



**User Manual for
HE500OCS300 / OCS301,
HE500OCS350 / OCS351,
HE500OCS451/ OCS551/ OCS651
HE800FOX104 / FOX404,
SmartStix**

Color Touch OCS Hardware

PREFACE

This manual explains how to use the Color-Touch OCS Modules.

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

Revisions to this Manual

This version (MAN0465-04) of the Color-Touch OCS User Manual contains the following revisions, additions, and deletions:

Added 8" screen (OCS451), 10" screen (OCS551), and 12" screen (OCS651) models to this manual.

Revised, reorganized, and re-numbered Chapter 1 to add three new models.

Revised Figure 2.14.

Moved Chapter 4 to Chapter 8; re-numbered remaining chapters.

Placed each Color Touch OCS model into its own individual chapter (chapters 3,4, 5, and 6).

Added new Chapter 11: SmartStix.

Added new Chapter 12: Compact Flash.

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CHAPTER 1: INTRODUCTION

1.1 Scope

This manual covers the following products.

a. Color Touch Operator Control Station (HE500OCS3xx, OCS451, OCS551, OCS651)

The specifications, installation, and configuration procedures of the Color Touch OCS are covered in detail in this user manual. Information is also provided for the use of the products in CsCAN and DeviceNet Networks.

b. SmartStack I/O Option Modules (HE800xxxxxx)

Because there is a wide variety of SmartStack Modules, the focus of the Control Station User Manual is to provide *general* installation and configuration data, which is common to *all* SmartStack Modules.

c. Fiber Optic Extension System (HE800FOX104 / FOX404)

Enables SmartStack I/O Modules to be mounted several meters from the Color Touch OCS; also increases the number of SmartStack I/O modules supported by one Color Touch OCS.

d. SmartStix Modules for CsCAN Networks (HE55xxxxxxx)

SmartStix is a family of remote I/O products for the OCS. This manual covers programming information for SmartStix used in CsCAN networks.

Table 1.1 – Product Descriptions

Color Touch OCS	Network	Screen Type		
HE500OCS300	CsCAN, DeviceNet	5.7" STN with 16 colors		
HE500OCS301	CsCAN, DeviceNet, On-Board Ethernet 10BaseT	5.7" STN with 16 colors		
HE500OCS350	CsCAN, DeviceNet	5.7" TFT with 16 colors		
HE500OCS351	CsCAN, DeviceNet, On-Board Ethernet 10BaseT	5.7" TFT with 16 colors		
HE500OCS451	CsCAN, DeviceNet, On-Board Ethernet 10BaseT	8" TFT with 32,768 colors		
HE500OCS551		10" TFT with 32,768 colors		
HE500OCS651		12" TFT with 32,768 colors		
All Color Touch OCS Models	Functions			
	Control	Display and Keypad	Network	I/O
	Yes	Yes	Yes	Yes
SmartStack Modules	Provides a wide variety of I/O options for the Color Touch OCS. Require little space and are easy to install. Up to <u>four</u> option modules can be connected to a controller.			
Fiber Optic Extension System (FOX104 / 404)	Extends a high-speed Color Touch OCS backplane enabling SmartStack I/O Modules to be mounted several meters from the Color Touch OCS. The FOX, also, significantly increases the number of SmartStack I/O modules supported by one Color Touch OCS.			
SmartStix Modules	Is a family of remote I/O products for the Color Touch OCS.			

1.2 Color Touch Models

1.2.1 Product Description

The Color Touch OCS provides controller, networking, I/O and operator interface capabilities in one unit using a highly visual, Color Touch display screen. All Color Touch OCS models can be used in CsCAN or DeviceNet networks. Models are also available that can be used in Ethernet networks in addition to CsCAN or DeviceNet networks. To use the Color Touch OCS in a DeviceNet network, a DeviceNet file can be downloaded from Cscape's Firmware Update Wizard (page 36).

Color Touch OCS models are equipped with one of two possible screen types – either a standard viewing screen (STN) or a wide-angle viewing screen (TFT), depending upon which model of Color Touch OCS is selected. An STN screen is viewed by looking directly into the front of the screen. A TFT screen offers wide-angle viewing that allows the screen to be viewed from the sides as well. Table 1.1 describes Color Touch OCS models that are available, the networks in which they can be used, and the types of screens used.

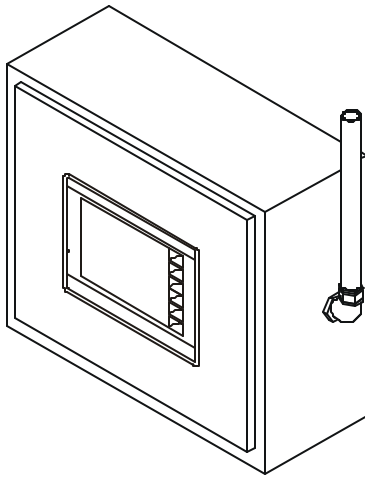
Color Touch OCS models have Serial and CAN (Controller Area Network) communication abilities. The units contain an RS-232 port for programming/debugging, monitoring and network administration from an IBM-compatible PC.

Color Touch OCS features include CsCAN (pronounced "see-scan") peer-to-peer network. CAN-based network hardware is used in the controllers because of CAN's automatic error detection, ease of configuration, low-cost of design and implementation and ability to operate in harsh environments. Networking abilities are built-in to the Color Touch OCS and require no external or additional modules.

When several Color Touch OCS models are networked together to achieve a specific purpose, the system acts like a large parallel-processing controller.

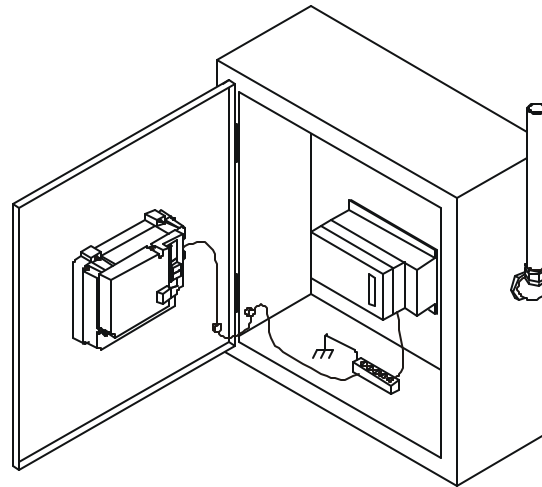
The Color Touch OCS combines several desirable functions in one compact package. Each unit is a highly integrated operator interface and controller with expandable I/O and networking capabilities have standard features consisting of the following:

- Color Touch, resistive screen (STN or TFT) in a variety of display sizes
- 24 VDC powered
- Dedicated I/O Processor
- RS-232 / RS-485 Serial Ports
- Integrated Bezel
- Real-Time Clock
- Flash Memory for easy field upgrades
- Compact Flash Memory (OCS/RCS 451,551,651 models)
- System Key and Configurable Function Keys.



001OCS001

**Figure 1.1– Color Touch OCS3xx
(Shown in Panel Box)**



001OCS002

**Figure 1.2–Back View of Color Touch OCS3xx
(Color Touch Shown in Panel Box Door)
(FOX Shown in Panel Box)**

The Color Touch OCS features the ability to pass through programming commands. When attached to an Color Touch OCS serial port, a programming package (i.e., Cscape) can access other Color Touch OCS units or any other OCS/RCS unit connected to a CsCAN network by passing the programming command through the serial port to the network port. One Cscape package (connected to one Color Touch OCS unit) can program all Color Touch OCS or other OCS/RCS units on the CsCAN network.

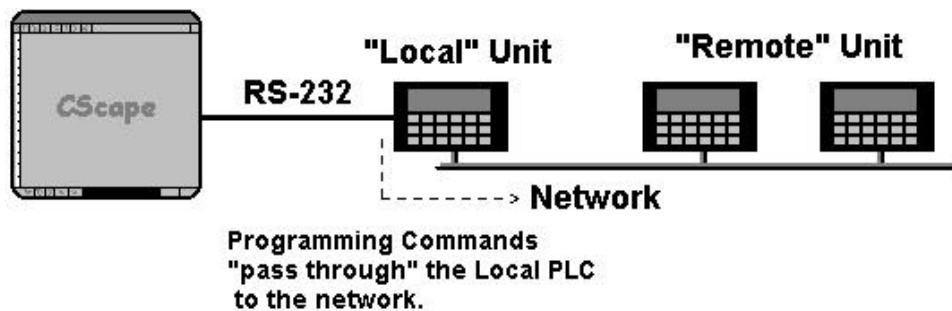


Figure 1.3 – Pass-Through Function (Available in CsCAN Networks Only)

After making a physical serial connection to one Color Touch OCS, the user must indicate which node is to be connected (called the TARGET). After that, Cscape and the Color Touch OCS automatically provide the pass through connection.

1.2.2 *Cscape Software*

Cscape Software (pronounced “see-scape”) is used with the Color Touch OCS products (Part # HE500OSW232). Cscape stands for **C**ontrol **S**tation **C**entral **A**pplication **P**rogramming **E**nvironment. The Windows-based software package is easy to use and aids in the integration of a CAN-based Distributed Control System. The program is used for configuring controllers. Cscape is also used for programming Color Touch OCS ladder logic, programming user displays for the Color Touch OCS, configuring the network for global digital and analog data, setting system-wide security and monitoring controllers in the system. Provided there is **one serial connection** to one node on the network (i.e., CsCAN Network), the operator has control over the entire system. The operator can upload, download, monitor and debug to any node on the network.

1.3 **SmartStack Fiber Optic Extension System (FOX)**

1.3.1 *Product Description*

The SmartStack Fiber Optic Extension System (FOX) extends a high-speed OCS backplane enabling SmartStack I/O Modules to be mounted several meters from the OCS. The FOX, also, significantly increases the number of SmartStack I/O modules supported by one OCS. SmartStack I/O Modules provide a wide variety of I/O options for all Color Touch OCS models. Refer to CHAPTER 7 for FOX specifications and other pertinent information.

1.4 Color Touch OCS Specifications

Table 1.2 - Color Touch OCS Specifications				
Models	OCS3xx (6-inch)	OCS451 (8-inch)	OCS551 (10-inch)	OCS651 (12-inch)
Display Type (LCD with backlight)	320 x 240 (TFT and STN models available.)	800 x 600 TFT	800 x 600 TFT	800 x 600 TFT
Display Size	5.7"	8.4"	10.4"	12.1"
Display Screen Dimensions	4.6"W x 3.5"H (117 x 88mm)	6.7"W x 5"H (170 x 128mm)	8.3"W x 6.2"H (211 x 159mm)	9.7"W x 7.3"H (246 x 185mm)
Display Memory	2 MBytes	8 MBytes		
User Keys	5 configurable keys + System Key	7 configurable keys + System Key		
Screens Supported	300 screens (50 data fields per screen)	1,023 screens (300 objects per screen)		
Number of Colors	16	32,768		
Primary Power	Steady State Current: 24VDC(+/-10%). 450mA @ 24VDC Inrush Current: (17A @ 24VDC) for 1ms.	Steady State Current: 24VDC(+/-10%). 1.0A @ 24VDC Inrush Current: (17A @ 24VDC) for 400µsec.	Steady State Current: 24VDC(+/-10%). 1.6A @ 24VDC Inrush Current: (17A @ 24VDC) for 400µsec.	Steady State Current: 24VDC(+/-10%). 1.6A @ 24VDC Inrush Current: (17A @ 24VDC) for 400µsec.
Primary Power Terminal Torque	10.6 In-Lb.	10.6 In-Lb.	12.0 In-Lb.	12.0 In-Lb.
Height	6.75" (171.45mm)	7.0" (178mm)	9.09" (231.0mm)	10.22" (259.6mm)
Width	10 3/16" (258.76mm)	9.17" (233mm)	11.96" (303.8mm)	12.85" (326.4mm)
Mounting Depth	3.00" (76.2 mm)	3.7" (94mm)	3.7" (94mm)	3.7" (94mm)
Keypad Material	Faceplate made of Lexan® HP92 by GE Plastics. The material is resistant to most corrosive substances found in industrial environments. The material also holds up well in most industrial conditions.			
Protocols supported				
Serial Ports:	CsCAN, Modbus Master, Modbus Slave, and ASCII Read and Write			
CAN Ports:	CsCAN (up to 253 drops) or DeviceNet Slave (Explicit Messaging, Polled Connection, Polled Snooping)			
Serial Ports	3 RS-232 / RS-485 Ports. Software Selectable.			
Network Ports	1 CAN (DeviceNet slave or CsCAN peer)			
Communications Options	On-board Ethernet 10BaseT supports TCP/IP with EGD and SRTP, CsCAN TCP, Modbus TCP Slave			
Expansion I/O	EIAJ RC-5720 Plastic Fiber, TX+RX 10m max. host (OCS or hub) to base			
Remote I/O	SmartStix support			
Microprocessor(s)	Dual Processors: Intel80C296 (control); Hitachi SH3 (graphics)		Dual Processors: Intel80C296 (control); Hitachi SH3-DSP (graphics)	
Control Memory	256K Ladder Memory plus 32KB Register Space			
Control Scan Rate	0.7mS / K Ladder Logic (typical)			
Portable Memory	None		Compact FLASH (CF) slot	
Temperature & Humidity	32 - 122°F (0 - 50°C), 5 to 95% Non-condensing			
UL	Please refer to Compliance Table located at http://www.heapg.com/Support/compliance.htm			
CE	Please refer to Compliance Table located at http://www.heapg.com/Support/compliance.htm OCS301 / 351: To maintain FCC and CE Radiated Emissions limits, you must install a ferrite (part number: 0461164181 available from Fair-Rite Corporation) within 25mm from the OCS end of the Ethernet cable.			

1.5 Color Touch OCS Resources

1.5.1 Overview

This section defines the resource limits that a programmer needs to know when writing a program using the Color Touch OCS. The Color Touch OCS combines operator interface (display and keypad), local I/O (analog and digital), networking, and controller, into a single product. In addition, the Color Touch OCS has graphical capabilities.

The controller portion of the Color Touch OCS products is programmed in ladder logic via the Windows-based Cscope (Control Station Central Application Programming Environment) package. Each Color Touch OCS provides a set of resources for use by the ladder logic control program.

1.5.2 Resource Limits

Table 1.4 shows the resources available in the Color Touch OCS. Note that although each register type inherently consists of either 1-bit or 16-bit registers, all registers can be accessed via User Screens and/or Ladder Code as 1, 8, 16 or 32-bit values or as ASCII character strings.

Table 1.3- Resource Limits							
Resource	OCS300	OCS301	OCS350	OCS351	OCS451	OCS551	OCS651
%S Registers	16						
%SR Registers	192						
%T Registers	2048						
%M Registers	2048						
%R Registers	9999						
%K Registers	5				7		
%D Registers	300				1023		
%I Registers	2048						
%Q Registers	2048						
%AI Registers	512						
%AQ Registers	512						
%IG Registers	64 CsCAN / 0 DeviceNet						
%QG Registers	64 CsCAN / 0 DeviceNet						
%AIG Registers	32 CsCAN / 16 DeviceNet						
%AQG Registers	32 CsCAN / 16 DeviceNet						
Network Port	CsCAN / DeviceNet						
Ethernet Port	No	Yes	No	Yes	Yes		

Table 1.3- Resource Limits							
Resource	OCS300	OCS301	OCS350	OCS351	OCS451	OCS551	OCS651
Controllers Per Network	253 CsCAN / 64 DeviceNet						
SmartStack I/O Modules	5 Fiber Optic Bases with 4 slots for a total of 20 I/O Modules.						
Keypad	7 Configurable Function Keys and System Key						
Display	320x240 STN		320x240 TFT		800 x 600 TFT		
Screen Memory	1024K				8,192K		
User Screens	300				1023		
Objects Per User Screen	300						
Ladder Code	256K						

1.5.3 Resource Definitions

System Registers

System Registers (%S and %SR) are used to store general Color Touch OCS status information. This information is used internally, and is also available to the operator via the System Menu, using the Control Station's display and keypad. The System Registers are also available for User Screens and can be accessed by Ladder Code.

1. %S Registers

%S Registers are 1-bit memory locations containing system status information, which are implemented as shown in **Table 1.4**:

Table 1.4- %S Registers		
Register	Name	Description
%S1	FST_SCN	On during first scan after entering RUN mode
%S2	NET_OK	On if Network is functioning properly
%S3	T_10MS	On for 5 ms.; Off for 5 ms.
%S4	T_100MS	On for 50 ms.; Off for 50 ms.
%S5	T_SEC	On for 500 ms; Off for 500 ms.
%S6	IO_OK	On if SmartStack I/O is configured properly
%S7	ALW_ON	Always On
%S8	ALW_OFF	Always Off
%S9	PAUSING_SCN	On during last scan before Pause
%S10	RESUMED_SCN	On during first scan after Pause resumes
%S11-16	-	<i>Reserved for Future Use</i>

2. %SR Registers

%SR Registers are 16-bit memory locations, containing system status information, implemented as shown in **Table 1.5**. **Note:** Where 2 %SRs are combined to make a 32-bit value, the lower numbered %SR is the low word, while the higher numbered %SR is the high word.

Table 1.5- %SR Registers				
Register	Name	Description	Min	Max
%SR1	USER_SCR	Current User Screen Number (0=none)	0	1023
%SR2	ALRM_SCR	Current Alarm Screen Number (0=none)	0	1023
%SR3	SYS_SCR	Current System Screen Number (0=none)	0	12
%SR4	SELF_TEST	Bit-Mapped Self-Test Result	0	65535
%SR5	CS_MODE	Control Station Mode (0=Idle, 1=Do I/O, 2=Run)	0	2
%SR6	SCAN_RATE	Average Scan Rate (in tenths of ms.)	-	1000
%SR7	MIN_RATE	Minimum Scan Rate (in tenths of ms.)	-	1000
%SR8	MAX_RATE	Maximum Scan Rate (in tenths of ms.)	-	1000
%SR9-10	Reserved	-	-	-
%SR11-12	LADDER_SIZE	Ladder Code Size	2	256K
%SR13-14	Reserved	-	-	-
%SR15-16	Reserved	-	-	-
%SR17-18	IO_SIZE	I/O Configuration Table Size	16	127K
%SR19-20	NET_SIZE	Network Configuration Table Size	34	1K
%SR29	NET_ID	This Station's Primary Network ID (CsCAN)	1	253
		This Station's Primary Network ID (DeviceNet)	0	63
%SR30	NET_BAUD	Network Baud Rate (CsCAN) (0=125KB; 1=250KB; 2=500KB; 3=1MB)	0	3
		Network Baud Rate (DeviceNet) (0=125KB; 1=250KB; 2=500KB)	0	2
%SR31	NET_MODE	Network Mode (0=Network Not Required; 1=Network Required; 2=Reserved; 3=Network Required and Optimized)	0	3
%SR32	LCD_CONT	LCD Display Contrast Setting	0	255
%SR33	FKEY_MODE	Function Key Mode (0=Momentary; 1=Toggle)	0	1
%SR34	SERIAL_PROT	RS232 Serial Protocol Mode (0=Firmware Update (RISM); 1=CsCAN; 2=Generic (Ladder- Controlled); 3=Modbus RTU; 4=Modbus ASCII)	0	4
%SR35-36	SERIAL_NUM	This Station's 32-bit Serial Number	0	2 ³² -1
%SR37	MODEL_NUM	This Station's Binary Model Number	0	65535
%SR38	ENG_REV	Main CPU Engine Firmware Rev Number x 100	0000	9999
%SR39	BIOS_REV	Main CPU BIOS Firmware Rev Number x 100	0000	9999
%SR40	FPGA_REV	FPGA Image Rev Number x 10	000	255
%SR41	LCD_COLS	LCD Graphics Display Number of Columns	320 Max. (OCS3xx) 800 Max. (OCS451,551, 651)	
%SR42	LCD_ROWS	LCD Graphics Display Number of Rows	240 Max. (OCS3xx) 600 Max. (OCS451,551, 651)	
%SR43	KEY_TYPE	Keypad Type (0=16 Keys; 1=17 Keys; 2=32 Keys; 3=36 Keys)	0	3
%SR44	RTC_SEC	Real-Time-Clock Second	0	59
%SR45	RTC_MIN	Real-Time-Clock Minute	0	59

Table 1.5- %SR Registers				
Register	Name	Description	Min	Max
%SR46	RTC_HOUR	Real-Time-Clock Hour	0	23
%SR47	RTC_DATE	Real-Time-Clock Date	1	31
%SR48	RTC_MON	Real-Time-Clock Month	1	12
%SR49	RTC_YEAR	Real-Time-Clock Year	1996	2095
%SR50	RTC_DAY	Real-Time-Clock Day (1=Sunday)	1	7
%SR51	NET_CNT	Network Error Count	0	65535
%SR52	WDOG_CNT	Watchdog-Tripped Error Count	0	65535
%SR53-54	BAD_LADDER	Bad Ladder Code Error Index	0	65534
%SR55	F_SELF_TEST	Filtered Bit-Mapped Self-Test Result	0	65535
%SR56	LAST_KEY	Key Code of Last Key Press or Release	0	255
%SR57	BAK_LITE	LCD Backlight On/Off Switch (OCS3xx): (OCS451,551,651):	0 (=off) 0 (=off)	1 (=on) 100 (=on)
%SR58	USER_LEDS	User LED Control / Status	0	65535
%SR59	S_ENG_REV	Slave CPU Engine Firmware Rev Number x 100	0000	9999
%SR60	S_BIOS_REV	Slave CPU BIOS Firmware Rev Number x 100	0000	9999
%SR61	NUM_IDS	This Station's Number of Network IDs (CsCAN)	1	253
		This Station's Number of Network IDs (DeviceNet)	1	1
%SR62-174	Reserved	-	-	-
%SR175	CompactFlash	This shows the current status of the CompactFlash interface (see Table 12.3)	0	6
%SR176-177	CompactFlash	This 32-bit register shows the free space on the CompactFlash card in bytes.	0	2 ³¹
%SR178-179	CompactFlash	This 32-bit register shows the total card capacity in bytes.	0	2 ³¹
%SR180	Reserved	-	-	-
%SR181	ALM_UNACK	Alarms Unacknowledged	-	-
%SR182	ALM_ACT	Alarms Active		
%SR183	SYS_BEEP	System Beep	0	1
%SR184	USER_BEEP	User Beep	0	1
%SR185	N/A	Screen Saver	0	1
%SR186	N/A	Screen Saver Time	1	1200
%SR187	NET_USE AVG	Network Usage (Avg)	0	1000
%SR188	NET_USE MIN	Network Usage (Min)	0	1000
%SR189	NET_USE MAX	Network Usage (Max)	0	1000
%SR190	NET_TX_USE AVG	Network TX Use (Avg)	0	1000
%SR191	NET_TX_USE MIN	Network TX Use (Min)	0	1000
%SR192	NET_TX_USE MAX	Network TX Use (Max)	0	1000

a. CompactFlash (%SR175 – 179)

%SR175 shows the current status of the CompactFlash interface. See **Table 12.3** on page 85 for CompactFlash status values.

User Registers (%T, %M and %R)

User registers are used to store application-specific Color Touch OCS data. This data can be accessed via User Screens and/or by Ladder Code.

1. %T Register

A %T Register is a non-retentive 1-bit memory location, used to store application-specific state information.

2. %M Registers

A %M Register is a retentive 1-bit memory location, used to store application-specific state information.

3. %R Registers

A %R Register is a retentive 16-bit memory location, used to store application-specific values.

HMI Registers

HMI registers give the user access to the Color Touch OCS keypad and display.

The Color Touch OCS has a touch-screen keypad and a graphics-based LCD display, but it does not yet support the Cscape Remote Display Terminal function. An operator is able to enter and display general and application-specific information using a virtual display and keypad.

1. %K Registers

A %K Register is a non-retentive 1-bit memory location (contact), used to store the state of a function key on the Control Station's keypad. If the function keys are set for momentary mode, a function key's associated %K register will be ON as long as the function key is pressed. If the function keys are set for toggle mode, a function key's associated %K register will toggle each time the function key is pressed.

2. %D Registers

A %D Register is a non-retentive 1-bit memory location (coil), which can be turned ON by Ladder Code to cause the corresponding User or Alarm Screen to be displayed.

3. User Screens

A User Screen is a combination of fixed text or graphics, along with variable Data Fields (called Graphics Objects in the Color Touch OCS), which together fill the LCD display screen. These screens are defined via Cscape dialogs and are then downloaded and stored into the controller's Flash memory. User Screens can be selected for display by operator entries on the keypad or by Ladder Code.

4. Data Fields

A Data Field is an area on a User Screen where variable data is displayed and edited. The source data for a Data Field can be any of the Control Station's Register resources as defined above. The field size and display format is programmable via Cscape dialogs.

SmartStack I/O Registers

SmartStack I/O Registers (%I, %Q, %AI and %AQ) give the user access to the SmartStack I/O Module data. This data can be accessed via User Screens and/or by Ladder Code.

1. %I Registers

A %I Register is a 1-bit memory location, which is normally used to store the state of one of the digital inputs associated with a SmartStack I/O module. When used in this way, %I registers are non-retentive. All extra %I registers, which are not associated with SmartStack inputs, are retentive, and can be used just like %M registers.

2. %Q Registers

A %Q Register is a non-retentive 1-bit memory location, which is normally used to store the state of one of the digital outputs associated with a SmartStack I/O module.

3. %AI Registers

A %AI Register is a 16-bit memory location, which is normally used to store the value of one of analog inputs associated with a SmartStack I/O module. When used in this way, %AI registers are non-retentive. All extra %AI registers, which are not associated with SmartStack inputs, are retentive, and can be used just like %R registers.

4. %AQ Registers

A %AQ Register is a non-retentive 16-bit memory location, which is normally used to store the value of one of the analog outputs associated with a SmartStack I/O module.

SmartStack I/O Modules

Five fiber optic bases each with four 4 slots allow a total of 20 SmartStack I/O Modules. They provide digital and analog I/O, and/or intelligent I/O, such as ASCII-Basic, High-Speed Counter, Stepper Motor Indexer, Power Monitor and Ethernet communication.

Global Data I/O Registers

Global Data I/O Registers (%IG, %QG, %AIG and %AQG) give the user access to the Network Port's Global I/O data. This data can be accessed via User Screens and/or by Ladder Code.

1. %IG Registers

A %IG Register is a retentive 1-bit memory location, which is normally used to store a global digital state obtained from another Control Station on the network.

2. %QG Registers

A %QG Register is a retentive 1-bit memory location, which is normally used to store a digital state to be sent as global data to the other Control Stations on the network.

3. %AIG Registers

A %AIG Register is a retentive 16-bit memory location, which is normally used to store a global analog value obtained from another Control Station on the network.

4. %AQQ Registers

A %AQQ Register is a retentive 16-bit memory location, which is normally used to store an analog value to be sent as global data to the other Control Stations on the network.

Network Port

The CsCAN Network is based on the Bosch Control Area Network (CAN), and implements the CsCAN Protocol, which is designed to take maximum advantage of the global data broadcasting capability of CAN. Using this network protocol, up to 64 Control Stations can be linked without repeaters, and up to 253 Control Stations can be linked by using 3 repeaters. For more information regarding CsCAN Protocol, refer to the **CsCAN Protocol Specification** document.

DeviceNet is an “open” higher layer protocol, which is supported by products from multiple vendors. In a Color Touch OCS, DeviceNet can be loaded as a replacement for the CsCAN Protocol Message Layer, and as a result, the Color Touch OCS becomes a DeviceNet Slave device. (See page 36.) Note that the Color Touch OCS still implements the CsCAN Protocol Command Layer with respect to the RS232 programming port. For more information regarding DeviceNet Protocol, contact the DeviceNet governing body (ODVA).

Ladder Code

The Ladder Code, stores ladder instructions generated by Cscape. This Ladder Code is downloaded and stored into the Control Station's Flash memory, to be executed each controller scan, when the controller is in RUN mode.

1.6 References

For further information regarding products covered in this manual, refer to the following references:

- a. *DeviceNet Implementation Using Control Station Modules (SUP0326)* - Covers the implementation of Control Station products in a DeviceNet network.
- b. *Cscape Programming and Reference Manual (MAN0313)* – Topics in this manual have been selected to assist the user through the programming process. It also covers procedures for creating graphics using the Color Touch OCS.
- c. *SmartStack Modules User Manual (SUP0246)* - Contains individual data sheets for each module and covers specifications, wiring, and configuration.
- d. *SmartStack Ethernet Module User Manual (SUP0341)* – Covers the SmartStack Ethernet Module for use in Ethernet networks.

1.7 Technical Support

For assistance, contact Technical Support at the following locations:

North America:

(317) 916-4274

www.heapg.com

Europe:

(+) 353-21-4321-266

www.horner-apg.com

NOTES

CHAPTER 2: INSTALLATION (COLOR TOUCH OCS)

2.1 General

Chapter Two covers installation information that applies to all models of the Color Touch OCS. For model-specific information, refer to the appropriate product chapter in this manual.

OCS3xx:	6-inch OCS	(Page 41)
OCS451:	8-inch OCS	(Page 43)
OCS551:	10-inch OCS	(Page 45)
OCS651:	12-inch OCS	(Page 47)

2.2 Mounting Requirements

2.2.1 Mounting Procedures (Installed in a Panel Door)

Note: The following instructions apply to all Color Touch OCS models. The OCS3xx is depicted as an example.

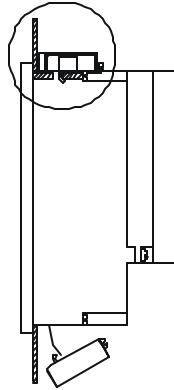
The Color Touch OCS is designed for permanent panel mounting. To install the Color Touch OCS, follow the instructions below.

1. Prior to mounting the Color Touch OCS, observe requirements for the panel layout design and adequate clearances. (A checklist is provided on page 26.)
2. Cut the host panel. (Panel Cut-outs and dimensions are found in the appropriate product chapter in this manual. For your convenience, page numbers are listed in Section 2.1.)
3. Insert the Color Touch OCS through the panel cutout (from the front). The gasket material needs to lie between the host panel and the Color Touch OCS panel.
4. Install and tighten the mounting clips (provided with the Color Touch OCS) until the gasket material forms a tight seal. Refer to Figure 2.1.

Caution: Do not over-tighten. Over-tightening can potentially damage the case.

5. Connect cables as needed such as communications, programming, power and fiber optic cables to the Color Touch OCS ports using the provided connectors.
6. Begin configuration procedures for the Color Touch OCS models.

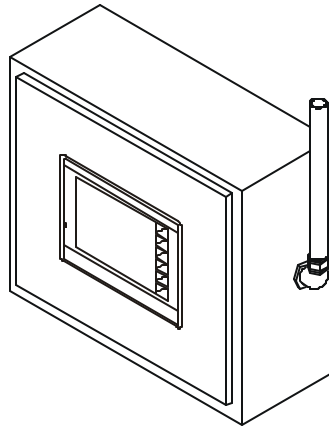
2.2.2 Color Touch OCS Mounting Clip



001OCS004

Figure 2.1 – Side View of Color Touch OCS with Mounting Clip (OCS3xx Shown as an Example)

2.2.3 Color Touch OCS Mounting Orientation



001OCS001

NOTE: There are NO orientation restrictions on the Color Touch OCS. However, the above orientation provides for optimum readability of the screen and ease of use of the keypad.

Figure 2.2 – Orientation of Color Touch OCS (OCS3xx Shown as an Example)

2.3 Factors Affecting Panel Layout Design and Clearances

Warning: It is important to follow the requirements of the panel manufacturer and to follow applicable electrical codes and standards.

The designer of a panel layout needs to assess the requirements of a particular system and to consider the following design factors. A convenient checklist is provided on page 26.

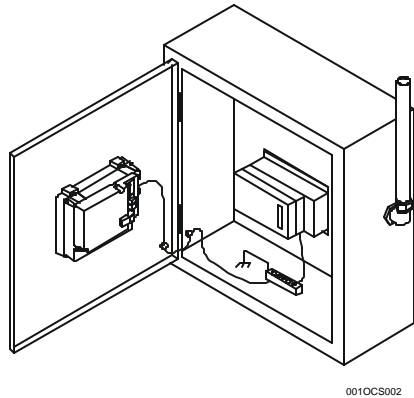


Figure 2.3 – Back view of Color Touch OCS (Shown On Panel Door) (OCS3xx Shown as an Example)

a. Clearance / Adequate Space

Install devices to allow sufficient clearance to open and close the panel door. Note that the Color Touch OCS is mounted on a panel door and the Color Touch OCS is mounted in a panel box.

Table 2.1 – Minimum Clearance Requirements for Panel Box and Door	
Minimum Distance between base of device and sides of cabinet	2 inches (50.80mm)
Minimum Distance between base of device and wiring ducts	1.5 inches (38.10mm)
<u>If more than one device installed in panel box (or on door):</u> Minimum Distance between bases of each device	4 inches between bases of each device (101.60mm)
<u>When door is closed:</u> Minimum distance between device and closed door (Be sure to allow enough depth for Color Touch OCS.)	2 inches (50.80mm)

b. Grounding

Warning: Be sure to meet the ground requirements of the panel manufacturer and also meet applicable electrical codes and standards.

Panel box: The panel box needs to be properly connected to earth ground to provide a good common ground reference.

Panel door: Tie a low impedance ground strap between the panel box and the panel door to ensure that they have the same ground reference.

c. Temperature / Ventilation

Ensure that the panel layout design allows for adequate ventilation and maintains the specified ambient temperature range. Consider the impact on the design of the panel layout if operating at the extreme ends of the ambient temperature range. For example, if it is determined that a cooling device is required, allow adequate space and clearances for the device in the panel box or on the panel door.

d. Orientation

There are no orientation restrictions on the Color Touch OCS. However, the orientation shown in Figure 2.3 provides for optimum readability of the screen and ease of use of the keypad.

e. Noise

Consider the impact on the panel layout design and clearance requirements if noise suppression devices are needed. Be sure to maintain an adequate distance between the Color Touch OCS and noisy devices such as relays, motor starters, etc.

Note: Fiber Cables can be routed in the same conduit as the power wires.

2.3.1 Panel Layout Design and Clearance Checklist:

The following list provides highlights of panel layout design factors.

___ Meets the electrical code and applicable standards for proper grounding, etc.?

___ Meets the panel manufacturer's requirements for grounding, etc.?

___ Is the panel box properly connected to earth ground? Is the panel door properly grounded? Has the appropriate procedure been followed to properly ground the devices in the panel box and on the panel door?

___ Are minimum clearance requirements met? (See **Table 2.1.**) Can the panel door be easily opened and closed? Is there adequate space between device bases as well as the sides of the panel and wiring ducts?

___ Is the panel box deep enough to accommodate the Color Touch OCS?

___ Is there adequate ventilation? Is the ambient temperature range maintained? Are cooling or heating devices required?

___ Are noise suppression devices or isolation transformers required? Is there adequate distance between the base of the Color Touch OCS and noisy devices such as relays or motor starters? Ensure that power and signal wires are not routed in the same conduit.

___ Are there other requirements that impact the particular system, which need to be considered?

2.4 Ports, Connectors, Cables, and Wiring

Note: For a detailed view of locations of **ports** and **connectors** for each Color Touch OCS model, refer to the appropriate product chapter:

- OCS3xx: 6-inch OCS (Page 41)
- OCS451: 8-inch OCS (Page 43)
- OCS551: 10-inch OCS (Page 45)
- OCS651: 12-inch OCS (Page 47)

2.4.1 Primary Power Port / Grounding

Table 2.2 – Primary Power Port Pins	
Signal Pin	Description
V+	Input power supply voltage
V-	Input power supply ground
	Frame Ground

Note: Power Supply Voltage Range is from 24VDC ±10%.

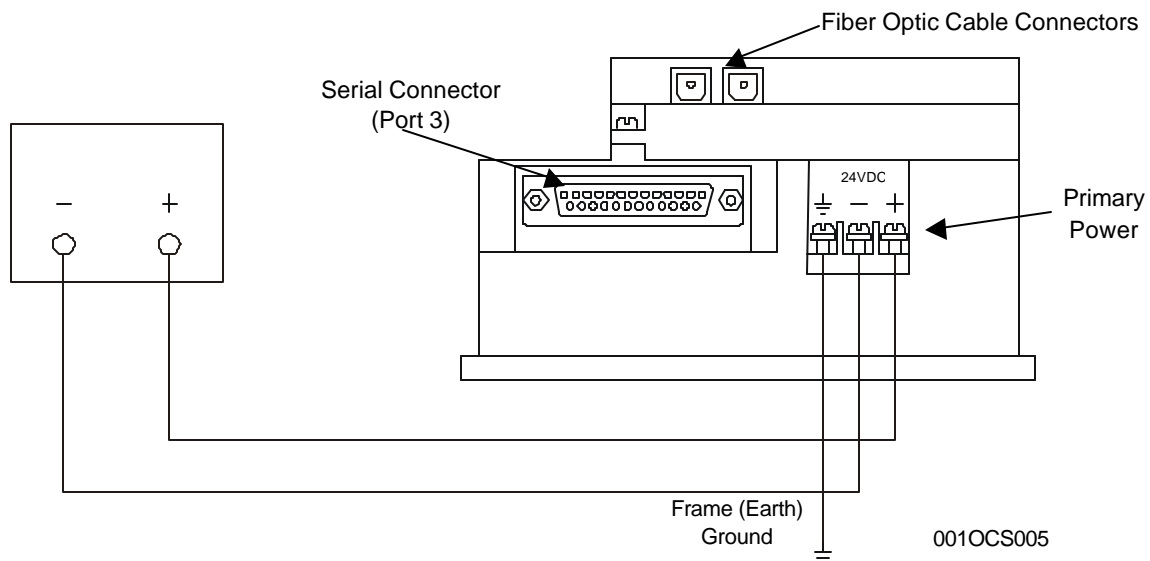
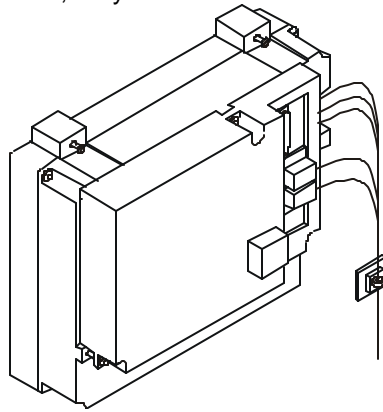


Figure 2.4 – Connectors and Grounding (OCS3xx Shown As An Example)

Figure 2.4 depicts grounding for the OCS3xx. The grounding procedure is similar for all Color Touch OCS models. Refer to the connector diagrams for each model contained in each individual product chapter (Chapters 3-6).

2.4.2 *Fiber Optic Cables*

When fiber optic cables are used, they are bundled as shown:



Note: Fiber Optic Cables can be bundled with the Power Cable.

Figure 2.5 – Suggested Method of Securing Fiber Optic Cables
(OCS3xx Shown as an Example)

2.4.3 *CAN Network / DeviceNet Network Port and Wiring*

a. **Connector**

Table 2.3 – CAN Port Pins		
Pin	Signal	Description
1	V-	Power -
2	CN_L	Signal -
3	SHLD	Shield
4	CN_H	Signal +
5	V+	Power +

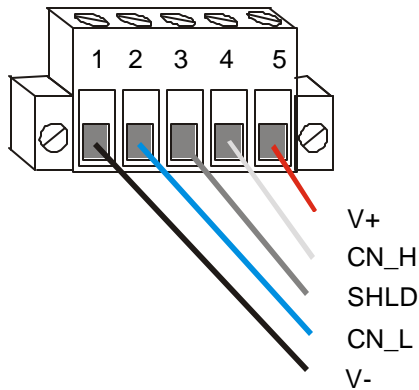


Figure 2.7 – Network Connector (CAN Port)

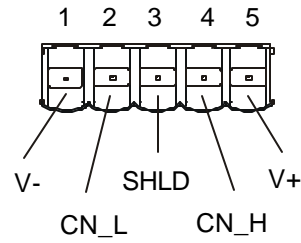


Figure 2.6– As viewed looking at the Color OCS

Note: To optimize CAN network reliability in electrically noisy environments, the CAN power supply needs to be isolated (dedicated) from the primary power.

b. Wiring

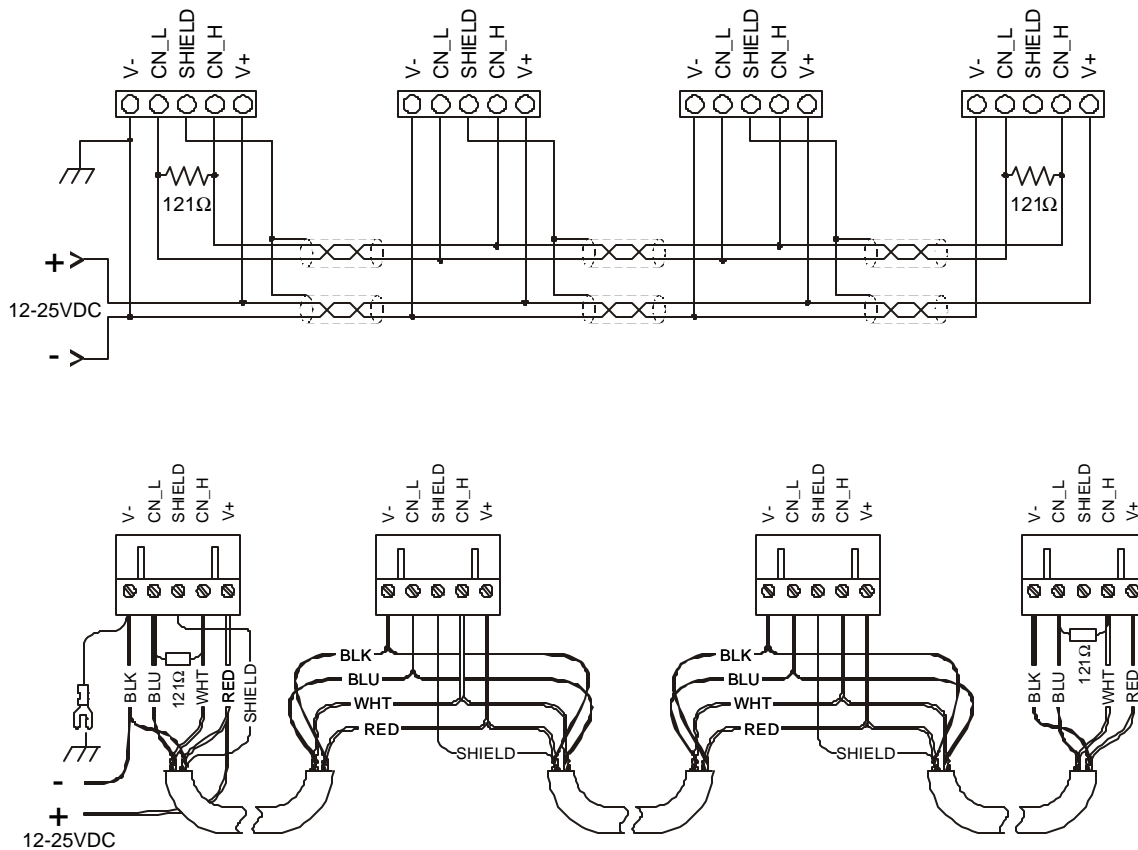


Figure 2.8 – CAN Wiring

Note: To optimize CAN network reliability in electrically noisy environments, the CAN power supply needs to be isolated (dedicated) from the primary power.

c. **CAN Wiring Rules** (See Figure 2.8)

Note: To optimize CAN network reliability in electrically noisy environments, the CAN power supply needs to be isolated (dedicated) from the primary power.

1. Wire the CAN network 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 need to have 121 ohm 1% terminating resistors connected across the CN_L and CN_H terminals.
3. Use data conductors (CN_L and CN_H) that are 24 AWG shielded twisted pair for "thin cable" and 22 AWG shielded twisted pair for "thick cable." They must also have 120-ohm characteristic impedance. In typical industrial environments, use a Belden wire #3084A ("thin"). Use #3082A ("thick") for network cable lengths greater than 100 meters environments where noise is a concern. Place data conductors (CN_L and CN_H) into a twisted pair together.
4. Use power conductors (V- and V+) that are 18 AWG twisted-pair for "thin cable" and 15 AWG twisted-pair for "thick cable." Place power conductors (V- and V+) into a twisted pair together.
5. If local codes require the local CAN power supply to be earth grounded, connect the V- power conductor to a good earth ground **at one place only** on the network, preferably at a physical endpoint. If multiple power supplies are used, only one power supply must have V- connected to earth ground. The remaining power supplies need to be isolated.
6. 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) is limited to 64 nodes (with 63 cable segments) with a maximum combined cable length of 1500 ft. at 125KBaud.
8. Up to four CAN network segments, which adhere to the above rules, may be connected together using three CAN repeaters. In this manner, a CAN network may be extended to 253 nodes with a total cable distance of 6000 ft. at 125KBaud.

d. **CsCAN or DeviceNet Cable**

Note: For more details about DeviceNet networks, refer to the *DeviceNet 2 Implementation Using Control Station Modules*. (Refer to page 20 for reference information.) -

The 5-wire, multi-conductor copper cable used in CsCAN or DeviceNet network include:

1. Two wires used as a transmission line for network communications.
2. Two wires used to transmit network power.
3. One conductor used as an electromagnetic shield.

Cabling is available in a variety of current-carrying capacities. On a CsCAN or DeviceNet fieldbus, every device must, at least, power its network transceivers from the network power supply. Some devices draw all of their power from the network supply. In CsCAN or DeviceNet, thick and thin cable is used as indicated:

1. **Thick cable:** Use for long distances and more power. Usually used for Trunk cable.
2. **Thin cable:** Use for shorter distances. Usually used for drop cables or where cable flexibility is needed.

Thick Cable – general specifications (e.g., Belden 3082A)	Two twisted shielded pairs –Common axis with drain wire in center. One signal pair (#18), blue/white; One power power pair (#15) black/red. Separate aluminized mylar shields around power pair and signal pair. Overall foil/braid shield with drain wire (#18), bare*. High Speed (Vp=75% min), low loss, low distortion, data pair (to keep propagation delays to a minimum). 8 amp maximum current capacity. PVC insulation on power pair. Industrial temperature range. High flexibility.
Thin Cable – general specifications (e.g., Belden 3084A)	Two twisted shielded pairs –Common axis with drain wire in center. One signal pair (#24), blue/white; One power power pair (#22) black/red. Separate aluminized mylar shields around power pair and signal pair. Overall foil/braid shield with drain wire (#22), bare*. High Speed (Vp=75% min), low loss, low distortion, data pair (to keep propagation delays to a minimum). 3 amp maximum current capacity. PVC insulation on power pair. Industrial temperature range. High flexibility
Network Topology	Bus with limited branching (truckline / dropline)
Redundancy	Not Supported
Network Power for Node devices	Nominal 24 VDC ±4%
Allowed Nodes (Bridging excluded)	64 nodes
Data Packet Size	0-8 bytes with allowance for message fragmentation
Duplicate Address Detection	Addresses verified at power-up
Error Detection / Correction	CRC – retransmission of message if validity not acknowledged byrecipient.
* The drain wire connects shields within the cable and serves as a means to terminate the shield into the connector.	

e. Bus Length

Several factors affect the maximum length of the bus including the accumulated length of drop lines, cable type, transfer rate and the number of drop lines. Although a branch is limited to one network per drop, it can have multiple ports. A branch can not exceed 6 meters.

Thick Cable: Network Data Rate	Maximum Total Cable Length
1Mbit / sec. (Does not apply to DeviceNet.)	40m (131 feet)
500Kbit / sec.	100m (328 feet)
250Kbit / sec.	200m (656 feet)
125Kbit / sec.	500m (1,640 feet)

f. Bus Power and Grounding

When using CsCAN or DeviceNet:

1. A power supply of 24VDC ($\pm 4\%$) at 16A maximum is required for use in a CsCAN / DeviceNet network
2. With thick cable, a single network segment can have a maximum of 8A. To do this, the power supply needs to be located in the center of two network segments.
3. Thin cable has maximum of 3A.
4. To ground the cable shield, connect to pin 3 as shown in Figure 2.8.
5. If local codes require the local CAN power supply to be earth grounded, connect the V- power conductor to a good earth ground **at one place only** on the network, preferably at a physical endpoint. If multiple power supplies are used, only one power supply must have V- connected to earth ground. The remaining power supplies need to be isolated.

g. CAN Repeater (Using the HE200CGM100)

The HE200CGM100 (CGM100) is an intelligent CAN network isolating repeater. The following guidelines are provided for using the CGM100. For additional information, refer to **MAN0008**. In a typical CAN network, each device is assigned a unique CAN node address (ID) to arbitrate network communication. Depending on the application protocol used, these IDs are assigned in the range of 0 to 253. Therefore, up to 254 devices may be logically attached to a CAN network.

However, the use of standard CAN transceiver chips limits the number of physically attached devices to 64. Thus, to reach the logical limit of 254 devices, up to three smart CAN repeaters are used to connect groups of devices together. A CAN network (without repeaters) is usually limited to a maximum cable length of 1,500 feet (assuming a Baud rate of 125 kHz). With repeaters, this limit can be extended to 6,000 ft.

Using CGM100's 1000V isolation virtually eliminates problems associated with ground potential differences that are inherent in long cable drops on many local area networks.

2.4.4 RS-232 Port / RS-485 Port

There are a variety of ways to connect to the RS-232 and RS-485 ports; Two modular jacks (Port 1) and Port 2) and a serial connector (Port 3) are available for use. **Table 2.6** indicates the ports and functions associated with each type of modular jack and connector.

Note: Each serial port can be configured for a maximum baud rate of 115,200K; however if PORT3 is used consecutively with either of the other ports within an application, do not exceed a baud rate of 57,600K for PORT3.

Table 2.6 – Ports and Functions (Port 1, 2, and 3)		
RS-232	RS-485	Functions
Port 1	Port 1	Programming, Debugging Monitoring, Configuring.
Port 1, Port 2, Port 3	Port 1, Port 2, Port 3	Ladder Logic-Controlled Serial Communications (e.g. communications to printers, bar code scanners, terminals, Modbus, and other types of applications.
Port 3	Port 3	Modems

Note: In the unlikely event that the label is removed, Port 1,2 and 3 correspond with the following markings on the case: **Port 1 (MJ1); Port 2 (MJ2); Port 3 (CN1).**

a. Port 1 / Port 2 Modular Jacks

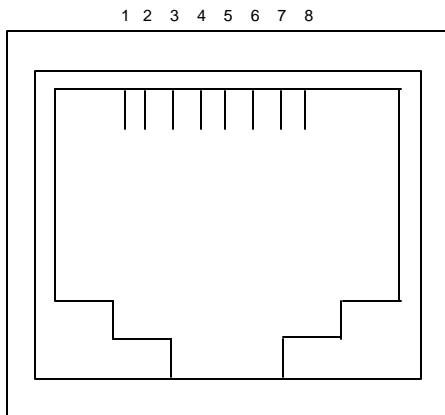


Figure 2.9 – Close-up of Port 1 /Port 2 (RS-232 and RS-485)

Table 2.7 – Port 1 / Port 2 Pins	
Port 1 Port 2 Pin	Signal
1	+SD/RD
2	-SD/RD
3	+5V
4	+5V
5	0V
6	0V
7	RXD
8	TXD
Output power supply: Max. 150mA	

b. Port 3 Connector

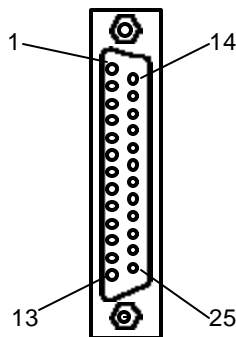


Figure 2.10– RS-232 / RS-485 Connector (Port 3)

Table 2.8– Port 3 Pins				
Pin #	Signal	Pin #	Signal	
1	FG	14	OCS3xx -RTS	OCS451, 551, 651 +RTS
2	TXD	15	Not Used	
3	RXD	16	Not Used	
4	RTS	17	OCS3xx +RTS	OCS451, 551, 651 -RTS
5	CTS	18	-CTS	
6	Not Used	19	+CTS	
7	SG	20	Not Used	
8	Not Used	21	Not Used	
9	+5V	22	Not Used	
10	0V	23	Not Used	
11	Not Used	24	+RD	
12	+SD	25	-RD	
13	-SD			

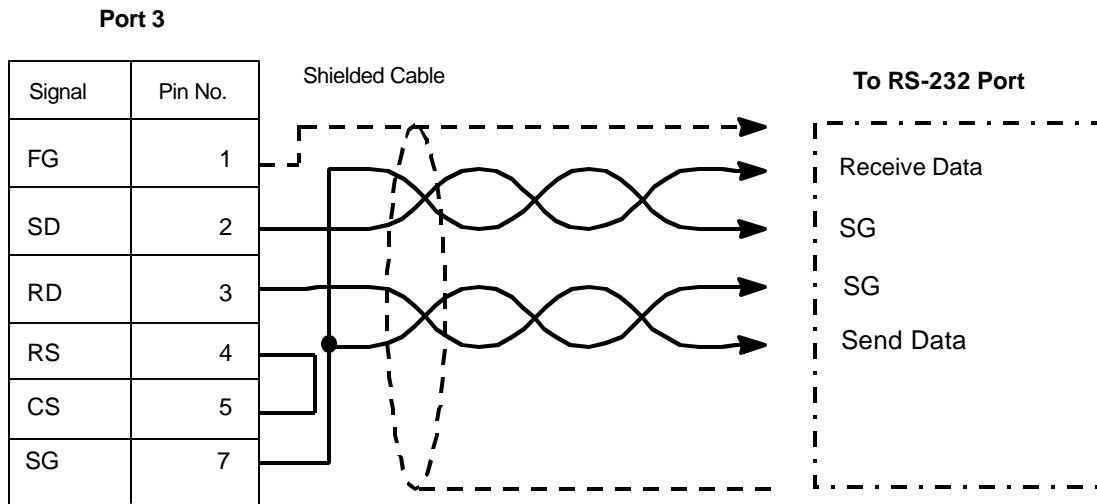


Figure 2.11 - RS-232 Port (Port 3)

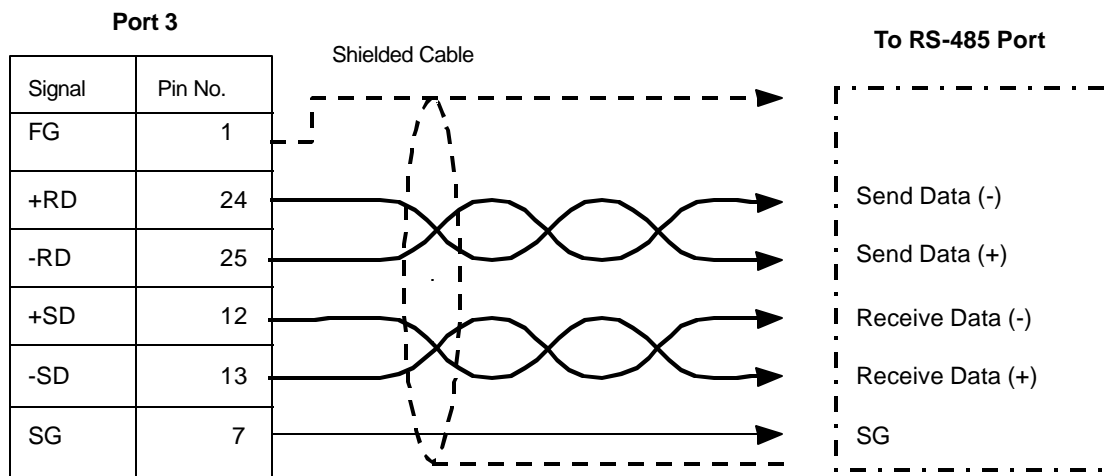


Figure 2.12 - RS-485 Port (Port 3)

2.4.5 Modem Setup

A modem can be used for remote communications between a computer (using Cscape Software) and the Color Touch OCS. The modem must operate at 9600 baud or higher.

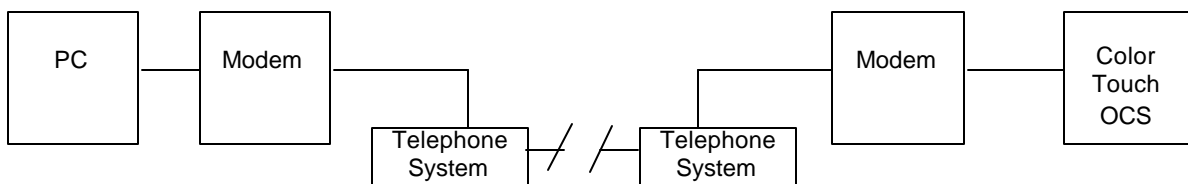


Figure 2.13 – Modem Setup

a. Setup

Setup the modems to match the default serial port characteristics of the Color Touch OCS.

9600 baud
8 data bits
No parity
1 stop bit
disable error checking
disable compression

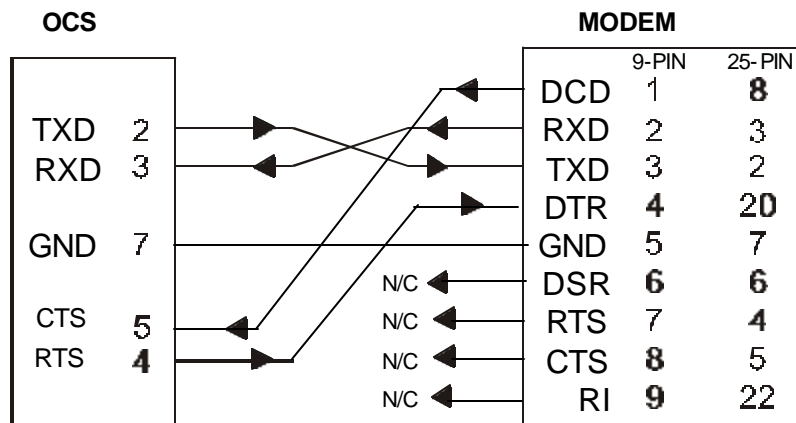
b. Cable Wiring

Figure 2.14 – Modem Wiring

The wire type used is not overly critical except where the length of the cable must be between 30 and 50 feet (10 to 15 meters). In all cases, the cable must be shielded multi-conductor with conductors of at least 20 gauge. The length of the cable must be as short as possible, and in no case, longer than 50 feet (15 meters).

The modem must be located as close as possible to the Color Touch OCS, preferably less than one meter. However, EIA-232 specifications allow for cable runs up to 50 feet (15 meters). If cable lengths longer than 30 feet (10 meters) are required, a special low capacitance cable must be used.

Warning: To connect a modem to the Color Touch OCS the controller to modem cable must be constructed or purchased. Using a Null Modem cable can cause damage to the Color Touch OCS, modem or both.

c. Recommended Modem

Selection of a telephone modem for use with the OCS is highly dependent on environment. For a relatively benign, low-noise environment, an off-the-shelf external modem like a U.S. Robotics Sportster Modem may work well. For a more industrial environment, however, it is appropriate to use a telephone modem designed for that environment. Check with Technical Support for the availability of an industrial modem from Horner APG (page 21). Other manufacturers such as Datalinc have models, which have been known to work in more harsh environments at a higher cost. ***If a modem is used which is not appropriate for the environment, there may be little that can be done to correct the situation other than change to a more appropriate model.***

For detailed information regarding the use of modems with Control Station Products, contact Technical Support (page 21). You can also find specific application information (cabling, modem commands, etc.) in the Cscape Help file as well.

2.4.6 CE Requirement for Ethernet Modules (OCS301 / OCS351)

To maintain FCC and CE Radiated Emissions limits, you must install a ferrite (part number: 0461164181 available from Fair-Rite Corporation) within 25mm from the OCS end of the Ethernet cable.

2.5 Firmware Update Wizard (Selecting DeviceNet Network)

To use the OCS in a DeviceNet network, use Cscape's Firmware Update Wizard.

1. Select **File, Firmware Update Wizard** from the pull-down menu. The following screen appears.



Figure 2.15 – Using Firmware Update Wizard

Select the product type using the pull-down menu and click on the circle next to the desired network. Press **OK**.

Note: If the following message box appears; press the **Yes** button to proceed with the download.

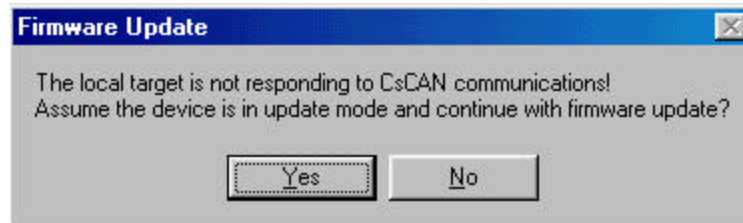


Figure 2.16 – Device Not Communicating

2. A Warning dialog box (see Figure 2.17) appears regarding the quality and length of the cable. Press **OK** to proceed.

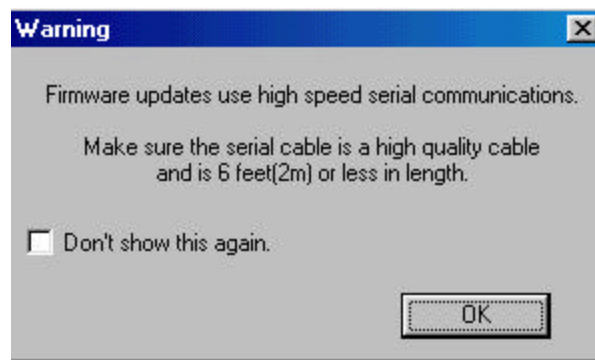


Figure 2.17 – Cable Warning

3. The following screen appears. Press **Start** to begin the firmware download. If any errors occur, verify that the cable is high quality: a straight-through RS-232 cable with all of the pins connected.

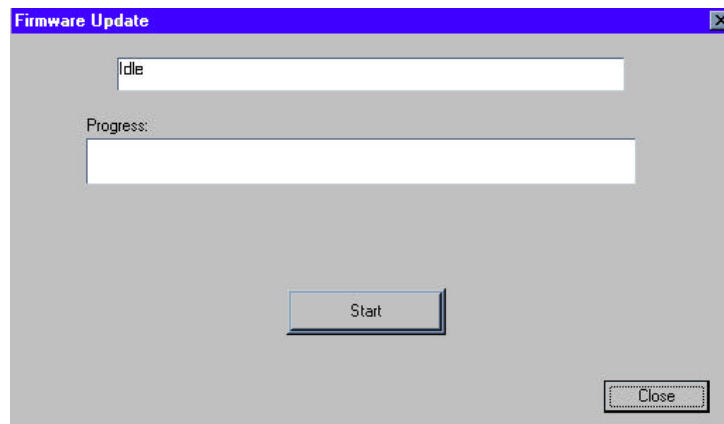


Figure 2.18 – Firmware Update

4. On the next screen, press **Send**. Firmware is now updated.
5. After the update is complete, press **OK**. Click on **Controller** and select **Status**. Ensure that the versions of the firmware, bios, and FPGS are current. The user program needs to be reloaded into the OCS unit. Use the Download Procedure to load the program into the OCS. For additional assistance, contact Technical Support (page 21).

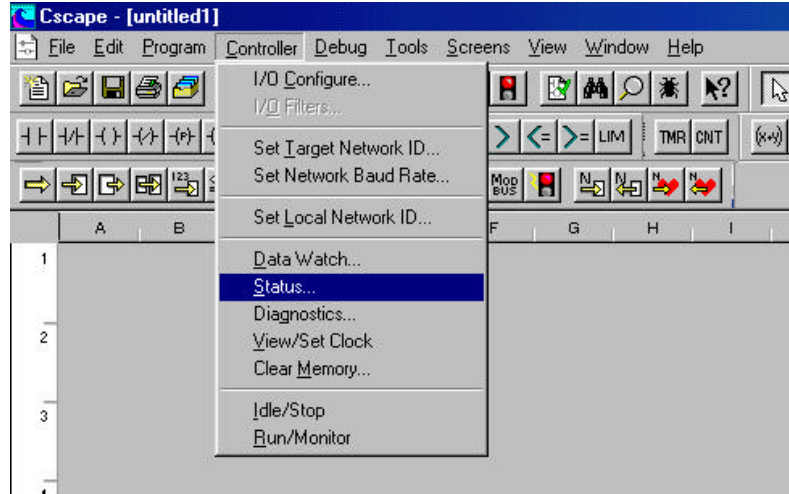


Figure 2.19 – Selecting Status

2.6 Color Touch LEDs

2.6.1 LEDs

LEDs are not physically located on the front panel of the Color Touch OCS. However, virtual RUN and OK LEDs can be accessed by pressing the SYSTEM key. (Refer to Figure 8.1.) Physical RUN, OK, CAN OK, and FIBER OK LEDs can be viewed on the back of the Color Touch OCS next to the fiber optic connectors.

Table 2.9 – Color Touch OCS LEDs	
RUN	<ul style="list-style-type: none"> • OFF indicates OCS is in IDLE/STOP mode. • Flashing indicates DO / IO mode or RUN with no ladder program. • ON indicates ladder code running.
OK	<ul style="list-style-type: none"> • OFF indicates one or more self-tests failed. • ON indicates all self-tests passed.
CAN OK	Randomly flashes during CAN communications.
FIBER OK	ON indicates Color Touch OCS's fiber input cable is properly connected and is receiving a carrier.

2.7 Battery Replacement

Warning: Disposal of lithium batteries must be done in accordance with federal, state, and local regulations. Be sure to consult with the appropriate regulatory agencies *before* disposing batteries. In addition, do not re-charge, disassemble, heat or incinerate lithium batteries.

Warning: Do not make substitutions for the battery. Be sure to only use the authorized part number to replace the battery.

NOTES

CHAPTER 3: 6-INCH OCS (OCS3XX)

3.1 General

Chapter Three covers information specific to the OCS3xx. Refer to Chapter Two for general installation information.

3.2 OCS3xx Panel Cut-out and Dimensions

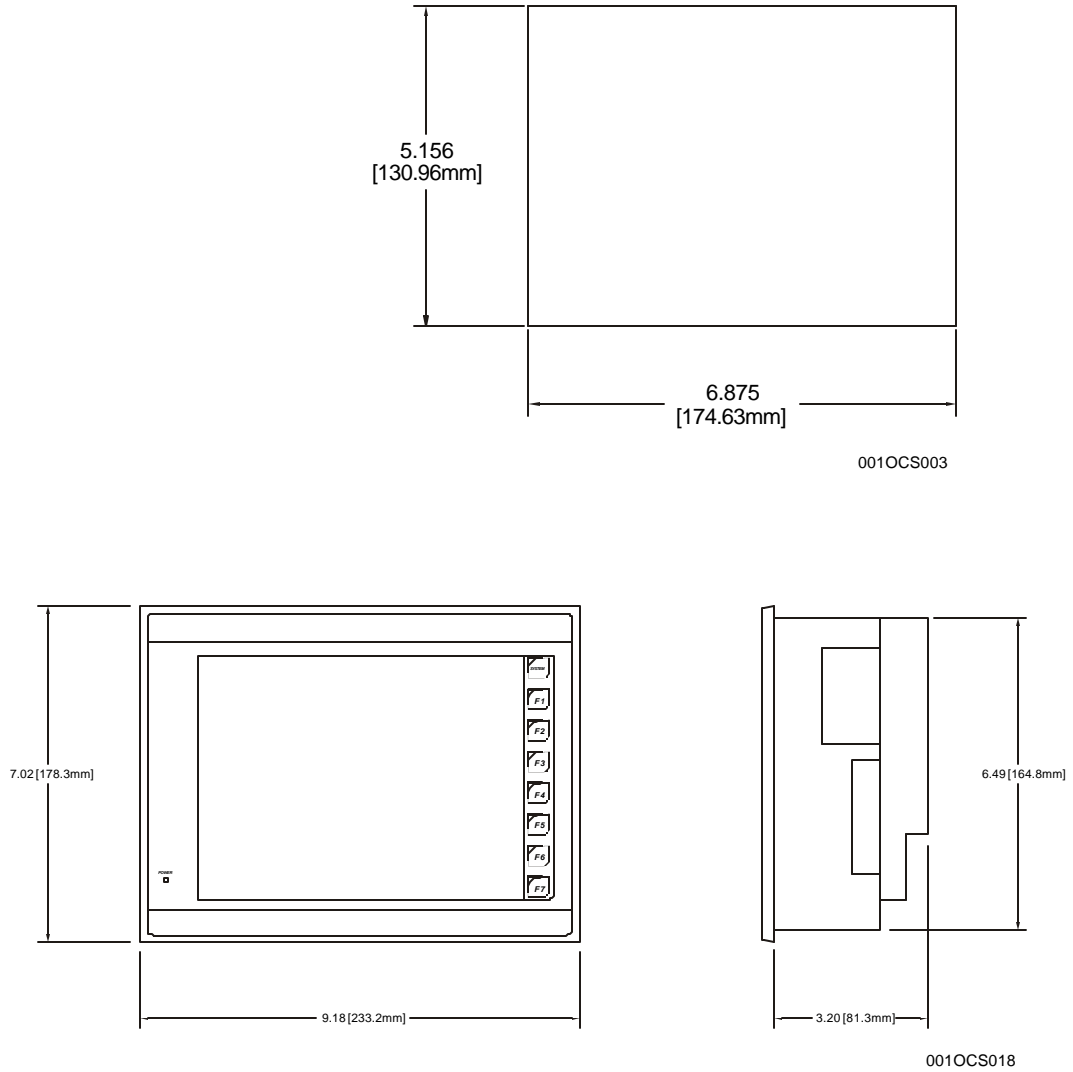
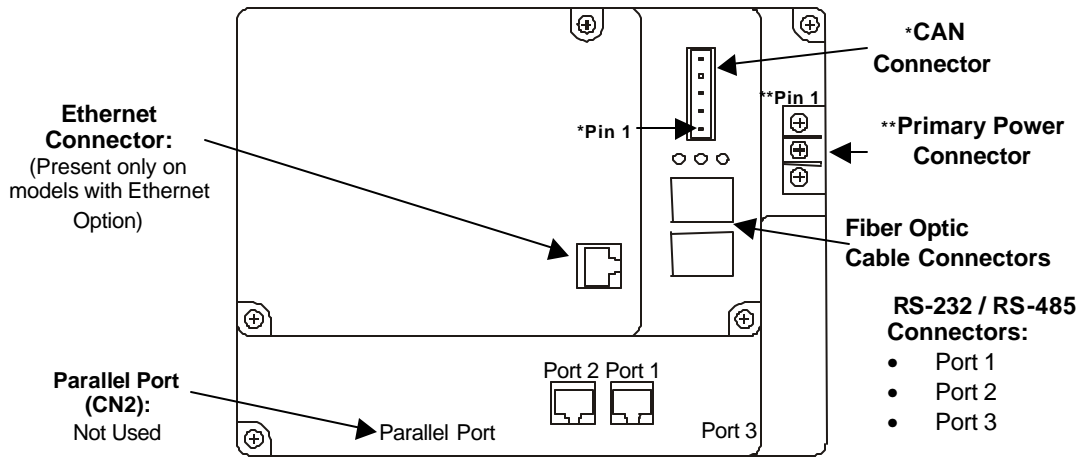


Figure 3.1 – Panel Cut-out and Dimensions

3.3 OCS3xx Ports and Connectors

The Color Touch OCS has power, network, programming and fiber optic ports. Depending upon the model used, the Color Touch OCS comes equipped either with or without an Ethernet connector. Three RS-232 and RS-485 ports are available (Port 1, 2, and 3). Refer to Figure 3.2 for a view of Color Touch ports and connectors.



Note: In the unlikely event that the label is removed, Port 1,2 and 3 correspond with the following markings on the case: Port 1 (MJ1); Port 2 (MJ2); Port 3 (CN1)

**Figure 3.2 – 6” OCS3xx Ports and Connectors
(Color Touch OCS with Ethernet Option Shown)**

3.4 Grounding

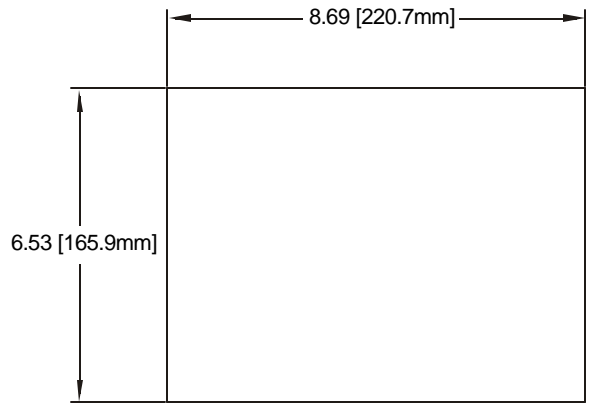
For a diagram depicting grounding, refer to Section 2.4.1 Primary Power Port / Grounding.

CHAPTER 4: 8-INCH OCS (OCS451)

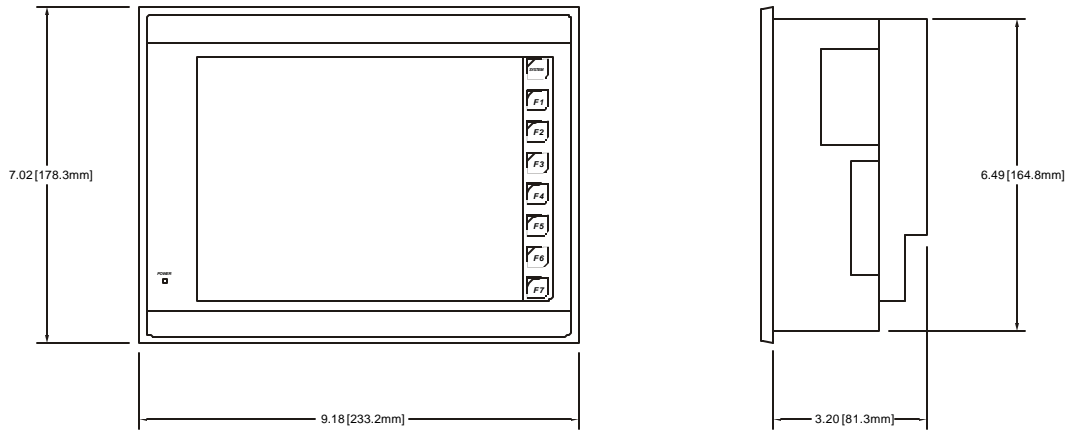
4.1 General

Chapter Four covers information specific to the OCS451. Refer to Chapter Two for general installation information.

4.2 OCS451 Panel Cut-Out and Dimensions



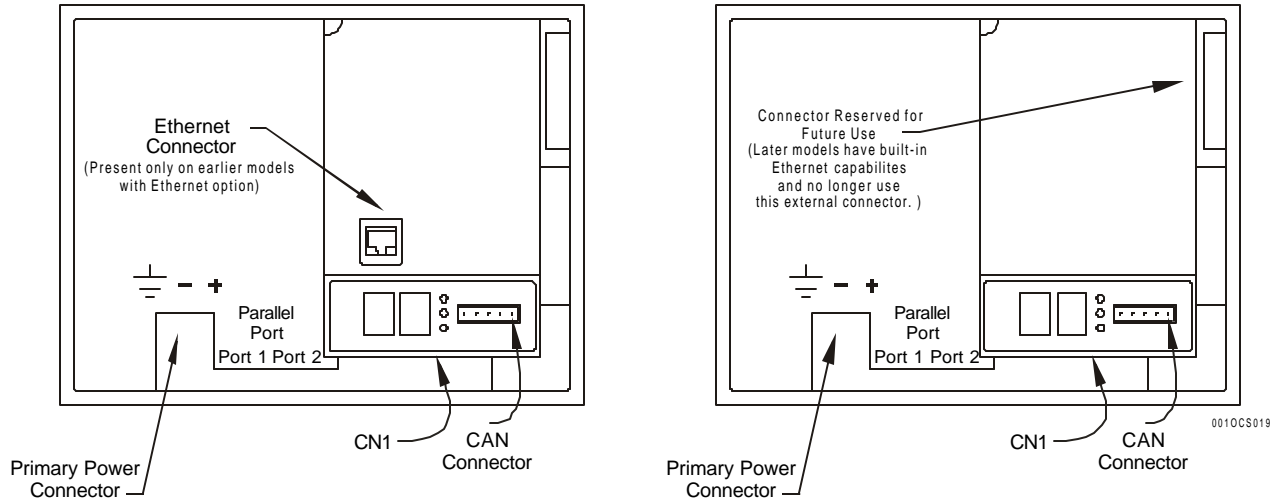
001OCS017



001OCS018

Figure 4.1 – Panel Cut-out and Dimensions

4.3 OCS451 Port and Connector Locations



Note: In the unlikely event that the label is removed, Port 1,2 and 3 correspond with the following markings on the case: Port 1 (MJ1); Port 2 (MJ2); Port 3 (CN1)

Figure 4.2 –8” OCS451 Port and Connector Locations

4.4 Grounding

For a diagram depicting grounding, refer to Section 2.4.1 Primary Power Port / Grounding.

CHAPTER 5: 10-INCH OCS (OCS551)

5.1 General

Chapter Five covers information specific to the OCS551. Refer to Chapter Two for general installation information.

5.2 OCS551 Panel Cut-out and Dimensions

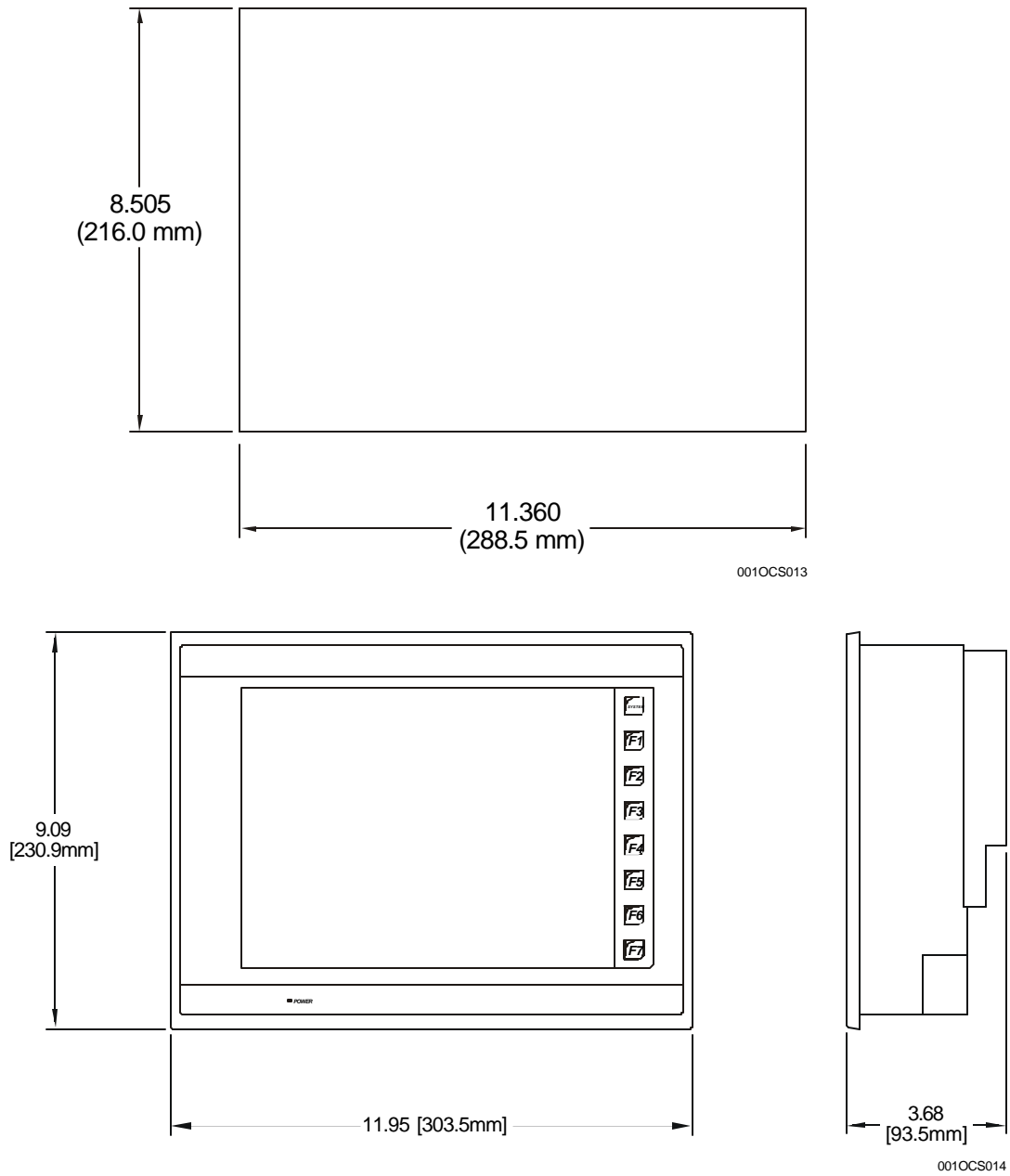
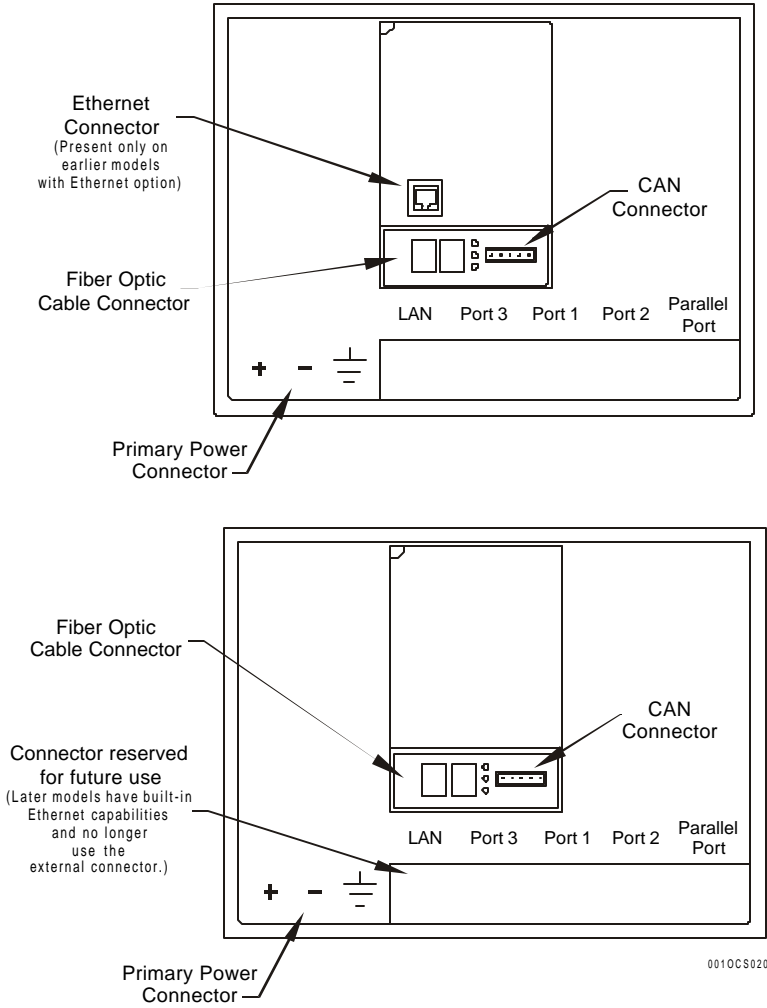


Figure 5.1 – Panel Cut-outs and Dimensions

5.3 OCS551 Port and Connector Locations



Note: In the unlikely event that the label is removed, Port 1,2 and 3 correspond with the following markings on the case: Port 1 (MJ1); Port 2 (MJ2); Port 3 (CN1).

Figure 5.2 – 10” OCS551 Port and Connector Locations

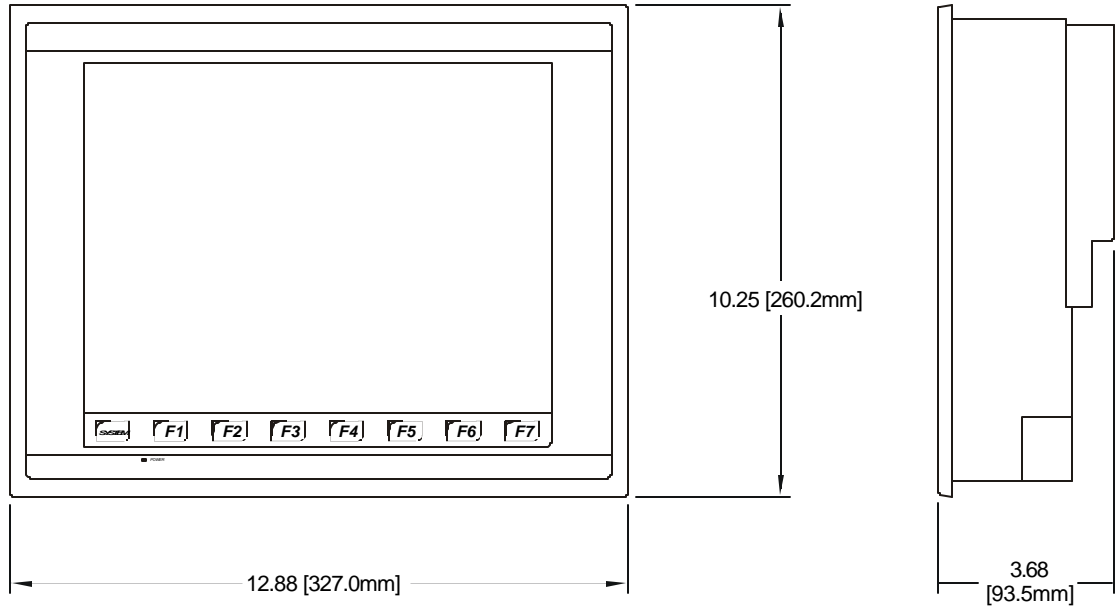
5.4 Grounding

For a diagram depicting grounding, refer to Section 2.4.1 Primary Power Port / Grounding.

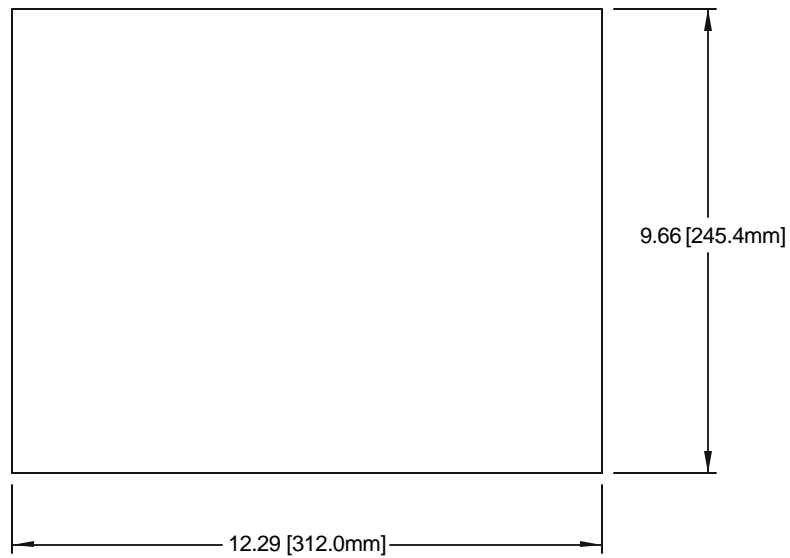
CHAPTER 6: 12-INCH OCS (OCS651)

6.1 General

Chapter Six covers information specific to the OCS651. Refer to Chapter Two for general installation information.



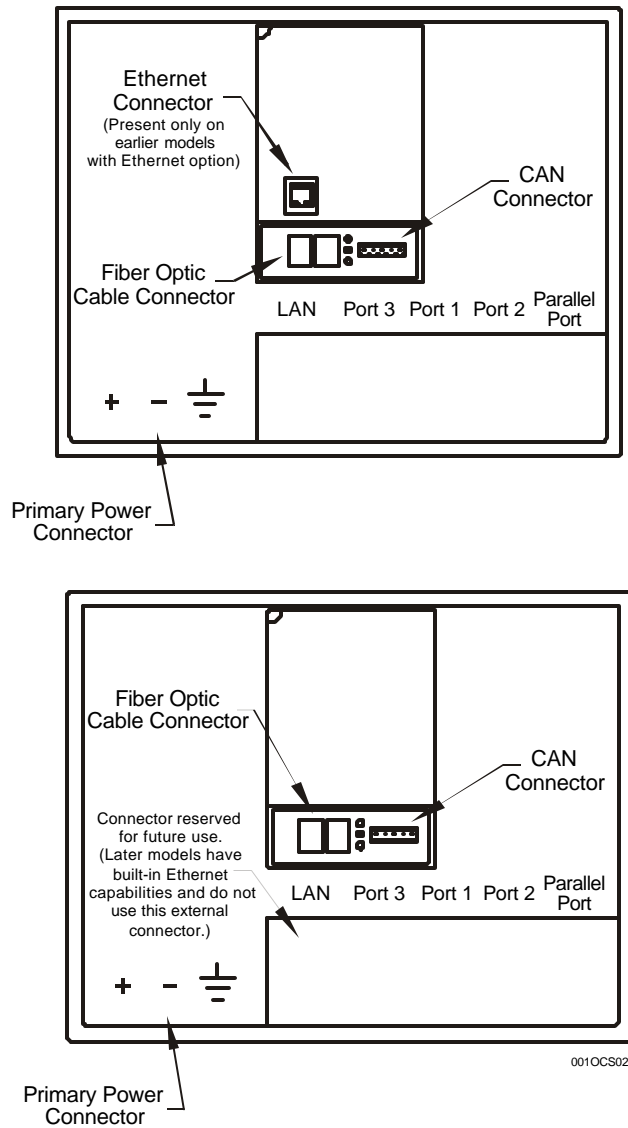
001OCS016



001OCS015

Figure 6.1 – Panel Cutout and Dimensions

6.2 OCS651 Port and Connector Locations



Note: In the unlikely event that the label is removed, Port 1,2 and 3 correspond with the following markings on the case: Port 1 (MJ1); Port 2 (MJ2); Port 3 (CN1).

Figure 6.2 – 12” OCS651 Port and Connector Locations

6.3 Grounding

For a diagram depicting grounding, refer to Section 2.4.1 Primary Power Port / Grounding.

CHAPTER 7: FIBER OPTIC EXTENSION SYSTEM (FOX)

7.1 General

Chapter Seven covers the SmartStack Fiber Optic Extension System (FOX).

7.2 FOX Specifications

The SmartStack Fiber Optic Extension System (FOX) extends a high-speed OCS backplane enabling SmartStack I/O Modules to be mounted several meters from the OCS. The FOX, also, significantly increases the number of SmartStack I/O modules supported by one OCS. The following specifications and limitations apply when using the FOX.

Table 7.1 – FOX Hub and Base Specifications	
Maximum number of stacks (total number of hubs and bases)	5
Maximum number of cable drops to any specific hub or base	3
Maximum length of Fiber Optic cable	10m per Drop
Fiber Cable Bend Radius (R)	25mm (minimum)
Base ID#	Each Base or Hub must have a unique Base ID #.
Expansion I/O	EIAJ RC-5720 Plastic Fiber, TX+RX 10m per drop max host (OCS or hub) to base
Type of Fiber Optic Cable	EIAJ RC-5720 (RC)
Primary Power	9-30VDC @ 400mA maximum
Power Draw	9-30VDC @ 400mA maximum
Height	4.25" (108 mm)
Width	6.63" (168.3 mm)
Mounting Depth	4.7" (119.4 mm)
Operating Temperature	32 - 122°F (0 – 60°C)
Humidity	5% to 95% non-condensing
UL	Class I, Groups A, B, C, D, Division 2
CE	Yes

7.3 Installation

7.3.1 Mounting Orientation

The base of the FOX need to be mounted with the proper orientation. Proper orientation helps to ensure a good connection when SmartStack Modules are installed. Up to four SmartStack Modules can be installed per FOX. The FOX is installed inside a panel box.

Caution: Do not install more than four SmartStack Modules per FOX. Improper operation or damage to the FOX and SmartStack Modules could result.

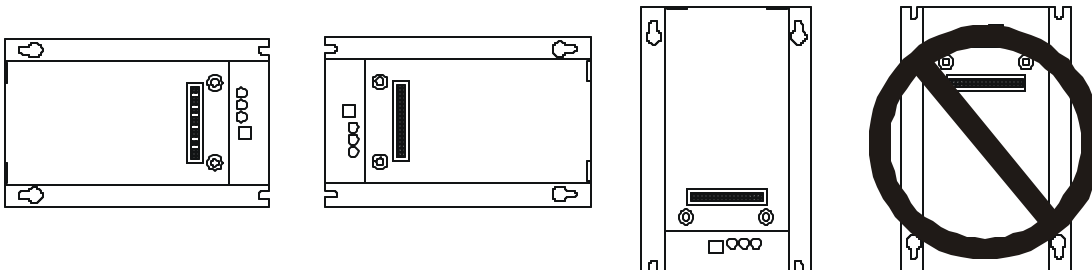


Figure 7.1 – FOX Orientation

001FOX006

7.3.2 Mounting Instructions

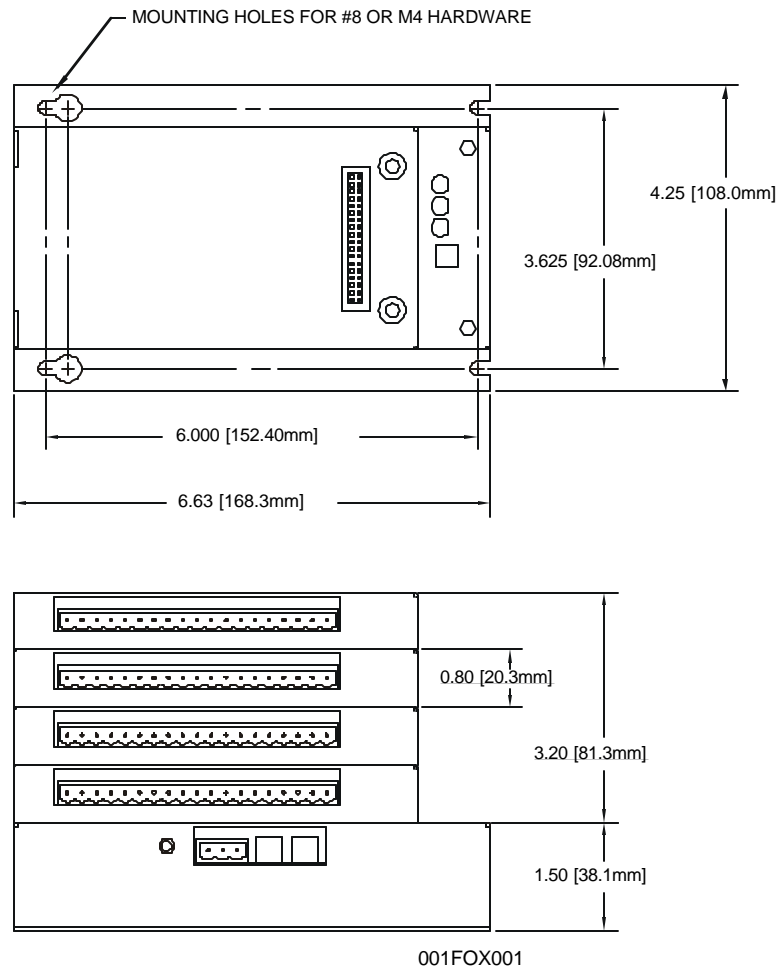
The FOX is designed for permanent panel mounting. To install the FOX in a permanent panel mounting, use the instructions that follow:

1. Read Chapter Two prior to mounting the FOX. Observe requirements for the panel layout design and adequate clearances. A checklist is provided for the user's convenience (page 26).
2. Drill holes as described in the Figure 7.2.

Warning: Make sure the power and network connectors are removed from the FOX.

3. Install and tighten washers and nuts. Do not over-tighten.
4. Connect the communications and power cables to the FOX ports using the provided connectors.
5. Install up to four SmartStack Modules on the FOX.

7.3.3 Dimensions and Hole Pattern



NOTE: Use #8-32 or M4 mounting hardware consisting of four pan head screws with external tooth lock washers.

Figure 7.2– FOX Hole Pattern Dimensions (Top) and FOX viewed with 4 SmartStack I/O Modules (Bottom)

7.4 Ports, Connectors, and Wiring

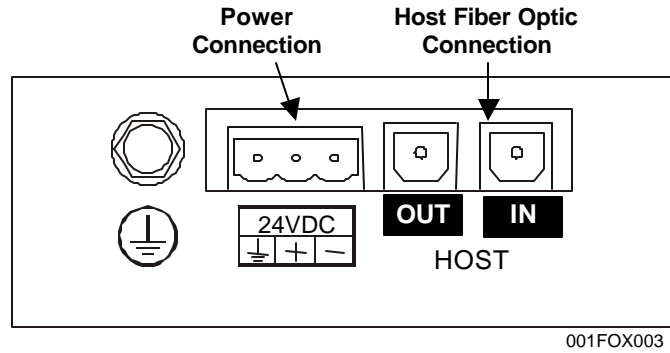


Figure 7.3 – FOX Connectors

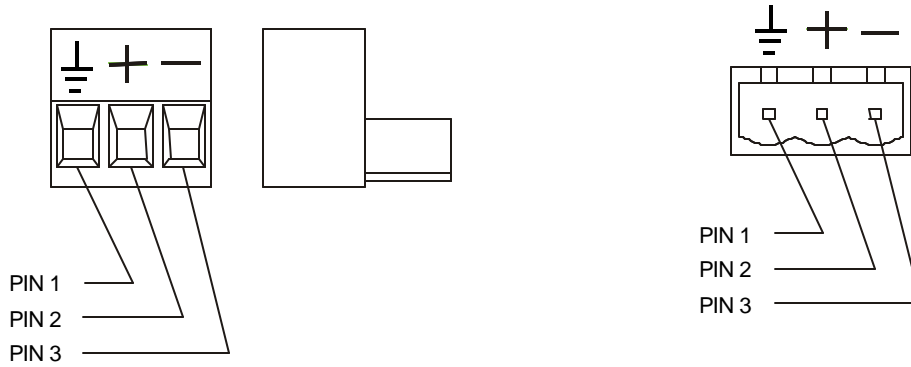


Figure 7.4 - FOX Power Plug

Figure 7.5 - FOX Power Connector Pins

Note: Power Supply Voltage Range is from 10-30 VDC.

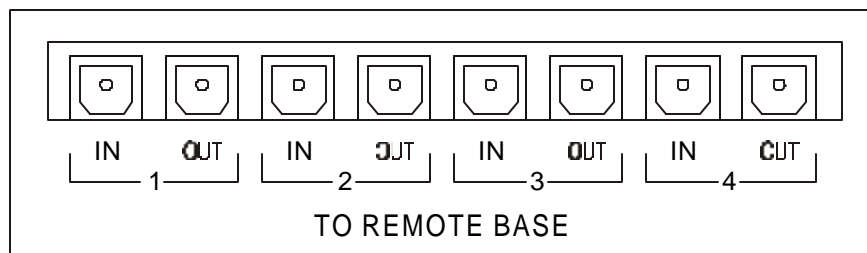


Figure 7.6 – FOX404

Table 7.2 – Fiber Optic Cables		
Feet (Meters)	Part Number	
3.3 ft. (1 m)	HE800CBF001	
6.6 ft. (2 m)	HE800CBF002	
16.4 ft. (5 m)	HE800CBF005	
32.8 ft. (10 m)	HE800CBF010	
In the event of an emergency, the following <i>Radio Shack</i> cables can also be used:		
Feet (Meters)	Part Number	Price (Note: Subject to change without notice. Check with Radio Shack for current prices.)
6 ft. (1.8 m)	15-1581	\$19.99

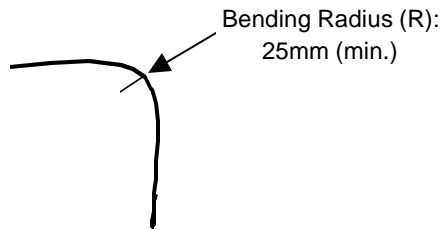


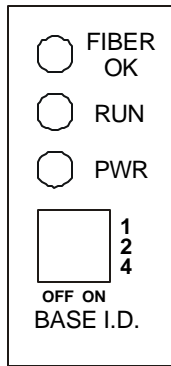
Figure 7.7 – Bend Radius (R) of Fiber Optic Cable

7.5 Base ID Switches

Each FOX needs a unique Base ID. (Refer to Table 7.3 for location of Base ID Switches.) Set Base ID switches using the following table.

Table 7.3 - Base ID Switches ON = 1 OFF = 0			
Base ID	Switch Number		
	4	2	1
Illegal	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6 Illegal	1	1	0
7 Illegal	1	1	1

7.6 FOX LEDs



001FOX005

Table 7.4 – FOX LEDs	
FIBER OK	ON indicates FOX's fiber input cable is properly connected and is receiving a carrier.
PWR	ON indicates FOX is receiving power.
RUN	<ul style="list-style-type: none"> • OFF indicates OCS is in IDLE/STOP mode or no power to the FOX or one of the fiber cables are detached or there is a configuration mismatch. • Flashing indicates DO / IO mode or RUN with no ladder program. • ON indicates ladder code running.

Figure 7.8 – FOX LEDs

7.7 Example FOX Setups

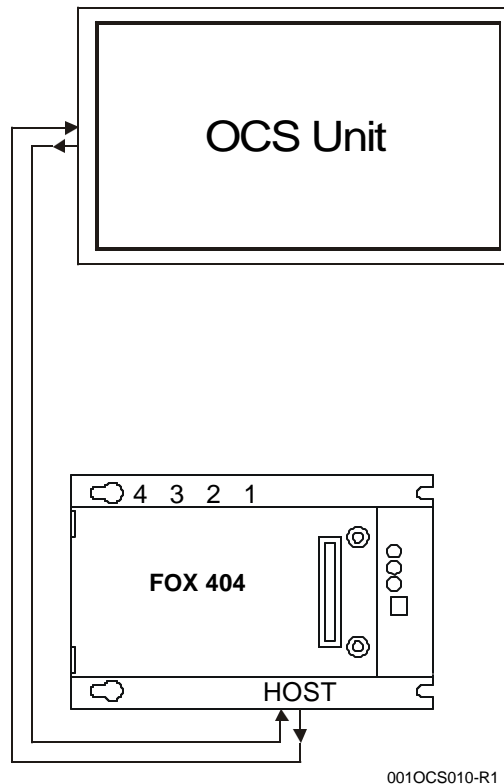


Figure 7.9 – Color Touch OCS to FOX (Single Hub)

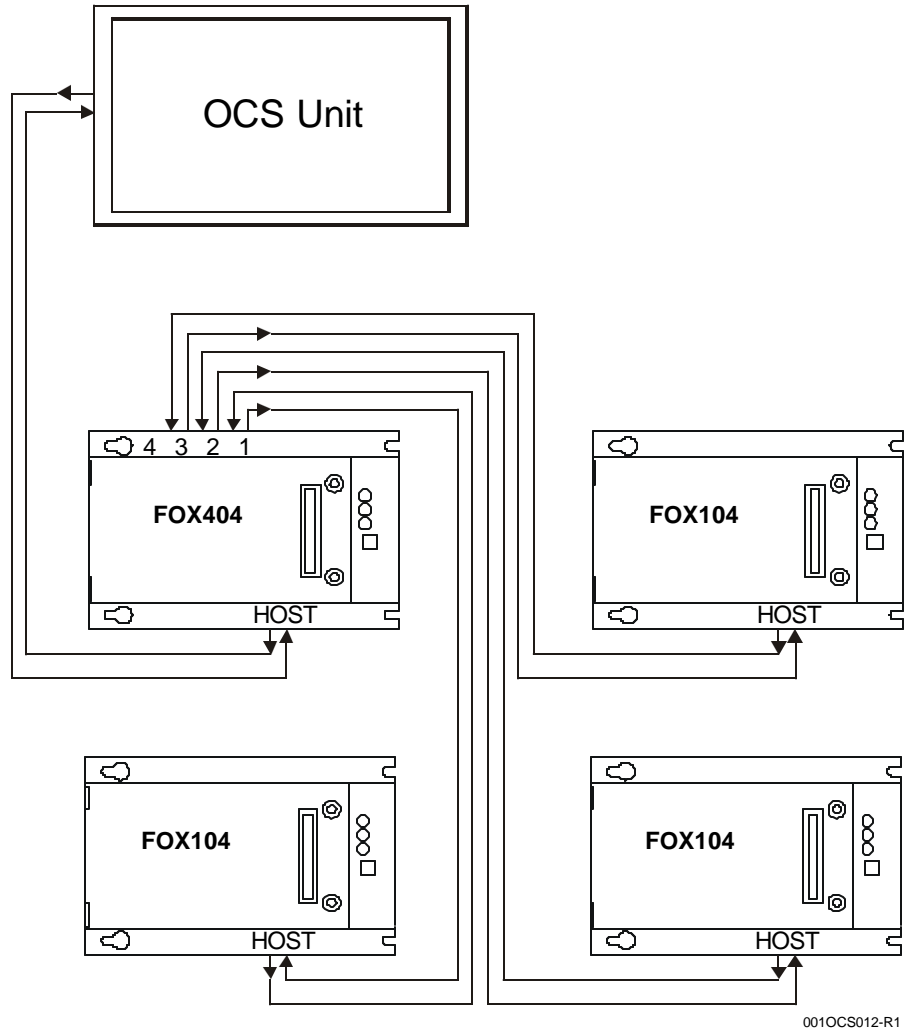
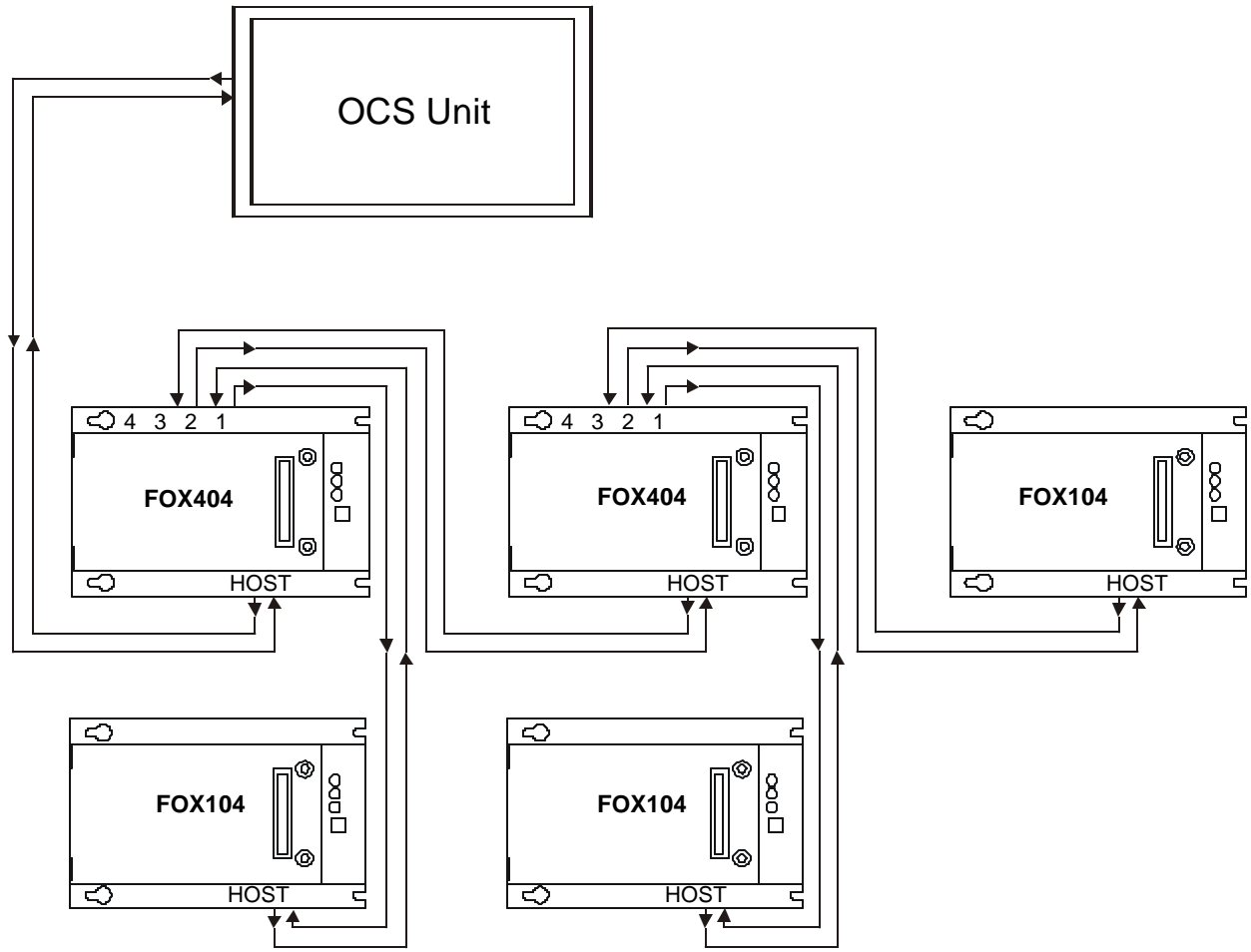


Figure 7.10 – Color Touch OCS to FOX (One Hub and Multiple Bases)



001OCS011-R1

Figure 7.11 – Color Touch OCS to FOX (Multiple Hubs and Bases)

NOTES

CHAPTER 8: SYSTEM MENU (CONFIGURATION)

8.1 General

Chapter Eight describes the system configuration for the Color Touch OCS. A virtual keypad and touch screen are used to access and edit System Menu parameters.

8.2 Navigating Through the System Menu

Prior to configuration, it is important to understand how to navigate through the System Menu using the following guidelines. After pressing the **System** key on the front panel of the Color Touch OCS, the System Menu main screen appears. It contains a virtual keypad and a list of options. (See Figure 8.1.)

1. Touch the screen over the desired menu option or press the \uparrow and \downarrow keys to scroll up or down through the menu options. Press **Enter**.
2. A screen appears containing one or more parameter names. If the parameter is editable, the parameter name is highlighted. Press **Enter**.
3. The parameter value field is highlighted. Use the \uparrow and \downarrow keys or numeric keys to edit the parameter value.
4. If multiple parameters are available for editing, use the \uparrow and \downarrow keys to scroll through parameters.
5. While in a system screen, press **ESC** (if not currently modifying a field) to return to the main System Menu. It may be necessary to press **ESC** more than one time to return to the main System Menu screen.

8.3 Editing System Menu Screen Fields

Prior to configuration, it is important to know how to edit the System Menu screen fields using the following guidelines.

1. There are two types of fields; Property Fields and Value Fields.

A **Property Field** is highlighted when selected using the arrow keys. A Property Field indicates the name of a property - it is not editable.

Saver Enable	No
Timeout (min)	15

Value Fields allow a property value to be edited.

2. To change a value in an editable field, press the **Enter** key to select **Edit Mode**. The Color Touch OCS indicates Edit Mode by highlighting the value field *.
3. In Edit Mode, the fields require one of the following methods for modifying the value. Refer to the field description to determine which method to use.

- | | |
|------------------|--|
| Enumerated entry | - use \uparrow and \downarrow keys to select appropriate value. |
| Numeric entry | - use Numeric keys or \uparrow and \downarrow keys on the appropriate digit. |
| Bar graph entry | - use \leftarrow and \rightarrow keys to adjust value. |

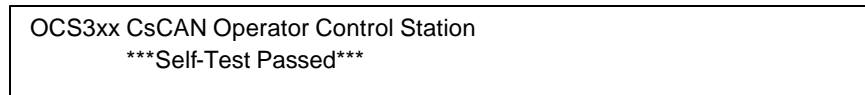
4. After the value is correctly entered, press the **Enter** key to accept the value.
5. Should the user not wish to accept the value before the **Enter** key is pressed, the **ESC** key can be pressed instead. This action restores the original value to the display. The Color Touch OCS also immediately exits Edit Mode.

8.4 Initial System Menu Screens and Self-Test

1. After turning on the power to the Color Touch OCS, the following example screen appears indicating that Self-Test is running. (OCS3xx is shown as an example.)



- a. If the Self-Test passes, the following example screen appears:



- b. If the Self-Test fails, a message briefly flashes on the screen for each error that occurs.
 - To view a summary screen of Self-Tests, see Section 8.6 System Menu Option Screens.

8.5 Entering the System Menu

To enter the System Menu, press the **System** key on the front panel of the Color Touch OCS. The System Menu main screen appears. It contains a virtual keypad and a list of options (Figure 8.1).

8.6 System Menu Option Screens

In addition to providing access to configuration parameters, the System Menu also provides power-up and runtime status. For brevity, both configuration and status fields are covered in this section.

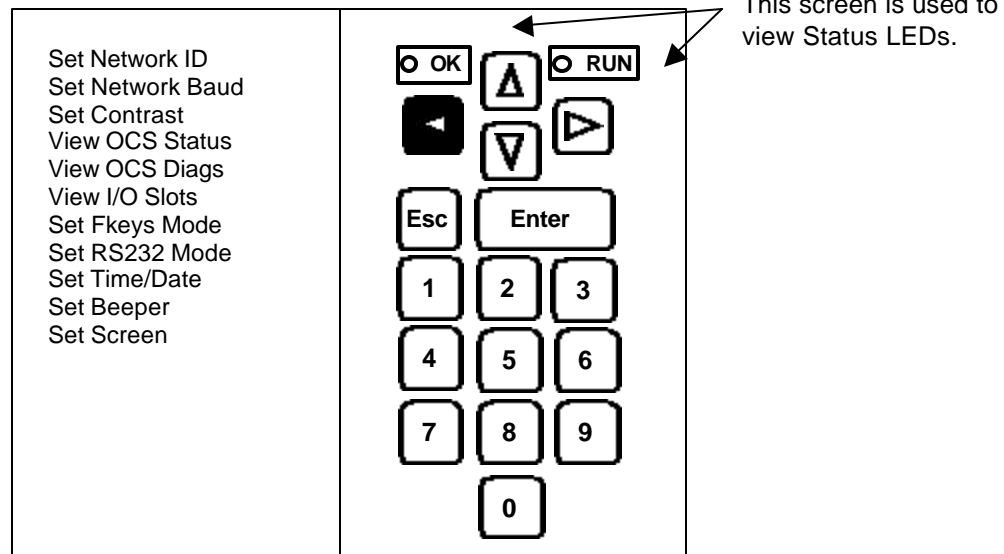


Figure 8.1 – System Main Menu Screen

The menu includes the following options:

- Set Network ID
- Set Network Baud
- Set Network Baud
- Set Contrast
- View OCS Status
- View OCS Diags
- View I/O Slots
- Set Fkeys Mode
- Set RS232 Mode
- Set Time/Date
- Set Beeper
- Set Screen

• Set Network ID

This screen contains two parameters. The first parameter (Network OK?) contains the current network status. The second parameter (Network ID) contains the current Network ID of the model. The second parameter is numerically editable and is used to configure the Network ID.

Each unit on the network **needs a unique ID number**. Using the virtual keypad, the correct ID number is entered here before physically attaching the unit to the network.

Cscan model: [1 - 253]
DeviceNet model: [0 - 63]

To edit the Network ID:

1. Press the **Enter** key until the Network ID parameter value field is highlighted.
2. Then type in the desired Network ID number by touching the virtual keypad and press **Enter**.
Note: If the **Enter** key is not pressed, the desired Network ID number does not take effect.

Note: If the Network ID setting is changed, the unit stops executing the ladder code (for up to 1 second) while the network is re-tested. If the "Network OK?" status changes from "Yes" to "No," the new Network ID is a duplicate, and another ID needs to be selected.

• Set Network Baud

This screen contains an editable enumerated parameter allowing the user to select the current baud rate of the network.

Cscan model: [125K, 250K, 500K, 1M]
DeviceNet model: [125K, 250K, 500K]

Note: All devices on the network must be at the same baud rate. A device configured for the wrong baud rate can shut down the network entirely.

• Set Contrast

This menu contains an editable bar graph entry allowing the user to set the contrast of the LCD display. The effects of the contrast setting are shown on the displayed color band. It is helpful to view the effects on the color band. The contrast setting affects the readability of graphics on the screen such as ON/OFF states of control buttons, lamps and switches.

Note: The Set Contrast setting is not functional when using TFT models.

- **View OCS (RCS) Status**

This screen contains one enumerated editable parameter that sets the Color Touch OCS scan mode **and** several non-editable status parameters that display information about the internal state of the Color Touch OCS. Press the ↑ and ↓ keys to scroll through the different items. Pressing **ESC** returns to the System Menu.

<u>Parameter</u>	<u>Description</u>
Mode :	Displays the current scanning mode. Allows the user to choose a scanning mode to view (Idle, Run, DoIO) by highlighting the mode parameter and using the ↑ and ↓ to change modes. In <i>Idle</i> mode, the I/O is <u>not</u> scanned and the OCS ladder program does <u>not</u> execute. The green "RUN" LED is OFF. In <i>Run</i> mode, the ladder program executes and the green "RUN" LED illuminates. <i>DoIO</i> mode is similar to <i>Run</i> mode, except the ladder logic is not solved. When the OCS is in <i>DoIO</i> mode, the user is able to exercise all of the I/O from Cscape, without interference from the ladder program. In this mode the green "RUN" LED flashes. This feature is a valuable troubleshooting tool.
Scan-Rate (ms.) :	Shows the number of milliseconds for the scan. The scan-rate is the sum of the time required to execute the following items: <ul style="list-style-type: none"> a. Scan inputs b. Solve logic c. Write outputs d. Handle network communications e. Handle host communications request f. Process data for operator interface
OCS Net Use (%) :	Shows the percentage of the network used by the Color Touch OCS.
All Net Use (%) :	Shows the percentage of the network used by all devices on the network.
Ladder Size :	Shows the number of bytes used by the ladder program.
Config Size :	Shows the number of bytes used by the I/O configuration
Graphics Size :	Shows the total size of the file containing graphics.
String Size :	Shows the total size of the text stored in the String Table.
Bitmap Size :	Shows the total size of the file containing bitmaps.
Text Tbl Size :	Shows the number of bytes used by the text tables.
Font Tbl Size :	Shows the number of bytes used by the downloadable font table.
Firmware Rev :	Shows the execution engine firmware version.
BIOS Rev :	Shows the BIOS firmware revision.
FPGA Rev :	Shows the FPGA Image version.
Self-Test :	Shows if the power-up self-test passed or failed by displaying Ok or Fault .

- **View OCS Diags**

This screen displays a list of self-test diagnostics results (no editable parameters). Each item describes a test and shows a result of **Ok** if the test passed or **Fault/Warn** if an error was found while running the test. **Fault** indications will prevent the loaded application from running. Warn(ing) indications allow the application to run but inform the user that a condition exists that needs correction.

System BIOS - This test checks for a valid BIOS portion of the controller firmware.

Ok The loaded BIOS firmware is valid

Fault The loaded BIOS is invalid.

(Engine) Firmware - This test validates the controller firmware.

Ok The firmware is valid.

Fault The controller firmware is invalid.

User Program - This tests for a valid user program and configuration data.

Ok The user program and configuration is valid.

Fault The user program and/or configuration are not valid.

System RAM - This test checks the functionality of the controller RAM at power up.

Ok The RAM is functioning correctly.

Fault The RAM is not functioning correctly.

Logic Error - This test checks for problems with the user program while running.

Ok No errors have been encountered while running a user program.

Fault Indicates the user program contained an instruction that was invalid or unsupported.

W-Dog Trips - This test checks for resets caused by hardware faults, power brownouts or large amounts of electrical interference.

0 No unintentional resets have occurred.

xx Indicates a fault with xx showing the number of occurrences.

Net Errors - This test checks for abnormal network operations while running.

0 No network errors were counted

xx Indicate serious networking problems exist, xx indicates the number of occurrences.

Network State - This test checks that the network sub-system is powered and operating correctly.

Ok The network system is receiving power and has determined other devices are communicating on the network.

Warn Power is not being applied to the network or no other devices were found to be communicating on the network.

Network ID - This test checks that the network ID is valid.

Ok The network ID is valid.

Warn The network ID is not valid for the selected protocol.

Dup Net ID - This test checks for duplicate IDs on a network.

Ok This controller's ID was not found to be a duplicate.

Warn Another controller on the network was found with the same ID as this controller.

DeviceNet In - (Displays for DeviceNet model only.)

Ok DeviceNet master is maintaining a polled connection and not sending IDLE.

Warn The DeviceNet master is no longer maintaining a polled connection or sending IDLE. (IDLE is a network state in which 'some' masters maintain a polled connection but sends zero data if an associated PLC controller is in IDLE mode. Refer to Master documentation for more information.)

Clock Error - This test checks that the real time clock contains valid data.

Ok The real time clock contains valid data.

Warn Indicates invalid data in the real time clock.

- **I/O System** - This test checks that the I/O configuration downloaded and the physical devices (SmartStack) attached to the controller match.
 - Ok** The I/O configuration matched the installed modules.
 - Warn** Indicates the downloaded configuration and attached modules do not match. (See View I/O Slot system screen for more information.)

- **View I/O Slots**

The View I/O Slots screen displays information about SmartStack modules (if any) that are currently connected to the Color Touch OCS. Some models support multiple I/O bases using a FOX (Fiber Optic eXpansion) interface. For these models, the View I/O Slots screen also allows selection of the I/O base to be displayed and indicates whether the I/O base is online, offline, or duplicated.

When viewing I/O slots, the following status screens are possible. Note that in the I/O slot display descriptions, the term **ModNum** refers to a SmartStack I/O module number such as DIQ611 or THM100.

- If an OCS slot has no configured I/O module and no module is physically attached, the message "**I/O: Empty**" is displayed for the appropriate slot.
- If an OCS slot has no configured I/O module and a module is physically attached, the message "**+I/O: ModNum**" is displayed for the appropriate slot.
- If an OCS slot has a configured I/O module and no module is physically attached, the message "**-I/O Missing**" is displayed for the appropriate slot.
- If an OCS slot is configured for a different module than what is physically attached, the message "**?I/O: ModNum**" is displayed for the appropriate slot.
- If an attached module is not supported by the OCS firmware, the message "***Unsupported**" is displayed for the appropriate slot. The module is either defective or an Engine firmware upgrade is required to support the module.
- If an attached I/O module has erroneous or outdated firmware in it, the message "**fI/O: ModNum**" is displayed for the appropriate slot. The module is either defective or a Module firmware upgrade is required.
- If an attached module has a configuration error, the message "**clI/O: ModNum**" is displayed for the appropriate slot. The configuration data for that module is incorrect.
- If an OCS slot configuration matches the attached I/O module, the message "**I/O: ModNum**" is displayed for the appropriate slot.

- **Set FKeys Mode**

This screen contains an editable enumerated field that allows the Function keys to be configured to operate in one of two modes. When a function key is pressed, it can TOGGLE the %K register associated with the key or it can MOMENTARILY turn the %K register ON when the key is pressed.

- **Set RS232 Mode**

This screen contains an editable enumerated parameter that allows the mode of the serial port to be set to one of two modes. The **CsCAN** mode allows Csape to connect to the serial port for uploads, downloads, monitoring and control. The **Update** mode allows a firmware update and factory test utility to be used. When Update mode is selected, the firmware is ready to download when the OK LED flashes. When using Cscape to perform firmware updates, the "Update" mode is not necessary.

- **Set Time/Date**

This screen contains two editable enumerated fields for displaying and modifying the Color Touch OCS's time and date. Each field is subdivided and allows the ↑ and ↓ key to modify the value.

- **Set Beeper**

This screen allows the Beeper to be enabled or disabled by pressing the ↑ and ↓ keys. When enabled, there are two types of beeps.

Short Beep - beeps when a key is pressed.

Long Beep – beeps when a parameter field is disabled.

It is also possible to have the Ladder Program write to the %SR184 Register, which causes beeps to occur. Any value higher than zero enables the beeper. The beeper remains enabled until the value is zero.

- **Set Screen**

This screen allows a screen saver to be enabled or disabled and the timeout for the screen saver to be set. To enable the screen saver, change **Saver Enable** to **Yes**. Edit the **Timeout (min)** to determine the number of minutes before the screen saver becomes active.

This screen also allows a pop-up status message to be configured for display when a mode change occurs. The possible settings are as follows:

OFF - No pop-up message occurs. This is the DEFAULT setting.

ON – *Any mode change* triggers a pop-up display screen to depict the condition of the controller and the status of the LEDs. For example, after the controller is initially powered up, a display screen pops up whenever **any mode change** occurs.

WARNING – A pop-up display screen is triggered **only if the mode changes to an abnormal condition**. For example, if the controller is in a non-run or error/warning condition, a screen pops up to depict the condition of the controller and the status of the LEDs.

NOTES

CHAPTER 9: KEYPAD AND DISPLAY

9.1 General

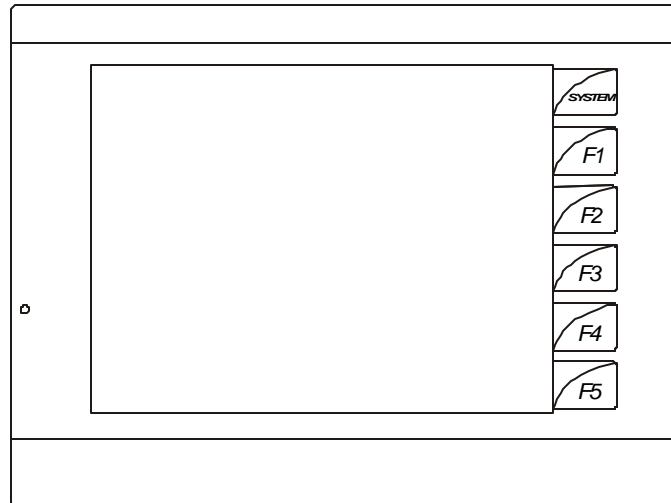
Chapter Nine covers the keypad and display of the Color Touch OCS.

9.2 Keypad / Display Description

The Color Touch OCS front panel contains a System Key and five configurable keys.

The user-programmable keys (function keys) serve the purpose of numeric and alphabetic character entry. Using Cscape's Ladder Program (%K registers), the user is able to program the keys according to the needs of the configuration.

The System Key brings up the System Menu. A virtual keypad and touch screen are used to access and edit System Menu parameters. Additionally, the main screen also depicts the Color Touch OCS's LEDs. For more information about the System Menu, refer to Figure 8.1 – System Main Menu Screen.



001OCS008

**Figure 9.1 – Color Touch OCS Front Panel Keys
(OCS3xx is depicted as an Example)**

9.3 Operation

When the Color Touch OCS unit first powers-up, it displays the OCS model number. Next, a message appears to indicate the OCS Self-Tests are running. After the OCS displays this message, the unit performs several internal and external tests. If no tests fail, a message is displayed indicating that Self-tests passed. If one or more tests fail, a message is displayed indicating which test(s) failed. Refer to the **System Menu View OCS Diags** (page 60) for list of self-test diagnostics results.

At any time, the Color Touch OCS unit can be reset by pressing SYSTEM + F2. (Be sure to press the keys at the same time and hold for 2 seconds.)

9.4 User Screens

This screen displays Self-Test results, system menus, and user screens.

CHAPTER 10: SMARTSTACK CONFIGURATION

10.1 General

Chapter Ten provides preliminary configuration procedures that are applicable to all SmartStack Modules. The SmartStack Modules use Cscape Software for configuration.

Note: Because the configuration parameters are different for each SmartStack Module, refer to the data sheet that is specific to the selected module. The SmartStack Module Supplement (SUP0246) contains all of the data sheets and is periodically revised.

10.2 Preliminary Configuration Procedures

1. From the Main Menu, select **Controller|I/O Configure**. The following screen appears.

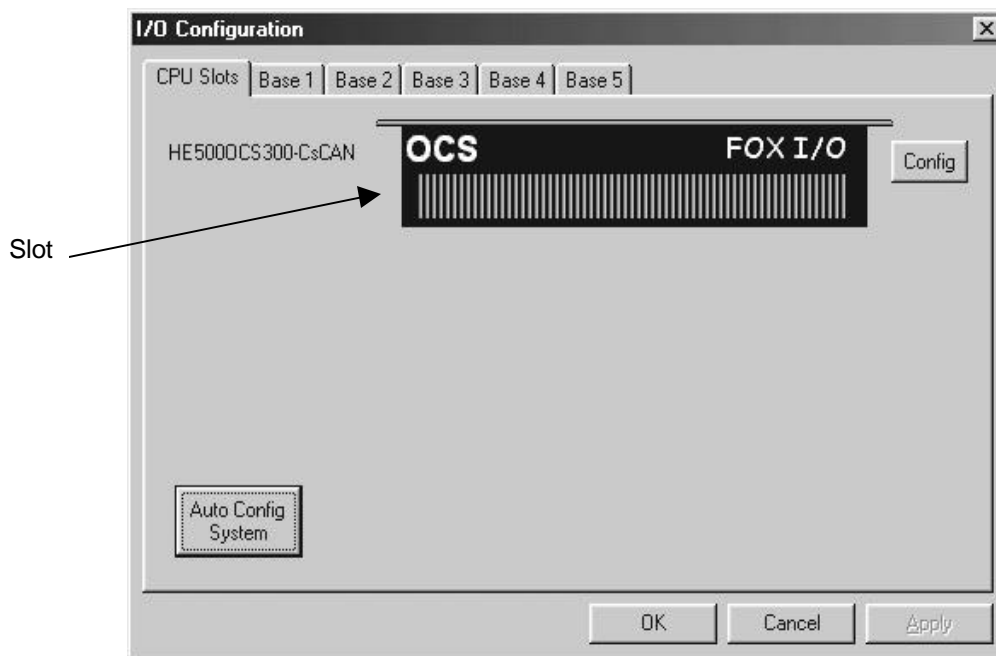


Figure 10.1 - Main Configuration I/O Screen

2. First, ensure that the desired controller is selected. The OCS300-CsCAN is shown as the selected controller in this example. If satisfied with the controller selection, press a **Base #** tab. Go to Step 3. If a different controller is desired, continue Step 2.

Note: The **Auto Config System** button can be pressed *prior* to selecting the desired controller *and* I/O. By pressing the button, the settings are deleted from any controller *and* I/O that is physically connected to the PC. A dialog box appears and indicates that settings will be deleted from currently configured models. If OK, press **Yes**. Then press **OK**.

Selecting a Different Controller

To select a different controller, ensure that the **CPU Slots** tab is pressed. Then, click on the slot or the **Config** button. The following screen appears.

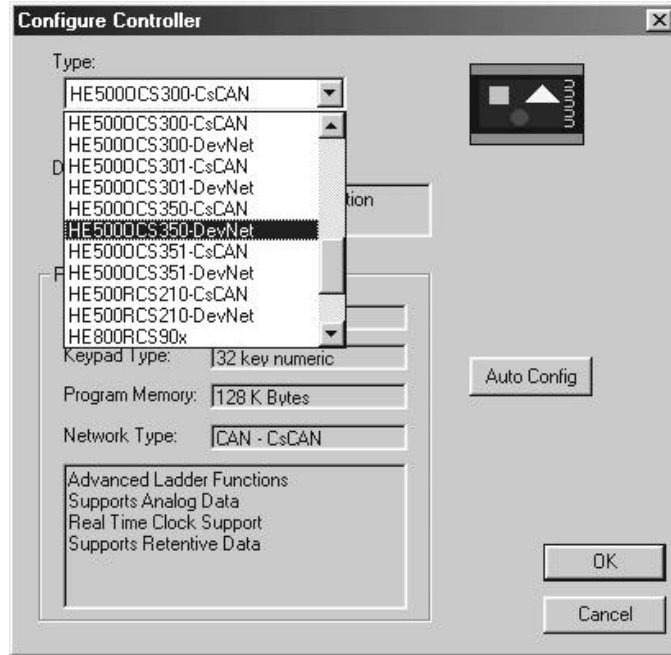


Figure 10.2 – Selecting a Controller

To select a different controller, click on the **Type** list box and select the desired controller. Then press OK. If satisfied with the controller selection, press a **Base #** tab at the top of the screen (Figure 10.1). Then, go to Step 3.

Note: The **Auto Config** button can be pressed *prior* to selecting the desired controller. By pressing the button, the settings are deleted from any controller that is physically connected to the PC.

- Figure 10.3 appears. In this configuration example, I/O modules are going to be selected and configured for Base 1.

Any Base can be selected. It is not necessary to select Bases in a specific order.

However, when a Base is selected, its Slot 1 position must be occupied by an I/O module.

Slot 1 Position →

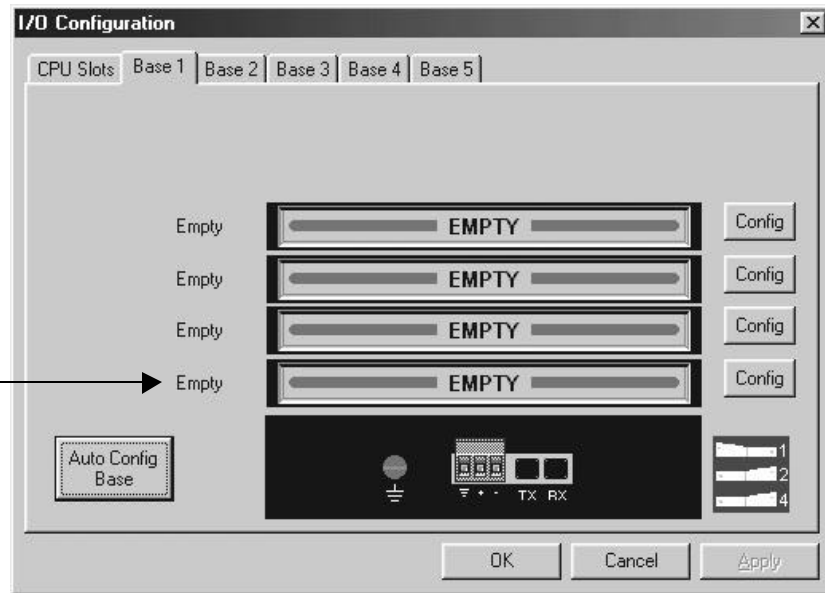


Figure 10.3 – Base 1 Selected

Double-click on a slot or press the **Config** button located next to the slot. The following screen appears. Select a tab at the top of the screen, and then select an I/O module. (For this example, the DIQ612 has been selected.) Press **OK**.

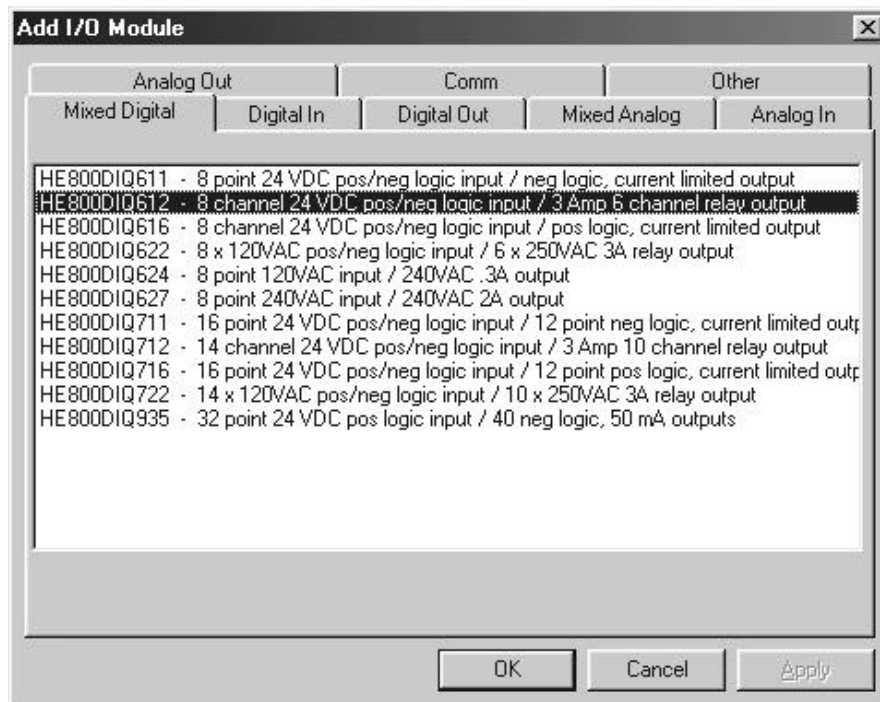


Figure 10.4 – Selecting an I/O Module

4. The following screen appears.

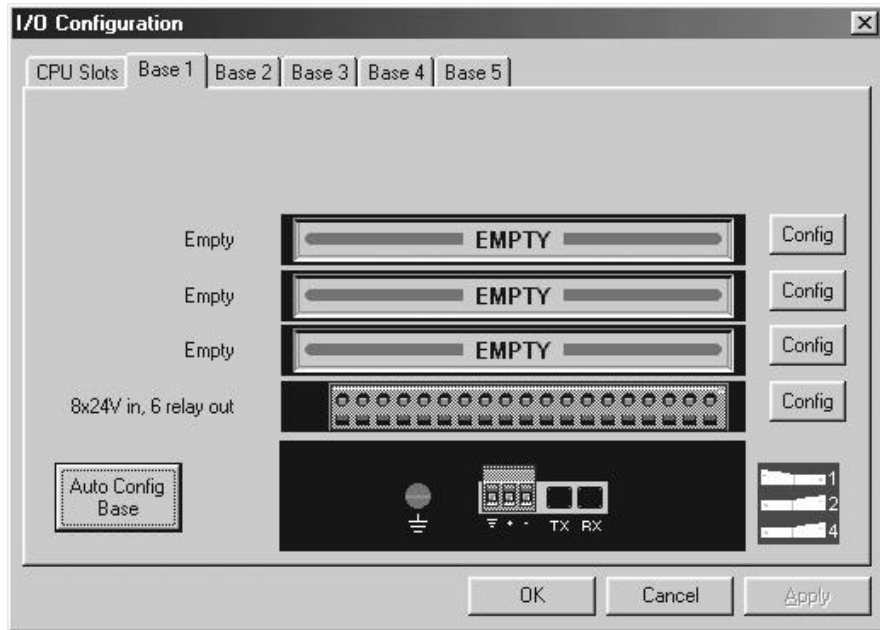


Figure 10.5 – Base 1 with an I/O Module Selected

The description and properties of the I/O module are provided. If satisfied with the selections, press **OK**.

Note: If a module already occupies a slot and a different module is desired, right-click on the slot and press **Replace**. To leave a slot empty, right-click on the slot and press **Delete**. By right-clicking on a slot, its configuration can be **copied** into another slot on the same base (or a different base) and **pasted** into a new slot.

5. The Module Configuration Screen appears (Figure 10.6). Two tabs are available for selection:

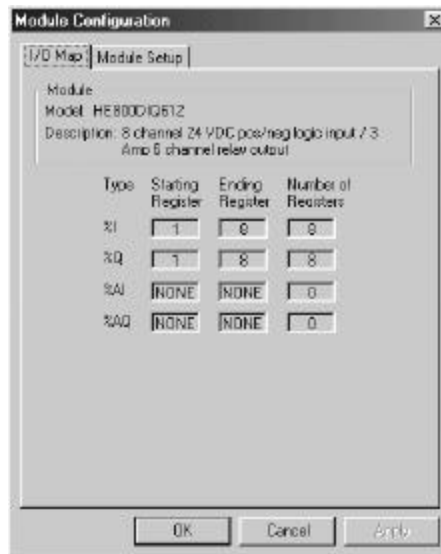


Figure 10.6 – I/O Map Tab

a. I/O Map Tab

The **I/O Map** describes the I/O registers assigned to a specific I/O module. Although there are no user-defined parameters, the I/O Map can be viewed after the SmartStack module is configured to review the registers.

- Model number Provides the part number.
- Description Describes the number of input and output channels and other key characteristics of the module.
- Type: Displays the register types assigned to the module.
- Starting Location: Denotes the starting location of the register type.
- Ending Location: Denotes the ending location of the register type.
- Number: Indicates the quantity of a particular register type.

Note: Do not confuse the described number of input and output channels with the numbers found in the Type column (i.e., %I and %Q). The numbers do not necessarily match.

b. Module Setup Tab

Note: The Module Setup screen varies according to the module selected. Users make selections based upon requirements. Guidelines that are specific to the module are provided in individual data sheets. **It is important to consult the datasheet for specific details pertaining to the Module Setup tab.**

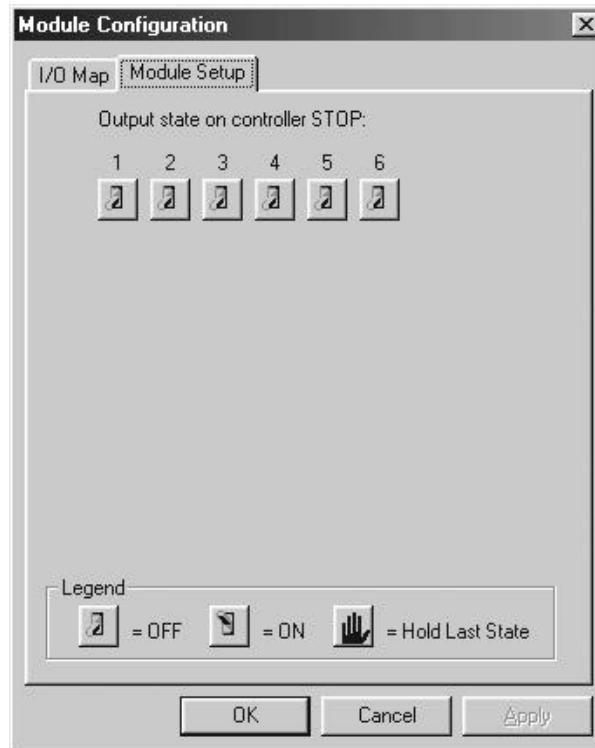


Figure 10.7 – Module Setup Tab Selected

The **Module Setup** is used in applications where it is necessary to change the default states of the outputs when the controller (e.g., OCS100) enters idle/stop mode. The default turns the outputs OFF when the controller enters idle/stop mode. By selecting the Module Setup tab, each output can be set to either turn ON, turn OFF or to hold the last state. Generally, most applications use the default settings.

Warning: The default turns the outputs OFF when the controller enters idle/stop mode. To avoid injury of personnel or damages to equipment, exercise extreme caution when changing the default setting using the **Module Setup** tab.

6. Depending upon the I/O module selected, additional configuration procedures can be required. Be sure to consult the individual data sheet to determine if a supplement is available for the specific module. Supplements provide configuration information and cover other important topics pertaining to a specific module.

CHAPTER 11: SMARTSTIX I/O

11.1 General

Chapter Eleven covers SmartStix I/O programming and configuration parameters.

11.2 SmartStix I/O Introduction

SmartStix I/O is a family of low-cost Remote I/O devices that are designed to extend the I/O capabilities of **Control Station** products, such as **MiniOCS**, **OCS** and **RCS**. SmartStix I/O Modules connect to Control Station devices via the **CsCAN Network** and communicate using **CsCAN Protocol**.

Devices with **CsCAN Network** ports that are connected to each other for peer-to-peer communication are called **CsCAN Nodes**. A device that is connected to a CsCAN Node's programming port for master-slave supervisory communication is called a **CsCAN Host**. For example, SmartStix I/O Modules and OCS Control Stations are CsCAN Nodes while a PC running Cscape is a CsCAN Host.

11.3 SmartStix I/O Modules

SmartStix I/O Modules are devices that exchange data with Control Stations over the CsCAN Network and control and monitor physical I/O points.

To control physical outputs, data is sent by a Control Station to the SmartStix I/O Module using CsCAN Directed Data Messages. To monitor physical inputs, a Control Station receives data from the SmartStix I/O Module using CsCAN Global Data Messages.

In addition to I/O control and monitoring, configuration and status data can be exchanged between a Control Station and a SmartStix I/O Module.

For example, a Control Station can send configuration data to a SmartStix I/O Module to tell it how often to expect output control data, and what to do if the Control Station stops sending output control data. Also, a Control Station can receive status data from a SmartStix I/O Module indicating if it needs configuration or if a fault has been detected.

All this is accomplished by using the PC-based Cscape programming tool to program the Control Station. Since the Control Station dynamically configures the SmartStix I/O Module, SmartStix I/O Modules can be readily deployed without having to configure them first.

BASIC SMARTSTIX PROGRAMMING

11.4 Using GET and PUT

11.4.1 Get Remote I/O Function Block

This function handles receiving data from a remote I/O device and places the received data in a set of registers specified by the user. This function passes power flow if the function is actively receiving data / heartbeat messages from the remote I/O device. This function stops passing power flow if it has not received data / heartbeat messages from the remote I/O device for 2000 milliseconds.

A remote I/O device consists of a CsCAN device such as a SmartStix Module that transmits global data and receives directed network data.

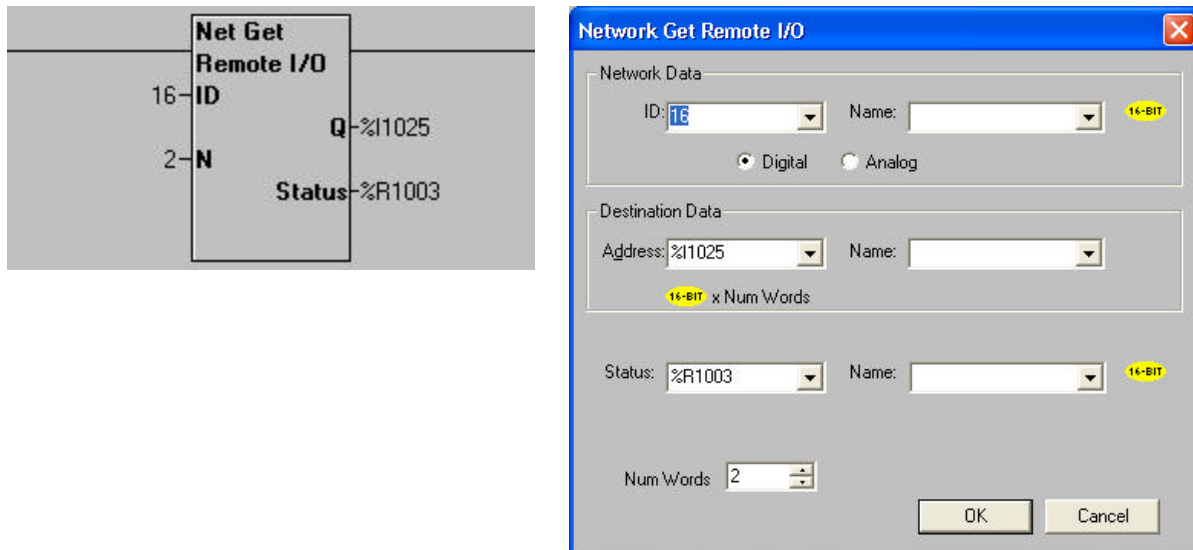


Figure 11.1 – Get Remote I/O Function Block and Parameter Screen

11.4.2 Get Remote Parameter Description:

ID – This is the network ID of the remote I/O from which to receive data. This can be a constant from 1 to 253 or a 16-bit register.

Digital / Analog – These radio buttons allow choosing digital or analog network data. Remote I/O devices with discrete inputs/outputs normally require digital data. Remote I/O devices such as voltage, current or thermocouple would require analog data.

Destination Data Address – This is the location to start placing data received from the remote I/O device. The number of registers used is defined by the **Num Words** parameter in this section. Any valid read/write OCS reference types can be used (%R, %AI, %I, %M, etc.).

Status – This 16-bit register is used internally. It must not be written by any other function block. Use the power flow from this function for the pass/fail status.

Num Words – This is the number of words to receive from the remote I/O device. Up to four words can be received from the remote I/O device. The function of these words are described in **Table 11.1**.

Table 11.1 - Consumed / Produced Parameter Descriptions		
Consumed Directed Digital Data Words	Function	Affects
Word 1 (bits 1 to 16)	Controls on/off state of digital outputs 1-16.	Relay or Digital output SmartStix
Word 2 (bits 17 to 32)	Controls on/off state of digital outputs 17-32.	Relay or Digital output SmartStix
Word 3 (bits 33 to 48)	Specifies whether SmartStix uses default configuration or values from Word 4.	Relay and Digital input and output
Word 4 (bits 49 to 64)	Sets digital inputs / heartbeat and life expectancy time data.	Relay and Digital input and output
Word 5 (bits 65 to 80)	Sets the default state of outputs 1-16.	Relay and Digital output
Word 6 (bits 81 to 96)	Sets the default state of outputs 17-32.	Relay and Digital output
Word 7 (bits 97 to 112)	Determines if default state is on or off for outputs 1-16.	Relay and Digital output
Word 8 (bits 113 to 128)	Determines if default state is on or off for outputs 17-32.	Relay and Digital output
Produced Global Digital Data Words	Function	Affects
Word 1 (bits 1 to 16)	On/off state of inputs 1-16.	Digital input SmartStix
Word 2 (bits 17 to 32)	On/off state of inputs 17-32.	Digital input SmartStix
Word 3 (bits 33 to 48)	Status bits and diagnostic data	Relay or Digital input and output
Word 4 (bits 49 to 64)	Device class number and firmware identifier sent by SmartStix module.	Relay or Digital input and output

Note: Table 11.1 summarizes SmartStix I/O module consumed and produced data words. For advanced users, refer to page 77 - 80 for sections describing the consumed and produced words in detail.

11.4.3 Put Remote I/O Function Block

This function handles sending data to a remote I/O device block obtained from a set of registers specified by the user. This function passes power flow if the remote I/O device is behaving normally. This function does not pass power flow if the remote I/O device has not sent a heartbeat in 2000 milliseconds. This function sends heartbeat messages to the output device every 1000 milliseconds. The default remote I/O operation is to expect heartbeat messages at least every 2000 milliseconds; otherwise the outputs are turned off (or their configured default state). Data is normally transmitted on change of state or if the remote I/O device is power-cycled.

A remote I/O device consists of a CsCAN device such as SmartStix Modules that transmit global data and receive directed network data.

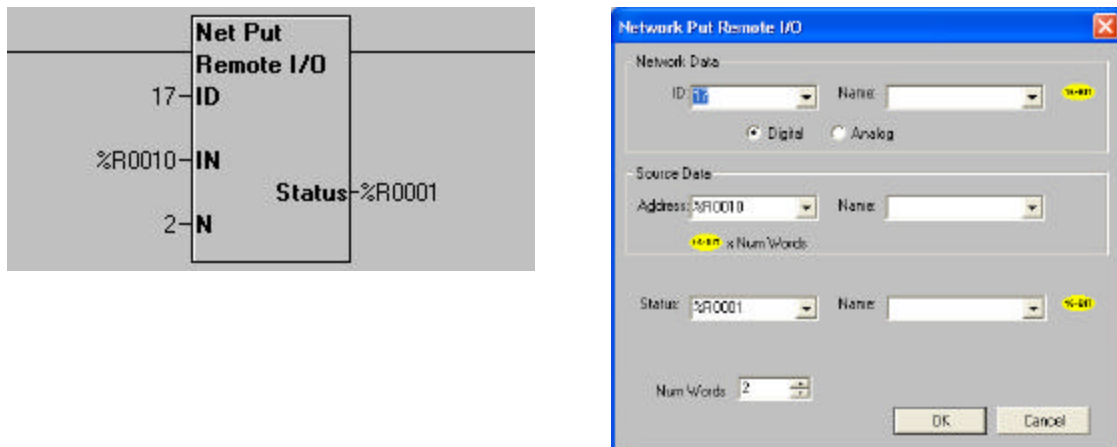


Figure 11.2 - Put Remote I/O Function Block and Parameter Screen

11.4.4 Put Remote Parameter Description:

ID – This is the network ID of the remote I/O to direct the sent data. This can be a constant from 1 to 253 or can be a 16-bit register.

Digital / Analog – These radio buttons allow choosing digital or analog network data. Remote I/O devices with discrete inputs/outputs normally require digital data. Remote I/O devices such as voltage, current or thermocouple require analog data.

Source Data Address – This is the starting location to get data to send to the remote I/O device. When this data changes state, it is sent to the remote I/O device. The number of registers used is defined by the *Num Words* parameter in this section. Any valid OCS reference types can be used (%R, %AQ, %Q, %M, etc.).

Status – this 16-bit register is used internally. It must not be written by any other function block.

- Bit 1-12 – reserved or internal use only
- Bit 13 – Remote I/O OK and in sync with supplied data
- Bit 14 – the Remote I/O detected a heartbeat error
- Bit 15 – the Remote I/O has just powered up
- Bit 16 – the function is forcing a send (unit just power cycled or first scan)

Num Words – This is the number of words to send to the remote I/O device. Up to 8 words can be sent to the remote I/O device. The function of these words are described starting with **Table 11.1**.

11.5 SmartStix I/O Default Operation

SmartStix I/O has been designed so that its default operation satisfies the most common applications. This keeps the user interface simple and makes the product easy to use. The default operation is summarized in **Table 11.2**. To change the default operator, see *Advanced SmartStix Programming* (page 77).

Table 11.2 – SmartStix I/O Default Operation	
Digital Input Devices	
Data Reporting Method	Change of State
Heartbeat Generation Interval	1000msec.
Digital Output Devices	
Update Method (using NETPUT Remote I/O Function block)	Change of State
Heartbeat Generation Interval	1000msec.
(LET) Life Expectance Time (Receipt of Heartbeat)	2000msec.
(LET) Action Upon Expiration	Turn all outputs OFF

ADVANCED SMARTSTIX PROGRAMMING

11.6 SmartStix I/O Module Device Classes

There are currently five SmartStix I/O Module device classes (0, 1, 2, 3 and 7) that control and monitor Digital I/O points and exchange Directed and Global Data words with a Control Station via the CsCAN Network.

Table 11.3 shows the five device classes along with the number of Digital I/O points they contain and the number of Directed and Global Data words they exchange.

Example: Determining the class of a SmartStix module using Table 11.3:

1. Select the number of digital output points and the number of digital input points using **Table 11.3**.
2. Upon doing so, the device class is located in the same row as the digital outputs and inputs; the words consumed and produced are also shown for that device class.

Device Class	Digital Output Points	Digital Input Points	Directed Data Words Consumed	Global Data Words Produced
0	16	0	8	4
1	0	16	8	4
2	16	16	8	4
3	0	32	8	4
7	32	0	8	4

All other device classes are reserved for future products.

Note that although all of the above device classes can **consume** eight Directed Data Words and can **produce** four Global Data words, each device class **uses** a specific subset of this data.

The following terms are defined:

Consumed Data: Directed Data received by a SmartStix I/O Module *from* a Control Station

Produced Data: Global Data transmitted by a SmartStix I/O Module *to* a Control Station

Table 11.1 summarizes SmartStix I/O module consumed and produced data words. For advanced users, the following sections describe the consumed and produced words in detail.

11.7 SmartStix I/O Module Consumed (Received) Directed Data

Table 11.4 – Consumed Directed Data Word 1															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
Digital Output Control Data – Low Word															
Q16	Q15	Q14	Q13	Q12	Q11	Q10	Q9	Q8	Q7	Q6	Q5	Q4	Q3	Q2	Q1

Q16...Q1 Controls the Off / On state of the SmartStix I/O Module's 1st 16 Digital Outputs, if any.

Table 11.5 – Consumed Directed Data Word 2															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
Digital Output Control Data - High Word															
Q32	Q31	Q30	Q29	Q28	Q27	Q26	Q25	Q24	Q23	Q22	Q21	Q20	Q19	Q18	Q17

Q32...Q17 Controls the Off / On state of the SmartStix I/O Module's 2nd 16 Digital Outputs, if any.

Table 11.6 – Consumed Directed Data Word 3																		
16-bit Word																		
8-bit High Byte								8-bit Low Byte										
Diagnostic Command Data								Configuration Command Data										
Reserved for Future Products																CIT	CH T	CL T

- CLT = 0 Command the SmartStix I/O Module to set its Life Expectancy Time to 2.0 seconds, as the maximum time to wait between Control Station to SmartStix I/O Module output control data messages, before setting all Digital Outputs to their default states.
- CLT = 1 Command the SmartStix I/O Module to use Word 4's Life Expectancy Time. In this case, a value of 0.0 disables the Life Expectancy feature.
- CHT = 0 Command the SmartStix I/O Module to set its Heartbeat Send Time to 1.0 second, as the minimum time between SmartStix I/O Module to Control Station Heartbeat messages.
- CHT = 1 Command the SmartStix I/O Module to use Word 4's Heartbeat Send Time. In this case, a value of 0.0 disables the Heartbeat Send feature.
- CIT = 0 Command the SmartStix I/O Module to send its Digital Input data to the Control Station, only when the Digital Inputs change state.
- CIT = 1 Command the SmartStix I/O Module to use Word 4's Digital Input Send Time, to determine how often to periodically send its Digital Input data to the Control Station. In this case, a value of 0.0 disables *automatic* sending of Digital Input data.

Note: Regardless of the CIT setting, Digital Inputs are always sent to the Control Station when the SmartStix I/O Module powers-up, and when specifically requested by the Control Station.

Table 11.7 – Consumed Directed Data Word 4															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
Digital Input / Heartbeat Send Time Data								Life Expectancy Time Data							
0.0 to 25.5 seconds = Minimum Send Interval								0.0 to 25.5 seconds = Maximum Receive Interval							

See Directed Data Word 3's CLT, CHT and CIT command descriptions above.

Table 11.8 – Consumed Directed Data Word 5															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
0 = Force Off / On 1 = Hold-Last-State								Default Digital Output Data - Low Word							
H16	H15	H14	H13	H12	H11	H10	H9	H8	H7	H6	H5	H4	H3	H2	H1

H16...H1 Determines default state of the SmartStix I/O Module's 1st 16 Digital Outputs, if any, when the configured Life Expectancy Time expires. If an H bit is 1, its corresponding Digital Output, by default, holds its last state. If an H bit is 0, its corresponding Digital Output is forced Off or On, depending on the corresponding F bit in Word 7 (Table 11.10).

Table 11.9 – Consumed Directed Data Word 6															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
0 = Force Off / On 1 = Hold-Last-State								Default Digital Output Data - High Word							
H32	H31	H30	H29	H28	H27	H26	H25	H24	H23	H22	H21	H20	H19	H18	H17

H32...H17 Determines default state of the SmartStix I/O Module's 2nd 16 Digital Outputs, if any, when the configured Life Expectancy Time expires. If an H bit is 1, its corresponding Digital Output, by default, holds its last state. If an H bit is 0, its corresponding Digital Output is forced Off or On, depending on the corresponding F bit in Word 8 (Table 11.11).

Table 11.10 – Consumed Directed Data Word 7															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
0 = Force Off 1 = Force On								Default Digital Output Data - Low Word							
F16	F15	F14	F13	F12	F11	F10	F9	F8	F7	F6	F5	F4	F3	F2	F1

F16...F1 Determines default Off or On state of each of the SmartStix I/O Module's 1st 16 Digital Outputs, if any, when the configured Life Expectancy Time expires, and when the corresponding H bit in Word 5 (Table 11.8) is 0.

Table 11.11 – Consumed Directed Data Word 8															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
0 = Force Off 1 = Force On								Default Digital Output Data - High Word							
F32	F31	F30	F29	F28	F27	F26	F25	F24	F23	F22	F21	F20	F19	F18	F17

F32...F17 Determines default Off or On state of each of the SmartStix I/O Module's 2nd 16 Digital Outputs, if any, when the configured Life Expectancy Time expires, and when the corresponding H bit in Word 6 (Table 11.9) is 0.

11.8 Consumed Directed Data Power-Up Initialization

At power-up, the SmartStix I/O Module's eight Consumed Directed Data words are all cleared to 0. Until Directed Data is actually received from a Control Station, the SmartStix I/O Module will exhibit the following behavior:

1. All Digital Outputs are Off, until Q data is received from a Control Station.
2. The device expects to receive Q data at least every two seconds.
3. The device transmits a Heartbeat every second.
4. The device transmits its Digital Input data, only when the Digital Inputs change state.
5. If Q data is received, and then not received for 2 seconds, the outputs go Off again.
6. At power-up, a request for Directed Data is transmitted to the CsCAN Network.

11.9 SmartStix I/O Module Produced (Transmitted) Global Data

Table 11.12 – Produced Global Data Word 1															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
Digital Input Status Data - Low Word															
I16	I15	I14	I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1

I16...I1 Monitors the Off / On state of the SmartStix I/O Module's 1st 16 Digital Inputs, if any.

Table 11.13 – Produced Global Data Word 2															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
Digital Input Status Data - High Word															
I32	I31	I30	I29	I28	I27	I26	I25	I24	I23	I22	I21	I20	I19	I18	I17

I32...I17 Monitors the Off / On state of the SmartStix I/O Module's 2nd 16 Digital Inputs, if any.

Table 11.14 – Produced Global Data Word 3																
16-bit Word																
8-bit High Byte								8-bit Low Byte								
Module Fault Data				Network Fault Data				Configuration Status Data								
PUP	I/O	ROM	RAM	LIFE	ID	DUP	NAK							SIT	SHT	SLT

- SLT CLT command status; matches CLT when command is complete
- SHT CHT command status; matches CHT when command is complete
- SIT CIT command status; matches CIT when command is complete

- NAK Network Acknowledge test failed; found no other Network devices
- DUP Network Duplicate ID test failed; found another Network device with our Network ID
- ID Network ID test failed; Network ID rotary switches illegally set to 00, FE or FF
- LIFE Network Life Expectancy Time has expired; outputs are in default state

- RAM Module RAM test failed; found a RAM memory fault during power-up-self-test
- ROM Module ROM test failed; found a ROM memory fault during power-up-self-test
- I/O Module I/O test failed; found an I/O fault during power-up-self-test
- PUP Module just powered up; using default configuration; outputs are Off

Table 11.15 – Produced Global Data Word 4															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
Firmware Revision Status Data								Device Identification Status Data							
0.00 to 2.55 = Version Number								0 to 255 = Device Class Number							

Device Class Number SmartStix I/O Module's numeric product identifier (see Table 11.3)
Version Number SmartStix I/O Module's numeric firmware identifier

11.10 Produced Global Data Power-Up Initialization

At power-up, a SmartStix I/O Module's four Produced Global Data words are initialized as follows:

1. Digital Inputs are read and loaded into Words 1 and 2.
2. Power-up-self-test result is loaded into Word 3; if tests passed, only PUP bit is On.
3. Module's Device Class Number and Version Number are loaded into Word 4.
4. All four Produced Global Data words are transmitted to the CsCAN Network.

11.11 SmartStix I/O Module LED Indicators

SmartStix I/O Modules provide diagnostic and status LED indicators

11.11.1 Diagnostic LED Indicators

The MS and NS diagnostic LEDs indicate the fault status of the module and the network, respectively. Note that the diagnostic LEDs correspond directly to the Module Fault and Network Fault bits as shown in Table 11.14.

The following table shows the possible LED states and their meanings:

Diagnostic LED	State	Meaning
MS (Module Status)	Solid Red	RAM or ROM test failed (RAM or ROM bit On)
	Blinking Red	I/O test failed (I/O bit On)
	Blinking Green	Module is in power-up state (PUP bit On)
	Solid Green	Module is running normally (all Module Fault bits Off)
NS (Network Status)	Solid Red	Network Ack or Dup ID test failed (NAK or DUP bit On)
	Blinking Red	Network ID test failed (ID bit On)
	Blinking Green	Module is in Life Expectancy default state (LIFE bit On)
	Solid Green	Network is running normally (all Network Fault bits Off)

11.11.2 Status LED Indicators

In addition to the MS and NS diagnostic LED indicators described above, SmartStix I/O Modules also provide a Power Status LED, which illuminates Red when power is applied to the module.

Also, there are I/O Status LED indicators for each of the Digital I/O points, which illuminate Red when the I/O point is On.

11.12 SmartStix I/O Module Network ID

Each SmartStix I/O Module (as well as all other CsCAN Nodes on the CsCAN Network) must be assigned a unique Network ID number, to arbitrate network data exchanges.

Since a Network ID is a number in the range 1 to 253, up to 253 CsCAN Nodes can be logically connected to a CsCAN Network. However, the use of standard CAN transceiver chips, limits the number of physically attached devices to 64. Thus, to reach the logical limit of 253 devices, up to three smart CAN repeaters (HE200CGM100) are used, to connect groups of devices together.

Assigning a SmartStix I/O Module's Network ID is accomplished by setting its two hexadecimal (base 16) Network ID rotary switches, which are labeled HI and LO. Each rotary switch has 16 positions, labeled 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E and F, where A through F represent the decimal values 10 through 15. The Network ID rotary switches are set as follows:

$$\text{Network ID} = (\text{Network ID}_{\text{HI}} \times 16) + \text{Network ID}_{\text{LO}}$$

This allows the Network ID to be set to any number from 0 to 255. However, since Network IDs 0, 254 and 255 (00, FE and FF) are reserved for other purposes, they are illegal settings for a SmartStix I/O Module. If a SmartStix I/O Module's rotary switches are set for an illegal Network ID, a default Network ID of 253 will be used, the ID Network Fault bit will be On, and the NS LED will blink Red.

NOTES

CHAPTER 12: USING COMPACTFLASHä MEMORY CARDS

12.1 General

Chapter Twelve provides an overview of the CompactFlash feature in Color Touch OCS models and Cscape Software.

Note: For detailed information regarding CompactFlash function blocks and parameters, refer to the help file in Cscape Software.

12.2 Compact Flash Overview

Several Color Touch OCS models provide a slot for a CompactFlash memory card. The CompactFlash manager is a graphical object that allows viewing the filenames, size and dates of files and directories on a CompactFlash card. The operator can optionally change directories, delete files and format a new flash cards. This object also supplies status information such as color change on card OK, card full and card missing status. The file view includes total card capacity and remaining free space.

Table 12.1 – Color Touch OCS Models with a CompactFlash Slot

OCS451
OCS551
OCS651

12.2.1 Connecting to a Color Touch OCS

- a. Insert a CompactFlash card into the Color Touch OCS CompactFlash slot.
- b. If not formatted, use the CompactFlash Manager object to format the card.
- c. The Color Touch OCS ladder application program can **read** and **write** to the CompactFlash card. The file is saved as a .csv file.

12.2.2 Connecting to a PC

- a. Insert or connect the CompactFlash memory card to the PC according to the manufacturer's instructions.
- b. The PC typically sees the CompactFlash card as a removable storage device like a small solid-state hard drive. Files can be read from and written to the CompactFlash card in the same way they are read/written to a standard hard disk. The only file format that can be read or written by an OCS application is a .csv (comma separated value) file.

12.3 CompactFlash Function Blocks in Cscape

Note: For detailed information regarding CompactFlash function blocks and parameters, refer to the help file in Cscape Software.

The following CompactFlash functional blocks are available in Cscape Software.

a. Read CompactFlash csv

This function allows reading of a comma-separated value file from the CompactFlash interface into the controller register space. The file format of the value file uses commas to separate values.

b. Write CompactFlash csv

This function allows writing of a comma-separated value file to the CompactFlash interface from the controller register space. The file format of the value file uses commas to separate values.

c. Rename CompactFlash csv

This function allows renaming a file on the CompactFlash card. The data in the file is not changed.

d. Delete CompactFlash csv

This function allows deleting a file on the CompactFlash card.

12.4 CompactFlash Manager in Cscape

The CompactFlash Manager is a graphical object that allows viewing filenames, size and dates of files, and directories on a CompactFlash card. The operator can optionally change directories, delete files, and format new flash cards. This object also supplies status information such as **Color change on card OK**, **Card full**, and **Card missing** status. For additional information, refer to **Cscape Help File**; select **Cscape Reference Manual**, and then select *Using Graphics Editor*.

12.5 Filenames Used with the CompactFlash Function Blocks

The OCS CompactFlash function blocks support the flash with a DOS/Windows standard FAT-16 file system. All names must be limited to the "eight dot three" format where the filename contains eight characters a period then a three-character extension.

The entire filename including any path must be less than or equal to 140 characters.

When creating filenames and directories it is sometimes desirable to include parts of the current date or time. There are six special symbols that can be entered into a filename that are replaced by the OCS with current time and date information.

Symbol	Description	Example
\$Y	Substitutes the current 2 digit year	2004 = 04
\$M	Substitutes the current month with a 2 digit code	March = 03
\$D	Substitutes the current day	22 nd = 22
\$h	Substitutes the current hour in 24 hour format	4 pm = 16
\$m	Substitutes the current minute	
\$s	Substitutes the current minute	

Note that all the symbols start with the dollar sign (\$) character. Date symbols are in upper case, time symbols are in lower case.

The following are examples of the substituted time/date filenames:

Current date and time: March 1, 2004 3:45:34 PM

Filename: Data\$M\$D.csv = Data0301.csv

Filename: Year\$Y\Month\$M\aa\$D_\$h.csv = Year04\Month03\aa01_15.csv

Filename: Month_\$M\Day_\$D\h_\$m_\$s.csv = Month_03\Day_01\15_45_34.csv

12.6 System Registers used with CompactFlash

%SR175 Status – This shows the current status of the CompactFlash interface.

Possible status values are shown in the table:

0	CompactFlash interface OK
1	Card present but unknown format
2	No card in slot
3	Card present, but not supported
4	Card swapped before operation was complete
5	Unknown error

%SR176 Free Space – This 32-bit register shows the free space on the CompactFlash card in bytes.

%SR178 Card Capacity – This 32-bit register shows the total card capacity in bytes.

NOTES

APPENDIX A: NETWORKS

1 CAN and CsCAN Networks

Appendix A describes the Controller Area Network (CAN) and CsCAN/DeviceNet.

2 Controller Area Network (CAN) Overview

The controller area network (or CAN bus) is a serial communications bus that was originally developed in the late 1980's by a German company (Robert Bosch) for use in the automotive industry. CAN is an ISO (International Standards Organization) - defined serial communications bus for real-time applications. Established in 1947, the International Standards Organization (ISO) is a multinational body dedicated to worldwide agreement on international standards. Specifically, CAN is documented in ISO 11898 (for high-speed applications) and ISO 11519 (for lower-speed applications).

a. CAN Features

CAN-based open automation technology successfully competes on the market of distributed automation systems because of the special features of the CAN protocol. The special features are CAN's producer-consumer-oriented (or peer-to-peer) principle of data transmission and its multi-master capability. The general design of CAN originally specified a high bit rate, high immunity to electrical interference and an ability to detect any errors produced. CAN networks have the following general attributes:

- Automatic error detection
- Easily configurable
- Cost-effective to design and implement
- Capable of operating in harsh environments

b. CAN Protocol

The CAN communications protocol simply describes the method by which information is passed between various devices. The CAN protocol conforms to the Open Systems Interconnection (OSI) model. An open system is a set of protocols that allows any two different systems to communicate regardless of their underlying architecture. The OSI model is defined in terms of seven ordered layers. These layers consist of the Physical (bottom-most layer), Data Link, Network, Transport, Session, Presentation and Application (top-most layer). CAN architecture defines the bottom two layers of the model. These layers are the physical and data link layers.

The physical and data link layers are typically transparent to the system designer and are included in any component that implements the CAN protocols. The physical layer is responsible for functions such as physical signaling, encoding, bit timing and bit synchronization. The data link layer performs functions such as bus arbitration, message framing and data security, message validation, and error detection. The application levels are linked to the physical medium by the layers of various emerging protocols (such as DeviceNet) dedicated to particular industry areas plus a variety of custom protocols defined and developed by individual CAN users.

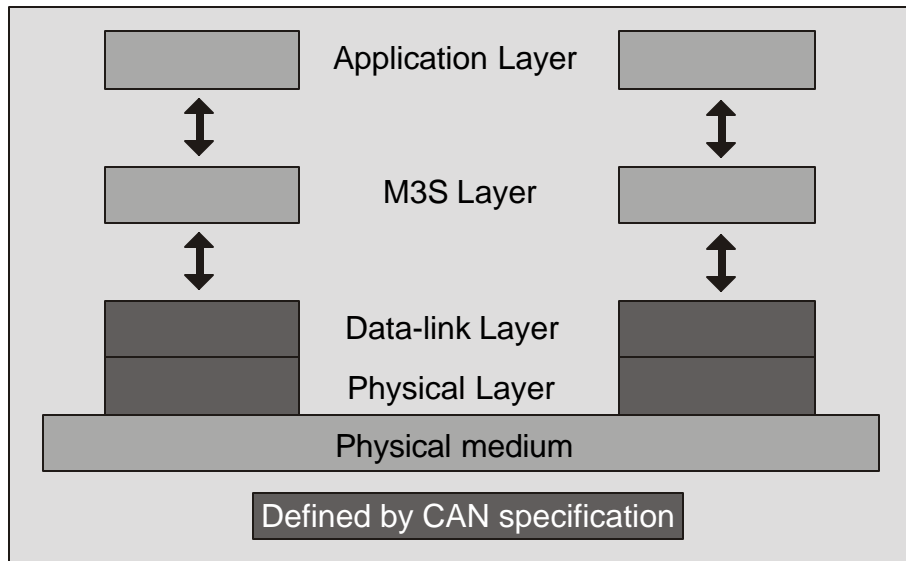


Figure 1 - OSI-Based Model

c. CAN Operation

CAN is capable of using a variety of physical media for transmission purposes. Two examples are twisted wire-pairs and fiber-optics. The most common physical medium consists of a twisted-pair with a termination resistance that is applicable to the cable in use (the CsCAN network typically calls for the use of a 121Ω resistor). CAN operates at data rates of up to 1 Megabits per second.

The signaling in CAN is carried out using differential voltages. The two signal lines are termed 'CAN_H' and 'CAN_L'. The use of voltage differentials allows CAN networks to function in very noisy environments. With the twisted pair, differential configuration, each wire is closer to the noise source (if a noise source is present) for half the time and farther away for the other half. Therefore, the cumulative effect of the interference is equal on both wires, thus canceling the interference.

The Full CAN protocol allows for two lengths of identifiers. These two parts are "Part A" and "Part B". Part A allows for 11 message identification bits, which result in 2032 different identifiers. Extended CAN (Part B) utilizes 29 identification bits, resulting in 536,870,912 separate identifiers.

Note: DeviceNet currently specifies Part A only, and the balance of this discussion is specific to Part A only.

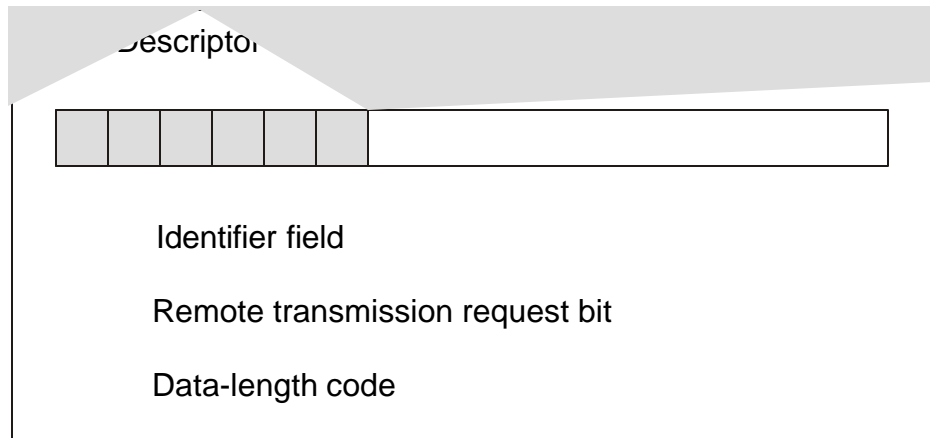


Figure 2 – Descriptor Bytes

There are 11 bits in the identifier field. The bits are used for identification of the message as well as determining its bus access priority. The priority is defined to be highest for the smallest binary value of the identifier. One very attractive quality of CAN is that it is capable of allocating priorities to messages. This feature makes it attractive for use within real-time control environments. All bits of the identifier field define the message priority. The CAN specification guarantees the latency time associated with priority values.

Since the CAN protocol specifies no rules for the assignment of message-identifiers, a variety of different, application-specific uses are possible. Assignment of the CAN message identifiers therefore is one of the most important decisions when designing a CAN-based communication system.

To summarize, CAN is currently being used in a very large number of applications in the automotive industry and in many other industrial applications. CAN is an excellent network to use in situations where microcontrollers need to communicate with each other or with remote devices. The popularity of CAN has been the result of the automatic error detection capabilities, the ability to operate in harsh environments, the relatively low-cost for development tools, and the wide availability of hardware.

3 CsCAN Network Overview

The CsCAN Network was first developed in 1993 by Horner. It was developed for use in a project that Horner completed for the United States Post Office. Horner developed its own network, because it needed a network that had a specific set of powerful peer-to-peer and host-to-node capabilities. The CsCAN Network has a “pass-through” feature whereby PC-based programs access other nodes connected to a network by passing the programming command through the serial port to the network port. (For a more detailed description, see below.) Horner found that by developing its own network, it satisfied several important needs. Horner continues CsCAN Network development to satisfy the requirements of today and the requirements of the future.

CsCAN Network Features

The CsCAN Network is based on CAN, which has many desirable features such as ruggedness, ease of configuration, etc. With Horner Controllers, data is passed at 125Kbps using a differential pair of wires plus a ground. It is important to note that the data rate is not limited to 125Kbps. The maximum data rate is 1Mbps (limited by the speed of light). The CAN implementation in the CsCAN controller allows up to 64 controllers to be networked with no additional hardware and up to 253 controllers with three CAN repeaters.

For the ladder programmer, little knowledge of networking procedures is needed. However for troubleshooting and optimizing, the following information is helpful. Instead of using master/slave or token passing, the hardware self-arbitrates based on the Network ID. **Controllers with lower Network ID numbers are given a higher priority than controllers with higher Network ID numbers.**

CsCAN Network Operation

When a controller needs to send data over the network, it first waits for the network to be idle (currently a maximum of 900 μ s). If two controllers start broadcasting information on the network at the same time, the "self-arbitration" causes the controller with the greater Network ID number to cease broadcasting without affecting the message-in-progress of the other controller.

In applications with a large number of networked controllers, better results may be achieved by assigning lower Network IDs to controllers that have more critical network data than other controllers. By assigning higher Network IDs to controllers that provide numerous network updates, the controllers are prevented from monopolizing the bus time.

Each controller is capable of broadcasting Global Digital Output bits (%QG) and Global Analog Output bits (%AQG), which are periodically broadcasted to the other controllers on the network. The coil representations %QG and %AQG can be used in ladder logic like any other coil or register reference.

All global outputs are broadcast to the network according to the way the programmer sets them up under the Program, Network Config in Cscape.

In addition to global data, the CsCAN Network is used to exchange data between a controller on the network and a PC-based Host Supervisory Tool such as the Cscape Ladder Editor or an OEM-specific cell controller.

A useful feature of the CsCAN network is that it supports a "Host-to-Node" protocol and has the ability to "pass through" programming commands. A programming package (like Cscape™), when attached to a Control Station serial port, can access other Control Station units connected to a network by passing the programming command through the serial port to the network port. In this way, one Cscape™ package connected to one Control Station unit can program all Control Station units on the network.

4 DeviceNet Overview

DeviceNet is an open network. The specification and the protocol are open. Vendors are not required to purchase hardware, software or licensing rights to connect devices to a system.

a. DeviceNet Features

DeviceNet is a low-cost communications link to connect industrial devices. It allows the interchangeability of simple devices while making interconnectivity of more complex devices possible. DeviceNet is based on CAN. It is an application layer protocol (ISO layer 7) and is defined in terms of an abstract object model, which represents the available communication services and the external visible behavior of a DeviceNet node.

The DeviceNet Model is application independent. DeviceNet provides the communication services needed by various types of applications. Many of today's lower level industrial control devices must retain their low cost/low resource characteristics even when directly connected to a network. DeviceNet takes this into consideration by defining a specific instance of the DeviceNet Model for communications typically seen in a Master/Slave application. This is referred to as the Predefined Master/Slave Connection Set. Some of the features and functionality of the DeviceNet network are described Table 1:

Table 1 - DeviceNet Features and Functionality									
Network Size	Up to 64 Nodes								
Network Length	Selectable end-to end network distance varies with speed								
	<table border="0"> <thead> <tr> <th>Baud Rate</th> <th>Distance</th> </tr> </thead> <tbody> <tr> <td>125 Kbps</td> <td>500m (1,640 feet)</td> </tr> <tr> <td>250 Kbps</td> <td>250m (820 feet)</td> </tr> <tr> <td>500 Kbps</td> <td>100m (328 feet)</td> </tr> </tbody> </table>	Baud Rate	Distance	125 Kbps	500m (1,640 feet)	250 Kbps	250m (820 feet)	500 Kbps	100m (328 feet)
Baud Rate	Distance								
125 Kbps	500m (1,640 feet)								
250 Kbps	250m (820 feet)								
500 Kbps	100m (328 feet)								
Data Packets	0-8 bytes								
Bus Topology	Linear (trunkline/dropline); power and signal on the same network cable								
Bus Addressing	Peer-to-Peer with Multi-Cast (one-to-many); Multi-Master and Master/Slave special case; polled or change-of-state (exception-based)								
System Features	Removal and replacement of devices from the network under power								

b. DeviceNet Protocol

Some of the communication protocol features of DeviceNet consist of the following:

A DeviceNet product can behave as a Client, a Server or both.

Master/Slave operation.

Capable of Peer-to-Peer exchange capability exists in which any DeviceNet product can produce and consume messages.

Capable of supporting 64 node addresses

Each node can support an unlimited number of I/O.

DeviceNet requires packets to have identifier fields for the data. The DeviceNet specification defines two different types of messaging. These two different types are I/O Messaging and Explicit Messaging. These messages provide multi-purpose, point-to-point communications paths between two devices. Explicit messages use low priority identifiers and contain the specific meaning of the message in the data field. I/O messages are for time-critical, control-oriented data. They provide a dedicated, special-purpose communication path between a producing application and one or more consuming applications. They are exchanged across single or multi-cast connections and typically use high priority identifiers.

c. DeviceNet Operation

The following restrictions are placed on operations when using an Color Touch OCS that is configured as a DeviceNet slave.

Currently, communication between the PC and the controller is only possible to the device physically connected to the PCs' serial port. Ladder logic downloads, uploads, monitoring, and configuration **cannot currently take place** over a DeviceNet network. The **local node ID and target controller node ID must be the same**.

DeviceNet network nodes are in a range from 0 to 63. The controller is able to observe network responses (polled connections) from any slave to the DeviceNet Master . The first 16-words of these observed responses are made available for mapping on the **Network Input Assignments** page. These correspond to the available nodes 0 to 63 and registers AQQ1 to AQQ16. Node 64 is used for a special case. When data is sent to a controller from a DeviceNet Master (via the polled connection) this data is mapped to node 64. Relative addressing is limited to -64 to +64.

Note: Horner manufactures a DeviceNet Master module. The part number is HE800DNT450.

APPENDIX B: DISTRIBUTED CONTROL SYSTEMS (DCS)

1 General

A Distributed Control System (DCS) is defined as a system for the control and monitoring of an industrial process which shares the computer-processing requirement between several processors. With DCS, processing is distributed among a multitude of different processors instead of one very large processing system.

MIMD (multiple instruction, multiple data) parallel processing technique is used in the CsCAN network. Each processor is capable of sharing data in this system. Typically, the processors are located in a wide variety of devices. These devices may take the form of Micro PLCs, conveyor controllers, operator interfaces, etc. Each of these devices serves a specific function.

It is common in a DCS for several different modules to be physically distributed in some type of arrangement around a plant. This is typically the case with devices connected to plant instrumentation since this greatly reduces plant cabling costs. The name "Distributed Control System" is not a reference to a *physical* layout but rather to the distribution of the processing. The devices in DCS are connected together via a high-speed communication link. Links such as CsCAN and DeviceNet are typical in DCS.

2 Attributes Desirable in DCS Design

There are three attributes that are desirable in any DCS design:

a. Ease of Implementation

Modern Distributed Control Systems should be able to implement most control requirements without the need for complex or unusual design.

b. Intuitive to the Operator

The group of individuals that use DCS most frequently are the operators. It is important that applications are designed so that they are operable in a logical and consistent manner and in a way that complements the general operation of a plant.

c. Maintainable

Achieving the required functionality is only part of the solution. The design must also be maintainable. The system should be designed so that it can be maintained without the need for major re-engineering.

Distributed control is becoming ever-increasingly popular. As the presence of networks become more common in industrial automation, finding better ways to use the networks effectively will become much more important. Central to the DCS philosophy, control needs to be distributed out onto the network so that control is implemented where the process actually takes place. With DCS, the overall amount of data on the network is essentially reduced, because only data that has been processed is broadcasted on the network. This allows for more devices to be installed on a network that have a finite bandwidth.

3 Key Factors in Distributed Control Systems

All programmable nodes can be programmed via the network. Each node communicates data onto the network that is readable by any other node on the network in the Producer/Consumer network mode. (Also known as Peer-to-Peer Networking). Network medium is flexible. Currently, the Controller Area Network (CAN) is the preferred solution, but it is anticipated that Ethernet will likely be dominant within 1-3 years.

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