Vorne Industries

2000S Series
Serial Input Alphanumeric Display
User's Manual

2000S SERIES SERIAL INPUT ALPHANUMERIC DISPLAY

Table Of Contents

1. INTRODUCTION TO THE 2000S DISPLAY

1.1 Operation

The 2000S is a serial input alphanumeric display. It can accept TTL, RS232, RS422, RS485, or Current Loop as serial data types (depending on input module implemented) and displays information on a field of 20 characters. Baud rates of 300, 1200, 2400, 4800 and 9600 are DIP switch selectable, as are protocol parameters of stop bits, data bits and parity. The 2000S can be set up to work in a line mode (updating the entire display field after receiving a carriage return, a line feed, or a carriage return line feed combination), or in an immediate mode (updating the display with every new character received). Up to 98 units can be individually addressed on a common data bus through use of internal DIP switches.

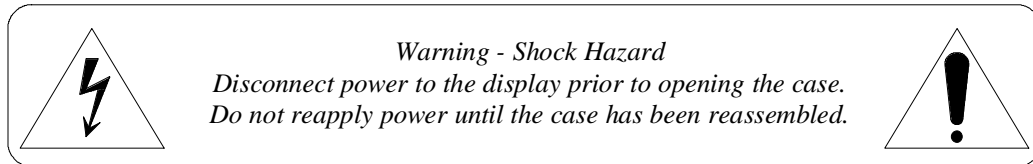| 1	2	3	4	5	6	7	8	9	10	MSD	LSD
300	1200	2400	4800	9600	7 8	off on	1 2	off on	off on	addrs	
		BAUD RATE			data	par	stop	cr	lf	00-no	99-all

1.2 Power Up Message

When power is applied to units ordered with current loop, Serial TTL or RS232 interface, they scroll address, Baud rate, data bit, parity and line terminator settings until valid serial data is received. Units with RS422 or RS485 interface do not display a power up message.

2. SETTING UP THE DISPLAY FOR YOUR APPLICATION

2.1 How To Change User Configurable Functions

All user configurable functions (input/output type, Baud rate, protocol parameters, line terminator, addressing modes) are located on the main logic board of the 2000S. Before removing the top cover of the display case, note the warning below.

> *Warning - Shock Hazard*
> *Disconnect power to the display prior to opening the case.*
> *Do not reapply power until the case has been reassembled.*

2.2 Selecting Input/Output Types

Any one of the five available serial types (TTL, RS232, RS422, RS485 or Current Loop) can be active at one time. Exchanging input/output boards selects the serial input and output type. Any input type can be ordered with a unit, as well as separately ordered. Serial output (retransmission) is available as RS232, RS485 or RS422. The input board is mounted to the logic board. In order to access the input board, it is necessary to remove the top cover of the display case (see warning above).

2.3 Selecting Baud Rates

The Baud rate is user selectable as either 300, 1200, 2400, 4800 or 9600, respectively, via the first 5 positions of a PC mounted, 10 position, in-line DIP switch. Only one switch of the first five should be in the on position and this switch will determine the Baud rate.

2.4 Selecting Protocol Parameters

Positions 6-8 of the PC mounted, 10 position, in-line DIP switch select protocol parameters. Position 6 selects the number of data bits (7 bits when off, 8 bits when on). Position 7 selects parity, and is selectable between none (switch off- no parity bit allowed) and mark (switch on- parity bit received and ignored). Position 8 selects the number of stop bits after the data word (1 stop bit when off, 2 stop bits when on).

2.5 Selecting A Line Terminator

Positions 9 & 10 of the PC mounted, 10 position, in-line DIP switch select the line terminator. The line terminator determines when the 2000S will update its display. If no line terminator is chosen (both 9 and 10 off), the display will be in the direct mode, and any valid character transmitted will be immediately displayed. If one or both of the line terminators (<CR> and <LF>) have been chosen, the display will update in a line mode.

To select carriage return (ASCII 0DH) as the line terminator, switch position 9 should be on. To select line feed (ASCII 0AH) as the line terminator, switch position 10 should be on. To select carriage return line feed as the line terminator (ASCII 0D 0AH), both switch positions 9 and 10 should be on.

2.6 Addressing

Addressing allows multiple 2000S units to be individually accessed on a common data bus. A set of two PC mounted, 10 position, rotary DIP switches determine the addressing mode. If addressing is not required, the two address switches should be set to 00.

If addressing is required, the display must be configured with an explicit line terminator (see SELECTING LINE TERMINATOR), and all data transmitted to the display must be in the format of two digits of display address, followed by the data to be displayed and ended with the line terminator. Each 2000S display that is to be used in the address mode must have an address between 01 and 98 set on the two PC mounted, rotary DIP switches. When this condition is met, the 2000S will display incoming data only when the transmitted address matches the address set internally in the unit. If it is desired to have a particular display show every set of data transmitted, regardless of the transmitted address, set the two address switches to 99. Conversely, if it is desired to have every display show a set of data transmitted, regardless of the display address, transmit an address of 99 preceding the data.

3. INTERFACING TO THE DISPLAY

3.1 Reset

Reset is internally pulled high and is active low (contact or switch closure to ground). Reset requires a 10 mS minimum duration signal. A reset places the unit in a state equivalent to power up (ready to receive data- display showing set conditions). The unit must be reset in order to acknowledge any changed baud rate, protocol, or address setting.

3.2 Direct Mode Operation

When in the direct mode, the 2000S displays any valid character as soon as it is received, starting from the most significant (leftmost) character position. After the least significant position has been filled, the next valid character received will be displayed in the rightmost character position, with the previous 19 characters shifting one position to the left. The recognized control codes in the direct mode are:

ASCII	Keyboard Character	Function
0DH	CR	Moves the cursor to the leftmost position, without changing display data.
0AH	LF	Clears the display and moves the cursor to the leftmost position.
08H	BS	Moves the cursor to the left one position, without changing display data.
7FH	DELETE	Blanks the previous character entered and moves the cursor to that position.

3.3 Line Mode Operation

When in the line mode, the 2000S display allows flashing of all or part of a message, scrolling of a message, as well as a full range of brightness controls, all through special transmitted codes. It is not recommended to flash or scroll messages when transmitting to multiple units as the display rate changes when data is transmitted through the serial link.

Portions of text delimited by control F (ASCII 06H) characters will be flashed, with multiple ^F characters allowable per text message. A single ^F preceding the text will flash the entire message.

The flash rate is adjustable via the control R (ASCII 12H) character. This command is sent as ^RX followed by a line terminator where X represents an integer between 0 and 9. The slowest flash rate is represented by 0, the fastest by 9. Any changed flash rate takes effect with the next transmitted string with embedded ^F characters.

The display brightness is adjustable via the ^B (ASCII 02H) character. This command is sent as ^BX followed by a line terminator where X represents an integer between 0 and 9. Minimum brightness is represented by 0, maximum brightness by 9. Any transmitted ^B command takes effect with the next transmitted text string.

Messages can be scrolled across the display by using the ^S (ASCII 13H) command. The command is sent as ^S X (where X represents an integer between 0 and 9) followed by 20 characters of text and a line terminator. Minimum scroll speed is represented by 0, maximum scroll speed by 9. The flashing function cannot be used in a scrolling message.

ASCII	Keyboard Command	Function
02H	Control BX	Brightness adjustment, X = 0 - 9. (0 = minimum brightness)
06H	Control F	Flash command.
12H	Control RX	Flash rate adjustment, X = 0 - 9. (0 = slow)
13H	Control SX	Scroll command, X = 0 - 9. (0 = minimum scroll speed)
0FH	Control OX	Output command, X = 0 or 1. (1 = relay on)

3.4 Display Update Time

There is a required time between transmissions over the serial link while the display interprets the previous data and moves it to the display. The 2000S has a minimum time required between transmissions of 5 mS.

3.5 Relay Output

The 2000S has a programmable output which can be accessed through the serial link. This output can be used to control external devices such as indicators or alarms. The command is sent as ^O (ASCII 0FH) X followed by a line terminator where X represents a 0 (output off) or a 1 (output on). Panel mount case units have an output relay that is rated for 3 Amps @ 120VAC and 3 Amps @ 28VDC. Bezel mount and open frame units have an open collector (NPN transistor) output that is rated for 0.25 Amps @ 30VDC.

3.6 Data Entry Examples

All examples are with a CR (carriage return) line terminator chosen. If you are not using addressing: set the address switches to 00 and reset the unit.

Data Transmitted	Comments	Data Displayed
2000S SERIAL DISPLAY {CR}		2000S SERIAL DISPLAY
{CNT F} HELLO {CR}	display flashes	HELLO
{CNT B} 0 {CR} VFD {CR}	display @ MIN brightness	VFD
{CNT R} 0 {CR} {CNT F} DISPLAY {CR}	display flashing @ MIN flash rate	DISPLAY
{CNT S} 9 MESSAGE {CR}	the word "message" scrolls across the display continuously at the maximum speed	MESSAGE

For units using addressing: set the address switches to 01, for example, and reset the unit.

Data Transmitted	Comments	Data Displayed
01 VFD {CR}		VFD
07 HELLO {CR}	unit ignores message	(same as previous)
01 {CNT F} DISPLAY {CR}	display flashes	DISPLAY
01 {CNT B} 0 {CR} 01 SERIAL {CR}	display @ MIN brightness	SERIAL
01 {CNT F} DISPLAY {CNT F} MESSAGE {CR}	only the word "display" flashes	DISPLAY MESSAGE
99 ALL UNITS {CR}		ALL UNITS
01 {CNT O} 1 {CR}	relay of unit 1 turns on	(display blanks)

3.7 Notes On Vacuum Fluorescent Displays

Vacuum fluorescent display technology was chosen for this product because of its superior brightness, viewing angle and spectral qualities. The natural color emitted by the display tube is a greenish-blue, peaking at a wavelength of 505 nanometers. The display is filterable to blue, red or yellow by using different labels. If one of these colors is desirable for your application, please consult the factory. The VFD tube has a rated life of 50,000 hours (almost six years of continuous operation). Rated life is said to be reached when the display tube reaches half brightness. To maximize the life of the display, it is important to avoid keeping the same message fixed on the display for extended periods of time (i.e. hours). Thus, if you wish to have a default message appear on the display (such as "ALL SYSTEMS GO", "MACHINE RUNNING", etc.), it is suggested that you scroll the message in order to prevent imprinting it on the display's phosphors.

4. WIRING AND SPECIFICATIONS

4.1 Powering The Display

The chart below outlines the operating power requirements of the three different size models of the 2000S display.

| MODEL	SIZE	OPERATING POWER	INRUSH CURRENT
2005S	5 mm (0.20")	2.3 VA	
2009S	9 mm (0.35")	3.6 VA	I(inrush) = I X 10
2015S	15 mm (0.59")	6.8 VA	

Formula for determining current is $I = P / E$

Power Connections For Displays With Housing Option "C" (Panel Mount Case) - Power connections are made to a separate six-terminal power connector (marked A through F). Power is wired into terminals A and B as shown below. Terminal C is used to provide earth ground to the enclosure. It is highly recommended that earth ground be wired to terminal C as this will provide a safety ground to the enclosure as well as a return path for external electrical noise disturbances.
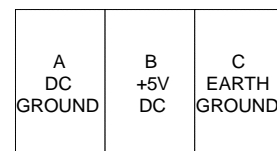
**OPERATING VOLTAGE OPTION 120**
120 Volt AC ± 15%

A 120 VAC	B 120 VAC	C EARTH GROUND
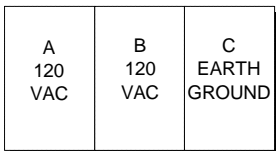
OPERATING VOLTAGE OPTION 24
10 - 30 Volt DC

A DC GROUND	B 10-30V DC	C EARTH GROUND
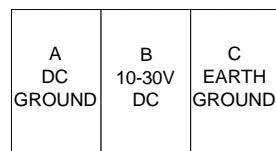
OPERATING VOLTAGE OPTION 5
5 Volt DC ± 5% (Regulated)

| A DC GROUND	B +5V DC	C EARTH GROUND

Power Connections For Displays With Housing Option "B" (Bezel Mount) Or "O" (No Housing) - Power connections are made to the first two terminals of the eight-terminal connector. The power supplied must be a very clean, well-regulated 5 Volts DC (± 5%).

1 DC GND IN	2 5V DC IN
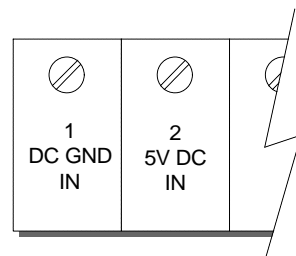
4.2 Wiring Units with 5VDC Power Supplies

Due to the requirement for a well regulated (±5%) 5VDC supply, the high inrush current demands and the potential for voltage drop in wiring, it is recommended to wire units in a "star" configuration limiting the number of parallel connections. Also to limit voltage drop, 18AWG stranded wire should be used.

5 Volt Supply — UNIT 1   UNIT 2   UNIT 3   UNIT 4   UNIT 5
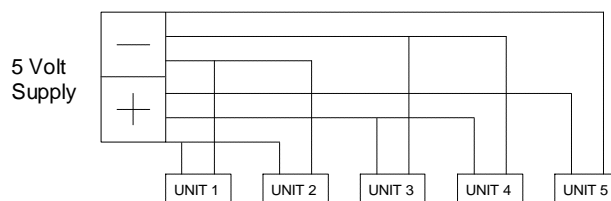
4.3 Wiring For Units In Panel Mount Case

Units in a case use Electrovert 6 & 8 pin detachable terminal strip connectors, (supplied with unit) for power and signal connections.

120 Volt AC - Panel Mount Case

POWER IN			RELAY			COMMUNICATION							
120 VAC	120 VAC	EARTH GND	N. OPEN	COMMON	N. CLOSED	DC GND	+5 VDC OUT	RESET	SERIAL IN +	SERIAL IN -	SER. OUT +	SER. OUT -	N.C.
A	B	C	D	E	F	1	2	3	4	5	6	7	8

10-30 Volt DC - Panel Mount Case

POWER IN			RELAY			COMMUNICATION							
DC GND	10 - 30 VDC	EARTH GND	N. OPEN	COMMON	N. CLOSED	DC GND	+5 VDC OUT	RESET	SERIAL IN +	SERIAL IN -	SER. OUT +	SER. OUT -	N.C.
A	B	C	D	E	F	1	2	3	4	5	6	7	8

5 Volt DC - Panel Mount Case

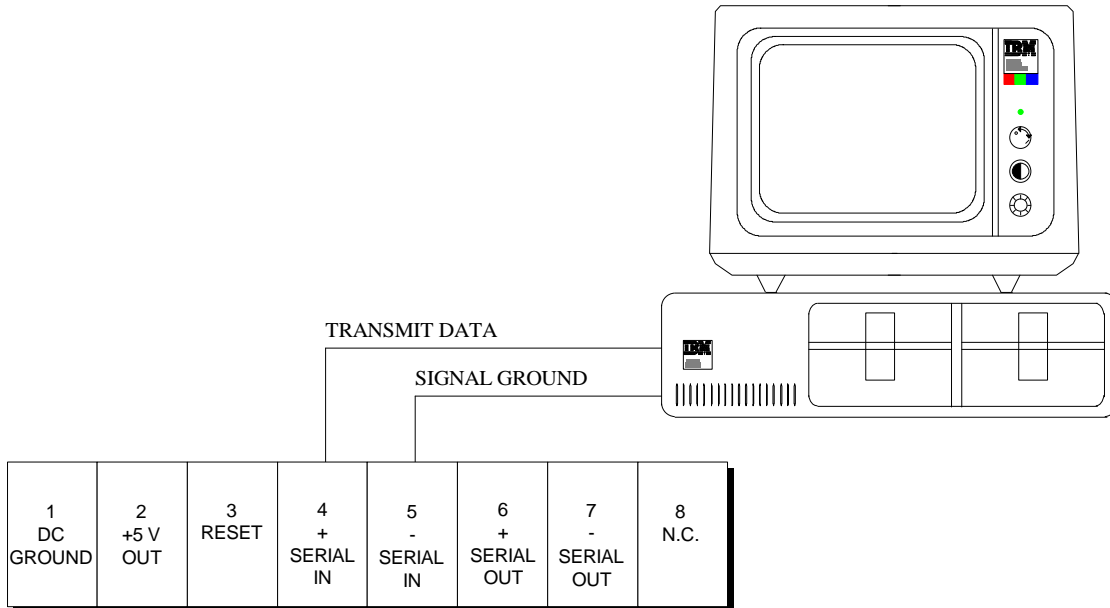| POWER IN			RELAY			COMMUNICATION							
DC GND	+5 VDC IN	EARTH GND	N. OPEN	COMMON	N. CLOSED	DC GND	+5 VDC OUT	RESET	SERIAL IN +	SERIAL IN -	SER. OUT +	SER. OUT -	N.C.
A	B	C	D	E	F	1	2	3	4	5	6	7	8

4.4 Wiring For Units With Bezel Or No Housing

Units with a bezel or no housing use a board-mounted, 8 position, Electrovert terminal strip. Use an Electrovert mating connector #25.320.0853.1 (provided with the unit).

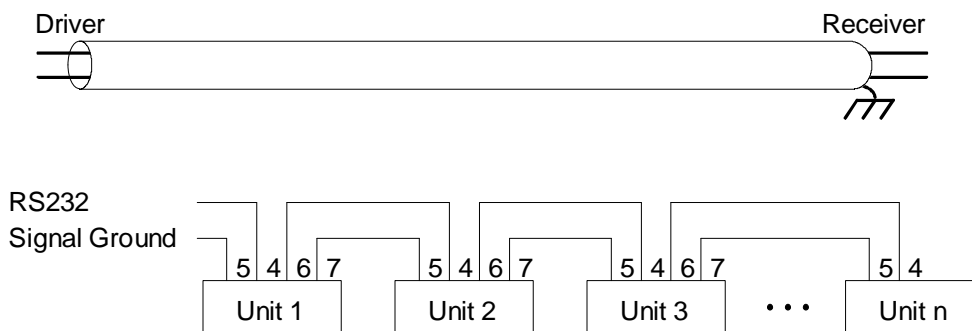| 1	2	3	4	5	6	7	8
			SER. IN		SER. OUT		
GND	+5 V IN	RST	+	-	+	-	OC

4.5 Wiring Units To A Computer

All serial output, such as the output from a personal computer, must match the communication standard of the serial input of the display.

TRANSMIT DATA

SIGNAL GROUND

| 1 DC GROUND	2 +5 V OUT	3 RESET	4 + SERIAL IN	5 - SERIAL IN	6 + SERIAL OUT	7 - SERIAL OUT	8 N.C.

4.6 RS232 Serial Transmission

Maximum length of transmission is 70 feet. We recommend using shielded cable with the shield grounded at the receiver end.

Driver   Receiver

RS232
Signal Ground

| 5 | 4 | 6 | 7 | | 5 | 4 | 6 | 7 | | 5 | 4 | 6 | 7 | | 5 | 4 |

Unit 1   Unit 2   Unit 3   • • •   Unit n

4.7 RS485 Serial Transmission

Maximum length of transmission is 4,000 feet. We recommend using a three-wire cable with the shield grounded at the receiver end. Add a 120 Ohm resistor across serial (+) and serial (-) as a line terminator at each end of the transmission line.
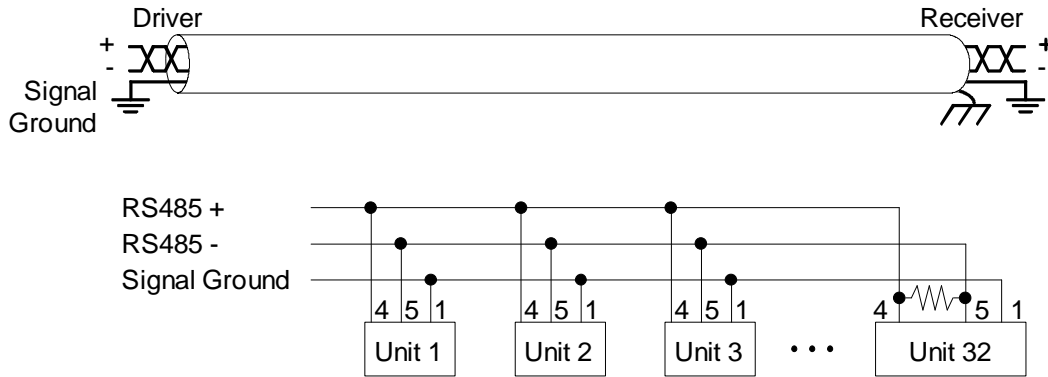
Appendix A Mounting Information

Housing Option "C" (Panel Mount Case)

The fully enclosed panel mount unit can be mounted through the front panel cutout and fastened to the panel with two side clips (provided).
An optional gasket provides front panel Nema 12 sealing.
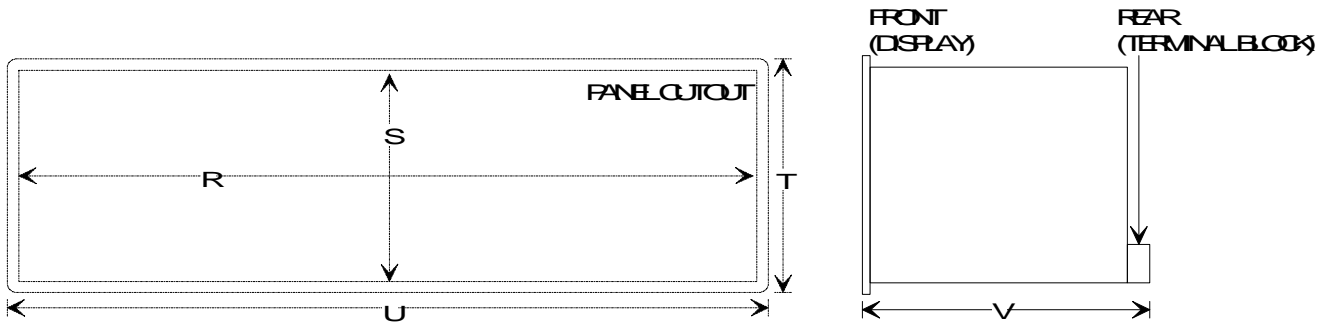
Housing Option "B" (Bezel Mount)

The bezel with attached display and logic boards can be mounted through the front of a panel cutout and fastened to the panel with four integral studs.
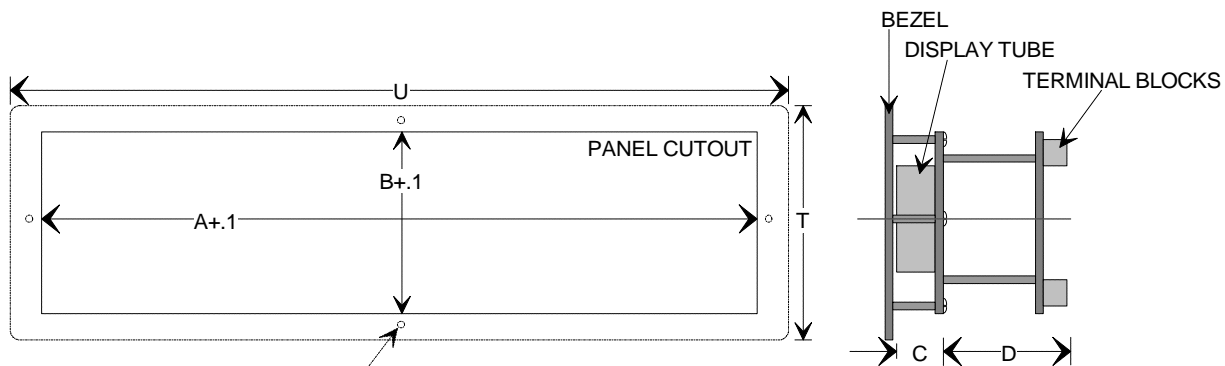
(4) 6-32 studs centered and 0.15 from bezel edge.
Mounting studs of bezel fit through clearance holes drilled in panel.

Housing Option "O" (No Housing)

The display and logic board can be mounted to the rear of a panel by using the circuit board mounting holes (6-32 clearance holes) provided on each side of the display tube.
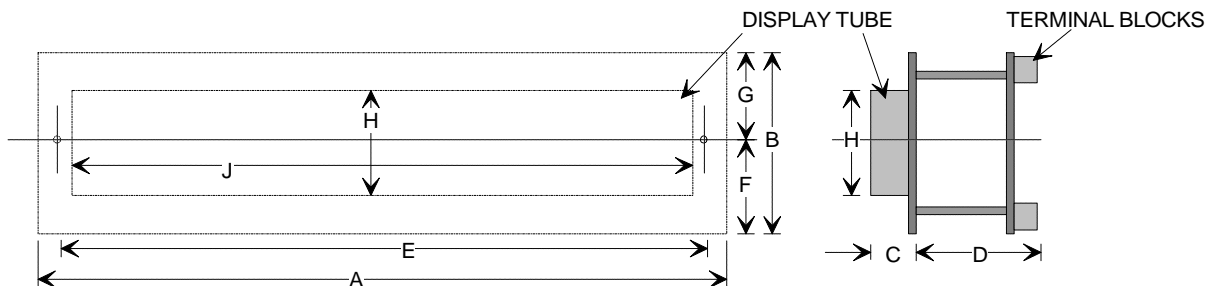
Model	Character Height	A	B	C	D	E	F	G	H	J	R	S	T	U	V
2005S	0.20	6.3	2.1	0.5	1.6	6.0	1.3	0.9	1.1	5.4	6.9	2.5	2.8	7.2	4.0
2009S	0.35	9.1	2.4	0.6	1.6	8.7	1.3	1.1	1.4	8.2	9.7	2.8	3.1	10.0	4.6
2015S	0.59	12.7	2.5	0.7	1.6	12.3	1.3	1.3	1.5	11.7	13.3	2.9	3.2	13.6	4.6

Note: All dimensions are in inches.

Appendix B Character Set

00h	01h	02h	03h	04h	05h	06h	07h
08h	09h	0Ah	0Bh	0Ch	0Dh	0Eh	0Fh
10h	11h	12h	13h	14h	15h	16h	17h
18h	19h	1Ah	1Bh	1Ch	1Dh	1Eh	1Fh
20h	21h	22h	23h	24h	25h	26h	27h
28h	29h	2Ah	2Bh	2Ch	2Dh	2Eh	2Fh
30h	31h	32h	33h	34h	35h	36h	37h
38h	39h	3Ah	3Bh	3Ch	3Dh	3Eh	3Fh
40h	41h	42h	43h	44h	45h	46h	47h
48h	49h	4Ah	4Bh	4Ch	4Dh	4Eh	4Fh
50h	51h	52h	53h	54h	55h	56h	57h
58h	59h	5Ah	5Bh	5Ch	5Dh	5Eh	5Fh
60h	61h	62h	63h	64h	65h	66h	67h
68h	69h	6Ah	6Bh	6Ch	6Dh	6Eh	6Fh
70h	71h	72h	73h	74h	75h	76h	77h
78h	79h	7Ah	7Bh	7Ch	7Dh	7Eh	7Fh

P0001R04