Table of Contents

Table of Contents

Table of Contents

List of Figures

LIST OF TABLES

1 Introduction

The PMD 150S Slave Message Display is a low-cost alphanumeric display panel that displays messages sent to it from a PMD master display, computer, or other intelligent device with serial communications capabilities.

Physical Characteristics

PMD slaves are housed in the same rugged, black aluminum case as PMD master displays. Only the back panel of the unit differs to provide the interfacing and addressing requirements of the slave display.

Panel cut-out and outline dimensions for the PMD 150S are located in Section 7 of this manual.

The Front Panel

The front panel of the display contains the 20- or 40-character display and the mounting hardware for the unit.

The vacuum-fluorescent display consists of 1 or 2 rows of 20 characters which are 5.05 mm high. Each character location consists of a 5 x 7 dot matrix which will display all standard ASCII characters. Displayed messages are legible at a distance of 10 feet from the unit.

The front panel has gasketing and built-in mounting studs. The unit is also available with a stainless-steel front panel.

The Back Panel

Section 2 of this manual covers the switches and connectors located on the back panel of the PMD 150 slave.

The switches select the group and unit numbers of the unit address and binary/BCD number coding for this address. The connectors provide connection for service power and for interfacing to the controlling device as well as other master/slave message displays.

The Message

All messages displayed on a PMD master display (including international character sets) can be duplicated on a PMD slave unit. These messages can vary in length and can be displayed in various ways.

1 Introduction

Standard Messages

Standard messages contain 20 or 40 characters or less and can be displayed alone or with other messages.

Messages can be overlaid on the display. Two or more messages can be displayed without clearing the display. The second message can cover parts of the first message and can skip over other parts of the first message where the second message is programmed with "null" characters. Large numbers of messages can be generated by overlaying several messages together.

Scrolled Messages

Scrolled messages contain up to 235 "characters" and can scroll upward or from right to left. For the two-line slave, upward-scrolling messages display one or two lines of text at a time. Each line of the message can be displayed first on the lower line, next on the top line, and then is scrolled off the display. For the one-line slave, upward-scrolling messages are displayed one line at a time. Left-scrolling messages scroll on either line of the display. The unused line (for a two-line) can be blank or display one line of a standard message or other left-scrolling message.

Special Message Display Features

Any message can contain time, date, and variable data from the controller, or null (non-programmed) characters. Additionally, the entire message can blink.

PMD slaves do not contain real-time clock circuits. Therefore, if time and date are to be displayed, they must be continually updated by the PMD master display or by special commands sent from a controlling computer. Variable data (up to four sets of up to five significant digits per message) is updated in the same manner.

Other Message Display Options

Other display options affect the manner in which messages are displayed.

1 Introduction

Scroll Options

Scrolling messages can repeat and scroll at a unique rate. Upward-scrolling messages can be displayed on either line or both. Left-scrolling messages can be displayed on either of the display's lines.

Centered/Uncentered Option

Standard and upward-scrolling messages can center their "lines" of message text on the 20-character framework of the message line. Standard, uncentered messages can begin at any character location between 1 and 20 (40). Upward-scrolling, uncentered messages begin at character position one.

Clear Display Option

Additionally, a standard message can either clear the display area of all previous messages or overlay the message on top of existing messages.

PMD Master Control

Section 3 of this manual provides information for controlling the PMD slaves and displaying messages with a PMD master unit. Slaves can be controlled by Master PMD units (controlled by a PLC) or in "Computer Interface Mode" (controlled by a computer). The system provides a few more options for slave control when the master is under computer control.

When PMD slaves are interfaced to a PMD master display controlled by a PLC, the master display is usually interfaced to discrete, data, or relay output modules on the controller. The controller selects a programmed message in the master display by directing the unit's input lines. These input lines are read by the master as a message number that was assigned to the message when it was programmed into the display or as a data set that is placed within the displayed message.

When the programmed message itself indicates that it should be sent to slave displays, the address of the slave or slaves in that particular message will designate which of the displays will receive and display that message.

1 Introduction

Computer Control

Sections 4 and 5 of this manual supply information for communication between PMD slave displays and a computer (or PLC ASCII interface). With this mode of operation, slaves do not require a master display.

By using various codes and specified formats, a computer or other device can duplicate the input requirements of the slave as provided by the master. Additionally, when information is sent to an individual slave in this manner, the slave will send a reply to the computer to indicate success or failure of the communications or to provide information about the unit interrogated.

Conclusion

Application of PMD Slave Displays is as diverse as individual business needs. Think of it, if you will, as a mailbox into which messages addressed to that location are delivered — and subsequently displayed.

Now consider several mailboxes in various locations within your company (the PMD slave is also comparable in size to a mailbox), and that delivery of these messages can occur in milliseconds. And remember — these messages were written by *your company* personnel to tell you *what is happening* at that very instant or to give you an *up-to-the-minute report*.

2 The Back Panel

The back panel of the PMD slave display contains two dip switches that set the unit address of the display, determine whether this address is a BCD or binary number, and select the character set.

Also located on the back panel are two terminal blocks: one for RS-422 interfacing to the controlling device and other message displays and one for service power. There is also a 9-pin 'D'-connector for RS-232 interfacing to a controlling device. Figure 2-1 shows the back panel of the PMD 150S slave display.

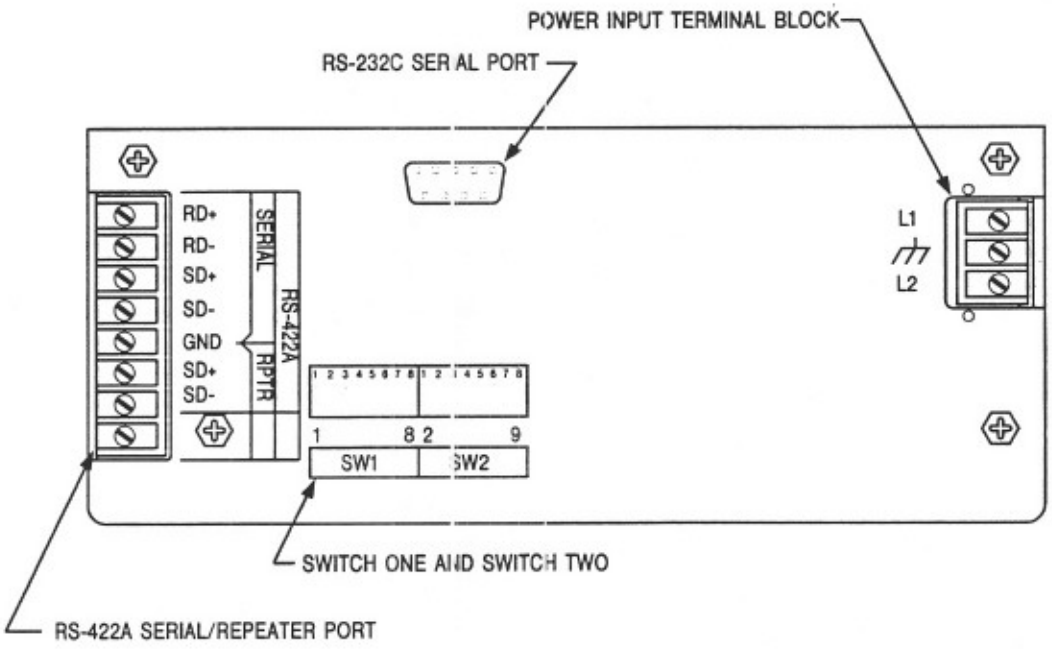

Figure 2-1. Back Panel of the PMD 150S Slave Display

2 The Back Panel

Switch One and Switch Two

These switches define the unit address (the unit and group number that the unit will respond to) and whether this address is a BCD or binary number. Switch Two (positions 2–4) also defines the international character sets used by the slave for messages display. Table 1 shows switch setting identification for the international character sets.

All eight positions of Switch One and the first position of Switch Two determine the unit number. Positions five through eight of Switch Two determine the group number. Position nine of Switch Two designates whether the other switches represent two BCD numbers or two binary ones.

Figure 2-2 demonstrates how Switch One and Switch Two are read. Table 2 defines the numerical value of the unit address positions of these switches. In binary numbering, the maximum values are 16 groups (0–15) and 511 units (1–511). When set for BCD, the maximum values are 10 groups (0–9) and 199 units (1–199).

NOTE: For BCD addressing, numbers greater than 9 in any position will have unpredictable results.

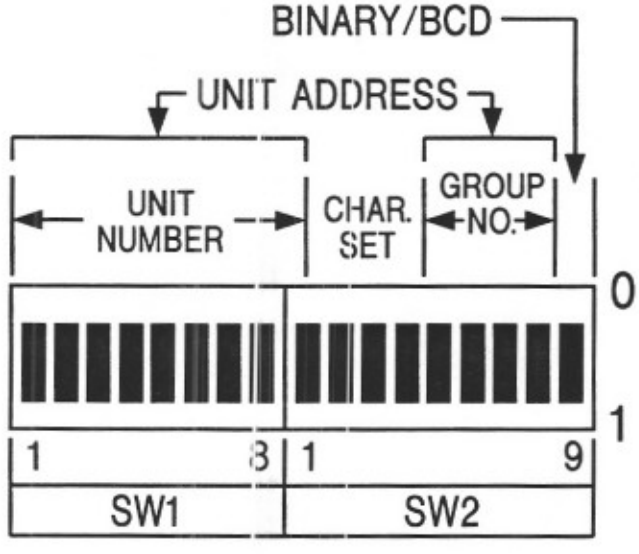

Figure 2-2. Switch One And Switch Two Definitions

2 The Back Panel

Table 2-1. International Character Sets Switch Identification

CHARACTER SET	SW2-2	SW2-3	SW2-4
United States	0	0	0
Cyrillic	1	0	0
French	0	1	0
German	1	1	0
English	0	0	1
Danish	1	0	1
Swedish	0	1	1
Japanese Kana	1	1	1

Table 2-2. Switch One and Switch Two Unit Address Identification

SWITCH POSITION	BINARY	BCD	DESIGNATION
SW1-1	1	1	unit number
SW1-2	2	2	unit number
SW1-3	4	4	unit number
SW1-4	8	8	unit number
SW1-5	16	10	unit number
SW1-6	32	20	unit number
SW1-7	64	40	unit number
SW1-8	128	80	unit number
SW2-1	256	100	unit number
SW2-5	1	1	group number
SW2-6	2	2	group number
SW2-7	4	4	group number
SW2-8	8	8	group number
SW2-9	1	0	BCD/binary

IMPORTANT NOTE: Messages sent to unit number zero are processed by all units within a specified group, therefore any unit that is assigned a unit number of zero cannot be individually addressed.

2 The Back Panel

RS-422A Serial/Repeater Port

The RS-422A Serial/Repeater Port is an 8-position terminal block through which all communications with master displays and RS-422 computer inputs to the unit take place. Wiring options used to interface message display systems are shown in figure 2-3.

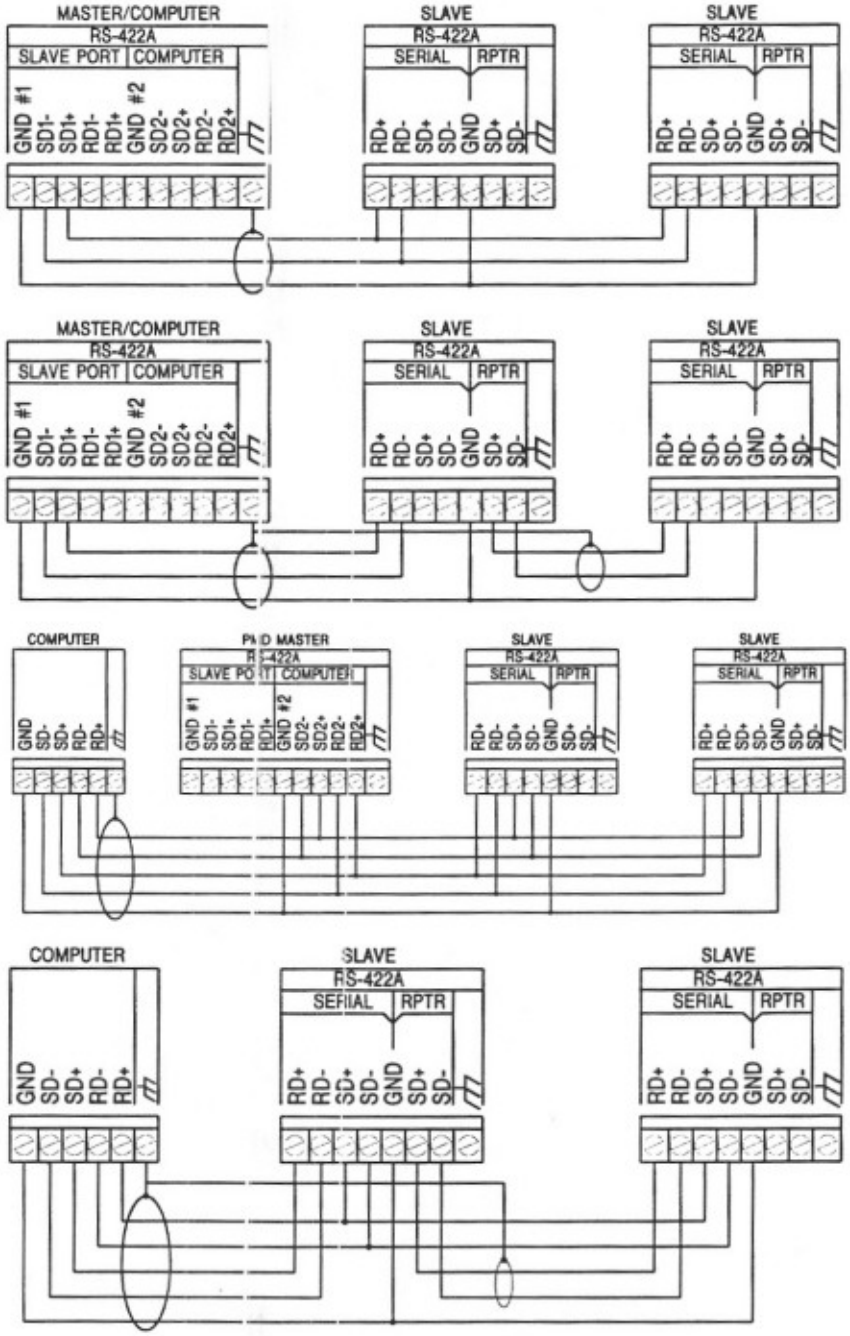

Figure 2-3. RS-422A Serial/Repeater Port Interfacing

2 The Back Panel

The first two diagrams in figure 2-3 can be used to interface slave units to either a master PMD or to a computer or PLC when only unidirectional communication is to take place. The third and fourth diagrams are for bidirectional communication that can only take place using computer control. The PMD master in the third diagram is optional and is not controlling the slaves. Notice that since PMD masters do not have repeater ports, they can only begin daisy-chains and cannot be included within the chain.

Multi-drop wiring requires signal boosting after every ten slaves and for slaves located further than 4000 feet (1200 meter) from the controlling device as well. Daisy-chain wiring providing signal boosting between each device is possible. (No provision is made for boosting the reply channel, however).

All RS-422 connections should be made with cable of equal or superior specifications and characteristics to those specified for *Belden cable number 9730.

An RS-422 "link" consists of a two-wire transmitting line, a two-wire receiving line (optional), signal common and the shield that is usually terminated to safety ground. Each two-wire line should physically be implemented with the two wires of one of the twisted pairs in the cable. (The cable specified for RS-422 connections consists of three twisted pairs.) Each twisted pair is individually shielded, and each shield is brought out to a drain wire. ***DO NOT USE WIRES FROM DIFFERENT TWISTED PAIRS TO MAKE UP A 2-WIRE SIGNAL LINE.***

*Belden is a registered trademark of Belden Electrical Wire Products, a division of Cooper Industries.

RS-232 D-Sub Serial Connector

The RS-232 connector can be used for computer control of the display at 1200 or 9600 baud. The commands can be repeated in RS-422 format via the repeater port. Refer to figure 2-4, next page.

— continued

2 The Back Panel

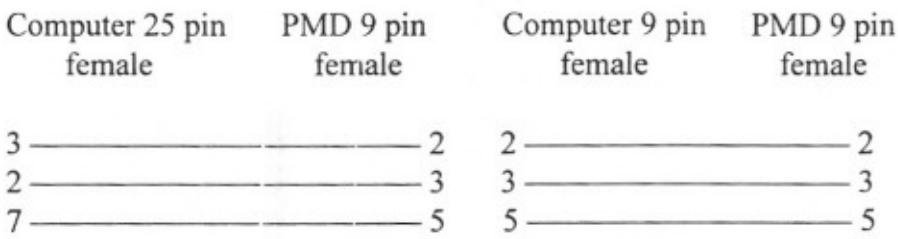

Figure 2-4. Pin Connections

NOTE: Additional wires or jumpers in the cable may cause communication problems between the computer and the PMD.

Power Inputs Terminal Block

This 3-position terminal block is for connecting to an external power source to power the unit. Always connect the ground terminal to safety ground.

Conclusion

The PMD slave display is identified by its unit address that is determined by the positioning of Switch One and Switch Two on the back panel of the unit. Switch Two also identifies the character set for the slave message display. The RS-422A Serial/Repeater Port provides connection to the unit for communication wiring, and the Power Input Terminal Block interfaces to service power.

Information concerning internal adjustments that may be necessary are covered in Section 7 of this manual.

Section 3 covers operation of the PMD display using a PMD master display, Section 4 covers the alternative operation of computer control with UTICOR protocol and Section 5 covers ASCII protocol.

3 PMD Master Control

Displaying messages on a PMD 150S slave display is easily accomplished by interfacing the unit to a programmed PMD master display.

Messages are programmed into the master display in a format that is understood and accepted by the slave display. The manner in which a message will be displayed (scrolling text, etc.) is programmed into the message along with the message text. The slave will display the message exactly as the master display does (according to the message's individual parameters).

Messages with real-time and variable data are updated from the PMD master. When the PMD slave receives new time/date/data information, the message currently being displayed will be updated. While this information is sent to all slave displays, the PMD slave will display only messages that were programmed with an address acceptable to a particular unit.

Master Control Preparation

Use the following procedure to prepare the PMD slave display for master control:

a. Set the unit address on Switch One and Switch Two.

b. Connect the RS-422A Serial/Printer Port to programmed master(s) and other slave(s) in the desired configuration shown in the first two examples of figure 2-3 in the preceding section.

c. Connect service power to the unit.

What Happens During Master Control...

The following sequence of events occurs when the PMD slave display is put into master control:

a. The PMD slave display is ready to communicate and displays the message:

PMD REV GR UNIT BAUD
150S X YY ZZZZ 9600

3 PMD Master Control

PMD 150S indicates the display is a 150S display. REV represents the product revision code of the software in the display. GR YY and UNIT ZZZZ indicates the current group and unit number settings from Switch One and Switch Two. Baud 9600 tells you the selected baud rate on the internal jumper. (PMD units must be set to operate at 9600 baud when under master control.)

NOTE: If your PMD 150S is a one-line unit, you will receive an upward-scrolling message providing you with this information.

b. The PMD slave displays this message until the PMD master begins communicating with the slave(s).

c. The display clears and then displays the selected message until the slave is addressed again with a new message.

d. The master sends time and date information to all slaves every one second. Once a slave receives this data, it expects to continue receiving it every one second. It three seconds lapse between time and date information, the slave displays a "NO COMMUNICATIONS" message until it receives either the time and date or a new message is selected.

e. Any changes to data set (variable data) information in the master causes the master PMD to send all four data sets to all slaves.

NOTE: There is an exception to item c, above — a scrolling message that does not repeat. In this case, the display clears (only the affected line clears on a left-scrolling message) and waits for a new message.

Addressing Slaves

Each PMD slave display is assigned a unit address. A unit address is programmed into each message (that is programmed to be output to slaves) to specify the unit or units that should display that message.

The unit address of a PMD slave display is defined by the setting of the dip switches located on the back panel of the unit. These switches can be changed at any time to alter the address of the unit.

3 PMD Master Control

Each unit address consists of two identifiers — a group number and a unit number. The unit addresses are divided into group and unit numbers to allow the master to address selected subsets of all the PMD displays connected to it. The following list shows the possibilities:

1. Group #00, Unit #0000 — addresses all units
2. Group #XX, Unit #0000 — addresses all units in group #XX
3. Group #XX, Unit #XXXX — addresses the specific unit indicated

When the group and unit number equal zero, messages sent by the master will be displayed by all slaves.

With a non-zero group number and a unit number of zero, all units in that group will display the message.

With a non-zero group and unit number, only the display with the indicated address will display the message.

Mixing Displays

One, two, and four line displays can be used on the same network (a four-line master with two-line slaves and vice versa). Because of the basic differences between the displays and their messages, the following rules apply to mixing PMD 150S slaves with larger character masters.

Using the PMD 150S with 200 and 300 Masters

The PMD 150S is compatible with the PMD 200 2-line display and the PMD 300 4-line display. Because the PMD 150S has either 20 or 40 characters and the PMD master has either 40 or 80 characters, the following rules apply to how messages are displayed on the PMD 150S.

1. Only the first two lines of a four-line master is displayed on a two-line PMD 150S.
2. Only the first line of a two- or four-line master is displayed on a one-line PMD 150S.

3 PMD Master Control

3. Messages programmed to scroll upward on lines 3 and/or 4 will scroll upward on both lines of a two-line PMD 150S display.

4. Messages programmed to scroll upward on lines 2 and/or 3 or 2, 3, and 4 will scroll upward on line 2 of a two-line PMD 150S display.

5. All messages programmed to scroll upward will scroll upward on the PMD 150S one-line display unless the message is programmed for line 2 only.

6. Left-scrolling messages programmed to scroll on lines 3 or 4 will scroll left on line 1 of the PMD 150S.

7. All left-scrolling messages scroll left on line 1 of a PMD 150S one-line display unless programmed for line 2.

Slave Control by Computer-Controller Master

Several options for control of slave units are available only when the master PMD controlling them is operating in computer interface mode. These options allow the controlling computer to select, during operation, subsets of a master's slaves to receive variable data and to display messages.

This will allow the slaves controlled by one master to display messages containing data from a number of groups of four data sets. A master operating in the normal display mode can send only one group of variable data to all of its slaves.

The sequence for these options are as follows (see the user manual for one of the PMD masters for complete descriptions of the commands mentioned below):

a. The control computer sends a Select Active Slave command (Code 15) to the master PMD. The data in the command will specify which of the master's slaves are to be made active and which are to be made inactive.

3 PMD Master Control

b. The master passes the Select Active Slave command on to its slaves, causing the specified activations and de-activations.

c. The control computer sends a Write Data Set Data To Master command (Code 16) to the master. The data contained in the command will include four sets of variable data and should indicate that the master is to pass the data on to active slaves only.

d. The master PMD will then retransmit the variable data it received to the active slaves by sending the Write Data Set Data command (Code 14) with the unit number to select active slaves only (Group #15, Unit #4095).

e. Only slaves that were activated will receive the new data. All others will continue to display the data that they have received previously. This sequence can be repeated as many time as needed to send different data sets to different groups of a master's slaves.

The same sequence can be used to send messages from the control computer to specific slaves. In this case, the control computer (step c., above) will send the Display Packet Message command (Code 02) to the master (in place of Code 16). Then the master (step d., above) will send the Slave Display Packet Message command (Code 17) to the slaves (in place of Code 14) using the address Group #15, Unit #4095. This will cause active slaves only to display the message.

Notice that with this type of operation, a PMD master display may use the address active display (Group #15, Unit #4095) addressing technique described in Section 4 of this manual. Because slaves can only be de-activated using computer interface, messages addressed to active slaves would be processed by all slaves (as in Group #00, Unit #0000) when no type of computer control is being used.

Conclusion

Because PMD slave displays contain no message program, all message text displayed on the slave is received from an outside source. When controlled by a master, a slave receives its information from the

3 PMD Master Control

master's programmed messages that are, in turn, selected by the device that controls that PMD master.

Information concerning the PMD master display and its message program is found in the PMD master display user manuals. Reference to these manuals is necessary for programming the master and preparing it for the master/slave network.

The following section of this manual covers the alternative method to communication with a PMD slave display. With this type of interface, PMD master displays may or may not be involved. In addition to receiving and displaying messages, individual slave displays can also send replies to the computer.

The PMD 150S display with ASCII protocol is offered for applications where PMD master displays are not involved. ASCII-driven slaves are covered in section 5 of this manual.

8 Internal Adjustments

The top cover of the PMD 150 slave must be removed to replace the fuse and to change the baud rate. Refer to figure 8-1, below, to remove the top cover.

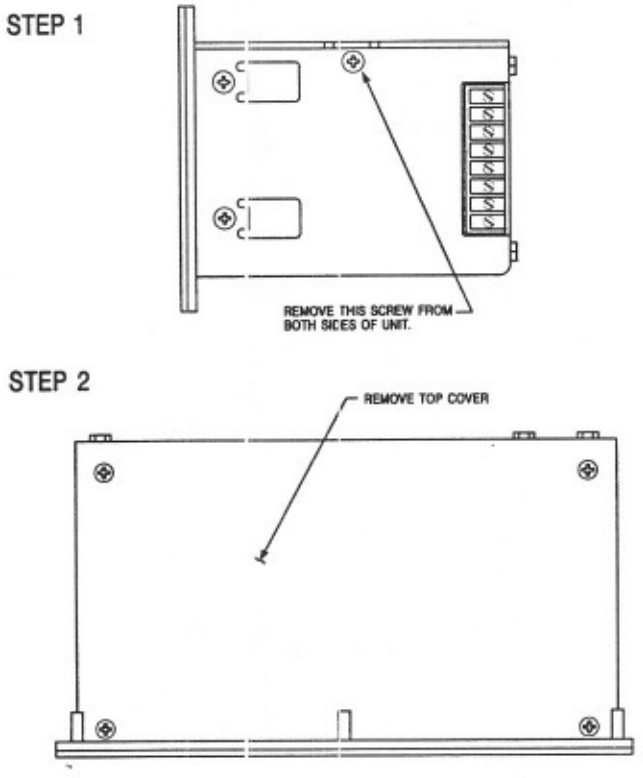

Figure 8-1. Removing the Top Cover

The Baud Rate

When interfaced to a Master PMD, the PMD 150S must be set for 9600 baud. When interfaced to a controlling computer, PLC ASCII interface unit, or other intelligent device (using the Computer Interface Mode), the baud rate may be set to 1200 or 9600 baud. Baud rate is dependent upon the internal setting of jumper JP1. In position A, JP1 sets the unit for 9600 baud. In position B, JP1 sets the unit at 1200 baud. The PMD 150S is shipped from the factory set for 9600 baud.

To change the PMD 150S baud rate, remove the top cover of the unit as shown in figure 8-1. Locate JP1 and move the header to the needed position. ***You must remove and reapply power to the unit before the unit will read the new baud rate setting.***

8 Internal Adjustments

WARNING!
Disconnect AC power from the unit before changing the fuse.

Figure 8-2 shows location of the fuse and jumper JP1 that sets the baud rate of the display. Baud rate settings are also shown.

JP1 POSITION	BAUD RATE
JP1 = A	9600 BAUD
JP1 = B	1200 BAUD

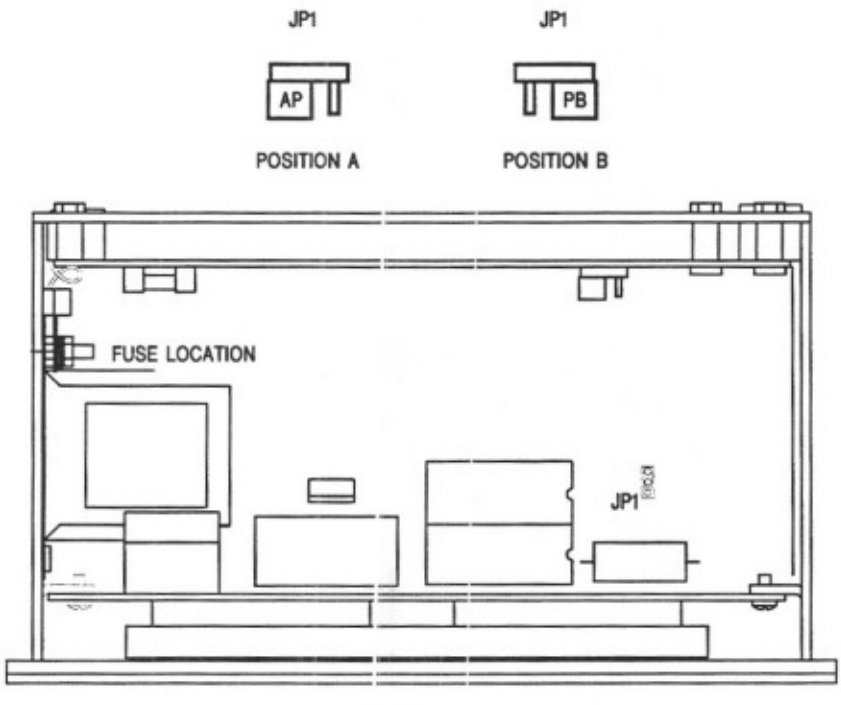

Figure 8-2. PMD 150 Slave Fuse Location and Jumper JP1 Location with Baud Rate Settings

4 Computer Control — UTICOR Protocol

The PMD Slave Display may also receive its information from a computer (mainframe, minicomputer, personal computer or PLC ASCII interface). By sending data in a format similar to that used in the memory of a PMD master display (in 8-bit ASCII), a computer can display messages directly on PMD slave displays without the use of a master. Using this mode of communication, the slave will respond to communication messages it receives and send replies to the controlling device.

This section of the manual describes the communication protocol that is acceptable to the PMD and the codes to which it will respond. This protocol is of the same design as the computer interface format for the PMD Master Display. Each user will have to develop a program for his control computer using the commands and protocol that follow.

Computer Communications Preparation

For computer communication, the PMD slave RS-422A Serial/Repeater Port is set to the following parameters:

Baud Rate	=	9600 or 1200 Baud
Stop Bits	=	1 Stop Bit
Parity	=	No Parity
Checksum	=	EOR Checksum

The baud rate is jumper selectable. This jumper is located on a circuit board inside the unit. The unit is shipped from the factory with this jumper set for 9600 baud communication. To change the port to 1200 baud, refer to section 8 of this manual. For information concerning the EOR checksum, refer to section 10 of this manual.

Use the following procedure to prepare for computer communication with PMD slave display(s):

a. Set computer parameters to match those of the PMD slave. If necessary, change baud rate on the slave unit.

b. Connect serial port of the computer to the RS-422A Serial/Repeater Port(s) of the display(s). Refer to figure 2-3 in section 2 to construct appropriate cable(s).

c. Connect power to the Power Input Terminal Block.

4 Computer Control — UTICOR Protocol

d. The PMD slave display(s) will be "active" and ready to communicate. The unit(s) will display the message:

PMD REV GR UNIT BAUD
150S X YY ZZZZ 9600

PMD 150S indicates that the slave is a 150S display. REV X represents the product revision code of the exec. in the display. GR YY and UNIT ZZZZ indicate the current group and unit number settings on Switch One and Switch Two. BAUD 9600 tells you the baud rate that has been selected on the internal jumper.

***NOTE** If your PMD 150S is a one-line unit, you will receive an upward-scrolling message giving you this information.*

Unit Address

Each PMD slave display is assigned a unit address. A unit address is sent in each message to specify which unit or units should respond.

The unit address in a command consists of two bytes that contain two identifiers. These identifiers consist of a group number and a unit number and are located at Byte 2 and Byte 3 of the command. Refer to figure 4-1, below, for bit assignments of the unit address bytes.

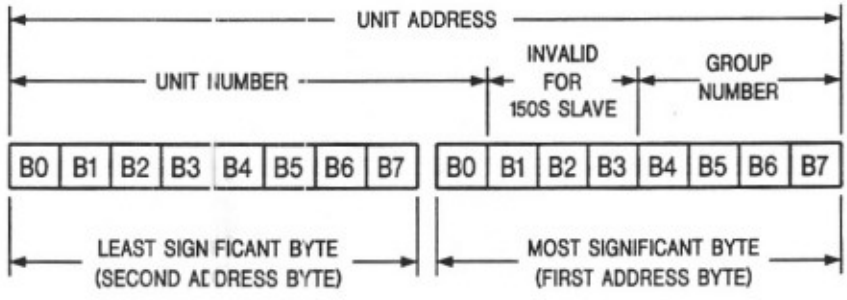

Figure 4-1. Unit Address Byte Designation

The unit address of a PMD slave display is defined by the setting of the dip switches located on the back panel of the unit. These switches can be changed at any time to alter the address of the unit.

4 Computer Control — UTICOR Protocol

CAUTION

Do NOT use the same unit address for PMDs that are connected serially using bi-directional communications. This could result in more than one reply to a computer interface command. If more than one reply is sent on the serial line, the serial drivers of the PMDs may be damaged.

Addressing Slaves

The unit addresses are divided into group and unit numbers to allow the controlling computer to communicate with selected subsets of all the PMD displays connected to it. The following list shows the possibilities:

1. Group #00, Unit #0000 — addresses all units
2. Group #XX, Unit #0000 — addresses all units in group #XX
3. Group #15, Unit #4095 — addresses all "active" slaves
4. Group #XX, Unit #XXXX — addresses the specific unit

When the group and unit number equal zero, messages broadcast by the control computer will be processed by all units (masters and slaves) attached.

With a non-zero group number and unit number of zero, all units with that group number will process the message.

Messages sent to Group #15 and Unit #4095 will be processed by all slave units that are currently "active" and ignored by all "inactive" slaves and all master displays (unless the master has the address of Group #15, Unit #4095).

When a message sent to an individual display is received, that display sends a reply to the control computer. When a message is received that used any of the above mentioned address grouping techniques, no reply is returned. Note that certain messages (those that require a reply other than the standard reply) cannot be processed when the units are addressed by any of the grouping techniques. The specific message types that cannot be processed with these techniques are noted in table 4-1.

4 Computer Control — UTICOR Protocol

Active/Non-Active Slave Units

The computer interface protocol provides another means to send messages to specific collections of PMD slave units beyond using group numbers. A computer interface command is provided to allow the controlling computer to "activate" or "de-activate" the slaves connected to it.

Slaves power-up activated. After that, the controlling computer can, by group or individual unit, activate or de-activate the slaves. Then, it can utilize the Group #15, Unit #4095 addressing mode described previously.

General Message Format

General message format for messages sent via computer is shown in figure 4-2, below.

HEX AA	One byte - indicates start of message
LENGTH	One byte - indicates message length
UNIT ADDRESS	Two bytes - indicates unit address
MESSAGE CODE	One byte - Code for message "type"
DATA	X bytes - Message/reply data
CHECKSUM	Two bytes - See Section 9, checksum bytes

Figure 4-2. Message Format For Computer

Note that *all* messages, including replies sent from the PMD slave, must begin with a hex byte equal to AA to indicate the start of a message.

Also note that the checksum of a message is calculated by using the bytes that represent; Length, Unit Address, Message Code, and Data.

The length byte is always the length of the entire communications message, less one (for the AA). The length specifically does include the length byte and checksum.

4 Computer Control — UTICOR Protocol

Unit address bytes are stored most significant byte first, least significant byte second.

Except where noted otherwise, all parts of the message are composed of Hex bytes (as opposed to ASCII or BCD).

Message Codes

Message codes are required to define the type of communication to take place. The PMD slave is programmed to process various types of messages, and these have been assigned Message Code Numbers (table 4-1.)

Table 4-1. Message Code Number Definitions

CODE	COMMAND
00	STANDARD REPLY
13	SET TIME AND DATE
14	WRITE DATA SET DATA
15	SELECT SLAVE(S)
17	SLAVE DISPLAY PACKET MESSAGE
*18	STATUS/ID MESSAGE

ALL NUMBERS ARE IN DECIMAL

* allowed only when individual units are addressed.

Message Replies

All messages sent to individual PMD slave displays (as opposed to any of the group addressing techniques described previously) will cause the slave to send a reply. The reply will indicate the success or failure of processing the command and will indicate that the display is ready to process another command.

In most cases, this message will be the "standard reply" described in the next section. One command (Status/ID Message) will cause the unit to send a special form of reply.

4 Computer Control — UTICOR Protocol

The following paragraphs cover the format of the message codes and provides a description of each.

The time delay between when the control computer finishes sending a command until the PMD slave begins to reply depends upon the specific command and the amount of data sent with the command. PMD slave displays, like the PMD master, do not "stack" commands. It is best to wait for a reply to a command before sending any more commands.

CODE 00 — STANDARD REPLY FORMAT

FORMAT:

REPLY	
BYTE NUMBER	**VALUE**
1	HEX AA = Start Of Message Byte
2	8 Length
3	B4-B7 = 4-Bit Group Number B0-B3 = Most Significant Bits Of 12-Bit Unit Number
4	8 Least Significant Bits Of 12-Bit Unit Number
5	00 Message Code
6	Message Code Of Received Message
7	Reply Error Code 0 = No Error 1 = Checksum Error 2 = Timeout 3 = Invalid Message Code 8 = Invalid Message Length
8	Checksum (2 bytes) LSB,MSB

DESCRIPTION:

This is the standard format for a PMD slave reply to the computer. When using the message commands described in this section, refer to this chart whenever a message command chart indicates that the reply is of standard format.

4 Computer Control — UTICOR Protocol

CODE 13 — SET TIME AND DATE

FORMAT:

COMMAND	
BYTE NUMBER	**VALUE**
1	HEX AA = Start Of Message Byte
2	13 Length
3	B4–B7 = 4-Bit Group Number B0–B3 = Most Significant Bits Of 12-Bit Unit Number
4	8 Least Significant Bits Of 12-Bit Unit Number
5	13 Message Code
6	HOUR MODE: 0 = 12 Hour Mode 1 = 24 Hour Mode
7	HOURS: 1–12 for 12 Hour Time (D7 = 1 = PM) 0–23 for 24 Hour Time
8	MINUTES: 00–59
9	SECONDS: 00–59
10	MONTHS:- 1–12
11	DATE: 1–31
12	YEAR: 00–99
13	Checksum (2 bytes) LSB, MSB
REPLY = STANDARD REPLY	

DESCRIPTION:

This command, when processed by a PMD slave display, will store the real-time information contained in the command in the slave displays addressed. This will update the time and date currently being displayed in a message once the command has been processed.

When sent to a single slave display, a standard reply will be returned to the computer.

Byte 6 (Hour Mode): select 12 or 24 hour mode. Only used bits of this byte should be set. All other bits should be kept to "0."

Byte 7 (Hours): when Byte 6 selects the 12-hour format, the hours byte indicates AM or PM in the high bit (D7).

D7 of byte 7: 0 = AM, 1 = PM

4 Computer Control — UTICOR Protocol

NOTES: When controlled by a master PMD, a slave display has its time and date updated every 1 second.

When the PMD slave unit is communicating via computer control, the "NO COMMUNICATIONS" timeout error is disabled.

CODE 14 — WRITE DATA SET DATA

FORMAT:

COMMAND	
BYTE NUMBER	**VALUE**
1	HEX AA = Start Of Message Byte
2	15 Length
3	B4–B7 = 4-Bit Group Number B0–B3 = Most Significant Bits Of 12-Bit Unit Number
4	8 Least Significant Bits Of 12-Bit Unit Number
5	14 Message Code
6	Status Byte 0 = BCD 1 = Binary
7	Data Set 1 (2 bytes) MSB,LSB
9	Data Set 2 (2 bytes) MSB,LSB
11	Data Set 3 (2 bytes) MSB,LSB
13	Data Set 4 (2 bytes) MSB,LSB
15	Checksum (2 bytes)
REPLY = STANDARD REPLY	

DESCRIPTION:

This command is used to define the values of the four data sets used by the PMD slave. All four data sets must be defined in the command. The data sent by this command will be used by the PMD slave(s) to which it is addressed.

Byte 6 (Status Byte): indicates whether the data is BCD or binary.
0 = BCD 1 = Binary

4 Computer Control — UTICOR Protocol

CODE 15 — SELECT ACTIVE SLAVE

FORMAT:

COMMAND	
BYTE NUMBER	**VALUE**
1	HEX AA = Start Of Message Byte
2	7+X Length
3	B4-B7 = 4-Bit Group Number B0-B3 = Most Significant Bits Of 12-Bit Unit Number
4	8 Least Significant Bits Of 12-Bit Unit Number
5	15 Message Code
6	Active Units Control Byte
7	X Amount Of Data In The Form Of 2 Byte Group and Unit Numbers. Same Form As Bytes 3 And 4 In Message
* 7+X	Checksum (2 bytes)
REPLY = STANDARD REPLY	

* X must be less than, or equal to 248, which can represent 124 (Group, Unit) number combinations.

DESCRIPTION:

This command lets the control computer to specify which of the PMD slaves are to be activated or de-activated.

Bytes 3 & 4 (Unit Address Bytes): specify the unit and group number of the slave displays to be affected by the command (typically Group #0, Unit #0).

Byte 6 (Active Units Control Byte): this byte is used to specify the application of the activate or de-activate command to the various slaves. (Refer to table 4-2.)

Bit 0 of this byte shows the requested state of the slaves whose addresses are within the list beginning at Byte 7. A "1" in this position indicates those slaves are to be activated. A "0" indicates they should be de-activated.

Bit 7 of this byte indicates what all other slaves (addressed by Bytes 3 & 4) status should become. If it is a "0", all of the

4 Computer Control — UTICOR Protocol

other slaves activation status is unchanged by this command. If it is set to "1", all other slaves are activated when bit 0 is a "0" and de-activated when bit 0 is a "1".

Table 4-2. Byte 6 — Active Unit Control Byte

B7	B0	APPLICATION
0	0	De-activate specified slaves only
0	1	Activate specified slaves only
1	0	De-activate specified slaves—Activate other slaves
1	1	Activate specified slaves—Deactivate other slaves

Byte 7 A list of unit and group numbers of slave displays to be activated or de-activated. *Note: Only units in the address at Bytes 3 and 4 will be affected by this command.*

CODE 17 — SLAVE DISPLAY PACKET MESSAGE

FORMAT:

COMMAND	
BYTE NUMBER	**VALUE**
1	HEX AA = Start Of Message Byte
2	10 + X Length
3	B4–B7 = 4-Bit Group Number B0–B3 = Most Significant Bits Of 12-Bit Unit Number
4	8 Least Significant Bits Of 12-Bit Unit Number
5	17 Message Code
6	Blink On Time Interval
7	Blink Off Time Interval
8	Time Interval Between Upward Scrolls
9	Time Interval Between Right To Left Scrolls
10	Message To Display (X bytes)
* 10+X	Checksum (2 bytes)
REPLY = STANDARD REPLY	

*X must be less than, or equal to, 235.

4 Computer Control — UTICOR Protocol

DESCRIPTION:

This command will display a valid message on the PMD slave's display. The message to be displayed must follow the format of a stored message in a PMD master display's message program.

Table 4-3. Bytes 6 through 9 — Definitions

BYTE NUMBER	ATTRIBUTE	VALID VALUES
6	Blink On Time Interval	1–99
7	Blink Off Time Interval	1–99
8	Time Interval Between Upward Scrolls	1–99
9	Time Interval Between Right-to-Left Scrolls	1–99

Byte 6 (Blink On Time Interval Byte): indicates the length of time that each blinking character of the message will blink on.

Byte 7 (Blink Off Time Interval Byte): indicates the length of time that each blinking character of the message will blink off.

Byte 8 (Time Interval Between Upward Scrolls): indicates the length of time that each line of message text will remain on each line of the display before being replaced by the subsequent line of the message.

Byte 9 (Time Interval Between Right-To-Left Scrolls): indicates the length of time that each character will remain at each character location as it moves across the display.

Valid values for Bytes 6 through 9 range from 1 (0.1 second) to 99 (9.9 seconds).

Byte 10 (First Message Text Byte): is where the message to be displayed begins. The first byte of the message to be displayed is the length byte. It must occupy Byte 10, followed by the balance of the message.

4 Computer Control — UTICOR Protocol

CODE 18 — STATUS/ID MESSAGE

FORMAT:

COMMAND		REPLY	
BYTE NUMBER	VALUE	BYTE NUMBER	VALUE
1	HEX AA =Start Of Msg Byte	1	HEX AA= Start Of Msg Byte
2	6 Length	2	9 Length
3	B4–B7 = 4-Bit Group No. B0–B3 = Most Significant Bits Of 12-Bit Unit No.	3	B4–B7 = 4-Bit Group No. B0–B3 = Most Significant Bits Of 12-Bit Unit No.
4	8 Least Significant Bits Of 12-Bit Unit No.	4	8 Least Significant Bits Of 12-Bit Unit No.
5	18 Message Code	5	18 Message Code
6	Checksum (2 bytes)	6	Device Type HEX 82 = 150 Slave
		7	Revision Code-ASCII Character for Revision Letter HEX 41 = Revision A HEX 42 = Revision B
		8	State: Active = 1 Non-Active = 0
		9	Checksum (2 bytes)

DESCRIPTION:

This command requests status and ID information from a PMD slave display. The command **must** be sent to a specific display to get a reply. The (non-standard) reply contains the requested information.

Reply Description —

Byte 6 (Reply Device Type): identifies the addressed device as either a master or slave PMD. This byte will equal 82 when the unit is a PMD 150 slave.

Byte 7 (Reply Revision Code): indicates the revision code letter of the software in the display and will be in the form of an ASCII character. (HEX revision codes shown in the table, above, are examples only.)

Byte 8 (Reply State): indicates whether the PMD slave is active or non-active.

4 Computer Control — UTICOR Protocol

PMD Message Format

The formats for messages sent from a control computer to a slave display are shown in table 4-4. This is the structure of the "Message To Display" in Code 17. The beginning of the message is made up of option selection bytes. Depending on the chosen message options, the number and meaning of option bytes vary.

Which of the four formats is appropriate depends upon the options required by the message. Table 4-5 relates the selected options to the formats shown in table 4-5. For example, a message with no options selected, would be structured as shown in 6 (A). A message that should scroll left would be formatted as in 6 (C).

Table 4-4. Message Format Of PMDs

BYTE	1	2	3	4	5	6	n
FORMAT A	LENGTH BYTE (n)	CONTROL BYTE #1	MSG DATA				LAST BYTE MSG/DATA
FORMAT B	LENGTH BYTE (n)	CONTROL BYTE #1	CONTROL BYTE #2	MSG DATA			LAST BYTE MSG/DATA
FORMAT C	LENGTH BYTE (n)	CONTROL BYTE #1	CONTROL BYTE #2	SCROLL OPTIONS	MSG DATA		LAST BYTE MSG/DATA
FORMAT D	LENGTH BYTE (n)	CONTROL BYTE #1	CONTROL BYTE #2	SCROLL OPTIONS	SCROLL TIME	MSG DATA	LAST BYTE MSG/DATA

Table 4-5. Message Options Versus Message Formats

FORMAT A	Chained, Printout, Print On One Line, Send <CR><LF> At Message End, Clear Display, Center Message
FORMAT B	Same As Format A Plus Energize Alarm and Blink Entire Message
FORMAT C	Same As Format B Plus Scroll Up, Scroll Left, and Repeat Message
FORMAT D	Same As Format C Plus Select Scroll Time Interval

NOTE: Slaves receiving formats that contain slave addresses (Formats E, F, and G shown in the PMD master manual) will ignore those slave addresses in the message.

4 Computer Control — UTICOR Protocol

Message Example

Table 4-6 shows a "byte diagram" of a message example to show how bytes are used in message memory. The third through sixteenth bytes in this example represent the message data itself and are contained in the message/data bytes area shown in table 4-4. The column on the left shows the actual Hex bytes which make up the message. The other column is in decimal, binary, or ASCII, for ease of interpretation.

Table 4- 6. Message Example Byte Diagram

HEX CODE		
10	16	____ Indicates that the message text is 16 bytes long (Byte 1 in Table 6)
10	00010000	____ Indicates the message is centered (Byte 2 in Table 6). Up to 6 control bytes per message (1 control byte per message minimum).
41	A	____ the first character of the first line
20		____ <SPACE> byte
40	M	
53	S	
47	G	
2E	.	
FF	FF	____ End of line marker for line 1
53	S	____ 'S' is the first character of the second line
41	A	
40	M	
50	P	
4CL		
45	E	
FF	FF	____ End of line marker for line 2

As shown in table 4-6, above, every byte needed to represent the message counts as a byte of the message and is counted as part of the total size of the message. Notice that the length byte also counts itself.

4 Computer Control — UTICOR Protocol

Control Byte 1

Control byte one selects some of the options possible for the message. A diagram of this byte is shown in figure 4-3, below, to illustrate the definitions of the 8 bits of this byte. Table 4-7 designates how byte 2 of each message is read

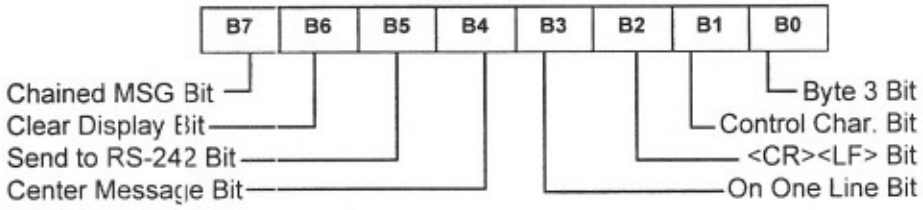

Figure 4-3. Bit Diagram Of Control Byte 1

Table 4-7. Bit Designations for Control Byte 1

BIT NO.	IF BIT = 1	IF BIT = 0
B7	Message Is Chained	Message Is Not Chained
B6	Overlay Existing Message	Message Clears Display
B5	Send Message to RS-232	Do Not Output Message
B4	Center Message	Message Not Centered
B3	Send On One Line (B5 must equal 1)	Send On Multiple Lines (B5 must equal 1)
B2	<CR><LF> At End of Msg (B5 must equal 1)	No <CR><LF> At End of Message (B5 must equal 1)
B1	Msg Has Control Characters	Msg Has No Control Characters
B0	Byte 3 Control Byte	No More Control Bytes Entire Message Does Not Blink Message Does Not Scroll No Relay Alarm Output Message Not Logged/Invisible Message Not Sent To Slave

4 Computer Control — UTICOR Protocol

NOTES: B7 -- Slave displays do not support chained messages. If this bit is set, the messages will not be displayed.

B5, B3, & B2 — Refers to RS-232 port printouts on master PMD. Ignored by slaves.

B1 — Set if message contains any ASCII control characters (HEX 00-1F). (Does not include time, date, or data set characters.)

B0— Set to enable second options byte.

Option Byte 2

Control byte one signifies whether the third byte of the message is a control byte (Control Byte 2). Control byte 2 will indicate if the message energizes the alarm relay, if the message is logged or invisible, if the message will scroll, and if the message is to blink. As noted, some of these options do not apply to slave displays. Figure 4-4 shows a diagram of control byte 2. Table 4-8 designates how byte 3 (as control byte 2) of a message is read.

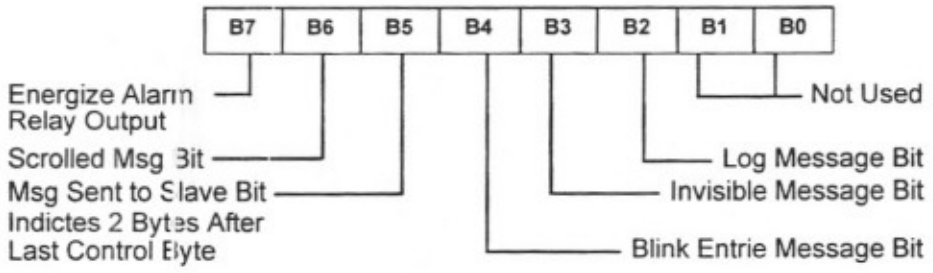

Figure 4-4. Bit Diagram of Control Byte 2

4 Computer Control — UTICOR Protocol

Table 4-8. Bit Designations For Control Byte 2

BIT NO.	IF BIT = 1	IF BIT = 0
B7	Message Energizes Alarm Relay Output	Message Does Not Energize Relay
B6	Message Scrolls Enable Scroll Options Byte	Message Does Not Scroll
B5	Message Sent To Slaves Enable Unit Number Bytes	Message Not Sent To Slaves
B4	Entire Message Blinks	Message Does Not Blink
B3	Message Is Not Displayed	Display Message On Master
B2	Log Message In Data Log	Do Not Log Message
B1	Not Used (Default = 0)	
B0	Not Used (Default = 0)	

NOTE: B7, B5, B3, and B2 are ignored by PMD slaves.

Scroll Options Byte

As noted previously, if control byte two indicates that a message will scroll, a third control byte (byte 4) is necessary to determine control options for scrolling. Figure 4-5 shows a diagram of byte 4 as the scroll option control byte. Table 4-9 designates how byte 4 (as control byte 3) of a message is read.

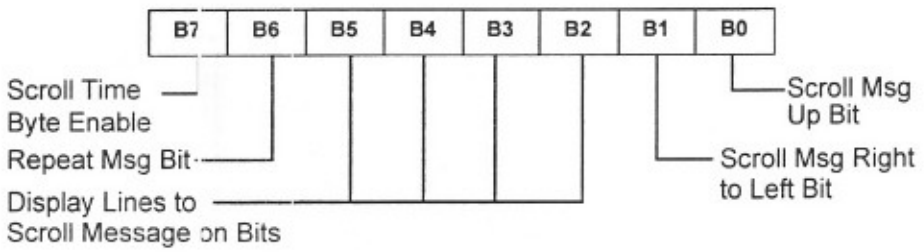

Figure 4-5. Bit Diagram Of Control Byte 3

4 Computer Control — UTICOR Protocol

Table 4-9. Bit Designations For Control Byte 3

BIT NO.	IF BIT = 1	IF BIT = 0
B7	Contains Scroll Time Interval Information in Byte 5	Message Does Not Contain Scroll Time Interval
B6	Message Repeats	Message Does Not Repeat
B5	Message Scrolls On Line 4	Does Not Scroll On Line 4
B4	Message Scrolls On Line 3	Does Not Scroll On Line 3
B3	Message Scrolls On Line 2	Does Not Scroll On Line 2
B2	Message Scrolls On Line 1	Does Not Scroll On Line 1
B1	Scrolls Right to Left	Message Does Not Scroll Left
B0	Message Scrolls Upward	Does Not Scroll Upward

NOTE: B2–B5 — Select lines of the display where a scrolling message will be displayed. For left-scrolling messages, one of these bits must = "1", and the other three must = "0". For upward-scrolling messages, one, two, three, or four contiguous lines can be set.

Scroll Time Byte

If byte 5 is used as the scroll time byte, the contents of the byte will specify how often the PMD will shift the scrolled message, either upwards or left. The time is specified in units of 0.1 seconds.

Message Text

Message text is to be entered as the last part of the message. A non-scrolling message must have two or four lines of 0 to 20 ASCII characters, each line terminated by HEX FF.

A scrolling message's text can be composed of any number of lines, each terminated by HEX FF. The total length of the message, including all control bytes and the size byte must be 235 characters or less.

4 Computer Control — UTICOR Protocol

Time And Date Characters

To enter the time into a message, enter the Hex character code for the time (HEX 81) eight times (to represent the eight time characters HH:MM:SS) To enter the date into a message, enter the Hex character code for the date (HEX 82) nine times (to represent the nine date characters DD-MMM-YY). Refer to table 4-10.

If you enter too few characters to represent the entire time or date in a message, the rightmost character(s) will be deleted from the message. For instance, entering 5 time characters will represent HH:MM only.

You may place the time and date next to each other. Two time or two date strings must be separated by a displayable non-time/date character.

Table 4-10. Character Codes For Time And Date

HEX 81	Character Code that indicates a Character of Time in a Msg
HEX 82	Character Code Used to Indicate Character of Date in a Msg

Variable Data Characters

Table 4-11 lists the character codes for all five characters of each of the PMD displays' four data sets. These codes can be entered in any order, anywhere in a message.

Table 4-11. Character Codes for Variable Data

CHARACTER CODES USED TO REPRESENT DATA SET # 1 CHARACTERS				
MSD HEX 85	HEX 86	HEX 87	HEX 88	LSD HEX 89
CHARACTER CODES USED TO REPRESENT DATA SET # 2 CHARACTERS				
MSD HEX 8A	HEX 8B	HEX 8C	HEX 8D	LSD HEX 8E
CHARACTER CODES USED TO REPRESENT DATA SET # 3 CHARACTERS				
MSD HEX 8F	HEX 90	HEX 91	HEX 92	LSD HEX 93
CHARACTER CODES USED TO REPRESENT DATA SET # 4 CHARACTERS				
MSD HEX 94	HEX 95	HEX 96	HEX 97	LSD HEX 98

4 Computer Control — UTICOR Protocol

To put variable data into a message via computer control, enter the Hex character code for the desired digit(s) for the desired data set(s) into the message at the desired location(s).

Conclusion

When interfaced (via RS-232 or RS-422) to the one of the serial input ports of PMD slave(s), a computer can be the controlling force of the message display network. Using an individually developed program and specified hexadecimal character codes, the information from all displays.

A control computer can send messages, including time, date, and variable data, to be displayed on one or more slaves. Slaves can be addressed individually or in groups (by using group addressing techniques or by using the activation/de-activation method). When an individual slave is addressed, that slave will send a reply to the computer.

5 Computer Control — ASCII Protocol

The PMD 150S comes from the factory with UTICOR and ASCII protocol software in it. The different protocols are selected by moving JP1 inside the unit. If you are using a slave with ASCII protocol, this section will be vitally important to you, the user.

In this section we will discuss the different commands that can be used in the ASCII Slave, their format and several examples. With this protocol you will not need, or be able to use, a PMD master to control the slave display. However, any standard ASCII terminal can be used to manage the slave display.

Preparation of the Unit

Remove the lid from the unit and move JP1 from the "A" position to the "B" position and replace the lid. The unit is equipped with an RS-232C and RS-422A ports. Either of these ports can be used for reception of the ASCII commands to control the display. You need only wire the unit's receive lines to the host's transmit lines because the transmitter port on the slave is not used.

JP1 POSITION	BAUD RATE
JP1 = A	UTICOR
JP1 = B	ASCII

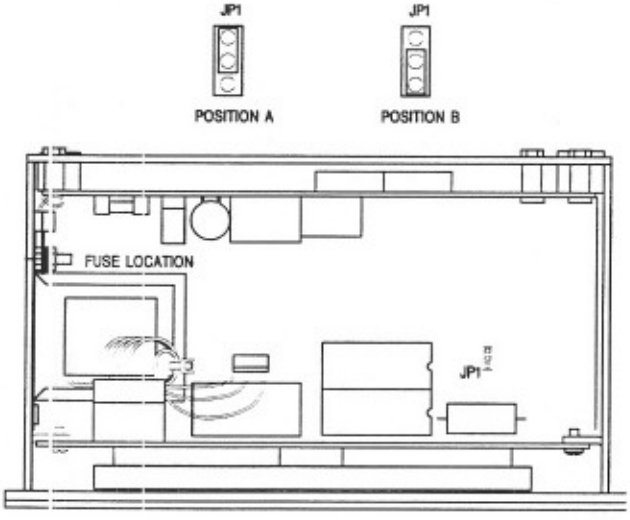

Figure 5-1. Protocol — Select Jumper Positions

5 Computer Control — ASCII Protocol

The slave is equipped with a repeater port. This port allows the slave to echo the information received by the Serial Port in an RS-422A fashion. Beside echoing the received information, the repeater also provides a signal boost for it. The slave units may be located 4000 feet (1200 meters) from one another.

Each unit is assigned a two part unit address consisting of a group and a unit number. The unit address is assigned to the unit with two dip switches on the back of each unit.

The eight position dip switch defines the first eight bits of the unit number. The nine position dip switch assigns the ninth bit of the unit number and the four bits of the group number. There are three switches on the nine position dip switch used to select international character sets. The other position (position nine) of the nine position switch is used to indicate BCD or Binary interpretation.

When the BCD/Binary interpretation switch is open, the numbers represented by the dip switches are interpreted as BCD digits. When it is closed, the dip switches are interpreted as binary bits. In BCD interpretation mode, the group number can range from 0–9 and the unit number from 0–199. In Binary interpretation mode, the group number can range from 0–15 and the unit number can range from 0–511.

After the unit's identification has been determined and all physical connections and adjustments have been made, you are ready to power-up the unit. The unit's identification will only be read during the power-up sequence. When the unit is powered it will display an initial message. This will be a two line message consisting of some or all of the following information: product name; software revision; unit address; and RS-422 serial link baud rate. When the unit does not have two display lines, an alternate power-up message will be displayed. This message will contain the same information as the standard message but is displayed one line at a time with a slight delay between each.

The power-up sequence gives the following unit parameters their initial values.

5 Computer Control — ASCII Protocol

Blink On Interval	1/2 second
Blink Off Interval	1/2 second
Scroll Interval	2/10 second
Blink Mode	Off
Center Mode	Off
Delimited Blink	Off
New Line	On
Wrap	On

These values can be changed through ASCII commands.

Terminal Operation

ASCII slave accepts and displays information one character at a time. This type of operation is similar to most terminals. The following ASCII codes are accepted by the unit. All other codes are simply thrown away. Please note that the ASCII circumflex ^ character is not accepted. This character is used to start different commands usable with this particular protocol.

Table 5-1. Valid ASCII Characters

DEC/HEX	CHAR.	Description	DEC/HEX	CHAR.	Description
32/20		(Space)	50/32	2	
33/21	!	(Exclamation Point)	51/33	3	
34/22	"	(Double Quote)	52/34	4	
35/23	#	(Number/Pound)	53/35	5	
36/24	$	(Dollars)	54/36	6	
37/25	%	(Percent)	55/37	7	
38/26	&	(Ampersand)	56/38	8	
39/27	'	(Sincle Quote)	57/39	9	
40/28	(	(Left Parenthesis	58/3A	:	(Colon)
41/29	)	(Right Parenthesis)	59/3B	;	(Semicolon)
42/2A	*	(Asterisk)	60/3C	<	(Less Than)
43/2B	+	(Plus)	61/3E	=	(Equals)
44/2C	,	(Comma)	62/3E	>	(Greater Than)
45/2D	-	(Hyphen)	63/3F	?	(Question Mark)
46/2E	.	(Period)	64/40	@	(At)
47/2F	/	(Forward Slash)	65/41	A	
48/30	0		66/42	B	
49/31	1		67/43	C	

5 Computer Control — ASCII Protocol

Table 5-1. Valid ASCII Characters — continued

DEC/HEX	CHAR.	Description	DEC/HEX	CHAR.	Description
68/44	D		100/64	d	
69/45	E		101/65	e	
70/46	F		102/66	f	
71/47	G		103/67	g	
72/48	H		104/68	h	
73/49	I		105/69	i	
74/4A	J		106/6A	j	
75/4B	K		107/6B	k	
76/4C	L		108/6C	l	
77/4D	M		109/6D	m	
78/4E	N		110/6E	n	
79/4F	O		111/6F	o	
80/50	P		112/70	p	
81/51	Q		113/71	q	
82/52	R		114/72	r	
83/53	S		115/73	s	
84/54	T		116/74	t	
85/55	U		117/75	u	
86/56	V		118/76	v	
87/57	W		119/77	w	
88/58	X		120/78	x	
89/59	Y		121/79	y	
90/5A	Z		122/7A	z	
91/5B	[	(Left Bracket)	123/7B	{	(Left Brace)
92/5C	\	(Backslash)	124/7C	|	(Broken Vertical Bar)
93/5D	]	(Right Bracket)	125/7D	}	(Right Brace)
95/5F	_	(Underscore)	126/7E	~	(ASCII Tilde)
96/60	`	(ASCII Grave)			
97/61	a				
98/62	b				
99/63	c				

Writing Characters to the Display

When a character is written to the display, it is written to the current cursor position. The cursor is an invisible cursor whose position the unit keeps internally. After the character has been written to the display, the cursor is advanced one character.

The result of writing a carriage return to the display is dependent upon the unit's current new line setting. When the new line setting is *on*, the cursor is advanced to the leftmost column of the next display line. If this line is past the bottom of the display, the contents of the display is shifted up one line, the bottom line of the display cleared, and the cursor positioned on the leftmost column of the bottom line. When the new line setting is *off* the cursor is advanced to the leftmost column of the line where the cursor currently resides.

5 Computer Control — ASCII Protocol

After a character is written to the display, the cursor is advanced to the next character on the display. If the cursor is not advanced past the end of the line, then nothing more is done. What happens to the display and its cursor when it is advanced past the end of a line is dependent upon the unit's current wrap setting.

When wrap is *on*, this indicates that the cursor should be advanced to the front of the next display line when it is advanced past the end of the line. If the next line is a valid display line, the cursor is simply positioned on the next line.

When the cursor is advanced past the end of the bottom display line, the contents of the display is shifted up one line, the bottom line of the display cleared, and the cursor positioned at the front of the bottom line.

When the cursor advances past the end of a line and wrap is *off*, the cursor is simply positioned at the end of the line again. The next character written will overwrite the character at the end of the line.

Operating Commands

The ASCII Slave has several commands that are considered advanced operation features for the unit. Each command is preceded by a circumflex(^). That is why the unit will not display that character. Every time that the unit receives the ASCII code for a circumflex, it is looking for a command to follow it. If this symbol is received while the unit is still reading another command, the first command will be ignored and the command following the second circumflex will be executed.

Following is a list of the different valid ASCII commands. It should be noted that all of these commands will be ignored by the unit unless it has been selected by a **^A** command.

Valid ASCII Commands ⇒

^Agguuuu	=	Select Unit
^Bn	=	Select Blink Mode
^Cn	=	Select Center Mode
^Dn<message text><CR>	=	Display Scrolling Text
^En	=	Reset Display
^Frr	=	Select Scroll Rate
^Gbbcc	=	Select On/Off Rate
^Hrrcc	=	Position Cursor
^In	=	Select New Line
^Jn	=	Select Wrap

5 Computer Control — ASCII Protocol

^Agguuuu SELECT UNIT

This command selects the unit or units that will process the ASCII commands that are sent out. It will allow multiple units to be connected and addressed. These units can be addressed as a whole, as a subset, or individually. Only selected units will process commands.

gg == a 2-digit group number
uuuu == a 4-digit unit number

In both cases, the number must be padded with zeroes (e.g., for unit 45, the number would be 0045).

All units will always process all **^A** commands to see if they have been selected or deselected. A unit is deselected by not being selected in a **^A** command.

There are three basic rules for selecting units.

1. Group x and Unit x selects only the unit with matching numbers.

2. Group x and Unit 0 selects all units in group x.

3. Group 0 and Unit 0 selects all units.

^Bn SELECT BLINK MODE

This command indicates to the display that all text on the display should blink.

n = 0 = turn blink off
n = 1 = turn blink on

^Cn SELECT CENTER MODE

This command lets the user center text on the display.

n = 0 = turn centering off
n = 1 = turn centering on

5 Computer Control — ASCII Protocol

^Dn<message text><CR> DISPLAY SCROLLING TEXT

This command allows the host to scroll information from right to left on a display line. The line where the terminal cursor resides when this command is accepted is the line where the text will scroll. Prior to the text being scrolled onto the line, the line is cleared of all data.

The <message text> portion of the command consists of any of the printable ASCII characters listed previously. This portion of the command can consist of no more than 255 characters. On the PMD 3000, the <message text> portion can also include the command to change character size, ^**Kn**, where **n** is "0," "1," "2," "3," or "4." Each three change character size sequences counts as two characters toward the 255 maximum.

n = 0 = no repeat
n = 1 = repeat
<CR>= ASCII carriage return (0D HEX, 13 DEC)

Once the text has begun to scroll, the terminal cursor is positioned on the line as if the cursor has been advanced to this line from another. Scrolling messages are shifted up along with any other terminal text when the terminal cursor is advanced beyond the bottom of the display.

When scrolling text is indicated to not repeat, the text is scrolled onto the display once and then scrolled off the display by scrolling in spaces until all of the scrolling text has been shifted off the display line. When scrolling text is to repeat, each time the end of the text is met, a space is shifted in before the text repeats in order to separate the beginning from the end of the text.

^En RESET DISPLAY

This command performs clear and/or reset of the selected unit. The user can specify which level of reset to perform.

n = 0 = clear the display and home the cursor
n = 1 = clear the display, home the cursor, and reset all parameters modified by ASCII protocol
n = 2 = clear the display and leave the cursor at its current position

5 Computer Control — ASCII Protocol

^Frr SELECT SCROLL RATE

This command selects the rate at which the unit will scroll text from right to left.

rr = 01 to 99
01 = .1 second
99 = 9.9 seconds

The number selected must be between 1 and 99. Values less than 10 must be padded with zeroes.

^Gbbcc SELECT ON/OFF RATE

The user selects the rate at which the display will blink on and off. The valid range is between 1 and 99. Values less than 10 must be padded with zeroes.

bb = 01–99 blink on interval
cc = 01–99 blink off interval
01 = .1 second
99 = 9.9 seconds

^Hrrcc POSITION CURSOR

This command allows the user to position the cursor anywhere on the display. The values for row and column must be within the range for the display being used.

rr = 01–02 row...valid range for 150S display
cc = 01–20 column...valid range for 150S display

^In SELECT NEW LINE

This command controls how a carriage return sent to the display will effect the cursor. If new line is *on*, then a carriage return will cause the cursor to be advanced to the beginning of the next line. If new line is *off*, then a carriage return will cause the cursor to be advanced to the beginning of the line that it is currently on. The default value for New Line is ON.

n = 0 = New Line is *off*
n = 1 = New Line is *on*

5 Computer Control — ASCII Protocol

^Jn SELECT WRAP

This command controls how the cursor will advance past the end of a display line. When wrap is *on*, the cursor will advance to the beginning of the next line. When wrap is *off*, the cursor will remain at the end of the line the cursor is currently on.

n = 0 = wrap is off
n = 1 = wrap is on

All variables in these commands that are represented by two or more of the same letter must be padded by leading zeroes if the desired value does not have enough digits to replace all the letters.

Sample Messages

In this section, we will give you samples of some messages with an ASCII format.

The first message will be sent to group 04, unit 0312. This message will be centered with the message "Bin 6 is EMPTY."

^A040312^C1Bin 6 is EMPTY

It should be noted that all messages after this one will be centered after this until another ^C command is received turning centering off.

The second sample message will be sent to all units in group 07 scrolling from right to left at a 3/10 of a second scroll rate on line 2 of the display. The whole message will also blink.

^A070000^F03^B1^H0201^D1Current Regulator Out of Range / Unit #3<CR>

The different options that your messages have are very versatile. You can operate the unit in many different ways to get the necessary information to the people who need it.

5 Computer Control — ASCII Protocol

Conclusion

This section provided information for the PMD 150S slave display using ASCII protocol. Sections 3 and 4 of the manual are irrelevant for ASCII mode. Standard or ASCII, the PMD 150S slave display expands your communications horizons.