DASCOR
DATA LOGGERS

COVERING

SERIES M1b Electronics

With JN09 Firmware

SOFTWARE
OPERATORS MANUAL

Software Release 6.10

Firmware Release JN09

PREPARED

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1 Notes for Release M1b-V6.10, Text Conventions

The M1b-V6.10 release of the DASCOR Data Logger Software is designed to work specifically with DASCOR **M1b Series** Data Loggers with **JN09 Firmware**. Operation with older loggers that have not been upgraded is not guaranteed, and may cause loss of data. With this hardware and software release, all known faults have been resolved, and the M1b-V6.10 release of the software is considered to be the **final release** for this Hardware and Firmware combination.

NOTE: the ***Data Logger*** tab will clearly identify the logger as using ***Firmware*** Release JN09.
After the first initialization of a logger, the displayed ***Header/Software version*** should be "0600/0610".

The Appendices contain images and detailed descriptions of all of the user interface screens, and should be treated as the final authority on the V6.10 release. The manual text, although detailed, may include material from earlier software releases. Operational use is covered in a separate manual for each field application (LRCpH, ML1008, and CDR Models).

One of the most significant changes with the V6.10 release is the ability to upgrade earlier Header Memory formats to the latest version without returning the logger to DASCOR for factory upgrading. Also included is the ability to access a "HELP" system on-line by using the Help menu items on the software screens. Being relatively new to the LRCpH system, , the online help system will receive periodic updates.

Throughout this manual, the following conventions apply:

Tabs or control buttons will be in ***bold italics***.

"Tab" implies that one of the nine tabs across the main screen has been selected.

"Screen" refers to any display for the active tab, or any special displays such as the real-time chart, that is visible and has been brought to the foreground.

"Message," "Box," or "Message Box" refer to small pop-up boxes that appear as needed to advise the operator of important conditions. Frequently, the message box only requires a single click on ***OK*** to confirm that the operator has read the contents of the box. However, where corrective operator action is required (or suggested), additional options are presented, including ***Cancel***, ***Abort***, or ***Ignore***. In each case the subsequent actions of the software will be explained in the box.

2 Quick-Start Guide – Getting Started Checklist for M1b

The following section is a quick review of the basic operation of the M1b Data Logger. It is recommended that you review this manual in detail, and become familiar with the various screen functions described in the Appendices.

2.1 Approved Computers and Operating Systems

The DASCOR software and interface hardware has been tested on a number of computers. To date, we have not seen problems with any make of desktop style computer that includes a standard DB-9 COMx port connector. Desktops without the COMx connector (but with a USB-2.0 interface) also seem to work well with the USB-RS232 interface dongle that is provided with the interface cable, if the driver software is installed correctly.

IBM and Toshiba laptops also seem to work well using either their COMx port or the USB adapter. We have received one report of problems with a Compaq laptop. DELL laptops, however, are known to have generic issues that prevent reliable use with serial interface devices. DASCOR does not recommend the use of Dell laptops, does not guarantee the successful operation of the applications software or hardware with a Dell laptop, and will not provide support. If you have problems with a Dell laptop, please contact your IT department for help.

The 6.10 software release was developed using Windows 2000Pro and XPpro, and there are no known conflicts. Operation with Microsoft Vista has not been tested and is not guaranteed to work properly, but problems are not anticipated. Operation with older systems (such as Windows 98, 3.xx, or other non-Windows operating systems) is no longer supported. Download speed is partially related to the speed of you computer and hard drive. The faster the better! Download for a full memory test can take up to 45 minutes on an 3-4 year old IBM laptop, dropping to about 25 minutes on a 2 year old desktop, and about 20 minutes on a brand new high-speed system running multiple tasks.

2.2 Software Installation

2.2.1 Getting the Software

If an installation CD was not included with your loggers or you were not provided with other specific instructions, then go to the DASCOR website's download tab (**http://www.dascor.com/download.html**) and download (save) the appropriate files into a new folder on your computer. In the event Version 6.10 is not available for download, or you have other difficulties, please contact DASCOR at **websales@dascor.com** or call 760-796-7788 for assistance.

2.2.2 Installing the Software

For the LRCpH application, the version 6.10 software is contained in a .MSI file. Double clicking on this file will start the installation process. Follow the prompts for a complete installation. A readme.txt file is included in the installation package that provides detailed instructions for installing the software and should be reviewed first. The ***Documentation*** Folder should be copied into the folder holding the installed software (typically "**C:\Program Files\DASCOR**") so that the manuals will be in a known location. This is also a good time to create shortcuts to the ***Documentation*** folder or directly to the manuals on the desktop.

2.2.3 USB-2920 USB-2.0 to RS232 Serial Adapter installation

If you are planning on using the USB-2.0 to RS232 Serial Adapter (Cables Unlimited Model USB-2920) with a laptop or desktop that does not have an available COMx port, you MUST follow the detailed directions below. The standard drivers and instructions provided with the adapter will not work successfully, and have been replaced with the new procedure. The following instructions are believed to be correct for Windows 98, 2K, XP, and Vista. If you already have a working installation for the USB-2920, no further action is required. However, if you have an unsuccessful installation, it will be necessary to remove it. Please contact DASCOR for a procedure to do this.

DO NOT plug in the USB-2920 dongle until instructed!

On the INSTALL CD or installation directory created by downloading the install files from the DASCOR website, find the file "**\USB-2920\CDM_2.02.04.exe**". Double click on the file to run it. A small command window

will pop up on the desktop and quickly disappear without a chance to read it. If you have a firewall or anti-virus system installed, a confirmation window may pop up. If so, do what is required to continue the installation.

Now, plug the USB-2920 dongle into an open USB port. After a few seconds, there should be one or more pop-up windows confirming that the hardware has been found and the installation is successful. If not, run the "**\USB-2920\CDM_2.02.04.exe**" program again. It may be necessary to turn off your fire wall or virus software, and/or instruct them that this software is permanently "approved" to get a successful installation, indicated by a pop-up screen similar to the one shown below.

Figure 1, Found New Hardware Message

Next, follow the sequence below to locate the settings for the dongle: From the *START* command, open the Control Panel and select *SYSTEM*, then *Device Manager*.

Figure 2, Getting to the Device Manager

On the Device Manager screen, find the *Ports (COM & LPT)* listing and click on the "+" to show the options. A *USB Serial Port (COMx)* will be shown. Double-click to show the *Properties*. Be sure that the settings are as shown, and then click on *Advanced*.

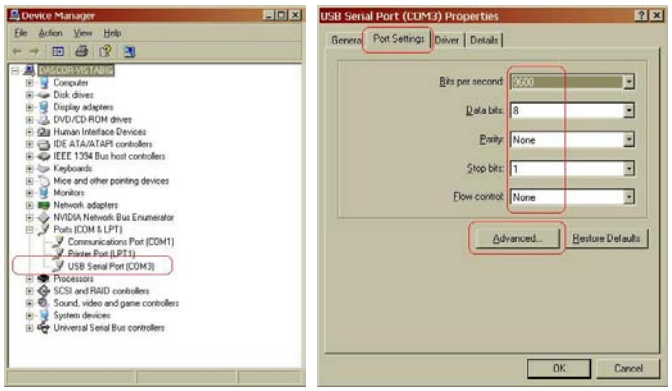

Figure 3, Getting to the Properties screen for the USB-2920 Dongle

On the ***Advanced*** screen, drop down the options list for the COM port, and select an unused port between 1 and 4 by double-clicking on your selection. In the example below, COM-1 is already in use, so COM-2 was selected. Do not change any other default settings. Note the port selected—it will be needed during the setup of the LRCpH software. When you are done, Click OK to back out of the Device Manager screens, then close the Control Panel. Setup of the dongle is complete, and it should be recognized every time it is plugged into a USB port.

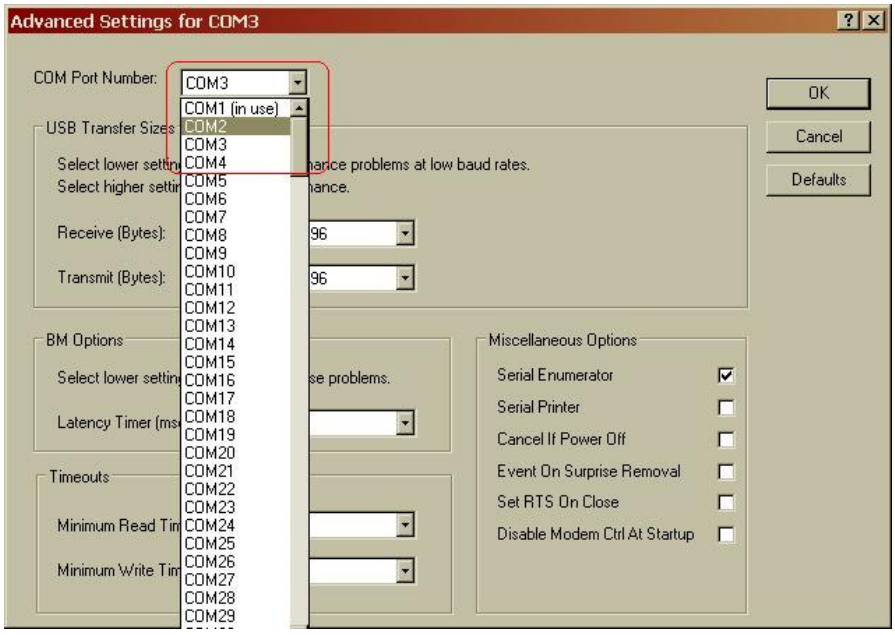

Figure 4, Selecting the COM port on the Advanced Screen

2.2.4 Running the Software—initial default setup

Click on the new Logger Icon on the desktop to bring up the software. Go to the ***Default*** tab and select the COMx port to be used. If you do not want to use the default download folder (C:\LoggerData) then use the directory frame to select the folder you want to use as the default. Also enter your time zone (+/- from GMT), and be sure that the clock on your computer is set correctly. All times used by the logger are based on the clock in the computer used to initialize a test, and if it is not accurate, logger times will not be accurate either. (nb: this does not effect the scan intervals, only clock time.)

Once you are finished, go to the ***logoff*** tab and close the software to lock in the defaults.

Plug in the Serial Interface Adapter cable (SIA), and re-open the software. The small box in the lower left corner should be red, and indicate no logger connected. If it is green and indicates a logger is connected, then the COMx port selected on the ***default*** tab is not correct and the correct port needs to be selected. Please contact your in-house IT person for assistance before contacting DASCOR.

2.3 Connecting the System and Signing On

The Serial Interface Adapter Cable (SIA) should be connected to the host PC using the 9-pin Serial cable supplied. Standard DB-9 "Mouse Extender Cables" may be placed in series if a longer length is needed. 25 feet is the upper limit. The Logger is connected to the SIA using the attached cable with the adapter included with the cable. Remove the cover on the logger to expose the connector and insert the plug end of the cable into it. The connectors are polarized so that they can only be plugged in correctly. Please note that several types of connectors may be used depending on the model variant. Loggers for use with the Micron DBST Sensors will have a Hirose Push-Pull type of connector, while other models will have an Alden push-on/twist-off type, or a DB-9 serial connector. For all types, the connector is oriented so the keyways are aligned with the receptacles, and then pushed in until firmly seated. A

click is felt or heard with circular connectors. The Alden's may require slightly more force to seat the sealing ring. When properly connected the alignment arrow will match the tab on the receptacle.

The Hirose type connector is removed by holding the shell of the plug and pulling straight out. The Alden type is removed by gently rotating the holding ring about 1/8 turn in the direction indicated by the arrow on the housing and gently pulled off at the same time. No connector requires any force to connect or disconnect, and no connector twists off or unscrews. If you feel excessive force is required, check the alignment of the keyways, look for bent pins, or for dirt or other obstructions in the receptacle or plug. DO NOT FORCE the connectors!

On successful connection, the software will read the logger information and display it on the PC. If the SIA is not connected, power is not available, or the SIA has not been upgraded to operate with this release, a message box may pop up indicating a problem. Please see the Appendices for details.

A more detailed top drawing identifying the various components may be provided on the distribution CD. Please note that the connections between the PC, wall power module (if used), and M1b loggers are virtually identical with older versions except for the shapes of the SIA modules and connectors.

2.4 Initial Calibration

LRCpH and CDR logger electronics and integral sensors should not require calibration more frequently than every 2-3 years, and should be returned to DASCOR for this service. Consumable or changeable sensors such as pH or external pressure should be calibrated as part of the system as often as required to maintain the desired level of accuracy. Please see the appropriate User's Guide for complete details on sensor calibration.

DASCOR maintains copies of the Calibration Data loaded into each logger shipped, and can provide copies on request for restoring loggers to their "as shipped" condition. Complete header information can also be backed up in the field. See the appropriate section for details of the procedure.

If the calibration data for logger and sensors being used has not been loaded into the logger or the sensors are changed, please go to the appropriate User's Guide for complete details on sensor calibration, or the calibration section of this manual and follow the detailed procedures given there. There is an optional password for the ***Calibration*** screen, which may be assigned by the system administrator using the ***Defaults*** tab. If a password is required, you will be required to enter only once per session on the first time attempt to access a calibration screen.

2.5 Setting Up a Test

Complete operational details are located in the User's Guide for each logger type. The following are generic procedures and may be different than those recommended for your specific logger model and application!

First, be sure that a NEW battery is installed in the logger. Connect the logger to the PC via the SIA. *Download* any test data in the logger from a prior test. Next, go to the *Setup* tab after the logger information is displayed, and then:

1. Select the number of channels to be logged.
2. Enter the time interval, and click on the *Seconds, Minutes,* or *Hours* button. Verify the maximum number of scans and logging duration in the *User Message Area.* The maximum allowable scan period is 18.2 hours, 1092 minutes, or about 65,520 seconds. The minimum allowable scan period is 1 second, but with potential communications problems. The recommended minimum is 10 seconds.
3. Enter up to 64 characters in the *Project Identification* field.
4. Print the screen and optional notes, if desired.
5. Initialize the logger. If data is on the logger from a previous test and has not been downloaded, then you will be offered the opportunity to download the data, or bypass the download and initialize the logger anyway. In either case, old data will be lost!
6. Follow the directions to disconnect the Logger and wait for the first flash of the LED to verify independent operation. Then reconnect the Logger to reload the display and verify that all the setup parameters are indeed correct.
7. Finally, disconnect the logger and deploy it.

2.6 Downloading Test Data

1. Connect the logger to the PC via the SIA.
2. Review the data on the logger that is displayed in the *Data Logger* tab.
3. Press the *Download* button to start the download process. The data will be stored to the default download path set in the *Defaults* tab, and a unique file name will be generated, based on the host PC's location code, and the date and the time. This information is displayed on a screen common to most windows' applications, and may be modified as desired. Press OK when the path and file name are acceptable.
4. If you get a small error box at this point, the default folder path was not stored correctly in the registry, or the folder has been deleted or moved. Go to the ***Defaults*** tab and correct the path.
5. Download progress will be shown on the Data Logger tab as a progress bar. Downloading occurs at about 500 characters a second. With a 292K memory and fast computer, downloading can take over 25 minutes, and up to an hour depending on the computer being used for the download.
6. When download is complete, you may proceed to another task by selecting the appropriate tab. or unplugging the logger from the SIA. When unplugged, or following download, the logger will also be in the low power/stop mode. If the logger is not going to be used for a while, it is best to remove the battery before storage. DO NOT leave the logger plugged in to the computer as it is kept in high power mode and will deplete the batteries rapidly!
7. The data, time, and download file name will be displayed on the ***Data Logger*** tab.
8. Two files can be created with the same name. The .CSV file is in the standard "Comma Separated Variable" format, which is readable by almost every spreadsheet or data analysis program. The .RAW file is an image of logger memory and is available for analysis in the event of lost or corrupted .CSV files. The .RAW file creation is optional and can be set on the ***Default*** tab. Selecting the .RAW file will increase the download time!

2.7 Observing Real Time Data

By selecting the Real Time tab, and selecting the appropriate commands, data may be rapidly taken by the logger and displayed in numeric or graphic format on the PC. This function is useful for checking the operation of sensors, generating or verifying calibration, and visually tracking data. Details on the screens, the commands, and options are given in the appendix A.

To utilize the high-speed features of the RT screen, the data logger must be stopped. However, it is possible to bypass stopping the logger and simply monitoring data as it is acquired and stored by the logger. In this case, the RT screens will be updated at the scan interval set into the logger—which could range from seconds to hours.

2.8 Signing Off

When you are done with all logger operations, select the ***Log Off*** tab, then click on the ***Exit*** button to shut down the program.

3 Theory of Operation

3.1 Overview

The Data Logger records from one to eight channels of information from connected sensors. The number of channels available is factory set based on the logger model and application and may be less than eight. Sampling rates are user definable from once per second to once every 18.2 hours. The Data Logger operates from a self-contained 9-volt battery and is totally autonomous once the Data Logger setup information has been uploaded to memory. Standard memory options vary from 16K to 229K. Data is retained even if power is lost. The Data Logger is designed to operate within a temperature range of -40 to +85 degrees Celsius (-40 to +185 F.) if suitable batteries are installed. Loggers have been accidentally exposed to temperatures has high as 150-200 degrees Celsius and recovered to operate with little or no detectable shifts in the calibration. The battery, however, usually dies almost immediately at the elevated temperatures, which will generate a *low battery* fault condition before the logger stops completely due to lack of adequate power. For loggers installed in PVC cases, the recommended maximum temperature is 55-60 C.

The Data Logger housing is dependent on the model and application, and can range from a small die-cast aluminum box (DBST style), a large Stainless Steel housing (CDR style), or PVC housing (LRCpH style). Logger variants will have different connector and sensor sets that are appropriate to the model and application. Refer to the diagram below for a connection block diagram or the Calibration setup Appendix for detailed photographs.

The Data Logger program operates on IBM compatible computers using the Windows operating system. Once started, the user may use the [tab] key, [enter] key, or mouse to move between tabs/options. The Data Logger is programmed by connecting the Data Logger serial port to a PC running the Data Logger software. Data is transmitted between the data logger and the host computer at 9600 baud. Data files are downloaded in both a "raw" memory image archive format file (optional) and ". CSV" comma separated variable file format, which can be input by most spreadsheet programs for data manipulation.

3.1.1 Channels

The number of installed channels in the Data Logger is dependent upon the Data Logger model purchased. Current models provide from one to eight channels. The number of active channels installed in a given Data Logger is presented on the *"Logger ID"* tab. Users have the option of determining how many of the installed channels will be active. This feature is provided by a row of push buttons on the *"Set Up"* tab. The number of active channel buttons displayed is limited to the number of channels installed in the Data Logger. Active channels always start with the first channel and count upwards. It is not possible to select random channels or provide a scan list with the M1b logger. If the sensors associated with a higher number channel is not required, selecting a lower channel count will increase the available memory for the test, and increase the test duration.

3.1.2 Memory

The Data Logger uses EEPROM memory. This results in retention of data even after battery power is lost. The amount of memory installed in a given Data Logger is presented on the Data *"Logger ID"* tab. Current Data Logger models range from 16K to 229K bytes, with 229K being the current default.

3.1.3 Rate

The Data Logger can record data from once every 18.2 hours to once per second. Models with faster scan rates are in development. The Data Logger utilizes a "burst" mode to sample the active channels to minimize skew between channels. It is not recommended to sample faster than once every 5-10 seconds if possible, as communications with the PC can be erratic, and the time base in the logger is subject to increased jitter.

In order to verify that the logger is in fact taking data when it is disconnected from the SIA, the first scan can be delayed by a ***delay in seconds*** set on the default screen. This allows the logger to be set up, disconnected from the SIA, and to have the LED blink on the first scan after a short interval where the operator can observe it.

In cases where a fast scan rate is required, but there will be an unknown interval between setup and the desired start of data taking, some logger models have a pair of pins designated for *Remote Start* or *Pause.* When these pins are shorted by the insertion of the ***Remote Start*** plug, the logger will not take data. From an intrinsic safety

standpoint, the absolute maximum voltage that will appear on this pin is the battery or external power supply voltage less one diode drop—typically this is 9 volts or less. Current is resistor limited to a few micro-Amps, and there is no capacitance in the circuit.

3.1.4 Environment

3.1.4.1 Temperature Limits

The Data Logger electronics are designed to operate within the temperature range of -40 degrees. to +70 degrees Celsius (-40 to 158 degrees F.). Limits on the battery installed in the logger will, however, restrict the total operating temperature range to that of the battery. Temperature also affects the available power from the battery—and thus its life—and should be considered when selecting batteries and setting up the test parameters. Loggers have been inadvertently exposed to temperatures in excess of 150 degC and have continued to operate successfully with no damage other than the loss of the battery.

3.1.4.2 Humidity

The M1b series Data Logger is designed to operate from 0 to 100% humidity, non-condensing, when operating as a stand-alone unit, with the enclosure intact. The LRCpH model is designed to operate submersed up to 10 feet.

3.2 Physical Characteristics

3.2.1 Dimensions

The M1b series Data Logger electronics are approximately 2.5 by 2.25 by 0.5 inches excluding connector protrusion. Housings will vary widely based on the model and application.

3.2.2 Weight

The M1b series 8-channel Data Logger weighs approximately 230 grams in the aluminum enclosure configuration, including the battery.

3.2.3 Power Requirements

9-volt batteries are used as the source of power for the M1b loggers. A lithium battery is recommended for both long life and safety considerations. High quality alkaline batteries will give good service at lower cost when shorter intervals between changes and their failure modes can be tolerated. Remember to reset the battery-installed date as well.

It is STRONGLY recommended that new batteries be installed at the beginning of tests which cannot be repeated easily due to their expense in set-up or duration. Batteries are very inexpensive compared to potentially lost data. Batteries should ALWAYS be removed when the logger will be transported or stored for more than a few days. Damage caused by battery leakage or other failures is not covered by warranty.

When connected to a SIA model powered by a 115v AC to 15V DC wall unit, the Data Logger will operate off the external power as long as external power is higher than internal power by about 1.6 volts. These conserves internal battery power during upload and download operations. It also enables continuous on-line logging, if desired. Only the Micron model has this feature at present. [FIX]

The loggers may be run with external power for special applications. Please contact the manufacturer for more information.

Sudden loss and rapid return of power will cause a “Power-On Reset” condition, which will be reported on the logger data screen. Logging will continue with accurate data being recorded, but the time base will be corrupt for all data logged after the error occurred. This is different than a low battery error, in that the battery has been disconnected and reconnected, rather than being used up. With a battery low condition, data taken after the battery passes its lower limit may be seriously corrupted.

3.3 Software Description

The software is provided as a self-installing program for Windows™ based IBM compatible personal computers. Once the program is installed, all communications with the Data Logger are performed by input to text boxes or selection of command buttons contained on the tabs. All required functions to setup, operate, maintain, and download the Data Logger, are provided by the Data Logger software. The user may move from one function to another through the use of the [enter] key, [tab] key, short cut keys or mouse. The shortcut keys consist of the [Alt] key and the underlined letter on the desired tab. The program is designed to run on an IBM compatible computer running the Microsoft Windows XP or 2000 Pro™ operating system. The Data Logger program was developed using Microsoft Visual Basic Version 6™.

3.3.1 Older and Newer Operating Systems

Versions prior to M1b-V6.10, and operating systems other than Windows 2000 or XP are NOT supported, although the software is believed to be stable on most installations of Vista, Windows NT 4.0 or later, and on Windows 98 Release 2. Operation on Dell computers has been frequently reported to be unreliable, and use on Dell computers is not recommended or supported. Problems with installations on computers running on operating systems other than XP will be handled on a case-by-case basis.

3.4 Installation

The software is provided on a CD, along with copies of this manual, and other useful Utilities. Please consult the README.TXT file in the root directory of the CD for current installation and setup information, as well as known bugs. Further detailed information is given in *the Installation and Documentation CD* section.

3.5 Version Information

This manual is intended for use with the program *Data Logger M1b-V6.10* **ONLY**. All screens were drawn from this version. Prior versions are different, but the overall concept has remained the same and it should be possible to move from older versions to the current version with a minimal learning curve.

4 Operator Tasks

4.1 Overview

The user programs the Data Logger by selecting the tab associated with the desired function. The tabs that appear when the program first starts are the Log-***On*** and the ***Defaults*** tabs. The ***Log-On*** tab enables the user to log on to the system and perform all normal logger functions. The ***Defaults*** tab enables a user to select the default COM port to be used by the computer to communicate with the Data Logger, the default file storage path, and other optional features. Successful log-on results in the system verifying that it is communicating with the Data Logger and displaying Data Logger identification information on the ***Data Logger*** tab. Download data capability is provided by a command button at the bottom of this tab. The user may then proceed to the ***Setup*** tab to input new Data Logger setup information or to any of the other tabs to select auxiliary functions. Prior versions allowed for three passwords with protected levels of access, which have been removed on this release. Prior to delivery, logger I. D. and sensor calibration data is up-loaded to the Data Logger memory. This information is subsequently displayed to the user on the ***Data Logger*** and ***Cal Data*** tabs. The various Tabs and the controls contained therein are shown in the Appendices, along with summary information on their use.

4.2 Tabs

4.2.1 Log-On Tab

The ***Log-On*** Tab enables the user to gain access to the system. Upon successful log-on, the appropriate tabs become visible and program variables are set. The individual data elements that appear on the ***Log-On*** tab are described below. The ***Log-On*** tab will automatically load the ***Waiting*** tab, after which the logger setup is loaded into the user's PC memory. Upon successful log-on, the title of the ***Log-On*** tab changes to ***Log-off***. To exit the program the user returns to the ***Log-Off*** tab and selects the ***Exit*** command button.

Also shown on the ***Log-On*** screen are the current date and time from the local computer, and the GMT (Greenwich Mean Time or UCT) based on the time zone information entered into the ***Default*** tab. Selecting this item terminates the program and returns the user to the main window.

4.2.2 Waiting Tab

This tab is displayed while the program is waiting for a Data Logger to be plugged in. Once connected, a progress bar is displayed while the Data Logger downloads header information. If communication could not be successfully established with the Data Logger, an error message is displayed advising the user to check the connections. Upon completion of header download the ***Data Logger*** tab is displayed.

If the information in the ***Data Logger*** tab needs to be updated, the logger should be disconnected and then re-connected. Following initialization, this step is required to allow observation of the first LED blink which verifies autonomous operation, and forces a reload of the setup information for further verification of the setup.

4.2.3 DATA LOGGER Tab

The ***Data Logger*** tab identifies the specific Data Logger that is connected to the PC. The individual data elements that appear in the ***Data Logger*** tab are described below. All fields are "read-only"--except where noted. Otherwise, data displayed is set at the factory and the user cannot change the displayed data. The data shown is retrieved from the Data Logger memory upon connection with the PC. Initial logger ID data is loaded by the factory prior to shipment. Advisory Messages and Current Set-Up information is derived from data currently stored in the Data Logger memory.

This screen is also updated after every initialization, and can be updated on command by clicking the lower left button in the status bar at the bottom of the open window. Several boxes will change color depending on the data contained and its importance to test status.

4.2.3.1 Model Number

Identifies the Model Number.

4.2.3.2 Serial Number

Identifies the Serial Number.

4.2.3.3 Header/Software Version

Identifies the Header Version which should be "**0600**" and the software version last used to initialize the logger, which should be "**0610**" or later.

4.2.3.4 Firmware Version

Identifies the Firmware Version, which should be "**JNO9**".

4.2.3.5 Memory Installed

Identifies the quantity of memory installed in bytes. Divide this number by two to get the number of possible data points. The number of data points may be divided by the number of active channels to get the maximum number of scans. Dividing the maximum number of scans into the total logging time will give the scan interval. During setup, these calculations are performed and the results are available on the ***setup*** tab.

4.2.3.6 Installed Channels

Identifies the number of installed channels. (i.e. the number of channels physically present and usable in the logger.)

4.2.3.7 Active Channels

Identifies the number of currently active channels. This information can be changed by the user on the ***Set-Up*** tab, and is limited by the number of installed channels.

4.2.3.8 Resolution

This value has been removed from Version 6.10 Software, as it is always 12-bit.

4.2.3.9 READINGS of the first three active channels

Readings are taken from the data logger when the header is read, and are displayed in engineering units. This display is useful to verify that the sensors are working. Chan-3 is the battery level in volts. NEW batteries will be typically over 9 Volts. Batteries that are below 8 volts do not have much life left, and should be replaced for new tests. Logger operation and data is questionable below 7 Volts, and the battery must be changed prior to further operation. Data can be successfully downloaded as long as battery voltage is 7.2 Volts or above.

The current readings can be updated by clicking on the blue button immediately above the readings.

4.2.3.10 Battery Change Date

Identifies the date the battery was last changed. The user can update the date of battery replacement on the ***Cal Data*** tab.

4.2.3.11 Project ID

Identifies the Project Identification information. The user can enter this information on the ***Set Up*** Tab. 64 characters are allowed.

4.2.3.12 Alerts

Displays a message describing conditions that affect the data and/or time base stored in the logger, along with the scan in the data file where the alert occurred. If a temporary low battery condition occurred, the low battery flag would be set. The low battery flag is set at 7.0 volts, which is the effective end of life for most 9-volt batteries. On low battery, the signal conditioner voltages are approaching a level where accuracy will be compromised, and the data will be unreliable. A power-on reset is most often caused by changing the battery. This condition will corrupt the time base following the event, but the data will still be valid.

4.2.3.13 Test Status

Displays a brief message on test and memory status. Messages are "Logging Enabled," "Test Done," and "Memory Full".

4.2.3.14 Download Time

Displays the date and time of the last data download.

4.2.3.15 Download Status

Displays the download status of the data in the logger. If the data has been downloaded, the file name will be shown (up to 32 characters).

4.2.3.16 Sampling Period, Start, and Stop Dates

Displays the sample period in hours, minutes, and seconds that is currently in Data Logger memory. User can change the sample period on the ***Set-Up*** tab by re-initializing the logger. The Start and Stop dates/times are the date and time the logger was initialized, and the projected date and time that memory will be filled. The stop time should be after the required end of test time!

4.2.3.17 Memory Available

This box contains three numbers in the following format: [e.g. 2045 / 2045 = 100%]. The first number is the number of scans remaining to be taken at the moment the logger is read. The second number is the number of scans commanded to be taken. This number should match closely the number of maximum scans calculated during logger setup. The cause of any deviations of more than 2% should be determined before deploying a logger to the field. The incidence of deviations will increase significantly at very low scan intervals (of a few seconds). The last number is the percentage of unused or remaining memory based on the known amount of installed memory and the actual memory pointer in the logger. The values shown may deviate from the results derived by dividing the first two numbers due to math errors caused by rounding effects.

4.2.3.18 Download Command Button

Selecting this command button enables the user to download the header and all the data stored in the connected data logger. Selection results in the display of a standard Windows Dialog box for opening and saving data to a file. User can select the default file name and directory or can input the directory and file name of their choice. Two files are downloaded. The first file carries the extension ".RAW". These is an archival log of the raw data coming through the serial port and is in a packed ASCII hexadecimal format, and is generally used only for debugging and recovering from setup and download problems. The creation of this file can be enabled on the ***Defaults*** tab. The default condition is OFF.

The second file carries the extension ". CSV". This file displays all the information from the header and the sensor readings after conversion to engineering units. The readings are indexed to the time that the reading was taken. This data can be displayed and manipulated in most spreadsheets as either columnar data or as a graph.

4.2.3.19 Print Command Button

Eliminated in V-6.10.

4.2.3.20 Stop Logging

This command button forces a *Stop Logging* condition to maximize battery life. It is used whenever it is desired to store the loggers for a short period of time without removing the batteries. Once selected, the logger must be re-initialized to set it up for any subsequent tests. In cases where very fast scan times are selected (e.g. 1 or 2 seconds), this button can be used to force the logger to stop logging even when the header data cannot be successfully downloaded. Once stopped, disconnect, then reconnect the logger and header download should work.

4.2.4 Setup Tab

The ***Set Up*** tab is used to initialize the Data Logger at the beginning of a test. The ***Set Up*** tab is shown in Appendix A. The individual data elements contained on the ***Set Up*** tab are described below.

4.2.4.1 Active Channels

A bar consisting of multiple push buttons allowing selection of 1 to 8 channels is displayed at the top of the tab. The number of buttons displayed is limited to the number of channels physically installed in the Data Logger. Selecting a button will enable recording of data on the number of channels indicated. Active channels always begin at channel one and progress upward. Individual channel selection is not supported.

One button must always be selected. The default will be based on information from the logger currently connected.

4.2.4.2 Scan Period

4.2.4.2.1 Interval

The user inputs how frequently the Data Logger is to scan the sensors and record the data. Acceptable values range from 1 second to 18.2 hours. Input of less than 1 second or more than 18.2 hours result in an error message being displayed. The M1b loggers were intended for long term environmental logging, and although it is possible to set the scan interval to once per second, it is not recommended to scan much faster than once per 10 seconds due to communication difficulties.

4.2.4.2.2 Time Unit

User inputs the unit of time to be used with the sampling interval. Unit selections are seconds, minutes or hours. One button must be selected. Changing any of the other settings will un-select all of the three options. The units must be selected again to force the correct calculations for start and stop times.

4.2.4.2.3 Calculations

Based on user scan period selections, installed memory, and number of active channels, the system computes the maximum logging duration and displays maximum scans and maximum logging duration. The stop date is also calculated and displayed in the Stop Date box. These messages are displayed in the User Message Area.

4.2.4.3 Project Identification

User may input up to 64 characters to describe the project. Any standard keyboard characters may be used.

4.2.4.4 Initialize Command Button

Selecting this item initiates the uploading of setup information to the Data Logger.

In the event the data in the logger has not been downloaded, or newer data has been acquired since the last download, a warning will be shown, and the screen will change to show two new commands: *Download Data* and *No Download, Initialize.* Selecting the first button returns the user to the ***Logger Data*** tab to allow a normal data download. After download, the user must return to the ***Set-Up*** tab to continue initialization of the logger.

The second button, *No Download, Initialize,* bypasses the data download and initializes the logger immediately. If the second button is selected, and data has not been downloaded in a recent prior session, all data from the previous test will be lost.

Once the logger is initialized, it is impossible to recover old data.

The PC Clock time at time when the initialize command is selected becomes the immediate start time. It is important the time setting of the Host PC's clock be accurate and set to a national time standard. The Atomic Clock software package from Parsons Software is an inexpensive way to maintain accuracy, and other shareware packages are available through NIST. Clock accuracy is particularly important if loggers are set and downloaded by multiple PC's, and the time of logged events must be compared between multiple loggers.

4.2.4.5 Print

This command button will send an image of the current window to the local printer.

4.2.5 Cal Data Tab

This tab option enables the user to view the sensor calibration data initially entered by the factory, or subsequently updated by the User.

This data is used to convert the raw data into engineering units.

4.2.5.1 Cal Data Summary by Channel

The displayed grid shows a summary of the cal data previously entered for each of the sensors. The individual columns are defined below.

4.2.5.1.4 CH # (Channel Number)

Numeric identification of channel position from one to eight.

4.2.5.1.5 Model Number

Model number of the specified sensor. May be up to 8 ASCII characters.

4.2.5.1.6 Sensor # (Serial Number)

Serial number of the specified sensor. May be up to 8 ASCII characters.

4.2.5.1.7 Slope

The value of the slope used in the calibration of the specified sensor. Used to convert the raw data to engineering units. This is the "m" of the formula "y = mx + b"

4.2.5.1.8 Offset

The value of the offset used in the calibration of the specified sensor. Used to convert the raw data to engineering units. This is the "b' of the formula "y = mx + b"

4.2.5.1.9 (Engineering) Units

The engineering units for the specified sensor, such as degrees Celsius (degC) or pounds per square inch (PSI). This may be up to four ASCII characters.

4.2.5.1.10 LOC (Location Code)

A brief indication of the location where the specified sensor is installed. This may be up to four ASCII characters.

4.2.5.1.11 CAL DATE

Due date for the next calibration.

4.2.5.2 To Perform Calibration

Channels are selected for calibration by double-clicking on one of the channels shown in the table. If the system administrator has entered a password on the default tab, then that password must be entered when attempting to access a calibration screen for the first time during a session.

This action presents a new form that enables the user to input selected data. Upon entering the data and selecting the ***Compute Calibration*** command button the calibration data is automatically calculated and shown on the screen. It is saved to the logger when exiting the form using the ***Exit/Save to Logger*** button. A complete description of various aspects of the Calibration Subroutine is provided in the Appendices.

Calibration in the field is not required for the electronics in LRCpH and CDR data logger models, or for permanently installed sensors. Field replaceable or consumable electrodes will require system calibration at the time of use. See the appropriate User's Guide for details. It is suggested that loggers be returned to the factory for calibration and upgrade every 2-3 years, or if the readings become questionable for any reason.

4.2.5.3 Battery Replaced

Checking this box results in the current system date being up-loaded to the Data Logger memory. This date is subsequently displayed on the ***Data Logger*** tab. It is the user's responsibility to check this box when a new battery has been installed! It has no effect on battery life or logger performance, but is included to help track the age of batteries. See the Appendices for more information on battery life.

Any data should be downloaded prior to changing the battery, and the logger must be re-initialized afterwards.

4.2.5.4 Save/Print/Recall

The first command button will allow the user to save all of the calibration setup to a file in the default logger data folder and/or send it to the local default printer. The second command button allows data previously stored in a file to be recalled into active memory temporarily. If-and-only-if the third button is clicked, the loaded data will be stored to the memory in the logger.

It is always good to use this to back up calibration data, but restoring and saving data to the logger from a file will completely replace the existing calibration data. This can be dangerous since it may cause the replacement of good calibration data with incorrect or obsolete data.

4.2.6 Defaults Tab

The *Defaults* tab can be accessed at any time. However, once a logger is connected, it should only be used to change the default data storage folder, correcting the time or time zone information.

4.2.6.1 Serial Port Selection

This menu selection enables the user to select which serial port will be used to communicate with the Data Logger. User may choose between communication ports 1 to 4. This data is saved to the PC's Registry and is recalled during subsequent startups of the program.

The program will not automatically search for the correct port. The user must determine the port and enter it correctly for the program to work. With the cable plugged into the pc, but not connected to a logger, the text box in the lower left corner of the window should be red and say "Logger Not Detected"…if it says "Logger Connected" in green letters, then the wrong port has been chosen, or is not operative.

4.2.6.2 Default Path

This group of boxes allows the user to select the default folder to be used for storage of data files. This data is stored in the PC's Registry and is recalled during subsequent startups of the program. It can be over-ridden when the data is downloaded from the logger.

4.2.6.3 Computer ID Code

This box allows the user to input a one letter location identifier or computer ID code. This information is subsequently included in each download data set, and differentiates between download computers. Its use is optional.

4.2.6.4 Calibration Password

This function allows the system administrator to require a password for access to the calibration screens for each channel. If no password is entered, then no password will be required. A password should always be used if non-trained operators may be using the system as it is possible to corrupt the calibration data unless it is protected.

4.2.6.5 CREATE REPORT

This button will allow the user to select a .CSV data file and convert it to a pre-formatted report, including charts, as a new XLS file with the same name as the source file. Conversion time is heavily dependent on computer speed! Please contact DASCOR for more information on customizing the report format.

4.2.6.6 RAW file

Check the box to create the optional .RAW binary file during download. This file is a direct image of the logger's memory and is usable for diagnosing problems.

4.2.6.7 Date Time Settings

Local system, and calculated GMT times are shown in the shaded boxes. Current date, time, and time zone (Difference in hours from time at the Greenwich meridian) offset may be entered in the light colored boxes and will update the PC's real time clock. If a separate program such as "Atomic Clock" is used to keep the PC's time current, then only the GMT delta in hours needs to be entered to have correct GMT time shown.

It cannot be over-emphasized that the accuracy of the dates and times used by the loggers are based on the correctness of the dates and times entered here!

4.2.7 Real Time Tab

This tab option allows the user to view the real time sensor readings on the active channels. This data is displayed in engineering units or in milli-Volts. Columns displayed are Sensor Number, Current Reading, and Engineering Units. A check box is also provided to display the data as milli-Volts without any conversion being applied. Another check box is provided to display cumulative statistics on each channel. Checking the box will reset the values and sample count, and start the process. Un-checking the box will freeze the readings at the last count.

Prior to actually entering this tab, the operator will have the option of stopping the logger if it is set up and logging. If the logger is stopped, then the Start/Stop buttons will function, and data will be read and displayed at the interval selected at the top of the window. If the logger is allowed to continue logging, then the screen will be updated whenever the logger takes data based on its own internal scan rate. If logging is stopped, then the logger must be re-initialized to continue logging data. Be sure to download any data prior to reinitializing!

The Stop and Start RT Display command buttons at the bottom of the window will start and stop the real time readings. Disconnecting the logger will also stop the display. RT Display should be stopped whenever leaving this tab.

Switching between displaying data in mV (ADC Counts) or in Engineering Units will also stop the real time display, which must then be restarted.

4.2.7.1 Update Interval

This box allows the user to input the desired sampling interval of the data displayed in the Real Time display grid. Entered numbers will update the sample interval at the next event. 1/2 [0.5] second is the fastest interval allowed.

4.2.7.2 Start Real Time Display Command Button

Selecting this item initiates data flowing into a data grid showing current sensor readings.

4.2.7.3 Stop Real Time Display Command Button

Selecting this item terminates additional readings from being displayed in the grid. It is always a good idea to stop the real time display before moving to a different tab, although this is done automatically under certain situations.

4.2.7.4 Show Graph Command Button

Selecting this command will bring up a strip chart presentation of the data in mV. Values for various Axis scaling can be set as well. Additional information is given in Appendix A-7b.

4.2.8 About Tab

This tab item provides a brief overview of the Data Logger functions and operator interface. It also provides contact information for the Data Logger manufacturer.

4.2.9 Program Help Tab

Although almost every command and option has a "tool tip" that pops up when the cursor is placed over the item, this manual is also accessible—complete with table of contents, index, and search functions. For quick access to answers for most questions, go directly to the screen descriptions in the Appendix.

Also included on this tab are buttons that allow storing and recovering complete sets of header and calibration information for each logger. These commands are intended to be used as for "last resort" diagnosis of problems, and for restoring the logger setup/header memory to its "as shipped" configuration. DASCOR maintains copies of the logger memory for each logger shipped after July 2007. and will assist in restoring any logger whose memory is corrupted.

An onsite backup of logger header memory is always a good idea. Click on the "Save Header Data to a File" button. ADD any identifiers to the END of the filename and save to the default folder. The first part of the filename is created from the serial number, date, and time of the download.

4.2.10 Log-Off Tab

The only option here is to exit the program.

4.3 Unit Maintenance

4.3.1 Battery Replacement

Battery replacement varies with the model of logger, and is given in detail in the appropriate User's Guide.

4.3.2 Frequency

Frequency of battery replacement is dependent upon the environment that the Data Logger is exposed to, amount of memory installed and scan frequency selections. Battery life is projected to be just over 1 year for normal use in environmental logging—but can be as short as a few days!

Batteries are Cheap compared to the cost of setting up and running a test—always install fresh batteries when starting a high cost or long duration test.

4.3.3 Methodology

Battery replacement is described in the User's Guide appropriate for your model logger. Upon completion of battery replacement, the new date is uploaded to Data Logger memory by checking the Battery Replaced box on the *Cal Data* tab.

4.3.4 Battery Type

The Data Logger uses a standard 9-volt radio battery. Lithium batteries are recommended for both life and safety considerations. Alkaline batteries may also be used. Carbon and Ni-Cd or other rechargeable batteries should not be used. Rechargeable batteries have much lower overall capacity, and a much lower starting voltage. Unless the tests are of short duration, and the proposed battery has been tested and proven to provide power for the minimum required test duration, rechargeable batteries should never be used.

There are significant differences in performance between batteries from different manufacturers—and often between batches of batteries. Please call DASCOR if you have any concerns over battery selection! ULTRALIFE brand lithium ion batteries are about $6 each, and are available from Mouser and most Radio Shacks.

4.4 Software & Documentation CD

4.4.1 Program Installation

Please see Section 2 (Quick-Start) for more details.

The software is supplied as a self-installing executable .MSI file. The current version of the program is written in Microsoft Visual Basic Version 6 and should install correctly and operate under Windows 95™, Windows 98™, and Windows NT 4.0™. HOWEVER, it is guaranteed to work properly ONLY under Windows XP or XPpro. Please read the README.TXT file included with the installation set for current instructions, changes to the software, and known bugs. Versions prior to M1b-V6.10 are no longer supported, as are loggers that have not been upgraded to the M1b standard, including the "JN09" firmware.

On first time installations, you will also need to go to the default screen and set the various required system parameters. The Administrator can set the calibration password if required. See the appropriate sections of the manual for details on these procedures.

If you receive a message that the COM port is already open, then a device may already be active on that port. Use the default tab to select another free port. You will then need to exit and re-enter the program for the change to take effect.

If older installations exist, they should be removed using the Windows Setup folder "Remove Software" option. Loggers used with older versions will have their header formats automatically updated to the new V6.10 format, and will no longer operate correctly with older versions of the software. Be sure to download all data from loggers initialized with the older software PRIOR to installing and using the new version.

4.4.2 Documentation

Complete documentation, including this manual, is located on the CD or downloaded install files in the folder called *Documentation*. The files are in Adobe Acrobat format (.PDF file type) and require the Acrobat Reader in order to access the files. Most systems set up for Internet access already have this utility installed, and double-clicking on any of the file Icons will bring up Acrobat and open the file. If not, you will need to install Acrobat on your system. It is suggested that copies of the documentation be moved to the folder holding the program (typically "C:\Program Files\DASCOR\") and shortcuts be placed on the desktop.

To install Acrobat, open the Adobe Acrobat Reader folder, and read the *readme.wrt* file for detailed instructions. From within Acrobat, you can print the files to your system printer.

The same information is also included in a .HLP file located with the program. This file can be accessed from the Help tab, or by pressing F1 for context sensitive help from any screen. The .HLP file will be updated periodically, and updates will be announced through the DASCOR Newsletter or by direct email.

5 Warranty

5.1 Time Period

DASCOR, or its resellers, provide a one-year warranty on materials and assembly of the Data Logger and Serial Interface Adapter hardware except for damage due to improper use or battery failure, as determined by DASCOR. DASCOR, or the reseller, will repair or replace standard production units at their option as soon as possible after receipt, freight pre-paid—typically within ten working days. Custom units, including those with DBST signal conditioners may require several weeks. In the event the problems are not covered by warranty, the purchaser will be advised of the options and costs for repair, replacement, or upgrade.

Please contact the company from which you purchased the logger before contacting DASCOR.

There are no warranties against loss of data or other consequential damages. Sensors and other consumable items do not have a warranty, although DASCOR will attempt to work with the User to identify the cause of any failures, and suggest means to prevent further occurrences.

5.2 Product Certifications and Registrations (UL, FM, EC, ETC.) & Fitness for Use

5.2.1 Regulatory and other Agencies

Due to their experimental nature and currently limited production, as well as being incorporated into products manufactured by others, the M1b loggers have not been tested to the requirements of any governmental or other regulatory agencies. Several users have performed in-house testing for use in explosive environments, and for shock and vibration resistance. Referrals are available on request.

The loggers are NOT ROHS compliant at this time, and have not been tested for FCC part-15 compliance due to their extremely low power (90 mW maximum, 0.42 mW normal), low duty cycles, and low frequency operation (32 KHz typical).

5.2.2 Fitness for Use

DASCOR and its resellers make no warranty of fitness of use for any particular applications. It is the sole responsibility of the purchaser to determine if the loggers and support software will meet the requirements of their particular application.

6 Trouble Shooting Suggestions

6.1 Port Already Open Error Message

This error message may occur on new installations if the Data Logger Programs' default port, COM port 1, is already in use by another program. Possible solutions are to change the Data Logger communication port to another port or to change the port assignment of the conflicting device. The Data Logger default port may be changed on the "Default' tab. Selecting this tab allows the user to select COM port 1, 2, 3, or 4. This data is then saved to the Registry and is used by the program as the new default port the next time the program is loaded. This error can also occur if a second copy of the program is opened. Use the CTRL-ALT-DEL key combination to check to see if a copy of the Data Logger Program is already open. If it is, choose *close task* to close the copy/ies already running, then re-open one new copy.

In extreme cases, MS-Windows gets confused, and nothing works but shutting down and re-booting the system. Unfortunately, this is a recurring problem with many applications and is not unique to ours, and we have not been able to positively identify the cause. This problem is known to occur with higher frequency on DELL brand Laptops.

6.2 Bad File Name or Number

This error may occur on new installations during the first attempt to download data to a file if the default path folder is not already created on the computer, or the default file path for download data is no longer valid. On first bringing up the software, select the "Default" tab and enter the desired default path for saving data files. Exit the program and Log-On again. The program will retrieve from the Registry the new default path that was entered and use it for saving data files. The V6.10 release will force the creation of a folder ***C:\Logger Data*** in the event it cannot find the default folder.

6.3 Cannot Communicate with Data Logger

Ensure that power is applied to the Serial Interface Unit, if applicable. Verify that a good battery is installed in the logger, with Vbat > 8 volts. Verify that all connections between the Data Logger, Serial Interface Unit and Computer are secure. Check for bent or missing pins on connector. There are also times when the software will continue to attempt to download or upload data after losing contact with the logger. This condition self-corrects if the logger is left unplugged for one or two minutes, and then is re-connected, or if the software is closed and then re-opened.

It is always a good idea to be sure the battery in the logger is good. Dead or low batteries will prevent the logger from starting and from communicating. Finding that a brand new battery is dead is very uncommon, but it does happen. Measure the battery voltage with a battery checker (available at Radio Shack for a few dollars).

6.4 Will Not Accept Password

Passwords are case sensitive, so ensure that proper combination of upper and lower letters are being used. Check with your Administrator to ensure that you have the latest password.

6.5 When in Doubt

When in doubt, always shut down the program and restart it. Cycle power to the SIA as well, if the external power option is installed. Serial ports will occasionally lock up, and restarting Windows will often cure the problem.

PLEASE!

Chronic problems that can be repeated under controlled circumstances should be reported to DASCOR as soon as they are identified.

If we don't know about them, we can't fix them.

6.6 Data Becomes Unusually Noisy Or Goes To An Extreme Value

"Clipping" (identified as "**HI-CLIP**" or "**LO-CLIP**") is almost always caused by one of the sensors failing. This results in a conditioned signal output that is higher than can be accepted by the analog to digital converter.

This condition can also be observed when periodically downloading data, or running ***real-time***. If a channel is showing maximum or minimum full-scale readings without changing, then the sensor, leads, or connectors are faulty.

Also, be sure the logger is grounded to a local chassis or earth ground point using the thumbscrew attachment point on the logger case if one is provided.

Please contact DASCOR for assistance if you continue to encounter these problems on newer units.

Additional information is included in the User's Guide.

7 Appendices

7.1 Appendix A - Data Logger Tabs

7.1.1 Active Tab: Log-On

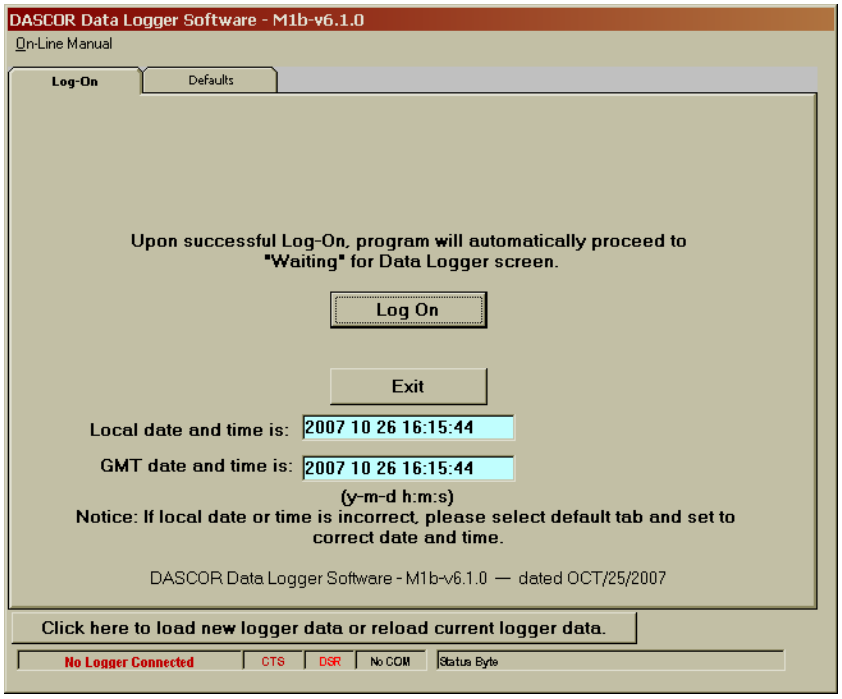

Figure 5, Logging On to the Software

Called By: When program starts

Description: Main Startup screen

Action: ***Log On***: Move to Waiting Screen while Logger downloads setup information or waits for a logger to be connected.

Exit: Exit the program and return to Windows.

Default Tab: To Set system defaults.

- Note the version number and date at the bottom of the window, and on the title bar at the top.
- The "*Defaults*" tab is available for setting systems options on startup.
- Please check the date and time locally and for GMT. Use the ***Defaults*** tab to correct for your time zone.
- The Status Bar at the bottom is visible from all tabs, and provides an indication of logger connection status, RTS and CTS handshake line activity, the selected Comm-port, and the status byte information returned by the connected logger. If you contact DASCOR regarding the software's operation, you may be asked to relate the information on the Status Bar.
- If the box at the bottom left has green lettering as says "Logger Connected" when no logger is connected, then there is a problem with the COMx port, or the SIA cable.
- Note the *On-Line Manual Menu* option above the tabs. This option is always available.
- Also note the command button to reload logger information without first disconnecting and reconnecting the logger. This is visible on all screens.

7.1.2 **Active Tab:** Defaults

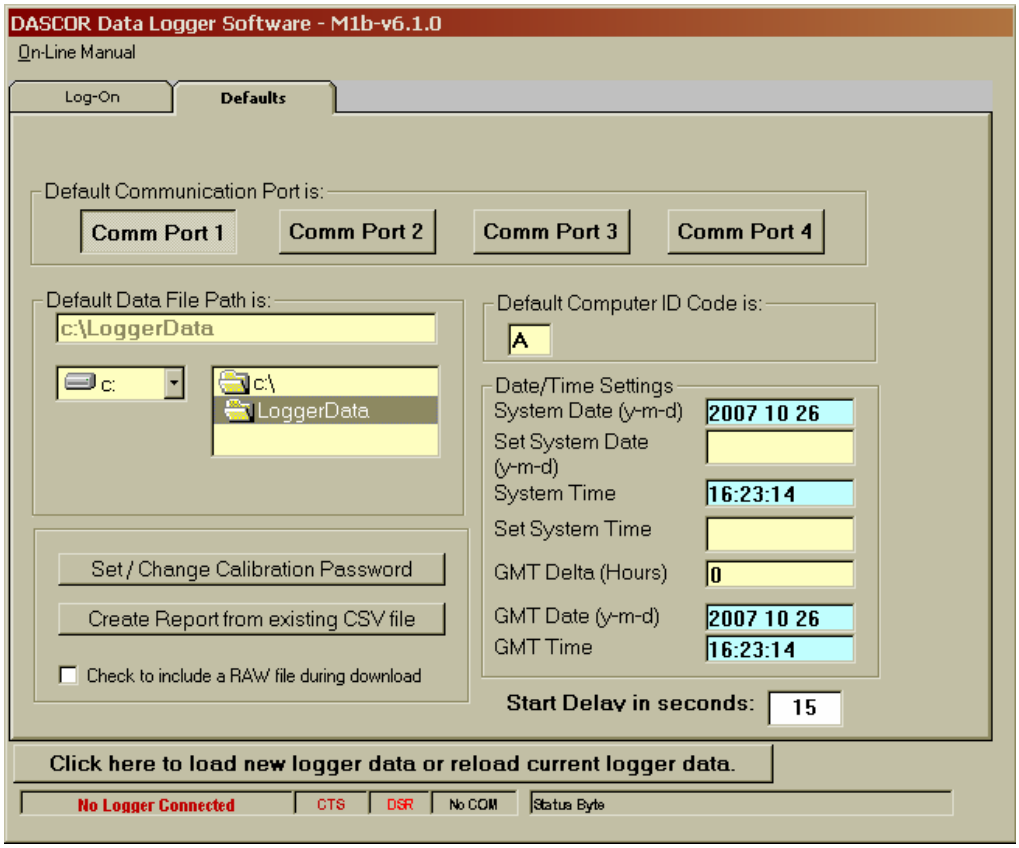

Figure 6, Main Screen, Defaults Tab

Called By: Main Startup screen when Defaults Tab is selected.

Description: Set Default Values for the Communications Port, and the Default Directory where data is stored. Also, set date and time.

Action:

Comm Port 1: Set Comm 1 as active Comm. Port.

Comm Port 2: Set Comm 2 as active Comm. Port.

Comm Port 3: Set Comm 3 as active Comm. Port.

Comm Port 4: Set Comm 4 as active Comm. Port.

Default Data File Path: Set the default path where data is to be stored.

Default Computer ID Code: Set the Default Computer ID Code.

System Date and Time: View and set the System Date and Time. GMT Delta is time zone E/W of Greenwich

Set / Change Calibration Password: Set password for access to the calibration screen

Log-On Tab: Move to Log on tab.

Start Delay in Seconds: Sets the time in seconds between the finish of the initialization process and the first scan. This is to allow at least one LED flash to be observed following initialization to confirm logger operation.

A Comm port MUST be selected.

- The default folder will be C:\LoggerData. The default data-file path should always be selected using the two lower boxes. Double clicking on the selection will move it to the top box, and will move you up and down

through the directory tree. The information in the top box is what is stored to the registry for future use when you leave this tab. The selected path is the default path for storing downloaded data from the logger. The file path must already exist in order to be located and selected.

- If you do not want the default folder, create your own using whatever file path and folder name is appropriate. The default file selection boxes will only identify and allow selection of existing folders!
- The Set System Date and Time boxes (yellow) may be used to enter the current date and time, or this may be done using the System Time option in the Windows Control Panel.
- The *GMT Delta* must be entered here. It is the number of hours difference between the local time zone and the Greenwich Time Zone. For example, for California (PST), the GMT Delta is +8 hours.
- PLEASE NOTE: GMT and Time Zone information is included in the Header Data. This information can be critical if the loggers are initialized and downloaded in different time zones.
- The *Default Computer ID Code* becomes the first letter of the filename automatically created for storing downloaded data. It is intended to identify the computer performing the download in the event there are multiple download locations.
- Use the *Set/Change Calibration Password* to set or change the password required to access the calibration screens for each channel. To set the password for the first time, type the password twice as requested. To change the password, enter the old password, then enter the new password twice. The default password is [NULL] i.e. no characters are entered, and allows immediate access to the calibration screens. A password is required ONLY if one is set using this command function. Further, a password need only be entered the first time a user tries to access a calibration screen during any given session.
- The *Start Delay in Seconds* box sets the number of seconds between the conclusion of initialization and the first scan. The intention is to allow enough time to complete initialization, unplug the logger so that it is running autonomously off of its internal battery, and have the first LED flash that accompanies the first scan happen fast enough that it can be observed by the user. If a flash is not observed, then logger initialization was not successful, or there is either no battery or a dead battery installed.

7.1.3 Active Tab: Waiting

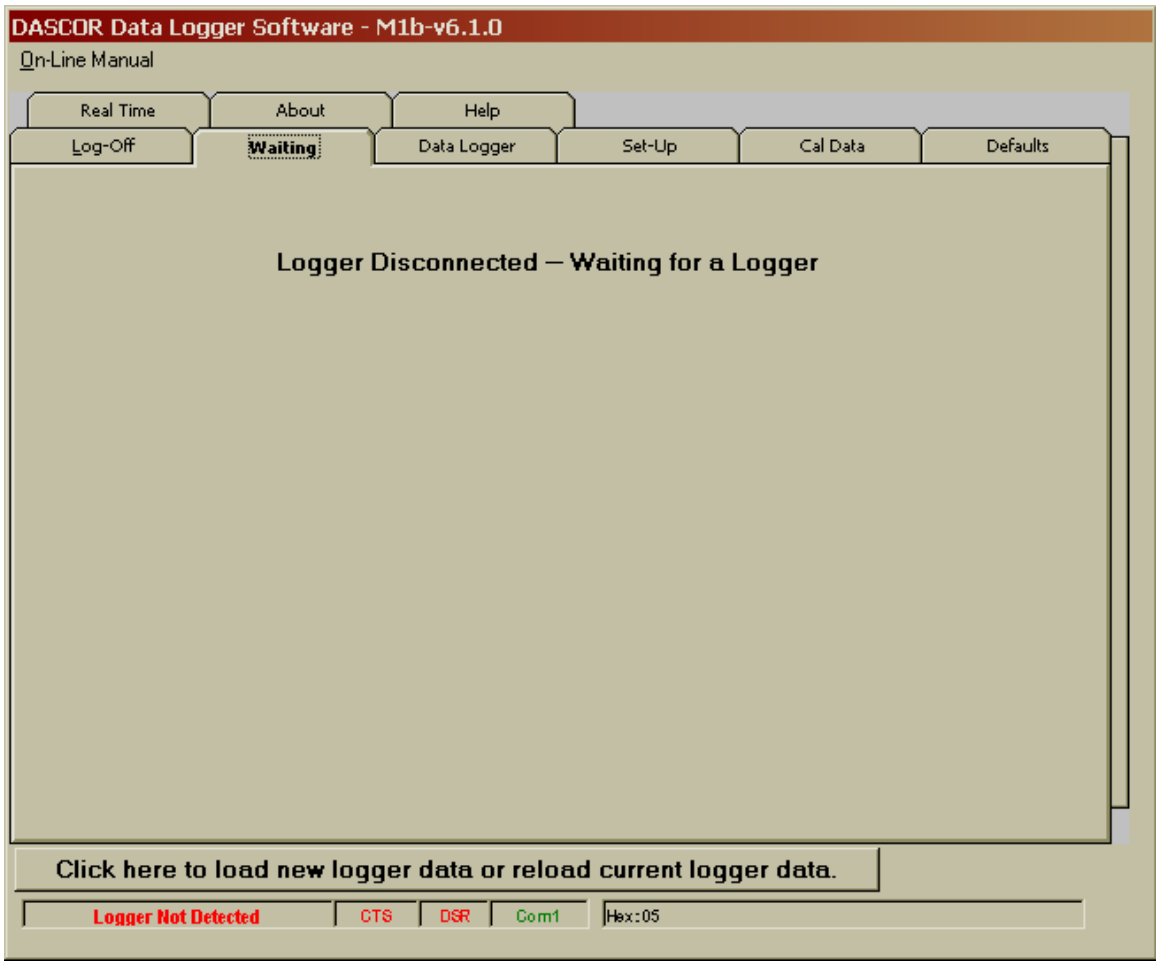

Figure 7, Main Screen, Waiting Tab

Called By: Main Startup screen once the Log-On button is selected

Description: A progress bar is displayed as information is downloaded from the Data Logger during initialization.

Action: **None** - Data Logger Tab will be displayed automatically on the completion of download.

Other messages may appear here requesting the user to disconnect the logger and check the LED for the first Scan blink, and then reconnect the logger to update and verify setup information.

- In the event that the information from the logger needs to be updated, disconnect then reconnect the logger to update the logger information tab—or click on the "Load New…" command button. When initializing a logger for a test, it is necessary to disconnect the logger to witness the first LED flash confirming operation. Then reconnect the logger to verify the setup prior to deployment.

7.1.4 Active Tab: Data Logger

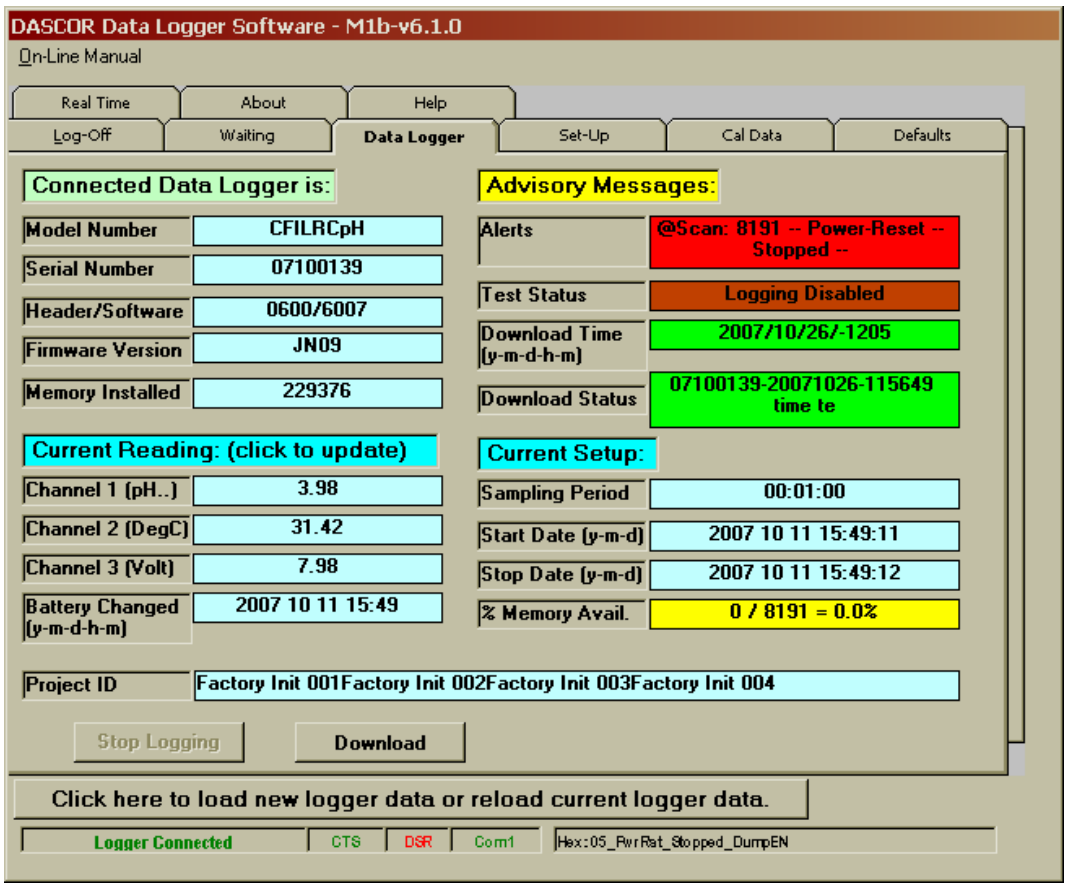

Figure 8, Main Screen, Data Logger Tab

Called By: Startup process after the Log-On button has been selected and the downloaded process has been completed.

Description: Displays information about the Data Logger.

Action: ***Stop Logging***: Stop the Data Logger and set it to Low Power Mode.
Download: Begin the process of downloading the Data Logger's data.
Any Tab: Select any one of the nine systems tabs.

- Use the Download button to download data. You will be required to stop logging.
- Note the battery voltage is 7.98 Volts….This battery should be replaced prior to a test.
- The light blue boxes hold the basic logger information from the logger currently connected.

PLEASE! Always check the Battery Voltage, sampling period, and start and stop dates and times
BEFORE deploying a logger.

- Note the Alerts box. This indicates conditions that occurred why data was being logged—and does not represent a condition present when the window is viewed. ***Stopped/Low Power*** indicates that the battery died

sometime during the test, or, there was a ***power-on reset*** caused by changing the battery. In the case of low battery, all data may be compromised. For Power-On Resets, the data is still valid, but the time base has been corrupted.

- The Test Status box indicates that logging has been stopped. This is normal after a download, calibration, or other procedure which requires that logging be stopped.
- Some of the boxes may be highlighted to draw the operator's attention to various conditions that may be of concern. Critical conditions are highlighted in RED and warnings are in yellow.
- The Download Status bar will turn green once the data has been downloaded. In the example above, the date, time, and filename are given for the downloaded data. Only 32 characters will be shown.
- The % Memory Available box shows Three numbers:
- The first number is the number of scans remaining to be taken—in this case none, since the test is complete. The box will turn YELLOW when less than 5% of memory is remaining. The third number is the percent of memory unused or remaining.
- The second is the number of scans that the logger has been commanded to take. This number times 2 times the number of active channels should always be close to the total memory installed. For 32K bytes and 8 channels, the normal maximum number of scans is 2047 (or 4095 for 64K), and the number in the box should be within a few scans. Occasionally, depending on scan rate and the number of channels, the figure given could be up to 4% low, which is caused by normal truncation and rounding of the various variables during calculations. This error should disappear as the scan duration increases. If an error has been detected during initialization, the Memory box will be RED to provide a positive warning.
- The last number is the percentage of available memory that is remaining for new data.

7.1.5 Active Tab: Set-Up

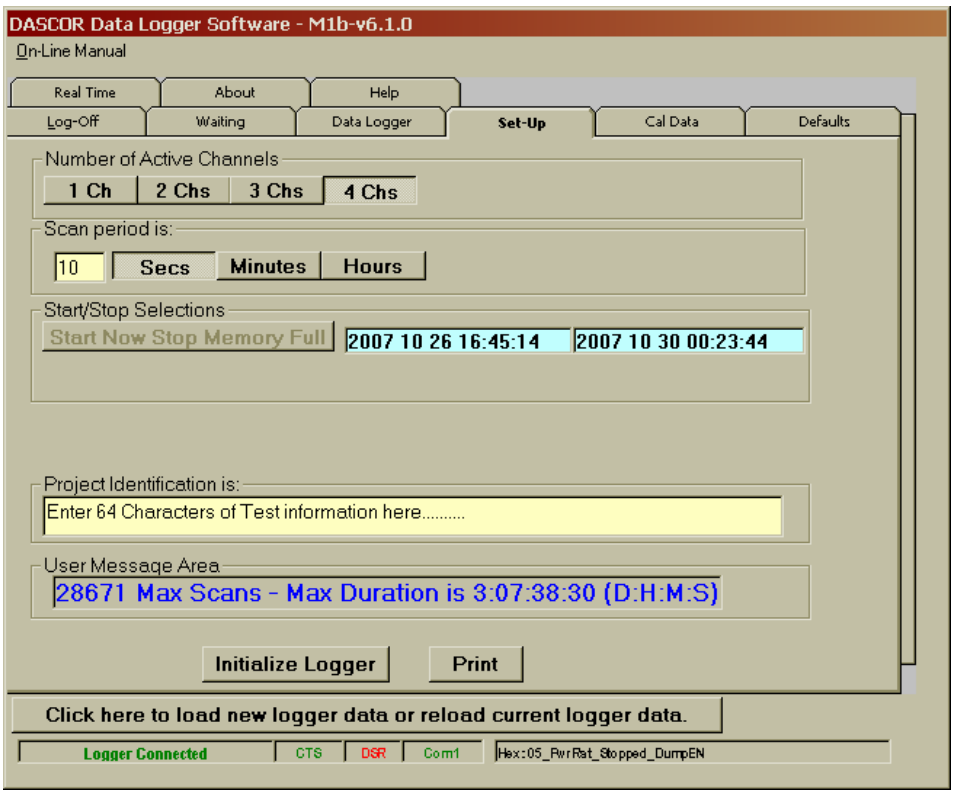

Figure 9, Main Screen, Setup Tab

Called By: By selecting the Set-up tab.

Description: Set the number of active channels and scan period. Enter Project Identification information.

Action: ***Number of Active Channels***: Select a button, [1 Ch] through [8 Ch], to set the number of active channels. Only installed channels will be shown….in this case 4 channels.

Scan Period is: First enter a number and then select the unit of measure. The start and stop times will be calculated. Maximum Scan Period is 18.2 Hours, about 1090 minutes, or about 32,000 Seconds.

Project Identification is: Enter notes identifying the project here. 64 characters amax.

Initialize Logger: Begin process of uploading logger settings information to the logger.

Print: to print the information on this tab.

Any Tab: Select any one of the eight systems tabs.

- Active Channels MUST be selected. (All 4 channels have been selected in this screen.) The scans will start with channel 1, and scan through the channel selected. Channels above the number selected will not be scanned. For example, if 5 is selected, the logger will scan channels 1, 2, 3, 4, & 5, but NOT 6, 7, & 8.
- Scan Period must be entered and the units (seconds, minutes, hours) selected as well. A scan interval of 10 seconds has been selected in this screen. **The scan period and units will be un-selected if changes are made to the number of active channels or an incorrect scan period is entered. Leaving the Tab and coming back will also clear all selections!**
- ***Project Identification*** is 64 characters of alpha-numeric data that may be entered by the operator to describe the current test. It acts as a "note pad."

- After selecting ***Initialize Logger***, the user will be provided with a series of opportunities to check the setup for correctness, or download data if that step had been forgotten. See the Message Box section for more details. In the event that data has not been downloaded, the following screen will appear:
- BE CAREFUL in selecting ***Initialize--No Download*** as any data in the logger that has not been downloaded will be lost!
- ALWAYS OBSERVE THE MAXIMUM NUMBER OF SCANS shown in the *User Message* area prior to initializing the logger! This number times 2 times the number of channels selected, should always be approximately equal to the memory installed. In the example shown 28671 * 2 * 4 -1 = 229367. Odd numbers of channels might result in a slightly smaller number, but never a larger one. This number should be compared to the first number shown in the % Memory Available box on the setup window following initialization. Small errors are acceptable, but when large ones occur, the logger should be re-initialized.
- This confirmation step should become automatic with most users. Version 6.10 has fixed all known issues that could result in errors, but it is always a good idea to check…particularly when data appears to be missing from the download files.

7.1.6 **Active Tab:** Cal Data

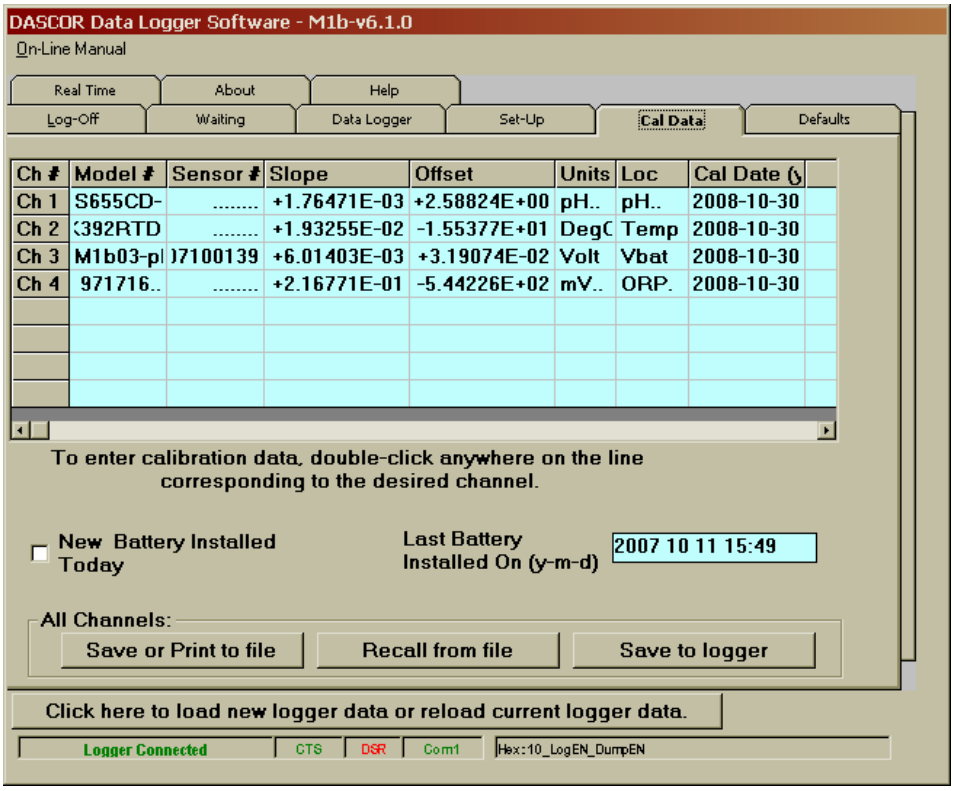

Figure 10, Main Screen, CAL(ibration) Data Tab

Called By: By selecting the *Cal Data* tab.

Description: Call the Calibration screen to set the calibration data for each active channel by double clicking a line on the Channels grid.

Action: ***Channel grid rows***: Select any channel by double clicking on it. This will take you to the screen to set the calibration data for the selected channel.

Save or ***Print***: to send a complete set of all calibration data to either or both the local printer or to a file.

Recall will bring the contents of a saved calibration file into active memory, and ***Save*** will store it in the logger. Good Calibration data can be erased and overwritten with incorrect data by saving to the logger….BE CAREFULL!

New battery installed check box: This writes todays date to the new battery memory location in the logger. ALWAYS download data before changing the battery and re-initialize the logger afterwards.

Any Tab: Select any one of the eight systems tabs.

- Data will be shown only for active channels. If you want to see all channels, go to the Set-Up tab and select the maximum available channels , then reinitialize the logger. If your logger has fewer than 8 channels installed, you will be able to view only those channels.
- Data may NOT be changed in this screen. However, the widths of the columns may be adjusted by placing the cursor over the vertical bar between column labels (it will turn to ←→) and may be used to drag the right hand side of the column to a new width. This works the same way as column management in Excel and Word. Access may be password protected. See the manual for more info.

7.1.7 **Active Tab:** Real Time

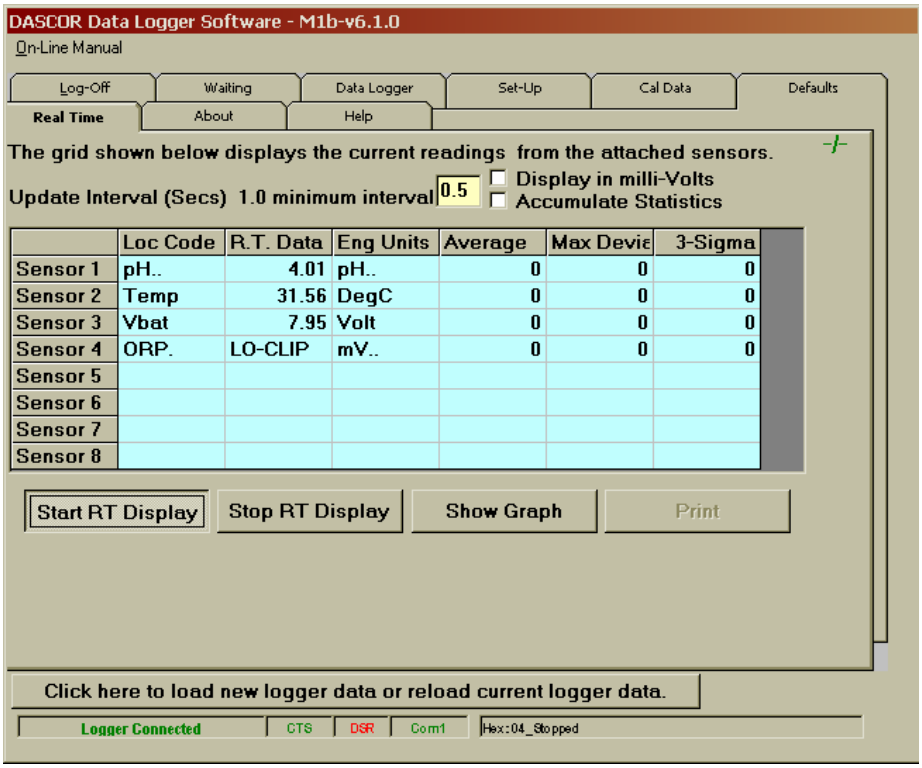

Figure 11, Main Screen, Real Time Tab

Called By: By selecting the Real Time tab.

Description: Displays Logger data in real time.

Action: ***Display in milli-Volts***: check the box to see data in milli-Volts.

Accumulate Statistics: check the box to have program calculate Average, Max Deviation, and 3-Sigma.

Start RT Display: starts active display

Stop RT Display: stops active display

Show Graph: display a window that will give a graphic display of the data.

Print: to print the current data being displayed.

Any Tab: Select any one of the eight systems tabs.

- Prior to getting to this tab, if the logger is in logging mode, you may be asked if you want to stop logging (which will allow the fastest possible scan rate), or to continue logging and display the data as it is acquired by the logger at the programmed scan rate. If you choose to stop logging (or the logger is already stopped), all the functions will be available. However if you choose not to stop logging, the ***Start Display*** and ***Stop Display*** functions will be disabled!
- Only active channels (i.e. the number of channels selected during setup) will be shown. Use the setup screen to select all available channels, then initialize the logger, to show all channels.
- In the example above, the Accumulate Statistics and Display in milli-Volts functions have not been enabled. A number to the right of the Accumulate Statistics (when it is checked) is the number of consecutive readings taken and used to calculate the statistics. Un-checking the Accumulate Statistics box will freeze the readings. Clicking it again will reset the count to zero and start accumulating again.

- The Display in Milli-Volts Function gives the data in milli-Volts (equal to ADC Counts), and is "raw" data that has not been converted to EU or Engineering Units. Un-clicking this box will display the data converted to EU using the calibration factors stored in the logger. The EU units will be updated on the next reading after restarting the RT Display.
- Remember that the Calibration values for the Cal Constants are stored using the Calibration tab, and the Data in the left hand set of columns in the .CSV file is Raw ADC counts (mV) and has NOT been converted to engineering units—even though the data shown in this screen may be in EU if the milli-volts box has not been checked. The right-most set of column in the .CSV file have been converted to EU.
- The Graphics button will bring up a real-time strip chart of the data, but data is presented only in mV.

7.1.8 Active Tab: Real Time Strip Chart

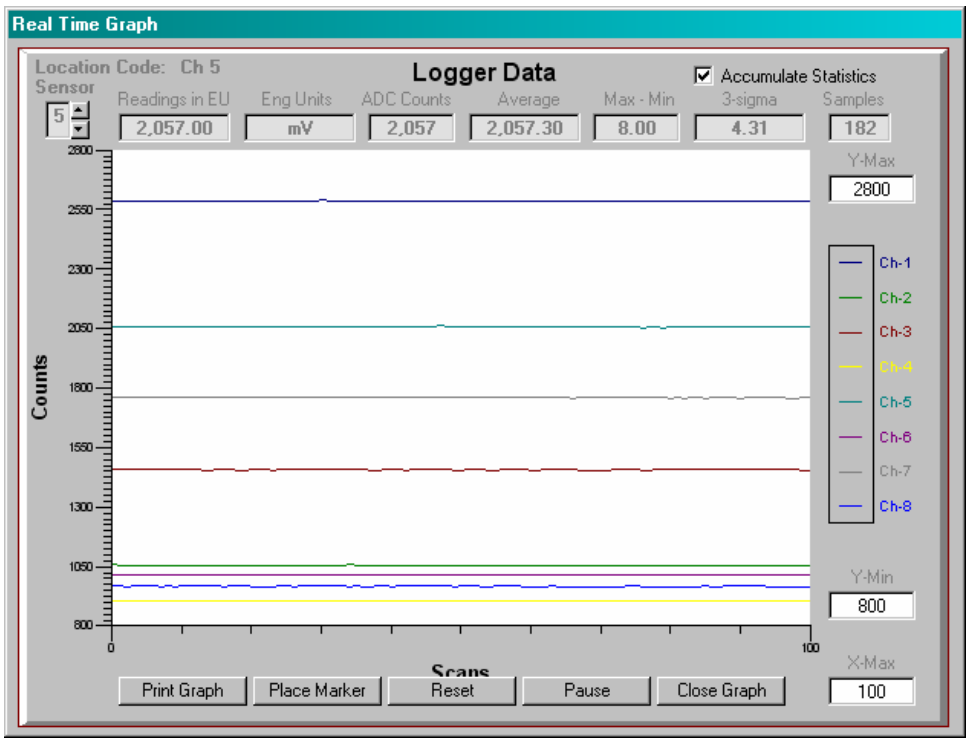

Figure 12, Strip Chart Window

Called By: By selecting the Real Time tab.

Description: Displays Logger data in real time.

Action: **Accumulate Statistics:** check the box to have program calculate Average, Max Deviation, and 3-Sigma for the channel selected. Repeats action in main table.

Select Channel: scrolls the statistics display up and down through the active channels.

Print Graph will dump the chart to the system printer.

Close Graph will close the chart and return to the RT tab.

X-Max sets the number of scans to be displayed in the horizontal axis. The minimum is 10. *Y-Max and Y-Min* sets the upper and lower values displayed (in mV). These numbers can range from 10 to 4095.

PAUSE or *RUN* is disabled when monitoring data being logged, and is operational when the logger is stopped. It mimics the *Start Display* and *Stop Display* buttons on the Real Time screen.

Place marker creates a vertical spike in the displayed data when pressed. This function is not operable in monitor mode.

If the display does not come up immediately, try clicking in the white central area. If the graph is in monitor mode, it will wait for the first data from the logger before updating the screen. This might take quite some time if the scan rate is in minutes or hours.

7.1.9 **Active Tab:** About

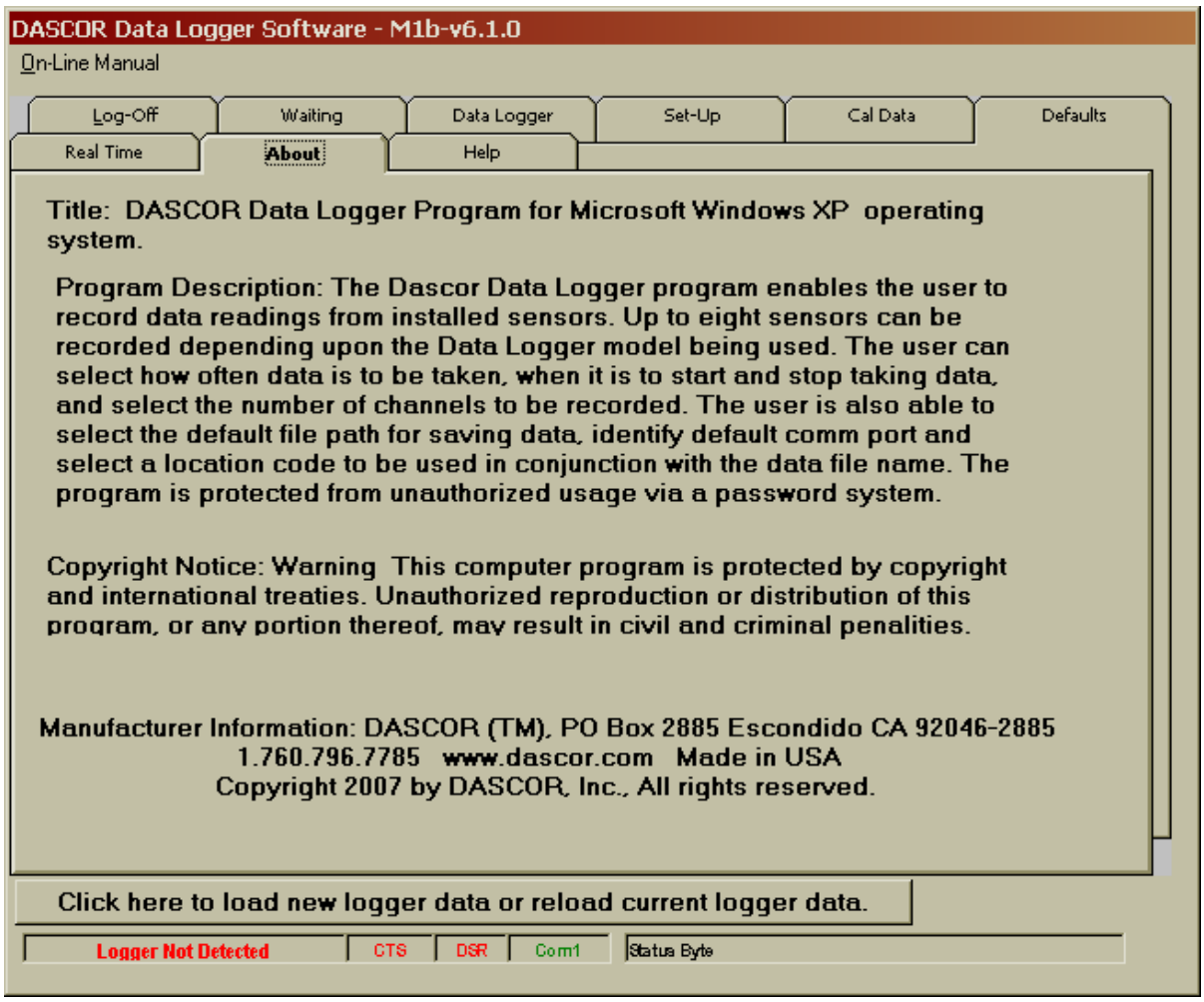

Figure 13, Main Screen, About Tab

Called By: By selecting the About tab.

Description: Displays information about the Data Logger program which includes the Software title, Program Description, Copyright Notice, and Manufacturers Information.

Action: **Any Tab:** Select any one of the nine systems tabs.

7.1.10 **Active Tab:** Help

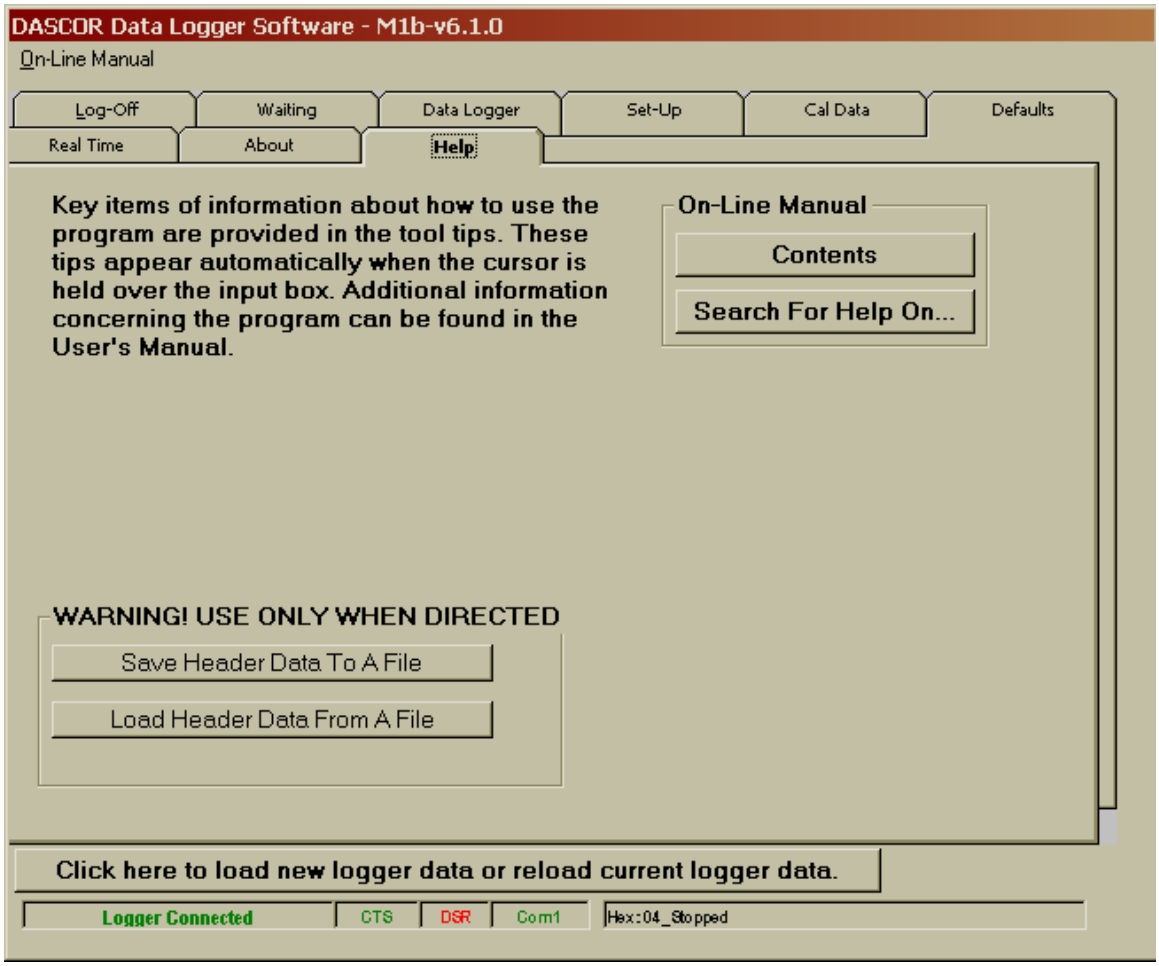

Figure 14, Main Screen, Help Tab

Called By: By selecting the Help tab.

Description: Displays information regarding the programs help system.

Action: ***On-Line Manual***: displays this document.

Any Tab: Select any one of the eight systems tabs.

PLEASE NOTE: This portion of the software is undergoing continual development. The system is intended to open this file and make it accessible on line. The F1 key is intended to bring up the page pertaining to the tab or box that was active when the key was pressed.

WARNING: The Save and Load Header commands are for backing up and restoring logger memory in the event of memory be corrupted, or for major updates and fixes. DO NOT mess around here! DASCOR maintains copies of the Header memory image for all loggers shipped after July 2007 in the event of a major failure, allowing reconstruction in the field. You may use the Save command to create backup files if you wish. However, reloading the wrong file will change the calibration values, serial numbers, and severely compromise further use of the logger!

7.1.11 Window Title: Real Time Data Notes

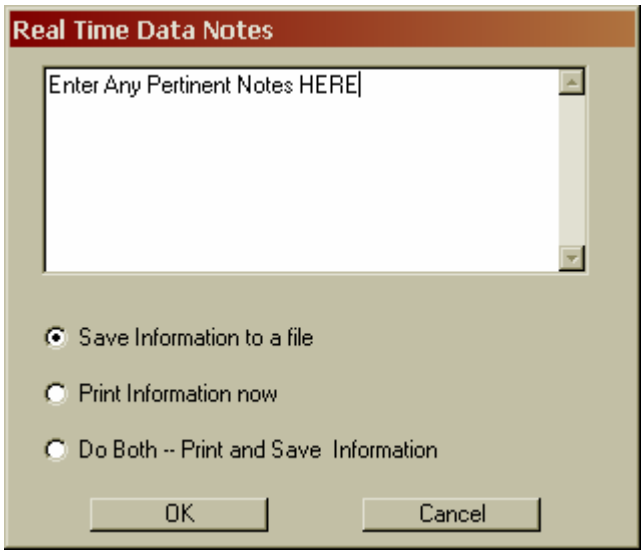

Figure 15, Real Time Data Notes Box

Called By: By selecting the ***Print*** button from the Real Time screen.

Description: Enter a description for the Real Time information to be printed. The description will show at the top of the Real Time print out.

Action: ***Enter Text***: Enter and edit text in the box.

Select print option: send to printer now or save to a file, or do both.

OK: to continue.

NOTE: There will be an opportunity to cancel this procedure in the printer setup window that appears next.

7.1.12 Window Title: Cal Data Notes

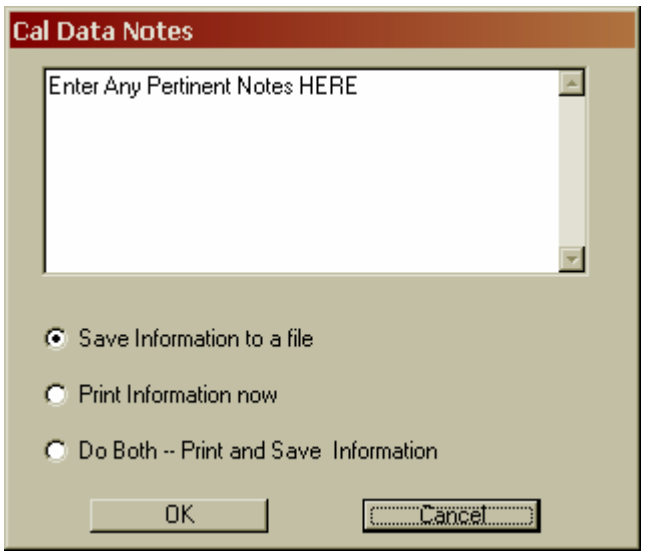

Figure 16, CAL Data Notes Box

Called By: By selecting the ***Save*** or ***Print*** button from the Cal Data screen.

Description: Enter a description for the Calibration information to be printed. The description will show at the top of the Cal Data print out or file.

Action: ***Enter or edit Text*** in the scroll box.

Select print option: send to printer now or save to a file, or both.

OK: to continue.

NOTE: There will be an opportunity to cancel this procedure in the printer setup window that appears next

7.1.13 Window Title: Data Calibration Sub-Routine

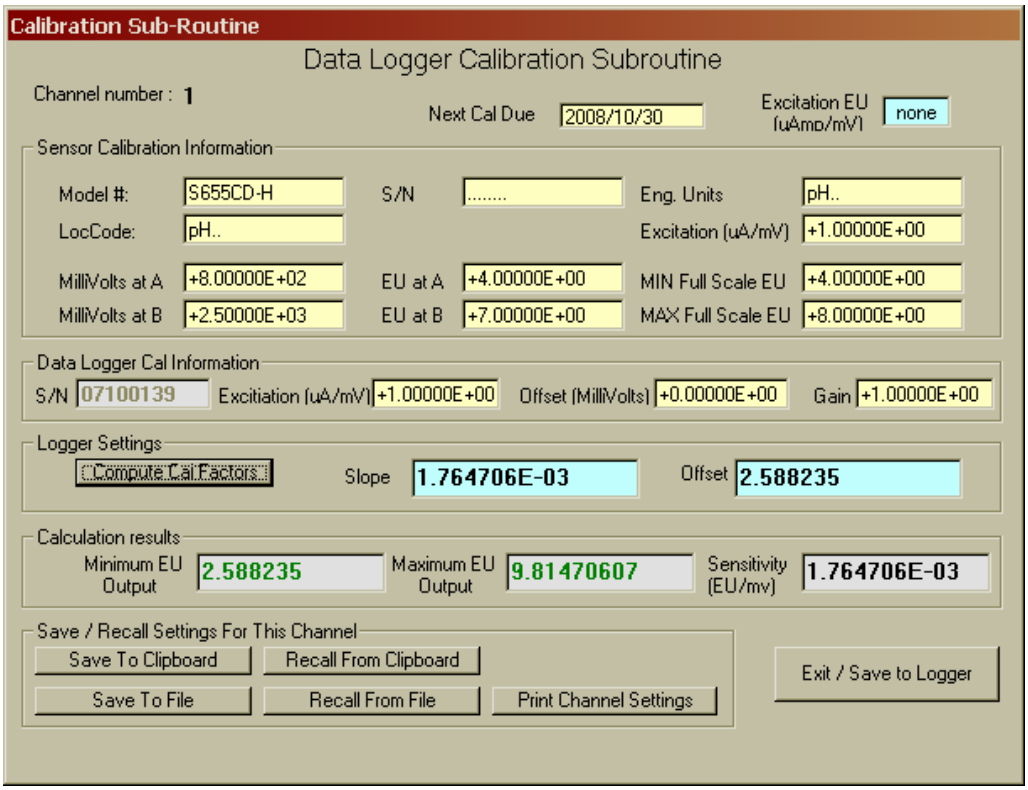

Figure 17, Calibration Subroutine (Channel Calibration)

Called By: The Calibration screen by double clicking a line on the Channels grid.

Description: Allows an authorized user to set up the calibration for the logger and the attached sensor.

Action: **Calibration sequence details and the meanings and functions of the command boxes are described in further detail in the logger specific Calibration Procedures Appendices, and in 7.1.13.**

Data Logger Cal Information: Data specific to the calibration of the logger itself is entered here. It should not be changed without first saving the screen to a file, and then only if performing a two-point field calibration.

Compute Cal Factor: Uses the sensor and logger calibration data to calculate the slope and offset factors to convert raw milli-Volt (ADC Count) data to engineering units (EU).

Save to Clipboard: Save the current settings so that they may be recalled when setting up the next sensor.

Save to File: Save the current settings to a file to recalled at any time.

Recall from Clipboard: Recall last saved Sensor setting.

Recall from File: Recall Sensor setting saved to a file.

Print Channel Settings: to print the current settings.

Exit / Save to Logger: To Exit this window and save sensor information to the logger. You will then be prompted to acknowledge that you wish to save the information. Choose yes to save changed settings or no to exit without saving.

- Only sensor calibration information should be changed in the *Sensor Calibration Information* fields.
- Signal conditioner Calibration Information in the *Logger Settings* frame is normally set at the factory and should not be changed unless a re-calibration is performed.

Changing data in the Signal Conditioner fields DOES NOT change the actual gains and offsets hardwired in the logger.

- These values are fixed in hardware and are NOT programmable. It may be necessary to change these values when doing two point field calibrations (See the appropriate appendix), or forcing the outputs to volts or milli-volts—but the original calibration numbers should be recorded for later re-entry.
- The small box in the upper Right Corner shows the units of the Excitation supplies being used—these units must be common to all excitation entries! The software does not really care what the units are—Volts, MV, Kilo-Amps, or micro-amps—as long as all measurements are present using the same units.

Channel Number	Channel number being calibrated
Cal Due	Optional 8-character text entry for a reminder of the next calibration due date.
Excitation EU	Engineering Units (EU) used for the excitation supply. Typically µA or Volt
Sensor Calibration Information	**SENSOR specific information**
Model Number	8-character text field for the model or type of sensors
Serial Number	8-character text field for the serial number of the sensor
Engineering Units	4-character field for the EU associated with the sensor (PSI, %RH, DegC, etc.)
Location Code	Optional 4-character code to note where the sensor is mounted (e.g. frame number x)
Excitation (µA/mV)	Numeric value for the excitation current or voltage used during the actual calibration of the sensor
MilliVolts at A	numeric value in Millivolts of input at calibration point A
EU at A	numeric value in EU for the stimulus applied at point A
MilliVolts at B	numeric value in Millivolts of input at calibration point B
EU at B	numeric value in EU for the stimulus applied at point B
MIN Full Scale EU	Numeric value in EU for the lowest reading possible by the sensor
MAX Full Scale EU	Numeric value in EU for the highest reading possible by the sensor
Data Logger Cal Information	**DATA LOGGER SIGNAL CONDITIONER specific information**
Serial Number	Serial number of the signal conditioner module, not user changeable
Excitiation (µA/mV)	numeric value for the channel excitation in µA or Volts
Offset (MilliVolts)	Numeric value for the channel offset in milliVolts or ADC Counts
Gain	Numeric value for the channel gain
Logger Settings	**Calculated y=mx+B factors for converting raw readings to EU**
Slope	"m" variable of the y=mx+b equation
Offset	"b" variable of the y=mx+b equation
Calculation results	
Maximum EU Output	Calculated maximum reading in EU…must be >MAX full scale entered for the sensor to avoid clipping data.
Minimum EU Output	Calculated mimimum reading in EU…must be <= MIN full scale entered for the sensor to avoid clipping data.
Sensitivity (EU/mv)	Calculated resolution of sensitivity in terms of EU per mV where one mV = 1 ADC Count.

7.1.14 Message Box Title: Compute Cal Factors Warning Message

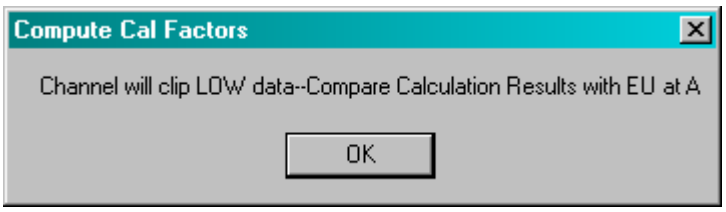

Figure 18, Cal Setup (Clipping) Warning Message

Called By: Calibration Sub-Routine after clicking the Compute Cal Factors button.
Description: A warning message displayed if the Calibration results are not within acceptable values.
Action: **OK:** acknowledges the message and returns to the calling window.

NOTE: A similar box will appear if the data will HI clip. Also, the limits on the calibration screen will also turn red for clipping, and green for within range. See the section directly above.

7.1.15 Message Box Title: Save Changes Warning Message

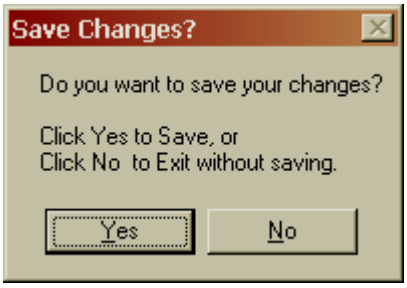

Figure 19, Save Changes Warning Message

Called By: Calibration Sub-Routine after clicking the Exit / Save to Logger button.
Description: A warning message displayed if the Calibration information has changed and needs to be saved before exiting.
Action: **Yes:** to save current settings.
No: to exit without saving.

7.1.16 Message Box Title: Stop / Low Power Mode Warning Message

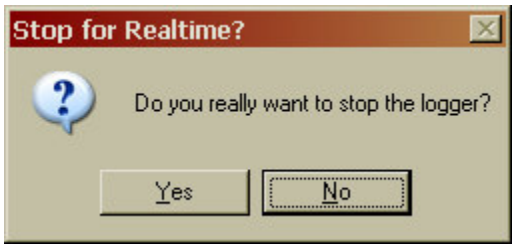

Figure 20, Stop Logger Confirmation Message Box

Called By: Data Logger screen ONLY after clicking the ***Stop/Low Pwr*** button.

Description: A warning message displayed to give a last chance cancel the process of stopping the Data Logger and setting it to Low Power Mode.

Action: **OK:** acknowledges the message and stop logging.
Cancel: to return to the Data Logger Screen without stopping the logger.

7.1.17 Message Box Title: Data Download Warning Messages

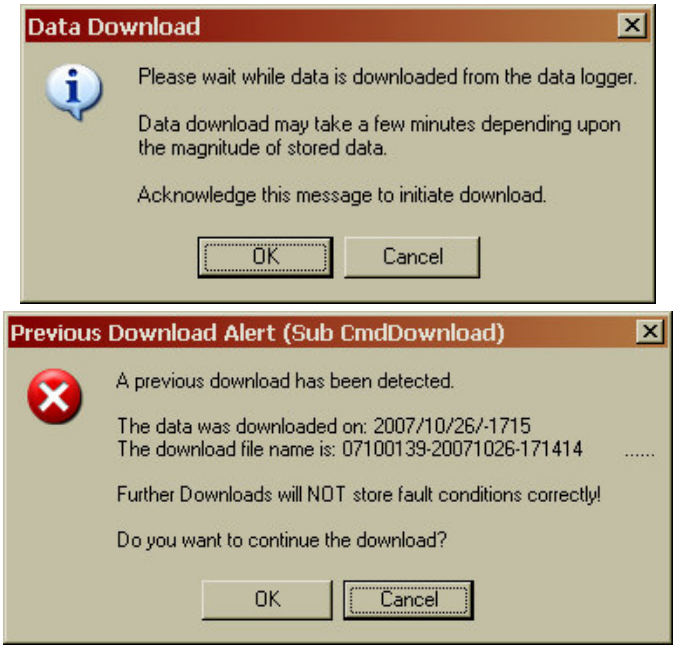

Figure 21, Data Download Warning Messages

Called By: Data Logger screen after clicking the Download button.

Description: Warning messages displayed to give conformation for the Data Logger to begin downloading data.

Action: ***OK*****:** acknowledges the message and initiate download.
Cancel**:** to return to the Data Logger Screen without downloading.

7.1.18 Window Title: Data Download Standard Dialog

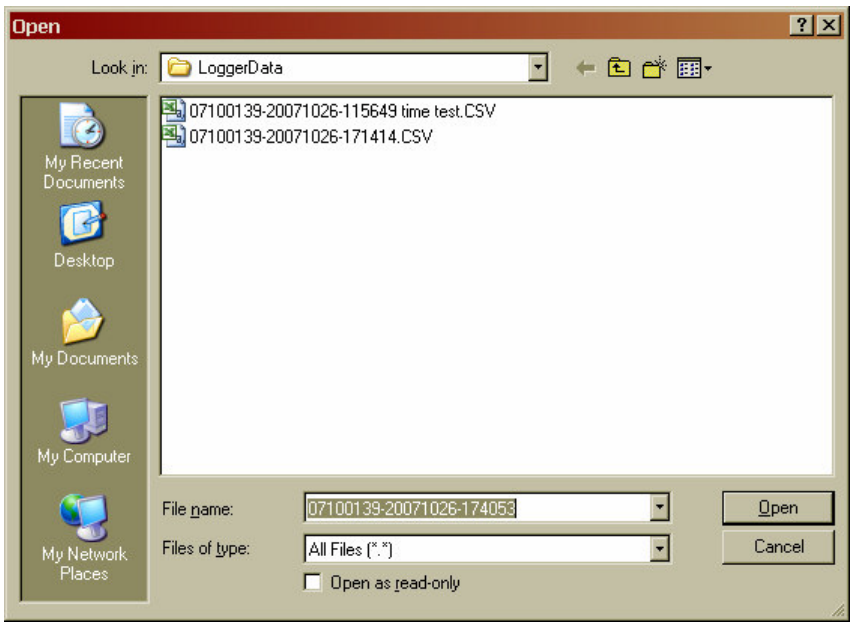

Figure 22, Data Download File Selection Window

Called By: Data Logger screen after clicking the Download button.

Description: A system specific standard dialog box to select the file to download the data to.

Action: ***File and Directory Selection*:** select the directory and file name where the data will to written. The folder specified on the default screen will be shown, along with a default file name constructed from the Logger Serial Number, the date, and time of the download. These may be changed as required. However, it is recommended that added information be added to the end of the default file name for user ID purposes.

***Open*:** To continue download of data to the specified file.

***Cancel*:** To cancel download.

Figure 23, File Error Message Box

If this box appears, the default path needs to be reset. This usually occurs when the M1b-V610.EXE file has been moved to a different folder than its original installation, or is being run from a net drive. It indicates that the reference in the Registry is no longer valid. It can be reset from the ***Default*** tab each time the program is loaded, or the shortcut must point to the .EXE file in the original installation directory folder.

7.1.19 Active Tab: Data Logger - Data Download Status

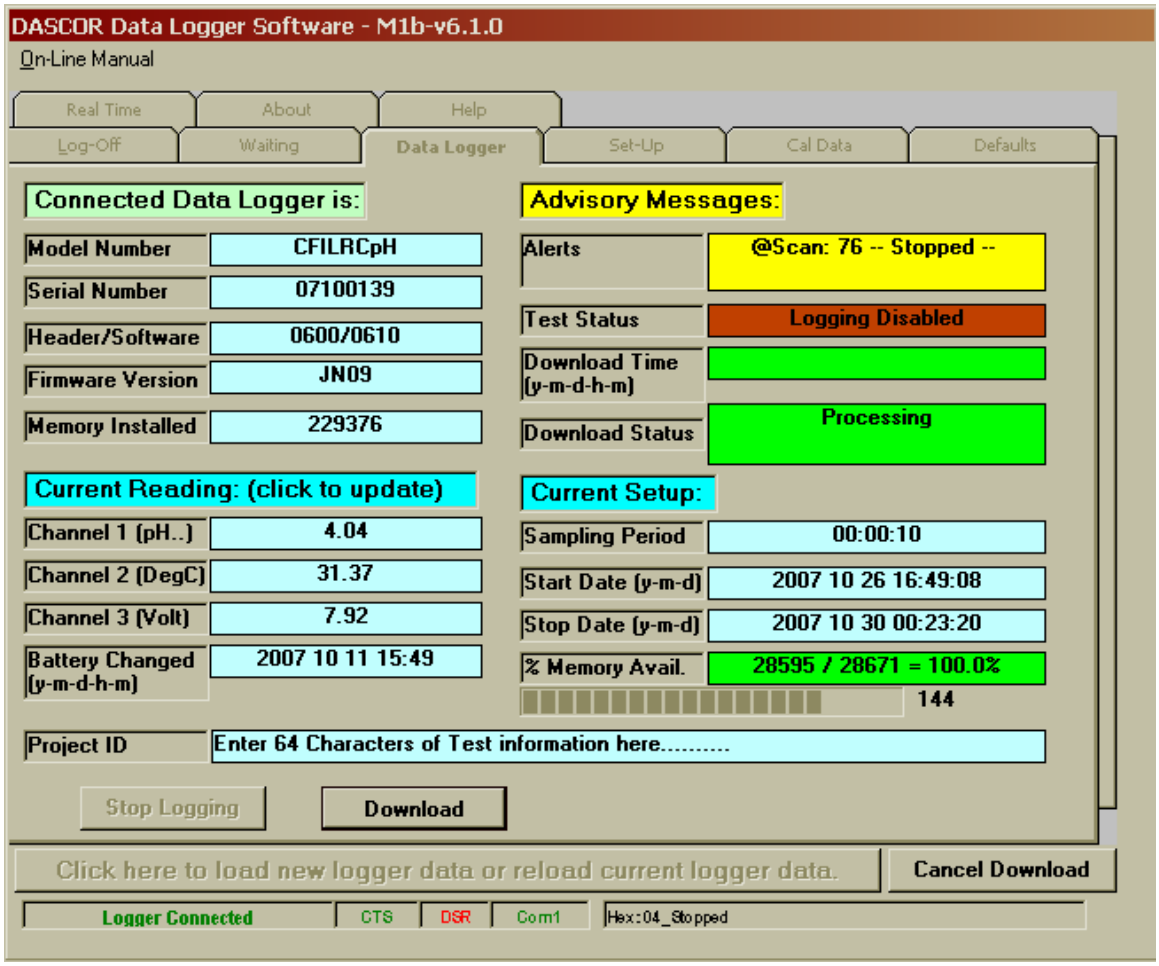

Figure 24, Main Screen, Logger Data Tab, after Download

Called By: Data Logger screen after clicking the Download button.

Description: The Download Status displays the green Processing message while the progress bar indicates how far through the download process the Logger is.

Action: ***None.*** The download status and progress bar are an indicator of how much longer the download process will take.

7.1.20 Active Tab: Data Logger - Data Download notes

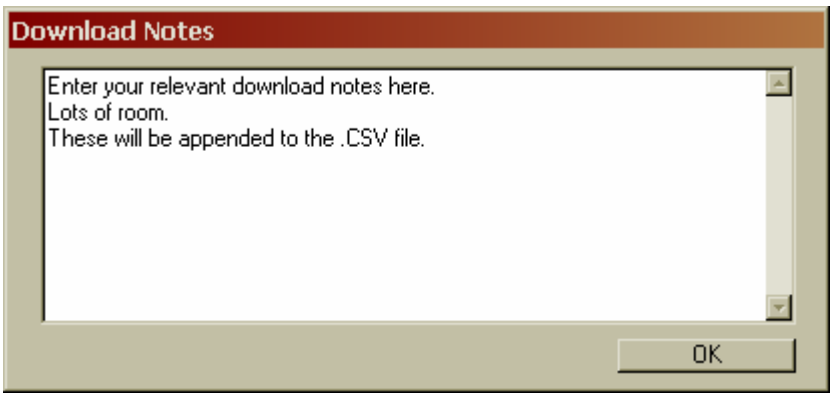

Figure 25, Download Notes Box

Called By: Data Logger screen after clicking the Download button at the end of the download process.

Description: Allows the user to enter notes relevant to the test data just downloaded. The notes will be appended to the test data at the end of the .CSV file..

Action: Enter text, including the ***Enter*** key for a new line. Clik ***OK*** to continue.

7.1.21 Active Tab: Data Logger – End of Download

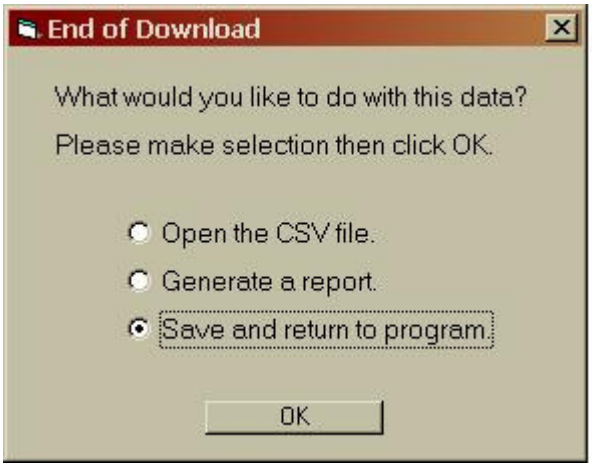

Figure 26, End of Download, Select Next Step Box

Called By: Data Logger screen after clicking the Download button at the end of the download process.

Description: Allows the user to open the CSV file created by the download (this assumes that a current version of EXCEL is installed), generate a pre-formatted report, or return to the program after saving the CSV file. The report generator is also available on the ***Default*** tab and will allow the selection of a file in the default data folder.

Action: Click on the desired selection. Clik ***OK*** to continue.

7.1.22 Active Tab: Data Logger - Data Downloaded Date/Time/File Name

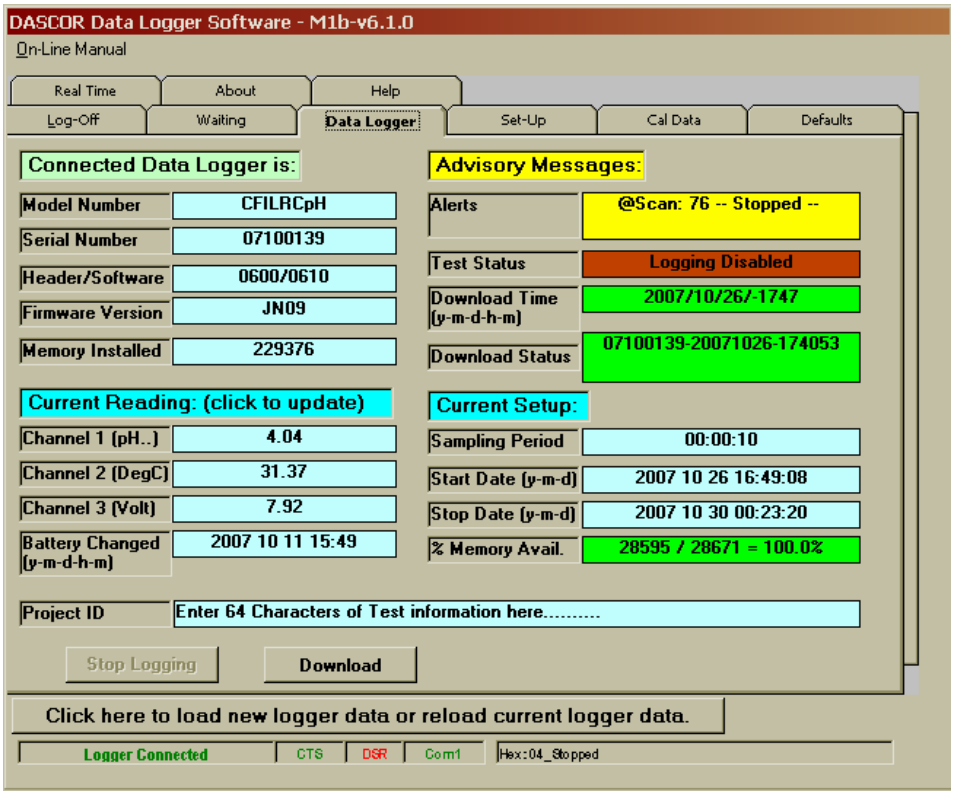

Figure 27, Main Screen, Data Logger Tab, After Download Complete

Called By: Data Logger screen after clicking the Download button.

Description: The Download Status displays the green Date and Time message to indicate when the data was downloaded.

Action: ***None.*** The download status is an indicator of when data was last downloaded and the file name.

7.1.23 **Message Box Title:** Set-Up - Upload Message

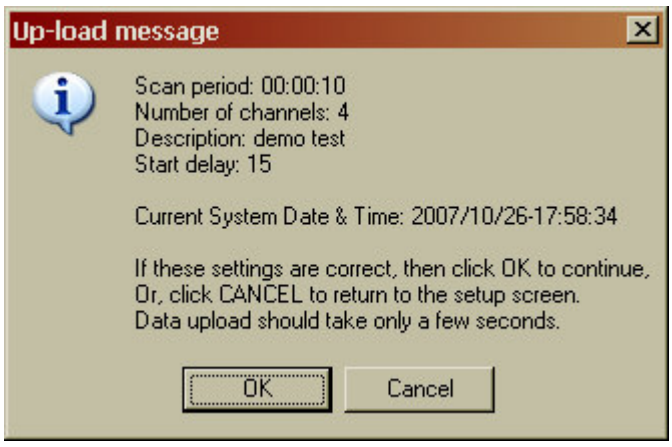

Figure 28, Confirm Setup Settings Box

Called By: Set-Up screen after clicking the Initialize Logger button.

Description: An informational message to display current settings for review before sending them to the Data Logger.

Action: **OK:** acknowledges the message and initiate upload.
Cancel: to return to the Set-Up Screen without uploading data.

ALWAYS Check this screen for accuracy before continuing.

7.1.24 Message Box Title: Set-Up - Upload Acknowledgement

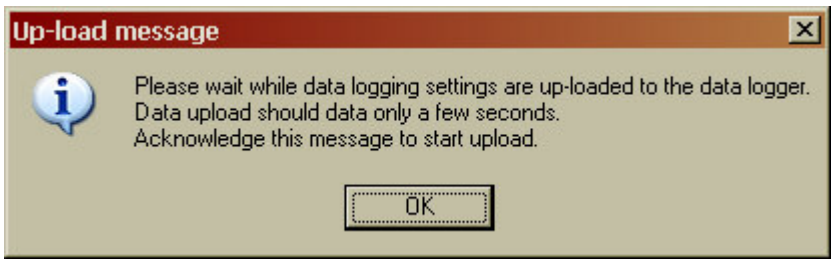

Figure 29, Acknowledge and Continue Setup Box

Called By: Set-Up screen after clicking the Initialize Logger button.
Description: An informational message to acknowledge the start of the upload process.
Action: **OK:** acknowledges the message and initiate upload.

7.1.25 Active Tab: Waiting - Upload Instruction

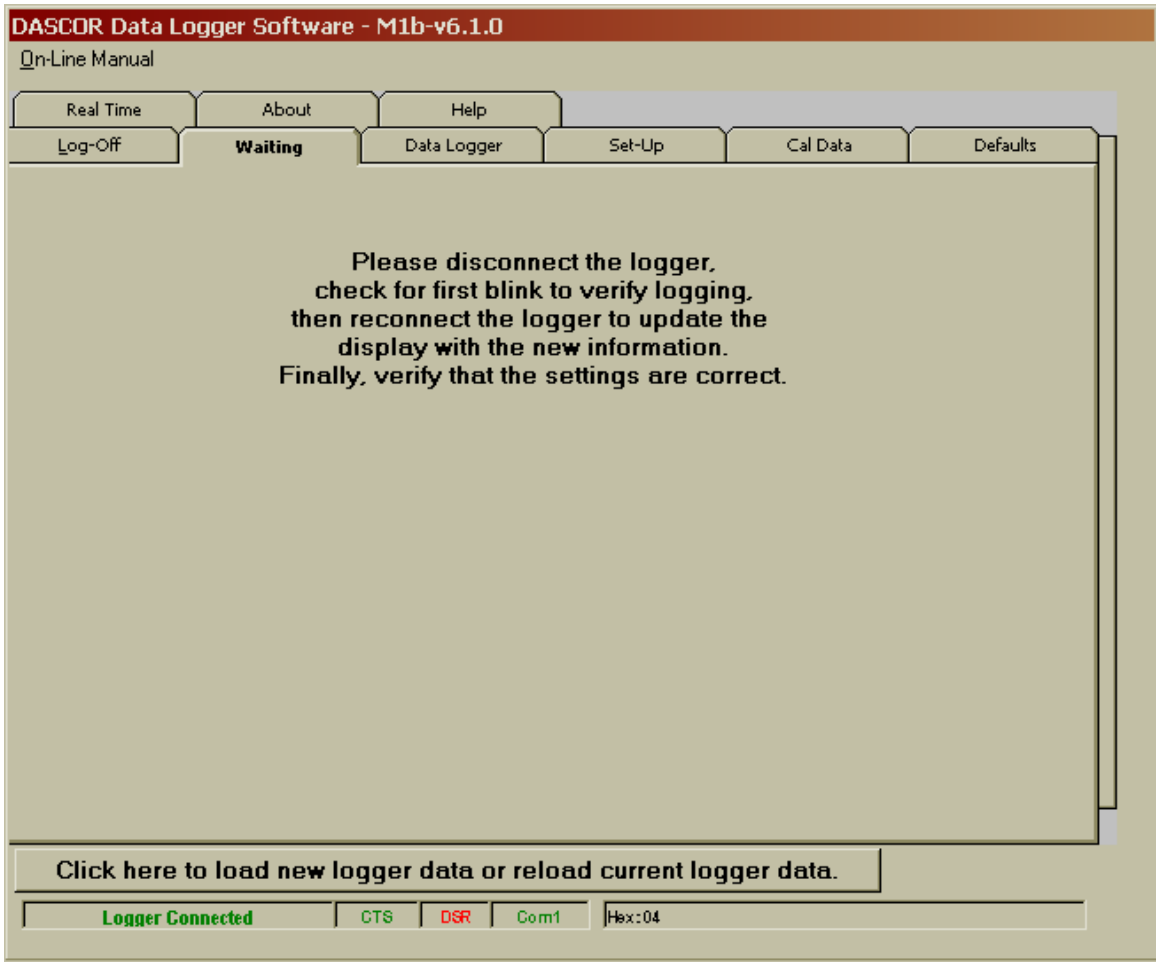

Figure 30, Main Screen, Waiting Tab after Logger Setup

Called By: Set-Up screen after clicking the Initialize Logger button.

Description: An informational message to instruct the user to disconnect, and then reconnect the logger to complete the upload process.

Action: Disconnect the logger at this time.

Wait for the first flash of the LED to indicate that the Logger is working autonomously, then reconnect the logger and verify the settings are correct. Check the memory box to be sure that at least one scan of data has been taken! Finally, disconnect and deploy the logger.

7.1.26 Active Tab: Waiting - Upload Message

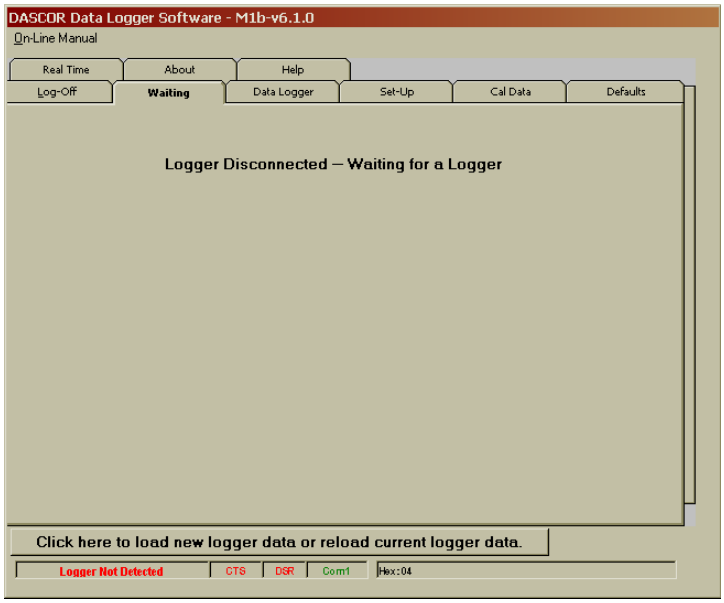

Figure 31, Main Screen, Waiting for a Logger Tab

Called By: Set-Up screen after clicking the Initialize Logger button.

Description: An informational message to instruct the user to reconnect the logger to complete the upload process.

Action: Reconnect the logger at this time.

7.1.27 **Message Box Title:** Enter Password

Figure 32, Enter Password Box

Called By: The Cal Data tab by double clicking a line on the Channels grid.
Description: When a password is set it provides password security for the calibration screen.
Action: ***OK*:** after entering password to continue to the calibration screen.
***Cancel*:** to return to the Cal Data screen.

7.1.28 **Message Box Title:** Set / Change Password

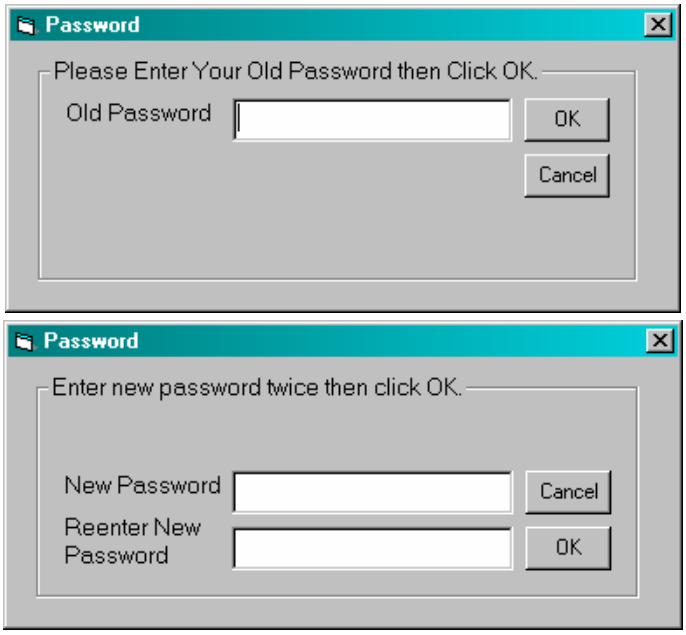

Figure 33, Change Password Boxes

Called By: The Defaults tab by clicking the Set / Change Calibration Password button.
Description: It provides a way to set and to change a password that can provide security for the calibration screen.
Action: ***OK*:** after entering password to continue to change your password.
***Cancel*:** to return to the Defaults tab without changing the password.

7.1.29 **Message Box Title:** RT Stop Logging?

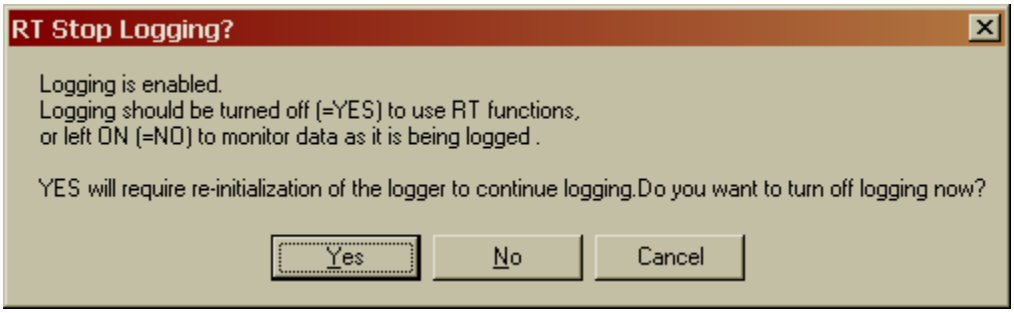

Figure 34, Stop Logging Option Box

Called By: The ***RealTIme*** tab when logging is enabled.

Description: This box provides the option of stopping the logger or not when entering the ***RealTime*** tab.

Action: ***Yes***: Stops the logger to allow the maximum speed for data acquisition. Enables the start and stop functions, graphics, statistics, and other functions.s The logger MUST be re-initialized before being used again.

No: Does not stop the logger, defeats most functions and monitors data being sent by the logger as it is logged. The scan interval is the same as that set into the logger during initialization. The logger will continue to log after being disconnected.

Cancel: to return to the ***DataLogger*** tab.

NOTE: Newer loggers run off of their battery at all times. The loggers turn on continuously when connected to the PC and remain in high power mode. This mode can drain a battery very rapidly, and should be used sparingly to verify operation, or during system/sensor calibration only. Always monitor battery voltage as one of the channels, or by using the ***DataLogger*** tab display.

7.1.30 **Message Box Title:** Confirm Serial Number

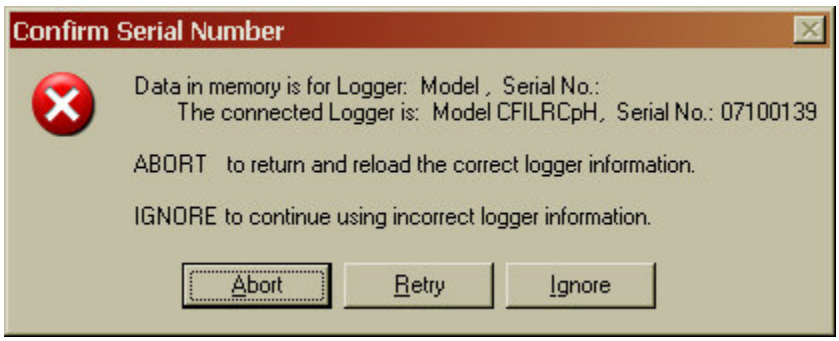

Figure 35, Confirm Serial Number

The software requires a few seconds to detect a disconnected logger and reset its internal memory. If a new logger is connected quickly enough, the information in the software will not be updated correctly, and there will be a mis-match between all header information, including calibration data! Any data displays will be erroneous as a result.

Every time a critical operation is requested, the system verifies that the connected logger's serial number matches that of the data in memory. If it does not, this warning box is displayed. Under most circumstances, the ABORT button is the correct choice. Then disconnect the logger, wait until the disconnect is announced, and reconnect to update the data correctly. ***Ignore*** at your own risk and only for specific reasons that will not jeopardize test data!!!!

8 Program Message List

The following are a number of the messages that may appear at various times to provide warnings and to confirm actions you have requested. Adverse results from a continuation of the action are always made clear so the User can make a reasonably knowledgeable decision. There are also several rare error message boxes that are not included here. If a Message ever appears where the required action is not intuitively obvious, please note the complete message text, the title of the message, and send this information to DASCOR.

Message:	THIS WILL DESTROY ANY TEST DATA! Have you downloaded? OK to continue Test, Cancel to abort
Called By:	***Check Data Memory*** on ***Help*** Tab.
Description:	To confirm start of test. Short test of data memory with random intervals. NOTE: Not available on all versions
Action:	***OK*:** to continue Test. ***Cancel*:** to abort.

Message:	Please confirm that you want to stop the logger and set it to low power mode. Ok to stop logging. Cancel to continue
Called By:	***Stop/LowPwr*** button on ***Data Logger*** Tab.
Description:	**Stop/LowPwr** message to stop the logger and set it in low power mode.
Action:	**OK:** to stop logging. **Cancel:** to Stop Logger.

Message:	Do you really want to stop the logger to reset?
Called By:	RESET LOGGER Low Power Mode button on Help Tab.
Description:	To confirm reset of the logger. NOTE: Not available on all versions
Action:	**Yes:** to reset the logger. The instructional message "Disconnect then reconnect logger to update display." will follow. **No:** to Cancel.

Message:	Logging is enabled. Logging must be turned off before continuing. You must re-initialize the logger to continue logging! Download data if necessary! Do you want to turn off logging now?
Called By:	Perform Calibration button on Cal Data Tab.
Description:	To confirm stopping the logger to enable user to perform sensor calibrations and transfer calibration data to ***Cal Update*** form.
Action:	**OK:** to stop the logger. The acknowledgement "Do you really want to stop the logger?" will follow. **Cancel:** to Cancel.

Message:	The default data file path is invalid. A data file folder has been created as 'C:\LoggerData'. See the manual for more information.
Called By:	Program startup.
Description:	This message is displayed if the default directory has not been set or if the default file path is invalid and the directory no longer exists.
Action:	**Ok:** to acknowledge the message.

Message:	The correct working Comm Port MUST be selected in the DEFAULTS tab before proceeding. Also, Be sure to set the correct path to the data file storage folder, or errors will occur during downloads. After setting all of the defaults, then select the LOG-ON tab and exit the program to complete the installation with the correct Registry settings. Read the README.TXT file for more details.
Called By:	Program startup.
Description:	This message is displayed if the Comm Port has not been set.
Action:	**Ok:** to acknowledge the message.

Message:	The Default Comm Port--Com # is not available. Please select a different Default Comm Port then exit the program and start it again.
Called By:	***Comm Port Selection*** on ***Defaults*** Tab.
Description:	To inform that the selected Comm. Port is invalid.
Action:	**Ok:** to acknowledge the message.

Message:	Logging is enabled. Logging should be turned off (=YES) to use RT functions, or left ON (=NO) to monitor data as it is being logged. YES will require re-initialization of the logger to continue logging. Do you want to turn off logging now?
Called By:	Selecting the Real Time Tab.
Description:	To confirm stopping the logging of data to enable user to use the Real Time display.
Action:	**Yes:** to stop logging. The acknowledgement " Do you really want to stop the logger?" will follow. **No:** to continue logging and monitor data. **Cancel:** to Cancel.

Message:	Scans Commanded are over 2% below the maximum allowed of [Maximum Number of Scans]. Please verify and re-initialize the logger if this is not correct.
Called By:	Up-load message.
Description:	To confirm ***Number of Scans***. Very rarely cumulative math errors in the date and time routines will cause the number of scans to be in error. If this message appears, re-initialize the logger. It occurs mostly when very short (<5 second) scan intervals are requested.
Action:	**Ok:** to acknowledge the message.

Message:	Error in reading eeprom, Logger may not be initialized. Contact factory for assistance if this error repeats after initializing logger.
Called By:	Initialization.
Description:	To acknowledge Invalid EEPROM. This is another very rare error and is usually encountered when the SIA plug is not rapidly connected to the logger and a number of intermittent connections occur (Contact bounce). Re-initializing the logger will almost always cure this problem. If not, please contact Dascor.
Action:	**Ok:** to acknowledge the message.

Message:	Please wait while data is downloaded from the data logger, Data download may take a few minutes depending upon magnitude of stored data. Acknowledge this message to initiate download.
Called By:	Download button on ***Data Logger*** Tab.
Description:	To acknowledge Data Download.
Action:	**OK:** To acknowledge the message and begin download. **Cancel:** to Cancel.

Message:	Scan Period must be greater than 0.1 hours for hour selection.
Called By:	***Hours*** button on Set-Up Tab.
Description:	To acknowledge ***Logging Duration.***
Action:	**OK:** To acknowledge the message.

Message:	Scan interval cannot exceed 18.2 hours, Please re-enter scan period.
Called By:	***Hours*** button on ***Set-Up*** Tab.
Description:	To acknowledge Invalid time period.
Action:	**OK:** To acknowledge the message.

Message:	Exceptionally long logging period, ensure battery is fresh.
Called By:	***Hours*** button on ***Set-Up*** Tab.
Description:	To acknowledge Long Logging Duration.
Action:	**OK:** To acknowledge the message.

Message:	Scan Period must be greater than 0.1 minutes for minute selections.
Called By:	***Minutes*** button on Set-Up Tab.
Description:	To acknowledge Logging Duration.
Action:	**OK:** To acknowledge the message.

Message:	Scan Period must be greater than one second.
Called By:	***Seconds*** button on Set-Up Tab.
Description:	To acknowledge Logging Duration.
Action:	**OK:** To acknowledge the message.

Message:	Please select the number of active channels.
Called By:	***Initialize Logger*** button on ***Set-Up*** Tab.
Description:	Called by ***Select number of channels*** if the requested number of active channels is less than 1 or greater than the number of installed channels.
Action:	**OK:** To acknowledge the message.

Message:	Please enter the scan period.
Called By:	**Initialize Logger** button on **Set-Up** Tab.
Description:	***Select scan period*** displayed if the scan period has not been set.
Action:	**OK:** To acknowledge the message.

Message:	Scan period cannot be zero, please re-enter scan period and time interval.
Called By:	***Initialize Logger*** button on ***Set-Up*** Tab.
Description:	Scan Period invalid displayed if the scan period has not been set.
Action:	**OK:** To acknowledge the message.

Message:	Please enter the scan period unit of measure.
Called By:	***Initialize Logger*** button on ***Set-Up*** Tab.
Description:	Select unit of measure displayed if unit of measure (hrs, min, sec) has not been set.
Action:	**OK:** To acknowledge the message.

Message:	Init_Error: Must select time unit for sample period.
Called By:	***Initialize Logger*** button on ***Set-Up*** Tab.
Description:	Select unit of measure displayed if unit of measure (hrs, min, sec) has not been set.
Action:	**OK:** To acknowledge the message.

Message:	Scan period: [# hh:mm:ss] Number of channels: [# Active Channels] Description: [the Description] Start delay: [Waits Time] Current System Date & Time: [" Date / Time, "yy/mm/dd-hh:mm:ss] If these settings are correct, then click OK to continue, Or, click CANCEL to return to the setup screen. Data upload should take only a few seconds.
Called By:	***Initialize Logger*** button on ***Set-Up*** Tab.
Description:	An informative Up-load message. Last chance to verify the settings.
Action:	**OK:** To acknowledge the message and continue with upload. **Cancel:** to Cancel.

Message:	Please wait while data logging settings are up-loaded to the data logger. Data upload should data only a few seconds. Acknowledge this message to start upload.
Called By:	***Initialize Logger*** button on ***Set-Up*** Tab.
Description:	Acknowledge this Up-load message to start upload.
Action:	**OK:** To acknowledge the message and continue with upload.

Message:	DATA HAS NEVER BEEN DOWNLOADED!

Select your choice from the below command buttons.

Called By: ***Initialize Logger*** button on ***Set-Up*** Tab.

Description: Data not Downloaded displayed if data on logger has never been downloaded.

Action: ***Download*****:** To cancel upload and go to do download procedure.

No Download, Initialize**:** To acknowledge the message and continue with upload. Current data will be lost.

Message: Value other than 0 must be entered.
Entry cannot be left blank.
Entry must be numeric.

Called By: ***Scan period*** entry on ***Set-Up*** Tab.

Description: Any one of these three message could be display if scan period input is invalid.

Action: **OK:** To acknowledge the message.

Message: Entry must be numeric.
Entry must be greater than one.
Entry must be less than 255.

Called By: ***Start Delay*** in seconds on ***Help*** Tab.

Description: Any one of these three messages could be display if the start delay input is invalid.

Action: **OK:** To acknowledge the message.

Message: The Slope or Offset appear to be manually entered.
Click OK to keep the entered Slope & Offset, or
Click Cancel to Exit then click the Compute Cal Factors button to calculate new values.

Called By: ***Exit / Sav***e to Logger button in the ***Data Logger Calibration*** Subroutine.

Description: To confirm use of the Slope or Offset that was manually entered.

Action: **OK:** to continue and save data.
Cancel: to Cancel and then Re Calculate Values.

Message: Unanticipated error writing [CH#], please check input values.

Called By: ***Exit / Save to Logger*** button in the ***Data Logger Calibration*** Subroutine.

Description: To advise that an Unanticipated error has occurred.

Action: **OK:** to continue.
Cancel: to Cancel.

Message: Error in entering data. If Type error 13 reenter cal date.

Called By: ***Exit / Save to Logger*** button in the ***Data Logger Calibration*** Subroutine.

Description: To confirm an Unanticipated error.

Action: **OK:** to continue.
Cancel: to Cancel.

Message:	Channel will clip LOW data--Compare Calculation Results with EU at A. Channel will clip HIGH data--Compare Calculation Results with EU at B.
Called By:	***Compute Cal Factors*** button in the ***Data Logger Calibration*** Subroutine.
Description:	One, or both of these messages may be displayed to warn of a possible problem due to values entered. Based on the logger calibration calculations, if the entered values for the full scale range of the sensor are higher than the calculated full scale input range, then one or both of these messages may occur. For example, if the calculated MAX reading is 125 PSI, and the stated full scale range of the sensor is 150 PSI, then the Clip HIGH Data message will appear since the full scale range of the sensor cannot be reached.
Action:	**OK:** to acknowledge.

Message:	Channel number greater than number of installed channels, please re-enter channel number. Channel number less than one, please re-enter channel number.
Called By:	***Channel number*** input area in the ***Data Logger Calibration*** Subroutine.
Description:	Invalid Channel Number. One, or both of these messages may be displayed to warn of a possible problem due to values entered. This message can only be reached by changing the channel number on the ***Data Logger Calibration*** Subroutine screen followed by a [`tab`] or clicking on another box.
Action:	**OK:** to acknowledge.

Message:	Range 0 – 1000000 Range 0 – [Maximum Y Value] Min can not be greater than Max Max cannot be less than Min
Called By:	When entering invalid values on Real Time Graph.
Description:	One, or more of these messages may be displayed to warn of incorrect values entered.
Action:	**OK:** to acknowledge.

Message:	Please verify that the header information is still correct on the next screen. OK to continue.
Called By:	***Check Header Memory*** button on ***Help*** Tab.
Description:	To inform user to check header information. NOTE: Not available on all versions
Action:	**OK:** to continue.

9 Appendix C - Battery Life Calculations

If formal Calibration Certificates are provided, the sheets for the individual loggers will contain two numbers essential to estimating battery life: Quiescent (or continuous) and Active current draws. These numbers can also be easily determined by inserting a sensitive milli-Amp meter in series with a battery lead.

Newer loggers use slightly higher currents (70 μA and 18 mA for the LRCpH loggers [FIX]), but the calculation methods give below can be applied to any logger where the quiescent and active currents can be measured. The actual numbers for your logger should be used in the following procedures. The numbers used below are a high, worst-case scenario using 4 of Micron's DBST sensors, and an 8-channel signal conditioner.

At 70 μA continuous, power consumption is 70 μA-Hour, 1.68 mAH-Day, 11.76 mAH-Week, 50.96 mAH-month, or 611.5 mAH-Year. In other words, μAH/Hour is simply the same as quiescent current draw. Multiply this number by 24 hours to get the draw per day, by 168 for a week, 728 per month, and 8736 per year.

The signal conditioner is on for 200 mS (55.6 μH) per scan, and off at all other times. At 26 mA/200mS per scan of 8 channels, one scan requires 1.44 μAH (1.44^{-3} mAH= 26 mA X 5.56 μH). To fill maximum memory (5120 scans) requires 7.39 mAH or 1.44 μAH X 5120.

At maximum scan rate of one scan per second, one hour of operation would use 5.20mAH, one day would use 124.8 mAH, one week would use 873.6 mAH, and two weeks would use 1747 mAH.

A Duracell Alkaline battery is nominally 580 mAH, and the UltraLife lithium batteries are nominally rated at 1,200 mAH. End-of-life voltage is considered to be 6.5 to 7.0 volts. Nominal "shelf life" of the UltraLife batteries is 10 years, with a temperature range of -40 to +70 degC. All calculations assume a constant 25 degC, and will change radically with temperature—particularly at the extremes. You should contact the manufacturer of the battery you plan to use to obtain current curves.

SO....for the lithium batteries:

No logging life: 1.96 years

Max continuous logging life at one scan per second: 1.37 weeks or 9.6 days.

One year of life would allow about 409,000 scans, for a scan interval of about 77 seconds.

Maximum life to fill memory once would be 1.95 years at a scan interval of 3.336 hours.

Are these numbers real? From data on a sample of 12 delivered loggers, the average quiescent current was 53 μA, peaking at 69 μA—thus the 70 μA used above. For Scan power, the average was 23 mA, with a worst case of 26--which is also used above. The 580 and 1200 mAH values are straight out of the Mouser and Digikey catalogs.

Please install fresh batteries at the beginning of a test of any duration.

10 Appendix D - Technical Specifications

A/D converter--Maxim MAX186D or MAX188

Note: all readings are ratio metric to Vref. 1 LSB = 0.024% or 244 PPM

Resolution 12 bits

"Relative Accuracy" +/- 1 LSB ("the deviation of the analog value at any code from its theoretical value after the full scale range has been calibrated.")

Differential Non-Linearity +/- 1 LSB

Offset Error +/- 3 LSB

Gain Error +/- 3 LSB

Vref output voltage 4.096 +/- 20 mV***

Vref Tempco +/- 30 PPM/degC

REF195's or Intersil reference IC's are used as the constant current and constant voltage sources

Reference voltage accuracy +/- 10 mV***

Long term Stability--1000 hours at 125DegC, 1.2 mV

Tempco, 10 PPM/degC

Offset and gain errors other than those related to temperature and time can be corrected during the system calibration of the sensor and the logger as a combined unit, and correction factors are incorporated into the y = mx + b coefficients entered into the logger and applied to the raw data during download.

Time related drifts are not quantified for the critical components such as the A/D, and can be gained only through experience.

Critical temperature data is given above. Worst offenders are the resistors used to set gains, calibration, and offset voltages at 10 or 25 PPM, and the Vref Tempco for the A/D converter at 30 PPM. Preliminary worst-case test runs suggest 9 mV over 0-50 degC, or about 180 PPM/degC from all sources.

In summary, overall accuracy should be better than six parts in 4096, or about 0.15% at constant temperature, and around 1% over 0-50 degC.

Other sources of error: signal noise coming down the cable from your sensors. Typically using stable, fixed resistor bridges on a 24 inch unshielded cable, this is about +/- 1 mV --with a maximum of about +/- three mV.

*** Items corrected during system calibration and reflected in the slope and offset calibration figures.

11 Appendix F - Intrinsic Safety Issues

11.1 GENERAL

The Mod-1 loggers were designed for long-term deployments running on a single battery, and they were to be removed from the environment being monitored to a non-hazardous depot for downloading and maintenance. Accordingly the components for the serial data interface to the PC and the external power supply were contained in a separate module called the SIA. The SIA also provided local power to the logger during the download stages, which was limited to approximately 11 volts DC, and derived from a small wall-mounted power supply. The logger itself had minimal protection of the interface—consisting primarily of Zener diodes from each I/O line to ground, which limit the maximum input power to 15 volts, and signal levels to 7.5 volts. There are no current limiting resistors or fuses on any of the lines.

BH-M1b Loggers, on the other hand, are designed to include some of the functions of the SIA within the logger case, and have RS-232 serial interface chips with up to 15KV of ESD protection. Up to 24 VDC external power can be applied to the logger. This supply can also provide current limiting if required—and it is fused and provided with both over-voltage protection Zener diodes, and reverse voltage protection diodes. This voltage is reduced to 5 volts DC for digital logic functions within the logger.

Both loggers are designed to run from internal batteries—nominally 9-volt transistor radio batteries—of either Alkaline or Lithium chemistries. The batteries are diode isolated from the external power, and whichever voltage is higher will provide the operating current to the loggers. The batteries are not fused and do not have over-voltage protection diodes. The batteries are capable of providing several hundred milli-Amps for short periods. However, they feed drop-down regulators designed to current limit in the 40-100 mA range, and normally fail in the "no-output" mode—although this should be verified with the manufacturers of the regulators.

If total isolation is required, the Mod-2 Loggers can have an optically isolated interface designed which would provide total isolation for the RS-232 signals. Since the Loggers draw minimal current while in operation, it would be practical to add external intrinsic safety barriers on the external power input.

Normally the logger itself would not be mounted in close contact with hazardous material. The sensors, however, may be in intimate contact with ignitable materials.

11.2 SIGNAL CONDITIONING CONSIDERATION

Both loggers draw from the 9-volt batteries to generate approximately +/- 6 volt power rails. These rails are capacitively bypassed (with a cumulative total of <30 μF for MOD1), and connect to the Instrumentation Amplifier (IA), op-amps, excitation, and reference voltage supplies. The IA's do not supply voltage to the signal inputs, and generally clamp the signal inputs to close to the power supply rails. Failure modes of the IA's are unknown at this time.

The DBST sensors require about 1 mA of excitation current supplied by a constant current supply in the logger. RTD senors are typically set to a constant current of about 200 μA. Compliance voltages are the battery voltage less about 3 volts. With a new battery, this would be about 7 volts, and about 4 volts with a dead battery. The constant current supplies have a 1 μF capacitor to ground.

12 Appendix G - Power and Timing Design Issues

Over the past year, a number of requests have been made for alterations to the Dascor Loggers to minimize power draw and change the logger's overall functionality. This brief discussion is intended to review the operational architecture of the hardware, firmware and software so that the advantages and limitations of the loggers are understood.

12.1 Date and Time Generation

There is no "real time clock" per se in the logger. This fundamental fact needs to be clearly understood! Time is kept very simply as a seconds count. There is a precise timer based on a watch crystal that activates the firmware once every second. A counter keeps track of the number of elapsed seconds, compares the reading with a "trigger" count, and performs an action when a match occurs. "Real" date and time of the initialization is stored as textual information within the logger, and indicates the "Zero count" moment when the seconds counter is set to zero and started.

If the operator enters a ***delayed logging start***, the applications software calculates the number of seconds between the current time of the PC and the desired start time. This count is then stored in the logger header. When the Delay Count and the elapsed seconds count match, then the logger starts logging data. This feature is used in the **delayed start** count on the **Defaults** tab.

The scan interval operates similarly. The scan interval in seconds, minutes, or hours is entered by the operator. The software again converts it to an interval in seconds, which is stored in the logger. Again, a comparison value is calculated and stored, and once a match is realized with the elapsed seconds counter, a scan occurs, the next elapsed count is calculated and stored into the comparator, and the cycle repeats.

When the data is downloaded, the Header contains the date and time of the initialization, the date and time of a delayed start, and the scan interval. During the download process, the actual date and time of each scan is derived mathematically from this basic information and added to the data file in the first column.

The key point here is that date and time information that appears in the .CSV data file is not based on a real-time clock in the logger, and is not stored in the logger--it is re-created from the basic setup information.

12.2 Using The PC's Clock

There is another critical point that needs to be made: The time and date stored in the logger is based on the time and date of the real-time clock in the PC or laptop that is setting up the logger. If that clock is in error--i.e. it does not reflect true Universal Coordinated Time with any time zone factors--then all times and dates reported by the logger will be relative to the initializing PC rather than "true" time and date.

If precise time relationships are required between multiple loggers to identify common events, then it is imperative that all of the loggers share a common, precise time reference. In turn this demands setting the internal clock on the PC's precisely to a common standard.

There are a number of public domain programs available from NIST, and an excellent application from Intuit Software called "Atomic Clock" (About $19 + Shipping) that will automatically call a nearby standards lab (e.g. NIST in Boulder Colorado, or the Greenwich Observatory in England) and set the PC's internal clock to match time and date within a few milliseconds of UCT. This does require a modem and phone connection.

There are also dedicated low cost radio receivers that will perform the same function by monitoring one of the WWV or WWVH stations. These units may not function in your location if the signals are particularly weak. GPS receivers with serial interfaces can also be used as very accurate time bases, but in either case you would need to contact the manufacturer of the device for software support.

The clocks in PC's are fairly stable, but do drift with time, temperature and variations in power supplies. "Nominal" accuracy is a few seconds a day, but variations of several minutes over a few days have been observed.

12.3 Logger Clock Accuracy

The clock in the data logger is derived from a standard watch crystal. Nominal accuracy is +/- 20 PPM or about 2 seconds per day. This is a ten-minute error over the course of a year. However, watch crystals have a fairly high temperature coefficient, and operation outside of a 20-25 degC ambient will cause significant time drift—70 PPM is not unusual. Tempco's are fairly predictable, and drift can be estimated if the temperature history is known, but can be several hours per year.

For precision time bases that are stable over time and temperature, crystals must be maintained in a constant temperature oven, and/or have compensating circuitry--both of which are expensive in terms of cost and power consumption--and are usually not justified in a relatively low cost or very low power data logger.

Why does your $10 watch keep better time than your $2000 computer? It is next to your skin, and your body heat maintains it at a reasonably constant temperature.

Actual timer tests using a precision Fluke Counter indicate that at short scan intervals (say <30 seconds) there is a fair amount of jitter in the timing of the individual readings—on the order of 60-100 PPM, or about an hour a year. At scan periods longer than a minute, the jitter settles down to a reasonable 5-10 PPM, or about 5 minutes a year.

In general, the shorter periods see the short-term drift of the crystal, while the longer periods average this effect and minimize it. Keep in mind that although the actual time of an individual scan may be off slightly, the overall should average out to the rated 20 PPM of the watch crystal if it is maintained at constant temperature.

12.4 Why not use a watch chip?

There were a number of reasons that went into the decision early in the design process. The main issues were programming complexity, cost, available memory, and the mandatory (at that time) requirement to monitor other activities such as the battery condition and the need to communicate with the external world. It was decided that the most effective solution from all standpoints was to dedicate a low cost, low power microprocessor to the task of keeping track of elapsed time and monitoring the battery and communications lines for activity, then waking up the main processor when required. Furthermore, storing trigger values as Years, Months, Days, Hours, Minutes, and Seconds would have required significantly more memory, and radically increased the complexity, reliability, and cost of the firmware and software.

12.5 Power Issues

The processor that keeps track of the elapsed seconds count, and the event match counts must run continuously. If it is turned off for any reason, including disconnecting the batteries, or being "put to sleep," it will stop counting elapsed seconds. When it is turned back on, it has no way of knowing how long it was not counting, and will pick up where it left off. The result is that there is a missing number of seconds that cannot be determined, and the relation of subsequent second counts will have NO relation to the time the logger was initialized--and any reconstructed dates and times will be meaningless.

12.6 Power Consumption

The lowest power consumption, by design, is when the clock processor is the only active device, and it is merely monitoring signal lines, counting elapsed seconds, and waiting for an event match. Typical power draw is typically between 30 and 50 micro-Amps--and is continuous.

When an event occurs, the main processor turns on, as does the signal conditioning power, and the current draw can go towards 30 milli-Amps--a three order of magnitude increase. However, when running strictly on battery power, the main processor is turned on for a fraction of a second at intervals ranging from one second to over 18 hours. As a result, when in environmental logging mode with scan intervals of several hours, the power drawn by the main processor and analog circuits is insignificant compared to the continuous draw of the clock. As scan rates increase (intervals decrease), the duty cycle increases, and this power draw starts to become more and more significant.

12.7 Power Conservation and Storage

Since the least amount of power is drawn when only the clock processor is running, the longest battery life is when the scan interval is at its maximum duration, and the delayed start is also at its maximum. These conditions effectively minimize the "on" time of the main processor and the analog circuitry.

If a logger is to be stored for extended periods of time without being used, the battery/s should be disconnected and removed--particularly if carbon or alkaline batteries are used. When the device is placed back into service, new batteries should be installed, and the device initialized using normal procedures.

For shorter periods of time, where it is not considered practical to remove the batteries, the logger should be placed into STOPPED mode, either by downloading the data, or using the ***Stop Logger*** button.

12.8 Power Sources

The data loggers are designed to derive their power from one or more internal batteries, or an external source. The internal "raw" power rail is connected to the various sources through isolating diodes. Whichever source has the highest voltage will supply the power to the "raw" power rail. This is why the SIA modules output about 11 volts--which is sufficient to over-ride the maximum fully charged battery voltage (9.5 volts MAX).

12.9 External Power

In cases where it is desired to run the SIA in conjunction with a laptop, and utility power is not available for the wall-supply, a separate battery clip and plug are provided to allow the SIA to operate off of a standard 9-volt transistor radio battery. The SIA draws about 12.5 mA in idle mode, and increases depending on the state of the battery in the logger.

In the case of the MOD-1 logger, if it is desired to power the logger from the external battery as well, then a standard 2.5MM male monaural audio plug can be used to connect the SIA to a standard 12 volt cell, cigarette lighter or other 12 volt DC power source. The tip is positive, and the ring or barrel is negative/ground.

Both units are designed to work from internal 9 volt batteries, or external 12 volt supplies. Both units should operate from 24 volts DC as well, but will internally self-protect at voltages much over 24 by appearing to the power source as a short circuit.

12.10 Storage Options

There are effectively two options: remove the batteries, or put the logger into the lowest power consumption mode.

The first option requires re-initialization on power-up. The second consumes small but finite amounts of power and potentially compromises battery life. It also requires re-initialization prior to deployment.

It should be noted that the "Remote Start" or “pause” option was implemented primarily to allow conservation of memory during "dead" transit times to the deployment site--but also happens to be a low power consumption mode (at a cost of an additional 5 µA).

12.11 Battery Disconnect Switches

It is possible to add a switch in series with the battery, so that the power to the logger may be completely disconnected for short-term storage without opening the case. However, it should be noted that the logger MUST be re-initialized on power-up to restore an accurate time base to the system, and any subsequent power-down and power-up will destroy any subsequent accuracy in the time base.

Further, a mechanical switch always has the potential of being "accidentally" turned off--or on--at the wrong time and potentially compromising all data in the logger. As a result, disconnect switches are not recommended and were not included in the original design.

It would be possible to add a mechanical switch to one of the logger engine battery stacks. During transport or storage, the second stack could be turned off, leaving the logger to draw power from the first stack. On field deployment, the second stack could be turned back on. Since it had not been used, it's higher voltage would prevail until the second stack had been drawn down to the level of the first. At this point, power would be drawn from both stacks until they reached the "low battery" alarm level, at which point the logger would be put into permanent sleep

mode until awakened by the download PC. The arguments above about accidental (or intentional) activation or de-activation of the second stack still apply.

12.12 Software Options

DASCOR has implemented an option to add a default ***Stop Logging*** button to the ***Logger Data*** tab that puts the logger into the lowest possible power consumption mode for short-term storage without removing the batteries.

13 Appendix J - Printer Setup

Many screens have a *Print* command button located on them. Clicking on this button will send an image of the present window to the system printer. In an office setting, this would be the "default" printer normally used when printing documents.

If you would like to send the image to a file for later printing (when running in the field on a lap-top, for example), then you will need to create a new printer and make it the system default.

Go Start / Settings / Printers / Add Printer. Create a new printer of the same make and model as your default system printer, but specify "FILE" for the destination, and "YES" to make the printer the system default.

Now when you hit the Print button, a file name dialog box will appear. You will need to enter the folder and file name for the file to be created, and click OK or save to store the image.

To print the image, move the file to the system with the actual printer and drag the icon from the folder to the printer icon on the desktop.

To reset your default printer to an actual printer, go to the printers window, select the desired printer, then select *File/Set Default.*

For unusual systems or problems, consult the Windows *HELP* system, or your MIS Manager.

14 SYSTEM CALIBRATIONS

For a two-point field calibration, see the appropriate User's Guide for detailed procedures. In essence, the signal conditioner gain box is set to **1.000**, the offset to **0.000**, and the excitation to whatever value is set for the sensor. The actual value entered for excitation can be just about anything…the critical point is that the sensor and signal conditioner excitation entries be identical.

The two points are generated by applying known stimuli to the sensor, and the ADC counts (mV) are read from the Real Time screen on the logger software. This data is then entered for points A and B, and the software will calculate a correct slope and offset that automatically takes all other corrections into account.

ALWAYS REMEMBER TO SAVE THE RESULTS TO THE LOGGER!

information from the original Data Logger.