Seconds.

- **Linear-Average** - Data is sampled at a specified period but logged at a slower rate. Each logged linear data sample is the averaged value of the specified consecutive samples (2-250) that were acquired at the defined sampling rate. Figure 3.14 shows a test where the instrument will take a sample once per minute and log the average of 10 samples. In this example, an averaged reading would be logged once every 10 minutes.
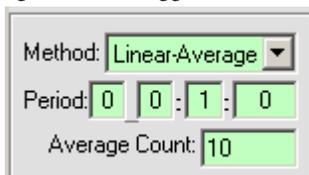
Figure 3.14

- **Logarithmic** - The rate of data sampling and logging initiates at the fastest possible rate of the Level Scout. The sample period then exponentially increases until the final maximum period is reached. The maximum period value is user specified. Data then continues to be sampled and logged at this maximum period for the remainder of the test profile. The initial scanning rate will be between 3 Hz and 10 Hz depending on the measurements and averaging specified in the Level Scout. This sampling method is useful for situations where data is required at a high sample rate initially but at slower rates as time elapses.

Figure 3.15

- **Event-Based** - Data is sampled internally at a defined constant period. If the acquired data meets an event trigger condition the data set will be logged, otherwise it is discarded. Event trigger conditions may be set up to force datalogging if either the pressure or temperature reading changes by a user defined limit relative to the last reading. Additionally, acquired data can be forced to be periodically logged at some default rate (even if the event condition is not met) by setting a maximum scan count on the Default # Scans box. **Note that when specifying the event trigger delta pressure or temperature, it must be specified in units of pounds per square inch or degrees Celsius.**

Figure 3.16

The **Other** tab (figure 3.17) has two functions: naming test profiles and vacating test profiles. Test profile names may be optionally added to help identify the profile. The test name is limited to 18 characters and may be changed on any test other than a test with a Done status.
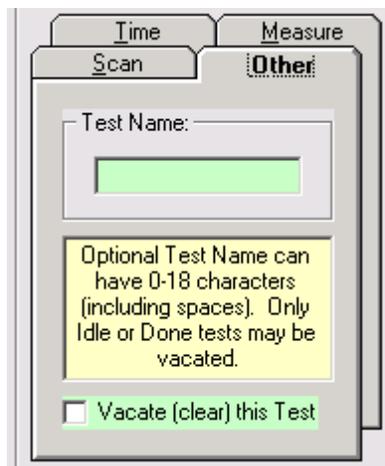
Figure 3.17

The vacate test control is used to clear any test definition information for a test profile. Only test profiles with a status of Done or Idle may be vacated. Active tests must be stopped before they can be vacated. **Once a test profile is vacated, its data can not be extracted.** Care must be taken to ensure that the data has been extracted prior to vacating the test profile definition.

> *Tip*
> Vacating a test does not free the memory that the test profile may have used to store its AutoLog data. Use the *Erase All Memory* control to free all AutoLog memory for future use (see Section 3.3.1).

By default, the frame labeled **Apply To**, located in the lower left corner of the Edit Test Window, normally applies all current edit changes for any selected tests to the currently selected transducer only (when the **OK** button is clicked). Clicking the **All Xducers** option applies the edit changes to all transducers in the current Run window, as long as each edit change makes sense in each of these other transducers for the same affected test number. In cases where the user is creating the same test in several transducers concurrently, this feature could save time as could the **Get** and **Put** buttons which are described in the Data Scout Advanced Operations Manual.

3.2 EXTRACTING AUTOLOG TEST DATA

Data Scout Advanced provides utilities to extract logged data for immediate display or later analysis by other applications. These utilities can be used to extract data from both completed tests as well as in-progress tests. The applicable forms for extracting and displaying test data are described in the following sections.

3.2.1 AUTOLOG EXTRACT TEST DATA FRAME CONTROLS

Clicking the **Extract Test Data** button in the **AutoLog** frame of the **Run** window opens the window shown below in figure 3.19. Before opening this window, Data Scout Advanced queries the attached Level Scout to determine the configuration and status of each of its sixteen internal test profiles. This configuration information is displayed within the AutoLog configuration windows to reflect the unit's current state. Note that this window is very similar to the window used to configure AutoLog tests. The main difference between them is the controls on the right side of the window. The various components of the **Extract AutoLog Data** window are described in detail in the following sections.
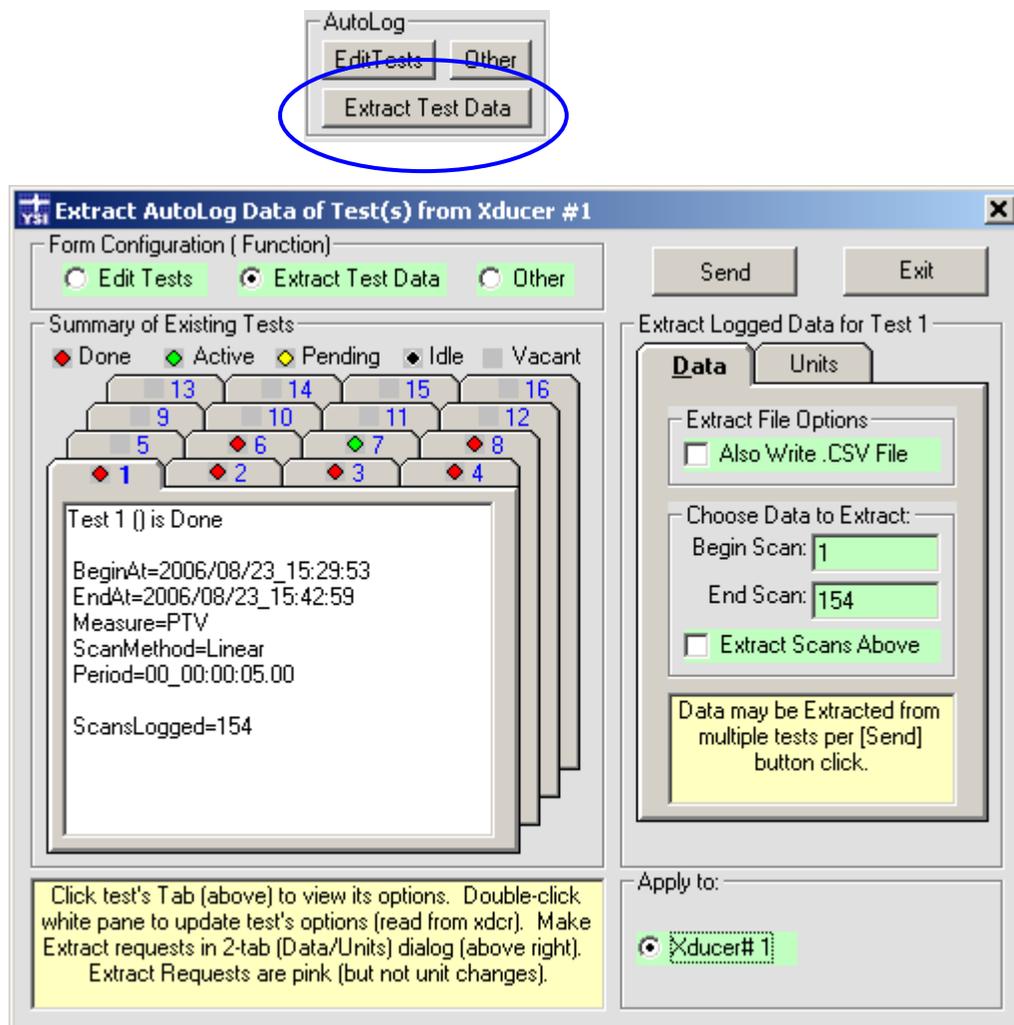
Figure 3.19

The frame labeled **Summary of Existing Tests** contains a tab for each of the sixteen internal Level Scout test profiles. The number on the tab reflects the internal test profile number. A color-coded symbol next to the test number on the tab provides a quick visual tool of the status of each test. The test status definitions and other aspects of this frame are the same as described in Section 3.1.10.

Tip
Only AutoLog Data from test profiles with a status of **Done** or **Active** may be extracted.

The frame labeled **Extract Test Data for Test X** provides easy to configure controls for the extraction of logged test data. The contents of this frame will vary as different test profile tabs are selected in the **Summary of Existing Tests** frame. There are two tabs within this frame to control the data extraction functions.

- The **Data** tab (figure 3.20) allows control of which scans from the test will be extracted. By default the fields on this tab will be set to extract all data points (first through last). If a subset of the data is required, the **Begin Scan** and/or **End Scan** data points may be changed to reflect the subset to be extracted. Click the **Extract Scans Above** check box to extract the indicated data sets.

- The **Extract File Options** frame has a checkbox that causes a spreadsheet compatible (.csv) data file to be created in addition to the normal Autolog test data file (.atd).
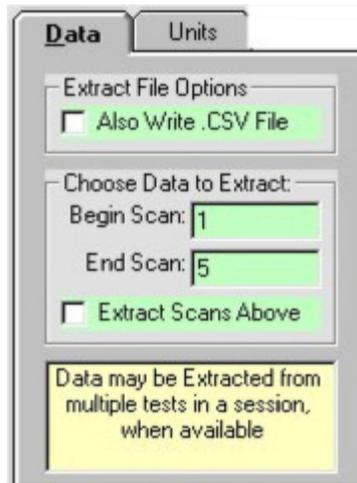
Figure 3.20

- The **Units** tab (figure 3.21) selects the parameter units which the extracted pressure and temperature data will be converted to when extracted. The precision of the pressure data may also be selected. The units of measure and precision settings will be used when the extracted data is displayed within Data Scout Advanced as well as the units saved in the extraction files (.atd and .csv). By default, the current pressure and temperature units of the transducer are selected.
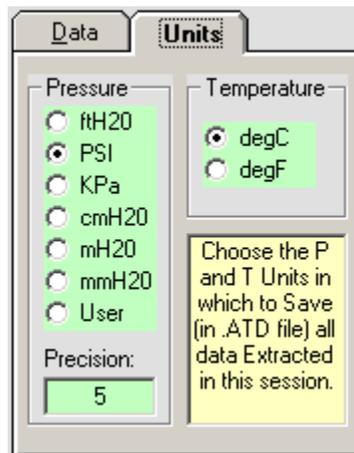
Figure 3.21

3.2.2 DISPLAY OF AUTOLOG DATA

Extracted AutoLog data may be displayed and analyzed within Data Scout Advanced. This is accomplished 'live' within the transducer **Run** window or later using the **Playback** application. Like live data acquisition, AutoLog data may be displayed in tabular form, graphical form or both.

> *Tip*
> Although extracted AutoLog data can be displayed in tabular form, the most useful way of displaying this data is to enable the Plot display type.

To configure the Run window to display AutoLog data instead of live data, change the default settings in the Display Options window. To enter this window, click the **Options** button in the Display frame located on the main Run window. When the Options button is clicked a screen similar to figure 3.22 will open. Note that if the **Table** display type is selected, many of the options of figure 3.22 will not be displayed since they only apply for plot displays.

To display the extracted AutoLog data, ensure the button labeled **AutoLog** in the **Plot Options** frame is selected. Also ensure the box labeled **Display Extracted AutoLog Data** is selected.

A more detailed description of all the controls found in the **Display Options** window is provided in the following section.
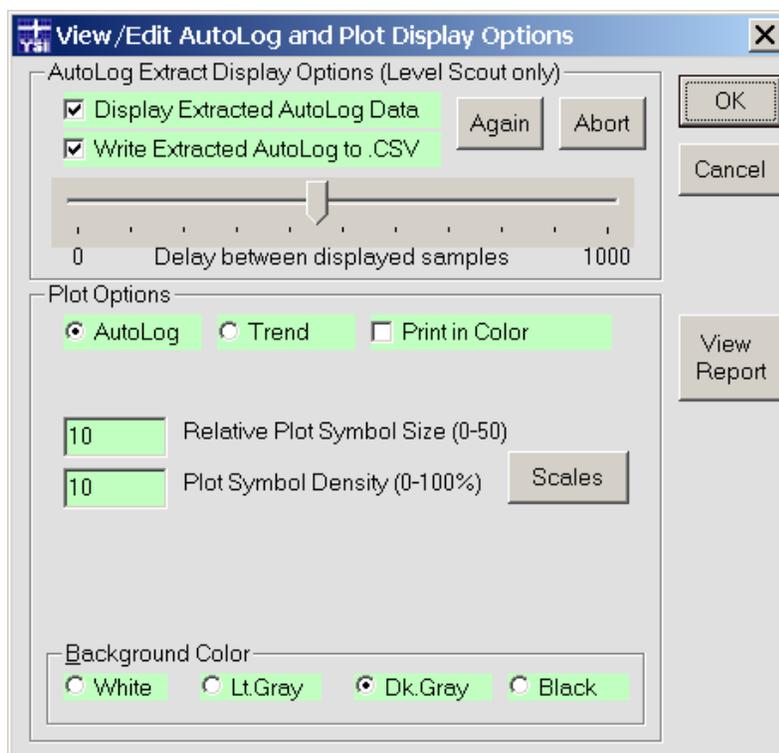
Figure 3.22

3.2.3 AUTOLOG EXTRACT DISPLAY OPTIONS

This control window determines how Data Scout Advanced will behave when AutoLog data is extracted from the Level Scout. The top frame of the **Display Options** window shown in figure 3.22 is a typical representation.

The **Display Extracted AutoLog Data** check box determines if the extracted AutoLog data will be displayed on the Run window. If checked, the extracted AutoLog data will be displayed in the current display format: table, plot or both.

> *Tip*
> If you wish to display extracted AutoLog data, make sure the **Display** type is set to either **Plot** or **Both** and the **Plot Options** box has **AutoLog** selected instead of **Trend.** AutoLog data that has already been extracted without this Display type selected, may still plotted by selecting the **AutoLog** button, the **Again** button, and then pressing **OK**.

The **Write Extracted AutoLog to .CSV** check box is used to tell Data Scout Advanced to write both a normal extracted AutoLog data file (.atd) and a file in comma separated variable (.csv) format. This optional file allows for direct import of the data by most spreadsheet applications.

> *Tip*
> The .csv format option also appears in the *Data* tab shown in figure 3.20 of the **Extract** window.

Assuming the standard installation directories were used, the logged data files will be stored in folder C:\YSI\DSAdv\Dat. File names will be of the format:

Model-sn_Test*x_yyyy-mm-dd_hh-mm-ss*.atd   (atd file)

Model-sn_Test*x_yyyy-mm-dd_hh-mm-ss*.csv   (Spreadsheet file)

Model is the unit's model number. *Sn* is the unit's serial number, Test*x* identifies the Level Scout's internal test profile number (Test1-Test16) and the date and time stamp represents the date and time that the data was extracted from the Level Scout.

The **Again** button is used to force Data Scout Advanced to redisplay extracted AutoLog data in the current display mode.

The **Abort** button is used to abort an in-process display of extracted AutoLog data. This function may be required if the display of the selected AutoLog data is requiring an excessive amount of time. This can happen if the file is very large or if the **Delay** slider control is set too high.

The slide control labeled **Delay between displayed samples** (figure 3.23) controls the amount of time Data Scout Advanced delays between screen updates for each AutoLog data point.
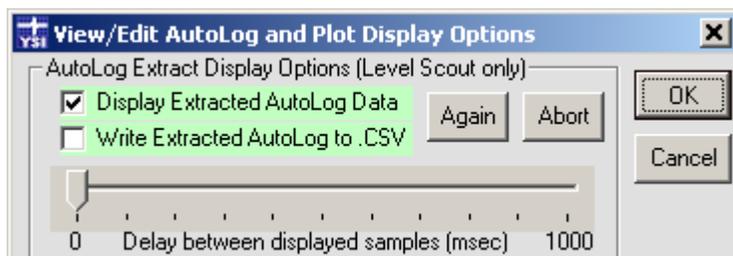
Figure 3.23

> *Tip*
> The **Delay** slider will only be visible if one of the display options that shows tabular data is selected.

3.2.4 PLOT OPTIONS

The **Plot Options** frame (figure 3.24) provides several controls to customize the Run window plots so they are easily read for the application. The controls of this frame will vary depending on whether the user has selected the plot display option for **AutoLog** or live **Trend** data. Selecting the **AutoLog** plot display will result in all extracted AutoLog data being displayed in the plot window. The AutoLog specific controls are described below.
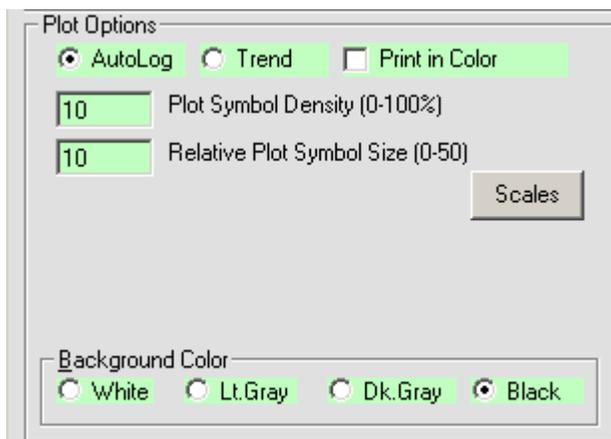
Figure 3.24

Level Scout

- The **Plot Symbol Density** field allows for control of the frequency of plot symbols used to identify actual extracted data values. A value of 0% results in no plot symbols being used. Only the data points will be displayed with a straight line connecting adjacent data points. A value of 100% will result in every data point being displayed with a plot symbol. A practical rule of thumb is to decrease the Plot Symbol Density as the number of data points increases.

- The **Relative Plot Symbol Size** input field determines the size of the plot symbols. A value of 0 results in an invisible plot symbol while a value of 50 results in an oversized symbol.

- Selecting the **Scales** button opens a window with inputs to determine the vertical scaling of all plotted data values. Minimum and maximum values for each vertical axis can be controlled for best viewing of the data of interest. Control of the horizontal axis minimum and maximum value is provided in order to zoom in on specific periods of data.

- The **Background Color** frame allows for customization of the plot background to best suit viewing preferences.

3.2.5 AUTOLOG DATA STORAGE

When AutoLog test profile data is extracted from the Level Scout, Data Scout Advanced will store the resulting data into a folder on the local computer. Data Scout Advanced will always create a formatted ASCII text file containing the extracted data. The format of the filename will be as follows:

Model-sn-Testx-yyyy-mm-dd_hh-mm-ss.atd

Model is the unit's model number. *Sn* is the unit's serial number, Test*x* identifies the Level Scout's internal test profile (Test1-Test16) and the date and time stamp represents the date and time that the data was extracted from the Level Scout. If the standard Data Scout Advanced installation directory is used, the AutoLog data files will be located in the folder C:\YSI\DSAdv\dat.

> *Tip*
>
> Clicking the **View Report** button on the Display Options window will display the ASCII text file for the AutoLog data currently displayed on the Run window.

3.3 OTHER USEFUL DATA SCOUT ADVANCED FUNCTIONS

Clicking the **Other** button within the AutoLog frame of the Run window will display the screen shown in figure 3.25. This window contains several useful status and configuration fields. For example, alarm scanning features are configured here. Alarm scanning allows the user to enter Hi and Lo alarm and warning values. If an alarm or warning value is acquired by a transducer, then the transducer can scan at a faster rate and broadcast the alarm data (if configured to do so). Alarm scanning is only available for pressure readings, not temperature.
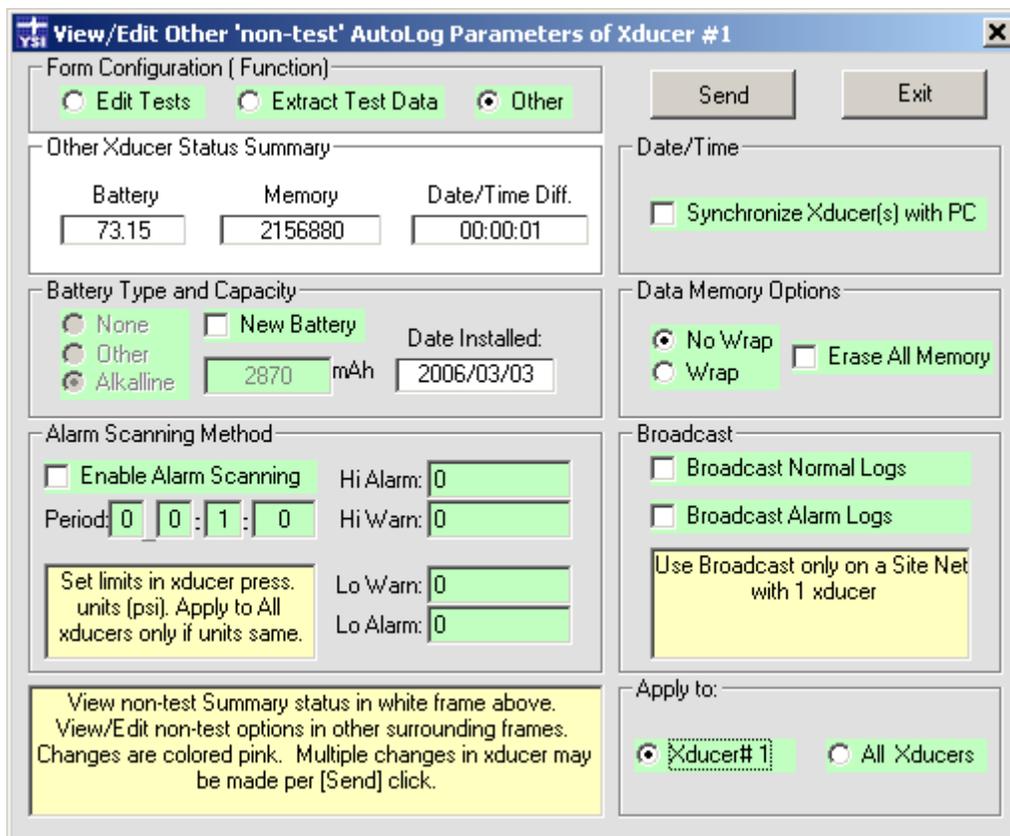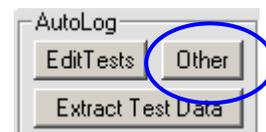
Figure 3.25

3.3.1 BATTERY, MEMORY AND INTERNAL CLOCK

The frame labeled **Other Xducer Status Summary** contains status information reported by the attached Level Scout as is described below (figure 3.26).
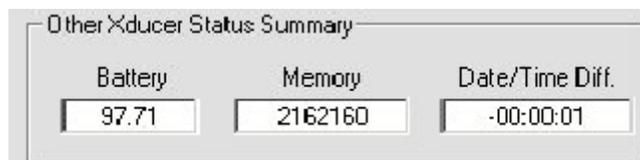
Figure 3.26

- The **Battery** field shows the remaining battery life percentage as calculated by the Level Scout. In order for the Level Scout to accurately calculate remaining battery life, new battery capacity must be properly entered when batteries are replaced (see section 4.1).

- The **Memory** field shows the amount of memory (in bytes) currently available for storing AutoLog test data. The number of samples that this free memory can store will be affected by what data the Level Scout is asked to record for each sample. The time stamp requires 7 bytes. Each additional measurement selected requires 4 bytes each.

- The **Date/Time Diff.** field shows the time difference between the attached Level Scout's internal clock and the clock of the PC it is connected to (hh:mm:ss).

The frame labeled **Date/Time** provides a check box function which will synchronize the attached Level Scout's internal clock to the clock of the PC running Data Scout Advanced (figure 3.27). The synchronization is performed when the **Send** button is selected.
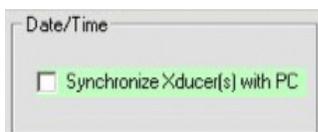
Figure 3.27

The frame labeled **Battery Type and Capacity** (figure 3.28) is used to inform the Level Scout when the internal batteries have been replaced. This provides accurate estimates of remaining battery. Chapter 4 of this manual gives detailed instructions for replacing the Level Scout's internal batteries.

Figure 3.28

The frame labeled **Data Memory Options** (figure 3.29) contains two controls related to the use of the Level Scout's internal non-volatile datalogging memory. The controls are described below.
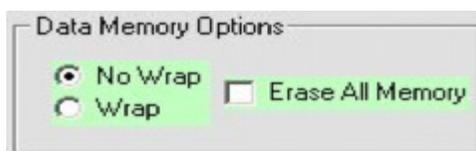
Figure 3.29

- The **No Wrap** and **Wrap** controls determine how the Level Scout with function when it uses all available memory. When set to **No Wrap** mode, the Level Scout will stop any logging test in progress once all available memory has been used. This mode ensures that the original data is never overwritten or lost. More recent data, however, will not be stored.

- If the **Wrap** mode is selected the Level Scout will continue executing Logging tests once all available memory has been used. This will result in older test profile data being overwritten as required to hold newer data. This mode ensures that the most recent data is always recorded but at the expense of older test profile data that will be lost.

- The **Erase All Memory** checkbox is used to reformat the non-volatile memory used for the storage of all AutoLog data. Enabling this check box and clicking the **Send** button will erase all memory, vacate all tests, and return the attached unit to its maximum data storage capacity.

Warning

Only use the **Erase All Memory Command** after all test profile data of interest has been extracted from the Level Scout and is stored on a PC. All internal test profile data will be lost after this command is executed.

The frame labeled **Apply To** always defaults to the currently selected transducer (figure 3.30). The **All Xducers** button allows the same action to be applied to all transducers in the current Run window.

Figure 3.30

3.3.2 ALARM SCANNING METHOD AND BROADCAST

The frame labeled **Alarm Scanning Method** allows the user to establish alarm and warning pressure limits(figure 3.31). When alarm scanning is enabled, if the pressure reading exceeds either of the Hi limits or is below either of the Lo limits the Alarm Scanning Method will be initiated, **overriding the current active scan method.** The Alarm Scanning Method may be optionally configured to use a different logging rate from the previous scanning method that was active. This is useful to obtain faster samplings should an unusual (outside of normal ranges) event occur. Note that both the normal and alarm data are stored within the current logging test profile.
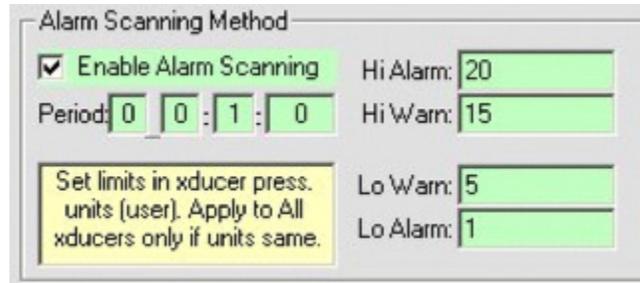
Figure 3.31

Warning

When using alarms (with or without broadcasts) make sure the normal logging period of the active test profile is not too long. The transducer only checks the measurement for an alarm condition at the moment the logging event is made. Short transients could be missed or sustained changes could be reported late by up to one normal logging period. For example, if the normal logging period is set to 15-minute intervals, the transducer only checks for an alarm condition once every 15 minutes. Once an alarm condition occurs the transducer can use the optional alarm scanning logging period (normally faster).

To enable the Alarm Scanning Method select the **Enable Alarm Scanning** check box. Next, enter the high and low level alarm and warning values in the provided input boxes. If only a single alarm/warn level is required (not a separate warn limit and alarm limit), the same value should be entered for the warn and alarm input boxes. If an alternate Alarm Scanning Method scan rate is desired, enter the scan period in the **Period** input box. A logging period of 0_0:0:0 will cause the transducer to use the existing logging period of the test profile that was running prior to the Alarm Scan Method.

Tip

The **Alarm Scanning Method** is frequently used with the **Broadcast** option described in the following section.

The frame labeled **Broadcast** (figure 3.32) enables the transmission of autonomous data packets from the Level Scout. Autonomous data is data that automatically transmits, without user requests. The unit can be configured to autonomously broadcast normal logged data packets, alarm logged data packets only, or both normal and alarm logged data packets. In either case, the Level Scout will broadcast the requested data items immediately after logging them to its internal data logging memory.
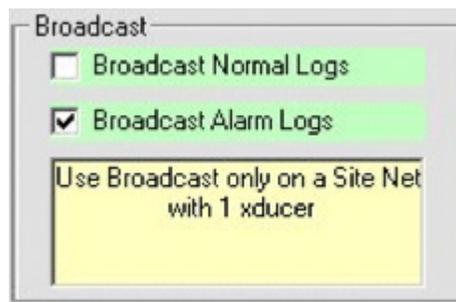
Figure 3.32

The format for the broadcast messages is ASCII characters (7 data, even parity, 1 stop bit) at the current baud rate, with the following formatted data:

'*accctt+yyyy/mm/dd_hh:mm:ss.ss,[v u,]<cr><lf>*'

Where '*a*' is the transducer address, '*ccc*' is the broadcast ID code (table 1), and '*tt*' is the active test profile number. Next follows a plus sign (+) and time stamp (*yyyy/mm/dd_hh:mm:ss.ss*) followed by the formatted decimal datum for each measurement actually scanned per the current test profile. Each datum value (*v*) is followed by a unit name (*u*).

A space separates each v and u, and a comma (,) follows each u. A carriage return, line feed combination ends the string.

Tip
When the **Broadcast** feature is enabled, only one Level Scout should be attached to the communications (Site) network. Use of multiple transducers may result in data transmission collisions resulting in a failure of correct packets to be transmitted.

Example:

The following example shows a transducer with address 0 broadcasting a Low Warning message from test profile number 3 at one (1) second before midnight, December 24, 2005, for two (2) measurements (pressure and temperature) logged:

0WLO03+2005/12/24_23:59:59.00, +0.05 psi, 75.5 degC, <cr><lf>

TABLE 1 – BROADCAST ID CODE DESCRIPTION

NLN	Normal, Linear Logged Scan
NLA	Normal, Linear Average Logged Scan
NLG	Normal, Logarithmic Logged Scan
NEB	Normal, Event Based Logged Scan
AHI	Alarm, Logged Scan Above High Alarm Limit
ALO	Alarm, Logged Scan Below Low Alarm Limit
WHI	Warn, Logged Scan Above High Warn Limit
WLO	Warn, Logged Scan Below Low Warn Limit

3.4 DATA SCOUT ADVANCED PLAYBACK FUNCTIONS

To access the **Playback** functions of Data Scout Advanced select **File** and then **Playback Any Data Files** from the Run(figure 3.33).
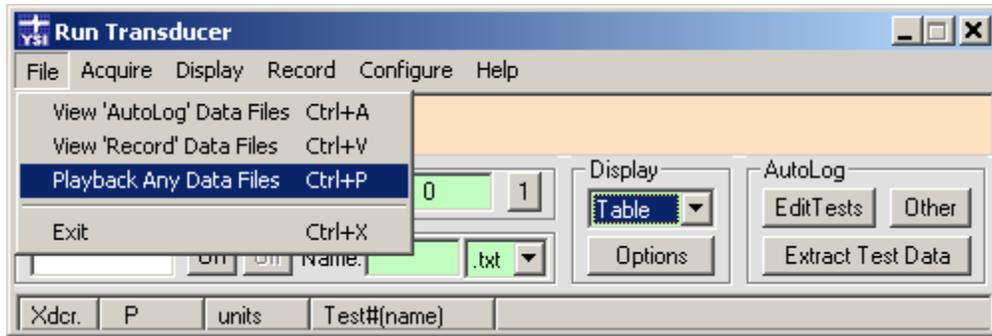
Figure 3.33

Playback is an independent application (DataScoutPlay.exe) which may also be started separate from Data Scout Advanced.

3.4.1 BASIC PLAYBACK OF DATA SCOUT DATA FILES

The Playback application has its own menu bar (figure 3.34). It also has a **Print Plot** button.
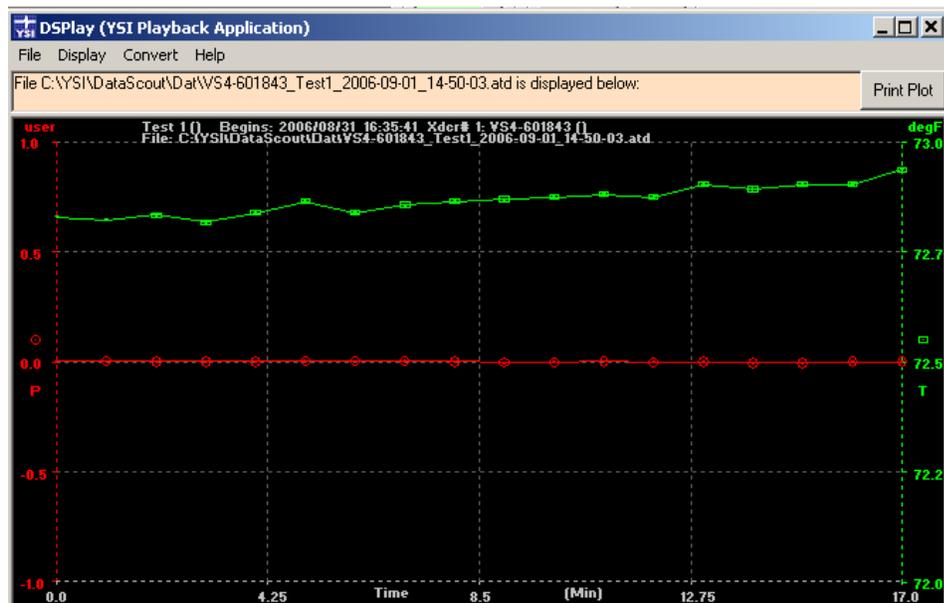
Figure 3.34

To use Playback, open any data file generated by Data Scout Advanced.

Playback also provides basic **Convert** functions for transforming data files in various ways. These data files are normally created by Data Scout Advanced's Run window and saved in its **Dat** subfolder. The user can display "live" recorded data (from .txt or equivalent .csv files) or AutoLog data extracted from the tests logged inside the Level Scout (from .atd or equivalent .csv files).

- Use the **Display │ Plot Graph** menu item to view the data file as a graph. Other display types allow viewing (or even editing) the file as text. The plot surface may be re-sized by dragging the right-bottom corner of the window (just like the Run window).

- Use the **File │Open** menu to select the desired file with a standard Windows® Open dialog window. Select the file type by choosing an appropriate "filter" for file extensions .atd, .txt, or .csv.

Playback remembers the last display type, file type, and file name used and restores them on restart. See the Data Scout Advanced Operations Manual for a complete description of all Playback functions. The Convert functions of Playback are described briefly below.

3.4.2 COMPENSATE ABSOLUTE PRESSURES WITH BAROMETER

If using a Absolute Level Scout, Playback can merge data collected from a BaroScout and Level Scout to compensate the Level Scout's data for changes in barometric pressure during the test. To correct for barometric pressure changes, select **Uncompensate the Data Per Barometer** under the **Convert** menu. Selecting this function opens a Convert window (figure 3.35).
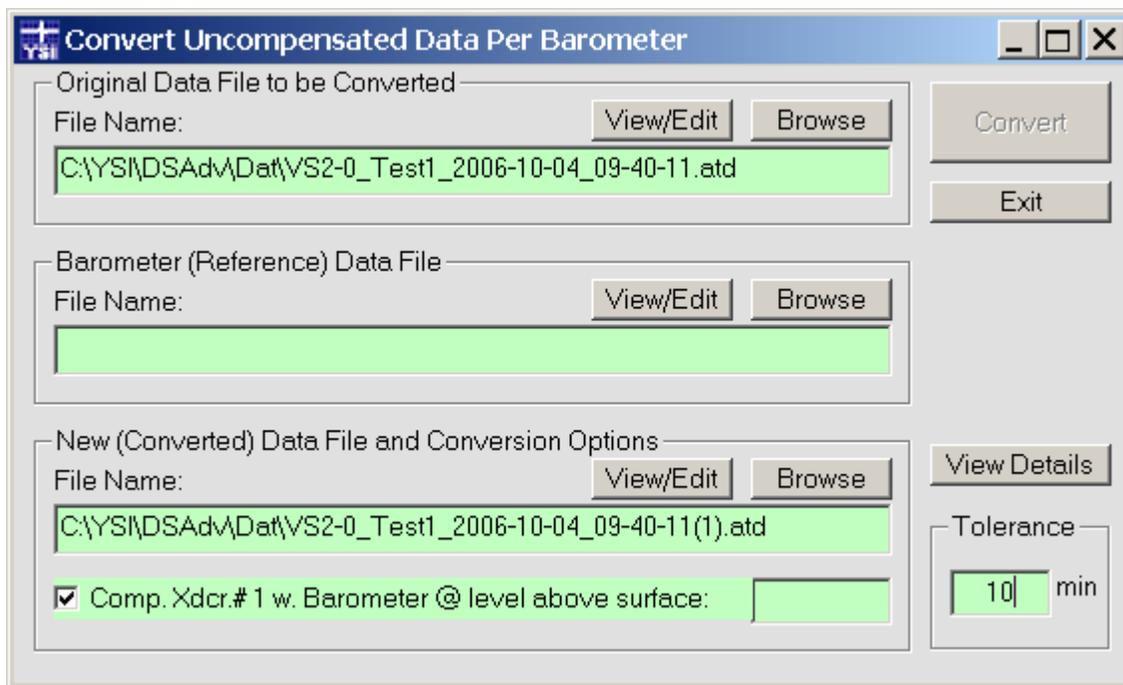
Figure 3.35

The default input file to be converted is the currently opened file. This file's name appears in the **Original** file frame in the **Convert** window. Use that frame's **Browse** button to choose a different file name. Use the **View/Edit** button to view or edit the contents of the selected file.

The **Barometer** (**Reference**) **Data File** frame (Barometer frame) must be populated with the name of the file containing absolute barometric reference data. Use the **Browse** button to select the appropriate data file extracted from an BaroScout. This file should have a date/time profile close to (the Original file to be compensated.

The default output file name in the **New** (**Converted**) **Data File and Conversion Options** frame is automatically set to the file name in the Original frame, but with a version string "(v)" added to it, where v is a version number. This makes the new file name unique. In this example, there were no previous versions of that file, so version "(1)" was added to the name.

Since the **Original** file contains data from only one level transducer, there is a single **Comp** check box (pre-checked) in the **New** frame, plus a single corresponding **Elevation** text box. The elevation box is normally blank (which defaults to 0 inches). However, any integer value may be entered (positive or negative) in inches (in), feet (ft), meters (m), or centimeters (cm). For example, manually edit this box to indicate that the reference BaroScout is located 1 foot above the surface of the water that contains the submerged level transducer to be compensated by entering 1 ft.

Since the date/time profiles of the two input files nearly match, but not quite perfectly, a special time tolerance for barometer readings of 10 minutes has been set in this example(see **Tolerance** frame in bottom right corner of the window). This tolerance is sufficient to allow for the date/time misalignment of the two files. If the tolerance was set to zero, then some compensated values in the New file might be replaced with the error string **nobaro** instead of numeric converted values because the required barometer reading was missing at the beginning or end of the file without an exact time correlation. With a tolerance larger than zero, the "closest" barometer reading available will still be used as an estimate.

When the **Convert** button is clicked, this program converts every absolute pressure sample in the uncompensated Original file, using the "closest" reference source of absolute pressure data in the Barometer file, and writes the New file. The conversion equations used are simple and straight forward, and are described fully in the Data Scout Advanced Operations Manual. If conversion is successful, a

bright green status message appears below the **Exit** button. Click the **View/Edit** button in the New frame to view that "compensated" file as a text report. By selecting the **Exit** button the Convert window closes, and this converted file becomes the new "current" file of Playback, and is immediately displayed (i.e. re-plotted).   For a complete description of the "diagnostic" Details report obtained by clicking the **View Details** button, refer to the Data Scout Advanced Operations Manual.

The previous example does not illustrate the case where both "input" files are actually the same file. Consider the new example of a 'live' data recording (.txt or .csv file) containing data from multiple pressure transducers where: one or more are to be compensated and one contains the reference barometer pressure. All these pressures have the same basic time stamp. In this case, additional controls appear in the **Barometer** and **New** frames of the Convert window in order to select which transducers are which.

The following describes other aspects of Convert that differ from the examples above. Each of these is fully described in the Data Scout Advanced Operations Manual.

- When a separate Barometer file's data has individual samples which were recorded at a frequency different from those in the original file, the program uses an estimated Barometer value calculated by interpolation. The user may also create a barometer file manually with a text editor that takes advantage of this feature.

- **DataPlay** accepts pressures (recorded in its input files) that are in pressure units other than psia which is required by the internal equations. The final compensated value for water level in psi is then converted back to the original units before being written to the New compensated file. If the compensated files start in psia and end in psi, the user can use another separate Convert function described in section 3.4.1 to convert these compensated psi pressure data to any other level units (ex. ft H_2O).

- If the Convert window is exited without a successful convert (i.e., the label below the **Exit** button is *bright red*), Playback's "current" file does not change from its original name to the New file created. In that case, Playback does not change its display (the original **Playback** data file remains displayed).
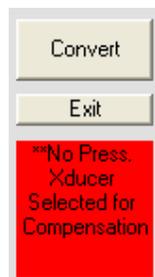
3.4.3 OTHER CONVERT FUNCTIONS

The other two Convert functions on the Playback Convert menu allow the user to:

- Convert any human-readable text file (.atd or .txt) into its equivalent spreadsheet import version (.csv) and vice versa (figure 3.36).
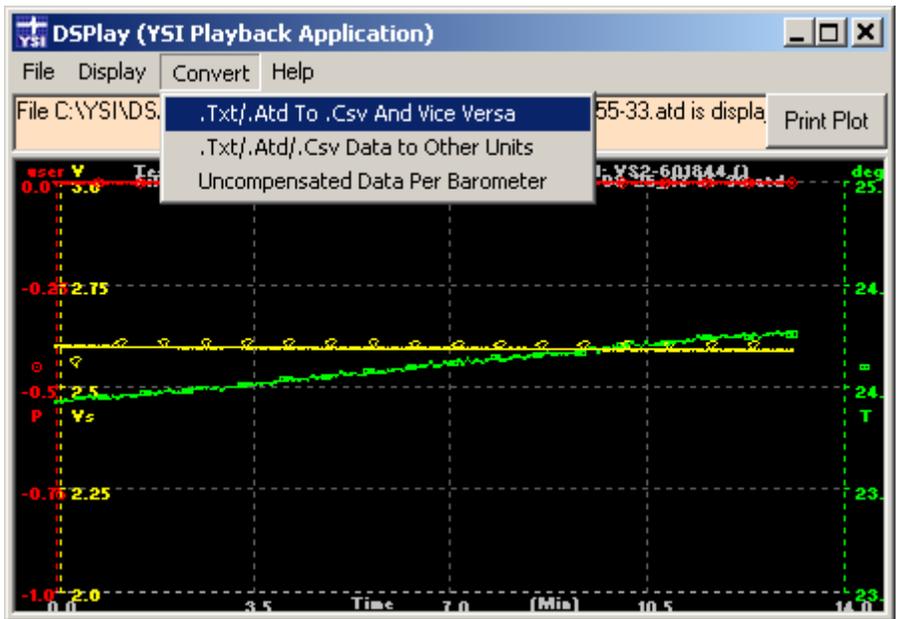
Figure 3.36

- Convert any pressure data or temperature data in any data file (.atd, .txt, or any of the equivalent .csv formats) into selected other pressure/level units or temperature units (figure 3.37).
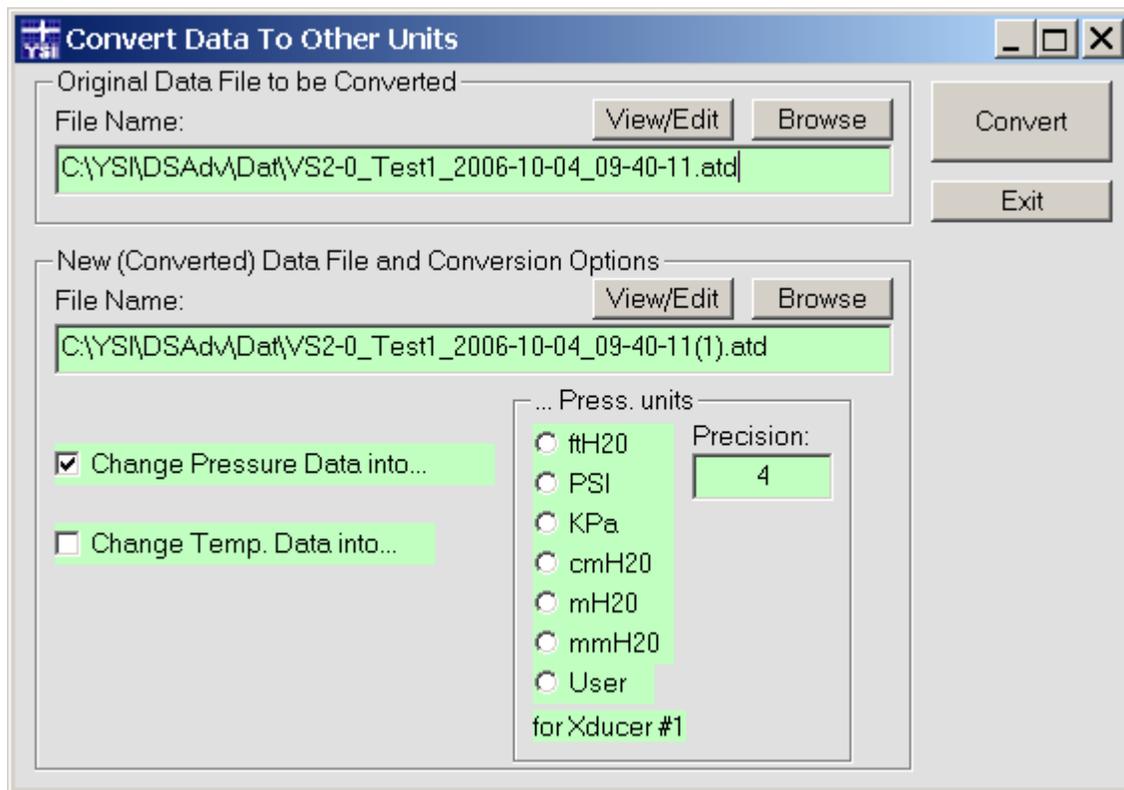
Figure 3.37

Before clicking the **Convert** button, select the new pressure units desired and the data precision. In this example, the precision is 4 digits to the right of each decimal point.

After exiting the Convert window, the **New** converted file becomes the new "current" Playback data file, and is displayed in its new units. This file also becomes the default file available to any other immediate future Convert function. Please note that the headers (first few text lines) of each new converted data file have new header lines added with each new conversion, thus keeping a date/time stamped history of every stage of conversion.

See the Data Scout Advanced Operations Manual for a complete description of these other convert functions and other Playback functions.

4.0 MAINTENANCE

This chapter will explain how to perform typical maintenance on a Level Scout. The Level Scout has been designed to provide many years of reliable service while requiring minimal maintenance.

4.1 BATTERY REPLACEMENT PROCEDURES

Periodic replacement of the internal batteries will be required every three to five years. The following simple steps will guide the user through this replacement process.

> ### Warning
>
> Due to the inherent explosion risks of lithium batteries when exposed to water, YSI does **not** recommend using lithium batteries in the Level Scout.

Remove the cable or wire from the transducer by holding the transducer in one hand and the retaining nut with the other hand. Gently unscrew the retaining nut of the cable or wire from the transducer. The nut will rotate while unscrewing from the transducer body, but the cable will remain stationary.
 	
    Twist this part to unscrew the cable from the transducer.
 	
    This part remains stationary.
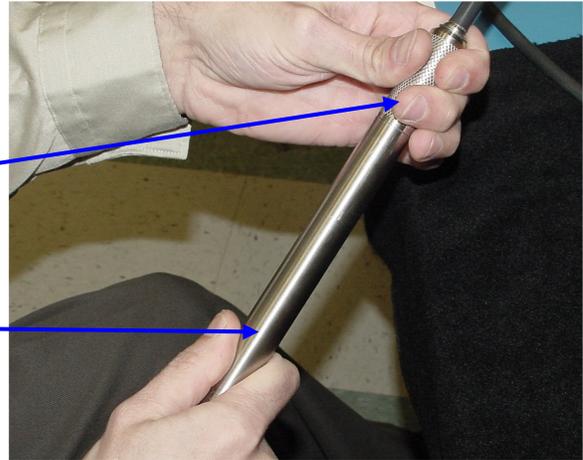	
	Figure 4.1

Continue to un-thread until the nut is completely un-threaded. Grasp the nut and gently pull it and the cable away from the transducer body (figure 4.2). Lay the cable end aside, on a clean, dry surface.	 Figure 4.2

With <u>one</u> finger, gently push downward on the internal connector until the connector circuit board is at the bottom of the retaining slot. Rotate the connector and board 35º counter clockwise until the tabs in the circuit board clear the retaining slot, figure 4.3.	 Figure 4.3
Once the tabs are free of the retaining slot, tilt the transducer and the batteries will slide out. They will push the small circuit board out with them, figure 4.4.	 Figure 4.4
Do not pull or twist the brown flexible cable attached to the circuit board shown in figure 4.5. Figure 4.5 shows the normal extension of this cable that is required for easy replacement of the batteries.	 Figure 4.5
Install two new industrial AA alkaline batteries into the Level Scout. When installing the batteries, pay attention to the polarity of the batteries. The negative battery terminal end of the battery should be installed into the housing first (figure 4.6).	 Figure 4.6
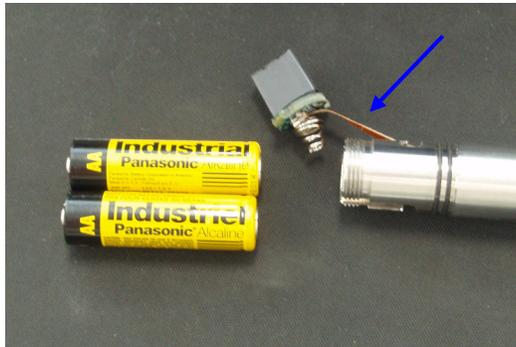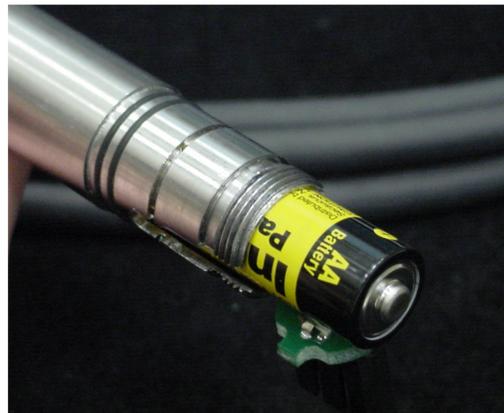
Reinsert the battery connector making sure to align the PCB tab into the correct housing slot.
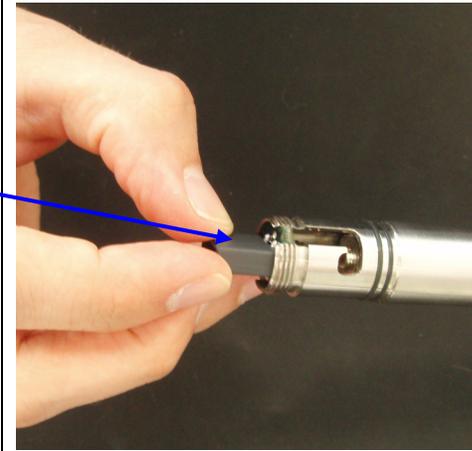
Figure 4.7

Push the connector down far enough that the retaining tabs have bottomed out in the entry groove. Rotate the connector 35º clockwise until the tabs line up with the retaining slot. Release pressure on the connector allowing the tabs on the circuit board to seat in the retaining slot.
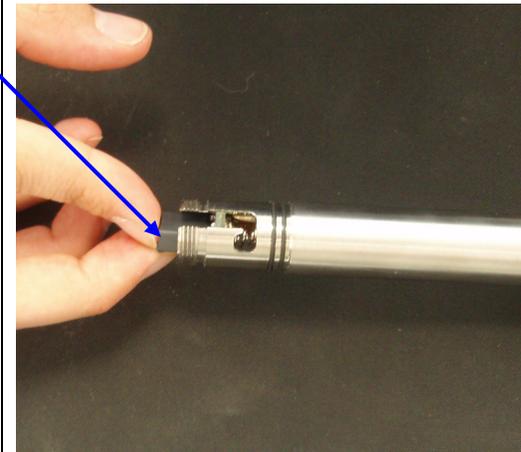
Figure 4.8

Verify that the tabs on the circuit board are fully seated in the retaining slot. Failure to do this can cause damage to the connector during cable installation.
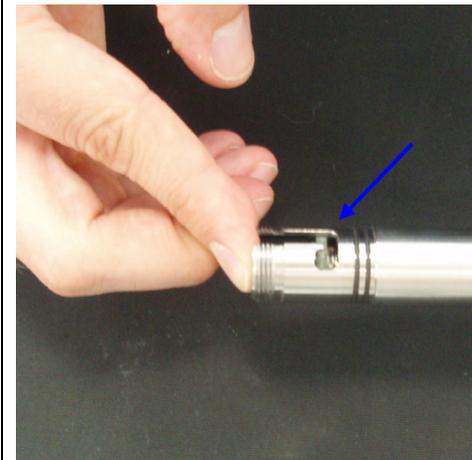
Figure 4.9

After verifying the connector board is properly seated, screw the unit back together, turning the knurled end and not the smooth end of your transducer.	Figure 4.10

Note

Once the new batteries are installed, the transducer resets itself. The default baud rate is 19200.

After installing new batteries, the transducer clock must be reset for proper timekeeping as described in section 4.2 below.

The battery type and rating must be downloaded to the transducer to begin the battery life estimation for the newly installed batteries. This process is explained in section 4.3.

All Autolog test configuration and logged data are retained when the batteries are removed and replaced.

4.2 SYNCHRONIZING THE TRANSDUCER INTERNAL CLOCK

Periodically, there may be a need to synchronize the Level Scout's internal clock to the local time. This can occur after shipping the Level Scout to different time zones, replacing the internal batteries, or simply to improve the accuracy of the time keeping.

To reset the Level Scout clock open Data Scout Advanced and click on **Run** to open the Run window (figure 4.11). Click the **Other** button in the Autolog Frame to open figure 4.12
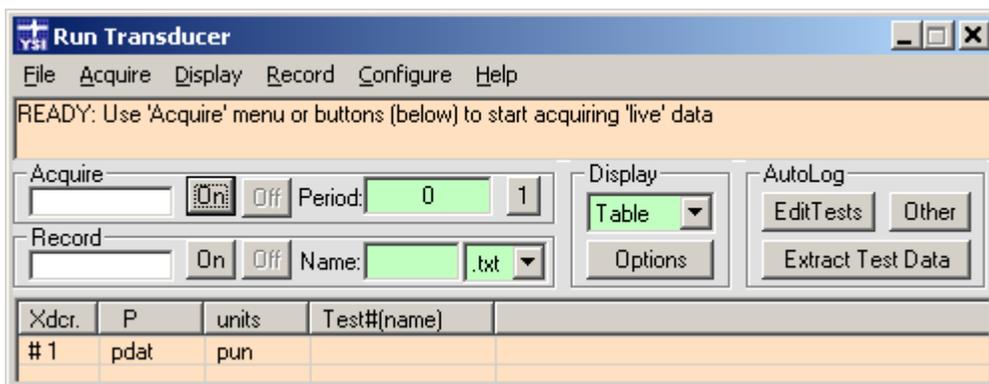
Figure 4.11
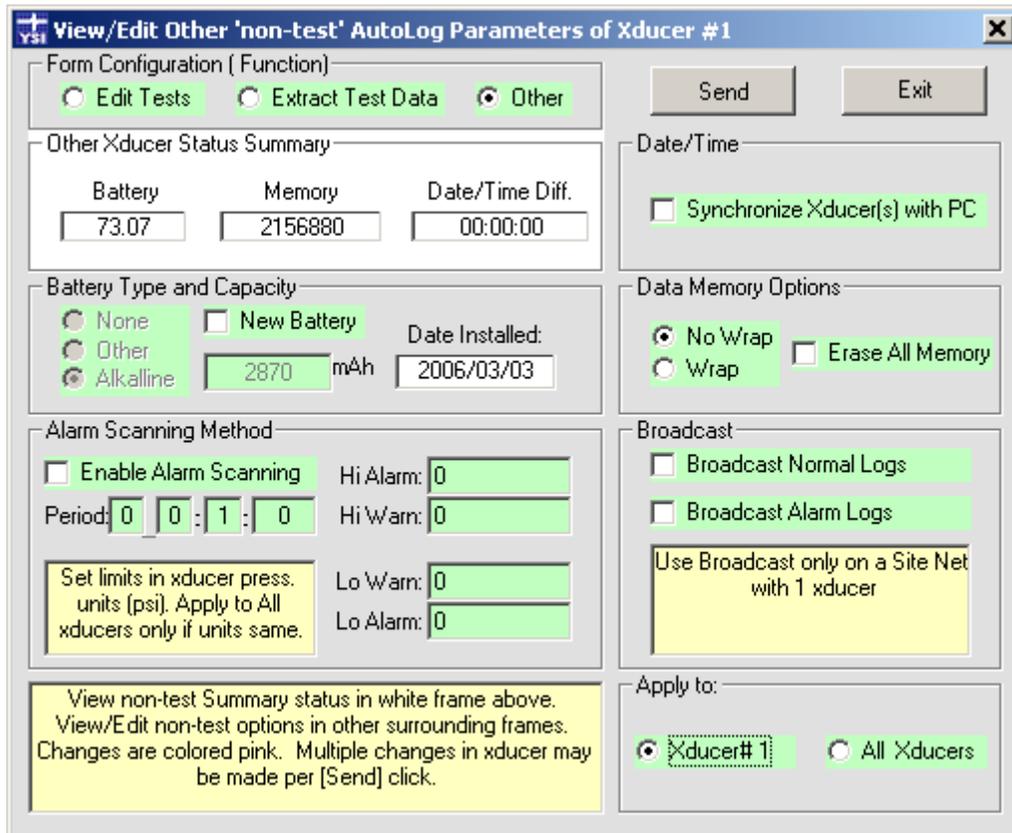
Figure 4.12

To synchronize the transducer clock with the PC's clock, click the box **Synchronize Xducer(s) with PC** in the upper right corner of the **Other** window. When the box is checked, the green will turn to pink, indicating that you should select **Send**, to transmit the information to the transducer.

4.3 DOWNLOADING NEW BATTERY INFORMATION

The Level Scout contains logic to estimate the remaining capacity of the internal batteries. In order for this to operate effectively, the transducer must be made aware of a battery replacement and the capacity of the installed batteries. Data Scout Advanced provides an easy method for configuring the battery information in the Level Scout. This procedure should only be performed at the time a new battery of known capacity is installed.

To configure the transducer's battery information open Data Scout Advanced and click on **Run** to open the Run window. Click the **Other** button in the Autolog frame (refer back to figure 4.11).

Check the box next to **New Battery** (figure 4.12), the green will turn to pink and the following notice will appear.

Figure 4.13

Click **OK** on the notice shown in figure 4.13 and enter the battery type and mAh capacity information about the new battery. If the entries are correct, click **Send** on the Other window to transmit the information to the transducer. Click **Cancel** on the Other window to cancel the transmission of the information. The user can also uncheck the **New Battery** checkbox to reverse all battery changes before pressing **Send** if other changes have been made that need to be transmitted to the Level Scout.

4.4 UPGRADING INTERNAL FIRMWARE

The Level Scout was designed with firmware that is easily upgraded by the user in order to take advantage of added features. When these upgrades are released they are made available, free of charge, for downloading from the YSI web site (www.ysi.com). Data Scout Advanced has built in features to support downloading firmware updates to the Level Scout either one at a time or to several at a time. The following steps should be used to upgrade the firmware.

1) Download the firmware update file from www.ysi.com. Make sure to remember the location where the downloaded file was saved. By default Data Scout Advanced will look for the file in the folder: C:\YSI\DataScoutAdvanced\Firmware.

2) Start Data Scout Advanced and connect to the unit(s) that needs upgraded. Open the Run window for the selected units or all units.

3) Select **Configure** and then **Lock Access** from the menu bar. Data Scout Advanced will query the selected unit and display the current lock state. Select the **Unlocked** button and then select **OK**. This will unlock the firmware memory to allow downloading of new firmware.

4) From the menu bar select **Configure** and then **Update Firmware**. The Update Firmware window will open (figure 4.14). Click the **Browse** button to locate the new firmware file to be downloaded to the Level Scout. To update all transducers listed on the Run window, ensure they have all been unlocked as described above, then click the **All Xdcucers** option in the Apply to frame.
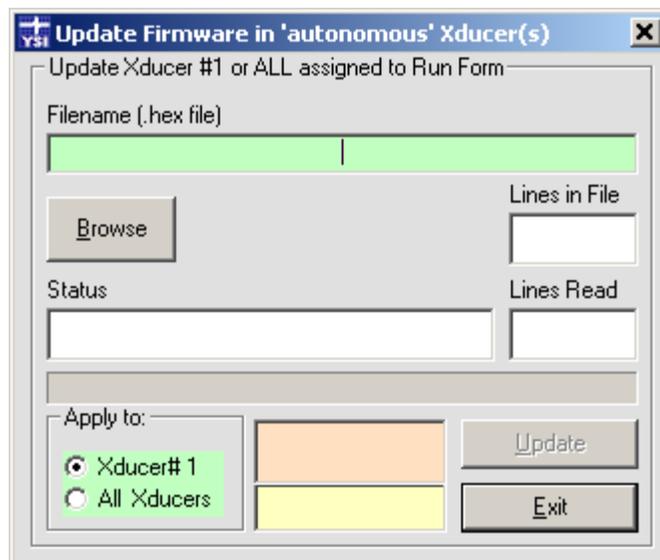
Figure 4.14

5) Select the **Update** button to begin the download process. Data Scout Advanced indicates progress in the white status boxes as it updates the transducer's firmware. If multiple transducers have been selected for update, the process is automatically repeated for each transducer.

6) When finished, the user will be prompted to synchronize the clock of the transducer with the PC's clock (see Section 4.2).

> *Tip*
>
> Do not disconnect the serial cable or terminate Data Scout Advanced in the middle of a firmware download. Interrupting a firmware download before it is complete will result in improper operation of the Level Scout.

4.4.1 RECOVERING FROM FIRMWARE UPGRADE ERRORS

If a firmware upgrade process is interrupted before completion, the transducer will be left in a state where it is unable to operate normally. If the transducer is left in this mode, use the following steps to enable the transducer's boot loader and download a valid firmware into the unit.

1) Remove external power from the Level Scout cable.

2) Go to the firmware download function by selecting **Configure** then **Update Firmware.**

3) Select the proper firmware download file using the **Browse** button.

4) Start the download process by clicking the **Update** button.

5) Data Scout Advanced will not be able to start the firmware download since the Level Scout contains previously corrupted firmware. While Data Scout Advanced is trying to start the download process, briefly short together the power input terminals of the cable.

6) The firmware download process should begin after the power terminals are shorted. Allow the download to complete.

4.5 FIELD CALIBRATIONS

The Level Scout is factory calibrated to characterize its pressure and temperature outputs. Under normal conditions, factory re-calibrations are not required. The Level Scout does provide the ability to perform simple field calibrations to provide offset corrections to the transducer in order to maximize accuracy in each application. Data Scout Advanced provides menus to simplify performing these field calibrations.

4.5.1 FIELD OFFSET ADJUSTMENT

The field offset is provided to allow for easy offset adjustments of the Level Scout's output without altering its main factory calibration. When calculating output pressure, the Level Scout firmware will <u>add</u> the field offset coefficient to the factory offset. This offset adjustment is useful to compensate for sensor shifts due to orientation, head pressures or sensor drift. The internal field offset can be configured by following the steps below for <u>Vented Level Scouts only</u>. **If using an Absolute Level Scout, refer to the next paragraph.**

1) Place the sensor in its normal operating orientation (normally vertical).

2) Make sure the transducer is completely removed from water (or other liquid) to provide a true zero pressure reading (or alternately apply the desired offset pressure/level to the transducer). An Absolute Level Scout should read 14.7xxx PSI when removed from water.

3) From the Run window menu bar select **Configure** then **Zero**. Data Scout Advanced will read the Level Scout's current field offset coefficient and pressure. It will then calculate the new field offset coefficient required to produce a pressure reading of zero.

4) Data Scout Advanced will open a window displaying the current measured pressure. If this looks reasonable click the **OK** button. Data Scout Advanced will then adjust the field coefficient.

Alternately, if the new field offset value is known or if using an Absolute Level Scout, the user may enter it directly by selecting **Configure** then **Field Offset** from the Run window menu bar. A window as shown in figure 4.15 below will be displayed. Enter the desired offset value to <u>add</u> the factory offset as well as its engineering units of measure. Click **OK** to transmit the value to the Level Scout.
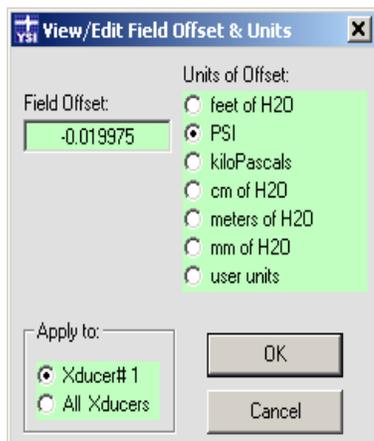
Figure 4.15

4.6 DESICCANT MAINTENANCE

Note – This maintenance procedure is not required for field cables that have the electrical in-line vent filter.

If using a cable with an external desiccant, it is recommended that you establish a regular replacement schedule for the desiccant. The desiccant should be changed when it is 75% spent. Spent desiccant will have a pink color where unspent desiccant is light blue. The frequency of the vent filter replacement will be a function of the local environment, particularly the humidity. Replacement filters are available from YSI or any Authorized YSI Representative. Even if its color indicates it is spent, *do not remove the old vent filter until a new one is available*. The desiccant vent filter will last at least one (1) year before replacement is necessary.

To replace the desiccant vent filter, use the following procedures:

1) Cut the nylon tie wrap securing the old vent filter to the cable assembly.

2) Disconnect the soft tubing of the old vent filter from the metal tube exiting the back of the 9-pin D-shell boot.

3) Immediately connect the soft tubing of the new vent filter onto the metal tube exiting the back of the 9-pin D-shell boot.

4) When the transducer is placed back into service, remove the protective cap from the end of the vent filter.

Remember, the most common failure mode of vented transducers is moisture and corrosion damage due to lack of use or maintenance of the vent filter.

4.7 DRYING THE TRANSDUCER CABLE

If water may have entered the cable vent tube or in the Level Scout, the following procedure can be used to dry either one out.

1) Remove the field cable assembly from the Level Scout.

2) If applicable, remove the desiccant from the cable.

3) Coil the cable then place it along with the transducer in a pan. Place the pan in an oven at 50^{0}C (122^{0}F) for a minimum of two (2) hours. Ensure the oven temperature does not exceed 50^{0}C (122^{0}F). Temperatures above 50^{0}C (122^{0}F) may damage both the transducer and cable.

4) If applicable, reattach the desiccant to the cable.

5) Reattach the cable to the transducer.

4.8 CLEANING THE TRANSDUCER

Either a clogged nose piece or a dirty transducer diaphragm could result in erroneous readings from the transducer. **NEVER** attempt to clean the transducer's nose piece or diaphragm with a sharp or hard object. To avoid damage to the diaphragm, **NEVER** insert a sharp or hard object into the nose piece. This could dent the sensor diaphragm and cause permanent damage to the transducer which is not covered under warranty. Use the following procedures to effectively clean the transducer:

Materials Required:
- Plastic bowls 8-12 inches in diameter and 4-6 inches deep
- Supply of clean, lint-free rags
- 32 ounce bottle of "The Works-Tub and Shower Cleaner" a mild detergent, manufactured by Lime-O-Sol Company and available at local stores.

Preparation:

Prior to cleaning the pressure transducer, ensure that the cable and the transducer body have been cleaned with a mild detergent to remove any hazardous materials. If applicable, the vent filter must be properly attached. The cable should be coiled to ensure ease of handling and it must be protected against the possibility of accidental abrasion and/or penetration of the cable jacket by sharp objects. A lead length of 1 to 1½ feet of cable from the transducer should be allowed to facilitate handling during cleaning. The protective dust cover (or similar protective device) that was shipped with the transducer should be attached to the transducer at all times if the cable is not connected to the transducer.

The work surface needs to be clean, free of clutter, and large enough to accommodate all materials required in addition to the transducer and cable. Fill one of the bowls with fresh water, one with a mild detergent mixed with water, and the last with 16 ounces of "The Works."

Cleaning:

- Holding the cable 6 inches from the transducer, immerse the unit in the bowl containing the mild detergent and stir for 20-30 seconds. Remove and rinse in the bowl containing the fresh water, using the same stirring motion used in the mild detergent. Wipe dry.

- Place the transducer in a vertical position with the pressure sensing end facing downward in the bowl containing "The Works" solution for approximately 15-20 seconds. Rinse in the bowl containing fresh water and wipe dry.

5.0 SUPPORT INFORMATION

5.1 WARRANTY

The YSI Level Scout instrument, cables, and suspension wires are warranted for two (2) years from date of purchase by the end user against defects in materials and workmanship, exclusive of batteries and any damaged caused by defective batteries. YSI Level Scout systems (instrument & cable/wire) are warranted for 1 year from date of purchase by the end user against defects in material and workmanship when purchased by rental agencies for rental purposes. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, write or call your local YSI representative, or contact YSI Customer Service in Yellow Springs, Ohio at +1 937-767-7241(800-897-4151 US). Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

LIMITATION OF WARRANTY

This Warranty does not apply to any YSI product damage or failure caused by:
1) failure to install, operate or use the product in accordance with YSI's written instructions;
2) abuse or misuse of the product;
3) failure to maintain the product in accordance with YSI's written instructions or standard industry procedure;
4) any improper repairs to the product;
5) use by you of defective or improper components or parts in servicing or repairing the product;
6) modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI's LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

5.2 SPECIFICATIONS

These specifications are subject to change without notice. For the most recent specifications please visit www.ysi.com.

Level	Range: (Vented)	0 - 10 ft, 3.05 m, 4.3352 PSI 0 - 50 ft, 15.24 m, 21.676 PSI 0 - 75 ft, 22.86 m, 32.5140 PSI 0 - 250 ft, 76.2 m, 108.38 PSI 0 - 692 ft, 210.6 m, 299.9956 PSI
	Range: (Absolute)	0-10 ft. 3.05 m, 19.035 PSI 0-50 ft, 15.24 m, 36.376 PSI 0-70 ft, 21.33 m, 45.046 PSI 0-230 ft, 70.1 m, 114.410 PSI 0-692 ft, 210.9 m, 314.696 PSI
	Accuracy:	0.05 % FS TEB* for ranges > 10 ft ± 0.10 % FS TEB* for ranges <= 10 ft
	Resolution:	0.00001 (Data Scout and Data Scout Mobile) 0.000001 (Data Scout Advanced, user selectable)
	Units:	psi, ft H_2O, mm H_2O, cm H_2O, m H_2O, kPA
Temperature	Range:	-20 to 50° C (Operating Range) -10 to 40° C (Compensating Range)
	Accuracy:	± 1.0° C (for S2, T2, AS2, AT2 models) ± 0.2° C (for S4, T4, AS4, AT4 models)
	Resolution:	0.001 (Data Scout and Data Scout Mobile) 0.01 (Data Scout Advanced)
BaroScout	Range:	8-16 psia, 55-110 kPa
Modes of Sampling		Linear, Linear Average, Event, and Logarithmic
Sampling Rate		Programmable, 8 readings per second max
Memory		2 MB (for S2, T2, AS2, AT2 models) 4 MB (for S4, T4, AS4, AT4 models)
Maximum Pressure Scans (Pressure with Time-Stamp)		196,560 (for S2, T2, AS2, AT2 models) 393,120 (for S4, T4, AS4, AT4 models)
Maximum Pressure and Temperature Scans (Pressure and Temp with Time Stamp)		144,144 (for S2, T2, AS2, AT2 models) 288,288 (for S4, T4, AS4, AT4 models)
Time-Stamp Accuracy		±2 min/year (over the compensated temp range)
Proof Pressure		2 x FS
Burst Pressure		3 x FS
Data Upload Time		100 scans/sec
Storage Temperature		-40 to 80° C without batteries, -20 to 50° C with batteries
Wetted Material		316 SS or Titanium; Viton®
Protection Rating		IP 69, NEMA 6P
Internal Batteries		(2) 1.5 volt AA Alkaline RECOMMENDED
Battery Life		3 years @ 15 minute sample intervals
External Excitation		6 – 16 VDC
External Input Current		8.0 mA (average current during measurement) 25.0 mA (15 mS peak current during page writes) 0.25 mA (sleep current)

Communication Interface	RS-485 (3 volt p-p differential with selectable baud rates from 1200 to 19200)
Protocol	SDI-12 ver 1.3 compliant
Weight	0.70 lbs, (318 grams) with batteries 0.15 lbs, (57 grams) cable assembly without cable 0.05 lbs/ft, (79 grams/m) cable 0.005 lbs/ft, (8 grams/m) suspension wire
Diameter	0.75 inches (12.0 mm)
Length	12.44 inches (316.0 mm) from tip to end cap
Cable	Polyurethane jacketed, molded polyurethane seal 200 lbs, 90 kg pull strength conductors, Conductor size – 22 AWG

* TEB – Total Error Band includes the combined errors due to nonlinearity, hysteresis, nonrepeatability, and thermal effects over the compensated temperature range per ISA S51.1

5.3 ACCESSORIES

770	Communication Cable, non submersible. Connects to Level Scout.　　Requires 771(+773) for PC connectivity.
771	RS-485 to RS-232 converter. Connects to 770, 779, or DB-9 shell style universal field cable, see section2.2.2 for a diagram of all adapters.
772	RS-485 toSDI-12 converter. Connects to 778, 779 or DB-9 shell style universal field cable.
773	RS-232 to USB converter. Connects to 771.
778	All in one adapter, connects to field cable with electrical in-line vent filter, see section2.2.2 for a diagram of all adapters. Provides RS-485, RS-232, and USB signals. Use with a 772 for SDI-12 communication.
779	Connect field cable with electrical in-line vent filter to 771 or 772.
780	Desiccant Vent filter
781	Cable Hanger
782	2" vented locking well cap with dock
783	2" vented locking well cap ONLY
784	2" dock ONLY
785	4" vented locking well cap with dock
786	4" vented locking well cap ONLY
787	4" dock ONLY
BS2	BaroScout, stainless steel, 2 MB memory
BS4	BaroScout, stainless steel, 4 MB Memory
711-X	Field cable with electrical in-line vent filter, Stainless Steel, polyurethane jacketed, X ft in length
721-X	Field cable with electrical in-line vent filter, Stainless Steel, ETFE jacketed, X ft in length
731-X	Field cable with electrical in-line vent filter, Titanium, polyurethane jacketed, X ft in length
741-X	Field cable with electrical in-line vent filter, Titanium, ETFE jacketed, X ft in length
750-X	Suspension wire, Stainless Steel, X ft in length
760-X	Suspension wire, Titanium, X ft in length
750-0	Stainless Steel Backshell deployment cap
760-0	Titanium Backshell, deployment cap

5.4 ORDERING & TECHNICAL SUPPORT

For ordering and technical support, please contact:

YSI Incorporated, World Headquarters
1700/1725 Brannum Lane
Yellow Springs, Ohio 45387
USA

Phone: +1-937-767-7241
US 800-765-4974
Fax: +1-937-767-9353
Email: environmental@ysi.com\

Or, visits us at www.ysi.com for a list of office locations.

5.5 SERVICE INFORMATION

YSI has authorized service centers throughout the United States and Internationally. For the nearest service center information, please visit www.ysi.com and click 'Support' or contact YSI Technical Support at 800-897-4151 (+1 937-767-7241).

When returning a product for service, include the Product Return form with cleaning certification. The form must be completely filled out for a YSI Service Center to accept the instrument for service. The form may be downloaded from the 'Support' page at www.ysi.com.

5.6 DECLARATION OF CONFORMITY

The undersigned hereby declares on behalf of the named manufacturer under our responsibility that the listed product conforms to the requirements for the listed European Council Directive(s) and carries the CE mark accordingly.

Manufacturer:	YSI Incorporated 1725 Brannum Lane Yellow Springs, Ohio 45387 USA
Product Name:	Level Scout pressure and temperature Logger
Instrument Model Numbers:	AS2, AS4, AT2, AT4, VS2, VS4, VT2, and VT4 with field deployment cable
Conforms to the following:	
Directives:	EMC Directive 89/336/EEC as amended by 92/31/EEC and 93/68/EEC Immunity Directive EN 61326-1 + A1:1998 + A2:2001 + A3:2003
Harmonized Standards:	EN61000-4-2:1995 + A1:1998 + A2:2001(IEC 61000-4-2) (ESD) EN61000-4-3:2002 (IEC 61000-4-3) (RF radiated immunity) EN61000-4-4:1995 + A1:2001 + A2:2001 (IEC 61000-4-4) (EFT) EN61000-4-5:1995 +A1:2001(IEC 61000-4-5) (Surge Immunity Test) EN61000-4-6:1996 + A1:2000(IEC 61000-4-6) (RF conducted immunity) EN61000-4-8:1993 + A1:2001 (IEC 61000-4-8) (Magnetic Field Immunity)
Supplementary Information:	This device complies with the requirements of the EMC Directive 89/336/EEC, Immunity Directive EN 61326-1, and carries the CE mark accordingly. All performance met the continuous unmonitored operation criteria as follows: 1. ESD, IEC 61000-4-2, Performance Criterion B 2. EM, IEC 61000-4-3, Performance Criterion A 3. Burst, IEC 61000-4-4, Performance Criterion B 4. Surge, IEC 61000-4-5, Performance Criterion B 5. Conducted RF, IEC 61000-4-6, Performance Criterion A 6. Magnetic Field, IEC 61000-4-11, Performance Criterion B
Authorized EU Representative	YSI Hydrodata Unit 8, Business Centre West, Avenue 1 Letchworth, Hertfordshire, SG6 2HB UK

Signed: Lisa M. Abel Date: 30 May 2009
Title: Director of Quality

LEVEL SCOUT CONNECTION DIAGRAMS

Figure A-1 shows the **778** all-in-one adapter. The 778 provides connection from a field cable with an in-line vent filter to a modem, Pocket PC, or computer. It includes built-in conversion to RS-232C and USB and has a DC input connector for temporary power. Use with a 772 for SDI-12 applications.
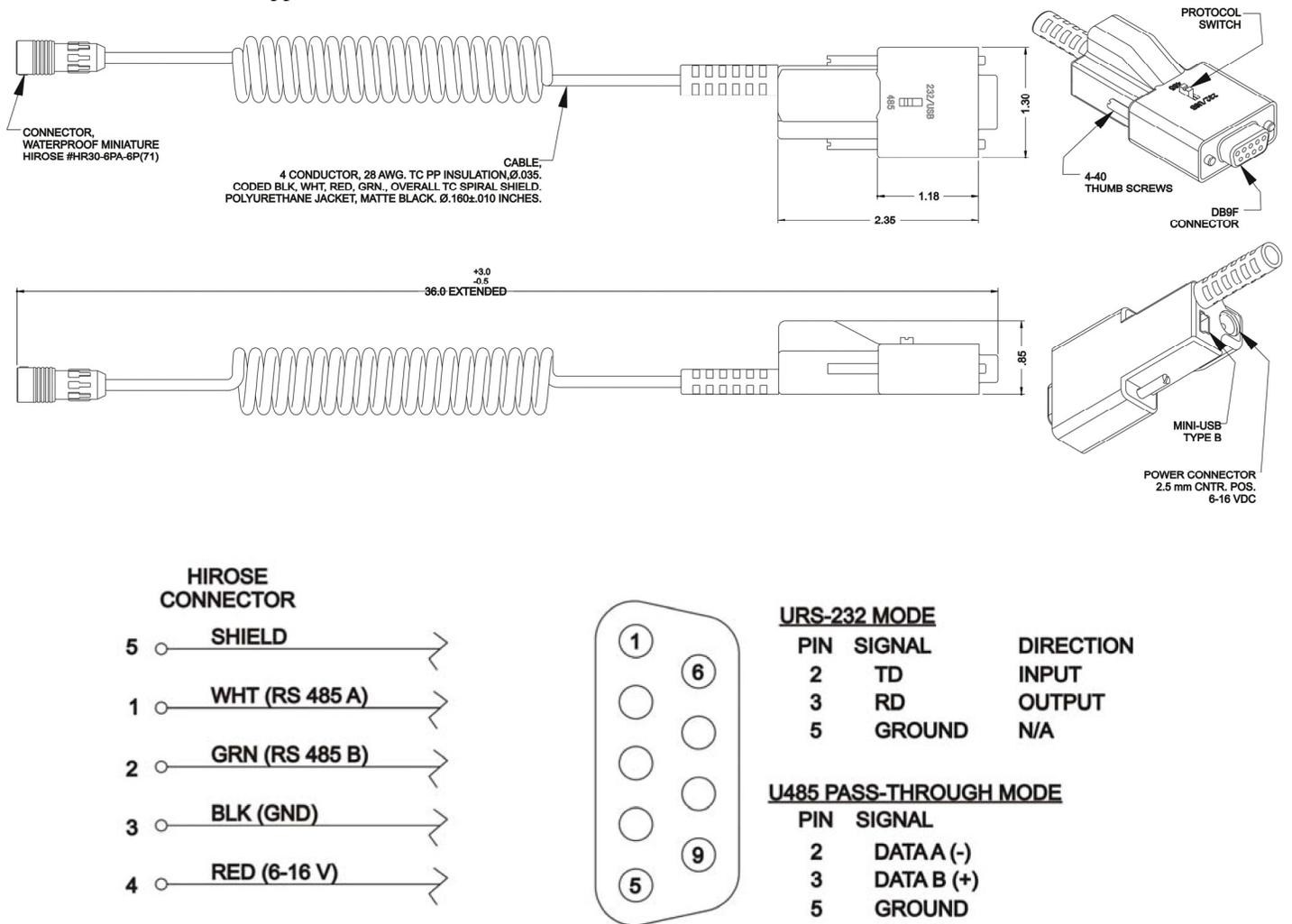
Figure A-1

Figure A-2 shows the RS-485 communications signal assignments on the 779-0-0 9-pin D-connector that are required for serial communications. Also shown are the signal assignments for the power connector of the 779-0-0. If you need to fabricate your own power connector to mate to this, ensure that the polarities are correct as shown below. The pins outs for the D-connector shown below are the same as those on the discontinued Universal Field cables that terminated in a 9-pin D-connector.,

PIN 2, RS-485A
PIN 3, RS-485B
PIN 4, GND

1 2 3 4 5
6 7 8 9

HIROSE
CONNECTOR

5 SHIELD
1 WHT (RS 485 A)
2 GRN (RS 485 B)
3 BLK (GND)
4 RED (6-16 V)

WIRING DIAGRAM
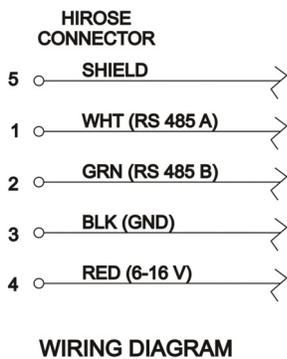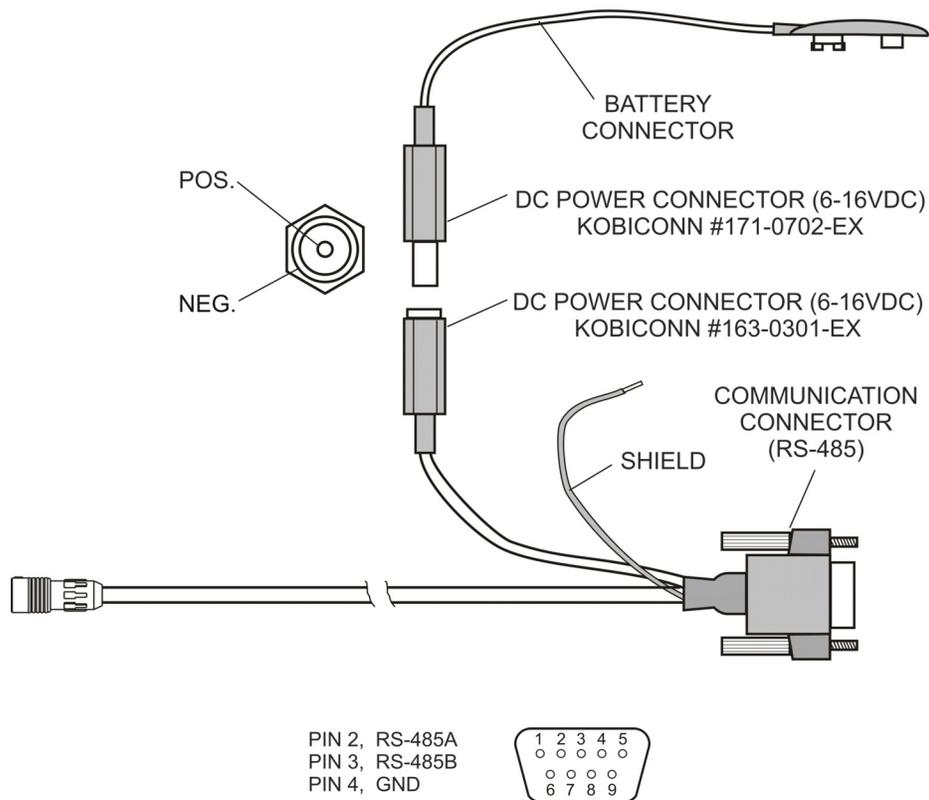
Figure A-2
779-0-0

Figure A-3 shows the signal assignment for the RS-232 side of the Model 771 RS-485 to RS232 converter.

Model 771
RS-485 to RS-232
Converter

SERIAL CABLE

PIN 2, RS-485A
PIN 3, RS-485B
PIN 4, GND

5 4 3 2 1
9 8 7 6

1 2 3 4 5
6 7 8 9

PIN 1, DCD
PIN 2, RD
PIN 3, TD
PIN 4, DTR
PIN 5, GND
PIN 6, DSR
PIN 7, RTS
PIN 8, CTS
PIN 9, RI
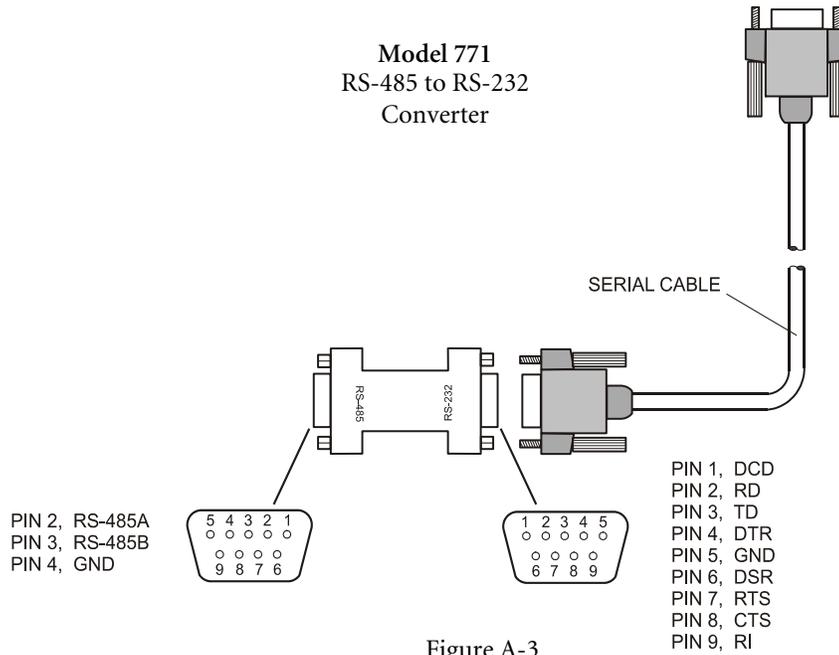
Figure A-3

Figure A-4 shows the signal assignments for the Model 772 RS-485 to SDI-12 converter.

Model 772

PIN 2, RS-485A
PIN 3, RS-485B
PIN 4, GND

5 4 3 2 1
9 8 7 6

RS-485

SDI-12

SDI-12

+12 VDC
DATA
GND
+12 VDC
GND

MUST USE GENDER CHANGER
FOR 855 CABLE
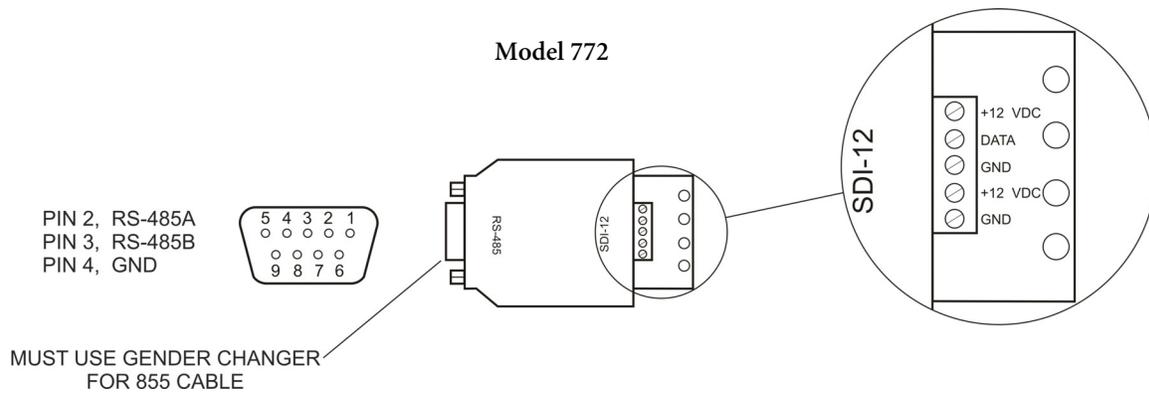
Figure A-4

Figure A-5 shows the 770 Non submersible Quick Disconnect Communication Cable. It includes an RS-485 communication connector, DC power connector, and battery connector. The 770 is not intended for field deployment.

Model 770

BATTERY
CONNECTOR

POS.

NEG.

DC POWER
CONNECTOR
(6-16VDC)

COMMUNICATION
CONNECTOR
(RS-485)

PIN 2, RS-485A
PIN 3, RS-485B
PIN 4, GND

1 2 3 4 5
6 7 8 9

8.0
[203mm]
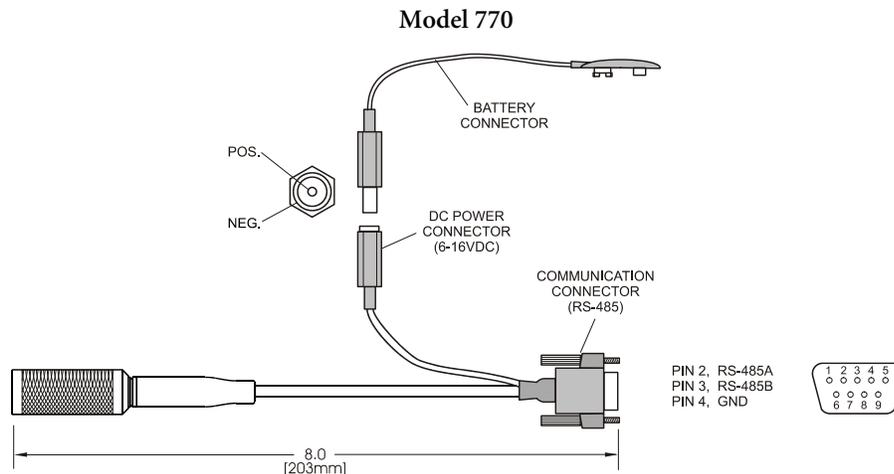
Figure A-5

Figure A-6 shows the Suspension Wire Assembly, Model 750 and 760. The Suspension Wire is intended for use with absolute transducers to suspend the unit during deployment. This assembly includes a stainless steel or titanium backshell, carabiner, and Teflon® coated stainless steel suspension wire.

Suspension Wire
Model 750 and 760

Figure A-6

APPENDIX B
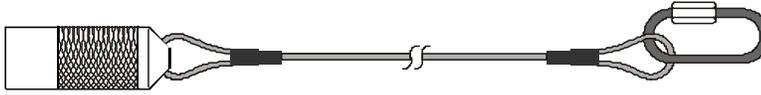
SDI-12 COMMUNICATION

SDI-12 is an industry standard serial digital interface bus. The bus was designed to allow compatibility between data collection devices of various manufacturers. SDI-12 is a single master multi drop bus and command protocol. As many as 10 sensors can be connected to the bus as a time. Each sensor is pre-assigned a unique address (0-9, a-z, or A-Z). Each Level Scout is factory-set to address 0 (zero).

This appendix documents some of the SDI-12 commands supported by the Level Scout transducer. All commands listed alphabetically have the following information:

Command	a 1-3 letter abbreviation (operation code for the command)
Function	a description of the command
Syntax	a complete rendering of the command's structure
Sensor Response	a description of the response(s) returned by the Level Scout

Some commands require another special **Get Data** command ("**D0**") to follow them (immediately or after a delay of "ttt" seconds, as indicated by a parameter in the "main" response). Also, some command responses generate a "main" response, which is followed "ttt" seconds later by a second response: called the **Service Request** response. In both cases, a standalone colon (**:**) will indicate this required *following* relationship between two commands and two responses.

To avoid unnecessary repetition of frequently-used parameter descriptions in the table entries, each occurrence of a simple "a" item always represents the address of the sensor. Also, "ttt" represents a common parameter of a "main" response: **time in seconds** until data will be ready to read with a following "**D0**" command. All responses end with a non-printable <**CR**><**LF**> character pair, which is not shown in the table.

Command	Function	Syntax	Sensor Response
I	Identify Sensor	**aI!**	A13—YSI---AS2---hhh-ssssss-vvv 13 Supports SDI Version 1.3 commands YSI Manufacturer AS2 Model Number hhh Hardware revision ssssss Serial Number vvv Software revision
D0	Get Data	**aD0!** **Note:** This command is only issued after a **Start Measurement** (various "**M[v]**" or "**C[v]**") command. It should **not** be issued until measurement time (returned in response) has expired or extra **Service Request** response has been received after a **Start Non-Concurrent Measurement** (various "**M[v]**") command is	av or apu avu or aputu or avv or avvvv p is ± pressure value. t is ± temperature value. "v" is other non-specific value "u" is + units indicator Example: 0-10.23-0 If previous measurement command was "M" or "C" above example response

		issued. Example: 0D0! (Send Get Data command to sensor "0"))	would be "avu" form and would indicate that the water level of sensor "0" is a 10.23 feet. Note: If address is returned alone with no data and unit values, this indicates that there is no data available. Either a Start Measurement command was not issued, the command was aborted by sending a new command before the measurement time expired, or an expected Service Request response was not yet received.
M **or M0**	Start non concurrent pressure measurement	**aM!** **:** **aD0!**	attt2 : a (service request response) "2") is number values in "D0" resp: apu or aputu "p" is ± pressure value "u" is + units indicator. Use "XUP" command to set units. If "XUM=1" command is executed then ± temperature value and units code (tu) also appended.
M1	Start non concurrent factory pressure measurement (factory calibrated value always in psi)	**aM1!** **:** **aD0!**	attt1 : a (service request response) "1" is number values in "D0" resp: ap "p" is ± pressure value (psi)
M2	Start non concurrent temperature measurement	**aM2!** **:** **aD0!**	attt2 : a (service request response) "2" is number values in "D0" resp: atu "t" is signed temperature, "u" is = units: 0-Celsius, 1=Fahrenheit. Use "XUT" command to set units.
M3	Start non concurrent scale factor measurement (user slope, user offset, and field calibration	**aM3!** **:** **aD0!**	a0013 : a (service request response)

	offset)		"3" is number values in "D0" resp: asoc "s" is signed user slope "o" is signed user offset (psi) "c" is signed field cal. Offset
M4	Start non concurrent standards lab scale factor measurement (standards lab calibration slope and calibration offset)	aM4! : aD0!	a0012 : a (service request response) "3" is number values in "D0" resp: aso "s" is signed cal. Slope "o" is signed cal. offset
M5	Start non concurrent high accuracy PCB temperature	aM5! : aD0!	attt2 : a (Service Request response) "2" is number values in "D0" resp: atu "t" is signed temperature, "u" is = units: 0-Celsius, 1=Fahrenheit. Use "XUT" command to set units is si
M6	Start non concurrent battery voltage measurement	aM6! : aD0!	a0021: : a (Service request response) "01" is number values in "D0" resp: av "v" is the battery voltage
M7	Start non concurrent pressure and temperature measurement	aM7! : aD0!	attt4 4 is number values in "D0" resp: aputu p is ± pressure value, first u is = units index. Units set by "XUP" command. t is ± temperature value, second u is +0 = Celsius or +1 = Fahrenheit. Use "XUT" command to set units.