



**User Manual for the
*HE500OCS050 &
HE500OCS051***

Operator Control Station

**Third Edition
01 September 1998**

MAN0022-03

PREFACE

This manual explains how to use the Horner Electric HE500OCS050 and HE500OCS051.

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Any example programs and program segments in this manual or provided on accompanying diskettes are included solely for illustrative purposes. Due to the many variables and requirements associated with any particular installation, Horner Electric cannot assume responsibility or liability for actual use based on the examples and diagrams. It is the sole responsibility of the system designer utilizing the HE500OCS050 and HE500OCS051 to appropriately design the end system, to appropriately integrate the HE500OCS050 and HE500OCS051 and to make safety provisions for the end equipment as is usual and customary in industrial applications as defined in any codes or standards which apply.

Note: The programming examples shown in this manual are for illustrative purposes only. Proper machine operation is the sole responsibility of the system integrator.

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Important Safety Notice

SAFETY NOTICE FOR THE HEOCS050/51

This product is NOT to be used in applications where critical control is done based on Network inputs to the unit. The integrity of the data being sent to the unit is uncertain in the first 1-10 scans of the unit. These units are primarily designed for the simple, non-safety-related control and data acquisition.

CHAPTER 1: INTRODUCTION

1.1 Product Description

The Horner Electric Operator Control Station (HE500OCS050 or HE500OCS051) combines the power of a Horner Electric OIU057 (small Operator Interface Unit) with on-board I/O capability and networking within one controller.

Powerful and compact, the controller has Serial and CAN (Controller Area Network) communication abilities. The unit contains a standard 9-pin RS-232 for programming/debugging, monitoring and network administration from an IBM-compatible PC. The HE500OCS050 uses Horner Electric's CsCAN (pronounced "Sea-scan") peer to peer networking. The HE500OCS051 works as a DeviceNet™ slave. When several Operator Control Stations are networked together to achieve a specific purpose, the system performs like a "large parallel-processing PLC".

The Operator Control Station has several desirable features. The front panel contains a 2x16 Liquid Crystal Display (with backlight), which is highly visible. The front panel also has five user-programmable keys, an UP key and a DOWN key. The bottom of the unit has two Horner Electric Micro I/O interface ports (for 8 inputs and 8 outputs), DC power port, serial communication and CAN communication ports. The controller measures 3.5"x6"x5"x6."

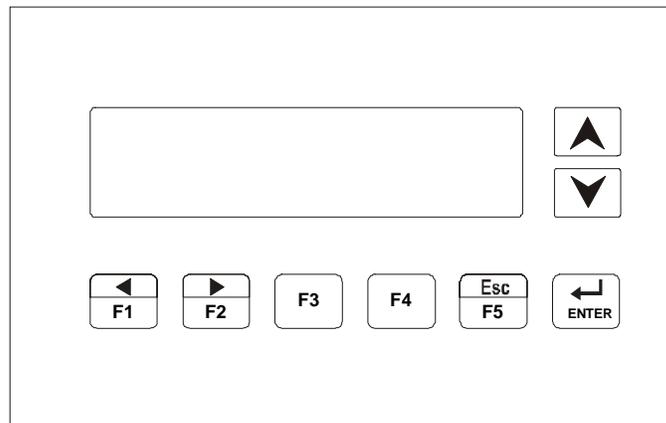


Figure 1.1 – Front View

1.2 Cscape™ Software Package Option

As an option, Horner Electric offers Cscape™ (pronounced "Sea-scape") Software for use with the HE500OCS050 and HE500OCS051. Powerful yet easy-to-use, the ladder editor programming software allows for the off-line creation, editing, saving and loading of ladder logic programs and text screens for the HE500OCS050 and HE500OCS051. When connected to the serial port of the Operator Control Station, the software user has the capability to download, upload, run and monitor ladder programs and text screens. A comprehensive documentation package is included with the purchase of Cscape™ Software and contains software, manuals, and a communication cable. The part number for Cscape Software is HE500OSW232.

Table 1.1 – Specifications	
General	
Processing Speed	75,000 ladder elements per second
Operating Temperature	0° to 60° C
Humidity	5% to 95% non-condensing
NEMA Rating	NEMA 4-12
DC Power Source	
Primary Power Range	9 - 32 VDC
Typical Power Draw	80mA@24VDC
Inrush Current	700mA@24VDC for 7mS
CAN Power Range	12 - 30 VDC
CAN Power Current	75mA maximum
Dimensions	
Height	3.50" (89mm)
Width	6.00" (153mm)
Mounting Depth	5.60" (142mm)
Internal Functions	
Output Coils	8
Internal Coils	48
Timers/Counters	16
Network Inputs	16
Network Outputs	16
Text Screens	50
User Keys	5
Communications	
Serial	Standard 9 pin RS-232 for programming, monitoring, and network administration from a IBM compatible PC
CAN	HE500OCS050 CsCAN peer to peer networking HE500OCS051 DeviceNet™ Slave (16 polled input, 16 polled outputs)
Input / Output	2 Horner Electric Micro I/O interface ports
Keypad	5 user programmable keys + UP, DOWN and ENTER
Display	2 x 16 Back-lit Liquid Crystal with 0.375" characters
Noise Specifications	
IEC Rating	IEC 1000-4-2, Severity Level 3 (performance criteria B for ESD Air Discharge) & Severity Level 2 (performance criteria A for ESD Direct Contact Discharge). IEC 1000-4-4, Severity Level 3 (performance criteria B for FTB on Power Lines) & Severity Level 3 (performance criteria A for FTB on I/O Lines).

CHAPTER 2: INSTALLATIONS

2.1 Connections

2.1.1 General

The HE500OCS050/051 connectors are located on the bottom of the module as depicted in Figure 2.1. The following sections describe each connector.

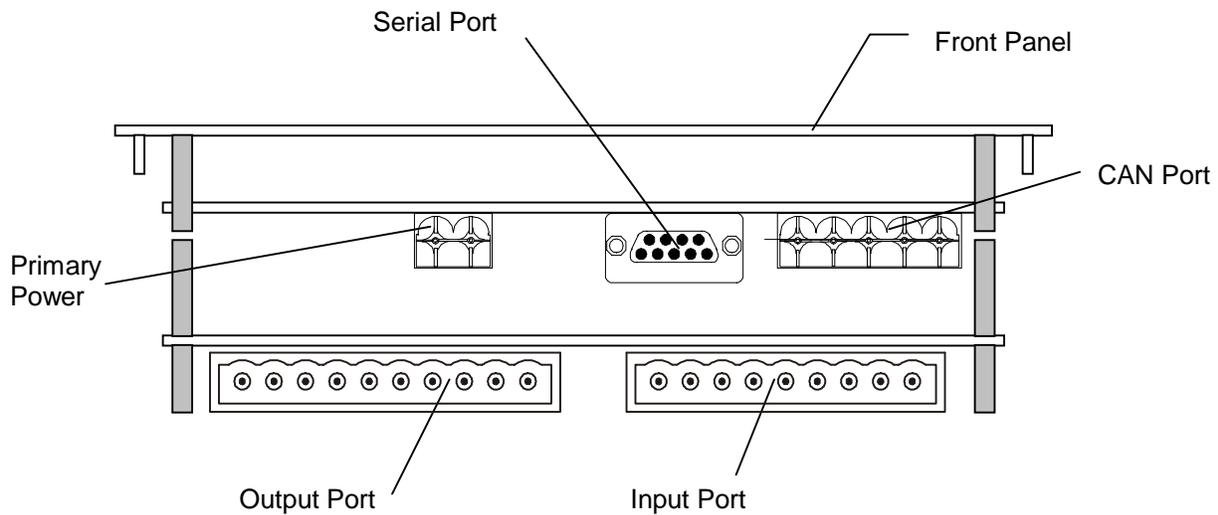


Figure 2.1 – Connectors, Bottom View of HE500OCS050/051

2.1.2 Primary Power Port

Table 2.1 – Primary Power Port Pins		
Pin	Signal	Description
1	V+	Input power supply voltage
2	V-	Input power supply ground

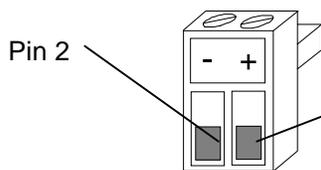


Figure 2.2 Power Connector (Primary Power Port)

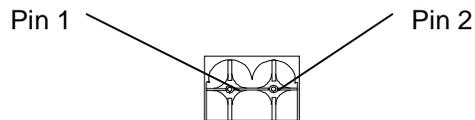


Figure 2.3 As viewed looking at the HE500OCS050/051

Note: Power Supply Voltage Range is from 9-32 volts DC.

2.1.3 CAN Port

Table 2.2 – CAN Port Pinsc		
Pin	Signal	Description
1	V+	CAN Power +
2	C+	CAN High
3	Shield	Shield
4	C-	CAN Low
5	GND	CAN Power Ground

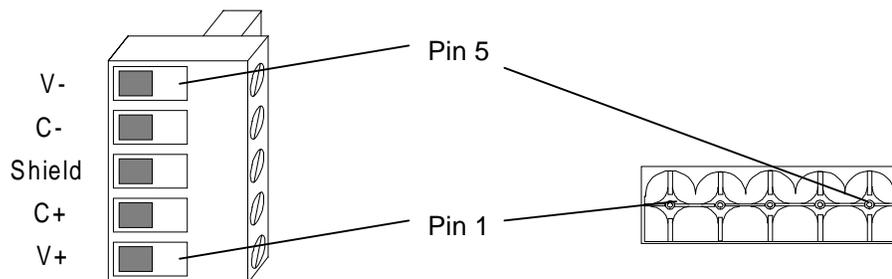


Figure 2.4 – Network Connector (CAN Port)

Figure 2.5 – As viewed looking at the HE500OCS050/051

a. CAN Wiring Rules (See Figure 2.6.)

1. A CAN network should be wired in a daisy-chained fashion such that there are exactly two physical end-points on the network.
2. **The two nodes at the physical end-points** should have 121 ohm 1% terminating resistors connected across the CN_L and CN_H terminals.
3. The data conductors (CN_L and CN_H) should be a 24 AWG shielded twisted pair for “thin cable” and 22 AWG shielded twisted pair for “thick cable”, with 120 ohm characteristic impedance. Horner Electric recommends using a Belden wire #3084A (“thin”) for typical industrial environments and a #3082A (“thick”) for environments where noise is a concern.
4. The power conductors (V- and V+) should be an 18 AWG twisted pair for “thin cable” and a 15 AWG twisted pair for “thick cable.”
5. The V- power conductor should be connected to a good earth ground **at one place only** on the network, preferably at one the two physical endpoints.
6. Notice that for a section of cable between two nodes, the cable shield is connected to the cable shield input at one end of the cable only.
7. A CAN network (without repeaters) should be limited to 64 nodes (with 63 cable segments) with a maximum cable length of 1500 ft.
8. Up to four CAN network segments, which adhere to the above rules, may be connected together using three CAN repeaters (HE200CGM100). In this manner, a CAN network may be extended to 253 nodes with a total cable distance of 6000 ft.

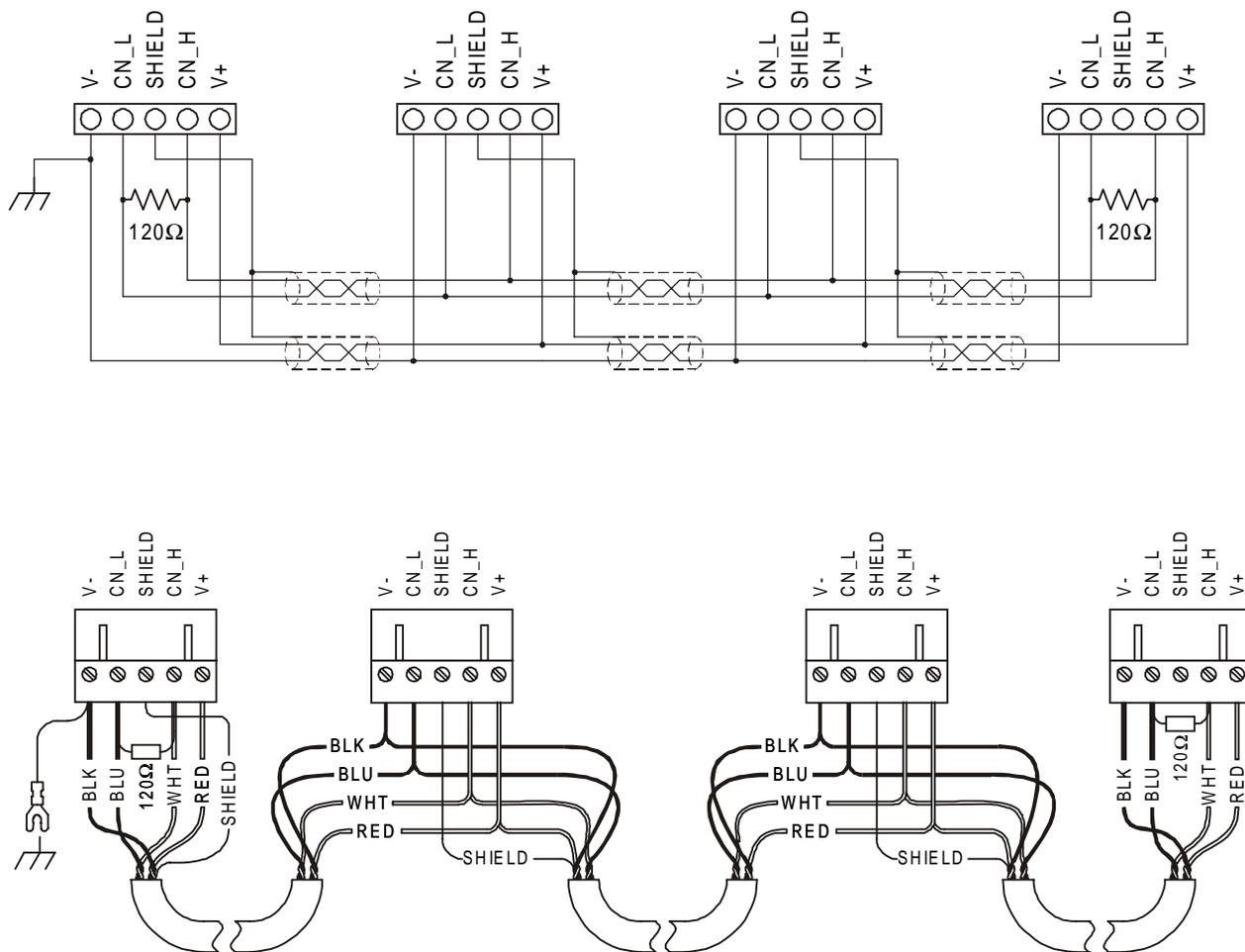


Figure 2.6 – CAN Port Wiring Diagram

2.1.4 RS-232 Port

Table 2.3 – RS-232 Port Pins			
Pin	Signal	Description	Direction
1	DCD	Always high	Out
2	TXD	Transmitted Data	Out
3	RXD	Received Data	In
4	DTR	Ignored	-
5	GND	Ground	-
6	DSR	Always high	Out
7	CTS	Clear to Send	In
8	RTS	Request to Send	Out
9	RI	Always high	Out

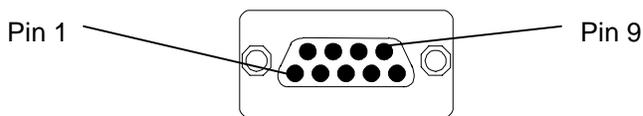


Figure 2.7 – RS-232 Port

a. RS-232 Communications Wiring

The OCS units feature an RS-232 port for connection to a personal computer (for programming the OCS). The wiring diagram for the RS-232 ports is shown below. If a permanent connection is to be made between the OCS and the personal computer, Horner Electric recommends using a shielded, multiple pair wire with a maximum length of 15 meters to ensure maximum performance.

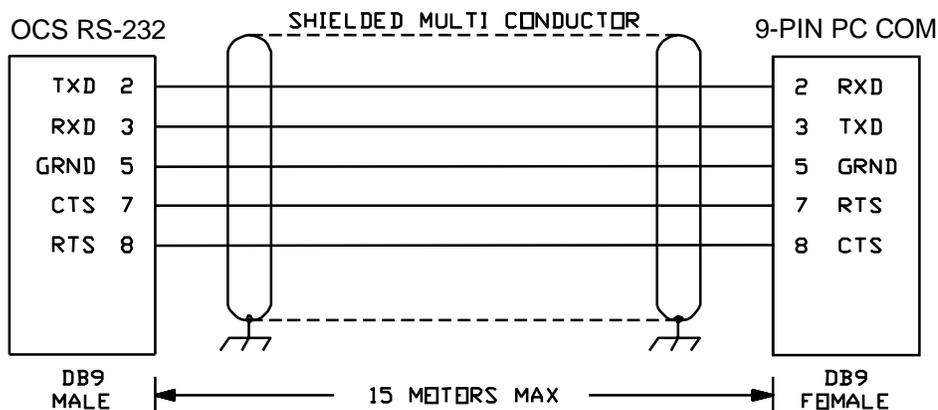


Figure 2.8 - OCS to PC Wiring Diagram

2.1.5 8 Positive (or Negative) to Isolated Common Inputs (Input Port)

Table 2.4 - Input Port	
Rated Voltage	± 24VDC
Input Voltage Range	-30 to +30VDC
Input Characteristics	
On-state Voltage	± 15 to ± 30VDC
Off-state Voltage	-6 to +6VDC
On-state Current	± 4.5mA minimum
Off-state Current	± 2.0mA maximum
On response Time	2ms maximum
Off response Time	2ms maximum

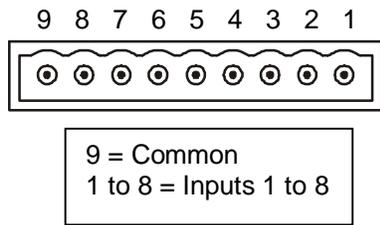


Figure 2.9 – Input Port (As viewed looking at the HE500OCS050/051)

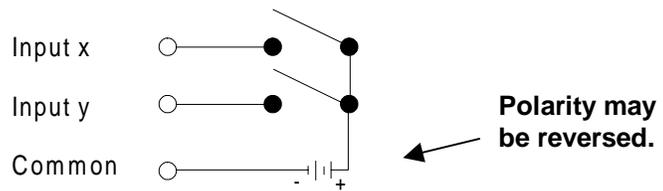


Figure 2.10 – Input Port Wiring Diagram

2.1.6 8 Sinking to Isolated Common Outputs

Table 2.5 – Output Port	
Rated Voltage	± 24VDC
Output Voltage Range	± 6 to ± 25VDC
Output Current	±0.5A continuous per point
Output Characteristics	
On Output Voltage	0.3V@100mA 0.5V@400mA 0.7V@700mA
On response Time	1ms maximum
Off response Time	1ms maximum
Current Limit	1A typical
Protection	Inductive clamp diode to isolated supply thermal shutdown

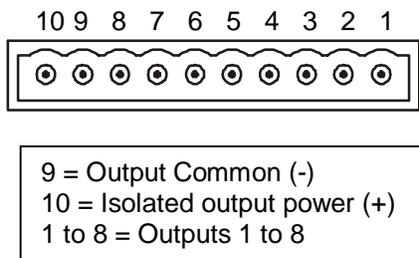


Figure 2.11 - Output Port (As viewed looking at the HE500OCS050/051)

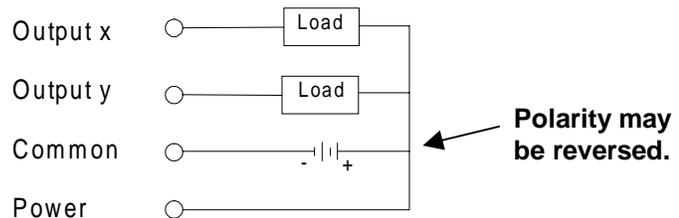
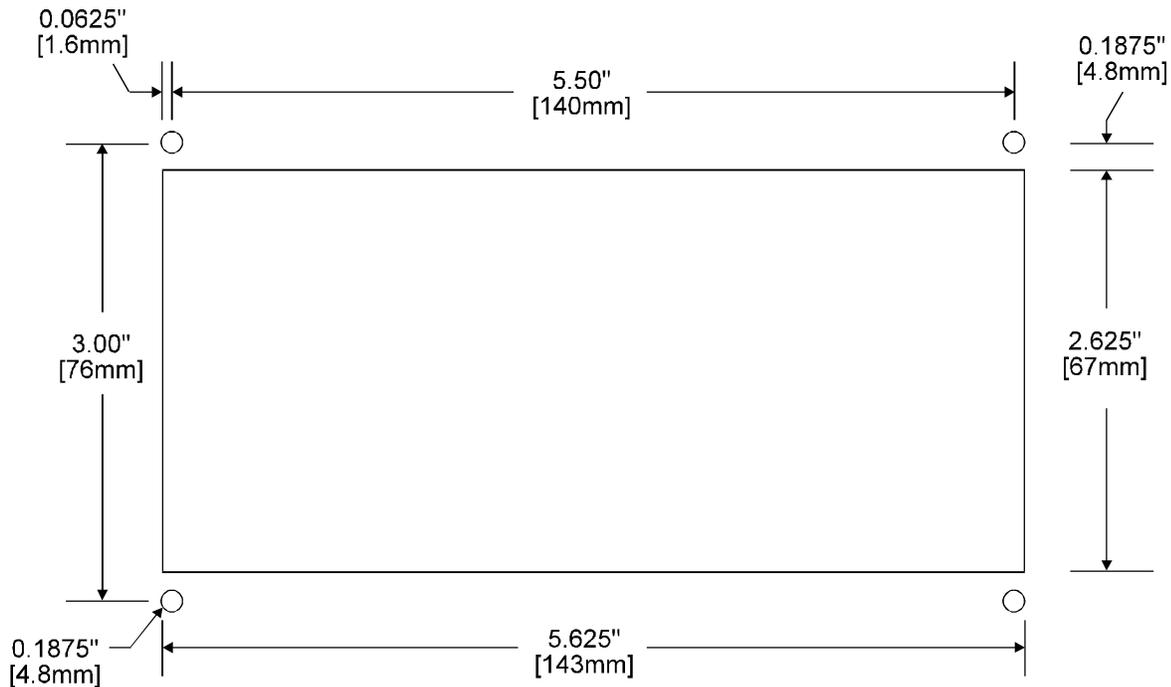


Figure 2.12 – Output Port Wiring Diagram

2.2 Mounting Requirements

The OCS is designed for permanent panel mounting. To install the OCS follow the instructions below:

1. Cut the host panel as described in the corresponding drawing on the next page.
2. Remove the rear cover by removing the four screws holding it in place.
3. Insert the OCS through the panel cutout (from the front). The gasket material should lie between the host panel and the OCS panel.
4. Install four hex nuts on the four mounting studs of the OCS. Tighten these nuts until the gasket material forms a tight seal. Do not over-tighten.
5. Replace the rear cover screws, which secure it to the OCS.
6. Connect the communications and power cables to the OCS ports.



Note: Drawing is not to scale.

Figure 2.13 – Panel Cutout for HE500OCS050/051

2.3 Placing the OCS into Service

Although the Operator Control Stations have been designed for use in industrial environments, the installation of the unit has an impact on its immunity to noise. A number of considerations must be made when placing the OCS into service to ensure years of reliable operation. A listing of some of the considerations follows:

a. Secure Physical Mounting

The OCS should be securely mounted, isolated from severe vibration.

b. Ground the OCS Chassis

The OCS chassis needs to be connected to a good earth ground. Make the connection to one of the four mounting studs on the unit. The studs provide a direct connection to the OCS chassis to which all OCS printed circuit board earth ground connections are made. With the OCS chassis grounded, electrical noise can generally be shunted effectively to earth ground.

c. Install the OCS Rear Cover

The steel rear cover provides important protection against RF (radio frequency) interference.

d. Use a Properly Constructed Communications Cable

Great care should be made in the construction of the communications cable connecting the OCS to the target device.

e. Ground the Communications Cable Shield

Ensure the proper grounding of the communications cable shield. Without proper shield grounding, the shield typically acts like an antenna and increases the amount of noise induced upon the cable.

f. Route Communications Cable Properly

Make sure that the communications cable is routed away from high voltage wiring. Communications cable need to be routed in conduit or a wire-way containing only communications or low energy signals. Be careful to avoid routing cable around traditionally noisy electrical components such as motor starters, solenoids, drives, inverters, etc. These components can inductively couple electrical noise onto the communications wiring.

g. Route Power Wiring Properly

When using the OCS with 9-32VDC power, route the OCS power conductors away from noise inducing electrical components and wiring.

2.4 Status Indicators

The operator is notified of the following states by a flashing character in the upper right corner of the display:

- a. The unit fails one of its self-tests.
- b. The unit is placed in idle mode.
- c. The unit is in firmware update mode.
- d. The unit is in DO/IO mode.

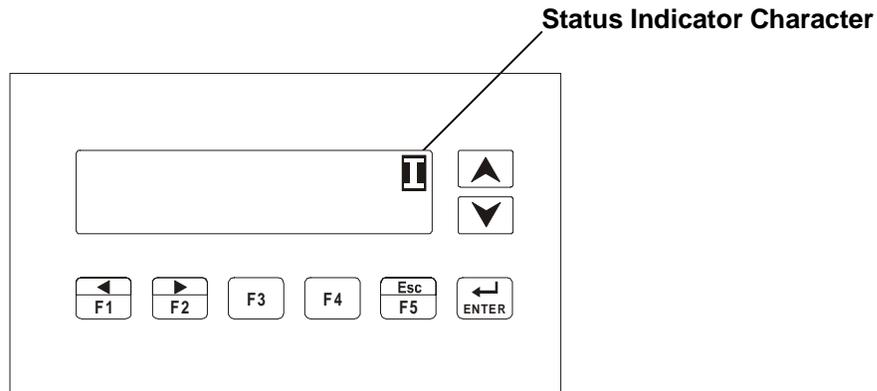


Figure 2.14 – Status Indicator Character

When the unit is placed in idle mode, the flashing character looks like the following:



When the unit has detected an error while performing a self-test, it displays this character. (The unit has been forced into idle mode as well):



When the unit is in DO/IO mode, the inputs are read, and outputs are written, but no ladder program operations are performed.



When the serial port is in firmware update mode, the serial port is not available to connect to the ladder editor. In this case, the following character is displayed:



2.5 Operation

When the OCS050 unit first powers-up, it displays "Horner Electric OCS: HE500OCS050". This message then fades and the first user screen will be displayed.

After the OCS displays this message, the unit will perform tests to see the current state of the network. Three different scenarios may occur. Each of them is described below.

Scenario #1: No power is supplied to the CAN port. The networking is turned OFF, the unit is placed in idle mode, and an error message is displayed on the screen for 1 second. When checking "**Diagnostics**" with Cscape, the **Network Operations** will display **ERRORS**.

Scenario #2: If there is power connected to the CAN port, and no other units are on the CAN network (or this is the first device to power-up on the network), the message "**Waiting for Net: F1 = Disable Net**" is shown. If another device is placed on the CAN network, the message clears and operation continues. If F1 is pressed, network is disabled and operation continues. (The PLC and interface portions continue to operate).

Scenario #3: If a unit powers-up and finds another unit with the same node number as itself, the display shows "**Duplicate ID Network Disabled**". The network is disabled, the network OK system bit (%S2) is cleared and is displayed on the editor (diagnostics screen) as "**Network Conflicts: Failed**".

Note: The ID checking works when one of two devices with the same ID is powered-up more than 1 second before the other. If both devices are powered-up at the same time, this method of ID checking may not work.

At any time, the OCS unit can be reset by pressing:  +  + .

2.6 User Screens

In normal operating mode there are a set of user-defined screens that can be scrolled through using the  and  keys.

If the ladder program energizes a text coil, the screen associated with this coil is displayed, overriding the "normal" user screens. This is designed to show alarm conditions. When the text coil is de-energized, the previous screen that was being viewed before the alarm is returned.

Note: If the user was in the middle of editing a set point, the edit will continue once the alarm screen clears.

If the screen contains a set point, the user can press the `Enter` key to enter the edit mode. When in edit mode, a cursor will appear on one digit of the editable number. Use the `F1` key to move to the digit to the left and the `F2` key to move to the digit to the right. Use  and  keys to increment or decrement the digit.

If there is more than one field on the screen, select a field by pressing `F1` or `F2` and edit as needed.

As a result of pressing the `F1` or `F2` keys, the value chosen may exceed the minimum or maximum set by the user program. If the value is outside of these minimum or maximum points, the value will not change.

Pressing `Enter` will exit the edit mode and return to the "normal" user screen mode.

Example:

Enter

Sheep count setpoint: 0002 <u>0</u>
--

 F1

Sheep count setpoint: 0002 <u>0</u>
--

Sheep count setpoint: 000 <u>3</u> 0

 Enter

2.7 HE500OCS051 DeviceNet™ Properties

The HE500OCS050 and the HE500OCS051 are essentially the same unit. The difference is that the firmware in each of the units is different. The HE500OCS051 is different in the fact that it works as a DeviceNet™ slave. The HE500OCS051 uses DeviceNet™ protocol instead of CSCAN protocol. Some differences to note when using the HE500OCS051 include the following:

- a. With DeviceNet™, nodes 0-63 are available and if the OCS is connected to one HE500OCS051 (through serial port), it is unable to monitor another OCS on the DeviceNet™ network.
- b. For applications that include more than one HE500OCS051, a DeviceNet™ Master module (#HE693DNT250) will be necessary.
- c. Before powering-up the HE500OCS051, it is necessary to apply network power to the unit and configure the DeviceNet™ network. If the controller is not connected to the network and the network is not properly configured, the unit remains in the power-up self-test mode.

CHAPTER 3: CONFIGURATION

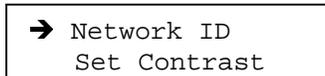
3.1 General

The OCS can be easily configured. The following sections describe the parameters and procedures used to configure the OCS. The sections describe the **on-board** configuration of the unit.

3.2 Entering the Configuration Menu

1. To enter the configuration menu, press the `key` and the `key` at the same time.

2. The Configuration Mode looks like the following:



3. Pressing the `Enter` key selects the option that the indicator arrow is pointed to. Pressing `or` allows the user to scroll up or down through the menu options as described in Section 3.3.

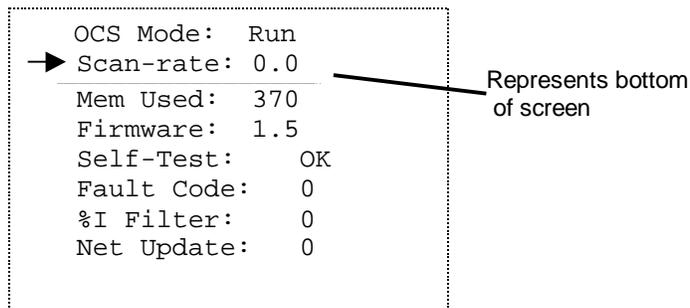
3.3 Menu Options

There are eight different menu options: The options include (a) View OCS Info (b) View Registers, (c) View I/O Slots, (d) View Char Set, (e) Set Fkeys Mode, (f) Set RS232 Mode (g) Set Network ID and (h) Set Contrast.

a. View OCS Info

OCS Information Screen

What the screen display looks like θ



The OCS Info screen shows information about the internal state of the unit. Pressing `and` scrolls through the different items. Pressing `ESC` will return to the Main Menu.

<u>Parameter</u>	<u>Description</u>
Firmware	Shows the execution engine firmware version.
OCS Mode	Shows the scanning mode (Idle, DO/IO, and Run).
%I Filter	Shows the number of scans a physical input must be stable before its state is accepted. A zero shows filtering is turned off.
Net Update	Shows the 100's of milliseconds before the network data is broadcast. This broadcast is in addition to change of state broadcast. A zero shows this feature is disabled.
Mem Used	Shows the number of bytes used by the ladder program.
Scan-Rate	Shows the number of milliseconds for the scan before this screen was displayed.
Self-Test	Shows if the power-up self-test passed or failed.
Fault Code	Shows the 8-bit fault code number in hexadecimal. (See Table 3.1.) If more than one fault is detected, the displayed code will be the hexadecimal sum of the

fault codes.

Code	Description
01	Bios checksum error
02	Firmware checksum error
04	User program checksum error
08	RAM test failed
10	Duplicate network ID error
20	Invalid network ID error
40	I/O configuration error
80	Network not usable error

Net Update

Global data is sent every time it's state changes. If it has not been sent in the time defined by the network update time-out, it is sent at that time. The network time-out is the maximum time that can elapse without broadcasting network data. If the data changes every scan this is the minimum time that can elapse before data is transmitted. If the time-out is set to zero, the data is sent only on change of state.

b. View Registers

What the screen display looks like θ

```
I1: 01010101
Q1: 00011100
```

The View Registers screen allows the user to view the state of internal PLC registers. Using the \leftarrow and \rightarrow keys, the different data types can be displayed. The data types include Inputs (I), Outputs (Q), Temporary (T), Global Network Inputs (IG), Global Network Outputs (QG), Timers and Counters (TC), Key Bits (K) and System (S). Pressing **ESC** will return to the configuration menu.

c. View I/O Slots

What the screen display looks like θ

```
1: 8I 8Q 24VDC
K: Keypad (8)
```

The View I/O Slots screen allows the I/O device on the unit to be displayed. Using the \leftarrow and \rightarrow keys, position the arrow next to the item to configure. Press **ESC** to return to the configuration menu.

d. View Char Set

What the screen display looks like θ

```
Use  $\uparrow\downarrow$  to view
Next char: 8= $\downarrow$ 
```

Press **Enter**, then use the \leftarrow and \rightarrow keys to scroll through the character set. Press **Enter**, then **Esc** to return to the configuration menu.

e. Set FKeys Mode

The user keys on the keypad can be configured to operate in one of two ways. When a user key is pressed it can TOGGLE the point associated with the key or it can MOMENTARILY turn the point ON when the key is pressed. Make a selection by pressing `Enter`, then use the `←` and `→` keys. Press `Enter` once your selection has been made.

Note: If the selection has been changed, the unit will stop executing the ladder code for up to 10 milliseconds while the key state is saved in non-volatile memory.

f. Set RS232 Mode

What the screen display looks like θ

```
Use ↑↓ to change
RS232 md: CSCAN
```

The Set RS-232 Mode screen allows the mode of the serial port to be set. Press `Enter`, then use the `←` and `→` keys to toggle between the options. Press the `Enter` key to save the option. The **CSCAN** mode allows Cscape to connect to the serial port for uploads, downloads, monitoring and control. The **Firmware Update** mode allows a Horner Electric (APG) firmware update and configuration utility to be used. Pressing `Enter` will save the selected mode. The firmware is ready to download when a solid “U” is displayed.

Note: If the port setting is changed, the unit will stop executing the ladder code for up to 10 milliseconds while the setting is saved in non-volatile memory.

g. Set Network ID

What the screen display looks like: θ

```
Network OK?   Yes
Network ID:   37
```

In the Set Network ID screen, the user is able to set the Network ID number. Each unit should have a unique ID number for the network. Press `Enter` to select “Network ID.” Use `←` and `→` to increment or decrement the digit under the cursor. If the node number does not need to be changed, press `Enter` and the unit will go back to displaying the menu screen. If you want to save the change to the node number, press `Enter`.

Note: The node number will be saved and the unit stops executing for one second while a series of network checks are performed with the new network ID.

h. Set Contrast

What the screen display looks like θ

```
Use ↑↓ to adjust
contrast: €€€€€€
```

The Contrast screen allows the contrast of the LCD display to be adjusted. By pressing the `←` key, the display gets darker, and the numbers increment. By pressing the `→` key, the display gets lighter, and the numbers decrement. Once the desired contrast is selected, press the `Enter` key and `Esc` to return to the configuration menu.

Note: If the contrast setting is changed, the unit stops executing the ladder code for up to 10 milliseconds while the setting is saved in non-volatile memory.

