MDL-DataManager™

Version 5.0 Reference Guide

For use with the MicroDataLogger® data acquisition system.

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www.archenergy.com

FCC Notice

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MDL-DataManager™ Software
and
MicroDataLogger® data acquisition system

Reference Guide

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1.0 Overview of the MicroDataLogger® System

Architectural Energy Corporation (AEC) has created the MicroDataLogger® data acquisition system that is a portable, four-channel, battery-powered logger with associated sensors and accessories. The MicroDataLogger unit (MDL) is a general-purpose microcomputer-based data logger with the following unique features.

- FLASH memory
- 12-bit resolution
- Modular interchangeable sensors
- Provided excitation power to sensors
- Automatic sensor identification
- Individual logger serial number
- Onboard LCD display
- Accepts analog and digital signals

The MicroDataLogger unit can be used as a stand-alone portable data acquisition system to meet any variety of user-defined data collection needs, or as part of an integrated system of application software, such as the ENFORMA series, with embedded engineering algorithms to solve specific performance evaluation problems.

AEC has recently enhanced the MicroDataLogger system by adding remote access capabilities. The new ***MDL-Remote***® system utilizes the MicroDataLogger acquisition system with a specially equipped modem and associated hardware to easily retrieve data via phone line from a customer's location. The new remote system integrates **MicroDataLogger®—DataManager™** software (**MDL-DataManager**) with a companion package called **MicroDataLogger®—DataRetriever™** software (**MDL-DataRetriever**).

A diverse set of customers benefit from AEC's MicroDataLogger data acquisition system that includes utilities, energy service companies, HVAC contractors, compressed air service companies, and energy consultants.

The MicroDataLogger unit is a small, battery-powered data logger capable of recording time-series information from a wide variety of sensors and electrical transducers. A personal computer is used to configure the MDL for a particular application and later to retrieve and analyze the recorded data.

The MicroDataLogger unit has four plug-in slots for signal conditioning modules (sensors). When a module is installed in the logger, an Auto-ID feature can identify the module's function and will automatically program the correct excitation power and sensor warm-up time. The MDL's non-volatile FLASH memory can store approximately 64,000 readings total or 16,000 readings for each of four channels.

The frequency of MDL measurements is user-defined and can vary from one measurement every three seconds to one every hour. To conserve the MDL's memory, a number of individual measurements can be averaged together and stored as one reading. At a typical measurement frequency of once every minute using typical low-power requirement sensors, the MDL can record data for more than 30 days.

Other features include a Liquid Crystal Display (LCD) display, real-time clock, 12-bit resolution, precision voltage reference, serial port, and easy-to-use Windows-based logger control software, **MDL-DataManager** software.

2.0 Quick Start Guide

Attaching Modules to the MicroDataLogger Unit

The MicroDataLogger unit (MDL) has four plug-in slots for sensor and signal conditioning modules. Facing the front of the MDL unit with the Liquid Crystal Display (LCD) at the top, these channels are numbered 1 to 4 from left to right. Modules are easily installed on the logger by sliding the module's rear mounting clip onto the edge of the MDL module mounting deck, while making sure the module's connector is correctly aligned with the pins on the MDL mating connector. When the pins are aligned, push the module completely into the MDL mating connector. This will lock the module securely into place and will protect it from being accidentally disconnected. To remove the module, pull it straight out of the logger.

> **Warning:**
> It is very important to properly align the module connector with the pins on the MDL mating connector. Improper alignment will bend the pins, making the MDL unable to accept modules and can result in a wide variety of problems.

LCD Display and Push Button

The MDL's alphanumeric LCD can be activated by the push button switch located on the right side of the logger.

Press once for a sequential display of the user-programmed logger name, the current time, and other information about the current state of the logger.

Press twice for the current (real time) readings from all four channels. The display will briefly show the units of measure and then display the channel readings for the next five minutes.

Press three times for a sequential display of the logger's user-programmed channel configuration information, logger serial number and firmware revision level.

Press four times for a continuous (5 minute) display of the battery voltage. The logger will emit a warning beep at the end of the 5-minute interval. You must have firmware version 1.07 or higher to support this feature.

> **Note:**
> If your MDL does not have firmware version 1.07 or higher, please call to order a firmware upgrade for your MDL. Firmware version 1.08 is standard on Model 202 MicroDataLogger units.

Once a display mode is activated, it will continue through its display sequence and then go back to sleep. To cancel and exit a display mode, press the button once.

Button Start/Stop

The pushbutton can also be used to override the programmed **Start Time**. Data logging can then start immediately or logging can be terminated early. This feature can only be used if the MDL was configured with the **Button Start/Stop** option. If Button Start/Stop is enabled, press and hold down the push button for five seconds to start data logging before the **Start Time**. Logging will continue until the configured **Stop Time** is reached, the memory is full, or the push button is held in again for 5 seconds.

You must have firmware version 1.07 and **MDL-DataManager** version 2.0 or higher to support the pushbutton stop feature.

Software Installation

The **MDL-DataManager** software is included on CD with the purchase or rental of a MicoDataLogger unit. Installation of the software is simple and straightforward when following the CD package instructions or the web site download directions.

The latest version of the **MDL-DataManager** software is made available for download on the Architectural Energy Corporation (AEC) web site (**www.archenergy.com**) at no charge. AEC requests that visitors downloading the software online provide contact information so that we can identify which customers are using which version of software in case technical bulletins or application notes need to be sent to software users.

The **MDL-DataManager** software has these system requirements for operation:

- Windows®-based system of Windows 95 or greater
- NT 4.0 or greater (NT 4.0 Requires Service Pack 4 or above)
- Requires Common Controls 32 (**MDL-DataManager** will install if not present)
- A Comm Port in range 1, 2, 3, 4

System Administrators are needed when installing **MDL-DataManager** on to Windows® NT (or Windows® 2000 or XP) Operating Systems.

Connecting the MicroDataLogger to a Computer

First, connect the end of the serial communication cable with the rectangular 9-pin female connector to the computer's serial port, and then insert the other end into the round DIN connector on the right side of the MDL. When the cable is plugged into a sleeping logger, the MDL will wake up and the LCD display will show ON for a brief moment (less than a second).

> **Note:**
> Before attempting to communicate with the MDL for the first time, be sure to use the command ***Preferences-Options***, ***Comm Port/Modem*** to select the correct communications port (**COMM 1**, **COMM 2**, **COMM 3**, or **COMM 4**).

AEC recently enhanced the MDL system by adding remote access capabilities. The new remote system integrates **MDL-DataManager** software with a companion package, the **MDL-DataRetriever** software. For configuration instructions, see the **MDL-DataRetriever™ Software** section.

Configuring the MicroDataLogger

The MicroDataLogger unit must be programmed for a particular data collection application before it can be used. This process is called *configuration*.

To configure the logger, use the following procedure:

1. First, plug in the appropriate modules if you would like the software to automatically configure the channels with the proper modules. *(This is not required to configure the MDL; however, it is good practice to ensure that the proper modules are placed into the proper channels and so that the **MDL-DataManager** software's Auto-ID feature also can be used.)*

2. Connect the MDL to the personal computer running the **MDL-DataManager** software.

3. Select ***Logger-Configure MDL*** from the Main Menu. See ***Configure MDL*** for more information about configuration issues. Enter **Start Date** and **Start Time**, **Duration** (a data collection/recording period) and the **Sample Interval** (a measurement frequency).

4. Complete the configuration process by sending the configuration to the logger by clicking on the ***Send Config*** button.

The correct operation of the MDL now can be confirmed by using the Menu Command ***Logger–Real Time Readings*** to display the configuration information stored in the logger's memory and see the current readings of each channel. Real Time Readings also may be viewed when using the real-time display on the logger by using the two-button press mode. After confirming proper operation, the MDL can be disconnected from the computer and deployed in the field.

When logging is completed, reconnect the MDL to the computer. Use the Menu Command ***Logger–Retrieve Data***. All the measurements stored in the logger's memory are now transferred to a disk file in the computer. The **MDL-DataManager** software's graphing features now can be used to view the data on screen and to send data to a printer. Refer to the **MDL-DataManager™ Software** section for further details.

Battery Capacity and Charging

The MicroDataLogger unit is powered by an internal, rechargeable 6 volt, 1.3 amp-hour battery. The logger typically spends most of its time in a low-power sleep mode. Whenever it is time to take a measurement, the MDL real-time clock wakes up the microprocessor to begin a sampling cycle.

Digital modules are an exception. The pulse, status, and occupancy modules can wake up the MDL at any time. Each time the microprocessor wakes up, it checks the battery voltage and, if the voltage is too low, it will stop logging and display a ***Low Battery Stopped*** alarm message. This protects the battery from being damaged by excessive discharge. Data in Flash memory up until the ***Low Battery Stopped*** event occurs will remain safely stored without power.

If the battery voltage is 6.2 volts or less, a Low Battery Warning message will be displayed upon entering the ***Configuration, Real Time Readings*** or ***Retrieve Data*** menus. This warning indicates that the battery may not be fully charged. A fully charged battery will read 6.4 volts or higher. The MDL will operate until the battery voltage drops to 5.6 volts, and then will enter the ***Low Battery Stop*** state. Connecting the logger to the charger and waiting until the voltage comes back up to 6.2 volts or higher will allow the logger to operate normally again. This can take several hours if the battery is fully discharged.

Battery Charging: Plug the charger into a standard 120 VAC wall outlet and insert the charger cable plug into the external power jack on the right side of the MDL.

Recharging time varies depending on the condition of the battery, but 8 to12 hours (overnight) is the maximum time required. The charger is designed to function at room temperature (65-75 degrees F) and will not charge properly in cold or hot environments. The red LED indicator on the charger will light brightly when first connected to a discharged battery. When the battery is charged, the LED will occasionally flash indicating that the charger is in Float mode. The charger can be left connected to the MDL unit continuously without damage to the battery.

Battery Voltage can be read from the MDL unit's Display Mode 4 (four presses of the push button) or from the **MDL-DataManager** software. To obtain an accurate battery voltage reading, disconnect the logger from the charger. After disconnecting the charger, the battery will typically read 6.5 to 7.5 volts, but this is not a reliable indication of the battery's charge. A fully charged battery typically will read about 6.4 volts (after sitting for 24 hours) on the LCD display. To read the battery voltage under load, perform a four-button press and read the battery voltage at the end of the 5-minute interval. (The alarm will sound and the last voltage reading will be displayed.) Battery voltage indications in the **MDL-DataManager** software will be lower than the Display Mode 4 indications because of the additional power required to operate the serial communication interface. Therefore, the most accurate indication of battery voltage is shown on the logger's LCD display in Display Mode 4.

Warning:
In order to preserve battery capacity and prevent permanent damage, the battery should be recharged after every deployment.

Loggers being stored for an extended period should have their batteries recharged every two months.

The maximum operating time of the MDL unit's battery depends on the power requirements of the modules and sensors used. Sensor **Warm-Up Time**, Sample Interval and the Ambient Temperature also influence the **Estimated Battery Run Time**. Under typical conditions, using low power sensors, a fully charged battery will power the MDL for more than 70,000 logged readings. More than anything else, the sample interval you choose has the largest influence on the amount of time you will be able to collect data.

Think of the battery as a large bucket of water and each time you sample your sensor you remove a thimble of water. The slower you sample the longer the bucket will contain water. Every time you sample the MDL's channels, you remove some of the charge from the battery. The faster you sample the sooner the battery's charge is depleted.

Estimated Battery Run Time

The following table shows an estimate of the maximum time that an MDL-202 with a new, full-capacity battery will run for various sample intervals with low-power sensors such as temperature sensors. Increasing the sample time, warm-up time, or using sensors with high-power requirements will decrease the run time of the MDL unit.

Sample Interval	Estimated Battery Life
3 seconds	2 days
15 seconds	10 days
1 minute	30 days
5 minutes	90 days
15 minutes	180 days

The MDL-202 battery has a capacity of 1.3 amp-hours. Capacity will decrease with age, the number of charge/discharge cycles, the length of time the battery sits in a discharged state, and the depth of discharge. The voltage at full charge of an older

battery will appear to be about the same as a new one, but its capacity and run time will be less. The MDL's battery is designed to maintain 80% of its new capacity after 200 charge/discharge cycles. Low ambient temperatures (0°F) will decrease capacity about 30%. In addition, the self-discharge rate of the battery at room temperature is about 5% per month. All of these effects should be considered when determining the sample interval for the desired logging duration.

A **Battery Runtime Test** should be performed if the condition of the battery is suspect.

Sensors with High Power Requirements

Some sensors supplied with the MDL or available from other manufacturers use significant power, and may be operated for only a short time before depleting the battery. The 12 volt sensor excitation power supply can provide up to 100 mA, but at that rate battery life is limited.

It is recommended that sensors with high power requirements be operated with the MDL connected to its external AC line powered battery charger or only operated for a short period of time using the internal battery. For extended operation, an external 6 volt battery of the required Amp-Hour rating should be used.

> **Note:**
> Power-hungry sensors that use significant power include hot wire anemometers, tachometers, aspirated radiation shields and many types of gas sensors (CO2, CO, etc.). For related information, see **Battery Runtime Test.**

Battery Runtime Test

In order to assure the reliability of the MDL's battery, it should be tested every three to six months and after any deployment in which the MDL fails to log for the configured duration or crashes. It's a good procedure to keep a log of test dates and runtimes for each MDL.

1. Disconnect all modules from the MDL and charge the battery for at least 8 hours.

2. Disconnect the charger from the MDL and check the battery voltage (four-button press) – it should read about 6.5 to 7.2 volts shortly after being disconnected from the charger.

3. Connect the MDL to a computer and configure the logger using the special battery test configuration file supplied with **MDL-DataManager** version 3.0 or higher software. To load this configuration, go to ***File-Use Existing Config*** and select **BATTEST2.CFG**.

4. Send the configuration to the MDL and then disconnect the serial cable and battery charger. Observe the LCD after logging begins. You should see SAMPLING flash on the screen every 6 seconds. If the MDL does not start on time, reconnect to the host computer and check the configuration.

5. Allow the MDL to continue running until it stops flashing SAMPLING. With new batteries, this may take 15 to 20 hours depending on the model year of the MDL. Logging will automatically stop when the battery voltage drops to 5.6 volts or less.

6. When logging has ended, reconnect the MDL to its charger and activate the LCD by pressing the button once. Look for the LOW BATTERY STOPPED warning message and note the Stop Date and Stop Time displayed. Pressing the button three times displays the configuration including the Start Date and Start Time. Subtract the Start Date and Start Time from the Stop Date and Stop Time to determine the number of hours of operation. If the MDL ran for less than ten hours or the battery is older than 5 years, the battery should be replaced.

After the test, remember to recharge the battery for eight or more hours before using or storing the MDL.

3.0 MDL-DataManager™ Software

MDL-DataManager software operates in the Windows operating system. Software installation instructions can be found in Section 2. When **MDL-DataManager** software is accessed, a title screen is shown, followed by a blank screen with the following menu commands shown across the top tool bar:

File Logger Graph View Preferences Help

Each of the six main menu commands are discussed in detail.

AEC has recently enhanced the MicroDataLogger system (MDL) by adding remote access capabilities. The new ***MDL-Remote*** system utilizes the MDL unit with a specially equipped modem and associated hardware equipment and software to easily retrieve the data via phone line from a customer's location.

The new remote system integrates **MDL-DataManager** software with a companion package, called **MDL-DataRetriever** software. For configuration instructions, see MDL Remote Software topic.

3.1 File Menu Commands

The ***File*** Menu Commands control all communications with the MicroDataLogger unit. The commands available are:

Configure MDL, ***Real Time Readings***, ***Retrieve Data***.

Use Existing Config

You can use a previously saved configuration file to configure the MicroDataLogger unit. When ***File–Use Existing Config*** is chosen, a file dialog box will open and show previously saved configuration files. Select a configuration file and click on ***OK***. This will open the ***Configuration Window*** and fill in the appropriate fields with information from the configuration file. For related information, see Configuration Window.

Delete

This menu item (***File–Delete***) opens the dialog box ***Delete an Existing File***. Select **Configuration (.cfg), Data (.log)**. or **Graph (.grf)** setup files to be deleted. Click ***OK*** to delete the file.

Warning:
Any files deleted are no longer available; this function should be used with care.

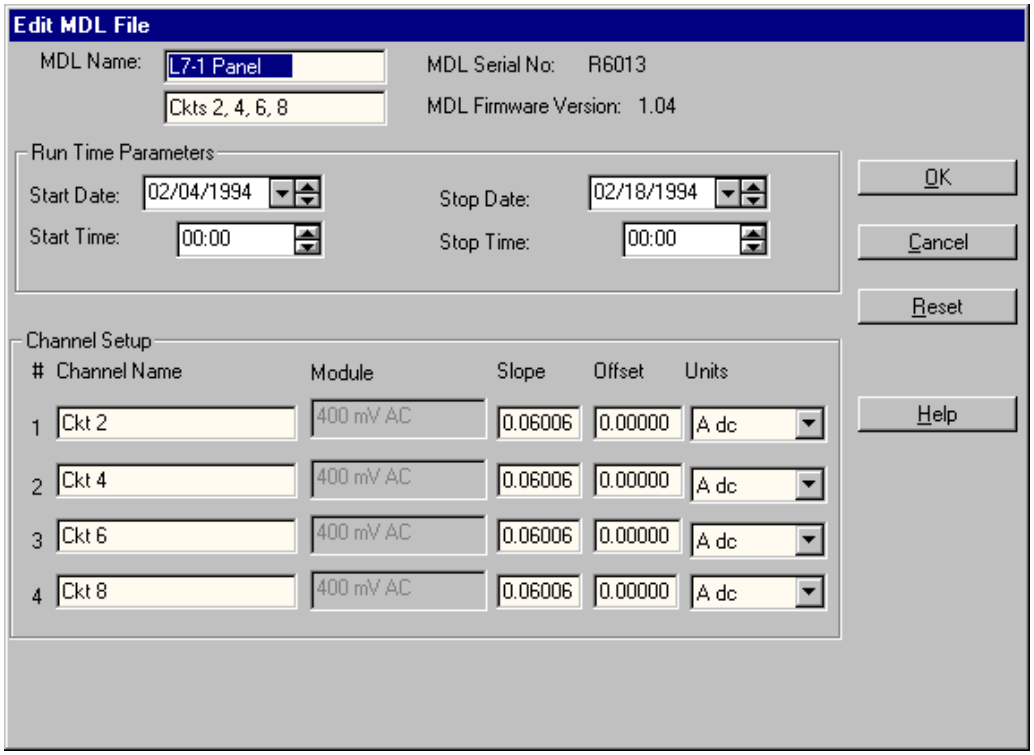
Export (to ASCII File)

The command ***File–Export*** (***to ASCII File***) creates an ASCII text file from a MicroDataLogger binary data file. The ASCII file can be loaded into other programs such as spreadsheets or text editors. This menu item opens a file dialog box that can be used to select the MicroDataLogger file to be exported to ASCII format. View the topic example ASCII file to see the format of a tab delimited ASCII file.

Note:
Select desired format (***Preferences–Options, Export File Format***) BEFORE *choosing* ***File–Export*** (***to ASCII File***). Default is set for Tab-Delimited.

The default export format is Tab Delimited, which imports into Excel very easily. There are two formats for the ASCII export file:
(1) Tab Delimited
(2) Comma Separated Values.

Edit Log File



At times, it is necessary to edit an MDL log file while still maintaining the MDL *.log format.

MDL log files can be edited by selecting Edit Log File under the File menu. When this menu option is selected, a standard file dialog is displayed to allow the selection of the file to be edited. When the file is selected, a new file name is suggested, usually by adding "_1" to the original file name. To protect original data, the software does not allow overwriting an existing file.

MDL Name
The logger name can be changed if desired to better reflect where it was located.

Logger start and stop dates and times
The start and stop of the log file can be changed to remove data from the beginning or the end of the file. This is useful particularly if the sensors were not properly installed before the start of the logging period, or if the logger sensors were removed before the end of the logging period.

Channel Name
The channel name can be changed if desired to better reflect the location of the measurement.

Slope, Offset, and Units
For data channels that used a user-configurable module that requires a slope and offset, these can be edited to correct errors made during installation. For example, if a slope for a 100 amp CT was used and a 200 amp CT was actually installed, the scale factor can be changed to correct the data. Similarly, if the wrong units were selected during the initial configuration, this also can be corrected.

To correct the Slope and Offset, type in the correct values. The software will perform the corrections when writing the new file.

If you wish to return all fields to their original contents, click the Reset button.

Print Configuration File Configuration files are saved while in the Configure MDL screen. The command ***File–Print Configuration File*** sends a MDL logger configuration file to the printer. First, the file dialog box ***Print a Configuration File*** is displayed. Select the MicroDataLogger configuration file to print. Click ***OK*** to print. This option is useful for documenting your monitoring setups.

Recent File The ***File-Recent File*** command is not a functioning command within the **MDL-DataManager** software at this time.

Exit ***File–Exit*** closes **MDL-DataManager** software.

3.2 Logger Menu Commands

The ***Logger*** Menu Commands control all communications with the MicroDataLogger unit. The commands available are:

Configure MDL, ***Retrieve Data, Real Time Readings***.

Configure MDL The ***Logger–Configure MDL*** command opens the ***Configure MDL*** window. This window is used to set up the logger prior to deployment and includes the module type for each channel, logging Start Time, Sample Interval, Duration and other configuration information which must be sent to the MDL before logging can begin. The following topics discuss each field in the Configure MDL window.

Operation of Auto-ID Feature
When ***Logger–Configure MDL*** or **Read Channels** is selected, the software uses the Auto-ID feature to determine the types of modules plugged into the logger and selects the proper modules from the module drop down lists.

When using ***Logger–Configure MDL***, if there are no modules plugged into the logger, the module configuration information used in the previous configuration will be used.

MicroDataLogger Name
Enter a ***Name*** for the MicroDataLogger unit in the **MDL Name** field, such as its location, use, project, etc. Up to two 16-character lines of identification information can be entered. This ***Name*** appears in both the configuration and the data files, and in the Logger LCD display mode 1. Like the Serial Number, the **MDL Name** will serve to identify resultant data files collected.

Values for the Channel Setup Group fields will be automatically configured based on the following rules:

1. A channel-by-channel comparison is made between the configuration information stored in the MDL and the modules currently plugged into the MDL. If the modules are the same type as defined in the configuration data stored in the MDL's memory, the stored configuration information is used.

2. If a module slot is empty (***Not In Use***), the configuration information stored in the MDL is used.

3. If the module slot contains a module type different from the type defined in the MDL's configuration, the default values for the module type installed are used.

Note:
If ***File–Use Existing Config*** from the File menu is chosen, the software will fill in all fields using the information stored in the existing file. However, if there are modules plugged into the logger and there is a difference between the physical module and the module type in the configuration file, a warning dialog will be displayed to ask if you want the contents of the file to override the actual configuration.

All of the fields also can be manually configured. Descriptions of each field are contained in the following topics.

Channel Name Field. Enter up to a 14-character alphanumeric label for each channel to easily identify the channel of data when plotting or exporting the data.

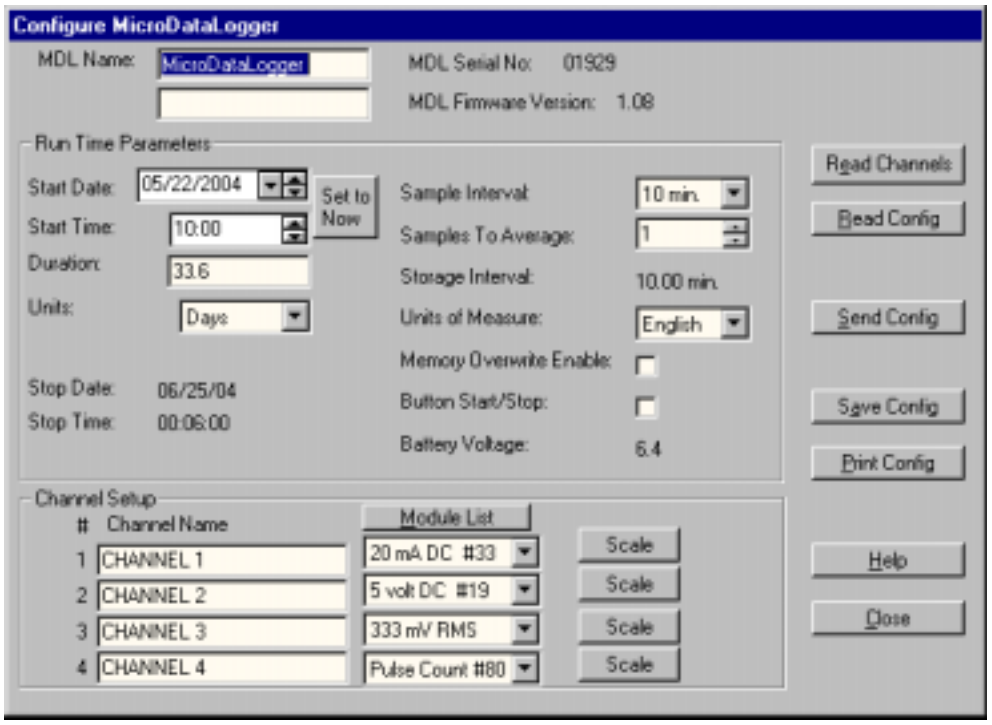
Module Description. The Module Description field identifies the type of module that the MDL will be configured for use. This field will be filled in automatically as described in Operation of Auto-ID. To manually select a different module type, use the drop-down list. Entering the first letter of the module type will automatically scroll the list to that entry.

Manual module description is used if the MDL being configured currently does not have any modules installed.

Edit Module List. This menu choice opens a window that displays all the current supported module types and allows the user to select whether the module type will be displayed in the drop down list on the MDL configuration screen. This makes it easier to find a module when the list only contains frequently used modules. If a module is Auto-ID'd by the software, and that module was not already selected, it will be selected and the module will appear in the list.

To select modules to be displayed in the list, click on the desired module.

Configuration Parameters Window



Run-Time Parameters

When ***Logger–Configure MDL*** is initially chosen from the ***Logger*** menu, the **Start Date** and **Start Time**, **Duration**, **Sample Interval,** and **Samples to Average** fields are filled in based on the configuration information stored in the MicroDataLogger unit

filled in based on the configuration information stored in the MicroDataLogger unit (MDL) from the last time it was configured.

If the ***File–Use Existing Config*** is initially selected, the **Start Date** and **Start Time**, **Duration, Sample Interval** and **Samples To Average** fields are filled in based on the information previously saved in a configuration file.

Start Date and Start Time. Fill in the desired Start Date and Start Time using "AM/PM" or military time, depending on how you have the clock set on your PC. The Increase and Decrease arrow buttons next to each field can be used to increase and decrease the values in whole days or hours, respectively. Values can also be entered from the keyboard.

Set to Now. This button automatically sets the start date and time to the current date and time.

Every time the MDL is configured, the logger synchronizes its internal clock to the clock of the PC being used to configure it.

Duration. The Duration is the length of time that the MDL will be deployed collecting data. Select the desired time units: days, hours, or minutes. Fill in the Duration field. The Increase and Decrease arrow buttons next to the Duration field can be used to increase and decrease the duration in whole days, hours, or minutes depending on the duration units selected.

> **Tip**:
> If you wish to collect data for the maximum period available at the selected storage interval, set the duration to a very large value (999 days) and **MDL-DataManager** will automatically change the duration to the maximum value possible.

Stop Date and Stop Time. The Stop Date and Stop Time are calculated fields and will be filled in automatically, based on the Start Date and Start Time and the Duration entered.

Sample Interval. The sample interval is the length of time the MDL will *sleep* before waking up to take the next sample (read the sensor values of all channels). Select the sample interval from the drop-down list.

> **Note:**
> Short sample intervals will decrease the amount of time that the logger can operate with only the built-in battery. For information on the period of time that the logger can operate for various sample intervals, see Estimated Battery Life.

Samples to Average. The Samples to Average is the number (1 to 255) of samples to be averaged and stored as one reading in the data file. For example, if the Sample Interval is set at 15 seconds and the desired Storage Interval is 1 minute, set the Samples to Average to 4.

> **Tip**:
> Use the Samples to Average feature when short of memory and you need a long duration time; however, averaging samples does not extend battery life.

Storage Interval. The Storage Interval is the time between stored values and is a calculated field. It will automatically be filled in based on the sample interval and the Samples to Average values.

Button Start/Stop

The MicroDataLogger unit has the capability of being started or stopped in the field manually by holding the push button in for five seconds. This feature is only available if the logger was configured with the **Button Start/Stop** Enable option selected. If a manual start in the field is desired, the **Button Start/Stop** Enable check box needs to be clicked on in the **Run Time Parameters** Group box.

To stop logging hold the push button in for five seconds. Logging will also end when the configured stop time is reached. The default is to have **Button Start/Stop** Enable disabled.

The Start/Stop feature does not permit users to repeatedly start and stop the MDL unit. The feature allows the MDL to be started with the push button command and also stopped with the push button command when the feature is enabled. Once the MDL is stopped with the push button command, it must be reconfigured to start logging data again.

Note:
This feature requires firmware version 1.07 or higher. If your MDL does not have firmware version 1.07 or higher, please call to order a firmware upgrade for your logger. All Model 202 loggers have firmware version 1.08.

Overwrite Data When Memory is Full

When **Memory Overwrite Enable** is checked, the MDL has the capability of overwriting the oldest data in memory to enable continuous monitoring. For example, if a piece of equipment is being monitored to detect a failure mode, but the user is uncertain when the failure will occur, the MDL can be configured to run for an indefinite period of time. When the memory is filled, the oldest data will be overwritten with the newest data. Flash memory is erased in 16 K blocks or about 11,000 readings.

To enable this option, click the check box **Memory Overwrite Enable**. If this option is chosen, a message box will confirm that you want this option to be selected:

Warnings:

With **Memory Overwrite Enable** selected, new data will overwrite the oldest data when memory is full. Verify or cancel this option.

When memory overwrite is enabled, deployment duration can be so long that the battery will become discharged (Low Battery Stop). To prevent this, use the Battery Charger for continuous operation from AC power.

Battery Voltage

The **Battery Voltage** display is the last item in the **Run Time Parameters** Group. The **Battery Voltage** display gives an approximate indication of the battery's state of charge. A better indication of battery voltage is obtained by pushing the MDL pushbutton 4 times and reading the voltage on the display.

Refer to **Battery Capacity** and **Charging** for more information.

Memory Capacity

MDL-DataManager software will automatically calculate the MDL's memory capacity, based on the user-selected **Sample** and **Storage Intervals** chosen. If a duration period is selected which exceeds the MDL's memory capacity, a dialog box (error message) will pop-up. Click the ***OK*** button. The duration period is automatically reduced to the maximum duration period allowed by the MDL's memory capacity.

Note:
The battery capacity may be the limiting factor in determining the maximum logging period. If fast sampling and averaging are used, then the battery could be depleted before the memory is filled.

Scale Buttons

There are four **Scale** buttons, one for each channel. These are enabled only if a User Configurable type of module is installed, such as a 0-5 VDC input module or a pulse input module, for example. When a user configurable module is installed, click the Scale button to open the module Configuration Parameters window.

Configuration Parameters.
User configurable modules can be configured with the following parameters.

Slope and Offset. The Scale Factors of Slope and Offset are used to convert raw data into engineering units suitable for display. These Scale Factors are very important for user-supplied sensors that do not Auto-ID in the **MDL-DataManager** software**. For guidance on how to calculate scale factors,** reference the **MDL-DataManager** Help topics and select Calculating Scale Factors**.**

Units of Measure. Selecting this menu option opens a window that provides a choice of either ***English*** or ***SI (metric)*** units of measure for the non-user configurable modules, such as temperature. After selecting the desired units, click ***OK*** to save this information.

Warm-Up Time. The MDL can supply 12-volt DC power for sensors and modules. Only User Configurable Modules (5 volt, 10 volt, 20 mA, etc.) can have their warm-up times adjusted, but not below the minimum value that automatically appears. These modules are typically used to input signals from sensors and transducers supplied by other manufacturers.

Some types of modules require power to be turned on prior to sampling a channel. This is called Warm-Up Time: the length of time excitation power is turned on before taking a sample. When an external sensor is powered by the MDL, the 12-volt sensor power needs to be turned on before taking a reading to allow the output signal to stabilize. The default warm-up time for most modules is five tenths of a second (500 mS). Depending on the characteristics of the sensor, the default warm-up time may need to be increased. Check the sensor manufacturer's specifications for how long it takes the output signal to become stable after the power is turned on.

If a longer warm-up time is needed, enter a new time such as ***10***, for a one second Warm-Up time (ie: 10 tenths of a second). All modules default to a minimum warm-up time and cannot be adjusted below that minimum.

> **Note:**
> Warm-Up times longer than two seconds automatically limit the Sample Interval to 6 seconds or longer. The Sample Interval must be longer than the longest warm-up time selected. If the Sample Interval needs to be adjusted to accommodate a long warm-up time, a dialog box will inform the user.

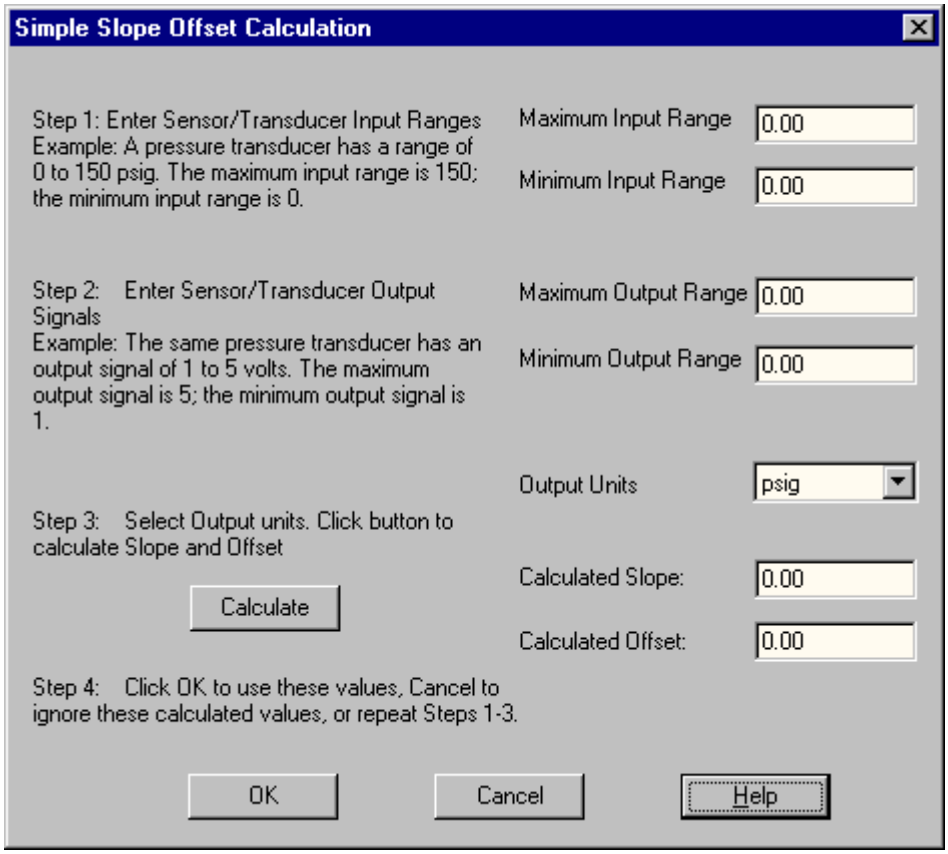
Decimal Digits. The Decimal Digits controls the number of decimal places to the right of the decimal point that will be displayed. Two decimal digits are the recommended number to have for any data collection efforts. A selection of three or more decimal digits will cause asterisks (********) to appear in the MicroDataLogger unit's display.

Slope and Offset Wizard. MDL-DataManager version 5.0 introduced a Wizard for performing the calculations required for Slope and Offset based on the information entered by the user. TO access the Wizard feature, click on the Slope and Offset Wizard button.

> **Note:**
> The MicroDataLogger unit's LCD displays a maximum of 5 digits plus a decimal point and the sign (-) of the number. If asterisks (********) appear in the display, reduce the number of decimal places. *Logged data is always recorded at full accuracy and is not affected by the display's decimal digits setting.*

Scale and Offset Wizard

A Wizard is provided that is accessed by clicking the Slope and Offset Wizard button. Different screens are displayed depending on the type of user-configurable module attached to the logger. An example window that requests user-defined parameters for Slope and Offset calculations is shown below. The Wizard that appears is based on the module selected.



Simply follow the step-by-step instructions on the window that appears, and be certain to click on the Calculate button at Step 3, and OK to return to the Configuration Parameters window where the Wizard automatically transfers the Slope, Offset and Output Units into their respective fields. The Wizard also provides a Help option to address user questions.

Command Buttons

There are various command buttons on the right-hand side of the Configure screen, described below:

Read Channels. The ***Read Channels*** command uses the Auto-ID feature to compare on a channel by channel basis the module configuration information stored in the MDL with the actual module types that may be currently installed in any of the four channel slots.

If the stored configuration module type is the same as the actual module type, the stored configuration information (module type, slope, offset, etc.) is used. If the module slot is empty, the configuration is changed to ***Not In Use***.

Note:
If the stored configuration module type is not the same as the actual module type installed in the channel slot, the actual module type is used. Default values are used for the required channel configuration information. It is good practice to visually verify that the module type displayed matches the module type used on a channel-by-channel basis.

Read Config. When the ***Read Config*** button is clicked, the software updates all the fields on the ***Configure MDL*** window with the configuration information stored in the MDL. The action is identical to that which occurs when you first enter the ***Configure MDL*** window. This option can be used to read a new MDL's configuration without having to exit the ***Configure MDL*** window. This allows multiple loggers to be configured more quickly.

Send Config. Clicking the ***Send Config*** button will send the configuration information, shown in the ***Configure MDL*** window, to the MDL. This must be done before the MDL can be used to collect data.

Save Config. The current configuration can be saved in a file on the host computer. Clicking the ***Save Config*** button will open a file dialog box that will allow the user to input a file name for the configuration file. The extension for the configuration file is *.CFG.

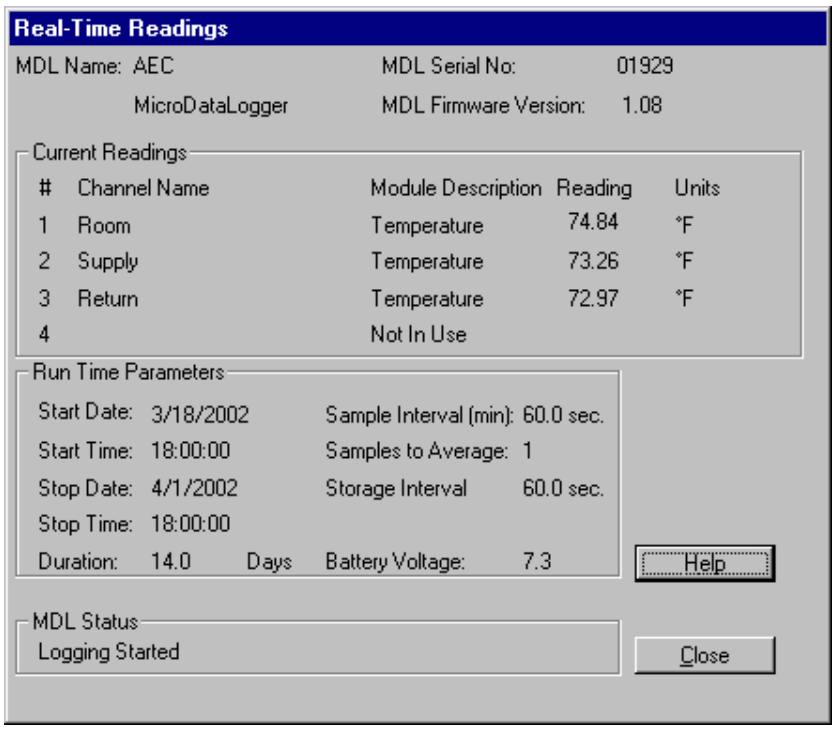
Saving a configuration is useful if a particular configuration will be used frequently. Use the ***Save Config*** Button Command to store all of the configuration information used for that deployment. The configuration file can be reused by selecting ***Use Existing Config*** from the **File** menu.

Print Configuration. The current logger configuration information can be printed by clicking the ***Print Config*** button to provide a hard copy record of the current MDL configuration.

Configuration files are saved while in the **Configure MDL** screen. The command ***File–Print Configuration File*** sends a MicroDataLogger configuration file to the printer. First, the file dialog box ***Print a Configuration File*** is displayed. Select the MicroDataLogger configuration file to print. Click ***OK*** to print. This option is useful for documenting your monitoring setups. View the **MDL-DataManager** Help topic Example Configuration File to see the contents of a configuration file report.

Close. Closes the configuration screen.

Real-Time Readings



The ***Logger–Real Time Reading*** Command displays the current channel readings and the status of the MicroDataLogger unit. The readings are updated approximately every two seconds. To close this screen, click the ***Close*** button.

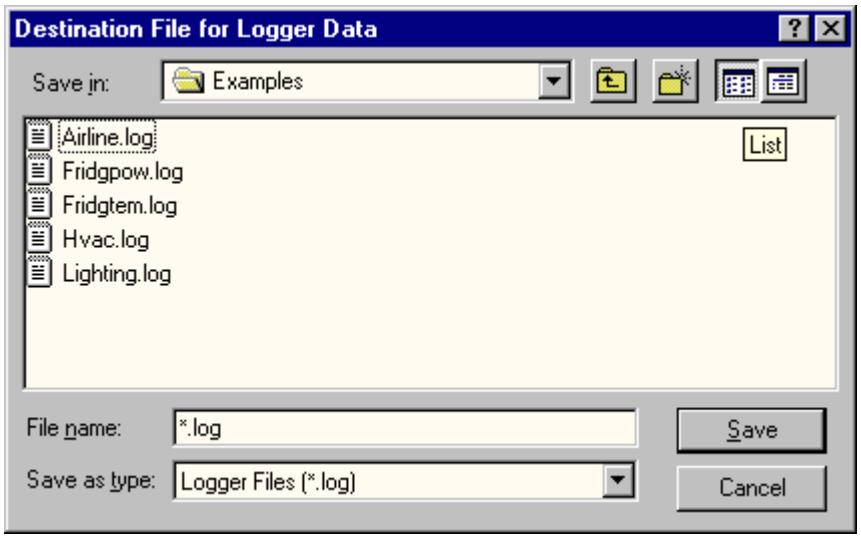
Another way to read real-time readings is to push the MDL pushbutton two times and read the real time readings on the logger display.

Note:
If you're having problems with this feature, verify that you are using **MDL-DataManager** software version 4.0 or higher. If you're using an earlier version of the software, upgrade to the latest available version. This can be done by visiting the Architectural Energy Corporation web site and downloading the software for free at www.archenergy.com.

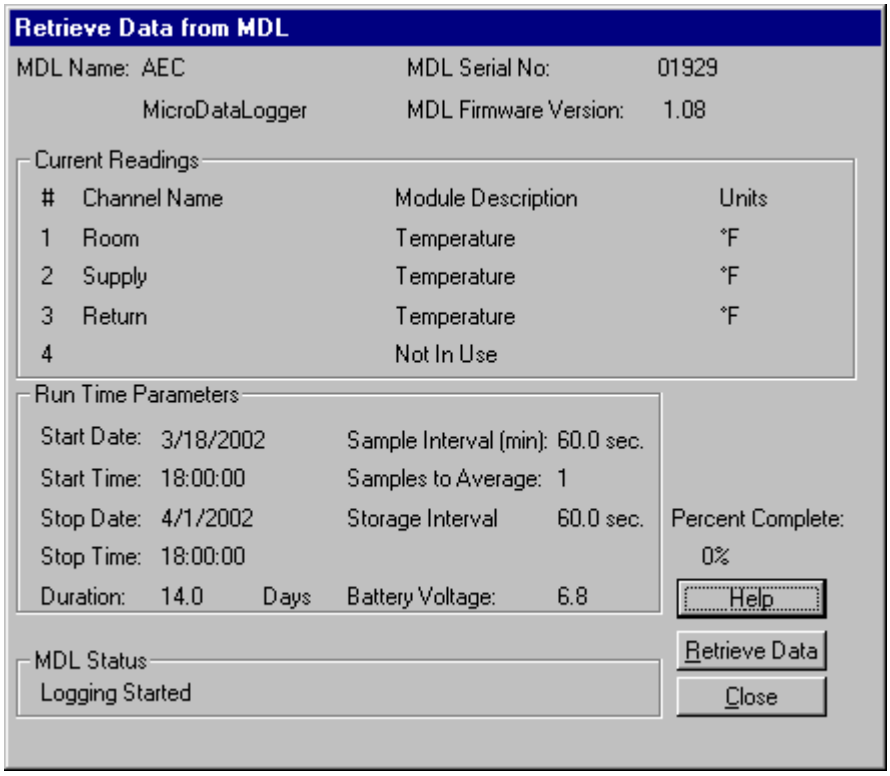
Retrieve Data

When ***Logger–Retrieve Data*** is selected, a window is displayed with logger information and two buttons as follows:

Retrieve Data. To initiate the data retrieval process, click on the ***Retrieve Data*** button. A file dialog box will open, permitting the user to retrieve data into a new or existing file. Type in a file name. The file extension ".log" will be added automatically by the program.



Data are typically retrieved after the data collection period has ended. Data can also be retrieved at any time before the MDL has completed data collection. Data retrieval will not interrupt ongoing data collection.



The MicroDataLogger unit will sound a tone when it begins transferring data. As the data is retrieved, a **Percent Complete** display will indicate progress. At about 90% complete, the MDL will sound a tone, which indicates that the data file has been successfully transferred to the host computer. The program then will run for a few moments more to convert the data and store it in the file. When the conversion is complete, a *Transfer Complete* message will be displayed (on older computers with slower microprocessors this delay may take 5-10 seconds).

Cancel. The ***Cancel*** button on the screen allows the user to close the screen without retrieving data. If data are being retrieved, the ***Cancel*** button can be clicked to stop the retrieval.

Tip:
If the battery voltage is low, connect the battery charger to the MicroDataLogger unit before retrieving data to prevent a Low Battery Stopped alarm shut-down. Even if the battery fails, the logged data is safely stored in FLASH memory which does not require battery backup.

3.3 Graph Menu Commands

The ***Graph*** menu functions provide many useful features. They provide quick viewing of MicroDataLogger data files. The graphing function permits the creation of up to four time-synchronized data plots from one to four data files collected by up to 4 MicroDataLogger units. Time and value scaling can be changed using mouse zooming. The data plots can be saved, imported into other programs using the clipboard, and printed.

New Graph Definition

The graphing function permits the creation of up to four data plots from one to four data files collected by up to 4 MicroDataLoggers in the multi-plot mode. In the "One-Plot" mode, up to 25 data streams can be added from any combination of data files. Time and value scaling can be changed using mouse zooming. The data plots can be

saved, imported into other programs using the clipboard, and printed. Follow these steps when ***Graph—–New Graph Definition*** is selected to create or edit a graph definition.

1. Select the desired MicroDataLogger data file in the file list box. When you select the file by clicking once on it, the data channels in the selected file will be listed in the "Channels" list box.

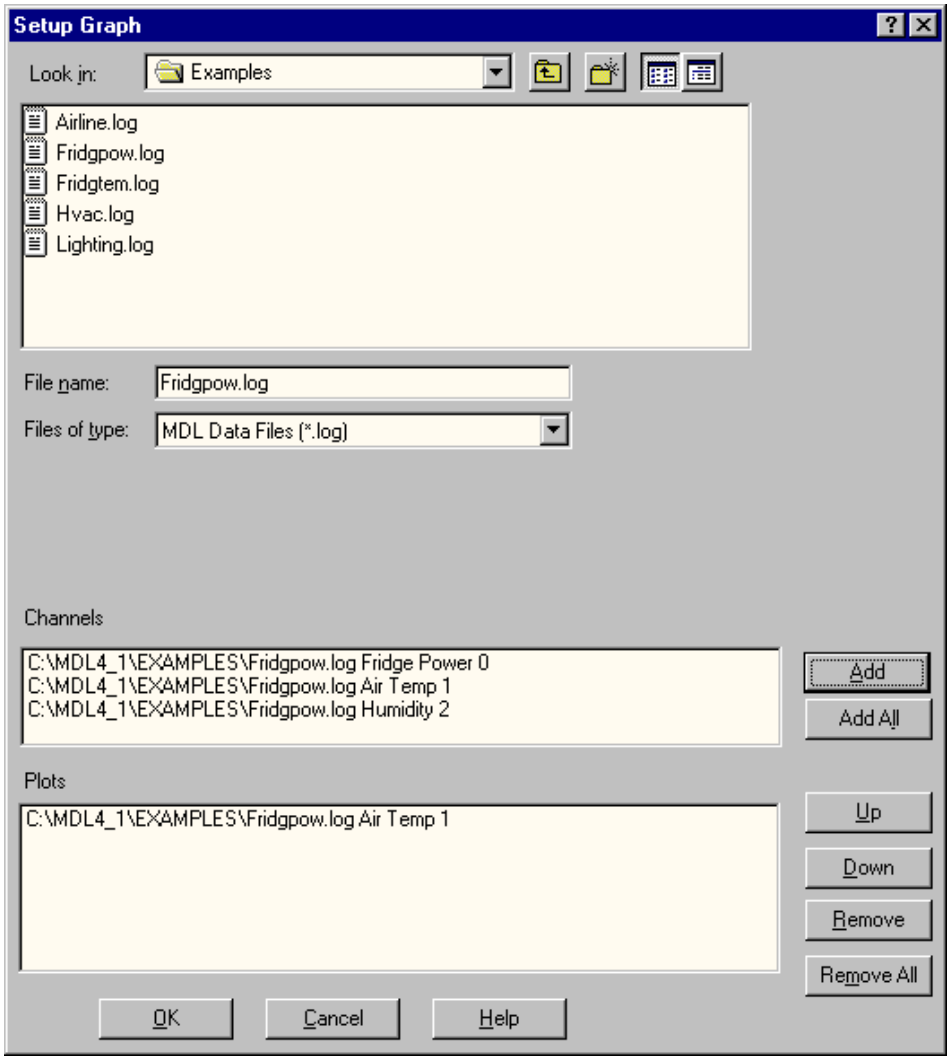
2. To add channels to the plot list, either select them individually by clicking once on each channel and add the selected channels to the plot list by clicking "Add", or all of the channels to the plot list by clicking "Add All".

   You can add unlimited additional data channels from other data files to the plot list using this technique, although only four data channels can be displayed at once. The data channels will be added to the drop-down channel lists in the Graph view.

3. To change the order of the data channels in the plot list, select individual channels and use the Up and Down buttons to change the order.

4. To remove data channels from the plot list, select individual channels and click the Remove button, or to remove all data channels from the list, use the Remove All button.

5. When the Plot List is finalized, click OK to close the window and display the Graph Window.

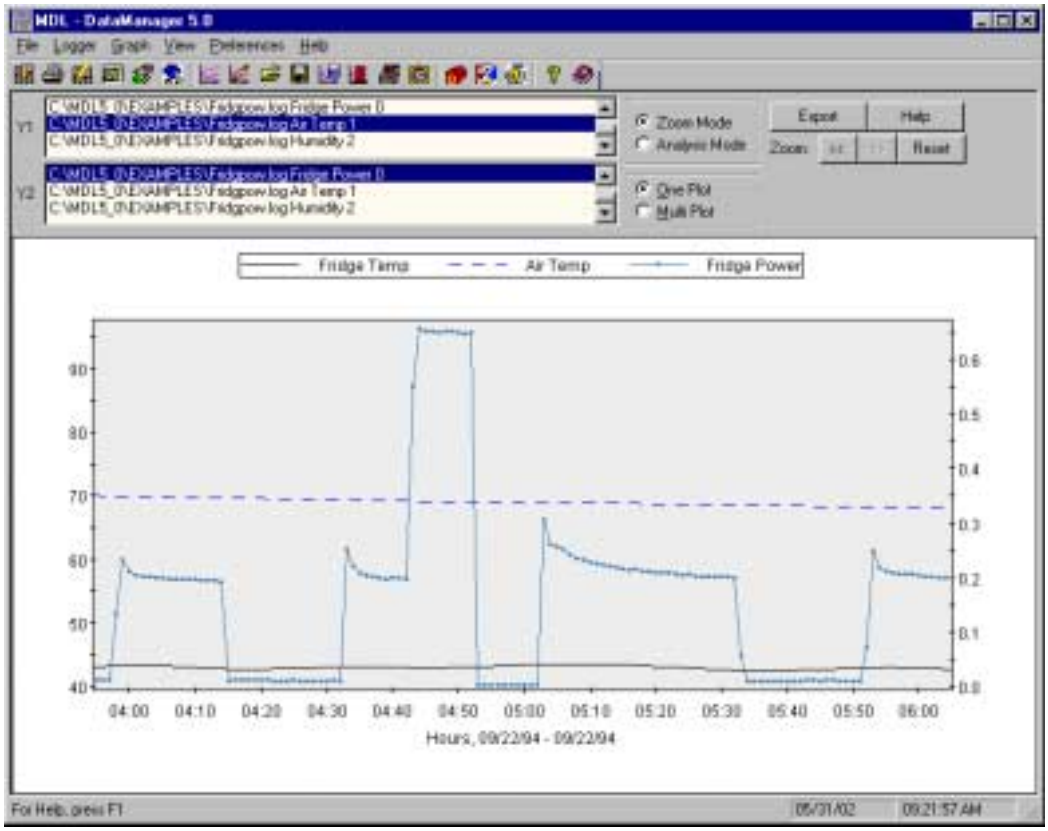


Open Graph Definition

When ***Graph–Open Graph Definition*** is selected from the menu, a file dialog box is displayed showing the available graph definition files. Graph definition files end in the extension *.grf. The Files shown in the ***Open an existing Graph Definition File*** window contain *pointers* (links) to the data files used to create a graph, **not** the data itself. If the graph definition and/or the data file are moved from their saved locations, these links will be broken.

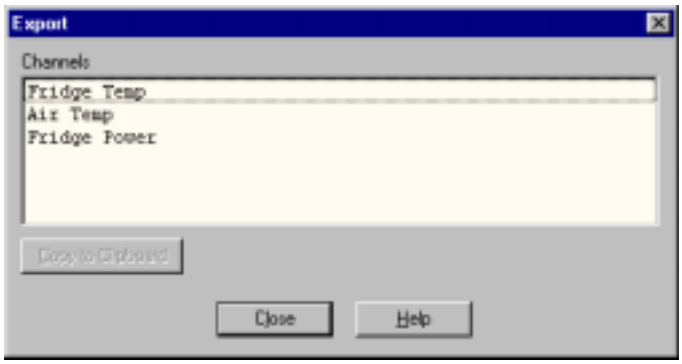
> **Note:**
> To create a graph, the original data files must be present on your computer's disk drive.

Graph Definition Display



Export Data

Export. Data currently displayed in the graph can be copied to the clipboard using the Export feature. To access this feature, click the Export button to display the dialog box shown below.



This dialog box lists the currently plotted data. Select the channels of data to copy to the clipboard by clicking on the desired channels. Multiple selections can be made by holding down the control key while clicking with the mouse. Click the Copy to

Clipboard button to complete the operation. The data can now be pasted into another application such as Microsoft® Word or Excel.

One Plot. When data are plotted on a single plot, up to 25 data streams from any combination of data files can be viewed. To facilitate viewing data with different units or vastly different values, data can be assigned to either the left (Y1) or right (Y2) axis. All of the data that was selected for plotting in the ***New Graph Definition*** dialog is listed in the Y1 and Y2 list boxes. Select data for each Y axis by clicking on it. To switch data from the Y1 to the Y2 axis, select the data in the Y2 list box. It will automatically be de-selected from the Y1 list box. Data can be switched to the Y1 list box using the same process. Data can be removed from the plot by clicking on the highlighted item in the list box.

Multi Plot. When originally created, graphs appear in the multi plot format. Only four data streams can be displayed in this mode and they appear stacked one on top of the other.

Edit Graph Definition

By selecting ***Graph-Edit Graph Definition*** when viewing a new or existing graph, you may add to or remove from the graph data streams by following the steps listed under New Graph Definition.

Close Graph Definition

Select ***Graph–Close Graph Definition*** to close the currently displayed graph.

Save Graph Definition

Graph–Save Graph Definition As and ***Graph–Save Graph Definition*** save the current Graph definition. If the current Graph definition has not previously been saved, a dialog box opens allowing the current Graph definition to be saved under a new or existing name.

All graph properties such as titles, colors and scaling are saved in additional graph properties files that have the same name but different extensions as the graph definition file.

Print Graph

Graph–Print Graph prints the current graph, first displaying the graph with the Print Previewer, using the current printer definition specified in the **Window's Print Manager.**

Copy Graph to Clipboard

The current graph can be copied to the clipboard and pasted into another document, such as Microsoft Word, using ***Graph–Copy Graph to Clipboard***.

The Mouse

The mouse has several functions when the ***Graph*** window is open that can be very useful.

Left Mouse Button

Zoom Mode: If the Zoom Mode radio button is selected, the mouse is in zoom mode. When the left mouse button is held down and the mouse pointer is dragged across the screen, the zoom feature will become activated. In multi-plot mode, a box is displayed on the screen showing the minimum and maximum time that will be used to draw the new re-scaled graph. Drag the mouse to include the portion of the time scale to be expanded. When the left button is released, the graph will be redrawn with the new time scale. This operation can be undone by clicking the left arrow button (<<) on the graph view, or redone by clicking the right arrow button (>>). To view the entire data set, click the Reset button.

When only one plot is shown, the zoom will scale both in the X and Y directions.

When the mouse pointer is dragged across the screen when the left mouse button is held down, a rectangle will be displayed that shows the area that will be included in the new graph.

Clicking on the Unzoom button returns the graphs to their original scale and appearance.

Analysis Mode: If the Analysis Mode radio button is selected, the mouse is in analysis mode. In Analysis Mode, the mouse is used to select a time region for analysis. The area is selected in the same way that zooming is performed. Once the area has been selected, a window will appear with Analysis Results.

Right Mouse Button.

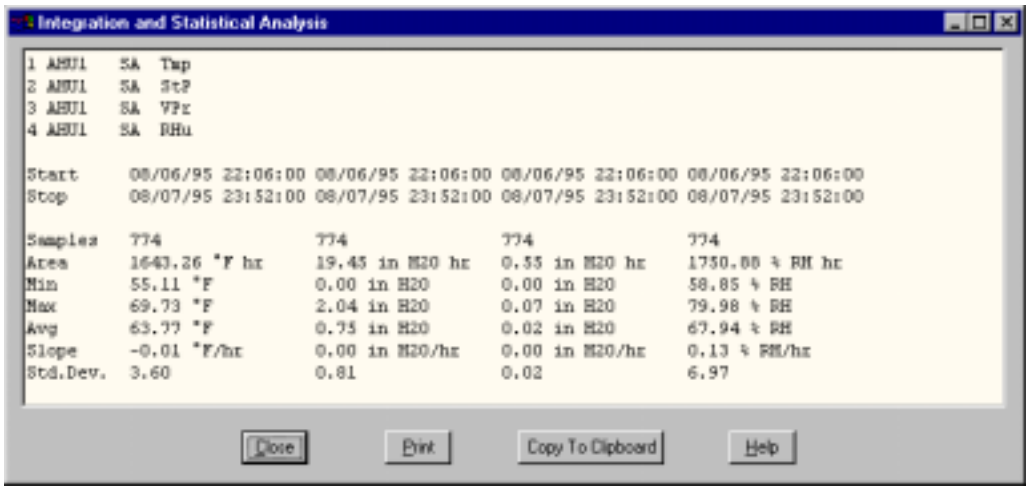
Clicking the right mouse button displays the property dialog box for the selected graph. To select a graph, click on it with the left mouse button. You can change labels, scaling, colors, and many other features of the graphs using the property dialog. For more information about the properties dialog box, click the help button on the dialog box.

3.4 Graph Analysis Features

Integration and Statistical Analysis

To perform an analysis of a region of the logger data, first click on the **Analysis Mode** radio button on the graph screen. Hold down the left-mouse button, and drag the mouse over the range of the graph to be analyzed. The points closest to the beginning and the end of the selected region will be used to define the range of the points in the analysis.

Tip:
Percent “On Time” data collected using the STATUS-81-3 module is not suited for Integration and Statistical Analysis mode. Export this kind of data to a spreadsheet for analysis.



The following information is appears in the analysis window for each plot.

Plot # Logger Channel Name. The plot number from 1 to 4, and the MicroDataLogger Channel Name assigned to the logger during the configuration process.

Start/Stop Date Time. The analysis period selected with the mouse. This may vary from one plot to another if the data was not collected from the same logger and the data streams do not start or end at the same time.

Number of Samples. The number of samples included in the selected region.

Area. The area is derived by integrating under the curve, using the 0 on the Y-axis as the lower bound. The integration algorithm used is Simpson's Method. If only a single data point is selected, the area is undefined.

Min. The minimum Y value for the selected region.

Max. The maximum Y value for the selected region.

Avg. The average Y value for the selected region.

Slope. The slope calculated between the first and the last samples in the region. Unless the data are very linear, this is relatively meaningless

Std. Dev. The standard deviation of all the samples in the region.

Four buttons are available at the bottom of this screen:

Close. This closes the analysis window. When the analysis window is closed, another region can be selected and analyzed until the Analyze Graph Data mode is turned off. This is done by selecting the Analyze Graph Data option in the Analysis menu. When this option is not checked (off), normal zooming of the graph is enabled once again.

Print. This option allows both the analysis information and the graph to be printed to a printer.

Copy to Clipboard. This option allows just the text in the analysis window to be copied to the Clipboard. It can then be pasted to another application.

Help. Displays the help text for this screen.

3.5 View Menu Commands

The View menu contains two viewing preferences. One preference is for the Toolbar that automatically appears at the top of the **MDL-DataManager** window. By selecting ***View-Toolbar***, you can remove or replace the checkmark to include or remove the toolbar from the window. The same actions can be taken to remove or replace the Status Bar at the bottom of the window. The Status Bar displays the current time and date as set on the host computer.

3.6 Preferences Menu Commands

The following preferences can be set from this menu: Options and Edit Module List.

The Options menu includes settings for the following: Comm Port/Modem, Export File Format, and Units of Measure. These preferences are stored in the file **PREF.MDL** and can be changed using this menu. The new preferences will be written to **PREF.MDL** and will be used for the current and all future **MDL-DataManager** sessions.

AEC recently enhanced the MicroDataLogger data acquisition system and **MDL-DataManager** software by adding remote access capabilities. Use the Comm Port/Modem tab listed under the Options menu to integrate **MDL-DataManager** with the **MDL-DataRetriever** software.

Options

This Preferences menu option displays a window with the following tabs for setting various options within the software:

Comm Port/Modem Configuration. Selecting ***Preferences–Options, Comm Port/Modem*** opens a window that provides a choice of communications port connection for a serial interface with a MicroDataLogger unit as well as phone and modem settings for **MDL-DataManager** software to store.

The **MDL-DataRetriever** software creates and uses scheduling information to automate retrieval of data from MDL units installed in the field. Please read the MDL-Remote for information regarding modem connections in the ***Preferences—–Options*** window.

Export File Format. Selecting ***Preferences—–Options, Export File Format*** opens a window that provides a choice of either **Tab Delimited** fields or **Comma Separated** fields for the format to use when creating an ASCII text data file. After selecting the desired format, click OK to save this preference.

This function allows for data to be exported as an ASCII text file for input into standard software applications (spreadsheet, database, word processor or statistical applications). The export function file name extension defaults to **.txt.**

Units of Measure. Select the engineering units which you would prefer your data be stored in: English or SI (Standard International/Metric).

Edit Modules List

This menu choice opens a window that displays all supported module types and allows the user to select whether the module type will be displayed in the drop down list on the MDL configuration screen. This makes it easier to find a module when the list only contains frequently used modules. If a module is Auto-ID'd by the software, and that module was not already selected, it will be selected and the module will appear in the list.

To select or remove modules to be displayed in the module list, click on the desired module.

3.7 Help Menu Commands

Help for **MDL-DataManager** software is provided in two forms. The Help bar at the bottom of the screen displays a short context sensitive help message. A comprehensive online reference guide can be accessed at any time by pressing the <F1> key or by selecting the ***Help–Help Topics*** menu item. All topics in Help are listed alphabetically.

Also provided under the Help menu is an About selection that redisplays the **MDL-DataManager** opening screen information: version of the software, phone numbers for MicroDataLogger sales & technical support, and Architectural Energy Corporation mailing information.

4.0 MDL-Remote™ Application

AEC enhanced the MicroDataLogger data acquisition system (MDL) by adding remote access capabilities. Remote access allows MDL users to automatically retrieve data from loggers using a phone line and download data to a computer while the equipment is still installed in the field. The ability to easily and quickly access data from a remote site is the main benefit of this enhancement.

Designed to integrate seamlessly with MDL units, sensors & accessories, and **MDL-DataManager** software, the new remote system includes the following components.

- MDL-Modem uniquely equipped for the MDL system to transfer data via phone line.
- MDL-Smart Port that allows connection of up to 5 loggers per modem.
- MDL-Remote extended length cable for connectivity from the MDL to the Smart Port or Modem.
- **MDL-DataRetriever** software automates data retrieval and splices collected data into one ".log" file. (**MDL-DataManager** software does not provide automated data retrieval or data splice features.)

MDL-Remote Operation

MDL-DataManager and **MDL-DataRetriever** software can be used to remotely configure and download data from MicroDataLogger units through the use of a modem, and can also be used with a modem and Smart Port to enable remote communication with up to five MDL units with a single modem. Once the software is configured, remote communication with MDLs is nearly identical to local communication over a local serial cable.

If a Smart Port is used, you can communicate with up to five MDL units, although you cannot communicate with all of them at once. You must individually select which MDL you wish to communicate with by selecting the desired Port ID in the MDL Options dialog, discussed below.

To use the **MDL-DataManager** software to communicate with a remotely installed MicroDataLogger unit, follow these steps.

While you're at the remote data collection site:

1. Install the MDL and sensors in the remote location.

Install the MDL and sensors. If you intend to leave the MDL in place for an extended period of time, be sure to plug the MDL into a battery charger (CHARGE-02). This will ensure that you can repeatedly download the logger without encountering a battery failure. It also allows you to store data at high frequencies with no concern about discharging the battery.

2. Configure the MDL for your application using MDL-DataManager software version 4.0 or higher. (optional)

While you are at the remote site, it is good practice to configure the MDL to ensure that all sensors are connected properly and that the readings are reasonable. You can also perform this initial configuration remotely over a modem, but if there are any problems with the physical setup of the loggers, you won't be able to fix it until you take a trip out to the site. So to avoid disappointment, configure your loggers before you leave the site!

Since you may want to automatically download the MDL for the duration of the data collection, use the following suggested run time parameters:

Memory Write Enable	If you wish to be able to collect data indefinitely, check this box. (Recommended only if you're going to be using **MDL-DataRetriever**.)
Duration	As long as you wish to collect data, or longer
Button Start/Stop	If you wish to be able to start the loggers by pushing the button before you leave the site, check this box. (**Disadvantage:** If you check this box and start the loggers with a button press, the time stamp for different loggers may be slightly different.)

3. Install Smart Port (MDL-SMPORT) if more than one MDL is being used.

If you are using more than one MDL, you can use a Smart Port to connect up to five MDL units to a modem. Connect the MDLs to the Smart Port using the standard MDL serial cable (CABLE-SERIAL). If the MDL needs to be placed farther than six feet from the Smart Port, then you can use a RS-232 extension cable (CABLE-EX-050 or 200) between the standard serial cable and the Smart Port. Extended distance RS-232 cables are stocked by AEC, and are available in standard 50 foot and 200 foot lengths. As many as four of the 50 foot cables may be connected together to create a combined length of 200 feet, but it is recommended that total extended lengths not exceed 200 feet due to possible signal degradation. If your extension needs are less than 25 feet, then a standard, readily available RS-232 extension cable may be used.

The Smart Port requires external power through the supplied power supply.

4. Connect modem (MDL-MODEM) to Smart Port (MDL-SMPORT), or to MDL if a single MDL is being used.

The modem connects to the Smart Port using the modem adapter cable (CABLE-MODEM). Although any modem that is capable of auto-answer can be used, we recommend that you use an AEC-provided modem (MDL-MODEM), which has been pre-configured and tested, and includes the required modem adapter cable. If necessary, an extension cable may be used between the modem and Smart Port, although in practice it may be easier to keep them close to one another since they both require power.

5. Connect the modem to the phone line using standard phone cable.

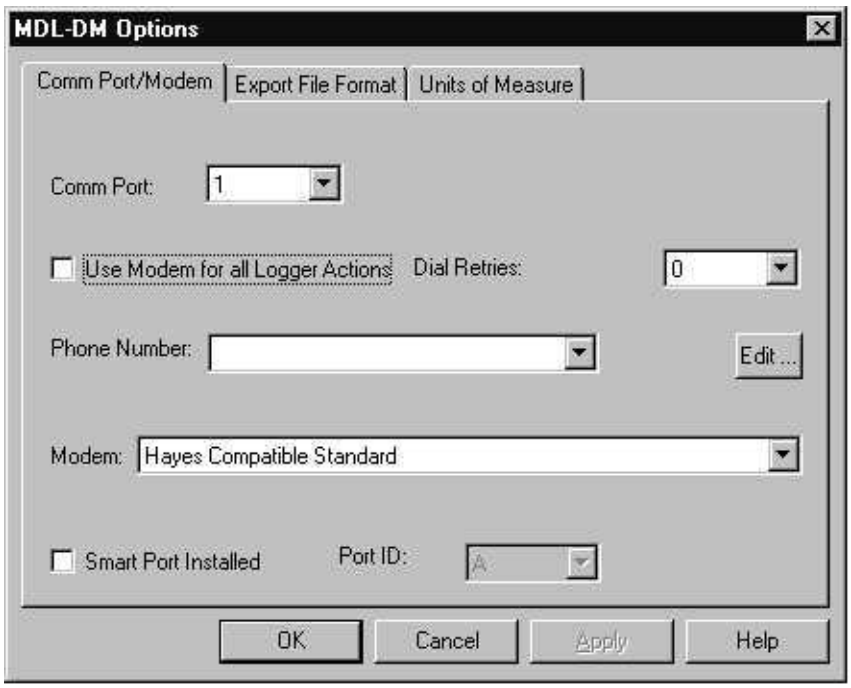
Configuring MDL-DataManager to remotely communicate with MDLs:

After physically setting up the MDLs, Smart Port, and modem and you've returned to the host computer, you can set up **MDL-DataManager** 4.0 or higher to communicate directly with the remote MDLs. To set all this up, start the **MDL-DataManager** software and follow these steps:

- Select **Options** under the ***Preferences*** menu.
- Select the **Comm Port/Modem** tab in the **Options** dialog and set up the phone number.
- If a Smart Port is installed, check the Smart Port checkbox.
- If a Smart Port is installed, select the Port ID for the desired MDL unit.

- Check the "Use Modem for all Logger Actions" check box to enable the software to use the modem.
- Set the number of "Dial Retries" to the maximum number of times you wish the software to try to reconnect with the remote modem.
- Click **OK** to close this dialog.
- To communicate with the remote MDL, select either **Configure MDL**, **Retrieve Data**, or **Real Time Reading** under the ***Logger*** menu
- To switch between loggers connected to a Smart Port, return to the **Options** dialog under the Preferences menu.
- To hang up the modem after finishing MDL communications, select "Hang Up Modem" under the ***Logger*** menu.

MDL-DataManager Options Window



Edit Phone Numbers

The Comm Port/Modem tab in the MDL-DM Options dialog allows you to create new phone numbers, edit existing phone numbers, or delete phone numbers that are no longer required. Leaving a phone number in the list that is no longer required will not cause problems, and if it is expected that the phone number may be required in the future, then leave it in the list.

To edit or add phone numbers to the Phone Number line, click on the Edit button. This brings up the Edit Phone Numbers dialog in which you can add, delete, or edit phone numbers for data retrieval.

Command Buttons

New	Creates a new line in the phone number list.
Delete	Deletes the selected phone number.
OK	Closes the "Edit Phone Numbers" dialog
Help	Displays this help.

Phone Number Information

A space for configuration information associated with each phone number is also provided. This can be useful when deploying the MDL-Remote equipment in multiple locations or when redeploying equipment at a previous logging site.

Item	Description
Number	Telephone number for connecting with the remote modem. The phone number may include dashes and parentheses, commas for pauses and any other codes that may be required for your phone system.
Description	An optional description associated with the selected number. This description is useful for identifying the site

MDL-DataRetriever Software

MDL-DataRetriever software is used to automatically dial up MicroDataLogger units and download their data on a regular schedule. The software allows automated retrieval to be scheduled at specific times. Every time a retrieval is performed the completion status and time of execution is saved. If a busy signal is detected, the program will redial the number for the specified number of retry times. The **MDL-DataRetriever** software also splices separate data retrievals together for one continuous “log” file.

A separate user guide is provided for the **MDL-DataRetriever** software.

5.0 Trouble Shooting

If you experience problems with your MicroDataLogger unit (MDL), **MDL-DataManager** software, or **MDL-DataRetriever** software, there are several potential sources of the problem.

The following is a table of potential MDL problems, and the appropriate action to take to correct the problem.

Hardware Problems

Symptoms	Action to be taken
"Low Battery Stop" occurs	After retrieving any data taken, fully charge MDL and perform a battery life test as described in the Battery Life Test help topic. If the run-time is less than 50 hrs, return to AEC for testing and/or battery replacement. If run-time is greater than 50 hrs, the "Low Battery Stop" most likely occurred due to short Sample Intervals and/or high-powered sensors.
No readings on a channel	Check to be sure that none of the channel's pins have been bent. Otherwise return to AEC for repair. **Call first to obtain an RMA number.**
MicroDataLogger unit crashes (Black Boxes Appear in LCD)	Use a small screwdriver or similar metal rod and gently touch the two conductors of the external power jack on the right side of the logger. This "re-boots" the logger. **Note:** A logger crash can be identified by many black boxes appearing in the LCD of the unit.
****** Appears in LCD**	The MicroDataLogger unit's LCD will display a maximum of 5 digits plus a decimal point and the sign (-) of the number. If asterisks (********) appear in the display, reduce the number of decimal places in the Configuration Parameters window for the channel(s) showing the asterisks. **Note:** Logged data is always recorded at full accuracy and is not affected by the display's decimal digits setting. Two decimal digits are the recommended number to have for any data collection efforts. A selection of three or more

	decimal digits will cause asterisks (********) to appear in the MicroDataLogger unit's display.
Battery voltage runs down	The battery will slowly self-discharge while a logger is sitting unused over time. While being stored, the battery should be recharged every two months. If the battery voltage runs down over a very short period of time, the battery may need to be replaced. The batter in the MDL units carries a 90-day warranty from the date of purchase.
Logger fails to correctly ID a plugged in module.	The module's ID feature may have been damaged due to electrostatic discharge. The module's other features should still work fine. Simply select the module type from the drop down menu on the Config Parameters screen. **Note:** This remedy may result in the "Module ID Mismatch" message appearing on the logger's LCD. This is normal because the logger can not properly ID the module due to user override of the module ID. The module will still work properly unless it has suffered more extensive damage.
Retrieve Data fails	If the MDL fails to "wake up" when **Retrieve Data** is attempted, perform a two-button press and then try to **Retrieve Data**.

PC Communication Problems

If your PC is having difficulty communicating with your MicroDataLogger unit (MDL):

1. First go to ***Preferences—Options*** in the **MDL-DataManager** menu, select ***Comm Port/Modem*** option.

2. Select the proper comm port (**COMM 1**, **2**, **3**, or **4**) to which your serial cable connects.

3. Try again to communicate with your MDL.

4. If you still cannot communicate with your MDL, check the MDL's battery voltage by pressing the button 4 times. If the battery voltage reads 6.2 volts or less, or the MDL's LCD does not respond, recharge you MDL for 6-10 hours and try to communicate again.

5. If you still are unable to communicate with your MDL, another software application may have taken precedence over the com port needed to use the MDL. Such applications include, but are not limited to: Palm Pilot® software, faxing software, automated dial up applications. Even if these applications have not been opened by you for use, they may be running in the background of your computer as part of your computer's **Startup Menu**. By disabling these applications when using MDL-DataManager, you should be able to regain communication with your MicroDataLogger unit to configure it for use or to download data from it.

6. With **MDL-DataManager** versions prior to 4.0, some virus scan applications caused com port communication problems. Although no current virus scan applications are known to cause PC/MDL communication problems, it is not possible to state that these problems could not recur due to ongoing virus scan update releases.

Windows 95 operating system or higher: One or more of the programs loaded in your **Startup Menu** may be conflicting with the serial communications functions of **MDL-DataManager**. Remove these programs from your **Start Menu**. Use the ctrl, alt, and delete keys simultaneously on your keyboard to display a list of the programs running in your startup. After closing the various tasks you should now be able to communicate with the MDL. One by one, replace the programs (that you use) back into your **Start Menu** and attempt to communicate with the MDL. When you can again no longer communicate with the MDL, you will have located the program or programs that conflict with the MDL communications. Permanently remove the conflicting program(s) from your **Start Menu**.

Appendix A – Module Wiring Connections

Architectural Energy Corporation (AEC) stocks signal conditioning modules for use with a wide array of AEC-supplied or third-party sensors. These different signal conditioning modules allow the MicroDataLogger unit (MDL) to connect to nearly any sensor or meter on the market based on the sensor or meter output signal. Each separate sensor or meter to be used with the MicroDataLogger data acquisition system will require a module to connect to the MDL to the sensor. It is important to note that AEC carries a number of sensors that are pre-wired to modules for your use: temperature, humidity, occupancy, and lite level.

General Signal Measurement Modules

A variety of plug-in modules are available for interfacing the MDL to a range of sensor and transducer output signals. Most third-party sensors and transducers – including those carried by AEC – can be used with the MDL.

The **MDL-DataManager** software enables the user to scale the signal being read and assign an appropriate engineering unit of measure. Sensor or field wiring is connected to the modules via a 4-circuit, plug-in, screw type terminal block. Current can be measured directly using the 20 mA DC module. Signal conditioning modules for full-scale ranges above 5 volts use a precision resistor divider to attenuate the input signal.

Note:
The 20 mA DC signal conditioning module, model ADC-33-3, can be damaged by transient voltages if it is connected to the current loop circuit while the circuit is energized.

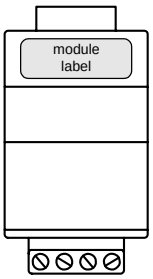
Screw Designations for Wiring

Part/Module Number	Pin	
ADC-33-3 (4-20mA)	1	– Signal Input
VDC-19-3 (5V)	2	+ Signal Input
VDC-29-3 (10V)	3	– 12 Vdc Return
	4	+ 12 Vdc Power Out

Part/Module Number	Pin	
VAC-17-3 (333mV)	1	n/c
	2	mV Input Low
	3	mV Input Hi
	4	n/c

Part/Module Number	Pin	
COUNT-80-3 (pulse)	1	Switch (–)
	2	Switch (+)
	3	n/c
	4	n/c

Part/Module Number	Pin	
STATUS-81-3 (AC/DC)	1	n/c
	2	n/c
	3	Voltage Low
	4	Voltage Hi



terminal block numbered left to right

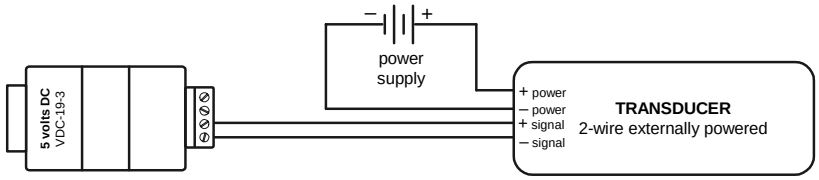
Module Wiring Diagrams

MicroDataLogger®

Wiring Diagrams for 5 volt, 10 volt & 20 mA Modules
VDC-19-3, VDC-29-3, ADC-33-3
Revised: 6/25/2000

Note: 10 volt module wired the same as 5 volt

1



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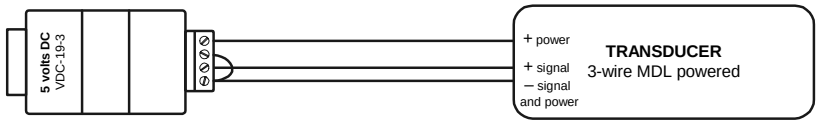

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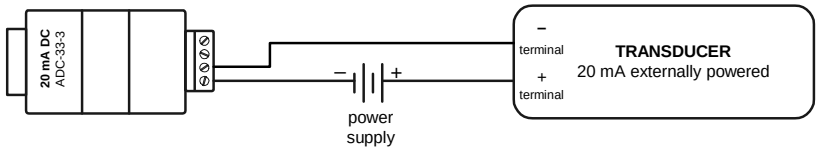

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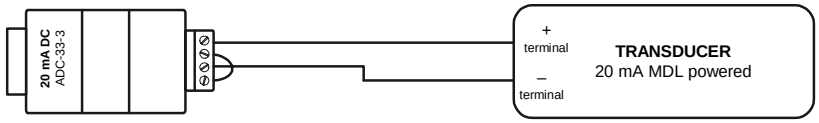

Module wiring information also appears in the **MDL-DataManager** software's Help.

Appendix B – Calculating Scale Factors

Architectural Energy Corporation (AEC) stocks signal conditioning modules for use with a wide array of AEC-supplied or third-party sensors. These different signal conditioning modules allow the MicroDataLogger unit (MDL) to connect to nearly any sensor or meter on the market based on the sensor or meter output signal. Each separate sensor or meter to be used with the MicroDataLogger data acquisition system will require a module to connect to the MDL to the sensor. It is important to note that AEC carries a number of sensors that are pre-wired to modules for your use: temperature, humidity, occupancy, and lite level.

Conversion Formula

Sensors and transducers converta physical input (pressure, amperage, etc.) into an electrical signal (volts, milliamps, pulses, etc.) that can be measured by the MicroDataLogger unit (MDL). For the MDL to accurately read the signal connected to it and record a corresponding electrical signal, a Slope and Offset need to be calculated and entered into the configuration of the MDL.

The conversion formula for this is shown below:

Reading in Engineering Units = (Sensor or Transducer Output) x ((Slope) + Offset)
Or, Reading in Engineering Units is (y = mx + b).

Determining Slope

Examining the equation of the line (y = mx + b) created by comparing the Sensor/Transducer Input (y) against the Sensor/Transducer Output (x), we can determine the Slope (m). The Slope, then, is determined by the following formula:

Slope = $\frac{\text{Full Scale Range or Transducer in Engineering Units}}{\text{Full Scale Output Signal Range of Sensor or Transducer (voltage, current)}}$

Example: You are using a 150 psig pressure transducer that has a 1-5 volt output signal.

150 psig Maximum Range less 0 psig Minimum Range = 150 psig
5 volt Max. Output Range less 1 volt Min. Range = 4 volts

Therefore, Slope = $\frac{150}{4}$ = 37.5

Determining Offset

To determine the Offset (b), we examine the line when the input is at a minimum. Thus, when y = y min, we have y min = mx + b. Solving for b yields b = y min - mx. Consequently we have:

Offset = (Minimum Sensor/Transducer Input Value in Eng. Units) – ((Slope) x (Sensor/Transducer Output* at Minimum Input Value))

**Voltage, etc.*

Example: You are using the same 150 psig pressure transducer that has a 1-5 volt output signal.

Therefore, Offset = 0 – (37.5 x 1 volt) = 0 – (37.5) = -37.5

Appendix C – MicroDataLogger® Specifications

Channel Capacity
Four universal input/output channels accept both analog and digital signal conditioning modules.

Module Auto ID
Automatic logger programming of module/sensor signal type and range information.

Analog Resolution
1.2 mV or 4,096 parts (12 bit A/D conversion).

Analog Accuracy
±0.1% of full scale reading based on a precision voltage reference (3 ppm/°C typical temperature coefficient).

Real-Time Clock
±1 minute/month over full operating temperature range.

Sample Interval
User-programmable sample intervals: 3, 6, 15, and 30 seconds and 1, 2, 3, 5, 10, 15, 20, 30, and 60 minutes.

Enclosure
Injection molded, gray ABS plastic, standard: environmentally sealed; NEMA-12, or 4X optional.

Mounting
Two through-holes each for #6-32 flat-head screws standard; magnetic, Velcro and other types of mounting optional.

Size and Weight
14.7 x 12.6 x 5.7 mm (6 x 5 x 2.25 inches) and 500 g (17.6 oz.) including internal battery and with no modules installed.

User Interface
16 characters by two line alpha-numeric display, push-button switch and audible signal tone.

User Interface
16 characters by two line alpha-numeric display, push-button switch and audible signal tone.

Computer Interface
RS-232 serial interface; baud rate: default 19,200 bps; data format: eight data bits, no parity, one stop bit; cable 72 in. (183 cm) with nine-pin female “D” type connector.

Memory Capacity
64,000 measurements total (i.e. 16,000 per channel).

Memory Retention
Data retention greater than 20 years without power, using non-volatile 128 kbytes Flash memory chip.

Internal Power
Six volt, one Ahr., rechargeable sealed lead-acid battery pack. Typical recharge time is 8 to 12 hours.

Environmental
Operating: +32 to +122 °F (0 to +50°C), 90% RH non-condensing.
Storage: -4 to +140 °F (-20 to +60°C), 5% to 95% RH non-condensing.

FCC Compliance
Class B, sub-part J, paragraph 15, and European standard CISPR 22

Battery Life
When taking readings once per minute using low-power sensors, battery is 30 days or more. Less frequent sampling results in longer battery life. A fully-charged battery will power a typically configured logger for a minimum of 70,000 logged readings.

Signal Conditioning Modules
DC Voltage Ranges: 5 to 500 V
333 mV RMS
20 mA DC
Occupancy
Pulse Counting
Relative Humidity
Status AC/DC Voltage
Temperature, thermistor

Sensors & Transducers
AC current, voltage
AC watts, kWh, P.F.
Light—Level and Status
Occupancy
Pressure–Barometric
Pressure–Differential
Pressure–Gage
Relative Humidity
Temperature
Flow
(View a catalog or the AEC web site for individual sensor specifications.)

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