



**User Manual for
*MiniOCS, MiniRCS,
and SmartStix***

Mini Hardware

**Fourth Edition
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MAN0305-04

PREFACE

This manual explains how to use MiniOCS / MiniRCS / SmartStix.

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

REVISIONS TO THIS MANUAL

This version (MAN0305-04) of the *Mini Hardware Manual* contains the following revisions, additions, and deletions:

1. Removed Mini data sheets from the back of this manual and moved them into a new manual.
Revised Section 1.5: Additional References.
2. Revised Section 1.1. to include the SmartStix product line.
3. Added Chapter 6: SmartStix.

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CHAPTER 1: INTRODUCTION

1.1 Scope

The *Mini Hardware* User Manual provides information about the following products:

- a. **MiniOCS** (HE500OCSxxx)
MiniRCS (HE500RCSxxx)

The specifications, installation, and configuration procedures of the Operator Control Station (OCS) and the Remote Control Station (RCS) are covered in detail in this user manual. Information is also provided for the use of the products in CsCAN and DeviceNet Networks.

Note: Mini data sheets are now located in their own manual. (Refer to *Additional References* on page 18).

- b. **SmartStix Modules for CsCAN Networks** (HE550xxxxxx).

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

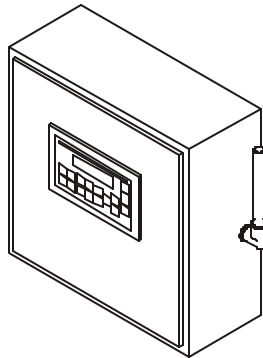


Figure 1.1 - Front View of MiniOCS (Shown on Door in Panel Box)

1.2 MiniOCS and MiniRCS Product Description

1.2.1 Functions and Features

The MiniOCS provides controller, I/O, operator interface, and optional networking capabilities in one unit. The MiniRCS has the same functionality as the MiniOCS except that it does not have local operator interface capabilities. Both the MiniRCS and the MiniOCS support a remote operator interface through a PC connected to the Mini unit's built-in network or serial port. The remote operator interface (Remote Text Terminal) is particularly useful when using the MiniRCS, which does not have a physical front panel screen or keypad.

The MiniOCS is mounted in a panel door; the MiniRCS is designed for backplate mounting. Both the MiniOCS and the MiniRCS can be used in CsCAN or DeviceNet networks. To use the MiniRCS in a DeviceNet network, a DeviceNet file can be downloaded from Cscape's Firmware Update Wizard.

A variety of MiniOCS / MiniRCS models are available. Each model comes equipped with one factory installed I/O board. Models of the MiniOCS / MiniRCS, which vary according to the type of I/O board installed, are available in non-network and network versions. Network versions contain an additional connector allowing connectivity to networks.

MiniOCS / MiniRCS devices have Serial and CAN (Controller Area Network) communication abilities. The units contain a standard 9-pin RS-232 port for programming/debugging, monitoring and network administration from an IBM-compatible PC. MiniOCS / MiniRCS models, which have built-in networking capabilities, use CsCAN (pronounced "Sea-scan") protocol and standard CAN network hardware. 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. The MiniOCS / MiniRCS can also be used in DeviceNet networks. Networking abilities are built-in to the MiniOCS / MiniRCS and require no external or additional modules. When several MiniOCS / MiniRCS units are networked together to achieve a specific purpose, the system acts like a large parallel-processing controller.

The MiniOCS / MiniRCS have standard features consisting of the following:

- 24 VDC powered
- One Internal I/O Module
- RS-232 Programming Port
- Integrated Bezel
- Real-Time Clock
- Flash Memory for easy field upgrades

1.2.2 Cscape Software

Cscape Software (pronounced "Sea-scape") is used with the MiniOCS / MiniRCS, OCS, and RCS products. (The part number for Cscape is 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 and I/O Modules. Cscape is also used for programming MiniOCS / MiniRCS ladder logic, programming user displays for the MiniOCS, 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 MiniOCS / MiniRCS Specifications

TBD = To Be Determined

Table 1.1 – Physical Specifications		
MiniOCS and MiniRCS		
Operating Temperature*	0°C to +50°C* (* Although the MiniOCS / MiniRCS withstands the temperature range of 0°C to +60°C, such temperatures can decrease the life of the display. The recommended rating is 0°C to +50°C.)	
Humidity	5% to 95% non-condensing	
NEMA Rating	NEMA 4X	
Primary Power Range	10-30VDC	
	Mini OCS	Mini RCS
Maximum Power Draw (Non-network Version)	200mA max. @ 24VDC	To Be Determined
Maximum Power Draw (Network Version)	200mA max. @ 24VDC	To Be Determined
Maximum Inrush Current ((Non-network Version)	900mA max. @ 24VDC for 1mS	To Be Determined
Maximum Inrush Current (Network Version)	900mA max. @ 24VDC for 1mS	To Be Determined
Ladder Execution Typical Execution Speed	2.0ms. per 1K of Boolean logic.	
CAN Power Range	12 – 25 VDC	
CAN Power Current	75mA maximum	
Serial	Standard 9 pin RS-232 for programming, monitoring, and network administration from a IBM compatible PC	
CAN	CsCAN Network / DeviceNet	
Input / Output	One factory-installed I/O board per model	
Keypad	10 user-programmable keys + , Esc, Enter and 4 direction keys Faceplate made of Marnot® XL Polyester by Tekra®.	
UL	Please refer to Compliance Table located at http://www.heapg.com/Support/compliance.htm	
CE		
MiniOCS		
Height	4.4" (111.76mm)	
Width	7" (177.80)	
Mounting Depth	2.25" (57.15) (approximately 2.75" [69.85] including Ground Screw extension)	
User Keys (MiniOCS Only)	17	
Display (MiniOCS only)	2x20 LCD w/backlight; 3.2mm w x 5.55mm h characters	
MiniRCS		
Height	4.13" (104.78mm)	
Width	5.83" (147.98mm)	
Mounting Depth	1.83" (46.48mm) (approximately 2.33" [59.18] including Ground Screw extension)	

1.3 MiniOCS / MiniRCS Resources

1.3.1 Overview

This section defines the resource limits that a programmer needs to know when writing a program using the MiniOCS / MiniRCS.

A MiniOCS / MiniRCS combine local I/O (analog and digital), networking, and controller, into a single product. The MiniOCS also provides an operator interface (display and keypad). The controller portion of the MiniOCS / MiniRCS is programmed in ladder logic via the Windows-based Cscape (Control Station Central Application Programming Environment) package. Each MiniOCS / MiniRCS provide a set of resources for use by the ladder logic control program as indicated in **Table 1.2**. The table shows the resources available in MiniOCS / MiniRCS products. 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 1.2 - MiniOCS/MiniRCS Resource Limits			
%S Registers	8		
%SR Registers	192		
%T Registers	2048		
%M Registers	2048		
%R Registers	2048		
%K Registers	10		
%D Registers	200		
%I Registers	2048		
%Q Registers	2048		
%AI Registers	512		
%AQ Registers	512		
%IG Registers	0 / 64 / 0		
%QG Registers	0 / 64 / 0		
%AIG Registers	0 / 32 / 16		
%AQG Registers	0 / 32 / 16		
Network Port	None / CsCAN™ / DeviceNet™		
Controllers Per Network	0 / 253 / 64		
SmartStack I/O Modules	1 Slot		
Keypad	16 Keys (Membrane) The faceplate is made of Marnot® XL Polyester by Tekra®. The material is resistant to most corrosive substances found in industrial environments. The material also holds up well in most industrial conditions. If used outdoors, the materials can yellow or crack.		
Local MiniOCS Display / Remote Text Terminal for MiniRCS and MiniOCS			
Display	2x20 Characters (Text LCD)	Text Tables	200
Screen Memory	64K	Items Per Text Table	20
User Screens	200	Ladder Code	64K
Data Fields Per User Screen	10		

1.3.2 Resource Definitions

This section defines the resources listed in **Table 1.2**.

System Registers

System Registers (%S and %SR) are used to store general OCS or RCS 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 1.3**:

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 3. **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.

Register	Name	Description	Min	Max
%SR1	USER_SCR	Current User Screen Number (0=none)	0	200
%SR2	ALRM_SCR	Current Alarm Screen Number (0=none)	0	200
%SR3	SYS_SCR	Current System Screen Number (0=none)	0	11
%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	EDIT_BUF	Data Field Edit Buffer	0	2 ³² -1
%SR11-12	LADDER_SIZE	Ladder Code Size	2	64K
%SR13-14	UTXT_SIZE	User Text Screen Table Size	4	64K
%SR15-16	Reserved	-	-	-
%SR17-18	IO_SIZE	I/O Configuration Table Size	16	64K
%SR19-20	NET_SIZE	Network Configuration Table Size	34	32K
%SR21-22	SD_SIZE	Security Data Table Size	-	-
%SR23	LADDER_CRC	Ladder Code CRC	0	65535
%SR24	UTXT_CRC	User Text Screen Table CRC	0	65535
%SR25	Reserved	-	-	-
%SR26	IO_CRC	I/O Configuration Table CRC	0	65535
%SR27	NET_CRC	Network Configuration Table CRC	0	65535

Table 1.4 - %SR Registers				
Register	Name	Description	Min	Max
%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 Text Display Number of Columns	20	20
		LCD Graphics Display Number of Columns	240	240
%SR42	LCD_ROWS	LCD Text Display Number of Rows	2	4
		LCD Graphics Display Number of Rows	128	128
%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
%SR62-192	Reserved	-	-	-

User Registers

User Registers (%T, %M and %R) are used to store application-specific Mini 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 OCS or RCS keypad and display.

The MiniOCS has a membrane keypad and text-based LCD display, allowing the operator to enter and display general and application-specific information. This same information can be entered and displayed for the MiniRCS (and MiniOCS if desired) via a remote PC using Cscape's Remote Display Terminal function.

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 MINIOCS), which together fill the LCD display screen. These screens are defined via Cscape dialogs and are then downloaded and stored into the Control Station'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.

e. Text Tables

A Text Table is a list of Text Items, which can be used in a Data Field, to display descriptive words and phrases to describe the value of a Register, instead of displaying numeric values. A simple example of this, would allow the strings "OFF" and "ON" to be displayed, instead of 0 and 1, to describe the state of the %I4 digital input. The maximum number of Text Tables and Text Items per Text Table is shown in Table 1, but the number can be further limited by overall User Screen memory usage.

Physical I/O Registers

Physical I/O Registers (%I, %Q, %AI and %AQ) give the user access to the Physical 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 Physical I/O module. When used in this way, %I registers are non-retentive. All extra %I registers, which are not associated with physical 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 Physical 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 Physical I/O module. When used in this way, %AI registers are non-retentive. All extra %AI registers, which are not associated with physical 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 Physical I/O module.

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 an OCS or RCS, DeviceNet can be loaded as a replacement for the CsCAN Protocol Message Layer, and as a result, the OCS or RCS becomes a DeviceNet Slave device. Note that the Mini still implements the CsCAN Protocol Command Layer with respect to the RS-232 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 MiniOCS / MiniRCS Models

Because there are several models of MiniOCS / MiniRCS models available, the MiniOCS / MiniRCS can be used in a wide range of applications. The MiniOCS consists of an Operator Control Station, and the MiniRCS consists of a Remote Control Station. Each model comes equipped with one factory installed I/O board. The models vary according to the type of I/O board installed and are available in non-network and network versions. Network versions contain an additional connector allowing connectivity to CAN networks. Refer to *Additional References* on page 18 to locate model-specific information for each Mini.

1.5 Additional References

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

- a. *Mini I/O* (MAN0581) – Contains a collection of individual data sheets covering model-specific information.
- b. *DeviceNet[™] Implementation Using Control Station Modules* (SUP0326) - Covers the implementation of Control Station products in a DeviceNet network.
- c. *Cscape Reference Manual* (MAN0313) – Contains topics specifically selected to assist you through the programming process.

1.6 Technical Support

For user manual updates, contact Technical Services at the following locations:

North America:

(317) 916-4274
www.heapg.com

Europe:

(+) 353-21-4321-266
www.horner-apg.com

CHAPTER 2: INSTALLATION

2.1 MiniOCS Mounting Requirements

2.1.1 MiniOCS Mounting Procedures (Installed in a Panel Door)

The MiniOCS is designed for permanent panel mounting. To install the MiniOCS, follow the instructions below.

1. Prior to mounting the MiniOCS, observe requirements for the panel layout design and adequate clearances. A checklist is provided on page 25.
2. Cut the host panel as described in the Figure 2.1 - Figure 2.6.

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

3. Insert the MiniOCS through the panel cutout (from the front). The gasket material needs to lie between the host panel and the MiniOCS panel.
4. Install and tighten the mounting clips (provided with the MiniOCS) until the gasket material forms a tight seal. (See Figure 2.7.)

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

5. Connect the communications, programming, and power cables to the MiniOCS ports using the provided connectors.
6. Begin configuration procedures for the MiniOCS models.

2.1.2 MiniOCS Dimensions and Panel Cut-outs

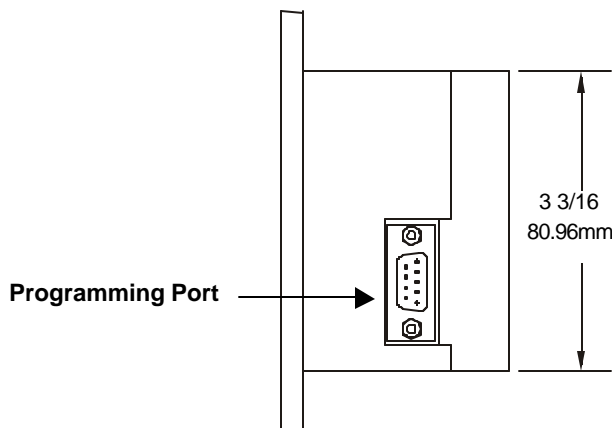


Figure 2.1 –Right-end View Network Model

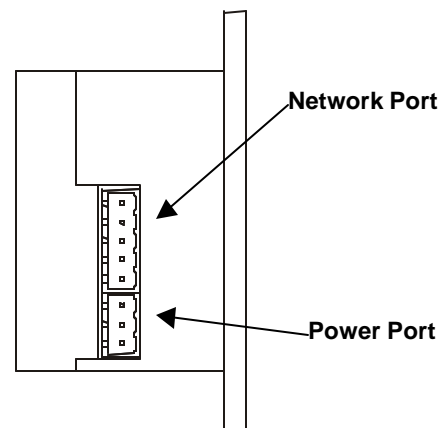


Figure 2.2 - Left-end View Network Model

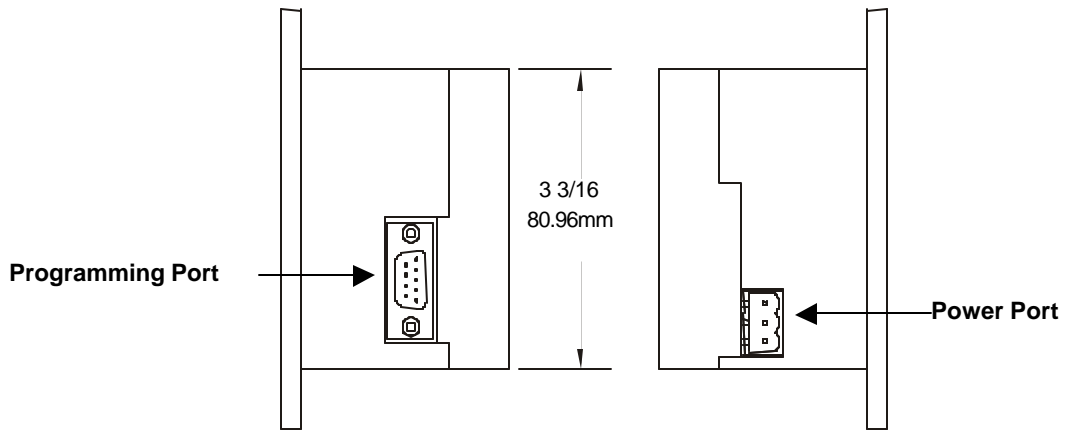


Figure 2.3 - Right-end View (Non-Network Model)

Figure 2.4 - Left-end View (Non-Network Model)

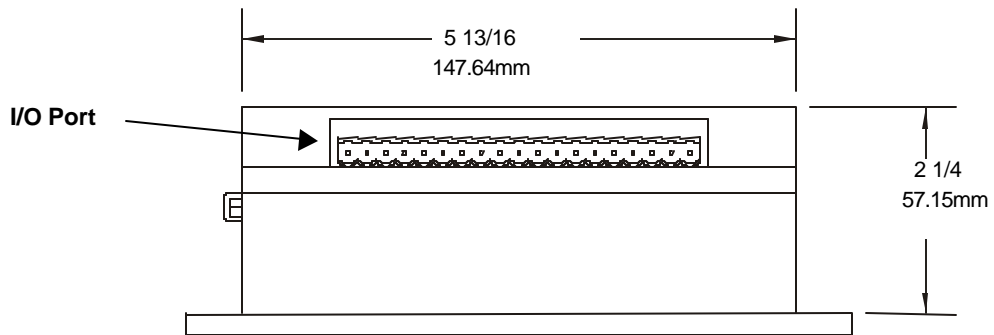


Figure 2.5 - Bottom View

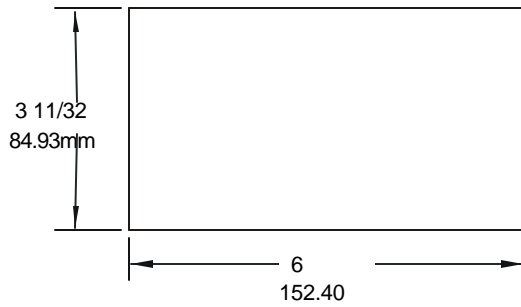


Figure 2.6 – Panel Cut-out (MiniOCS)

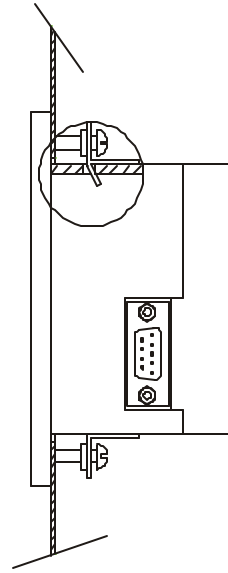


Figure 2.7 – MiniOCS Mounted in Panel Box using Mounting Clips.

2.1.3 MiniOCS Mounting Orientation

The bases of the MiniOCS model needs to be mounted with the proper orientation.

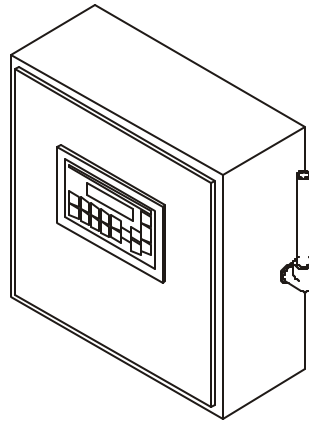


Figure 2.8 - Orientation of MiniOCS (Shown in Panel Box)

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

2.2 MiniRCS Mounting Requirements

2.2.1 MiniRCS Mounting Procedures (Installed in a Panel Box)

The MiniRCS is designed for permanent installation in a panel box. *To install the MiniRCS in a panel box, use the instructions that follow:*

1. Prior to mounting the MiniRCS, observe requirements for the panel layout design and adequate clearances. A checklist is provided on page 25.
2. Drill holes as described in the Figure 2.9.

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

3. Install and tighten washers and nuts. Do not over-tighten.
4. Connect the communications and power cables to the MiniRCS ports using the provided connectors.
5. Begin configuration procedures for the MiniRCS models.

2.2.2 MiniRCS Dimensions and Panel Cut-outs

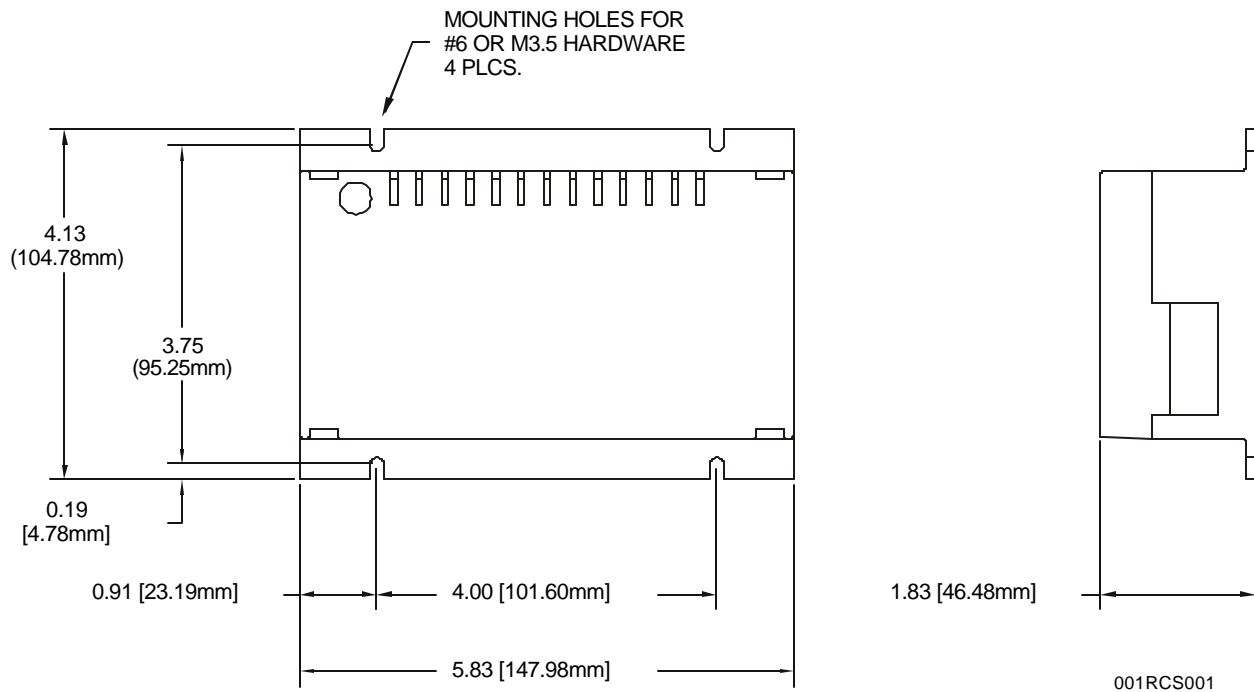


Figure 2.9 – MiniRCS Dimensions / Mounting Holes and MiniRCS Side View

2.2.3 MiniRCS Mounting Orientation

There are NO orientation restrictions on the MiniRCS. However, the orientation shown provides for the ease of use of the keypad.

2.3 Factors Affecting Panel Layout Design and Clearances

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

The designer of a panel layout needs to assess the requirements of a particular system and to consider the following design factors. A convenient checklist is provided on page 25.

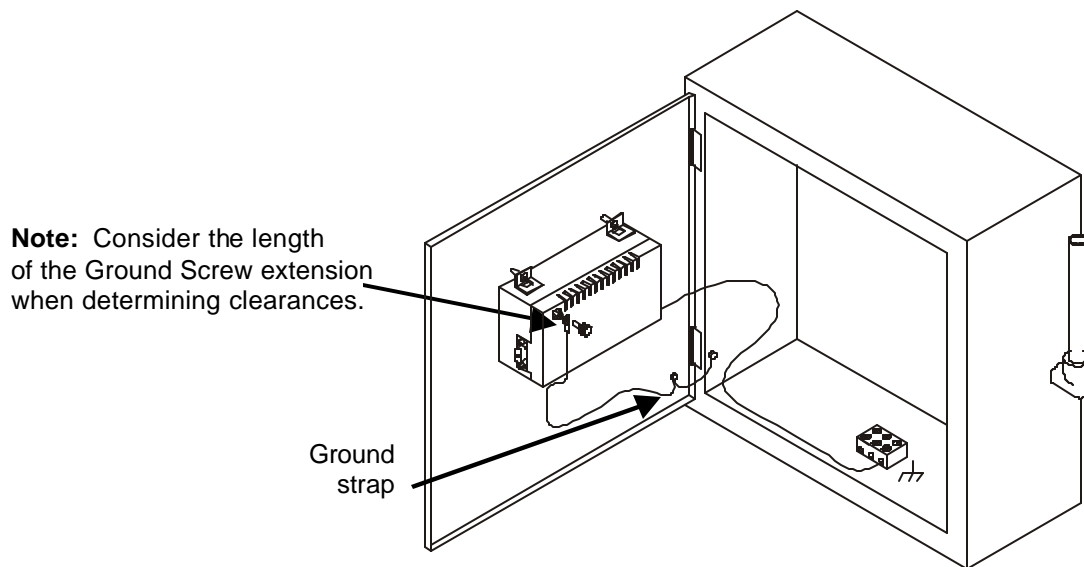


Figure 2.10 – Back view of MiniOCS (Shown On Panel Door)

a. Clearance / Adequate Space

Install devices to allow sufficient clearance to open and close the panel door. Note that the MiniOCS is mounted on a panel door and the MiniRCS 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 MiniOCS / MiniRCS 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.

Warning: To provide maximum noise immunity and to insure minimum EMI radiation, the V-signal (DC power return) need to be connected to earth ground at the power supply. The user must ensure that the power supply selected is compatible with this method of grounding.

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 (Figure 2.10).

Devices in panel box and on the panel box door:

Use the mounting hardware provided with the device, which includes mounting clips.

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

Observe guidelines for proper orientation of the bases when mounting the MiniOCS / MiniRCS (page 25). Proper orientation helps to ensure a good connection when MiniOCS / MiniRCS models are installed into the devices.

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 MiniOCS / MiniRCS and noisy devices such as relays, motor starters, etc.

Note: Do not route power and signal wires in the same conduit.

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? (See page 25.)

___ 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 MiniOCS / MiniRCS. (Be sure to consider the Ground Screw extension.)

___ Are the device bases oriented correctly? (See page 25.) The MiniOCS / MiniRCS devices are mounted on the door of a panel box.

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

___ Are noise suppression devices or isolation transformers be required? Is there adequate distance between the base of the MiniOCS / MiniRCS 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?


<p>Warning: To provide maximum noise immunity and to insure minimum EMI radiation, the V-signal (DC power return) need to be connected to earth ground at the power supply. The user must ensure that the power supply selected is compatible with this method of grounding.</p>

2.4 Ports, Connectors, and Wiring

2.4.1 Power, Network, and Programming Ports

The MiniOCS / MiniRCS Power, Network, and Programming Ports are shown in Figure 2.11 - Figure 2.12. for both the network and non-network versions of the MiniOCS / MiniRCS. The MiniOCS / MiniRCS I/O Module receptacle is located on the bottom.

2.4.2 Primary Power Port

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

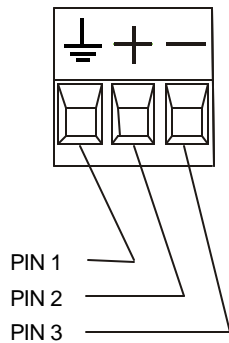


Figure 2.11 - Power Connector (Primary Power Port) (Front and Side Views Shown)

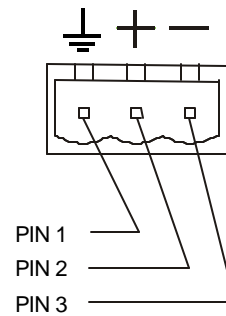


Figure 2.12 - As viewed looking at the Mini

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

Warning: To provide maximum noise immunity and to insure minimum EMI radiation, the V-signal (DC power return) need to be connected to earth ground at the power supply. The user must ensure that the power supply selected is compatible with this method of grounding.

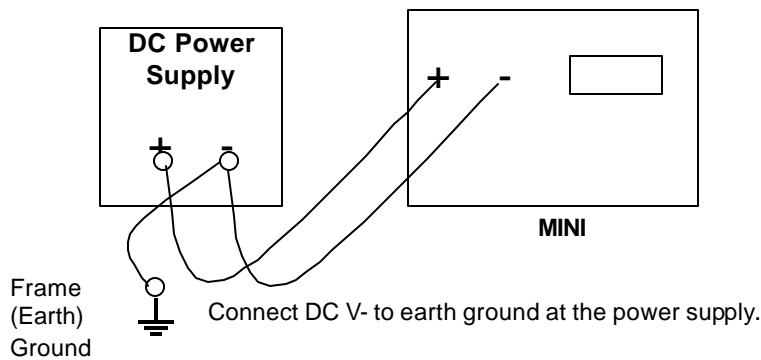


Figure 2.13 - Grounding

2.3.3 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 +

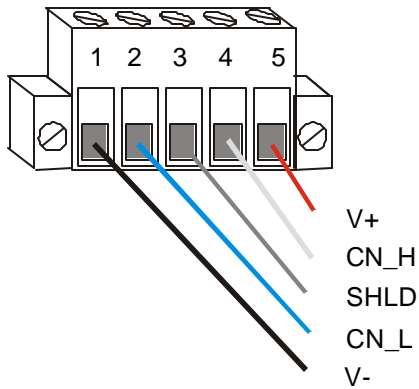


Figure 2.14 – Network Connector (CAN Port)

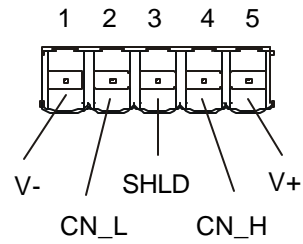


Figure 2.15 – As viewed looking at the Mini

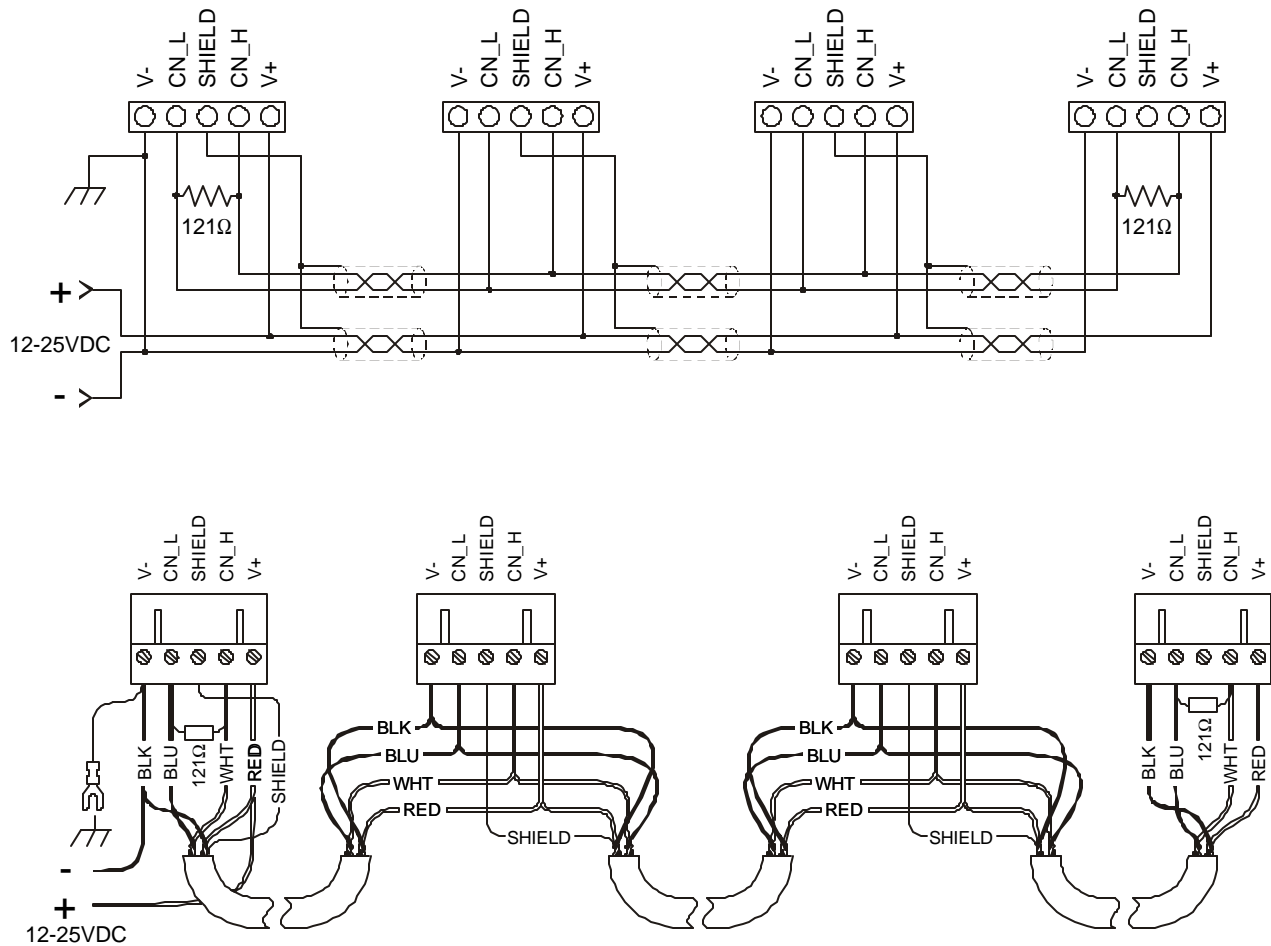


Figure 2.16 – CAN Wiring

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

- a. CAN Wiring Rules (See Figure 2.16.)
 1. Wire the CAN network in a daisy-chained fashion such that there are exactly two physical end-points on the network.
 2. The two nodes at the physical end-points need to have 121 ohm 1% terminating resistors connected across the CN_L and CN_H terminals.
 3. Use data conductors (CN_L and CN_H) that are 24 AWG shielded twisted pair for “thin cable” and 22 AWG shielded twisted pair for “thick cable.” They must also have 120-ohm characteristic impedance. In typical industrial environments, use a Belden wire #3084A (“thin”). Use #3082A (“thick”) for network cable lengths greater than 100 meters environments where noise is a concern. Place data conductors (CN_L and CN_H) into a twisted pair together.
 4. Use power conductors (V- and V+) that are 18 AWG twisted-pair for “thin cable” and 15 AWG twisted-pair for “thick cable.” Place power conductors (V- and V+) into a twisted pair together.
 5. If local codes require the local CAN power supply to be earth grounded, connect the V- power conductor to a good earth ground **at one place only** on the network, preferably at a physical endpoint. If multiple power supplies are used, only one power supply must have V- connected to earth ground. The remaining power supplies need to be isolated.

6. For a section of cable between two nodes, the cable shield is connected to the cable shield input at *one end of the cable only*.
7. A CAN network (without repeaters) is limited to 64 nodes (with 63 cable segments) with a maximum combined cable length of 1500 ft. at 125KBaud.
8. Up to four CAN network segments, which adhere to the above rules, may be connected together using three CAN repeaters. In this manner, a CAN network may be extended to 253 nodes with a total cable distance of 6000 ft. at 125KBaud.

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 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 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 by recipient.
* 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 not 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)
Thin Cable Maximum Total Cable Length	
Maximum bus length is independent of network data rate. Maximum bus length is 100m.	
Note: Network baud rates above 250Kbit/sec are not recommended for the MiniOCS / MiniRCS . The potential for a high rate of network messages can cause an unacceptable increase in the ladder scan rate.	

d. Bus Power and Grounding

When using CsCAN or DeviceNet:

1. A power supply of 24VDC ($\pm 4\%$) at 16A maximum is required for use in a CsCAN / DeviceNet network
2. With thick cable, a single network segment can have a maximum of 8A. To do this, the power supply needs to be located in the center of two network segments.
3. Thin cable has maximum of 3A.
4. To ground the cable shield, connect to pin 3 as shown in Figure 2.16.
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.

2.3.4 RS-232 Programming Port and Wiring

Table 2.6 – RS-232 Port Pins			
Pin	Signal	Description	Direction
1	DCD	Always high	Out
2	RXD	Received Data	Out
3	TXD	Transmitted Data	In
4	DTR	Data Terminal Ready	In
5	GND	Ground	-
6	DSR	Data Set Ready	Out
7	RTS	Request to Send	In
8	CTS	Clear to Send	Out
9	RI	Ring Indicate	Out

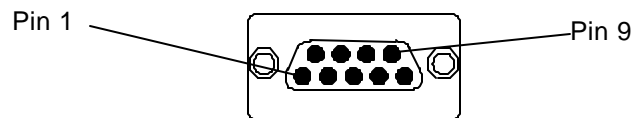


Figure 2.17 – RS-232 Port

a. RS-232 Communications Wiring

The MiniOCS / MiniRCS features an RS-232 port (Programming/Debug) for connection to a personal computer. This port is used for the purposes of MiniOCS / MiniRCS programming, configuring, monitoring, and debugging. This port can also be used for general ladder logic controlled serial communications to printers, modems, terminals, etc. When ladder has control of this port, it is not available for programming or debugging. The wiring diagram for the RS-232 ports is shown in Figure 2.18. For connection between the MiniOCS / MiniRCS and the PC, the use of a shielded, multiple conductor wire with a maximum length of 15.24 meters (50 feet) enables proper performance.

Note: A shorter cable can be required when used for high-speed MiniOCS / MiniRCS firmware updating.

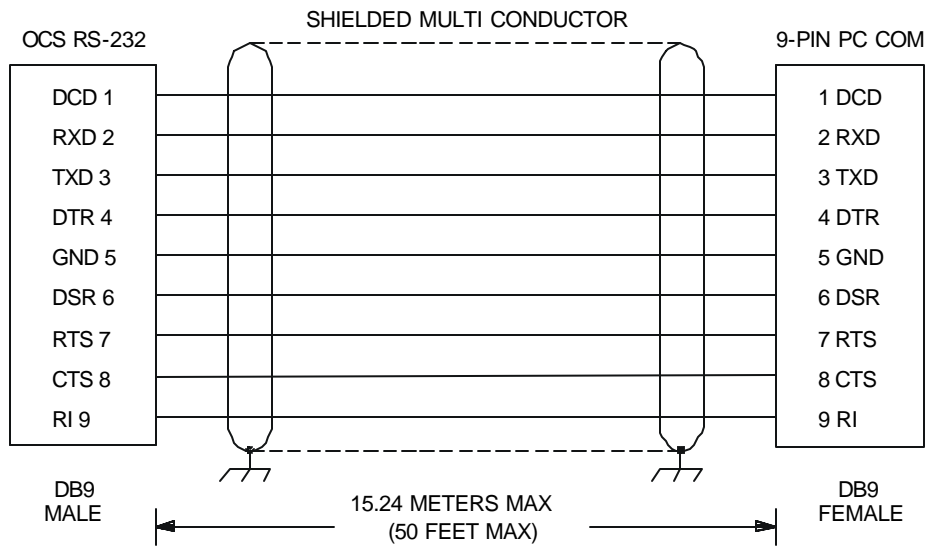


Figure 2.18 – MiniOCS / RCS to PC Wiring

2.3.5 Modem Setup

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

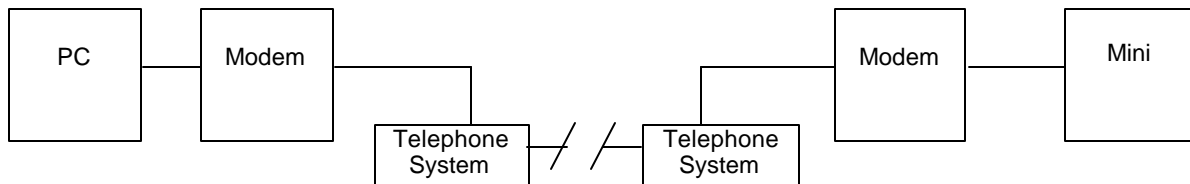


Figure 2.19 – Modem Setup

a. Setup

Setup the modems to match the default serial port characteristics of the MiniOCS / MiniRCS.

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

b. Cable Wiring

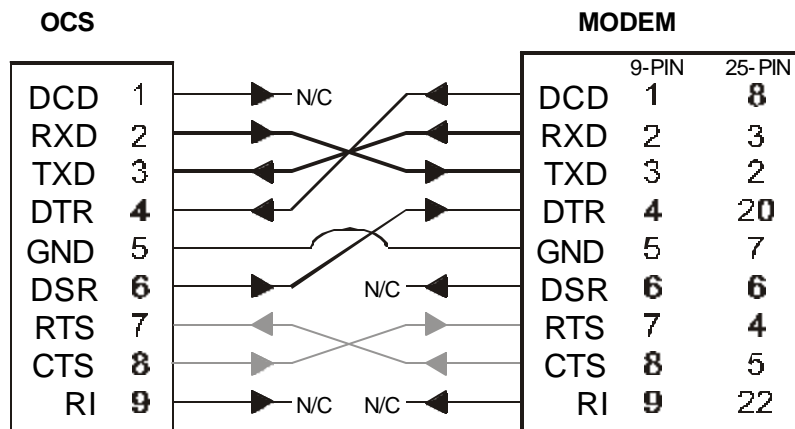


Figure 2.20 – Modem Wiring

Note: If the modem has a DB25 connector, a 9-to-25-pin adapter may need to be supplied.

The grayed connections —▶ are used only if hardware handshaking between the controller and modem is required.

The wire type used in 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 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: Damage can result if the CD and RI lines are connected to each other or to any other signal on the connector or through the cable to the other unit.

Warning: To connect a modem to the MiniOCS / MiniRCS the controller to modem cable must be constructed or purchased. Using a Null Modem cable can cause damage to the MiniOCS / MiniRCS, 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 can 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. (See page 18.) You can also find specific application information (cabling, modem commands, etc.) in the Cscape Help file as well.

2.5 Selecting DeviceNet Network (Firmware Update Wizard)

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 2.21 – Using Firmware Update Wizard

Select the product type (MiniOCS or MiniRCS) 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 MiniOCS / MiniRCS LEDs

The following LED information is provided for the MiniOCS / MiniRCS.

Table 2.7 - LEDs	
LED	MiniOCS / MiniRCS
RUN	<ul style="list-style-type: none"> • OFF indicates OCS is in IDLE/STOP mode. • Flashing indicates DO / IO mode or RUN with no ladder program. • ON indicates ladder code running.
OK	<ul style="list-style-type: none"> • OFF indicates one or more self-tests failed. • ON indicates all self-tests passed. • FLASHING indicates all self-tests passed and one or more I/O points is currently forced.

MiniOCS LED status is indicated on the physical unit as shown in the following figure.

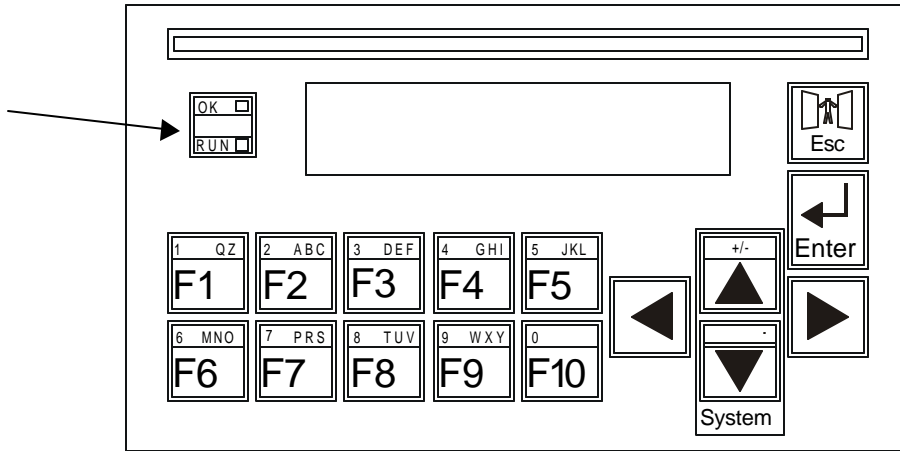
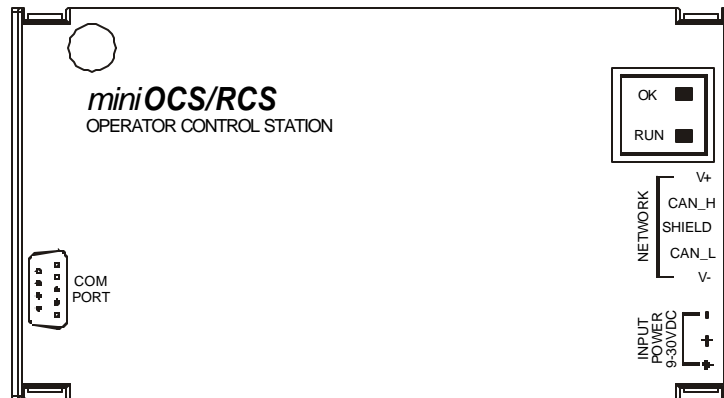


Figure 2.22 – MiniOCS LEDs

The MiniRCS LEDs are also viewed by looking at the physical unit. They are not viewable from a remote screen.



001RCS002

Figure 2.23 – MiniRCS LEDs (I/O Connections Not Shown)

2.7 Mini Battery Replacement

The following instructions apply to the MiniOCS and MiniRCS.

1. Disconnect power from the unit.
2. Remove ground screw (item #1) from back of unit.
3. Remove back cover (item #2) by carefully pressing in on one corner locking tab and lifting back cover to disengage the locking tab. Repeat this for all four corners.
4. Unscrew the grounding spacer (item #3) using a ¼" Hex nut driver.
5. Gently lift up and remove the I/O board (item #4) from the three snap top fasteners on the CPU board.
6. Once the CPU board is exposed locate the battery (item #5, U7). Remove the battery by prying up slightly on each end until it lifts free. Dispose of the battery.

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.

7. Replace the battery with **HE500BAT005** noting the polarity tab at one end of the battery. Use care when replacing the battery that this tab is located in the right direction. Use only the authorized battery part number.

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

8. Reassemble the Mini unit by first replacing the I/O board then replacing the ¼" hex spacer. It is recommended that *Loctite® 222MS Threadlocker* or an equivalent be applied to the male threads of item #xx before reassembling. Line up the back cover with ground hole over the ground spacer and press back in place. Make sure all four locking tabs of the back cover snap into place. Reconnect the ground wire. Follow the instructions in the units' manual for powering up the Mini and restoring it to operation.

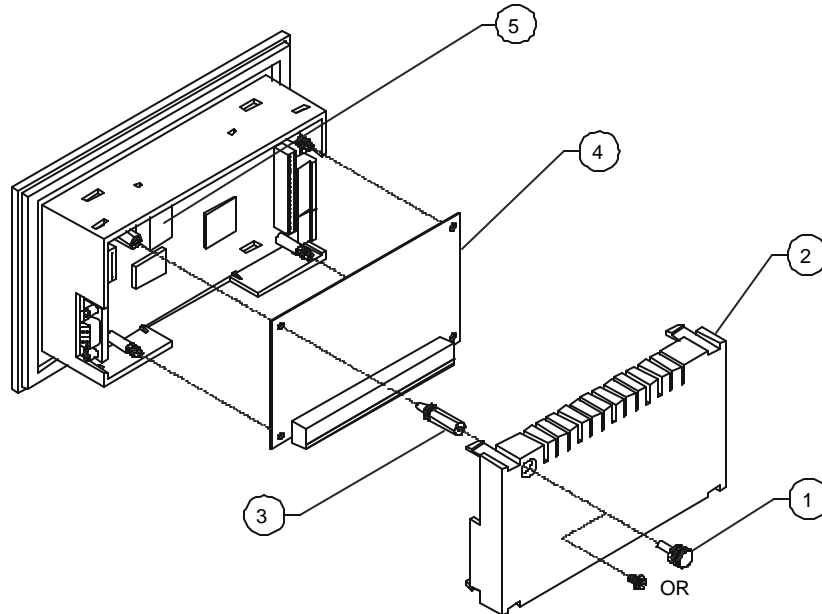


Figure 2.24 – Battery Replacement

NOTES

CHAPTER 3: SYSTEM MENU

3.1 General

Chapter Three describes the System Menu for the MiniOCS / MiniRCS.

The System Menu is used to access and edit information using the MiniOCS front panel or using the **Remote Text Terminal**, which is a feature available in both the MiniOCS and the MiniRCS. The Remote Text Terminal is particularly useful when using the MiniRCS, because the MiniRCS does not have a physical front panel display screen or keypad. For more information, see page 45.

The following list contains examples of parameters that can be set using the System Menu:

- Network ID
- Network Baud
- RS232 Mode
- Time/Date
- LCD contrast
- Fkeys mode

3.2 Navigating Through the System Menu

Prior to configuration, it is important to know how to navigate through the System Menu using the following guidelines.

1. Pressing the \uparrow and \downarrow keys scroll up or down through the menu options.
2. Pressing the **Enter** key selects the system screen that the indicator arrow is pointing to.
3. Once in a system screen, press **ESC** (if not currently modifying a field) to return to the main System Menu.

3.3 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. Some fields in the system screens are editable; others are not editable. The MiniOCS / MiniRCS model indicates an editable field with a solid cursor ($_$) under the first character in the field.
2. To change a value in an editable field, press the **Enter** key to select edit mode. The MiniOCS / MiniRCS model 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 \uparrow and \downarrow keys to select appropriate value.
 - Numeric entry - use Numeric keys or \uparrow and \downarrow keys on the appropriate digit.
 - Bar graph entry - use \leftarrow and \rightarrow keys to adjust value.
4. After the value is correctly entered, press the **Enter** key to accept the value.
5. Should the user not wish to accept the value before the **Enter** key is pressed, the **ESC** key may be pressed instead. This action restores the original value to the display. The MiniOCS / MiniRCS model also immediately exits edit mode; however, the Text models remains in edit mode with the original value and requires the **Enter** key to be pressed to exit.

3.4 Remote Screen / Keypad (Using Remote Text Terminal and Status Bar)

The MiniRCS has the same functionality as the MiniOCS except that it does not have a local operator screen and keypad. However, the MiniRCS (as well as the MiniOCS) supports a remote operator screen and keypad through a PC connected to the Mini unit's built-in network or serial port. If desired, the remote operator interface and keypad can be displayed (using Cscape software) by pressing **Screens, Remote Text Terminal**. A virtual display screen and keypad appear that are similar to that of the MiniOCS, and the user can navigate through the system menu, make selections, and edit fields using a mouse. In addition, the **Cscape Status Bar** can be used as a tool to ensure that communications are properly established. **For more information on the Remote Text Terminal and the Cscape Status Bar feature, see page 45.**

3.5 Initial System Menu Screens and Self-Test

Note: The examples in this chapter depict the MiniOCS, but the information also applies to the MiniRCS when using the Remote Text Terminal screen. (Refer to **Section 3.4.**)

1. After turning on the power to the Mini, the following screen appears which indicates the product name and the network it is connected to. It also indicates that the Self-Test is running. (This screen does not appear when using the Remote Text Terminal.)

```
MiniOCS - CsCAN
Self-Test Running
```

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

```
** Self-Test **
**** Passed ****
```

- b. If the Self-Test fails, see **View OCS(RCS) Diags** (page 41.)

3.6 Entering the System Menu

- a. To enter the System Menu on the MiniOCS using the **local** keypad, press both the ↑ and ↓ keys at the same time. Notice that the two keys are surrounded by a white outline and the word "System" on the silkscreen of the keypad.
- b. If using the MiniRCS, refer to Section 4.1 (starting on page 45) to use the **Remote Text Terminal** to create a virtual keypad and screen. Be sure to follow the procedures to establish and verify proper communications (page 46). After doing so, the following menu options can be accessed by clicking the specified key in the display representation using a mouse.

3.7 System Menu Option Screens

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

There are up to ten different menu options, which include the following:

- Set Network ID
- Set Network Baud
- Set Contrast
- View OCS(RCS) Status
- View OCS(RCS) Diags
- View I/O LEDs
- View OCS(RCS) Model
- Set Fkeys Mode
- Set RS232 Mode.
- Set Time/Date

- **Set Network ID**

This screen contains two fields. The first field contains the current network status. The second field contains the current Network ID of the model. The second field is numerically editable and is used to configure the Network ID.

Each unit on the network **needs a unique ID number**. The correct ID number should be entered here before physically attaching the unit to the network.

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

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 field 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 may 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.

- **View OCS (RCS) Status**

This screen contains both a single enumerated editable field that sets the MiniOCS / MiniRCS scan mode and status fields that display information about the internal state of the MiniOCS/ MiniRCS. Pressing the ↑ and ↓ keys scrolls through the different items. Pressing `ESC` returns to the System Menu.

<u>Parameter</u>	<u>Description</u>
OCS Mode	Displays the current scanning mode (Idle, Run, DoIO). In <i>Idle</i> mode, the I/O is <u>not</u> scanned and the OCS ladder program does <u>not</u> execute. The green "RUN" LED is OFF. In <i>Run</i> mode, the ladder program executes and the green "RUN" LED illuminates. <i>DoIO</i> mode is similar to <i>Run</i> mode, except the ladder logic is not solved. When the OCS is in <i>DoIO</i> mode, the user is able to exercise all of the I/O from Cscape, without interference from the ladder program. In this mode the green "RUN" LED flashes. This feature is a valuable troubleshooting tool.
Scan-Rate	Shows the number of milliseconds for the scan. The scan-rate is the sum of the time required to execute the following items: <ul style="list-style-type: none">a. Scan inputsb. Solve logicc. Write outputsd. Handle network communicationse. Handle host communications requestf. Process data for operator interface
OCS Net Use	Shows the percentage of the network used by the Mini.
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
Text Size	Shows the number of bytes used by the text screens
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(RCS) Diags**

This screen displays a list of self-test diagnostics results (no editable fields). 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. (Network models only.)

- 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. (Network models only.)

- 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. (Network models only.)

- 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. (Network models only.)

- 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 - (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 configured (downloaded) model number matches the physical I/O module installed in the controller.

Ok The configured model number matches the installed I/O module.

Warn Indicates the configured model number does not match the installed I/O module. (See View OCS(RCS) Model system screen for more information.)

- **View I/O LEDs**

The View I/O LEDs simulate the LEDs and show the statuses of the first 16 %I and first 16 %Q registers.

- **View OCS(RCS) Model**

The View OCS(RCS) Model screen allows the user to view the MiniOCS / MiniRCS model number.

When viewing the model number, the following status screens are possible. Note the term **OCSxxx** (or **RCSxxx**) refers to the MiniOCS (or MiniRCS) model number such as OCS082 (or RCS082).

- a. If the Mini model number is not configured and no I/O module is installed, the message "**I/O: Empty**" is displayed.
- b. If the Mini model number is not configured but has an I/O module installed, the message "**+Mini OCSxxx** (or **RCSxx**)" is displayed.
- c. If the Mini model number is configured but no I/O module is installed, the message "**-I/O Missing**" is displayed.
- d. If the configured Mini model number does not match the installed I/O module, the message "**?Mini OCSxxx** (or **RCSxx**)" is displayed.
- e. If the installed I/O module is not supported by the Mini firmware, the message "***Unsupported**" is displayed. The module is either defective or an Engine firmware upgrade is required to support the module.
- f. If the installed I/O module has erroneous or outdated firmware in it, the message "**fMini OCSxxx** (or **RCSxx**)" is displayed. The module is either defective or a Module firmware upgrade is required.
- g. If the installed I/O module has a configuration error, the message "**cMini OCSxxx** (or **RCSxx**)" is displayed. The configuration data for that module is incorrect.
- h. If the configured Mini model number matches the installed I/O module, the message "**Mini OCSxxx** (or **RCSxx**)" 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 point associated with the key or it can MOMENTARILY turn the point ON when the key is pressed.

- **Set RS232 Mode**

This screen contains an editable enumerated field 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 Mini's time and date. Each field is subdivided and allows the ↑ and ↓ key to modify the value.

NOTES

CHAPTER 4: KEYPAD AND SCREEN

4.1 Remote Screen and Keypad Capability

4.1.1 Remote Text Terminal

The MiniRCS has the same functionality as the MiniOCS except that it does not have a local operator screen and keypad. However, the MiniRCS (as well as the MiniOCS) supports a remote operator screen and keypad through a PC connected to the Mini unit's built-in network or serial port. The remote operator interface and keypad can be displayed using Cscape software by pressing **Screens, Remote Text Terminal**. A virtual display screen and keypad appear that are similar to the MiniOCS physical front panel, and the user can navigate through various screens, make selections, and edit fields using a mouse.

4.1.2 Cscape Status Bar

When the MiniOCS/ MiniRCS is connected to a PC using Cscape software, *and* the Remote Text Terminal feature is selected, a Cscape Status Bar appears at the bottom of the screen. The Cscape Status Bar can be used to determine if communications have been established between the Mini and the Cscape program. Components of the Cscape Status Bar are explained in page 45.

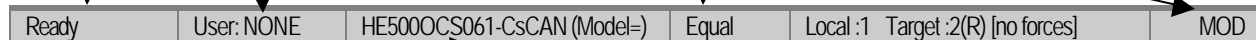
Message Line - contains Cscape messages sent by the programs. The contents of these messages are context sensitive. The Message line can be empty.

Equal Indicator – indicates whether the current program in Cscape is equal to the program stored in the Target Controller.

- If **Equal**, the program in Cscape is the same as the program stored in the Target Controller.
- If **Not Equal**, the program in Cscape is not the same as the program stored in the Target Controller.
- If **Unknown**, there may have been a change since the last time the program in Cscape was compared to the Target Controller.

Current User - indicates who is logged (for security purposes).

File Modified Indicator - indicates that the file in the selected window has been modified but has not been saved.



Controller Model - Network (Model Confirmation)

- **Controller Model** indicates the MiniOCS or MiniRCS for which the program in Cscape is configured.
- **Network** indicates the type of network that the program in Cscape expects to use (e.g., CsCAN or DeviceNet).
- **(Model Confirmation)** provides the following indications:
 - **(Model=)** - the actual Target Controller matches the configured Controller Model and Network.
 - **(Model Not=)** – the actual Target Controller does not match the configured Controller Model and Network.
 - **(Model ?)** – there may have been a change since the last time the Target Controller was compared to the configured Controller Model and Network.

Communications Status - indicates the current status of the "pass through" Connector.

- **Local: xx** – indicates the Network ID of the Mini to which the Cscape program is physically connected through its serial port. It can serve as a "pass through" device to other nodes on the network.
- **Target: yy(R)** – indicates the Network ID of the Mini with which the Cscape program is exchanging data.

Note: The **Local** unit and **Target** unit can be the same unit or they can be separate units.

The following are status indicators:

- (R) – Running
- (D) - Do I/O
- (I) – Idle
- (?) – Cscape is not communicating with the remote unit.
- [no forces] – indicates no I/O has been forced.

4.1.3 *Establishing Communications using the Remote Text Terminal*

1. Start Cscope software. Press **Screens, Remote Text Terminal**.
2. Establish communications between the Cscope program and Mini by pressing **Controller, Set Network Target ID**. Set the Target ID.
3. Again, select **Controller, Configure I/O**. Follow the procedures specified in Chapter Five: Configuration.
4. Download the program from Cscope to the Mini by pressing **Program, Download**.
5. Check the **Cscope Status Bar** as described in Section 4.1.2 to ensure that the program in Cscope matches the program downloaded to the Mini model. Be sure to check the Status Bar often. Another way to check that the download occurred is to press **Program, Verify**.
6. Click on the **System Key** in the display representation and continue the procedures to enter the system menu beginning on page 38.

4.2 **Keypad Description**

The MiniOCS keypad contains 10 user-programmable keys, *Esc*, *Enter* and four direction keys. The user-programmable keys, or function keys, also serve the purpose of numeric and alphabetic character entry. Function keys F1-F10 are available (%K registers). Depending on the configuration of the MiniOCS and the field needing to be edited, the MiniOCS automatically knows what type of digit or alphanumeric character needs to be entered.

The MiniOCS keypad also contains four direction keys. The ↑ and ↓ keys contain split fields. The ↑ key also contains the +/- function. The ↓ key also contains the . function. Similar to the operation of the function keys, the MiniOCS automatically knows if a decimal point or a positive or negative indicator is required. The ↑ and ↓ keys are also used to increment and decrement fields, respectively. The ← and → keys are used to move the cursor from one character to another in an editable field and to switch from one editable field to another editable field.

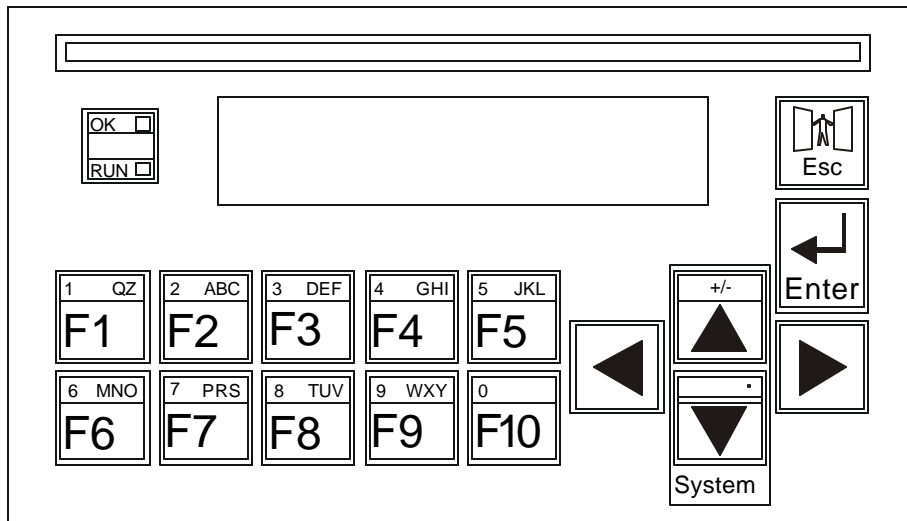


Figure 4.1 - MiniOCS Keypad

The MiniOCS features an *Esc* and an *Enter* key. The *Esc* key is used to exit out of a number of different menus and fields or abort an editing operation. The *Enter* key is used to select a field for editing and for sending data to the MiniOCS. The *Enter* key can also be used to escape out of some selected fields.

The MiniOCS keypad has “OK” and “RUN” indicators. These indicators are green LEDs that are built into the keypad. When there are no errors present in the MiniOCS and the Self-Tests have “passed,” the green “OK” LED illuminates. When the controller is running logic, the RUN LED illuminates. If the controller is in the RUN mode with no logic loaded or if it is in the DO I/O mode, the RUN LED flashes.

4.3 Operation

When the MiniOCS unit first powers-up, it displays “MiniOCS Self-Test In Progress.” Next, the message “MiniOCS Self-Tests In Progress...” appears. After the Mini displays this message, the unit performs tests to examine the current state of the network. Four different scenarios can occur:

Scenario #1: No power is supplied to the CAN port. The message “No Network Power Network Disabled” is displayed. Assuming the controller is configured to require the network, the OCS then displays the message “Self-Tests Failed.” Also, there is a Fault Code of 80 displayed in “View OCS Info” in the System Menu (see Chapter 3). The green “OK” light does not illuminate.

Scenario #2: No other units are on the CAN network (or this is the first device to power-up on the network). The message "**Waiting for Net: F1 = Disable Net**" is shown. If another device is placed on the CAN network, the message clears and operation continues. The message “Self-Tests Passed” is displayed. The green “OK” light illuminates. If F1 is pressed the message “No Net Response Network Disabled” appears and is followed by the message “Self-Tests Failed”. The green “OK” light does not illuminate.

Scenario #3: If a unit powers-up and finds another unit with the same node number as itself, the display shows "**Duplicate ID Network Disabled**". The network is disabled, and the unit displays the message “Self-Tests Failed.” The green “OK” light does not illuminate.

Note: The ID checking works when one of two devices with the same ID is powered-up more than 1 second before the other. If both devices are powered-up at the same time, this method of ID checking may not work. In this case, the Mini continues to check for duplicate IDs during operation.

Scenario #4: If a unit powers up and it has network power, and other units are powered up on the network, the message “Self-Tests Passed” is displayed, and the green “OK” light is illuminated.

At any time, the Mini unit can be reset by pressing: ↑ + F1 + F2 (press the keys **at the same time**)

4.4 User Screens

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

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

If the screen contains an editable field, the user can press the `Enter` key to enter the edit mode. When in edit mode, a cursor appears on one digit of the editable field. Use the direction keys (← and →) to move the cursor to the desired position. Use the ↑ and ↓ keys to increment or decrement the digit or enter the number/data with the alphanumeric keys.

If there is more than one field on the screen needing to be edited, use the direction keys (← and →) to move the cursor to the desired location.

The value chosen by the user may not exceed the minimum or maximum set by the user program. If the user tries to exceed the maximum point or enter a value below the minimum point, the value does not change.

Note: If the MiniOCS displays ">>>>>" in a text field, the value is too big to display in the field or is above the maximum for an editable field. If the MINI displays "<<<<" in a text field, the value is too small to display or is below the minimum for an editable field.

4.4.1 Cursor Types

There are three different cursor types, which may show on the display:

- a. Solid underline
- b. Blinking block
- c. Blinking underline

A *solid underline cursor* appears under an editable field which is not being edited yet. The ← key and the → key can be used to move this type of cursor to select a different editable field, if required. Press **Enter** to start editing the selected field. This causes a *blinking block cursor* to appear.

A *blinking block cursor* appears in an editable field when `Enter` is first pressed to start editing the field. The *blinking block cursor* indicates that the field will be cleared when a numeric (or alphanumeric for an ASCII field) key is pressed. This allows a new value to be entered for the field just as it would be entered on a PC keyboard or a calculator. If a direction key (←, →, ↑, ↓) is pressed, the cursor changes from a *blinking block* to a *blinking underline*, and single-digit edit mode is entered.

A *blinking underline cursor* appears under an editable field which is being edited in single digit edit mode. In this mode, the digit (or character) above the cursor can be modified individually. This can be done by pressing ↑ or ↓ (increments or decrements) or by pressing a numeric (or alphanumeric) key. Pressing ← or → moves the cursor to the previous or next digit (or character).

CHAPTER 5: MINI CONFIGURATION

5.1 General

Chapter Five provides preliminary configuration procedures that are applicable to all MiniOCS / MiniRCS models.

Remote Screen Usage for the the MiniRCS: The MiniRCS has the same functionality as the MiniOCS except that it does not have a local operator screen and keypad. However, the MiniRCS supports a remote operator screen and keypad. through a PC connected to the Mini unit's built-in network. If desired, the remote operator interface and keypad can be displayed (using Cscape software) by pressing **Screens, Remote Text Terminal**. A virtual display screen and keypad appears that is similar to that of the MiniOCS. In addition, a Status Bar can be used as a tool to ensure that communications are properly established. **For more information on the Remote Test Terminal and the Status Bar feature, see page 45.**

Note: The examples in this chapter depict the MiniOCS, but the information also applies to the MiniRCS when using the Remote Text Terminal screen.

The MiniOCS / MiniRCS models use Cscape Software for configuration. General information is also provided pertaining to the screens that the user encounters when configuring specific modules. In addition, each MiniOCS / MiniRCS model has its own data sheet which covers specifications, wiring and other pertinent information. (See page 18.)

5.2 Preliminary Configuration Procedures

1. The MiniOCS / MiniRCS configuration is accomplished through the Configure Controller Type Dialog.

Note: The configuration examples in this chapter depict the MiniOCS, but the procedures also apply to the MiniRCS as well.

a. Using Auto Configuration

From the Main Menu, select controller|configure for the following dialog. If the desired MiniOCS / MiniRCS is physically connected to the PC, press **Auto Config**. A dialog box appears and indicates that settings will be deleted from currently configured models. If OK, press **Yes**. Then press **OK**.

To obtain a description of the MiniOCS / MiniRCS model, double-click on the box (or press the top **Config** button) to select the desired controller from the pull-down menu.

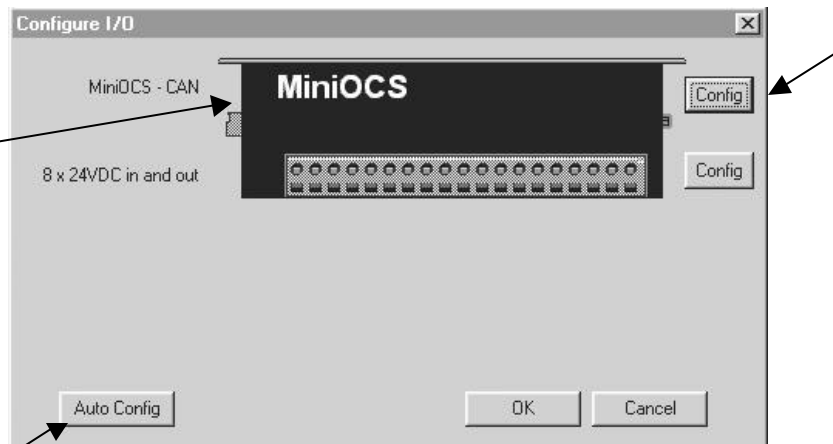


Figure 5.1

Note: The configuration examples in this chapter depict the MiniOCS, but the procedures also apply to the MiniRCS.

b. Manual Selection of MiniOCS / MiniRCS Model and Obtaining a Description of the Model

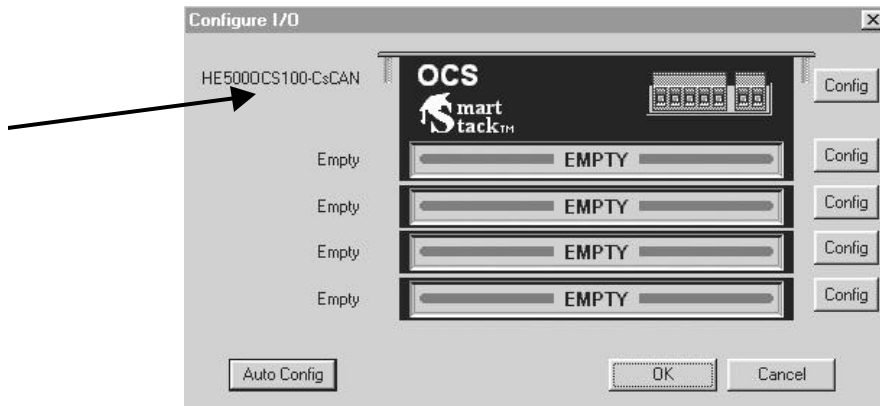


Figure 5.2

If a different controller is installed, select the MiniOCS / MiniRCS by double-clicking on the box (or press the top **Config** button) and select the desired controller from the pull-down menu.

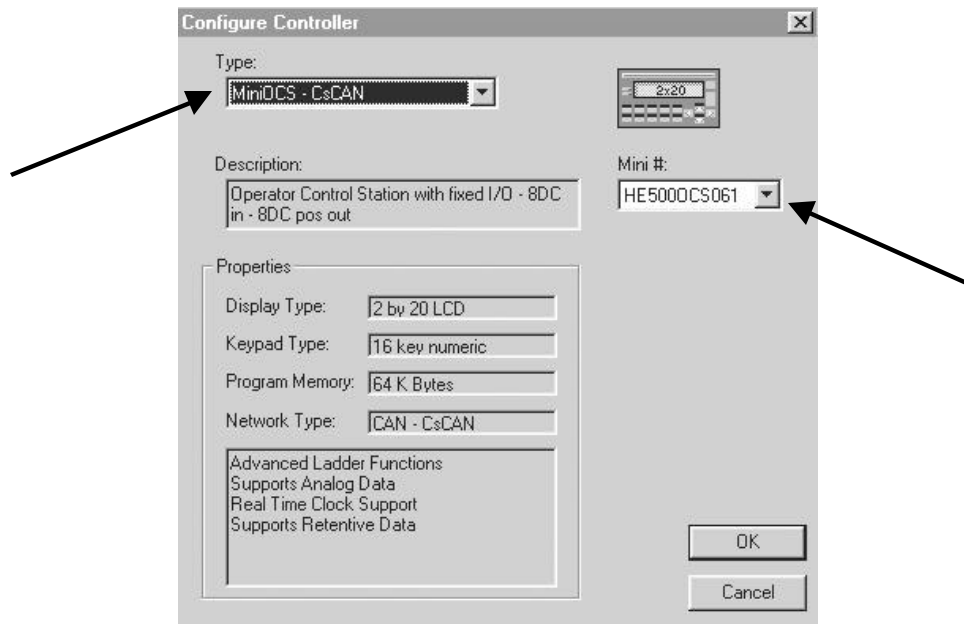


Figure 5.3

Note: The configuration examples in this chapter depict the MiniOCS, but the procedures also apply to the MiniRCS.

Using pull-down menus, select either a network version of the MiniOCS / MiniRCS (**MiniOCS / MiniRCS – CsCAN**) or a non-network version (**MiniOCS / MiniRCS – No net**). Then, select the MiniOCS / MiniRCS model that is going to be configured. A description of the selected model is provided on this screen. Press **OK**.

2. The following screen appears.

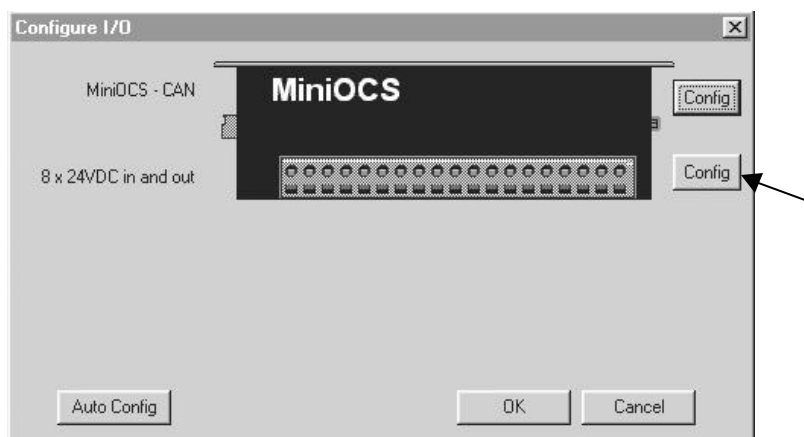


Figure 5.4

3. To view the registers associated with the MiniOCS / MiniRCS model, press the lower **Config** button.
 - a. A screen appears showing the **I/O Map** for the MiniOCS / MiniRCS model selected. The user (i.e., programmer) needs to view the I/O Map to determine which registers are assigned to the model.

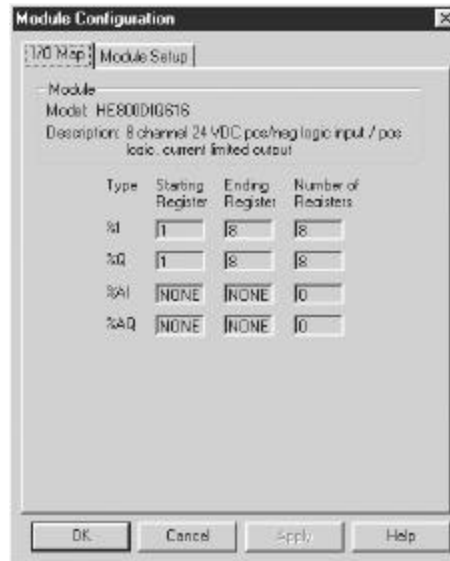


Figure 5.5

- Model number: Provides the I/O 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/Ending : Denotes the starting and ending locations of the register type.
Number: Indicates the quantity for a particular register type.

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

- b. Selecting the **I/O Map** tab provides information about the I/O registers, which are assigned to a specific MiniOCS / MiniRCS Module. The I/O Map is determined by the model number. The I/O Map is not edited by the user.

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.

4. There is no further configuration required for *most* MiniOCS / MiniRCS models. The exceptions are the High Speed Counter MiniOCS / MiniRCS Models which include 033/063 and 034/064. Refer to the *SmartStack High Speed Counter Supplement* for further information.

CHAPTER 6: SMARTSTIX

6.1 General

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

6.2 SmartStix I/O Introduction

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

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

6.3 SmartStix I/O Modules

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

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

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

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

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

BASIC SMARTSTIX PROGRAMMING

6.4 Using GET and PUT

6.4.1 Get Remote I/O Function Block

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

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

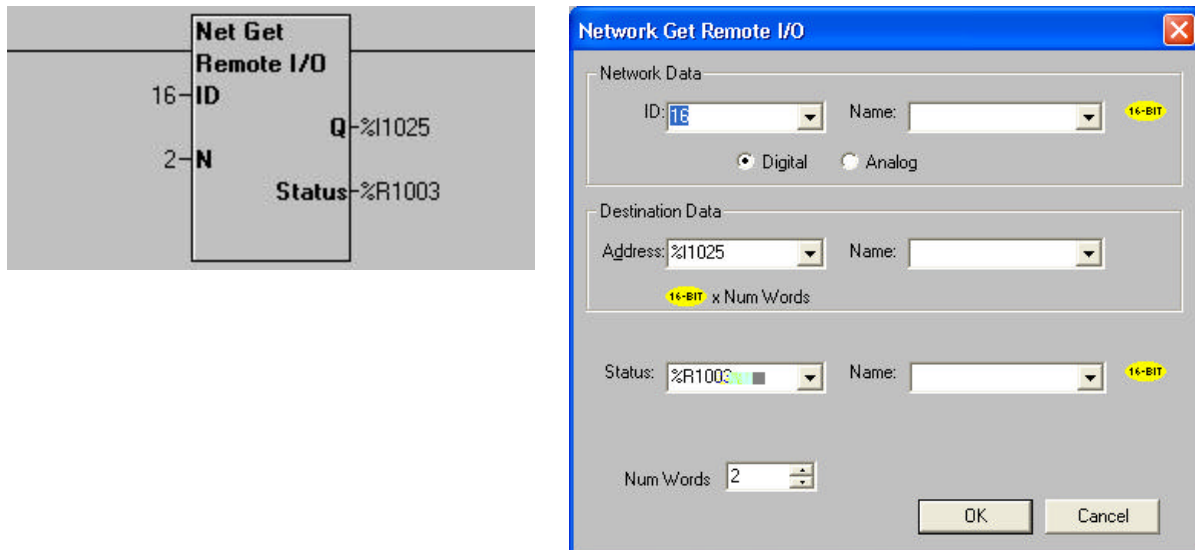


Figure 6.1 – Get Remote I/O Function Block and Parameter Screen

6.4.2 Get Remote Parameter Description:

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

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

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

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

Num Words – This is the number of words to receive from the remote I/O device. Up to four words can be received from the remote I/O device. The function of these words are described in **Table 6.1**.

Table 6.1 - Consumed / Produced Parameter Descriptions		
Consumed Directed Digital Data Words	Function	Affects
Word 1 (bits 1 to 16)	Controls on/off state of digital outputs 1-16.	Relay or Digital output SmartStix
Word 2 (bits 17 to 32)	Controls on/off state of digital outputs 17-32.	Relay or Digital output SmartStix
Word 3 (bits 33 to 48)	Specifies whether SmartStix uses default configuration or values from Word 4.	Relay and Digital input and output
Word 4 (bits 49 to 64)	Sets digital inputs / heartbeat and life expectancy time data.	Relay and Digital input and output
Word 5 (bits 65 to 80)	Sets the default state of outputs 1-16.	Relay and Digital output
Word 6 (bits 81 to 96)	Sets the default state of outputs 17-32.	Relay and Digital output
Word 7 (bits 97 to 112)	Determines if default state is on or off for outputs 1-16.	Relay and Digital output
Word 8 (bits 113 to 128)	Determines if default state is on or off for outputs 17-32.	Relay and Digital output
Produced Global Digital Data Words	Function	Affects
Word 1 (bits 1 to 16)	On/off state of inputs 1-16.	Digital input SmartStix
Word 2 (bits 17 to 32)	On/off state of inputs 17-32.	Digital input SmartStix
Word 3 (bits 33 to 48)	Status bits and diagnostic data	Relay or Digital input and output
Word 4 (bits 49 to 64)	Device class number and firmware identifier sent by SmartStix module.	Relay or Digital input and output

Note: **Table 6.1** summarizes SmartStix I/O module consumed and produced data words. For advanced users, refer to pages 58 and 60 for sections describing the **Consumed** and **Produced** words in detail.

6.4.3 Put Remote I/O Function Block

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

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

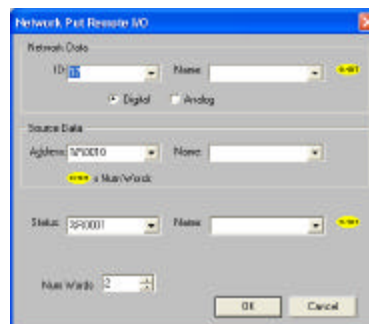
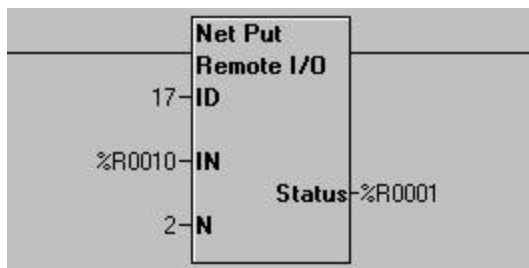


Figure 6.2 - Put Remote I/O Function Block and Parameter Screen

6.4.4 Put Remote Parameter Description:

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

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

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

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

Bit 1-12 – reserved or internal use only

Bit 13 – Remote I/O OK and in sync with supplied data

Bit 14 – the Remote I/O detected a heartbeat error

Bit 15 – the Remote I/O has just powered up

Bit 16 – the function is forcing a send (unit just power cycled or first scan)

Num Words – This is the number of words to send to the remote I/O device. Up to 8 words can be sent to the remote I/O device. The function of these words are described in **Table 6.1**.

6.5 SmartStix I/O Default Operation

SmartStix I/O has been designed so that its default operation satisfies the most common applications. This keeps the user interface simple and makes the product easy to use. The default operation is summarized in **Table 6.2**. To change the default operator, see *Advanced SmartStix Programming* (page 57).

Table 6.2 – SmartStix I/O Default Operation	
Digital Input Devices	
Data Reporting Method	Change of State
Heartbeat Generation Interval	1000msec.
Digital Output Devices	
Update Method (using NETPUT Remote I/O Function block)	Change of State
Heartbeat Generation Interval	1000msec.
(LET) Life Expectance Time (Receipt of Heartbeat)	2000msec.
(LET) Action Upon Expiration	Turn all outputs OFF

ADVANCED SMARTSTIX PROGRAMMING

6.6 SmartStix I/O Module Device Classes

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

Table 6.3 shows the five device classes along with the number of Digital I/O points they contain and the number of Directed and Global Data words they exchange.

Example: Determining the class of a SmartStix module:

1. Select the number of digital output points and the number of digital input points using **Table 6.3**.
2. Upon doing so, the device class is located in the same row as the digital outputs and inputs; the words consumed and produced are also shown for that device class.

Table 6.3 – SmartStix I/O Module Device Classes				
Device Class	Digital Output Points	Digital Input Points	Directed Data Words Consumed	Global Data Words Produced
0	16	0	8	4
1	0	16	8	4
2	16	16	8	4
3	0	32	8	4
7	32	0	8	4

All other device classes are reserved for future products.

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

The following terms are defined:

- Consumed Data:** Directed Data received by a SmartStix I/O Module *from* a Control Station
Produced Data: Global Data transmitted by a SmartStix I/O Module *to* a Control Station

Table 6.4 summarizes SmartStix I/O module consumed and produced data words. For advanced users, the following sections describe the consumed and produced words in detail.

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

Table 6.4 – Consumed Directed Data Word 1															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
Digital Output Control Data – Low Word															
Q16	Q15	Q14	Q13	Q12	Q11	Q10	Q9	Q8	Q7	Q6	Q5	Q4	Q3	Q2	Q1

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

Table 6.5 – Consumed Directed Data Word 2															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
Digital Output Control Data - High Word															
Q32	Q31	Q30	Q29	Q28	Q27	Q26	Q25	Q24	Q23	Q22	Q21	Q20	Q19	Q18	Q17

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

Table 6.6 – Consumed Directed Data Word 3																		
16-bit Word																		
8-bit High Byte								8-bit Low Byte										
Diagnostic Command Data								Configuration Command Data										
Reserved for Future Products																CIT	CH T	CL T

CLT = 0 Command the SmartStix I/O Module to set its Life Expectancy Time to 2.0 seconds, as the maximum time to wait between Control Station to SmartStix I/O Module output control data messages, before setting all Digital Outputs to their default states.

CLT = 1 Command the SmartStix I/O Module to use Word 4's Life Expectancy Time. In this case, a value of 0.0 disables the Life Expectancy feature.

CHT = 0 Command the SmartStix I/O Module to set its Heartbeat Send Time to 1.0 second, as the minimum time between SmartStix I/O Module to Control Station Heartbeat messages.

CHT = 1 Command the SmartStix I/O Module to use Word 4's Heartbeat Send Time. In this case, a value of 0.0 disables the Heartbeat Send feature.

CIT = 0 Command the SmartStix I/O Module to send its Digital Input data to the Control Station, only when the Digital Inputs change state.

CIT = 1 Command the SmartStix I/O Module to use Word 4's Digital Input Send Time, to determine how often to periodically send its Digital Input data to the Control Station. In this case, a value of 0.0 disables *automatic* sending of Digital Input data.

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

Table 6.7 – Consumed Directed Data Word 4															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
Digital Input / Heartbeat Send Time Data								Life Expectancy Time Data							
0.0 to 25.5 seconds = Minimum Send Interval								0.0 to 25.5 seconds = Maximum Receive Interval							

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

Table 6.8 – Consumed Directed Data Word 5															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
0 = Force Off / On 1 = Hold-Last-State								Default Digital Output Data - Low Word							
H16	H15	H14	H13	H12	H11	H10	H9	H8	H7	H6	H5	H4	H3	H2	H1

H16...H1 Determines default state of the SmartStix I/O Module's 1st 16 Digital Outputs, if any, when the configured Life Expectancy Time expires. If an H bit is 1, its corresponding Digital Output, by default, holds its last state. If an H bit is 0, its corresponding Digital Output is forced Off or On, depending on the corresponding F bit in Word 7 (Table 6.10).

Table 6.9 – Consumed Directed Data Word 6															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
0 = Force Off / On 1 = Hold-Last-State								Default Digital Output Data - High Word							
H32	H31	H30	H29	H28	H27	H26	H25	H24	H23	H22	H21	H20	H19	H18	H17

H32...H17 Determines default state of the SmartStix I/O Module's 2nd 16 Digital Outputs, if any, when the configured Life Expectancy Time expires. If an H bit is 1, its corresponding Digital Output, by default, holds its last state. If an H bit is 0, its corresponding Digital Output is forced Off or On, depending on the corresponding F bit in Word 8 (Table 6.11).

Table 6.10 – Consumed Directed Data Word 7															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
0 = Force Off 1 = Force On								Default Digital Output Data - Low Word							
F16	F15	F14	F13	F12	F11	F10	F9	F8	F7	F6	F5	F4	F3	F2	F1

F16...F1 Determines default Off or On state of each of the SmartStix I/O Module's 1st 16 Digital Outputs, if any, when the configured Life Expectancy Time expires, and when the corresponding H bit in Word 5 (Table 6.8) is 0.

Table 6.11 – Consumed Directed Data Word 8															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
0 = Force Off 1 = Force On								Default Digital Output Data - High Word							
F32	F31	F30	F29	F28	F27	F26	F25	F24	F23	F22	F21	F20	F19	F18	F17

F32...F17 Determines default Off or On state of each of the SmartStix I/O Module's 2nd 16 Digital Outputs, if any, when the configured Life Expectancy Time expires, and when the corresponding H bit in Word 6 (Table 6.9) is 0.

6.8 Consumed Directed Data Power-Up Initialization

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

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

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

Table 6.12 – Produced Global Data Word 1															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
Digital Input Status Data - Low Word															
I16	I15	I14	I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1

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

Table 6.13 – Produced Global Data Word 2															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
Digital Input Status Data - High Word															
I32	I31	I30	I29	I28	I27	I26	I25	I24	I23	I22	I21	I20	I19	I18	I17

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

Table 6.14 – Produced Global Data Word 3																
16-bit Word																
8-bit High Byte								8-bit Low Byte								
Module Fault Data				Network Fault Data				Configuration Status Data								
PUP	I/O	ROM	RAM	LIFE	ID	DUP	NAK							SIT	SHT	SLT

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

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

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

Table 6.15 – Produced Global Data Word 4															
16-bit Word															
8-bit High Byte								8-bit Low Byte							
Firmware Revision Status Data								Device Identification Status Data							
0.00 to 2.55 = Version Number								0 to 255 = Device Class Number							

Device Class Number SmartStix I/O Module's numeric product identifier (see Table 6.3).
Version Number SmartStix I/O Module's numeric firmware identifier

6.10 Produced Global Data Power-Up Initialization

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

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

6.11 SmartStix I/O Module LED Indicators

SmartStix I/O Modules provide diagnostic and status LED indicators

6.11.1 Diagnostic LED Indicators

The MS and NS diagnostic LEDs indicate the fault status of the module and the network, respectively. Note that the diagnostic LEDs correspond directly to the Module Fault and Network Fault bits as shown in Table 6.14.

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

Table 6.16 – SmartStix I/O Module Diagnostic LED Indicators		
Diagnostic LED	State	Meaning
MS (Module Status)	Solid Red	RAM or ROM test failed (RAM or ROM bit On)
	Blinking Red	I/O test failed (I/O bit On)
	Blinking Green	Module is in power-up state (PUP bit On)
	Solid Green	Module is running normally (all Module Fault bits Off)
NS (Network Status)	Solid Red	Network Ack or Dup ID test failed (NAK or DUP bit On)
	Blinking Red	Network ID test failed (ID bit On)
	Blinking Green	Module is in Life Expectancy default state (LIFE bit On)
	Solid Green	Network is running normally (all Network Fault bits Off)

6.11.2 Status LED Indicators

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

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

6.12 SmartStix I/O Module Network ID

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

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

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

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

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

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