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# PMD 1100/1200/1205 Slave User Manual

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# **PMD 1100/1200/1205 SLAVE**

## **USER'S 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.

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## 1 Introduction

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### Introducing the PMD 1100, PMD 1200 and the PMD 1205

The PMD 1100, 1200 and 1205 are single-line alphanumeric displays that can be united with numerous other PMD 1100s, 1200s or 1205s to make a multi-line slave display. The units can be controlled by a PMD master, a computer, or any other intelligent device with serial communications capabilities. When you receive the unit, it will be set to operate at 115 VAC. It can also operate at 230 VAC. If you have a multi-line PMD 1100/1200/1205 or several units on the same communication link, you can give each one a separate identity. This way you can choose which display will show a message.

The PMD 1100, 1200 and 1205 are housed in a rugged black anodized aluminum case with a scratch-resistant plastic lens on the front. The housing meets NEMA 12 standards. Dimensions of the units are located in Section 7, this manual.

On the top and bottom of the unit are knockouts for routing wires inside the unit to connect service power and communication cabling. The single-line PMD 1100/1200/1205 will display up to twenty red LED characters at a time. The PMD 1100's characters are 2 inches high and the PMD 1200's characters are 4 inches high. The PMD 1205 is like the 1200, however, it displays only ten red LED characters at a time. The characters displayed will be from one of eight international character sets that are switch selectable inside the unit. Characters will include all standard ASCII characters. The international character sets include US, Japanese Kana, Cyrillic, England, France, Sweden, Germany, and Denmark. Definitions of the switch settings for the different character sets can be found in table 2, this manual. The different characters that can be shown are provided in Section 8, this manual.

Messages can be stationary, blink, or scroll left. Individual characters can also blink within a message. A Message can be either centered or uncentered and can either blank the display of previous messages or be overlaid on the existing message on the display. When the display comes to you from the factory, it is set up for RS-422 communication with UTICOR protocol. You can also select RS-485 communication or ASCII protocol.

# 1 Introduction

Applications of PMD Slave Displays are as diverse as individual business needs. By using strategic addressing of the slave displays, you can be assured the message you send will go to the display you intended.

Each PMD 1100/1200/1205 has an RS-422 serial repeater port that lets you daisy-chain numerous groups of displays together, or, if you use RS-485 communications, you can have up to 32 units on the same communication line. Yet, by assigning each unit a unique address, only the desired message will be displayed at each station.

## Installation Options

The PMD 1100/1200/1205 has many options. You will want to choose the options that are right for your particular application *before* installation of the units. Figure 1 is a chart listing the different options available. Further information regarding selection options is provided in Section 2 of this manual.

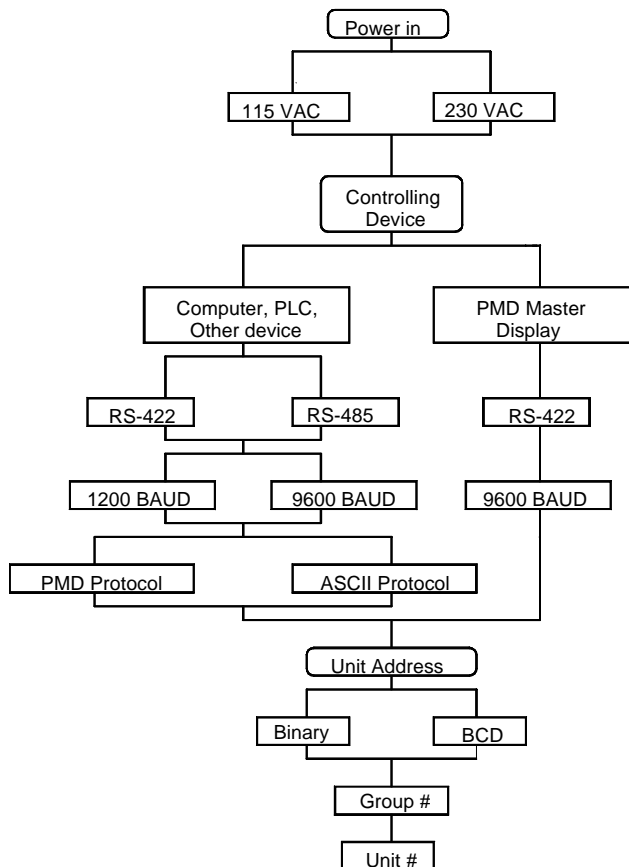


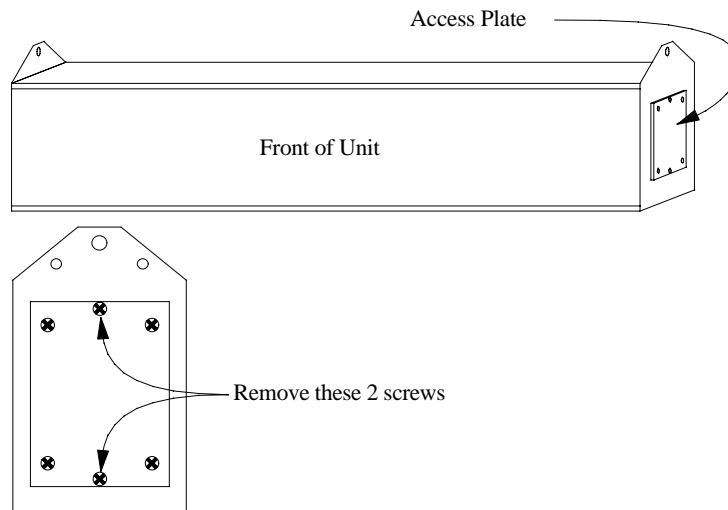
Figure 1. Option Chart



## 2 Unit Preparation

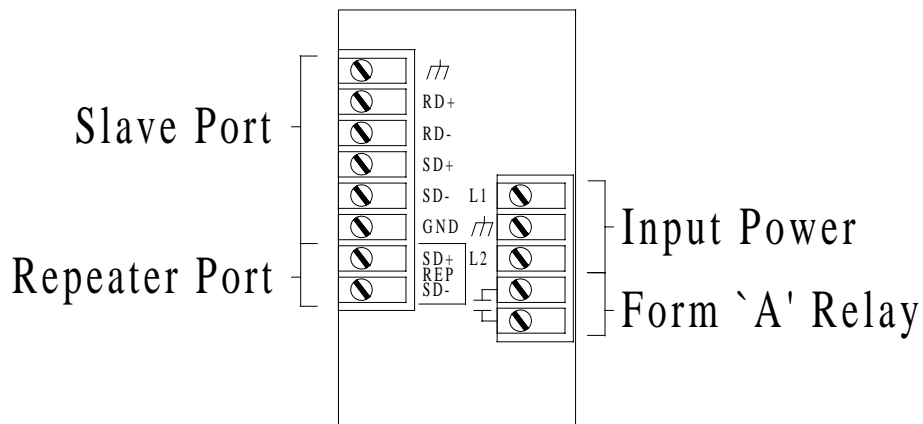
### Access Panel

Physical connections to the PMD 1100, PMD 1200 and PMD 1205 are made by removing the access panel on the right side of the unit as you face it. You will need to remove the cover plates for access to the terminations. Instructions for opening the unit are shown below.



**Figure 2. Opening the access panel**

Once the access panel has been removed, you will see the wire clamp terminal blocks for attaching both the “power in” wiring and the communications wiring.

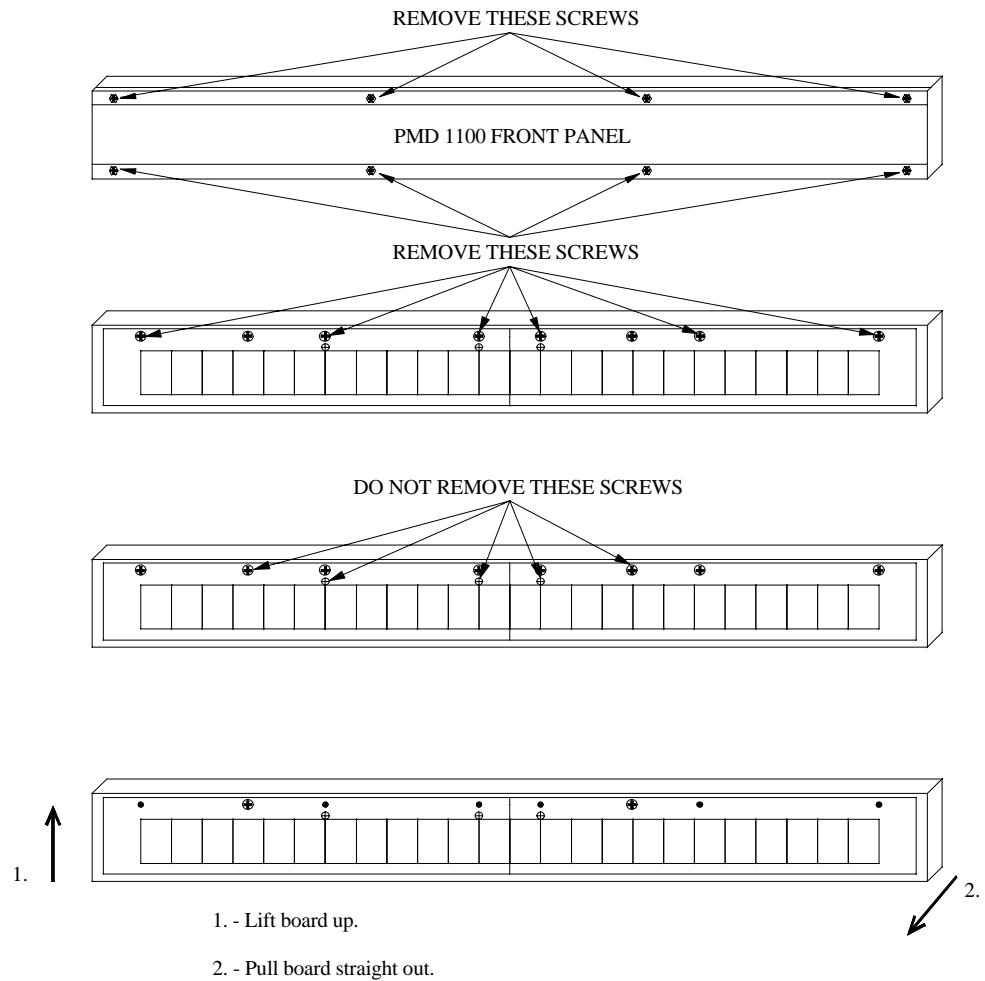


**Figure 3. Interface Circuit Board**

## 2 Unit Preparation

### Input Power

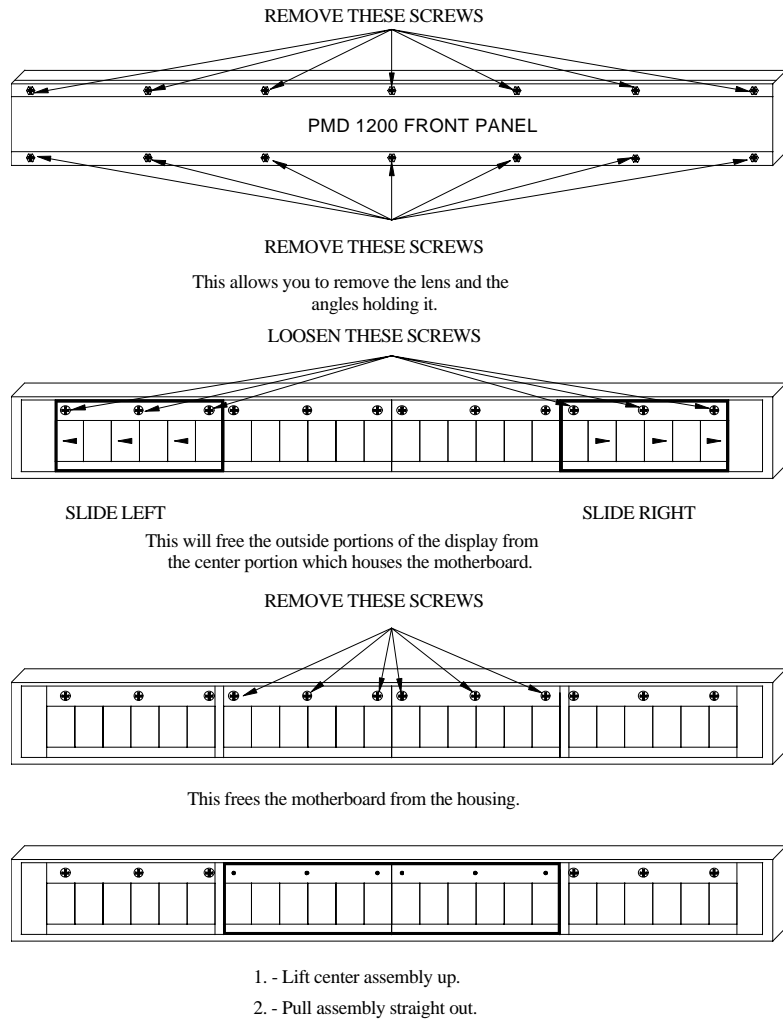
With the PMD 1100/1200/1205, you have two choices for input power. The choices are either 115 VAC or 230 VAC. The unit will come from the factory set to be operated at 115 VAC. However, you can set it up for 230 VAC operation. To do so you must open the unit up. Instructions for opening the units are shown in figures 4 and 5.



**Figure 4. Opening the PMD 1100**

## 2 Unit Preparation

**WARNING**  
Remove power before opening the unit. Also, when setting up a multi-line display, be sure to set all units the same.



When reassembling the unit, be sure to get all the pins aligned while sliding the outside boards in.

**Figure 5. Opening the PMD 1200/1205**

To set the unit up for 230 volt operation, you will need to move the voltage select jumper and change the fuse. Refer to figure 6 for the location of these components. Replacement fuse type can be found in the General Specifications provided in Section 6.

*Note: The PMD 1100/1200/1205 is configured for 115 VAC from the factory. If 230 VAC is desired, the whole unit must be opened up as shown in figures 4 and 5, above.*

## 2 Unit Preparation

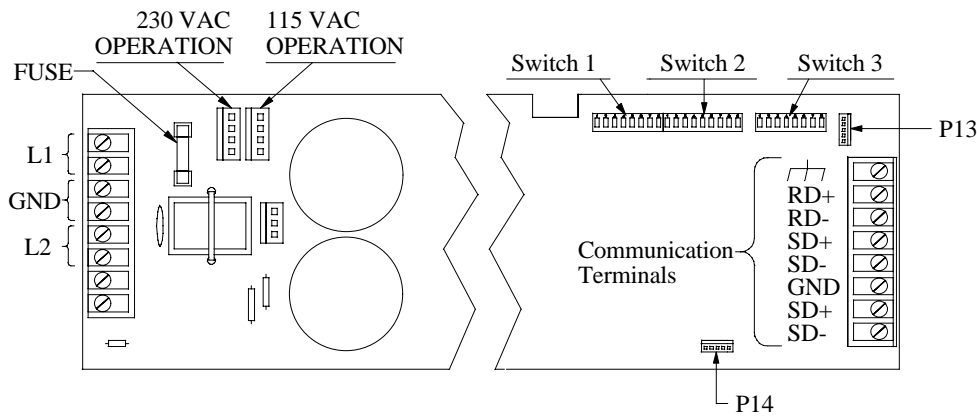


Figure 6. Internal Components

## Controlling Device

The choices for a controlling device, for the PMD 1100/1200/1205 can be broken into two groups. The two groups are a PMD Master Display/Controller or Computer that includes any other intelligent device with serial communication capabilities.

### PMD Master Control

Units are shipped with the following factory settings:

- 9600 Baud
- PMD Protocol
- RS-422
- Termination Resistor ON
- Group 0
- Unit 1 (on multi-line units, unit number is 2 for line 2, 3 for line 3, etc.)
- Internally, units are daisy-chained.

When using a UTICOR PMD Master to control the PMD 1100/1200/1205 Slave, communication will be at 9600 baud using RS-422. Connections will be made from the SD+ and SD- terminals of the PMD Master's slave port, to the RD+ and RD- terminals of the PMD 1100/1200/1205. In multi-line configurations, the top unit will receive the data from the master. The units will already have the wiring terminations made between them. To connect several units or several groups of units, use the repeater port on the bottom display to go to the top line of the next unit on the communication line. The repeater port provides signal boost. Units can be located 4000 feet (1200 meters) apart. The replay channel will be wired together on multi-line units. No provision is made for boosting the reply.

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.

## 2 Unit Preparation

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An RS-422 “link” consists of a two-wire transmitting line, a two-wire receiving line (optional), signal common, and the shield that is normally terminated to safety ground. Each two-wire line should physically be implemented with the two wires of one of the twisted pairs in the cable. (The cable specified for RS-422 connections consists of three twisted pairs.) Each twisted pair is individually shielded, and each shield is brought out to a drain wire. **DO NOT** use wires from different twisted pairs to make up a two-wire signal line.

### Computer Control

Using a computer, PLC, or other intelligent device to control your PMD 1100/1200/1205 is possible — and the use of this type of control is very flexible. When using computer control, you can use either RS-422 or RS-485 communication format at 1200 or 9600 baud. You also have the option of using UTICOR’s PMD message protocol or ASCII protocol to send the messages to the slave display. The different options you have make the PMD 1100/1200/1205 very accommodating to your needs. Refer to Dip Switch Definitions in this section for information on how to select these options. If you have a multi-line unit and are using RS-485, it will be necessary to remove the jumpers between P13 and P14 when wiring the unit. Refer to figure 6 for the location of P13 and P14.

Following are figures of different methods for hooking up your controlling device using both RS-422 and RS-485 communication format.

### RS-422 Terminations

**CAUTION**  
Unit is shipped with dropping resistor enabled.

The unit is shipped with the dropping resistor enabled. Disable all but the last one in multi-drop configurations. This is done by setting switch 3, position 8 accordingly (refer to table 3, this section.)

## 2 Unit Preparation

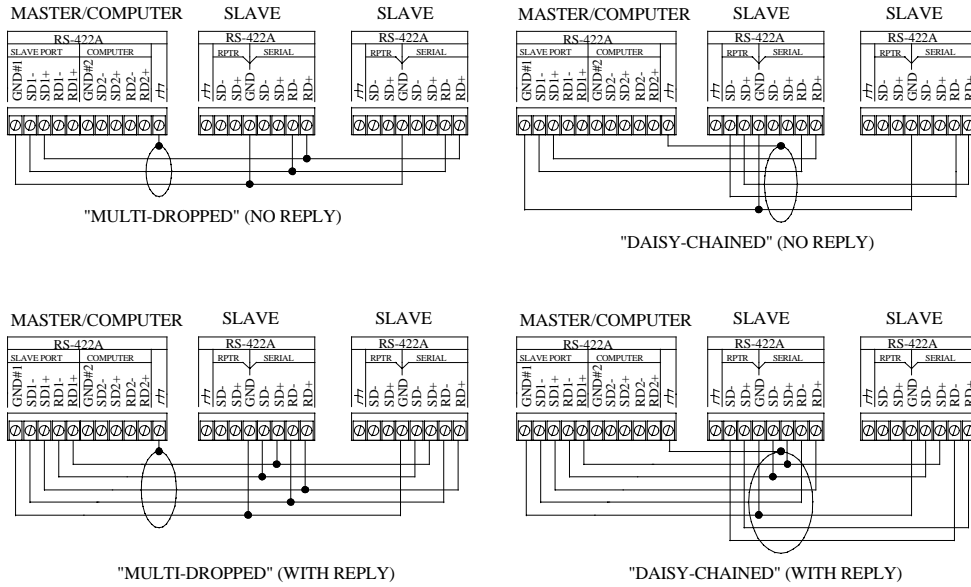


Figure 7. RS-422 Terminations

## RS-485 Terminations

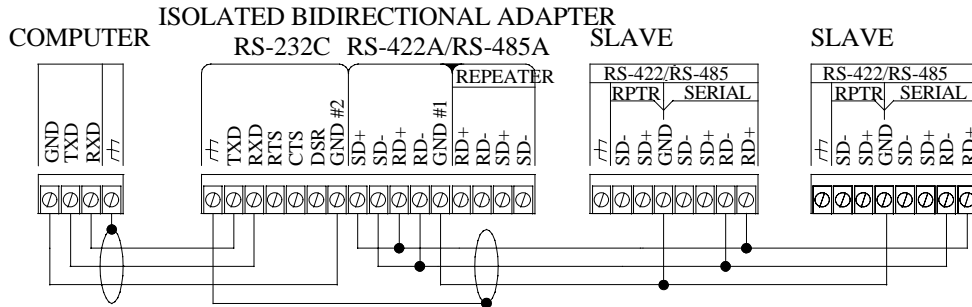


Figure 8. RS-485 Terminations

## Alarm Relay

Also available on the interface terminal blocks is a N.O. form "A" relay. The relay is activated through message commands from a PMD master unit. The contacts are rated for 8 Amps @ 250 VAC. Refer to figure 3 for location.

## 2 Unit Preparation

### DIP Switch Settings

There is another access panel located on the back side of the PMD 1100, 1200, and 1205. Behind the panel you will find three blocks of DIP switches. The switches are used to set several options. The options include: baud rate, unit address, communication protocol and mode, terminating resistor, and character set. Instructions for opening the access panel are shown in figure 9.

Units are shipped with the following factory settings:

- 9600 Baud
- PMD Protocol
- RS-422
- Termination Resistor ON
- Group 0
- Unit 1 (on multi-line units, unit number is 2 for line 2, 3 for line 3, etc.)
- Internally, units are daisy-chained.

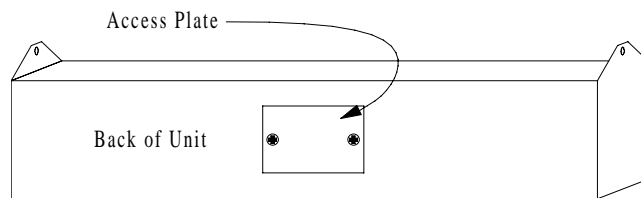


Figure 9. DIP Switch Access Panel

Figure 10 is an illustration defining what each of the DIP switches is used for. Tables, 1, 2, and 3 give more refined definitions of these switches.

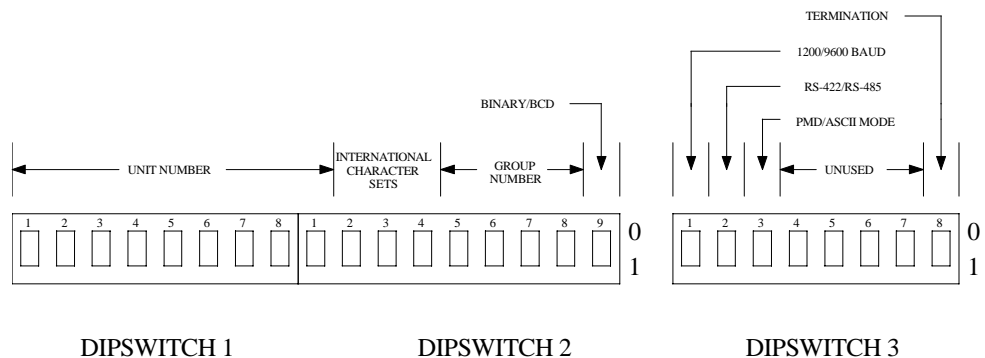


Figure 10. DIP Switch Definitions

## 2 Unit Preparation

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### Unit Address Switches

Switch 1 will have all of its bits used to define the unit number. They will define bits 1 through 8. Position 1 will be the least significant bit and position 8 will define the most significant of the first 8 bits.

Switch 2, position 1 will define bit 9 of the unit number. Switch 2, positions 5 through 8 will be used to define the four bit group number. Switch 2, position 9 will be used to determine whether the group and unit numbers are to be interpreted as a binary or BCD number.

---

*Table 1. Unit Addressing Switches*

---

Switch 1, Position 1	Unit Number	1 Binary	1 BCD
Switch 1, Position 2	Unit Number	2 Binary	2 BCD
Switch 1, Position 3	Unit Number	4 Binary	4 BCD
Switch 1, Position 4	Unit Number	8 Binary	8 BCD
Switch 1, Position 5	Unit Number	16 Binary	10 BCD
Switch 1, Position 6	Unit Number	32 Binary	20 BCD
Switch 1, Position 7	Unit Number	64 Binary	40 BCD
Switch 1, Position 8	Unit Number	128 Binary	80 BCD
Switch 2, Position 1	Unit Number	256 Binary	100 BCD
Switch 2, Position 5	Group Number	1 Binary	1 BCD
Switch 2, Position 6	Group Number	2 Binary	2 BCD
Switch 2, Position 7	Group Number	4 Binary	4 BCD
Switch 2, Position 8	Group Number	8 Binary	8 BCD
Switch 2, Position 9	Binary/BCD	1 = Binary	0 = BCD

---



## 2 Unit Preparation

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### International Character Set Switch Settings

Switch 2, positions 2 through 4 will give the 3 bit code that defines which character set is being used. Refer to table 2 for definitions of these three switches.

*Table 2. International Character Set Switch Settings*

	Switch 2-2	Switch 2-3	Switch 2-4
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

### Switch 3 Assignments

Switch 3, position 1 will be used to select the baud rate. If the switch is closed, the baud rate will be set at 1200 baud. If the switch is open, the baud rate will be 9600 baud. Position 2 will be used to select the communication mode. If the switch is closed, the unit will accept RS-422 communications. If the switch is open, the unit will accept RS-485 communications. Position 3 will be used to select PMD or ASCII protocol for communications. When this switch is closed, the unit will be set for PMD protocol and when it is open, the unit will be set for ASCII protocol. Positions 4 through 7 are currently not used. Switch 3, position 8 is used to select a terminating resistor. If RS-422 communications are to be used, this switch must remain closed. With RS-485 communication, this switch must be opened on every unit except for the last unit in the communication string. The last unit is defined as this: when there is only one unit, it is the last unit; when there are multiple units, you should use a main communication line with short spurs dropping to each unit or group of units. At the last drop of the main communication line, you will go to the last unit in that string to define the last unit.

## 2 *Unit Preparation*

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*Table 3. Switch 3 Assignments*

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Switch 3, Position 1	Baud Rate Select	0 = 1200	1 = 9600
Switch 3, Position 2	Communication Mode	0 = RS-422	1 = RS-485
Switch 3, Position 3	Communication Protocol	0 = PMD	1 = ASCII
Switch 3, Position 8	Terminating Resistor	0 = In Circuit	

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### 3 *PMD Master Control*

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Displaying messages on a PMD 1100/1200/1205 slave display is easily accomplished by interfacing the unit to a programmed PMD master display.

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

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

## Master Control Preparation

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

1. Set the unit address on Switch One and Switch Two.
2. Connect the RS-422A Serial/Printer Port to programmed master(s) and other slaves(s) in the desired configuration shown in the first two examples (with no reply) of figure 7.
3. Connect service power to the unit. (For 230 VAC operation, you must move the power input connector and change the fuse first —illustrated in figure 6.)

*(Reference: PMD Master User Manual)*

## What Happens During Master Control

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

1. The PMD slave display is ready to communicate and displays an alternating line message:

**REVISION** \_\_  
**GROUP** \_\_ **UNIT** \_\_\_\_  
\_\_\_\_ **BAUD**

### 3 *PMD Master Control*

---

**REVISION\_\_** represents the product revision code of the software in the display. **GROUP \_\_** and **UNIT\_\_** indicate the current group and unit number settings on Switch One and Switch Two. **BAUD\_\_** tells you the baud rate that has been selected on the internal jumper. (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 this 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 COMMUNICATIONS” 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.

*Exceptions: The exception to item 3, above, is a scrolling message that does not repeat. In this case, the display clears and waits for a new message.*

*Errors: See Section 9 — No Communications*

*Reference: See Section 2 — Baud Rate Selection*

## Addressing Slaves

Each PMD slave display is assigned a unit address. A unit address is programmed into each message (that is programmed to be sent to slaves) 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 processor board of the unit.

### 3 *PMD Master Control*

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

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

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

With a nonzero group number and a unit number of zero, all units with that group number will display the message.

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

*Reference: See Section 2 — Switch One and Switch Two*

## Mixing Displays

One, two, and four line displays can be used in the same network. Because of the basic differences between the displays and their messages, the following rules apply to mixing PMD 1100/1200/1205 slave displays with larger character masters.

### Using the PMD 1100/1200/1205 with 200 and 300 Masters

The PMD 1100/1200/1205 is compatible with the PMD 200 two-line display and the PMD 300 four-line display. Because the PMD 1100/1200/1205 has 20 characters and the PMD master has either 40 or 80 characters, the following rules apply to how messages are displayed on the PMD1100/1200/1205.

1. One the first line of a four-line master is displayed on a PMD 1100/1200/1205.
2. Messages programmed to scroll upward will only scroll on the one line of the display.

### 3 *PMD Master Control*

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3. All left-scrolling messages scroll left on the only line of a PMD 1100/1200/1205 display at a fixed rate.

## Slave Control By Computer-Controlled Master

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

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

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

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 are to be made inactive.
2. The master passes the Select Active Slave command on to its slaves, causing the specified activations and deactivations.
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).
5. Only slaves that were activated will receive the new data. All others will continue to display the data that they have received

### 3 *PMD Master Control*

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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 technique described in Section 4 of this manual. Because slaves can only be deactivated 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 See Section 4 — UTICOR Protocol (Computer Control)  
PMD Master Display User Manuals*

## Conclusion

Because PMD slave displays contain no message program, all message text displayed on the slave is received from an outside source. Information concerning the PMD master display and its message program is found in the master display user manuals.

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### **3 *PMD Master Control***

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## 4 *UTICOR Protocol*

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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, refer to Section 5.

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

### Computer Communications Preparation

For computer communication, the PMD slave RS-422A/RS-485 Serial/ Repeater Port is set to the following parameters:

Baud Rate	=	9600 or 1200 Baud
Data Bits	=	8 Data Bits
Stop Bits	=	1 Stop Bit
Parity	=	No Parity
Checksum	=	XOR Checksum

The baud rate is switch selectable. This switch is located on the processor board inside the unit. The unit is shipped from the factory with this switch set for 9600 baud communication. To change the port to 1200 baud, refer to Section 2 of this manual. For information concerning the XOR checksum, refer to Section 10 of this manual.

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/RS-485 Serial/Repeater Port(s) of the display(s). Refer to figure 7 and 8 to construct appropriate cable(s).
3. Connect power to the Power Input Terminals. See figures 2 and 3.

## 4 UTICOR Protocol

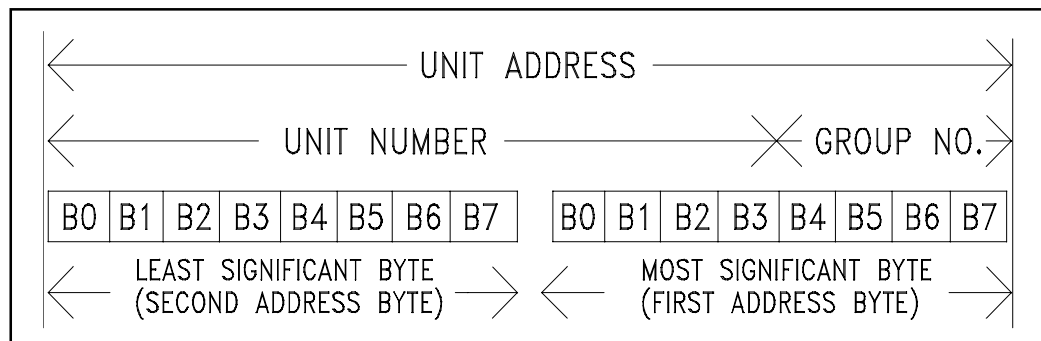
4. The PMD slave display(s) will be “active” and ready to communicate. The unit(s) will display a message to indicate the software revision number, the unit address, and the baud rate.

**Reference** See Section 2 — RS-422A/RS-485 Terminations, Power Input, and DIP Switch Definitions; Section 10 — XOR Checksum

### 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 that contain two identifiers. These identifiers consist of a group number and a unit number and are located at Byte 2 and Byte 3 of the communications message. Refer to figure 11, below, for bit assignments of the unit address bytes.



**Figure 11. Unit Address Byte Designation**

The unit address of a PMD 1100/1200/1205 slave display is defined by the setting of the DIP switches located on the processor board of the unit.

### 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:

## 4 *UTICOR Protocol*

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### **CAUTION**

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

1. Group #00, Unit #0000 — addresses all units
2. Group #XX, Unit #0000 — addresses all units in group #XX
3. Group #15, Unit #4095 — addresses all “active” 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 nonzero group number and unit number of zero, all units with that group number will process the message.

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

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

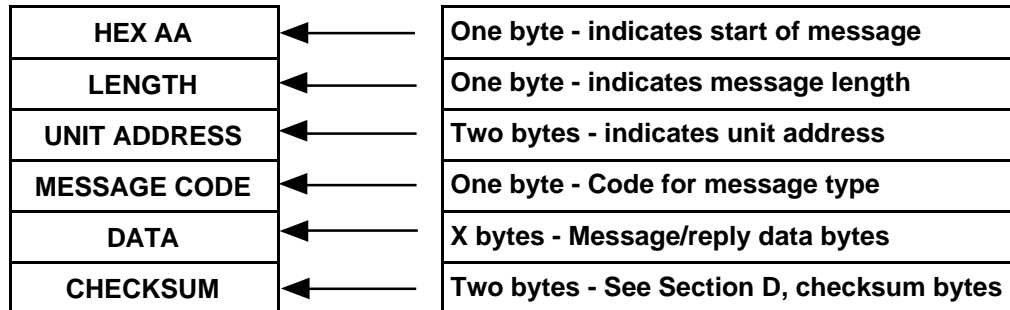
## **Active/Non-Active Slave Units**

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 “deactivate” the slaves connected to it. Slaves power-up activated and the controlling computer can, by group or individual unit, activate or deactivate the slaves. Then, it can utilize the Group #15, Unit #4095 addressing mode described previously.

## 4 UTICOR Protocol

### General Message Format

General message format for messages sent via computer is shown in figure 12, below.



*Figure 12. 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).

### Valid 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.)

## 4 *UTICOR Protocol*

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*Table 4. Message Code Number Definitions*

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

**ALL NUMBERS ARE IN DECIMAL**

\* allowed only when individual units are addressed.

### Message Replies

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

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

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

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

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### CODE 00 — STANDARD REPLY

The standard reply code is the standard format sent back to the controlling computer when special information has not been requested by the code sent to the PMD. 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. The format for the standard reply is as follows.

BYTE NUMBER	VALUE
1	HEX AA = Start Of Message Byte
2	8 Length
3	B4–B7 = 4-Bit Group Number B0–B3 = Most Significant Bits Of 12-Bit Unit Number
4	8 Least Significant Bits Of 12-Bit Unit Number
5	00 Standard Reply Message Code
6	Reply to Message Code
7	Reply Error Code 0 = No Error 1 = Checksum Error 2 = Timeout 3 = Invalid Message Code 8 = Invalid Message Length 15 = Invalid Format of Display Bar Graph Command (PMD 1100 and 1200 only)
8–9	Checksum (MSB,LSB)

#### 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.

### CODE 13 — SET TIME AND DATE

This command is used to set the real-time clock in the PMD master or update the time data in the slave message to the values indicated in the command.

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### Command:

BYTE NUMBER	VALUE
1	HEX AA = Start Of Message Byte
2	13 Length (11 Length with no Checksum)
3	B4–B7 = 4-Bit Group Number B0–B3 = Most Significant Bits Of 12-Bit Unit Number
4	8 Least Significant Bits Of 12-Bit Unit Number
5	13 — Set time and date code
6	HOUR MODE: 0 = 12-hour Mode 1 = 24-hour Mode
7	HOURS: 1–12 for 12-hour Mode 0–23 for 24-hour Mode
8	MINUTES: 00–59
9	SECONDS: 00–59
10	MONTH:- 1–12
11	DATE: 1–31
12	YEAR: 00–99
13	Checksum
14	One's complement of checksum

### REPLY = STANDARD REPLY

**Byte 7 (Hours):** when Byte 6 selects the 12-hour format, the hours byte indicates AM or PM in the high bit (bit 7). 0 = AM, 1 = PM

### Example:

BYTE NUMBER	HEX VALUE	Description
1	AA	Start of message
2	0D	The length is 13
3	F0	Master unit is in group 15 <sub>10</sub>
4	14	Unit number is 20 <sub>10</sub>
5	0D	Replying to code 13
6	00	Time is in 12-hour format
7	83	The hour is 3 PM
8	15	It is 21 minutes past the hour
9	0B	It is 11 seconds into the minutes
10	0A	The month is October
11	1F	It is the 31 <sup>st</sup> day of the month
12	5D	1993 is the year
13	30	XOR of previous bytes other than start of message
14	CF	One's complement of checksum

## 4 UTICOR Protocol

### Reply:

BYTE NUMBER	HEX VALUE	Description
1	AA	Start of message
2	08	The length is 8
3	F0	Master unit is in group 15 <sub>10</sub>
4	14	Unit number is 20 <sub>10</sub>
5	00	Code 00 — Standard reply
6	0D	Replying to code 13
7	00	No errors
8	E1	The XOR value of all previous bytes in the reply
9	1E	The one's complement of the first checksum byte

In this example, the computer sent the time 3:21:11 PM, October 31, 1993 to unit 20 in group 15.

## CODE 14 — WRITE DATA SET DATA TO SLAVE

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 NUMBER	VALUE
1	HEX AA = Start Of Message Byte
2	15 Length
3	B4–B7 = 4-Bit Group Number B0–B3 = Most Significant Bits Of 12-Bit Unit Number
4	8 Least Significant Bits Of 12-Bit Unit Number
5	14 — Write data set data
6	Status Byte    0 = BCD 1 = Binary
7	Most significant byte of Data Set 1
8	Least significant byte of Data Set 1
9	Most significant byte of Data Set 2
10	Least significant byte of Data Set 2
11	Most significant byte of Data Set 3
12	Least significant byte of Data Set 3
13	Most significant byte of Data Set 4
14	Least significant byte of Data Set 4
15	Checksum
16	One's complement of checksum



## 4 UTICOR Protocol

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### REPLY = STANDARD REPLY

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

*Example:*

BYTE NUMBER	HEX VALUE	Description
1	AA	Start of message
2	0F	The is 15 <sub>10</sub> bytes long
3	F0	The display is in group 15 <sub>10</sub>
4	14	Unit 20 <sub>10</sub> is being addressed
5	0E	Code 14 — Write data set data
6	01	Data is being read in binary
7	12	MSB of data set 1 value 4660 <sub>10</sub>
8	34	LSB of data set 1 value 4660 <sub>10</sub>
9	56	MSB of data set 2 value 22136 <sub>10</sub>
10	78	LSB of data set 2 value 22136 <sub>10</sub>
11	90	MSB of data set 3 value 36882 <sub>10</sub>
12	12	LSB of data set 3 value 36882 <sub>10</sub>
13	34	MSB of data set 4 value 13398 <sub>10</sub>
14	56	LSB of data set 4 value 13398 <sub>10</sub>
15	0C	XOR of previous bytes other than start of message
16	F3	One's complement of checksum

1	AA	Start of message
2	08	The length is 8
3	F0	Master unit is in group 15 <sub>10</sub>
4	14	Unit number is 20 <sub>10</sub>
5	00	Code 00 — Standard reply
6	0E	Replying to code 14
7	00	No errors
8	E2	The XOR value of all previous bytes in the reply
9	1D	The one's complement of the first checksum byte

*Reply:*

This example sends data set values for data sets 1 through 4 to the slave that is unit 20 in group 15.

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### CODE 15 — SELECT ACTIVE SLAVE

This command allows the control computer to specify which of the PMD slaves are to be activated or deactivated.

BYTE NUMBER	VALUE
1	HEX AA = Start Of Message Byte
2	7+X Length
3	B4–B7 = 4-Bit Group Number B0–B3 = Most Significant Bits Of 12-Bit Unit Number
4	8 Least Significant Bits Of 12-Bit Unit Number
5	15 — Select active slave code
6	Active Units Control Byte
7	First byte of group and unit number(s) (same format as bytes 3 and 4) of slave(s) to be activated and/or deactivated. There will be X number of bytes.
7+X	Checksum
8+X	One's complement of checksum

*Command:*

**Bytes 3 & 4** (Unit Address Bytes): specify the master unit(s) that are to process the command. When a master processes this message, it sends this same command to all slaves connected to it. For slave displays, the unit address bytes specify the unit and group number of the PMD slaves 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 deactivate command to the various slaves. **Bit 0** of this byte indicates the requested state of the slaves whose addresses are within the list beginning at Byte 7. A “1” in this position indicates those slaves are to be activated. A “0” indicates they should be deactivated.

**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 deactivated when bit 0 is a “1”.

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*Table 5. Byte 6 — Active Unit Control Bytes*

B7	B0	Result
0	0	Deactivate specified slaves only
0	1	Activate specified slaves only
1	0	Deactivate specified slaves—Activate other slaves
1	1	Activate specified slaves—Deactivate other slaves

**Byte 7** A list of unit and group numbers of slave displays to be activated or deactivated. *Note: Only units in the address at Bytes 3 and 4 will be affected by this command. Also note that the list cannot exceed 248 bytes.*

*Example:*

BYTE NUMBER	HEX VALUE	Description
1	AA	Start of message
2	0B	The code is 11 <sub>10</sub> bytes long
3	F0	The display is in group 15 <sub>10</sub>
4	14	Unit 20 <sub>10</sub> is being addressed
5	0F	Code 15 — Select active slave
6	01	Activate only the slaves selected in the following bytes that are under the control of the master selected in bytes 3 and 4.
7	10	First address byte of the slave group 1, unit 3
8	03	Second address byte of the slave group 1, unit 3
9	10	First address byte of the slave group 1, unit 16
10	10	Second address byte of the slave group 1, unit 16
11	F2	XOR of previous bytes other than start of message
12	0D	One's complement of checksum

*Reply:*

1	AA	Start of message
2	08	The length is 8
3	F0	Master unit is in group 15 <sub>10</sub>
4	14	Unit number is 20 <sub>10</sub>
5	00	Code 00 — Standard reply
6	0F	Replying to code 15
7	00	No errors
8	01	The XOR value of all previous bytes in the reply
9	FE	The one's complement of the first checksum byte

**4 UTICOR Protocol**

This example activated two slaves that are being controlled by the master whose address is unit 20 of group 15. The slave addresses are unit 3 and 6 of group 1.

**CODE 17 — SLAVE DISPLAY PACKET MESSAGE**

This command displays a valid message on a PMD slave display. The message displayed follows the format of a stored message in a PMD master display.

*Command:*

BYTE NUMBER	VALUE
1	HEX AA = Start Of Message Byte
2	10 + X Length
3	B4–B7 = 4-Bit Group Number B0–B3 = Most Significant Bits Of 12-Bit Unit Number
4	8 Least Significant Bits Of 12-Bit Unit Number
5	17 — Slave display packet message
6	Blink On Time Interval
7	Blink Off Time Interval
8	Scroll Up Time Interval
9	Scroll Left Time Interval
10	First byte of message data
9 + X	Last byte of message data
10+X	Checksum
11	One’s complement of checksum

**Bytes 6 through 9** (Attribute Bytes): these bytes are necessary since the slave display does not have user memory. If the packet message does not scroll or blink, insert zeroes into these bytes.

*Table 6. Bytes 6 through 9 — Definitions*

Byte Number	Attribute	Valid Range
6	Blink On Time Interval	1–99
7	Blink Off Time Interval	1–99
8	Scroll Up Time Interval	1–99
9	Scroll Left Time Interval	1–99

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**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** (Scroll Up Time Interval): 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** (Scroll Left Time Interval): indicates the length of time that each character will remain at each character location as it moves across the display.

**X** (Message Length): the message data must be less than, or equal to 235.

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

### CODE 18 — STATUS/ID MESSAGE

This message request some status information from the PMD. The reply contains the requested information.

**COMMAND:**

**REPLY:**

BYTE NUMBER	VALUE	BYTE NUMBER	VALUE
1	HEX AA =Start Of Msg Byte	1	HEX AA= Start Of Msg Byte
2	6 Length	2	9 Length
3	B4–B7 = 4-Bit Group No. B0–B3 = Most Significant Bits Of 12-Bit Unit No.	3	B4–B7 = 4-Bit Group No. B0–B3 = Most Significant Bits Of 12-Bit Unit No.
4	8 Least Significant Bits Of 12-Bit Unit No.	4	8 Least Significant Bits Of 12-Bit Unit No.
5	18 — Status/ID Code	5	18 — Status/ID Code
6	Checksum	6	Device Type: PMD 1100/ 1200 = 89, PMD 1205 = 8A

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BYTE NUMBER	VALUE	BYTE NUMBER	VALUE
7	One's comp. checksum	7	Revision Code: ASCII Code for software revision letter
		8	State: Active = 1 Non-Active = 0
		9	Checksum
		10	One's compl. of checksum

### *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 (nonstandard) reply contains the requested information.

### **Reply Description —**

**Byte 6** (Reply Device Type): identifies the addressed device as either a master or slave PMD. This byte will equal 89 to indicate that the unit is a PMD 1100/1200 slave.

**Byte 7** (Reply Revision Code): indicates the revision code letter of the software in the display and will be in the form of an ASCII character.

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

## CODE 44 — DISPLAY BAR GRAPH

This feature involves the ability to display a bar graph on the display. This can only be done when you are using a computer to control the slave display. This feature is not supported by any of UTICOR's master displays at this time. Neither can the PMD 1205 display bar graphs due to its size.

The first time the display bar graph command is received by the PMD, the display is cleared. The bar graph will then be displayed. The bar graph will appear in the bottom four and leftmost 100 LEDs on the display. The actual length of the bar is determined by the command sent. There are LEDs lit every ten places across the top of the display to make the graph more readable. The graph will start from the left and

## 4 UTICOR Protocol

fill right as numbers are plugged in. If desired, the number being represented can be displayed on the right side of the display.

When using UTICOR protocol to control the display, the bar graph information remains on the display until cleared by a “Display packet message” command.

### Command:

BYTE NUMBER	VALUE
1	HEX AA = Start of Message Byte
2	8 Length
3	B4–B7 = 4-Bit Group Number B0–B3 = Most Significant Bits of 12-Bit Unit Number
4	8 Least Significant Bits of 12-Bit Unit Number
5	44 Message Code
6	Display Digits, 0 = NO , 1 = YES
7	Length of Bar (0–100 = Valid Values)
8	Checksum
9	One’s complement of checksum

### REPLY = STANDARD REPLY

### Example:

BYTE NUMBER	HEX VALUE	Description
1	AA	Start of message
2	08	The code is 8 <sub>10</sub> bytes long
3	10	The display is in group 1 <sub>10</sub>
4	0F	Unit 15 <sub>10</sub> is being addressed
5	2C	Code 44 — Display bar graph
6	01	Display number also in digits
7	3F	Length of bar is 63 <sub>10</sub> (0–100 are valid values)
8	05	XOR of previous bytes except start of message
9	FA	One’s complement of checksum

### Reply:

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BYTE NUMBER	HEX VALUE	Description
1	AA	Start of reply
2	08	The length is 8
3	10	Unit is in group 1 <sub>10</sub>
4	0F	Unit number is 15 <sub>10</sub>
5	00	Code 00 — Standard Reply
6	2C	Replying to code 44
7	00	No errors
8	36	XOR of all previous bytes except start of message
9	C4	One's complement of checksum

This example has the controlling computer instructing the slave to illuminate a graph that is 63% of full scale. The slave is also being instructed to display the number that is being represented. This command is not usable with the PMD 1205 message display.

### 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 are shown in table 7. 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 upon the chosen 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 pertaining to slaves that is appropriate depends upon the options required by the message. Table 8 relates the selected options to the formats shown in table 7 (A)–(D). For example, a message with no options selected, would be structured as shown in 7 (A). A message that should scroll left would be formatted as in 7 (C).



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*Table 7. Message Format Of PMDs*

BYTE	1	2	3	4	5	6	7	8	n
<b>FORMAT A</b>	LENGTH BYTE (n)	CONTROL BYTE #1	MESSAGE DATA						LAST BYTE MSG/DATA
<b>FORMAT B</b>	LENGTH BYTE (n)	CONTROL BYTE #1	CONTROL BYTE #2	MESSAGE DATA					LAST BYTE MSG/DATA
<b>FORMAT C</b>	LENGTH BYTE (n)	CONTROL BYTE #1	CONTROL BYTE #2	SCROLL OPTIONS	MESSAGE DATA				LAST BYTE MSG/DATA
<b>FORMAT D</b>	LENGTH BYTE (n)	CONTROL BYTE #1	CONTROL BYTE #2	SCROLL OPTIONS	SCROLL TIME	MESSAGE DATA			LAST BYTE MSG/DATA

*Table 8. Message Options Versus Message Formats*

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

### Control Byte 1

Control byte one selects some of the options possible for the message. A diagram of this byte is shown in table 9, below, to illustrate the definitions of the 8 bits of this byte. Table 10 designates how byte 2 of each message is read.

*Table 9. Bit Diagram of Control Byte 1*

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

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*Table 10. Bit Designations for Control Byte 1*

BIT #	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 Msg (B5 must equal 1)	No <CR><LF> At End (B5 must equal 1)
B1	Msg Has Control Characters	Msg Has No Control Char.
B0	Byte 3 Control Byte	No More Control Bytes, Entire Message Does Not Blink, Message Does Not Scroll, No Relay Alarm Output, Message Not Sent To Slave

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

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

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### Option Byte 2

Control byte one signifies whether the third byte of the message is a control byte (Control Byte 2). Control byte 2 will indicate if the message energizes the alarm relay output, if the message is logged or invisible, if the message will scroll, and if the message is to blink. As noted, some of these options do not apply to slave displays. Table 11 shows a diagram of control byte 2. Table 12 designates how byte 3 (as control byte 2) of a message is read.

**Table 11. Bit Diagram of Control Byte 2**

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

**Table 12. Bit Designations For Control Byte 2**

BIT #	IF BIT = 1	IF BIT = 0
B7	Message Energizes Alarm Output	Message Does Not Energize Relay
B6	Message Scrolls Enable Scroll Options Byte	Message Does Not Scroll
B5	Message Sent To Slaves Enable Unit Number Bytes	Message Not Sent To Slaves
B4	Entire Message Blinks	Message Does Not Blink
B3	Message Is Not Displayed	Display Message On Master
B2	Log Message In Data Log	Do Not Log Message
B1	Not Used	(Default = 0)
B0	Not Used	(Default = 0)

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

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### Scroll Options Byte

As noted previously, if control byte two indicates that a message will scroll, a third control byte (byte 4) is necessary to determine control options for scrolling. Table 13 shows a diagram of byte 4 as the scroll option control byte. Table 14 designates how byte 4 (as control byte 3) of a message is read.

**Table 13. Bit Diagram Of Control Byte 3**

B7	Scroll Time Byte Enable	B3	Display Lines to Scroll Msg
B6	Repeat Message Bit	B2	Display Lines to Scroll Msg
B5	Not Used	B1	Scroll Msg Right to Left Bit
B4	Not Used	B0	Scroll Msg Up Bit

**Table 14. Bit Designations For Control Byte 3**

BIT #	IF BIT = 1	IF BIT = 0
B7	IGNORED	IGNORED
B6	Message Repeats	Message Does Not Repeat
B5	NOT USED	NOT USED
B4	NOT USED	NOT USED
B3	Message Scrolls On Line 2	Does Not Scroll On Line 2
B2	Message Scrolls On Line 1	Does Not Scroll On Line 1
B1	Scrolls Right to Left	Message Does Not Scroll Left
B0	Message Scrolls Upward	Does Not Scroll Upward

**NOTE:** *B2–B5 — Select lines of the display where a scrolling message will be displayed. For left-scrolling messages, one of these bits must = “1”, and the other three must = “0”. For upward-scrolling messages, one, two, three, or four contiguous lines can be set. These bits are ignored by the PMD 1100/1200.*

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### Scroll Time Byte

The scroll rates in the PMD 1100, 1200 and 1205 are a fixed rate and cannot be altered. The Scroll Time Byte is ignored.

### 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.

### 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, data, and data set bytes have the most significant bit set, but cannot individually blink.

### 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.

*Table 15. Character Codes for Time and Date*

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

## 4 UTICOR Protocol

---

### Variable Data Characters

Table 16, below, lists the character codes for all five characters of each of the PMD displays' four data sets. These codes can be entered in any order, anywhere in a message.

*Table 16. Character Codes for Variable Data*

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

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).

---

## 5 ASCII Protocol

---

### Introduction

**The PMD 1100/1200/1205s come from the factory with UTICOR and ASCII protocol software in them. The simple movement of a switch allows you to select either protocol. If you are using a slave with ASCII protocol, this section will be vitally important to you, the user.**

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

### Preparation of the Unit for ASCII Operation

The unit is equipped with a RS-422A/RS-485 port. This is the port that will be used for reception of the ASCII commands to control the display. You need only wire the unit's receive lines to the host's transmit lines because the transmitter port on the slave is not used.

The slave is equipped with a RS-422 repeater port. This port allows the slave to echo the information received by the RS-422A Serial Port. Besides 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 processor board 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 that are used to select international character sets. The other position (position nine) of the nine position switch is used to indicate BCD or Binary interpretation.

When the BCD/Binary interpretation switch is closed (=0), the numbers represented by the DIP switches are interpreted as BCD digits. When it is open (=1), the DIP switches are interpreted as binary bits. In BCD interpretation mode, the group number can range from 0–9 and the unit number from 0–199. In Binary interpretation mode, the group number can range from 0–15 and the unit number can range from 0–511.

## 5 ASCII Protocol

---

After the unit's identification has been determined and all physical connections and adjustments have been made, you are ready to power-up the unit. The unit's identification will only be read during the power-up sequence. When the unit is powered it will display an initial message. This will be a four line message consisting of: ASCII mode, product name, software revision, unit address, and RS-422 serial link baud rate. The power up message will scroll up a line at a time.

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	Internally defined (not changeable)
Blink Mode	Off
Center Mode	Off
Delimited Blink	Off
New Line	On
Wrap	Off

Other than the scroll interval, these values can be changed through ASCII commands.

## Terminal Operation

ASCII slave accepts and displays information one character at a time. The following ASCII characters are displayed by the unit. Please note that the ASCII circumflex  $\wedge$  ( $94_{10}$  or  $5E_{16}$ ) character is not accepted. This character is used to start different commands usable with this particular protocol.

## 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.



## 5 ASCII Protocol

---

Whether or not a character blinks when it is written to the display depends upon the blink status most recently set up by the reception of 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 text on the display line is shifted up off of the display and the cursor is advanced to the leftmost column of the next display line. When the new line setting is *off*, the cursor is advanced to the leftmost column of the display line.

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*, advancing the cursor past the end of the display line has no effect. Writing a character to the cursor when it is past the end of the display line causes the text on the line to be shifted up off the display. The display line will be cleared before the character is written at the front of it. The cursor is then positioned behind the character.

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

### Operating Commands

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

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

## 5 ASCII Protocol

---

<b>Valid ASCII Commands</b>	<b>^Agguuuu</b>	=	Select Unit
	<b>^axyyy</b>	=	Display Bar Graph
	<b>^Bn</b>	=	Select Blink Mode
	<b>^Cn</b>	=	Select Center Mode
	<b>^Dn&lt;message text&gt;&lt;CR&gt;</b>	=	Display Scrolling Text
	<b>^En</b>	=	Reset Display
	<b>^Gbbcc</b>	=	Select On/Off Rate
	<b>^Hrrcc</b>	=	Position Cursor
	<b>^In</b>	=	Select New Line
	<b>^Jn</b>	=	Select Wrap
	<b>^Xn</b>	=	Blink Delimiter On/Off
<b>^Yn</b>	=	Relay On/Off	

### **^Agguuuu SELECT UNIT**

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

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

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

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

There are three basic rules for selecting units.

1. Group x and Unit x selects only the unit with matching numbers.
2. Group x and Unit 0 selects all units in group x.
3. Group 0 and Unit 0 selects all units.

### **^axyyy DISPLAY BAR GRAPH**

The ASCII protocol command for displaying a bar graph is **^axyyy**. If x is equal to 0, then the digits will not be displayed. If x is equal to 1, then the digits will be displayed. The variables yyy are used to represent the length of the bar. Use leading zeroes if all variable placeholders are not filled.

## 5 ASCII Protocol

---

The bar graph will be cleared when the unit receives a Scroll (^D), Reset (^En), or Position cursor (^H01XX) command or when it receives an ASCII character to be displayed. If another bar graph command is received, the display will adjust the graph to reflect the new command. In ASCII protocol, the blink on command (^B1) can be used to blink the bar graph.

The first time the display bar graph command is received by the PMD, the display is cleared. The bar graph will then be displayed. The bar graph will appear in the bottom four and leftmost 100 LEDs on the display. The actual length of the bar is determined by the command sent. There are LEDs lit every ten places across the top of the display to make the graph more readable. The graph will start from the left and fill right as numbers are plugged in. If desired, you can display the number being represented by the graph on the right side of the display.

### **^Bn SELECT BLINK MODE**

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

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

### **^Cn SELECT CENTER MODE**

This command lets the user center text on the display.

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

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

This command allows the host to scroll information from right to left on a display line. The line where the terminal cursor resides when this command is accepted is the line where the text will scroll. Prior to the text being scrolled onto the line, the line is cleared of all data. The <message text> portion of the command consists of any of the printable ASCII characters shown in Section 8 of this manual. This portion of the command can consist of no more than 255 characters.

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

## 5 *ASCII Protocol*

---

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

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

### **^En RESET DISPLAY**

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

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

### **^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 row...valid range for 1100/1200 display
- cc = 01–20 column...valid range for 1100/1200 display

## 5 ASCII Protocol

---

### **^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 advance the cursor to the beginning of the display and the line will be cleared. If new line is *off*, a carriage return will advance the cursor to be advanced to the beginning of the line that it is currently on, but the line will not be cleared. 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

### **^Xn BLINK DELIMITER**

This command will be used to blink individual characters or groups of characters within a message. Once blink is turned on, the characters after the command will blink until blink is turned off.

n = 0 = blink is off  
n = 1 = blink is on

### **^ Yn RELAY CONTROL**

This command is used to control the PMD 1100/1200/1205 relay. It was added for the software revision "C".

n = 0 = relay is off  
n = 1 = relay is on

## 5 *ASCII Protocol*

---

### Sample Messages

In this section, we will give you samples of some messages with an ASCII format. The first message will be sent to group 04, unit 0312. This message will be centered with the message “Bin 6 is EMPTY.” The word “EMPTY” will be flashing.

```
^A040312^C1Bin 6 is ^X1EMPTY^X0
```

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

The second sample message will be sent to all units in group 07 scrolling from right to left.

```
^A070000^D1Current Regulator Out of Range / Unit #3<CR>
```

---

## 6 General Specifications

---

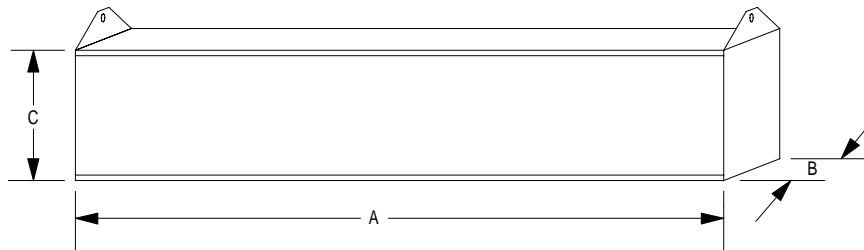
<b>Power Supply:</b>	102–132 VAC (P1 Socket) @ 47– 68 Hz 194–250 VAC (P2 Socket) @ 47–68 Hz
<b>VA Rating:</b>	45 VA
<b>Fuse Rating:</b>	3/4 A @ 115 VAC 3/8 A @ 230 VAC
<b>Operating Temperature:</b>	0 to 60° C Ambient
<b>Storage Temperature:</b>	-40 to 95°C Ambient
<b>Humidity:</b>	10–95% RH Non-Condensing
<b>Electrical Interference Tolerance:</b>	NEMA ICS 2–230 Showering Arc Test ANSI C37.90a-1974 (SWC) Surge Withstand Capability Test
<b>Weight — 1100:</b>	Approx. 15 lbs for 1100-1 (multiply this weight by the number after the hyphen (-2,-3, etc.) for an approx. weight of your unit)
<b>— 1200/1205:</b>	Approx. 40 lbs for 1200-1 (multiply this weight by the number after the hyphen for an approx. weight of your unit)
<b>Baud Rate:</b>	1200 or 9600 Baud
<b>Communication Parameters:</b>	RS-422 or RS-485, PMD or ASCII Protocol
<b>Character Height:</b>	PMD 1100 = 2" (50.8 mm) PMD 1200 = 4" (101.6 mm)
<b>Characters/Line:</b>	20 Characters per line
<b>Display Type:</b>	Red LED 5 x 7 matrix
<b>Relay:</b>	Form "A" — 8 Amps @ 250 VAC

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## 7 Outline and Dimensions

This section of the manual shows the dimensions of the different units.

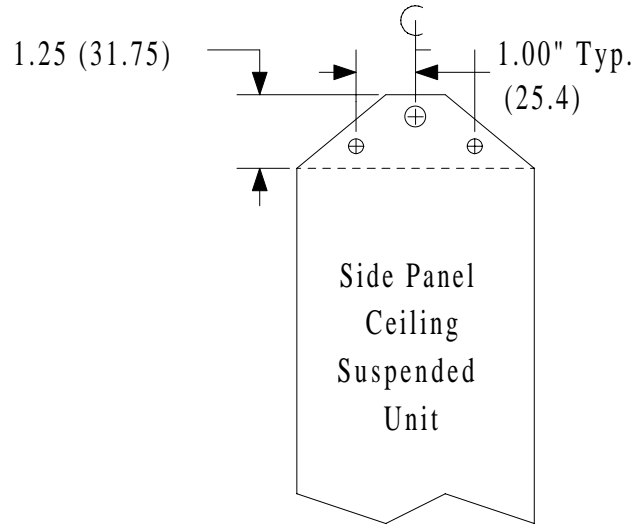


*Figure 13. Outline dimensions of PMD 1100*

<b>Unit Description</b>	<b>Dimension A</b>	<b>Dimension B</b>	<b>Dimension C</b>
1100-1	38.45 (976.71)	4.22 (107.29)	4.25 (107.95)
1100-2	38.45 (976.71)	4.22 (107.29)	8.52 (216.41)
1100-3	38.45 (976.71)	4.22 (107.29)	12.79 (324.87)
1100-4	38.45 (976.71)	4.22 (107.29)	17.06 (433.32)
1100-5	38.45 (976.71)	4.22 (107.29)	21.33 (541.78)
1100-6	38.45 (976.71)	4.22 (107.29)	25.60 (650.24)
1100-7	38.45 (976.71)	4.22 (107.29)	29.87 (758.70)
1100-8	38.45 (976.71)	4.22 (107.29)	34.14 (867.16)
1200-1	74.45 (1891.03)	4.22 (107.29)	6.50 (165.10)
1200-2	74.45 (1891.03)	4.22 (107.29)	13.02 (330.71)
1200-3	74.45 (1891.03)	4.22 (107.29)	19.54 (496.32)
1200-4	74.45 (1891.03)	4.22 (107.29)	26.06 (661.92)
1200-5	74.45 (1891.03)	4.22 (107.29)	32.58 (827.53)
1200-6	74.45 (1891.03)	4.22 (107.29)	39.10 (993.14)
1200-7	74.45 (1891.03)	4.22 (107.29)	45.62 (1158.75)
1200-8	74.45 (1891.03)	4.22 (107.29)	52.14 (1324.36)
1205-1	38.45 (976.71)	4.22 (107.29)	6.50 (165.10)
1205-2	38.45 (976.71)	4.22 (107.29)	13.02 (330.71)
1205-3	38.45 (976.71)	4.22 (107.29)	19.54 (496.32)
1205-4	38.45 (976.71)	4.22 (107.29)	26.06 (661.92)
1205-5	38.52 (978.48)	4.22 (107.29)	32.58 (827.53)
1205-6	38.52 (978.48)	4.22 (107.29)	39.10 (993.14)
1205-7	38.52 (978.48)	4.22 (107.29)	45.62 (1158.75)
1205-8	38.52 (978.48)	4.22 (107.29)	52.14 (1324.36)

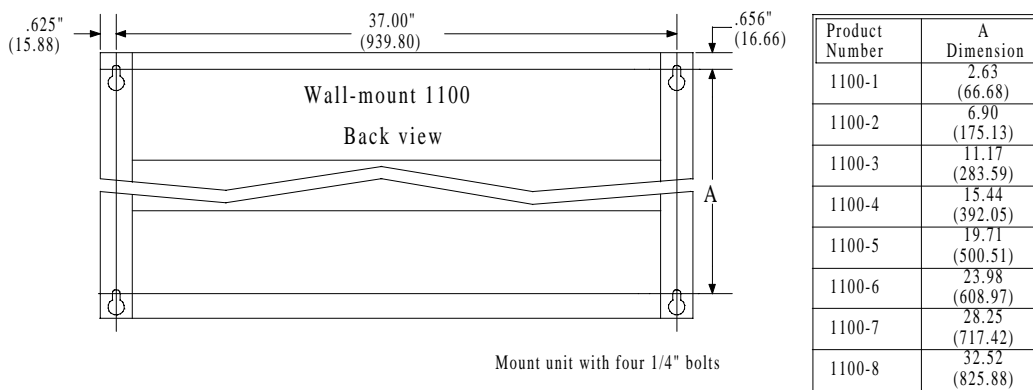
## 7 Outline and Dimensions

For ceiling-suspended units, add 1.25" (31.75) to the **C** dimension in figure 13. For wall-mounted units, add .59" (14.99) to the **B** dimension in figure 13. Figure 14, below, shows the location of the mounting holes for the ceiling suspended units. Be sure to use adequately rated chain to suspend the unit.



**Figure 14. Mounting holes for ceiling-suspended units**

For wall-mount units, you will need to locate the mounting holes prior to the installation of the unit. Figure 15, below, gives you the hole locations for the PMD 1100 wall-mounted units.



**Figure 15. Mounting dimensions for wall-mount PMD 1100s**

## 7 Outline and Dimensions

Figure 16 gives you the hole locations for the PMD 1200 wall-mounted units.

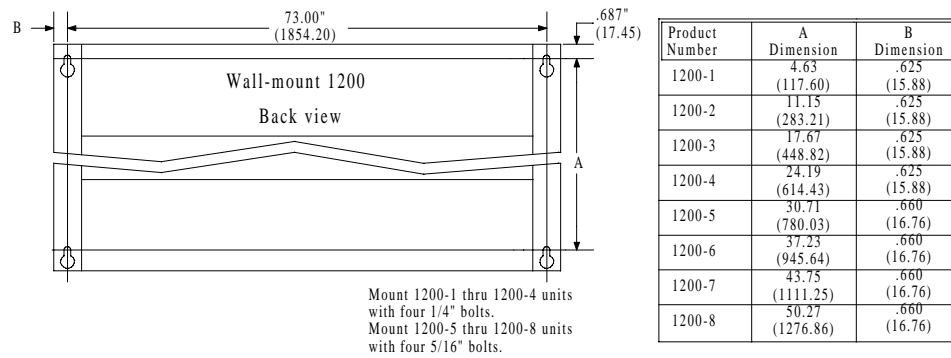


Figure 16. PMD 1200 wall-mount dimensions

Figure 17 gives the hole locations for the PMD 1205 wall-mount units.

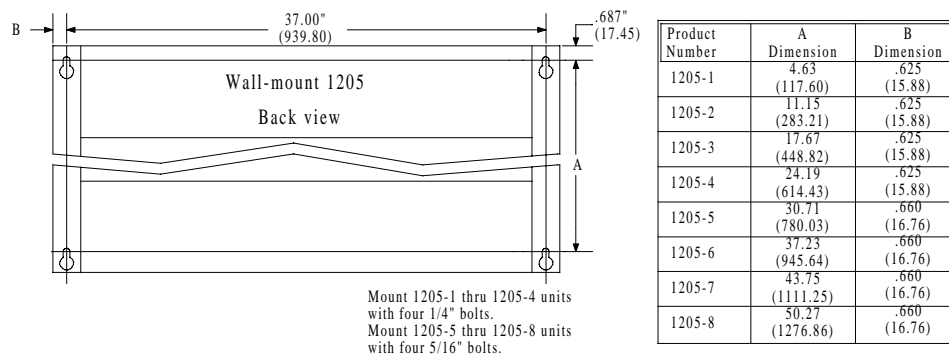
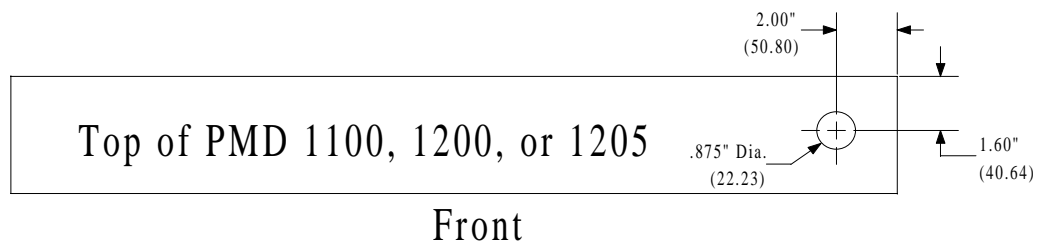


Figure 17. PMD 1205 wall-mount dimensions.

## 7 Outline and Dimensions

For all PMD 1100, PMD 1200, and PMD 1205 units, there is a hole for routing the power and communication wires into the unit. The locations for this hole is on the top of the unit on the right side. The dimensional location is shown in figure 18, below.



*Figure 18. Cable routing hole location*

## 8 International Character Sets

The PMD 1100/1200 slave displays messages in 7 international character sets in addition to U.S. The 1100/1200 slave is set to the specific character set on positions 2, 3, and 4 on Switch Two (see section 2, 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.

	AMERICA	CYRILLIC	GERMANY	ENGLAND	DENMARK	SWEDEN	FRANCE	KANA
# 35								
\$ 36								
ø 64								<SPACE>
A 65								
B 66								
C 67								
D 68								

Figure 19. ASCII conversion chart

## 8 International Character Sets

	AMERICA	CYRILLIC	GERMANY	ENGLAND	DENMARK	SWEDEN	FRANCE	KANA
E 69								
F 70								
G 71								
H 72								
I 73								
J 74								
K 75								
L 76								
M 77								
N 78								
O 79								
P 80								
Q 81								
R 82								
S 83								
T 84								

## 8 International Character Sets

	AMERICA	CYRILLIC	GERMANY	ENGLAND	DENMARK	SWEDEN	FRANCE	KANA
U 85								
V 86								
W 87								
X 88								
Y 89								
Z 90								
[ 91								
\ 92								
] 93								
^ 94								
_ 95								
· 96								
a 97								
b 98								
c 99								
d 100								

## 8 International Character Sets

	AMERICA	CYRILLIC	GERMANY	ENGLAND	DENMARK	SWEDEN	FRANCE	KANA
e 101								
f 102								
g 103								
h 104								
i 105								
j 106								
k 107								
l 108								
m 109								
n 110								
o 111								
p 112								
q 113								
r 114								
s 115								
t 116								



## 8 International Character Sets

	AMERICA	CYRILLIC	GERMANY	ENGLAND	DENMARK	SWEDEN	FRANCE	KANA
u 117								
v 118								
w 119								
x 120								
y 121								
z 122								
{ 123								
 124								
} 125								
~ 126								

## **8    *International Character Sets***

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## 9 Error Messages

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The PMD slave will return error messages — either on its display or in computer control command message replies — when problems occur during operation.

The following paragraphs discuss the error messages sent by the PMD 1100/1200 Slave Message Display.

### PMD Master Control Errors

#### No Communications

This message indicates that communications between a master PMD display and a PMD slave have been broken.

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

If seven seconds lapse since receiving this information, the PMD slave will display the “NO COMMUNICATIONS” message until time and date information is received or a new message is selected. If time/date data is received, the display will clear the error message. If a message is selected, the new message will be displayed.

*NOTE: 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 reapplied.*

### 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

## **9 Error Messages**

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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 that 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.

---

## **10 XOR Checksum**

---

PMD slaves use the EOR (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 message code byte. The new 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, then the two-byte XOR checksum would be 06F9 HEX.

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## **10 XOR Checksum**

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