



Vorne Industries

M1000
Serial Message Display
User's Manual

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Notice Of Disclaimer

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Chapter 1 Setting Up Your Display For Operation

This chapter describes how to set up the display hardware for operation, including setting the dip switches, connecting power, and wiring to the serial communication port. There are many references in this chapter to the term **host device**. Simply stated, the host device is whatever device will be sending serial data to the M1000 display. Some typical host devices are PLC BASIC modules, computers, scales, master clock systems, panel meters, etc.

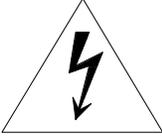
1.1 Accessing Wiring Connections And Selection Switches

All external power and communication line connections to the display are made to printed circuit board mounted terminal strips. These terminal strips, as well as a COM PORT selection switch can be accessed by removing the wiring user access plate.



WARNING - SHOCK HAZARD

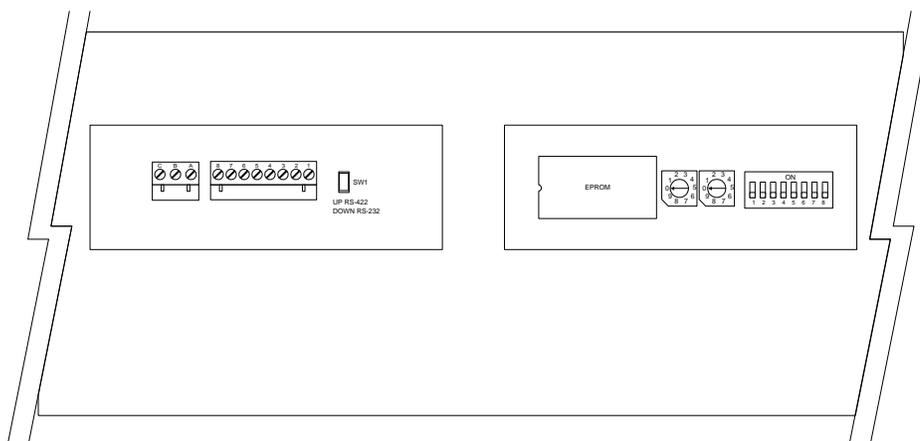
Always completely disconnect power from the display before opening the user access plate. Do not reapply power to the display until the access plate has been reinstalled and securely closed.



There are three liquid tight fittings on the Wiring access plate, provided for bringing external wiring into the display enclosure. The left most conduit opening is provided for power wiring, the center and right most for signal wiring. **It is not recommended to run power wiring and signal wiring in the same conduit!**

A 8 position DIP switch, two rotary DIP switches, and the EPROM of the unit can be accessed by removing the rightmost access plate.

Access Plates



1.2 Setting The DIP Switches For Your Application

Note: Changes to the DIP switches are only acknowledged at power up. Factory default settings are shown in gray.

Baud Rate

The **baud rate** of your M1000 series display determines how fast serial data will be communicated to the display. In all cases this setting must match the baud rate of the device that will be sending serial data to the display (the host device).

| 3 | 2 | 1 | Baud Rate |
|-----|-----|-----|-----------|
| OFF | OFF | OFF | 300 |
| OFF | OFF | ON | 600 |
| OFF | ON | OFF | 1,200 |
| OFF | ON | ON | 2,400 |
| ON | OFF | OFF | 4,800 |
| ON | OFF | ON | 9,600 |
| ON | ON | OFF | 19.2K |
| ON | ON | ON | NOT USED |

Data Bits

The number of Data Bits selected must match the number of data bits transmitted by the host.

| 4 | Data Bits |
|-----|-----------|
| ON | 8 |
| OFF | 7 |

Power Up Font

The Power Up font determines what font the M1000 will use after power up. All data received after power up will use this font setting until a new font command is selected.

| 7 | 6 | 5 | Font # | Description |
|-----|-----|-----|--------|--|
| OFF | OFF | OFF | 1 | 2 lines by 20 characters |
| OFF | OFF | ON | 1 | 2 lines by 20 characters |
| OFF | ON | OFF | 2 | 2 lines by 15 characters |
| OFF | ON | ON | 3 | 1 line by 10 characters |
| ON | OFF | OFF | 4 | 1 line by 8 characters |
| ON | OFF | ON | 5 | 1 line by 15 characters |
| ON | ON | OFF | 6 | 1 line by 12 characters |
| ON | ON | ON | 1 | 2 lines by 20 characters. Powers up blank. |

At power up the M1000 displays a diagnostic screen which shows the firmware version, and an information screen which shows the Baud rate, Data bit and address setting. Six seconds after this message appears, the unit will accept serial data.

Reserved

Switch 8 is reserved for future features, or custom operation.

| | |
|----------|-----------------|
| 8 | Reserved |
| ON | Special |
| OFF | Standard |

Unit Address Switches

Unit Address is a rotary DIP switch selection that allows you to select an individual unit address. Individual unit addresses can range from **01** to **99**, allowing up to 99 displays to be individually addressed in a network. Address **00** selects no address.

Addressing Multiple Displays

Using an RS-422 or RS-485 network (described in Section 1.6 RS-422 Or RS-485 Communication To One Or More Displays) together with addressing allows a host computer or PLC to communicate with specific individual displays. Each display in the network may be assigned a unit address. If you do not need to address individual displays, simply leave the display set to the default setting of address 00, and skip this section.

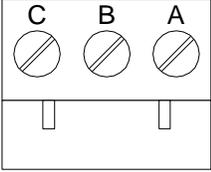
If a message is directed to a specific unit address, only units set to that address will respond to the data. More than one display may use the same unit address. Remember, if the data in the message is meant for a specific unit address, the address command must follow the **<ESC>** character in the transmission packet (as shown in the examples below).

The following examples assume that Unit Address is set to **10**.

| To Show Only On Displays With A Unit Address Of 10... | Transmit |
|---|--------------------------|
| Hello | <ESC>10AHello<CR> |
| Test Message | <ESC>10ATest Message<CR> |

1.3 Connecting Power To The Display

Power connections are made to the three pin POWER terminal strip (marked A B C). Connect power to this terminal strip as shown below. For M1000-120 refer to the 120VAC wiring. For M1000-220, refer to the 220VAC wiring. Wiring the unit to the wrong power supply voltage can cause damage to the display.

| 3 Pin POWER Terminal Strip (P1) | Pin | 120 VAC Powered Units | 220 VAC Powered Units |
|---|-----|-----------------------|-----------------------|
|  | A | 120 VAC (Hot) | 220 VAC (Hot) |
| | B | 120 VAC (Neutral) | 220 VAC (Neutral) |
| | C | Earth Ground | Earth Ground |

Proper grounding is an important aspect of power wiring, both as a safety measure and for improved electrical noise immunity. **Always** connect Earth Ground to the M1000 display. The power requirement for the M1000 display is listed in Appendix A.



WARNING

Terminal C (Earth Ground) must always be connected to a reliable low impedance earth ground. This provides a safety ground to the enclosure, as well as a return path for electrical noise.

1.4 Basic Information About Serial Communication Ports

This section provides some basic background information regarding different types of serial communication ports. Each M1000 display contains both an RS-232 port and an RS-485 port (which is also compatible with RS-422 communication), however, *only one of the two ports can be used at any given time to communicate with a host device.*

RS-232 ports are the most common type of serial ports, although they are more common in an office environment than an industrial environment. This is because RS-232 can only be run for short distances (under 50 feet), and in environments where EMI (electromagnetic interference) is minimal. Also, one host RS-232 port is normally limited to directly communicating with one device. Every M1000 display has a built in data converter that overcomes this limitation.

RS-422 ports are very common in industrial environments. They are well suited for distances up to 4000 feet, and have substantially superior EMI immunity characteristics. Additionally, one host RS-422 port can communicate with a minimum of 10 devices without repeating the signal.

RS-485 ports are basically an improved version of RS-422, and in most cases are completely compatible with RS-422 devices (and vice versa). In fact, many newer products with built in RS-422 ports actually use driver circuits that meet the RS-485 specification (M1000 displays fall

into this class). RS-485 offers better EMI immunity characteristics, and improved drivers that have the ability to communicate with up to 32 devices without repeating the signal. There is sometimes confusion regarding RS-485 because it has an additional ability to communicate in both directions over one pair of wires, a feature not supported by RS-422 or by the M1000 display.

20 mA current loop was commonly used for industrial applications in the past but is less common today. To use a 20mA current loop serial port with an M1000 display, all that is required is an external 20 mA current loop to RS-422 converter. Vorne can provide such a converter if your application requires it.

1.5 RS-232 Communication To A Single Display

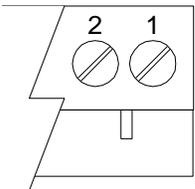
This section provides the information necessary to successfully interface a host RS-232 port to one M1000 display. If you would like to interface a host RS-232 port to multiple M1000 displays, read this section as well as sections 1.6 and 1.7.

Selecting RS-232 Communication

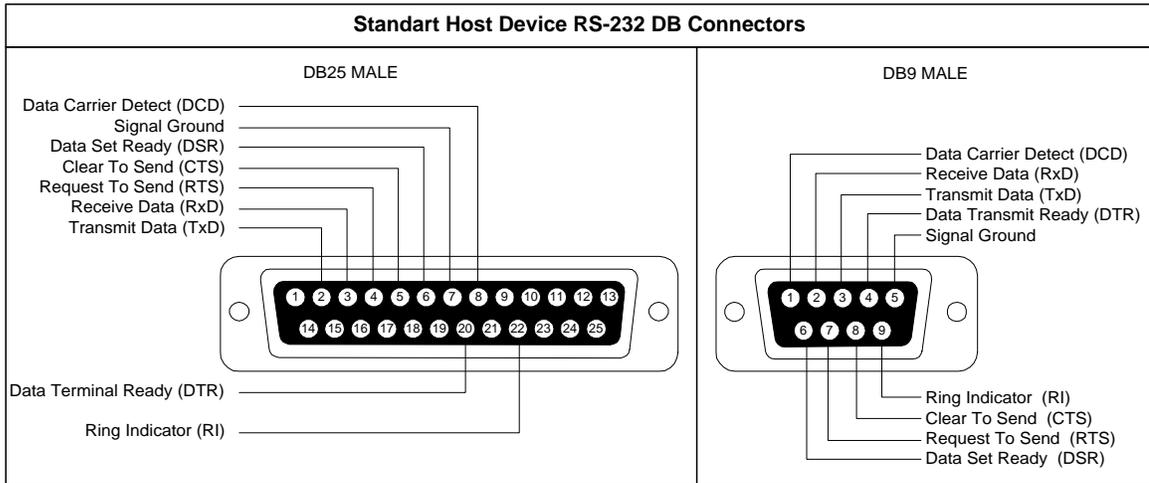
A printed circuit board mounted COM PORT push / pull switch (labeled SW1), located approximately one inch to the right of the 8 pin COM PORT terminal strip, is used to select between RS-232 and RS-422/RS-485 communication. When the switch is pushed down, RS232 is selected. If the switch is pulled up, RS422/RS485 is selected. Set this switch to the **RS-232** position.

RS-232 Connectors

The RS-232 port is fully opto-isolated and is available on pins 1 and 2 of the 8 pin communication port terminal strip (marked 1 through 8). The RS-232 portion of this terminal strip is shown below.

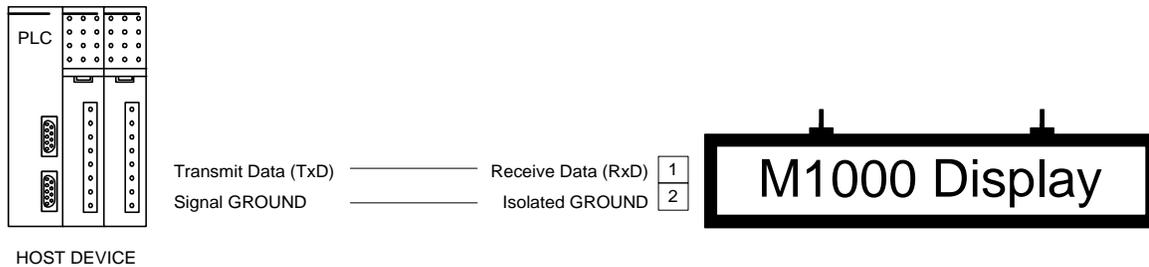
| 8 Pin COM PORT Terminal Strip (P2) | Pin | Function |
|--|--------|--|
| Pins 1 and 2 RS-232 Port  | 1 2 | RS-232 Receive Data (RxD) Isolated Communication GROUND |

Many host devices use either DB25 or DB9 connectors for their RS-232 ports. For your reference, two common RS-232 DB interfaces are shown on the next page. They are the standard male DB25 interface, and the standard male IBM/AT® style DB9 interface.



Wiring Diagram For An RS-232 Host Device To One Display

The only connections necessary for one way communication between a host device and an M1000 display are the ones shown in the diagram below. Please refer to the Guidelines For Wiring RS-232 Devices section below for important wiring recommendations.



Guidelines For Wiring RS-232 Devices

For best results when wiring RS-232 devices please follow these guidelines:

1. Use a 50 foot maximum cable length.
2. Use a baud rate of 19,200 or less.
3. Use a shielded cable with the shield connected to Earth Ground *only at the M1000 display*. Belden 9842 is a recommended cable.
4. Carefully check your equipment and cable to ensure that Earth Ground is *not* connected at both ends of the cable. If there is a significant difference in Earth Ground potential between the two ends of the cable, it could cause data transmission errors, or even damage to the RS-232 communication ports.
5. Keep the cable length as short as possible, and do not run the RS-232 cable parallel to any power cables.

1.6 RS-422 Or RS-485 Communication To One Or More Displays

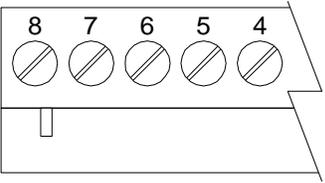
This section provides the information necessary to successfully interface a host RS-422 or RS-485 port to one or more M1000 displays. Note that the M1000 display contains an opto-isolated RS-485 port which is also fully compatible with RS-422 host devices.

Selecting RS-422/RS-485 Communication

A printed circuit board mounted COM PORT push / pull switch (labeled SW1), located approximately one inch to the right of the 8 pin COM PORT terminal strip, is used to select between RS-232 and RS-422/RS-485 communication. When the switch is pushed down, RS232 is selected. If the switch is pulled up, RS422/RS485 is selected. Set this switch to the **RS-422** position.

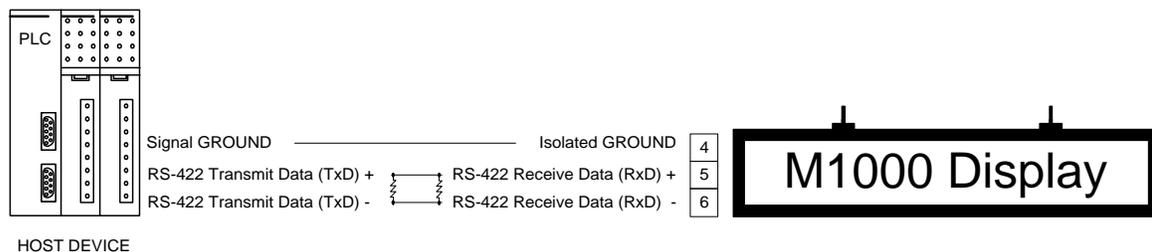
RS-422/RS-485 Connectors

The RS-422/RS-485 port is fully opto-isolated and is available through the last five pins of the eight pin communication port terminal strip (marked 1 through 8). The RS-422/RS-485 portion of this terminal strip is shown below.

| 8 Pin COM PORT Terminal Strip (P2) | Pin | Function |
|---|-----|------------------------------------|
| Pins 4 to 8 RS-422/RS-485 Port  | 4 | Isolated Communication GROUND |
| | 5 | RS-422/RS-485 Receive Data (RxD) + |
| | 6 | RS-422/RS-485 Receive Data (RxD) - |
| | 7 | RS-422/RS-485 Retransmit + |
| | 8 | RS-422/RS-485 Retransmit - |

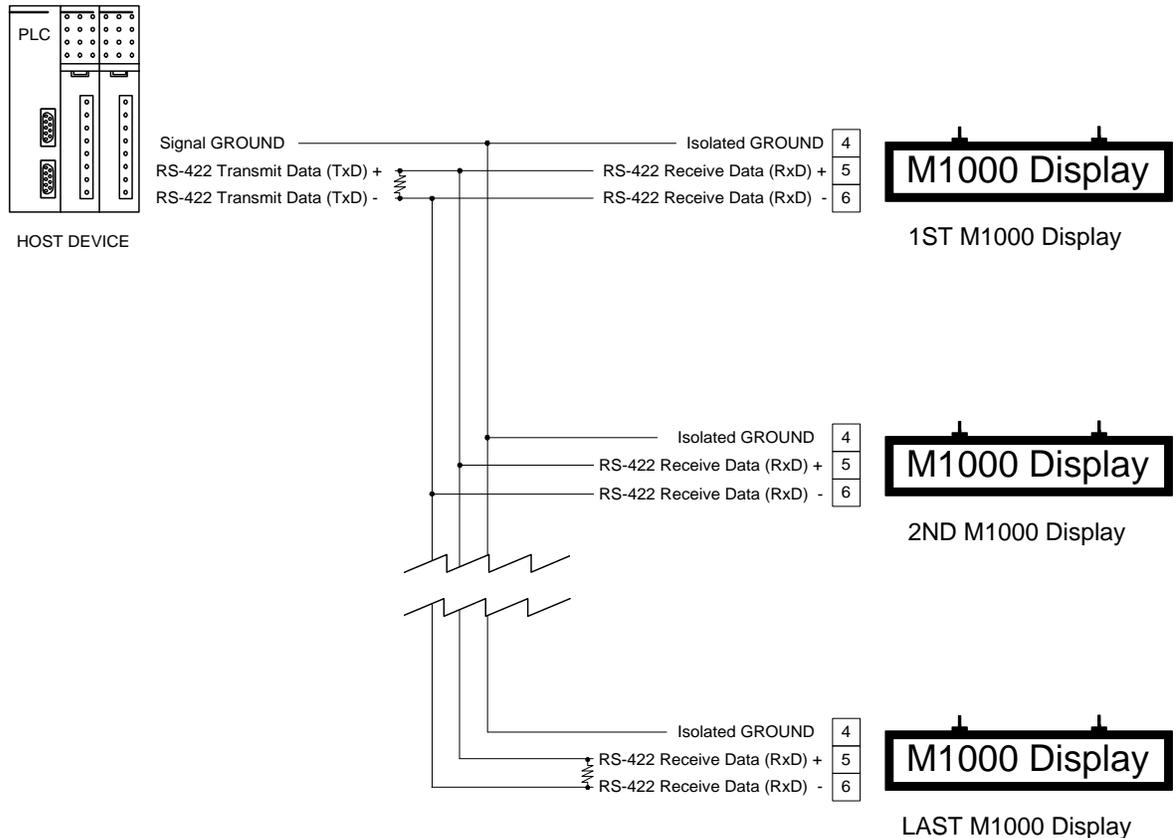
Wiring Diagram For An RS-422 Or RS-485 Host Device To One Display

Below is a diagram which shows how to wire an RS-422 (or RS-485) host device to one display. Please refer to the Guidelines For Wiring RS-422 Or RS-485 Devices section below for important wiring recommendations, and take special note of the two terminating resistors shown in the diagram below.



Wiring Diagram For An RS-422 Or RS-485 Host Device To More Than One Display

Below is a diagram which shows how to wire an RS-422 (or RS-485) host device to multiple displays. Please refer to the Guidelines For Wiring RS-422 Or RS-485 Devices section below for important wiring recommendations, and take special note of the two terminating resistors shown in the diagram below.



Guidelines For Wiring RS-422 Or RS-485 Devices

For best results when wiring RS-422 or RS-485 devices please follow these guidelines:

1. Use a 4,000 foot maximum total cable length.
2. Use a maximum of 10 displays connected to one RS-422 host port, or 32 displays connected to one RS-485 host port unless your host device specifies a higher number.
3. Use a shielded cable with the shield connected to Earth Ground *only at the M1000 display*. Belden 9843 is a recommended cable.
4. Carefully check your equipment and cable to ensure that Earth Ground is *not* connected at both ends of the cable. If there is a significant difference in Earth Ground potential between the two ends of the cable, it could cause data transmission errors, or even damage to the RS-422 or RS-485 communication ports.

5. Terminate the cables. *In all RS-422 and RS-485 installations, the cable must be correctly terminated with a set of resistors, one set at each end of the network. This applies even if you are only using one display connected to one host device.* The terminating resistors prevent reflection problems that can interfere with data transmission. The resistance value of the terminating resistors should match the characteristic impedance of the cable. A typical value is 120 ohms. The terminating resistors must be placed at the two farthest ends of the RS-422 or RS-485 network, regardless of where the host device is. In some cases host device RS-422 and RS-485 ports have built in or optional terminating resistors. Take care to check that your network (whether it has one display or 32 displays) has only one set of terminating resistors.
6. In applications with multiple displays, bring the communication wiring point to point. In other words do not run stubs from the "backbone" network wiring to each display. If you find it absolutely necessary to run a stub from the backbone network wiring, make sure it is under one foot in length.

1.7 RS-232 Communication To More Than One Display

M1000 displays have a built in data converter that can be used to convert host device RS-232 data to RS-485 data and vice versa. This allows the host device to communicate via RS-232 to one M1000 display (called the **converting display**), which will retransmit any RS-232 data received from the host device as RS-485 data to all other displays in the network.

To wire a network of displays that can be communicated to from one host device RS-232 port, follow these steps:

- Step 1:** Wire your host device RS-232 port to the first display's RS-232 port as described in Section 1.5 RS-232 Communication To A Single Display. This display will be the converting display. Make sure to set the COM PORT push / pull switch to the **RS-232** position *only* for the converting display. All other displays in the network should have the COM PORT push / pull switch set to the **RS-422** position.
- Step 2:** Use the converting display's RS-485 port to connect to other displays in the network as described in Section 1.6 RS-422 Or RS-485 Communication To One Or More Displays. Where Retransmit + of the converting display is connected to RxD+ of the other displays in the network and Retransmit - of the converting display is connected to RxD- of the other displays in the network.

Chapter 2 Message Structure and Escape Commands

The M1000 is a serial input alphanumeric display capable of receiving and displaying RS232, RS422 or RS485 serial ASCII data with field selectable data formats and baud rates. The full set of 256 ASCII characters can be displayed with a variety of display fonts, allowing versatile display formatting. A simple to use command structure provides for scrolling, sparkling and blinking text, as well as intensity control of the display.

Communication to the M1000 is accomplished by sending a formatted string of ASCII literal characters and escape commands terminated with a <CR> (carriage return) to the display. The maximum length of a transmission is 256 characters, including all escape commands, literal characters and terminating characters.

The following example outlines the basic protocol for communication with the display. In this example literal characters are represented by (t) and the most important position dependent escape commands are shown. A more complete discussion of the escape commands follows.

<ESC>##A<ESC>#Ltt. ..tttt<CR>

<ESC>##A (address) must be the first group of characters. This allows the M1000 to recognize the subsequent data. An address can appear only once in a message.

<ESC>#L (line number), if used, must follow the address command. The subsequent text is displayed on the specified line.

<CR> is the terminating character and causes action to take place on the message just received. Previous information on the M1000 continues to be displayed while a new message is received (up to the receipt of <CR>).

#'s are ASCII numbers 0 to 9, -, or +. A field of ### can have a maximum value of 255. Absence of a # implies 0. A + or - without a number, implies +1 or -1.

Example Message

<ESC>24A<ESC>S Test Message<CR>

The example packet would send the message:

<ESC>S Test Message

to a M1000 display set to address 24. The script instructs the M1000 display to scroll the text " Test Message" on the first line.

Displaying Literal Text

The most basic message for a M1000 display involves the printing of literal text on the LED display. The message for this function is formed exactly as it is to be displayed. For example, to display the phrase "Hello, world!", the message would be composed of the text within the double quotes. The cursor will be left in the character position immediately following the displayed text.

Message #1:

Hello, world!

If a second message "Bad results." immediately follows the first message, it would over write the first phrase because the display is cleared before each new message is displayed. This feature can be changed by using the Implicit Clear command described in section 2.10.

The M1000 display treats incoming text much like a terminal. Characters will be placed one after the other on the screen until the end of the display line is reached. When the end of the display line is reached, one of two possible results can occur. If the text was on the top line, additional characters will be placed on the display starting at the leftmost position of the bottom line. If the text was on the bottom line, any characters received past the end of the line are not displayed.

Using Control Characters

Control characters can be used to control how messages appear on the display. These control characters are treated as special functions by the display. They allow a message to clear the screen and move the cursor around the screen simply by including them as part of the message text. The Table below gives a list of available control characters. Since control characters are not displayable on most terminals or computers, a control character in this manual will always be depicted as a code name abbreviation enclosed between angle brackets. For example, the ASCII Form Feed character, decimal value 12, will be shown as <FF>. The real message must contain the actual ASCII code (see Literal Control Characters later in this section).

Control Characters

| Code Name | Hex | Abbr. | Function |
|--------------------------|-----|-------|--|
| Null | 00h | <NUL> | Ignored |
| End of Transmis- sion | 04h | <EOT> | Marks the end of a scrolled portion of text. |
| Backspace | 08h | <BS> | Move the cursor back (left) one position. |
| Horizontal Tab | 09h | <HT> | Move the cursor to the next tab stop. Stops are set at character columns 8 and 16. |
| Line Feed | 0Ah | <LF> | Ignored. (allows <CR><LF> combinations as termina- tors). |
| Vertical Tab | 0Bh | <VT> | Move the cursor to the leftmost position of the next line. |
| Form Feed | 0Ch | <FF> | Clear the display and move the cursor to the leftmost position of the top line. |
| Carriage Return | 0Dh | <CR> | Terminates a message. |
| Escape | 1Bh | <ESC> | Process the next characters as a command. |

Command Strings

The combination of literal text and the control characters shown above illustrate how a great variety of text can be displayed on the M1000. Additional features such, as blinking and different fonts require an additional control character, <ESC>. The <ESC> character, decimal value 27, is used by the M1000 to mark the beginning of a special display command. All extended functions are built using escape command sequences.

All escape command strings must begin with the <ESC> character and end with an upper or lower case letter. The letter is the part of the sequence, which describes its function. Since there are 26 letters in the alphabet and both upper and lower case letters are used, there are 52 possible commands available. The M1000 uses far less than 52, making it possible to let the letter have meaning to the user. For example, the letter 'B' is used to end the Blink command and 'C' refers to the Cursor command.

Between the <ESC> character and the command letter is the argument list for the command. It is the argument list, which allows the cursor command to move to a specific location or choose whether blink should be on or off. An individual argument is a number in the range -1 to +255. A semicolon is placed between adjacent arguments to separate them. The arguments are arranged in a reverse ordered list called a stack. As the display reads the escape sequence, it must separate the arguments.

The display considers an argument to begin when it finds a digit, '0' through '9', or a '+', or a '-'. The end of the argument is assumed to be the first non-digit found. If the sequence is correctly formatted, all arguments will end with a semicolon or the actual command letter for the function.

Once the display has found an entire argument, it is placed on the stack, as shown in the Stack Handling Table on the next page. The arguments wait on the stack until the display finds a command letter. When the command letter is found, the display begins removing arguments from the top of the stack to use in the command. The very first argument removed from the stack will always be the argument immediately preceding the command letter. If an argument list is shorter than the number required for a command, then attempting to get an argument from the stack will result in a zero value argument. Please note the shortcut arguments used in The Stack Handling Table. They are used to conserve message space. Extra spaces preceding an argument are ignored. This accommodates serial systems, which insert a leading space for any positive number printed.

Stack Handling

| Sequence | Stack After Sequence Has Been Read |
|--------------------|---|
| <ESC>C | Top: 0 Note: No argument Defaults to zero |
| <ESC>2;3C | Top: +3 Bottom: +2 |
| <ESC>2;-3;5C | Top: +5 Next: -3 Bottom: +2 |
| <ESC>-;+C | Top: +1 '+' is a shortcut for +1 Next: 0 No argument = 0 Bottom: -1 '-' is a shortcut for -1 |
| <ESC>255;-;3;0;+;C | Top: 0 No argument = 0 Next: +1 '+' is a shortcut for +1 Next: 0 Next: +3 Next: -1 '-' is a shortcut for -1 Bottom: +255 |

Each command letter determines the number of arguments required and the valid values that can be assigned. For example, the Cursor command (command letter C) expects to find two arguments on the stack. The top of the stack is always considered to be the column position and the next argument is always the line position.

For the first sequence in the table above, <ESC>C, the column to move to is zero. The Cursor command expects two arguments to be present in the script. The missing argument will be given the value of zero. In this case, the result should be to move the cursor to column zero, line zero. Since zero is not a valid value, the value "zero" will be replaced with the value "one". The actual result of this script would be to move the cursor to column one, line one.

In the third sequence, the column value is five. The line value "-3" is negative. For negative Line values, the result will be no line cursor movement. Therefore, the result of this sequence would be to move the cursor to column five of the current line. The Cursor command only expects two arguments and the third sequence has more than two arguments. When more arguments are present than expected, the extra arguments will be discarded.

Virtually every feature of the M1000 display can be accessed with some kind of escape sequence, allowing messages to have complete control of the M1000 display unit. Escape sequences fall into two broad categories: Display Attribute Control and Script Flow Control. Display Attribute controls are used to determine the appearance of the displayed text. Script Flow controls are used to control the order in which it is processed. The following Table summarizes the standard M1000 series escape sequences.

Standard M1000 Display Escape Sequences

| Command | Letter | Type | Description |
|----------------------|--------|--------------|---|
| Marker | @ | Flow | Mark the return place for a Goto command. |
| Blink | B | Display | Control blinking of characters. |
| Inverse Blink | b | Display | Select inverse blink. |
| Cursor | C | Display | Set the next display write position. |
| Absolute cursor move | c | Display | Reposition cursor to pixel location. |
| Font | F | Display | Choose a character set. |
| Goto | G | Flow | Loop back to a script marker. |
| Graphics | g | Display | Select graphics mode. |
| Hue | H | Display | Set character foreground & background color. |
| Intensity | I | Display | Set brightness level. |
| Implicit Clear | i | Display | Select new message handling. |
| Line | L | Display | Select line to use. |
| Lock Message | l | Flow | Lock message until completed. |
| Move Pixel Cursor | m | Display | Move pixel cursor specified distance. |
| Pixel Draw | p | Display | Select color of pixel location. |
| Repeat | R | Display | Repeat character a specified number of times. |
| Scroll | S | Flow/Display | Set scrolling for the current line. |
| Wait | W | Flow | Stop message execution for a while. |

Simple Examples To Try

This example assumes that the unit address is set to 0. Refer to the following sections for more information on the Scroll (2.17), Cursor (2.3), and Blink (2.1) commands used below.

Let's display message "Status OK!" on line 1 of the display.
Status OK!<CR>

Now, let's scroll the message "Status OK! " on line 2 of the display.
<ESC>2;1C<ESC>28;SStatus OK! <CR>

Notice that the fixed text on line 1 was not cleared.

Now, let's blink the text "WARNING! " on line 1 of display starting at column 8.
<ESC>1;8C<ESC>128;+BWARNING!<ESC>-B<CR>

Once the blink message is received, the scrolling message will stop scrolling and the blinking message will appear in the location specified without clearing the first line.
We're done!

Literal Control Characters

| Control Character | HEX/ASCII Value | Decimal Value | Character |
|-------------------|-----------------|---------------|-----------|
| <NUL> | 0 | 0 | NA |
| <SOH> | 1 | 1 | ␣ |
| <STX> | 2 | 2 | ␢ |
| <ETX> | 3 | 3 | ␣ |
| <EOT> | 4 | 4 | NA |
| <ENQ> | 5 | 5 | ␣ |
| <ACK> | 6 | 6 | ␣ |
| <BEL> | 7 | 7 | ␣ |
| <BS> | 8 | 8 | NA |
| <HT> | 9 | 9 | NA |
| <LF> | 0A | 10 | NA |
| <VT> | 0B | 11 | NA |
| <FF> | 0C | 12 | NA |
| <CR> | 0D | 13 | NA |
| <SO> | 0E | 14 | ␣ |
| <SI> | 0F | 15 | ␣ |
| <DLE> | 10 | 16 | ␣ |
| <DC1> | 11 | 17 | ␣ |
| <DC2> | 12 | 18 | ␣ |
| <DC3> | 13 | 19 | ␣ |
| <DC4> | 14 | 20 | ␣ |
| <NAK> | 15 | 21 | ␣ |
| <SYN> | 16 | 22 | ␣ |
| <ETB> | 17 | 23 | ␣ |
| <CAN> | 18 | 24 | ␣ |
| | 19 | 25 | ␣ |
| <SUB> | 1A | 26 | ␣ |
| <ESC> | 1B | 27 | NA |
| <FS> | 1C | 28 | ␣ |
| <GS> | 1D | 29 | ␣ |
| <RS> | 1E | 30 | ␣ |
| <US> | 1F | 31 | ␣ |
| | 7F | 127 | ␣ |

2.1 Blink

The Blink command is used to make displayed characters blink at a specified rate. The text to be blinked must be bracketed on each side by a Blink command string.

Format: <ESC>rate;switch**B**

rate This argument is used to specify the blinking rate. The range of values is 1 through 255. The fastest rate is 1 and 255 is the slowest rate. If zero is entered, the rate that was used in the last Blink command will be chosen. The M1000 Display is initialized with a default blink rate of 20. The blink rate is a global setting. Therefore, display characters with the blinking attribute will blink at whatever rate was most recently selected.

<ESC>128;+B is a midrange blink rate

<ESC>1;+B is the fastest blink rate

<ESC>255;+B is the slowest blink rate

switch This argument is used to turn blinking on, off, or to toggle the current setting. Toggle is useful for terminating Blink in a script.

+ Blink on (+ is a shortcut for +1).

- Blink off (- is a shortcut for -1).

0 Toggle from previous state. If the first Blink command starts text blinking, the second Blink command can have zero entered for this argument which would toggle the Blink command from start blinking to stop blinking. The default value is 0.

B The upper-case letter **B** is used to invoke the Blink command.

Example:

```
<ESC>+B Blinking<ESC>B Not<CR>
```

In this example, two Blink command strings are included. The first command string turns on the blink effect and the second command string terminates the blink effect. The word "Blinking" will blink at the previously selected or default blink rate. The word "Not" will not blink.

2.2 Inverse Blink

The Inverse Blink command is used to make displayed characters alternate between text and an all dots on screen. This command will remain active until it is turned off.

Format: <ESC>*rate*;*switchb*

rate This argument is used to specify the blinking rate. The range of values is 1 through 255. The fastest rate is 1 and 255 is the slowest rate. If zero is entered, the rate that was used in the last Blink command will be chosen. The M1000 Display is initialized with a default blink rate of 20. The blink rate is a global setting. Therefore, display characters with the blinking attribute will blink at whatever rate was most recently selected.

<ESC>1;+B is the fastest blink rate
<ESC>255;+B is the slowest blink rate

switch This argument is used to specify the new inverse blinking setting.

+ Inverse Blink on (+ is a shortcut for +1).

- Inverse Blink off (- is a shortcut for -1).

0 Toggle from previous state. The default value is 0.

b The lower-case letter **b** is used to invoke the Inverse Blink command.

2.3 Cursor

The Cursor command is used to explicitly specify the position where the next character will be placed without clearing the display. Two arguments are associated with this command.

Format: <ESC>*line*;*columnC*

line This argument is used to specify the line on which the next character will be placed. The range of values for this argument is 1 or 2. Zero, no number, or a number greater than the maximum number of lines on the display, default to 1. Negative values will result in no cursor movement.

column This argument is used to specify the column position where the next character will be placed. The range of values for this argument is 1 thru 20. One is the left most column and 20 is the right most column. Zero, no number, or numbers greater than 20 default to one. Negative values will result in no column cursor movement.

C The upper-case letter **C** is used to invoke the Cursor command.

Example:

<ESC>CM<CR>

In this example, the letter "M" will be placed in the first column of the first line.

Example:

<ESC>2;15CT<CR>

In this example, the letter "T" will be placed in the fifteenth column of the second line.

2.4 Absolute Dot Cursor Move

The absolute dot cursor move command repositions the active cursor location to a new pixel location. The new pixel location will be the new top left of the next character displayed.

Format: <ESC>row;columnc

row Specifies the new pixel row of the cursor. The range of values for this argument is 0 to 15. Where 0 is the top pixel row and 15 is the bottom pixel row.

column Specifies the new pixel column of the cursor. The range of values for this argument is 0 to 119. Where 0 is the left pixel column and 119 is the right pixel column.

c The lower-case letter **c** is used to invoke the Absolute Cursor command.

See the Graphics Command for examples.

2.5 Font

The Font command is used to select the character set that will be displayed on the M1000 Display. Available fonts include the full 256 character IBM® set, the JIS8 (Katakana) character set, the Slavic (Latin II) character set and the Cyrillic character set. One argument is required for this command. The IBM® character set is the default character set. Note that the bottom "page" of 128 characters is the same for all of the fonts. It is the upper "page" of 128 characters that varies between fonts. Refer to Appendix C - Character Sets. When a font selection is made, it remains in effect for subsequent messages unless explicitly changed.

Format: <ESC>fontF

font This argument specifies the character set to be used following the Font command. Available values for this argument are 1 through 9. The default is 1. Multiple fonts can be displayed on the same screen simultaneously.

| | | | |
|---|--------------|---------------------------|------------------------------|
| 1 | 8x6 pixels | 2 lines of 20 characters. | Selects the full IBM® set. |
| 2 | 8x8 pixels | 2 lines of 15 characters. | Selects the full IBM® set. |
| 3 | 16x12 pixels | 1 lines of 10 characters. | Selects the full IBM® set. |
| 4 | 16x15 pixels | 1 lines of 8 characters. | Selects the full IBM® set. |
| 5 | 16x8 pixels | 1 lines of 15 characters. | Selects the full IBM® set. |
| 6 | 16x10 pixels | 1 lines of 12 characters. | Selects the full IBM® set. |
| 7 | 8x6 pixels | 2 lines of 20 characters. | Selects JIS8 (Katakana) set. |
| 8 | 8x6 pixels | 2 lines of 20 characters. | Selects the Slavic set. |
| 9 | 8x6 pixels | 2 lines of 20 characters. | Selects the Cyrillic set. |

F The upper-case Letter **F** is used to invoke the Font command.

Example:

```
<ESC>3F<CR>
```

In this example, the one line by ten character set will be used for the text following the Font command entry.

2.6 Goto

The Goto command is used to repeat the preceding text and commands the number of times specified by the argument. The repeated portion of the message would be from the Marker position. Refer to the description of the Marker command, Section 2.13. One argument is required for this command.

Note: If a marker command is not included in a message containing a Goto command, the Goto command will loop to the beginning of the message.

Format: <ESC>repeat**G**

repeat This argument specifies the number of times to repeat the preceding part of the message before the display will move on to process the rest of the message. The range of values for this argument is 0 through 255. Zero will cause repeating until a new message (also called an infinite goto). The default value is zero.

G The upper-case letter **G** is used to invoke the Goto command.

Example:

```
Repeat again<ESC>@<HT> and again<ESC>2G!!<CR>
```

This script executed on a M1000 will clear the display, write "Repeat again" on the first line and then repeat two times the process of moving to the next tab stop and writing "and again". Finally, the unit will write "!!" following the last repeated text. Note that the

Marker for the Goto in the example message is <ESC>@. The resulting message would appear as:

```
Repeat again and
again and again!!
```

2.7 Graphics

The graphic mode command allows individual pixels to be written. When in graphics mode, characters that would ordinarily be displayed are instead interpreted to be the new color of the pixel at the active cursor location. Once written, the active position is moved one pixel to the right. Writing past the end of the line will cause unpredictable results.

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Definition |
|---|---|---|---|---|---|---|---|--|
| | | | | | | X | X | 00 = off, 01 = low, 10 = medium, 11 = high |
| | | | | | X | | | 0 = no sparkle, 1 = sparkle |
| | | | X | | | | | 0 = no flash, 1 = flash |

Format: <ESC>*switchg*

- switch* Specifies the new mode of the display.
- + Graphic Mode on (+ is a shortcut for +1).
 - Graphic Mode off (- is a shortcut for -1).
 - 0 Toggle from previous state. The default value is 0.
- g** The lower-case letter **g** is used to invoke the Graphic command.

Example:

By using the Absolute Dot Cursor Move and Move Pixel Cursor commands, the goto command, and the graphics mode command, interesting pseudo-special effects can be created. For example, to create a marquee, send the following data stream to the M1000 display (the line is split up for legibility; the entire sequence can be sent as one data stream):

```
<ESC>+g<ESC>c4<ESC>@4567<ESC>29G455<ESC>1;c4<ESC>@4567<ESC>29G455
<ESC>2;c77<ESC>116m66<ESC>3;c66<ESC>116m77<ESC>4;c55<ESC>116m44
<ESC>5;c44<ESC>116m55<ESC>6;c77<ESC>116m66<ESC>7;c66<ESC>116m77
<ESC>8;c55<ESC>116m44<ESC>9;c44<ESC>116m55<ESC>10;c77<ESC>116m66
<ESC>11;c66<ESC>116m77 <ESC>12;c55<ESC>116m44<ESC>13;c44<ESC>116m55
<ESC>14;c7<ESC>@7654<ESC>29G766<ESC>15;c7<ESC>@7654<ESC>29G766<ESC>-g
```

2.8 Hue

The Hue command sets the background and foreground color to use for literal text characters.

Format: <ESC>*background*;*foreground***H**

| | |
|-------------------|--|
| <i>background</i> | This argument specifies the background Hue of the character. |
| 0 | Selects off (power up setting). |
| 1 | Selects dimmest. |
| 2 | Selects medium brightness. |
| 3 | Selects brightest. |
| 4 | Selects sparkle. |
| <i>foreground</i> | This argument specifies the foreground Hue of the character. |
| 0 | Selects off (default). |
| 1 | Selects dimmest. |
| 2 | Selects medium brightness. |
| 3 | Selects brightest (power up setting). |
| 4 | Selects sparkle. |

H The upper-case letter **H** is used to invoke the Hue command.

Multiple HUE commands can be contained within a command string, enabling a single line to have several different brightness levels at the same time. If there is no argument to the command the default will be 0 (off), however the display powers up with a HUE foreground setting of 3 (maximum brightness).

Example:

<ESC>3Hbright <ESC>1Hdim <ESC>2Hmedium <ESC>Hdark <ESC>3Hbright

would be displayed as:

```
    bright      dim   medium      bright
    *****    ----  ++++++      =====  *****
```

Where * symbolizes the brightest characters, - symbolizes the dimmest characters, + symbolizes medium brightness characters and = symbolizes off characters.

Note that since <ESC>3H was the last HUE command, that level of brightness will be in effect for all subsequent messages unless explicitly changed.

2.9 Intensity

Intensity is a global command and affects the full display. Note that the HUE command is relative to the intensity set with this command. For example, if intensity is set to 10, then the hue setting of 3 will be at intensity 10, while hue settings of 1 and 2 will be somewhat dimmer.

Format: <ESC>level**I**

level This argument is used to set the level of intensity. The range of values is 0 through 15. The dimmest setting is 0 and 15 is the brightest. If zero or no value is entered, the intensity will be set at whatever level was most recently selected. The unit defaults to a level of 15 at power up.

I The upper-case letter **I** is used to invoke the Intensity command.

2.10 Implicit Clear

This escape sequence will modify, the way the M1000 behaves before a new script is played.

Format: <ESC>mode**i**

mode Specifies the implicit clear mode.

0 The display will not clear, and the cursor position will not return to the home position when a new message is received.

1 The display will not clear, and the cursor position will return to the home position.

2 The display will clear, and the cursor position will return to the home position. The default value is 2.

i The lower-case letter **i** is used to invoke the Implicit Clear command.

Examples:

```
<ESC>2imessage one<CR>
```

In this example, the display will be cleared and the text "message one" will be displayed starting from the home position (Line 1, leftmost character).

```
<ESC>0imessage two<CR>
```

In this example, the display will not be cleared and the text "message two" will be displayed after the previous text.

2.11 Line

The Line command is used to specify the line number that text should be written to. The line command must follow the address and precede the message portion of any data sent to the M1000. Line commands cannot appear more than once or in any other part of a message. Note that to use any of the full screen fonts (fonts 3,4 and 5) the display must be selected for line 0 (the entire display).

Format: <ESC>*line***L**

line This argument is used to specify the line number to use. The default value is zero.

0 Selects the entire display.

1 Specifies the top line.

2 Specifies the bottom line.

L The upper-case letter **L** is used to invoke the Line command.

<ESC>**L** defaults to the entire display. Absence of an <ESC>**L** command implies that a message is for the same line as the last line number command.

2.12 Lock Message

The lock command is used to control message display. When the lock mode is enabled, the message must complete before another message can be executed. If the lock mode is disabled, the current message will be terminated upon receiving a new message. One argument is required for this command.

Note: Messages with infinite Scroll, or infinite Goto commands should not be used in the lock mode. The message will never be completed and the subsequent messages will not be executed.

If the current message is locked and executing when a new message is sent, up to 8 new messages of 256 characters can be queued.

Format: <ESC>*switch***l**

switch This argument is used to enable or disable the lock mode. The default value is zero.

 + Enable lock mode (+ is a shortcut for +1).

 - Disable lock mode (- is a shortcut for -1).

0 Toggle from previous state.

l The lower-case letter **l** is used to invoke the lock command.

Example:

```
<FF><ESC>+lPriority Message<ESC>200W<ESC>-l<CR>
```

This message clears the screen and displays "Priority Message", then waits for 20 seconds before unlocking the message. The message cannot be interrupted until it is unlocked. Refer to Section 2.18 for details on using the Wait command.

2.13 Marker

The Marker command is used to specify the beginning point of a Goto loop.

Format: <ESC>@

@ This is the matching argument to the marker value in the Goto command so that the loop is from the Marker location to the Goto command location. The ASCII symbol @ (40h) is used to invoke the Marker command.

Example:

I feel <ESC>@GREAT! <ESC>2G<CR>

This example would display as:

```
I feel GREAT! GREAT!
```

2.14 Move Pixel Cursor

The Move Pixel Cursor command moves the active cursor the specified distance from the current location.

Format: <ESC>row;columnm

row Specifies the distance to move vertically.

-15 to -1 Move up the specified number of pixels.

0 No movement of the pixel cursor.

1 to 15 Move down the specified number of pixels.

column Specifies the distance to move horizontally.

-119 to -1 Move left the specified number of pixels.

0 No movement of the pixel cursor.

1 to 119 Move right the specified number of pixels.

m The lower-case letter **m** is used to invoke the move pixel cursor command.

2.15 Pixel Draw

The pixel draw command changes the color of the specified pixel to the current foreground color. The active cursor is not affected.

Format: `<ESC>row;columnp`

row Specifies the pixel row location to modify. The range of values for this argument is 0 to 15. Where 0 is the top row and 15 is the bottom row.

column Specifies the pixel column location to modify. The range of values for this argument is 0 to 119. Where 0 is the left column and 119 is the right column.

p The lower-case letter **p** is used to invoke the pixel draw command.

2.16 Repeat

The Repeat command allows the character following the command string to be repeated a specified number of times. This can be used to insert multiple blank characters when scrolling or reduce the size of messages with many repeating characters. One argument is required for this command.

Format: `<ESC>countR`

count This argument specifies the number of times the character following the command string is to be repeated. The range of values is 1 to 255. Zero and one produce one character. The default value is zero.

R The upper-case letter **R** is used to invoke the Repeat command.

Example:

```
<ESC>8R-Vorne<ESC>7R-<CR>
```

In this example, eight dashes would be displayed, then the word "Vorne" followed by seven more dashes.

2.17 Scroll

The Scroll command is used to scroll characters, from right to left, on the current line. The text to be scrolled must be preceded by the Scroll command and terminated by either an <EOT> character (decimal value 04) or the line terminator. Regardless of the column position of the cursor, scrolling text will always begin at the rightmost character of the current line and scroll to the left, pushing any existing text off the line ahead of it. The two possible arguments for the Scroll command allow the user to specify the speed of the scrolled message and how many times the text should scroll.

Format: <ESC>rate;repeat**S**

rate This argument specifies the scroll rate. Where 1 is the slowest setting and 3 is the fastest setting. The range of acceptable values is 1 through 255. Thus a character can take from 1.5, 3 or 5 seconds to travel across the line. A value of zero or no number selects the previous rate, or, if no previous rate is available, selects the default rate of 2 (medium).

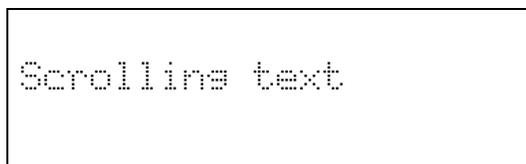
repeat This argument specifies the number of times the scrolling text should repeat. Acceptable values are from 1 through 3, and represent the actual number of repeats. A value of zero or no number will cause the text to scroll continuously until it is explicitly cleared or a new message is received by the display (also called an infinite scroll).

S The upper-case letter **S** is used to invoke the Scroll command.

Examples:

```
<ESC>2;0S_ _ _ _ scrolling text<CR>  
( '_' indicates a space character)
```

This example message would cause the text



```
Scrolling text
```

to continuously scroll across the current line. The four spaces provide a break between consecutive scrolls. The scroll speed would be such that it would take three seconds for a character to move completely across the line. The scrolling would continue until the line is explicitly cleared or another message takes control of the line.

The user should note that, when scrolling repetitively, consecutive scrolls will immediately follow the previous one. For this reason, space characters should be inserted preceding or following the scrolled text to provide a break between repetitions, as shown

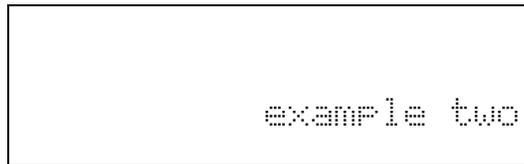
in the preceding example, it should also be noted that the scrolling will come to a halt on the last repetition once the last character of the scrolled text (including any spaces) has appeared at the far right of the line. If it is desired to have the visible text scroll all the way off the line on the last repetition, the user should either pad the text with 20 trailing spaces, or use another Scroll command that simply scrolls 20 spaces onto the line. The first method will insert 20 spaces between each consecutive scroll. The second technique will allow the user to use fewer spaces between the repeated text and still scroll off the last repetition.

Example:

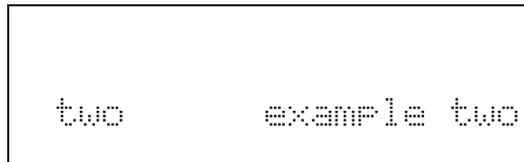
```
<ESC>2;1C<ESC>7S_ _ _ _ _example two<EOT><ESC>1S<ESC>20R_<CR>
```

('_' indicates a space character)

This example script would cursor to line 2 and scroll the text



seven times at the previously specified or default rate. After the text has scrolled on to the line for the seventh time, the unit is finished processing the first Scroll command. If the script ended here, the display would end up showing:



However, there is another Scroll command, which will scroll on twenty space characters. This will have the effect of scrolling off the existing text left over from the first Scroll command. The second Scroll command specifies the same rate as the first Scroll command and since there is no delay, the leftover text from the first scroll will simply keep moving to the left as it is scrolled off by the twenty spaces. Note the use of the Repeat command as a shortcut to typing twenty space characters.

2.18 Wait

The Wait command is used to pause the processing of a script for a specified length of time. The Wait command allows timing control and with the Goto command, allows control over alternating several lines of text or repeating some text or function, without having to retransmit any data.

Format: <ESC>*time***W**

time This is the multiplier used to define the wait period specified with the function argument. For example, if the delay is to be 10 seconds, the time value must be 100. Valid values for the time parameter are 0 thru 255. A value of zero will generate an infinite delay.

W The upper-case letter **W** is used to invoke the Wait command.

Example:

```
<FF><ESC>@WARNING<ESC>20W<FF><ESC>5W  
Low Pressure<ESC>30W<FF><ESC>5W<ESC>0G<CR>
```

This message uses the Wait command in combination with the Goto and Marker commands to control the timing of a repetitive looping message. The message clears the display of any existing text, drops a Marker reference, and then writes the text "WARNING" on the first line. Next, the unit waits for 2 seconds, clears the display, waits 0.5 seconds, and then writes the text "Low Pressure." Following a 3 second wait, the unit again clears the display, waits 0.5 seconds, and then loops back to the Marker location. The Goto command specifies continued repetitions, so the script will continue alternating between "WARNING" and "Low Pressure" until it is terminated by a different message.

2.19 Defeating Hardware Handshaking

The M1000 does not provide Hardware Handshaking. For Host devices, which require Hardware handshaking, the handshaking lines can be defeated by making the following connections at the Host devices serial connector.

| | DB-9 pin # | DB-25 pin # |
|-------------------|-------------|--------------|
| RTS to CTS | 7 to 8 | 4 to 5 |
| DTR to DCD to DSR | 1 to 4 to 6 | 6 to 8 to 20 |

2.20 Using XON / XOFF Software Handshaking

In cases where the Host device must wait until a specific message finishes playing, software handshaking may be used. For software handshaking, pin 3 of the 8 pin Terminal strip must be connected to the serial input connector of the Host device COM port and the host device must be set to XON / XOFF handshaking.

If the M1000 is busy, the unit will transmit the ASCII 13h character (DC3) to the Host device. This will suspend serial transmission by the Host device. When the M1000 is available, the unit will transmit the ASCII 11h character (DC1) to the Host Device to indicate that serial transmission can resume.

Appendix A Operating Specifications

LED Life 100,000 hours typical

Serial Input RS-232, RS-485

Power Supply

M1000-120 120VAC +/- 15% (50 - 60 Hz)

M1000-220 220VAC +/- 15% (50 - 60 Hz)

Power Requirements

65W Maximum

Temperature Range

Operating 32 to 122 degrees F (0 to 50 degrees C)

Humidity 5% to 95% non-condensing

Weight 25 pounds

Appendix B Character Set Listing

The full IBM®, JIS8 (Katakana), Slavic (Latin II) and Cyrillic character sets are available on the M1000 Display. All fonts share the first 128 characters (00h to 7Fh).

Common Character Set

| | | | | | | | | |
|-----------|----|-----------|-----------|-----------|-----------|-----------|------------|------------|
| 0 00h | NA | 16 10h | 32 20h | 48 30h | 64 40h | 80 50h | 96 60h | 112 70h |
| 1 01h | 0 | 17 11h | 33 21h | 49 31h | 65 41h | 81 51h | 97 61h | 113 71h |
| 2 02h | 0 | 18 12h | 34 22h | 50 32h | 66 42h | 82 52h | 98 62h | 114 72h |
| 3 03h | 0 | 19 13h | 35 23h | 51 33h | 67 43h | 83 53h | 99 63h | 115 73h |
| 4 04h | NA | 20 14h | 36 24h | 52 34h | 68 44h | 84 54h | 100 64h | 116 74h |
| 5 05h | 0 | 21 15h | 37 25h | 53 35h | 69 45h | 85 55h | 101 65h | 117 75h |
| 6 06h | 0 | 22 16h | 38 26h | 54 36h | 70 46h | 86 56h | 102 66h | 118 76h |
| 7 07h | 0 | 23 17h | 39 27h | 55 37h | 71 47h | 87 57h | 103 67h | 119 77h |
| 8 08h | NA | 24 18h | 40 28h | 56 38h | 72 48h | 88 58h | 104 68h | 120 78h |
| 9 09h | NA | 25 19h | 41 29h | 57 39h | 73 49h | 89 59h | 105 69h | 121 79h |
| 10 0Ah | NA | 26 1Ah | 42 2Ah | 58 3Ah | 74 4Ah | 90 5Ah | 106 6Ah | 122 7Ah |
| 11 0Bh | NA | 27 1Bh | 43 2Bh | 59 3Bh | 75 4Bh | 91 5Bh | 107 6Bh | 123 7Bh |
| 12 0Ch | NA | 28 1Ch | 44 2Ch | 60 3Ch | 76 4Ch | 92 5Ch | 108 6Ch | 124 7Ch |
| 13 0Dh | NA | 29 1Dh | 45 2Dh | 61 3Dh | 77 4Dh | 93 5Dh | 109 6Dh | 125 7Dh |
| 14 0Eh | 0 | 30 1Eh | 46 2Eh | 62 3Eh | 78 4Eh | 94 5Eh | 110 6Eh | 126 7Eh |
| 15 0Fh | 0 | 31 1Fh | 47 2Fh | 63 3Fh | 79 4Fh | 95 5Fh | 111 6Fh | 127 7Fh |

Font 1 through 6 IBM® Character Set

| | | | | | | | | | | | | | | | |
|------------|--|------------|--|------------|--|------------|--|------------|--|------------|--|------------|--|------------|--|
| 128 80h | | 144 90h | | 160 A0h | | 176 B0h | | 192 C0h | | 208 D0h | | 224 E0h | | 240 F0h | |
| 129 81h | | 145 91h | | 161 A1h | | 177 B1h | | 193 C1h | | 209 D1h | | 225 E1h | | 241 F1h | |
| 130 82h | | 146 92h | | 162 A2h | | 178 B2h | | 194 C2h | | 210 D2h | | 226 E2h | | 242 F2h | |
| 131 83h | | 147 93h | | 163 A3h | | 179 B3h | | 195 C3h | | 211 D3h | | 227 E3h | | 243 F3h | |
| 132 84h | | 148 94h | | 164 A4h | | 180 B4h | | 196 C4h | | 212 D4h | | 228 E4h | | 244 F4h | |
| 133 85h | | 149 95h | | 165 A5h | | 181 B5h | | 197 C5h | | 213 D5h | | 229 E5h | | 245 F5h | |
| 134 86h | | 150 96h | | 166 A6h | | 182 B6h | | 198 C6h | | 214 D6h | | 230 E6h | | 246 F6h | |
| 135 87h | | 151 97h | | 167 A7h | | 183 B7h | | 199 C7h | | 215 D7h | | 231 E7h | | 247 F7h | |
| 136 88h | | 152 98h | | 168 A8h | | 184 B8h | | 200 C8h | | 216 D8h | | 232 E8h | | 248 F8h | |
| 137 89h | | 153 99h | | 169 A9h | | 185 B9h | | 201 C9h | | 217 D9h | | 233 E9h | | 249 F9h | |
| 138 8Ah | | 154 9Ah | | 170 AAh | | 186 BAh | | 202 CAh | | 218 DAh | | 234 EAh | | 250 FAh | |
| 139 8Bh | | 155 9Bh | | 171 ABh | | 187 BBh | | 203 CBh | | 219 DBh | | 235 EBh | | 251 FBh | |
| 140 8Ch | | 156 9Ch | | 172 ACh | | 188 BCh | | 204 CCh | | 220 DCh | | 236 ECh | | 252 FCh | |
| 141 8Dh | | 157 9Dh | | 173 ADh | | 189 BDh | | 205 CDh | | 221 DDh | | 237 EDh | | 253 FDh | |
| 142 8Eh | | 158 9Eh | | 174 AEh | | 190 BEh | | 206 CEh | | 222 DEh | | 238 EEh | | 254 FEh | |
| 143 8Fh | | 159 9Fh | | 175 AFh | | 191 BFh | | 207 CFh | | 223 DFh | | 239 EFh | | 255 FFh | |

Font 7 JIS8 (Katakana) Character Set

| | | | | | | | |
|------------|------------|------------|------------|------------|------------|------------|------------|
| 128 80h | 144 90h | 160 A0h | 176 B0h | 192 C0h | 208 D0h | 224 E0h | 240 F0h |
| 129 81h | 145 91h | 161 A1h | 177 B1h | 193 C1h | 209 D1h | 225 E1h | 241 F1h |
| 130 82h | 146 92h | 162 A2h | 178 B2h | 194 C2h | 210 D2h | 226 E2h | 242 F2h |
| 131 83h | 147 93h | 163 A3h | 179 B3h | 195 C3h | 211 D3h | 227 E3h | 243 F3h |
| 132 84h | 148 94h | 164 A4h | 180 B4h | 196 C4h | 212 D4h | 228 E4h | 244 F4h |
| 133 85h | 149 95h | 165 A5h | 181 B5h | 197 C5h | 213 D5h | 229 E5h | 245 F5h |
| 134 86h | 150 96h | 166 A6h | 182 B6h | 198 C6h | 214 D6h | 230 E6h | 246 F6h |
| 135 87h | 151 97h | 167 A7h | 183 B7h | 199 C7h | 215 D7h | 231 E7h | 247 F7h |
| 136 88h | 152 98h | 168 A8h | 184 B8h | 200 C8h | 216 D8h | 232 E8h | 248 F8h |
| 137 89h | 153 99h | 169 A9h | 185 B9h | 201 C9h | 217 D9h | 233 E9h | 249 F9h |
| 138 8Ah | 154 9Ah | 170 AAh | 186 BAh | 202 CAh | 218 DAh | 234 EAh | 250 FAh |
| 139 8Bh | 155 9Bh | 171 ABh | 187 BBh | 203 CBh | 219 DBh | 235 EBh | 251 FBh |
| 140 8Ch | 156 9Ch | 172 ACh | 188 BCh | 204 CCh | 220 DCh | 236 ECh | 252 FCh |
| 141 8Dh | 157 9Dh | 173 ADh | 189 BDh | 205 CDh | 221 DDh | 237 EDh | 253 FDh |
| 142 8Eh | 158 9Eh | 174 AEh | 190 BEh | 206 CEh | 222 DEh | 238 EEh | 254 FEh |
| 143 8Fh | 159 9Fh | 175 AFh | 191 BFh | 207 CFh | 223 DFh | 239 EFh | 255 FFh |

Font 8 Slavic (Latin II) Character Set

| | | | | | | | | | | | | | | | |
|------------|--|------------|--|------------|--|------------|--|------------|--|------------|--|------------|--|------------|--|
| 128 80h | | 144 90h | | 160 A0h | | 176 B0h | | 192 C0h | | 208 D0h | | 224 E0h | | 240 F0h | |
| 129 81h | | 145 91h | | 161 A1h | | 177 B1h | | 193 C1h | | 209 D1h | | 225 E1h | | 241 F1h | |
| 130 82h | | 146 92h | | 162 A2h | | 178 B2h | | 194 C2h | | 210 D2h | | 226 E2h | | 242 F2h | |
| 131 83h | | 147 93h | | 163 A3h | | 179 B3h | | 195 C3h | | 211 D3h | | 227 E3h | | 243 F3h | |
| 132 84h | | 148 94h | | 164 A4h | | 180 B4h | | 196 C4h | | 212 D4h | | 228 E4h | | 244 F4h | |
| 133 85h | | 149 95h | | 165 A5h | | 181 B5h | | 197 C5h | | 213 D5h | | 229 E5h | | 245 F5h | |
| 134 86h | | 150 96h | | 166 A6h | | 182 B6h | | 198 C6h | | 214 D6h | | 230 E6h | | 246 F6h | |
| 135 87h | | 151 97h | | 167 A7h | | 183 B7h | | 199 C7h | | 215 D7h | | 231 E7h | | 247 F7h | |
| 136 88h | | 152 98h | | 168 A8h | | 184 B8h | | 200 C8h | | 216 D8h | | 232 E8h | | 248 F8h | |
| 137 89h | | 153 99h | | 169 A9h | | 185 B9h | | 201 C9h | | 217 D9h | | 233 E9h | | 249 F9h | |
| 138 8Ah | | 154 9Ah | | 170 AAh | | 186 BAh | | 202 CAh | | 218 DAh | | 234 EAh | | 250 FAh | |
| 139 8Bh | | 155 9Bh | | 171 ABh | | 187 BBh | | 203 CBh | | 219 DBh | | 235 EBh | | 251 FBh | |
| 140 8Ch | | 156 9Ch | | 172 ACh | | 188 BCh | | 204 CCh | | 220 DCh | | 236 ECh | | 252 FCh | |
| 141 8Dh | | 157 9Dh | | 173 ADh | | 189 BDh | | 205 CDh | | 221 DDh | | 237 EDh | | 253 FDh | |
| 142 8Eh | | 158 9Eh | | 174 AEh | | 190 BEh | | 206 CEh | | 222 DEh | | 238 EEh | | 254 FEh | |
| 143 8Fh | | 159 9Fh | | 175 AFh | | 191 BFh | | 207 CFh | | 223 DFh | | 239 EFh | | 255 FFh | |

Font 9 Cyrillic Character Set

| | | | | | | | |
|------------|------------|------------|------------|------------|------------|------------|------------|
| 128 80h | 144 90h | 160 A0h | 176 B0h | 192 C0h | 208 D0h | 224 E0h | 240 F0h |
| 129 81h | 145 91h | 161 A1h | 177 B1h | 193 C1h | 209 D1h | 225 E1h | 241 F1h |
| 130 82h | 146 92h | 162 A2h | 178 B2h | 194 C2h | 210 D2h | 226 E2h | 242 F2h |
| 131 83h | 147 93h | 163 A3h | 179 B3h | 195 C3h | 211 D3h | 227 E3h | 243 F3h |
| 132 84h | 148 94h | 164 A4h | 180 B4h | 196 C4h | 212 D4h | 228 E4h | 244 F4h |
| 133 85h | 149 95h | 165 A5h | 181 B5h | 197 C5h | 213 D5h | 229 E5h | 245 F5h |
| 134 86h | 150 96h | 166 A6h | 182 B6h | 198 C6h | 214 D6h | 230 E6h | 246 F6h |
| 135 87h | 151 97h | 167 A7h | 183 B7h | 199 C7h | 215 D7h | 231 E7h | 247 F7h |
| 136 88h | 152 98h | 168 A8h | 184 B8h | 200 C8h | 216 D8h | 232 E8h | 248 F8h |
| 137 89h | 153 99h | 169 A9h | 185 B9h | 201 C9h | 217 D9h | 233 E9h | 249 F9h |
| 138 8Ah | 154 9Ah | 170 AAh | 186 BAh | 202 CAh | 218 DAh | 234 EAh | 250 FAh |
| 139 8Bh | 155 9Bh | 171 ABh | 187 BBh | 203 CBh | 219 DBh | 235 EBh | 251 FBh |
| 140 8Ch | 156 9Ch | 172 ACh | 188 BCh | 204 CCh | 220 DCh | 236 ECh | 252 FCh |
| 141 8Dh | 157 9Dh | 173 ADh | 189 BDh | 205 CDh | 221 DDh | 237 EDh | 253 FDh |
| 142 8Eh | 158 9Eh | 174 AEh | 190 BEh | 206 CEh | 222 DEh | 238 EEh | 254 FEh |
| 143 8Fh | 159 9Fh | 175 AFh | 191 BFh | 207 CFh | 223 DFh | 239 EFh | 255 FFh |

Appendix C Display Dimensions

The M1000 display was designed to be suspended from a pair of chains.

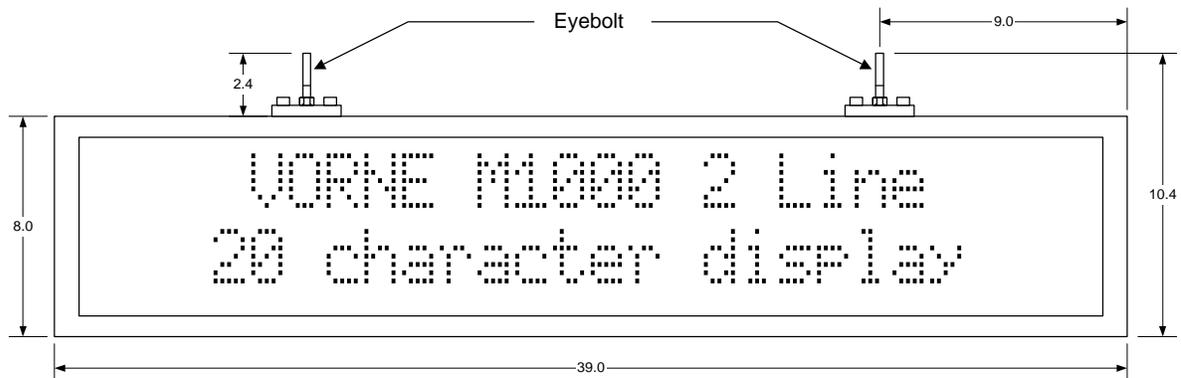
Chain for Hanging Displays:

Hanging of the enclosure should be done with welded "Coil Chain" or "Machine Chain" with a working load limit of not less than 400 pounds (182 Kg). Chain material should be "Hot galvanized steel" for standard working environments where there are not severe acidic or basic environments (such as in plating and metal finishing plants, steel mills, etc.). In severe environments, type 304L stainless steel chain with the same working load limits should be used.

Mounting Instructions:

Chains (as defined above) should be attached to each of the two eye bolts (1/2" opening) on the display with a steel shackle made from the same material as the chain and a rated working load limit of not less than 400 pounds (182 Kg). Attachments of the chains to a support structure or ceiling should be done in a way to support 400 pounds working load. The two attachment points should be at the same spacing as the spacing between the eyebolts (21 inches).

Failure to follow these recommendations could result in damage to property, or personal injury.



Dimensions in inches



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