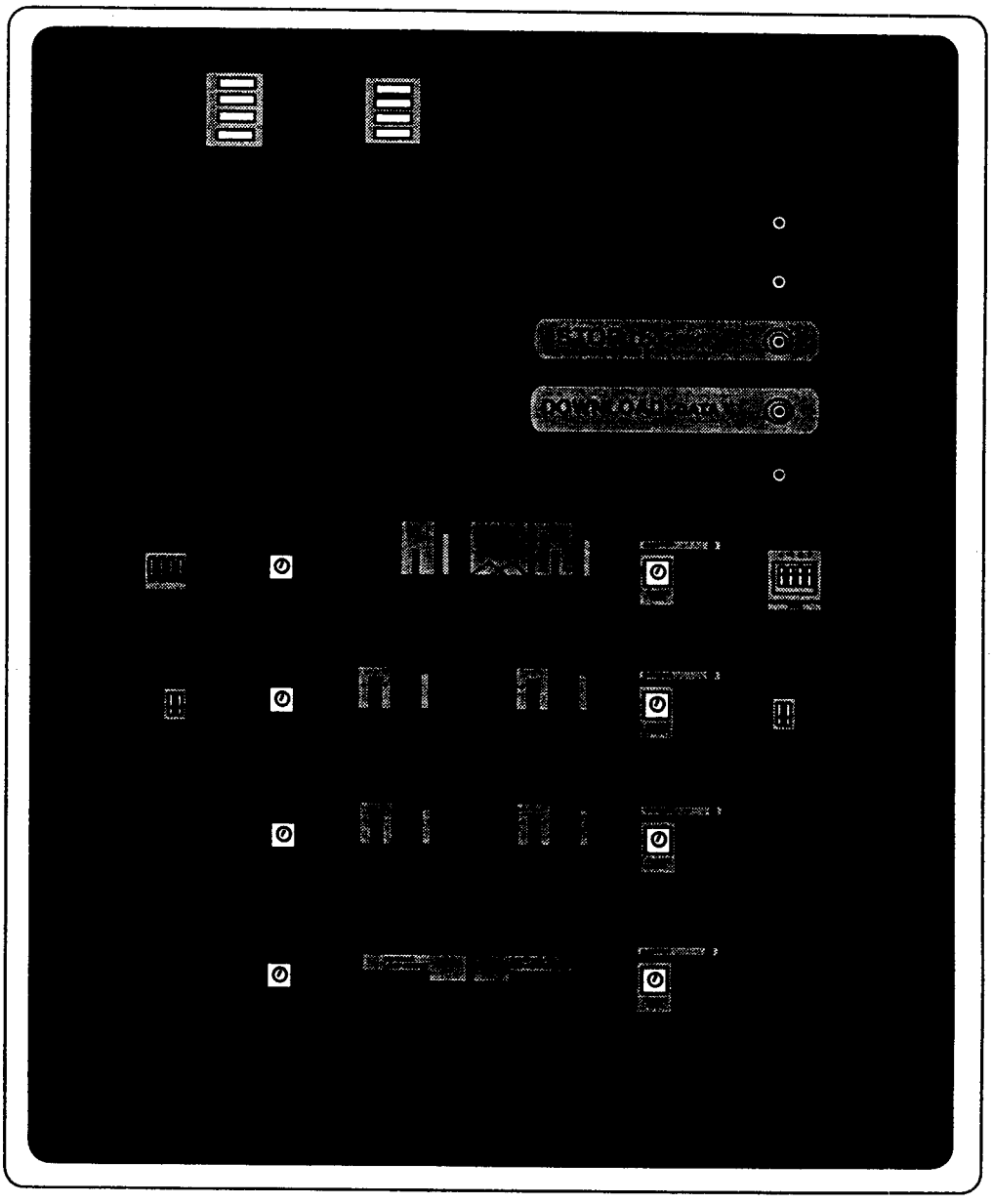
OM-220

Versatile Portable Data Logging System



OMEGA®

An OMEGA Technologies Company

Operator's Manual

OMEGA®
An OMEGA Technologies Company

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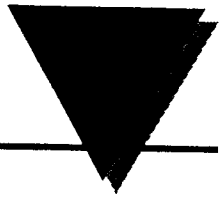

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OM-220 Data Logging System (1)
Operator's Manual (1)

If you have any questions about the shipment, please call the OMEGA Customer Service Department. When you receive the shipment, inspect the container and equipment for signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor damage claims unless all shipping material is saved for inspection. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

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CONTENTS

For information on the following subjects refer to the inside back cover of this manual:

WARRANTY

OMEGA ENGINEERING PHONE NUMBERS

RETURN POLICY

REPAIR PROCEDURE

TECHNICAL ASSISTANCE

PHONE NUMBER

NOTES:

USING THE OM-220

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1..INTRODUCTION

1.1 MANUAL OVERVIEW

This Users manual provides information relative to the use of the OM-220™ portable data logger manufactured by Omega Engineering Incorporated, Stamford, CT.

The manual is organized into a progression of sections to acquaint the user with the set-up, operation, and maintenance of the OM-220.

Sections 1 through 3 are best read in their entirety as they explain device preparation, standard controls, and provide the User with a familiarization of the product.

The appropriate Logging Mode instructions of Section 5..LOGGING DATA that pertains to the type of logging operation desired should then be reviewed.

The remaining Sections and the Appendices can be read as experience with the OM-220 builds and advanced functions are required.

The manual is provided in a 3-ring notebook format so that as additional accessories are acquired, their associated instructions (supplied with the equipment at time of purchase) can be inserted into the appropriate sections. Additionally, notes and specific application information can be easily added for future reference.

1.2 GENERAL DESCRIPTION

The OM-220 is a simple-to-use, 'flexible application' portable data logger. The OM-220 is most commonly used in applications where it is setup on site and left unattended for a period of time to collect and store data from different sensed inputs. After a logging session is completed (minutes, hours or months later), the stored data can be downloaded to a file on a personal computer. This Download file data can then be graphically displayed on the screen and sent to a printer using the Quick-Graph feature of the OM-220 Communications software program (provided on disk with the OM-220).

Additionally, the Download file can be converted into spreadsheet format using the OM-220 Communications File Conversion utilities. The resultant file can be directly loaded from within the spreadsheet environment. The File Conversion utilities directly support Lotus 1-2-3, Lotus Symphony, and an ASCII file format that is readily utilized by main frame computers or DBASE users. Additionally, Quattro Pro, Excel, and other major spreadsheets readily import these spreadsheet formats. The data can then be analyzed and graphed using the high powered spreadsheet program commands that are quite often already User known. No esoteric programming languages unique to the OM-220 are required for successful data

ogging.

Vhen not employed in isolated, stand-alone remote data logging applications, the OM-220 is readily used n the laboratory, at remote-sites with phone connection and/or in production environments. Through the RS-232, modem, or RS-485 (2-wire) Communication ports, the OM-220 can be directly connected to, and under the control of a PC. This allows for Real Time 'TRACK' mode logging applications (in addition to normal logging functions) where the data is dumped to the PC or printer as the data is taken.

The heart of the OM-220 is a VLSI CMOS Z80 family microprocessor and its associated memory. During logging, the microprocessor collects sensor data via the plug-in Input Modules and stores the data internally in Static Random Access Memory (SRAM). At the end of the data recording session, all data stored in the SRAM can be easily and readily downloaded into a personal computer via the provided RS-232, RS-485, or Modem serial communication ports.

A provided software diskette containing the OM-220 Communications™ program (OC.EXE) provides the User with several powerful features. Full communication support via each of the three serial communication protocols; Real-Time Graph, Scroll, and Window Tracking of data; Quick-Graph immediate graphic display of collected data; mathematical manipulation of collected data through User defined Algebraic Processing Blocks (APB); and conversion of collected data to fully annotated spreadsheet formats.

1.3 INPUT MODULES

A broad array of Input Modules are available, enabling the OM-220 to monitor various physical parameters. Input module set-ups (e.g. sample rate, sensor range, sensor type, etc) can be quickly changed in the field commonly with a minimal loss of data logging time. Input modules for receiving current, pressure, voltage, humidity, temperature, resistance, frequency, event, and 4 to 20 mA loop are but a few of the parameters within the OM-220's capabilities. For applications requiring on-site display and storage of Engineering Units data, a OM-220 RUN Program can be employed for scaling and offset corrections, units conversions, and remotely programmable Sample Rate setup for all of the Input Module types. Additional Input Modules are constantly being developed - contact the factory for your specific needs.

1.4 APPLICATIONS

Portable, splash proof,dust proof battery operation allows the OM-220 to record data in areas too punishing for other forms of instrumentation such as strip chart recorders, plotters, etc.

Just a few uses of the OM-220 are:

- → Performance monitoring of heat exchangers and heating and cooling cycles
- → Burn-in or retort temperature cycle verification.
- → Monitoring of component failure, production throughput, shipping shock, vibration, solar radiation, refrigerated transport, meteorological data, and more.
- → Onboard vehicle testing

Additionally, troubleshooting of problematic equipment in the field is drastically simplified with the collection of critical pre-failure parameters (eg over temperature and over-pressure conditions) - all well within the capability of the OM-220.

1.5 FEATURES

- → Extremely simple set-up and use
- → Dust proof,splash proof, self-contained, ready for stand-alone on-site use
- → One to sixteen channel recording capability
- → Up to 12 month recording capability
- → Individually settable channel sample rates
- → Modular Plug-in Input modules for a wide variety of sensors and inputs
- → Programmable scaling, offsets, and Engineering Units conversion
- → Provided OM-220 Communication software with Quick-Graph and Real-Time Track graphic data display
- → Compatible with most commonly known spreadsheet programs
- → APB - User defined Algebraic Processing Blocks for real-time and post-collection data manipulation, display, and analysis
- → Monitor verification of signals during logging
- → Multiple mode operation -- STORE data in the field or TRACK real time logging with direct computer connection.
- → Direct to serial printer data tracking/recording capability
- → Auxiliary power back-up for memory retention
- → Powered by internal batteries, external AC, DC, or photovoltaics
- → Full Hayes AT command set Modem support
- → Integral RS-485 and RS-232 Transceiver circuitry
- → Two year Memory Backup
- → Battery backed-up Real Time Clock with 24 Hr. Time and Date

NOTES:

2..PREPARATION FOR USE

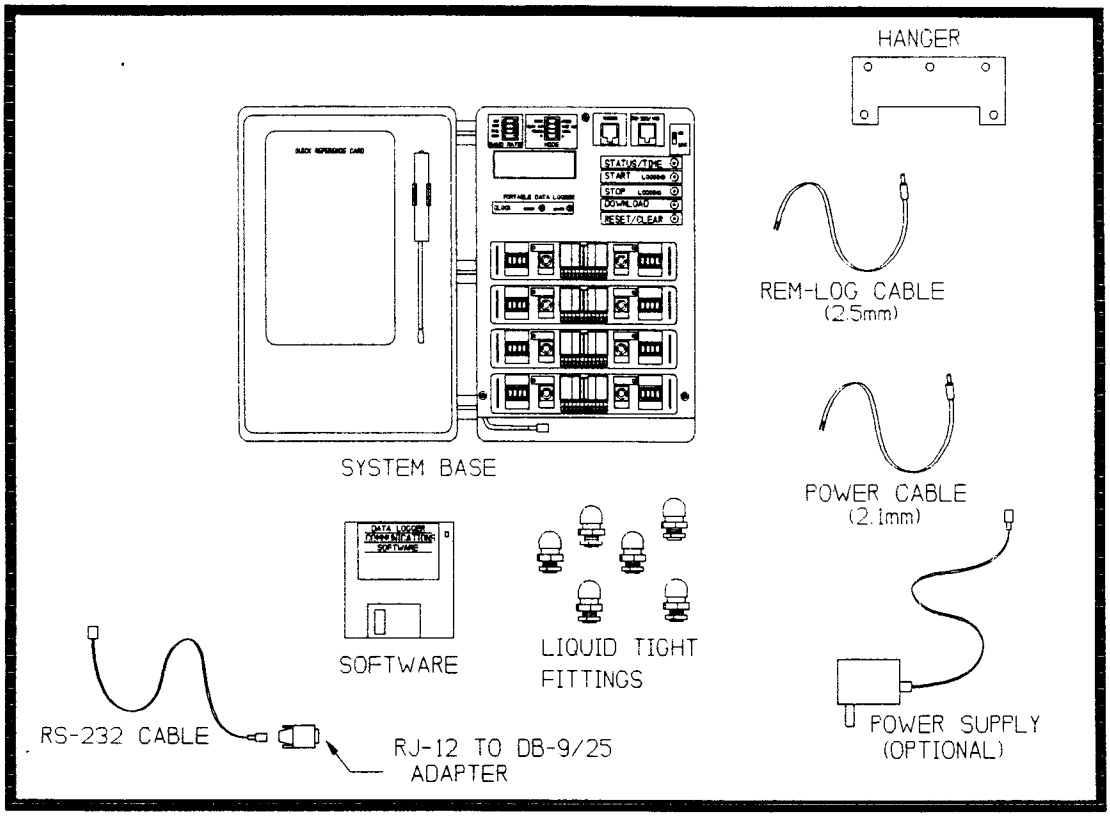

FIGURE 2.1: OM-220 SYSTEM COMPONENTS

2.1 EQUIPMENT CHECKLIST (REF FIG 2.1)

The OM-220 is supplied with the following items:

→ One OM-220 user's manual "USING THE OM-220"

→ One 5' RS-232 / RS-485 Serial Communication Cable

→ An adapter plug to convert the OM-220 RJ-12 'phone wire type' plug (on the end of the 5' cable) to a DB-9 or DB-25 connector for your PC serial port (Contact the factory for alternate pin-out adapters).

→ Six alkaline C-cells (may be installed in the unit)

→ Module adjustment, terminal strip wiring, and 'Programming' screwdriver

→ Liquid-tight plastic wire access fittings w/nuts (6)

→ OM-220 mounting hanger and screws (2)

→ External Power Lead/Plug (2.1mm inside hole diameter)

→ Remote Logging Lead/Plug (2.5mm inside hole diameter)

→ Input Modules (as ordered)

→ Blank module panels (as ordered to cover unused I/M Ports)

→ Quick Reference Cards (QRC) for the System Base and a QRC for each input module ordered

→ One software diskette containing the OM-220 Communications program. (format and disk per your specification at the time of order)

********** **NOTE** **********

CONTACT THE FACTORY IMMEDIATELY CONCERNING ANY DISCREPANCIES

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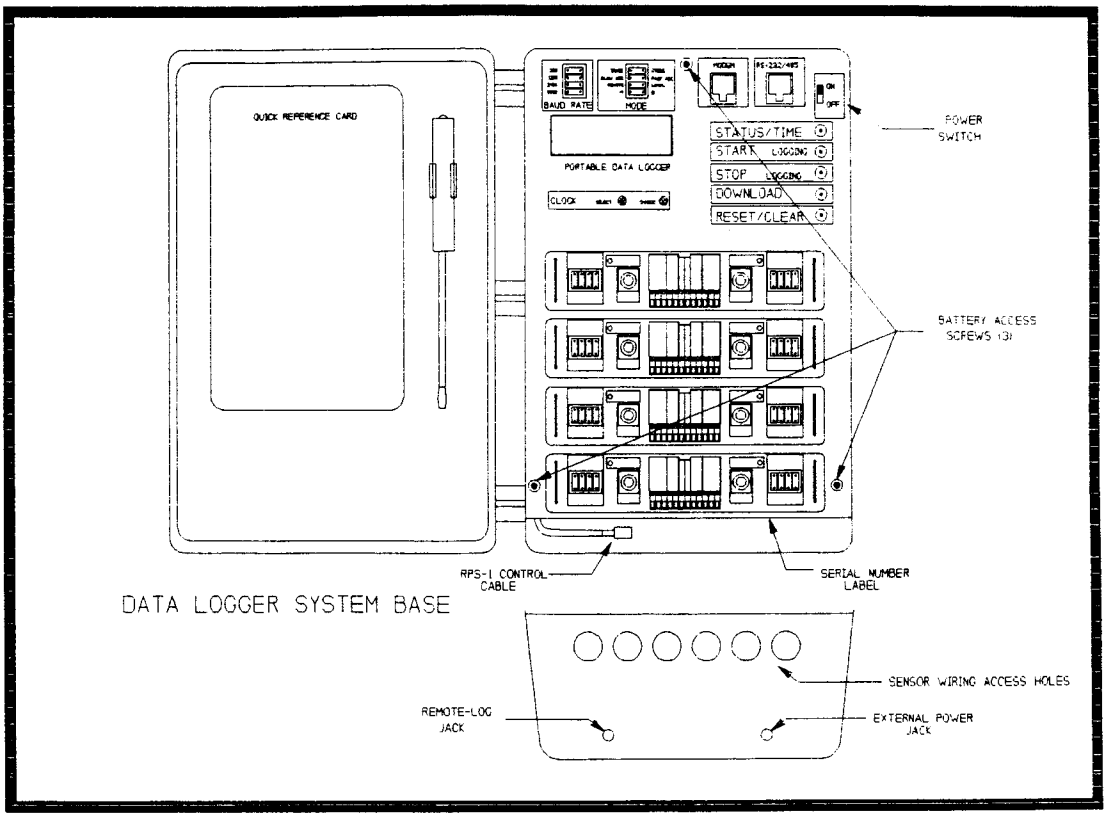

FIGURE 2.2: SYSTEM BASE

2.2 POWER REQUIREMENTS

The OM-220 operates on a nominal 9 VDC which can be supplied by the internal batteries (six C-cells), an external AC or DC power source, or from a regulated photovoltaic source (Refer to DCXF 115/12, RPS-1, and PPM 12/24 power sources in SECTION 7: ACCESSORIES)

2.2.1 INSTALLING THE INTERNAL BATTERIES

********** CAUTION **********
TURN POWER OFF BEFORE REMOVING OM-220 FROM CASE OR PERMANENT DAMAGE TO THE UNIT MAY RESULT
****

Check that the SYSTEM POWER (FIG 2.2) switch on the front panel of the OM-220 is OFF. To install the batteries, it is necessary to remove the System Base from the plastic case. This is accomplished by the following steps:

Remove the three retaining screws (FIG 2.2) holding the front panel in place.

Lift the case and invert the OM-220 into your hand. The system base unit as a whole will slide from the case. Extreme care should be exercised in handling the unit while it is outside of it's protective case. (Avoid scratching, dropping, contamination, etc)

Turn the unit over on a soft non-conductive surface and slide the white battery tray out (toward the top of the unit). Remove the old batteries and install the new batteries **OBSERVING POLARITY CAREFULLY**. Slide the battery tray back into the unit

********** **CAUTION** **********
MAKE SURE THAT THE BATTERIES ARE INSTALLED WITH CORRECT POLARITY. REFER TO RED (+) POLARITY CAPS AT ONE END OF THE BATTERY HOLDER
****

After properly inserting the batteries, carefully reinstall the system base into the case (while avoiding pinching any wires) and secure with the three retaining screws.

2.2.2 MEMORY AND CLOCK BACK-UP BATTERIES

The data memory (SRAM) and the Real Time Clock are powered by two separate 3 volt lithium cells when the OM-220 Main Power switch is OFF. The cells are located in at the bottom of the unit in each corner of the bottom circuit board. The left cell is for the Real Time Clock and the right powers the data memory. (Diagram in APPENDIX E).

The voltage (approximate state of charge indication) of the lithium cells should be checked yearly (a voltage of 2.6VDC or less indicates a low state of charge) and replaced if low voltage is detected or approximately every two years during normal usage.

To replace the cells, remove the OM-220 from its enclosure (refer to SECTION 2.2.1 for procedure) and gently pry the cell to be replaced out of its holder with a small blunt non-metallic tool being careful not to puncture the cell or damage any surrounding circuitry. Insulated tweezers may assist in pulling the cell out of the holder.

Slide a new cell (P/N Panasonic BR 2325 or equivalent) into the holder with the positive terminal UP. A properly installed cell will seat approximately flush with the holder.

********** **NOTE** **********
When the Memory Backup lithium cell is replaced, all data within memory INCLUDING THE CURRENTLY LOADED RUN PROGRAM (SECTION 6.2) will be lost. Download any valuable data from OM-220 memory before replacing the lithium cell. After replacing the cell, if EXTERNAL PROGRAM mode is enabled (SECTION 6.2), a

new RUN Program must be transmitted to memory from the PC before initiating another logging session.

****

********** CAUTION **********

USE CARE IN HANDLING LITHIUM CELLS. CURRENTLY MANUFACTURED CELLS SUCH AS THE BR2325 ARE VERY STABLE AND SAFE PARTS, HOWEVER, DO NOT TEMPT FATE! DO NOT PUNCTURE, SHORT, OR DISPOSE OF IN FIRE AS EXPLOSIONS COULD OCCUR.

****

2.2.3 EXTERNAL POWER

The OM-220 can be powered from any number of different sources through the External Power Jack (FIG 2.2). Use of an external power source will extend the life of the internal batteries. The internal batteries are not charged while using the external source.

When utility power is available, the OM-220 can be powered from a DCXF-115/12 (or DCXF-230/12 for 230VAC applications) plug-in transformer pak (see SECTION 7: ACCESSORIES). This will extend the life of the internal batteries, however the internal batteries will not be charged. This transformer is designed to plug directly into a 120VAC outlet and supply the OM-220 with a nominal 12 VDC at the External Power Jack.

Any clean voltage source that is capable of supplying 150 mA and is regulated within the voltage ranges of 6 to 23 VDC or 8 to 16 VAC will satisfactorily power the OM-220 and can be connected through the use of the OM-220 External Power Jack.

********** CAUTION **********

APPLICATION OF VOLTAGES OUTSIDE OF THE ABOVE SPECIFIED RANGES TO THE OM-220 EXTERNAL POWER JACK WILL RESULT IN PERMANENT DAMAGE TO THE OM-220

****

Two similar looking plugs, with two conductor leads (FIG 2.3), are supplied with the OM-220, one for the External Power Jack and one for the Remote Logging Jack. Upon close examination of the plugs, a difference in the two inside hole diameters of the plugs can be discerned. The plug with the smaller hole is the Power Plug. (The size difference minimizes the possibility of inadvertently reversing the connections on an installed unit)

To utilize the supplied Power Plug, connect the power source to the plug leads being sure to observe polarity of the connections if a DC source is used.

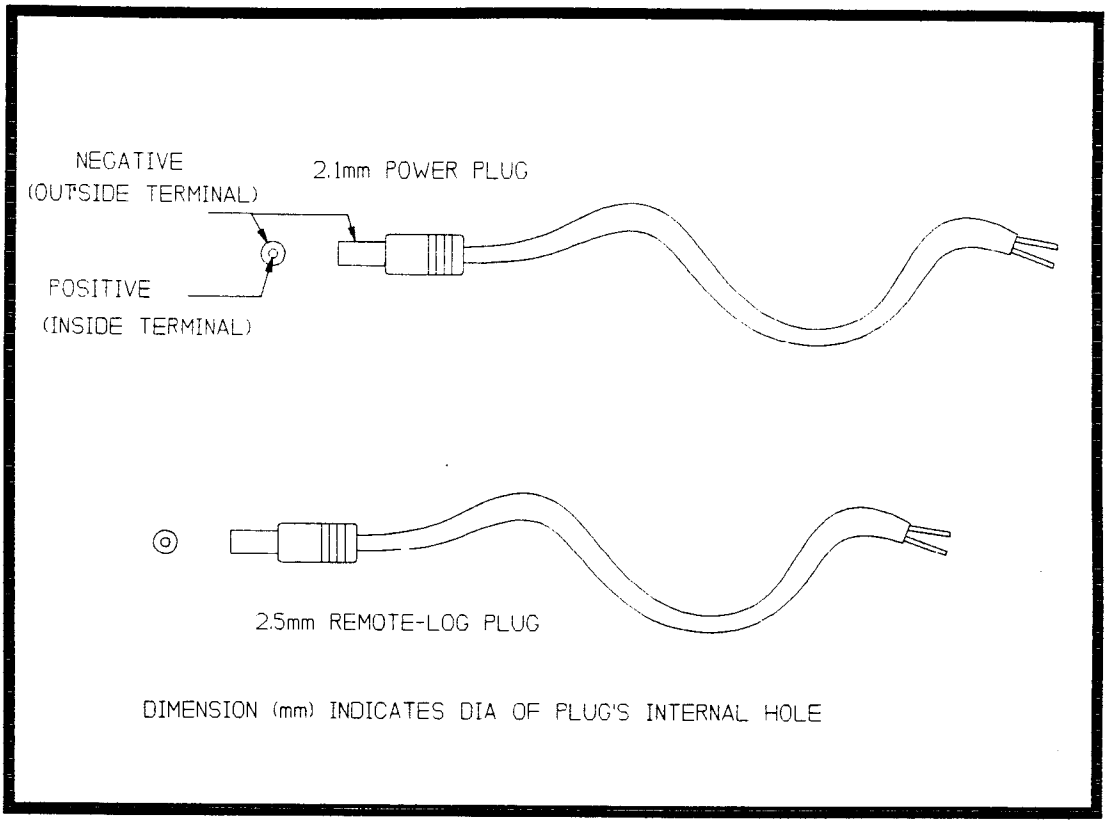

FIGURE 2.3: POWER PLUG CONNECTIONS

********** CAUTION **********

IF THE POLARITY IS REVERSED FROM THE EXTERNAL SUPPLY TO THE OM-220, THE OM-220 WILL DRAW POWER FROM THE INTERNAL BATTERIES...NOT THE EXTERNAL POWER SOURCE.

BEFORE CONNECTING THE POWER TO THE EXTERNAL POWER JACK MEASURE THE VOLTAGE AND POLARITY ON THE PLUG TO INSURE THAT ALL IS CORRECT.

****

2.3 INSTALLING INPUT MODULES

A variety of Input Modules (I/M) to interface to different sensors and signals are available for use with the OM-220 System Base. The System Base has four 'mini-rack mount' I/M ports (FIG 3.1) for the plug-in modules. Each I/M has two or four channel capability, resulting in OM-220 configurations that can range from one channel to sixteen channels of sensor/signal interface.

Blank panels can be purchased for the OM-220 to cover any unused I/M ports. These panels are removed for the installation of additional I/M's by pulling on the small handles, in a direction directly out of the unit. The panels are held in place by friction on the card guides.

Input Modules should be installed into the OM-220 System Base while the Main Power Switch is OFF. An Input Module is installed into the open port by sliding the module into the OM-220 System Base. Insure that the wider of the two circuit cards that make up the Input Module aligns with the card guides on the sides of the OM-220 chassis then carefully slide the module into place. Connections from the Input Modules are automatically made by the DIN connectors mating at the back of the module. After installation of an I/M, a SYSTEM RESET should be performed to initialize the I/M.

Six liquid tight fittings are provided with the OM-220 System Base for installation into the corresponding sensor access holes in the bottom of the OM-220. These fittings seal well on jacketed multi-conductor sensor wire. Wiring and set-up of the individual Input Modules is covered in detail in SECTION 3.3.

2.4 MOUNTING THE OM-220

The OM-220 can be semi-permanently mounted using the provided aluminum hanger. The two provided screws are used to fasten the hanger to the back of the OM-220 case (two blind holes near the top). The OM-220/ hanger assembly can then be fastened to any other surface using the holes in the hanger.

The OM-220 is provided in a weatherproof case and performs best when mounted in an upright position allowing water to drip away from the wiring access holes and fittings.

********** CAUTION **********

THE OM-220 IS NOT DESIGNED FOR DIRECT IMMERSION. MOUNT UPRIGHT FOR BEST MOISTURE PROTECTION. FOR EXTREMELY DEMANDING ENVIRONMENTS, SEE THE SYSTEM 7 IN SECTION 7: ACCESSORIES.

****

2.5 OM-220 COMMUNICATIONS SOFTWARE OVERVIEW

The OM-220 Communications program (OC) is provided on diskette for use in IBM compatible Personal Computers (PC). OC performs four major functions in utilization of the OM-220 Portable Data Logging System:

SERIAL COMMUNICATIONS:
Serial communication is fully implemented allowing the OM-220 to communicate with the Personal Computer (PC) via a RS-232 serial link (cable and adapter provided), RS-485 multi-drop link, and/or a telephone modem based serial link. Communication is employed in programming the OM-220 from the PC,in the transfer of collected data from the OM-220 memory to the PC, and in real-time Tracking of data from the OM-220 inputs directly to the PC display.

OM-220 PROGRAMMING:
In addition to a very simple front panel setup, individual input channels can be programmed for Offset, Scaling, Engineering units conversion, and Sample Rates from a RUN Program loaded into the OM-220 memory. This RUN Program is developed on the PC (using the OC program) then transferred to the OM-220's memory.

QUICK GRAPH DATA DISPLAY:
Data collected by the OM-220 in a Logging session can be graphically displayed on the PC for analysis using the included Quick-Graph feature.

SPREADSHEET FILE CONVERSION:
Powerful file conversion utilities are provided within OC that convert the OM-220 collected data directly into various file formats utilized by such spreadsheet packages as Quattro, 123, and Symphony. These resultant spreadsheet files are pre-formatted for the de-facto standards utilized by these spreadsheets and can be directly loaded from within the spreadsheet environment.

2.5.1 PC HARDWARE REQUIREMENTS

The following minimum equipment is required to run the OM-220 Communications program and communicate with the OM-220:

- → 8086, '286, '386 or '486 IBM compatible PC
- → DOS 3.0 or higher
- → Hercules type monochrome, CGA, EGA, VGA, or S-VGA display or an LCD implementation of one of the above display formats
- → RS-232 Serial Port
- → 512K of System RAM
- → Floppy disk drive (720K or larger)

The addition of a hard disk drive, color display, and EPSON compatible dot-matrix printer provide for full speed and capability of the provided OC program. The OC program running on 8088/8086 based PCs will run noticeably slower during the data display mode due to the intense internal calculations performed...however, the software will perform.

2.5.2 INSTALLATION

The OM-220 Communications software is provided on a floppy diskette. The software is not copy protected. A backup copy of the supplied disk should be made immediately, and the master disk should be stored in a safe place. Refer to APPENDIX C for descriptions of the included files.

********** NOTE **********

Check the supplied diskette for an ASCII file 'README'. This file may be supplied on the OC diskette with the most current comments, corrections, etc. README can be viewed through any ASCII editor or Wordprocessing program in the non-document mode, or by using the DOS 'TYPE ' command.

****

No special tedious installation procedure is required for the OC software installation. The software has been written in a powerful auto-configuring format and automatically adapts to most IBM PC compatible hardware configurations on the market today.

HARD DISK INSTALLATION:

Users utilizing a PC equipped with a hard disk drive should make a sub-directory, then copy all of the files from the supplied OM-220 Communications disk into this sub-directory. Approximately 400K is required for the program and support files. Data files will require additional space as they are collected.

Boot the PC and change to the sub-directory containing the copied files. Type <OC> and <ENTER> and the OM-220 Communications program will start.

********** NOTE **********

Users utilizing a PC equipped with a Liquid Crystal Display (LCD) or Monochrome Display should start the OC program by typing <OC/L> then <ENTER>. The /L 'switch' forces the OM-220 Communications program to operate in a monochrome mode.

****

********** CAUTION **********

SOME MEMORY RESIDENT PROGRAMS MAY INTERFERE WITH THE OPERATION OF THE OM-220 COMMUNICATIONS SOFTWARE. IF ERRATIC OR UNUSUAL PROGRAM OPERATION OCCURS, REBOOT THE SYSTEM WITH A CLEAN COPY OF DOS AND LOAD ONLY THE OM-220 COMMUNICATIONS PROGRAM.

****

FLOPPY DISK INSTALLATION:
Boot the PC from the DOS disk, insert the disk containing the OC program and supporting files into a floppy drive, change to that drive and type <OC> and <ENTER>. The OM-220 Communications program will start.

NOTE: Users utilizing a PC equipped with a Liquid Crystal Display (LCD) or Monochrome Display should start the OC program by.typing <OC/L> then <ENTER>.

Within a few seconds after <OC> or <OC/L> is entered, a WELCOME screen will commence, eventually displaying the opening OM-220 Communications screen and Software Version number. During this character scramble, a program file integrity check is performed. A few seconds later, OC will display the following **MAIN MENU** screen.

********** NOTE **********
To bypass the Character Scramble and File integrity check at the start of OC, type OC/S (or OC/L/S on LCD or Monochrome displays) to start OC.
****

The display of the **MAIN MENU** screen indicates proper loading of the operating system (DOS) and verifies that a good copy of the OM-220 Communications (OC) file has been made. Detailed use of the OC program will be explained in SECTION 5: LOGGING DATA.

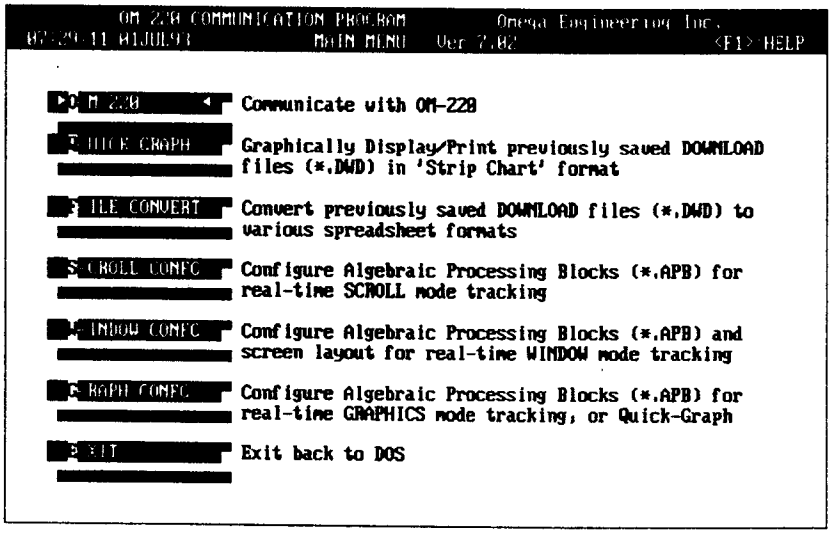

FIGURE 2.4: OM-220 COMMUNICATIONS MAIN MENU

2.5.3 USER INTERFACE...BASIC FUNCTION

MENU SELECTIONS:
The OC program utilizes a friendly and functional user interface. Menu selections are entered in two main ways, by pressing the first letter of the desired command or by using the arrow keys to highlight the desired command then pressing <ENTER>.

Depending on the type of Menu Selection involved, the current settings may toggle (eg in Baud Rate Selection), or the program may advance to another command screen or file selection screen.

The menu 'tree' structure has been intentionally designed to be very shallow. Most selections from the **MAIN MENU** are only one or two pages deep. This minimizes the chances of getting lost in the program.

At any time, the <ESC> key may be pressed and the current command will be aborted. Repeated <ESC> strokes will step the program back to the **MAIN MENU** (menu displayed at the start of the program).

RUN-TIME HELP:
The <F1> key is used to pull up HELP screens about a screen or a command. Highlighting a command (by using the arrow keys), then pressing the <F1> key will bring up a HELP screen for that selection. Additionally, most of the ERROR SCREENS that might appear due to incorrect configuration, hook-ups, or other problems have associated HELP screens that can be readily accessed by pressing the <F1> key while the ERROR message is displayed.

Certain commands require a OM-220 to be connected to the PC via the serial port before they can function (eg COMMUNICATION Commands). If a OM-220 is not connected and one of these commands is attempted, an Error messages will result (and if possible, a remedy will be suggested).

FILE HANDLER:
The file handler incorporated into OC is very simple in function. An example can illustrate the operation of the file handler:

From the **MAIN MENU**, press <Q> to move into the Quick-Graph function, then to specify a Download file (Files containing data collected by the OM-220 and transferred to the PC are called Download Files) press <D>. Then use the arrow keys to highlight the desired file from the pop-up menu and press <ENTER>. If the desired file is in a different directory, use the F2 key to define a new path for the search. The proper syntax for a new path specification follows:

C:\COMM\OM-220\DWD
(where DWD is a sub-directory)

If a sub-directory does not exist, an error message will appear. If the specified sub-directory is desired, it is necessary to exit the OC program and use DOS to make the direc-

tory, then return to OC and specify it.

To use the Current Directory that the OC program is running from, use a '.'(DOS single period) for the path (the Current Directory is the default path at program start-up). As shipped, OC utilizes the current drive and path (where the OC program is stored) as the default drive and path for all files (*.RUN, *.DWD, *.APB, etc).

3..OM-220 HARDWARE

3.1 SECTION OVERVIEW

A detailed description of the OM-220 System Base hardware is presented with functional descriptions of the set-up and control switches/buttons. The procedure for setting the time is presented.

Additionally, controls and functions common to all Input Modules (I/M) are explained and individual instruction sheets for each of the available I/Ms are provided.

Throughout this section, number references refer to the 'balloon' number arrows in FIGURE 3.1 of the System Base.

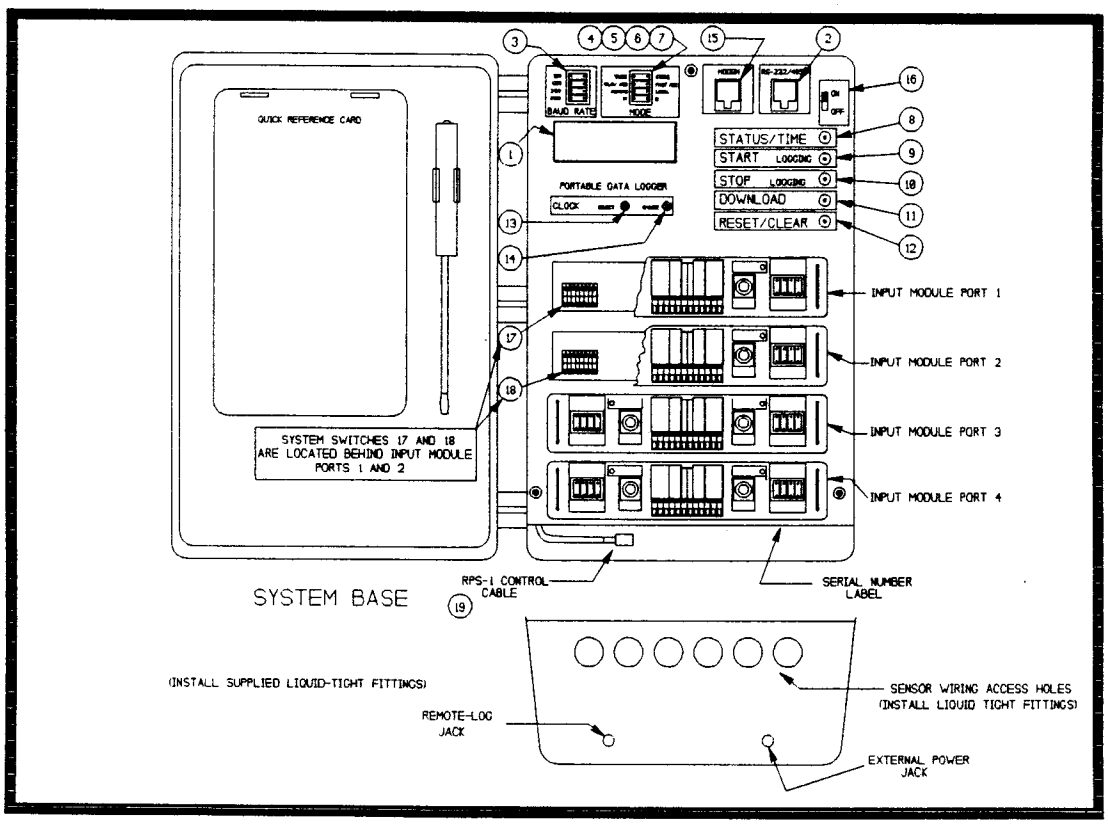

FIGURE 3.1: OM-220 SYSTEM BASE

3.2 OM-220 SYSTEM BASE (FIGURE 3.1)

All of the System Base controls and the liquid crystal display are located on the System Base front panel and include the following:

3.2.1 DISPLAY (1)

An extended temperature range, 2-line by 16 character, liquid crystal display (LCD) is provided. Date, time, status and other informational set-up and operational messages are displayed here.

3.2.2 RS-232 / RS-485 SERIAL COMMUNICATIONS PORT (2)

A female 6/6 RJ-12 modular phone type jack is provided. The internal four conductors are used for the RS-232 serial communications and the outside two conductors are used for RS-485 serial communication (refer to APPENDIX D for a detailed pin-out).

3.2.3 FRONT PANEL SYSTEM SWITCHES

BAUD RATE SWITCHES (3)

Four switches set the rate of digital signal transmission during serial data communication from the OM-220 to the modem, PC, or serial printer. Four different data signal transmission rates are provided for selection; 300, 1200, 2400, and 9600.

The Baud Rate is selected on the OM-220 to match the rate at which the receiving device (ie PC, modem, or serial printer) is capable of receiving data. The receiving equipment must have a Baud Rate setting the same as the OM-220. For most general purpose RS-232 and RS-485 applications, the Baud Rate on the OM-220 and on the receiving equipment can be set to 9600 Baud with good results.

The Baud Rate is set by rocking (ie pushing in) **ONE** of the switches toward the desired rate. All of the other switches must be rocked away from the Baud Rate numbers.

TRACK / STORE SWITCH (4)

Used to select either the LOCAL TRACK or STORE mode of data logging from the OM-220. This switch setting is not applicable when the OM-220 is being controlled through the RS-232, RS-485, or modem serial communication ports.

LOCAL TRACK MODE:

As the inputs are sampled, the data is immediately output through the RS-232 serial port to the PC or to a serial type printer. LOCAL TRACK **should not be confused** with the more commonly used REMOTE TRACK mode in which the OM-220 is under control of a remote PC via the OM-220 Communications program and a serial link.

STORE MODE:

As the inputs are sampled, the data is stored in the OM-220 memory (SRAM) for retention and eventual Download to the PC at a later time.

ADC SLOW / ADC FAST SWITCH (5)
Selects one of the two conversion speeds that the Analog to Digital converter is capable of performing.

ADC-SLOW:
The dual slope converter runs with a conversion speed of 7.5 conversions/second. This allows for an integration period of 33.33 mS (two 60 hz periods) minimizing signal error due to 60 hz noise on signal inputs. This speed should be selected in environments with high levels of 60 hz noise.

ADC-FAST:
The dual slope converter runs with a conversion speed of 30 conversions/second. This allows for an integration period of 8.33 mS. FAST ADC selection will allow more channels to run at a faster rate than SLOW with some compromise in 60 hz noise rejection and ultimate accuracy.

REMOTE / LOCAL SWITCH (6)
RS-232 Control Mode selection switch. Switch setting determines if control of the OM-220 is from the Front Panel buttons (LOCAL) or if control is from a REMOTE RS-232 device (personal computer,terminal) via the RS-232 serial cable link and the OM-220 Communications software.

The status of the switch is read each time a SYSTEM RESET is performed and the OM-220 then enters into the selected Control Mode. To change back and forth between the modes, set the REMOTE/LOCAL switch as desired and perform a SYSTEM RESET.

********** NOTE **********
THE REMOTE/LOCAL SWITCH IS ONLY FOR RS-232 COMMUNICATION. RS-485 AND MODEM COMMUNICATIONS SHOULD BE RUN WITH THE SWITCH IN THE LOCAL POSITION AS BOTH OF THESE COMMUNICATION TYPES WILL SEND 'WAKE-UP' INTERRUPTS TO THE OM-220 WHICH WILL TURN ON THE APPROPRIATE SERIAL COMMUNICATION CIRCUITRY. THE REMOTE/LOCAL SWITCH IS EFFECTIVELY AN ON/OFF SWITCH FOR THE OM-220 RS-232 CIRCUITRY, AND IS READ AFTER EACH SYSTEM RESET. SEE SECTION 4 FOR DETAILS.
****

M/D SWITCH (7)
No function at this time. Setting has no effect on operation.

3.2.4 OPERATION BUTTONS

STATUS/TIME BUTTON (8)
Depressing this button during logging sessions will result in a quickly flashed 'LOGGING' message on the display indicating that the unit is busy logging data.

During non-logging periods, depressing this button will result in a complete system status display sequence:

DATE AND TIME: in their standard format

POWER FAIL STATUS: displays only if a Power Failure has occurred (during logging and/or if data is present in memory). See APPENDIX A for message details.

MODEM PORT ENABLED: message displayed if the 'Modem Enable' Internal System Switch is ON (SECTION 3.2.7).

RS-485 PORT ENABLED: message displayed if the 'RS-485 Enable' Internal System Switch is ON (SECTION 3.2.7). The Unit ID# is also displayed.

LOGGING MODE: Specifies the operational mode during Logging per the setting of various System Switches:

TRACK (SECTION 3.2.3): as data is collected it is transmitted out the serial port

STORE (SECTION 3.2.3: as data is collected, it is stored internally in the OM-220 Memory.

DUAL (SECTION 3.2.3 and 3.2.7): as data is collected, it is transmitted out the serial port **AND** stored internally in OM-220 Memory.

BURST TRACK (SECTION 3.2.7): faster, non-time based data sampling and transmittal out the serial port.

BURST STORE (SECTION 3.2.7): faster, non-time based data sampling and storage to the OM-220 internal memory.

RUN PGM STATUS: (SECTION 3.2.7 and APPENDIX M) - The current RUN Program (External Program) STATUS is displayed:

ENABLED & FLOAT: An External RUN PROGRAM has been developed and loaded into OM-220 memory for use during logging. Data Samples will be processed in FLOAT format (resulting in nearly unlimited range of data magnitude with reduced memory capacity in STORE MODE). This is the recommended RUN PROGRAM mode for general use.

ENABLED & INTEGER: An External RUN PROGRAM has been developed and loaded into OM-220 memory for use during logging. Data Samples will be handled in INTEGER format (resulting in a limited range of data magnitude with increased memory capacity in STORE MODE). **NOTE:** Use **CAUTION** when implementing this mode as over-range calculations will result in erroneous data. Refer to APPENDIX M for additional information.

DISABLED & FLOAT: No External RUN PROGRAM will be utilized during logging (ie the current OM-220 / Input Module Front Panel settings with default units will be used). **NOTE:** This mode should not normally be used for logging as memory capacity is needlessly reduced. Refer to APPENDIX M for additional information.

DISABLED & INTEG: No External RUN PROGRAM will be utilized during logging (ie the current OM-220 / Input Module Front Panel settings with default units will be used). This mode will optimize dynamic signal range and memory capacity and should be used in preference over DISABLED & FLOAT when no RUN Program is used. Refer to APPENDIX M for additional information.

MEMORY - unused memory available for storing data, specified in Samples.

ACTIVE CHANNEL REVIEW - a sequential display of I/M channels that are ON and their particular set-up parameters (channel location, type of I/M, sample rate, location, etc). In the event that the OM-220 is running with a RUN Program installed, the Sample Rates displayed will be from this RUN Program and NOT from the Input Module Sample Rate Switch settings.

REMAINING DIRECTORY - a directory (software bookkeeping file) is maintained in the OM-220 memory. This directory can hold a total of 150 entries before reaching capacity. Each time a logging session is started, for every active channel, a directory entry is consumed. For example, with all 16 possible input channels active, nine separate logging sessions could be performed before the stored data would need to be downloaded to clear out the directory, (or alternatively, 150 single active channel logging sessions could be performed).

BATTERY STATUS - an approximation of the state of charge (full, 3/4, 1/2, 1/4, low) and the voltage of the internal batteries (or external power source whichever is greater) is displayed.

********** **CAUTION** **********

BATTERY STATUS IS ONLY AN APPROXIMATION AND CAN BE AFFECTED BY TEMPERATURE AND OTHER PARAMETERS. FOR THIS REASON, REPLACE THE BATTERIES BEFORE STARTING ANY LONG TERM LOGGING SESSIONS.

WHEN THE OM-220 IS CONNECTED TO EXTERNAL POWER, THE BATTERY STATUS DISPLAY IS REPRESENTATIVE OF THE EXTERNAL POWER - NOT THE INTERNAL BATTERIES STATE OF CHARGE.

****

START LOGGING BUTTON (9)
Initiates the logging of data by the OM-220. After depressing the button, the display indicates the current configuration and mode of operation, then 'WAIT' for a short period of time during which initialization and RPS-1 Warm-up occurs, then 'START LOGGING'.

At the start of logging, if any erroneous conditions exist (eg the directory is full, sample rates are set too fast, no channels are active, etc) an error message will be displayed indicating the problem. A description of the error message and instructions on what action to take are detailed in APPENDIX A: ERROR MESSAGES. Logging does not start if an error message is displayed - the problem must be corrected before logging is started.

STOP LOGGING BUTTON (10)
Stops the current logging session. At termination of the session, the message 'STOP LOGGING' and the number of logging sessions currently stored in memory is displayed.

DOWNLOAD DATA BUTTON (11)
No function at this time. Control of the Download function is handled exclusively via connection to a PC or remote device.

CLEAR MEMORY/RESET BUTTON(S) (12)
Used in conjunction with the STOP LOGGING button to perform system resets and if desired, clear data memory. This button must be pressed simultaneously with the STOP LOGGING button for response (to insure against accidental clearing of memory).

A manual RESET must be performed after changing any switch settings, after installation of Input Modules, or to clear error conditions and/or error messages from the OM-220 display and resume normal operation. A RESET with CLEARing of memory is normally performed after data has been downloaded to PC memory before a new set of data logging sessions begins.

If data is present in memory from prior logging sessions when the two buttons are pressed, a message indicating 'DATA PRESENT' will be displayed, followed immediately by the instructional display 'RESET AGAIN TO CLEAR MEMORY'. At this point, a OM-220 system reset has occurred without affecting data stored in memory. If no further action is taken, the display will blank in a few seconds.

If erasure of stored data in OM-220 memory is desired, the two buttons must be depressed a second time while the 'RESET AGAIN TO CLEAR MEMORY' message is still displayed. A message will then prompt the User 'ARE YOU SURE?'. If memory clear is desired, perform a third two button RESET.

This action will initiate a memory erasure sequence with corresponding memory bank clearing message displays.

Standard memory configured OM-220s with 48K of data memory will display a message indicating clearing of banks 1, 2, and 3. Expanded Memory units (EXM-1 option) with 112K of data memory, will clear banks 1 through 7.

********** CAUTION **********

IF DATA STORED IN MEMORY IS TO BE RETAINED, THE DATA MUST BE DOWNLOADED TO THE PC BEFORE CLEARING MEMORY.

DATA CLEARED FROM MEMORY CANNOT BE RESTORED.

****

At the completion of the memory clearing process, the display blanks. Total available memory can be verified with the STATUS/TIME BUTTON.

3.2.5 CLOCK SELECT (13) AND CHANGE (14) BUTTONS

The SELECT and CHANGE buttons are used for setting the time and date of the 24 hour clock. The buttons function as follows:

SELECT:
Depressing SELECT wakes up the internal clock set program. This allows the user to step through the date and time digits and, upon completing the update, enter the new settings.

CHANGE:
Depressing CHANGE changes the value of the SELECTed (blinking) time or date digit (hours, seconds, etc).

The date and time display format is:

MM/DD/YY
HH:MM:SS

3.2.6 SETTING THE 24 HOUR CLOCK

The clock should be set upon initial power-up of the OM-220. The clock can only be set while the OM-220 is not busy LOGGING or Downloading data. The set time will be retained even while the system power switch is OFF.

To set the time:

Press the SELECT button to bring the DATE/TIME up on the display.

Press the CHANGE button to increment the blinking digit to the desired value.

Press the SELECT button to move to the next parameter to be changed. Press the CHANGE button as required and repeat this process until the time and date are set correctly.

After CHANGING the last digit (seconds), when the SELECT button is depressed again, the new DATE/TIME will be entered and then displayed for approximately three seconds before the display blanks.

NOTE: During the DATE/TIME set process, if no buttons are pressed for approximately 5 seconds, the OM-220 will blank the display and return to the originally displayed unchanged date and time.

3.2.7 INTERNAL SYSTEM SWITCHES

PORT 1 SYSTEM SWITCH (17)

An eight switch DIP switch is accessible by removing the cover or Input Module installed in the top (#1) Input Module port. This switch is used to enable/disable the following functions:(the left-most switch is #1)

TEMPERATURE UNITS (SWITCH #1): Selects Celsius or Fahrenheit scales for the display and storage of temperature data. ON=F, OFF=C.

BURST MODE ENABLE (SWITCH #2): ON position enables the BURST data logging mode. In the BURST mode, the OM-220 free runs, scanning all active channels as fast as it can independent of the real time clock. Throughput rates of up to 8 analog channels per second are achievable in this mode.

DUAL MODE ENABLE (SWITCH #3): ON position enables DUAL MODE (SIMULTANEOUS TRACK AND STORE) mode (SECTION 6.3). If this switch is ON, Switches 4 and 5 must be OFF.

RS-485 ENABLE (SWITCH #4): Enables the RS-485 port. This switch must be ON to allow communication with the RS-485 port. If enabling this switch, see Unit ID switches 6,7, and 8 also. If this switch is ON, switch 5 (Modem Enable) must be OFF.

MODEM ENABLE (SWITCH #5): Enables the Modem port. This switch must be ON to allow communication with the Modem port. If this switch is ON, switch 4 (RS-485 Enable) must be OFF.

RS-485 UNIT ID (SWITCH #6,7,8): Sets a unit identification number from 0 through 7. This Unit ID number is used by the RS- 485 communication in multi-drop applications (ie up to 8 OM-220s on one twisted pair serial communication link) to differentiate between units. The number is binary encoded with all switches OFF = #0, all ON = #7. When the RS-485 switch (#4) is ON, the current Unit ID is displayed on the OM-220 display when the STATUS button is pressed.

PORT 2 SYSTEM SWITCH (18)

A second eight switch DIP switch bank is accessible by removing the cover or Input Module installed in the second (#2) Input Module port. This switch is used to enable/disable the following functions: (the left-most switch is #1)

ROLL-OVER MEMORY (SWITCH #1): (SECTION 6.5) **ON** enables the Roll-Over Memory function. With Roll-Over Memory enabled, the OM-220 will fill memory with samples, then commence writing over the oldest data with new data. With this technique, the OM-220 memory will always contain the most current data (SECTION 6.5). **OFF** disables the Roll-Over memory function and the OM-220 will log data and stop when the memory is filled or a STOP LOGGING command is received.

EXTERNAL PROGRAM ENABLE (SWITCH #2): (SECTION 6.2) With External Program capability enabled (Switch 2 ON), the OM-220 uses Sample Rates and Scaling, Offset, and Engineering Units conversion equations from a RUN Program that has been loaded into its memory via a serial link from a PC. **In conjunction with this function, Switch 3 should be set appropriately for proper operation.**

When this function is disabled (Switch #2 is OFF), the OM-220 operates from the standard Input Module configuration switches and defaults to standard units.

FLOAT / INTEGER FORMAT (SWITCH #3): (SECTION 6.2) Specifies the data format used for internal storage of collected data. This switch setting should NOT be changed if valuable data is in memory as it will be corrupted. Clear memory after changing this switch setting to re-initialize the data memory.

UN-USED SWITCHES (SWITCHES #4,5,6,7,8): These five switches are reserved for future functions.

********** **CAUTION** **********

IF THE EXTERNAL PROGRAM SWITCH AND/OR THE FLOAT /INTEGER DATA FORMAT SWITCH IS CHANGED, MEMORY MUST BE CLEARED TO REINITIALIZE DATA MEMORY BEFORE LOGGING IS STARTED. DOWNLOAD DATA IN MEMORY BEFORE CHANGING THE SWITCH SETTINGS IF DATA IS OF VALUE.

****

3.2.9 SYSTEM POWER SWITCH (16)

Turns the power to the OM-220 ON and OFF. Power must be turned OFF when installing batteries, Input Modules, or removing the OM-220 from its case.

The system power does not affect data in memory as the memory has its own lithium battery backup power source. (APPENDIX E). This memory back-up battery will protect stored data for approximately two years at normal room temperatures.

With the OM-220 in 'sleep' mode (ie System Power switch ON but OM-220 not actively logging data or communicating) a new set of internal batteries will last for up to eight months.

To extend main battery life, Download any valuable data from memory into the PC and turn the SYSTEM POWER OFF whenever the OM-220 is to be left for any extended periods of non- use.

********** NOTE **********

For extended periods on non-use, the 6 alkaline C-cells should be removed to minimize the possibility of damage to the OM-220 due to leaking batteries.

****

3.2.10 MODEM PORT (15)

An RJ-45, 8 conductor modular phone jack is provided for direct connection of modems. Refer to pin-out details in APPENDIX G and connection in SECTION 4.3.

3.2.11 RPS-1 PIGTAIL (19)

A two conductor polarized plug is provided to connect to the optional RPS-1 Remote Power Supply accessory control cable. The RPS-1 can provide regulated voltage sensor excitation from its internal batteries under the control of the OM-220 via this pigtail. Refer to section 6.8 for RPS-1 details.

3.3 INPUT MODULES (I/M)

To collect data, an interface must be supplied between the fundamental sensor/signal (eg thermocouple, RTD, etc.) and the OM-220 System Base. This interface serves to excite, amplify, cold-junction compensate, filter, and/or otherwise adapt the incoming signal to a standardized signal that can be handled by the OM-220 System Base.

This interface function is performed in the OM-220 by the various Input Modules which plug into any of the four I/M ports in the lower half of the OM-220 System Base.

A typical I/M is shown in FIG 3.2.

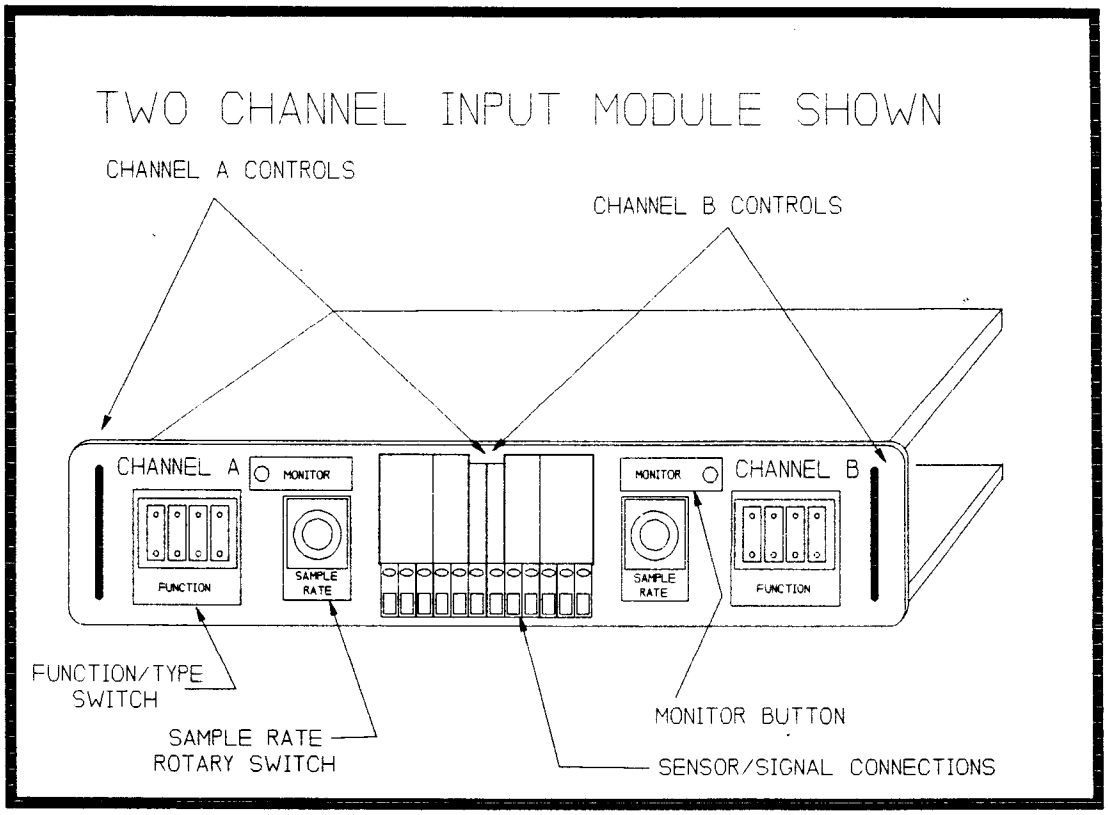

FIGURE 3.2: TYPICAL TWO CHANNEL INPUT MODULE

3.3.1 INPUT MODULE STANDARD CONTROLS AND FEATURES

All of the standard I/M's share some basic User control switches and functions. These consist of (FIG 3.2):

MONITOR BUTTONS:

During system set-up, wiring, and during logging at slower Sample Rates, individual channels can be checked for proper operation by depressing the MONITOR button for the particular channel of interest. The OM-220 will then display:

CHANNEL SELECTED (1A, 1B, etc.)
I/M TYPE (and configuration if applicable)
CURRENTLY SET SAMPLE RATE
SENSED INPUT (5 consecutive readings)

During STORE logging sessions, if the MONITOR buttons are depressed, the OM-220 decides if sufficient microprocessor processing time is available to sample the selected channel and display its current values on the LCD.

If insufficient time is available (due to the number of active channels and their corresponding Sample Rates being set for higher speed sampling), the OM-220 displays the message 'LOGGING'.

If sufficient time is available to sample the channel input and display the values, the OM-220 performs the operation. If during this sampling or display, the internal command is received from the clock that it is time to take readings, the display may immediately blank. If this happens, the User can wait a moment, then depress the MONITOR button again.

Generally, if the Sample Rates are set at the 30 Second rate or slower on all channels, the MONITOR button will give readings during logging. If the sample rates are set faster than 30 Seconds, this decision is a function of the number of active channels and their Sample Rate settings.

Four channel Input Modules have a single MONITOR switch for all four channels. The MONITOR button will display the values for all four channels simultaneously.

********** **NOTE** **********

When an OVER RANGE signal (i.e., an input that is beyond the specified or selected input range of an Input Module) is detected by the OM-220, all 9's (eg 999.9) will be the output. This OVER RANGE indication will show on the Display during a MONITOR and be stored in memory and/or sent out the RS-232 port during a logging session.

****

SAMPLE RATE ROTARY SWITCH

Sets the Real Time frequency of data collection from that channel (i.e. the interval between consecutive readings on that channel) when **NOT IN EXTERNAL PROGRAM MODE.** If EXTERNAL PROGRAM MODE is enabled, the OM-220 utilizes the Sample Rate Settings as specified in the RUN Program maintained in memory (SECTION 6.2). Each of the 16 positions of the switch correspond to a particular rate as follows:

0 - OFF	4 - 15 SEC	8 - 5 MIN	C - 2 HOUR
1 - 1 SEC	5 - 30 SEC	9 - 15 MIN	D - 4 HOUR
2 - 2 SEC	6 - 1 MIN	A - 30 MIN	E - 6 HOUR
3 - 5 SEC	7 - 2 MIN	B - 1 HOUR	F -12 HOUR

********** NOTE **********

Sample Rates are individually User settable on each input channel (except on Four Channel Input Modules) as described above. At the start of a logging session, the maximum rate at which samples can be taken is then calculated by the OM-220 based on a number of parameters such as Input Module type, Track/Store setting, number of active channels, etc.

If the set sample rates cannot be achieved by the OM-220 (due to hardware and software limitations) the error message 'Reduce Sample Rates' is displayed and logging does NOT start. The User must then reduce the fastest Sample Rate setting(s) and restart the logging session.

****

SIGNATURE

Each I/M has an internal code set that identifies several technical parameters about the I/M. This feature allows the OM-220 to automatically identify the type of I/M in each port and set-up internal program functions accordingly relieving the User of this tedious task. This signature is in place and ready for the OM-220 as soon as the I/M is plugged into one of the four I/M Ports.

MISCELLANEOUS SET-UP SWITCHES

Different I/M's have varying numbers of other switches to allow the User to configure the I/M for that particular logging session and/or sensor input type or range. Typical settings provided are for such parameters as type of thermocouple, voltage input range, temperature range, RTD type, etc.

These switches are easily set with the use of the Input Module Quick Reference Card (supplied with the I/M at time of purchase) and/or the individual I/M instructions in the following section.

3.3.2 INPUT MODULE OPERATION AND INSTRUCTIONS

Each I/M has specific characteristics and instructions for set-up and use that are unique to that particular I/M. Installation and Operation Instructions for individual I/M's are provided in the following pages.

TCIM-2; THERMOCOUPLE INPUT MODULE (Two Channel)

OVERVIEW:

The TCIM-2 is a two channel thermocouple interface module for use in conjunction with the OM-220 System Base. The TCIM-2 plugs directly into one of the four mini-rack mount OM-220 Base input ports and allows for direct connection of type J, K, E, and T thermocouples. Each channel can be set for an independent Sample Rate and Thermocouple Type.

NOMINAL THERMOCOUPLE INPUT RANGES:

J - 0 TO 750C	(32 TO 1380F)	white/red
K - 0 TO 1250C	(32 TO 2280F)	yellow/red
E - 0 TO 900C	(32 TO 1650F)	purple/red
T - -150 TO 350C	(-238 TO 662F)	blue/red

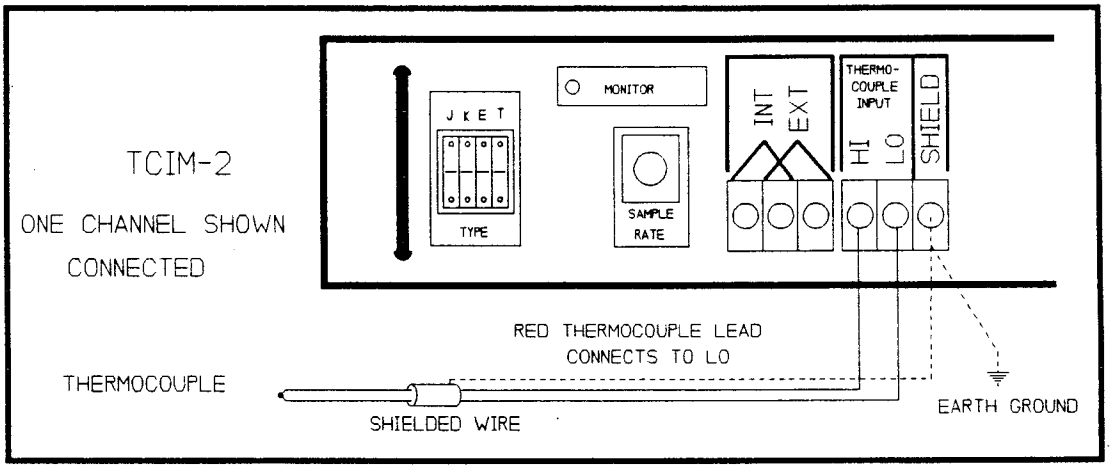

FIGURE 3.3: TYPICAL TCIM-2 WIRING

TCIM-2 UNIQUE USER CONTROLS:

(refer to SECTION 3.3.1 for standard Input Module controls)

THERMOCOUPLE TYPE SELECT SWITCH - four switches provided for each Channel's (A and B) thermocouple type. Select only **ONE** type. All other type switches should be in the DOWN

position.

THERMOCOUPLE CONNECTION - make thermocouple/extension wire connections direct to the terminals labeled **INPUT**. Observe polarity (Red thermocouple lead should connect to LOW).

THERMOCOUPLE SHIELD CONNECTION - optionally used to earth ground the thermocouple wire shield. When using shielded thermocouple wire, the shield should be connected to this terminal.

If using the SHIELD connection(s), a separate wire should then be connected from an earth ground external to the OM-220 to one of the SHIELD terminals on any installed Input Module. All of the various OM-220 Input Module SHIELD/GUARD connections are interconnected within the OM-220, hence a single earth ground wire will suffice. Do not earth ground the shield at the sensor end.

COLD JUNCTION COMPENSATION CONNECTIONS - for Internal thermocouple cold junction compensation, place a copper wire jumper across the **INT** connections. Internal compensation utilizes a sensor located within the TCIM-2 for automatic cold junction compensation. For most applications, Internal compensation should be used.

The **EXT** connection allows for external (remote) cold junction compensation. Contact Omega Engineering Inc for details.

APPLICATION NOTES:

The internal Cold Junction Compensation sensor senses the temperature of the terminal block and through software, compensates for the thermocouple junction developed between the thermocouple wire and the terminal strip. Any temperature differential from the metal terminal strip connections to the circuit board connections (the location of the sensor) will result in direct measurement errors. To minimize this potential error, the OM-220 should be allowed to temperature stabilize to the ambient before logging begins. The cover should be closed during logging to minimize rapid internal temperature changes.

To minimize current loop induced errors, use isolated type thermocouples or insure that all thermocouple junctions are at ground potential. Insure that input voltages do not exceed 3.5V above or below OM-220 circuit ground (maximum common mode voltage).

The OM-220 System is designed for low voltage connections ONLY. Never apply HIGH VOLTAGES to the OM-220 or Input Modules.

TCIM-4; THERMOCOUPLE INPUT MODULE (Four Channel)

OVERVIEW:

The TCIM-4 is a four channel thermocouple interface module for use in conjunction with the OM-220 System Base. The TCIM-4 plugs directly into one of the four mini-rack mount OM-220 Base input ports and allows for direct connection of type J, K, E, T, R, and S thermocouples.

The TCIM-4 Sample Rate and Thermocouple Type switch settings are common to all four of the TCIM-4 input channels. All four channels will be scanned and stored during each reading of the TCIM-4...open (un-used) channels will store an over-range reading.

NOMINAL THERMOCOUPLE OPERATING RANGES:

J - 0 TO 750C	(32 TO 1380F)	white/red
K - 0 TO 1250C	(32 TO 2280F)	yellow/red
E - 0 TO 900C	(32 TO 1650F)	purple/red
T - -200 TO 350C	(-328 TO 662F)	blue/red
R - 0 TO 1000C	(32 TO 1832F)	black/red
S - 0 TO 1750C	(32 TO 3182F)	black/red

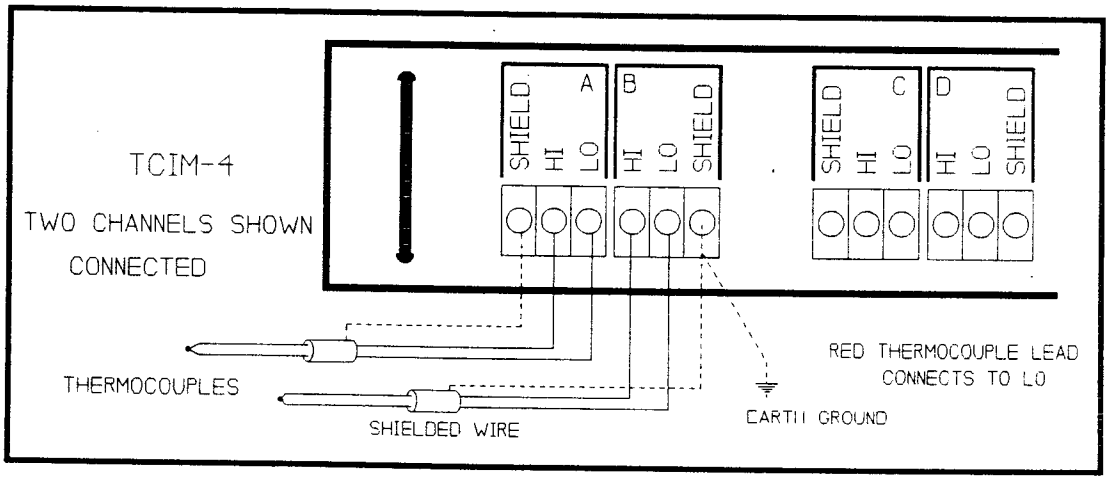

FIGURE 3.4: TYPICAL TCIM-4 WIRING CONFIGURATION

TCIM-4 UNIQUE USER CONTROLS:

(refer to SECTION 3.3.1 for standard Input Module controls)

THERMOCOUPLE TYPE SELECT SWITCH - select only **ONE** type. All other type switches should be in the DOWN position. This TYPE switch determines the thermocouple type for all four channels on the Input Module.

THERMOCOUPLE CONNECTION - make thermocouple/extension wire connections direct to the terminals labeled **INPUT**. Observe polarity (the RED lead in all thermocouple types connects to the LO (-) terminal).

THERMOCOUPLE SHIELD CONNECTION - optionally used to earth ground the thermocouple wire shield (shielded extension wire is recommended in electrically noisy environments for optimum signal protection). Connect the extension wire shield to this terminal and connect a separate wire from earth ground to any of the installed input module's SHIELD terminal. All of the input module SHIELD terminals are interconnected in the OM-220 so only one OM-220 System earth ground connection is required. Do NOT earth ground the extension wire shield at the sensor end.

APPLICATION NOTES:

The internal Cold Junction Compensation sensor senses the temperature of the terminal block and compensates accordingly. Any temperature differential from the metal terminal strip connections to the circuit board connections (the location of the sensor) will result in direct measurement errors. To minimize this potential error, the OM-220 should be allowed to temperature stabilize to the ambient before logging begins. The cover should be closed during logging to minimize rapid internal temperature changes.

To minimize current loop induced errors, use isolated type thermocouples or insure that all thermocouple junctions are at ground potential. Insure that input voltages do not exceed 3.5V above or below OM-220 circuit ground (maximum common mode voltage).

The OM-220 System is designed for low voltage connections ONLY. Never apply HIGH VOLTAGES to the OM-220 or Input Modules.

VIM-2; DC VOLTAGE INPUT MODULE (Two Channel)

OVERVIEW:

The VIM-2 is a two channel bipolar DC voltage signal interface module for use in conjunction with the OM-220 System Base. The VIM-2 plugs directly into one of the four mini-rack mount OM-220 Base input ports and allows for direct input, measurement and recording of bipolar DC voltage signal inputs from -20VDC to 20VDC in three separate input ranges.

Inputs are true balanced differential design and have 5 megohm input resistance. Input self-calibration is performed with every reading.

NOMINAL INPUT VOLTAGE RANGES:

-200 mVDC	to	+200 mVDC
-2 VDC	to	+2 VDC
-20 VDC	to	+20 VDC

VIM-2 UNIQUE USER CONTROLS:

(refer to SECTION 3.3.1 for standard Input Module Settings)

VOLTAGE INPUT RANGE SWITCH - each input channel has a two switch bank associated with it. The position of these two switches determines the active input range for that channel. Both switches **DOWN** sets the Input Module to +/-20 VDC full scale input. Setting the 200mV switch **UP** and the other switch **DOWN** sets the I/M for +/-200mV range and setting the 2V switch **UP** and the other switch **DOWN** sets the I/M for +/-2V full scale input range.

INPUT SIGNAL TERMINAL STRIP CONNECTIONS:

2V / 200mV INPUT CONNECTIONS - Connect signal wiring directly to these two terminals observing marked polarity for signals using the **2VDC** or **200mVDC** input ranges.

20 V INPUT - Connect signal wiring directly to these two terminals observing marked polarity for signals using the **20 VDC** input range.

SHIELD CONNECTION - optionally used to earth ground the extension wire shield (if shielded extension wire is used). Connect the extension wire shield to this terminal and connect a separate wire from earth ground to one of the I/M SHIELD connections. All of the TRIM-2, TCIM-2, RTDIM-2, BRIM-2, VIM-2, etc. SHIELD/GUARD connections are interconnected within the OM-220 so only one OM-220 System earth ground connection is required. Do NOT earth ground the extension wire shield at the sensor end.

APPLICATION NOTES:

EXTENSION WIRE SELECTION

Shielded extension wire should be used in electrically 'noisy' environments, in long extension wire installations, and/or if unstable readings occur in the OM-220. '18 AWG or 20 AWG twisted pair with shield extension wire' will give the best results for most logging environments. If shielded wire is not used, the next best choice is 18 or 20 AWG 'twisted pair' extension wire.

COMMON-MODE INPUT RANGE CONSIDERATIONS

The OM-220 circuit ground is isolated from voltage signal inputs by relatively high impedances (see simplified 200mV/2V and 20V input schematics below). The negative terminal of the external power supply jack is common to circuit ground.

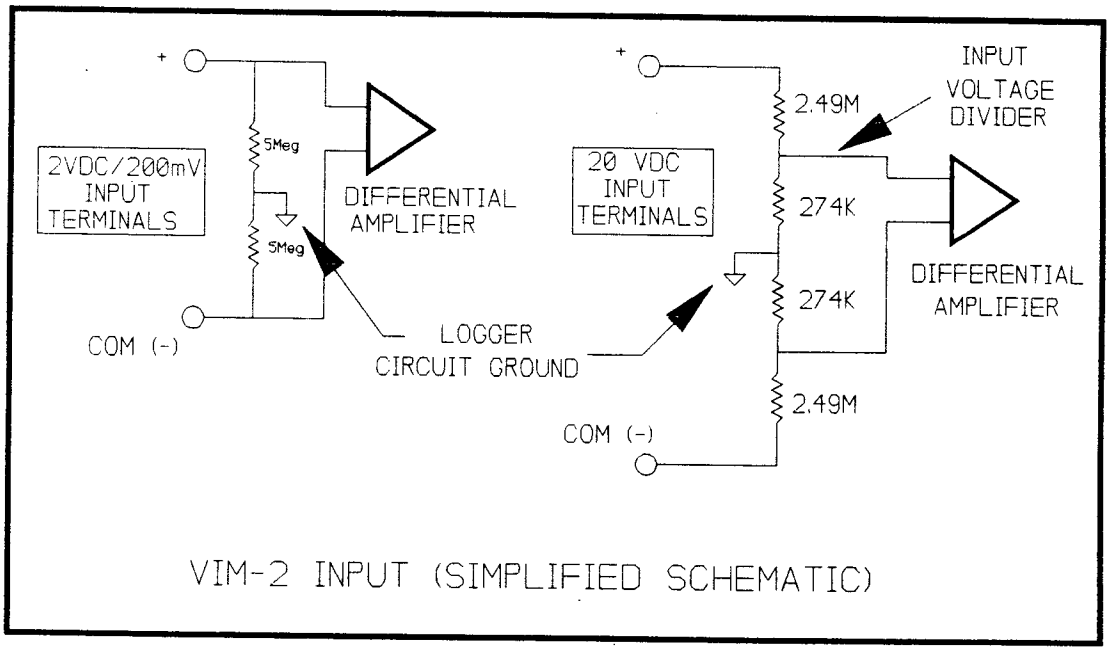

FIGURE 3.5: VIM-2 INPUT CIRCUIT DESIGN

To prevent saturation of the input amplifier stages and erroneous readings, no voltages should be applied to any input terminals that are greater than 3.5V above or below circuit ground. If the signal being measured is not connected to the OM-220 circuit ground (i.e. 'isolated' supplies are used), common mode input voltages up to 32V can be accepted. Voltages above this level can be lethal and should not be applied to the OM-220. Supply isolation can be achieved by allowing the OM-220 to run from its internal batteries (rather than an external source)

Measurement error inducing ground currents can exist in voltage measuring applications where more than one input module channel is connected to different points on a common circuit. Single ended measurements may be required. Consult the factory for application assistance.

NOTE: The OM-220 System is designed for LOW VOLTAGE INPUTS ONLY. Never apply HIGH VOLTAGES to the Input Modules.

VIM-4; DC VOLTAGE INPUT MODULE (Four Channel)

OVERVIEW:

The VIM-4 is a four channel voltage signal interface module for use in conjunction with the OM-220 System Base. The VIM-4 plugs directly into one of the four mini-rack mount OM-220 Base input ports and allows for direct input, measurement and recording of DC voltage signal inputs from 0 to +/-20 VDC in three separate input ranges.

Inputs are true balanced differential design and have high input resistance. (20 VDC range - 2.7 Megohm; other ranges 300 Megohm typical, 70 Megohm minimum). Input self-calibration from a precision trimmed voltage reference is performed with every reading.

The VIM-4 Sample Rate and Input Range switch settings are common to all four of the VIM-4 input channels. All four channels will be scanned and stored during each reading of the VIM-4...open (un-used) channels will store an over-range reading (20VDC Range will store a zero reading).

NOMINAL VOLTAGE INPUT RANGES:

-200 mVDC	to	+200 mVDC
-2 VDC	to	+2 VDC
-20 VDC	to	+20 VDC

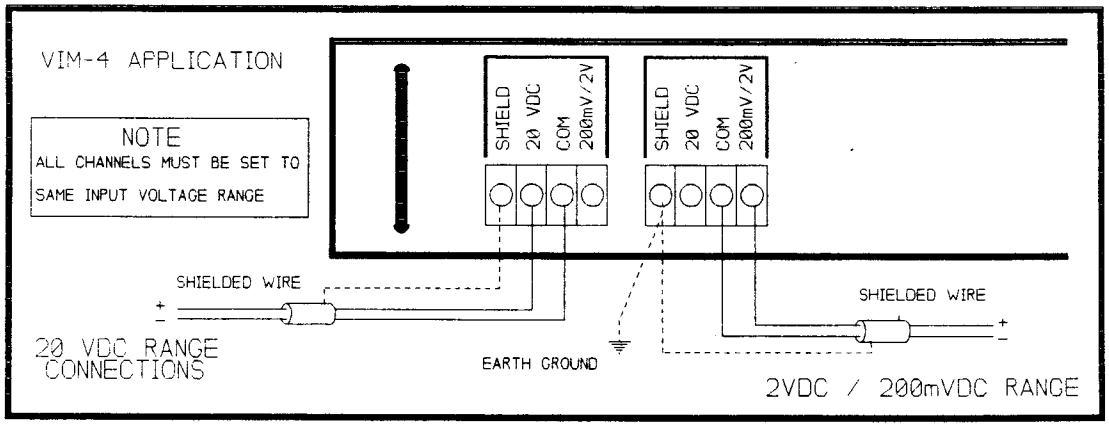

FIGURE 3.6: TYPICAL VIM-4 WIRING CONFIGURATION

VIM-4 UNIQUE USER CONTROLS:

(refer to SECTION 3.3.1 for standard Input Module controls)

VOLTAGE INPUT RANGE SWITCH - A two switch RANGE SWITCH is provided on the front panel to program the input range for all four of the VIM-4 channels. The position of these two switches determines the active input range for all four channels. Both switches **DOWN** sets the Input Module to +/-20 VDC full scale input. Setting the 200mV switch **UP** and the other switch **DOWN** sets the I/M for 200mV range and setting the 2V switch **UP** and the other switch **DOWN** sets the I/M for 2V full scale input range.

INPUT SIGNAL TERMINAL STRIP CONNECTIONS:

2V / 200mV INPUT CONNECTIONS - Connect signal wiring directly to these two terminals observing marked polarity for signals using the **2VDC** or **200mVDC** input ranges.

20 V INPUT - Connect signal wiring directly to these two terminals observing marked polarity for signals using the **20 VDC** input range.

SHIELD CONNECTION - optionally used to earth ground the extension wire shield (if shielded extension wire is used). Connect the extension wire shield to this terminal and connect a separate wire from earth ground to one of the I/M SHIELD connections. All of the TRIM-2, TCIM-2, RTDIM-2, BRIM-2, VIM-2, etc. SHIELD/GUARD connections are interconnected within the OM-220 so only one OM-220 System earth ground connection is required. Do NOT earth ground the extension wire shield at the sensor end.

APPLICATION NOTES:

EXTENSION WIRE SELECTION

Shielded extension wire should be used in electrically 'noisy' environments, in long extension wire installations, and/or if unstable readings occur in the OM-220. '18 AWG or 20 AWG twisted pair with shield extension wire' will give the best results for most logging environments. If shielded wire is not used, the next best choice is 18 or 20 AWG 'twisted pair' extension wire.

COMMON-MODE INPUT RANGE CONSIDERATIONS

The OM-220 circuit ground is isolated from voltage signal inputs by relatively high impedances (see simplified 200mV/2V and 20V input schematics below). The negative terminal of the external power supply jack is common to circuit ground.

To prevent saturation of the input amplifier stages and erroneous readings, no voltages should be applied to any input terminals that are greater than 3.5V (32V for 20V input terminals) above or below circuit ground. If the signal being measured is not connected to the OM-220 circuit ground (i.e. 'isolated' supplies are used), common mode input voltages up to 32V can be accepted. Voltages above this level can be lethal and should not be applied to the OM-220. Supply isolation can be achieved by allowing the OM-220 to run from its internal batteries (rather than an external source)

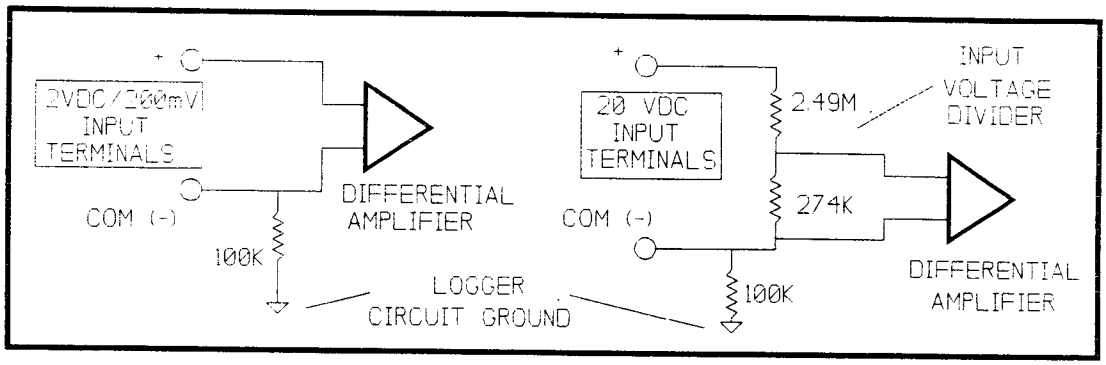

FIGURE 3.7: VIM-4 INPUT CIRCUIT DESIGN

Measurement error inducing ground currents can exist in voltage measuring applications where more than one input module channel is connected to different points on a common circuit. Single ended measurements may be required. Consult the factory for application assistance.

NOTE: The OM-220 System is designed for LOW VOLTAGE INPUTS ONLY. Never apply HIGH VOLTAGES to the Input Modules.

FTTIM-2; 4 to 20mA INPUT MODULE (Two Channel)

OVERVIEW:
The FTTIM-2 is a two channel 0-20 mA / 4-20 mA current loop interface module for use in conjunction with the OM-220 System Base. The FTTIM-2 plugs directly into one of the four mini-rack mount OM-220 Base input ports and allows for direct connection of one or two current loop inputs.

NOMINAL FTTIM-2 INPUT RANGE:

-20 to +20 mA

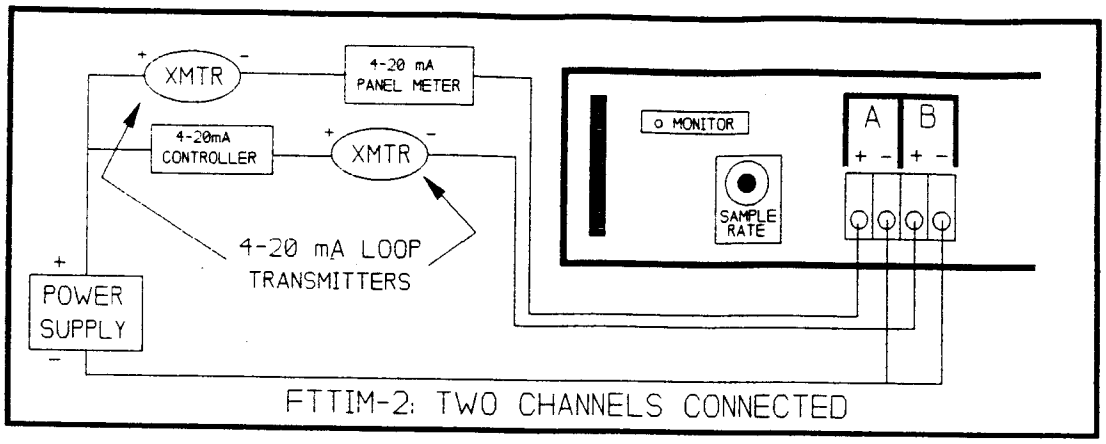

FIGURE 3.8: TYPICAL FTTIM-2 WIRING CONFIGURATION

FTTIM-2 UNIQUE USER CONTROLS:

(refer to SECTION 3.3.1 for Standard Input Module controls)

CURRENT LOOP CONNECTIONS - connect the 4-20mA loop directly to the terminal strip connections. Observe proper polarity. Input resistance of the FTTIM-4 is 100 ohms (ie loop burden).

APPLICATION NOTES:

WIRING / SENSOR CONNECTIONS: (FIGURE 3.8)
In wiring multiple transmitters to the OM-220 through the FTTIM-2, the Common Mode input voltage specification of 3.5VDC must not be exceeded. This means that the highest voltage allowed relative to any other inputs (including other Input Modules and OM-220 circuit ground) is 3.5 VDC.

A simple way to comply with this spec is to insure that all COMMON (-) inputs on the FTTIM-2 are connected directly to the GROUND (-) terminal of the power supply used for excitation of the 4 to 20 mA loop (eg the Omega Engineering RPS-1 portable power supply). This will insure that the voltage developed across the 100 ohm resistor internal to the FTTIM-2 will never exceed 2 VDC (ie 20mA X 100 ohms = 2 VDC) relative to any channels (-) terminal.

Any other panel meters, controls, etc in the current loop should be installed on the (+) side of the Input Module as shown in the Typical Wiring Configuration diagram.

CALIBRATION:
After lab or field calibration of the 4 to 20 mA sensor/transmitter, field SPAN and ZERO readings can be taken to be used later in the development of a RUN Program (two-point AUTOCALC data), Quick-Graph APBs or for use within a spreadsheet environment for data corrections.

Set the transmitter output to a ZERO level (or some known level near zero), press the FTTIM-4 MONITOR button and record the displayed reading. Repeat this process for the SPAN using a full scale input or if available, the 80% FS test feature incorporated into many transmitters.

Record and save these ZERO and SPAN readings for use later in correcting data for ZERO offset and SPAN slope (mx + b). Alternatively, a short logging session can be done to record these values in memory which can then be readily used for data correction at the time of download.

The OM-220 System is designed for LOW VOLTAGE INPUTS ONLY. Never apply HIGH VOLTAGES to the OM-220 or Input Modules.

FTTIM-4; 4 to 20mA INPUT MODULE (Four Channel)

OVERVIEW:

The FTTIM-4 is a four channel 0-20 mA / 4-20 mA current loop interface module for use in conjunction with the OM-220 System Base. The FTTIM-4 plugs directly into one of the four mini-rack mount OM-220 Base input ports and allows for direct connection of up to four current loop inputs.

The FTTIM-4 Sample Rate and Input Range switch settings are common to all four of the FTTIM-4 input channels. All four channels will be scanned and stored during each reading of the FTTIM-4. Open (un-used) channels will store a zero reading.

NOMINAL FTTIM-4 INPUT RANGE:

-20 to +20 mA

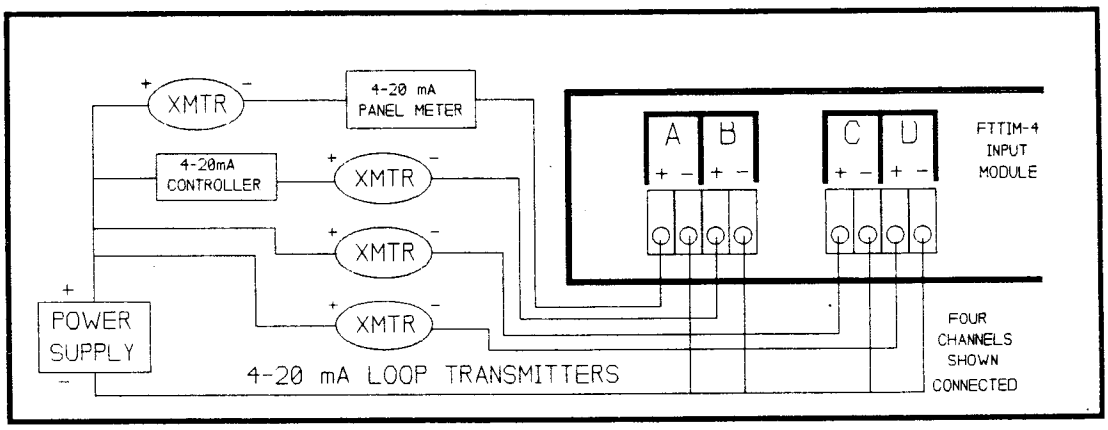

FIGURE 3.9: TYPICAL FTTIM-4 WIRING CONFIGURATION

FTTIM-4 UNIQUE USER CONTROLS:

(refer to SECTION 3.3.1 for Standard Input Module controls)

CURRENT LOOP CONNECTIONS - connect the 4-20mA loop directly to the terminal strip connections. Observe proper polarity. Input resistance of the FTTIM-4 is 100 ohms (ie loop burden).

APPLICATION NOTES:

WIRING / SENSOR CONNECTIONS: (FIGURE 3.9)
In wiring multiple transmitters to the OM-220 through the FTTIM-4, the Common Mode input voltage specification of 3.5VDC must not be exceeded. This means that the highest voltage allowed relative to any other inputs (including other Input Modules and OM-220 circuit ground) is 3.5 VDC.

A simple way to comply with this spec is to insure that all COMMON (-) inputs on the FTTIM-4 are connected directly to the GROUND (-) terminal of the power supply used for excitation of the 4 to 20 mA loop (eg the Omega Engineering RPS-1 portable power supply). This will insure that the voltage developed across the 100 ohm resistor internal to the FTTIM-4 will never exceed 2 VDC (ie 20mA X 100 ohms = 2 VDC) relative to any channels (-) terminal.

Any other panel meters, controls, etc in the current loop should be installed on the (+) side of the Input Module as shown in the Typical Wiring Configuration diagram.

CALIBRATION:
After lab or field calibration of the 4 to 20 mA sensor/transmitter, field SPAN and ZERO readings can be taken to be used later in the development of a RUN Program (two-point AUTOCALC data), Quick-Graph APBs or for use within a spreadsheet environment for data corrections.

Set the transmitter output to a ZERO level (or some known level near zero), press the FTTIM-4 MONITOR button and record the displayed reading. Repeat this process for the SPAN using a full scale input or if available, the 80% FS test feature incorporated into many transmitters.

Record and save these ZERO and SPAN readings for use later in correcting data for ZERO offset and SPAN slope (mx + b). Alternatively, a short logging session can be done to record these values in memory which can then be readily used for data correction at the time of download.

The OM-220 System is designed for LOW VOLTAGE INPUTS ONLY. Never apply HIGH VOLTAGES to the OM-220 or Input Modules.

CIM-2; DC CURRENT INPUT MODULE (Two Channel)

OVERVIEW:

The CIM-2 is a two channel current signal interface module for use in conjunction with the OM-220 System Base. The CIM-2 plugs directly into one of the four mini-rack mount OM-220 Base input ports and allows for direct input, measurement and recording of DC current signal inputs from 0 to +/-2 ADC in three separate input ranges.

Inputs are of differential design. The 2A input range utilizes a 0.1 ohm shunt while the 20mA/200mA range utilizes a 10 ohm shunt. Input and shunt self-calibration is performed under microprocessor control at the initiation of readings.

NOMINAL CURRENT INPUT RANGES:

-20 mADC	to	+20 mADC
-200 mADC	to	+200 mADC
-2 ADC	to	+2 ADC

CIM-2 UNIQUE USER CONTROLS:

(refer to SECTION 3.3.1 for standard Input Module settings)

CURRENT INPUT RANGE SWITCH - each channel has a two switch, DIP switch associated with it. The position of these two switches determines the active input range. Both switches **DOWN** sets the Input Module to +/-2 ADC full scale input. Setting the 200mA switch **UP** and the other switch **DOWN** sets the I/M for +/-200mA range and setting the 20mA switch **UP** and the other switch **DOWN** sets the I/M for +/-20mA full scale input range.

INPUT CONNECTIONS

20mA / 200mA INPUT CONNECTIONS - terminal strip input connection for signal current while using either of these two full scale ranges. Observe polarity for proper results.

2A INPUT - terminal strip input connection for signal current while using the 2 A full scale current input range.

SHIELD CONNECTION - optionally used to earth ground the extension wire shield (if shielded extension wire is used). Connect the extension wire shield to this terminal and connect a separate wire from earth ground to one of the I/M SHIELD connections. All of the TRIM-2, TCIM-2, RTDIM-2, BRIM-2, VIM-2, etc. SHIELD/GUARD connections are interconnected in the OM-220 so only one OM-220 System earth ground connection is required. Do NOT earth ground the extension wire shield at the sensor end.

APPLICATION NOTES

EXTENSION WIRE SELECTION:

Shielded extension wire should be used in electrically 'noisy' environments, in long extension wire installations, and/or if unstable readings occur in the OM-220. Twisted pair with shield, type extension wire will give the best results for most logging environments. If shielded wire is not used, the next best choice is 'twisted pair' wire. Choose a wire gauge heavy enough to minimize voltage drop for the current level being monitored.

COMMON-MODE INPUT RANGE CONSIDERATIONS:

The OM-220 circuit ground is isolated from current signal inputs by relatively high impedances (see simplified 200mA/20mA and 2A input schematics below). (NOTE: The negative terminal of the external power supply jack is common to circuit ground.)

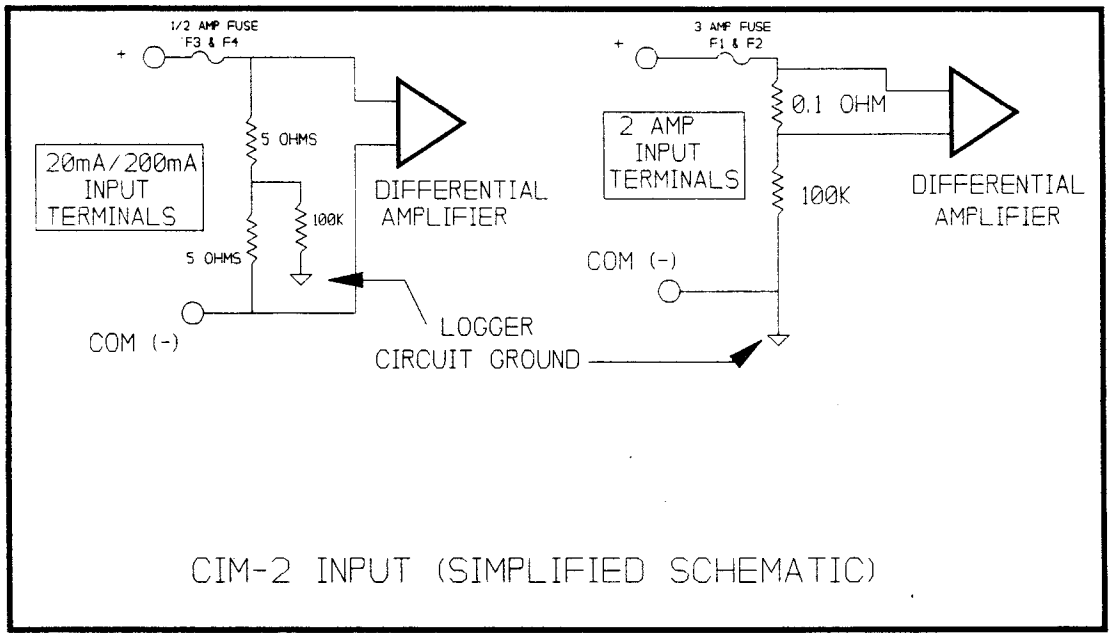

FIGURE 3.10: CIM-2 SIMPLIFIED INPUT SCHEMATIC

To prevent saturation of the input amplifier stages and erroneous readings, no voltages should be applied to any input terminals that are greater than 3.5V above or below circuit ground. If the signal being measured is not connected to the OM-220 circuit ground (i.e. 'isolated' supplies are used), common mode input voltages up to 32V can be accepted. Voltages above this level can be lethal and should not be applied to the OM-220. Supply isolation can be achieved by allowing the OM-220 to run from its internal batteries (rather than an external source)

Measurement error inducing ground currents can exist in current measuring applications where more than one input module channel is connected to different points on a common circuit. Single ended measurements may be required. Consult the factory for application assistance.

FUSES:

No current flow through an input channel indicates a blown input protection fuse. The fuses (4) are located on the edge of the Input Module. Remove the Module from the OM-220 and pull on the fuses to unplug. F1 & F2 (3A fuse) protect the 2A range (reorder P/N 3046.00010). F3 & F4 (1/2A fuse) protect the 20mA/200mA ranges (reorder P/N 3046.00009). A replacement 1/2A and 3A fuse is supplied with the CIM-2 at time of purchase.

NOTE: The OM-220 System is designed for LOW VOLTAGE INPUTS ONLY. Never apply HIGH VOLTAGES to the Input Modules.

NOTES:

RTDIM-2; RTD INPUT MODULE (Two Channel)

OVERVIEW:

The RTDIM-2 is a two channel Platinum RTD interface module for use in conjunction with the OM-220 System Base. The RTDIM-2 plugs directly into one of the four mini-rack mount OM-220 Base input ports and allows for direct connection of two pt100, 100 ohm @ 0C European or American (0.00385 or 0.00391) curve Platinum RTD's. Sensor excitation is provided by the OM-220 power supply through the EXCITATION connections on the RTDIM-2. Two temperature ranges are provided for resolution optimization, Full and Limited.

NOMINAL RTD INPUT RANGES:

LIMITED RANGE	-200C to +200C (-328 to 392F)
FULL RANGE	-200C to +800C (-328 to 1472F)

RTDIM-2 UNIQUE USER CONTROLS:

(refer to SECTION 3.3.1 for standard Input Module settings)

CURVE SELECTION SWITCH - specifies the type of pt100 RTD alpha coefficient. American or European.

RANGE SELECTION SWITCH - specifies the temperature input range from the RTD sensor. Limited range will give maximum resolution.

SIGNAL CONNECTIONS

EXCITATION CONNECTION - terminal strip connections for source of RTD element excitation voltage (nominal 5VDC open circuit, nominal 1.1 mA @ 0C). Sources the current that flows through the RTD sensor, developing a temperature related voltage across the RTD.

SENSE CONNECTION - terminal strip connections for input measuring the temperature related voltage developed across the RTD element.

NOTE: BE SURE THAT SAME POLARITY SENSE AND EXCITATION CONNECTIONS ARE WIRED TO THE SAME COMMON RTD LEAD.

RTD SHIELD CONNECTION - optionally used to earth ground the RTD extension wire shield (if shielded extension wire is used). Connect the extension wire shield to this terminal and connect a separate wire from earth ground to one of the I/M SHIELD connections. All of the TRIM-2, TCIM-2, RTDIM-2, BRIM-2 SHIELD/GUARD connections are interconnected in the OM-220 so only one OM-220 System earth ground connection is required. Do NOT earth ground the extension wire shield at the sensor end.

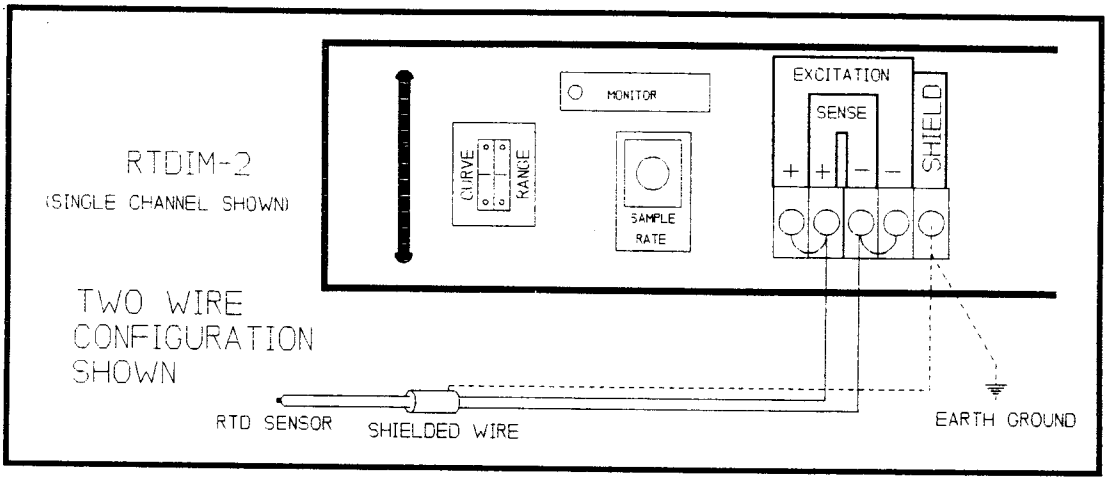

FIGURE 3.11: RTDIM-2 SINGLE CHANNEL 2-WIRE CONNECTION SHOWN

APPLICATION NOTES:

EXTENSION WIRE SELECTION

Shielded extension wire should be used in electrically 'noisy' environments, in long extension wire installations, and/or if unstable readings occur in the OM-220. '18 AWG or 20 AWG twisted pair with shield extension wire' will give the best results for most logging environments. If shielded wire is not used, the next best choice is 18 or 20 AWG 'twisted pair' extension wire.

2-WIRE / 4-WIRE SENSOR CONNECTION

The RTDIM-2 allows for connection of the RTD sensor in a 4- WIRE or a 2-WIRE circuit configuration.

The 4- Wire configuration is commonly used when extension wires are long and/or measurement accuracy is to be maximized. The 4-Wire method, minimizes the effect of extension wire resistance on the sensed RTD element resistance. With the 4-WIRE configuration, two pairs of wires must be run out to the sensor.

The 2-WIRE configuration is sufficient for most general purpose short extension wire (ie less than 20 feet total wire length) applications requiring +/- 0.5 degree accuracy. In this configuration, jumpers should be installed at the RTDIM-2 terminal strip (see diagram)

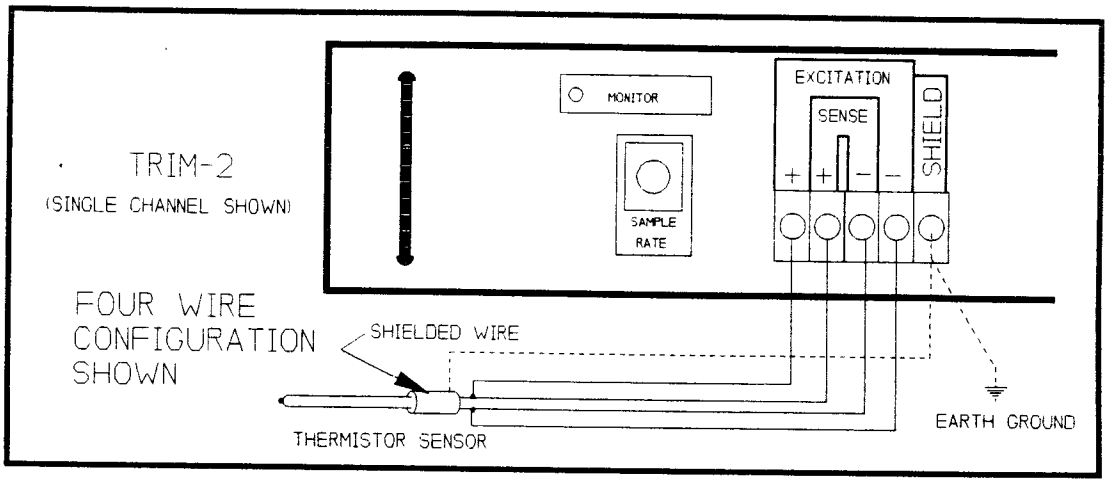

FIGURE 3.12: RTDIM-2 SINGLE CHANNEL 4-WIRE CONNECTION SHOWN

The OM-220 System is designed for LOW VOLTAGE INPUTS ONLY. Never apply HIGH VOLTAGES to the OM-220 or Input Modules.

NOTES:

TRIM-2; THERMISTOR INPUT MODULE (Two Channel)

OVERVIEW:

The TRIM-2 is a two channel thermistor interface module for use in conjunction with the OM-220 System Base. The TRIM-2 plugs directly into one of the four mini-rack mount OM-220 Base input ports and allows for direct connection of two 10k ohm @ 25C, Fenwall curve 16 or equivalent NTC thermistors. Sensor excitation is provided by the OM-220 power supply through the EXCITATION connections on the TRIM-2. Three thermistor reference calibration points below can be used to check curve compatibility.

TEMPERATURE	THERMISTOR RESISTANCE
-30C (-22F)	177000 ohms
25C (77F)	10000 ohms
175C (325F)	107 ohms

NOMINAL THERMISTOR INPUT RANGE:

-30C (-22F) to +175C (325F)

TRIM-2 UNIQUE USER CONTROLS:

(refer to SECTION 3.3.1 for standard Input Module settings)

SIGNAL CONNECTIONS:

EXCITATION CONNECTION - source of thermistor excitation voltage (nominal 5VDC open circuit). Sources the current that flows through the thermistor sensor, developing a temperature related voltage across the thermistor.

SENSE CONNECTION - input measuring the temperature related voltage developed across the thermistor.

NOTE: BE SURE THAT SAME POLARITY SENSE AND EXCITATION CONNECTIONS ARE WIRED TO THE SAME COMMON THERMISTOR LEAD.

THERMISTOR SHIELD CONNECTION - optionally used to earth ground the thermistor extension wire shield (if shielded extension wire is used). Connect the extension wire shield to this terminal and connect a separate wire from earth ground to one of the I/M SHIELD connections. All of the TRIM-2, TCIM-2, RTDIM-2, BRIM-2 SHIELD/GUARD connections are interconnected in the OM-220 so only one OM-220 System earth ground connection is required. Do NOT earth ground the extension wire shield at the sensor end.

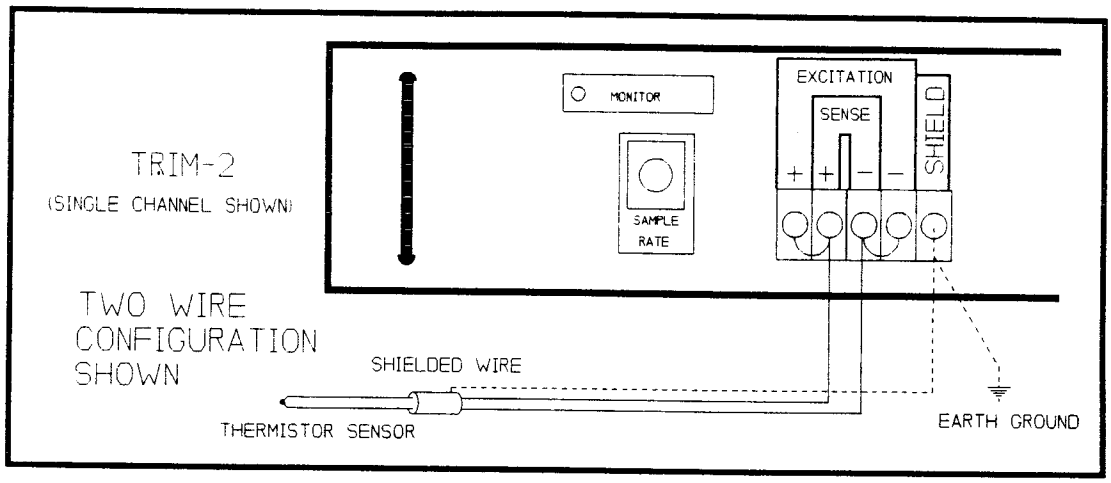

FIGURE 3.13: SINGLE TRIM-2 CHANNEL 2-WIRE CONFIGURATION SHOWN

APPLICATION NOTES:

EXTENSION WIRE SELECTION

Shielded extension wire should be used in electrically 'noisy' environments, in long extension wire installations, and/or if unstable readings occur in the OM-220. '18 AWG or 20 AWG twisted pair with shield extension wire' will give the best results for most logging environments. If shielded wire is not used, the next best choice is 18 or 20 AWG 'twisted pair' extension wire.

2-WIRE / 4-WIRE SENSOR CONNECTION

The TRIM-2 allows for connection of the thermistor sensor in a 4-WIRE or a 2-WIRE circuit configuration.

The 4- Wire configuration is commonly used when extension wires are long and/or measurement accuracy is to be maximized. The 4-Wire method, minimizes the effect of extension wire resistance on the sensed thermistor element resistance. With the 4-WIRE configuration, two pairs of wires must be run out to the sensor.

The 2-WIRE configuration is sufficient for most general purpose short extension wire (ie less than 20 feet total wire length) applications requiring +/- 0.5 degree accuracy. In this configuration, jumpers should be installed at the TRIM-2 terminal strip (see figure 1)

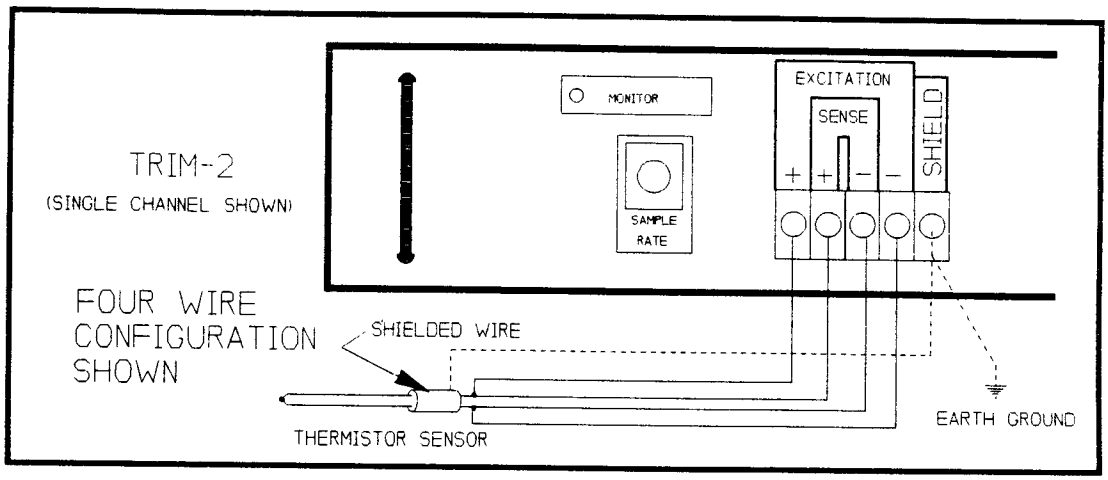

FIGURE 3.14: SINGLE TRIM-2 CHANNEL 4-WIRE CONFIGURATION SHOWN

The OM-220 System is designed for LOW VOLTAGE INPUTS ONLY. Never apply HIGH VOLTAGES to the OM-220 or Input Modules.

NOTES:

BRIM-2; BRIDGE INPUT MODULE (Two Channel)

OVERVIEW:

The BRIM-2 is a two channel Wheatstone bridge signal interface module for use in conjunction with the OM-220 System Base. The BRIM-2 plugs directly into one of the four mini-rack mount OM-220 Base input ports and allows for direct input, measurement and recording of DC voltage signal inputs from Strain Gage, Load Cell, and Pressure type full bridge circuits.

Inputs are of differential design and have 5 Megohm input resistance. Input self-calibration is performed with every reading. Bridge excitation voltage is measured with every reading and the signal voltage is normalized to mV of SIGNAL per Volt of EXCITATION units. This feature loosens the load regulation requirements of the bridge excitation voltage source. Two Input Ranges are available and can be readily set via front panel switches.

NOMINAL BRIDGE INPUT RANGES:

-50mV to +50mV
-200mV to +200mV

BRIM-2 UNIQUE USER CONTROLS:

SIGNAL INPUT RANGE SWITCH: - each channel has a two switch 'DIP switch' associated with it. The position of these two switches selects the full scale Signal Voltage input range. Setting the 200mV switch **UP** and the other switch **DOWN** sets the I/M for +/-200mV range and setting the 50mV switch **UP** and the other switch **DOWN** sets the I/M for +/-50mV full scale input range. Select the range that will cover the anticipated or specified transducer full scale output.

INPUT CONNECTIONS:

SIGNAL SENSE INPUT CONNECTIONS - terminal strip input connection for Signal voltage.

EXCITATION SENSE INPUT CONNECTIONS - terminal strip input connection for Excitation voltage sensing input leads. Excitation voltage input range is +/- 20 VDC for ISOLATED SUPPLY configurations and +/- 7 VDC for COMMON SUPPLY configurations. (See the following COMMON-MODE INPUT RANGE CONSIDERATIONS section for further explanation)

SHIELD CONNECTION - optionally used to earth ground the extension wire shield (if shielded extension wire is used). Connect the extension wire shield to this terminal and connect a separate wire from earth ground to one of the I/M SHIELD connections. All of the TRIM-2, TCIM-2, RTDIM-2, BRIM-2, VIM-2, etc. SHIELD/GUARD connections are interconnected in the OM-220 so only one OM-220 System earth ground connection is required. Do NOT earth ground the extension wire shield at the sensor end.

APPLICATION INFORMATION:

EXTENSION WIRE SELECTION

Shielded extension wire should be used in electrically 'noisy' environments, in long extension wire installations, and/or if unstable readings occur in the OM-220. '18 AWG or 20 AWG twisted pair with shield extension wire' will give the best results for most logging environments. If shielded wire is not used, the next best choice is 18 or 20 AWG 'twisted pair' extension wire.

COMMON-MODE INPUT RANGE CONSIDERATIONS

To prevent saturation of the input amplifier stages and erroneous readings, voltages greater than 3.7 VDC above or below OM-220 **circuit ground** should not be applied to the Vsense input terminals (note that OM-220 circuit ground is **not** the same as the previously mentioned SHIELD connection).

To comply with the above mentioned constraint, two different bridge excitation circuits are commonly employed, ISOLATED SUPPLY or COMMON SUPPLY.

In ISOLATED SUPPLY circuits, the power supply used to excite the bridge and the OM-220 power supply are electrically isolated (except internally at point 'A' in the schematic below). With this configuration, the Excitation Voltage can be as high as +/- 20 VDC and the Vsense inputs will be within the +/- 3.7 VDC range specified above. Isolation can be achieved by powering the OM-220 from its internal batteries and exciting the bridge with a separate supply. Note that the RS-232 cable has a conductor at OM-220 circuit ground potential and can defeat isolation if connected to the Excitation source.

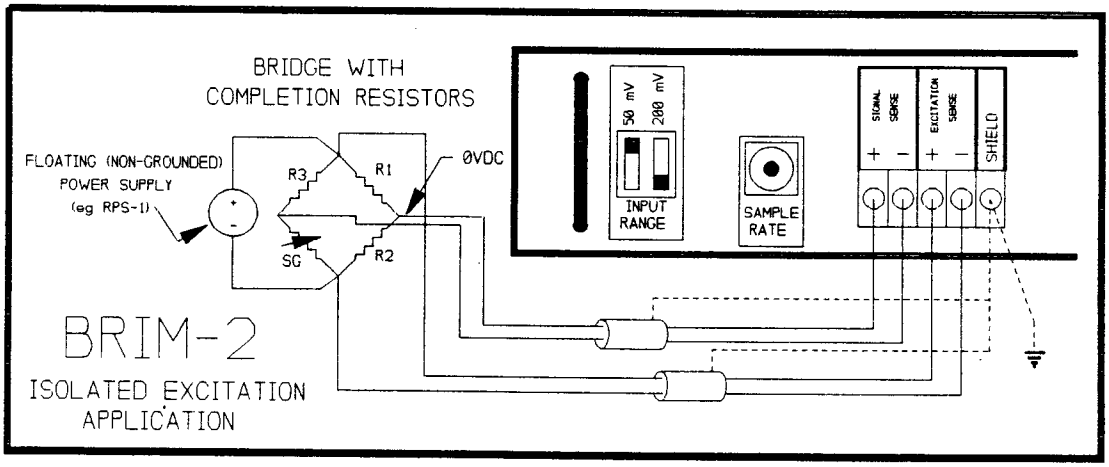

FIGURE 3.15: BRIM-2 ISOLATED SUPPLY WIRING SCHEMATIC

In COMMON SUPPLY excitation circuits, the OM-220 **circuit ground** and the Excitation supply are interconnected with a common ground. (OM-220 circuit ground can be accessed at the negative terminal of the EXTERNAL POWER JACK)

With a Vexc/2 (ie R1 = R2 in the COMMON SUPPLY schematic) reference node bridge configuration, this limits the maximum Vexcitation to 7.0 VDC, to prevent exceeding the Vsense maximum input voltage of 3.7 VDC (Vexcitation/2 + 200 mV signal max).

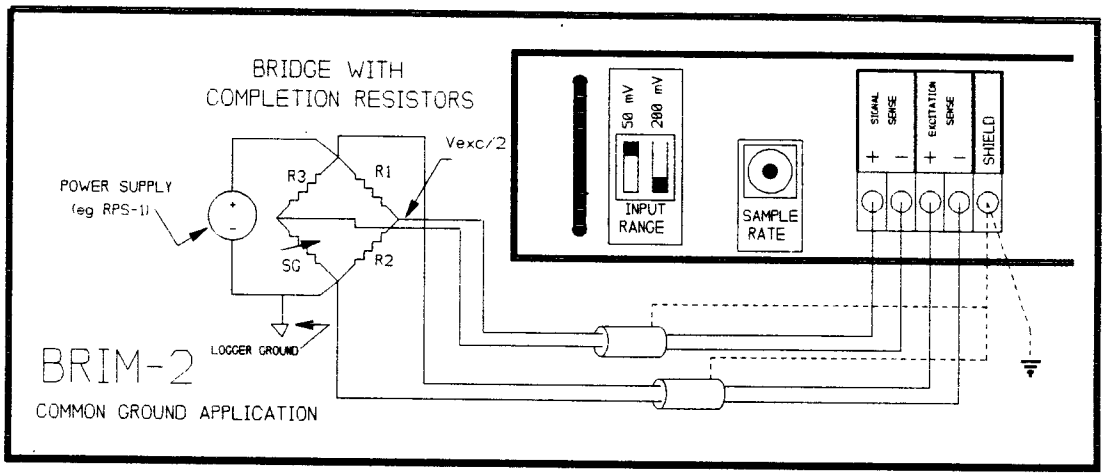

FIGURE 3.16: BRIM-2 COMMON SUPPLY WIRING SCHEMATIC

NOTE: The OM-220 System is designed for LOW VOLTAGE INPUTS ONLY. Never apply HIGH VOLTAGES to the Input Modules.

NOTES:

DPIM-2; DIGITAL PULSE INPUT MODULE (Two Channel)

OVERVIEW:

The DPIM-2 is a two channel digital input signal interface module for use in conjunction with the OM-220 System Base. The DPIM-2 plugs directly into one of the four mini-rack mount OM-220 Base input ports and allows for direct input, measurement and recording of Event, Frequency, and Counter/Pulse type inputs.

EVENT FUNCTION - Real time/date and level of each event signal input are recorded upon the state change of the input. Inputs can be either contact closure or voltage level (low = 0-1 VDC; high = 4-15 VDC) signals. Input signals are debounced when the DEBOUNCE switch is ON (RC=10mS). Event status is sampled every second resulting in Event timing resolution of 1S.

COUNTER FUNCTION - Input signal pulses are counted and recorded based on the User selected input channel Sample Rate. (e.g. with a Sample Rate of 15 seconds, pulses are totalized for the 15 second period, the counter is read, the total count is stored, the counter is cleared and counting resumes for the next period). The maximum totalized count without overflow per sample period (set by the Sample Rate) is 32,768. To maintain count integrity, the Sample Rate should be selected sufficiently fast to prevent overflow as well as provide the User with desired count time distribution. Pulses are counted on the negative going edge. Input signal requirements and Debounce capability are the same as described in EVENT.

FREQUENCY FUNCTION - Input frequency sampling is capable of reading input frequencies in the range of 10 hz to 25 Khz with square, sine, and sine approximating input waveforms with peak to peak amplitudes of 1 to 15 Vp-p. The input is AC coupled to a dual FET high sensitivity input stage for signal conditioning and shaping. A 3.579 Mhz frequency reference provides accuracy of 1 % (+/- 1 Hz).

********** NOTE **********

INPUTS CONFIGURED FOR FREQUENCY SAMPLING MUST BE INSTALLED AND CONFIGURED AS THE LAST CHANNEL(S) IN THE SEQUENCE OF ACTIVE CHANNELS IN THE OM-220. (PORT 1A IS THE FIRST CHANNEL).

****

DPIM-2 UNIQUE USER CONTROLS:

********** NOTE **********

FOR OPTIMUM PERFORMANCE DURING QUICK-GRAPH DISPLAY OF COLLECTED DATA (OM-220 COMMUNICATIONS V5.0 OR LATER) SET ANY ACTIVE EVENT CHANNEL SAMPLE RATES TO THE SAME RATE AS ONE OF THE OTHER ACTIVE NON-EVENT CHANNELS.

****

MONITOR BUTTON - depress to verify channel operation. Active only during set-up and during slow Sample Rate logging. Five consecutive readings are taken and displayed. The Counter function MONITOR will display accumulated counts for five consecutive 1 second sample periods. The EVENT function MONITOR will display a **OPEN** or **CLOSED** indicating the state of a switch contact input.

FUNCTION SELECT SWITCH - each channel has four DIP switches associated with it. The first three switches are used to select that channel's Function (Event, Frequency, or Counter) and the fourth switch enables and disables the Debounce circuit on the Event or Counter input. When the Debounce circuit is ON, an RC filter is inserted into the input signal path which eliminates multiple high frequency pulses that are generated when mechanical switch contacts close. This switch should be set ON whenever a contact closure type input is connected. (The need for Debouncing circuitry is evidenced by multiple readings being detected for a single input pulse.) NOTE: Only ONE of the three FUNCTION switches (Event, Counter, Frequency) should be selected ON at one time.

SIGNAL INPUT CONNECTIONS

EVENT and COUNT - Connect Event or Counter type inputs between the **EVENT/COUNT** terminal strip connection and the **COMMON**

FREQUENCY - Connect Frequency type inputs between the **FREQ** and **COMMON** terminal strip connections.

SHIELD CONNECTION - optionally used to earth ground the extension wire shield (if shielded extension wire is used). Connect the extension wire shield to this terminal and connect a separate wire from earth ground to one of the I/M SHIELD connections. All of the TRIM-2, TCIM-2, RTDIM-2, BRIM-2, DPIM-2, etc. SHIELD/GUARD connections are interconnected in the OM-220 so only one OM-220 System earth ground connection is required. Do NOT earth ground the extension wire shield at the sensor end.

APPLICATION NOTES:

HOOK-UP / WIRING CONSIDERATIONS:
Shielded extension wire should be used in electrically 'noisy' environments, in long extension wire installations, and/or if unstable readings occur in the OM-220. '18 AWG or 20 AWG twisted pair with shield extension wire' will give the best results for most logging environments.

The OM-220 circuit ground is DIRECTLY CONNECTED to the COMMON connections on the DPIM-2. When making connections, especially from common powered signal sources, insure that no high currents are introduced into this ground circuit from the external sources due to reversed polarity, shorts, etc.

QUICK-GRAPH DATA DISPLAY:
When Quick Graphing an EVENT channel, another fixed Sample Rate channel must be graphed concurrently (ie, EVENT channels cannot be Quick Graphed alone).

NOTE: The OM-220 System is designed for LOW VOLTAGE INPUTS ONLY. Never apply HIGH VOLTAGES to the Input Modules.

4..SERIAL COMMUNICATIONS

4.1 OVERVIEW

Communication with the OM-220 is required for data transfer and control. Three types of serial communication are supported by the OM-220 and the OM-220 Communications Program:

RS-232
RS-485
Modem

All of the serial communication is done through one of the two modular phone type jacks on the OM-220 front panel (FIGURE 3.1).

The basic command functions utilized in communicating with the OM-220 through all three types of serial communication are essentially the same. The main differences between the different types of serial link are in the Hardware used to implement the serial link, the Communication Configuration (Baud rate, port, etc.) of the OM-220, and the Communication Configuration of the PC.

Once a communication link has been established, the type of link used is transparent to the user and very similar OM-220 CONTROL menus are presented from within the OM-220 Communication software for OM-220 control and interrogation.

4.2 RS-232 COMMUNICATION

RS-232 is most commonly used for short distance (ie up to 50') communication between the OM-220 RS-232 port and the PC.

4.2.1 RS-232 HARDWARE

PC REQUIREMENTS:
To communicate with RS-232, the PC must have a RS-232 Serial Port (most commonly a DB-25 or DB-9 type connector). Most PC's have RS-232 Serial ports built in or supplied at time of purchase with one of the many standard expansion boards. RS-232 expansion boards can be purchased (usually they contain more than just the RS-232 port) at any local computer shop.

OM-220 REQUIREMENTS:
The modular phone jack serial port accessible on the front panel labeled RS-232/RS-485 has the necessary connections and driver circuitry to directly communicate per the RS-232 specification.

INTERCONNECTION WIRING REQUIREMENTS:
A 6 conductor cable and adapter is provided with the OM-220 for interconnection from the OM-220 to the PC. Both ends of the cable are terminated with RJ-12 6/6 type male plugs. One end of the cable should be plugged directly into the OM-220 RS-232 Jack. The other end plugs into the supplied RJ-12 to DB-25 (or DB-9) adapter which in turn connects to the PC serial port.

********** CAUTION **********
Utilize ONLY adapters supplied from Omega Engineering for the RS-232 Serial Communications cabling. DB-9 to DB-25 (or DB-25 to DB-9) cable adapters from alternate sources commonly have pins reversed which prevent communication between the PC and the OM-220. Contact Omega Engineering for a tested adapter to meet your cabling needs.
****

Conventional modular phone wiring extension wire and connectors (available at any phone supplies store) can be used to lengthen the provided RS-232 cable as required. RS-232 Communication through 100' of cable has been achieved with good success in relatively noise-free environments and at low Baud rates (although the RS-232 Specification states 50' maximum).

********** NOTE **********
Supplied with the OM-220 is a 6 conductor cable with type 6/6 plug connectors on each end (the 6/6 specification indicates a plug size for 6 conductors with 6 conductors installed; also known as RJ-12). In RS-232 communications with the OM-220, only the center 4 conductors are utilized (the outside conductors are used for RS-485 communication).

This allows users to construct their own custom length cables utilizing the more commonly available 4 conductor cable and type 6/4 plugs (plug size for 6 conductors with only 4 conductors installed). The 4 conductor cable and type 6/4 plugs are sold and used for interconnection from telephone wall jacks to the phone. (Not to be confused with the type 4/4 plugs sold for interconnection from the phone to the handset). Pinout details are shown in APPENDIX D.)
****

4.2.2 SETTING RS-232 COMMUNICATION FORMATS

The OM-220 and the PC must have matching serial communication formats. Except for the Baud rate, the format for the OM-220 is fixed by design. The format for the PC is set through the use of the OC program.

SETTING THE OM-220 FORMAT:
All parameters for the serial communication format, excluding the Baud Rate, are permanently fixed within the OM-220. Select one of the Baud rates and position the Front Panel Baud Rate switches accordingly. 9600 is a rate that gives good performance in

most conditions with optimum data transfer speed.

SETTING THE PC FORMAT:
Turn on the PC and start the OM-220 Communications program, OC (refer to SECTION 2.5).

From the **MAIN MENU** displayed on the PC SCREEN upon start-up, select choice <B> COMMUNICATE WITH OM-220, then choice <2> RS-2-32.

The following **RS-232 SETUP MENU** screen will be displayed. Select <P> and/or <B> to modify the current Communication Port and/or Baud Rate settings for the PC.

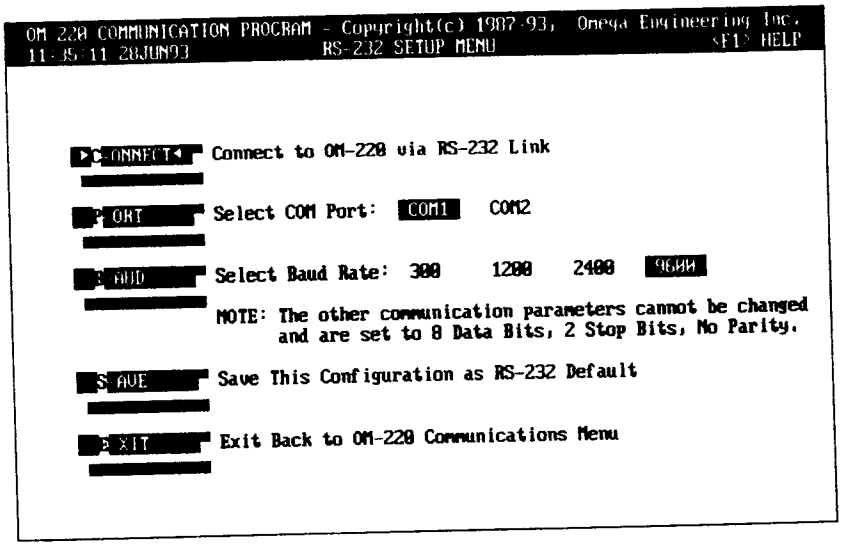

FIGURE 4.1: RS-232 SETUP MENU

PORT: the Serial Port on the PC into which the OM-220 cable is plugged. If unsure of the Port number, select one and try to communicate (SECTION 4.2.3). If communication is unsuccessful, try the other Com Port.

BAUD RATE: set to match the Baud Rate currently selected on the OM-220 Front Panel Baud Rate Switch.

DATA BITS, STOP BITS, and PARITY: (more technical parameters used in describing the signal format involved in RS-232 serial communications) cannot be changed and are pre-set to match the OM-220.

If you plan on using these changed parameters often, you might want to make them the DEFAULT values by selecting choice <S> to SAVE the currently displayed settings.

4.2.3 ESTABLISHING RS-232 COMMUNICATION

ENABLE OM-220 RS-232 SERIAL CIRCUITRY:
Set the OM-220 REMOTE/LOCAL Front Panel switch to REMOTE and perform a

SYSTEM RESET (SECTION 3.2.4). The display will indicate 'REMOTE CONTROL MODE READY'. If the battery state of charge is low or extended REMOTE Control Mode operation is planned, an external power supply should be connected to the OM-220 as the power consumption of the RS-232 circuitry is higher than in the normal OM-220 'Sleep' mode (SECTION 2.2.3).

ESTABLISH COMMUNICATION:

Wait for the 'REMOTE CONTROL MODE, READY' message to be displayed on the OM-220, then from the PC keyboard, advance through OC from the **MAIN MENU**...<B> Communicate With OM-220; <2> RS-2-32; <C> Connect to OM-220, and the **RS-232 COMMUNICATION MENU** will be displayed. The OM-220 is now under the control of the PC and will respond to commands appropriately.

********** NOTE **********

THE REMOTE/LOCAL SWITCH IS ONLY FOR RS-232 COMMUNICATION. RS-485 AND MODEM COMMUNICATIONS SHOULD BE RUN WITH THE SWITCH IN THE LOCAL POSITION AS BOTH OF THESE COMMUNICATION TYPES WILL SEND 'WAKE-UP' INTERRUPTS TO THE OM-220 WHICH WILL TURN ON THE APPROPRIATE SERIAL COMMUNICATION CIRCUITRY. THE REMOTE/LOCAL SWITCH IS EFFECTIVELY AN ON/OFF SWITCH FOR THE OM-220 RS-232 CIRCUITRY, AND IS READ AFTER EACH SYSTEM RESET.

****

********** NOTE **********

If running from internal battery power, always return the OM-220 to the low-power, LOCAL Control Mode to maximize battery life. In the REMOTE Control Mode, the OM-220 serial communication circuitry draws an additional 10mA (vs 1 to 2 mA in LOCAL mode).

****

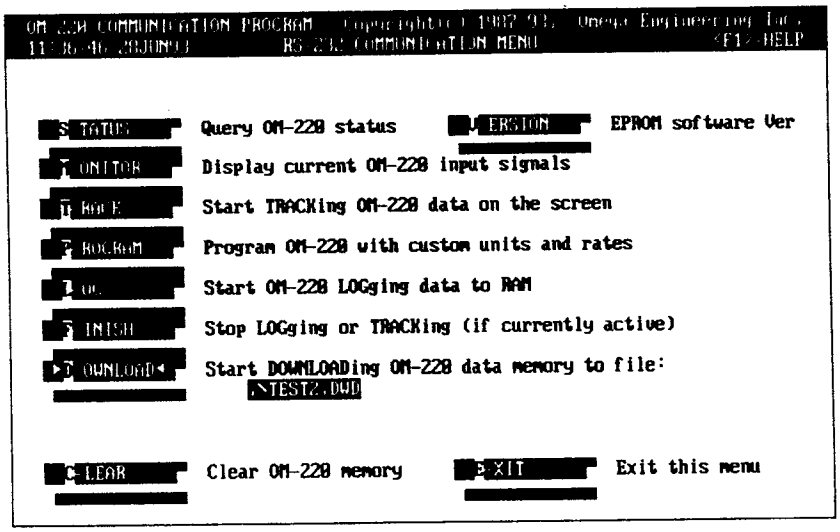

FIGURE 4.2: RS-232 COMMUNICATION MENU

4.3 MODEM COMMUNICATION

Direct connection of a standard modem to the OM-220 Modem port allows for long distance telephone communication between a PC and the OM-220 over the telephone lines. The OM-220 supports auto-answer at all four baud rates. Upon receipt of a call, the OM-220 location modem sends a Carrier Detect (CD) signal to the OM-220 interrupting (awakening) the OM-220 and allowing communication to take place transparently from the PC location.

An answer only (minimum) modem is required at the location of the OM-220. This modem does not need to support the AT Command Set however, upon answer, the OM-220 is expecting a continuous Carrier Detect (CD) signal from the modem while connected.

4.3.1 OM-220 LOCATION HARDWARE SET-UP

OM-220 HARDWARE SET-UP:

TRACK / STORE SWITCH: Must be in STORE position. TRACK and STORE sessions will be controlled via the modem.

MODEM ENABLE SWITCH: For modem operation, the Port 1 Internal System Switch (SECTION 3.2.7) must have switch #5 (Modem Enable) ON. Switch #4 must be off to prevent RS-485/Modem communication conflict.

BAUD RATE SWITCH: All parameters for the serial communication format, excluding the Baud Rate, are fixed within the OM-220. Select a Baud Rate to match the fastest Baud Rate capability of the attached modems and position the OM-220 Front Panel Baud Rate switches accordingly.

INTERCONNECTION: Connect the modem to the OM-220 using the Omega Engineering Inc, CAM-4 (DB-25 to RJ-45, eight pin modular phone jack) cable assembly (available from Omega Engineering Inc). The cable should be plugged into the 'MODEM' jack on the front panel of the OM-220 and into the DB-25 on the modem. For reference, a detailed pin-out diagram is supplied in APPENDIX G.

MODEM HARDWARE SET-UP:

Modem set-up switches (or jumpers) should be set as follows:

Auto-Answer
8 Data Bits, 2 Stop Bits, No Parity
Baud Rate to match OM-220 Setting

Hayes AT Command Set Compatible modems should have the following switches set as well (if switches are available).

DTR override enabled (always ON)
Disable Result Codes
Carrier Detect functional (High when ONLINE, Low when OFFLINE
AT Command Set recognition disabled

********** NOTE **********

Due to the plethora of telephone modems currently available on the market and their corresponding permutations in setup configuration, modem setup can be a fairly intense and/or agonizing procedure. Configuration details for a number of readily available modems is provided in APPENDIX L.

To minimize the *modem setup blues* and insure ultimate ease of setup, field proven, pre-configured modems are available from Omega Engineering Inc. that are ready for immediate use with the OM-220.

****

PRE-DEPARTURE SITE INSPECTION:

Before leaving the OM-220/modem installation site, a number of checks should be made. It is **HIGHLY RECOMMENDED** that a call be made to the OM-220 to confirm proper operation of the complete Modem/OM-220 setup, however this is not always feasible. Pre-departure checklist:

Press the STATUS button on the OM-220 and insure that the MODEM PORT ENABLED message is displayed.

The STATUS messages will also serve to verify the desired sample rates, ranges, etc of each Input Module channel.

Pressing each active channel's MONITOR button will confirm sensor and wiring integrity.

Check that the modem and OM-220 are set for the same Baud rates.

Check that the modem is connected to the phone line (check wiring as well as the position of any online/offline switches)

Check for sufficient battery or external power source to supply both the modem and the OM-220 requirements for the duration of the test.

Check that the modem and OM-220 power switches are both ON.

Press START LOGGING and observe the OM-220 display insuring that no error messages exist.

4.3.2 PC LOCATION HARDWARE SET-UP

PC REQUIREMENTS:

A 'Hayes AT Command Set' compatible modem is required at the PC location. The OM-

220 utilizes the AT command set for communication commands and response monitoring. 300, 1200, 2400, and 9600 Baud is presently supported by the OM-220 Communications software.

Connect the modem to the desired Serial Port on the PC.

CONFIGURING THE MODEM AT THE PC:

From the OM-220 Communications **MAIN MENU** (SECTION 2.5), select <O> O-M-220, then <M> M-ODEM, and the following **MODEM SETUP MENU** will be displayed showing the current DEFAULT settings for the PC based MODEM. Each of the parameters can be changed then saved into a DEFAULT configuration that will be utilized each time Modem Communications is used. Explanations of each of the parameters follows:

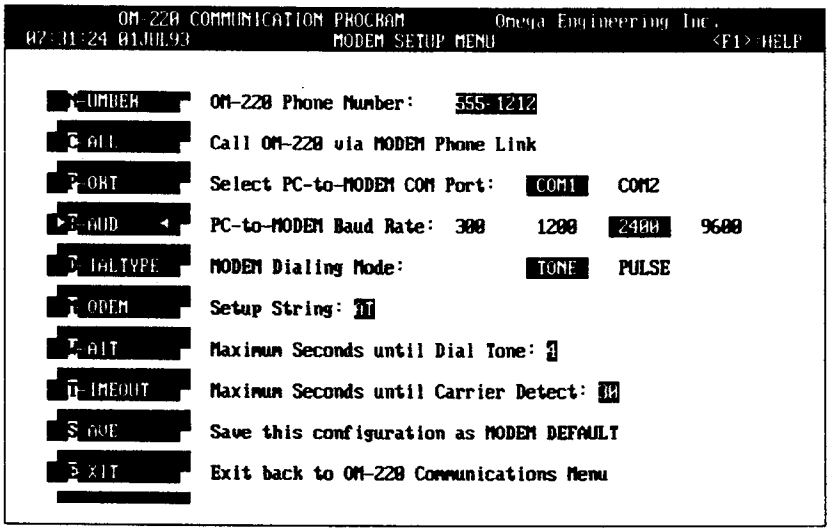

FIGURE 4.3: MODEM SETUP MENU

NUMBER: The phone number of the remote OM-220 site to be called. Commas inserted in the sequence of digits to be dialed will result in 2 second delays (per comma).

CALL: The command to actually Dial the Remote Site OM-220 using the currently displayed parameters.

PORT: The serial port on the PC to which the modem is connected. Pressing <P> toggles between the Ports.

BAUD: Toggles and selects the Baud Rate for the serial communication between the PC and the PC connected Modem. In most applications, this Baud Rate should be set to the same as that set on the OM-220.

DIAL TYPE: Specifies the type of dialing. Pulse or Touch Tone.

MODEM: Allows for entry of a Modem Setup String consisting of a sequence of

characters to initialize the Modem for advanced functions above and beyond those specified on this screen. For most applications, this string should be left with the Default setting of AT. (Note to Advanced function Users: OC sends the modem this Setup String followed by a RESET command. Then the Initialization sequence built from the other parameters specified on this screen are sent. Using this Setup String, modem's internal configurations (NOVRAM) can be rewritten via OC. OC expects an 'OK' response from the Modem following the RESET.)

WAIT: Specifies the time period the PC modem waits after going OFF-HOOK (ie picking up the phone) before it automatically starts to dial. 2 to 4 seconds is a normal wait for the dial tone on most systems.

TIMEOUT: Specifies the time period the calling modem waits for a carrier signal after completion of dialing. If the carrier is not detected within the specified time, the modem goes ON-HOOK (hangs up).

SAVE: If you plan on using these changed parameters often, you might want to make them the DEFAULT values by selecting SAVE before exiting the screen.

4.3.3 ESTABLISHING MODEM COMMUNICATIONS

After configuring the Modem Parameters above, select **C-ALL** from the **MODEM SETUP MENU** and the connected modem will be initialized and dialed with visual status of the sequence of steps indicated on the PC screen.

The PC screen will automatically advance to the **MODEM COMMUNICATION MENU** upon a successful connection to the remote site.

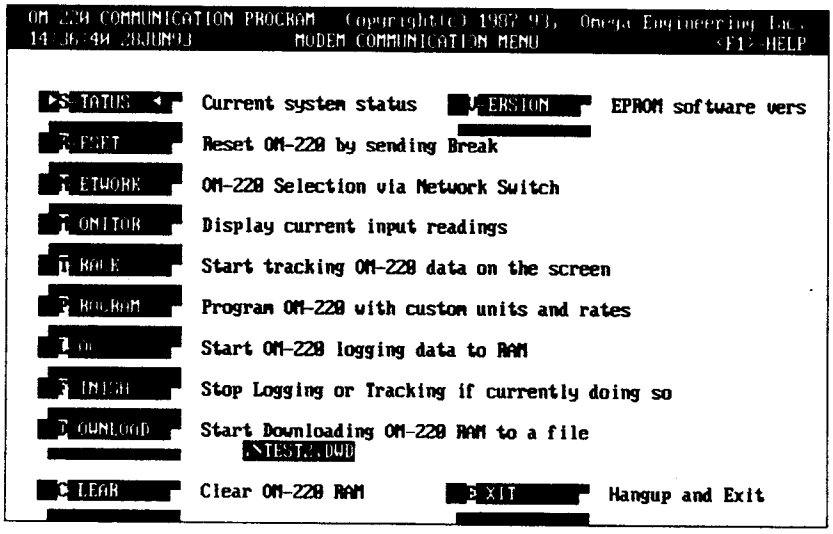

FIGURE 4.4: MODEM COMMUNICATION MENU

4.4 RS-485 COMMUNICATION

Through the use of the OM-220 RS-485 Network, a simple multi-location data acquisition system can be easily configured. RS-485 allows for serial communication between a single PC and up to 8 OM-220s which are multi-dropped along a single twisted pair of wires. Communications can be achieved over distances up to 4000'at Baud rates supported by the OM-220 up to 9600 Baud. This configuration allows the User to send commands (Start Logging, Start Tracking, Clear Memory, Download Memory, etc.) and receive data from multiple OM-220s that may be distributed about a production floor or local processing site.

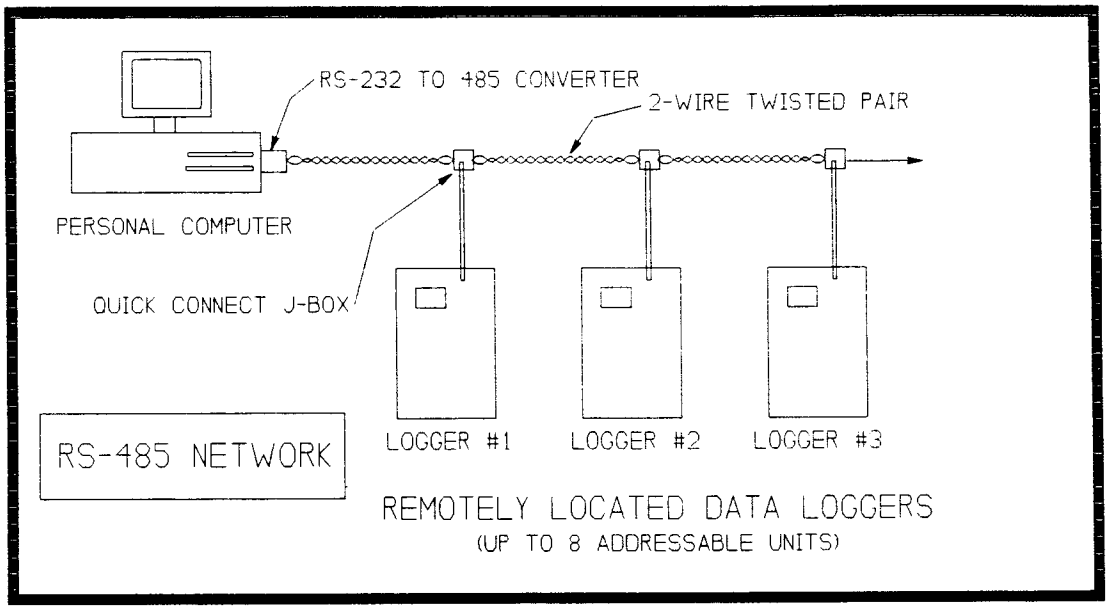

FIGURE 4.6: OM-220 NETWORK WITH RS-485 LINK

All of the OM-220s are connected to the same twisted pair of wires and each is set with a unique Unit Identification number. The User can then address and interrogate specific units through the RS-485 Command Menus from within the OM-220 Communications Software running on the PC.

The RS-485 Network is detailed in the following three sections:

Network Wiring
OM-220 Hardware Set-up
Personal Computer Set-up

4.4.1 MULTI-DROP NETWORK WIRING INSTALLATION

RS-485 Communication is transmitted through a main trunk line consisting of a twisted pair of 18 to 24 AWG conductors (Wiring Diagram in APPENDIX I). A conventional system has one end of

the trunk line connected to a RS-485 transceiver at the PC location and the remaining line is then routed to the desired sites of remotely located OM-220s.

OM-220 CONNECTION:
At each of the OM-220 sites, an RS-485 Quick Connect Junction Box (JB-1) is spliced into the twisted pair. OM-220s at each location are then connected to the Junction Boxes via the supplied 6 conductor cable. One end of the cable plugs into the OM-220 RS-485 Jack and the other plugs into the mating jack on the Junction Box.

NETWORK CABLE SELECTION:
24 AWG to 18 AWG solid conductor twisted pair cable will give good results in most applications. In extremely long runs and/or in electrically noisy environments, a shielded twisted pair of cables can be used for improved communications. Cable should be selected that has insulation sufficiently rugged to withstand the routing environment. Additionally, at either end of the cable, a load resistance approximately matching the characteristic impedance of the cable (typically a 240 ohm to 1000 ohm resistor) connected across the two conductors will improve transmission characteristics. This resistor is readily installed across the screw terminals within the last OM-220 site Junction Box.

NETWORK POLARITY:
Each device connected to the RS-485 Trunk line has two connections, INVERTING (+) and NON- INVERTING (-). In an RS-485 network, care must be taken at the time of installation to insure that all of the inverting terminals connect to the same wire and all of the non-inverting terminals connect to the other wire. The Junction Boxes are marked with a (+) and (-) on the appropriate terminals and instructions provided with the PC RS-485 Transceiver are similarly identified.

If non-color coded Trunk line wire is utilized, the polarity must be determined before connecting any devices to the line. This can be simply determined by connecting a low voltage battery to the conductors at one end (NOTE: NO OM-220S OR OTHER DEVICES TO BE CONNECTED DURING THIS TEST) and marking the polarity of the wires at each location of a RS-485 device as determined with a voltmeter.

4.4.2 OM-220 LOCATION HARDWARE SET-UP

OM-220 HARDWARE SET-UP:

TRACK / STORE SWITCH: Must be set in the STORE position. TRACK and STORE sessions will be controlled from the PC.

RS-485 ENABLE SWITCH: For RS-485 operation, the Port 1 Internal System Switch (SECTION 3.2.7) must have switch #4 (RS-485 Enable) set to ON. Switch #5 must be off to prevent Modem/RS-485 interrupt conflict.

BAUD RATE SWITCH: Set the OM-220 Front Panel Baud Rate switch to 9600 Baud. No other Baud Rates are supported for RS-485 communication.

INTERCONNECTION: Connect the OM-220 to the Trunk Line Junction Box using the Omega Engineering Inc, CAR-4, 6 conductor RJ-12 plug cable assembly (provided with the OM-220). The cable should be plugged into the 'RS-485/RS-232' jack on the front panel of the OM-220 and into the mating jack on

the Junction Box.

OM-220 UNIT ID: Each of the OM-220s connected to the RS-485 network must have a unique Unit Identification number assigned. The ID number is used in initiating communication with a specific OM-220. This ID is set by the positions of three of the Port 1 Internal System Switches (SECTION 3.2.7) Any ID from 0 to 7 can be set as follows:

UNIT ID	SW6	SW7	SW8
0	OFF	OFF	OFF
1	ON	OFF	OFF
2	OFF	ON	OFF
3	ON	ON	OFF
4	OFF	OFF	ON
5	ON	OFF	ON
6	OFF	ON	ON
7	ON	ON	ON

PRE-DEPARTURE SITE INSPECTION:

Before leaving the OM-220 installation site, a number of checks should be made. A pre-departure checklist follows:

Perform a System Reset which will re-initialize the unit (ie read the current configuration).

Press the STATUS button on the OM-220 and insure that the RS-485 PORT ENABLED message is displayed with the desired Unit ID number.

The STATUS messages will also serve to verify the desired sample rates, ranges, etc of each input module channel.

Pressing each active channel's MONITOR button will confirm sensor and wiring integrity.

Check that the OM-220 Baud Rate is set to 9600.

Check for sufficient battery or external energy to supply both the modem and the OM-220 requirements for the duration of the test.

If TRACKING of data over the RS-485 link will be performed and any channel sample rates are set faster than 15 seconds, a quick check must be done to verify that the OM-220 communication processing can be done at the desired sample rates. This is done by setting the TRACK/STORE mode switch (SECTION 3.2.3) temporarily to the TRACK position and pressing the START LOGGING button. If the sample rates are too fast, a message stating 'REDUCE SAMPLE RATES' will be displayed on the OM-220 and the rates must be reduced and the test repeated.

NOTE: BE SURE TO RETURN THE TRACK/STORE SWITCH TO THE 'STORE' POSITION AND PERFORM A SYSTEM RESET BEFORE LEAVING THE SITE.

4.4.3 PC LOCATION HARDWARE SET-UP

PC REQUIREMENTS:

An RS-485 Transceiver is required at the Personal Computer location. This device may be an internal board or more commonly a separate external module that is connected to the RS-232 serial port on the PC and converts the RS-232 signal to the RS-485 signal levels. Both of these type RS-485 transceivers are available from Omega Engineering Inc. (Ref Omega Engineering Inc. P/N ETXM-485 or ETXF-485).

Connect the RS-485 Trunk line to the Transceiver observing proper polarity (ie Inverting and Non-inverting) of the two conductors. If utilizing the external RS-485 Module, connect it to the PC RS-232 port of choice.

SETTING THE PC FORMAT:

Turn on the PC and start the OM-220 Communications program, OC (SECTION 2.5).

From the **MAIN MENU** displayed on the PC SCREEN upon start-up, select <B> OM-220 Communication, then <4> RS-485 and the following **RS-485 SETUP MENU** screen will be displayed. Explanations of the Menu choices on this screen follow:

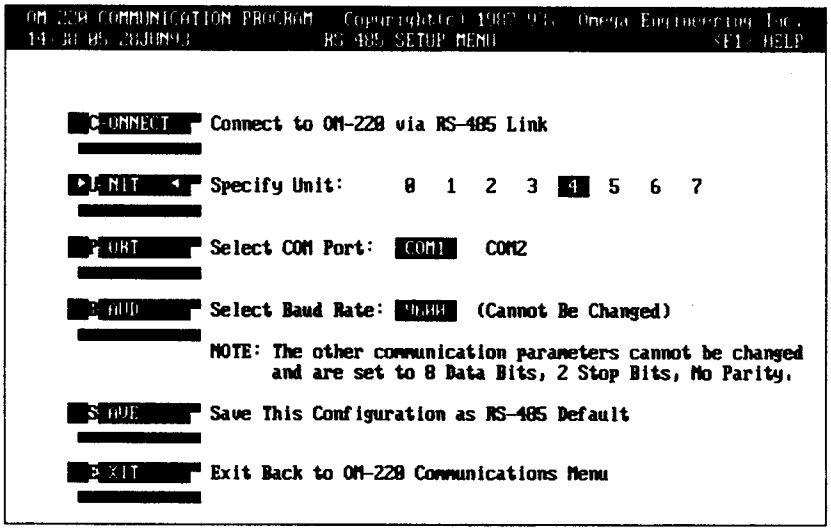

FIGURE 4.6: RS-485 SETUP MENU

CONNECT: Initiates serial communication with the currently specified OM-220 via the RS-485 link. Insure that the other parameters on this screen are configured as desired before attempting to CONNECT.

UNIT: Toggles between the eight possible OM-220's IDs on the RS-485 network. Specify the unit with which to communicate.

PORT: Specifies the serial port on the PC to which the RS-485 Transceiver is connected. Toggle between COM1 and COM2. If unsure of the Port number, try

one then the other.

BAUD: The Baud Rate for RS-485 is fixed at 9600.

SAVE: If you plan on using these changed parameters often, select <S> to Save the settings to the RS-485 Default configuration file.

4.4.4 ESTABLISHING RS-485 COMMUNICATIONS

From the **MAIN MENU** in OC, select <B> OM-220 Communication, <4> RS-485, then <C> Connect to OM-220. After a short hook-up and identification time, contact will be made with the specified unit and the screen will automatically advance to the following **RS-485 COMMUNICATION MENU**.

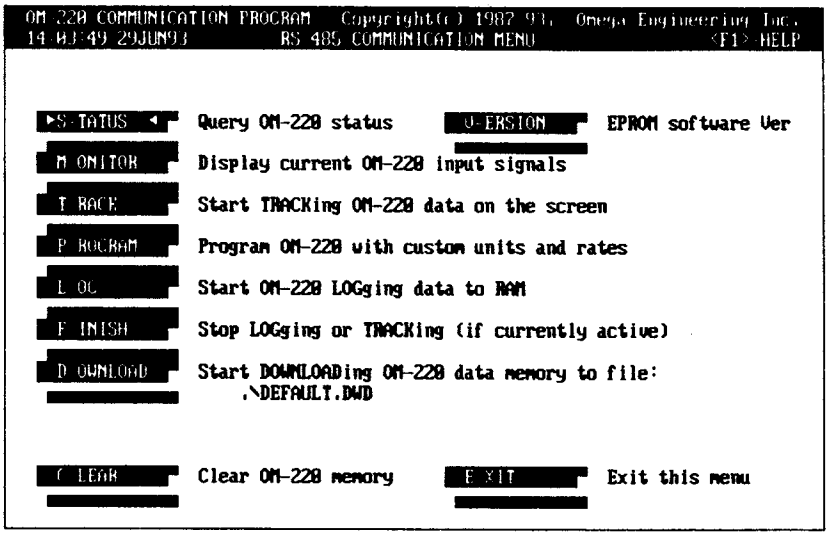

FIGURE 4.7: RS-485 COMMUNICATION MENU

If connection is unsuccessful, an error message will flash on the screen indicating possible sources of the problem. Most common problems are mis-matched baud rates, reversed polarity, or open connections.

NOTES:

5..LOGGING DATA

OM-220 COMMUNICATION PROGRAM - Copyright(c) 1987 93, Omega Engineering Inc.
14:22:56 29JUN93 REAL TIME TRACK SCROLL MODE <F1>-HELP

BL TIME	T-inlet	T-out	Delta-T	Proc-IN	Proc-OUT	PUMP-CAV	T-motor	I-motor
13:05:26	75.00	75.00	0.00	95.00	87.00	136.60	166.60	10.00
13:05:29	75.00	75.00	0.00	95.00	87.00	136.60	166.60	10.00
13:05:31	75.00	75.00	0.00	95.00	87.00	136.60	166.60	10.00
13:05:33	75.00	75.00	0.00	95.00	87.00	136.60	166.60	10.00
13:05:35	75.20	82.90	-7.70	95.20	87.20	150.00	165.40	10.20
13:05:37	75.20	86.80	-11.60	95.20	87.20	158.60	165.40	10.20
13:05:39	75.20	88.10	-12.90	95.20	87.20	161.20	165.40	10.20
13:05:41	75.00	88.70	-12.90	95.00	87.00	162.40	166.60	10.00
13:05:43	75.00	88.10	-12.30	95.00	87.00	161.20	166.60	10.00
13:05:45	75.90	88.10	-12.20	95.90	87.90	161.20	166.00	10.90
13:05:47	75.90	88.10	-12.20	95.90	87.90	161.20	166.00	10.90
13:05:49	75.90	88.10	-12.20	95.90	87.90	161.20	166.00	10.90
13:05:51	75.90	93.30	-17.40	95.90	87.90	171.60	166.00	10.90
13:05:53	75.90	90.70	-14.80	95.90	87.90	166.40	166.00	10.90
13:05:55	76.50	92.00	-15.50	96.50	88.50	169.00	160.00	11.50
13:05:57	76.50	92.00	-15.50	96.50	88.50	169.00	160.00	11.50
13:05:59	75.90	91.40	-15.50	95.90	87.90	167.80	166.00	10.90
13:06:01	76.50	92.70	-16.20	96.50	88.50	170.40	160.00	11.50
13:06:03	76.60	91.40	-14.80	96.60	88.60	167.80	160.20	11.60
13:06:05	75.90	91.40	-15.50	95.90	87.90	167.80	166.00	10.90
BL TIME	T-inlet	T-out	Delta-T	Proc-IN	Proc-OUT	PUMP-CAV	T-motor	I-motor

Press <ESC> to terminate tracking, or <F2> to toggle printer...

FIGURE 5.1: TRACK SCROLL MODE DISPLAY

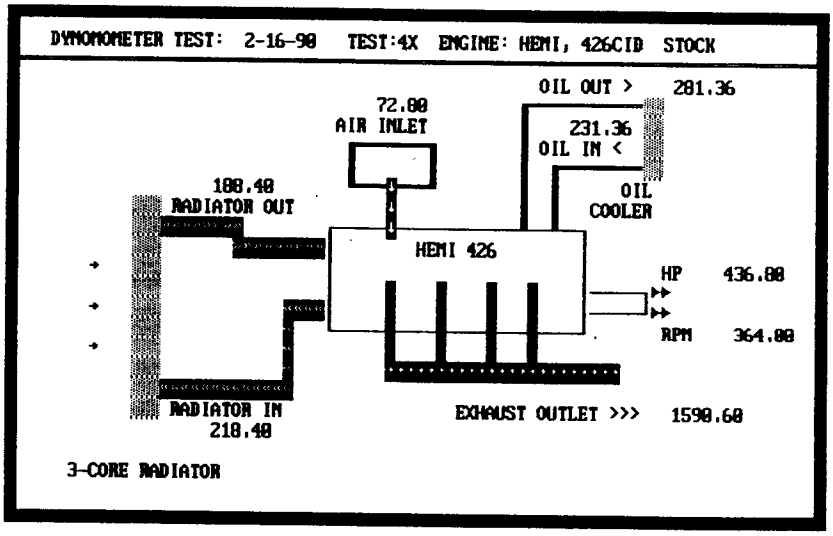

FIGURE 5.2: WINDOW TRACK MODE DISPLAY

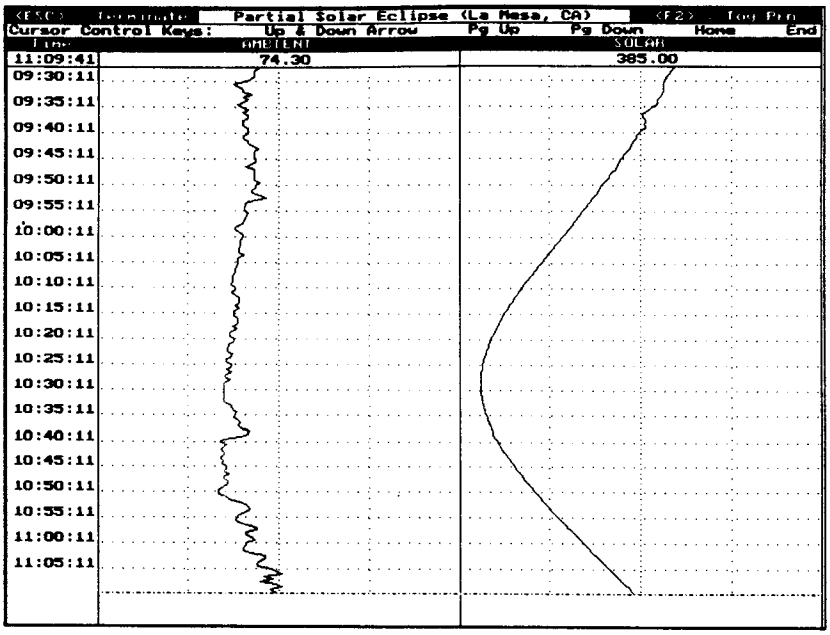

FIGURE 5.3 - GRAPH TRACK MODE DISPLAY

5.1 LOGGING OVERVIEW

The OM-220 is most commonly used for logging data in one of the following four modes of operation:

STORE MODE:
The OM-220 takes readings from the inputs and stores them internally in the OM-220 SRAM data memory. The data is then downloaded at a later time into a Download file on a PC. This Download file can then be Quick-Graphed (using the Quick-Graph feature provided within the OM-220 Communications software package) for immediate graphic display of the collected data.

Alternatively, the Download File can be converted into a fully annotated spreadsheet file (using File Conversion Utilities also provided within OC) for User analysis within a spreadsheet environment.

TRACKING - SCROLL MODE:
Readings are taken by the OM-220 from the inputs and transmitted to the PC on a Real Time basis (i.e. as the OM-220 takes readings they are immediately sent out the serial port to the PC). SCROLL mode allows the user to see up to eight Real and/or Math Channel's values as the sampled inputs scroll up the display sequentially as they are read by the OM-220 (FIG 5.1).

Optionally, at the User's prompt, the data can be simultaneously saved to a Download file within the PC and/or printed on a dot matrix printer as the readings are taken. As in the STORE mode, this Download file can then be converted at a later time to a spreadsheet or used with Quick-Graph for an immediate graphical review of the data.

TRACKING - WINDOW MODE:
Similar to the SCROLL-TRACKING MODE, however additional flexibility is allowed in construct-

ing the display format for the sampled data. A User designed WINDOW DISPLAY SCREEN is developed using a screen editor provided with the OC software, which then becomes the display format for the sampled data display (FIG 5.2). This mode is commonly used where complex system real time monitoring is required as considerable information can be incorporated into the WINDOW DISPLAY SCREEN easing the burden for the User. The resultant display is very similar to an industrial control type 'annunciator panel' display with display capability of up to 16 Real and/or Math Channels.

Optionally, at the User's prompt, the data can be simultaneously saved to a Download file within the PC and/or printed on a dot matrix printer as the readings are taken. As in the STORE mode, this Download file can then be converted at a later time to a spreadsheet or used with Quick-Graph for an immediate graphical review of the data.

TRACKING - GRAPHIC MODE:
Similar to the SCROLL-TRACKING MODE, however the data is displayed on the PC screen in the form of a multiple pen strip chart display (FIG 5.3). This graphical display gives excellent trending information on up to eight Real and/or Math channels as various inputs are being monitored.

Optionally, at the User's prompt, the data can be simultaneously saved to a Download file within the PC and/or printed on a dot matrix printer as the readings are taken. As in the STORE mode, this Download file can then be converted at a later time to a spreadsheet or used with Quick-Graph for an immediate graphical review of the data.

In addition to the four main modes of operation, a number of additional variations/modes of operation of the OM-220 are described in detail in **SECTION 6: ADDITIONAL MODES & FEATURES:**. These include:

EXTERNAL PROGRAM MODE
TRACKING TO A SERIAL PRINTER/TERMINAL
DUAL MODE DATA LOGGING (SIMULTANEOUS TRACK AND STORE)
BURST MODE DATA LOGGING
ROLL-OVER MEMORY

Each of the following instructional sections for the four modes of LOGGING stands by itself and can be read independently of the others. The OM-220 Communications (OC) software is used in all sections. Before proceeding, insure that a copy of the OM-220 Communications software has been made and the original has been stored safely.

The basic command functions utilized in communicating with the OM-220 (while running OM-220 Communications) through all three types of serial communication (RS-232, RS-485, and Modem) are essentially the same. The main differences between the different types of serial link are in the Configuration of the OM-220 and the PC to a particular type of serial link. The details of set-up and establishing a serial communication link between the OM-220 and the PC are covered in SECTION 4 and SHOULD BE READ BEFORE CONTINUING.

This section assumes that the user has read SECTION 4 and is capable of advancing to the **COMMUNICATION MENU** within the OM-220 Communications software.

5.2 STORE MODE

n STORE MODE, I/M (Input Module) channels are read by the OM-220 based on the pre-set Sample Rates, and the data is stored in OM-220 memory for Download to the PC at a later time. A sequence of our steps is performed in a STORE logging session:

Set-up the OM-220 Hardware

Log the Data

Download the stored data to a PC Download file

Analyze the collected data:

Using the Download file to Spreadsheet conversion utilities or

Using Algebraic Processing Blocks (APB) and Quick-Graph

Details of the STORE logging sequence follow:

5.2.1 OM-220 HARDWARE SET-UP

INPUT MODULES:
Turn OFF the System Power and plug the desired I/M's into the I/M ports insuring that they are properly aligned in the guides and that they insert fully.

Set the I/M front panel switches for the desired Sample Rates, type of sensor, etc. Refer to the individual I/M instruction sheets (SECTION 3.3.2) for detailed instructions.

Route the sensor/signal wiring through the fittings and wiring holes in the bottom of the OM-220 box and connect them to the appropriate wiring connections on the I/M terminal strips. Refer to the detailed Instruction sheets for the I/M's used in SECTION 3.3.2.

SYSTEM BASE:
Configure the Front Panel System Switches as follows:

BAUD RATE: Not applicable at this time
TRACK/STORE: STORE
SLOW ADC/FAST ADC: User's Choice
RS-232 REMOTE/LOCAL: LOCAL
SYSTEM POWER: ON

Configure the Port 1 and Port 2 Internal System Switches as desired for any special logging functions (eg Roll-over memory, Deg C/F, Burst Mode, etc). Refer to SECTION 3.2.7 and SECTION 6 for details on configuration of these switch settings.

********** NOTE **********

For basic logging applications and while gaining familiarity with the OM-220, setting all of the Internal System Switches OFF will allow for normal operation of the OM-220 that will meet most application needs.

****

Set the system clock date and time (if incorrect).

Perform a System RESET with the RESET/CLEAR and STOP LOGGING buttons. Clear memory if the data in memory has been downloaded successfully or is of no value. (refer to SECTION 3.2.4)

Press the MONITOR button on each active I/M channel to verify sensor wiring, sample rates, etc.

Press the STATUS/TIME button and review all system parameters for proper set-up and operation.

5.2.2 LOGGING DATA

Press START LOGGING to start the collection of data and storage in memory. If any error conditions exist in the system, error messages will be displayed at this time and LOGGING WILL NOT START. If this is the case, refer to APPENDIX A: ERROR MESSAGES for action to be taken.

********** NOTE **********

After pressing the START LOGGING button on the OM-220, observe the OM-220 display. Any error messages will be displayed at this time AND LOGGING WILL NOT START. Refer to APPENDIX A for Error message explanations.

****

After the desired data has been taken, terminate the logging session by pressing STOP LOGGING. The OM-220 display will acknowledge the STOP logging command and display the number of this just completed Logging Session. Data will be retained in the OM-220 memory for download. At this time, I/M switches can be changed as desired and another logging session can be immediately started.

5.2.3 DOWNLOADING STORED DATA

OVERVIEW:
Downloading of the data stored in the OM-220 is done while running the OM-220 Communications (OC) software on the PC. It is assumed that the user has read the appropriate sections covered in SECTION 4 for the type of serial communication to be employed during this download of data.

The Download procedure consists of the following sequence of steps:

Establish the Serial Communication link between the OM-220 and the PC

Download the stored data to an intermediate Download file in the PC

ESTABLISHING THE SERIAL LINK:
Follow the steps in SECTION 4 to reach the **COMMUNICATION MENU** for the type of serial communication employed.

DOWNLOADING THE DATA:
At the **COMMUNICATION MENU**, select <D> DOWNLOAD stored data, enter a Path (if different than the current directory) and filename (that complies with DOS filename specifications) for the Download file. When the Download file is created, OC appends the filename extension '.DWD' to the User specified name before adding it to the disk directory.

If it is desired to have the file written to other than the default disk drive, specify the drive letter at the time that the name is requested (eg B:\DATA\FILENAME).

If desired, the Download of the data to the PC can be aborted in the middle of a download session by pressing ESC. The data will be retained in the OM-220 memory however the Download data file in the PC will be incomplete.

A bit of general information... Download files (from STORE OR TRACK logging sessions) are in a standard ASCII format (described in APPENDIX F) that allows them to be converted by the OC program to spreadsheet compatible files as well as used in Quick-Graph data displays. Although most applications of the Download file are for one of these two methods of analysis, the files can be viewed using any editor (word processor) or the DOS 'TYPE' command.

********** NOTE **********
A Download file can be as large as approximately 150K bytes of data with a standard memory configuration (22,000+ samples) OM-220. This volume of data can take several minutes to Download to disk at 9600 Baud and will consist of approximately 140 'Blocks' of data. Sufficient free space on the target disk should be verified before initiating the transfer of data.
****

After writing the Download file to disk, a short musical tune will play and a message within OC indicating successful completion with an ErrorCount of 000 will be displayed, pressing any key will return the program to the **COMMUNICATION MENU**. After completing any other communication with the OM-220 (SECTION 5.6), press <E> EXIT several times to return to the **MAIN MENU**.

********** **NOTE** **********
To disable the musical tune response to Download action, start OC with the command OC/Q (for Quiet) or OC/L/Q for LCD displays.
****

During the Download process, the OM-220 divides the data within memory into a number of 'blocks' which are transmitted one at a time to the PC with a 'block CRC checksum'. This CRC checksum is used to insure the integrity of the communicated data. During a Download, the OC screen displays the BlockCount indicating normal data transfer.

If any data communication errors occur during the transfer of data between the OM-220 and the PC (e.g. due to telephone line noise during modem communication), the ErrorCount display will increment and the data block will be re-transmitted up to nine times in attempts to accurately communicate the data. In the event that the data block is not received accurately after nine attempts, the Download is aborted. The communication line problem should then be rectified and the Download process repeated.

5.2.4 DATA ANALYSIS - USING SPREADSHEETS:

Upon completion of the following Download File to Spreadsheet File conversion step, a spreadsheet compatible data file will exist which can be retrieved from within the User's spreadsheet environment.

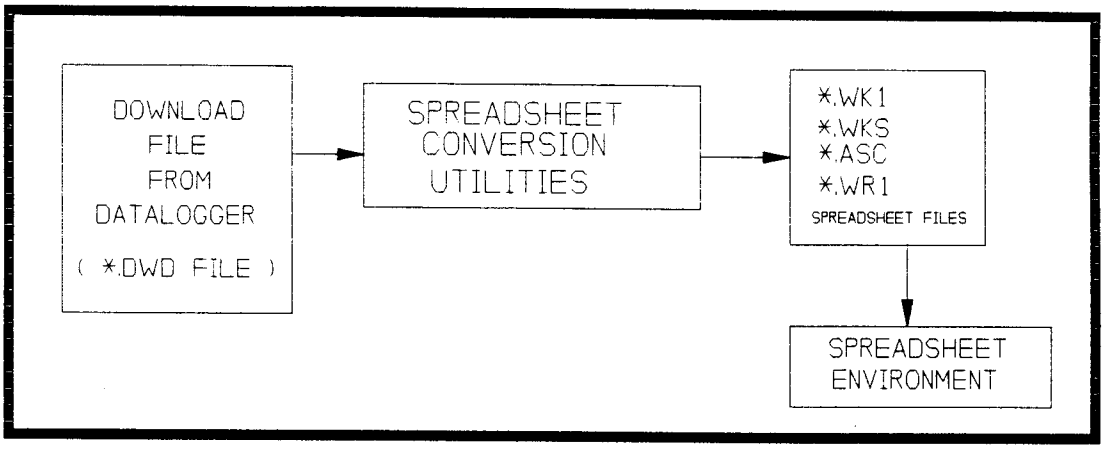

FIG 5.4 - Conversion of DOWNLOAD file to SPREADSHEET file

From the **MAIN MENU**, select <F> FILE CONVERSION to advance to the **FILE CONVERSION MENU** which allows for conversion of the Download file (or any other previously saved Download file) to an ASCII or LOTUS Spreadsheet format file.

OC supports the LOTUS 1-2-3 (Ver 1, 1A, 2) and SYMPHONY file formats directly. Paradox, Quattro and most other spreadsheets either work with or are capable of reading and importing LOTUS formatted files. If using other than the LOTUS packages, see your specific spreadsheet/database software users manual for instructions on importing LOTUS formatted files.

CONVERTING A FILE:

Press <D> to specify the Download file to be converted. A menu will pop up listing all of the *.DWD files on the current Default directory. To specify a DWD file in a different directory, press the F2 hot key and specify the desired path (eg C:\DATA2\) will allow you to change the directory path for display of existing Download files on disk.

Press <T> TYPE to select the desired spreadsheet output format. The ASCII data file format is commonly used for import into DBASE or mainframe systems.

Press <F> FILENAME to specify the name of the spreadsheet DESTINATION file. This

is the name of the spreadsheet compatible file that will be constructed from the previously defined Download file. As normally done, specify a drive prefix and path (eg B:\DATA\FILENAME) if the spreadsheet file is to be created and written to other than the default path.

Note that it is not necessary to specify a different filename for the Destination spreadsheet file as the Download Filename will be used and a different filename extension will be appended for the particular spreadsheet format selected.

Press <C> CONVERT to initiate conversion of the Download file to a spreadsheet file format. The **SESSION SELECTION MENU** will be displayed. If more than one logging session is contained in a Download file, use the <N> NEXT and/or <P> PREVIOUS keys to display the desired Session for conversion then press <S> SELECT to commence conversion.

After conversion, OC indicates a successful conversion and any key press returns OC to the **FILE CONVERSION MENU.** The converted file is then complete and can be accessed using the conventional spreadsheet commands while operating in that spreadsheet environment.

********** NOTE **********

To disable the musical tune response after File Conversions, start OC with the command OC/Q (for Quiet) or OC/L/Q for LCD displays.

****

********** NOTE **********

NOTE: It may be necessary to change the column widths the first time the spreadsheet file is retrieved within the spreadsheet environment. The need for wider columns is indicated by asterisks instead of number entries in cells.

****

********** NOTE **********

Lotus spreadsheet files built from Download files can be up to five times the size of the Download file. Check for sufficient memory and/or target disk space before starting a conversion.

****

5.2.5 DATA ANALYSIS - USING QUICK-GRAPH

OVERVIEW:

As an alternative to analysis of collected data from within the spreadsheet environment, the OM-220 Communications program contains a fast and powerful graphical display tool called Quick-Graph that allows the User to view (and print) multiple channels of data directly from the Download file in a vertical multi-pen strip chart type display.

In order to use the Quick-Graph function, the User must first build an Algebraic Processing Block (APB) file that is used by Quick-Graph in the display of data (FIGURE 5.5). This simply built APB file contains information such as the number of channels to display, mid-point and range of each channel's plot, any algebraic manipulations to perform on the data prior to display (eg inter-channel calculations, units conversion, etc), and labels for units.

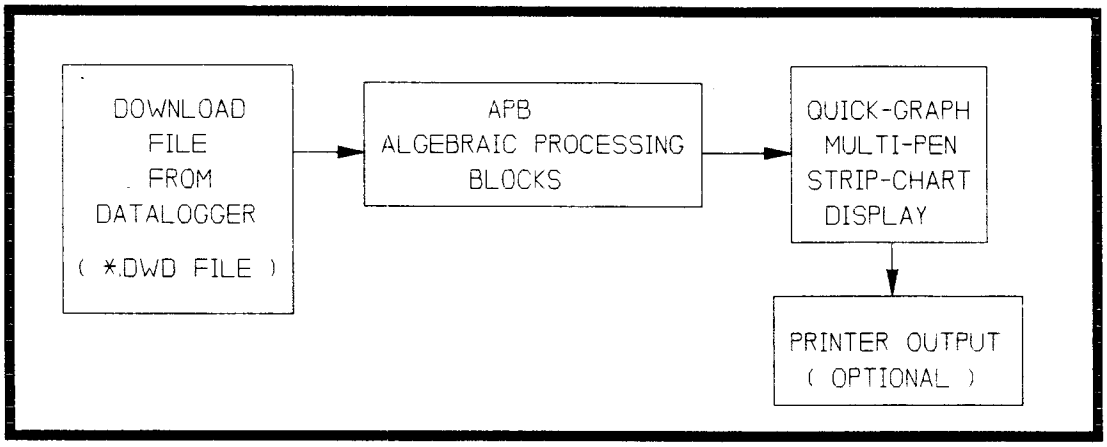

FIG 5.5: DATA ANALYSIS USING APB'S AND QUICK-GRAPH

In the use of Quick-Graph , channel data from the Download file is fed through APBs and algebraically massaged and plotted per the parameters specified within the APB. Multiple data channels from a Download file can be used in a formula to result in a single APB Channel.

A simple example application of the use of the Quick-Graph function with APBs would be in the display of operational temperatures of a heat exchanger. Assume that two channels of temperature data (inlet and outlet temperatures) has been collected by the OM-220 during a normal data logging session and downloaded to a DWD file on the PC. An APB file can be configured and used for the display of this temperature data that would display three channels of information:

Inlet Fluid Temperature
Outlet Fluid Temperature
Delta-T; (Outlet minus Inlet Temperature)

CONSTRUCTING AN APB GRAPH SCREEN:
Within OC, from the **MAIN MENU**, select <G> GRAPH CONFIGURE. OC will advance to the **GRAPH SETUP MENU**.

Press <S> SOURCE to specify an existing APB file to load and edit. Press <D> DESTINATION to specify the filename under which to save the edited APB. (This method of SOURCE and DESTINATION specification readily allows for loading and editing of an existing file and saving under a new filename.) The supplied DEFAULT file is supplied as a SOURCE file that can serve as a good starting point for generation of APBs. Save the resulting APBs to filenames other than DEFAULT so that the DEFAULT file is maintained as a consistent SOURCE file from which to build other APBs.

When specifying SOURCE and DESTINATION filenames, a different Drive and/or Path can be specified (eg A:\OM220\APB\DELTAT). When loading APBs using the pop-up directory, use the <F2> Function key to change Drives and Paths.

After specifying the SOURCE and DESTINATION filenames, press <C> CONFIGURE and OC will advance to the **APB EDITING MENU** from which the editing of individual APB Channels is performed.

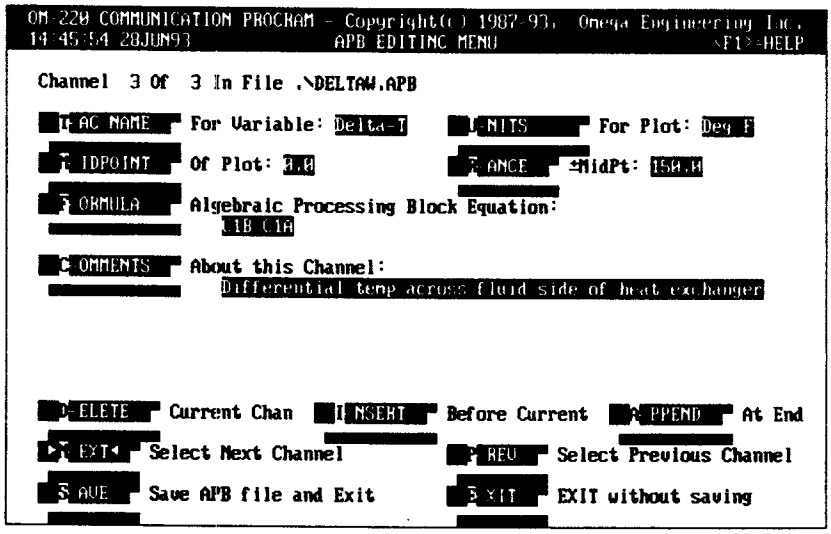

FIGURE 5.6: APB EDITING MENU

In operation, Quick-Graph pulls data from the User specified channels within the Download file, algebraically manipulates them (if desired) and plots the data on the PC screen and/or printer.

An APB channel must exist for each channel that is to be DISPLAYED during the Quick-Graph function. However, it is not necessary to use all of the channels contained within a Download file during Quick-Graph. Conversely, a single channel of data within a Download file could be used and displayed by several APB channels simultaneously. (e.g. a single temperature channel within a Download file could be fed into three different APB display channels that would display this single channel data in Degrees C, Degrees F, and a Delta-T relative to another channel).

On the **APB EDITING MENU**, the APB Channel currently being edited is displayed in the upper left section of the screen in the format 'Channel X of Y in File...'. Use the functions at the bottom of the Menu to Append, Delete, and Insert APB Channels as well as to move from one to another. The Quick-Graph display can handle from 1 to 8 APB

Channels.

For each APB channel desired, six User defined entries are to be made.

TAG: A short (8 characters maximum) name-tag for the channel (eg INPUT, OUTPUT, TEMP, PRESSURE). This TAG will be displayed as a column heading during Quick-Graph.

FORMULA: A mathematical expression whose result is displayed on the screen during Quick-Graph. These FORMULAS consist of:

CHANNEL NUMBER: A Download file channel number which references data collected by an active OM-220 channel during a logging session. The Channel format consists of the letter 'C' followed by the Input Module Port number (1-4) and the Input Module letter channel (A or B for two channel Input Modules and A, B, C, or D for four channel Input Modules). For example, C1A, C4D, etc.

DECIMAL SPECIFICATION: A decimal places specification for the precision of the displayed result. If none is specified, two significant digits to the right of the decimal point are displayed as a Default.

EQUATION: The actual equation which can contain algebraic operators such as multiply, divide, exponentiation, etc. If no equation is supplied (eg the Formula is 'C2A', then Channel C2A from the Download file is passed directly through for display without any algebraic manipulation. For example the APB Formula to calculate the difference between two channels of temperature data collected in a logging session on Channel 1A and 1B would be entered as follows:

C1B-C1A

Additional examples of Formulas and a listing of the algebraic operators available with syntax specified are included in APPENDIX K.

UNITS: A short (8 characters maximum) title for units of measure for that particular channel (eg VOLTS, PSI, GPM). The UNITS title is used during print-out of Quick-Graph.

MIDPOINT: Enter the value desired for the mid-scale value for that channel's plot. (eg if measuring relative humidity, a midpoint value of 50% may be chosen). Acceptable values for the MIDPOINT must be in the range of +/- 99999.

RANGE: Enter a magnitude value for the upper and lower extents of the plot. (eg if measuring relative humidity, a RANGE value of 50 with a MIDPOINT of 50 will give a graphical display range of 0 to 100 %, ie the MIDPOINT +/- the RANGE). Acceptable values for the RANGE must be within 0 to 99999. With the judicious selection of the MIDPOINT and RANGE settings, visual resolution of the Quick-Graph display can be optimized.

COMMENT: A line of general user comments for annotation of each APB

channel can be entered here. These notes can be an invaluable reference when reviewing historical Quick-Graph sessions.

When all channels are configured as desired, delete extra unused APB channels by pressing D-ELETE while the unused channel is displayed on the screen. Verification of the deletion is evident by a corresponding decrease in the 'Channel X of Y...' display on the editing screen. Then S-AVE the APB file (it will be saved under the filename specified as the DESTINATION file in the previous screen).

QUICK-GRAPHING THE DOWNLOAD FILE:

To Quick-Graph data contained within a Download file, select <Q> Quick-Graph from the **MAIN MENU**. From the displayed **QUICK-GRAPH SETUP MENU**, specify the filename (and path) for the Download file to be used as well as the APB file to use for the graphical display. Optionally, a T-ITLE for the graph can be entered. This Title will be displayed at the top of the graph and on the print-out if selected. From this **SETUP MENU**, an X-PANSION level can also be specified. This Expansion level varies the Time Base used during the display of data resulting in a 'zoom' effect.

Select Q-UICK-GR and the screen will advance to the **SESSION SELECTION MENU**. A single Download file may contain multiple logging sessions. Utilize the Session Selection Buttons to review and select the particular session from within the specified Download file to Quick-Graph. If only one session is contained within the Download file, merely press S-ELECT to initiate Quick-Graphing.

If any errors exist in the APB file (eg in the equation entry or syntax) the graph will not start and an error message will be displayed. The most common error message displayed will be 'Expression error in APB file'. This indicates that an error exists in the FORMULA section of the APB file. If an error occurs, reopen the APB file (G-RAPH CONFG from the **MAIN MENU**) and scrutinize the FORMULA section for syntax or algebraic operator errors. Correct any errors and repeat the above Quick-Graph procedure.

CURSOR CONTROL:

When the Quick-Graph mode is first entered, the PC will plot data as fast as it can to the screen. In this fast plot mode, the cursor is hidden at the top of the screen. By pressing the DOWN ARROW key, a cursor will come on the screen and the plot will stop. The cursor can then be positioned over data that is of interest and actual values (including time) will be displayed on the cursor update line just below the reverse video TAG line.

The Up and Down Arrow keys and the Page Up and Page Down keys allow for movement of the cursor. To continue plotting new data from the file, press the END key and the cursor will drop to the end of the plot and new data will start appearing on the screen at a rate slightly less than the initial graphing mode.

PRINTER CONTROL:

To generate a hardcopy (print-out) of the graph, the printer can be toggled ON and OFF with the F2 key. Epson compatible dot matrix printers are currently supported by the OM-220 Communications program.

SPECIAL QUICK-GRAPH NOTES:

At any time, the plot can be terminated by pressing the <ESC> key. During Quick-Graphing, the Download file is not modified in any way.

If data is plotted from channels with different sample rates, a time base is used that will allow for plotting of all data. For example, if one channel of data (within the Download file) had been recorded at 1 sample every 2 minutes and another at one sample every 5 minutes, a one minute time base will be automatically selected for the Quick-Graph display.

When data is plotted from data channels that have been logged at different sample rates, the rate of data plotting will be determined by the faster channel. The slower channel will continue to show the value of the last actual sample taken preceded by a question mark in the cursor display line. This question mark then indicates to the user that the actual value of this channel may have changed however, due to the sample rate specified, the data has not yet been updated.

If extreme differences exist between the fastest and slowest plotted APB channel sample rates (eg 1 sample/sec and 1 sample per hour), graph discontinuities will result. However, in almost all real-world applications this extreme difference in sample rates would never exist.

When Quick-Graphing, every data point is plotted. No spikes or anomalies captured by the OM-220 will be averaged or omitted.

When Quick-Graphing an EVENT channel, another fixed Sample Rate channel must be graphed concurrently (ie event channel(s) cannot be displayed alone). Event channels should always have their sample rates set slower than the fastest non-event input channel in order to achieve optimum Quick-Graph performance (refer to DPIM-2 instruction sheet). The display of a fixed Sample Rate channel along with the event channel(s) provides a consistent time base for the graphing process.

5.3 TRACKING DATA; SCROLL-TRACKING MODE

In SCROLL-TRACKING MODE, data is taken from the OM-220 inputs and transmitted to the PC on a Real Time basis (i.e. as data samples are taken from the I/M's, the data is immediately communicated to the PC through the selected serial communication link). This allows the user to see the sampled inputs scrolling up the display as they are scanned by the OM-220 (FIG 5.1).

Optionally, at the User's prompt, the data can be simultaneously saved to a Download file within the PC and/or printed as the readings are taken. As in the STORE mode, this Download file can then be converted at a later time to a spreadsheet format or used with Quick-Graph (SECTION 5.2.5) for an immediate graphical review of the data.

Three steps are required to perform a SCROLL-TRACKING MODE logging session:

Set-up the OM-220 Hardware

Configure a SCROLL TRACK Algebraic Processing Blocks (APB)

Establish the Communication link and TRACK the data to the PC display and printer

Detailed procedures for each of the above steps follow:

5.3.1 OM-220 HARDWARE SET-UP

INPUT MODULES:
Turn OFF the System Power and plug the desired I/M's into the I/M ports insuring that they are properly aligned in the guides and that they insert fully.

Set the I/M front panel switches for the desired Sample Rates, type of sensor, etc. Refer to the individual I/M instruction sheets (SECTION 3.3.2) for detailed instructions.

Route the sensor/signal wiring through the fittings and wiring holes in the bottom of the OM-220 box and connect them to the appropriate wiring connections on the I/M terminal strips. Refer to the detailed Instruction sheets for the I/M's used in SECTION 3.3.2.

SYSTEM BASE:
Configure the Front Panel System Switches as follows:

BAUD RATE: 9600 (or other)
TRACK/STORE: STORE
SLOW ADC/FAST ADC: User's Choice
REMOTE/LOCAL: LOCAL (initially)
SYSTEM POWER: ON

Configure the Port 1 and Port 2 Internal System Switches as desired for any special logging functions (eg Roll-over memory, Deg C/F, Burst Mode, etc). Refer to SECTION 3.2.7 and SECTION 6 for details on configuration of these switch settings.

********** NOTE **********

For basic logging applications and while gaining familiarity with the OM-220, setting all of the Internal System Switches OFF will allow for normal operation of the OM-220 under RS-232 Communication mode that will meet most application needs.

****

Set the system clock date and time (if incorrect).

Perform a System RESET with the RESET/CLEAR and STOP LOGGING buttons. Clear memory if the data in memory has been downloaded successfully or is of no value. (refer to SECTION 3.2.4)

Press the MONITOR button on each active I/M channel to verify sensor wiring, sample rates, etc.

Press the STATUS/TIME button and review all system parameters for proper set-up and operation.

5.3.2 CONFIGURE THE SCROLL TRACK SCREEN AND APBS

OVERVIEW:

In order to use the SCROLL TRACK mode, the User must first build an Algebraic Processing Block (APB) file that is utilized by the OM-220 Communications program during SCROLL TRACKING. As the OM-220 transmits readings to the PC via the serial data communication link, the data is received and routed through this APB file before displaying the data on the PC screen.

This simply built APB file contains information on the number of channels to display, any algebraic manipulations to perform on the data prior to display (eg inter-channel calculations, units conversion, offsets, etc) and Tag names used to title the columns of data.

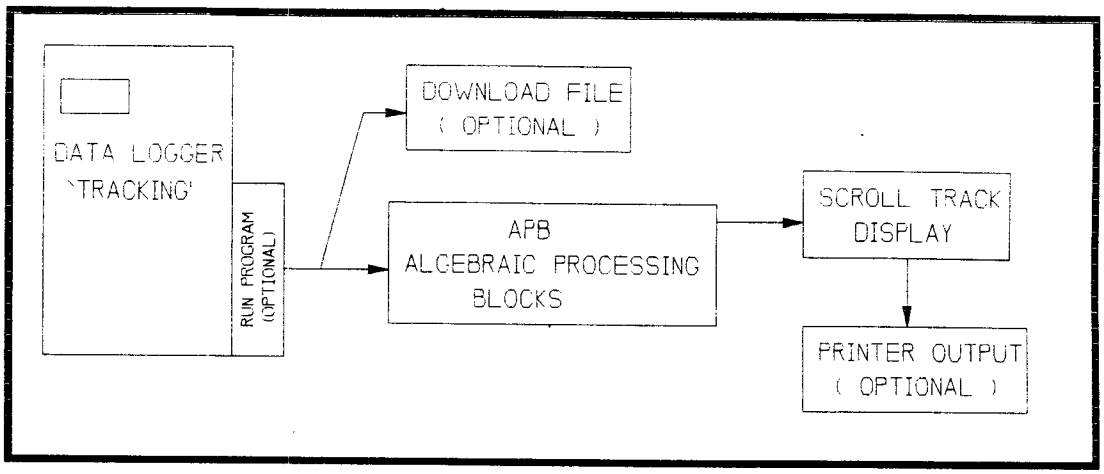

FIGURE 5.7: DATA FLOW DURING SCROLL TRACKING SESSION

CONSTRUCTING A SCROLL - TRACK SCREEN APB:

Within OC, from the **MAIN MENU**, select <S> S-CROLL CONFIGURE. OC will advance to the **SCROLL TRACK SETUP MENU**.

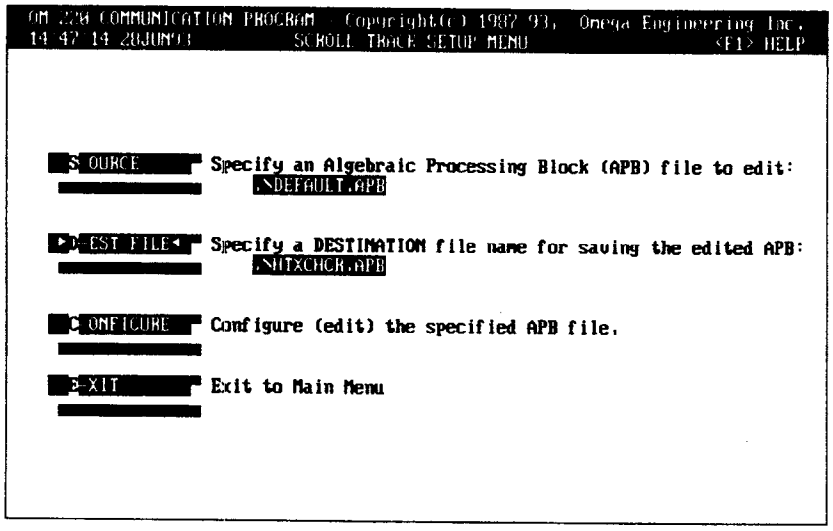

FIGURE 5.8: SCROLL-TRACK SETUP MENU

Press <S> SOURCE to specify an existing APB file to load and edit. Press <D> DESTINATION to specify the filename under which to save the edited APB. (This method of

SOURCE and DESTINATION specification readily allows for loading and editing of an existing file and saving under a new filename.) The supplied DEFAULT file is supplied as a SOURCE file that can serve as a good starting point for generation of APBs. Save the resulting APBs to filenames other than DEFAULT so that the DEFAULT file is maintained as a consistent SOURCE file from which to build other APBs.

When specifying SOURCE and DESTINATION filenames, a different Drive and/or Path can be specified (eg A:\BITLOG\APB\DELTAT). When loading APBs using the pop-up directory, use the <F2> Function key to change Drives and Paths.

After specifying the SOURCE and DESTINATION filenames, press <C> CONFIGURE and OC will advance to the **APB EDITING MENU** from which the editing of individual APB Channels is performed.

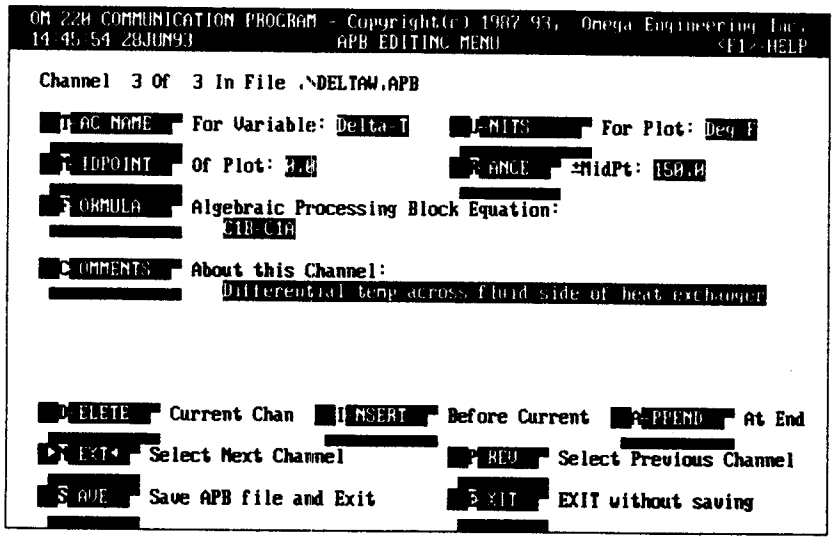

FIGURE 5.9: APB EDITING MENU

During a SCROLL-TRACK session, as the OM-220 takes readings from active channels and sends them to the PC, the readings are routed through the APB file. The APB file algebraically processes the incoming data and displays it in columnar numerical format on the screen.

An APB channel must exist for each channel that is to be DISPLAYED during the Scroll-Track function. However, it is not necessary to use all of the active OM-220 channels during a Scroll-Track session. Conversely, a single active channel could be used and displayed by several APB channels simultaneously. (e.g. a single temperature channel from a OM-220 could be fed into three different APB display channels that would display this single channel data in Degrees C, Degrees F, and a Delta-T relative to another channel).

On the **APB EDITING MENU**, the APB Channel currently being edited is displayed in the upper left section of the screen in the format 'Channel X of Y in File...'. Use the functions at the bottom of the Menu to Append, Delete, and Insert APB Channels as well as to move from one to another. The Scroll-Track screen format can display from 1 to 8 APB Channels simultaneously.

For each APB channel desired, only two of the six User defined entries on the APB EDITING MENU must be completed (TAG and FORMULA), however if ALL of the entries are completed, the APB can also be used during Quick-Graph (SECTION 5.2.5) and for Graphic-Tracking (SECTION 5.5). Explanations for the entries follow:

TAG: A short (8 characters maximum) name-tag for the channel (eg INPUT, OUTPUT, TEMP, PRESSURE). This TAG will be displayed as a column heading during Scroll-Track.

FORMULA: A mathematical expression whose result is displayed on the screen during Scroll-Tracking. These FORMULAS consist of:

CHANNEL NUMBER: A Channel Number which references an active OM-220 channel during logging. The Channel format consists of the letter 'C' followed by the Input Module Port number (1-4) and the Input Module letter channel (A or B for two channel Input Modules and A, B, C, or D for four channel Input Modules). For example, C1A, C4D, etc.

DECIMAL SPECIFICATION: A decimal place specification for the precision of the displayed result. If none is specified, the display defaults to two significant digits to the right of the decimal point.

EQUATION: The actual equation which can contain algebraic operators such as multiply, divide, exponentiation, etc. If no equation is supplied (e.g. the Formula is 'C2A)', then the Channel is passed directly through for display without any algebraic manipulation. For example the APB Formula to calculate the difference between two active channels scanning temperature inputs (e.g. thermocouples) on Channel 1A and 1B would be entered as follows:

C1B-C1A

Additional examples of Formulas and a listing of the algebraic operators available with syntax specified are included in APPENDIX K.

UNITS: (not required for Scroll-Track) A short (8 characters maximum) title for units of measure for that particular channel (eg VOLTS, PSI, GPM). The UNITS title is used for print-outs during Graphic-Tracking and Quick-Graph.

MIDPOINT: (not required for Scroll-Track) Enter the value desired for the mid-scale value for that channel's plot. (eg if measuring relative humidity, a midpoint value of 50% may be chosen). Acceptable values for the MIDPOINT must be in the range of +/- 99999. The MIDPOINT entry is used during Graphic-Tracking and Quick-Graph displays.

RANGE: (not required for Scroll-Track) Enter a magnitude value for the upper and lower extents of the plot. (eg if measuring relative humidity, a RANGE value of 50 with a MIDPOINT of 50 will give a graphical display range of 0 to 100 %, ie the MIDPOINT +/- the RANGE). Acceptable values for the RANGE must be within 0 to 99999. The RANGE entry is used during Graphic-Tracking and Quick-Graph displays. With the judicious selection of the MIDPOINT and RANGE settings, visual resolution of the Graphic-Tracking and/or Quick-Graph

display can be optimized.

COMMENT: (optional) A line of general user comments for annotation of each APB channel can be entered here. These notes can be an invaluable reference when reviewing historical APB files.

When all channels are configured as desired, delete extra unused APB channels by pressing D-ELETE while the unused channel is displayed on the screen. Verification of the deletion is evident by a corresponding decrease in the 'Channel X of Y...' display on the editing screen. Then S-AVE the APB file (it will be saved under the filename specified as the DESTINATION file in the previous screen).

5.3.3 ESTABLISH THE SERIAL LINK AND START LOGGING DATA

SCROLL TRACKING of data to the PC from the OM-220 is done while running the OM-220 Communications (OC) software on the PC. Follow the steps outlined in SECTION 4 to establish a serial link (RS-232, Modem, or RS-485) and advance to display the **COMMUNICATION MENU**.

********** NOTE **********

If utilizing an RS-232 serial link between the OM-220 and the PC, it is necessary to switch the OM-220 REMOTE/LOCAL switch into the REMOTE position and perform a System RESET to enable the OM-220 serial communication circuitry. When in the REMOTE mode, the OM-220 display will indicate 'REMOTE CTRL MODE; READY'.

****

To initiate the SCROLL TRACKING MODE logging session, from the **COMMUNICATION MENU** of OC, select <T> Start TRACKing data to the screen... and OC will advance to the **TRACK SETUP MENU**.

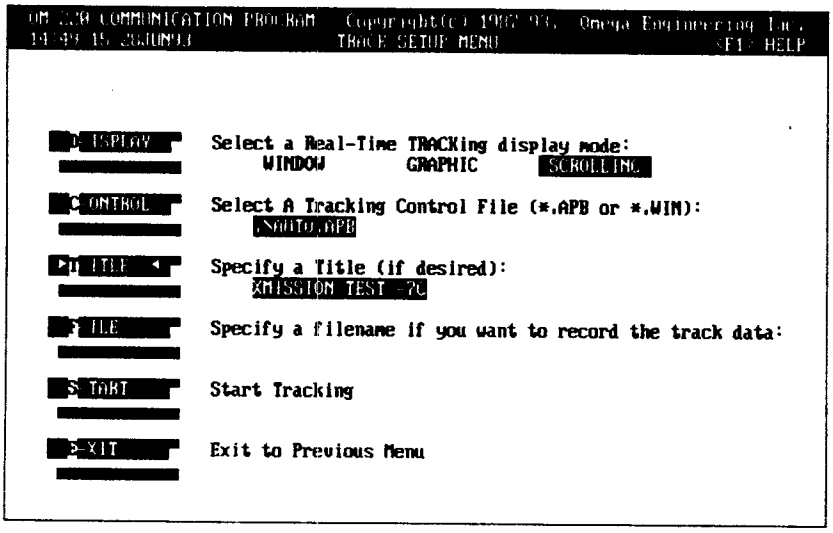

FIGURE 5.10: TRACK SETUP MENU

Press <D> to sequence through the options and highlight SCROLLING as the TRACKING display mode.

Press <C> C-ONTROL and select the previously developed APB file to use during the SCROLL-TRACKING session (SECTION 5.3.2).

If it is desired to save the logging data in a Download file on the PC for later conversion to a spreadsheet format and/or use with Quick-Graph (SECTIONS 5.2.4 and 5.2.5), press <F> F-ILE and enter a filename (and optionally Drive/Path specification if different than the default) into which to save the data.

********** NOTE **********

Entering a filename under this F-ILE entry enables the storage of Track data to disk. Before starting an extended TRACK session with simultaneous recording to a file on disk, insure that sufficient disk space exists.

****

To start the SCROLL-TRACKING session, press <S> S-TART and the PC will receive and display the current OM-220 Channel configuration. If the configuration is correct, enter <Y> Yes and the data will begin scrolling up the page with the OM-220 Time displayed at the far left of each line of data. Use the displayed commands to toggle the printer ON and OFF <F2>, or terminate logging <ESC>.

********** NOTE **********

If any errors exist in the APB file (eg in the equation entry or syntax) the SCROLL-TRACKING session will not start and an error message will be displayed. The most common error message displayed will be 'Expression error in APB file'. This indicates that an error exists in the FORMULA section of the APB file. If an error occurs, reopen the APB file (S-CROLL CONFG from the MAIN MENU) and scrutinize the FORMULA section for syntax or algebraic operator errors. Correct any errors and repeat the above SCROLL-TRACK initiation procedure.

****

5.4 TRACKING DATA; WINDOW-TRACKING MODE

In WINDOW-TRACKING MODE, data is taken from the OM-220 inputs and transmitted to the PC on a Real Time basis (ie as data samples are taken from the I/M's, the data is immediately communicated to the PC through the serial communication link). WINDOW TRACKING mode allows the user to view up to 16 channels of data in a User customized Annunciator Panel type PC display as the data is continually updated by the OM-220 (FIGURE 5.2).

The User creates these custom screens for data display by creating and merging two files; a CUSTOM SCREEN LAYOUT file (created using the integral graphic editor) which contains text and graphic information to be displayed in addition to the data and an ALGEBRAIC PROCESSING BLOCK (APB) file which contains the algebraic equations (scaling, units conversion, etc) for each channel to be displayed. The combined SCREEN and APB files result in a completed WINDOW TRACKING file.

Optionally, during WINDOW TRACKING, at the User's prompt, the sampled data can be simultaneously saved to a Download file within the PC as the OM-220 readings are taken. As in the STORE mode, this Download file can then be converted at a later time to a spreadsheet or used with Quick-Graph for an immediate graphical review of the data.

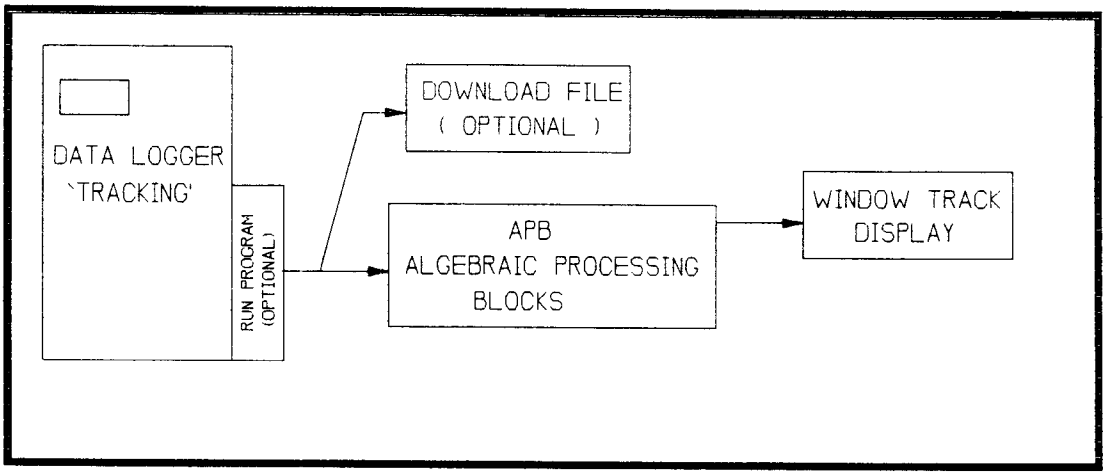

FIGURE 5.11: DATA FLOW DURING A WINDOW TRACKING SESSION

A sequence of three steps are performed to execute a WINDOW TRACKING logging session:

Set-up the OM-220 Hardware

Construct a WINDOW TRACKING file set from within OC

Establish the Comm link and TRACK the data to the PC display and printer

Details for each of the above steps follow:

5.4.1 OM-220 HARDWARE SET-UP

INPUT MODULES:
Turn OFF the System Power and plug the desired I/M's into the I/M ports insuring that they are properly aligned in the guides and that they insert fully.

Set the I/M front panel switches for the desired Sample Rates, type of sensor, etc. Refer to the individual I/M instruction sheets (SECTION 3.3.2) for detailed instructions.

Route the sensor/signal wiring through the fittings and wiring holes in the bottom of the OM-220 box and connect them to the appropriate wiring connections on the I/M terminal strips. Refer to the detailed Instruction sheets for the I/M's used in SECTION 3.3.2.

SYSTEM BASE:
Configure the Front Panel System Switches as follows:

BAUD RATE: 9600 (or other)
TRACK/STORE: STORE
SLOW ADC/FAST ADC: User's Choice
REMOTE/LOCAL: LOCAL (initially)
SYSTEM POWER: ON

Configure the Port 1 and Port 2 Internal System Switches as desired for any special logging functions (eg Roll-over memory, Deg C/F, Burst Mode, etc). Refer to SECTION 3.2.7 and SECTION 6 for details on configuration of these switch settings.

********** NOTE **********
For basic logging applications and while gaining familiarity with the OM-220, setting all of the Internal System Switches OFF will allow for normal operation of the OM-220 under RS-232 Communication mode that will meet most application needs.
****

5.4.2 CONSTRUCT A WINDOW TRACKING FILE SET:

OVERVIEW:

Three steps are required to construct a WINDOW TRACKING File Set that can be used in the WINDOW TRACKING mode:

Construct an APB file

Construct a Graphic display SCREEN LAYOUT file

Merge the APB and SCREEN LAYOUT files into a WINDOW-TRACKING file set.

CONSTRUCTING THE WINDOW-TRACKING APB FILE:

Within OC, from the **MAIN MENU**, select <W> W-INDOW CONFG and OC will advance to the **WINDOW TRACK SETUP MENU**.

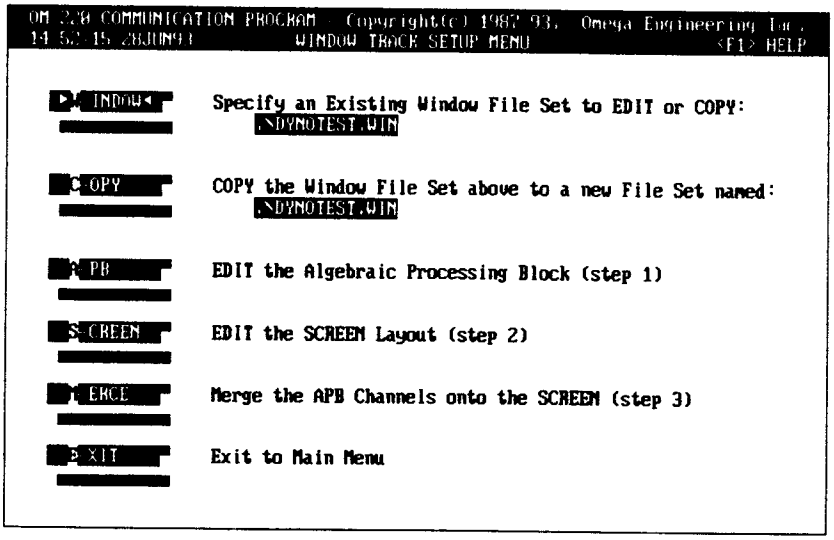

FIGURE 5.12: WINDOW TRACK SETUP MENU

Select <W> W-INDOW and choose an existing WINDOW File Set to edit or copy. If this WINDOW File Set is to be saved (after editing) to a different WINDOW File Set, then select <C> C-OPY and specify the new WINDOW File Set filename under which it will be saved. Specify Drives and Path specifications as desired to locate files.

Typically, if generating a new WINDOW File Set, the DEFAULT file will be selected under <W> (as the DEFAULT file serves as a good starting point) and a new User desired filename will be specified under <C>.

********** NOTE **********

The WINDOW File Set filename specified will be used in the generation of three files:

The master WINDOW File Set (*.WIN)
The WINDOW APB file (*.APB)
The WINDOW SCREEN file (*.SCN)

In the construction of these three files under the WINDOW TRACK SETUP menu, OC will automatically assign the same filename to each (eg TEST.WIN, TEST.APB, and TEST.SCN). Since these three files are all required and operate in concert, it is advisable to locate all WINDOW type support files in one directory...separate from the other APBs generated for Quick-Graph, Scroll-Track, and Graph-Track.

****

After specifying the W-INDOW and C-OPY filenames, press <A> A-PB and OC will advance to the **APB EDITING MENU** from which the editing of individual APB Channels is performed.

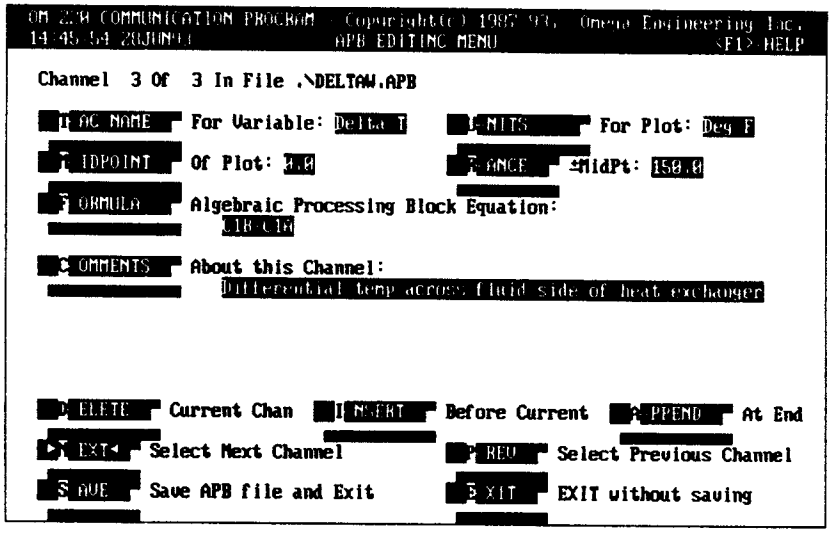

FIGURE 5.13: APB EDITING MENU

During a WINDOW-TRACK session, as the OM-220 takes readings from active channels and sends them to the PC, the readings are routed through the APB file. The APB file algebraically processes the incoming data and displays it within the graphic SCREEN layout (to be discussed) on the screen.

An APB channel must exist for each channel that is to be DISPLAYED during the WINDOW-TRACK function. However, it is not necessary to use all of the active OM-220 channels during a WINDOW-TRACK session. Conversely, a single active channel could be used and displayed by several APB channels simultaneously. (e.g. a single temperature channel from a OM-220 could be fed into three different APB display channels that would display this single channel data in Degrees C, Degrees F, and a Delta-T relative to

another channel).

On the **APB EDITING MENU**, the APB Channel currently being edited is displayed in the upper left section of the screen in the format 'Channel X of Y in File...'. Use the functions at the bottom of the Menu to Append, Delete, and Insert APB Channels as well as to move from one to another. The WINDOW-TRACK screen format can display from 1 to 16 APB Channels simultaneously.

For each APB channel desired, only two of the six User defined entries on the **APB EDITING MENU** must be completed (TAG and FORMULA), however if ALL of the entries are completed, the APB can also be used during Quick-Graph (SECTION 5.2.5) and for Graphic-Tracking (SECTION 5.5). Explanations for the entries follow:

TAG: A short (8 characters maximum) name-tag for the channel (eg INPUT, OUTPUT, TEMP, PRESSURE). In WINDOW-TRACK, this TAG is used during the process of locating the APB data channel on the Graphic Screen (following section).

FORMULA: A mathematical expression whose result is displayed on the screen during WINDOW-TRACKING. These FORMULAS consist of:

CHANNEL NUMBER: A Channel Number which references an active OM-220 channel during logging. The Channel format consists of the letter 'C' followed by the Input Module Port number (1-4) and the Input Module letter channel (A or B for two channel Input Modules and A, B, C, or D for four channel Input Modules). For example, C1A, C4D, etc.

DECIMAL SPECIFICATION: A decimal place specification for the precision of the displayed result. If none is specified, the display defaults to two significant digits to the right of the decimal point.

APB EQUATION: The actual equation which can contain algebraic operators such as multiply, divide, exponentiation, etc. If no equation is supplied (e.g. the Formula is 'C2A)', then the Channel is passed directly through for display without any algebraic manipulation. For example the APB Formula to calculate the difference between two active channels scanning temperature inputs (e.g. thermocouples) on Channel 1A and 1B would be entered as follows:

C1B-C1A

Additional examples of Formulas and a listing of the algebraic operators available with syntax specified are included in APPENDIX K.

UNITS: (not required for WINDOW-TRACK) A short (8 characters maximum) title for units of measure for that particular channel (eg VOLTS, PSI, GPM). The UNITS title is used for print-outs during Graphic-Tracking and Quick-Graph.

MIDPOINT: (not required for WINDOW-TRACK) Enter the value desired for the mid-scale value for that channel's plot. (eg if measuring relative humidity, a midpoint value of 50% may be chosen). Acceptable values for the MIDPOINT

must be in the range of +/- 99999. The MIDPOINT entry is used during Graphic-Tracking and Quick-Graph displays.

RANGE: (not required for WINDOW-TRACK) Enter a magnitude value for the upper and lower extents of the plot. (eg if measuring relative humidity, a RANGE value of 50 with a MIDPOINT of 50 will give a graphical display range of 0 to 100 %, ie the MIDPOINT +/- the RANGE). Acceptable values for the RANGE must be within 0 to 99999. The RANGE entry is used during Graphic-Tracking and Quick-Graph displays. With the judicious selection of the MIDPOINT and RANGE settings, visual resolution of the Graphic-Tracking and/or Quick-Graph display can be optimized.

COMMENT: (optional) A line of general user comments for annotation of each APB channel can be entered here. These notes can be an invaluable reference when reviewing historical APB files.

When all channels are configured as desired, delete extra unused APB channels by pressing D-ELETE while the unused channel is displayed on the screen. Verification of the deletion is evident by a corresponding decrease in the 'Channel X of Y:..' display on the editing screen. Then S-AVE the APB file (it will be saved under the filename specified under the C-OPY selection in the previous screen).

CONSTRUCTING A GRAPHIC WINDOW DISPLAY SCREEN FILE:

After completing and saving the APB file, OC will return to the **WINDOW TRACK SETUP MENU**. Select <S> S-CREEN to advance into the WINDOW SCREEN EDITOR information screen. Pressing <ALT> advances the screen into the Editor.

USING THE SCREEN EDITOR:

At this time, text can be typed directly onto the screen and the cursor is moved about using the standard cursor control keys (arrows, PG UP, PG DOWN, HOME, END).

********** REMEMBER THIS **********
WHILE USING THE SCREEN EDITOR, PRESSING THE <ALT> KEY AT ANY TIME WILL BRING UP THE MENU OF COMMANDS. AS THROUGHOUT THE OC PROGRAM, PRESSING <F1> WILL PULL UP HELP SCREENS.
****

Standard alpha-numeric and graphic characters can be drawn on the screen to make fundamental graphical displays. To draw graphic characters, first display the available characters by pressing <ALT> C, then move the cursor to highlight the desired character and press the <ESC> key to load the selected character into a temporary memory buffer.

The screen will change back to the Users custom screen. To place the selected character, move the cursor to the desired location and press <SHIFT> arrow key and the character will be drawn.

Various colors, foregrounds, backgrounds, and blinking are all attributes that can be utilized for advanced SCREEN designs with the <ALT A> command from within the Screen Editor.

During the design of a custom SCREEN layout, it is recommended that the bottom line of the screen be left blank as it is obscured in the MERGE process (following step) with a command line.

The PC time can be displayed on the SCREEN layout (in addition to the Channel data) during WINDOW-TRACKing by the use of a string of tilde (~) characters. To display the time (HH:MM:SS format) at a particular location on the SCREEN layout, place 8 contiguous tilde characters at the desired time location (~~~~~~~~). This displayed time is updated every time the OM-220 sends new data to the PC.

********** NOTE **********

On some PC's without separate numerical keyboards (eg most laptops and notebooks) the PC manufacturers have overlayed the numerical keypad into the QWERTY keyboard as dual function keys. For these PCs, a different combination of key strokes is required to draw characters. In these cases, try NUM-LOCK with the ARROW key, or NUM-LOCK, SHIFT ARROW key, or NUM-LOCK, SHIFT, FN

****

While designing the custom display, leave the areas where each of the APB channels data is to be displayed, blank. Approximately 8 blank spaces is sufficient for most data formats and ranges.

When the screen is completed, press <ALT S> and the screen will be saved with the filename specified under C-OPY on the previous screen and the extension *.SCN.

MERGING THE WINDOW APB AND GRAPHIC SCREEN FILES:

The last step in building the WINDOW TRACKING File Set is to merge (combine) the previously built APB and SCREEN files into one master file set that can then be used in the WINDOW TRACKING mode.

From the **WINDOW TRACK SETUP MENU**, select <M> M-ERGE and OC will advance to display the previously designed Custom Graphic Screen along with a special Command Line at the bottom of the screen.

In the lower left corner, the first TAG from the related APB file is displayed. Using the cursor control arrow keys, move the cursor to the desired location for the named TAG data display. Locate the cursor at the location for the first character of the data display and press <F2>. The TAG name will now display at that location indicating that during a WINDOW-TRACK session, the data from that TAG APB channel will display on the screen at that location.

Repeat this step locating each of the APB channel TAGS at the desired locations until the 'MERGE COMPLETE' message appears on the screen. If all is correct, press <F3> to save the completed WINDOW TRACKING File Set. If changes are desired, the Merge process can be aborted with the <ESC> key and performed again.

5.4.3 ESTABLISH THE SERIAL LINK AND START LOGGING DATA

WINDOW-TRACKING of data to the PC from the OM-220 is done while running the OM-220 Communications (OC) software on the PC. Follow the steps outlined in SECTION 4 to establish a serial link (RS-232, Modem, or RS-485) and advance to display the **COMMUNICATION MENU**.

********** NOTE **********

If utilizing an RS-232 serial link between the OM-220 and the PC, it is necessary to switch the OM-220 REMOTE/LOCAL switch into the REMOTE position and perform a System RESET to enable the OM-220 serial communication circuitry. When in the REMOTE mode, the OM-220 display will indicate 'REMOTE CTRL MODE; READY'.

Refer to SECTION 4 for a detailed explanation on serial communication.

****

To initiate the SCROLL TRACKING MODE logging session, from the **COMMUNICATION MENU** of OC, select <T> Start TRACKing data to the screen... and OC will advance to the **TRACK SETUP MENU**.

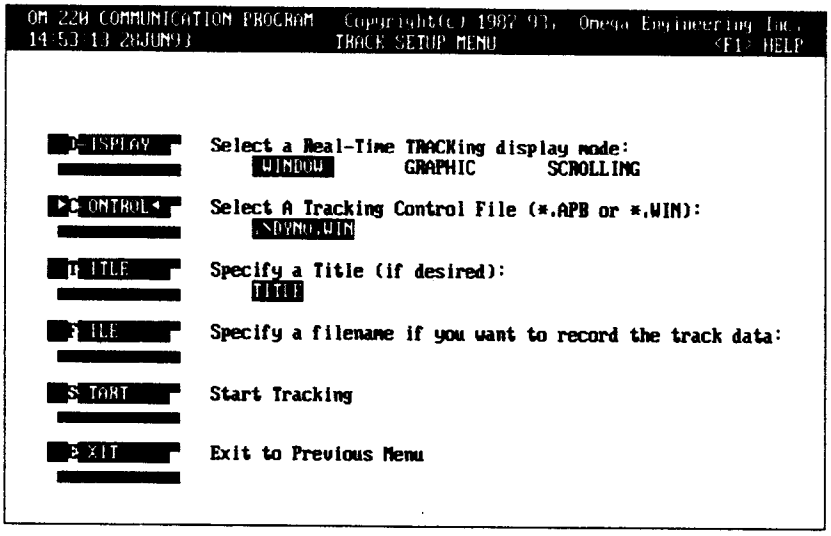

FIGURE 5.14: TRACK SETUP MENU

Press <D> to sequence through the options and highlight WINDOW as the TRACKING display mode.

Press <C> C-ONTROL and select the previously developed WINDOW-TRACKING file set to use during the WINDOW-TRACKING session.

The <T> T-ITLE selection is not used during WINDOW-TRACKING and has no effect on the operation.

If it is desired to save the logging data in a Download file on the PC for later conversion to a spreadsheet format and/or use with Quick-Graph (SECTIONS 5.2.4 and 5.2.5), press <F> F-ILE and enter a filename (and optionally Drive/Path specification if different than the default) into which to save the data.

********** NOTE **********

Entering a filename under this F-ILE entry enables the storage of Track data to disk. Before starting an extended TRACK session with simultaneous recording to a file on disk, insure that sufficient disk space exists.

****

To initiate the WINDOW-TRACK session, press <S> S-TART and the PC will receive and display the current OM-220 Channel configuration. If the configuration is correct, enter <Y> Yes and the PC screen will change to the custom design and data will start updating on the screen at the Sample Rates specified (SECTION 5.4.1). Press <ESC> to terminate logging.

While WINDOW-TRACKING, a SCROLL type printout can be simultaneously generated on a Epson compatible dot-matrix type printer by pressing the <F2> key. Pressing <F2> a second time toggles the printer OFF.

********** NOTE **********

If any errors exist in the APB file (eg in the equation entry or syntax) the WINDOW-TRACKING session will not start and an error message will be displayed. The most common error message displayed will be 'Expression error in APB file'. This indicates that an error exists in the FORMULA section of the APB file. If an error occurs, reopen the APB file (W-INDOW CONFG from the MAIN MENU, then A-PB) and scrutinize the FORMULA section for syntax or algebraic operator errors. Save the corrected APB file and repeat the above WINDOW-TRACK initiation procedure. After minor edits in the APB file (i.e. no additions/deletions of channels), it is not necessary to re-merge the SCREEN and APB files.

****

5.5 TRACKING DATA; GRAPH-TRACKING MODE

In GRAPH-TRACKING MODE, data is taken from the OM-220 inputs and transmitted to the PC on a Real Time basis (i.e. as data samples are taken from the I/M's, the data is immediately communicated to the PC through the selected serial communication link). This allows the user to see the sampled inputs plotted in a multi-pen strip chart display as they are read by the OM-220 (FIGURE 5.3).

Optionally, at the User's prompt, the data can be simultaneously saved to a Download file within the PC as the readings are taken. As in the STORE mode, this Download file can then be converted at a later time to a spreadsheet format or used with Quick-Graph (SECTION 5.2.5) for an immediate graphical review of the data.

Three steps are required to perform a GRAPH-TRACKING MODE logging session:

Set-up the OM-220 Hardware

Configure a GRAPH-TRACK Algebraic Processing Block (APB)

Start TRACKING the data to the PC display (and printer)

Detailed procedures for each of the above steps follow:

5.5.1 OM-220 HARDWARE SET-UP

INPUT MODULES:
Turn OFF the System Power and plug the desired I/M's into the I/M ports insuring that they are properly aligned in the guides and that they insert fully.

Set the I/M front panel switches for the desired Sample Rates, type of sensor, etc. Refer to the individual I/M instruction sheets (SECTION 3.3.2) for detailed instructions.

Route the sensor/signal wiring through the fittings and wiring holes in the bottom of the OM-220 box and connect them to the appropriate wiring connections on the I/M terminal strips. Refer to the detailed Instruction sheets for the I/M's used in SECTION 3.3.2.

SYSTEM BASE:
Configure the Front Panel System Switches as follows:

BAUD RATE: 9600 (or other)
TRACK/STORE: STORE
SLOW ADC/FAST ADC: User's Choice
REMOTE/LOCAL: LOCAL (initially)
SYSTEM POWER: ON

Configure the Port 1 and Port 2 Internal System Switches as desired for any special logging functions (eg Roll-over memory, Deg C/F, Burst Mode, etc). Refer to SECTION 3.2.7 and SECTION 6 for details on configuration of these switch settings.

********** NOTE **********
For basic logging applications and while gaining familiarity with the OM-220, setting all of the Internal System Switches OFF will allow for normal operation of the OM-220 under RS-232 Communication mode that will meet most application needs.
****

Set the system clock date and time (if incorrect).

Perform a System RESET with the RESET/CLEAR and STOP LOGGING buttons. Clear memory if the data in memory has been downloaded successfully or is of no value. (SECTION 3.2.4)

Press the MONITOR button on each active I/M channel to verify sensor wiring, sample rates, etc.

Press the STATUS/TIME button and review all system parameters for proper set-up and operation.

5.5.2 CONFIGURE THE GRAPH-TRACK APB

OVERVIEW:
In order to use the GRAPH-TRACK mode, the User must first build an Algebraic Processing Block (APB) file that is utilized by the OM-220 Communications program during GRAPH-TRACKING. As the OM-220 transmits readings to the PC via the serial data communication link, the data is received and routed through this APB file before displaying the data on the PC screen.

This simply built APB file contains information on the number of channels to display, the Ranges and Midpoints for plotting, any algebraic manipulations to perform on the data prior to display (eg inter-channel calculations, units conversion, offsets, etc) and Tag names used to title the columns of data.

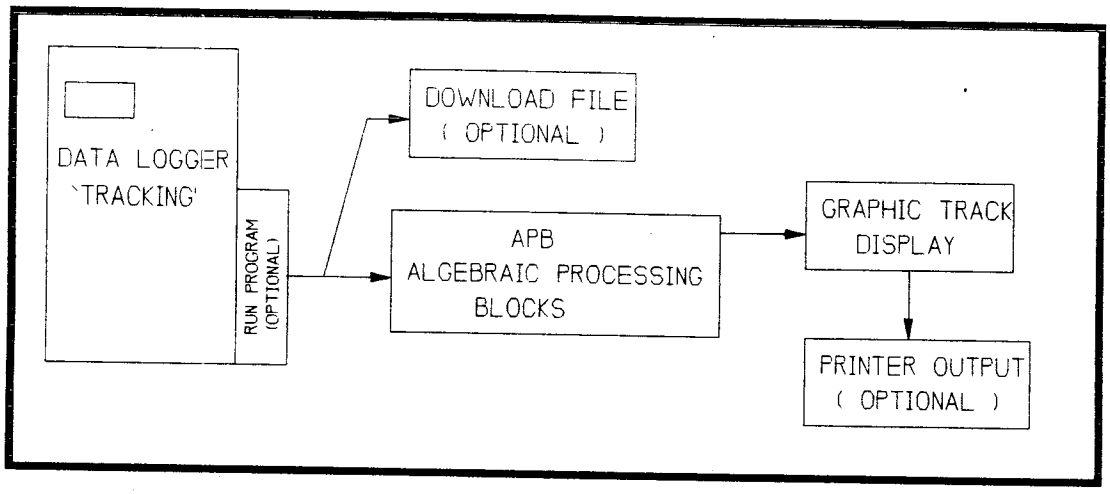

FIGURE 5.15: DATA FLOW DURING GRAPH-TRACKING SESSION

CONSTRUCTING A GRAPH-TRACK SCREEN APB:
Within OC, from the **MAIN MENU**, select <G> G-RAPH CONFIGURE. OC will advance to the **GRAPH SETUP MENU**.

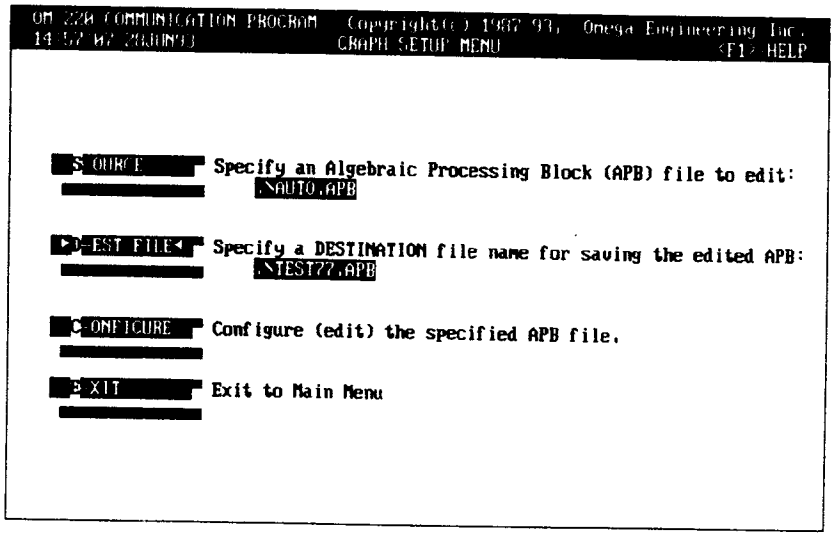

FIGURE 5.16: GRAPH SETUP MENU

Press <S> SOURCE to specify an existing APB file to load and edit. Press <D> DESTINATION to specify the filename under which to save the edited APB. (This method of

SOURCE and DESTINATION specification readily allows for loading and editing of an existing file and saving under a new filename.) The supplied DEFAULT file is supplied as a SOURCE file that can serve as a good starting point for generation of APBs. Save the resulting APBs to filenames other than DEFAULT so that the DEFAULT file is maintained as a consistent SOURCE file from which to build other APBs.

When specifying SOURCE and DESTINATION filenames, a different Drive and/or Path can be specified (eg A:\BITLOG\APB\DELTAT). When loading APBs using the pop-up directory, use the <F2> Function key to change Drives and Paths.

After specifying the SOURCE and DESTINATION filenames, press <C> CONFIGURE and OC will advance to the **APB EDITING MENU** from which the editing of individual APB Channels is performed.

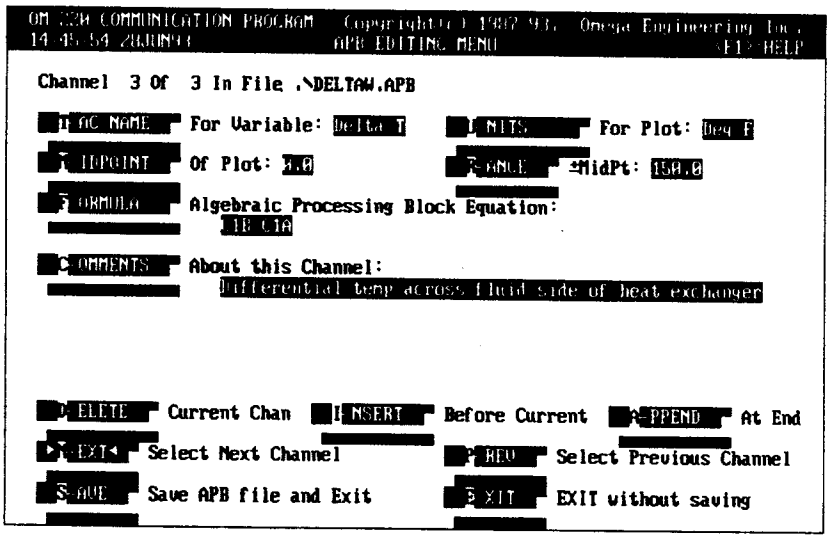

FIGURE 5.17: APB EDITING MENU

During a GRAPH-TRACK session, as the OM-220 takes readings from active channels and sends them to the PC, the readings are routed through the APB file. The APB file algebraically processes the incoming data and displays it in a multi-pen strip chart display format on the screen.

An APB channel must exist for each channel that is to be DISPLAYED during the GRAPH-TRACK function. However, it is not necessary to use all of the active OM-220 channels during a GRAPH-TRACK session. Conversely, a single active channel could be used and displayed by several APB channels simultaneously. (e.g. a single temperature channel from a OM-220 could be fed into three different APB display channels that would display this single channel data in Degrees C, Degrees F, and a Delta-T relative to another channel).

On the **APB EDITING MENU**, the APB Channel currently being edited is displayed in the upper left section of the screen in the format 'Channel X of Y in File...'. Use the functions at the bottom of the Menu to Append, Delete, and Insert APB Channels as well as to move from one to another. The GRAPH-TRACK screen format can display from 1 to 8 APB Channels simultaneously.

For each APB channel desired, six User defined entries are to be made. Explanations of each of the entries follow:

TAG: A short (8 characters maximum) name-tag for the channel (eg INPUT, OUTPUT, TEMP, PRESSURE). This TAG will be displayed as a column heading during GRAPHIC-TRACKING.

FORMULA: A mathematical expression whose result is displayed on the screen during GRAPHIC-TRACK. These FORMULAS consist of:

CHANNEL NUMBER: A Channel Number which references an active OM-220 channel during logging. The Channel format consists of the letter 'C' followed by the Input Module Port number (1-4) and the Input Module letter channel (A or B for two channel Input Modules and A, B, C, or D for four channel Input Modules). For example, C1A, C4D, etc.

DECIMAL SPECIFICATION: A decimal place specification for the precision of the displayed result. If none is specified, the display defaults to two significant digits to the right of the decimal point.

APB EQUATION: The actual equation which can contain algebraic operators such as multiply, divide, exponentiation, etc. If no equation is supplied (e.g. the Formula is 'C2A)', then the Channel is passed directly through for display without any algebraic manipulation. For example the APB Formula to calculate the difference between two active channels scanning temperature inputs (e.g. thermocouples) on Channel 1A and 1B would be entered as follows:

C1B-C1A

Additional examples of Formulas and a listing of the algebraic operators available with syntax specified are included in APPENDIX K.

UNITS: A short (8 characters maximum) title for units of measure for that particular channel (eg VOLTS, PSI, GPM). The UNITS title is used during print-out of GRAPHIC-TRACK.

MIDPOINT: Enter the value desired for the mid-scale value for that channel's visual plot. (eg if measuring relative humidity, a midpoint value of 50% may be chosen). Acceptable values for the MIDPOINT must be in the range of +/- 99999.

RANGE: Enter a magnitude value for the upper and lower extents of the plot. (eg if measuring relative humidity, a RANGE value of 50 with a MIDPOINT of 50 will give a graphical display range of 0 to 100 %, ie the MIDPOINT +/- the RANGE). Acceptable values for the RANGE must be within 0 to 99999. With the judicious selection of the MIDPOINT and RANGE settings, visual resolution of the GRAPHIC-TRACK display can be optimized.

COMMENT: A line of general user comments for annotation of each APB

channel can be entered here. These notes can be an invaluable reference when reviewing historical GRAPHIC-TRACK sessions.

When all channels are configured as desired, delete extra unused APB channels by pressing D-ELETE while the unused channel is displayed on the screen. Verification of the deletion is evident by a corresponding decrease in the 'Channel X of Y...' display on the editing screen. Then S-AVE the APB file (it will be saved under the filename specified as the DESTINATION file in the previous screen).

5.5.3 ESTABLISH THE SERIAL LINK AND START LOGGING DATA

GRAPHIC-TRACKING of data to the PC from the OM-220 is done while running the OM-220 Communications (OC) software on the PC. Follow the steps outlined in SECTION 4 to establish a serial link (RS-232, Modem, or RS-485) and advance to display the **COMMUNICATION MENU**.

********** NOTE **********

If utilizing an RS-232 serial link between the OM-220 and the PC, it is necessary to switch the OM-220 REMOTE/LOCAL switch into the REMOTE position and perform a System RESET to enable the OM-220 serial communication circuitry. When in the REMOTE mode, the OM-220 display will indicate 'REMOTE CTRL MODE; READY'.

Refer to SECTION 4 for a detailed explanation on serial communication.

****

To initiate the GRAPHIC-TRACKING logging session, from the **COMMUNICATION MENU** of OC, select <T> Start TRACKing data to the screen... and OC will advance to the **TRACK SETUP MENU**.

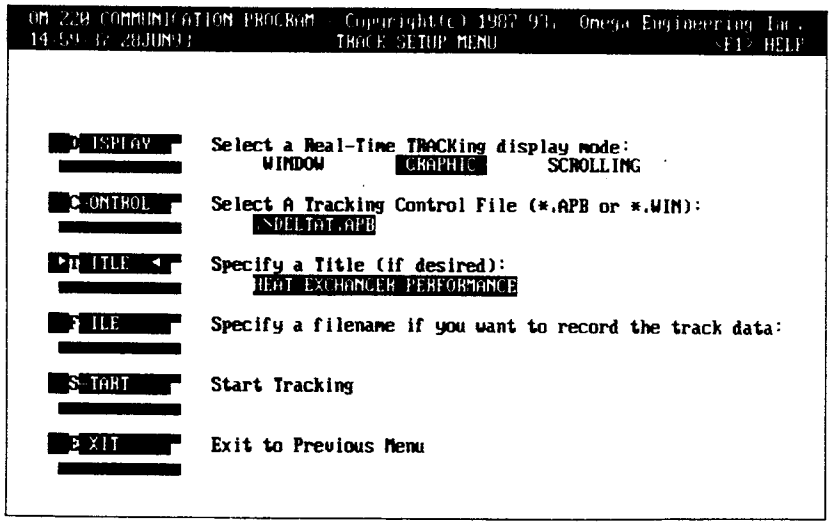

FIGURE 5.18: TRACK SETUP MENU

Press <D> to sequence through the options and highlight GRAPHIC as the TRACKING display mode.

Press <C> C-ONTROL and select the previously developed APB file to use during the GRAPH-TRACKING session (SECTION 5.3.2).

Press <T> T-ITLE to optionally specify a TITLE to be displayed on the screen (and printout) during the GRAPH-TRACK session.

If it is desired to save the logging data in a Download file on the PC for later conversion to a spreadsheet format and/or use with Quick-Graph (SECTIONS 5.2.4 and 5.2.5), press <F> F-ILE and enter a filename (and optionally Drive/Path specification if different than the default) into which to save the data.

********** NOTE **********

Entering a filename under this F-ILE entry enables the storage of Track data to disk. Before starting an extended TRACK session with simultaneous recording to a file on disk, insure that sufficient disk space exists.

****

To start the GRAPH-TRACKING session, press <S> S-TART and the PC will receive and display the current OM-220 Channel configuration. If the configuration is correct, enter <Y> Yes and the data will begin plotting down the screen with the OM-220 Time displayed periodically at the far left. Use the displayed commands to toggle the printer ON and OFF <F2>, or terminate logging <ESC>.

********** NOTE **********

If any errors exist in the APB file (eg in the equation entry or syntax) the GRAPH-TRACKING session will not start and an error message will be displayed. The most common error message displayed will be 'Expression error in APB file'. This indicates that an error exists in the FORMULA section of the APB file. If an error occurs, reopen the APB file (G-RAPH CONFG from the MAIN MENU) and scrutinize the FORMULA section for syntax or algebraic operator errors. Correct any errors and repeat the above GRAPH-TRACK initiation procedure.

****

CURSOR CONTROL:

When the GRAPHIC-TRACK mode is first entered, the Cursor Bar follows the last data plotted and moves down the screen with each data update and corresponding plot from the OM-220. The Cursor Bar can be moved up and down on the data with the Up and Down Arrow keys or for larger steps the PGUP and PGDN keys. The Cursor Bar can then be positioned over data that is of interest and actual values (including time) will be displayed on the Cursor Update Line just below the reverse video TAG line.

To continually display the last data received from the OM-220, on the Cursor update line, press the END key and the cursor will drop to the end of the plot and advance with each receipt of data from the OM-220.

PRINTER CONTROL:
To generate a hardcopy (print-out) of the graph, the printer can be toggled ON and OFF with the F2 key. Epson compatible dot matrix printers are currently supported by the OM-220 Communications program.

SPECIAL GRAPH TRACK NOTES:

At any time, the plot can be terminated by pressing the <ESC> key.

If data is plotted from channels with different sample rates, a time base is automatically calculated and used that will allow for plotting of all data. For example, if one channel of data (coming from the OM-220) is being sampled at 1 sample every 2 minutes and another at one sample every 5 minutes, a one minute time base will be automatically selected for the Graphic Track display.

When data is plotted from data channels that are logging at different sample rates, the rate of data plotting will be determined by the faster channel. The slower channel will continue to show the value of the last actual sample taken preceded by a question mark in the cursor display line. This question mark then indicates to the user that the actual value of this channel may have changed however, due to the difference in sample rates specified, the data has not been yet been updated.

If extreme differences exist between the fastest and slowest plotted APB channel sample rates (eg 1 sample/sec and 1 sample per hour), graph discontinuities will result. However, in almost all real-world applications this extreme difference in sample rates would never exist.

Due to the asynchronous nature of Event data (from DPIM-2 Input Modules) when GRAPHIC TRACKING an EVENT channel, another fixed Sample Rate channel MUST be graphed concurrently (ie Event channel(s) cannot be displayed alone). Event channels (see the DPIM-2 instruction sheet) should always be set with sample rates slower than the fastest non-event channel for consistent graphing. The display of a fixed Sample Rate channel along with the Event channel(s) provides a consistent time base for the graphing process.

5.6 ADDITIONAL OM-220 CONTROL COMMANDS

The **COMMUNICATION MENU** has a number of additional commands (previously not discussed) available for interrogation and control of the OM-220. The **COMMUNICATION MENUs** for RS-232, Modem, and RS-485 vary slightly with the available command offering. Explanations for these additional commands follow:

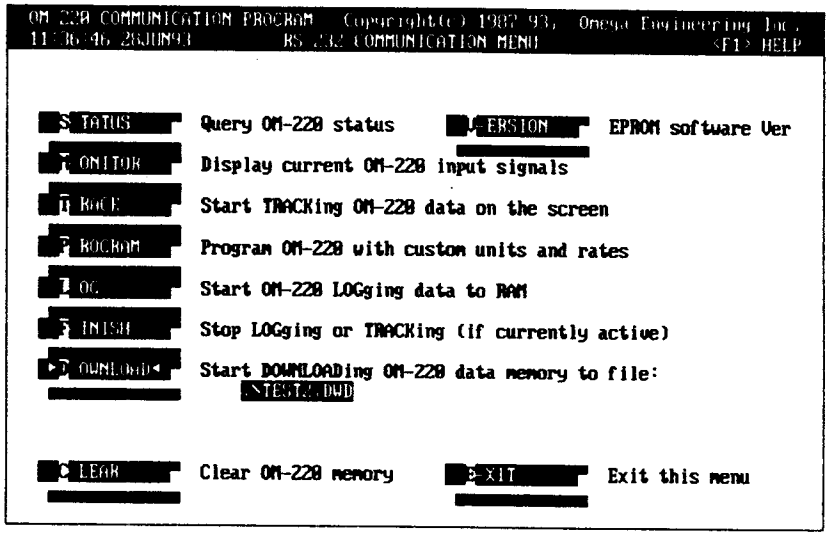

FIGURE 5.19: RS-232 COMMUNICATION MENU

S-TATUS :
The Status command queries the OM-220 for its current setup and displays this information on the PC. Displayed information includes:

DATE AND TIME - the currently set OM-220 Date and Time

LOGGING MODE - OM-220 Logging Mode

RUN PROGRAM STATUS - Current status of OM-220 EXTERNAL PROGRAM; indicating if the currently loaded RUN Program is Enabled or Disabled and what data storage format is currently set, Integer or Float.

POWER FAIL STATUS - displays only if a Power Failure has occurred (during logging and/or if data is present in memory). See APPENDIX A for message details.

MEMORY - unused memory available for storing data, specified in Samples.

ACTIVE CHANNEL REVIEW - a sequential display of I/M channels that are ON and their particular set-up parameters (channel location, type of I/M, sample rate, location, etc). In the event that the OM-220 is running with a RUN Program installed, the Sample Rates displayed will be from this RUN Program and NOT from the Input Module Sample Rate

Switch settings.

REMAINING DIRECTORY - a directory (software bookkeeping file) is maintained in the OM-220 memory. This directory can hold a total of 150 entries before reaching capacity. Each time a logging session is started, for every active channel, a directory entry is consumed. For example, with all 8 possible input channels active, eighteen separate logging sessions could be performed before the stored data would need to be down-loaded to clear out the directory.

BATTERY STATUS - an approximation of the state of charge (full, 3/4, 1/2, 1/4, low) and the voltage of the internal batteries (or external power source whichever is greater) is displayed.

********** **CAUTION** **********

BATTERY STATUS IS ONLY AN APPROXIMATION AND CAN BE AFFECTED BY TEMPERATURE AND OTHER PARAMETERS. FOR THIS REASON, REPLACE THE BATTERIES BEFORE STARTING ANY LONG TERM LOGGING SESSIONS.

WHEN THE OM-220 IS CONNECTED TO EXTERNAL POWER, THE BATTERY STATUS DISPLAY IS REPRESENTATIVE OF THE EXTERNAL POWER - NOT THE INTERNAL BATTERIES STATE OF CHARGE.

****

M-ONITOR:
The Monitor command requests instantaneous readings from all of the active OM-220 input channels and displays them on the screen. Units are also displayed. If a RUN Program is utilized (SECTION 6.2) custom units are displayed.

If the Monitor command is sent to a OM-220 that is busy logging data, the OM-220 decides if sufficient microprocessor time is available to respond with the current readings. If insufficient time is available, the OM-220 responds with a BUSY message resulting in a corresponding Busy Logging Data message on the PC screen.

********** **CAUTION** **********

The MONITOR command should not be used if the OM-220 is logging data in the BURST mode. Interjection of the MONITOR command during a BURST session will result in a time skew of data and potentially User misleading information.

****

V-ERSION:
Version command queries the OM-220 for its current version of EPROM.

P-ROGRAM:
Advances OC into the **DEVELOP RUN PROGRAM MENU** for User development of Custom RUN

Programs for transfer to the OM-220 memory. With this powerful feature, the OM-220 can be programmed with custom Scaling, Offsets, Units, and Sample Rates. The development of custom RUN Programs is detailed in SECTION 6.2.

L-OG:
Commands the OM-220 to initiate a Logging Session, storing data to OM-220 memory.

F-INISH:
Commands the OM-220 to Stop a Logging Session.

C-LEAR:
Commands the OM-220 to clear its data memory. **USE THIS COMMAND WITH CAUTION!**

In addition to the above commands, when in the **MODEM COMMUNICATION MENU**, two additional commands are available unique to control of the OM-220 during Modem communications. These command descriptions follow:

N-ETWORK:
Allows for user selection of the OM-220 with which to communicate in Modem Networked applications. See SECTION 7 for information on OM-220 Modem Networks.

R-ESET: When communicating with the OM-220 via a Modem Serial Link, a OM-220 RESET command is available. RESET performs a hardware reset of the OM-220 which allows the User to regain control of the remotely located system. This command performs the same function as a RESET from the front panel. RESET can be used if a remotely located OM-220 is unresponsive due to system failures that may occur due to some unknown reason or from such forces as extremely noisy electromagnetic environments (eg extreme electrical storms or noise spikes on inputs).

NOTES:

6..ADDITIONAL FEATURES

6.1 REMOTE LOGGING

The OM-220 START LOGGING and STOP LOGGING button control functions can be alternately controlled from a switch (contact closure) input to the REMOTE-LOG jack. This feature allows for initiation and termination of STORE or LOCAL TRACK logging session based on some external input such as a time clock, pressure switch, or other precursory event.

The REMOTE LOGGING jack (FIGURE 2.2) located on the bottom of the OM-220 is used for this function. When the jack contacts are 'shorted' and held, the OM-220 starts a logging session. When the contacts are 'opened', the session stops.

When using the Remote Logging input to initiate a logging session, the logging session starts immediately after the input is shorted and a message 'START LOGGING' is displayed for one second on the Display. The normal display sequence that is displayed when the START logging front panel is pressed is skipped allowing for minimal delay in start up of the logging session. Additionally, the RPS-1 control line (SECTION 3.2.10) is immediately enabled upon receipt of the Remote Log input signal.

An example application of the Remote Logging function is in troubleshooting an overheating remote site gas powered generator. Appropriate sensors would be connected to the cooling system, oil pressure sender, and other critical sense points on the engine/generator. The Remote Logging input would be wired across **ISOLATED** contacts on a relay that closes when the ignition for the engine turns on. In this way, logging of data will take place only during the time that the problem is likely to occur... while the engine is running, while conserving OM-220 battery life and data memory during non-run times.

The Remote Logging jack input is filtered and debounced (500 mS) and will function satisfactorily with most switch or small relay contact closures.

A plug (2.5mm) with leads is supplied with the OM-220 for use with the Remote Logging jack (SECTION 2.1).

********** NOTE **********

If no Input Modules are installed or ON (ie the Sample Rates are set to other than 0), and a logging session is attempted to be started via the REMOTE LOG input, the unit will not start logging and will have to be manually RESET via the normal two button RESET sequence to reinstate normal operation. This is not a normal operational condition however, Users should be aware.

****

********** CAUTION **********

THE REMOTE LOGGING JACK INPUT IS FOR CONTACT CLOSURE INPUT ONLY. DO NOT APPLY VOLTAGE TO THIS INPUT

****

6.2 EXTERNAL PROGRAM MODE

6.2.1 OVERVIEW

In the EXTERNAL PROGRAM mode, the OM-220 can be User programmed for custom Scaling and Offsets of input signals and remotely configured for Sampling Rates. With the Scaling and Offset capability, Engineering units conversion, (e.g. 4-20mA input conversion to 200 to 5000 PSI) become possible and are easily implemented. Additionally, known sensor errors (e.g. thermocouple offsets) or tare weights can be nulled out before the data is stored within OM-220 memory.

To utilize the EXTERNAL PROGRAM mode, a RUN Program is developed from within OC that includes User specified Scaling, Offsets, and Sample Rates, and the RUN Program is transferred to the OM-220 memory. When the OM-220 is then started in an EXTERNAL PROGRAM mode logging session, it utilizes the settings and conversion equations contained in the RUN Program residing in its memory. Data Download and analysis is unaffected (with the exception that the Units defined within the RUN Program are used for headings in Spreadsheet conversions) and is implemented using the standard procedures previously detailed in earlier sections.

Conceptually, the EXTERNAL PROGRAM feature has many similarities to the use of APB's from within OC. Some comments on the similarities and dissimilarities follow:

RUN Programs operate real-time during the collection of data from various inputs in a OM-220. The input signals are algebraically manipulated before the data is stored, transmitted out a serial port, and/or displayed after a front panel MONITOR button press.

APBs operate on data after any RUN program manipulations. In the various TRACK modes, data from the OM-220 is sent out the serial port to the PC where APBs manipulate the data before it is displayed, printed, and/or written to disk.

During Quick-Graph, APBs operate on data contained within a Download File, i.e. data that has been previously collected by the OM-220 then Downloaded to the PC memory.

The APBs can perform inter-channel calculations (eg delta-T) whereas RUN Programs within the OM-220 contain equations that operate on only one input channel.

Four steps are required to implement and utilize the EXTERNAL PROGRAM mode during a logging session:

Configure the OM-220 hardware

Determine the OM-220 I/M (Input Module) Configuration

Develop and transfer a RUN Program containing Offsets, Scaling factors, and Sample Rates to the OM-220 memory

Log Data and Download Data to PC for analysis

Details of each of these steps follow:

6.2.2 CONFIGURING THE OM-220 FOR EXTERNAL PROGRAM

The OM-220 Input Modules and System Base should be configured for the desired logging operation as explained in CHAPTER 5 with the exception of the following points:

The Input Module front panel Sample Rate switches are not read by the OM-220 when it is in the EXTERNAL PROGRAM mode hence their settings are not essential.

Set the Input Modules Range, Type, Function, etc. switches as normal as they will be utilized by the OM-220.

Within the OM-220 System Base, set Port 2 System Switch #2 **ON** to enable the EXTERNAL PROGRAM mode. Additionally, set Port 2 System Switch #3 ON to enable the FLOAT format of data storage.

********** **NOTE** **********

Port 2 System Switch #3 is used to define the format used by the OM-220 in the storage of data to its internal memory. FLOAT format or INTEGER format are selected by the setting of this switch.

INTEGER/FLOAT DATA STORAGE FORMAT GUIDELINES:

FLOAT format is 'safe' to use any time the OM-220 is used in the EXTERNAL PROGRAM mode (i.e. if Port 2 System Switch # 2 is ON, set Switch #3 ON as well).

INTEGER format should always be used when the EXTERNAL PROGRAM mode is NOT enabled (i.e. if Port 2 System Switch #2 is OFF, set Switch #3 OFF also). Additionally, INTEGER format can be used when in EXTERNAL PROGRAM mode providing processed data values (per the RUN Program) comply with the guidelines detailed in APPENDIX M.

A OM-220 running in the INTEGER mode can store approximately twice the number of samples as a unit running in FLOAT mode, however insure that the guidelines specified within APPENDIX M are met.

****

6.2.3 DETERMINING THE OM-220 I/M CONFIGURATION

OVERVIEW:

The RUN Program containing the User specified Scaling factors, Offsets, and Sample Rates is developed from within OC.

To develop a RUN Program for a particular OM-220, the User must first determine what Input Modules are installed in the OM-220 and the settings of the installed Input Module's front panel Function, Range, and Type Switches. This information, if not currently known is readily collected in one of the two following ways depending on accessibility of the OM-220.

DETERMINING LOCAL OM-220 CONFIGURATIONS:

If the OM-220 is physically located close by, observe the currently installed Input Modules and their switch settings and write down their settings channel by channel (1A through 4D on a 16 channel system).

DETERMINING REMOTE SITE OM-220 CONFIGURATIONS VIA MODEM or RS-485:

In many applications, the OM-220 will be located at a remote site and information on its current configuration may not be readily available. It will be necessary in these situations to connect to the unit via serial link and interrogate it to determine its current hardware configuration. The following sequence of steps will result in the required configuration information:

Per CHAPTER 4, using OC, connect up to the OM-220 via the serial link and advance to the applicable **COMMUNICATION MENU**. Send the <F> F-INISH logging command if the OM-220 is currently logging data then select <P> P-ROGRAM and OC will advance to the **DEVELOP RUN PROGRAM MENU**.

********** **NOTE** **********

IT IS ASSUMED THAT THE OM-220 AT THE REMOTE SITE IS CURRENTLY RUNNING IN AN EXTERNAL PROGRAM MODE (ITS PORT 2 SYSTEM SWITCH #2 ON)

****

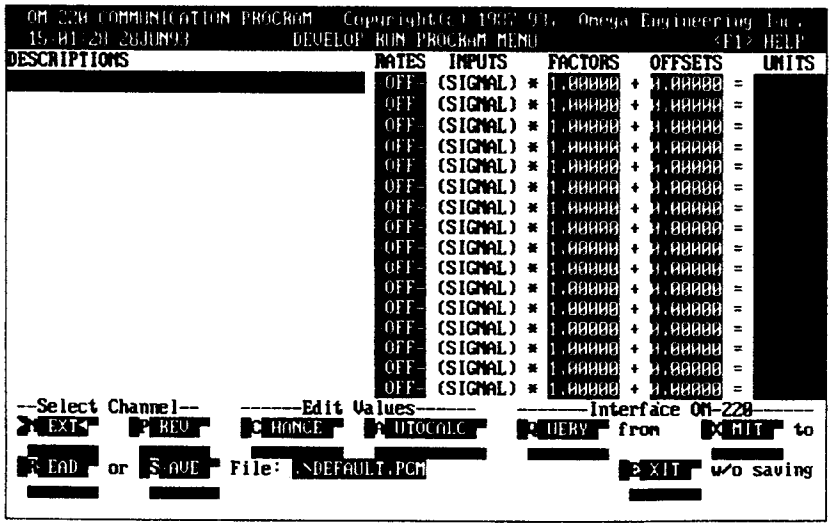

FIGURE 6.1: DEVELOP RUN PROGRAM MENU

In order to determine the remotely located OM-220's hardware configuration, it will be necessary to load a test RUN Program into its memory...overwriting the existing RUN Program currently residing in memory.

********** NOTE **********
If desired, the RUN Program currently loaded into OM-220 memory can be read from the OM-220 and written to disk for future use/reference. To read the currently loaded RUN Program, press <Q> Q-UERY and after a communication sequence and delay, the DEVELOP RUN PROGRAM MENU will update and display the current settings from the OM-220 memory. To save this current setting, select <S> S-AVE and specify the filename (and Drive/Path if different than the current default) under which to save this RUN Program.
****

Select <R> R-EAD file and highlight the filename **IM-TEST.PGM**. This RUN Program file has been provided with the original copy of OC. Send IM-TEST to the remote OM-220's memory by selecting <X> X-MIT to send the IM-TEST program. After a short communication sequence and delay, a TRANSMIT RUN PROGRAM WARNING will display on the PC indicating that discrepancies between the RUN Program and the OM-220 settings exist...ignore the warning (this time) and select <Y> YES to complete sending of the IM-TEST RUN Program. Depending on the OM-220 settings, it is possible (but not likely) that the warning message will not display and the IM-TEST RUN Program will be loaded without any User Y/N prompts.

Upon successful completion of the transmission, select <Q>-UERY and the current OM-220 configuration will be loaded into the **DEVELOP RUN PROGRAM MENU** display (FIGURE 6.2). If desired, <S> S-AVE this current setting to a file (use a different filename) for future reference of this particular OM-220's settings.

6.2.4 RUN PROGRAM DEVELOPMENT

OVERVIEW:
Development of a RUN Program for transfer to the OM-220 memory consists of editing parameters on the **DEVELOP RUN PROGRAM MENU**.

Two components are required for each active channel in the RUN Program for a OM-220:

SAMPLE RATE SETTING: which overrides the Input Module front panel Sample Rate Switch setting

EQUATION: which algebraically manipulates the sampled data for Scaling and Offsets (mX+b format) for units conversion and/or calibration of sensors and signals.

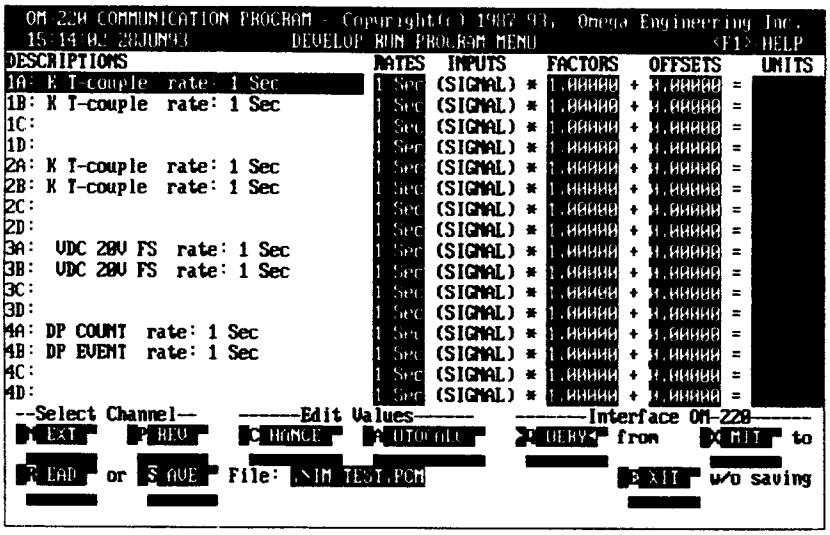

FIGURE 6.2: DEVELOP RUN PROGRAM MENU (AFTER Q-UERY)

DEVELOP RUN PROGRAM MENU SCREEN LAYOUT:

The top two-thirds of the **DEVELOP RUN PROGRAM MENU**, called the Programming Field, displays the OM-220 configuration and the User programmable Sample Rate and Equation fields. The bottom one-third of the screen, the Command Field, displays User editing commands (FIGURE 6.2).

PROGRAMMING FIELD: The Programming Field consists of the following four main sections divided vertically:

CHANNEL NUMBERS: On the far left of the screen under the **DESCRIPTIONS** column are listed all 16 possible Input Module channels from 1A to 4D. Not all OM-220 configurations will have Input Modules in all 16 channels (although our Sales Department would like that...).

CHANNEL CONFIGURATION: Also under the **DESCRIPTIONS** column, next to each Channel Number is the Channel Configuration which consists of the type of Input Module, and the channel's currently selected (via the I/M front panel switch) Type, Range, Curve, Function, etc. The Sample Rate Setting from the currently loaded RUN Program is displayed to the right of this other Channel Configuration information.

RUN PROGRAM SAMPLE RATE: To the right of the Input Module Channel **DESCRIPTIONS** column is the **RATES** column listing of the Sample Rates currently defined by the RUN Program for each of the 16 channels. This field is edited by the User in the development of a new RUN Program.

SCALING AND OFFSET EQUATIONS: The right half of the screen is dedicated to the specification of the **FACTORS**, **OFFSETS**, and resultant **UNITS** for the 16 channels. These fields are edited by the User in the development of a new RUN Program. The displayed Equations

[SIGNAL * 1.0000) + 0.00000 = UNITS] for each channel are in the linear equation format of mX+b (actually Xm+b) where:

m = the slope or scaling FACTOR
X = the incoming SIGNAL from the OM-220 (see APPENDIX K) for the units and precision of each of the types of SIGNALS)
b = an additive (or subtractive if a negative value is used) OFFSET.
UNITS = the result that will be Stored (or Tracked) to OM-220 memory and eventually Downloaded to the PC Download file (eg PSI, GPM).
* = multiply operator

COMMAND FIELD: The Command field lists the User commands used for editing and communication of the RUN Program to/from the OM-220. The command descriptions follow:

CHANNEL SELECTION COMMANDS

N-EXT - moves the highlighted channel selection bar DOWN.

P-REV - moves the highlighted channel selection bar UP.

FILE COMMANDS

R-EAD - loads a a previously developed and saved RUN Program into the Programming Field.

S-AVE - saves the RUN Program currently displayed in the Programming Field to a User specified file.

OM-220 INTERFACE COMMANDS

Q-UERY - requests a copy of the RUN Program currently residing in OM-220 memory for display in the Programming Field.

If a RUN Program is not currently residing in memory (e.g. due to replacement of the lithium cell), this **Q-UERY** command response may be scrambled. If this is the case, merely **X-MIT** a new (or the DEFAULT) RUN Program to the OM-220 memory and repeat the **Q-UERY** command.

X-MIT - transmits the RUN Program currently displayed in the Programming Field to the OM-220 Memory

EDITING COMMANDS

C-HANGE - advances OC into the **CHANGE PROGRAM MENU** where the Sample Rate, Offset, Scaling factors, and Units can be manually edited for the Channel currently highlighted in the Programming Field. This choice is used most commonly for simple Scaling and Offset corrections. The A-UTOCALC technique is generally the preferred choice for development of Equations with more complex values.

A-UTOCALC - advances OC into the **AUTOCALC PROGRAM MENU** where the Offset and Scaling factors for the Channel currently highlighted in the Programming Field can be edited using the AUTOCALC two-point technique. The Sample Rate and Units are edited manually.

EDITING A RUN PROGRAM CHANNEL USING C-HANGE:

To edit a Channel, select the Channel to be edited by highlighting it with the cursor (N-EXT and P-REV commands). Then select C-HANGE to advance to the **CHANGE PROGRAM MENU** for that Channel.

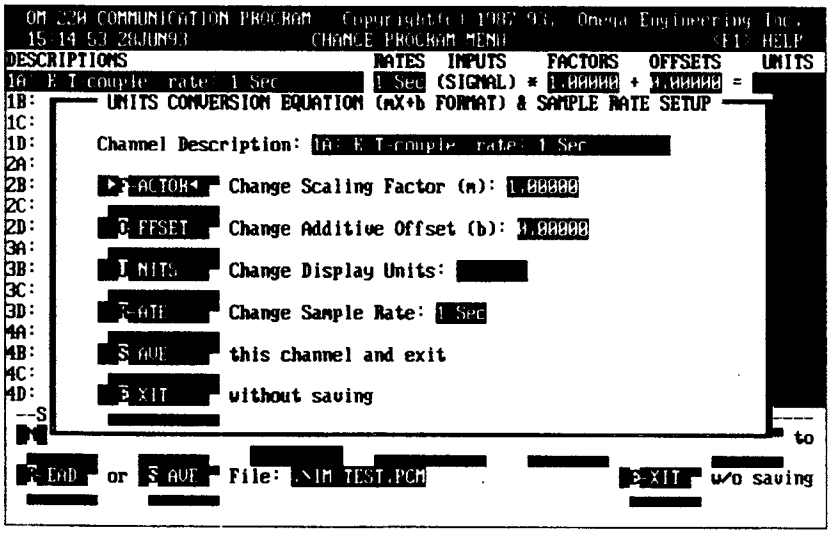

FIGURE 6.3: CHANGE PROGRAM MENU

Use the following selections to edit the EQUATION used for processing that channel within the OM-220:

F-ACTOR - enter a Scaling FACTOR (m in the mX+b linear equation format) that will be used as a multiplier for the input SIGNAL.

O-FFSET - enter a fixed constant OFFSET value (b in the mX+b linear equation format) to be added to the [SIGNAL*FACTOR] term. This value can be signed positive or negative for resultant additive or subtractive OFFSETS.

U-NITS - enter up to 7 characters for a UNITS name to be used by the OM-220 for its display and within the Download file. Typical UNITS might be PSI, Kg, Feet, etc.

R-ATE - pressing <R> for R-ATE steps the Sample Rate setting through the 16 possible values (OFF to 1 Sample/12 hrs).

S-AVE - enters the edited values into the Programming Field

E-XIT - E-XITs back to the DEVELOP RUN PROGRAM screen without making any changes to the edited Channel's settings.

After completing the configuration of the desired channels, return to the **DEVELOP RUN PROGRAM** screen and S-AVE the RUN Program to a file, then X-MIT the RUN Program to the OM-220 memory. After successfully transmitting the file, a Q-UERY command can be sent to confirm the OM-220 hardware and RUN Program setup.

C-HANGE EDIT EXAMPLE 1:
A load cell with transmitter has just returned from the Cal lab and it has been calibrated to deliver 0.00 VDC @ 0 lbs. load and 100 mVDC @ 500 lbs load. Using a VIM-2 Input Module on the 200 mVDC Full Scale Range setting, the Standard Units is found from APPENDIX K as millivolts. By simply multiplying the Input Signal by a FACTOR of 5, with no OFFSET, the Result will be in Units of lbs. (eg if the load was 100 lbs, the OM-220 signal would be 20 mVDC; multiplied by a FACTOR of 5 gives the Result as 100 lbs.

Program this Channel with a FACTOR = 5.0, OFFSET = 0, and UNITS of Lbs for a resulting Equation of:

[SIGNAL * 5.0 + 0.0 = Lbs]

C-HANGE EDIT EXAMPLE 2:
The above mentioned load cell is now to be employed in another application...a weighing system for SPC analysis the weight variance of produced parts. To aid in the weighing process the user wants to add a pan onto the load cell to contain the parts while the sample weight is taken (the stereotypical tare weight problem). The user has two options:

1) Send the load cell back to the Cal Lab and have its ZERO adjusted with the pan in place.

2) Correct for the pan weight by reprogramming the load cell channel in the OM-220 RUN Program.

The user opts for the second choice. After determining that the pan weighs 4.7 lbs, the user simply reprograms the OM-220 channel Equation to null the weight of the pan...using the OFFSET constant in the mX+b Equation. An OFFSET of -4.7 is entered and the new equation becomes:

[SIGNAL * 5.0 + -4.7 = Lbs]

EDITING A RUN PROGRAM CHANNEL USING A-UTOCALC:

To edit a Channel using the A-UTOCALC technique, select the Channel to be edited by highlighting it with the cursor (N-EXT and P-REV commands). Then select A-UTOCALC to advance to the **A-UTOCALC PROGRAM MENU** for that Channel.

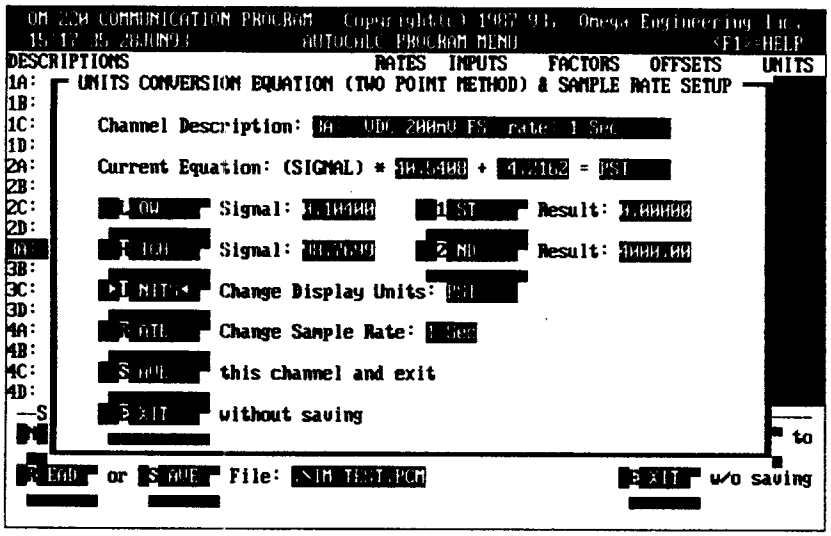

FIGURE 6.4: AUTOCALC PROGRAM MENU

The AUTOCALC technique is used in applications where the Scaling FACTOR and OFFSET calculations for a particular channel/sensor are more complex. The AUTOCALC technique automatically calculates the Scaling FACTOR and OFFSET values to use for the linear equation from two User supplied data points within the operating range of the sensor. The User supplies a SIGNAL value (the output from the transducer/sensor; e.g. 148.2 mVDC) and its corresponding RESULT (the actual Engineering Units value at this SIGNAL point; e.g. 74.3 PSI) for the two points. For optimum accuracy, one point should be chosen near the low end of the operating/measurement range, and the other near the high end of the operating/measurement range.

The following menu choices facilitate entry of these two point's parameters and the corresponding automatic generation of the OFFSET and SCALING values to be used in the EQUATION for processing that channel within the OM-220. This EQUATION is displayed on the AUTOCALC screen and updates as entries are made.

L-OW - enter the value of the first point's transducer SIGNAL near the low end of the operating range.

1-ST - enter the corresponding RESULT at this LOW end point in Engineering Units

H-IGH - enter the value of the second point's transducer SIGNAL near the high end of the operating range.

2-ND -enter the corresponding RESULT at this HIGH end point in Engineering Units

U-NITS - enter up to 7 characters for a UNITS name to be used by the OM-220 for its display and within the Download file. Typical UNITS might be PSI, Kg, Feet, etc.

R-ATE - pressing <R> for R-ATE steps the Sample Rate setting through the 16 possible values (OFF to 1 Sample/12 hrs).

S-AVE - initiates the automatic calculation of the Scaling FACTOR and OFFSET for this channel's Equation and enters the calculated values into the appropriate locations in the Programming Field.

E-XIT - E-XITs back to the DEVELOP RUN PROGRAM screen without making any changes to the edited Channel's settings.

After completing the configuration of the desired channels, return to the **DEVELOP RUN PROGRAM** screen and **S-AVE** the RUN Program to a file, then **X-MIT** the RUN Program to the OM-220 memory. After successfully transmitting the file, a **Q-UERY** command can be sent to confirm the hardware and RUN Program setup within OM-220 memory.

A-UTOCALC EDIT EXAMPLE 1:
A 0-250 PSI pressure transducer equipped with a 0 - 1 VDC output transmitter has just returned from testing (but not re-calibration) in the Cal lab with test data as follows:

Its output at 1.8 PSI is 0.023 VDC
Its output at 247.3 PSI is 1.012 VDC

To utilize this transducer without manually calculating the appropriate Scaling FACTOR and OFFSET values, the User opts to use the A-UTOCALC feature of OC in the development of the channel Equation. The transducer will be connected to a VIM-2 Input Module set on the 2VDC Range. Referring to APPENDIX K, the User sees that the Standard Units output from the VIM-2 Input Module on the =/- 2VDC range is in VDC (i.e. not mV, uV, etc).

Within the **AUTOCALC PROGRAM MENU**, the User selects

L-OW and enters a SIGNAL value of .023 (Volts); then

1-ST and enters a RESULT value of 1.80 (PSI); then

H-IGH and enters a SIGNAL value of 1.012 (Volts); then

2-ND and enters a RESULT value of 247.3 (PSI)

The U-NITS are entered as PSI and S-AVE is selected to save and return to the **DEVELOP RUN PROGRAM MENU** where the AUTOCALC results (Scaling FACTOR and OFFSET) are displayed for that Channel Equation:

[SIGNAL * 248.230 + -3.9093 = PSI]

A-UTOCALC EDIT EXAMPLE 2:
A 0-100 PSI pressure transducer equipped with a 4-20 mA output transmitter has just returned from testing (but not re-calibration) in the Cal lab with test data as follows:

Its output at 0 PSI is 4.012 mA
Its output at 98.6 PSI is 20.12 mA

To utilize this transducer without manually calculating the appropriate Scaling FACTOR and OFFSET values, the User opts to use the A-UTOCALC feature of OC in the development of the channel Equation.

The transducer will be connected to a FTTIM-2 Input Module. Referring to APPENDIX K, the User sees that the Standard Units output from the FTTIM-2 Input Module are mA. The information supplied by the Cal Lab can be directly input into the two-point, LOW/1ST and HIGH/2ND equation calculating AUTO-CALC screen.

Within the **AUTOCALC PROGRAM MENU**, the User selects

L-OW and enters a SIGNAL value of 4.012 (mA); then

1-ST and enters a RESULT value of 0.0 (PSI); then

H-IGH and enters a SIGNAL value of 20.12 (mA); then

2-ND and enters a RESULT value of 98.6 (PSI)

The U-NITS are entered as PSI and S-AVE is selected to save and return to the **DEVELOP RUN PROGRAM MENU** where the AUTOCALC results (Scaling FACTOR and OFFSET) are displayed for that Channel Equation:

[SIGNAL * 6.12118 + -24.558 = PSI]

6.2.5 LOGGING AND DATA ANALYSIS

LOGGING DATA:
After developing and transmitting the RUN Program to the OM-220 memory, the OM-220 can be started into any of the Store and Track modes as covered in earlier Sections. The OM-220 will utilize the Sample Rate settings and conversion equations programmed via the RUN Program as evidenced during a STATUS (front panel) button press and resulting displays. The RUN Program will be retained in memory until a new RUN Program is loaded. If front panel operation is desired, return the Port 2 System Switch #2 to OFF and #3 to OFF (integer mode), perform a System RESET and the OM-220 will operate without the RUN Program...however the RUN Program will still be retained in memory.

DATA ANALYSIS:
Download of a OM-220 containing data collected via a RUN Program is performed as normal...however, the Download File (*.DWD) will contain the Units programmed via the RUN Program.

In analyzing the Download File data with Quick-Graph and APBs, the User should keep in mind that the Units are per the RUN Program.

After conversion of a Download File to spreadsheet format, these RUN Program defined Units will title the spreadsheet data columns. Data can be further manipulated per standard spreadsheet commands.

6.3 DUAL MODE: TRACK AND STORE DATA LOGGING

The OM-220 can be configured to perform a **simultaneous** TRACK and STORE logging session in which the data is logged to internal OM-220 memory and simultaneously sent out the RS-232 serial port. This DUAL Mode can be used to provide a hardcopy printout (through a serial printer connected to the RS-232 port; SECTION 6.9) while logging data to memory for later download to a PC and Quick-Graph or Spreadsheet analysis.

********** NOTE **********

DUAL mode can ONLY be used in the LOCAL mode and in the REMOTE TRACK mode via RS-232 (modem and RS-485 are not allowed).

If a STORE session is attempted from the REMOTE (ie PC control) mode (via Modem or RS-485) while the DUAL mode is enabled, an error message will result and logging will not start.

****

To enable DUAL mode logging, set the Port 1 System Switch number 3 (SECTION 3.2.7) to the ON position and perform a OM-220 System Reset (to reinitialize the OM-220). Insure that the Inside System Switches 4 (RS-485) and 5 (MODEM) are OFF if the DUAL MODE switch 3 is enabled (ON).

6.4 BURST MODE DATA LOGGING

A special higher speed data logging mode can be enabled with the Port 1 Internal System Switch 2 (SECTION 3.2.7). In this BURST mode, the OM-220 circuitry is continually energized and the unit scans all active channels as quickly as possible independent of the internal OM-220 Real Time Clock.

In the BURST mode, the Sample Rate switches on the Input Modules are used to set a RATIO of sample frequency between channels rather than an absolute time based Sample Rate. All active installed channels will be scanned each cycle in a ratio set by their Sample Rate switch settings. For example, assume a BURST mode logging session is initiated with a two channel Input Module installed and Channel A set to a 1 Second Sample Rate and Channel B set to a 5 Second Sample Rate. The OM-220 will scan both channels every cycle and store Channel A data to memory each cycle. Channel B data will be stored to memory every fifth cycle.

In another example, if one channel was set to 1 second and another was set to 5 Minutes, the second channel would store data once every 300 scans (5 Mins * 60 Sec/Min = 300). As in all types of Logging Sessions, non-used channels should be set to '0' (off).

The BURST mode can be active during TRACK, STORE, TRACK AND STORE, and Remote Log initiated logging sessions.

When displaying a Download file resulting from a BURST mode logging session within Quick-Graph, the time stamp will be replaced with an incrementing scan number.

When converting a BURST mode Download file to spreadsheet format, Lotus 123 Version 1 should be selected as the conversion choice to prevent the insertion of misleading date and time stamps. Conversion to this 123 version inserts consecutive integer numbers for each scan line rather than time and date stamps.

When running in the BURST mode during a TRACK session (SCROLL or GRAPHIC) times are sent to the screen from the OM-220 with one second resolution. Scans of all channels may be done at a faster or slower rate than one second resulting in varying time stamp increments however in actuality, the actual time between scans is a fairly consistent period.

In any BURST mode logging session, the RPS-1 control line (SECTION 6.8) is turned ON at the start of the session and remains ON until the session ends.

********** **CAUTION** **********

The MONITOR command should not be used if the OM-220 is logging data in the BURST mode. Interjection of the MONITOR command during a BURST session will result in a time skew of data and potentially User misleading information.

In BURST mode, insure that at least one active Input Channel is set to a Sample Rate of 1S/S (ie the 1 position) for an absolute reference time base.

On slower PC's (eg early model 8088 based machines), GRAPH-

TRACKING may not function while running multi-channel configured OM-220 in the BURST mode due to the intensive calculations performed during plotting.

****

6.5 ROLL-OVER MEMORY LOGGING

6.5.1 OVERVIEW

A special memory utilization feature, Roll-Over Memory can be enabled within the OM-220 for applications requiring continual logging. When the OM-220 has its Roll-Over Memory function enabled, instead of stopping when the data memory is full, it proceeds to start writing over the oldest data memory one block at a time. With this feature, a OM-220 can be left at a site monitoring a process continually... constantly writing over the oldest memory and maintaining the latest data in memory. When the Logging Session is eventually stopped, approximately 2/3 (or 6/7 in Expanded Memory equipped OM-220s) of the OM-220 memory will contain data prior to the stop of logging.

6.5.2 THEORY OF ROLL-OVER MEMORY

A fundamental understanding of the technique employed to implement the Roll-Over memory function helps in its utilization.

The OM-220 data memory is divided into logical sections called pages. In a standard memory OM-220, the memory contains 3 pages and in Expanded Memory equipped (EXM-1 option) OM-220s, data memory consists of 7 pages.

When the Roll-Over memory function is enabled, the OM-220 starts a logging session and fills the first page with data. Upon filling, the OM-220 automatically ends that session, then starts a new session to fill the next page, etc. When the last page is filled, it ends that session and returns to the first page and proceeds to write over it. This start and stop of logging sessions writing over the pages continues until the User stops the logging session (eg with the STOP LOGGING button). With this technique, the User will be assured of having a minimum of 2 out of the 3 pages filled with data and in most cases, additional data will partially fill the last active page. In Expanded Memory equipped OM-220s, 6 of the 7 pages will be filled.

6.5.3 ENABLING THE ROLL-OVER MEMORY FUNCTION

To enable the Roll-Over memory function, set the OM-220 Port 2 System Switch #1 **ON**. Then perform a System RESET and MEMORY CLEAR (after Downloading any data pre-existing in memory) to re-initialize memory for the Roll-Over mode.

Proceed to set other System Switches for desired functions and initiate a logging session as normal.

********** NOTE **********

In the Roll-Over Memory mode, the OM-220 memory must be cleared before a logging session can be started. If memory is not cleared and START LOGGING is pressed, the OM-220 will display the FULL MEMORY, DOWNLOAD OR CLEAR message.

When logging is stopped, the memory is marked as FULL, preventing restarts of logging without first Downloading and/or Clearing

the OM-220 memory.

In the event of a OM-220 power failure during a Roll-Over Memory Mode logging session, the OM-220 will NOT automatically restart Logging upon power up (SECTION 6.6).

****

6.5.4 DOWNLOADING AND ANALYSIS OF ROLL-OVER MEMORY

After a Roll-Over memory logging session is completed, Downloading of the data can proceed as normal (SECTION 5.2.3).

The Download file containing Roll-Over memory data will contain a number of logging sessions, one for each 'page'. These logging sessions can all be graphed, spreadsheet converted, etc as normal using the conventional data analysis/conversion utilities supplied with OC.

6.6 POWER FAILURE DURING LOGGING

In the event that a power failure of the main OM-220 batteries occurs during a logging session, the OM-220 will immediately close out the current logging session and set an internal memory flag indicating the failure. Upon a STATUS or RESET of the unit this flag is read and a message is displayed on the OM-220 that states that a power failure occurred and data is present in memory.

After the OM-220 closes out the current logging session and sets the Power Failure flag, if sufficient system power should return to provide a normal RESET/POWER-UP sequence, the OM-220 will perform a battery voltage self-test. If the battery voltage tests above 6.5 VDC, a new logging session is started automatically. This automatic restart sequence helps insure against data loss due to momentary interruptions in power due to mechanical shock, ESD or other potentially interruptive disturbances.

The Power Fail While Logging message is maintained in memory until the OM-220 memory is cleared.

********** NOTE **********

In the event of a OM-220 power failure during a ROLL-OVER MEMORY logging session, the OM-220 will NOT automatically re-start Logging upon power up (as the memory is marked as being FULL).

****

6.7 DATA RETRIEVAL; DISCHARGED BATTERIES

Upon return to the OM-220 after a logging session if the unit is totally unresponsive to the front panel buttons (eg STATUS, or STOP LOGGING), the batteries or external power supply are most likely depleted.

To insure that this is the case, perform a System RESET and observe the display. If no response is seen, the batteries are discharged. Data in memory will be retained as it is backed up by a separate battery.

To retrieve the data in memory, turn off OM-220 System power and either replace the batteries or connect an external power source to the EXTERNAL POWER jack (SECTION 2.2.3).

Turn the OM-220 System Power ON and observe the display. If power failed during the prior logging session the OM-220 will commence sequencing through the normal initiation of another logging session without user intervention and a POWER FAIL WHILE LOGGING message will be displayed. Wait for this sequence to complete and press STOP LOGGING. At this time data can then be downloaded as normal. (Refer to section 6.6 for details about this auto restart sequence)

6.8 INTERFACE TO RPS-1; REMOTE POWER SUPPLY

The short output cable with connector located in the wiring compartment of the OM-220 is for control of a OM-220 accessory, the Rechargeable Power Supply (LBI P/N: RPS-1).

The RPS-1 consists of two programmable power supplies, 12 VDC Gel-Cell batteries, control circuitry, and photovoltaic or utility charging circuitry in a drip-proof enclosure.

With a OM-220 and a RPS-1, Remote Power Supply, complete stand alone data logging systems are readily implemented. The RPS-1 can provide excitation currents and voltages for a multitude of sensors and transducers...all under the supervisory control of the OM-220 system.

In applications utilizing the RPS-1 the output connector (on the OM-220) is plugged into a mating receptacle on the RPS-1 Remote Power Supply control cable. Ten seconds BEFORE the OM-220 takes sample readings, the OM-220 switches this output HIGH (5VDC) which turns on the programmable power supplies within the RPS-1. These power supplies then provide source loop current, sensor excitation voltage, etc. for sensors connected to the OM-220. After the scan of all active OM-220 Input Module channels is completed, the output returns LOW (0VDC), turning off the RPS-1 power supplies and conserving RPS-1 battery energy.

In applications where the sample rates within the OM-220 are set faster than the 15 Second rate, the output stays HIGH continually. The output drive is from an HCMOS gate with a series 8.2K resistor. If a RPS-1 is not utilized, the connector should be left disconnected (as shipped).

Refer to SECTION 7 for more information about the family of OM-220 accessories.

6.9 LOGGING DATA TO A SERIAL PRINTER

In addition to the standard three logging modes, the OM-220 can be utilized in the TRACK (LOCAL) mode to dump data directly to a serial printer through the RS-232 port as data is taken. This mode is useful where a written copy of the data is required on site for immediate use.

Three steps are required to initiate a SERIAL PRINTER TRACKING session:

Set-up the OM-220 Hardware

Configure The Serial Printer

Log the Data

6.9.1 OM-220 HARDWARE SETUP

SERIAL COMMUNICATION CABLE CONNECTION:

Turn the printer OFF. Plug one end of the RJ-12 (phone type) plug on the end of the OM-220 serial communications cable into the mating jack labeled RS-232 /RS-485 in the OM-220 front panel. Plug the other end into the supplied DB-25 (or DB-9) to RJ-12 adapter. Plug the adapter into the printer serial communications port connector.

Refer to APPENDIX D for OM-220 and adapter pin-outs for special applications.

INPUT MODULE:

Plug the I/M's desired into the I/M ports insuring that they are properly aligned in the guides and that they insert fully.

Perform a System RESET with the RESET/CLEAR and STOP LOGGING buttons. CLEAR MEMORY if the data in memory has been previously saved in a Download file or is of no value.

Set the I/M switches for the desired sample rates, type of sensor, etc. Refer to the individual I/M instruction sheets (SECTION 3.3) for detailed instructions.

Make the appropriate wiring connections to the I/M terminal strips and neatly route the wiring out the wiring holes in the bottom of the OM-220 box.

SYSTEM BASE:

Configure the System Set-up Switches as follows:

BAUD RATE: 1200 (see NOTE below)
TRACK/STORE: TRACK
FAST/SLOW: User's choice
REMOTE/LOCAL: LOCAL (front panel) Control

********** NOTE **********

To achieve successful serial communications, both communicating devices must have matching serial communication formats (ie both devices must follow the same predefined rules for timing, word length, etc). Except for the Baud Rate, the format for the OM-220 is fixed by design and cannot be changed by the User. (The Baud Rate is the speed that the digital information is transmitted through the serial cable)

****

9600 Baud is a good general use rate that gives good performance. Use a slower Baud rate if data communication problems arise or if operating in an electromagnetically noisy environment.

Set the OM-220 24 hour clock (if not current).

Press the MONITOR button on each active I/M channel to verify sensor wiring, sample rates, etc.

Press the STATUS/TIME button and review all system parameters for proper set-up and condition.

6.9.2 CONFIGURE THE SERIAL PRINTER

COMMUNICATION FORMATS:

The OM-220 and the Printer must have matching serial communication formats. Except for the Baud rate, the format for the OM-220 is fixed by design. Utilize the serial printer programming switches (refer to printer Users Manual) to set the printer format to match the OM-220 format as follows:

NO auto line feed

8 Data Bits

2 Stop Bits

No Parity

Baud Rate to match that set on the OM-220

XON/XOFF Format

Check for sufficient paper, turn the printer power ON, and place the printer 'ON LINE'.

6.9.3 LOGGING DATA TO THE SERIAL PRINTER

Press the START LOGGING button on the OM-220 to initiate TRACKING TO SERIAL PRINTER, logging of data. Press STOP LOGGING to terminate logging.

If the DUAL MODE switch (SECTION 3.2.7 and 6.3) is enabled during this TRACKING TO

SERIAL PRINTER logging session, data will be retained in the OM-220 memory (for later download) simultaneous with transmission of the data out of the serial port to the printer.

6.9.4 LOGGING TO TERMINALS

In place of the serial printer, a terminal or PC running a serial communication software package can be connected to the OM-220 (via RS-232) running in the LOCAL TRACK mode. As readings are taken by the OM-220, the data is serially transmitted to the terminal or PC and displayed on the screen.

If the DUAL MODE switch (SECTION 3.2.7 and 6.3) is enabled during this logging session data will be retained in memory for later download simultaneous with transmission of the data out of the serial port to the terminal or PC.

7..ACCESSORIES

The OM-220 Portable Data Logger has a family of support product accessories available for specific User needs. These include:

INPUT MODULES

A full line of signal conditioning Input Modules are available for interface to most types of sensor and signal inputs.

DCXF-115/12; PLUG-IN TRANSFORMER POWER PAK

An external power source for powering the OM-220 from the 120 VAC utility line. 220VAC 50hz adapters are also available.

RPS-1; RECHARGEABLE POWER SUPPLY

The RPS-1 is a self-contained, weatherproof rechargeable power supply used in conjunction with the OM-220 for sensor loop excitation and for OM-220 power in remote site applications utilizing photovoltaic module power.

Dual regulated power supply outputs are available from the unit with User programmable voltages (3.5 to 22 VDC. 150mA). Charging circuitry, integral State of Charge indicator, and control interface to allow for cycling of the outputs (and battery life optimization) are standard features.

PHOTOVOLTAIC POWER MODULE

Modules used for charging the RPS-1 Remote Power Supply internal batteries for long term remote logging applications.

COS-II TELEPHONE MODEM OM-220 NETWORK

A complete system allowing for multiple (8 maximum) OM-220s at a single location to share a single telephone line and modem for interrogation and control.

AUTO-POLL; AUTOMATED OM-220 POLLING SOFTWARE

The Auto-Poll software package allows for the unattended automated polling of modem equipped OM-220 systems via a single PC equipped with a telephone modem. Auto-Poll can be setup to call on a periodic time base (eg daily, hourly, etc) and Download data from up to 1000 OM-220s with full error checking and auto-configuring capability for each site. Efficiently implemented color configuration menus facilitate SIMPLE setup and operation.

SYSTEM 7

A NEMA 4, 12, 13 housed data logging system consisting of a OM-220, plug-in power supply (back- up power), and optionally a telephone modem, and/or Rechargeable Power Supply (RPS-1). A rugged, pre-wired, wall mountable package for remote site or industrial data logging locations requiring modem communications.

ETXF/M-1; RS-485 NETWORK TRANSCEIVERS

RS-485 modules to plug into a standard personal computer RS-232 port to allow networking communication of multiple OM-220s.

8..APPENDIX A:

OPERATIONAL AND ERROR MESSAGES

LOCAL CONTROL MODE ERRORS; OM-220 DISPLAY:

The following error messages will be displayed on the **OM-220 Display** during erroneous operation conditions in the LOCAL Control Mode of operation. Short explanations and instructions follow.

ERROR: RS-485/
MODEM CONFLICT

Displayed continually in the event that both the Modem and the RS-485 ports are user enabled simultaneously (both switches ON)

This condition must be corrected before using the OM-220. Correct by insuring that ONLY the MODEM or the RS-485 System Switch (internal) is selected. Refer to section 3.2.7 for details.

ERROR: CONFLICT
CHECK SWITCHES

Displayed upon RESET if DUAL MODE is selected (Port 1 Internal System Switch #3 is ON) **and** the RS-485 or MODEM functions are enabled (ie Port 1 System Switch #4 or #5 ON). Correct the conflict in switch settings and RESET the OM-220 to continue.

Displayed upon RESET if ROLL-OVER MEMORY function (Port 2 Internal System Switch #1 ON) **and** DUAL MODE (Port 1 Internal System Switch #3 ON) are both selected. Correct the conflict in switch settings and RESET the OM-220 to continue.

Refer to SECTION 3.2.7 for details.

POWER FAILURE
DATA IS PRESENT

Displayed upon a System RESET and when STATUS is pressed, when a power failure has occurred (including user turn off of the main OM-220 power switch) with logged data present in memory. Shut off the OM-220 power, replace batteries or correct external power problem, RESET system and resume use. Memory must be cleared to clear this message from memory.

POWER FAILURE
WHILE LOGGING

Displayed if power has failed while logging data was active. Message is first displayed during RESET sequence or after power is turned ON (eg new batteries installed or an external power source is connected to the unit). This message will be displayed in the STATUS display sequence until memory is cleared.

MEMORY FULL
DOWNLOAD/CLEAR

Displayed upon a System RESET and when STATUS is pressed whenever the OM-220 has filled available memory while logging data. Download, clear memory, RESET system, and resume

logging.

This message will also be displayed when in the Roll-Over Memory mode of logging and an attempt is made to start a second logging session without first clearing memory (SECTION 6.5).

DIRECTORY OVERFLOW
MUST DOWNLOAD &/OR CLEAR MEMORY

Displayed at the start of logging if there is no room in the directory for the current logging session. The memory must be cleared (after Downloading if memory data is to be retained).

REDUCE SAMPLE
RATES

Displayed if the OM-220 cannot sample data at the rates presently set on the Input Modules. Selecting FAST ADC will allow for faster sampling. If the message persists, or if it is not desired to utilize the FAST ADC mode, then the sample rates of the fastest active channels must be reduced.

NO ACTIVE
MODULES

No I/M's are installed or all installed I/M's have Sample Rates set to OFF per their front panel rotary Sample Rate switches or per the RUN Program Sample Rate settings (External Program mode).

LOGGING

Message is flashed when any button (STATUS, MONITOR, etc) is pressed and the OM-220 is actively logging data. If Sample Rates are set sufficiently slow during a logging session to allow additional processing of input data, upon depression of a MONITOR button, the actual channel input will be displayed.

SERIAL COMMUNICATION ERRORS; OM-220 AND PC:

The following error message listing indicates operation and communication errors and their corresponding numbers that may be displayed during erroneous conditions while the OM-220 is communicating through the serial communication ports (modem, RS-232, RS-485).

The following errors may be seen on the OM-220 display (by reference number) and on the PC screen if the indicated error conditions exist.

0	No error to report
1	Unknown command received by OM-220 - repeat the command
2	Bad command syntax
12	Sample rates too high - decrease the fastest Input Module Sample Rate switch settings.
13	No data to download
14	No active modules
15	Data memory full - must download data before starting another logging session.

16 Directory full - must download data before starting another logging session.
17 Dual Mode -error displayed if a REMOTE (ie PC location) STORE logging session is attempted to be initiated when the OM-220 DUAL MODE function is enabled (SECTION 3.2.7),
18 Unknown Error code received from OM-220. Can be caused by noise in communication link.

OTHER MISCELLANEOUS ERROR CONDITIONS

TRACKING RELATED ERRORS:

TIME SKEW POTENTIAL -if TRACKING data at 300 Baud with sample rates set to the fastest rates, time skew may occur on the time tags. The correct time will be displayed on the screen, however, frames (scans of all active channels) may not be the programmed and desired time interval apart. Additionally, if the data is saved to a file during this tracking session, upon conversion to the Spreadsheet format, the time tags will be erroneous. This condition can be corrected by selecting a faster Baud Rate.

ALGEBRAIC PROCESSING BLOCK RELATED ERRORS:

EXPRESSION ERROR IN APB FILE: If an error exists in any channel's equation of an APB file, this message will display on the screen at the start of a TRACK or Quick-Graph session utilizing this error infested APB. Check the syntax, math operator symbol, channel designation, etc for the non-conformance to the APB specifications outlined in APPENDIX K.

QUICK-GRAPH RELATED ERRORS:

ERROR CONFIGURATION FROM *.DWD / *.APB FILE: indicates damaged files. Review the files for proper format. If the problem is with an APB file, reconfigure it with the main menu command; if the problem is with a *.DWD file, perform another download.

DOS RELATED ERRORS:

FILE I/O ERROR: INSUFFICIENT DISK SPACE - displayed while running the OM-220 Communications program. Indicates that insufficient disk space exists on the specified drive for the Downloading or Converting file. Provide more space and repeat command.

FILE I/O ERROR: OPENING FILE XXXXXX.XXX - Specified file could not be found in path, directory, or disk. Check accuracy of file name and specified path.

SPREADSHEET RELATED ERRORS:

COLUMNS FILLED WITH ASTERISKS - indicates that the data to be displayed in that

column is wider than the current column width. Widen the column and the data should appear.

READINGS INDICATING 10.00, 100.0, ETC - OM-220 inputs that are not connected to a sensor or signal input will overrange to display 99.99, 999.9, etc. When these overrange readings are converted to a shorter format within a spreadsheet, the readings are rounded (eg 99.99 may display as 10.0). To verify this is the case, the format for the spreadsheet data can be lengthened and the overrange number will appear. Properly, all un-used channels during a logging session should be OFF.

8..APPENDIX B

OM-220 SPECIFICATIONS

SYSTEM BASE:

CPU.....	CMOS Z80 VLSI
DATA MEMORY.....	22,000 Samples (Integer mode) 55,000 Samples (Integer mode) with EXM-1 memory expansion option.
ROM (PROGRAM).....	32K X 8
SERIAL INTERFACE.....	RS-232C, RS-485, Modem 8 data bits, 2 stop bits, no parity, XON/XOFF
DATA TRANSFER RATE.....	300, 1200, 2400, & 9600 BAUD
INPUT MODULES.....	4 MAXIMUM, (16 CHANNELS)
MODULE INTERFACE.....	DIRECT CONNECTION WITH SYSTEM BOARD VIA 32-PIN DIN CONNECTOR
DISPLAY.....	TWO-LINE DOT MATRIX LIQUID CRYSTAL DISPLAY (LCD) 16 CHARACTERS PER LINE
CLOCK.....	24-HOUR REAL-TIME MO/DAY/YEAR HR: MIN: SEC
POWER REQUIREMENTS.....	9 VDC (NOMINAL) 2 mA STANDBY,40 mA DURING SAMPLING, 60 TO 100 WITH SERIAL COMM PORTS ENABLED.
INTERNAL POWER.....	6 STANDARD ALKALINE C-CELLS
EXTERNAL POWER.....	PROVISIONS FOR EXTERNAL POWER INPUT PROVIDED. ACCEPTS 7-23 VDC, 7-16 VAC
MEMORY BACKUP.....	MEMORY BACKUP POWER IS PROVIDED FOR ONE YEAR @ 25 DEGREE C; Replacement cell: Panasonic BR2325 or Equiv.

CLOCK BACKUP.....	CLOCK BACKUP POWER IS PROVIDED FOR ONE YEAR @ 25 DEGREE C; Replacement cell: Panasonic BR2325 or Equiv.

ENVIRONMENTAL:

OPERATING TEMPERATURE.....	-10 C TO 60 C 14 F TO +140 F
SHIPPING TEMPERATURE.....	-30 C TO +65 C
STORAGE TEMPERATURE.....	-30 C TO +70 C
RELATIVE HUMIDITY.....	90% NON-CONDENSING
ENCLOSURE.....	Drip-proof; plastic with gasketed door Liquid-tight wiring fittings provided
ALTITUDE (OPERATING)..... (NON-OPERATING).....	15,000 FT ABOVE SEA LEVEL 50,000 FT ABOVE SEA LEVEL
SHOCK AND VIBRATION.....	The OM-220 will withstand the shock and vibration conditions normally encountered in regular commercial shipping & handling
DIMENSIONS.....	9.75"H X 8.5"W X 5.5" D
WEIGHT.....	3 LBS (including batteries)

OM-220 COMMUNICATIONS PROGRAM:

DISKETTE FORMAT.....	OM-220 COMMUNICATIONS software provided on 3.5" (720K) diskette with each OM-220.
HOST PC REQUIREMENTS.....	IBM-PC/XT/286/386/486 or compatible w/ DOS 3.1 or later. LCD, Herc Mono, CGA, EGA, VGA displays supported. Epson Dot Matrix (or compatible printer.

8..APPENDIX C

OM-220 COMMUNICATION; FILE LISTING

THE FOLLOWING FILES ARE SUPPLIED ON THE OM-220 COMMUNICATIONS DISKETTE:

OC.EXE	Main OM-220 Communications Program
OM220.HLP	OM-220 Communications Help Files <F1>
LOGGER.PTH	OC Default Paths
MODEM.DEF	OC Default settings for Modem Communications
RS485.DEF	OC Default settings for RS485 Communications
SETUP.DEF	OC Default settings for RS-232 Communications
DEFAULT.APB	The Default APB for eight channels. Used as a building block for new APB's.
DEFAULT.SCN	Default Graphic Display Screen used in construction of the Default Window Tracking File (DEFAULT.WIN)
DEFAULT.WIN	Default Window Tracking File for eight channels.
README	Informative file containing latest manual updates and information on the OM-220 products. View using word processor or DOS 'TYPE' command: TYPE README <ENTER>.
DYNO.APB, SCN, WIN	Demo files for simulated dynamometer test stand. View in Window Tracking with two active channels (analog) for Channels 1A and 1B. See README file for additional information.
RC.APB, DWD	Demo file of RC (resistive-capacitive) charge and discharge for playback in Quick-Graph and/or File conversion.
ECLIPSE.APB, DWD	Demo file of solar radiation during partial solar eclipse for playback in Quick-Graph and/or File conversion.
AUTO.DWD, APB	Demo file of various under hood temperatures within an automobile for playback in Quick-Graph and/or File conversion.
HOT-TIP.DWD, APB	Demo file of soldering station tip thermal cycling for playback in Quick-Graph and/or File conversion.
IM-TEST.PGM	A pre-configured RUN Program used for evaluating current OM-220 hardware configurations.

NOTES:

8..APPENDIX D

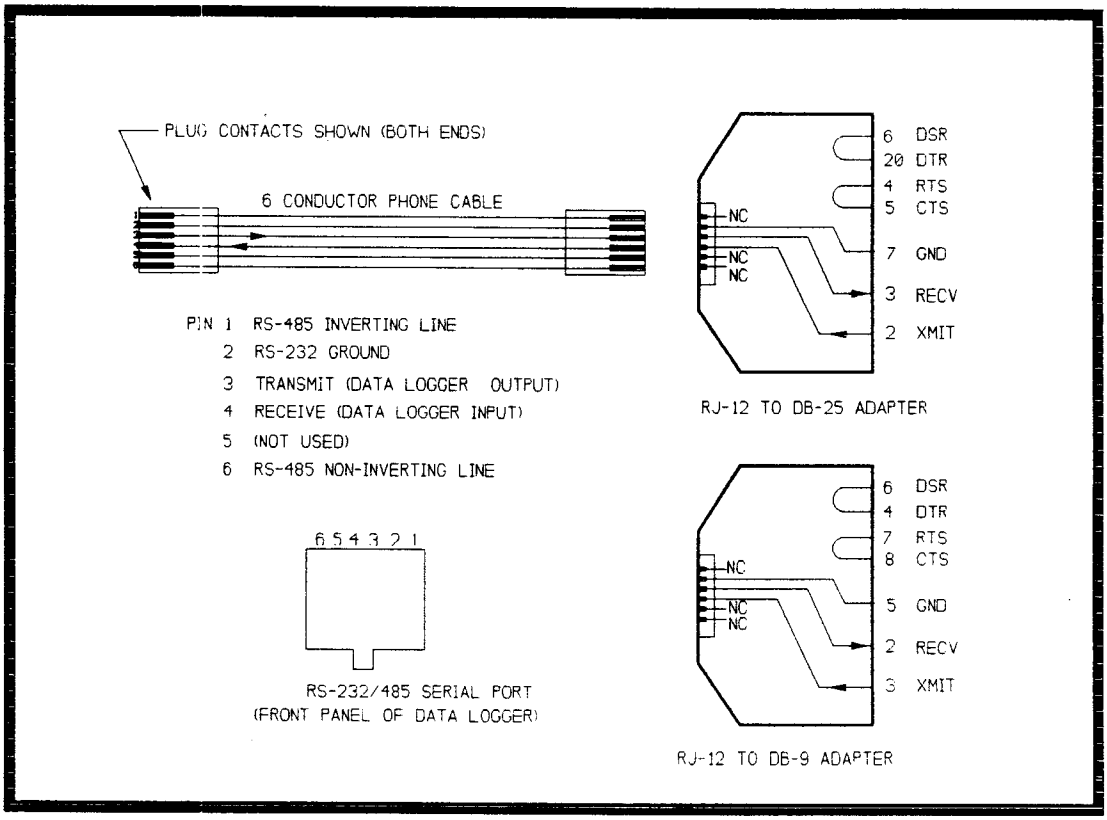

FIGURE 8.1: RS-232, RS-485 PORT and RJ-12 to DB-25 (9) ADAPTER PIN-OUT

NOTES:

8..APPENDIX E

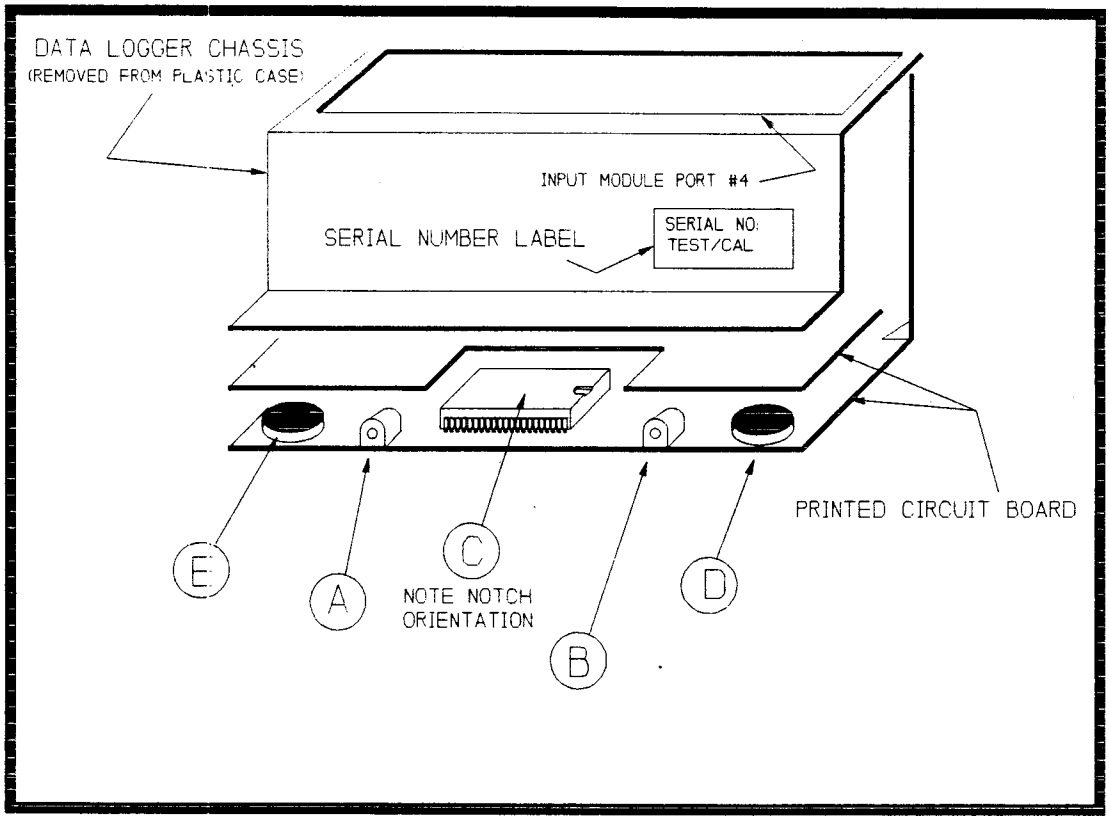

FIGURE 8.2: EPROM, JACK, MEMORY AND CLOCK BATTERY LOCATIONS

(END VIEW SHOWN - UNIT REMOVED FROM PLASTIC CASE)

A - REMOTE LOGGING JACK (CONTACT CLOSURE INPUT ONLY)

B - EXTERNAL POWER JACK

C - PROGRAM 'EPROM' MEMORY

D - BATTERY BACK-UP, DATA MEMORY (Panasonic BR2325 lithium or equivalent)

E - BATTERY BACK-UP, REAL TIME CLOCK (Panasonic BR2325 lithium or equivalent)

NOTES:

8..APPENDIX F

DOWNLOAD FILE FORMAT SPECIFICATION

The OM-220 utilizes an information 'Header' system to record times, dates, active input modules, sample rates, etc about each active channel in a logging session. This information is contained in all download (FILENAME.DWD) files in the following format with separation by colons.

~RUN PROGRAM UNITS
:HEADER INFORMATION
:DATA RECORDS
:^Z (end of file indication)

RUN PROGRAM UNITS:

This line is contained only in Download files received from OM-220s operating from EPROM Version 6.0 or higher. Download files from OM-220s running earlier versions of EPROM will not have this line and the Download file will start with a ':' and the HEADER INFORMATION.

OM-220s running in an EXTERNAL PROGRAM mode, will generate the RUN Program Units line with a Tilde character followed by up to 16 seven character length Units names with following TABs. The line ends with a CRLF.

OM-220s running without a RUN Program will generate this line but no Units values will exist, merely the tilde followed by 16 TABs and a CRLF.

~ (Tilde, starting character)
UNITS <TAB> UNITS <TAB> .....(up to 16 UNITS).....UNITS <TAB> <CRLF>

HEADER INFORMATION:

The records within each channel's header section are assigned values as follow:

: (Starting Colon)

Logging Session 0,1,2,3,etc

Module Port
0 = 1 (top input module port)
1 = 2
2 = 3
3 = 4 (bottom port)

Channel side
0 = A side
1 = B side

Input Module ID
0 = no module
1 = Thermocouple (2 channel module)
2 = RTD

3 = Thermistor
4 = 4 to 20 mA loop (2 channel module)
5 = Voltage (2 channel module)
6 = Current
7 = Bridge
8 = Digital Pulse
12 = Thermocouple (4 channel module)
13 = Voltage (4 channel module)
14 = 4 to 20 mA (4 channel module)

Module Channel Configuration Switch Settings

Thermocouple Module:
J = 1
K = 2
E = 4
T = 8
R = 16
S = 32

4 to 20 mA loop: no switches

Voltage I/M:
20V = 0
2V = 2
200 mV = 1

Current I/M:
2 A = 0
200 mA = 2
20 mA = 1

Bridge I/M:
50 mV = 1
200 mV = 2

RTD I/M:
Full/European = 6
Full/American = 4
Ltd/European = 2
Ltd/American = 0

Thermistor: No switches

Digital Pulse I/M:
Frequency = 1
Event = 2
Counter = 4

Temperature Scale and BURST mode Enabled/Disabled (dual purpose variable)

00 = Burst disabled / Celsius
01 = Burst disabled / Fahrenheit
10 = Burst enabled / Celsius
11 = Burst enabled / Fahrenheit

Sample Rate Setting (see Quick Reference Card)

Number of Samples this channel

Starting Date: MM
" " DD
" " YY

Starting Time: HH (24 hour clock)
" " MM
" " SS

Ending Date and Time (Same format as Starting Time)

DATA RECORDS:

The DATA RECORD section of the Download file starts with a colon. Individual data records follow, separated with TABS, and the line ends with a carriage return, linefeed (CRLF). Consecutive data record lines start with a TAB (not a colon).

: <TAB> DATA1 <TAB> DATA2 <TAB> DATA3.....(up to 16 records).....DATA <CRLF>

END OF FILE INDICATION:

The last line in a Download file contains a final colon and Control Z.

: CTRL Z (Ending Colon and Control Z, EOF indicator)

NOTES:

8..APPENDIX G

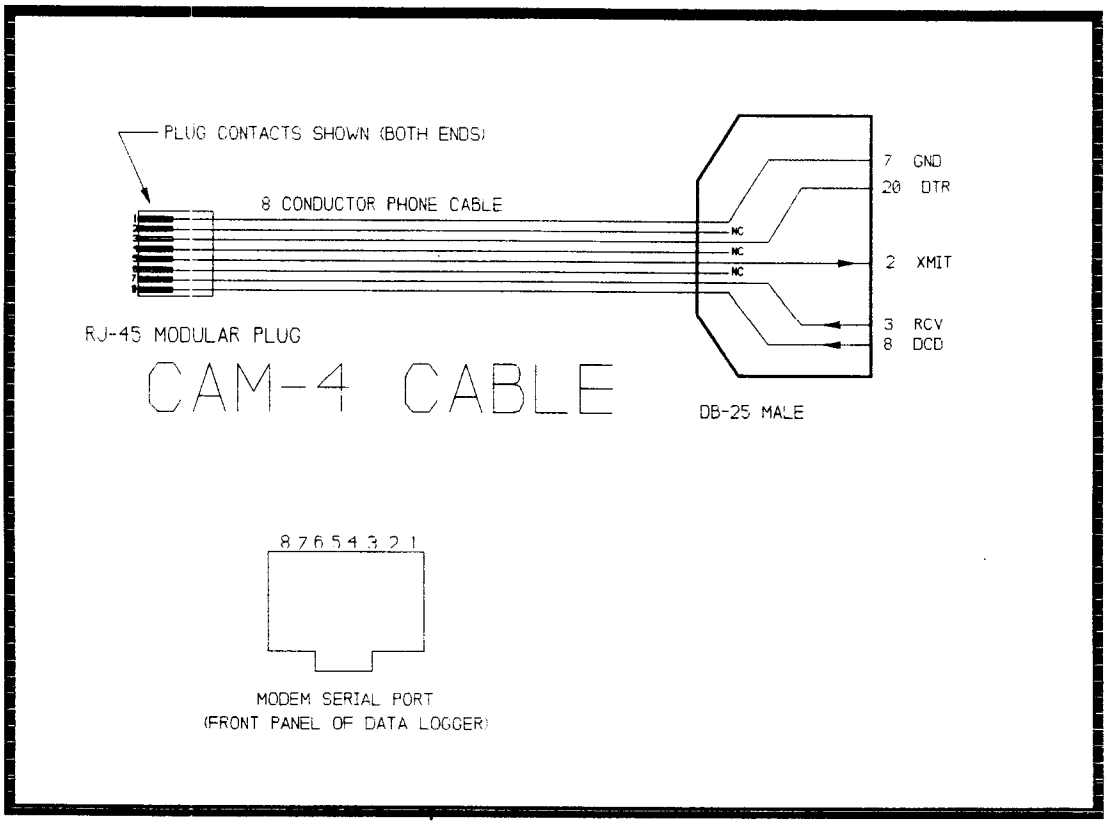

FIGURE 8.3: OM-220 MODEM SERIAL PORT PIN-OUT

NOTES:

8..APPENDIX H

SERIAL COMMUNICATION CONTROL CODES

The OM-220 utilizes a unique serial communications protocol with a simple set of commands. The following is a listing of the command set codes sent to the OM-220 during serial communications and the corresponding set of response codes sent by the OM-220 to the personal computer (DTE).

These commands are embedded in the OM-220 Communications software package code however they are provided here for users desiring the necessary information for development of custom OM-220 communication and/or control software.

COMMANDS SENT TO THE OM-220 (upper case letters):

ESC C	Clear OM-220 memory
ESC D	Request Download of data memory
ESC T	Start a Track Logging session
ESC S	Start a STORE Logging session
ESC E	END a Logging session
ESC Y	Request the last communication Error Code
ESC V	Request the OM-220 Firmware Version number
ESC Z	Turn OFF the serial communication port (RS-485 only)
ESC X	Request OM-220 STATUS
CTRL Z	Abort currently running Download sequence
ESC Q	Request RUN Program currently loaded in memory
ESC L	Load RUN Program from PC to OM-220 memory
ESC H	Request current OM-220 Input Module STATUS (active Port and channel)
ESC R	Request a scan of all active channel readings

RESPONSE CODES SENT TO THE PC FROM THE OM-220:

CTRL A	Error in received command
CTRL B	Busy
CTRL C ♥	Last command finished, now READY for another
CTRL D ♦	Command accepted, in process of executing

OM-220 RESPONSE UPON RECEIPT OF ESC H (REQUEST FOR INPUT MODULE STATUS):

When the OM-220 receives an ESC H command, it responds with a CTRL D (♦) followed by a string of 16 pairs of numbers. Each pair of numbers returned with a value other than '90' indicates an Active Channel (i.e Input Module installed and Sample Rate set to a rate other than OFF). A '90' in the string indicates that channel is not Active.

In the pair, the first number indicates the Port (a value from 1 to 4) and the second number indicates the Channel (a value of 1 to 4 corresponding to Channels A to D).

OM-220 RESPONSE UPON RECEIPT OF ESC R (REQUEST FOR ACTIVE CHANNELS SCAN):
When the OM-220 receives an ESC R command scans all of the active Input Module channels and returns a DIAMOND (CTRL D; ♦) followed by each Channel's reading. Readings are separated by a TAB and the line is completed with a CR (carriage return) character. A typical response follows:

♦ CH1A TAB CH1B TAB CH2A TAB CH2B TAB CH2C TAB CH2D TAB TAB TAB TAB <CR>

Where CH1A, etc indicates a reading from that channel
Non active channels will still force a TAB
The line ends with a Carriage Return, (no Line Feed)

OM-220 PACKET DOWNLOAD COMM PROTOCOL

OVERVIEW:
Communication with the OM-220 from a terminal or PC via RS-232, 485, or MODEM is handled via a series of PC initiated commands which are listed above. The Download of data is unique from the other commands in that it requires a series of handshake communications to achieve a complete transfer of data from the OM-220 to the PC.

Data collected and stored within the OM-220 memory is downloaded to the PC in consistent size packets of data called BLOCKS. Upon a command from the PC, the first block of data is sent with its CHECKSUM (a unique number calculated from the data contained within the block) to the PC. The PC receives the data block, calculates its own checksum and compares this checksum to the one received with the block from the OM-220. If all is in agreement, a command to send the next block of data is sent to the OM-220 and the procedure repeats. If an error exists, the OM-220 is requested to resend the last block.

DOWNLOAD PROCESS:
The Download process is initiated when a Download command is sent to the OM-220.

Download command = 'ESC' D (1BH, 44H)

The OM-220 responds by sending the data in the following way:

The data transferred by the OM-220 is divided up into blocks. Each block consists of start-of-block character (1DH), a one byte block number, up to 2048 bytes of data, end-of-block character 18H), and a one byte checksum. The number of data bytes in the block can be less than 2048, the last block of data is usually a short block.

The block number starts at zero, and after nine it goes back to 0. The checksum is a single byte computed by adding together the ASCII values of all the characters in the block. All eight bits are included. Bits 6 and 7 are then added to the number formed by bits 0 through 5.

CHECKSUM = 32 + ((sum + ((sum AND 192)/64)) AND 63)

[+ is math addition operator, AND is logical AND operator]

During the download process the OM-220 pauses between blocks to wait for an 'ACK', acknowledgement (06H = ctrl F) character before the next block of data is transferred. If the OM-220 receives a not acknowledge,'NAK' (15H = ctrl U) character,it will send the same block of data again. NAK cycles can be repeated up to 10 times. OM-220 will abort the downloading if more than 10 NAK's have been received for the same block of data or if the receiving computer does not ACK, acknowledge the block transmission at all within 30 seconds.

********** NOTE **********

If error checking is not required, the PC could merely send an acknowledge signal upon receipt of an end-of-block character. The OM-220 will then send the next block. For insured data transmission integrity, the OM-220 Communications software utilizes the complete error checking protocol.

****

The OM-220 will abort the download if the character (1AH = ctrl Z) is sent to it during the download.

Through this ACK-NAK process, the OM-220 transfers data to a Download file on the PC. During this transfer, the logging session stored first is also downloaded first. The data from different active channels in a session is downloaded in order it was recorded by the OM-220.

A detailed specification of the Download file format is contained in APPENDIX F.

NOTES:

8..APPENDIX I

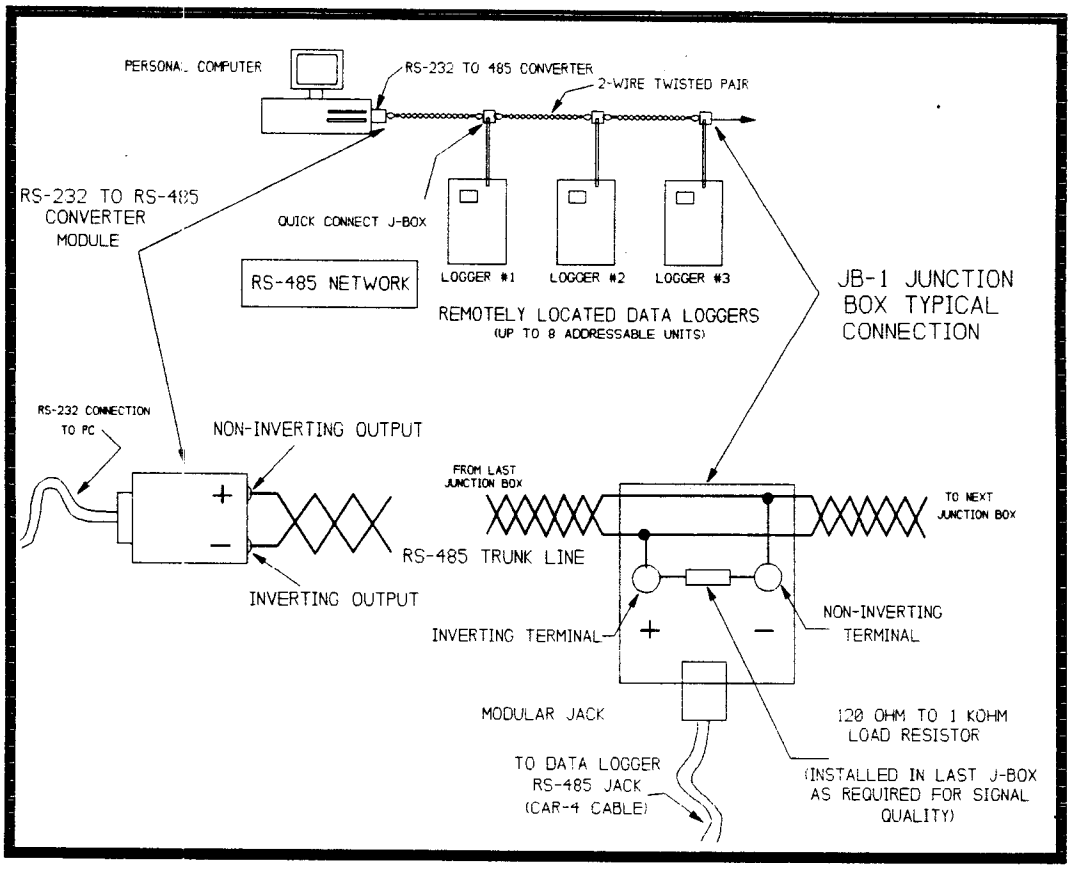

FIGURE 8.4: RS-485 NETWORK WIRING

NOTES:

8..APPENDIX J

CHANGING THE OM-220 EPROM

Updates to improve performance and / or add features are sometimes performed on the OM-220 by changing the EPROM to a later version EPROM. The EPROM contains the software code which controls the function of the OM-220. In the event that an update is initiated by Omega Engineering Inc, the User will be sent a package containing the necessary components. At this time (and only at this time) will the customer be requested to follow the following procedure which outlines the steps required to exchange EPROMs.

********** CAUTION **********

THE EPROM CHIP IS ESPECIALLY SENSITIVE TO DAMAGE FROM STATIC DISCHARGE WHEN OUT OF ITS SOCKET. DISCHARGE BODY STATIC BEFORE WORKING WITH THE OM-220 / EPROM BY TOUCHING A GROUNDED SURFACE BEFORE STARTING THIS PROCEDURE.

****

********** NOTE **********

Download any valuable data currently stored in OM-220 memory before starting this update procedure.

****

The EPROM exchange procedure follows:

TURN OFF OM-220 POWER, remove the three unit retaining screws and remove the OM-220 from its enclosure. Carefully, using a small flat screwdriver, pry the EPROM chip, located on the bottom circuit board, out of its socket (refer to identifying bubble 'C' in FIGURE 8.5). Replace the removed EPROM with the new enclosed EPROM by orienting the chip in its socket with the notch to the right, carefully aligning the pins, then slowly pressing the IC evenly into its socket.

********** CAUTION **********

ORIENT THE EPROM WITH THE NOTCHED END TO THE RIGHT (ie toward the right edge of the OM-220)

****

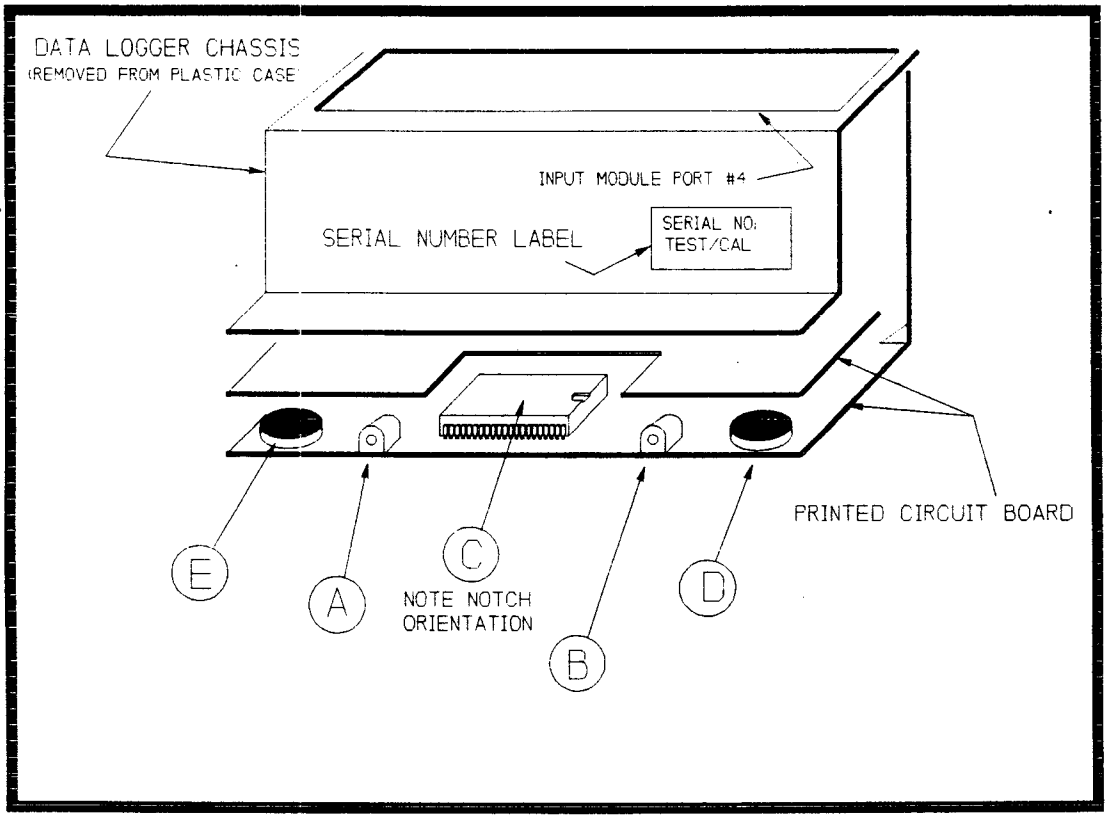

FIGURE 8.5: EPROM LOCATION AND ORIENTATION

After completely seating it in the socket, observe all of the pins to make sure that they have been properly seated and did not bend. Looking under the part from the end is a good inspection practice.

Reinstall the OM-220 into its case and turn on System Power. After a reset, the display should reflect the appropriate Firmware revision number. If the display does not come up; turn off power and re-inspect the EPROM to insure that all leads are properly seated.

CLEAR MEMORY to reinitialize the OM-220 memory. If using the OM-220 in the EXTERNAL PROGRAM mode, it will be necessary to load (X-MIT) a new RUN Program into memory before using the OM-220.

8..APPENDIX K

ALGEBRAIC PROCESSING BLOCK (APB) SPECIFICATIONS

The Algebraic Processing Block function provided within OC allows for powerful inter-channel calculations and advanced algebraic manipulation of collected data prior to display. The APB function operates on data within a Download file , previously collected by a OM-220 during a logging session. The APB function provides for additional math calculation capability in adjunct to the slope/offset programming capability which can be programmed into the BL via a RUN Program.

Contained within this appendix is detailed information that will be commonly referenced when building APB's. Five reference sections are provided:

OM-220 Standard Data Format Table

Valid APB Math Operators Listing

Significant Digit Specification

APB Equation Examples

APB Real World Applications

OM-220 STANDARD UNITS/DATA FORMAT TABLE:
The following table specifies the STANDARD data format and units that the OM-220 transmits or stores from different types of Input Modules signal inputs. OM-220s programmed with RUN Programs (SECTION 6.2) may have different Precision and Units due to the Slope and Offset equation for each channel.

The STANDARD Precision and Units listed below are the format that is Stored/Tracked if no additional RUN Program calculations are performed. This information is of value when developing APB equations as it is critical to understand the units used by the OM-220 in taking readings before a units conversion equation can be written. Users utilizing RUN Programs must keep track of the programmed output units for reference during APB construction.

INPUT MODULE	RANGE	PRECISION	UNITS
TCIM-2/4 (Thermocouple)	All	XXXX.X	Deg C or F
TRIM-2 (Thermistor)	-	XXX.X	Deg C or F
RTDIM-2 (RTD)	ALL (note 1)	XXX.X	Deg C or F
VIM-2/4 (Voltage)	200 mV	XXX.X	mVDC
	2 V	X.XXX	VDC
	20 V	XX.XXX	VDC

CIM-2 (Current)	20 mA	XX.XX	mADC
	200 mA	XXX.X	mADC
	2 A	X.XXX	ADC
FTTIM-2/4 (4 to 20 loop)	-	XX.XXX	mADC
BRIM-2 (Bridge)	All	XXX.XX	mV/V of excitation
DPIM-2 (Digital Pulse)	Freq	XXXXX.X	Hz
	Event	0 or 1	Closed/Open
	Counter	XXXXX	Counts

NOTE 1: The units (Degrees F or C) output by the OM-220 is a function of the internal System Switch setting (see section 3.2.7)

VALID APB MATH OPERATORS LISTING:

The following is a list of math operators and the acceptable syntax recognized by the OM-220 Communications APB equation expression evaluator.

Note that references to channels within the OM-220 or Download files are in the format C1A where the 'C' merely indicates that this parameter in the equation is a channel and the '1A' indicates the actual channel per the numbering on the OM-220 front panel.

Note that each APB equation must have a channel in the equation. For example an APB equation '125/6' will not function.

Addition: C3A+32	Adds 32 to channel 3A value
Subtraction: 100-C3B	Subtracts channel 3B value from 100
Multiplication: 2.5*C1A	Multiplies channel 1A times 2.5
Division: C2A/1.8	Divides channel 2A by 1.8
Exponentiation: C4A^3	Channel 4A cubed
Parentheses: 2*(C3B+4)	2 times the quantity of channel 3B+4
Square Root: SQRT (C2A)	Square root of channel 2A
Absolute Value: ABS(C4B)	Unsigned magnitude of channel 4B
Natural Log: LN(C1A)	Natural Log of channel 1A
Log Base 10: LOG10(C3B)	Base Ten log of channel 3B
Sine: SIN(1.5)*C1A	Sin of 1.5 Radians times channel 1A
Cosine: COS(1.3)* C3B	Cos of 1.3 Radians times channel 3B
Exponential: EXP(5)*C2B	e to the 5th power times channel 2B

APB SIGNIFICANT DIGIT SPECIFICATION:

The number of displayed significant digits past the decimal point (precision) of the APB equation result is specified at the start of the equation with a percent symbol followed by the desired places (a numerical value) and a space.

For example: %3 C1A will display the value of channel 1A with the XX.XXX format.

If no precision is specified (ie no % symbol is included in the start of the APB equation), the precision automatically defaults to two significant digits past the decimal (XX.XX).

APB EQUATION EXAMPLES

The following are some typical APB equation examples with a brief description following.

%1 C2A*1.8+32
Converts the OM-220 channel 2A from degrees C to degrees F with one significant digit to the right of the decimal.

C2B
This APB passes the value from channel 2B directly through without any processing. As no % symbol is used, the value defaults to 2 significant digits to the right of the decimal point.

(C1B-C1A)*1.8+32
The difference between two temperatures (read in Celsius) on channels 1A and 1B is calculated then converted to degrees F for display. Since no % symbol is specified, the result will display 2 significant digits to the right of the decimal point.

APB REAL WORLD APPLICATION EXAMPLES:

OVERVIEW:
This application note provides examples of APB equations that can be used for conversion of conventional linearized industry standard signals (4-20 mA loop, 0 - 5 VDC) to desired engineering units. In many applications of the OM-220, this Units conversion will be handled through the EXTERNAL PROGRAM feature and a RUN Program (SECTION 6.2) in which case the following information may serve as background theory of interested Users. The two-point AUTOCALC feature provided within OC (RUN Program development) utilizes the following theory in its application.

GRAPHIC ANALYSIS:
A Units conversion problem can be graphically demonstrated as shown in FIGURE 8.6 where the X-axis (horizontal axis) has one parameter plotted (eg 4-20 mA or 0-5 VDC) and the Y-axis has the converted parameter plotted. The parameter on the Y-axis is a function of the value on the X-axis (eg pressure in PSI (Y-axis) is a function of the current level (X-axis) in the 4-20 mA loop from the pressure transmitter). The line plotted on these axis is of the standard format:

$$Y = mX + b$$

Where:
Y is the converted value on the Y-axis (the desired output value)
X is the measured input signal
m is the slope of the plotted line function (the change in the Y value [delta Y] divided by the change in the X value [delta X])
b is a constant (fixed) offset value for the function

4-20 mA LOOP CONVERSION; AN IDEAL CASE

Assume a 5000 PSI Full Scale 4-20 mA pressure transmitter is connected to a OM-220 via the standard FTTIM-2 input module. The transmitter has recently been calibrated and it is known that the output is 4 mA @ 0 PSI and 20 mA @ 5000 PSI (an ideal, but not too common scenario).

Per the STANDARD UNITS TABLE (above) we see that the OM-220 stores signals from the FTTIM-2/4 in units of mA (ie not Amps). In this application we then know that at 0 PSI, the OM-220 reads 4.000 and for 5000 PSI, the OM-220 reads 20.0mA. Refer to FIGURE 8.6.

To calculate the equation for the function which will then be used in the APB software, we follow these steps:

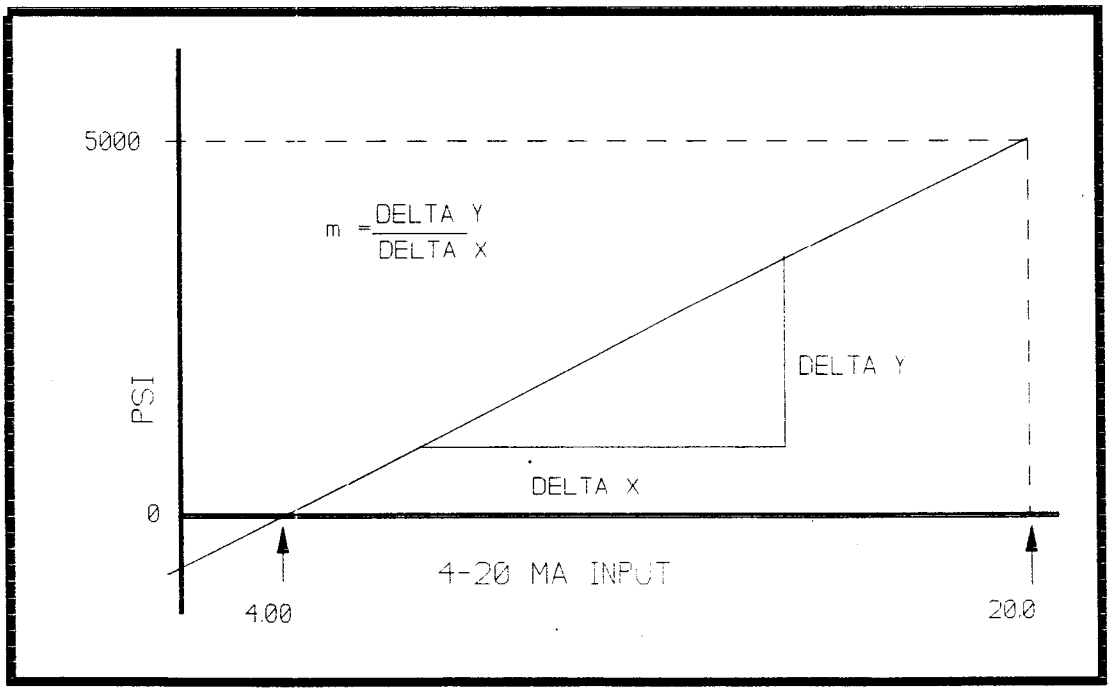

FIGURE 8.6: 'IDEAL' TRANSDUCER CURVE

1) Calculate the slope of the function, m:

m= delta Y / delta X

= (5000-0 / 20.0-4.0) = 5000/16 = 312.5

resulting in the equation Y = 312.5*X + b

2) Calculate the Offset, b:

Since we know two valid values for X and Y, (ie at 20.0mA the pressure is 5000 PSI) we can substitute one pair of these values into our equation and solve for b...

Y = 312.5*X + b
5000 = 312.5*20.0 + b
5000 = 6250 + b
so b = -1250 in this case and our equation is Y = 312.5*X-1250

3) Put the equation into the proper syntax for use as an APB equation in the OM-220 Communications. The input from that channel (eg assuming it was Channel B on Port 2) is 'C2B'.

The APB line equation that will be entered onto the appropriate equation line is

C2B*312.5-1250

4 - 20 MA LOOP CONVERSION; A MORE REALISTIC CASE

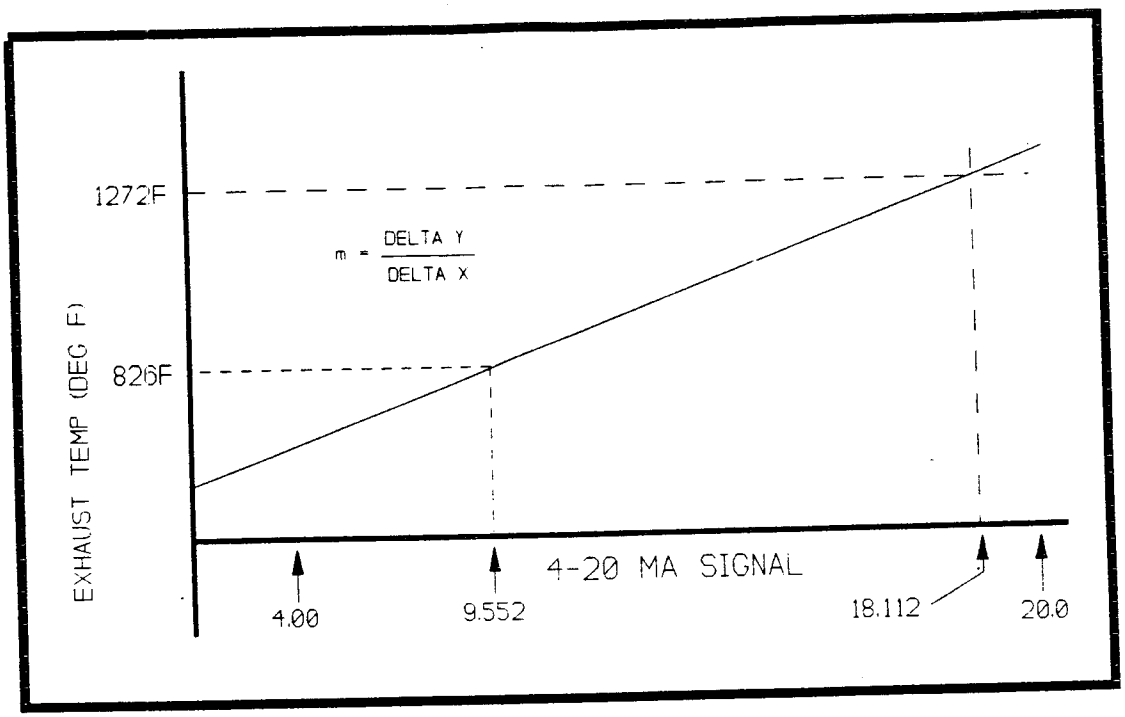

FIGURE 8.7: A MORE REALISTIC CASE...

In the real world, less than ideal situations abound. Here is one: An infrared temperature detector/transmitter (4-20 mA) is used for measuring the temperature of engine exhaust. The BAD news is that the transmitter is out of calibration. The GOOD news is that we

know it is out of calibration and we have a another thermometer (which is in cal) that we can use to get a couple of readings for reference. We hook the IR transmitter to the OM-220 and...

1) Measure the engine exhaust at one temperature with the calibrated thermometer while pressing the MONITOR button on the OM-220 input channel. The measured temperature is 826F and the OM-220 MONITOR function displays 9.552mA We then put a load on the engine and the exhaust is again measured. The measured temperature is 1272F and the MONITOR display reads 18.112mA Recording the results:

826F = 9.552mA
1272F = 18.112mA

2) Calculate the slope of the line (refer to FIGURE 8.7):

m = delta Y / delta X = (1272-826) / (18.112-9.552) = 52.102

resulting in the equation Y = 52.102*X + b

3) Calculate the Offset, b using one pair of the known absolute values (eg 9.552mA = 826F)

Y = 52.102*X + b
826 = (52.102 * 9.552) + b
826 = 497.68 + b
826-497.68 = b
328.32 = b and the equation becomes

Y = 52.102*X + 328.32

4)Put the equation into the proper syntax for use in the APB file. Assuming the signal was being measured on OM-220 channel A, Port 3, the equation entered on the equation line for that APB channel is:

(C3A*52.102)+328.32 (the parens are not really necessary)

CONCLUSION

These same conversion techniques can readily be employed for conversion of a multitude of different input signals to standardized engineering units. For example, transducers that produce a linear voltage output as a function of the measured physical parameter can readily be converted.

Ultimately, with the power of the OM-220 Communications APB functions and the RUN Program data collection capability of the OM-220, research data can be quickly and efficiently collected and analyzed.

8..APPENDIX L:

MODEM CONFIGURATION; EXAMPLES

Modems shipped from Omega Engineering Inc for use with OM-220 Data Logging Systems have been tested and configured at Omega Engineering Inc. **If the modem is not used with the OM-220 system, it will need to be set back to factory settings and then configured for the specific purpose.** The following configuration information is used by our staff to setup the listed modems and is provided for reference to Users configuring their own modems.

BEST PRODUCTS 2400X MODEM:

The 2400X modem has been programmed (non-volatile memory) to emulate a 'DUMB' modem with auto-answer mode enabled after 1 ring. This was done via a serial connection to the modem and sending the following command:

AT&FS0=1S14=20&D2&C1&W<ENTER>

AT Attention command (indicates that the following characters are commands to the modem not to pass through the RS-232/phone link)

&F Set modem to factory defaults.

S0=1 Enables auto-answer after 1 ring

S14=20 (ie binary word 00010100 for bits 7-0 of register S14)
Local echo disabled
Result codes disabled
n/a
Dumb mode (ie terminal mode)
Tone dialing mode
n/a
Answer mode

&D2 DTR active at all times

&C1 DCD active only when carrier is detected

&W Writes above configuration in N-V ram.

NOTE: When connecting the 2400X to the OM-220 system, do not turn power on to the modem until all the cables have been securely connected. If RS-232 cable is removed or inserted while power is on, it is possible that the modem configuration can change.

UDS 212ALP (300/1200 Baud) MODEM:

The two switches on the back of the UDS modem have been set to ANSWER 1200 BAUD. Connection of the modem to the telephone utility can be done by plugging the phone cable into the modular phone jack marked TELCO.

This modem does not require a separate power source as it draws operating current from the telephone line.

UDS FASTALK 32X (9600 BAUD) MODEM:
UDS FASTALK 2400/5MNP (2400 BAUD) MODEM:

The FASTALK line of modems have the capability to operate on different baud rates and can automatically adjust to match the baud rate of the calling modem. However, the OM-220 front panel Baud Rate switch must match the data transfer rate. Since the baud rate is not locked, communications problems can arise if the OM-220 rate is picked to be slower than the modems fastest rate.

The phone utility should be plugged into the modem modular phone jack marked LINE. The 32X modem uses an RJ-45, 8 conductor size modular phone/jack combination. A four foot cable with an RJ-45 plug on one end (plug into the modem) and an RJ-12 (6 conductor) plug on the opposite end (plug into the telephone line J-box) has been supplied with the modem.

The 2400X utilizes the more common RJ-12 (6/4 size) modular phone plug for connection to the phone line and a cable is included.

The FASTALK modem has been programmed (non-volatile memory) to emulate a 'DUMB' modem with auto-answer mode enabled after 1 ring. This was done via a serial connection to the modem and sending the following command:

AT\Q&C1&S1&D2\N1&RS0=1&W&W1<ENTER>

AT	Attention command (indicates that the following characters are commands to the modem not to pass through the RS-232/phone link)
\Q	Disables flow control
&C1	DCD ON with carrier
&S1	DSR normal
&D2	If DTR drops, disconnect
\N1	Operate in DIRECT mode
&R	CTS follows RTS
S0=1	Auto-answer after 1 ring

&W&W1	Write configuration to non-volatile locations 0 and 1

After the configuration was done, internal SMART/DUMB jumper strap was moved to DUMB position to disable further programming and disable response codes.

NOTE: When connecting the FASTALK modem to the OM-220 system, do not turn power on to the modem until all the cables have been securely connected. If RS-232 cable is removed or inserted while power is on, it is possible that the modem configuration can change.

UDS FASTALK II MODEM

The UDS FASTALK II modem is capable of operating at speeds up to 14,400 baud. It will automatically adjust to match the baud rate of the calling modem. Since the OM-220 can only operate up to 9600 baud, communications problems can occur if the modem connection rate exceeds the baud rate setting on the OM-220.

If you will be calling the OM-220 with a 9600 baud or slower modem, be sure to set the **Baud Rate Switch** on the front panel of the logger.

If you will be calling the OM-220 with a modem faster than 9600 baud, you must setup your modem to limit the connection speed to whatever the OM-220's **Baud Rate Switch** is set to.

Example:
If you are using a U.S. Robotics Sportster 14.4 fax/modem, put one of the following A T commands in the **Modem Setup String** entry in the **Modem Setup Menu.**

AT &N6	(forces connection to 9600)
AT &N3	(forces connection to 2400)
AT &N2	(forces connection to 1200)

The FASTALK II has been programmed (non-volatile memory) to emulate a 'DUMB' modem with auto-answer mode enabled after 1 ring. This was done via a serial connection to the modem and sending the following command from a terminal program:

AT Q1 S0=1 &C1 \J1 \N3 \V0 B2 E0 \Q0 &W0 &Y0

AT	Attention command (indicates that the following characters are commands to the modem not to pass through the RS-232/phone link
Q1	Modem does not send responses
S0=1	"S" register Zero -answer after 1 ring
&C1	Turn on Carrier Detect when remote carrier signal is present
\J1	DTE to modem rate will follow modem to modem rate
\N3	attempt MNP or normal data link
\V0	Do not send extended responses
B2	Autoscan for baud rate enabled
E0	Commands are not echoed
\Q0	Turns off software flow control
&W0	Writes configuration to profile location zero
&Y0	Loads profile 0 after reset or power up

Date: 12-1-95, 11-22-96
USR14-om.DOC

Using the US Robotics Sportster External FAX / Modem with the OM-220

Configuring the USR Sportster for use at the OM-220 location

To use a Sportster 14.4, 28.8, or 33.6 at the OM-220 location (connected to the OM-220 front panel Modem Port via the CAM-4 cable) the modem must be configured as a "DUMB" modem with auto-answer mode enabled after 1 ring. The Sportster will automatically adjust to match the baud rate of the calling modem. Configuration of the modem is done manually by setting the dip switches on the back of the modem as follows:

Switches	1	DOWN	Modem ignores DTR (Override)
	2	DOWN	Numeric results
	3	UP	Result Code Display suppressed
	4	DOWN	Command Mode Local Echo suppressed
	5	UP	Auto Answer on first ring
	6	UP	Carrier Detect, Sends CD signal upon connection.
	7	DOWN	Load factory default configuration at power-up
	8	UP	Command recognition disabled(Dumb Mode)

Configuring the USR Sportster at the PC location for calling a remotely located OM-220:

For compatibility with the OM-220 Communications software, the switches on the US Robotics Sportster should be set as follows:

Switches	1	DOWN	Modem ignores DTR (Override)
	2	UP	Verbal (word) results
	3	DOWN	Result Code Display enabled
	4	UP	Command Mode Local Echo enabled
	5	UP	Auto Answer on first ring (Down is also OK)
	6	UP	Carrier Detect, Sends CD signal upon connection.
	7	DOWN	Load factory default config at power-up (UP is also OK)
	8	DOWN	Command recognition enabled (Smart Mode)

The US Robotics Sportster modems are capable of operating at speeds greater than 9600 baud. The OM-220 has a maximum operating speed of 9600 baud, so communication problems may arise if the modem connection rate exceeds the baud rate setting on the OM-220.

To insure that there is proper communication with the OM-220, the speed of the **calling modem** must be forced to emulate the baud rate set on the **Baud Rate Switch** of the OM-220. The answering modem at the OM-220 location will adjust to the calling modems rate and communication will commence.

To force the PC modem to call at a particlular Baud Rate, enter one of the following commands (depending on the baud rate set on the OM-220 front panel) into the OM-220 Communications software *Modem Setup String* field (within the Communicate/Modem screen).

For a U.S. Robotics Sportster modem, the AT commands are:

AT&N6	(for 9600 baud rate setting on the OM-220)
AT&N3	(for 2400 baud rate setting on the OM-220)
AT&N2	(for 1200 baud rate setting on the OM-220)

Date: 12-1-95
LIFE28OM.DOC

Using the Motorola Lifestyle 28.8 Modem (MDM-6) with the OM-220

Configuring the Lifestyle 28.8 for use at the OM-220 location:
To use a Lifestyle 28.8 at the OM-220 location (connected to the OM-220 front panel Modem Port via the CAM-4 cable) the modem must be configured as a "DUMB" modem with auto-answer mode enabled after 1 ring. Configuration of the modem for this type operation is done by programming the modem from a PC running a serial communication program (such as ProComm, Qmodem, etc) via an RS-232 serial connection.

To program the Lifestyle 28.8, send the following command string from within the serial comm terminal program.

ATE0Q1&C1&D0S0=1&R0&S0&Y0\J1\M0\Q0&W

AT	Attention code - command prefix
E0	Local character echo off
Q1	Response displays off
&C1	DCD on while carrier is present
&D0	DTR ignored
S0=1	AutoAnswer after one ring
&R0	CTS normal operating state
&S0	DSR Always on
&Y0	Power up with user option #1
\J1	Enable Slaved computer/modem speed (constant speed computer off)
\M0	V.42 fast detect data sequence disabled
\Q0	Disable computer flow control
&W	Store current configuration to user option set #1

Configuring the Lifestyle 28.8 at the PC location for calling a remotely located OM-220:
The Motorola Lifestyle 28.8 modem is capable of operating at speeds up to 28800 baud. The OM-220 has a maximum operating speed of 9600 baud, so communication problems may arise if the modem connection rate exceeds the baud rate setting on the OM-220.

To insure that there is proper communication with the OM-220, the speed of the **calling modem** must be forced to communicate over the phone link at the speed set on the **Baud Rate Switch** of the OM-220. If properly configured (see above) the OM-220 modem will automatically adjust to match the baud rate of the calling modem.

To force the PC modem to call at a particular Baud Rate, enter one of the following commands (depending on the baud rate set on the OM-220 front panel) into the OM-220 Communications software *Modem Setup String* field (within the Communicate/Modem screen).

If you are using the Lifestyle 28.8 modem at the PC location, enter the following AT commands in the **Modem Setup String** entry in the **Modem Setup Menu**.

AT%B6	(for 9600 baud rate setting on the OM-220)
AT%B3	(for 2400 baud rate setting on the OM-220)
AT%B2	(for 1200 baud rate setting on the OM-220)

If you are using a UDS FASTALK II modem, the AT commands would be:

ATB8	(for 9600 baud rate setting on the OM-220)
ATB6	(for 2400 baud rate setting on the OM-220)
ATB5	(for 1200 baud rate setting on the OM-220)

If you are using a U.S. Robotics Sportster 14.4 modem, the AT commands would be:

AT&N6	(for 9600 baud rate setting on the OM-220)
AT&N3	(for 2400 baud rate setting on the OM-220)
AT&N1	(for 1200 baud rate setting on the OM-220)

If you are using a MicroCom TravelCard Fast 28.8 (PCMCIA) the AT commands would be:

AT%G1%B9600	(for 9600 baud rate setting on the OM-220)
AT%G1%B2400	(for 2400 baud rate setting on the OM-220)
AT%G1%B2400	(for 1200 baud rate setting on the OM-220)

8..APPENDIX M:

DATA STORAGE OPTIONS: FLOAT VS INTEGER

OVERVIEW:
When operating the OM-220 in the EXTERNAL PROGRAM mode, it is possible to effectively double the data storage capacity through the use of the INTEGER mode (set with Port 2 Switch #3). **However**, before this mode is enabled, an Input Span Test should be performed by the User to insure that the INTEGER mode is capable of handling the range of input signals to be encountered during a logging session. Failure to accurately perform this Input Span Test will result in unusable data.

********** NOTE **********
If their is any doubt relative to the Data Storage mode to select, follow these rules:

1) If in FRONT PANEL mode (i.e. NOT EXTERNAL PROGRAM mode) always use INTEGER Data Storage Format.

2) If in EXTERNAL PROGRAM mode, use FLOAT Data Storage Format
****

INPUT SPAN TEST:
A relatively easy test can be performed on the OM-220 inputs to insure that they can be stored to memory using the INTEGER Data Format.

For **each active OM-220 channel**, perform the following analysis:

1) Estimate the maximum positive and negative value result (after processing through any RUN Program equation) that would normally be stored to memory.

2) Compare this maximum value to the RANGE specification for the particular type of Input Channel in the following Span Table.

3) If the maximum value will ALWAYS be within the RANGE specification, INTEGER Data Format can be used in the EXTERNAL PROGRAM mode (i.e. Port 2 Switch #3 OFF). If the maximum value will ever be outside the RANGE specification, use the FLOAT Data Format.

4) Note that **ALL ACTIVE CHANNELS** must comply with the above test steps to use INTEGER Data Format.

INPUT CHANNEL	RANGE
TCIM-2/4	-3225.6 to +3225.6
TRIM-2	-3225.6 to +3225.6
RTDIM-2	-3225.6 to +3225.6
FTTIM-2/4	-322.56 to +322.56
VIM-2/4 (20V RANGE)	-322.56 to +322.56
VIM-2/4 (2V RANGE)	-32.256 to +32.256
VIM-2/4 (200mV RANGE)	-3225.6 to +3225.6
CIM-2 (2A RANGE)	-32.256 to +32.256
CIM-2 (200mA RANGE)	-3225.6 to +3225.6
CIM-2 (20mA RANGE)	-322.56 to +322.56
BRIM-2	-322.56 to +322.56
DPIM-2 (FREQ)	0 to 32256
DPIM-2 (COUNT)	0 to 32256
DPIM-2 (EVENT)	NO LIMITS

SPAN TABLE

8..APPENDIX N

ASCII CONVERSION FILE FORMAT SPECIFICATION

The OM-220 Communications software contains a Download (*.DWD) file to ASCII file (*.ASC) conversion utility under the <F> F-ILE CONVERT selection from the **MAIN MENU**. This utility uses the Download file data as input and creates a comma delimited file (CDF) with a data and time for each scan of readings.

The ASCII file has the following format:

MM-DD-YY,HH:MM:SS,DATA1,DATA2,DATA3,.....DATA15,DATA16,CRLF

The DATA terms are in 10.3 format delimited by commas and an end of line CRLF. The file ends with a <CNTL Z>. Missing channels (ie not active) still have place holding commas.

A sample file with ten active channels follows. The first two channels were sampling at 5 Second rate and the others were all set at a 15 Second rate.

```
06-11-93,13:54:23,  25.000,  24.700, -25.000, -25.000, -25.000, -25.000,  0.000, 99999.000, 99999.000,  0.000,,,,,,,
06-11-93,13:54:28,  25.000,  24.700,,,,,,,,,,,,,,,
06-11-93,13:54:33,  25.000,  24.700,,,,,,,,,,,,,,,
06-11-93,13:54:38,  25.000,  24.700, -25.000, -25.000, -25.000, -25.000,  0.000, 99999.000, 99999.000,  0.000,,,,,,,
06-11-93,13:54:43,  25.000,  24.700,,,,,,,,,,,,,,,
06-11-93,13:54:48,  25.000,  24.800,,,,,,,,,,,,,,,
06-11-93,13:54:53,  25.000,  24.800, -25.000, -25.000, -25.000, -25.000,  0.000, 99999.000, 99999.000,  0.000,,,,,,,
06-11-93,13:54:58,  25.000,  24.800,,,,,,,,,,,,,,,
06-11-93,13:55:03,  25.000,  24.800,,,,,,,,,,,,,,,
06-11-93,13:55:08,  25.000,  24.800, -25.000, -25.000, -25.000, -25.000,  0.000, 99999.000, 99999.000,  0.000,,,,,,,
06-11-93,13:55:13,  25.100,  24.800,,,,,,,,,,,,,,,
06-11-93,13:55:18,  25.100,  24.800,,,,,,,,,,,,,,,
06-11-93,13:55:23,  25.100,  24.800, -25.000, -25.000, -25.000, -25.000,  0.000, 99999.000, 99999.000,  0.000,,,,,,,
```

NOTES:

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THE END

MADE IN USA

WARRANTY/DISCLAIMER

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID, if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. Nevertheless, OMEGA only warrants that the parts manufactured by it will be as specified and free of defects.

OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

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CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY / DISCLAIMER language, and additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA ENGINEERING Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS OR **CALIBRATION,** consult OMEGA for current repair/calibration charges. Have the following information available BEFORE contacting OMEGA:

1. P.O. number to cover the COST of the repair/calibration,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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Where Do I Find Everything I Need for Process Measurement and Control? OMEGA...Of Course!

TEMPERATURE

- Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- Wire: Thermocouple, RTD & Thermistor
- Calibrators & Ice Point References
- Recorders, Controllers & Process Monitors
- Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- Transducers & Strain Gages
- Load Cells & Pressure Gauges
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL

- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY

- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

DATA ACQUISITION

- Data Acquisition and Engineering Software
- Communications-Based Acquisition Systems
- Plug-in Cards for Apple, IBM & Compatibles
- Datalogging Systems
- Recorders, Printers & Plotters

HEATERS

- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

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