Color-Touch OCS Hardware

User Manual for
IC300OCS300 / IC300OCS301,
IC300OCS350 / IC300OCS351,
IC300FOX104 / IC300FOX404

Color-Touch OCS Hardware

27 April 2002

GFK-1971B

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Note

Notes merely call attention to information that is especially significant to understanding and operating the equipment.

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Revisions to this Manual

This version (GFK-1971B) of the Color-Touch OCS User Manual contains the following revisions, additions, and deletions:

1. Revised Table 1.2: Added CE Specification.
2. Added Section 2.4.6: CE Requirement for Ethernet Modules (OCS301 / OCS351).
3. Revised Figure 2.5. Made a correction to the drawing by reversing the labels of Port 1 and Port 2.
4. Revised Section 2.4.4 to add note regarding PORT 3.
5. Revised Section 2.4.5, Item C: Recommended Modem.

Table of Contents

CHAPTER 1: INTRODUCTION

1.1 Scope

1.1.1 Products Covered in this Manual

The Color Touch OCS User Manual provides information covering specifications, installation, and configuration procedures for the Color Touch OCS. In addition, the SmartStack Fiber Optic Extension System (FOX) is also covered.

1.1.2 References

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

a. *DeviceNet Implementation Using Control Station Modules* (GFK1763) - Covers the implementation of Control Station products in a DeviceNet network.

b. *Cscape Programming and Reference Manual* (GFK-1722) – Topics in this manual have been specifically 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* (GFK-1601) - Contains individual data sheets for each module and covers specifications, wiring, and configuration.

d. *SmartStack Ethernet Module User Manual* (GFK-1784) – Covers the SmartStack Ethernet Module for use in Ethernet networks.

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 (Section 2.5).

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. The following table describes Color Touch OCS models that are available, the networks in which they can be used, and the types of screens used.

Table 1.1 – Color Touch Models				
Model	**Network**		**Screen Type**	
IC300OCS300	CsCAN, DeviceNet		5.7” STN with 16 colors	
IC300OCS301	CsCAN, DeviceNet, On-Board Ethernet 10BaseT		5.7” STN with 16 colors	
IC300OCS350	CsCAN, DeviceNet		5.7” TFT with 16 colors	
IC300OCS351	CsCAN, DeviceNet, On-Board Ethernet 10BaseT		5.7” TFT with 16 colors	
All Color Touch OCS Models	**Functions**			
	Control	***Display and Keypad***	***Network***	***I/O***
	Yes	Yes	Yes	Yes

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)
- 24 VDC powered
- Dedicated I/O Processor
- RS-232 / RS-485 Serial Ports
- Integrated Bezel
- Real-Time Clock
- Flash Memory for easy field upgrades
- System Key and Configurable Function Keys.

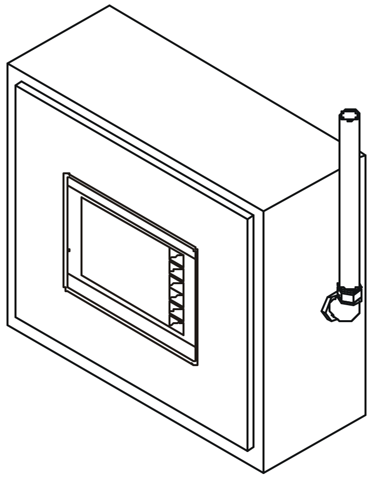

Figure 1.1 – Color Touch OCS
(Shown in Panel Box)

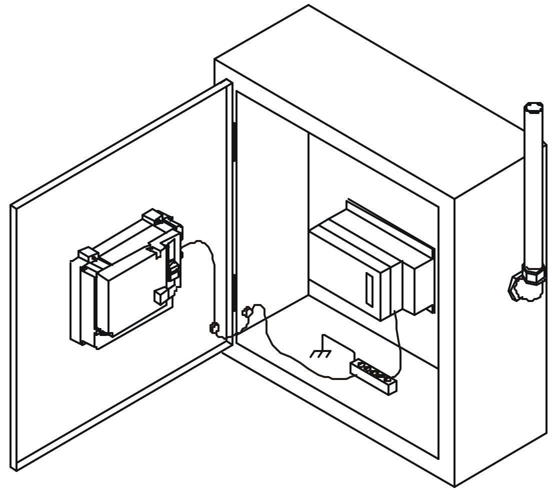

Figure 1.2 –Back View of Color Touch OCS
(Color Touch Shown in Panel Box Door)
(FOX Shown in Panel Box)

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.

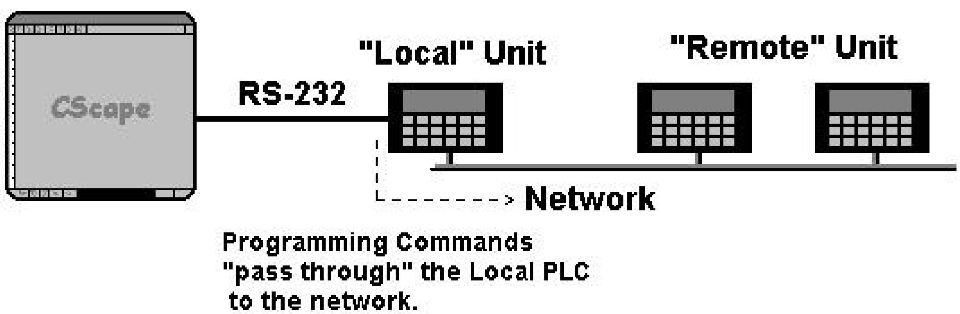

Figure 1.3 – Pass-Through Function (Available in CsCAN Networks Only)

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 “Sea-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.

1.2.3 Color Touch OCS Specifications

Table 1.2 – Color Touch OCS Specifications	
Color Touch Models	
Logic Scan Time Ladder Execution Typical Execution Speed	0.7 ms. per 1K of Boolean Logic.
Memory	32K Register, 2M Display, 128K Ladder
I/O Support	SmartStack I/O via Expansion Base: 5 fiber optic bases with 4 slots each for a total of 20 I/O Modules
I/O Models Available	Variety of 40+ SmartStack I/O Modules offering a wide range of I/O Options
Maximum I/O	2048 Digital Inputs, 2048 Digital Outputs, 512 Analog Inputs, 512 Analog Outputs
Display Type	320x240 LCD with backlight. TFT and STN models available.
Display Screen Dimensions	4-6"W x 3.5"H (117 x 88mm)
Display	5.7" (115.17mm x 86.37mm) Graphic LCD w / backlight
User Keys	5 configurable keys + System Key
Touchscreen	Resistive Analog 1024W x 1024H
Touchscreen Life	Greater than 1 million operations
Screens Supported	300 screens (50 data fields per screen)
Keypad	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.
Ports (3) RS-232 / RS-485	**Port 1** (Programming Port); **Port 2** (Applications); **Port 3** (Serial Port)
Network Ports	1 CAN (DeviceNet slave or CsCAN peer)
Protocols supported: Serial Ports: CAN Ports:	CsCAN, Modbus Master, Modbus Slave, and ASCII Read and Write CsCAN (up to 253 drops) or DeviceNet Slave (Explicit Messaging, Polled Connection, Polled Snooping)
Communications Options	On-board Ethernet 10BaseT (optional) supports TCP/IP with EGD and SRTP
Expansion I/O	EIAJ RC-5720 Plastic Fiber, TX+RX 10m max. host (OCS or hub) to base
Primary Power	24VDC(+/-10%). 450mA @ 24VDC. Inrush Current 2A for 3ms.
CAN Power Usage	12 – 25 VDC
I/O Power	10-30VDC, 400mA max. @ 24VDC
CAN Power Current	75mA maximum
CAN Port Isolation	500V
Height	6.75" (171.45mm)
Width	10 3/16" (258.76mm)
Mounting Depth	3.00" (76.2 mm)
Operating Temperature	32 - 122°F (0 - 50°C)
Humidity	5% to 95% non-condensing
NEMA Rating	12, 4, 4X
UL	Class I, Groups A, B, C, D, Division 2
CE	Yes **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. This requirement applies to Ethernet Modules OCS301 and OCS351.

1.3 Color Touch OCS Resources

1.3.1 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 Cscape (Control Station Central Application Programming Environment) package. Each Color Touch OCS provides a set of resources for use by the ladder logic control program.

1.3.2 Resource Limits

Table 1.3 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
%S Registers	8			
%SR Registers	192			
%T Registers	2048			
%M Registers	2048			
%R Registers	9999			
%K Registers	5			
%D Registers	300			
%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
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	System Key and 5 Configurable Function Keys			
Display	320x240 STN Display		320x240 TFT Display	
Screen Memory	1024K			
User Screens	300			
Data Fields Per User Screen	50			
Ladder Code	256K			

1.3.3 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.

a. %S Registers

%S Registers are 1-bit memory locations, containing system status information, 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

b. %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	200 300
%SR2	ALRM_SCR	Current Alarm Screen Number (0=none)	0	300
%SR3	SYS_SCR	Current System Screen Number (0=none)	0	12 1
%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	-	-	-

Table 1.5 - %SR Registers

Register	Name	Description	Min	Max
%SR15-16	Reserved	-	-	-
%SR17-18	IO_SIZE	I/O Configuration Table Size	16	127K
%SR19-20	NET_SIZE	Network Configuration Table Size	34	1K
%SR21-22	SD_SIZE	Security Data Table Size	-	-
%SR23	LADDER_CRC	Ladder Code CRC	0	65535
%SR24	Reserved	-	-	-
%SR25	Reserved	-	-	-
%SR26	IO_CRC	I/O Configuration Table CRC	0	65535
%SR27	NET_CRC	Network Configuration Table CRC	0	65535
%SR28	SD_CRC	Security Data Table CRC	0	65535
%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	320
%SR42	LCD_ROWS	LCD Graphics Display Number of Rows	240	240
%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
%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 (0=Off; 1=On)	0	1
%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

Table 1.5 - %SR Registers

Register	Name	Description	Min	Max
%SR62-180	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

User Registers (%T, %M and %R) are used to store application-specific Color Touch OCS data. This data can be accessed via User Screens and/or by Ladder Code.

a. %T Register

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

b. %M Registers

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

c. %R Registers

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

HMI Registers

HMI Registers (%K and %D) 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.

a. %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.

b. %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.

c. 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.

d. 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.

a. %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.

b. %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.

c. %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.

d. %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.

e. SmartStack I/O Modules

Five fiber optic bases 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.

a. %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.

b. %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.

c. %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.

d. %AQG Registers

A %AQG 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.

e. 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. 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.

1.4 Fiber Optic Extension System (FOX) Product Description

Table 1.6 – FOX Models	
IC300FOX104	Each Supports 4 SmartStack Modules.
IC300FOX404	Each Supports 4 SmartStack Modules plus 4 additional I/O Bases.

1.4.1 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.

1.5 Technical Support

For assistance, contact Technical Support at the following locations:

North America:
1-800-433-2682 or visit our website at www.gefanuc.com.

Europe:
(+) 353-21-4321-266

NOTES

CHAPTER 2: INSTALLATION (COLOR TOUCH OCS)

2.1 General

Installation information is covered in Chapter Two that applies to all models of the Color Touch OCS.

2.2 Mounting Requirements

2.2.1 Mounting Procedures (Installed in a Panel Door)

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 in Section 2.3.1.

2. Cut the host panel. Refer to Figure 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 2.2.

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 Panel Cut-Out and Dimensions

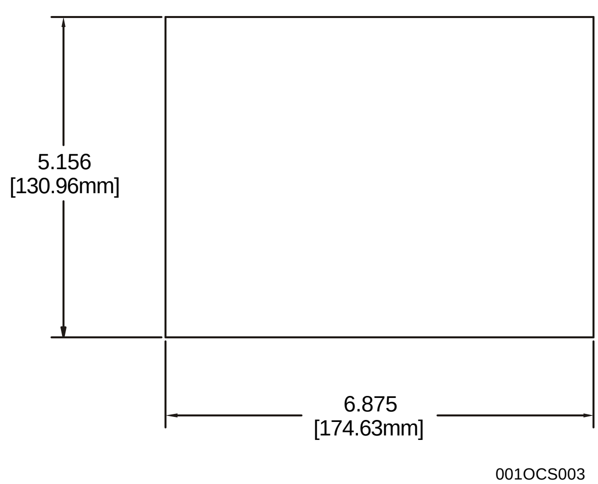

Figure 2.1 – Panel Cut-out and Dimensions

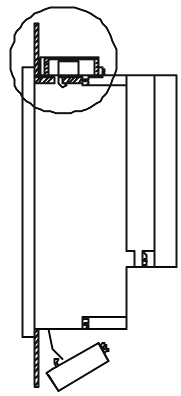

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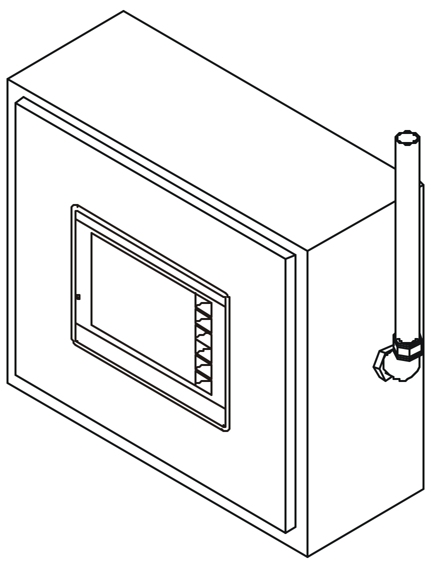
Figure 2.2 – Side View of Color Touch OCS (Shown with Mounting Clip)

2.2.3 Color Touch OCS Mounting Orientation



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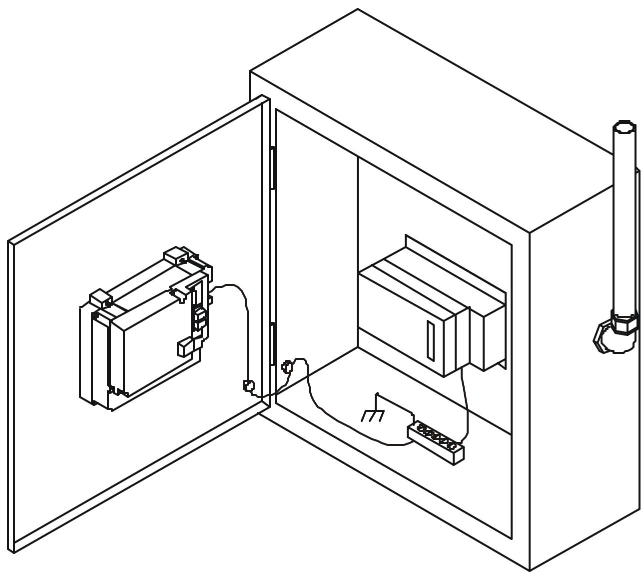
NOTE: There are NO orientation restrictions on the Color Touch OCS. *However, the above orientation provides for optimum readability of the screen and ease of use of the keypad.*

Figure 2.3 – Orientation of Color Touch OCS

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 Section 2.3.1.*



001OCS002

Figure 2.4 – Back view of Color Touch OCS (Shown On Panel Door)

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 Model and Ground Screw Extension.)	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? (Be sure to consider the Ground Screw extension.)

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

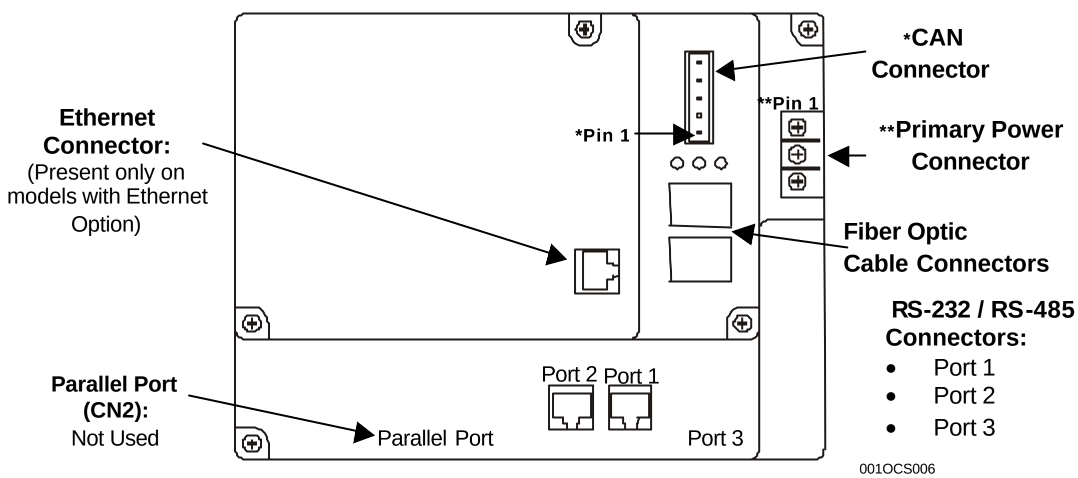
____Are noise suppression devices or isolation transformers required? Is there adequate distance between the base of the Color Touch OCS and noisy devices such as relays or motor starters? Ensure that power and signal wires are not routed in the same conduit.

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

2.4 Ports, Connectors, and Wiring

2.4.1 Location of Ports and Connectors on Color Touch OCS

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 2.5 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 2.5 – Location of Ports and Connectors (Color Touch OCS with Ethernet Option Shown)

2.4.2 Primary Power Port

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

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

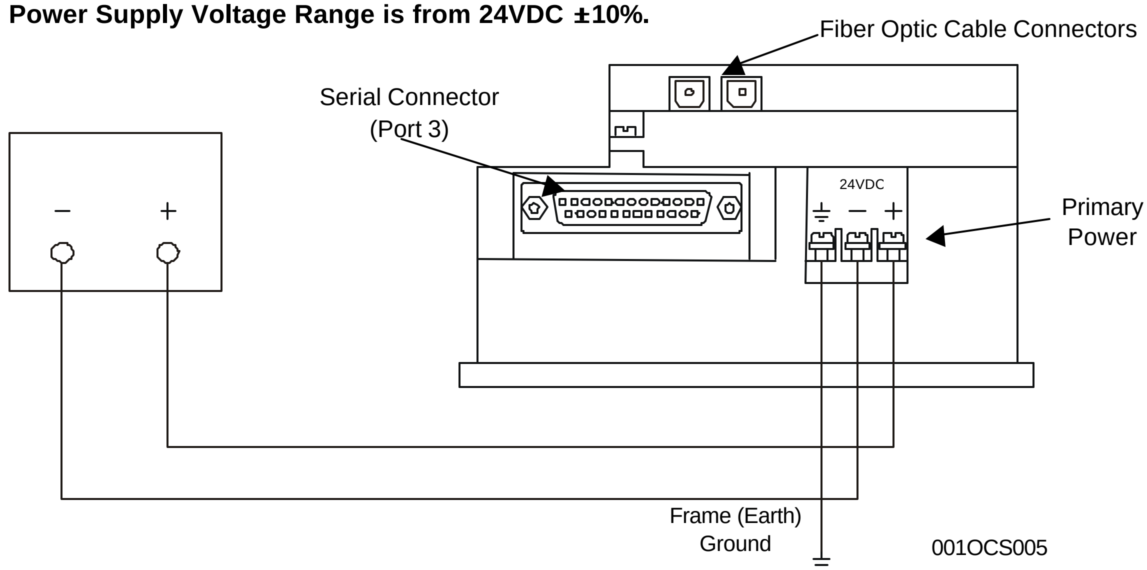
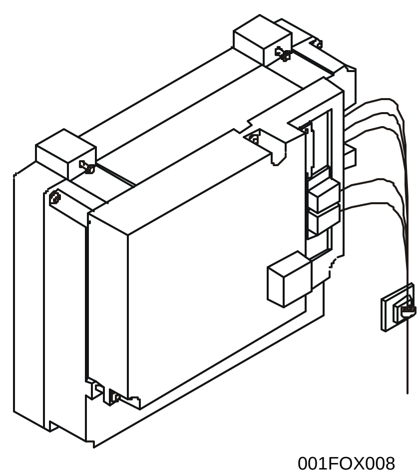


Figure 2.6 – Grounding



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

Figure 2.7 – Suggested Method of Securing Fiber Optic Cables

2.4.3 CAN Network / DeviceNet Network Port and Wiring

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 +

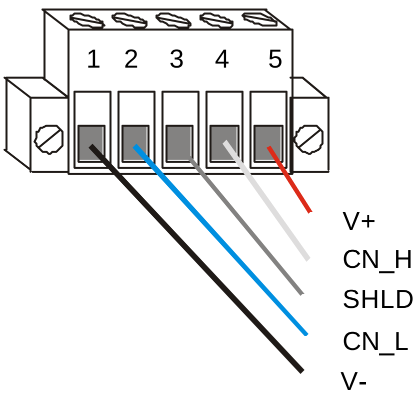


Figure 2.8 – Network Connector (CAN Port)

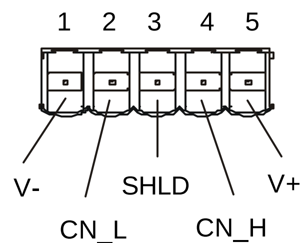


Figure 2.9 – As viewed looking at the Color Touch OCS

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

a. CAN Wiring Rules (See Figure 2.10)

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 envi ronments 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.

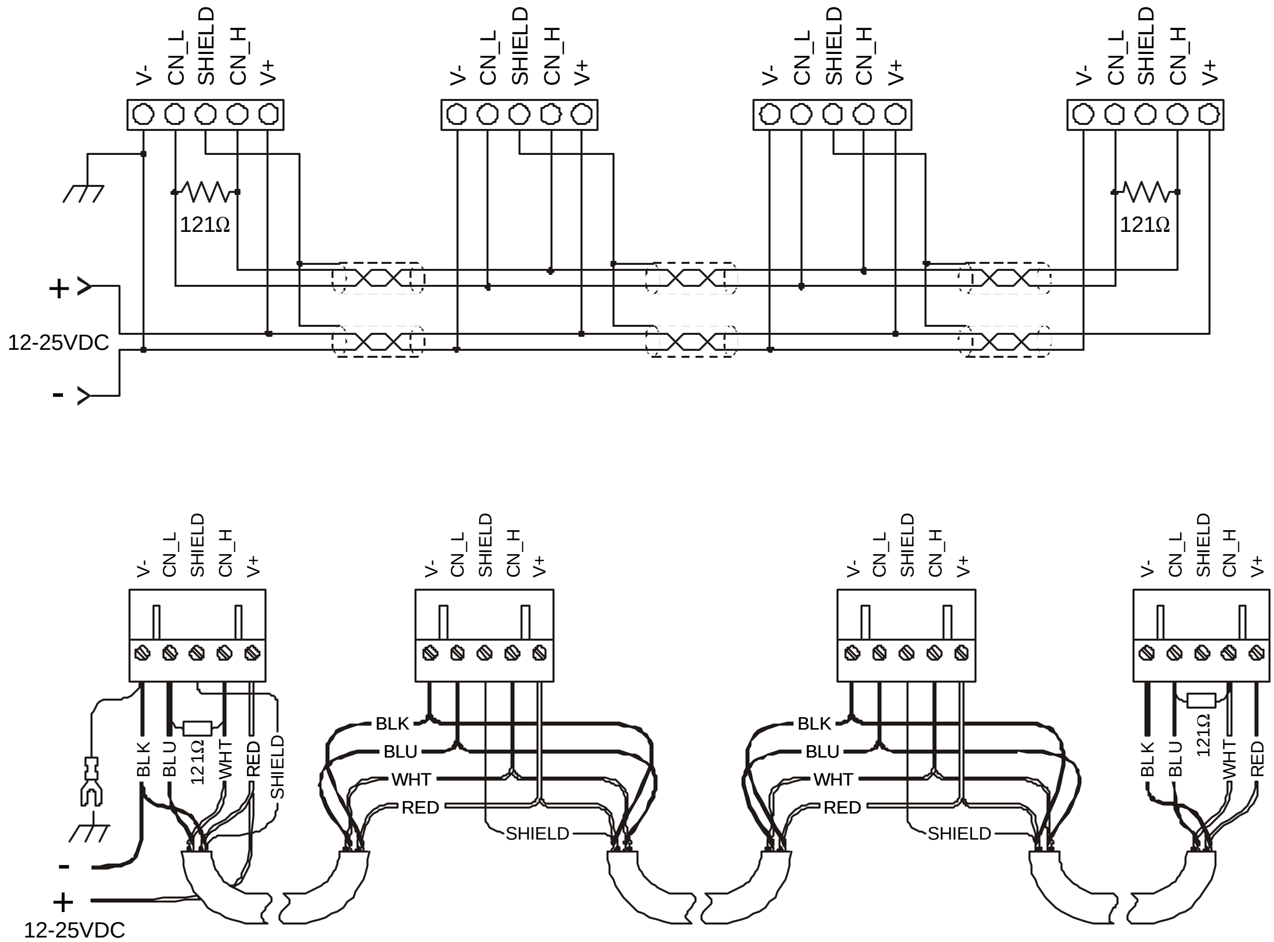


Figure 2.10 – CAN Wiring

b. CsCAN or DeviceNet Cable

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.

Table 2.4 -CsCAN / DeviceNet Cable Specifications	
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.	

c. 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 <u>not</u> exceed 6 meters.

Table 2.5 - CAN Network Baudrate vs. Total Cable Length
Note: The following values apply to both CsCAN or DeviceNetworks except as indicated.

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)

d. Bus Power and Grounding

When using CsCAN or DeviceNet:

1. A power supply of 24VDC (±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 2.10.
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.

e. 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 (MJ1 and MJ2) and a serial connector (CN1) 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 115,300K; however, if PORT 3 is used consecutively with either of the other ports within an application, do not exceed a baud rate of 57,600K for PORT 3.

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

a. Port 1 / Port 2 Modular Jacks

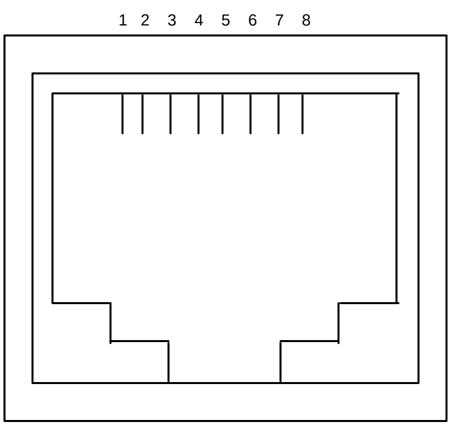


Figure 2.11 – Close-up of Port 1 /Port 2 (RS-232 and RS-485)

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

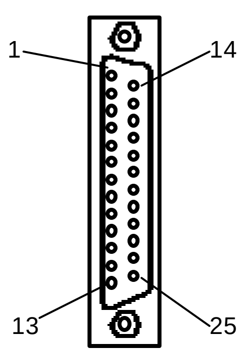


Figure 2.12 –RS-232 / RS-485 Connector (Port 3)

Table 2.8 – Port 3 Pins

Pin Number	Signal	Pin Number	Signal
1	FG	**14**	-RTS
2	TXD	**15**	Not Used
3	RXD	**16**	Not Used
4	RTS	**17**	+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		

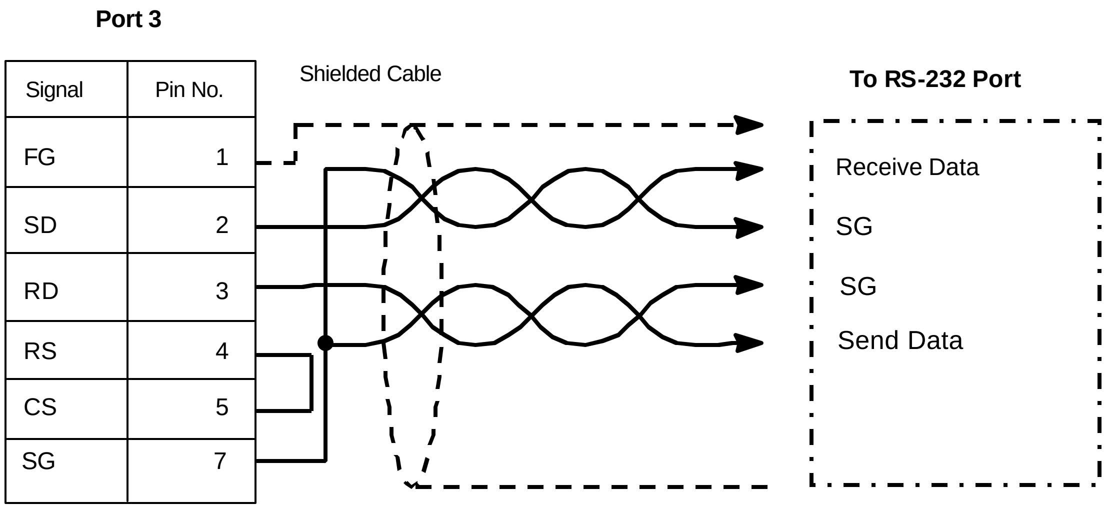


Figure 2. 13 - RS-232 Port (Port 3)

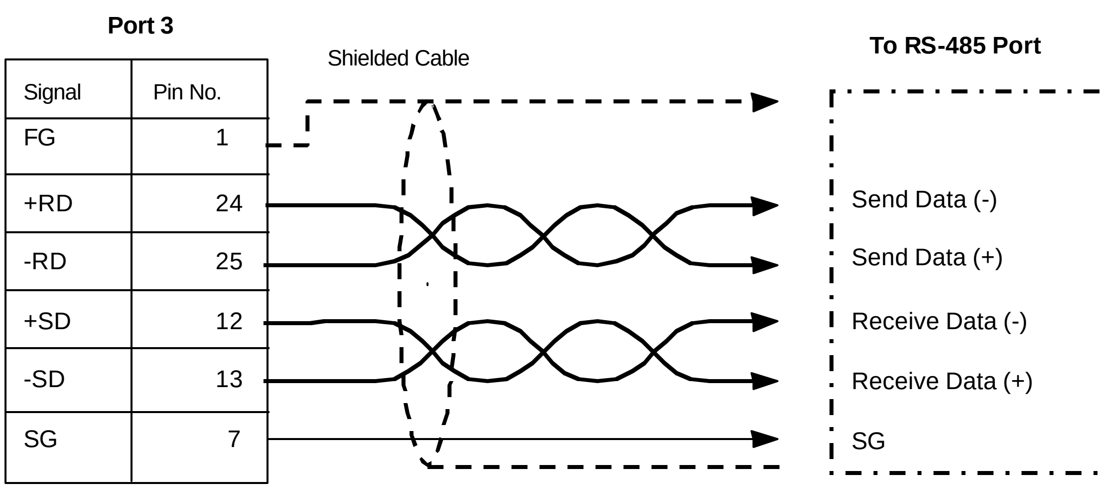


Figure 2. 14 - RS-485 Port (Port 3)

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.

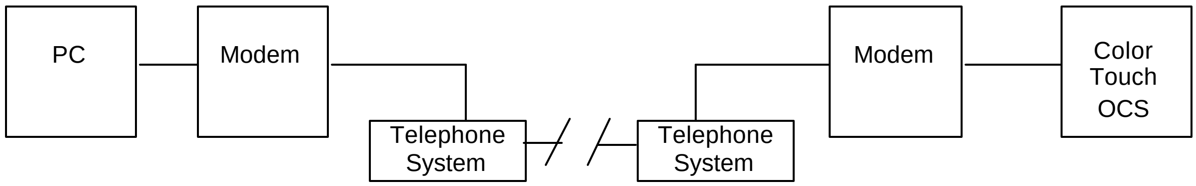


Figure 2.15 – Modem Setup

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

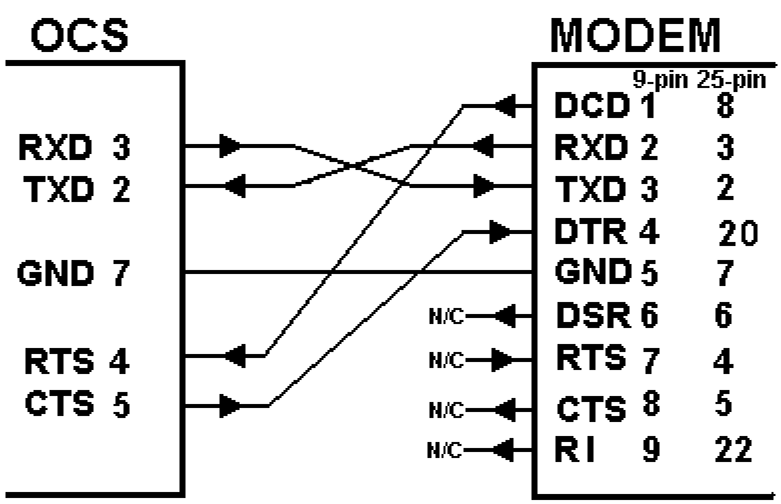


Figure 2.16 – Modem Wiring

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. Manufacturers such as Datalinc and Sixnet 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. You can also find specific application information (cabling, modem commands, etc.) in the Cscape Help file as well. (See Chapter 1 for Technical Support contact information.)

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. This requirement applies to Ethernet Modules OCS301 and OCS351.

2.5 Firmware Update Wizard (Selecting DeviceNet Network)

To use the OCS in a DeviceNet network, use Cscape's Firmware Update Wizard. Select **File, Firmware Update Wizard** from the pull-down menu. The following screen appears.

Figure 2.17 – 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**. On the next screen, press **Send**. Firmware is now updated.

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 4.1.) 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	• 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	• 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: FIBER OPTIC EXTENSION SYSTEM (FOX)

3.1 General

Chapter Three covers the SmartStack Fiber Optic Extension System (FOX104 and FOX404).

3.2 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 3.1 – FOX Hub and Base Specifications

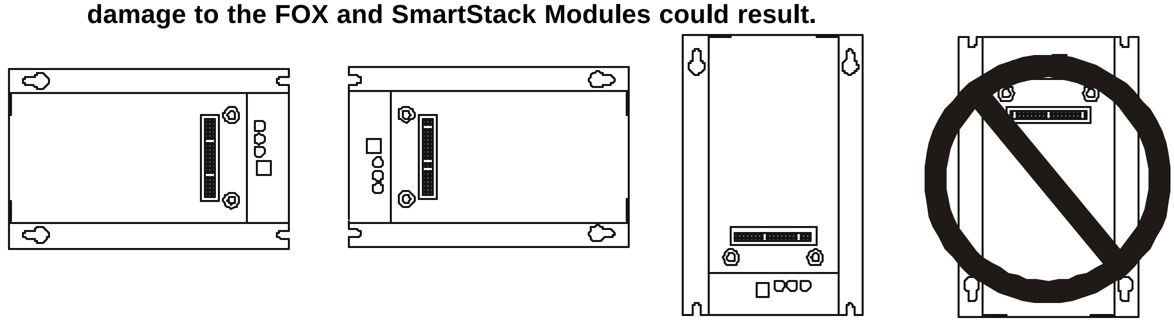
Maximum number of stacks (total number of hubs and bases)	5
Maximum number of cable drops to any specific hub or base	3
Maximum length of Fiber Optic cable	10m per Drop
Fiber Cable Bend Radius (R)	25mm (minimum)
Base ID#	Each Base or Hub must have a unique Base ID #.
Expansion I/O	EIAJ RC-5720 Plastic 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 - 50°C)
Humidity	5% to 95% non-condensing
UL	Class I, Groups A, B, C, D, Division 2
CE	Yes

3.3 Installation

3.3.1 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.



001FOX006

Figure 3.1 – FOX Orientation

3.3.2 Mounting Instructions

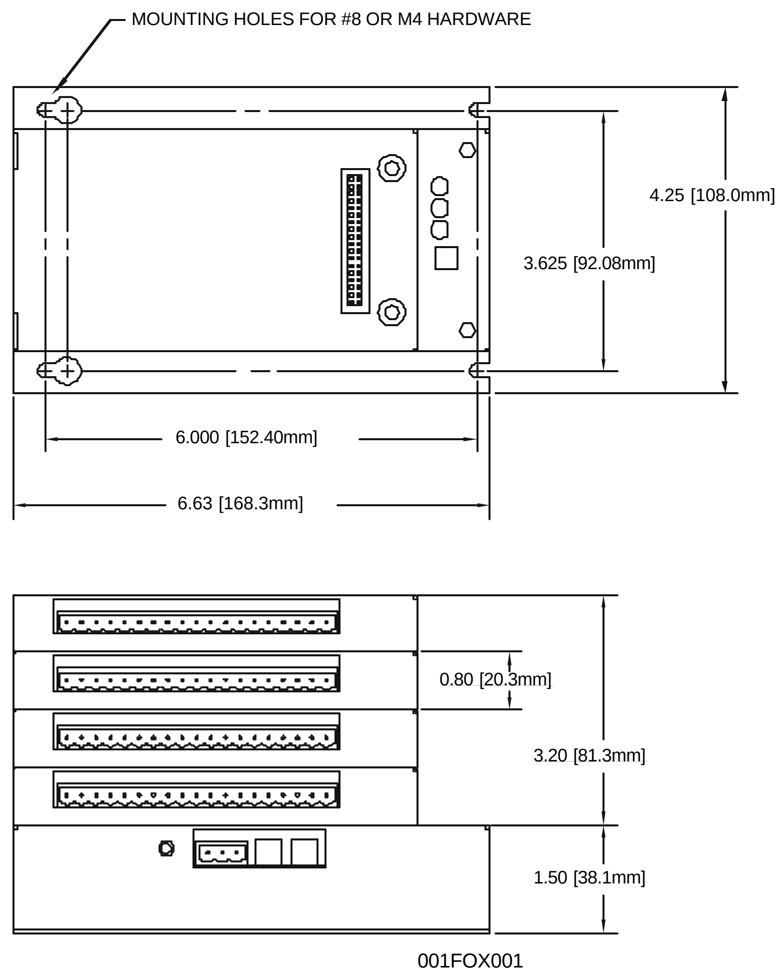
The FOX is designed for permanent panel mounting. To install the FOX in a permanent panel mounting, use the instructions that follow:

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 Section 2.3.1.
2. Drill holes as described in the Figure 3.2.

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.

3.3.2 Dimensions and Hole Pattern



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

Figure 3.2 – FOX Hole Pattern Dimensions (Top) and FOX viewed with 4 SmartStack I/O Modules (Bottom)

3.4 Ports, Connectors, and Wiring

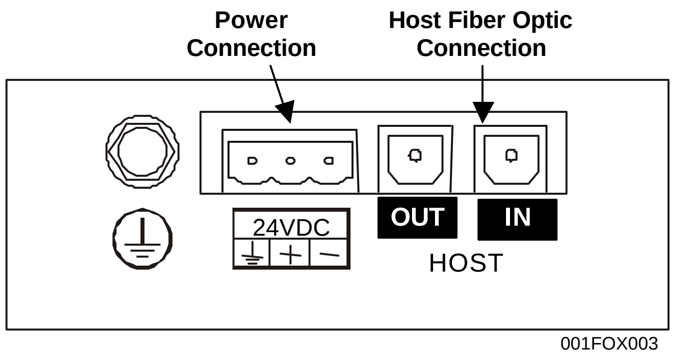


Figure 3.3 – FOX Connectors

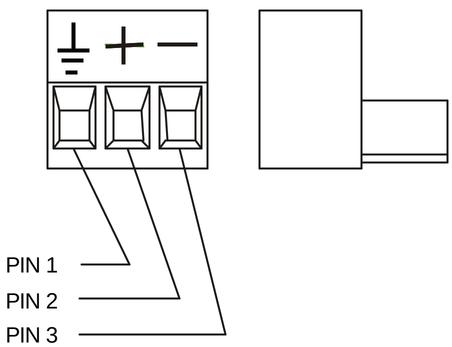


Figure 3.4 - FOX Power Connector

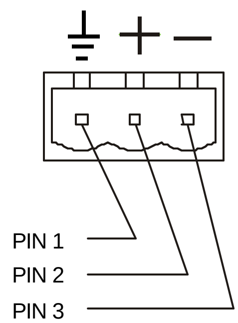


Figure 3.5 - FOX Power Connector

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

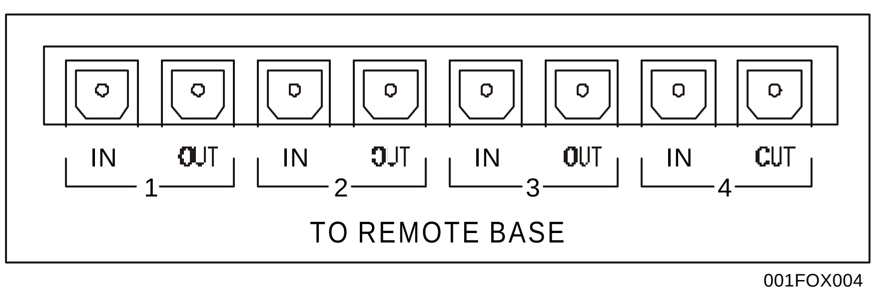


Figure 3.6 – FOX404

Table 3.2 – 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 ***Radio Shack*** cables can also be used:		
Feet (Meters)	**Part Number**	**Price** (Note: Subject to change without notice. Check with Radio Shack for current prices.)
3 ft. (0.9 m)	15-1580	$24.99
6 ft. (1.8 m)	15-1581	$34.99
12 ft. (3.7 m)	15-1582	$44.99

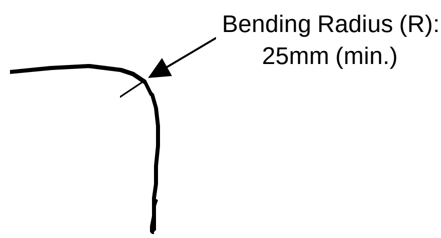


Figure 3.7 – Bend Radius (R) of Fiber Optic Cable

3.5 Base ID Switches

Each FOX needs a unique Base ID. (Refer to Figure 3.8 for location of Base ID Switches.) Set Base ID switches using the following table.

Table 3.3 - Base ID Switches ON = 1 | OFF = 0			
Base ID	**Switch Number**		
	2	**1**	**0**
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

3.6 FOX LEDs

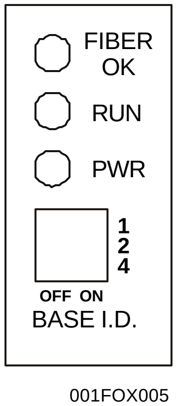


Table 3.4 – FOX LEDs	
FIBER OK	ON indicates FOX's fiber input cable is properly connected and is receiving a carrier.
PWR	ON indicates FOX is receiving power.
RUN	• OFF indicates OCS is in IDLE/STOP mode **or** no power to the FOX **or** one of the fiber cables are detached **or** there is a configuration mismatch. • Flashing indicates DO / IO mode or RUN with no ladder program. • ON indicates ladder code running.

Figure 3.8 – FOX LEDs

3.7 Example FOX Setups

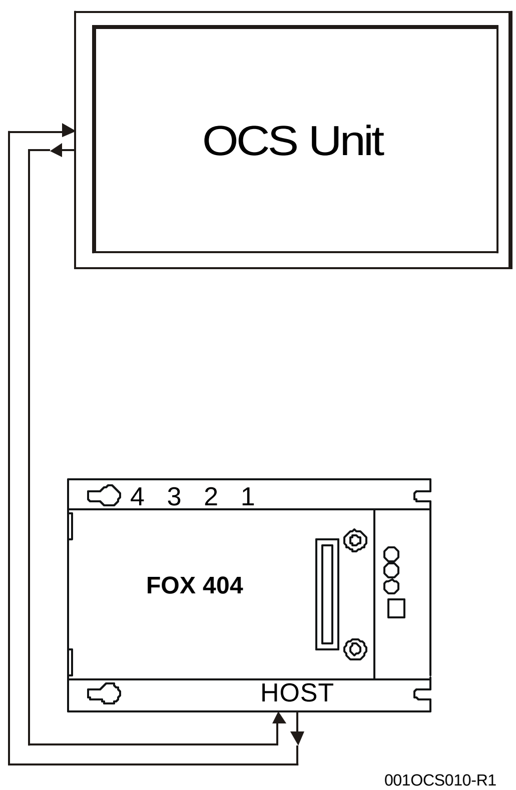


Figure 3.9 – Color Touch OCS to FOX (Single Hub)

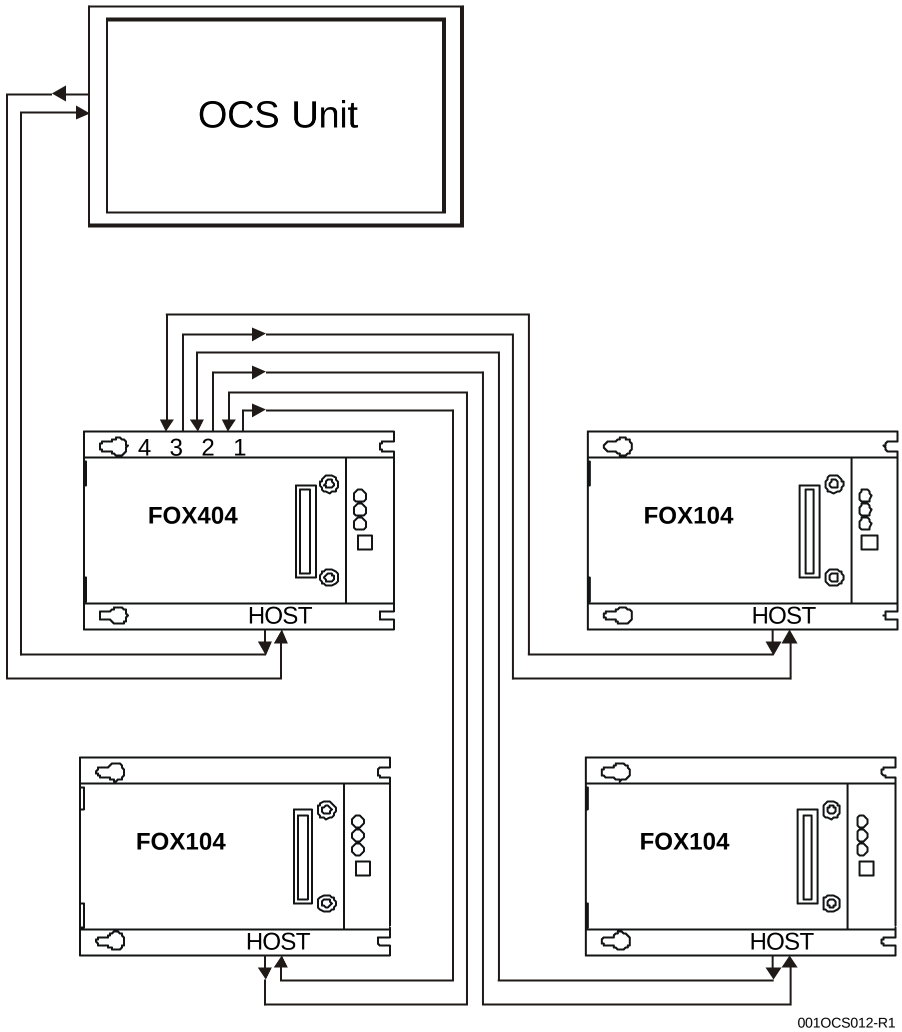


Figure 3.10 – Color Touch OCS to FOX (One Hub and Multiple Bases)

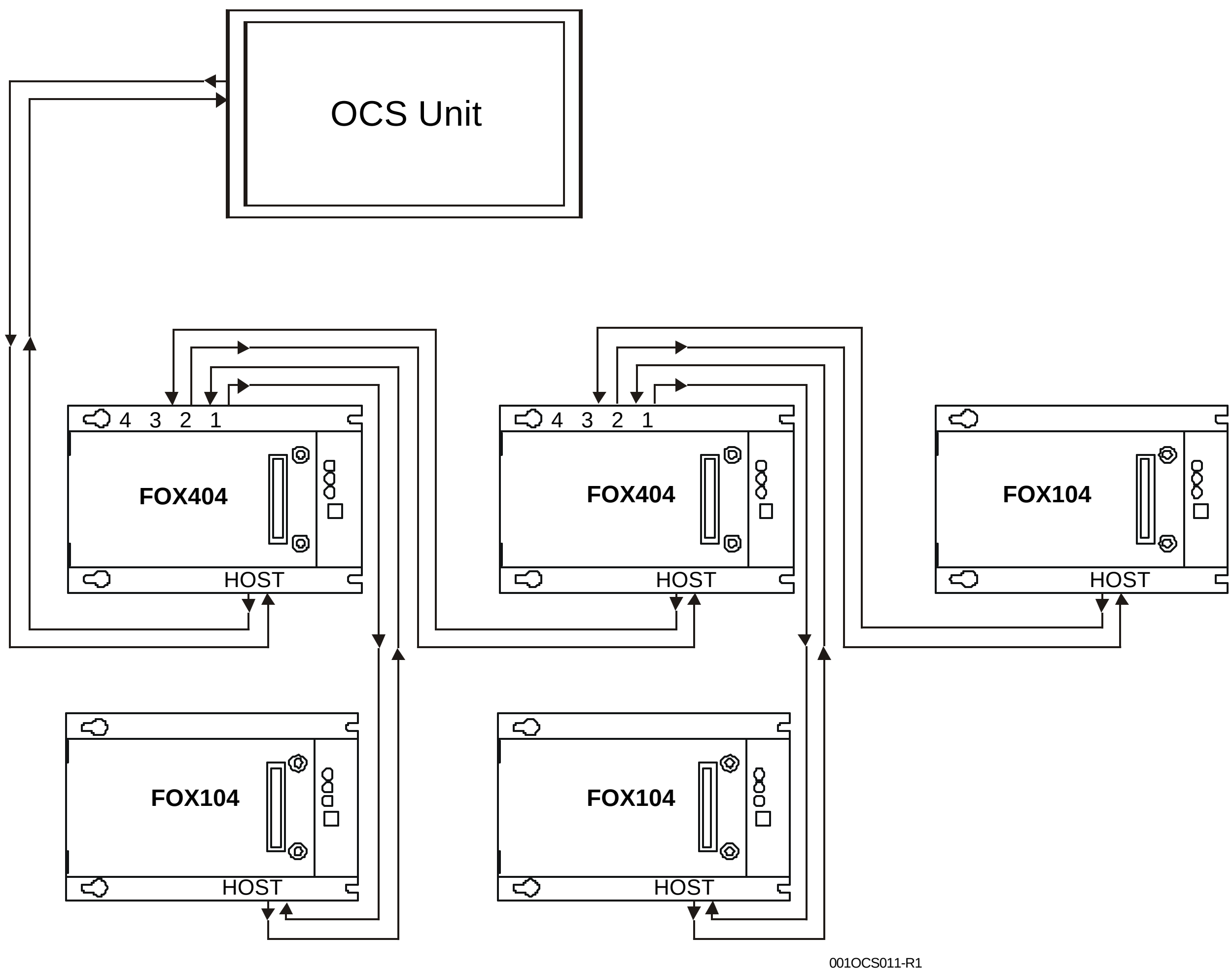


Figure 3.11 – Color Touch OCS to FOX (Multiple Hubs and Bases)

NOTES

CHAPTER 4: SYSTEM MENU (CONFIGURATION)

4.1 General

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

4.2 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 4.1.)

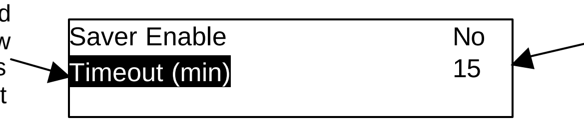
1. Touch the screen over the desired menu option or press the ↑ and ↓ keys to scroll up or down through the menu options. Press **Enter**.
2. A screen appears containing one or more parameter names. If the parameter is editable, the parameter name is highlighted. Press **Enter**.
3. The parameter value field is highlighted. Use the ↑ and ↓ keys or numeric keys to edit the parameter value.
4. If multiple parameters are available for editing, use the ↑ and ↓ 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.

4.3 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.



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 displaying a flashing block cursor.
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 ↑ and ↓ keys to select appropriate value.
Numeric entry	- use Numeric keys or ↑ and ↓ keys on the appropriate digit.
Bar graph entry	- use ← and → 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.

4.4 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 Production Release Firmware

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

OCS3xx CsCAN Operator Control Station Self-Test Passed

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 4.6.

4.5 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. (See Figure 4.1.)

4.6 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.

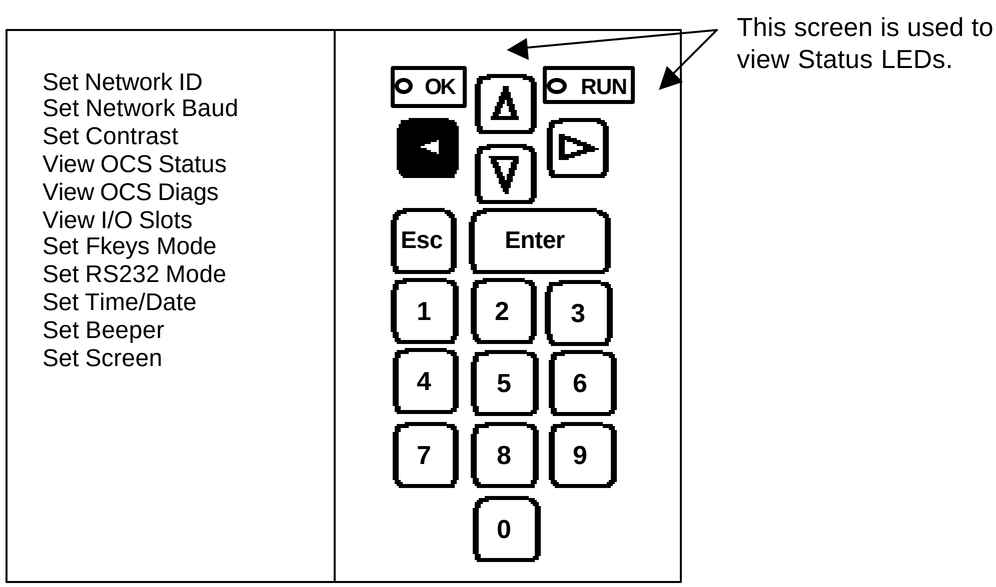


Figure 4.1 – System Main Menu Screen

The menu include the following options:

- Set Network ID
- 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 <u>not</u> pressed, the desired Network ID number does <u>not</u> 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.

Parameter	Description
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 *Idle* mode, the I/O is not scanned and the OCS ladder program does not execute. The green "RUN" LED is OFF. In *Run* mode, the ladder program executes and the green "RUN" LED illuminates. *DoIO* mode is similar to *Run* mode, except the ladder logic is not solved. When the OCS is in *DoIO* 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: 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.
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**

This screen displays the currently installed SmartStack I/O Modules connected to a specific FOX base. It also indicates if the base is on-line. Other FOX bases can be checked by changing the FOX base number in the Value field. The following are examples of possible displays.

Note: The **module name** is presented as 'aaannn' where aaa is the module definition prefix and nnn is the module number. (The module name is the actual product number of the attached SmartStack Module.)

If the OCS is <u>not</u> configured for a SmartStack Module <u>and</u> no module is physically attached to the OCS, the message **" I/O: Empty"** is displayed in the appropriate slot.

If the OCS is <u>not</u> configured for a SmartStack Module and a module is physically attached to the OCS, the message **"+I/O: [module name]"** is displayed in the appropriate slot.

If the OCS is configured for a SmartStack Module <u>and</u> the module is <u>not</u> physically attached to the OCS, the message **"-I/O: Missing"** is displayed in the appropriate slot.

If the OCS is configured for a <u>different</u> module than what is physically attached to the OCS, the message **"?I/O: [module name]"** is displayed in the appropriate slot

If a module that is <u>not</u> supported by the OCS firmware is physically attached, the message **"*Unsupported"** is display in the appropriate slot regardless of whether the OCS contains a configuration for that slot. The module is either defective or an ENGINE firmware upgrade is required to support the module.

If a module is physically attached that has a firmware error, the message **"fI/O: [module name]"** is displayed in the appropriate slot regardless of whether the OCS contains a configuration for that slot. The module is either defective or a MODULE firmware upgrade is required.

If a module is physically attached that has a configuration error, the message **"cI/O: [module name]"** is display in the appropriate slot. The configuration data for that module is incorrect.

If the SmartStack Module that is physically attached to the OCS <u>matches</u> what the OCS configuration, the message **" I/O: [module name]"** is displayed.

- **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 %SR 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.

NOTES

CHAPTER 5: KEYPAD AND DISPLAY

5.1 General

Chapter Five covers the keypad and display of the OCS300.

5.2 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 Chapter Four.

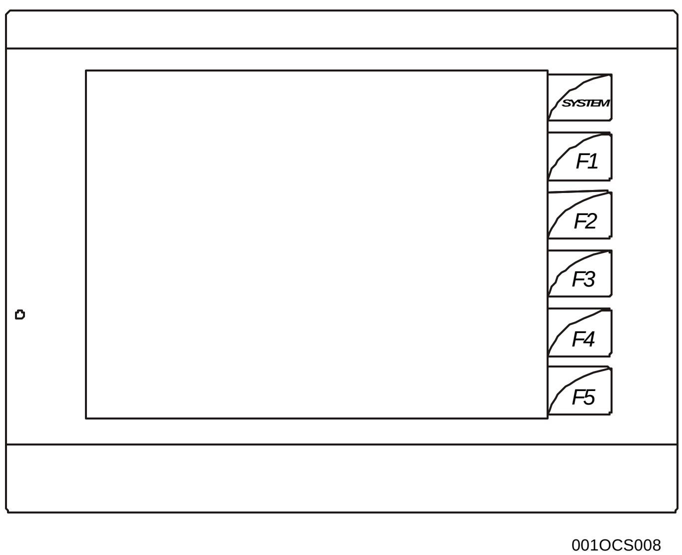


Figure 5.1 – Color Touch OCS Front Panel Keys

5.3 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** (Section 4.6) 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.)

5.4 User Screens

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

CHAPTER 6: SMARTSTACK CONFIGURATION

6.1 General

Chapter Six 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 (GFK-1601) contains all of the data sheets and is periodically revised.

6.2 Preliminary Configuration Procedures

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

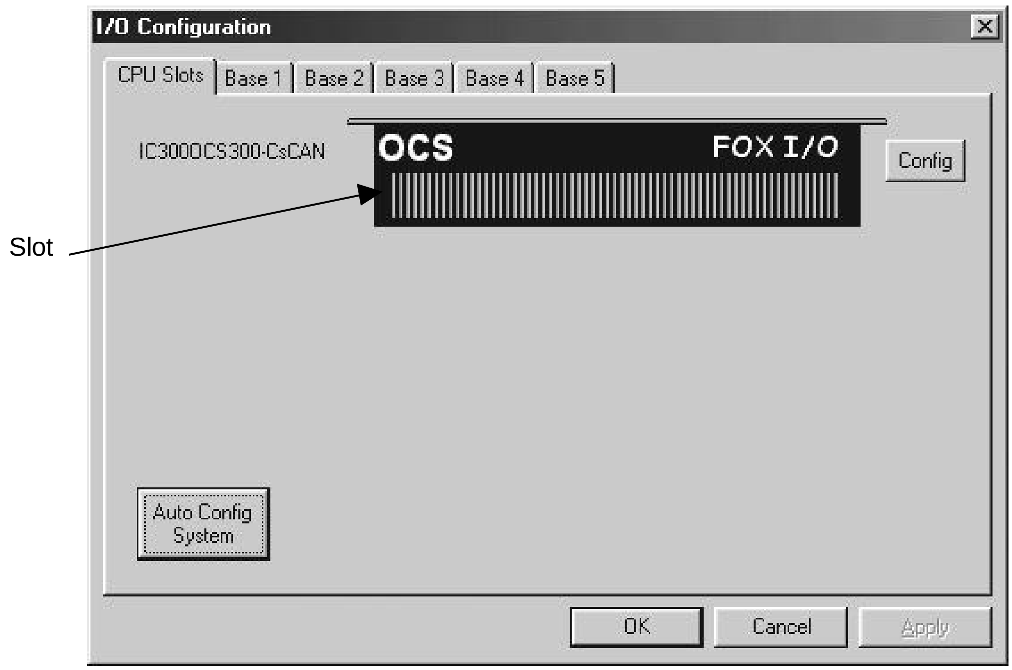


Figure 6. 1 - Main Configuration I/O Screen

2. First, ensure that the desired controller is selected. The OCS300-CsCAN is shown as the selected controller (Figure 6.1) 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.

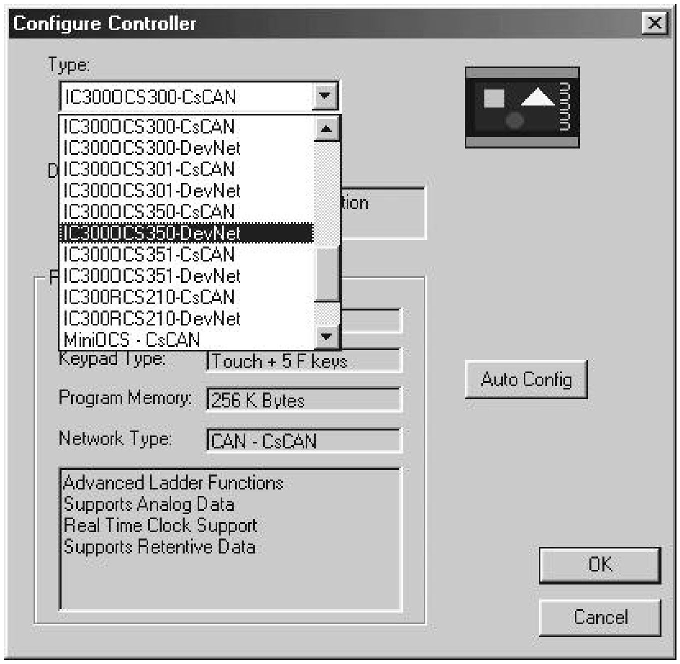


Figure 6.2 – Selecting a Controller

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 6.1). 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.

3. Figure 6.3 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

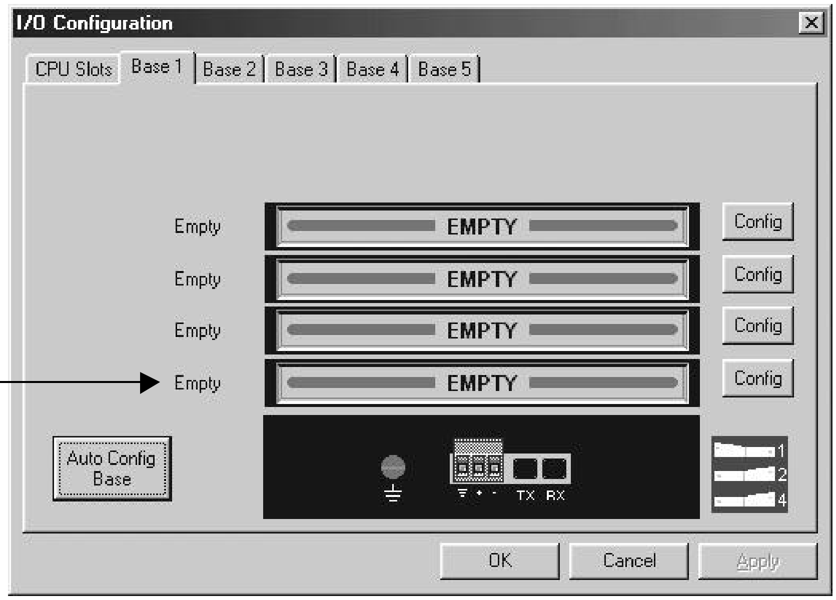


Figure 6.3 – Base 1 Selected

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**.

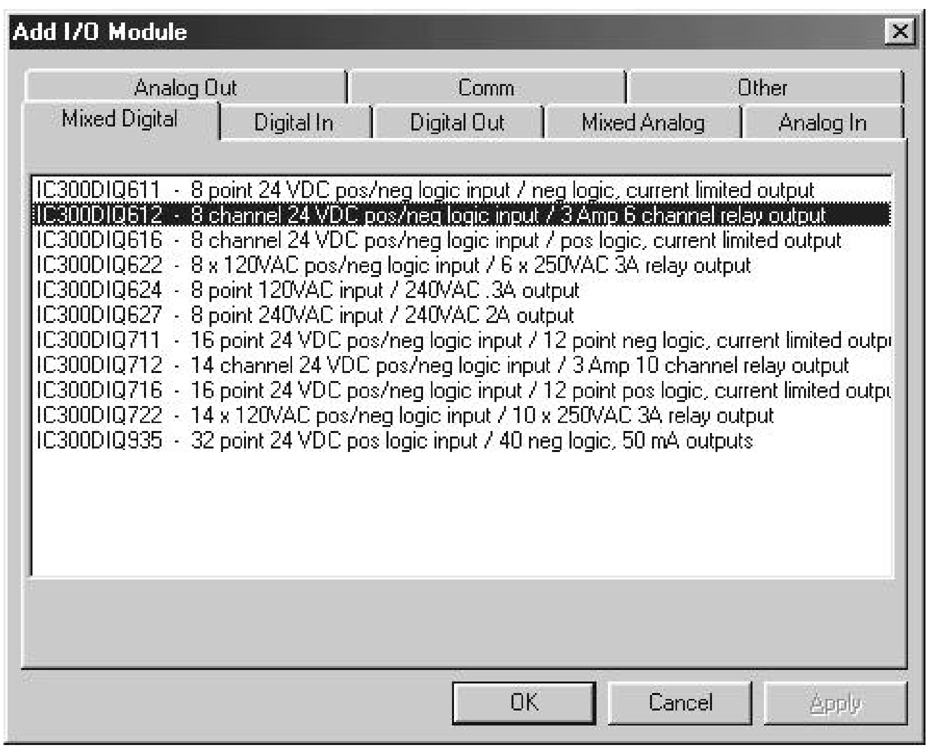


Figure 6.4 – Selecting an I/O Module

4. The following screen appears.

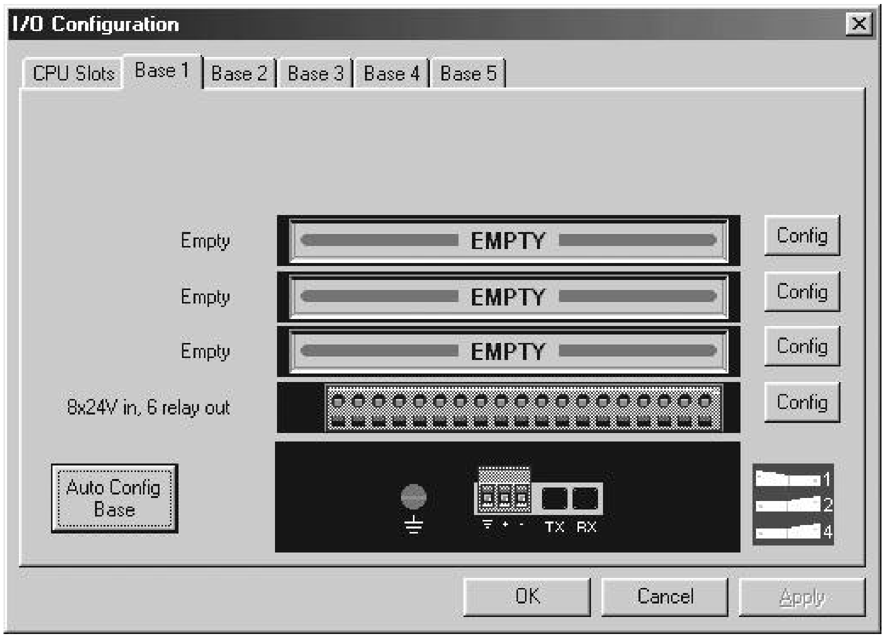


Figure 6.5 – Base 1 with an I/O Module Selected

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 6.6). Two tabs are available for selection:

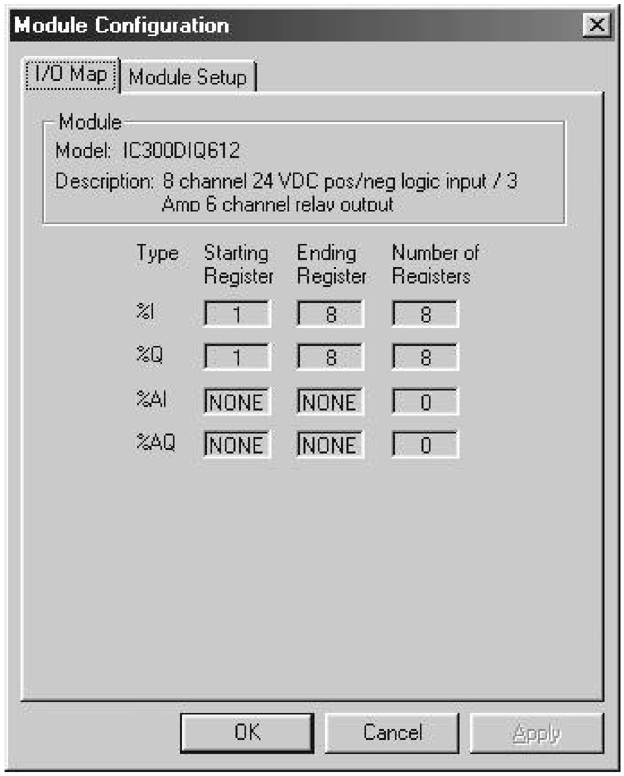


Figure 6.6 – I/O Map Tab

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 <u>after</u> 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 <u>not</u> 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 <u>not</u> 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.**

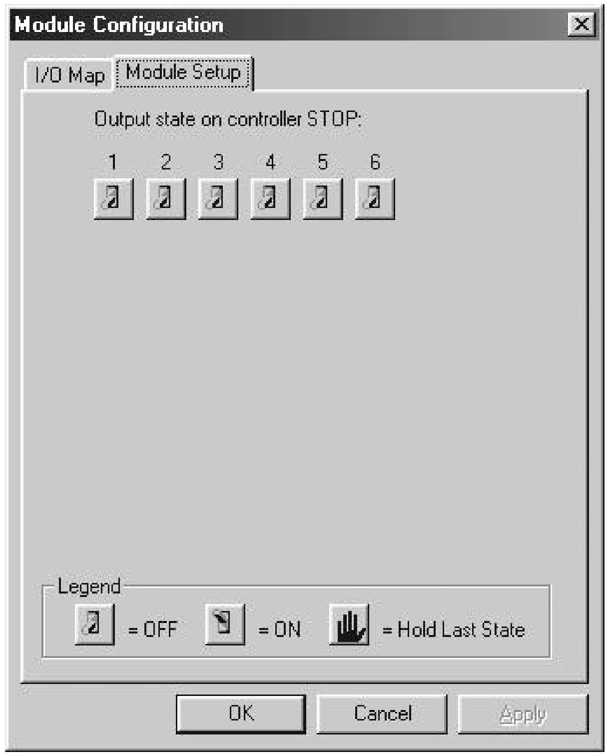


Figure 6.7 – Module Setup Tab Selected

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.

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 (**I**nternational **S**tandards **O**rganization) - 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.

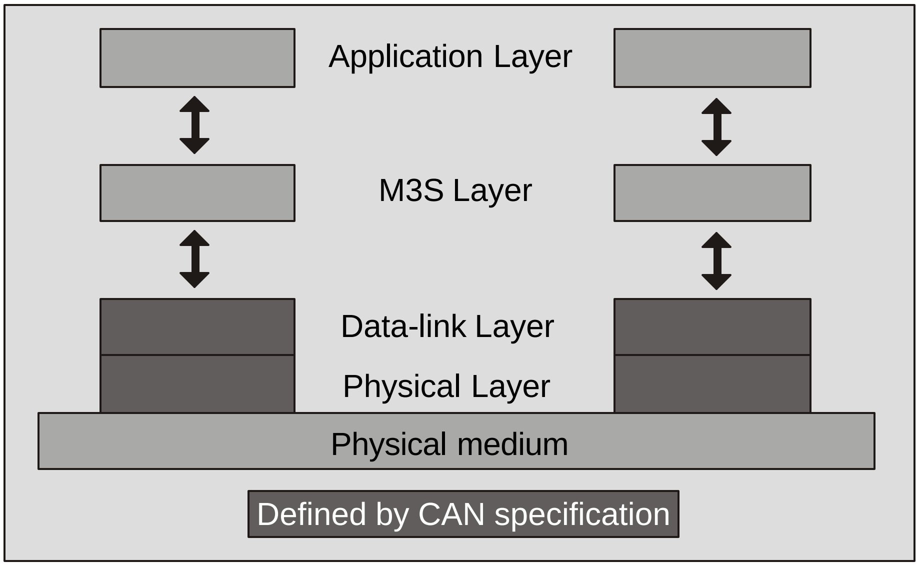


Figure 1 - OSI-Based Model

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.

Part A devices are *only* able to transmit and receive *standard* CAN protocol. If Part A devices are used on an *extended* CAN system in which 29 bit IDs are present, the device causes errors and the entire network may not operate correctly. The Philips SJA1000 is a Part A device (11 ID bits) but has the ability to be used with extended CAN without causing any bus errors. This is achieved by ignoring the extended CAN frames, which are known as "part B passive" devices and are similar to what Horner uses. The data link layer defines the format and timing protocol with which the messages are transmitted. There are two descriptor bytes and up to eight data bytes. The descriptor bytes are important, because they define the priority of the message and the type of message being transmitted.

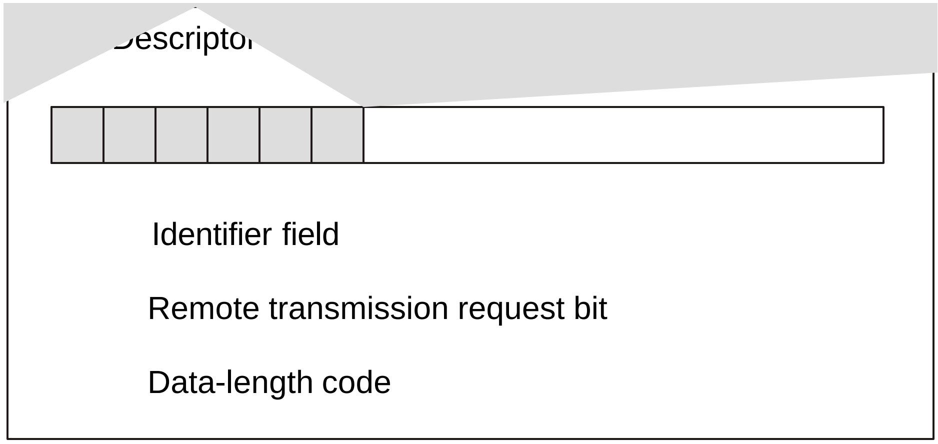


Figure 2 – Descriptor Bytes

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 APG. It was developed for use in a project that Horner APG completed for the United States Post Office. Horner APG 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 APG found that by developing its own network, it satisfied several important needs. Horner APG 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 APG 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 <u>not</u> 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 900µs). 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 <u>not</u> 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 A.1:

Table 1 - DeviceNet Features and Functionality

Network Size	**Up to 64 Nodes**
Network Length	Selectable end-to end network distance varies with speed 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 AQG1 to AQG16. 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 APG 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 serve 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.

NOTES

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