PMD 200S, 300S, 3000, 3500 Slave User Manual
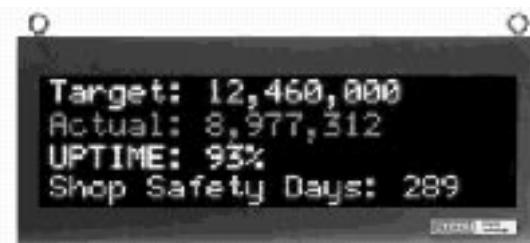
79722-7
09/05/01

PMD 200S,300S,3000,3500
SLAVE MESSAGE DISPLAY
USER MANUAL

WARNING!

In the application of UTICOR Technology, LP programmable control devices, you should consider them components. Therefore, provisions other than the programmable control device must be taken to protect personnel in the event of a programmable control device malfunction. Programmable control devices should not be used as stand-alone protection in any application. Unless proper safeguards are used, unwanted start-ups could result in equipment damage or personal injury. If programmable controllers are used with operator interface and like devices, this hazard should be of primary importance. The operator should be made aware of this hazard and appropriate precautions should be taken.

In addition, consideration should be given to the use of an emergency stop function that is independent of the programmable controller.

The diagrams and examples in this user's manual are included for illustrative purposes only. UTICOR Technology, LP cannot assume responsibility or liability for actual use based on the diagrams and examples.

Caution

Static messages that remain on the display for extended periods of time may cause uneven illumination of the dot matrix grid. This is caused by inherent properties of all vacuum fluorescent display technology. To avoid unevenness of display characters, power down unit when not in use. Do not leave the same message on the display for indefinite periods.

Brightness damage may be partially restored to normal by performing the "TEST FUNCTION — DISPLAY" option on the PMD.

Trademarks

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Manual Part No. 79722-7

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GENERAL SPECIFICATIONS

POWER REQUIREMENTS:

Model Numbers 76538 76547, 3000 & 3500:	115/230 VAC (102-132)(194-250) 47-63 Hz (Jumper Selected — see 2.5)

PMD 200S —	18 VA
PMD 300S —	22 VA
1W2H —	70 VA
2W2H/1W4H —	130 VA
2W4H/1W8H/4W2H —	250 VA
2W8H/4W4H —	490 VA

Model Numbers 76544 and 76550:	24 VDC (21.6-26.4) 18 VA

OPERATING TEMPERATURE:	0 to 60 ºC (0 to 140 ºF) Ambient
STORAGE TEMPERATURE:	−40 to +95 ºC (−40 to +203 ºF) Ambient
HUMIDITY:	0-95% RH Noncondensing
ELECTRICAL INTERFERENCE TOLERANCE:	NEMA ICS 2-230 Showering Arc Test , ANSI C37.90a-1974 (SWC) Surge Withstand Capability Test

FUSE TYPE:

Model Number 76538:	115 VAC Operation — 0.759 Amp @ 250 V (factory installed) 230 VAC Operation — 0.375 Amp @ 250 V (customer supplied) 0.177" x 0.58" , 2AG, Fast Acting (see 2.5.1 for replacement)
Model Number 76544:	1.5 Amp @ 250 V 0.177" x 0.58", 2AG Slo-Blo
Model Number 76547:	115 VAC Operation — 1.0 Amp @ 250 V (factory installed) 230 VAC Operation — 0.5 Amp @ 250 V (customer supplied) 0.177" x 0.58". Subminiature, Slo-Blo (see 2.5.2 and Figure 2-5 for replacement)
Model Number 76550:	1.5 Amp @ 250 V 0.177" x 0.58", 2AG, Slo-Blo
3000 Transformer Fuse:	1W2H/2W2H/1W4H — 1.5 Amp @ 250 V 2W4H/1W8H/4W2H — 3.0 Amp @ 250 V 2W8H/4W4H — 5.0 Amp @ 250 V 0.250" x 1.250 Slo-Blo (see 2.5.3 for replacement)
OVERALL DISPLAY PMD 200S:	2 Lines of 20 Characters Vacuum Fluorescent (Blue) 5 x 7 Dot Matrix — 11 mm High Characters
OVERALL DISPLAY PMD 300S:	4 Lines of 20 Characters Vacuum Fluorescent (Blue) 5 x 7 Dot Matrix — 2.51 mm High Characters
OVERALL DISPLAY PMD 3000/3500:	2", 4", 6", 8", or 8" compressed Red LED Characters (PMD 3000) or Tri-color LED Characters (PMD 3500) (see Part Numbers for display sizes) 5 x 7 Dot Matrix — 50.8 mm (2") High Characters 10 x 14 Dot Matrix — 101.6 (4") High Characters 15 x 21 Dot Matrix — 152.4 (6") High Characters 20 x 28 Dot Matrix — 203.2 (8") High Characters 10 x 28 Dot Matrix — 203.2 (8") High Characters
CHARACTER SET:	All Standard ASCII Upper/Lower Case and Symbols
INTERNATIONAL CHARACTER SETS:	U.S., Cyrillic, English, Swedish, Danish, French, German, Japanese Kana

SPACE REQUIREMENTS:

PMD 200S Panel Space:	14.370" Wide x 4.378" High x 4.800" Deep (Standard Model) 14.870" Wide x 4.875" High x 4.800" Deep (Stainless-Steel Model)

| **PMD 300S Panel Space:** | 14.370" Wide x 6.180" High x 4.800" Deep (Standard Model) |
| | 14.870" Wide x 6.680" High x 4.800" Deep (Stainless-Steel Model) |

PMD 3000/3500: Dependent upon unit size (see A.3)

PMD 200S/300S Housing: Black Anodized Aluminum

PMD 3000/3500 Housing: 14 Gauge Steel
1W4H also available in 0.090" 5052-H32 Aluminum

200S/300S Front Panel: Black, Anodized Aluminum (Standard Model)
Oil-Tight Gasketing — 6 Built-in Mounting Studs

Stainless Steel (Stainless-Steel Model)
Water Resistant Gasketing — 8 Built-in Mounting Studs

WEIGHT:

PMD 200S —	5 pounds, 10 ounces		
PMD 300S —	7 pounds, 10 ounces		

		Single Unit	Double Units
PMD 3000/3500	1W2H	47 pounds	95 pounds
(with	1W4H	65 pounds	130 pounds
hanging kit)	1W4H — Al.	50 pounds	100 pounds
	*1W8H	101 pounds	208 pounds
	2W2H	81 pounds	162 pounds
	2W4H	112 pounds	225 pounds
	2W8H	178 pounds	361 pounds
	*4W2H	189 pounds	378 pounds
	*4W4H	250 pounds	500 pounds

CONNECTORS:

Power Input: 3 Wire-Clamp Screws for 12-18 AWG

Serial/Repeater Port: 8 Wire-Clamp Screws for 18-22 AWG

PART NUMBER:

76538 —	PMD 200S 115/230 VAC Standard Model
76538SS —	PMD 200S 115/230 VAC Stainless-Steel Model
76544 —	PMD 200S 24 VDC Standard Model
76544SS —	PMD 200S 24 VDC Stainless-Steel Model
76547 —	PMD 300S 115/230 VAC Standard Model
76547SS —	PMD 300S 115/230 VAC Stainless-Steel Model
76550 —	PMD 300S 24 VDC Standard Model
76550SS —	PMD 300S 24 VDC Stainless-Steel Model

Part Number -   3 0 0 0 - <u>N</u> <u>1 W 2 H</u>
                                   *1   *2

OR

Part Number -   3 5 0 0 - <u>N</u> <u>1 W 2 H</u>
                                   *1   *2

*1 - HOUSING   NEMA 12 Enclosure - Consult Factory for Price and Availability of
Housings other than NEMA 12

*2 - SIZE
1W2H   11.5" x 40" x 4.25"
1W4H   16.3" x 40" x 4.25"
**1W8H   25.9" x 40" x 4.25"

2W2H   11.5" x 76" x 4.25"
2W4H   16.3" x 76" x 4.25"
2W8H   25.9" x 76" x 4.25"

**4W2H   11.5" x 150" x 4.25"
**4W4H   16.3" x 150" x 4.25"

**Sizes preceded by two asterisks are not available for the PMD 3500 tricolor display

SECTION 1. INTRODUCING THE PMD 200S/PMD 300S/PMD 3000/PMD 3500

1.0   INTRODUCTION

The PMD 200S, PMD 300S, PMD 3000 , and the PMD 3500 are cost-efficient, alpha-numeric slave displays. The PMD 200S has two lines of 20 vacuum fluorescent characters. The PMD 300S has four lines of 20 vacuum fluorescent characters. The PMD 3000 is a large-character LED display that is available in several sizes. The PMD 3500 is a tricolor LED display and can display characters in red, green, or yellow. These slaves display messages sent to them from a PMD master display, a computer, or other intelligent device with serial communications capabilities.

1.1   PMD 200S SLAVE

The PMD 200S slave features 2 lines of 20 (40 in all) 11 mm high, vacuum fluorescent characters. The front panel measures approximately 4.4" x 14.4" and has built-in mounting studs for panel mounting.

1.2   PMD 300S SLAVE

The PMD 300S slave has 4 lines of 20 (80 total) 12.51 mm high, vacuum fluorescent characters. Its front panel measures approximately 6.2" x 14.4" and, like the PMD 200S, features 6 or 8 built-in mounting studs on its front panel.

1.3   PMD 3000/3500 SLAVE

The PMD 3000 is a large LED slave display available in 3 widths and 3 heights for a total of 8 different sizes. The PMD 3000 is a red LED display that displays messages in 2", 4", 6", and 8" characters. The PMD 3000 uses suspended mounting: either using the eyebolts on top or mounting kits that allow adjustable angled viewing. Also available is a PMD 3500 that is similar to the PMD 3000 only with a tricolor display (red, green, and yellow). The 3500 is available in two heights and two widths for a total of four sizes. The PMD 3500 is composed of blocks of 2 sticks high, so it cannot have an odd number of sticks high.

1.4   PHYSICAL CHARACTERISTICS

The PMD 200S and PMD 300S slaves are housed in the same rugged, black aluminum case as their master counterparts. The front panels contain a protective, blue lens/filter. The back panels provide the interfacing and addressing requirements of the slave display.

The PMD 3000 and PMD 3500 are housed in a steel case. Two knockouts are provided for routing wires. Fuses, connectors, and switches can be accessed by removing the back panel.

The front panel of the PMD 3000/3500 contains a scratch-resistant lens/filter that covers the LED field and protects the inside of the unit. The LED field is offered in eight sizes. The display area is 4.8", 9.6", or 19.2" high. Field width sizes are 36", 72", or 144" wide. A maximum width, maximum height unit is not available.

Section 2 provides hardware information for the slave displays. Wiring requirements, switch settings, fuse locations, etc. are found in Section 2. Panel cut-out and outline dimensions for PMDs are located in Appendix A.

1.5   MASTER CONTROL

Section 3 of this manual provides information for controlling the PMD slaves and displaying messages with a PMD master unit. A slave can be controlled by a Master PMD unit which is controlled by a PLC or can be 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 manipulating the unit's input lines. These input lines are read by the master as a message number which was assigned to the message when the message was programmed into the display or as a data set which 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 the selected message.

1.6   COMPUTER CONTROL

Section 4 of this manual supplies information for communication between PMD slave display(s) and a computer (or serial interface) using UTICOR message protocol. With this mode of operation, slaves do not require the use of 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.

Section 5 of this manual provides information for communication between PMD slave display(s) and a computer (or serial interface) using ASCII message protocol. With this mode of operation, slaves do not require the use of a master display.

1.7   THE MESSAGE

How messages look depend on the way they were programmed. Messages programmed into PMD masters have message options that determine message outputs and visual appearance. One of the master message output options is sending messages to slave(s). When the message contains this option, the message can be displayed on one, some, or all slave(s).

The behavior of the message is determined by selected message options and/or embedded codes. Messages can be stationary, flashing, or scrolling. Scrolled messages scroll up or left. Other options determine if message text is centered on lines, if previous text remains on the display or is removed, etc. (See Section 4.12 for specific options available.) Embedded codes place time, date, and variable data locations in the message. These locations display the continuously-updated information it receives from the controller or computer.

The PMD slave displays also feature international character sets. This option is switch-selectable to allow message display in U.S., English, French, Danish, Swedish, German, Cyrillic, or Japanese Kana for the PMD slave displays.

The PMD 3000 and PMD 3500 have a large, LED field on which to display messages. The PMD 3500 LED character display is tri-color. The size of this field varies (see part numbers) and provides a variety of ways to display messages. 2",

4", 6", 8", and 8"compressed characters can be displayed simultaneously, even within the same message. Because of this, programmed embedded codes are used to change character size (which is otherwise read from a dip-switch setting). Another code, a frame definition code, can be used to determine which lines of the display are used by a particular message.

Since the LED field differs from vacuum fluorescent displays (which have distinct character locations), the PMD 3000/3500 displays scrolled messages differently than the smaller displays. Left-scroll messages feature "smooth scrolling", that is, letters move one LED at a time. Each portion of a letter will illuminate every dot in that row when it scrolls across the display. Upward-scrolling messages actually do not scroll at all. Rather, they "wipe on" to the display in an upward fashion. The first section of message lines appear, then the display pauses, clears, and displays the next section of text.

1.8   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 (some PMDs are as small as a mailbox). Delivery of these messages take a matter of milliseconds. And remember that these messages were written by employees of your company for employees of your company to keep everyone informed.

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SECTION 2.   UNIT HARDWARE

2.0 INTRODUCTION

The PMD 200S and PMD 300S have terminal blocks and switches located on their back panels. All wiring terminations and adjustments are located inside the PMD 3000. While physical locations differ, these components share common functions. This section will cover these components in a parallel fashion, that is, will alternate between the PMD 200S/300S and the PMD 3000/3500.

Figure 2-1 shows the back panels of the PMD 200S/300S. Figure 2-2 shows the PMD 3000/3500 with the back panel removed. General components referenced in following section are labeled. Please note that PMD 3000/3500 displays come in many sizes. Figure 2-2 shows one of the larger units. Proportions will seem different for smaller display, however, general locations remain the same.
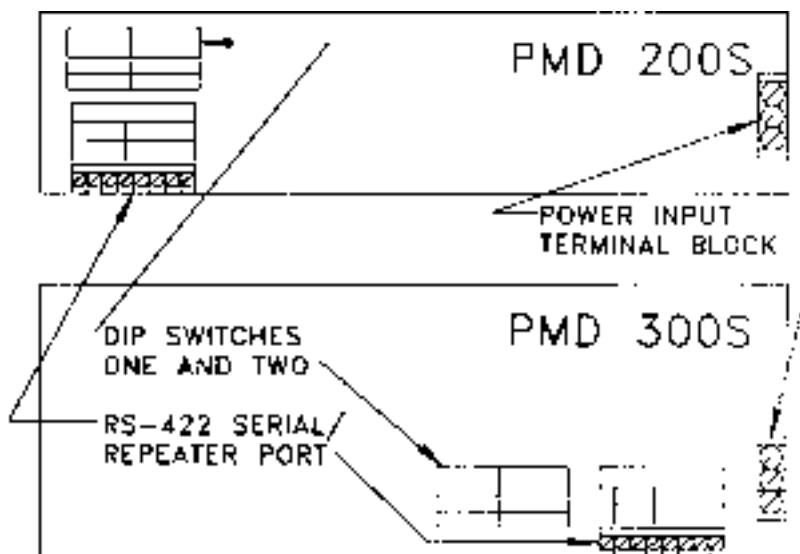
Figure 2-1.   Back Panel of the PMD 200S and PMD 300S Slaves.

2.1 SLAVE INTERFACING

As previously mentioned, terminal blocks located on the PMD 200S/300S back panel are located inside the PMD 3000/3500. It is necessary to put holes in the cabinet for routing communication and power cables in and out of the cabinet.

2.1.1 POWER INPUT TERMINALS

Three terminals are provided for connecting operating power to the unit. On the PMD 200S/300S, the Power Input terminals are located on the right-hand side of the back plate (see Figure 2-1). On the PMD 3000/3500, these terminals are located on the transformer/connector sub-plate (see figure 2-2). Figure 2-3 shows the location of the Power Input terminals on the PMD 3000/3500 transformer/ connector sub-plate that contains the filter and fuse (see figure 2-2). The transformer fuse is also shown. Power Input terminals are labeled L1, L2, and chassis ground (///). Always connect the ground terminal to the safety ground.

The PMD 3000/3500 and AC-powered 200 and 300 slaves are shipped from the factory set for 115 VAC operation. Refer to 2.5 to reconfigure these slaves for 230 VAC operation.

View with back plate removed
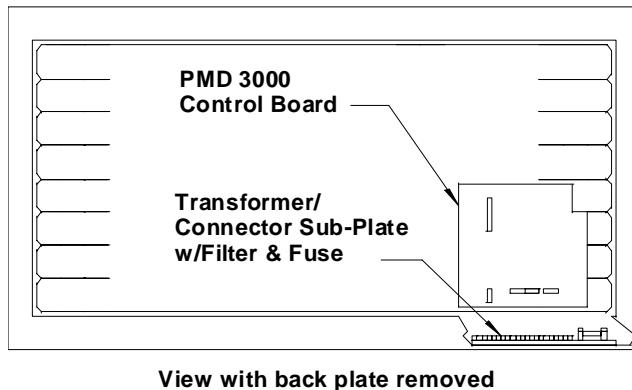
Figure 2-2. Back View of the PMD 3000 Slave Display

Transformer/Connector Sub-plate
with filter and fuse

Power Input Terminals ———
Transformer Fuse ———
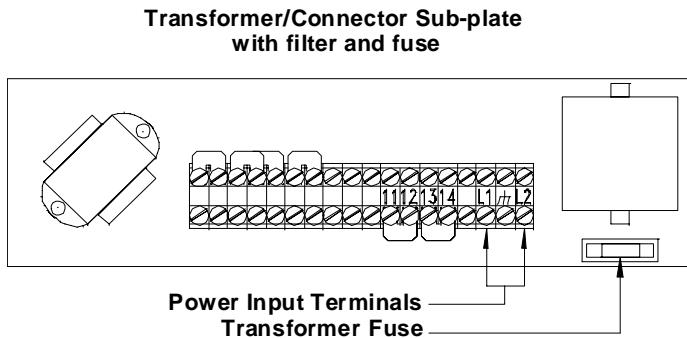
Figure 2-3. PMD 3000/3500 Power Input Terminal Locations.

2.1.2 RS-422A SERIAL/REPEATER PORT

The RS-422A Serial/Repeater Port is an 8-position terminal block through which all communications to the unit take place. On the PMD 200S/300S, this port is located at the bottom of the back plate (see figure 2-1). The PMD 3000/3500 Serial/Repeater Port is located on the Control Board. The PMD 3000 and the PMD3500 Control Boards and their components are shown in figure 2-5.

The PMD 3000 also has alternative RS-232 transmission capabilities (see figure 2.1.3). Typical wiring options for the Serial/Repeater Port are found in figure 2-4. The two configurations on the left 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 configurations on the right are for bidirectional communication which can only take place using computer control. The PMD master in the top right configuration is optional and is not controlling the slave. Notice that since PMD masters do not have repeater ports, they can only begin daisy-chains and cannot be included anywhere within the chain. Multi-drop wiring requires signal boosting after every ten slaves or for slaves located further than 4000 feet (1200 meters) from the controlling device. Daisy-chain wiring provides signal boosting through the repeater circuits of each slave, and a 4000 foot distance between each device is possible. (No provision is made for boosting the reply channel, however.)
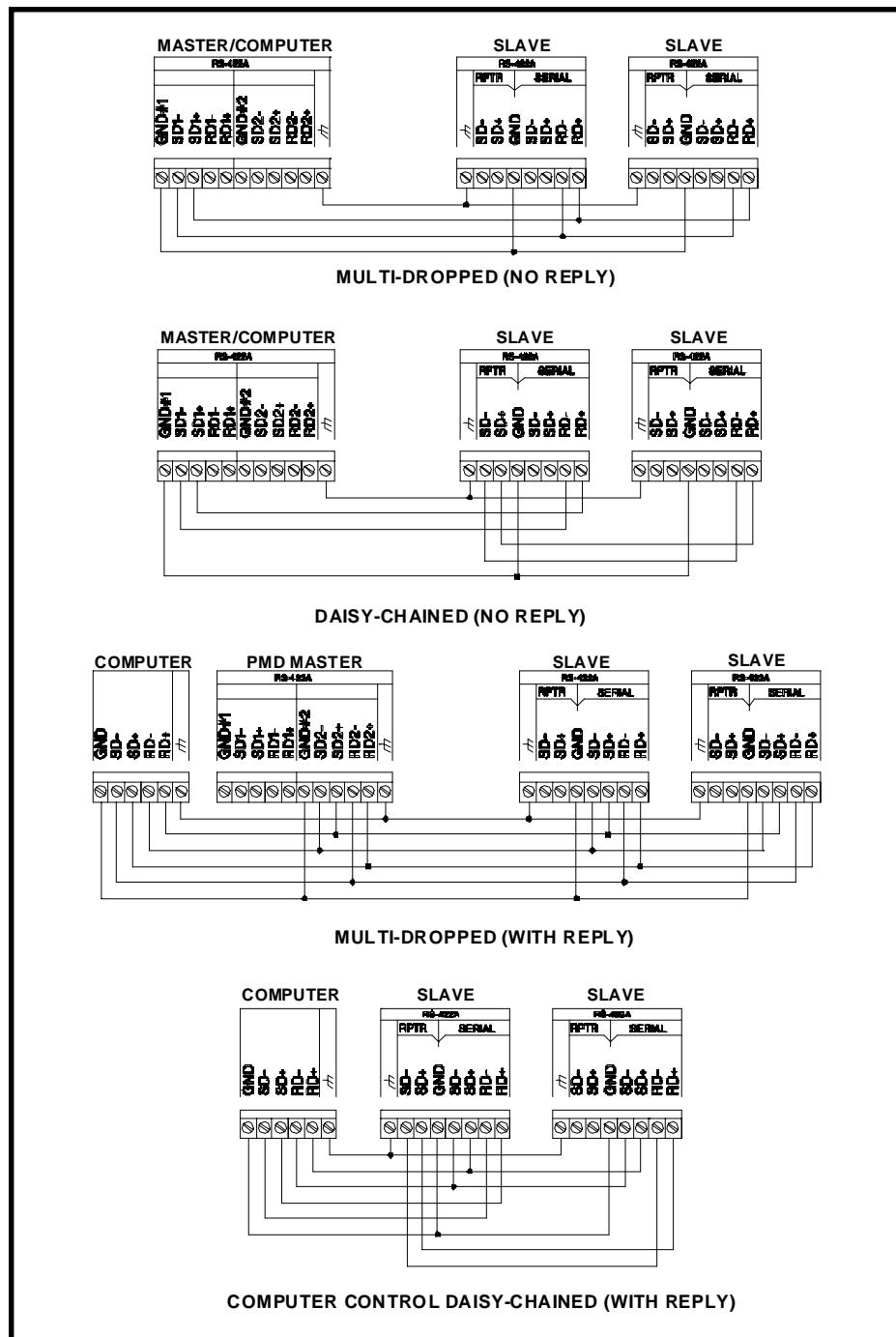
Figure 2.4 RS-422A Serial/Repeater Port Interfacing

Note that the terminal sequence differs slightly between the PMD 200S/300S and the PMD 3000/3500. Reference designation levels of the terminals when using figure 2-4 for wiring purposes.

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

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

An RS-422 "link" consists of a two-wire transmitting line, a two-wire receiving line (optional), signal common and the shield which usually is 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. <u>DO NOT USE WIRES FROM DIFFERENT TWISTED PAIRS TO MAKE UP A TWO-WIRE SIGNAL LINE</u>.

PMD 3000
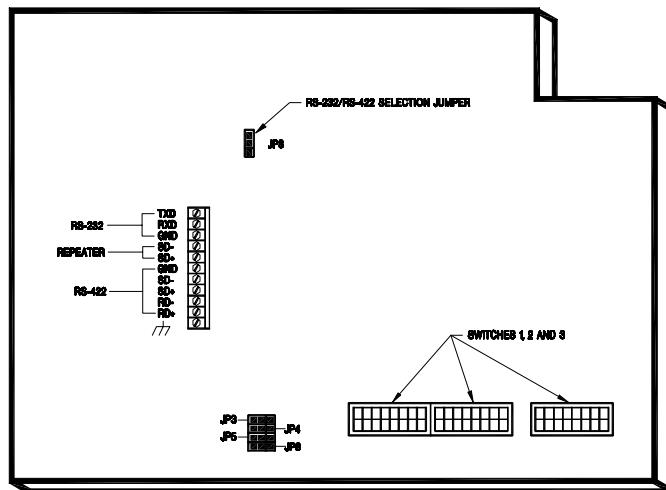
PMD 3500
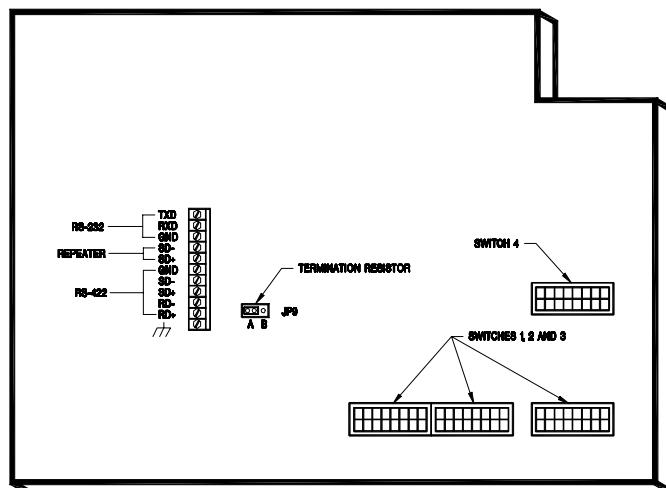
Figure 2-5. PMD 3000 and PMD 3500 Control Board Components.

2.1.3 PMD 3000 RS-232 PORT

The PMD 3000/3500 Port provides an optional RS-232 port for communication from a computer. This port is switch selectable on jumper JP8. See figure 2-5 for JP8 location. See figure 2-6 for jumper JP8 positions. Figure 2-7 shows RS-232 interfacing. RS-232 wiring (from computer to the PMD 3000) should not exceed 50 feet. Additional PMD slave displays can be daisy-chained from the PMD 3000 RS-422 Repeater port. 4000 feet between these slaves is possible. The PMD 3500 does not require a jumper for RS-232/422 selection.
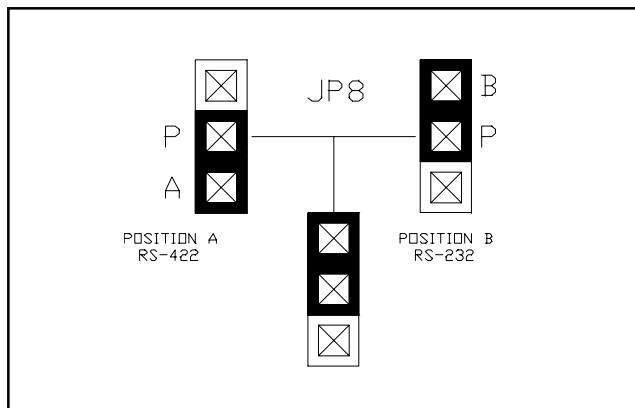
Figure 2-6. Jumper JP8 Positions.
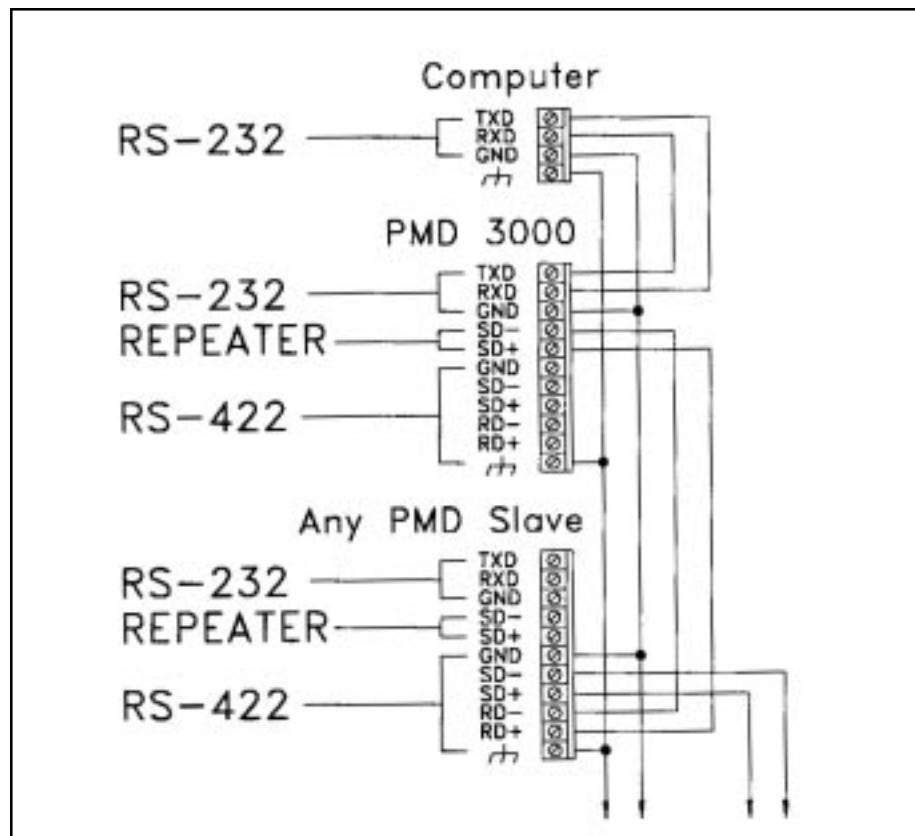
Figure 2-7. RS-232 Interfacing.

2.2 SWITCH ONE AND SWITCH TWO — UNIT ADDRESS

Switches One and Two define the Unit Address (the Group and Unit Number that the slave will respond to). Switch One is an 8-position dip switch and Switch Two is a 9-position dip switch. These switches are located on the back panel of the PMD 200S/300S (see figure 2-1) and on the Control Board of the PMD 3000 (see figure 2-5). The switches on the PMD 3000 are labeled open. The switches on the PMD 3500 are labeled 0 and 1. An open switch on the PMD 3000 is the same as a "1" on the PMD 3500. 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. Switch Two - position nine designates whether the other switches represent two BCD numbers or two binary numbers.

On the PMD 300S, positions two through four of Switch Two are also for the Unit Number. The PMD 200S and the PMD 3000 allow Unit Numbers up to 511 binary. The PMD 300S can have a Unit Number as large as 4095 Binary. On the PMD 200S, positions two through four of Switch Two let you select from the International Character Sets that are displayable on the PMD 200S display.

On the PMD 3000/3500, the switch selectable extended U.S./Japanese Kana character set is selected on positions 2 through 4 of Switch 2. PMD 3000 Switch 2 positions 2 through 4 settings are: 1) 2-4 Open = U.S. with Japanese Kana extension and 2) 2-4 Closed = Standard U.S. character set. (Dip switch packages 1 and 2 of the PMD 3500 are defined the same as the PMD 3000, but remember that, as stated in the first paragraph of this section, an open switch on the PMD 3000 is the same as a "1" on the PMD 3500.)

Figure 2-8 shows how Switch One and Switch Two are read. Table 2-1 defines the numerical value or setting for each position of these switches.

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	100	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	0 (PMD 3000/3500) 1 (200S/300S)	1 (PMD3000/3500) 0 (200S/300S)	BCD/Binary
Binary and BCD values refer to when the switch is in the "1" position.			

PMD SLAVE INTERNATIONAL CHARACTER SET			
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 2-1. Switch One and Switch Two Definitions.

Reference: 3.3   - Addressing Slaves
                   4.2.1 - Addressing Slaves

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

CAUTION—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.

In binary numbering, the maximum values are 16 groups (0-15) and 512 units (1-511). When set for BCD, the maximum values are 10 groups (0-9) and 200 units (0-199).
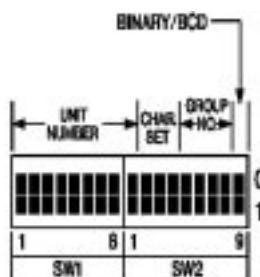
**PMD 200S SLAVE and
PMD 3000 SLAVE SETTINGS**
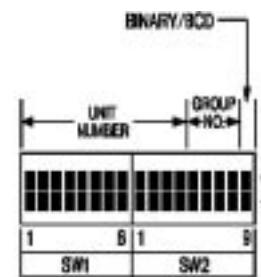
PMD 300S SLAVE SETTINGS

Figure 2-8.   Switch One and Switch Two Definitions.

2.3 SWITCH THREE - PMD 3000/3500 UNIT SIZE/CHARACTER HEIGHT

PMD 3000

The PMD 3000 also has Switch Three located on its Control Board (see figure 2-5). Switch Three positions 1 through 7 indicate to the Control Board the width and height of the particular display. These settings are pre-set at the factory and should never be changed. Without proper settings on these switches, messages will not be displayed properly. These settings are shown in Table 2-2 in case they are changed accidentally.

Positions 8 and 9 of Switch Three set the default character height for displayed messages. The default character height determines what size message character will be when character height is not indicated within the message. Character height default settings are also shown in Table 2-2.

<table>
<tr><td colspan="5" align="center">SWITCH THREE (PMD 3000)
DISPLAY SIZE - CHARACTER HEIGHT DEFAULT IDENTIFICATION</td></tr>
<tr><td>DISPLAY WIDTH</td><td>POSITION 1</td><td>POSITION 2</td><td>POSITION 3</td><td>-</td></tr>
<tr><td>1W</td><td>CLOSED</td><td>OPEN</td><td>OPEN</td><td>-</td></tr>
<tr><td>2W</td><td>CLOSED</td><td>CLOSED</td><td>OPEN</td><td>-</td></tr>
<tr><td>4W</td><td>CLOSED</td><td>CLOSED</td><td>CLOSED</td><td>-</td></tr>
<tr><td>DISPLAY HEIGHT</td><td>POSITION 4</td><td>POSITION 5</td><td>POSITION 6</td><td>POSITION 7</td></tr>
<tr><td>2H</td><td>CLOSED</td><td>OPEN</td><td>OPEN</td><td>OPEN</td></tr>
<tr><td>4H</td><td>CLOSED</td><td>CLOSED</td><td>OPEN</td><td>OPEN</td></tr>
<tr><td>8H</td><td>CLOSED</td><td>CLOSED</td><td>CLOSED</td><td>OPEN</td></tr>
<tr><td>CHARACTER HEIGHT</td><td>POSITION 8</td><td>POSITION 9</td><td>-</td><td>-</td></tr>
<tr><td>TWO-INCH</td><td>OPEN</td><td>OPEN</td><td>-</td><td>-</td></tr>
<tr><td>FOUR-INCH</td><td>CLOSED</td><td>OPEN</td><td>-</td><td>-</td></tr>
<tr><td>SIX-INCH</td><td>OPEN</td><td>CLOSED</td><td>-</td><td>-</td></tr>
<tr><td>EIGHT-INCH</td><td>CLOSED</td><td>CLOSED</td><td>-</td><td>-</td></tr>
</table>

Table 2-2.   PMD 3000 Switch Three Definitions.

PMD 3500

Switch package 3 is defined differently on the PMD 3500 (and there is a DIP Switch 4 added, this is discussed later.)

SWITCH THREE (PMD 3500) DISPLAY SIZE - CHARACTER HEIGHT DEFAULT IDENTIFICATION				
DISPLAY WIDTH	**SW3-1**	**SW3-2**	**SW3-3**	**SW3-4**
1W	*	1	1	*
2W	*	0	1	*
3W	*	1	0	*
4W	*	0	0	*
* Switch not used and available for future features.				
DISPLAY HEIGHT	**SW3-5**	**SW3-6**	**SW3-7**	**-**
2H	1	1	1	-
4H	0	1	1	-
6H	1	0	1	
8H	0	0	1	-
10H	1	1	0	-
12H	0	1	0	-
14H	1	0	0	-
16H	0	0	0	-
CHARACTER HEIGHT	**SW3-8**	**SW3-9**	-	-
TWO-INCH	1	1	-	-
FOUR-INCH	0	1	-	-
SIX-INCH	1	0	-	-
EIGHT-INCH	0	0	-	-

Table 2-3. PMD 3500 Switch Three Definitions.

2.4 CHANGING THE BAUD RATE

PMD slaves can operate at 1200 or 9600 baud. To communicate with a PMD master, slaves must be set 9600 baud (factory set). When controlled by a computer, PLC serial interface, or other intelligent device, the PMD slave can be set to either 1200 or 9600 baud. To change the baud rate, you must restart (remove and re-apply power) to the unit before the new baud rate setting is recognized.

2.4.1 PMD 200S SLAVE BAUD RATE

To change the baud rate on the PMD 200S, you must first remove the top cover of the display as shown in figure 2-9. Be sure to remove power from the unit first. Then locate JP5 as shown in figure 2-10. Move the jumper to the desired setting, replace the top cover, and re-apply power. The initial message after self-test indicates the current baud rate setting.
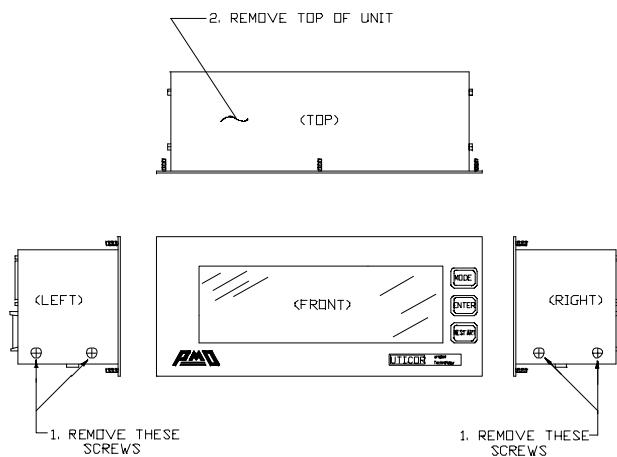
Figure 2-9. Removing the Top Cover - PMD 200S/300S.
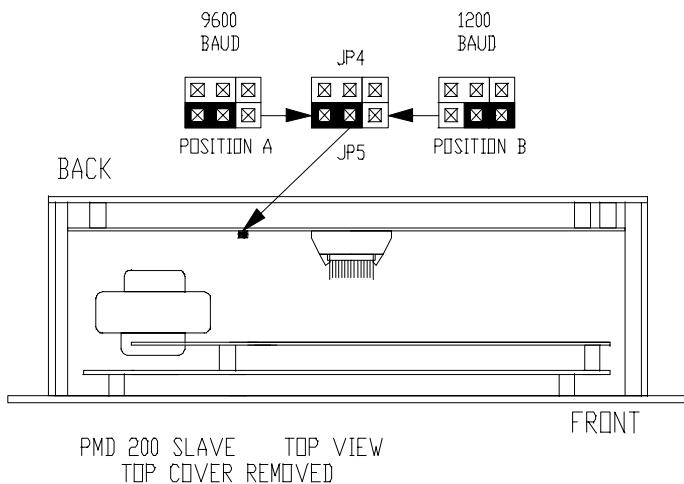
Figure 2-10. PMD 200S Jumper JP5 Locations and Baud Rate Settings.

To change the baud rate on the PMD 300S, first remove the top cover of the display as shown in figure 2-9. Be sure to remove power from the unit first. Then locate JP5 as shown in figure 2-10. Move the jumper to the desired setting, replace the top cover, and re-apply power. The initial message after self-test indicates the current baud rate setting.
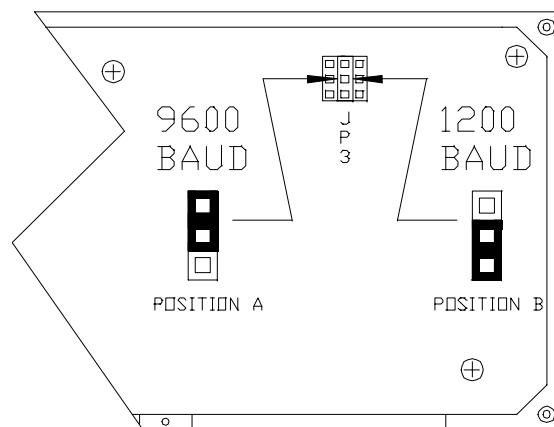
Figure 2-11.   PMD 300S Jumper JP3 Location and Baud Rate Settings.

2.4.3 PMD 3000 SLAVE BAUD RATE

PMD 3000/35 00 baud rate is adjusted by moving jumper JP3 on the Control Board. Refer to figure 2-5 for jumper JP3 location. Refer to figure 2-12 for JP3 settings. Be sure to remove power from the unit before touching components.
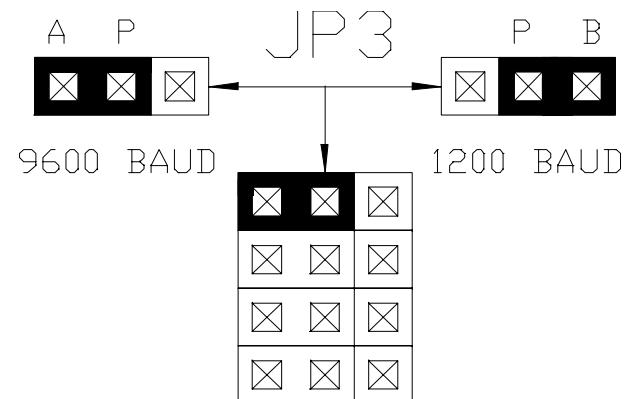
Figure 2-12.   PMD 3000 Jumper JP3 Baud Rate Settings.

2.4.4 PMD 3500 SLAVE BAUD RATE AND COMMUNICATIONS PROTOCOL

DIP Switch package 4 (SW4) has been added to the PMD 3500. Two of the switches of SW4 define the protocol used (PMD or ASCII) and the baud rate for the computer interface (these are defined by jumpers on the PMD 3000.)

Switches 4-1 through 4-5, and Switch 4-8 are not used and remain available for future use. SW4-6 defines the Baud Rate; 0 = 1200, 1 = 9600. SW4-7 defines the communications protocol; 0 = ASCII Protocol, 1 = PMD Protocol.

2.5 CHANGING FROM 115 VAC TO 230 VAC INPUT POWER • CHANGING FUSES

AC powered units can be changed from 115 VAC operation to 230 VAC operation. This change involves moving internal jumpers or connectors and changing fuses. All AC units are shipped from the factory set for 115 VAC operation.

For the PMD 200S and PMD 300S slaves, refer to figure 2-13 for general PC board and transformer locations. These items are referred to in the following sections.
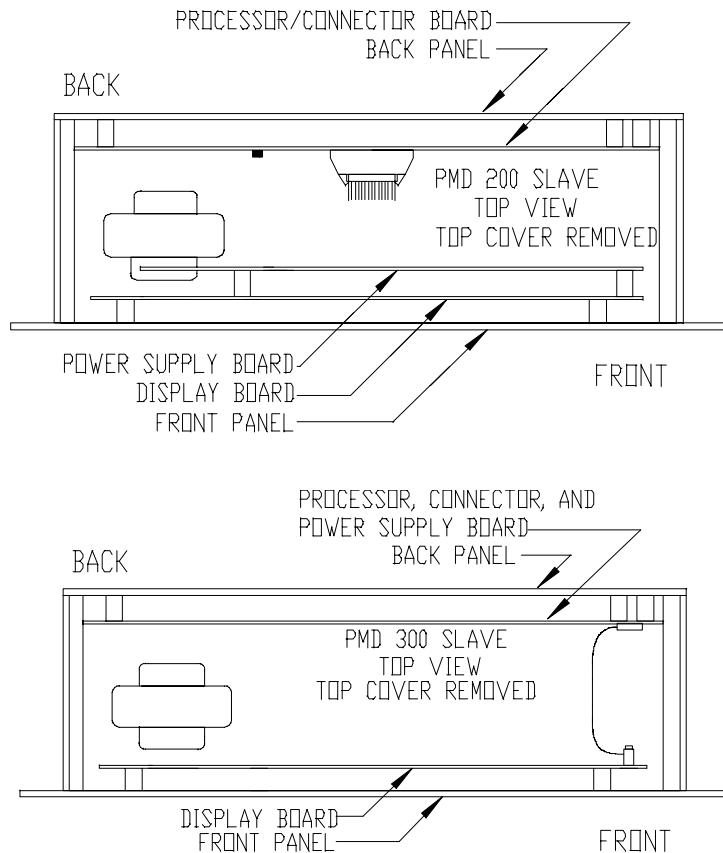
Figure 2-13. PMD 200S/PMD 300S PC Board and Transformer Locations.

2.5.1 PMD 200S INPUT POWER AND FUSES

To operate Model 76538 at 115 VAC (as shipped from factory):

1) The power input connector (from the transformer to the processor and communications board) must be plugged into the 115 VAC position connector (see figure 2-14).
2) The input fuse must be a 0.75 Amp, Fast Acting 250 V (0.177" x 0.57") — factory installed.

To operate Model 76538 at 230 VAC:

1) The power input connector (from the transformer to the processor and communications board) must be plugged into the 230 VAC position connector (see figure 2-14).
2) The input fuse must be a 0.375 Amp, Fast Acting 250 V (0.177" x 0.57") — customer supplied.
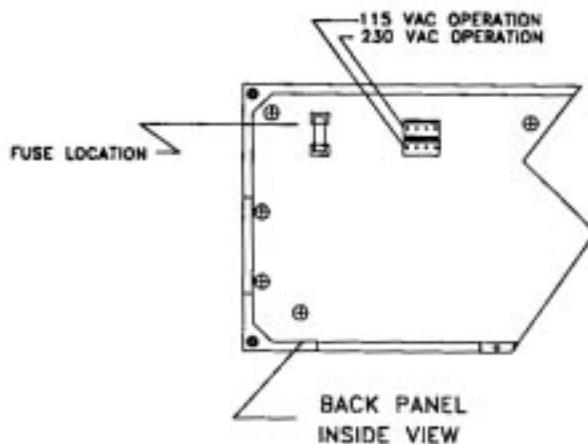
Figure 2-14. PMD 200S Processor/Communications Board with Power Input Connector/Fuse Locations.

WARNING!! **DISCONNECT AC POWER FROM THE UNIT BEFORE CHANGING THE FUSE!!**

2.5.2 PMD 300S INPUT POWER AND FUSES

To operate Model 76547 at 115 VAC (as shipped from factory):

1) The power input connector (from the transformer to the processor and communications board) must be plugged into the 115 VAC position connector (see figure 2-15).

2) The input fuse must be a 1.0 Amp, Slo-Blo 250 V (0.177" x 0.57") — factory installed.

To operate Model 76547 at 230 VAC:

1) The power input connector (from the transformer to the processor and communications board) must be plugged into the 230 VAC position connector (see figure 2-15).

2) The input fuse must be a 0.5 Amp, Fast Acting 250 V (0.177" x 0.57") — customer supplied.
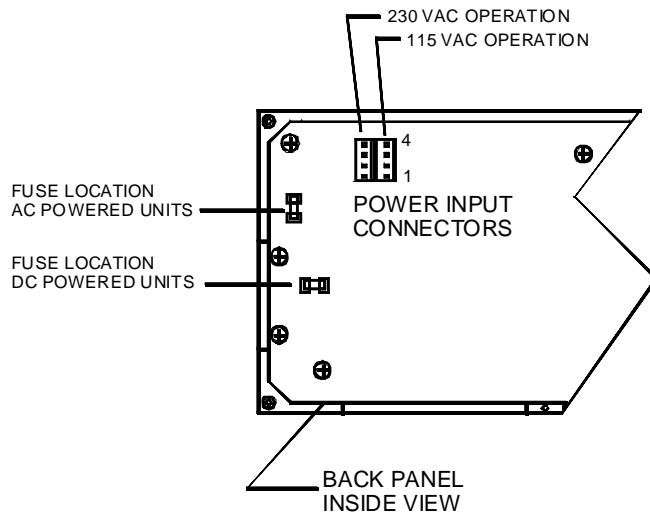
Figure 2-15. PMD 300S Processor/Communications Board with Power Input Connector and Fuse Locations.

2.5.3 PMD 3000/3500 INPUT POWER AND FUSES

To operate the PMD 3000/3500 at 115 VAC (as shipped from the factory): The Transformer/Connector Sub-Plate with filter and fuse must have terminals 11 and 12 jumpered together and terminals 13 and 14 jumpered together (see figure 2-16).

To operate the PMD 3000/3500 at 230 VAC (customer adjustable): The Transformer/Connector Sub-Plate with filter and fuse must have terminals 12 and 13 jumpered together (see figure 2-16). Remove the two jumpers (from 11 to 12 and from 13 to 14) and replace one in the position shown.
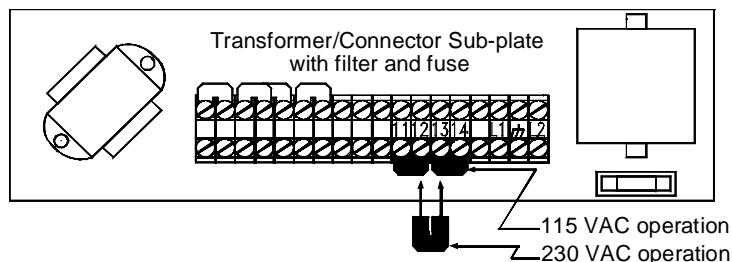
Figure 2-16. PMD 3000/3500 Transformer/Connector Sub-Plate Jumper Settings for 115/230 VAC Operation.

2.6 CONCLUSION

Section 2 covered the PMD slave hardware. Unit power is connected to three input power terminals. All communications take place through the RS-422 Serial/Repeater Port. PMD Slaves are identified by their unit address which is determined by the positioning of Switch One and Switch Two. The PMD 200S also provides dip switch settings for selecting an international character set for displaying messages. The PMD 3000 and PMD 3500 also contain a Switch Three which identifies unit size and lets you select a default setting for display character size. The PMD 3500 has a Switch Four that identifies Baud Rate and the Communictions Protocol.

PMD slaves also contain jumpers or switches for selecting baud rate and changing the input power requirements. Fuse locations are also shown in this section. Section 3 explains slave operation.

SECTION 3.   PMD MASTER CONTROL

3.0 INTRODUCTION

The overseer of a PMD slave can be a computer or a PMD master. This section covers master control of a PMD slave.

Messages are programmed into the master in a format that is understood by the slave display. The way a message is displayed (blinking characters, scrolling text, etc.) is programmed into the message along with the text. Slaves display the message exactly as the master does (given the message's individual display options). But because PMDs vary widely in configuration, they have dissimilar ways to adapt to messages of different sizes (discussed later).

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 is updated. While this information is sent to all slave displays, the PMD slave displays only messages that were programmed with an address acceptable to the particular unit. Refer to 3.3.)

3.1 MASTER CONTROL PREPARATION

To prepare the PMD slave for master control:

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

2.   Connect the RS-422A Serial/Repeater Port to the programmed master and other slave(s) as shown in one of the first two examples of Figure 2-4.

3.   Connect service power to the unit. (For 230 VAC operation, you **must** move the power input connector and change the fuse first.)

Reference: PMD Master Manual

3.2 WHAT HAPPENS DURING MASTER CONTROL

When the PMD slave display is put into master control:

1.   The PMD slave display is ready to communicate and displays a message to indicate the software revision code, the unit address (group and unit number), and the baud rate. (PMD units must be set to operate at 9600 baud when under master control.)

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

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

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

5.   Any changes to data set (variable data) information in the master causes the master PMD to send all four data sets to all slaves. Only computer interface operation permits selective transmission of data values (see 3.5).

6. Time, date, and data are updated on all PMD 200S and PMD 300S messages continuously. Time, date and data information are updated continuously on the PMD 3000/3500 for displayed non-scrolling messages only. Scrolled messages are updated at each repetition. Please note that the PMD 3000/3500 will update time, date, and data of static messages when a scrolling message is being displayed.

7. On a PMD 200S/300S, any characters of any message can blink except for Time, Date and Variable data; for these characters to blink, the "Blink Entire Message" option must be selected.

   PMD 3000 /3500 non-scrolling messages can contain blinking characters also (Time, Date, Variable Data behave as described for the 200S/300S).

   PMD 3000 /3500 scrolled messages cannot have blinking characters; stationary messages can blink but not while a scrolling message is being simultaneously displayed.

   Reference   B.2 - Baud Rate Selection

3.3 ADDRESSING SLAVES

Each PMD slave display is assigned a unit address. A unit address is programmed into each message (programmed for slave output) to specify which unit or units 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.

Each unit address consists of two identifiers which are a group 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 in all groups

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 are displayed by all slaves. With a non-zero group number and a unit number of zero, all units with that group number display the message. With a non-zero group and unit number, only the display with the indicated address displays the message.

Reference   2.2 - Switch One and Switch Two

3.4 MIXING DISPLAYS

Displays of all sizes can be used in the same network (a 2-line master with 4-line slaves, etc.). PMD slaves can be used with any PMD master (excepting the PMD 150 which does not have a slave port). PMD family members contain size and other small differences that are outlined in the following sections.

3.4.1 USING A 200S SLAVE

The PMD 200S has a two-line by twenty-character framework that limits stationary message display to forty characters and upward scrolling messages to two lines at a time. Table 3-1 (below) shows format differences between the PMD 200S slave and the various masters that can control it.

PMD 200S	2 x 20	2x 20	Lines 1 and 2	Line 1 or 2
	Character Framework	**Standard Messages**	**Scroll Up Messages**	**Scroll Left Messages**
PMD 160	1 or 2 x 20	2 x 20	Lines 1 and/or 2	Line 1 or 2
PMD 200	2 x 20	2 x 20	Lines 1 and 2	Line 1 or 2
PMD 300/400 or Msg Controller	4 x 20	First 40 Characters	Lines 1 and/or 2	Line 1 or 2
PMD 3100	1 to 8 x 5, 10, 20, 40, or 80	First 40 Characters	Lines 1 and/or 2	Line 1 or 2

Table 3-1. PMD 200S Slave/PMD Master Comparison.

1. **Standard messages** — Only the first 40 characters (or first 2 lines of text) of a standard message from a master are displayed on the PMD 200S. The rest of the message is truncated.

2. **Scroll up messages** — When using masters other than the PMD 160 or PMD 200, all messages programmed to scroll upward will scroll upward on one selected line of the PMD 200S display regardless of the line option used.

3. **Scroll left messages** — Left-scrolling message programmed to scroll on line 2 will scroll left on line 2 of the PMD 200S. Messages programmed to scroll left on lines 1, 3, or 4 of the PMD master will scroll left on line 1 of the PMD 200S.

3.4.2 USING A 300S SLAVE

The PMD 300S has a four-line by twenty-character framework that permits stationary message display of 80 characters. Upward-scrolling message can scroll on any contiguous lines (1-4). Because of the different sizes of masters available, some restrictions apply. Table 3-2 shows format differences between the PMD 300S and the various masters that can control it.

PMD 300S	4 x 20	4 x 20	Lines 1–4	Lines 1, 2, 3, or 4
	Character Framework	**Standard Messages**	**Scroll Up Messages**	**Scroll Left Messages**
PMD 160	1 or 2 x 20	2 x 20	Lines 1 and/or 2	Line 1 or 2
PMD 200	2 x 20	2 x 20	Lines 1 and 2	Line 1 or 2
PMD 300/400 or Msg Controller	4 x 20	First 80 Characters	Lines 1–4	Line 1, 2, 3, or 4
PMD 3100	1 to 8 x 5, 10, 20, 40, or 80	First 80 Characters	Lines 1–4	Line 1, 2, 3, or 4

Table 3-2. PMD 300S Slave/PMD Master Comparison.

1. **Standard messages** —The first 80 characters (or the first 4 lines of text — or the restricted length of standard messages for the particular master) of a standard message from a master PMD is displayed on the PMD 300S. Message lines longer than 20 characters (from a PMD 300, for instance) will be truncated on the 300S display.

2. **Scroll up messages** —Scroll up messages from PMD 200 masters are always displayed on lines 1 and 2 of the PMD 300S. Scroll up messages from other masters will scroll as indicated (lines 1 - 4).

3. **Scroll left messages** - Left-scroll messages from a PMD 160 or PMD 200 will scroll on lines 1 or 2 as indicated in the message. Other masters can display left-scroll messages on any one line (1-4).

3.4.3 USING A 3000/3500 SLAVE — ADVANCED FEATURES OF THE PMD 3000 and PMD 3500

The PMD 3000 is offered in several size configurations and has variable character height. Therefore, behavior of the PMD 3000 depends on: message options and the actual message sent, the size of the PMD 3000's display, character height, and frame definition. Advanced features of the PMD 3000 are defined, followed by Table 3-3: a PMD 3000 comparison.

THE LED FIELD
The PMD 3000 display area is composed of up to 16 LED "sticks". These sticks are denoted in your display size by the W and H numbers, that is, a 2W4H display is 2 sticks wide and 4 sticks high. When formatting your message for your particular size display, keep in mind the display's stick-height.

For instance, a 4H unit can display:

> 4 lines of 2-inch characters
> 2 lines of 4-inch characters
> 1 line of 4-inch characters and 2 lines of 2-inch characters
> 1 line of 6-inch characters and 1 line of 2-inch characters
> 1 line of 8-inch characters

Each stick-height represents a 2-inch high character. Two stick-heights represents a 4-inch tall character or two 2-inch characters. One stick-width supports 20 2-inch characters. Two stick-widths support 40 2-inch characters or 20 4-inch characters, etc.

Each stick is 8 LEDs high and 120 LEDs wide. Together, these LED sticks form the LED display "field". Character size and field definitions can change continuously and can be hardware and/or software defined.

FRAME DEFINITIONS
Frame definition specifies the portion of the LED field that will display the message. This "enables" a defined number of LED sticks (the entire width is always enabled) for message display. This can be done, either by "default" or by frame definition.

Default specification is calculated from the character height specified + the actual message. For instance, a scroll-left message with 4-inch characters programmed to scroll on line 2 will be displayed on stick 3 and 4 (and leave 2 sticks or one 4" stick-area above it).

Embedded frame definition can be indicated by **the first six bytes** of the message sent. This frame definition lets you define "message lines" on your LED field which helps you set up your 3000 for multiple character heights and/or multiple message display. This definition must contain 6 bytes. The first 2 bytes indicate the frame definition code - <ESC> <F>. This is followed by the top stick definition (2 bytes) and the bottom stick definition (2 bytes). Frame definition is defined as follows:

<ESC><F>(n1)(n2)

n1 is the top stick enabled and represents a 2-digit number between 01 and 08. n1 must be <= the stick-height of the display. n2 must be >= n1 and <= the stick height of the display.

	<ESC><F> (in ASCII)	- 1B 46 (in HEX)	• 2 bytes
n1	<0><1> to <0><8> (in ASCII)	- 30 to 38 (in HEX)	• 2 bytes
n2	<0><1> to <0><8> (in ASCII)	- 30 to 38 (in HEX)	• 2 bytes

To enter the <ESC> code on your keyboard, enter the **^** character, followed by the **[** character. For example, to enable sticks 2-5 enter:

^[F0205

When the top stick specification is larger than (below) the bottom stick specification, the message will not be displayed.

If no frame definition is specified, the PMD 3000 will specify the frame according to the character height (read from Switch Three settings) and the number of lines in the message.

CHARACTER HEIGHT
The PMD 3000 supports four character heights: 2-inch, 4-inch, 6-inch, and 8-inch characters. PMD 3000 default character height is defined on Switch Three — positions 8 and 9. When no character definition exists within the message, the message is displayed according to the height set on the dip switches.

Embedded character-height definitions can be placed anywhere within the message. All characters following a character-height definition will be displayed in the specified size until another definition appears (that is, they are not limited by the end-of-line, just the end-of-message).

Embedded character definitions are as follows:

2-inch = <ESC><0> (in ASCII)	- 1B 30 (in HEX)	• 2 bytes
4-inch = <ESC><1> (in ASCII)	- 1B 31 (in HEX)	• 2 bytes
6-inch = <ESC><2> (in ASCII)	- 1B 32 (in HEX)	• 2 bytes
8-inch = <ESC><3> (in ASCII)	- 1B 33 (in HEX)	• 2 bytes
8-inch compressed = <ESC><4> (in ASCII)	- 1B 34 (in HEX)	• 2 bytes

As mentioned, use the ^[escape sequence to enter the <ESC> code when using an ASCII keyboard.

DISPLAYING PMD 3000/3500 MESSAGES
When the PMD 3000/3500 receives a message, it will count the number of lines in the message and assign it a frame according to the number of lines and the default character height. It first checks for invalid character dimension sequences. This check looks for character dimensions that will not fit within the frame specified for the message. A sequence that will not fit is invalid. Invalid sequences are converted to the maximum character dimension that will fit within the message's frame. When no frame is specified, the PMD 3000/3500 defines the frame according to the **default** (dip switch) character size.

For example, when the dip switch is set for 2-inch characters and no frame is specified, the first four sticks are enabled for a standard message. If the message contains 4- or 6-inch characters, they will be displayed in their programmed size and that message line will be located to accommodate the size. However, lower lines of the message may not fit and therefore will not be displayed.

PLEASE NOTE THE FOLLOWING ABOUT THE PMD 3500 MESSAGE DISPLAY*: the constraints on the physical display size of the PMD 3500 is very similar to the PMD3000. Like the PMD 3000, the PMD 3500 may have no more than 16 sticks and be no more than 4 sticks wide or 16 sticks high. The PMD 3500, however, is composed of blocks of 2 sticks high, so it cannot have an odd number of sticks high. Each "half block" of the PMD 3500 is still referred to as a stick. The selection of display size of the PMD 3500 through the DIP switches is slightly different than that of the PMD. The display size settings for the PMD 3500 are shown in section 2 of this manual (page 2-9).*

Table 3-3 compares the PMD 3000/3500 with the various masters.

	Character Framework	Standard Messages	Scroll Up Messages	Scroll Left Messages
PMD 3000/3500	1 to 8 x 5, 10, 20, 40, or 80	8 x 80 (230 character max)	use frame definition for lines 5–8	use frame definition for lines 5–8
PMD 160	1 or 2 x 20	2 x 20 (use FD for lines 3–8 x 20)	Lines 1 and/or 2 (use FD for lines 3–8 x 20)	Line 1 or 2 or use frame definition
PMD 200	2 x 20	2 x 20 (use FD for lines 3–8 x 20)	Lines 1 and 2 (use FD for lines 3–8 x 20)	Line 1 or 2 or use frame definition
PMD 300/400 or Msg Controller	4 x 20	8 x 80 (230 character max)	Lines 1–4 x 80 or use frame definition	Line 1, 2, 3, or 4 or use frame definition
PMD 3100	1 to 8 x 5, 10, 20, 40, or 80	8 x 80 (230 character max)	Lines 1–4 x 80 or use frame definition	Line 1, 2, 3, 4, 5, 6, 7, or 8 or use frame definition
Note: FD = frame definition				

Table 3-3. PMD 3000/3500 Slave/PMD Master Comparison.

Please note the following about PMD 3000/3500 message behavior:

1. A message programmed to clear the display will clear all information from the display prior to displaying itself.

2. All sticks designated by the message frame will be cleared for the message. Non-scroll messages with blank lines (end-of-line marker only) will **not** clear messages from these lines unless programmed to do so. The size of the blank line (i.e., number of blank sticks) is determined by the character height preceding the blank line.

3. For a standard message, a message line displays only the number of characters physically allowed. The remainder of the message line is truncated.

4. You may display multiple scroll-up and scroll-left messages at the same time so long as they do not overlap. All scroll-left messages will move synchronously. Scroll rates for left-scroll messages are fixed and cannot be changed by scroll rate settings of the master display.

5. Scroll-up messages of the PMD 3000/3500 behave differently than those of the vacuum fluorescent displays. PMD 3000/3500 scroll-up messages wipe onto the display in an upward direction. The PMD 3000/3500 first figures how many message lines can be placed within the frame. Then these message lines are visually "brushed" across the display from bottom to top, the bottom line of text being revealed first, on up to the first line.

   The display then pauses with this portion of the message, then clears and repeats the process with the second portion of message lines to fit the frame, etc. The pause time (scroll-up rate times the number of lines to be unveiled) is determined by:

   $$\boxed{\text{PMD master default rate or programmed scroll rate}} \times \boxed{\text{Number of lines in the message frame}} = \textbf{Pause Time}$$

   Example: ***1 second scroll rate x 3 lines = 3 second pause time.***

6. Standard message lines that do not fit the LED field are truncated. Standard messages that do not fit the stick-height structure of the display are truncated.

7. Blinking characters sent by masters do not blink when using scroll up or scroll left.

THE PMD 3000 EMBEDDED CODES FOR COMPUTER INTERFACE
When programming packet messages in computer interface for the PMD 3000/3500 display, frame definitions and character height definitions are programmed as embedded escape codes. For computer interface, escape codes in Basic are programmed using the escape code CHR$(27). Examples follow:

CHR$(27)+"0" — TWO-INCH CHARACTER CODE
CHR$(27)+"1" — FOUR-INCH CHARACTER CODE
CHR$(27)+"2" — SIX-INCH CHARACTER CODE
CHR$(27)+"3" — EIGHT-INCH CHARACTER CODE
CHR$(27)+"4" — EIGHT-INCH COMPRESSED CHARACTER CODE
CHR$(27)+"F"+"nn"+"NN" — FRAME DEFINITION CODE

"nn" indicates top LED stick and ranges from 01 to 08. "NN" indicates the bottom LED stick, also ranges from 01 to 08, and must be >= "nn".

3.5 SLAVE CONTROL BY COMPUTER CONTROLLED MASTER

Several options for control of slave units are available only when the master PMD controlling them is operating via the computer port. 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 message 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.) It also allows data **not** sent from a master to be displayed on selected slaves.

The sequence for these options are as follows (see the Master PMD Manual for complete descriptions of the commands mentioned below):

1. 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 to be made inactive.

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

3. 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.

4. 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). This will cause active slaves only to display the message.

5. Only slaves that were activated will receive the new data. All others will continue to display the data that they had received previously. This sequence can be repeated as many times 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 3 above) will send the Display Packet Message command (Code 02) to the master (in place of Code 16). Then the master (Step 4 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 described in 4.2.1. Since 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.

Reference   4.0 - Computer Control
                   4.2.1 - Addressing Slaves
                   PMD Master Manuals

3.6 DEFINING CHARACTER COLOR FOR THE PMD 3500

The PMD 3500 can display characters in three colors(red, yellow, and green). If no specific color is defined, the characters will be displayed in red. In order to change the color that characters are displayed in, enter the escape code (**^[**) followed by **C** (indicating color), then a color-select digit. The proper codes for selecting color are shown below.

        ^[C1 = red characters
        ^[C2 = green characters
        ^[C3 = yellow characters

Once a character color is selected, all subsequent characters will be displayed in that selected color until a different color code or a new message is sent. The color of the last character in a message being displayed does not determine the color of the characters in the next message triggered on the display.

Below is an example of a PMD 3500 message using different character colors.

        ^[C3Caution ^[C2Current ^[C1Out of Range

In this example, the word **"Caution"** will be displayed in yellow; the word **"Current"** will be displayed in green; and **"Out of Range"** will be in red.

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

Information concerning the PMD master display and its message program is found in PMD Master Programmable Message Display User's Manuals. Reference to those manuals are necessary for programming the master and preparing it for the master/slave network.

The following section of this manual covers the alternate method for communication with a PMD slave display. With this type of interfacing, the device controlling the slave display is a computer, and master displays may or may not be involved. In addition to receiving and displaying message, individual slave displays can also send replies to the computer.

SECTION 4. COMPUTER CONTROL

4.0 INTRODUCTION

The PMD Slave Display may also receive its information from a computer (mainframe, minicomputer, personal computer or PLC ASCII interface that can handle 8-bit binary). By sending data in a format similar to that used in the memory of a PMD master display (in 8-bit binary), 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.

If you have a slave with which you are going to use ASCII protocol, you should refer to Section 5. This section will be of little or no use to you.

This section of the manual describes the communication protocol that is acceptable to the PMD and the commands 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.

4.1 COMPUTER COMMUNICATION 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	=	XOR ecksum

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 Appendix B.

For information concerning the XOR checksum, refer to Appendix D.

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

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

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

3. Connect power to the Power Input Terminal Block.

4. The PMD slave display(s) will be 'active' and ready to communicate. The unit(s) will display a message to indicate the software revision number, the unit address, and the baud rate.

Reference 2.2 - RS-422A Serial/Repeater Port
B.2 - Changing The Baud Rate
Appendix C - XOR Checksum

4.2 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 communications message consists of two bytes which 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 communications message. Refer to figure 4-1 for bit assignments of the unit address bytes.
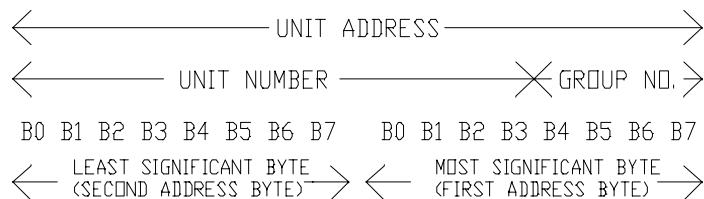
Figure 4-1. Unit Address Byte Designation

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. The unit address will only be read from these switches during power up transition.

Reference   2.1 - Switch One And Switch Two

4.2.1 ADDRESSING SLAVES

The unit address is 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 in all groups

2.   Group #XX, Unit #0000 - addresses all units in group #XX

3.   Group #15, Unit #4095 - addresses all 'active' slave units

4.   Group #XX, Unit #XXXX - addresses the specific unit indicated

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 with the 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).

Reference   4.2.2 - Active/Non-Active Slave Units
           4.9   - Select Active Slave

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 which cannot be processed with these techniques are noted in Table 4-1.

WARNING! Do NOT use the same unit address for PMDs that are connected together 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 become damaged.

Note: The unit address slave message displays is only read during the unit's power-up transition sequence.

4.2.2 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' and 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 in 4.2.1.

Reference   4.9 - Code 15 - Select Active Slave

4.3 GENERAL MESSAGE FORMAT

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

HEX AA	← One byte — indicates start of message
LENGTH	← One byte — indicates message length
UNIT ADDRESS	← Two bytes — indicates unit's address
MESSAGE CODE	← One byte — Code for message type
DATA	← X bytes — Message/reply data bytes
CHECKSUM	← Two bytes — See Appendix D Checksum Bytes
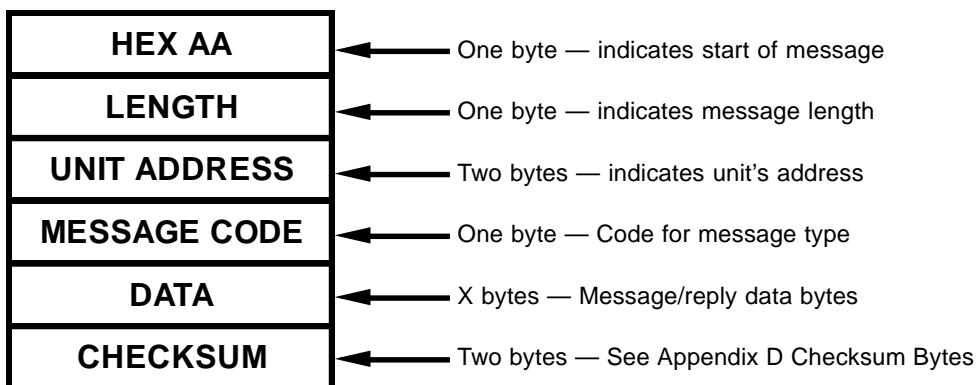
Figure 4-2. Message Format For Computer.

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.

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).

4.4 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 defines message code numbers:

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
Note: All numbers are in decimal. *Allowed only when individual units are addressed.	

Table 4-1.   Message Code Number Designations.

4.5 MESSAGE REPLIES

All messages sent to individual PMD slave displays (as opposed to any of the group addressing techniques described in 4.2.1) 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.

The following section covers 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.

4.6 CODE 00 — STANDARD REPLY FORMAT

FORMAT

REPLY	
BYTE NUMBER	**VALUE**
1	HEX AA = Start of Message Byte
2	8 Length
3	B1–B3 = Not Used B0 = Most Significant Bit of 9-Bit Unit Number
4	8 Least Significant Bits of 9-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.

4.7 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 B1-B3 = Not Used B0 = Most Significant Bit of 9-bit Unit Number
4	8 Least Significant Bits of 9-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

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.

Reference   3.2 - What Happens During Master Control
C.1 - PMD Master Control Errors

4.8 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 B1-B3 = Not Used B0 = Most Significant Bit of 9-bit Unit Number
4	8 Least Significant Bits of 9-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

4.9 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 B1-B3 = Not Used B0 = Most Significant Bit of 9-bit Unit Number
4	8 Least Significant Bits of 9-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. Form is the same 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 allows 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 indicates the requested state of the slaves whose addresses are contained in 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 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".

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

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

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

Reference   4.2.2 - Active/Non-active Slave Units

4.10 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 B1–B3 = Not Used B0 = Most Significant Bit of 9-bit Unit Number
4	8 Least Significant Bits of 9-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 + X	Checksum (2 bytes)
REPLY = STANDARD REPLY	
X must be less than, or equal to, 235.	

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.

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

Table 4-3.   Bytes 6 through 9 — Definitions.

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. As specified in Section 4.12, 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.

Reference   4.12   - PMD Stored Message Format
            4.12.1 - Message Example

4.11 CODE 18 — STATUS/ID MESSAGE

FORMAT

COMMAND		REPLY	
BYTE NUMBER	**VALUE**	**BYTE NUMBER**	**VALUE**
1	HEX AA = Start of Message Byte	1	HEX AA = Start of Message Byte
2	6 Length	2	9 Length
3	B4–B7 = 4-bit Group Number B1–B3 = Not Used B0 = MSB of 9-bit Unit Number	3	B4–B7 = 4-bit Group Number B1–B3 = Not Used B0 = MSB of 9-bit Unit Number
4	8 Least Significant Bits of 9-bit Unit Number	4	8 Least Significant Bits of 9-bit Unit Number
5	18 Message Code	5	18 Message Code
6	Checksum (2 bytes)	6	Device Type: HEX 01 = 200 Master HEX 02 = 300 or 400 Master HEX 82 = 200 Slave HEX 83 = 300 or 3000 Slave HEX 8D = 3500 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 (<u>Reply</u> Device Type) — identifies the addressed device as either a master or slave PMD. This byte will equal 82 to indicate that the unit is a PMD 200S slave, 83 to indicate that it is a PMD 300S or PMD 3000 slave, or 8D to indicate that it is a PMD 3500 slave.

Byte 7 (<u>Reply</u> 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 are examples only.)

Byte 8 (<u>Reply</u> State) — indicates whether the PMD slave is active or non-active.

Reference   4.2.2 - Active/Non-Active Slaves
4.9   - Select Active Slave

4.12 PMD MESSAGE FORMAT

The formats for message storage within a PMD master's memory and for messages sent from a control computer to a master or slave display is 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 message options selected, the number and meaning of option bytes vary. There are seven different message formats. Three of these formats pertain to master PMDs only.

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

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 TUNE	MSG DATA	LAST BYTE MSG/DATA

Table 4-4.   Message Format of PMDs.

FORMAT A	Chained, Printout, Print On One Line, Send <CR><LR> At Message End Clear Display, Center Message
FORMAT B	Same as Format A, plus Energize Alarm, Blink Entire Message
FORMAT C	Same as Format B, plus Scroll up, Scroll Left, Repeat Message
FORMAT D	Same as Format C, plus Select Scroll Time Interval

Table 4-5.   Message Options Versus Message Formats.

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

4.12.1 Message Example

Figure 4-3 illustrates a "byte diagram" of a message example to show how bytes are utilized 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.

HEX CODE		
10	16	Indicates that the message text is 16 bytes long (Byte 1 in figure 4-2)
10	00010000	Indicates the message is centered (Byte 2 in figure 4-2) Up to 6 control bytes are used for each message (1 control byte per message minimum) *** Location of optional frame definition code for the PMD 3000
41	A	'A' is the first character of the first line
20		<SPACE> byte
4D	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	
4D	M	
50	P	
4C	L	
45	E	
FF	FF	End of line marker for line 2

Figure 4-3. Message Example Byte Diagram.

As shown in figure 4-3, 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.

4.12.2 Control Byte 1

Control byte one selects some of the options possible for the message. A diagram of this byte is shown in Table 4-6 to illustrate the definitions of the 8 bits of this byte. Table 4-7 designates how byte 2 of each message is read:

B7	Chained Msg Bit
B6	Clear Display Bit
B5	Send to RS-232 Bit
B4	Center Message Bit
B3	On One Line Bit
B2	<CR><LF> Bit Repeat Chain Bit
B1	Control Character Bit
B0	Byte 3 Bit

Table 4-6. Bit Diagram of Control Byte 1.

BIT NUMBER	IF BIT = 1	IF BIT = 0
B7	Message is Chained	Message is Not Chained
B6	B7 = 0 then Overlay Existing Msg B7 = 1 then Repeat Chain	Message Clears Display Chain Does Not Repeat
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 Message (B5 must equal 1)	No <CR><LF> at end of Message (B5 must equal 1)
B1	Message has Control Characters	No Control Characters
B0	Byte 3 Control Byte	No More Control Bytes Entire Msg Does Not Blink or Scroll No Relay Alarm Output Message Not Logged or Invisible Message Not Sent to Slave

Table 4-7. Bit Designations for Control Byte 1.

NOTE: **B7** — Slave displays do not support chained messages. If this bit is set, the message will not be displayed.
B5, B3, & B2 — Refer to RS-232 port printouts on master PMD and are 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.

4.12.3 Option Byte 2

Control byte one indicates whether the third byte of the message is a control byte (Control Byte 2). Control byte 2 will indicate if the message is to energize the alarm relay output, if the message is logged or invisible, if the message will scroll, and if the entire message is to blink. As noted, some of these options do not pertain to slave displays. A diagram is shown in Table 4-8 of control byte 2. Table 4-9 designates how byte 3 (as control byte 2) of a message is read.

B7	Energize Alarm Relay Output
B6	Scrolled Message Bit
B5	Message Sent to Slave Bit Indicates 2 bytes after last control byte
B4	Blink Entire Message Bit
B3	Invisible Msg Bit
B2	Log Message Bit
B1	Not Used
B0	Not Used

Table 4-8.   Bit Diagram of Control Byte 2.

BIT NUMBER	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 on Data Log Stack	Do Not Log Message
B1	Not Used	(Default = 0)
B0	Not Used	(Default = 0)

Table 4-9.   Bit Designations For Control Byte 2.

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

4.12.4 Scroll Options Byte

As noted previously in 4.12.3, if control byte two indicates that a message will scroll, a third control byte (byte 4) is necessary to determine control options for scrolling. Table 4-10 shows a diagram of byte 4 as the scroll option control byte. Table 4-11 designates how byte 4 (as control byte 3) of a message is read.

B7	Scroll Time Byte Enable
B6	Repeat Message Bit
B5	Display Lines to Scroll Msg On Bit
B4	Display Lines to Scroll Msg On Bit
B3	Display Lines to Scroll Msg
B2	Display Lines to Scroll Msg
B1	Scroll Msg Right to Left Bit
B0	Scroll Msg Up Bit

Table 4-10. Bit Diagram Of Control Byte 3.

BIT NUMBER	IF BIT = 1	IF BIT = 0
B7	Message 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	Message Does Not Scroll on Line 4
B4	Message Scrolls on Line 3	Message Does Not Scroll on Line 3
B3	Message Scrolls on Line 2	Message Does Not Scroll on Line 2
B2	Message Scrolls on Line 1	Message Does Not Scroll on Line 1
B1	Scrolls Right to Left	Message Does Not Scroll Left
B0	Message Scrolls Upward	Message Does Not Scroll Upward

Table 4-11. Bit Designations For Control Byte 3.

NOTE: B2– B5 — Select which lines of the display a scrolling message will be displayed on. 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.

4.12.5 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.

4.13 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 80 (230 maximum) 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. PMD 3000 scroll-up time interval can vary, but scroll-left time is fixed and cannot be changed.

4.13.1 Blinking Characters

Blinking of individual characters is coded into the message text by setting the most significant bit (B7) of the byte of the ASCII character to be blinked. Blink delimiters are not used in the stored message format. Also, note that time, date, and data set bytes have the most significant bit set, but cannot be made to individually blink.

4.13.2 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).

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.

HEX 81	Character Code Used to Indicate Character of Time in a Message
HEX 82	Character Code Used to Indicate Character of Date in a Message

Table 4-12. Character Codes For Time And Date.

4.13.3 Variable Data Characters

Table 4-13 lists the character codes for all five characters of each of the four data sets maintained by the PMD displays. These codes can be entered in any order, anywhere in a message.

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

Table 4-13. Character Codes For Variable Data.

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).

4.13.4 PMD 3000 Embedded Codes

The PMD 3000 reads embedded codes within the message text. These codes can change character size or specify the frame definition. Character size codes can be placed anywhere within message text. These codes toggle the character size between 2", 4", 6", 8", and 8" compressed characters. A frame definition codes sets up which LED "sticks" will display the message. This 6-byte code must be located where shown in figure 4-3. These codes are shown in the following table, Table 4-14.

Character Size	ASCII Code	HEX Code
2"	<ESC><0>	1B 30
4"	<ESC><1>	1B 31
6"	<ESC><2>	1B 32
8"	<ESC><3>	1B 33
8" Compressed	<ESC><4>	1B 34
Frame Definition Code	Top Stick	Bottom Stick
<ESC><F>	## 2-digit number	## 2-digit number

Table 4-14. PMD 3000 Embedded Code Definitions.

In BASIC, <ESC> is programmed as CHR$(27), so an escape sequence to enable sticks 3 through 8 would be: CHR$(27)+"F"+"03"+"08". Note that this is an example for a <u>BASIC</u> program and will vary for other program languages. Also note that these codes instruct the PMD 3000 only. Messages that include character size codes and frame definitions are displayable on the master and other kinds of

slaves. All characters and digits within the codes are displayed on units other than the PMD 3000. To avoid displaying these extra characters, set up the PMD 3000 message as invisible to the master. Program a separate message for master (and other slave) display.

4.13.5 PMD 3500 Character Colors

The color of the display characters for the PMD 3500 can be selected by escape codes in PMD protocol message text. If the color is not specified, the default color of red will be used. The same ASCII characters are used for the color codes in both protocols (for information on character color using ASCII protocol, see section 5, this manual). These color codes are as follows:

Color Code	Color
1	Red
2	Green
3	Yellow

In PMD protocol, colors are selected by escape sequences within the text of a packet message. The select color escape sequence format is as follows:

<ESC>	=	Cc
<ESC>	=	escape code (1B hex)
C	=	"C" (43 hex)
c	=	character color code

There may be more than one select color escape sequence per message. A select color escape will effect all displayed characters in the same message after it and before the next select color escape sequence. Each time a packet message is received, all displayed characters before the first select color escape sequence in the message will appear in the default color of red. The color of the last character of a packet message does not determine the starting color of the first character of the next packet message. Select color escape sequences may be placed anywhere in the text of the packet message. If a message is to be displayed in only red, a message packet need not have a select color escape sequence.

4.14 COMPUTER INTERFACE SAMPLES

The the following paragraphs, 4.14.1 and 4.14.2, show sample programs for computer interface command 02 (Display Packet Message). The sample display packet messages are for master displays only. The first sample shows a typical program using BASIC. The second example uses QUICKBASIC.

4.14.1 SAMPLE OF DISPLAY SLAVE PACKET MESSAGE IN BASIC

PROGRAM	COMMENTS
20 OPEN "com1:9600,n,8,1" FOR RANDOM AS #1	sets RS-232 port for 9.6K baud, no parity, 8 data bits, 1 stopbit
25 MSG(1)=170	HEX AA, start of message byte
30 MSG(2)=96	length of message (not including HEX AA)
35 MSG(3)=0	4-bit group number/1 MSB of 9-bit unit number
40 MSG(4)=0	8 LSBs of 9-bit unit number
45 MSG(5)=17	message code 17 = display slave packet message
50 MSG(6)=0	blink On
55 MSG(7)=0	blink Off
60 MSG(8)=0	scroll Up
65 MSG(9)=0	scroll Left
70 MSG(10)=86	message to display
75 MSG(11)=0	message control attributes
80 MSG(32)=255	end of line marker for line 1
85 MSG(53)=255	end of line marker for line 2
90 MSG(74)=255	end of line marker for line 3
95 MSG(95)=255	end of line marker for line 4
100 A$="FRONT AXLE 12500"	message to be displayed on line 1
105 B$="DRIVE AXLES 31440"	message to be displayed on line 2
110 C$="TRAILER AXLES 36000"	message to be displayed on line 3
115 D$="GROSS WEIGHT 79940"	message to be displayed on line 4
120 FOR I=1 TO 20:MSG(I+11)=ASC(MID$(A$,I,1)):NEXT I	
125 FOR I=1 TO 20:MSG(I+32)=ASC(MID$(B$,I,1)):NEXT I	message 1-4 being set up in ASCII
130 FOR I=1 TO 20:MSG(I+53)=ASC(MID$(C$,I,1)):NEXT I	(note - message 1 starts as byte 10)
135 FOR I=1 TO 20:MSG(I+74)=ASC(MID$(D$,I,1)):NEXT I	
140 GOSUB 500	go to checksum routine
END	do you want to send message?
145 CLS:INPUT "SEND AGAIN?";Y$	if yes send string again
150 IF MID$(Y$,1,1)="Y" THEN 25	
155 END	
500 REM CHECKSUM ROUTINE	
505 CKSUM=0	checksum routine
510 FOR I=1 TO 95	
515 IF I>1 THEN CKSUM=CKSUM XOR MSG(I)	
520 PRINT #1,CHR$(MSG(I));:NEXT I	send message to comm port
525 PRINT #1, CHR$(CKSUM);CHR$(255-CKSUM);:RETURN	

4.14.2 SAMPLE OF DISPLAY SLAVE PACKET MESSAGE IN QUICKBASIC*

*QUICKBASIC is a registered trademark of Microsoft Corporation.

MESSAGE TEXT	COMMENTS

```
ms1$ = "LINE 1 OF DISPLAY" + CHR$(255)                          'CHR$(255) is end of line marker
ms2$ = "LINE 2 OF DISPLAY" + CHR$(255)
ms3$ = "LINE 3 OF DISPLAY" + CHR$(255)
ms4$ = "LINE 4 OF DISPLAY" + CHR$(255)
messages$ = ms1$ + ms2$ + ms3$ + ms4$                           'complete message text

meslength = LEN(message$) + 2                    'message$ + control byte + meslength byte
comlength = meslength + 10                                       'total length less start byte

start = 170                                             'start of command message HEX AA
unit1 = 0                                                     'group and unit number
unit2 = 0                                                             'unit number
code = 17                                   'command code (SLAVE DISPLAY PACKET MESSAGE)
blinkon = 0
blinkoff = 0
scrollup = 0
scrollleft = 0
control = 0

'calculate checksum
checksum = 0                                                        'calculate checksum
checksum = checksum XOR comlength
checksum = checksum XOR unit1
checksum = checksum XOR unit2
checksum = checksum XOR code
checksum = checksum XOR blinkon
checksum = checksum XOR blinkoff
checksum = checksum XOR scrollup
checksum = checksum XOR scrollleft
checksum = checksum XOR meslength
checksum = checksum XOR control

FOR I = 1 TO LEN(message$)
checksum = checksum XOR   ASC(MID$(message$,I,1))
NEXT I

OPEN "COM1:9600,N,8,1" FOR RANDOM AS #1

PRINT #1, CHR$(start);
PRINT #1, CHR$(comlength);
PRINT #1, CHR$(unit1);
PRINT #1, CHR$(unit2);
PRINT #1, CHR$(code);
PRINT #1, CHR$(blinkon);
PRINT #1, CHR$(blinkoff);
PRINT #1, CHR$(scrollup);
PRINT #1, CHR$(scrollleft);
PRINT #1, CHR$(meslength);
PRINT #1, CHR$(control);
PRINT #1, message$;
PRINT #1, CHR$(checksum);
PRINT #1, CHR$(255 - checksum);
```

4.15 CONCLUSION

When interfaced (via an RS-232/RS-422 adapter) to the RS-422A Serial/Repeater Port(s) 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 computer can send information to and receive 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.

SECTION 5. ASCII PROTOCOL

5.0 INTRODUCTION

All PMD slave displays come from UTICOR to the customer with the ability to be set up in either standard PMD protocol or ASCII protocol. If you plan on using the 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.

International character sets are available for any slave with ASCII protocol.

NOTE   ASCII communication will be conducted with 8 data bits, no parity, and 1 stop bit at 1200 or 9600 baud. Factory baud rate setting is 9600 baud.

5.1 PREPARATION OF THE UNIT

All slave units are equipped with an RS-422A port. This is the port that will be used for reception of the ASCII commands to control the display. On the PMD 200S and 300S, the port is on the back of the unit. On the PMD 3000, this port is located internally. The units will come to you set up for UTICOR protocol. To change them to ASCII protocol, you must move an internal jumper. The location of the protocol select jumper is shown in section 5.4.

The slave is equipped with a repeater port. This port allows the slave to echo the information received by the RS-422A Serial Port. 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 (positions 2-4) that are used to select the 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. (This is true of the PMD 3000 only. It is just the opposite for the 200S and 300S.) 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 the unit up. The unit's identification will only be read during the power-up sequence. When the unit is powered it will come up with an initial message. This will be a two line message consisting of some or all of the following information: 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.

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.

5.2 TERMINAL OPERATION

The 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.

DECIMAL/ HEXADECIMAL VALUE	CHARACTER and DESCRIPTION (if necessary)	DECIMAL/ HEXADECIMAL VALUE	CHARACTER and DESCRIPTION (if necessary)
32/20	(Space)	79/4F	O
33/21	! (Exclamation Point)	80/50	P
34/22	" (Double Quote)	81/51	Q
35/23	# (Number/Pound)	82/52	R
36/24	$ (Dollars)	83/53	S
37/25	% (Percent)	84/54	T
38/26	& (Ampersand)	85/55	U
39/27	' (Single Quote)	86/56	V
40/28	((Left Parenthesis)	87/57	W
41/29	) (Right Parenthesis)	88/58	X
42/2A	* (Asterisk)	89/59	Y
43/2B	+ (Plus)	90/5A	Z
44/2C	, (Comma)	91/5B	[(Left Bracket)
45/2D	- (Hyphen)	92/5C	\ (Backslash)
46/2E	. (Period)	93/5D	] (Right Bracket)
47/2F	/ (Forward Slash)	95/5F	_ (Underscore)
48/30	0	96/60	' (ASCII Grave)
49/31	1	97/61	a
50/32	2	98/62	b
51/33	3	99/63	c
52/34	4	100/64	d
53/35	5	101/65	e
54/36	6	102/66	f
55/37	7	103/67	g
56/38	8	104/68	h
57/39	9	105/69	i
58/3A	: (Colon)	106/6A	j
59/3B	; (Semicolon)	107/6B	k
60/3C	< (Less Than)	108/6C	l
61/3D	= (Equals)	109/6D	m
62/3E	> (Greater Than)	110/6E	n
63/3F	? (Question Mark)	111/6F	o
64/40	@ (At)	112/70	p
65/41	A	113/71	q
66/42	B	114/72	r
67/43	C	115/73	s
68/44	D	116/74	t
69/45	E	117/75	u
70/46	F	118/76	v
71/47	G	119/77	w
72/48	H	120/78	x
73/49	I	121/79	y
74/4A	J	122/7A	z
75/4B	K	123/7B	{ (Left Brace)
76/4C	L	124/7C		(Broken Vertical Bar)
77/4D	M	125/7D	} (Right Brace)
78/4E	N	126/7E	~ (ASCII Tilde)

Table 5-1. Valid ASCII Characters

BLINK DELIMITERS

The ASCII characters **[** and **]** are used as the blink on and blink off delimiter characters respectively. When a blink delimiter is received, it causes the blink character status to be setup accordingly. A blink on delimiter will set it up to indicate blink characters received and a blink off delimiter will set it up to indicate not to blink characters received. These delimiters are only valid when using the U.S. character set. To blink individual characters with the other character sets, use the ^Xn command.

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.

Whether or not a character blinks when it is written to the display depends upon the blink status most recently set up by a blink delimiter. 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 beginning of the current.

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 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 and a character is written, the contents of the display is shifted up one line and that character is written at the start 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 overwrites the character at the end of the line.

5.3 OPERATING COMMANDS

The ASCII Slave has several commands which are considered advanced operation features for the unit. Each of these commands are 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 looks for a command to follow it. If this symbol is received while the unit is still reading another command, the first command is 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.

^Agguuuu	=	Select Unit
^Bn	=	Select Blink Mode
^Cn	=	Select Center Mode
^Dn<message text><CR>=		Display Scrolling Text
^dCc	=	Select Character Color**

^En	=	Reset Display
^Frr	=	Select Scroll Rate
^Gbbcc	=	Select On/Off Rate
^Hrrcc	=	Position Cursor
^In	=	Select New Line
^Jn	=	Select Wrap
^Kn	=	Select Character Size*
^Ln	=	Select Number of Sticks per Line*
^Mrrcc	=	Position Cursor Without Clearing the Line*
^Xn	=	Blink Delimiters On/Off

Descriptions of commands followed by an asterisk(*) are valid for PMD 3000/ 3500s only. Two asterisks (**) indicate only the PMD 3500 will use the command.

^Agguuuu SELECT UNIT
This command selects which unit(s) will process the ASCII commands sent. It allow smultiple units to be connected and addressed. These units can be addressed as a whole, as a subset, or as individual units. Only units that have been selected process commands.

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

For width, pad the number with zeroes (i.e., for unit 45, the number would be 0045).

All units 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 allows the user to center text on the display.

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

^Dn<message text><CR> DISPLAY SCROLLING TEXT
This command lets the host scroll data from right to left on a display line. The line that the cursor is on when this command is accepted as the line the text scrolls on. 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 printable ASCII character mentioned in Table 5-1. This portion of the command can consist of no more than 255 characters. On the PMD 3000/3500, the <message text> portion can also include the command to change character size,**^Kn**, or change character color, **^dCc** (for the 3500). Each three change character size packets count as two characters toward the 255 maximum. Each change character color sequence counts as three characters toward the 255 maximum.

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

Once the text begins to scroll, the terminal cursor is positioned on the line as if the cursor had been advanced there from another. Scrolling messages are shifted up with any other terminal text when the terminal cursor is advanced past the display bottom. When scrolling text does not repeat, the text is scrolled onto the display once and then scrolled off the display. When scrolling text irepeats, 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. On the PMD 3000/3500, the scroll rate is fixed at a display dependent value.

On the PMD 3000/3500, blinking anywhere on the display is not possible when there is a scrolling message displayed. The blink delimiters **[** and **]** or the ^Xn command areignored within scroling text.   Scrolling text is terminated and the line it used cleared when a character is written to the display terminal on the line the scrolling text occupies.

^dCc SELECT CHARACTER COLOR
This command is used to select the color of the message's characters for the PMD 3500.

    ^dCc   c = 1 = red
                  c = 2 = green
                  c = 3 = yellow

Characters received prior to this command will be red. The last select color command in a scrolling message determines the starting color for the next scrolling message or static text entered if no other select color command is sent.

^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
n   = 3*=   clear the line and set the cursor to the beginning of the line. The
               line consists of one to four sticks determined by the sticks per
               line parameter *PMD 3000 only

^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. This command is ignored in the PMD 3000 due to a fixed scroll rate.

^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 - 04 row...valid range for 200S/300S displays
cc = 01 - 20 column...valid range for 200S/300S displays
rr = 01 - 08 row...valid range for PMD 3000*
cc = 01 - 80 column...valid range for PMD 3000*
    * Dependent on size of 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

^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

^Kn SELECT CHARACTER SIZE
This command lets the host select the displaed character size and stays in effect until another size command is received or the unit loses power. When power is reapplied, the dip switches decide character size. If there are not enough sticks in the current line to display the character size commanded, the largest character that fits is displayed. This, and change character color are the only commands that can be within a scroll command sequence. The last character size change command within a scroll command sequence specifies the default character size for future static messages. The format for this command is as follows:

n = 0 = two-inch characters
n = 1 = four-inch characters
n = 2 = six-inch characters
n = 3 = eight-inch characters
n = 4 = eight-inch compressed characters (4"x8")

^Ln SELECT NUMBER OF STICKS PER LINE
This command selects the number of sticks per display line and takes effect only when the cursor position is such that there are enough sticks above it to form the line and there are no characters on the current line. If characters exist on the current line, the command takes effect when a new line is formed. The stick the

cursor occupies becomes the bottom stick of the line. This command also takes effect when it is the first command after power up or immediately after a Clear/Home/Reset, **^E1**, command. The format of the command is:

n = 0 = one stick per line
n = 1 = two sticks per line
n = 2 = three sticks per line
n = 3 = four sticks per line

^Mrrcc POSITION CURSOR WITHOUT CLEARING THE LINE
This command positions the cursor without clearing the line. The valid values for the variables are relative to two-inch characters and where they would be positioned. If the value for either variable is less than 10, that value must be padded with a leading zero. Characters received after this command overwrite characters already on the display. The character size in effect when this command is received is usually be the same after it is received. The only exception is if the system character size is too big for the line the cursor was moved to. Then the system character size will be changed to the largest character that fits in the line. Once the cursor is moved, the character size may be changed. Characters may overwrite characters of a different size already on the display. Overwritten characters will not appear if the line is ever shifted up on the display. Since internally there is a one-to-one correspondence between characters received and characters on the display , even those of different size, some of the characters that appear whole on the display may disappear when the line is shifted up. The system value for number of sticks per line will remain the same after this new command is sent but the number of sticks for the line moved to will remain the same.

If the stick specified in the command is part of a scrolling linr or on a line with centered text, the result will be the same as if the position cursor command (**^Hrrcc**) had been received.

rr = 01 - 08...valid range for PMD 3000*
cc = 01 - 80...valid range for PMD 3000*
    * Dependent on the size of display

Xn Blink Delimiter
The ^Xn command lets you turn blink on and off so that only certain characters on the display blink. If the U.S. character set is selected, the '[' and ']' characters can still be used. The international character will be displayed in the other character sets.

n = 0 = blink off
n = 1 = blink 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 of the variable letters.

5.4 PMD ASCII SLAVE CONFIGURATION

The PMD 200S, 300S, 3000, 3500 come from the factory set for UTICOR proto-col. However, they have the ability to be set to ASCII protocol. This portion of the manual discusses how to set up the PMDs for ASCII protocol. All units (except the PMD 3500) will have ASCII protocol selected by moving JP4. However, JP4 is located in different places on the different units. The PMD 3500's communication protocol is set by DIP Switch SW4-7, see section 2, paragraph 2.4.4, *PMD 3500 SLAVE BAUD RATE AND COMMUNICATIONS PROTOCOL.*

The PMD 200S and 300S protocol select jumpers are on the back board of the unit. Their locations are shown in figure 5-1 and 5-2 respectively. See Section 2.4.4
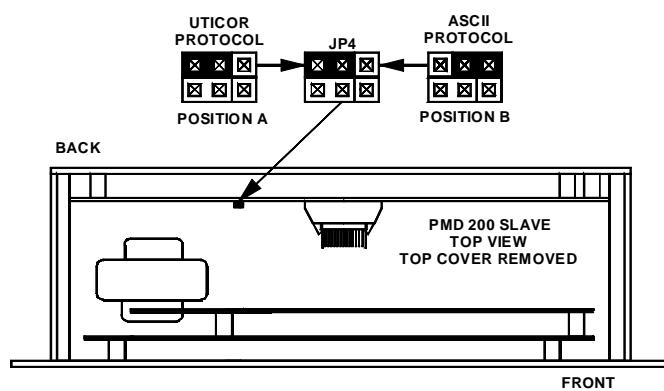

Figure 5-1. PMD 200S Protocol Select Jumper.
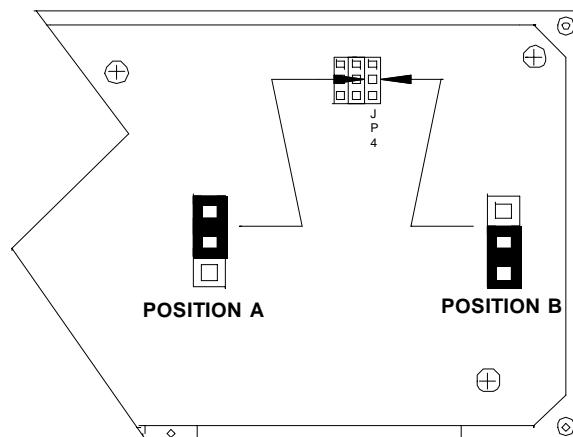
Figure 5-2. PMD 300S Protocol Select Jumper.

In order to set up your PMD 3000 for ASCII mode, you must remove the back cover of the unit. After the cover has been removed, the control board must be located. The control board is located in the lower right hand corner of the unit.(See Figure 5-3.) Once the control board is found, you will need to find JP4.(See Figure 5-4.) As the unit comes from the factory, the jumper will be set in the "A" position. You must move the jumper to the "B" position. After the jumper is moved, replace the back cover and the unit is ready to be used.
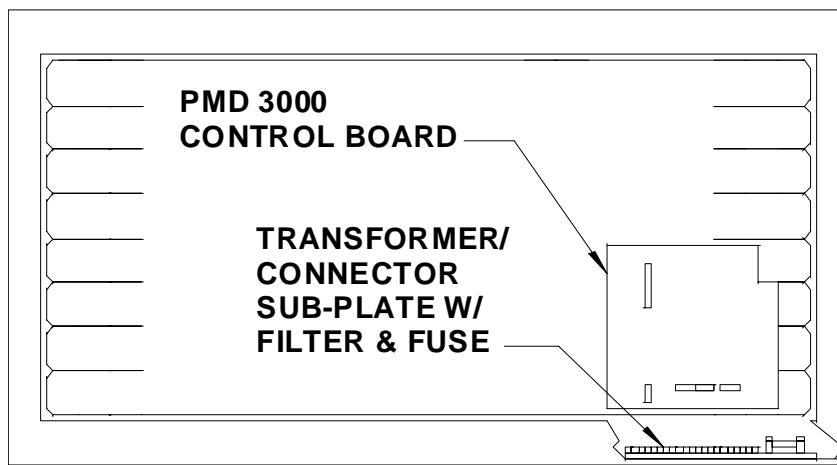
PMD 3000 BACK VIEW WITH BACK PANEL REMOVED

Figure 5-3. PMD 3000 Back View with Back Panel Removed
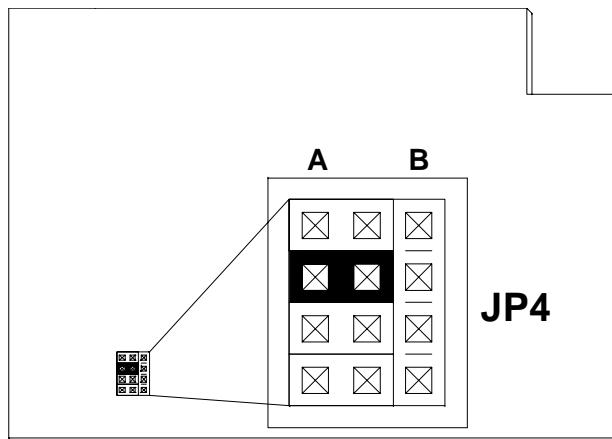
Figure 5-4. Control Board with JP4 Location

5.5 SAMPLE MESSAGES

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

The first example can be sent to any of the slaves discussed in this manual. The first message will be sent to group 04, unit 0312. This message will be centered with the message "Bin 6 is EMPTY." The word "EMPTY" will be flashing.

```
^A040312^C1Bin 6 is [EMPTY] for U.S. character set
          or
^A040312^C1Bin 6 is ^X1EMPTY^X0 for the other sets
```

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

The second sample message can be sent to a PMD 200S or 300S. This 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>
```

This message could also be sent to a PMD 3000/3500 but the **^F** command, to set the scroll rate would be ignored due to the fixed scroll rate. Also, the positioning of the cursor can be to any column. The message will start on the right side of the display regardless.

The third sample message will be for a PMD 3000/3500 only. This message will be sent to the unit addressed group 45, unit 1234. A Clear/Home/Reset command is sent to clear the display and make the display willing to accept the Sticks per Line command **^L**. Each line will be 4 sticks high. The first word (ALERT) will be in compressed 8-inch high characters*. The rest of the message will be displayed in 4-inch characters*.

* Provided there are enough sticks to accommodate the character size.

```
^A451234^E1^L3^K4ALERT^K1 Valve 3 is open
```

If the message were to have another line, after a carriage return, the cursor would be placed on the next line. This next line would be located four sticks lower than the bottom of the last line. This is due to having selected four sticks per line.

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

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APPENDIX A — PANEL CUTOUT AND OUTLINE DIMENSIONS

The following figures provide information necessary for mounting the PMD Slave Displays (standard and stainless-steel versions).

A.1 — PMD 200S

STANDARD MODEL
Figure A-1 shows the panel cut-out and outline dimensions for the PMD 200S Slave Display (standard model).
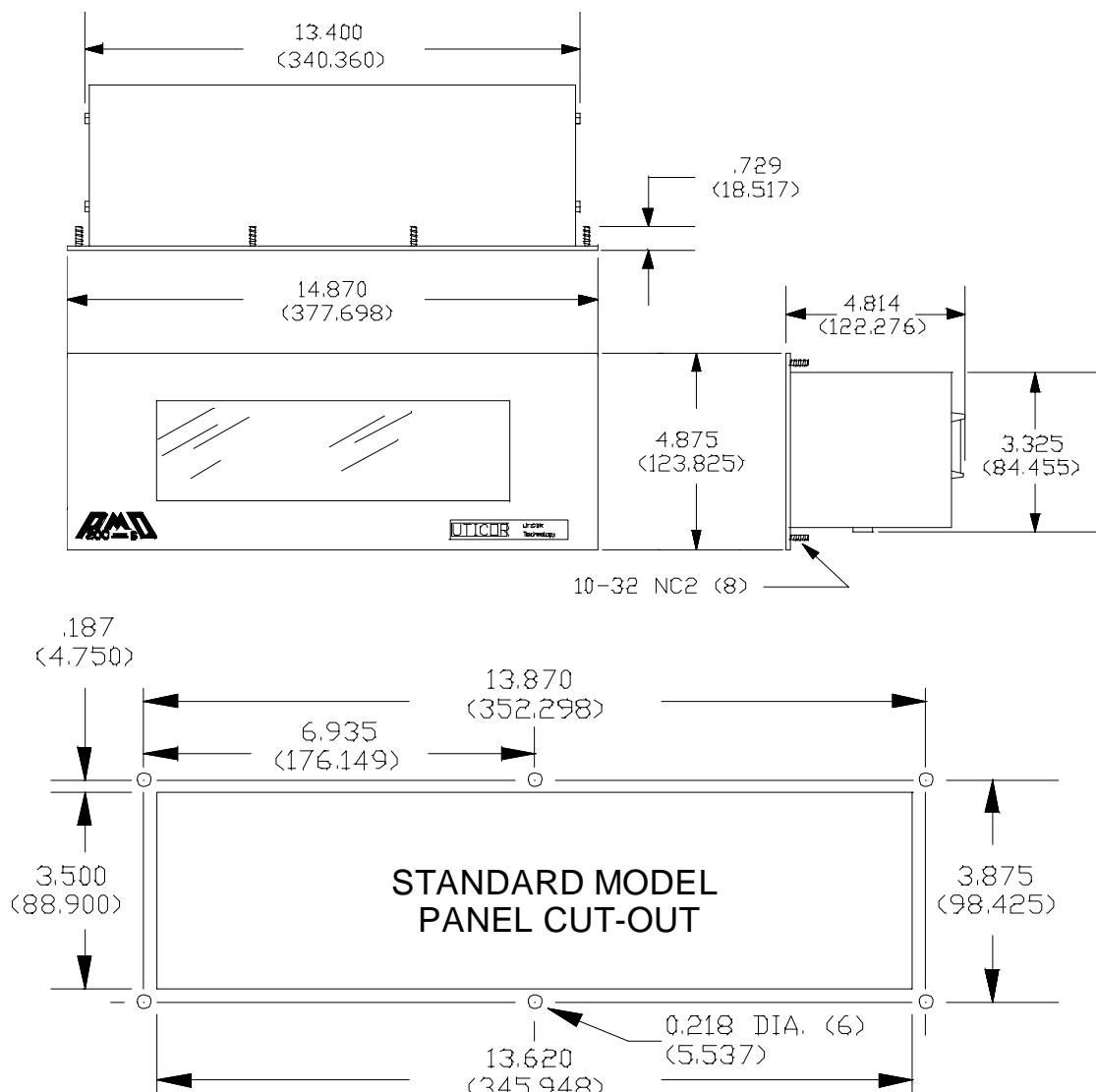
Figure A-1. Panel Cut-Out and Outline Dimensions for Standard Model 2-Line Display.

STAINLESS STEEL MODEL
Figure A-2 shows the panel cut-out and outline dimensions for the PMD 200S Slave Display (stainless-steel model).

13.400
(340.360)

.729
(18.517)

14.870
(377.698)

4.814
(122.276)

4.875
(123.825)

3.325
(84.455)

10-32 NC2 (8)

.187
(4.750)

13.870
(352.298)

4.623
(117.424)

4.624
(117.450)

4.623
(117.424)

3.500
(88.900)

STAINLESS STEEL MODEL
PANEL CUT-OUT

3.875
(98.425)

0.218 DIA. (8)
(5.537)

13.745
(349.123)
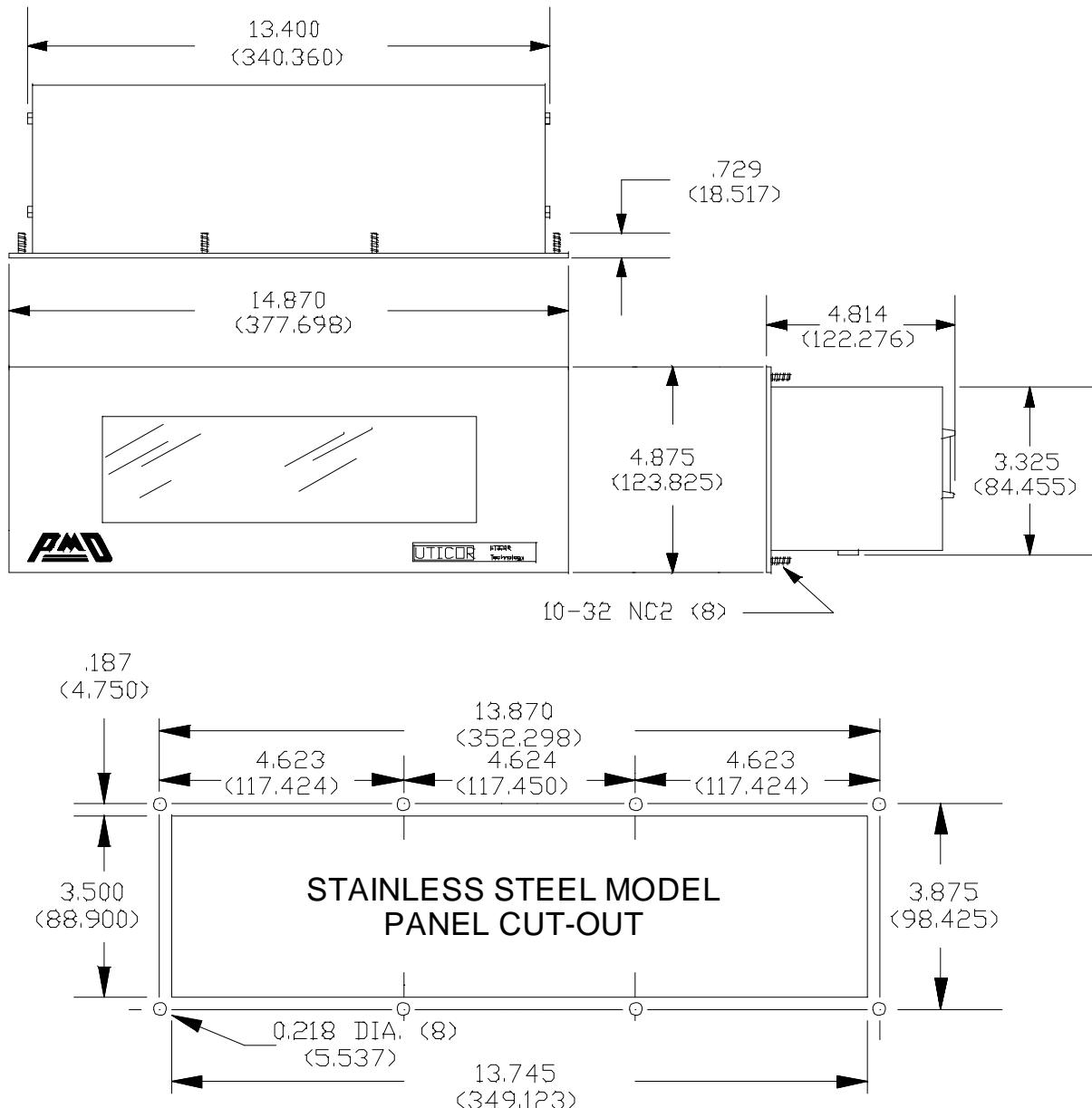
Figure A.2 Panel Cut-Out and Outline Dimensions for Stainless-Steel Model 2-Line Display.

A.2 — PMD 300S

STANDARD MODEL

Figure A-3 shows the panel cut-out and outline dimensions for the PMD 300S Slave Display (standard model).
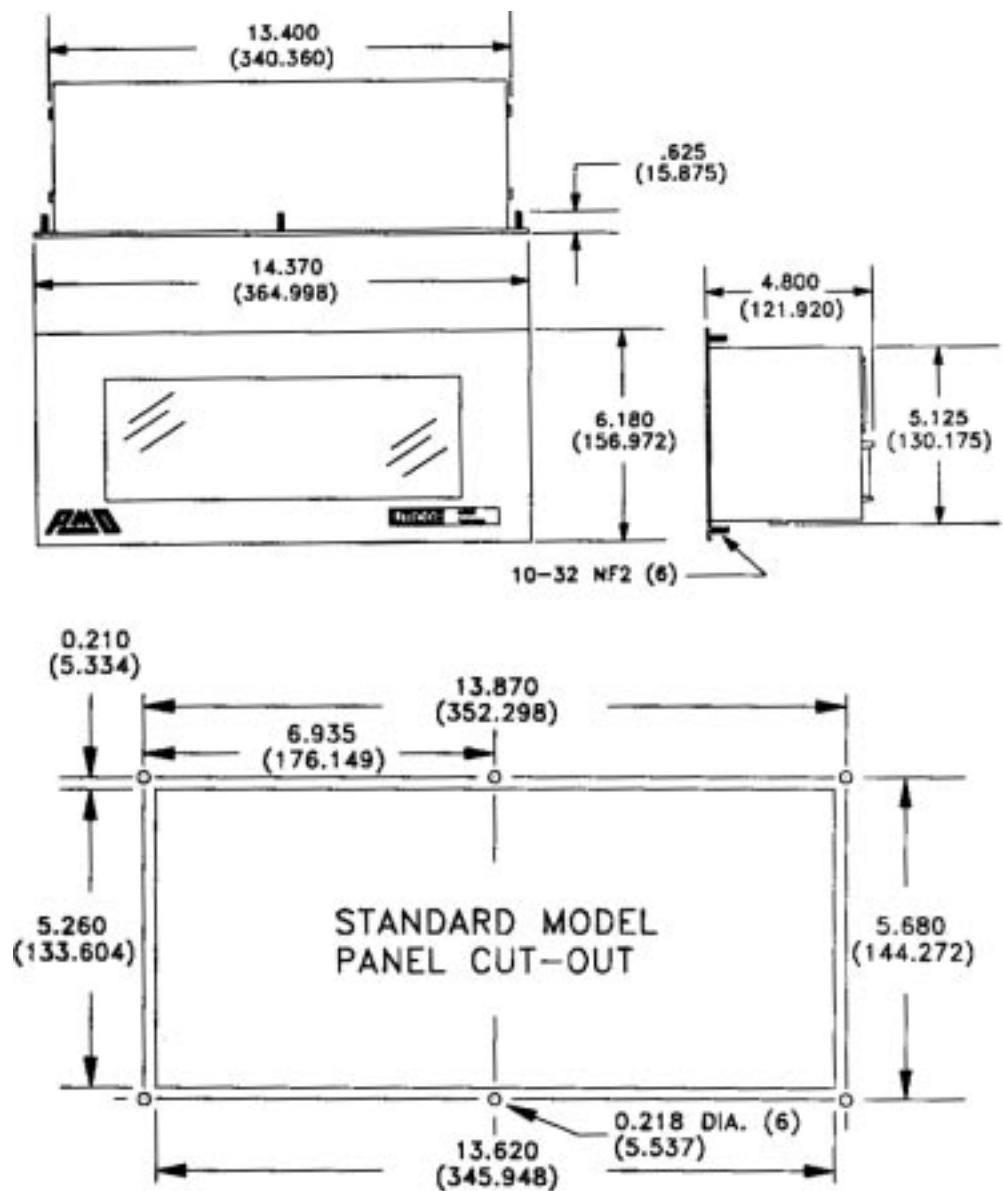

Figure A.3 Panel Cut-Out and Outline Dimensions for the Standard Model PMD 300S.

STAINLESS-STEEL MODEL
Figure A-4 shows the panel cut-out and outline dimensions for the PMD 300S Slave Display (stainless-steel model).
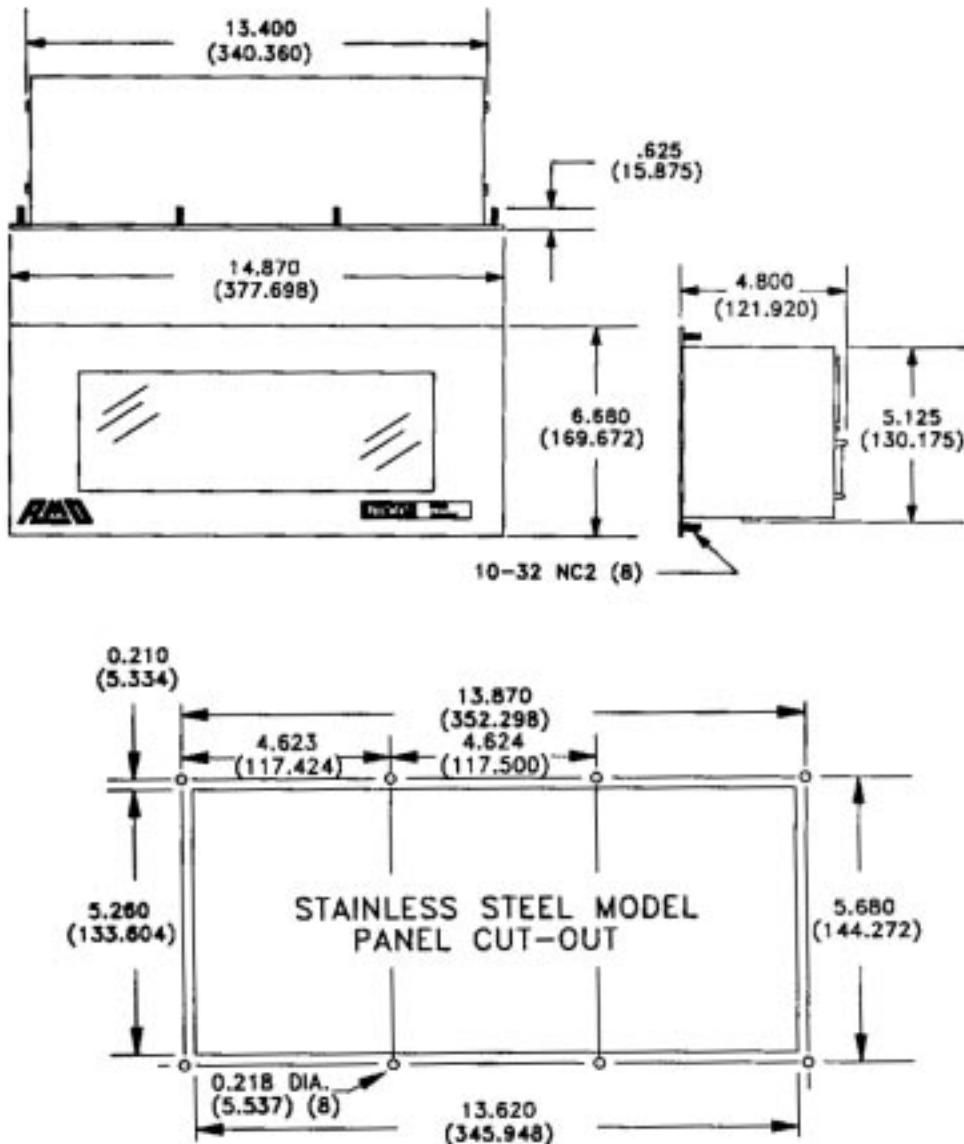
Figure A-4. Panel Cut-Out and Outline Dimensions for the Stainless-Steel Model PMD 300S.

A.3 — PMD 3000/3500

Table A-1 below shows PMD 3000 dimensions and configurations. All PMD 3000 displays have a 4.25" unit depth. Unit weights are found in the general specifications section.

Note: The 8-inch narrow characters are denoted by "8N." These characters are half the width of the other 8-inch characters.

Part Number	Display Height	Display Width	Character Height (")	Characters Per Line	Number of Lines
1W2H	11.5"	40"	2/4	20/10	2/1
1W4H	16.3"	40"	2/4/6/8/8N	20/10/6/5/10	4/2/1/1/1
1W8H*	25.9"	40"	2/4/6/8/8N	20/10/6/5/10	8/4/2/2/2
2W2H	11.5"	76"	2/4	40/20	2/1
2W4H	16.3"	76"	2/4/6/8/8N	40/20/13/10/20	4/2/1/1/1
2W8H*	25.9"	76"	2/4/6/8/8N	40/20/13/10/20	8/4/2/2/2
4W2H*	11.5"	150"	2/4	80/40	2/1
4W4h*	16.3"	150"	2/4/6/8/8N	80/40/26/20/40	4/2/1/1/1
* Not available in the PMD 3500 Tricolor Display.					

Table A-1.   PMD 3000/3500 Part Numbers, Dimensions, and Configurations.

MOUNTING KITS

The PMD 3000 features optional mounting kits for both single and dual applications. These mounting kits offer suspended, angled viewing. Provided safety chains connect the PMD 3000 eyebolts to the mounting bracket as a backup for the bolts which attach the mounting bracket to the side of the PMD 3000 unit. Table A-2 shows part numbers for PMD 3000 mounting kits. Mounting kits are shown in Figure A-5.

Part #	Description	Part #	Description	Part #	Description
58257	1W2H 2W2H Single	58260	1W2H 2W2H Double	58268	4W2H 4W4H Single
58258	1W4H 2W4H Single	58261	1W4H 2W4H Double	58270	4W2H 4W4H Double
58259	1W8H 2W8H Single	52862	1W8H 2W8H Double		

Table A-2.   PMD Hanging Kit Part Numbers.

Customer supplied hanging chain

Hanging Kit

Safety chain supplied with kit

PMD
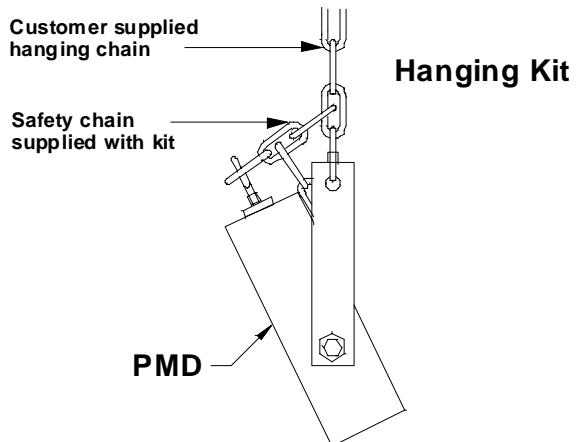
**Single Unit Hanging Kit
(side view)**

Hanging Kit

Customer supplied hanging chain

Safety chain (4) included with kit

**PMD**

PMD
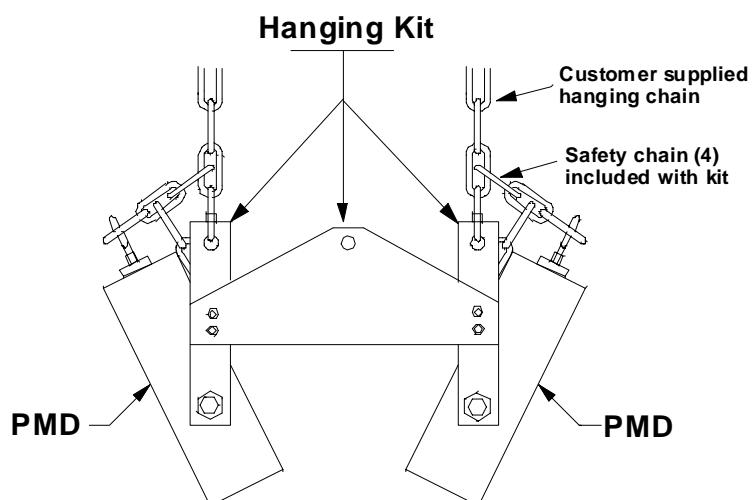
**Dual Unit Hanging Kit
(side view)**

Figure A-5. PMD 3000/3500 Hanging Kits.

APPENDIX B — ERROR MESSAGES

The PMD slave will return error message — either on its display or in computer i\control command message replies — when problems occur during operation. The following sections cover the error messages sent by the PMD slave.

B.1   PMD MASTER CONTROL ERRORS

No Communications
This message indicates that communications between a master PMD display and a PMD slave has been broken.

Once a PMD slave has received time and date information from a PMD master display, the slave will expect to receive this information every one second from this point on.

After seven seconds lapse since receiving this information, the PMD slave will display the "NO COMMUNICATION" message until time and date information is received or a new message is sent. If time/date data is received, the display will clear the error message. If a messages is sent, this message will be displayed.

NOTES: Communication between a master and slave is temporarily terminated when a PMD master's memory is being loaded.

When switching from master control to computer control, a slave should have power removed and then re-applied.

B.2   COMPUTER CONTROL ERRORS

Error Code 1
Checksum Error—returned if the checksum received at the end of a command does not agree with the checksum the display calculated as it received the message.

Error Code 2
Timeout Error—returned if control computer waits too long between sending characters once it has begun a message. Once a message has begun, no more than 800 msec. should be allowed between characters. If the slave detects this timeout, it will return the standard reply with Error Code 2 and will ignore the message than was being transmitted.

Error Code 3
Invalid Message Code—returned if the message code sent by the control computer is an invalid number.

Error Code 8
Invalid Message Length—returned in reply to Code 17 if message to be displayed contains a length byte of greater than 235.

APPENDIX C — XOR CHECKSUM

PMD slaves use the XOR (Exclusive-OR) communications error detection code when communicating via computer control.

The XOR checksum of a message for the PMD slave computer interface applications is derived as follows:

The length byte is XORed with the unit number bytes. The result is XORed with the first data byte, etc. until the XOR of the last data byte is taken. The result of this XOR operation is the first byte of the two-byte XOR checksum. The one's complement of the first byte becomes the second byte of the checksum. If, for instance, the first byte happens to be 06 HEX (MSB), then the two-byte XOR checksum would be 06F9 HEX (LSB).

APPENDIX D — INTERNATIONAL CHARACTER SETS

The PMD slaves display messages in 7 international character sets in addition to the U.S. character set. The slave is set to the specific character set on positions 2, 3, and 4 on Switch Two (see pages 2-6 and 2-7 of this manual). The slave will display messages according to the ASCII conversion chart on the following pages.

To program messages (into a master display or the computer) in a non-U.S. character set, refer to the ASCII conversion chart. Enter the ASCII character or code equivalent to the non-U.S. character desired. Blank areas on the chart indicate no change from the American set. If no character is shown for the character set in use, the American character is displayed.

For example, when using the English character set, enter the "#" character (Program Mode) or HEX 23 (Computer Interface Mode) to program and display the "£" character. All international character sets use the standard ASCII codes. The programming terminal always shows only the American character set. To check your messages, use the View command of the Program Mode.

	AMERICA	CYRILLIC	GERMANY	ENGLAND	DENMARK	SWEDEN	FRANCE	KANA
# 35	#			£		Ü		
$ 36	$					¤		
@ 64	@		§			É	à	<SPACE>
A 65	A							
B 66	B							
C 67	C							
D 68	D							
E 69	E							
F 70	F							

	AMERICA	CYRILLIC	GERMANY	ENGLAND	DENMARK	SWEDEN	FRANCE	KANA
G 71	G							
H 72	H							
I 73	I							
J 74	J							
K 75	K							
L 76	L							
M 77	M							
N 78	N							
O 79	O							
P 80	P							
Q 81	Q							
R 82	R							

	AMERICA	CYRILLIC	GERMANY	ENGLAND	DENMARK	SWEDEN	FRANCE	KANA
S 83	S							
T 84	T							
U 85	U							
V 86	V							
W 87	W							
X 88	X							
Y 89	Y							
Z 90	Z							
[91	[							
\ 92	\							
] 93	]							
~ 94	~							

	AMERICA	CYRILLIC	GERMANY	ENGLAND	DENMARK	SWEDEN	FRANCE	KANA
— 95								
. 96								
a 97								
b 98								
c 99								
d 100								
e 101								
f 102								
g 103								
h 104								
i 105								
j 106								

	AMERICA	CYRILLIC	GERMANY	ENGLAND	DENMARK	SWEDEN	FRANCE	KANA
k 107	k	Ѧ						ト
l 108	1	К						フ
m 109	m	Л						＼
n 110	n	М						ホ
o 111	o	Н						マ
p 112	p	О						ミ
q 113	q	П						ム
r 114	r	Р						メ
s 115	s	С						モ
t 116	t	Т						ヤ
u 117	u	У						ユ
v 118	v	Ф						ヨ

	AMERICA	CYRILLIC	GERMANY	ENGLAND	DENMARK	SWEDEN	FRANCE	KANA
w 119								
x 120								
y 121								
z 122								
{ 123								
| 124								
} 125								
~ 126								