USER'S GUIDE

for the

OM-480, 481, 490, 491

DATALOGGERS

OMEGA ENGINEERING, INC.

An OMEGA Technologies Company

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DATALOGGER INTRODUCTION & SYSTEM OVERVIEW

The OMEGA OM-480 is a very powerful, expandable, low cost, benchtop or remote datalogger with 16 differential, bipolar, analog input channels (with programmable upper/lower limits), 16 digital output/alarm channels, and 4 digital input channels. The OM-490 is an enhanced version of the OM-480 with input signal scaling and offset via the standard mX+b formula for each input channel. A pushbutton front panel is available (OM-481, OM-491) for standalone operation or local user control when networked, etc. All OM-480 series dataloggers have a set of built-in diagnostics that may be invoked to assure proper operation. The OM-480, 490, 481, and 491 support DC Volts/mVs, 4-20mA signals, thermocouples (J, K, T, & R with CJC and linearization), contact closures, and any other TTL/CMOS compatible input signal. The OM-480 series provides signal conditioning, data acquisition, data formatting, data display and/or data transmission (via the built-in serial port) to computers, printers, terminals, or other data receivers allowing graphic display or analysis of data via virtually any software package including Lotus 123, Labtech Notebook, etc. Five different data buffers (one circular 64K; four linear 64K, 256K, 512K, 1Meg) are available for data storage during standalone operation or may be used as printer buffers or intermediate data buffers for data transfer to computers, etc.

As a standalone system, the OM-481 & OM-491 are extremely versatile having a sealed membrane front panel with enhanced contrast LCD display for easy readability in any lighting situation. The front panel allows local setup of such parameters as time/date, data logging interval, High/Low Alarm limits, channel selection as well as data display in engineering units (mV, °C or °F, etc) for each channel(s). All setup parameters are stored in battery backed RAM. A single OM-481 or 491 may be used to control up to 4 other units (5 total) with the same capability.

A built-in, fully bidirectional, serial port may be used as a simple data transfer pathway to any computer supporting the RS-232C standard or, when used in conjunction with the optional Application & Communication software package and any IBM PC/XT/AT compatible, the OM-480 series becomes one of the most cost effective outboard Data Acquisition and Control Systems available. A wide variety of options and accessories cover virtually all application areas allowing up to 80 input channels per system (without computer control). When used in conjunction with any IBM PC/XT/AT compatible, the OM-480 series dataloggers can be configured for up to 50 OM-480s with a total channel count of 800 analog input channels, 200 digital input channels, and 800 digital output channels. All this from a single RS-422 serial port.

A full line of low cost accessories is available for the OM-480 series dataloggers. These are: 5 different data buffers from 64Kbytes to 1MegaByte of battery backed RAM for remote/field data collection, an industry standard Alarm Panel (driven directly from the digital outputs) with relay output control capability, a serial to Centronics printer adapter for use with low cost Centronics type printers, a Solid State Relay rack for uncompromising control capability, and much more. Also available are several very popular software packages including Labtech Notebook and our own System Applications and PC Communications Software Package.

This START-UP GUIDE (pages 1-5) is provided as a quick method to get your datalogger operating with a Personal Computer. It is not intended as a rigorous treatment of the datalogger and all of its functions. For that, you must read the other relevant sections of the manual. However, this START-UP GUIDE will allow you to exercise the datalogger thereby verifying proper operation. Additionally, the START-UP GUIDE will allow you to send commands to and receive information from the datalogger. This GUIDE assumes no knowledge of the datalogger itself and minimal knowledge of the computer being used. A communication program supplied on the start up diskette is all that is required to "converse" with the datalogger. In order to use the Communication program (MSKERMIT.EXE), you will need the following minimal system components:

- A OM-480, 481, 490, or 491 datalogger
- The Diskette provided with this Start-up Kit
- IBM PC/XT or PC/AT compatible
- Interface cable (OM-480-PC-6 for the PC/XT or OM-480-AT-6 for the PC/AT)
- This Start-up Guide

Cautions and Notations for Use

Throughout this GUIDE, several common notations are used. They are:

<cr> means press the ENTER key
Characters or words you are to type at the keyboard are in **BOLD face** type.
[CTRL-N] means press and hold the "Ctrl" key, then press the "N" key.
Blank spaces are denoted as blank spaces. They are important.

Datalogger command words are position specific and are separated by a valid command separator. Complete datalogger commands are terminated by a valid terminator (a full list of these is included in the User's Guide that follows).

Unit Channel Assignment

On the underside of the datalogger is a series of rotary and DIP switches along with various charts showing how to set these switches. If you have more than one datalogger in your system, each must be configured with a unique channel assignment number (designating the first channel in that unit). Each unit is assigned twenty channels beginning with the unit channel assignment number. If you have only one datalogger or if you are configuring the Master Unit in a networked system, set the Unit Channel Assignment Number to 000 by turning the arrow on the rotary switches to the number 0. Each succeeding unit in the system will be set to 020, 040, 060, etc.

Mode Selection Switches

For the purposes of this START-UP GUIDE, set ALL Mode Selection Switches OFF.

Serial Port Switches

Also on the underside of the datalogger is an 8-gang DIP switch for configuring the serial port. It is important that the datalogger serial port be configured to match that of the computer you are using. Generally, you will set the datalogger serial port to the following settings (this matches those in the MSKERMIT communication program):

Parameter	Sw	1	2	3	4	5	6	7	8
9600 Baud		OFF	OFF	ON					
No Parity					OFF	OFF			
8 Data Bits							OFF		
XON/XOFF								ON	ON

Failure to set the switches in the above manner may result in conflicts with the MSKERMIT program and may cause difficulty in communicating with the datalogger.

Invoking MSKERMIT

Connect the serial cable between the IBM PC/XT/AT or compatible (COM1) and the datalogger. Check the datalogger to be certain that the power switch is in the OFF position. Plug the datalogger power supply into the rear of the datalogger and a convenient wall outlet, respectively. "Boot" the computer and insert the Getting Started Diskette into Drive A (or install on the Hard Disk, as desired). Type MSKERMIT<cr> (target the Hard Disk directory with the MSKERMIT files on it and type MSKERMIT<cr>). The following should be displayed on the computer screen:

MSKERMIT<cr>

```
[Connecting to host, type Control-] C to return to PC
```

and the bottom of the screen should look like this:

```
Esc chr: ^] Port:1, Speed: 9600, Parity: None, Echo: Lcl,
Type ^]? for Help
```

NOTE: MSKERMIT will normally autoconnect when invoked. If it does not, simply type "CONNECT". The status line normally states that Echo is in a Lcl state. If it does not, simply type a "Control-] C" to disconnect from the datalogger, then type "set local on" and reconnect to the datalogger (by typing "connect"). Also note that there is a file called MSKERMIT.DOC that may be read for further information concerning the MSKERMIT program. You may also want to check the status of the MSKERMIT settings by using the "status" command (computer must not be "connected" to the datalogger for this command to work).

If your datalogger is not turned on, turn it on now. The datalogger will sign on like this:

```
Powered down at:    07 Mar 89    09:09:12
Current time is:    10 Oct 89    10:11:41
```

If you have a OM-490 or 491 model, you may scan all the data channels by typing the following (spaces are important):

Kermit-MS>**S D 000 019**<cr>

The OM-480 & 481 models will always send data for all channels so that the channel specifiers are not required. The computer screen should look something like this depending upon the way the TCV-16 rotary switches are set:

```
Ch000 = ?XXXX. Deg F    OFF
Ch001 = ?XXXX. Skip     OK
Ch002 = +0000. Skip     OK
Ch003 = ?XXXX. Skip     OK
Ch004 = ?XXXX. Skip     OK
Ch005 = ?XXXX. Skip     OK
Ch006 = ?XXXX. Skip     OK
Ch007 = ?XXXX. Skip     OK
Ch008 = ?XXXX. Skip     OK
Ch009 = ?XXXX. Skip     OK
Ch010 = ?XXXX. Skip     OK
Ch011 = ?XXXX. Skip     OK
Ch012 = ?XXXX. Skip     OK
Ch013 = ?XXXX. Skip     OK
Ch014 = ?XXXX. Skip     OK
Ch015 = ?XXXX. Skip     OK
Ch016 = ?XXXX. Skip     OK
Ch017 = ?XXXX. Skip     OK
Ch018 = ?XXXX. Skip     OK
Ch019 = ?XXXX. Skip     OK
```

At this point, both your datalogger and computer serial ports are operating correctly. If none of the above works, check all cable connections, switch settings, and make sure that the power is on. Also check that all cables are properly seated. Retry the above or see the trouble-shooting guide if problems persist.

Troubleshooting the Serial Port

If you have had any trouble communicating with the datalogger, several common problems and their most immediate resolutions are listed below:

1) One of the most common problems is loose connectors. Make sure that all cables and connectors are securely seated in their respective receptacles.

2) Beyond this, make sure that the switches are set according to the description and drawings shown earlier.

3) If your computer has more than one serial port, you may be connected to Port 2. If so, simply invoke MSKERMIT, disconnect from the datalogger (by typing Control-] C) and type the following MSKERMIT command :

Kermit-MS>**DO COM2**

Then "reconnect" the datalogger and computer (type "connect") and run through the above procedure again.

Minimum OM-480 System

A minimum datalogging system requires the following equipment, cables, etc.:

1) OM-481 or OM-491 series datalogger
2) TCV-16 Removable I/O Signal Termination Module
3) START-UP GUIDE Diskette

In addition, if you have either the OM-480 or OM-490 (no front panel), a serial cable is also required (IBM PC/XT requires a OM-480-PC-6; IBM PC/AT requires a OM-480-AT-6). Optional Application and Communication software is available as are a variety of other modules, cables, battery packs, etc.

System Configuration

Every OM-480 series DATALOGGER must be configured prior to use. These configuration parameters cover Channel Assignments and MODE of operation. If you have more than one DATALOGGER in your system, each DATALOGGER must have a unique channel assignment number (designates the first channel in that unit). Each unit is assigned 20 channels (starting with the Unit channel assignment number). If you have only one DATALOGGER or if you are configuring the Master Unit in a DATALOGGER network, the Unit channel assignment number must be 0 (thru 19). The Unit Channel Assignment configuration switches (rotary switches) are on the underside of the DATALOGGER and are set by selecting the first two numbers of the channel assignments (if you have a single unit, set the switches to 000, the next "N" units will have channels 020, 040, 060, etc).
The MODE SELECTION switch and associated chart (located on the underside of the DATALOGGER) are self-explanatory and cover overall operation of the unit. The following brief explanation of the various parameters may be of help when setting these switches:

OM-480 Series MODE SELECTION SWITCH

Switch #	Function	
1	*Temperature Units*	Selects °C or °F as indicated.
2	*Output Format*	Long/Short Data Format [1]
3	*Self Test*	Enables/Disables Self-test Feature (Normally OFF)
4	*Calibrate*	Enable for Calibration. (Normally OFF)
5	*Scan Transitions*	Disables data reporting during Alarm state (Hi/Lo Limits exceeded).
6	*Scan Data Upon Transition*	Allows data transmission during alarm state only (data not reported during non-alarm state).
7	*Front Panel Lockout*	Disables editing via front panel. Prevents inadvertent program changes.
8	*T/C Resolution*	Thermocouple resolution selection. 1° resolution Full Scale or 0.1° resolution (to 999.9)

[1] Data being transmitted via the RS-232 serial port are of two types:
The long format looks like this:
CHAN 01= -0.49VOLTS LO ALARM
CHAN 02= +84DEGREES C HI ALARM

The short format looks like this:
001A -49004EAF +00810AEO

The short format is generally used with application specific software and takes less space (see data format section for a full explanation).

CHANNEL CONFIGURATION & INPUT SIGNALS (TCV-16)

The TCV-16 is a removable signal termination and channel configuration assembly that plugs into any OM-480 series DATALOGGER. It contains 16 range configuration rotary switches (one for each channel) allowing each analog channel to be independently configured for type of input (T/Cs, V/mV, 4-20mA, etc). All input signals to the dataloggers are via the TCV-16.

There are 9 possible settings for each analog input channel. Each input channel and corresponding range configuration switch is clearly marked. The switch settings are:

Sw Setting	Function
0	J-type T/C
1	K-type T/C
2	R-type T/C
3	T-type T/C
4	+/- 100mV
5	+/- 1 Vdc
6	+/- 10 Vdc
7	4-20 mA
8	Unused Channel (Skip)

NOTE: All unused channels should be set to position 8 (Skip) so that data is not transmitted and the channels are not scanned. This increases system performance and allows maximum use of the system.

ANALOG SIGNALS

After setting the channel input configuration, you may also want to wire your input signals to the appropriate termination block. Be sure that the magnitude of the input signal does not exceed the input range setting for that particular channel (otherwise the DATALOGGER will display an "OL" reading). Signal connections are marked on the termination assembly as H, L, and S for High, Low and Shield, respectively.

DC Volts

If you are measuring a differential voltage signal (not referenced to ground) connect the "+" side of the signal to the H terminal and the "-" side to the L terminal. If the signal leads have a shield, connect one end of the shield to either the DATALOGGER or the sensor/transducer/instrument. One end of the shield must float (remain unattached) in order to avoid ground loops which may cause electrical noise or possibly damage the unit. If your DC Volts signal is referenced to ground, wire the signal side (+ or -) to the H terminal and the ground side to the L terminal. You must also wire a jumper between the L and S terminals of each channel used.

4-20mA Current Inputs

4-20mA current measurements require the use of a 20 Ohm shunt resistor (OM-SHUNT kit or use 1/8 Watt, 1% tolerance) allowing damaging current to bypass the DATALOGGER input. The resistor should be wired between the H & L terminals. The "+" side of the 4-20mA signal is wired to the H terminal and the "-" side of the signal is wired to the L terminal. The range switch for each 4-20mA input channel must be set to location 7 (4-20mA).

Thermocouple Inputs

The OM-480 series supports the four most popular thermocouples (including Cold Junction Compensation and linearization) throughout their entire full range span. All standard thermocouple have a RED lead corresponding to the "-" (low) side of the thermocouple signal. Wire this lead to the L terminal. The other thermocouple lead is wired to the H terminal. If the thermocouple has a shield, wire the shield to the DATALOGGER and allow the other end to remain unattached (this is called floating). If the shield is not used, wire a jumper between the S and L terminals of each channel. Be sure that the channel configuration switch is set correctly for the type of thermocouple being used on that channel (0 for J; 1 for K; 2 for R; 3 for T).

DIGITAL SIGNALS

Digital Inputs

Each basic OM-480 series DATALOGGER has four digital input channels (they are marked DI16 through DI19) with an associated ground terminal for each. The digital inputs are TTL/DTL, CMOS and +5 Vdc compatible with <1.0V being low and >3.5V being high (and may be used for contact closures, limit switch sensing, etc). All Digital input channels have an internal 10KOhm pull-up resistor allowing sensing of dry contacts closures. Digital signals are connected by wiring the signal lead to the "DI" channel and the ground lead to its associated ground for each channel. Since the digital channels float high (+5 Vdc), they may be checked for proper operation by simply closing a contact between the "DI" and "GND" of each channel while monitoring that channel.

Digital (ALARM) Outputs

The sixteen Alarm outputs are associated with the sixteen Analog input channels and are activated (enabled) when the corresponding Analog channel exceeds a predefined upper or lower signal limit (the status of each analog channel is checked every four seconds regardless of sampling interval). The Alarm outputs provide 0V or 5V logic level outputs capable of sourcing or sinking 5mA. Jumper J11 sets the logic Alarm state for each C (digital Common) terminal associated with its Alarm output channel to either a high (+5V) or low (0V) state. The Digital Alarm outputs are available via either a screw termination strip or a 34 pin ribbon connector that may be connected to either of the optional Alarm Relay Boards. The OM-480-ALARM is a wall-mountable alarm panel providing visual indication of channel Alarm states while the SSS-PC16 is a Solid State Relay board providing both AC and/or DC relays for driving external visual/audio alarms, solenoids, relays etc. (See Appendix B for details).

Digital Output (Alarm) Pinout

Pin #	Digital Output	Pin #	Digital Output
4	DO 0	20	DO 8
6	DO 1	22	DO 9
8	DO 2	24	DO 10
10	DO 3	26	DO 11
12	DO 4	28	DO 12
14	DO 5	30	DO 13
16	DO 6	32	DO 14
18	DO 7	34	DO 15

TCV-16 Module Insertion

Before inserting the TCV-16 I/O module into any OM-480 DATALOGGER, set the range switches for all unused channels to position 8 (unused channel). This setting causes the DATALOGGER to ignore the channel thus improving system performance.

Route all sensor wires over the foam padding at the rear of the TCV-16 avoiding kinks excess strain on the lead wires, and close the cover. The TCV-16 I/O modules slides into any OM-480 series DATALOGGER by simply inserting it into the opening in the rear of the unit and seating it in place.

Setting the TOP Channel

After wiring your signals and configuring the DATALOGGER, the next step is to set the highest or TOP channel in your system. This is done in the calibration mode and can be accomplished via either the front panel or computer connected to the DATALOGGER. If several dataloggers are connected in a system, the Master DATALOGGER sets the highest (TOP) channel for the entire system. Setting the highest channel is done, principally, for enhanced system performance eliminating unnecessary (and often unavailable) channels being scanned. In certain situations, the DATALOGGER will scan all channels in a network (default TOP channel is 99). If your system has less than the default number of channels, time is wasted while the DATALOGGER attempts to get information from these (imaginary) channels. The TOP or highest channel may be set as the last step in the calibration procedure or you may skip the calibration procedure and only set the top channel. If you are not calibrating the DATALOGGER but wish to set the top channel, do the following. Otherwise go through the Cal procedure and then set the TOP channel.

Front Panel (OM-481 & 491)

Turn OFF DATALOGGER. Turn it over and set Mode Select Switch 4 ON.

Repower DATALOGGER. Press the VALUE button three times. This will bring you to Mode 4 and will display the current TOP channel.

Change the displayed value by using the DIGIT and VALUE keys and then press ENTER to save the TOP channel in memory.

Note that the TOP channel cannot be set higher than 99 from the front panel.

When complete, set Mode Select Switch (4) OFF.

Via Computer

Turn OFF DATALOGGER, turn it over and set Mode Select Switch 4 ON.

Repower DATALOGGER. Two commands are used from the computer to Read and Set the TOP channel number. They are:

Command	Abbreviation	Comments
channel read	c r	Displays TOP channel number
channel set	c s <ch>	Set TOP channel

The channel set (c s) command requires that a value (top channel number) follow the "c s" command as in; "c s 59". All commands are terminated with a carriage return, line feed, or semi-colon.
After resetting the TOP channel number, you should verify it by using the "c r" command.

When complete, set Mode Select Switch (4) OFF.

Exercising the DATALOGGER via Built-in Diagnostics

A set of built-in diagnostics are used to exercise the basic functions of the DATALOGGER and ensure proper operation. The self-test may be run with any of the four DATALOGGER models and will require a printer & interface cable (minimum) for the OM-481 & 491 or a computer, serial cable, and communication software for the OM-480 & 490. If you are using a computer to control the OM-480, please ensure that the communication setup for the DATALOGGER matches that of the computer (see Appendix A or the under side of the OM-480 series DATALOGGER for details). Remember that if you are using the WB-PC480 parallel printer adapter (for Centronics compatible printers), the Baud rate must be set to 9600 baud. Once you are convinced that the serial port is configured correctly, you may want to run the diagnostics as follows:

If you are not using a computer, simply set the Self-test switch ON (turn the DATALOGGER over and enable the MODE SELECTION switch "3"). Then apply power to the DATALOGGER. The Self-test will begin execution of the various functional units built into the DATALOGGER and will output a report to the printer, etc. after each test . You will be prompted after to either go to (press VALUE) or skip (press ENTER) the next test. The OM-480 series self-test covers the RS-232 PORT, MEMORY, FRONT PANEL DISPLAY, RS-422, A/D CLOCK FREQUENCY, A/D OPERATION, SETUP SWITCH SETTINGS, and the DIGITAL OUTPUTS. After performing the self-test, you will probably want to disable the self-test switch so that the test does not run every time the unit is powered.

OM-481 & 491 FRONT PANEL OPERATION

Introduction

The OM-481 & 491 dataloggers are capable of operating in a stand alone configuration or as a master control unit for other dataloggers connected to it via the RS-422 serial port. The front panel of the 481 & 491 contains a sealed membrane pushbutton keypad and an enhanced contrast Liquid Crystal display for displaying data and/or setup configuration. All the functions available through computer control are also available from the front panel. This section of the User's Guide contains a description of those functions and illustrates proper setup and operation of the datalogger. It can also be used as a tutorial and, later, as a reference guide.

The front panel is laid out so that the function keys (DATA DISPLAY, TIME, DATE, HI LIMIT, LO LIMIT, SCAN INTERVAL) are on the left-hand side of the display while the setup keys (DIGIT, SCAN, VALUE, SKIP, ENTER) are on the right-hand side of the display.

DATALOGGER SETUP

DIGIT and VALUE keys

The DIGIT and VALUE keys are used to enter or change information for the selected function and channel. The DIGIT key is used to select the digit (digit blinks when selected) to be changed while the VALUE key increments the number. Once a value has been changed, press the DIGIT key again to select the next digit or enter to save the selected value.

Setting the Date

The date is stored in battery backed RAM (or in the Master unit if more than one unit is connected via a network system) and is sent every time data is transmitted from the datalogger. Press The **DATE** key:

1) Use the **DIGIT** key to select the desired digit.
2) Use **VALUE** key to set the value for that digit.
3) Press **ENTER** to save the new date to memory.

NOTE: If you have set the wrong date or wish to start over, simply press DATE and the old date will be displayed.

Setting the Time

The time is entered, displayed, and transmitted in 24 hour format and is stored in the Master Unit if more than one is connected (networked). It is sent every time data is transmitted from the datalogger(s). Press the **TIME** key:

1) Use the **DIGIT** to select the desired digit.
2) Use the **VALUE** keys to change the value of the selected digit.
3) Press **ENTER** to save the new time in memory.

NOTE: If you have set the wrong time or wish to start over, simply press **TIME** and the old time will be displayed.

Setting Channel Skips

Skipping or ignoring inactive channels is essential for efficient use of the datalogger. Inactive channels may be skipped either via hardware (position 8 on the Channel Configuration Switch in the TCV-16 I/O Module), from the front panel (if applicable), or via software (using the "Channel Disable" command). Note that data for all channels is transmitted (regardless of channel status) via the serial port if the SCAN button is pressed on the OM-4X1 series or if the "Scan Data" command is used in the OM-4X0 series. However, channel skips (hardware or software) operate properly when using the "Interval Enable" command for both the OM-480 & 490 series. When channels are "Skipped" (hardware or software) data is not displayed (on the front panel) nor is it transmitted with the 4X0 series. Channels skipped via hardware cannot be activated by software. Press the **DATA** key:

1) Use the **DIGIT** and **VALUE** keys to select the desired channel.
2) Use the **SKIP** key to SKIP the desired channel.
3) Press **ENTER** to save the new time in memory.

NOTE: To restore the old skip setting, simply press **SKIP** rather than **ENTER**.

Setting the Sampling Interval

The sampling interval dictates the period between transmission of data via the serial port. At the end of every sampling interval, data is sent for all active (non-skipped) channels. Only one sampling interval is set per datalogger (the Master Unit dictates the sampling interval to the slaves). The sampling interval does not affect the alarm scan which is done every 4 seconds. If very short sampling intervals are set, data is transmitted at the fastest interval, i.e. continuously). Maximum sampling interval is about 4 days (99Hrs:59Mn:59Sc). Press the **INTRVL** key:

1) Use the **DIGIT** to select the desired digit.
2) Use the **VALUE** keys to change the value of the selected digit.
3) Press **ENTER** to save the new time in memory.

NOTE: If you have set the wrong interval or wish to start over, simply press **INTRVL** and the old sampling interval will be displayed.

Setting, Skipping, & Restoring High/Low Alarm Limits

Each analog channel of the OM-480 series datalogger has the capability of setting Upper and Lower Alarm limits which, when exceeded will output a digital signal from the corresponding Digital Output line (0-15). These outputs may be used for visual or audio alarms or may be connected to relay boards for controlling various external parameters via solenoids, relays, etc. If the SCAN TRANSITIONS switch is ON (underside of the datalogger) when an Alarm state exists, data from the channel that is in Alarm is transmitted via the RS-232 port. Similarly, if the SCAN DATA UPON TRANSITIONS switch is ON, data from ALL channels is transmitted via the serial port if ANY channel is in Alarm. Also, when a High or Low limit is exceeded, the 481 & 491 dataloggers display a flashing **HI** (or LO) indicator (the limit may be displayed by keying the relevant Limit button and selecting the channel). Limits are set and displayed as numbers, not as measurements. For example, a limit of 50 relates to the number 50 regardless of whether measurements are taken in Deg, Volts, 4-20mA or whatever. All channels are scanned every 4 seconds to check for Alarm status regardless of the scan interval set (a maximum of 4 seconds may, therefore, elapse from the time a channel goes into Alarm and the Alarm indication becomes active).

Since each analog input channel has only one associated alarm output, it is advisable to disable the upper limit for the channel if it is not being used or the lower limit if it is not being used. This will avoid inadvertent alarm output. For example, you may be interested in monitoring only the high temperature limit for a certain input channel and do not want the low limit to inadvertently trip. In this case, you would want to "SKIP" the low limit.
Press the **HI** (or LO) **LIMIT** key:

1) Use the **DIGIT** and **VALUE** keys to select the desired channel.
2) Use the **DIGIT** and **VALUE** key to select and change the sign (+/-).
3) Use the **VALUE** key to change the value or the **SKIP** key to skip.
4) Press **ENTER** to save the change and make the limit active or
5) Press **HI LIMIT** (or LO LIMIT) to start over without saving.

A series of periods (.) will be displayed if the limit for that channel has been skipped. The previous High (or Low) limit may be restored after having been skipped by pressing **HI LIMIT** (or LO LIMIT), **DIGIT & VALUE** keys (for channel selection), and the **SKIP**, & **ENTER** keys to restore.

Displaying Channel Data

At certain times, you may wish to simply view data. This is certainly handy prior to setting the High or Low Alarm limits or simply to assure yourself that a signal is, indeed, coming into a certain channel. Whatever the reason, data can be viewed for channels 00 to 99 on the front panel. To display data, simply press **DATA** and use the **DIGIT** and **VALUE** keys to select the desired channel. You may also press the **HI LIMIT** or **LO LIMIT** keys to view either the Hi or Lo limit setpoints, respectively.

SCAN

The SCAN button on the front panel is used to transmit data for **ALL** channels via the serial port. When hooked to a printer, the SCAN button allows a convenient method for obtaining a hardcopy of the current data.

Command Reference and Syntax

All dataloggers may be operated from any IBM PC/XT/AT compatible computer or any other computer with a serial port (see Appendix A for serial port configuration). A built-in set of commands allows you to set up and/or control the datalogger from the computer. General command structure is such that commands are position dependent with spaces, commas, etc. being important.

The command structure should be followed to avoid problems:

General Command Format:

Commands are of the type:

Prefix Identifier Activator (LoChan HiChan) Terminator

as in:

SCAN DATA 4 9<cr> (Scan channels 4 through 9; OM-490 series only)

or:

S D 4 9<cr>

Each word in the command must be separated from its predecessor by a valid command separator, and each command must be terminated with a valid command terminator. Also, since the datalogger interprets commands by the first letter in each word, the second example may be used.

Command Word Separators:	Command Terminators:
Space ( )	Carriage Return <cr>
Comma (,)	Line Feed <lf>
Colon (:)	Semi-Colon (;)
Slash (/)	

COMMAND SET FOR OM-480 & 481

SCAN DATA<cr>	Displays data
SCAN HIGH<cr>	Displays high limits
SCAN LOW<cr>	Displays low limits
SCAN REF<cr>	Displays Reference Temperature
SCAN TRANSITIONS<cr>	Displays transitions
SCAN STATUS<cr>	Firmware version number
LIMIT HIGH ENABLE (XXX YYY)<cr>	Enable High Limit [1]
LIMIT HIGH DISABLE (XXX YYY)<cr>	Disable High Limit
LIMIT HIGH CONNECT (XXX YYY)<cr>	Enable High Limit Alarm
LIMIT HIGH REMOVE (XXX YYY)<cr>	Disable High Limit Alarm
LIMIT HIGH (+/-val) (XXX YYY)<cr>	Set High Limit Value
LIMIT LOW ENABLE (XXX YYY)<cr>	Enable Low Limit [1]
LIMIT LOW DISABLE (XXX YYY)<cr>	Disable Low Limit
LIMIT LOW CONNECT (XXX YYY)<cr>	Enable Low Limit Alarm
LIMIT LOW REMOVE (XXX YYY)<cr>	Disable Low Limit Alarm
LIMIT LOW (+/-val) (XXX YYY)<cr>	
CHANNEL ENABLE (XXX YYY)<cr>	Enable Skipped Channels [2,3]
CHANNEL DISABLE (XXX YYY)<cr>	Disable Skipped Channels
CHANNEL READ<cr>	Displays TOP Channel
CHANNEL SET (XXX)<cr>	Sets TOP Channel
OUTPUT SET (XXX YYY)<cr>	Outputs set to 0Vdc [4]
OUTPUT RESET (XXX YYY)<cr>	Outputs set to +5Vdc
TIME READ<cr>	Displays Current Time
TIME SET HH:MM:SS<cr>	Sets Internal Datalogger Time
TIME DISPLAY<cr>	Displays Time and Date
DATE READ<cr>	Display Current Date
DATE SET DD:MM:YY<cr>	Sets Internal Datalogger Date
DATE DISPLAY<cr>	Displays Time and Date
INTERVAL ENABLE<cr>	Transmit Channel Data Each Interval
INTERVAL DISABLE<cr>	Stop Transmission of Channel Data
INTERVAL READ<cr>	Display Sampling Interval
INTERVAL SET HH:MM:SS<cr>	Set Sampling Interval
PANEL ENABLE<cr>	Front Panel Unlocked
PANEL DISABLE<cr>	Front Panel Locked

[1] A "B" may be substituted for the "LIMIT" prefix thus disabling limit data transmission.
For Example: B HIGH ENABLE (XXX YYY)<cr>
B LOW ENABLE (XXX YYY)<cr>

[2] An "A" may be substituted for the "CHANNEL" prefix thus disabling Channel data transmission.
For Example: A ENABLE (XXX YYY)<cr>

[3] Enabling Skipped Channels has no affect if the channel(s) has been disabled via hardware.

[4] The OUTPUT Commands will not work unless the High and Low Limits are either disabled or removed for those channels.

COMMAND SET FOR OM-490 & 491

The 490 & 491 series dataloggers support all of the above commands plus those commands for input scaling and offset via the mX+b formula. Therefore, the following extra commands are available with the OM-490 & 491:

SCAN DATA (XXX YYY)<cr>	Display data for specified channels
SCAN HIGH (XXX YYY)<cr>	Display high limits
SCAN LOW (XXX YYY)<cr>	Display low limits
SCAN TRANSITIONS (XXX YYY)<cr>	Display Transitions for channels
SCAN STATUS (XXX YYY)<cr>	Display Status for channels
SCAN M (XXX YYY)<cr>	Display Slope (m) Value
SCAN B (XXX YYY)<cr>	Display Intercept (b) Value
M ENABLE (XXX YYY)<cr>	Enables use of slope (m) factor
M DISABLE (XXX YYY)<cr>	Disables use of slope (m) factor
M SET (+/-Val) (XXX YYY)<cr>	Sets value of slope (m) factor
B SET (+/-Val) (XXX YYY)<cr>	Sets value of intercept (b) factor
UNITS ENABLE (XXX YYY)<cr>	Enables use of labels for Channels
UNITS DISABLE (XXX YYY)<cr>	Disables use of labels for Channels
UNITS SET (label) (XXX YYY)<cr>	Sets label for Channels

NOTE: The Channel Label may be up to 5 characters in length.

Data Format

The OM-480 & 490 series dataloggers provide data in two distinct formats; long and short. The long data format is generally used when data is read and interpreted directly by operators or printed to a printer, terminal, etc. The short data format is used, primarily, with application specific software (such as Labtech Notebook) capable of interpreting and manipulating the data. The short data format requires less room in memory and disk and takes less time to transmit serially. Data format selection is set via switch 2 of the Mode Selection Switch on the underside of the datalogger. If the datalogger is set for the short data format, data is sent for ALL channels as a block of data. This provides a consistent size block of data for data management programs. Data in the long format may be sent for single channels, however.

NOTE: The OM-480 series will send data for all channels when a "Scan Data" command is given. The OM-490 series requires beginning and ending channels be specified.

Long Data Format

The long data format is quite straight-forward and generally looks like this:

```
Ch000 = +079.1   Deg F  OK
Ch001 = ?XXXX.   Skip   Off
Ch002 = +0.906   V dc   Off
.
.
```

The first 5 characters indicate the channel number from which data was taken. Character 7 indicates polarity (+/-) or status (? means disabled channel), or indicates an open (unconnected) input. Characters 8-12 are the actual data, followed by a space and then the units (if applicable) or channel skip status, and finally an indication of whether the High or Low Limit has been set and its status.

Short Data Format

Switch 2 of the Mode Select Switch is ON for short data format. Channel data is preceded by a 4 character header identifying the starting channel (000 below) and type of data being sent (A below) followed by twenty channels of data (nine characters each):

```
S D
000A +D4121EAD +01200EEC -00700EDS +07681DDA +00402EEF
-00044AEF ?XXXX0DDC +04000EEB +06321EEC -04001EEQ
+00320DDD +00131EES +03500EEB -01200EER +07231EED
?XXXX0DDI ?XXXX0DDH ?XXXX0DDE ?XXXX0DDT
```

Data Type Information (000A above):

Character	# of Records	Function
A	20	Channel Data
B	16	High Limit Data
C	16	Low Limit Data
D	Variable	Transitions Data
E	1	Reference Temperature
F	2	Setup Data
G	1	Current Time
H	1	Power Down
I[1]	20	M (slope)
J[1]	20	B (slope)
K[1]	20	Units Data

[1] Used only on 490 & 491 models

Short Data Format Information
Short data format consists of nine characters (for example +04121EAD) per channel with twenty sequential channels of data being sent. The table lists the meaning of each character:

Digit #	Mnemonic	Function
1	+	Positive Data Sign/Status
	-	Negative Data Sign/Status
	?	Channel Disabled
	O	Open Thermocouple
	R	Overrange
2-5		Channel Data (with leading zeros)
6	0	Decimal Point Placement (XXXX.)
	1	Decimal Point Placement (XXX.X)
	2	Decimal Point Placement (XX.XX)
	3	Decimal Point Placement (X.XXX)
	4	Decimal Point Placement (.XXXX)
7	E	High Limit Alarm Status - Enable
	D	High Limit Alarm Status - Disable
	A	High Limit Alarm - Exceeded
8	E	Low Limit Alarm Status - Enable
	D	Low Limit Alarm Status - Disable
	A	Low Limit Alarm - Exceeded
9	A	J-type Thermocouple Data - °F
	B	K-type Thermocouple Data - °F
	C	R-type Thermocouple Data - °F
	D	T-type Thermocouple Data - °F
	E	100mV range
	F	1 Volt range
	G	10 Volt range
	H	4-20mA range
	I	Hardware Skip (Inactive Channel)
	P	Digital Input (490 & 491 only)
	Q	J-type Thermocouple Data - °C
	R	K-type Thermocouple Data - °C
	S	R-type Thermocouple Data - °C
	T	T-type Thermocouple Data - °C

NOTE: If the ninth character (a-t) is lower case, mX+b and/or user specified units are used.

Examples:

The following examples illustrate usage of the Command Set. Bear in mind that the 480 series will return data for all channels when using the "Scan Data" command whereas the 490 series returns data only for the specified channels:

S D	Scan Data
Ch000 = + 040.2 Deg F LO	Display data for Ch 0

Channel 0 (default for 490 series) shows temperature reading of 40.2°F with Low limit active.

s d 8 10	Scan Channels 8 to 10
Ch008 = ?XXXX. Skip Off	Channel 8 Data
Ch009 = ?XXXX. Skip Off	Channel 9 Data
Ch010 = -0.004 V dc LO	Channel 10 Data

Data for channels 8 through 10. 8 & 9 are skipped. Channel 10 shows the reading, the range setting, and the active Low Alarm.

S h 7	Scan high limit. Ch 7
Ch007 HI Limit = +080.0 Deg F Enabled	High Limit for Ch 7

S R	Scan reference temp
Unit 000 ref temp = +074.8 Deg F	Display Reference Temp

s t 07:34:00	Set Master Time

t d	Display Current Time
07:34:05	Current Time

DATALOGGER TROUBLE-SHOOTING

In the unlikely event that something goes wrong or you simply can't get the datalogger to work either alone or in conjunction with a printer, terminal, computer or whatever, the following section may help to isolate the cause of the problem and suggest corrective measures. You should attempt to isolate (or define) the problem prior to calling our Technical Support staff for assistance. Most problems can be traced to several common causes and, therefore, diagnosed and remedied in a matter of minutes.

Can't Make Changes From the Front Panel

Front panel lockout switch (underside of the datalogger) is enabled.

Can't Activate Channel from Front Panel

CHANNEL CONFIGURATION SWITCH (TCV-16) set to position 8 (Skip).

Printer or Computer in Permanent BUSY State

Serial Port Misconfigured. Check Serial Port Configuration Switches on both the Datalogger and Printer/Computer.

Display Shows OL

Input signal too high for selected range. Check the CHANNEL CONFIGURATION SWITCH (TCV-16) and/or the input signal.

Check that the voltage difference between High Input and Ground and between Low Input and Ground for the affected channel.

PC Won't Communicate with Datalogger

Improper serial cable, Improper Serial Port Configuration, Improper Serial Port Targeted (try COM1 or COM2) or Improper Communication Software. Check all of the above.

Front Panel Buttons Have No Effect on Datalogger Display

Internal Clock Battery Depleted. Replace Battery.

Replacing Batteries

Each datalogger contains a battery which provides power to the Clock IC and its battery-backed memory containing the Date and Time. When this battery is weak, the front panel becomes inactive and the correct time and date are usually lost.

The battery is active only when primary operating power (24Vdc) is removed from the datalogger. Even so, it may eventually become depleted and require replacement. Simply locate the battery on the display board of the datalogger and replace it with the same or an equivalent battery. You may also want to check the battery voltage to ensure that the problem is, indeed, the battery.

The SRAM (U34) has a self-contained lithium battery providing power for setup information storage. When this battery becomes weak or dead, calibration and other setup data are lost and the datalogger beeps 5 times at power-up to indicate that it is out of calibration. The self-contained SRAM battery is not field replaceable and, when replacement is required, should be sent back to the factory for service.

DATALOGGER CALIBRATION (A/D & TEMPERATURE REFERENCE)

A/D Converter Calibration

Periodic recalibration of the A/D portion of the datalogger is essential for maintaining the original high accuracy readings you have come to expect. Calibration should be done yearly under normal conditions and more often under adverse conditions. ADC calibration consists of bringing the datalogger in line with a known (accurate) DC voltage. Each datalogger in the network must be individually calibrated, if applicable. The following procedure is the same regardless of whether you are using the front panel (481 & 491) or a computer. Also provided on the getting started diskette is a calibration program for use with an IBM PC/XT compatible (see the relevent appendix for a full description). An accurate calibration requires an accurate DC source capable of mV output. Note that cycling through the calibration steps via the front panel (OM-481 & 491) will transmit data via the serial port.

1) Remove power from the datalogger and set the MODE SELECTION SWITCH #4 ON (located on the underside of the datalogger).

2) Connect the voltage source leads to the Input High and Input Low terminals of channel 00 (located in the TCV-16 I/O Module). Then slide the TCV-16 back into the datalogger.

3) Set the output of the voltage source to 10.0000 Volts and turn ON both the datalogger and the Voltage source. Allow both to warm up and stabilize (about 20 minutes).

4) 10.0000 Volt Range Calibration. To calibrate, simply press the **ENTER** key or the **Ctrl-Z** key on the computer. A successful calibration will cause the datalogger to beep once. An unsucessful calibration will be indicated by 5 beeps from the datalogger. If unsucessful, check all wiring and proceed again. Once calibration is successful, press the **VALUE** key or **Ctrl-K** to proceed to the next step.

5) Steps 2 & 3 are accomplished the same way with 1.000 volts and 0.1000 volts, respectively.

6) After a successful calibration, shut OFF the datalogger, remove the the voltage source leads, and set switch 4 to the OFF position. Repower the datalogger. A single beep at power up indicates a successful calibration.

NOTE: Step 5 (Real Time Clock Calibration) is for factory use only. You should skip this part of the calibration. However, if you accidently reset the real time clock, it should have no effect. Press the VALUE key to skip this step.

Temperature Reference Calibration

All dataloggers contain an internal temperature reference sensor. The internal reference temperature should be calibrated periodically to maintain maximum accuracy during thermocouple measurements. Calibration consists of bringing the datalogger in line with a known (accurate) temperature reading (normally zero degrees). The known temperature may be an ice bath (0°C) or an accurate thermocouple calibrator.

1) Remove power from the datalogger. Remove the TCV-16 I/O module. Remove the nylon insert plug in the top (cover) of the datalogger to gain access to potentiometer R3.

2) Connect the calibrator to the + and - terminals of channel 10 (or connect a thermocouple to channel 10). Set the range switch (TCV-16) for Channel 10 to the type of thermocouple you are using and the MODE switch (# 1) to 0.1°C resolution.

3) Repower the datalogger and set the calibrator on 0°C (32°F). Allow the datalogger to stabilize (about 20 minutes). Alternatively, place the thermocouple in the ice bath and allow it to stabilize for about 1 hour.

4) Using a small screwdriver, adjust R3 until the reading on the datalogger coincides with that on the calibrator (or until it reads 0°C in an ice bath). Once calibrated, replace the nylon plug.

DATALOGGER SPECIFICATION

All specifications are typical @ 25°C unless otherwise noted.

Analog Input Channels	16 differential per Unit
Analog Input Type	Switch Selectable for: Thermocouple: (J, K, R, T) DC Volts: (+/- 100mV, +/-1Vdc, +/-10 Vdc) Current: (4-20mA, requires 20 Ohm shunt)
Input Impedance	> 20 MegOhms in parallel with 47nF.
Common Mode Rejection	140db @ 60 Hz (+/-1% or DC) w/ 1KOhms unbalance
Channel-Channel Rejection	> 120db @ 60Hz (> 105db @ DC)
Normal Mode Rejection	> 40db @ 60 Hz (+/-1%)
Digital Input Channels	4 per unit
Digital Input Type	Contact Closure TTL & CMOS compatible
Maximum Input	14 Vdc (peak AC) between Hi & Lo input terminals and interchannel. All channels together can be floated to +/- 170Vdc (peak AC) from case.
A to D Converter Type	Dual Slope Integrating (for max noise rejection)
Resolution	Equal to 4.5 digit DVM (14.5-bits, approx)
Speed	5 readings per second
Dynamic Range	+/-20,000 counts (plus 4000 counts overrange) Autocalibration, Autozero
Gain	Software Compensated via calibration data
Resolution	10uV (100mV range), 100uV (1 Vdc range), 1mV (10 Vdc range), 0.1% (4-20mA range)

Datalogger Accuracy:
(includes noise, gain, drift, linearization, and input junction errors)

100mV range	+/-0.035% (+0.01mV) 90 days @ 18-28°C +/-0.04% (+0.01mV) 1 year @ 18-28°C +/-0.06% (+0.02mV) 1 year @ 0-50°C
1 Vdc range:	+/-0.035% (+0.1mV) 90 days @ 18-28°C +/-0.04% (+0.1mV) 1 year @ 18-28°C +/-0.07% (+0.1mV) 1 year @ 0-50°C
10 Vdc range:	+/-0.035% (+1mV) 90 days @ 18-28°C +/-0.04% (+1mV) 1 year @ 18-28°C +/-0.07% (+1mV) 1 year @ 0-50°C
Warm-up Time	20 Minutes to rated Accuracy
Temperature Reference	Type L Solid State Sensor
Location	Centered among Signal Input Terminals
Calibration	via multi-turn potentiometer (can be used for compensation of inherent T/C offset errors)

Type J T/C Measurement Accuracy

-50 to 200°C:	+/-0.8°C (90 days @ 18-28°C)
	+/-0.9°C (1 year @ 18-28°C)
	+/-1.5°C (1 year @ 0-50°C)
200 to 760°C:	+/-1.1°C (90 days @ 18-28°C)
	+/-1.1°C (1 year @ 18-28°C)
	+/-9.8°C (1 year @ 0-50°C)
-180 to -50°C:	+/-1.2°C (90 days @ 18-28°C)
	+/-1.2°C (1 year @ 18-28°C)
	+/-2.1°C (1 year @ 0-50°C)

Type K T/C Measurement Accuracy

-50 to 200°C:	+/-0.9°C (90 days @ 18-28°C)
	+/-0.9°C (1 year @ 18-28°C)
	+/-1.6°C (1 year @ 0-50°C)
200 to 610°C:	+/-1.1°C (90 days @ 18-28°C)
	+/-1.2°C (1 year @ 18-28°C)
	+/-1.9°C (1 year @ 0-50°C)
-180 to -50°C:	+/-1.4°C (90 days @ 18-28°C)
	+/-1.4°C (1 year @ 18-28°C)
	+/-2.4°C (1 year @ 0-50°C)

Type T T/C Measurement Accuracy

-50 to 200°C:	+/-0.9°C (90 days @ 18-28°C)
	+/-0.9°C (1 year @ 18-28°C)
	+/-1.7°C (1 year @ 0-50°C)
200 to 400°C:	+/-1.0°C (90 days @ 18-28°C)
	+/-1.0°C (1 year @ 18-28°C)
	+/-1.6°C (1 year @ 0-50°C)
-180 to -50°C:	+/-1.4°C (90 days @ 18-28°C)
	+/-1.4°C (1 year @ 18-28°C)
	+/-2.4°C (1 year @ 0-50°C)

Type R T/C Measurement Accuracy

0 to 200°C:	+/-2.6°C (90 days @ 18-28°C)
	+/-2.6°C (1 year @ 18-28°C)
	+/-4.9°C (1 year @ 0-50°C)
200 to 1768°C:	+/-2.2°C (90 days @ 18-28°C)
	+/-2.3°C (1 year @ 18-28°C)
	+/-3.9°C (1 year @ 0-50°C)

Digital (Alarm) Outputs	16 per unit
Digital Output Type	TTL level; compatible with industry standard alarm boards and SSRs (3 Amp, AC/DC switching)

RS-232 Serial Port	DB-25S (Socket) 1 per unit Switch selected for: Baud Rate: 75 to 19200 Parity: Odd, Even, None Word Length: 7 or 8 data bits Stop Bits: 1 or 2 Handshake: Hardware (DTR) or Software (XON/XOFF)
RS-422 Serial Port	DB-9S (Socket) 2 per unit 1 Mile Total Length (max) local network
System Throughput	30 readings per second, max per system 5 channels per second, max per datalogger
Front Panel Features: (OM-481 & 491)	Power Indicator (LED) Custom LCD Readout 11 Key Touchpad: (6 Function, 3 Edit, and 2 Instruction Keys)
Real-Time Clock (OM-481 & 491)	Battery-backed, 7 years with accuracy of < 2 Min/Yr @ 25°C
Operating Temperature Storage Temperature Humidity	0 to 50°C -20 to 60°C 90% RH non-condensing (0 to 25°C) 75% RH non-condensing (25 to 40°C) 45% RH non-condensing (40 to 50°C)
Size (HxWxD)	2.5" x 6.9" x 13.5" (6.4 x 17.5 x 34.3, cm)
Weight	6.5 lbs (3 Kilogams)
Power Requirements	External AC power: 120VAC (+/-10%) @ 47-63 Hz Datalogger Input: 24 VAC, 8 Watts

BASIC Language Programming

All series dataloggers are capable of being operated from any computer (with a serial port) and in any language supporting data transfer via the serial port. The following is a brief introduction to programming in (IBM) BASICA under PC-DOS (MS-DOS). It assumes a knowledge of BASICA as well as some experience or knowledge of the datalogger. If you are unfamiliar with either or both of these, you should become familiar with them prior to attempting a datalogger program. However, the short program illustrated below will allow rudimentary operation of the datalogger.

Serial I/O

In order to communicate with the datalogger, you must have previously configured the serial ports of both the datalogger and the computer. This can be done quite easily by reading the "GETTING STARTED" section of this manual in conjunction with the MSKERMIT program supplied on the "GETTING STARTED" diskette. Once you are confident that the computer and the datalogger are "talking", proceed with the following short program.

Example Program

```
10   ' DDL.BAS                                  'Program name
20   DIM CH$(20)                                'Set up string array
30   OPEN"COM1:9600,N,8,2" AS #1                'Open Com Port #1
40   CLS                                        'Clear Screen
45   IF EOF(1)=-1 THEN 60:ELSE INPUT #1, GARB$
50   LOCATE 1,1
60   PRINT #1, "S D 000 019"                    'Datalogger Command
70   FOR I=0 TO 19                              'Channel data loop
80   INPUT #1, CH$(I)                           'Put data into Array
90   NEXT I                                     'Increment loop
100  FOR N=0 TO 19                              'Same loop to display data
110  PRINT CH$(N)                               'Display data
120  NEXT N                                     'Increment loop
130  LOCATE 22,1:PRINT"LOOP # :";A:A=A+1
140  GOTO 45                                    'Go back for more data
```

Note that the above program appears to have certain peculiarities. In order for the program to work with either the 480 or 490 series, we must take data for all 20 channels but only display the analog channels (0-15). This is because the 480 series of dataloggers returns data for all channels when using the Scan Data command. Also line 45 checks for an empty Communications buffer prior to collecting data. This is simply a safeguard so that no extraneous characters are collected and displayed. Also note that 1 or 2 stops bits may be used in the OPEN"COM1:....." statement.

Appendix A
Serial Communications

All series dataloggers are equipped with a built-in communication port (RS-232) for data transfer to printers, terminals, other dataloggers, etc or for use with a computer as a powerful Data Acquisition and Control System. In order to communicate with other devices, the serial port configuration for both devices must match. The datalogger serial port is configured via a DIP switch on the under side of the unit along with a series of charts showing how to set the switches for the particular configuration desired. The charts below are a reproduction of those on the OM-480. Typical settings are in **BOLD** type.

RS-232 PORT SETUP

BAUD RATE

Switch	1	2	3
19.2K	OFF	OFF	OFF
9600	**OFF**	**OFF**	**ON**
4800	OFF	ON	OFF
2400	OFF	ON	ON
1200	OFF	ON	ON
600	ON	OFF	ON
300	ON	ON	OFF
75	ON	ON	ON

PARITY

Switch	4	6
ODD	ON	ON
EVEN	OFF	ON
NONE	**ON**	**OFF**
NONE	OFF	OFF

WORD LENGTH

Switch	6
7 BITS	ON
8 BITS	**OFF**

HANDSHAKE PROTOCOL

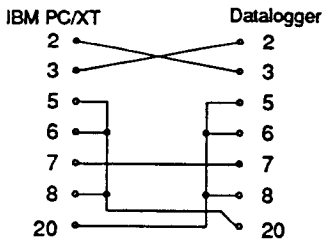
Switch	7	8
XON/XOFF	**ON**	**ON**
ACK/NAK	ON	OFF
NONE	OFF	ON
NONE	OFF	OFF

The START-UP GUIDE is supplied with every datalogger (it is the first section of this manual) along with the GETTING STARTED diskette. Make certain that you have this diskette. Communication to the datalogger may be done via the MSKERMIT.EXE file on the GETTING STARTED diskette. The serial cable that you require for your specific setup will depend upon several factors, but should not be difficult to ascertain with a little help from the following section and drawings.

If you are using an IBM PC/XT compatible with an RS-232 port (either built-in or a plug-in card) you will most likely require the OM-480-PC-6. This is a relatively standard configuration with a DB-25-S on one end and a DB-25-P on the other (the S and P are Socket and Plug). However, some serial cards use a DB-9 rather than a DB-25 so that you will then require a DB-9 to DB-25 cable. Also, certain serial cards may require a null modem or gender changer for proper operation. This will become apparent once you start working with the various parts and looking at the computers serial I/O port. The following serial pin-out should be of help if you need anything other than the standard cable.

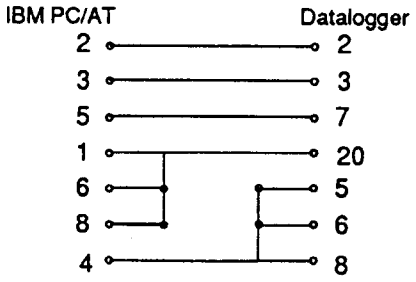
Datalogger Pin #	**Function**	
1	Ground	
2	TD	(Transmit Data from Datalogger)
3	RD	(Receive Data to Datalogger)
4	RTS	(Ready to Send from Datalogger)
5	CTS	(Clear to Send to Datalogger)
6	DSR	(Data Set Ready to Datalogger)
7	SG	(Signal Ground)
8	CD	(Carrier Detect to Datalogger)
19	SCD	(Signal Carrier Detect from Datalogger)
20	DTR	(Data Terminal Ready from Datalogger)

The OM-480-PC-6 has the following internal wiring scheme and will, normally, be all that is required for datalogger operation with a PC compatible.



Part #OM-480-PC-16

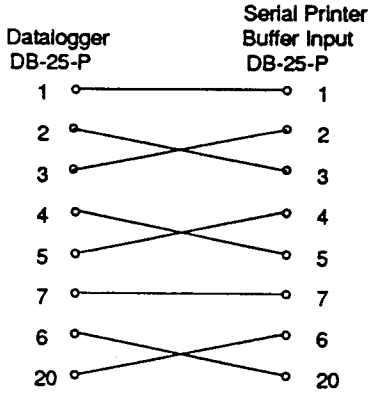
The IBM PC/AT uses a DB-9 connector and is wired somewhat differently requiring a OM-480-AT-6 cable. It's internal wiring scheme is as follows:



Part #OM-480-AT-6

Serial Printer Connections

Serial printers may also be connected to the datalogger via the serial port (A serial to parallel converter is also available for connecting to centronics compatible printers; part #WB-PC480). Most serial printers use a standard serial cable with two DB25P connectors so that you may use any standard serial interface cable or the OM-480-S-6. The pinout is shown below.



Part #OM-480-S-6

Appendix B
Single Signal to Multiple Channels,
Multiple Units, Networking, etc.

Connecting Single Input to Multiple Channels

Certain applications require a single input signal be connected to multiple datalogger input channels. For example, when setting progressively higher alarm setpoints with progressively more acute action being taken. The first setpoint may simply turn on a fan or chiller, the second setpoint may light a warning light, the next may sound an audio alarm and finally the last may shut down the system or open a pressure bleed value. This redundancy is especially useful in large expensive systems where single alarm failure can be catastrophic.

Redundancy is accomplished by feeding the main signal into channel 0, for example, and running copper wire to the secondary (redundant) channels in a parallel fashion. Then set the high (or low) setpoints as desired for the action to be taken.

Connecting Slaves to a Master Unit

Multiple (slave) dataloggers may be connected to a Master Unit when more input channels are required. Any OM-491 or 481 may act as a Master Unit (channel 000) and can control up to 4 additional units (80 Analog input channels plus 15 Digital Input channels, max). In any Master/Slave combination, data is sent to the Master Unit from the Slaves allowing the Master Unit to act as the controller for data transmission. As such, the time and date of the Master Unit is used for all slaves.

When controlled from any IBM PC/XT/AT compatible computer via an RS-422 link, up to 50 dataloggers may be controlled from the computer (800 Analog Input Channels and 195 Digital Input Channels, max). A OM-481 or 491 is desirable in a network so that some of the parameters may be controlled directly from the front panel.

Slaves are connected to Masters and to each other via the RS-422 ports (DB-9 connectors) on each datalogger. An RS-422 cable (part # OM-480X-CAB422) is used to interconnect the Masters to slaves (normally contiguous channels) and slave to slave for a total of 5 units when not computer controlled and up to 50 units when used with a computer. The total maximum length for all RS-422 cables must not exceed 1 mile.

Making an RS-422 Serial Cable

In the event that you either have an existing serial cable (DB-9P to DB-9P) or simply want to purchase the connectors and make your own interconnect cable, the following diagram is provided:

DB-9P		DB-9P
Pin 1	----- Shield ----	Pin 1
Pin 4	----- Twisted ---	Pin 4
Pin 5	----- Pair ----	Pin 5
Pin 8	----- Twisted ---	Pin 8
Pin 9	---- Pair ----	Pin 9

Note that on very long cable lengths, connect the shield to pin 1 or earth ground at one end only. This will avoid ground loop problems.

Appendix C
Implementing mX+b (OM-490 Series)

The OM-490 and 491 dataloggers were designed specifically for interfacing to a very wide variety of sensors and transducers and reporting/displaying their resultant data in engineering units. The software built into the datalogger is capable of implementing a standard mX+b algorithm and applying this mathematical function to the input signal (VDC, 4-20mA, etc) with resultant conversion to virtually any engineering unit (GPM, psi, Degrees, Tons, lbs, etc). The OM-49X series actually applies the mX+b algorithm to all input signals with a default function of m = 1 and b = 0 (the incoming signal is multiplied by 1 and therefore remains unchanged). Implementation of mX+b involves changing the default values to the values you wish to use. This is done on a per channel basis allowing each channel to implement a different scaling factor (m) and offset (b) as required.

Programming

The following discussion is directed at the OM-49X and computer system. Assigning values for m and b can be done only via the serial port in conjunction with a computer. This example uses the MSKERMIT communication program supplied on the "GETTING STARTED" diskette and assumes some familiarity with the program and it's operation. If you are not familiar with MSKERMIT, you might want to review the START-UP section of this manual for a full explanation.

Invoke MSKERMIT:

The program should autoconnect. If not, simply type **connect**. Make sure that you have local echo ON. Then simply type:

m set -5 0 5	This command sets m to a value of -5 for channels 0 thru 5
bn set 20 1 3	Sets b to +20 for channels 1 thru 3
scan b 1 3	Returns value of b for channels 1 thru 3
scan m 0 10	Returns value of m for channels 0 thru 10

Assigning Labels to the Channels

In conjunction with the mX+b algorithm, the 490 series of dataloggers is also capable of label assignments in order to identify the various channels other than the default labels (automatically assigned with the TCV-16 channel type rotary switch). Assigning the various labels is simply a matter of using the "UNITS SET" command followed by the label (no spaces) and the various channels desired.

units set psig 1 3	Assigns the label "psig" to channels 1 thru 3

Calculating Values for M and B

Suppose a flow rate transmitter (4-20mA) has been calibrated to read a full scale range of 0 to 400 gallons per minute. The output from the transmitter must be scaled by the datalogger to read/report data as Gallons per Minute. The 4mA signal corresponds to 0 gallons per minute and the 20mA signal corresponds to a maximum reading of 400 gallons per minute. Since the full scale range of the input signal is 16mA (20 minus 4), each mA corresponds to 25 gallons per minute (400/16 = 25). Therefore, we must multiply the datalogger signal "X" by 25 (m=25) and use a zero offset of -100 (since 4mA x 25 = 100).

The M and B values are applied to the input signal prior to data transmission or display (on the front panel) so that the number seen is actual gallons per minute, in this case.

Appendix D
Datalogger Built-In Diagnostics

Datalogger Self-Test

A set of built-in diagnostics are used to exercise the basic functions of the datalogger and ensure proper operation. The self-test may be run with any of the four datalogger models and will require a printer & interface cable (minimum) for the OM-481 & 491 or a computer, serial cable, and communication software for the OM-480 & 490. If you are using a computer to control the with any of the dataloggers, please ensure that the communication setup for the datalogger matches that of the computer (see Appendix A or the under side of the datalogger for details). Remember that if you are using the WB-PC480 parallel printer adapter (for Centronics compatible printers), the Baud rate must be set to 9600 baud. Once you are convinced that the serial port is configured correctly, you may proceed.

The self-test may be run from either the front panel or from a computer. The operation of the test is similar regardless of front panel or computer operation. In either case the instructions are printed on the printer or on the computer screen (whichever you are using).

To run the self test, simply set the Self-test switch ON (turn the datalogger over and enable the MODE SELECTION switch "3"). Then apply power to the datalogger. The Self-test will begin execution of the various functional units built into the datalogger and will output a report to the printer, etc. after each test. You will be prompted after each test to either go to the next test (press VALUE) or skip the next test (press ENTER).

There are 8 separate tests:

1) RS-232 PORT test
2) MEMORY test
3 FRONT PANEL DISPLAY test (if applicable)
4) RS-422 OPERATIONAL test
5) A/D CLOCK FREQUENCY test
6) A/D OPERATIONAL test
7) SETUP SWITCH test
8) DIGITAL OUTPUT test

After performing the self-test, you will probably want to disable the self-test switch so that the test does not run every time the unit is powered.

Appendix E
OM-480-ALRM
Datalogger Alarm Panel

The OM-480-ALRM is a complete global alarm indicator that may be mounted virtually anywhere. It is used, principally, to indicate alarm states of the various (16 analog) input channels. Either an AC or DC type relay may be used with the OM-480-ALRM output to directly drive audio/visual alarms, solenoids, pumps, motors, etc. The versatility of the OM-480-ALRM allows simple ON/OFF control schemes to be implemented. It has a built-in, automatic power-up delay sequence allowing transducers, etc a chance to settle prior to actual operation (manual override of turn-on delay is standard). Each DDL-ALRM monitors up to 16 individual channels while providing visual annunciator LEDs for each channel.

Setting up the DDL-ALRM

The OM-480-ALRM consists of:

OM-480-ALRM panel
34 Conductor Ribbon Cable (supplied)
115VAC to 9VDC Wall Adapter (supplied)

Optional Components:

VDC or VAC Relay Module[1]

[1] If you are adding a relay module to the OM-480-ALRM you will also need a small, flat blade screwdriver and several lengths of stranded wire (#16 AWG or smaller).

Connecting the Optional Relay

Connecting the optional relay is done as follows:

1) Plug the relay module into the socket located on the top of the OM-480-ALRM panel ensuring that the screw (in the module) is closest to the bottom of the OM-480-ALRM.
2) Locate the Global Alarm output connector (beneath the RELAY OUT label). Use a small flat blade screwdriver to push in the spring loaded retainer on the connector and insert the stranded wire, then remove the screwdriver. Do this for both connectors.
3) Wire the relay output in series with both the power source (AC or DC depending upon relay used) and load to be driven (fan, motor, pump, etc).

Connecting the OM-480-ALRM to the Datalogger

Once the optional relay has been installed (if desired), you can connect the OM-480-ALRM to the TCV-16 I/O Module of the datalogger. Simply proceed as follows:

1) Remove and open the TCV-16 I/O Module from the datalogger. Locate the Digital Output Connector (bottom center of the module).

2) Connect the 34-conductor Alarm Ribbon Cable from the TCV-16's Digital Output Connector to the TTL INPUT Connector of the OM-480-ALRM. Pay particular attention to interface connectors as they are keyed to avoid incorrect mating.

3) Close the TCV-16 cover and reinstall it in the datalogger.

4) Connect the VAC to 9VDC adapter jack to the OM-480-ALRM and plug it into a convenient wall outlet.

Operating the OM-480-ALRM

Once installed, the OM-480-ALRM is active. Depending upon the High/Low alarm setpoints for each (analog) channel in the datalogger, the Alarm Status Indicators on the OM-480-ALRM will light. However, the global alarm indicator (and optional relay, if installed) remains **inactive** for 15 minutes after power-up (this is a built-in time delay function allowing transducers and other incoming signals to settle and, therefore, alarm states to clear). A GREEN LED indicates the ARMing of the global alarm (and relay). To ARM the OM-480-ALRM immediately after power-up, simply press the RESET button. The GREEN LED should indicate ARMed status. A second pressing of the RESET button will disarm the Global Alarm Indicator (and Relay).

Testing the OM-480-ALRM

You may test the OM-480-ALRM with or without an incoming signal by simply setting the High Alarm Limit (on channel 0, for example) to a number lower than incoming signal and making that channel the active channel. If you do not have an appropriate signal, simply set the range switch (on the TCV-16) for channel 0 to read a thermocouple (position 0, for example) and leave the signal input connector open (unconnected). This will cause a high reading (out of range) for that channel and will light the alarm indicator, the Global Alarm indicator, and the Global Alarm Relay (if installed). In both cases, make sure that the channel is active (not SKIPPED) and that the OM-480-ALRM is ARMed.

To deactivate the Global Alarm Indicator (and Relay), press the RESET button. This will clear the Global Alarm condition, but the alarm status indicator for that channel will remain lit. Then set a channel SKIP and/or reconfigure the High/Low Alarm limits (and the range switch on the TCV-16) for the channel in question.

OM-480-ALRM Specifications:

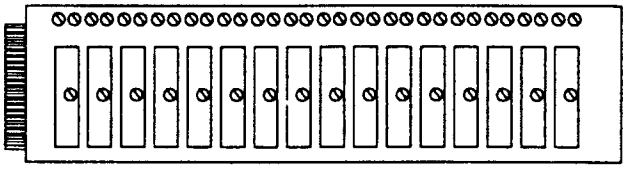
Required OM-480-ALRM Power	+9VDC @ 600 mA (supplied by converter)	
Operating Temperature	0 to 50° C	
Relative Humidity	< 80% (non-condensing)	
Optional Relay Compatibility	AC Volts:	OMEGA AC05
	DC Volts:	OMEGA DC05

Appendix F
SSS-PC16
Solid State Relay Control Board

Introduction

The SSS-PC16 is a rugged, industrial quality Solid State Relay Control board designed for use with up to 16 Industry Standard Solid State Relays (Part #s AC05 for AC Volts and DC05 for DC Volts). These SSR's are capable of switching both AC (24-140 VAC @ 3 Amps, max) and DC (5-60 Vdc @ 3 Amps, max) voltages from the TTL level output signals of the datalogger (must be used in conjunction with the OM-5VDC power supply). The SSS-PC16 may be interfaced directly to the datalogger or to the OM-480-ALRM Alarm Panel via the OM-480-RB ribbon cable. The SSS-PC16 is used to individually control high power components (motors, fans, chillers, pumps, etc) from the datalogger alarm outputs. The solid state relays may be ordered individually allowing a mix & match configuration, thereby customizing the specific control output function to the analog input signal. Each relay is independently enabled by it's corresponding analog input signal exceeding the High or Low limit setpoint for that channel.

Block Diagram



Configuration & Usage

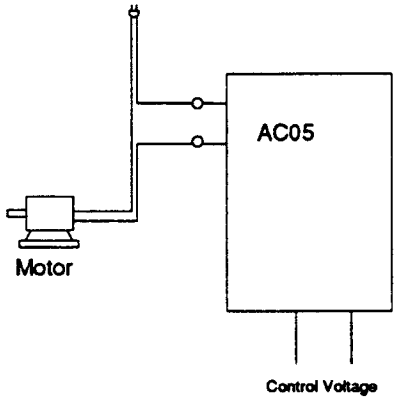
The SSS-PC16 may be connected directly to the digital output connector of the TCV-16 I/O module (J1) or to the OM-480-ALRM output connect via the OM-480-RB cable.

1) Be certain that power has been removed from the datalogger prior to interconnection. Then simply plug the cable into either the TCV-16 module or the OM-480-ALRM and the SSS-PC16.

2) Be certain that the OM-5VDC is **NOT** plugged into the wall. Then wire the output from the power supply to the power terminals of the SSS-PC16.

3) Finally, wire a compatible load (fan, motor, pump, etc) to the desired output terminals (of the SSS-PC16) corresponding to the analog input channel of the datalogger. An AC load may be wired to either side of the SSS-PC16 output terminal (observe polarity when using DC driven loads). Common electrical practice calls for breaking the Black wire from the load rather than the White one.

Typical Wiring Diagram



Specification

SSS-PC16 Output Controller Board:	
Size	3.5" x 14.5"
Required power	+5 Vdc (250 mA, Typ) Use Part # OM-5VDC
General AC/DC Relay:	
Switch Type	Form A (SPST-NO, Continuous duty)
Steady State Load Current	3 Amps, max (@ 25°C) 2 Amps (@ 50°C)
Transient Noise Immunity	Typically > 3000 Volts, p-p
Isolation	4000 V rms
AC Output Relay (AC05):	
Load Voltage	24-140 VAC @ 47-63Hz
DC Output Relay (DC05):	
Load Voltage	5-60 Vdc

Appendix G
WB-PC480
Serial to Centronics Printer Adapter

Introduction

The WB-PC480 is a serial (RS-232) to parallel (Centronics) converter specifically designed for use with Centronics compatible printers. It requires no external power since it is powered from the serial interface of the datalogger and is supplied with all required interface cables and other hardware. The WB-PC480 provides an error indicator (LED) that checks for proper operation and configuration. Use of the WB-PC480 will eliminate the need to purchase a separate serial printer for use with the datalogger when you have a parallel printer already.

Configuring the WB-PC480

The WB-PC480 requires virtually no setup since everything is configured in the datalogger itself. The serial port is configured by turning the datalogger over and setting the Serial Port switches according to the diagram on the WB-PC480. An error status LED will light if the dataloggers serial port is incorrectly configured.

Prior to connecting the WB-PC480 between the printer and datalogger, be sure to **shut off power to both**. Interconnection of the WB-PC480 to both the datalogger and your Centronics compatible printer is done by plugging the DB-25 connector into the RS-232 (serial) port of the datalogger and plugging the 36-pin Centronics compatible connector into the parallel port of the printer (the connectors will only mate correctly so you needn't worry about improper connection).

Operating the WB-PC480

Once installed, the operation of the WB-PC480 is transparent to the user so that no operational check is required unless there is a problem. If the error indicating LED is lit, check the configuration of the datalogger serial port, reseat all connectors involved, and retry datalogger to printer transmission.

To check proper operation, simply set the Interval rate to some convenient number (10 seconds, for example) and SCAN the desired Channel(s) or simply press the SCAN button on the front panel (481 & 491 models only).

Specifications

Serial Input	Compatible with datalogger serial output (Not compatible with other serial devices)
Baud Rate	9600
Parity	None
Word Length	8 Bits
Parallel Output	Centronics
Power Requirements	Supplied by datalogger
Operating Temperature	0 to 50° C
Humidity	90% RH (0 to 25° C, non-condensing) 75% RH (25 to 50° C, non-condensing)

Appendix H
OM-480-PK
Battery Backup System for Data Buffers

Introduction

The OM-480-PK datapack is a rechargable battery pack for use with any of the datalogger buffers. It protects data in memory for up to 24 hours during power failures as well as allowing data to be transported (in buffer) from one physical location to another. The OM-480-PK consists of a 12Vdc lead acid battery (6 Amp hours) and it's own, integral recharging circuitry. When plugged into a wall outlet, the datapack recharges while supplying power to the data buffer so that once recharged, it will always maintain a full charge. Physically, the OM-480-PK datapack has a built-in handle for easy transport and a double height case for data buffer storage (and transport, if desired). Each buffer is supplied with its own manual so that the following description is applicable only to the datapack.

Setting up the OM-480-PK Datapack

The datapack is supplied with all required cables and other hardware necessary for operation. Setting up the databuffer is done as follows:

1) Remove any cables from the datapack and buffer.
2) Turn the buffer over and remove the rubber feet and screws.
3) Remove the buffer from it's case by sliding it rearward and reinsert the buffer (minus it's case) into the OM-480-PK's lower case from the front.
4) Secure the data buffer in place with the original screws and rubber feet.

Charging the Datapack Prior to Use

The OM-480-PK should be recharged prior to actual use in conjunction with a buffer. This will assure that data is protected in the event of a power interruption or failure. The datapack will be fully charged within 16 hours of initial power up. To recharge the data pack, simply plug the power cord into convenient wall outlet. After 16 hours you may connect the dc output connector to the 9VDC input receptacle on the back of the data buffer. Check that the POWER Indicator on the front of the data buffer is lit (Universal data buffers may require you press the POWER button on the front panel of the data buffer).

Caution: Universal Data Buffers require that the POWER button be left ON at all times, otherwise **data will be lost.**

Using the Datapack

Once the datapack has been charged and hooked up to the appropriate data buffer, the buffer may be used in a datalogger system. You should check the data buffer manual for connections to and from the data buffer. Generally speaking, however, the buffer is connected from the dataloggers serial port on the incoming side and to the computer's serial port on the outgoing side. Refer to your data buffer manual for configuration parameters.

Specifications

Power Rating	12 VDC @ 6 AH
Battery Charging Time	16 hours to full charge
Battery Type	Sealed Lead Acid
Weight	8 lbs, 14 Oz
Size	6" (H) x 6.9" (W) x 9.6" (D)
Battery Backup Life	24 Hours @ 70° C (non-printing)

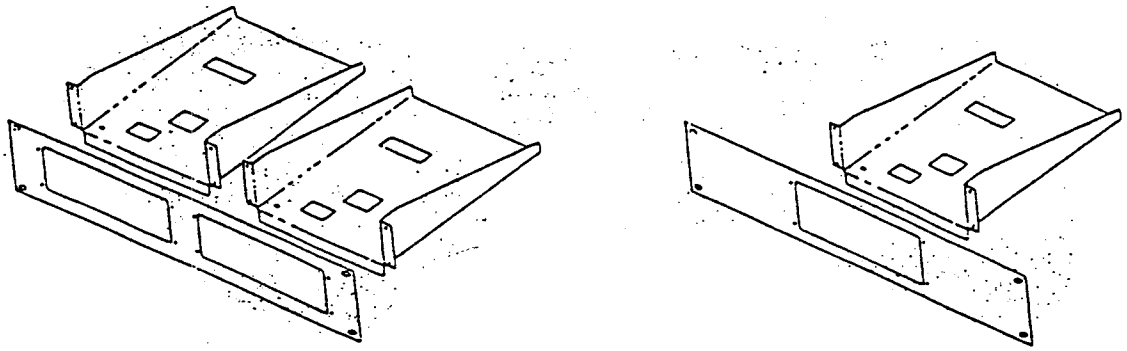
Appendix I
RMK-SING & RMK-DUAL
Datalogger Rack Mount Rack Mount Kits

The RMK-SING & DUAL rack mount kits are attractive, single and dual datalogger mounting kit with faceplates for any of the OM-480 series dataloggers and/or data buffers. Both kits contain all necessary hardware for installation of dataloggers and buffers into any industry standard 19" rack. The mounting plates are provided with cutouts on the bottom for easy access to the various Mode and Configuration DIP switches on the dataloggers.

Assembly is quick and easy requiring only a small, flat blade screwdriver and small pliers or adjustable wrench.

Rack Mount Kit Assembly Instructions

Refer to the drawings below for orientation and identification prior to attempting installation.



Then Proceed as Follows:

1) Lay the faceplate on soft cloth to avoid scratching the finish. The threaded studs on the faceplate should be pointing upwards.

2) Position the mounting plate over the faceplate mounting studs and secure with a washer and nut. The faceplate is symmetric so that there is no top or bottom.

3) Remove the two front rubber feet and center screws of the datalogger (or all four rubber feet of the buffer). Slide the data logger (or buffer) onto the mounting plate until it protrudes through the faceplate approximately 3/8". Secure the datalogger (or buffer) to the mounting plate with the four screws supplied by fitting the screws into the appropriate holes. The face plate may now be secured to any 19" rack.

Appendix J
DDLCAL.EXE CALIBRATION SOFTWARE
FOR OM-4XX DATALOGGERS

DDLCAL.EXE is supplied on the GETTING STARTED diskette allowing fast and easy calibration of any OM-4XX series datalogger. DDLCAL.EXE is a fully executable file requiring no other special equipment or computer language. With DDLCAL, you are able to configure your COMM port, run the datalogger SELF-TEST routines, calibrate the datalogger, and operate the datalogger for data acquisition and control.

It is important to run these programs only when the datalogger is hooked up to the computer. If this is not done, your computer system may "hang" and lockout the keyboard. If this occurs, it will be necessary to shutdown the computer in order to restart it.

The programs are structured so that each program runs through the COMPUTER COMMUNICATION (COM1) PREPARATION PROCEDURE first, then returns to the Main Menu where you must rechoose whichever selection desired. This is a safeguard to ensure proper set up. Each program then goes through the various switch settings required for the desired program. The program then goes to the COMM MENU where you may choose one of the following:

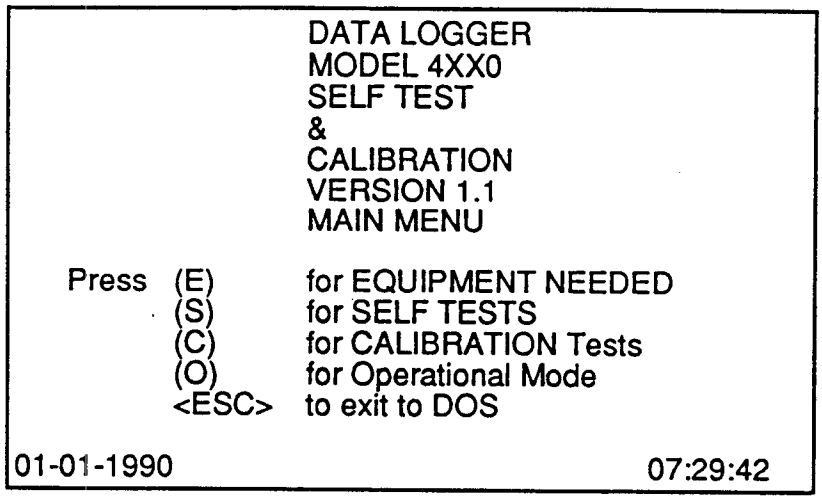
1) Description of the Comm Program
2) Send/Receive Data Mode
3) Halt Comm Program

To communicate with the datalogger for each function, choose 2.

INVOKING DDLCAL.EXE:
Prior to operating DDLCAL.EXE, we suggest that you make a copy of the "GETTING STARTED" diskette (containing DDLCAL.EXE) and put the original diskette in a safe place. DDLCAL may be called by simply typing the name of the program at the DOS prompt as follows:

A:>*DDLCAL*<cr>

The MAIN MENU:
The DDLCAL Main Menu will appear on the screen as follows:



EQUIPMENT NEEDED:
The "Equipment Needed" screen simply lists the equipment required for a successful calibration of the datalogger. The only auxiliary equipment required (besides the datalogger and an IBM PC/XT compatible) is an accurate DC Calibrator and perhaps a small flat-blade screwdriver.

From this menu, you are allowed to continue, repeat the same screen, go back to the Main Menu, go to the next step, or exit to DOS. Continuing to the next step will allow you to set up the Comm port. Note that the each program should be performed at 2400 Baud to avoid data transmission errors.

SELF TESTS:
The Self Test screens gives information on running the internal OM-4XX self tests as well as how to configure the datalogger for self-test at 2400 baud. As always, you should have a datalogger hooked up to the computer prior to running the self tests. Failure to do this may cause your computer to "hang" and lockout the keyboard requiring a complete computer shutdown and restart.

There are 8 self tests (a full explanation of each is found on page 39 of this manual as well as interactively with the datalogger). You should perform all of them if you are having trouble with the datalogger. The sequence may not start on Step 1, but should be advanced to Step 1 prior to starting the Self Tests. If a Device Timeout error occurs, check all cables and connections to and from the datalogger as well as the communications parameters.

CALIBRATION:
Datalogger calibration is quick and easy requiring only those items listed above. As with the Self Test Mode, this selection shows you how to set up the datalogger for calibration at 2400 baud. The calibration procedure is fully explained earlier (starting on page 26) in this manual. You should perform only calibration steps 1 through 3 and skip calibration steps 4 and 5 (these are factory adjustments only).

OPERATION MODE:
DDLCAL.EXE also allows you to operate the datalogger for data display in order to verify proper operation after recalibration or Self Tests. This is often helpful since it allows you to spot inconsistencies in operation prior to actual data collection and control.

Appendix K
Data Conversion to
Data Interchange Format (DIF)
for Use with Lotus 1-2-3

Data that has been stored in the long data format to disk may be converted to a format compatible with several common spreadsheet programs such as Lotus 1-2-3. This allows collected data to be analyzed, graphed and otherwise manipulated under the control of these spreadsheet packages. Conversion is a simple matter of invoking the conversion program (ABUF2DIF.EXE) and, when prompted, entering the filename (with .DAT extension) of the file to be converted. For example:

C:ABUF2DIF<cr>

Enter the input filename or <Esc><cr> to exit:**TEST.DAT<cr>**

ABUF2DIF.EXE will automatically convert data that has been stored in the **TEST.DAT** file to a DIF compatible file named **TEST.DIF**. Once this has been done, you must then run the LOTUS Utility program that converts .DIF files to LOTUS compatible .WK1 files.

Invalid data, if found, is identified by the line number where it was found within the data file and this information is displayed on your computer monitor screen.

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