



User Manual for

X5 OCS

HE-X5



MAN1039-01-EN

PREFACE

This manual explains how to use the X5 OCS.

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LIMITED WARRANTY AND LIMITATION OF LIABILITY

Horner APG, LLC, ("HE-APG") warrants to the original purchaser that the X5 OCS module manufactured by HE-APG is free from defects in material and workmanship under normal use and service. The obligation of HE-APG under this warranty shall be limited to the repair or exchange of any part or parts which may prove defective under normal use and service within two (2) years from the date of manufacture or eighteen (18) months from the date of installation by the original purchaser whichever occurs first, such defect to be disclosed to the satisfaction of HE-APG after examination by HE-APG of the allegedly defective part or parts. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE AND OF ALL OTHER OBLIGATIONS OR LIABILITIES AND HE-APG NEITHER ASSUMES, NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR HE-APG, ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF THIS X5 OCS module. THIS WARRANTY SHALL NOT APPLY TO THIS X5 OCS module OR ANY PART THEREOF WHICH HAS BEEN SUBJECT TO ACCIDENT, NEGLIGENCE, ALTERATION, ABUSE, OR MISUSE. HE-APG MAKES NO WARRANTY WHATSOEVER IN RESPECT TO ACCESSORIES OR PARTS NOT SUPPLIED BY HE-APG. THE TERM "ORIGINAL PURCHASER", AS USED IN THIS WARRANTY, SHALL BE DEEMED TO MEAN THAT PERSON FOR WHOM THE X5 OCS module IS ORIGINALLY INSTALLED. THIS WARRANTY SHALL APPLY ONLY WITHIN THE BOUNDARIES OF THE CONTINENTAL UNITED STATES.

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To obtain warranty service, return the product to your distributor with a description of the problem, proof of purchase, post paid, insured and in a suitable package.

ABOUT PROGRAMMING EXAMPLES

Any example programs and program segments in this manual or provided on accompanying diskettes are included solely for illustrative purposes. Due to the many variables and requirements associated with any particular installation, Horner APG cannot assume responsibility or liability for actual use based on the examples and diagrams. It is the sole responsibility of the system designer utilizing the X5 OCS module to appropriately design the end system, to appropriately integrate the X5 OCS module and to make safety provisions for the end equipment as is usual and customary in industrial applications as defined in any codes or standards which apply.

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

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| FIRST STEP of ANY TASK: DATASHEET | | | |
|---|--|--|--|
| <p>Each X5 OCS unit is sent with a datasheet in the box. The datasheet is the <u>first</u> document you need to refer to for model-specific information related to X5 OCS models such as pin-outs, jumper settings, and other key installation information. Visit our website http://www.heapg.com to obtain updates to datasheets, manuals and user documentation.</p> | | | |
| QUICK START | INSTALLATION | PROGRAMMING | TROUBLESHOOTING |
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CHAPTER 1: SAFETY / COMPLIANCE

1.1 Safety Warnings and Guidelines

When found on the product, the following symbols specify:



Warning: Consult user documentation.



Warning: Electrical Shock Hazard.

WARNING – EXPLOSION HAZARD – Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous

WARNING: To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

WARNING: To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.

WARNING: Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.

WARNING: In the event of repeated failure, do not replace the fuse again as a repeated failure indicates a defective condition that will not clear by replacing the fuse.

WARNING – EXPLOSION HAZARD – Substitution of components may impair suitability for Class I, Division 2

WARNING - The USB parts are for operational maintenance only. Do not leave permanently connected unless area is known to be non-hazardous

WARNING – EXPLOSION HAZARD - BATTERIES MUST ONLY BE CHANGED IN AN AREA KNOWN TO BE NON-HAZARDOUS

WARNING - Battery May Explode If Mistreated. Do Not Recharge, Disassemble or Dispose Of In Fire

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

- a. All applicable codes and standards need to be followed in the installation of this product.
- b. For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG or larger.

Adhere to the following safety precautions whenever any type of connection is made to the module.

- a. Connect the green safety (earth) ground first before making any other connections.
- b. When connecting to electric circuits or pulse-initiating equipment, open their related breakers. Do not make connections to live power lines.
- c. Make connections to the module first; then connect to the circuit to be monitored.
- d. Route power wires in a safe manner in accordance with good practice and local codes.
- e. Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.
- f. Ensure hands, shoes, and floor is dry before making any connection to a power line.
- g. Make sure the unit is turned OFF before making connection to terminals. Make sure all circuits are de-energized before making connections.
- h. Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.

1.2 Grounding

Grounding is covered in various chapters within this manual.

1.3 CE Compliance

To check for compliance and updates, visit our website at:

<http://www.heapg.com> or <http://www.horner-apg.com>

CHAPTER 2: INTRODUCTION

2.1 Visual Overview of X5 OCS



- 1 – Virtual function keys slide in from the right on command
- 2 – 4 DC inputs, 4 analog inputs
- 3 – RS232/RS485 serial port
- 4 – USB A port
- 5 – 4 DC outputs
- 6 – Wide-range DC power
- 7 – CAN port (via RJ45)
- 8 – Ethernet LAN port
- 9 – High capacity microSD slot
- 10 – USB mini-B port

2.1.1 Where to Find Information about the X5 OCS

- a. **Datasheets** - The **datasheets are the first documents you need to refer to for key information** related to specific X5 OCS models.

The datasheets for all X5 OCS models are available on our website.

Datasheets contain pin-outs, jumper settings and other model specific information.

- b. **User Manual** -This manual provides general information that is common to X5 OCS models and can be downloaded from our web. Visit our website at <http://www.heapg.com> to obtain user documentation and updates.

2.1.2 *Four main types of information are covered in the manual.*

- a. Safety and Installation guidelines / instructions (Mechanical and Electrical)
- b. Descriptions of hardware features
(Serial ports, Removable Media, Communication Options, etc.)
- c. Configuration and Use of the X5 OCS
- d. Maintenance and Support

2.1.3 *Manual Index*

[Index](#)

Major topics of interest may be found in the [Index](#) towards the end of this manual.

2.1.4 *Table of Figures*

[Table of Figures](#)

Location of important drawing, illustrations (etc) may be found in the [Table of Figures](#) .

2.2 Connectivity to the X5 OCS

The X5 OCS has excellent capabilities for connecting to a variety of devices. The diagram below shows some examples of devices that can be used with the X5 OCS.

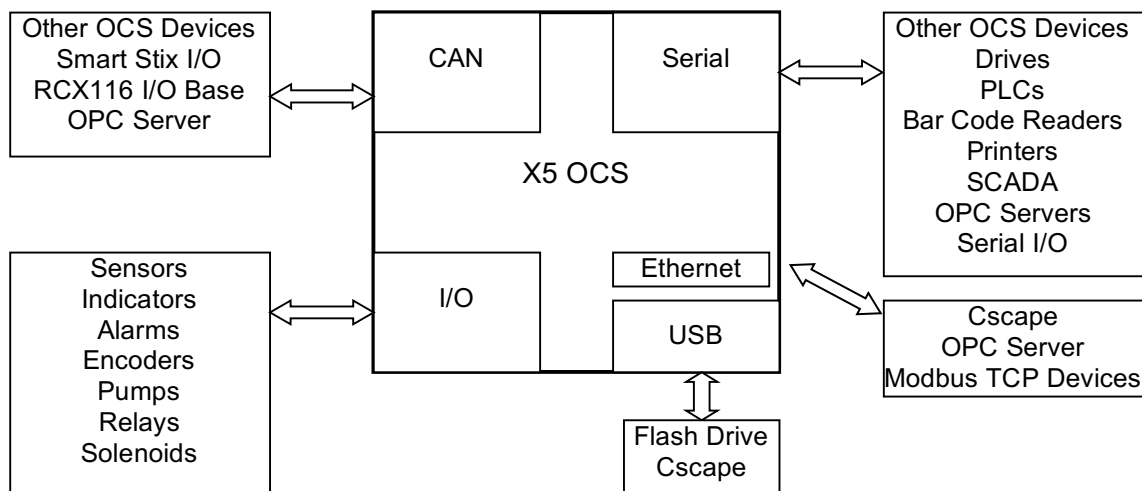


Figure 2.3 – Visual Overview of Types of Devices that can be connected to X5 OCS

2.3 Features of X5 OCS

The X5 OCS are all-in-one industrial control devices. They combine control, user interface, I/O and networking into a single, integrated package. Unique features of the X5 OCS include:

- Bright, 65K color graphical touch sensing LCD display.
- Display of complex graphical objects including trends, gauges, meters and animations.
- High performance graphic processing
- Advanced control capabilities including floating point, multiple auto-tuning PID loops and string handling capabilities.

- Removable media for FAT32 format (up to 2TB) of storage of programs, data logging or screen captures.
- CsCAN networking port for communication with remote I/O, other controllers or PCs.
- High speed USB port for communication with PCs and programming of controller.
- Configurable serial protocols for communication to drives, PLCs, or other serial peripherals.
- Full featured, built-in I/O including high resolution analog, high speed counter inputs, and PWM outputs.
- Advanced high speed I/O capabilities
- Cscape programming software that allows all aspects of the X5 OCS to be programmed and configured from one integrated application.
- On board Ethernet port (10/100Mbps) for Cscape programming and application defined communication, with Auto MDI/MDI-X.

2.4 Required and Suggested Accessories

The following list contains a *sampling* of required and suggested X5 OCS accessories. Visit our website to view updates on new products and accessories.

Note: The X5 OCS is not shipped with a programming cable in the box. To obtain a programming cable, order HE500CBL300.

| Table 2.1 – X5 OCS Accessories | |
|--------------------------------|---|
| Part Number | Description |
| HE-MC1 | Removable Media card - compatible with X5 OCS. Card capacity is 2 GB or larger. |
| HE-MR1 | Media Card Reader for HE-MC1. Portable device allows HE-MC1 to be plugged into the USB port of personal computers as a portable hard drive. |
| HE-X24-AS | Power supply 100-240VAC or 140-340VDC Switching supply that outputs 1.5 A / 3 A (HE-X24-AS/AL) at 24 VDC. Mounts on Standard DIN rail. Designed for X Family products. |
| HE-X24-AL | Power supply 100-240 VAC or 140-340 VDC Switching supply that outputs 1.5 A / 3 A (HE-X24-AS/AL) at 24VDC. Mounts on Standard DIN rail. Designed for X Family products. |
| HECSP | Cscape Software Package on a reusable USB flash drive with symbol library. |
| HE-XCK | Programming cables for all X products including a USB to serial adapter in a travel case. |
| HE-CPK | Cscape on a reusable usb flash drive, Programming cables for all X products including a USB to serial adapter in a travel case. |

2.5 Useful Documents and References

The following information serves as a *general* listing of Horner controller products and other references of interest with their corresponding manual numbers. Visit our website to obtain user documentation and updates.

| Table 2.2 – OCS Reference Document numbers | |
|---|---------------|
| Note: This list is <u>not</u> intended for users to determine which products are appropriate for their application; controller products differ in the features that they support. If assistance is required, refer to Technical Support. | |
| Controllers | Manual Number |
| Ethernet Supplement | SUP0740 |
| CAN Networks | MAN0799 |
| Spark Quenchers (output protection) | MAN0962-01-EN |
| Wiring Accessories and Spare Parts Manual | MAN0347 |
| X5 Datasheet | MAN1040 |

CHAPTER 3: MECHANICAL INSTALLATION

Note: The datasheet is the first document you need to refer to for model-specific information related to X5 OCS models such as pin-outs, jumper settings, and other key installation information. Visit our website to obtain datasheets, user documentation, and updates.

3.1 Overview

The mechanical installation greatly affects the operation, safety and appearance of the system. Information is provided to mechanically install the unit such as cut-out sizes, mounting procedures and other recommendations for the proper mechanical installation of the unit.

3.2 Mounting Requirements

3.2.1 Mounting Procedures (Installed in a Panel Door)

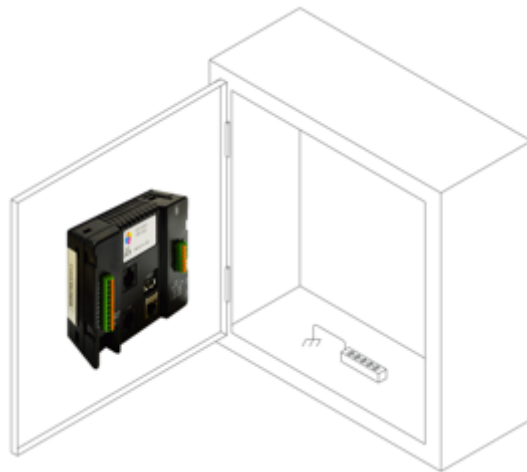


Figure 3.1 – Panel Mounting of an X5 Series OCS

Once the panel design has been completed using the criteria and suggestions in the following sections, use the following steps to panel mount the X5 OCS.

1. Remove all connectors from the X5 OCS unit.
2. Make sure the gasket is installed on the X5 OCS and is free from dust and debris. Check that the corners of the gasket are secure.
3. Pass the unit through the panel.
4. Insert the each of the four (**4**) mounting clips into the slots in the X5 OCS case. One clip should be installed on each corner. Lightly tighten each screw so the clip is held in place.
5. Tighten the screws on the clips such that the gasket is compressed against the panel. Recommended torque is 4 ft lb (5.4 N m).

3.3 Mounting Orientation

3.3.1 X5 OCS Mounting Orientation



NOTE: For panel mounting:
The orientation shown above provides for optimum readability of the screen and ease of use of the keypad.

Figure 3.3 – Orientation of X5 OCS

3.4 Panel Cut-Out

For installations requiring NEMA4X liquid and dust protection the panel cutout should be cut with a tolerance of $\pm 0.005"$ (0.1 mm).

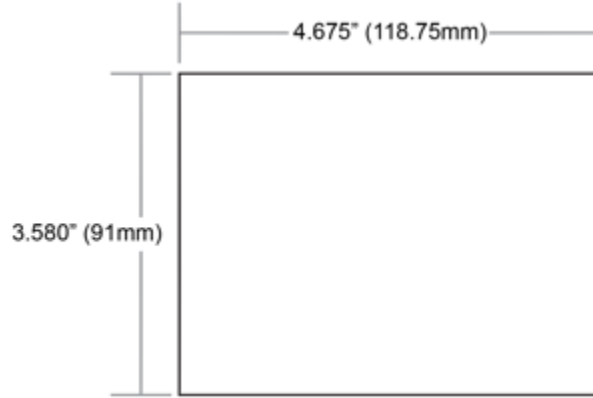


Figure 3.4 – Panel Cutout Tolerances

3.5 X5 Dimensions

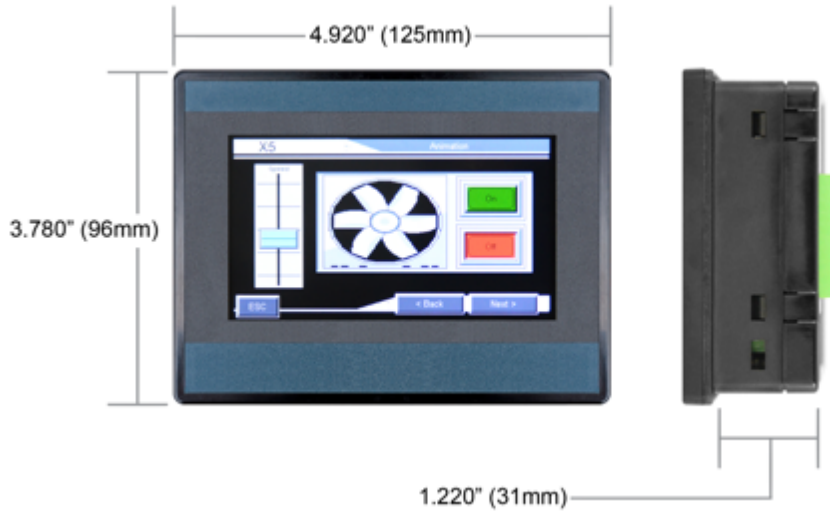


Figure 3.5 – X5 OCS Dimensions

3.6 Factors Affecting Panel Layout Design and Clearances

Warning: It is important to follow the requirements of the panel manufacturer and to follow all 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.

3.6.1 Clearance / Adequate Space

Install devices to allow sufficient clearance to open and close the panel door.

| Table 3.1 – 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 the OCS.) | 2 inches (50.80mm) |

3.6.2 Grounding

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

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

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

3.6.3 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.

3.6.4 *Orientation*

When panel-mounted, there are no orientation restrictions on the X5 OCS.

3.6.5 *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 X5 OCS and noisy devices such as relays, motor starters, etc.

For details on output protection, especially when using contactors, solenoids... see MAN0962 on "Spark Quenchers".

3.6.6 *Shock and Vibration*

The X5 OCS has been designed to operate in typical industrial environments that may inflict some shock and vibration on the unit. For applications that may inflict excessive shock and vibration please use proper dampening techniques or relocate the X5 OCS to a location that minimizes shock and/or vibration.

3.6.7 *Panel Layout Design and Clearance Checklist*

The following list provides highlights of panel layout design factors:

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

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

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

___ Are minimum clearance requirements met? 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 X5 OCS?

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

___ Are noise suppression devices or isolation transformers required? Is there adequate distance between the base of the X5 OCS and noisy devices such as relays or motor starters? Ensure that power and signal wires are not routed in the same conduit.

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

NOTES

CHAPTER 4: ELECTRICAL INSTALLATION

Note: The datasheet is the first document you need to refer to for model-specific information related to X5 OCS models such as pin-outs, jumper settings, and other key installation information. Visit our website to obtain datasheets, user documentation, and updates.

4.1 Grounding Definition

Ground: The term **Ground** is defined as a conductive connection between a circuit or piece of equipment and the earth. Grounds are fundamentally used to protect an application from harmful interference causing either physical damage such as by lightning or voltage transients or from circuit disruption often caused by radio frequency interference (RFI).

4.2 Ground Specifications

Ideally, a ground resistance measurement from equipment to earth ground is 0 ohms. In reality it typically is higher. The U.S. National Electrical Code (NEC) states the resistance to ground shall not exceed twenty-five (25) ohms. Horner APG recommends *less than* fifteen (15) ohms resistance from our equipment to ground. Resistance *greater than* twenty-five (25) ohms can cause undesirable or harmful interference to the device.

4.3 How to Test for Good Ground

In order to test ground resistance, a Ground Resistance Tester must be used. A typical Ground Resistance Meter Kit contains a meter, two or three wire leads, and two ground rods. Instructions are supplied for either a two-point or three-point ground test.

Figure 4.1 shows a two-point ground connection test.

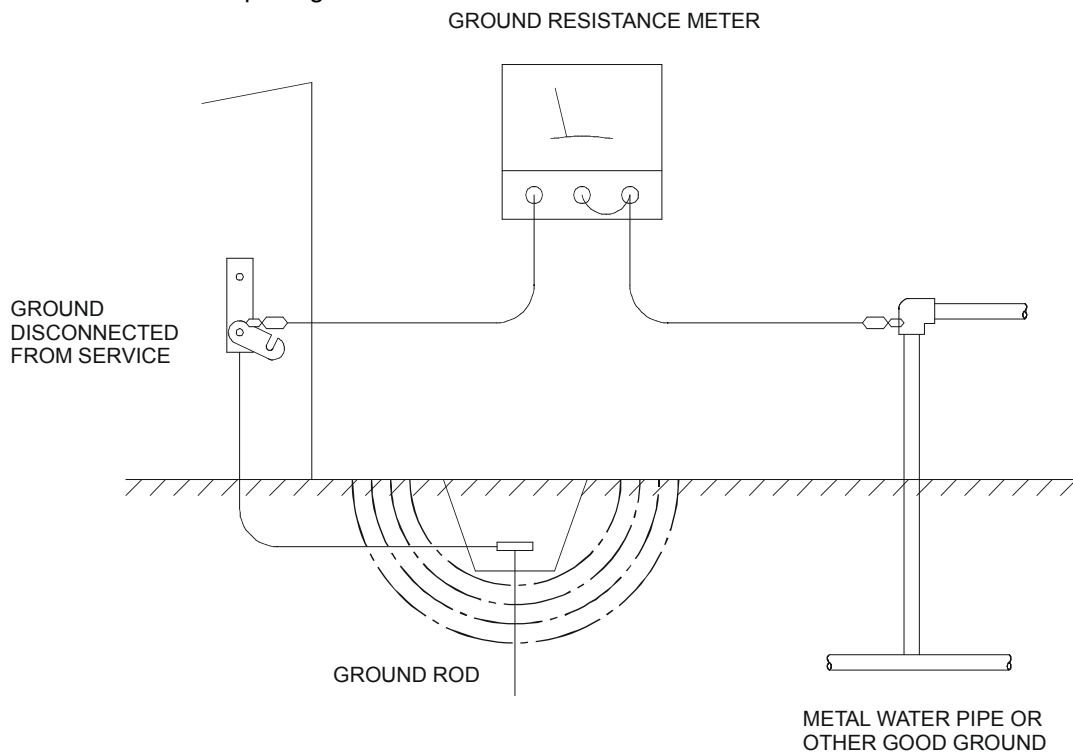

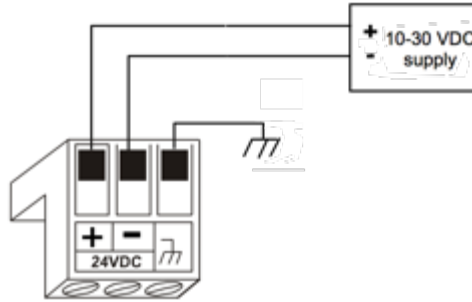


Figure 4.1 – Two-Point Ground Connection Test

4.4 Primary Power Port

| Table 4.1 – Primary Power Port Pins | | |
|-------------------------------------|---|-------------------------------------|
| Pin | Signal | Description |
| 1 |  | Frame Ground |
| 2 | 0V | Input power supply ground |
| 3 | +24V | Input power supply positive voltage |



Power Connector

Power Up:
 Connect to Earth Ground.
 Apply 10 – 30 VDC.
 Torque rating 4.5 - 7 Lb-In
 (0.50 – 0.78 N-m)

Figure 4.2 – Power Connector (Primary Power Port)

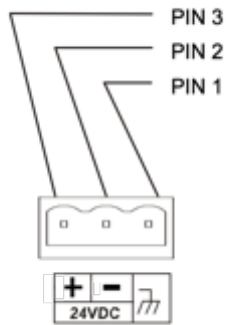


Figure 4.3 – Primary Power Port as Viewed Looking at the X5 OCS

CHAPTER 5: SERIAL COMMUNICATIONS

5.1 Overview

All X5 OCS models provide two serial ports, which are implemented with a single 8-position modular jack that is labeled **MJ1/2**. The MJ1 serial port is RS-232 while the MJ2 port is RS-485. MJ1 defaults to OCS programming by connecting it to the COM port of a PC running Cscape. In addition, both MJ1 and MJ2 can be used for application-specific communication, using a variety of standard data exchange protocols.

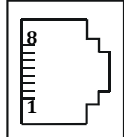
5.2 Port Descriptions

The MJ1 serial port contains a RS-232 interface with RTS/CTS handshaking.

The MJ2 serial port contains half-duplex RS-485 interface with no handshaking. The MJ2 RS-485 interface provides switchable termination and bias resistors internally.

5.3 Wiring and Dip Switches

If needed, wiring for MJ1/2 can easily be broken out into 8 separate screw terminals using the HE200MJ2TRM adapter.



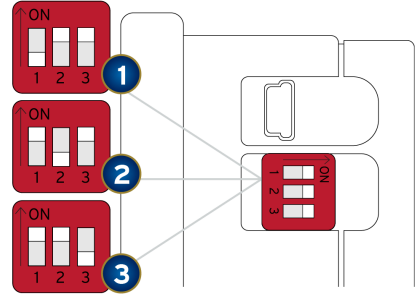
MJ1/2 Serial Ports

MJ1: RS-232 w/Full Handshaking

MJ2: RS-485 Half-Duplex

Two Serial Ports on One Modular Jack (8posn)

| Pin | MJ1 Pins | | MJ2 Pins | |
|-----|----------|-----------|-----------|-----------|
| | Signal | Direction | Signal | Direction |
| 8 | TXD | OUT | - | - |
| 7 | RXD | IN | - | - |
| 6 | 0 V | Ground | 0 V | Ground |
| 5 | +5V@60mA | OUT | +5V@60mA | OUT |
| 4 | RTS | OUT | - | - |
| 3 | CTS | IN | - | - |
| 2 | - | - | RX- / TX- | IN / OUT |
| 1 | - | - | RX+ / TX+ | IN / OUT |



| Switch | Name | Function | Default |
|--------|--------------------|-----------------|---------|
| 1 | RS-485 Termination | ON = Terminated | OFF |
| 2 | CAN Termination | ON = Terminated | OFF |
| 3 | Factory Use | Always Off | OFF |

5.4 RS-485 Termination

Proper RS-485 termination minimizes reflections and improves reliability.

The 485 serial port allows an internal RS-485 termination resistor to be placed across pins 1 and 2 by DIP Switch Setting.

Only the two devices physically located at the endpoints of the RS-485 network should be terminated.

5.5 RS-485 Biasing

RS-485 biasing passively asserts a line-idle state when no device is actively transmitting, which is useful for multi-drop RS-485 networking.

The 485 serial ports allow internal RS-485 biasing resistors to be switched in, pulling pin 1 up to 3.3V and pulling pin 2 down to ground. The **Set Serial Ports** item in the **System Menu** can be used to enable RS-485 biasing. Also, application code that sets or resets %SR164.1 enables or disables MJ2 biasing.

If biasing is used, it should be enabled in only one of the devices attached to the RS-485 network.

5.6 CAN Termination

Proper CAN bus termination minimizes reflections and improves reliability.

The CAN port allows an internal termination resistor to be placed across the CAN_H and CAN_L connections by DIP Switch Setting.

Only the two devices physically located at the endpoints of the CAN bus should be terminated.

5.7 Cscape Programming via Serial Port

The X5 OCS MJ1 serial port supports CsCAN Programming Protocol. If a PC COM port is connected to the X5 OCS MJ1 serial port, Cscape can access the X5 OCS for programming and monitoring. Programming can also be done via the CAN port, USB port or Ethernet.

5.8 Ladder-Controlled Serial Communication

Using Serial Communication function blocks, both MJ1 and MJ2 support Generic, Modbus Master and Modbus Slave Protocols. In addition, external modems can be connected and accessed using Init, Dial and Answer Modem function blocks.

5.9 Downloadable Serial Communication Protocols

Both MJ1 and MJ2 also support downloadable protocols, such as Allen Bradley DF1, CsCAN Master, GE Fanuc SNP and Modbus Master.

Note: Refer to the download section of our website for the list of latest supported protocols.

CHAPTER 6: CAN COMMUNICATIONS

Note: For additional CAN information, refer to the CAN Networks manual (search MAN0799-01) at <http://www.heapg.com>.

6.1 Overview

The X5 OCS provides a CAN networking port, which is implemented with an 8-position modular jack. The connector is labeled **CAN**.



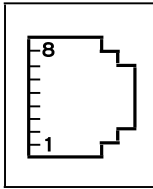
Figure 6.1 – CAN Connector

Like the MJ1 serial port, the CAN port can be used for X5 OCS programming by connecting it to the CAN port of a PC running Cscope. The CAN port also allows the X5 OCS to exchange global data with other OCS/RCS controllers and to access remote Network I/O devices (SmartStix, Smart Blocks and Smart Rail Modules).

6.2 Port Description

The X5 OCS CAN1 port implements the ISO 11898-2 physical layer and the CAN 2.0A data link layer standards. Also, since the CAN port is powered by an internal isolated power supply, external CAN power is not required.

6.3 CAN Port Wiring



| PIN | SIGNAL | DIRECTION |
|-----|---------------|-----------|
| 8 | No Connection | - |
| 7 | Ground | - |
| 6 | Ground | - |
| 5 | Ground | - |
| 4 | Ground | - |
| 3 | Ground | - |
| 2 | CAN Data Low | IN/OUT |
| 1 | CAN Data High | IN/OUT |

Figure 6.2 – CAN Port Connector

6.4 Cscape Programming via CAN

The CAN port supports CsCAN Programming Protocol. If a PC has a CAN interface installed (via PCI card or USB), and the PC CAN port is connected to the X5 OCS CAN port, Cscape can access the X5 OCS for programming and monitoring.

In addition, the X5 OCS supports single-point-programming of all X5 OCS and other OCS/RCS devices that are connected to a CAN network. If the PC COM port is connected to the X5 OCS MJ1 serial port, the X5 OCS can act as a pass-through gateway allowing Cscape to access all X5 OCS and OCS/RCS devices that are attached to the CAN network.

6.5 Ladder-Controlled CAN Communication

Using Put and Get Network Words function blocks, the CAN port can exchange digital and analog global data with other OCS/RCS devices (nodes) attached to the CAN network.

In addition, Put and Get Network Heartbeat function blocks allow nodes on the CAN network to regularly announce their presence and to detect the presence (or absence) of other nodes on the network.

6.6 Using CAN for I/O Expansion (Network I/O)

Connecting Network I/O devices (SmartStix, SmartBlock or SmartRail) to the X5 OCS CAN port allows the X5 OCS I/O to be economically expanded and distributed. A variety of modules are available for this purpose.

CHAPTER 7: ETHERNET COMMUNICATION

7.1 Ethernet Module Protocols and Features

The following table describes the Ethernet Module Protocols and features supported by X5.

| Protocol / Feature | Protocol / Feature Description |
|--------------------------|--|
| ICMP Ping | Internet Control Message Protocol |
| EGD (Peer) | GE Fanuc Ethernet Global Data |
| SRTP Server | GE Fanuc Service Request Transfer Protocol |
| CsCAN TCP Server | Horner APG CsCAN over Ethernet |
| Modbus TCP Client | Modbus over Ethernet |
| Modbus TCP Server | Modbus over Ethernet |
| Ethernet / IP Client | ODVA CIP over Ethernet |
| Ethernet / IP Server | ODVA CIP over Ethernet |
| FTP Server | File Transfer Protocol |
| HTTP Server | HyperText Transfer Protocol (Web Server) |
| ASCII over TCP/IP Server | ASCII Data over Ethernet |
| SMTP Client | E-mail Send capabilities |

7.2 Ethernet Module Specifications

| | |
|-----------------------------|--|
| Speeds | 10 BaseT Ethernet (10-Mbps) 100 BaseTx Fast Ethernet (100-Mbps) |
| Modes | Half or Full Duplex |
| Auto-Negotiation | Both 10/100-Mbps and Half/Full Duplex |
| Connector Type | Shielded 8-position Modular Jack |
| Cable Type (Recommended) | CAT5 (or better) UTP |
| Port | Auto MDI/MDI-X (Auto Crossover) |

7.3 Ethernet Module Configuration

Note: The following configuration is required for all applications regardless of the protocols used. Additional configuration procedures must be performed for each protocol used.

To configure the Ethernet Module, use Cscape Programming Software to perform the following steps

1. On the main Cscape screen, select the **Controller** menu and its **I/O Configure** sub-menu to open the I/O Configuration dialog (Figure 7.1)
2. If configuring a different OCS Model than the one shown in the I/O Configuration dialog, select the correct Series, Device Type, and Model #

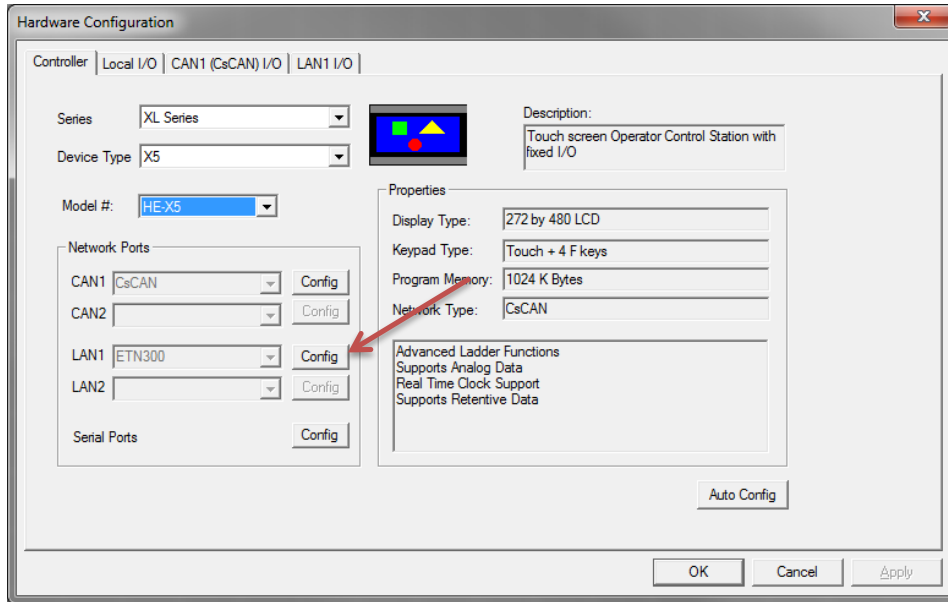


Figure 7.1 – I/O Configuration Dialog

3. Click the **Config** button to the right of the LAN1 Network Port, revealing the Ethernet Module Configuration dialog as shown in Figure 7.2

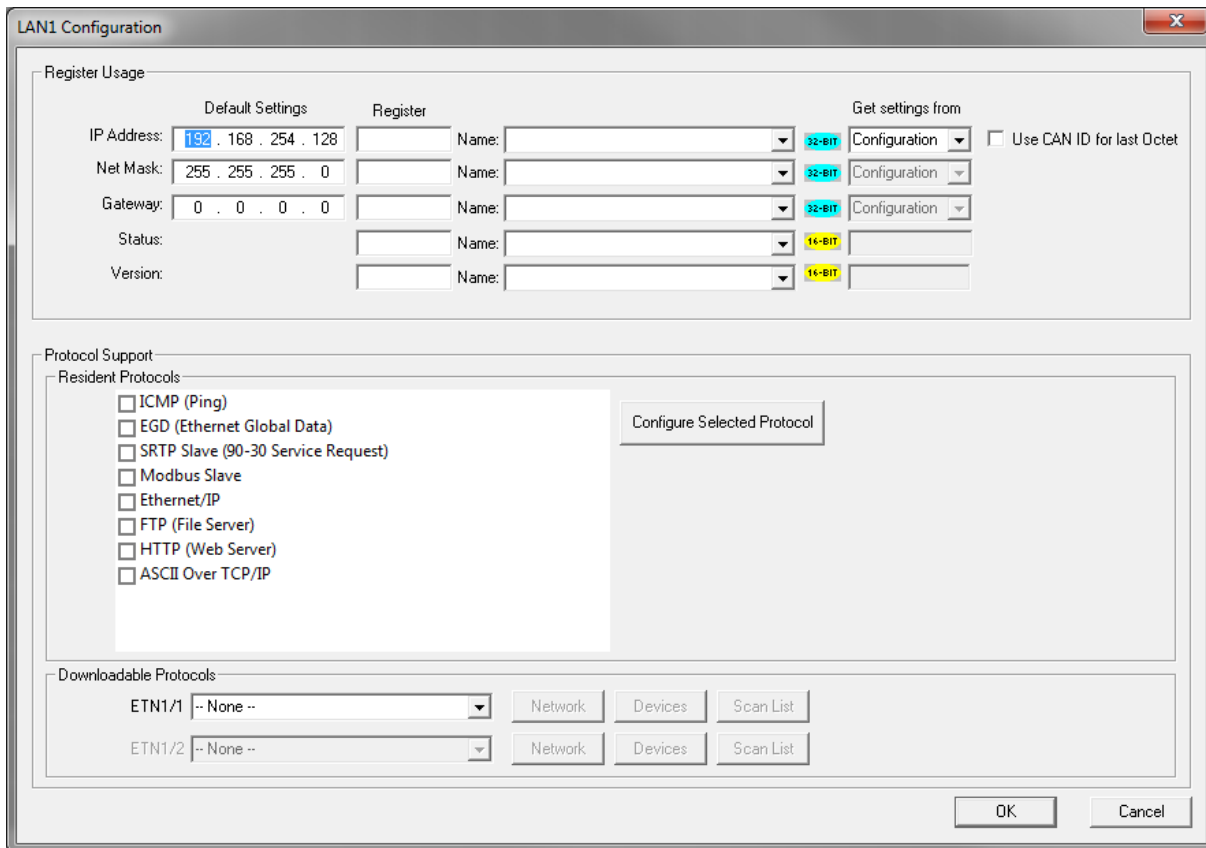


Figure 7.2 – Ethernet Module Configuration

4. Configure the Ethernet Module parameters as follows:

IP Address: Enter the static IP Address for the Ethernet Module being configured.

Note: IP Addresses are entered as four numbers, each ranging from 0 to 255. These four numbers are called octets and they are always separated by decimal points.

Net Mask: Enter the Net Mask (sometimes called Subnet Mask) being used by all nodes on the local network. Typical local networks use Class C IP Addresses, in which case the low octet (rightmost number) is used to uniquely identify each node on the local network. In this case, the default Net Mask value of 255.255.255.0 should be used.

Gateway: Enter the IP Address of a Gateway Server on the local network that allows for communication outside of the local network. To prevent the Ethernet Module from communicating outside the local network, set the Default Gateway IP Address to 0.0.0.0 (the default setting).

Status Register: Optionally enter an OCS Register reference (such as %R100) to indicate which 16-bit OCS register will have the Ethernet Status word written to it. Table 7.1 shows how this register value is formatted and explains the meaning of each bit in the Status Word.

| Table 7.1 - Ethernet Status Word Register Format | | | | | | | | | | | | | | | |
|--|--------|--|--------|--------|--------|--------|-------|------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| High Byte | | | | | | | | Low Byte | | | | | | | |
| Bit 16 | Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 |
| 0 | 0 | Dup | Spd | 0 | Rx | Tx | Link | TCP Connections | | | | | | | |
| Status Bit(s) | | Status Indication | | | | | | Status Values | | | | | | | |
| 0 | | Reserved | | | | | | Always 0 | | | | | | | |
| Dup | | Link Duplex (Auto-Negotiated) | | | | | | 0 = Half Duplex 1 = Full Duplex | | | | | | | |
| Spd | | Link Speed (Auto-Negotiated) | | | | | | 0 = 10 MHz 1 = 100 MHz | | | | | | | |
| Rx | | Receive State | | | | | | 0 = Inactive 1 = Active | | | | | | | |
| Tx | | Transmit State | | | | | | 0 = Inactive 1 = Active | | | | | | | |
| Link | | Link State | | | | | | 0 = Down 1 = Up | | | | | | | |
| TCP Connections | | Total Number of Active TCP Connections (CsCAN, Modbus, EIP, FTP, HTTP, etc.) | | | | | | 0 40 | | | | | | | |

Version Register: Optionally enter an OCS Register reference (such as %R101) to indicate which 16-bit OCS register will have the Ethernet Firmware Version written to it. For example, for Ethernet Firmware Version 4.30, the Version register will contain 430. This version will only change with a complete controller Firmware Update.

Ethernet Module Register Usage - Standard Configuration

To perform a Standard Configuration, fill in the **IP Address**, **Net Mask**, and **Gateway** with addresses that are valid for the network to which the controller is connected. If desired, registers may be specified in which these settings will be reflected. Leave the **Get settings from** selection set to **Configuration**.

Optionally, check the **Use CAN ID for last Octet** box in order to leave the last octet of the IP Address editable by way of changing the controllers CAN ID. This does not affect the Net Mask or Gateway settings.

Note that **Get settings from** may be specified for **Configuration** or **Register**.

If set to **Configuration**, addresses will be obtained from the Default Settings column. They may temporarily be changed via the X5 System Menu (Chapter 12), which is useful to obtain an Ethernet connection initially. These temporary settings will revert to those configured in Cscape each time the controller is placed in RUN mode, i.e. after a program download or upon power-up.

If set to **Register**, addresses will be obtained from the configured register only, whether via the application code or a data field on the touchscreen or any combination thereof. The Default Settings column is ignored in this case. The X5 System Menu will reflect the current addresses, but the addresses may not be edited from the System Menu.

Ethernet Module Protocol Configuration

The Protocol Support area contains a list of the resident protocols supported by the platform being configured. To activate a protocol, check its checkbox.

For protocols that require additional configuration, click on a listed protocol to select it and then click the Configure Selected Protocol button. This will open a new dialog with configuration options for the selected protocol.

For detailed information on individual protocol configuration refer to the latest version of the Ethernet Supplement... Search for "ETN300" on <http://www.heapg.com> and select the **SUP0740** document

NOTES

CHAPTER 8: REMOVABLE MEDIA

8.1 Overview

All X5 OCS models provide a Removable Media slot, labeled **Memory Card**, which supports standard Micro SD Flash memory cards. Micro SD cards can be used to save and load applications, to capture graphics screens and to log data for later retrieval.



Figure 8.1 – Removable Micro SD Memory Card Slot

8.2 Micro SD Cards

When the Micro SD card format was introduced, it was originally called TransFlash. Cards labeled either Micro SD or TransFlash, with up to 32 GB of Flash memory, are compatible with the X5 OCS Memory slot (larger sizes were not tested at time of publication).

The Memory slot is equipped with a “push-in, push-out” connector and a Micro SD card can be safely inserted into the Memory slot whether the X5 OCS power is On or Off.

To install a Micro SD card: Align its 8-pin gold edge connector down, facing the front of the X5 OCS unit as shown in **Figure 8.2**; then carefully push it all the way into the Memory slot. Ensure that it clicks into place.

To remove the Micro SD card: Push down on the top of the card gently to release the spring. The card pops up for removal.



Figure 8.2 – Installing Removable Memory Card

8.3 Micro SD File System

The Micro SD Memory slot uses the PC-compatible FAT32 File System. This means that a PC, with a Micro SD-compatible card reader, can read files that have been written by the X5 OCS and can write files that can be read by the X5 OCS.

However, the X5 OCS does not support long filenames, but instead implements the 8.3 filename format. This means that all file and directory names must consist of up to 8 characters, followed by an optional dot, and an optional extension with up to 3 characters.

Directories and sub-directories can be nested up to 16 levels deep as long as each pathname string does not exceed 147 characters.

8.4 Using the Removable Media Manager

The Removable Media Manager is an interactive X5 OCS screen that performs the following functions:

- a. Display number of total and free K bytes
- b. Browse file and directory lists
- c. Delete files and directories
- d. Format a Micro SD card
- e. Load and save application programs
- f. View screen capture bitmaps

The Removable Media Manager can be accessed via the System Menu or by using Cscope to place a Removable Media Manager object on an application graphics screen.

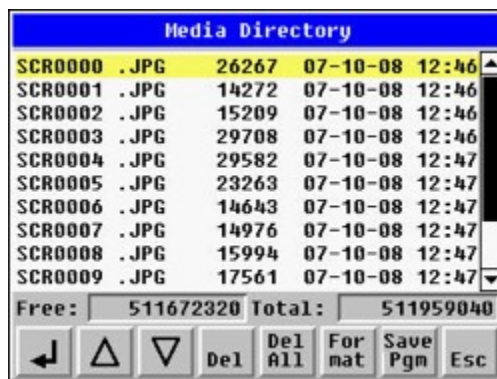


Figure 8.3 – Removable Media Submenu

8.5 Using Removable Media to Log Data


Using Read and Write Removable Media function blocks, an application ladder program can read and write X5 OCS register data in the form of comma-delimited files, with a .CSV extension. These files are compatible with standard database and spreadsheet PC programs. In addition, an application ladder program can use Rename and Delete Removable Media function blocks to rename and delete files.

8.6 Using Removable Media to Load and Save Applications

A special file type, with a .PGM extension, is used to store X5 OCS application programs on Micro SD.

To load an application from Micro SD to the X5 OCS, use the Removable Media Manager (open the Removable Media Manager in the System Menu) to find and highlight the desired .PGM file, and then

press the Enter key. 


To save an application from the X5 to Micro SD, open the Removable Media Manager in the System Menu and press the Save Pgm  function key. The application will be saved in a file called **DEFAULT.PGM** in the Micro SD root directory.

Note: Saving an application to Micro SD can only be done from the Removable Media System Menu and is not available on a Removable Media Manager object that was placed on an application graphics screen by Cscope.

Cscope can also save an application directly to a Micro SD card, which is plugged into the PC's Micro SD compatible card reader by selecting the Export to Removable Media item on the Cscope File menu.

8.7 Using Removable Media to View and Capture Screens

The X5 OCS File System uses bitmap files with the .BMP extension or JPEG files with the .JPG extension to store X5 OCS graphic screen captures.

To view a captured X5 OCS screen, use the Removable Media Manager to find and highlight the desired .BMP or .JPG file, and then press Enter. 

To capture an X5 OCS screen, turning On the assigned **Screen Capture Control Register** will capture the current X5 OCS graphics screen and write it to the Micro SD card using the assigned **Screen Capture Filename**.

Before capturing an X5 OCS screen, Cscope must first be used to assign a **Screen Capture Control Register** and **Filename** in the application. To do this, first open the Graphics Editor by selecting the **View / Edit Screens** item on the Cscope **Screens** menu. Next select the **Screen Capture** item of the Graphics Editor Config menu and then enter a **Control Register** and **Filename**.

8.8 Removable Media (RM) Function Blocks in Cscope

Note: For detailed information regarding RM function blocks and parameters, refer to the help file in Cscope Software. Refer 'USB Flash Media support for RM Functions' for USB flash drive access details.

The following RM functional blocks are available in Cscope Software. These function blocks will reference

- Micro SD when filename is prefixed with 'A:' or nothing OR
- USB A Flash Drive when filename is prefixed with 'B:'.

a. Read RM csv

This function allows reading of a comma-separated value file from the Micro SD interface into the controller register space.

b. Write RM csv

This function allows writing of a comma-separated value file to the Micro SD interface from the controller register space.

c. Rename RM csv: This function allows renaming a file on the RM card. The data in the file is not

changed.

d. Delete RM csv: This function allows deleting a file on the RM card.

e. Copy RM csv: This function allows copying a file on the RM card. The data in the file is not changed.

8.9 Filenames used with the Removable Media (RM) Function Blocks

The RM function blocks support the flash with a DOS/Windows standard FAT-16 file system. All names must be limited to the "8.3" format where the filename contains eight characters a period then a three-character extension.

The entire filename including any path must be less than or equal to 147 characters.

When creating filenames and directories it is sometimes desirable to include parts of the current date or time, or even the screen number in the case of screen capturing. There are special symbols that can be entered into a filename that are replaced by the OCS as follows.

| Table 8.1 – Filename Special Symbols | | |
|--------------------------------------|---|-----------------------|
| Symbol | Description | Example |
| \$Y | Substitutes the current 2 digit year | 2004 = 04 |
| \$M | Substitutes the current month with a 2 digit code | March = 03 |
| \$D | Substitutes the current day | 22 nd = 22 |
| \$h | Substitutes the current hour in 24 hour format | 4 pm = 16 |
| \$m | Substitutes the current minute | 45 = 45 |
| \$s | Substitutes the current second | 34 = 34 |
| \$p | Substitutes 4-digit current screen displayed | Screen 76 = 0076 |

Note that all the symbols start with the dollar sign (\$) character. Date symbols are in upper case, time symbols are in lower case. The following are examples of the substituted time/date filenames:

Current date and time: March 1, 2004 3:45:34 PM; Screen 4 is currently displayed

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

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

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

Filename: captures\SCR\$p.bmp = captures\SCR0004.bmp

8.10 System Registers used with RM

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

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

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

Possible status values are shown in the table:

| Table 8.2 – RM Status Values | |
|------------------------------|--|
| 0 | RM interface OK |
| 1 | Card present but unknown format |
| 2 | No card in slot |
| 3 | Card present, but not supported |
| 4 | Card swapped before operation was complete |
| 5 | Unknown error |

CHAPTER 9: GENERAL I/O

Note: Each X5 OCS unit is sent with a datasheet in the box. The datasheet is the first document you need to refer to **for model-specific information related to X5 OCS models such as pin-outs, jumper settings, and other key installation information.** Visit our website to obtain datasheets, user documentation, and updates.

9.1 Overview

The X5 OCS is a compact unit that contains four (4) digital inputs, four (4) solid-state digital outputs, and four (4) analog inputs. Using the I/O properly requires wiring to the proper terminals and configuring Cscape properly. This section will offer some tips and suggestions to configure the I/O properly. For the register mapping of the I/O, see the Registers and Cscape Configuration chapters for more details.

9.2 Solid-State Digital Outputs

Solid-state digital outputs are generally used to activate lamps, low voltage solenoids, relays and other low voltage and low current devices.

Note: *The digital outputs used on the X5 OCS are “sourcing” outputs.* This means the output applies a positive voltage to the output pin when turned ON. When turned off, the output applies approximately zero volts with respect to the I/O ground.

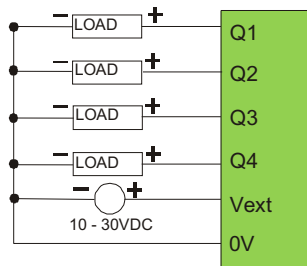


Figure 9.2 – Typical Output Wiring

The digital outputs used in the X5 OCS have electronic short circuit protection and current limiting. While these electronic protections work in most applications, some application may require external fusing on these outputs.

The digital outputs in the X5 OCS are typically controlled via %Q bits in the register mapping. Some of the outputs are designed for high-speed applications and can be used for PWM or frequency output applications. Please see the data sheet and the chapter on High Speed I/O for additional information.

When the controller is stopped the operation of each output is configurable. The outputs can hold the state they were in before the controller stopped or they can go to a predetermined state. By default digital outputs turn off.

For more information on Digital Output configuration and use, see the chapter on Cscape Configuration.

9.3 Digital Inputs

Note: The digital inputs on the X5 OCS are designed for low voltage DC inputs. The inputs are designed to support both positive and negative input modes. The mode is set by a configuration parameter in Cscape. All the inputs on the unit must be configured to the same mode.

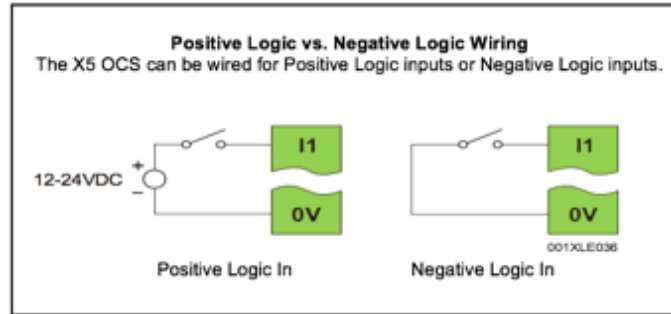


Figure 9.3 – Positive and Negative Inputs

In positive logic mode a positive voltage applied to the input will turn the input ON. The internal design of this mode is basically a resistor from the input to I/O ground. This mode is sometimes called sourcing.

In negative logic mode, connecting the input to the I/O ground or zero volts will turn the input ON. The internal design of this mode is basically a resistor from the input to the positive I/O voltage (usually 12 or 24 volts). This mode is sometime called sinking.

Some of the digital inputs may support high speed input functional such as counting or frequency measurement.

For more information on Digital Input configuration and use, see the chapter on Cscape Configuration.

9.4 Analog Inputs

The analog inputs on the X5 OCS allow voltage or current measurement from a variety of devices. The voltage or current mode is set through settings in Cscape. Each channel can be separately configured for voltage or current mode.

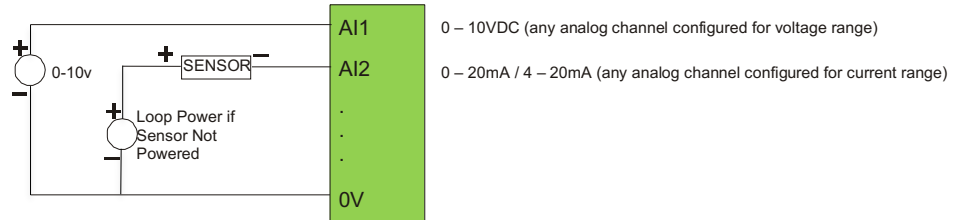


Figure 9.4 – Analog Inputs

The analog inputs have a digital filter that can be used to filter electrical noise that may be unavoidable in some installations. The downside to digital filtering is the inputs will respond more slowly to sudden changes in the actual input.

For more information on Analog Input configuration and use, see the chapter on Cscape Configuration.

CHAPTER 10: HIGH SPEED I/O (HSC / PWM)

10.1 Overview

In addition to the compliment of simple analog and digital I/O, several of the X5 OCS I/O modules support High Speed Counting (HSC) I/O functions and may also support Pulse Width Modulation (PWM) Output functions (non-relay modules). The HSC functions include: internal timing, frequency, totalizing, pulse width/period and quadrature measurement. The PWM functions include: traditional PWM (with variable rate and duty cycle) and a stepper (limited functionality) with variable acceleration and deceleration rates. To determine function availability, refer to the associated model's Specification/Installation sheet (Digital DC Input / Output sections.)

This chapter describes the operation of these high level I/O functions. For configuration details of these functions, see Cscope Configuration.

10.2 Glossary

| | |
|-----------------|--|
| Accumulator | Register used to accumulate or store up a sum or count of many items or events. |
| Clear | A special function to zero out the value in a specific register. (Not used with Frequency or Period Measurement.) |
| Disable | A special function to prevent the counter from running. |
| Encoder | A sensor or transducer for converting rotary motion or position to a series of electronic pulses |
| Frequency Input | The number of times an electromagnetic signal repeats an identical cycle in a unit of time, usually one second. |
| Latch (strobe) | A special function that uses a digital logic circuit to store one or more bits. A latch has a data input, a clock input and an output. When the clock input is active, data on the input is "latched" or stored and transferred to the output register either immediately or when the clock input goes inactive. The output retains its value until the clock goes active again. |
| Marker | Input into the OCS that indicates a particular position. Typically an encoder has a marker output that represents a specific point in the rotation. |
| Polarity | A Polarity pull-down box is associated with each function and indicates the manner in which the trigger happens (e.g., High level, Low Level, Falling Edge, Rising Edge). |
| Preload (load) | A special function used to trigger loading of a value into a register upon an event. (Not used with Frequency or Period Measurement.) |
| Quadrature | A high speed device that expresses the phase relationship between two periodic quantities of the same period when the phase difference between them is one fourth of a period. A coupler in which the two output signals are 90° out of phase. |
| Totalizer | A counter that sums the total number of cycles applied to its input. |

Table 10.1 – Glossary of High Speed I/O Terms

10.3 High Speed Counter (HSC) Functions

The X5 supports up to four very high speed, configurable counters. The four digital inputs may be configured for a number of different options. Each of the counters can run in one of four modes. Those modes are Totalizer, Frequency Counter, Pulse Width Measurement, and Period Measurement. Additionally, one counter may be configured for Quadrature mode when in 2 Counter mode. For some modes, more than one HSC input may be consumed. The measurement values are provided to ladder in an %AI register (see mapping later in this chapter).

10.3.1 Frequency

In frequency mode, the frequency of the input signal is written to the accumulator in terms of Hertz (cycles/second). When using frequency mode, four update selections are provided which specify the width of the sample window. Note that selecting a shorter sample window provides a quicker measurement (faster response) but lowers the frequency accuracy (resolution) and increases the minimum frequency measurement limit. In this mode the Disable and Latch special functions are allowed. Please see section 10.2 for a description of these functions.

10.3.2 Totalize

In totalize mode, the accumulator is simply incremented or decremented each time the input transitions in a specific direction.

The totalizer supports the following modes:

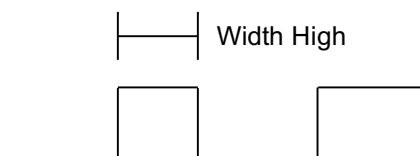
| | |
|---|--|
| Internal | This mode ties the input to the counter to an internal 10MHz or 1MHz clock. The special functions can be used to accurately time events. |
| Count Up | This increments the accumulator when the input is enabled. Note that two inputs can be assigned. Either input can cause the counter to increment. The second input can also be disabled. |
| Count Down | This decrements the accumulator when the input is enabled. Note that two inputs can be assigned. Either input can cause the counter to decrement. The second input can also be disabled. |
| Up/Down (Input 1 Up/Input 2 Down) | In this mode, input 1 (assigned to any of the four inputs) increments the counter, while input 2 (also assigned to any of the 4 inputs) decrements the counter. |
| Clk/Dir (Input 1 Clk, Input 2 Dir) | This mode uses input 1 as a clock signal to increment or decrement the counter and then uses input 2 to decide the direction. Input 2 disabled increments the counter, while input 2 enabled decrements the counter. |

NOTE: the totalize mode enables the Disable, Latch, Preload, and Clear special functions. Please see section 10.2 for details.

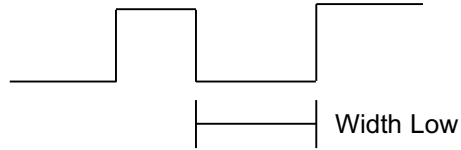
10.3.3 Pulse Width Measurement

In pulse width measurement mode, the high-speed input can measure the width of a pulse stream in one of two modes and provides a continuous indication of the last sampled value. In this mode the Disable and Latch special functions are allowed. Please see section 10.2 for a description of these functions.

Width High 1 μ s Counts – In this sub-mode the accumulator value will contain the number of 1 μ s counts the pulse is high.



Width Low 1 μ s Counts - In this sub-mode the accumulator value will contain the number of 1 μ s counts the pulse is low.

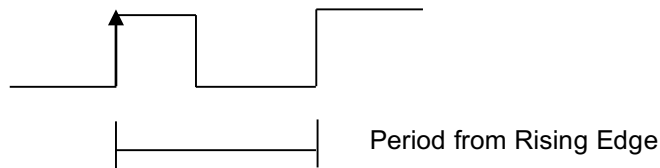


Figures 10.1-10.2 - Pulse Width Measurements, High & Low

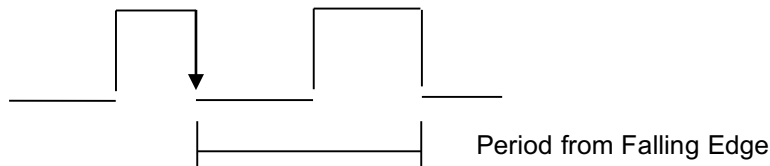
10.3.4 Period Measurement

In period measurement mode, the high-speed input can measure the period of a pulse stream in one of two modes and provides a continuous indication of the last sampled value. In this mode the Disable and Latch special functions are allowed. Please see section 10.2 for a description of these functions.

Period Rising Edges 1 μ s Counts – In this sub-mode the period of the input signal is reported in one (1) μ s units. The period measurement will start on the rising edge of the input.



Period Falling Edges 1 μ s Counts – In this sub-mode the period of the input signal is reported in one (1) μ s units. The period measurement will start on the falling edge of the input.



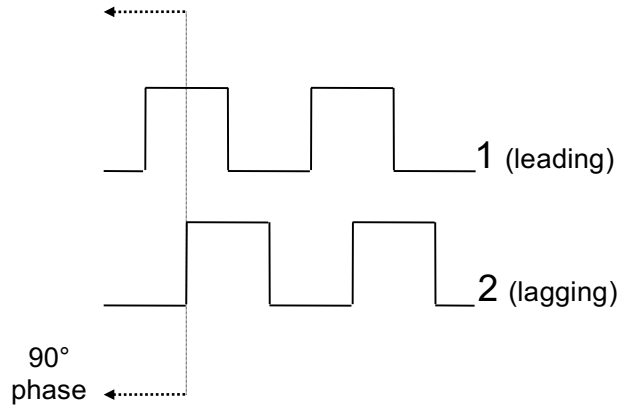
Figures 10.3-10.4 – Period Measurement, Rising Edges & Falling Edges

10.3.5 Quadrature

Quadrature mode uses two HSC inputs; any of the four HSC inputs can be assigned for this purpose.

Quadrature mode works much like the totalizer except the accumulator will automatically increment or decrement based on the rotation phase of the two inputs. See the following example for more details. Quadrature inputs are typically used for reporting the value of an encoder.

Two modes are available for quadrature that select whether the accumulator counts up or down when the phase of input 1 leads input 2. Check the encoder's documentation to determine the output form it uses or try both modes to determine if the encoder counts up when expected.



Figures 10.5 – Quadrature

Using the above waveforms and a HSC input configuration of “Quadrature” - “1 leads 2, count up,” the accumulator will count up when 1 is rising and 2 is low, 1 is high and 2 is rising, 1 is falling and 2 is high, and when 1 is low and 2 is falling. This results in 4 counts per revolution. So in order to determine the number of cycles, the accumulator would have to be divided by 4.

Marker reset operation is configured in the special operations and can be assigned to any of the 4 high speed inputs or can be assigned to be controlled by a “Q” bit in ladder.

Note, the quadrature mode enables the Disable, Latch, Preload, Clear and Marker special functions. Please see section 10.2 for details.

10.3.6 Register Match

All counter modes support a register match function. When the accumulator value matches the Match 1 or Match 2 value setup in %AQ registers a high speed output with either turn on, turn off or toggle based on settings in Cscape.

10.4 HSC Functions Register Map

The register assignments for the high speed I/O can be moved via a setting in Cscope. The values shown are the DEFAULT values and may not match the same starting point as the values shown below.

| Table 11.2 – HSC Functions Register Map | | | | |
|---|-----------|-------|-----------------------------|---------------------|
| Register | Frequency | Pulse | Totalize | Quad |
| %AI5-6 | | | Accumulator - Counter 1 | |
| %AI7-8 | | | Latch Value – Counter 1 | |
| %AI9-10 | | | Accumulator – Counter 2 | |
| %AI11-12 | | | Latch Value – Counter 2 | |
| Counter 1 | | | | |
| %AQ1-2 | | | Preload – Counter 1 | |
| %AQ3-4 | | | Match1 – Counter 1 | |
| %AQ5-6 | | | Match2 – Counter 1 | |
| %AQ7-8 | | | Preload – Counter 2 | |
| %AQ9-10 | | | Match1 – Counter 2 | |
| %AQ11-12 | | | Match2 – Counter 2 | |
| Counter 2 | | | | |
| %I17 | | | Overflow Flag – Counter 1 | |
| %I18 | | | Underflow Flag – Counter 1 | |
| %I19 | | | High Speed Out 1 | |
| %I20 | | | Reserved | |
| %I21 | | | Overflow Flag – Counter 2 | |
| %I22 | | | Underflow Flag – Counter 2 | |
| %I23 | | | High Speed Out 2 | |
| %I24 | | | Reserved | |
| Counter 1 | | | | |
| %Q17 | | | Latch – Counter 1 | |
| %Q18 | | | Preload – Counter 1 | |
| %Q19 | | | Clear – Counter 1 | |
| %Q20 | | | Disable – Counter 1 | |
| %Q21 | | | Direction – Cnt 1 | |
| %Q22 | | | Output Reset – Counter 1 | |
| %Q23 | | | Preload Disable – Counter 1 | |
| %Q24 | | | Latch Disable – Counter 1 | |
| %Q25 | | | | Disable Marker – C1 |
| %Q26 | | | | Latch Marker – C1 |
| %Q27 | | | | Preload Marker – C1 |
| %Q28 | | | | Clear Marker – C1 |
| %Q29-32 | | | Reserved | |
| Counter 2 | | | | |
| %Q33 | | | Latch – Counter 2 | |
| %Q34 | | | Preload – Counter 2 | |
| %Q35 | | | Clear – Counter 2 | |
| %Q36 | | | Disable – Counter 2 | |
| %Q37 | | | Direction – C2 | |
| %Q38 | | | Output Reset – Counter 2 | |
| %Q39 | | | Preload Disable – Counter 2 | |
| %Q40 | | | Latch Disable – Counter 2 | |
| %Q41 | | | | Disable Marker – C2 |
| %Q42 | | | | Latch Marker – C2 |
| %Q43 | | | | Preload Marker – C2 |
| %Q44 | | | | Clear Marker – C2 |

10.5 High Speed Output Functions

On units that support High Speed Output functions, two dedicated outputs are available that can be configured for one of four modes of operation. Those modes are Normal, PWM, HSC Match and Stepper.

10.5.1 Normal

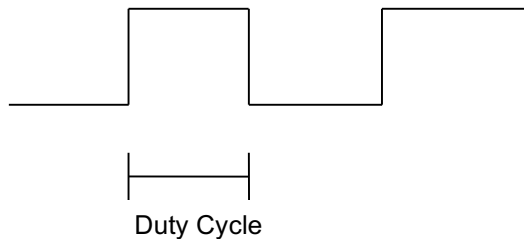
When either Q1 or Q2 is configured for Normal operation, the digital output registers %Q1 and %Q2 drives that respective output.

10.5.2 PWM

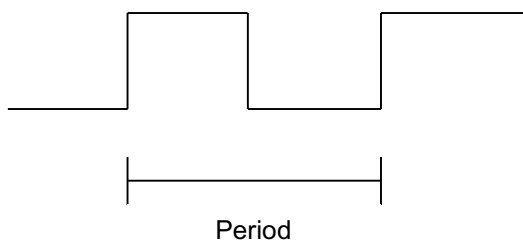
When either Q1 or Q2 is configured for PWM, the PWM function drives that respective output. Both PWM channels may be individually enabled and can have independent frequency and duty cycles.

The PWMs require two parameters (%AQs) to be set for operation. These parameters may be set at run-time.

Duty Cycle - The Duty Cycle is a 32 bit value from 0 to 32,000 indicating the relative duty cycle of the output. For example a value of 8000 would indicate a 25% duty cycle, a value of 16,000 would indicate a 50% duty cycle. 0 turns the output off, 32,000 turns the output on.



Frequency - The Frequency is a 32 bit value indicating the output frequency in Hertz. One over the frequency is the period.



Figures 10.6 & 10.7 – PWM, two parameters, Duty Cycle & Frequency

At controller power-up or during a download, the PWM output is maintained at zero until both the Frequency and the Duty cycle are loaded with non-zero values. When the controller is placed in stop mode, the state of the PWM outputs is dependent on the *PWM State on Controller Stop* configuration. This configuration allows for either hold-last-state or specific frequency and duty cycle counts. Specifying zero for either the period or duty causes the PWM output to remain low during stop mode.

NOTE: The maximum recommended PWM frequency is 500kHz, due to the limitations of built-in output circuitry.

10.5.3 High Speed Counter Match

When either Q1 or Q2 is configured for HSC Output operation, their output state is based on a comparison between the counter accumulator and match registers. See details above in the high speed input section.

10.5.4 Stepper Function

The X5 supports two stepper functions, one on each high speed output.

The Stepper requires five parameters (%AQs) to be set for operation. These parameters may be set at run-time but are 'latched' when the stepper is commanded to start:

| | |
|---|---|
| Start Frequency (pulses per second) | Sets the frequency for the first cycle during the acceleration phase and the frequency of the last cycle during the deceleration phase. When an acceleration or deceleration count is specified, the Start Frequency must be greater than 0 and must not exceed the run frequency or an error is generated. |
| Run Frequency (pulses per second) | Sets the frequency for the last cycle during the acceleration phase, the consistent frequency during the run phase, and the frequency of the first cycle during the deceleration mode. The Run Frequency must be greater than 0 and must not exceed 5000Hz (standard), 400,000Hz (HE-XHSQ) or 1.0 MHz (HE-XHSQ-5) |
| Acceleration Count | Sets the number of cycles to occur within the acceleration phase. The frequency of the cycles within this mode will vary linearly between the specified Start and Run frequency. The Accel count must not equal 1 or an error is generated. Setting this value to zero disables this phase. |
| Run Count | Sets the number of cycles to occur within the run phase. The frequency of the cycles within this mode is constant at the specified Run frequency. The Run count may be any value. Setting this value to zero disables this phase. |
| Deceleration Count | Sets the number of cycles to occur within the deceleration phase. The frequency of the cycles within this phase will vary linearly between the specified Run and Stop frequency. The Decel count must not equal 1 or an error is generated. Setting this value to zero disables this phase. |

The stepper provides two Boolean registers to provide stepper status:

| | |
|-------------------|---|
| Ready/Done | A high indication on this register indicates the stepper sequence can be started (i.e. not currently busy) and also when the move is completed. |
| Error | A high indication on this register indicates that one of the analog parameters specified above is invalid or the stepper action was aborted before the operation was complete. This register is cleared on the next start command if the error was corrected. |

The stepper requires one discrete register to control the stepper action. Setting this register starts the stepper cycle. This register must remain set to complete the entire cycle. Clearing this register before the cycle is complete aborts the step sequence and sets the error bit.

NOTE: Setting the PLC mode to stop while the stepper is in operation causes the stepper output to immediately drop to zero and the current stepper count to be lost.

NOTE: The stepper output level may cause damage or be incompatible with some motor drive inputs. Consult drive documentation to determine if output level and type is compatible.

10.6 High Speed Output Functions Register Map

The register assignments for the high speed I/O can be moved via a setting in Cscope. The values shown are the DEFAULT values and may not match the same starting point as the values shown below.

| Register | PWM | Stepper |
|----------|---------------------------|--------------------------------|
| %AQ21-22 | PWM 1 Duty Cycle (32-bit) | Start Frequency – Stepper 1 |
| %AQ23-24 | PWM 1 Frequency | Run Frequency – Stepper 1 |
| %AQ25-26 | | Acceleration Count – Stepper 1 |
| %AQ27-28 | | Run Count – Stepper 1 |
| %AQ29-30 | | Deceleration Count – Stepper 1 |
| %AQ31-32 | PWM 2 Duty Cycle (32-bit) | Start Frequency – Stepper 2 |
| %AQ33-34 | PWM 2 Frequency | Run Frequency – Stepper 2 |
| %AQ35-36 | | Acceleration Count – Stepper 2 |
| %AQ37-38 | | Run Count – Stepper 2 |
| %AQ39-40 | | Deceleration Count – Stepper 2 |
| %Q1 | | Start Move Bit – Stepper 1 |
| %Q2 | | Start Move Bit – Stepper 2 |
| %I33 | | Ready/Done – Stepper 1 |
| %I34 | | Error – Stepper 1 |
| %I35 | | Ready/Done – Stepper 2 |
| %I36 | | Error – Stepper 2 |

10.7 PWM Examples

| Example 1 | Duty Cycle | Frequency |
|--|-----------------------|-----------------------|
| To get a 50% Duty Cycle @ 10 kHz waveform on PWM1: | Set %AQ21-22 = 16,000 | Set %AQ23-24 = 10,000 |

| Example 2 | Duty Cycle | Frequency |
|--|--|----------------------|
| To get a 50% Duty Cycle on PW1 and 90 % Duty Cycle on PWM2 @ 1 kHz waveform: | Set %AQ21-22 = 16,000 | Set %AQ23-24 = 1,000 |
| | Set %AQ31-32 = 28,800 (<i>duty cycle (32000 * 0.9)</i>) | Set %AQ33-34 = 1,000 |

| Example 3 | Duty Cycle | Frequency |
|--------------------------------------|-----------------------|--------------------------|
| To turn PWM 1 output ON all the time | Set %AQ21-22 = 32,000 | Set %AQ23-24 = Any Value |

| Example 4 | Duty Cycle | Frequency |
|---------------------------------------|------------------|--------------------------|
| To turn PWM 1 output OFF all the time | Set %AQ21-22 = 0 | Set %AQ23-24 = Any Value |

10.8 STP Examples

| Example 1 | Start Frequency | Run Frequency | Accel Count | Run Count | Decel Count |
|-----------------------------------|-----------------------|-----------------------|----------------------------------|----------------------------------|----------------------------------|
| 10,000,000 steps control sequence | Set %AQ21 = 2500 (Hz) | Set %AQ22 = 5000 (Hz) | Set %AQ23-24 = 1,000,000 (Steps) | Set %AQ25-26 = 8,000,000 (Steps) | Set %AQ27-28 = 1,000,000 (Steps) |

When the start bit is energized, the example starts at 2.5 kHz and ramps up to 5 kHz during the first 1,000,000 steps. Then, it runs at 5 kHz for the next 8,000,000 steps. Finally during the last 1,000,000 steps it slows to a stop.

| Example 2 | Start Frequency | Run Frequency | Accel Count | Run Count | Decel Count |
|----------------------------------|----------------------|-----------------------|----------------------------------|----------------------------------|----------------------------------|
| 5,000,000 steps control sequence | Set %AQ21 = 500 (Hz) | Set %AQ22 = 1000 (Hz) | Set %AQ23-24 = 2,000,000 (Steps) | Set %AQ25-26 = 2,000,000 (Steps) | Set %AQ27-28 = 1,000,000 (Steps) |

When the start bit is energized, the example starts at 0.5 kHz and ramps up to 1 kHz during the first 2,000,000 steps. Then, it runs at 1 kHz for the next 2,000,000 steps. Finally during the last 1,000,000 steps it slows to a stop.

| Example 3 | Start Frequency | Run Frequency | Accel Count | Run Count | Decel Count |
|----------------------------------|---------------------|----------------------|--------------------------------|----------------------------------|--------------------------------|
| 6,000,000 steps control sequence | Set %AQ21 = 50 (Hz) | Set %AQ22 = 250 (Hz) | Set %AQ23-24 = 150,000 (Steps) | Set %AQ25-26 = 5,500,000 (Steps) | Set %AQ27-28 = 350,000 (Steps) |

When the start bit is energized, the following example starts at 50 Hz and ramps up to 250 Hz during the first 150,000 steps. Then, it runs at 250 Hz for the next 5,500,000 steps. During the last 350,000 steps it slows to a stop.

Note: Prior to the start of a move, the Ready/Done bit for that channel must be ON (%I33 or %I35 for channel 1 and 2 respectively). The Ready/Done bit will turn OFF during the move, and then back ON once the move is completed.

Note: The pulse generation hardware on the X5 can generate any frequency that can be evenly divided into 10Mhz (10,000,000 Hz) under the maximum recommended frequencies for each model. This results in a very smooth operation at lower frequencies, with a progressively choppier operation at higher frequencies, as the units reach their maximum recommended frequency.

CHAPTER 11: SYSTEM SETTINGS AND ADJUSTMENTS

11.1 System Menu - Overview



The X5 has a built-in System Menu, which lets the user view System Settings and makes adjustments. To start the System Menu, press the far upper right corner of the touchscreen to bring out the function keys, then press the SYSTEM key (or set %SR3 to 1), which will display the Main Menu. Then use the ↓ and ↑ (Up Arrow or Down Arrow) keys to select a **Main Menu** item and press **Enter** (Return Arrow) to display the item's Sub-Menu.

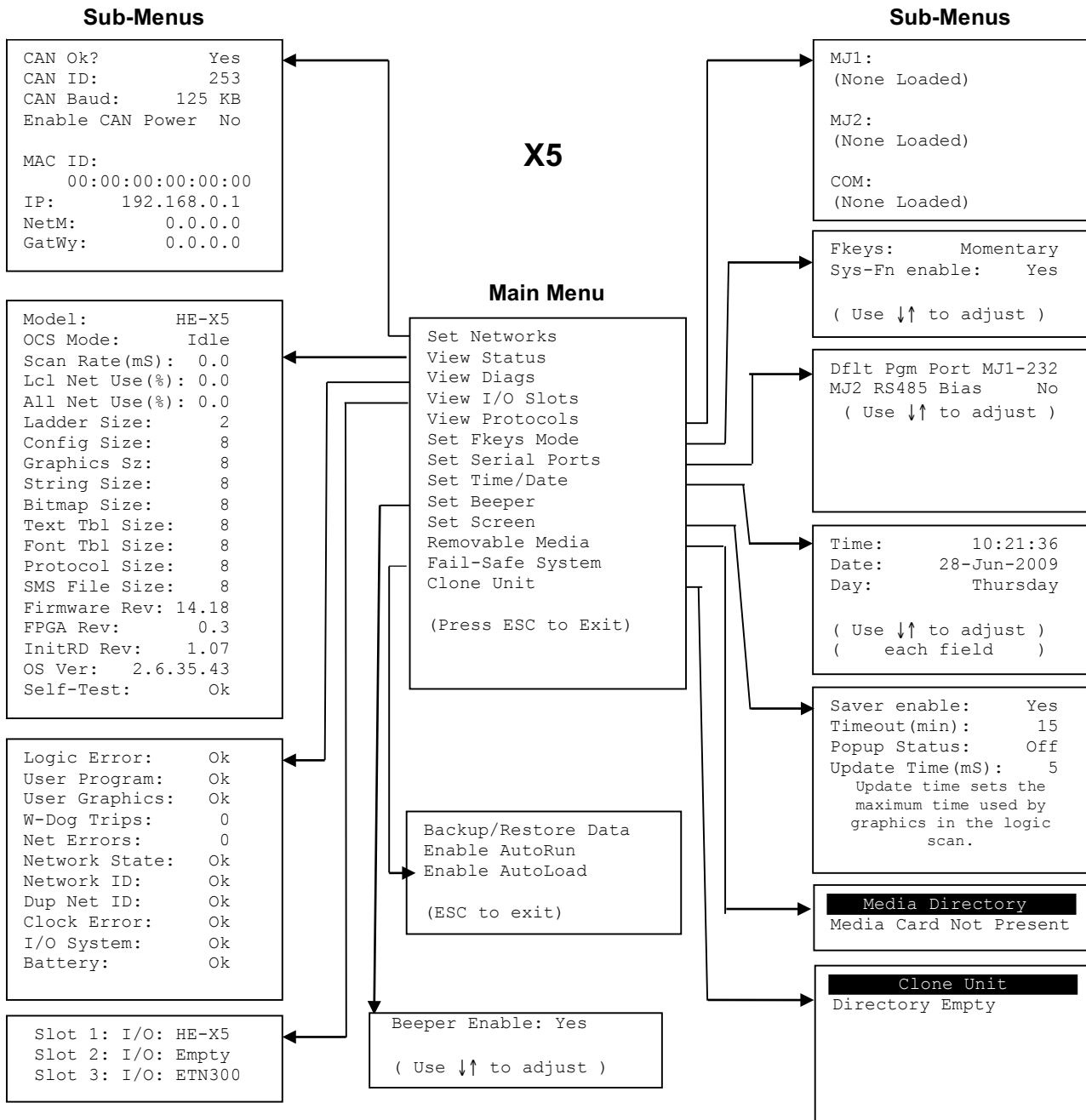


Figure 11.1 – System Menu

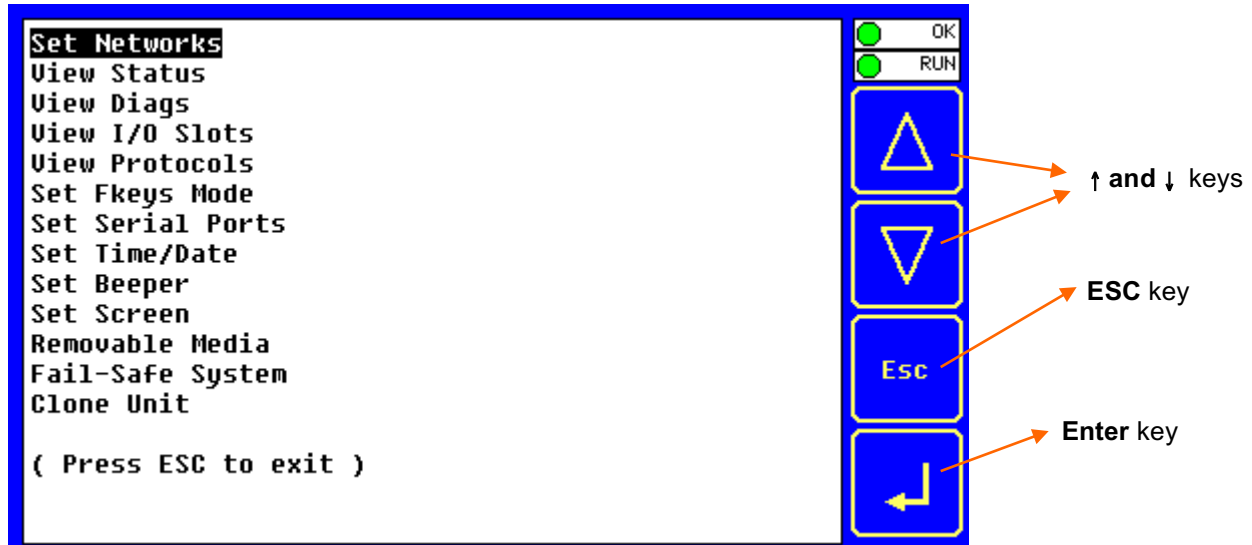




Figure 11.2 – System Menu (X5) Screenshot

11.2 System Menu – Navigation and Editing

As mentioned above, the System Menu is started by pressing the System key on the X5. Next press **ESC** to exit the System Menu, or use **↓ and ↑** to select an item and press **Enter**  to display the item's Sub-Menu.

A Sub-Menu generally shows a list of System Settings and their values. After opening a Sub-Menu, if any of its System Settings are editable, the first System Setting that can be edited is highlighted. If desired, the **↓ and ↑** keys can be used to select a different System Setting to be edited.

At this point, either press **ESC** to exit the Sub-Menu (returning to the Main Menu) or press **Enter** to edit the highlighted System Setting. If **Enter** is pressed, the System Setting's value will be highlighted, indicating that it is ready to be modified.

When modifying a System Setting's value, use either the arrow keys (**← → ↓ ↑**)  or the numeric keys, or the appropriate touch screen icons to select a new value.

The arrow keys are used to edit System Settings that have just a few possible values. Each time the arrow key is pressed, a new possible value is displayed. When the desired value appears, press the **Enter** key to save it; otherwise press the **ESC** key to cancel the edit.

The numeric keys are normally used to enter numeric System Settings.

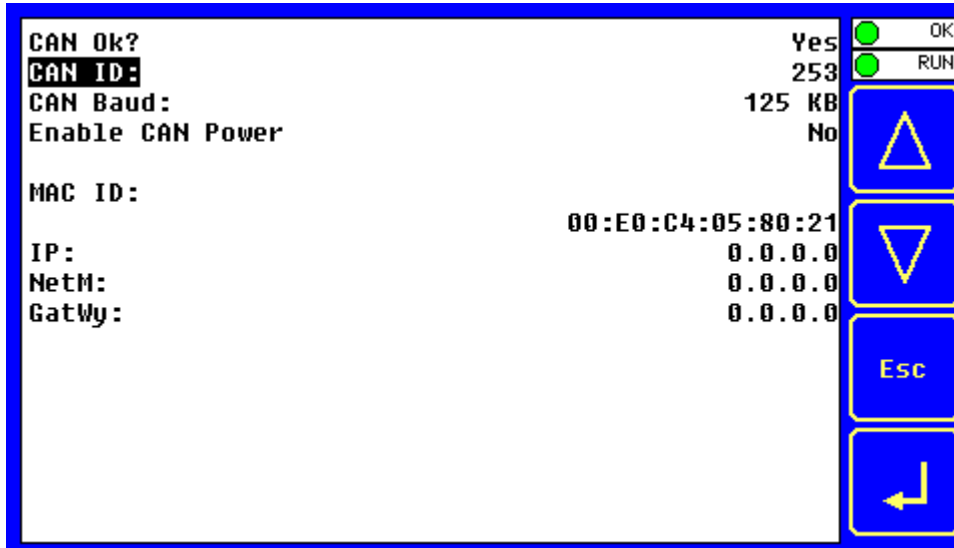


In addition, to edit a single numeric digit, use the **←** or **→** key to select the digit and then either press a numeric key or use **↓** or **↑** to modify the digit. In any case, after entering the new desired value, press the **Enter** key to save it; otherwise press the **ESC** key to cancel the edit.

11.3 System Menu – Details

The following sections describe each of the Sub-Menus in detail.

Set Networks

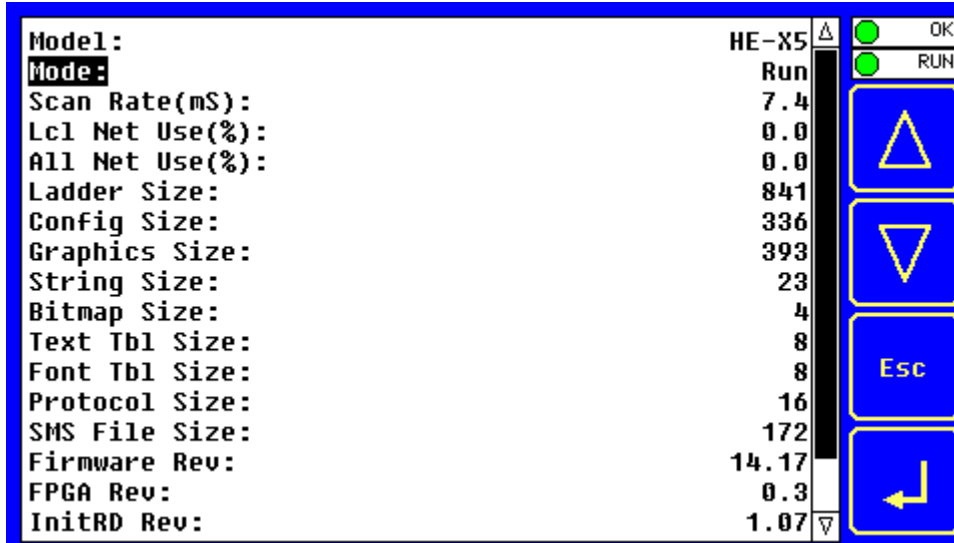


This sub menu allows setting for the CAN and Ethernet network to be viewed or changed.

| | | |
|-------------------------|----------|--|
| CAN Ok? | Yes | = CAN1 connected to a CAN network and functioning properly |
| | No | = Not ready to communicate on CAN network |
| CAN ID: | 1 to 253 | = This node's CsCAN Network ID; must be unique on network |
| CAN Baud: | 125 KB | = 125 KBaud CAN network |
| | 250 KB | = 250 KBaud CAN network |
| | 500 KB | = 500 KBaud CAN network |
| | 1 MB | = 1 MBaud CAN network |
| Enable CAN Power | | Currently disabled in hardware |
| MAC ID: | | Displays the Ethernet MAC ID of the unit |
| IP: | | Displays the Ethernet IP address of the unit |
| NetM: | | Displays the Ethernet net mask of the unit |
| GatWy: | | Displays the Ethernet gateway of the unit |

Note: The IP address, Net Mask and Gateway can be changed from the system menu. This is designed for commissioning or temporary field changes. The actual parameters are defined in Cscape under the Ethernet configuration.

View Status



The View Status Sub-Menu displays up to 19 System Settings. Only the **Mode** System Setting is editable.

| | | |
|-----------------------|--------------|---|
| Model: | HE-X5 | = Model number of this X5 OCS unit |
| OCS Mode: | Idle | = X5 OCS is in Idle mode |
| | DoIO | = X5 OCS is in Do I/O mode |
| | Run | = X5 OCS is in Run mode |
| Scan Rate(mS): | 0.0 | = X5 OCS is not in Run mode |
| | 0.1 to 999.9 | = Average number of mS for each ladder scan |
| OCS Net Use %: | 0.0 to 100.0 | = CAN network bandwidth % used by this X5 OCS node |
| All Net Use %: | 0.0 to 100.0 | = CAN network bandwidth % used by all nodes |
| Ladder Size: | x | = Number of bytes in application ladder program |
| Config Size: | x | = Number of bytes in application I/O configuration |
| Graphics Size: | x | = Number of bytes in application graphic screens |
| String Size: | x | = Number of bytes in application string table |
| Bitmap Size: | x | = Number of bytes in application bitmaps |
| Text Tbl Size: | x | = Number of bytes in application text tables |
| Font Tbl Size: | x | = Number of bytes in application font tables |
| Protocol Size: | x | = Number of bytes in application downloaded protocols |
| SMS File Size: | x | = Number of bytes in application SMS protocol configuration |
| Firmware Rev: | xx.yy | = Current firmware version |

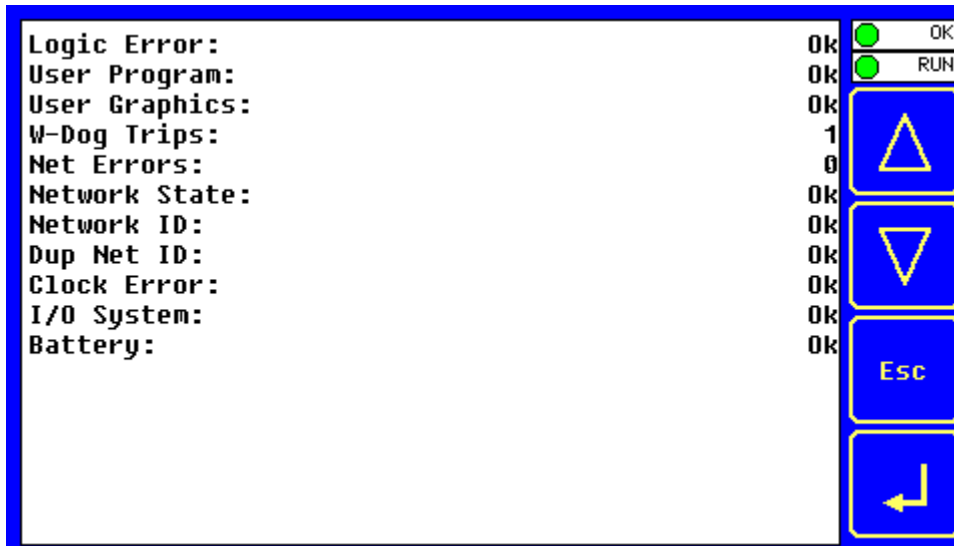
FPGA Rev: x.y = Current FPGA version (High Speed IO Sub System)

OS Ver: a.b.cd.yz = Current Operating System version

InitRD Rev: x.yz = Bootloader version

Self-Test: Ok = All power-on self-tests passed
 Fault = One or more power-on self-tests failed

View Diags



The View Diags Sub-Menu displays up to 11 System Diagnostics, none of which are editable.

The first two System Diagnostics are critical. If any of them indicate a Fault condition, the X5 OCS will not enter or remain in Run mode, and the problem must be investigated and corrected.

Logic Error: Ok = All executed ladder instructions are legal for loaded firmware
 Fault = A ladder instruction not supported by firmware was found

User Program: Ok = Ladder program and I/O configuration loaded successfully
 Fault = Ladder program or I/O configuration not loaded or load failed

The last nine System Diagnostics are informational. If any of them indicate a Warning condition, the X5 OCS can still enter and remain in Run mode, but the problem should be investigated and corrected.

User Graphics: Ok = Application graphics objects loaded successfully
 Fault = Application graphics objects not loaded or load failed

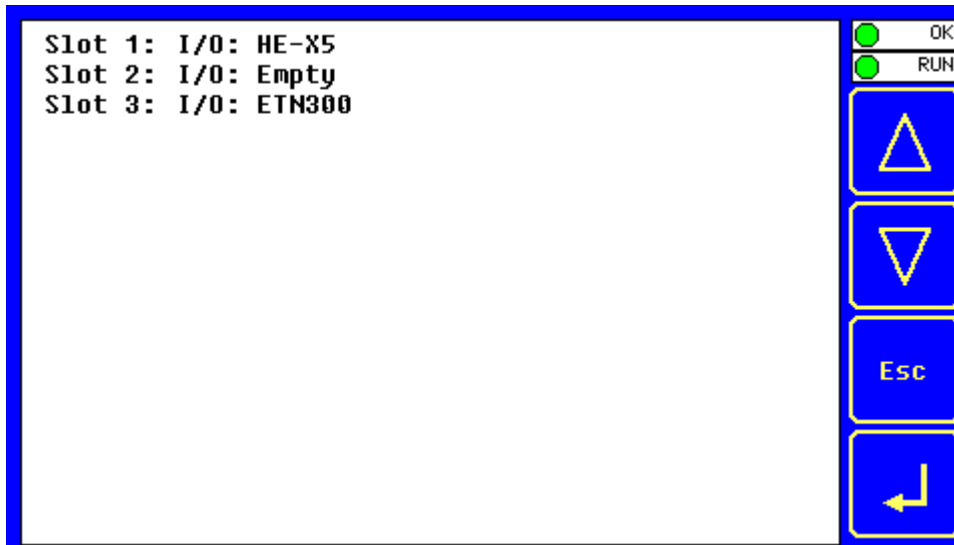
W-Dog Trips: 0 = Watchdog timer has not tripped since the last power-up
 x = Number of times watchdog timer has tripped

Net Errors: 0 = No CAN network bus-off errors have occurred
 x = Number of CAN network bus-off errors that have occurred

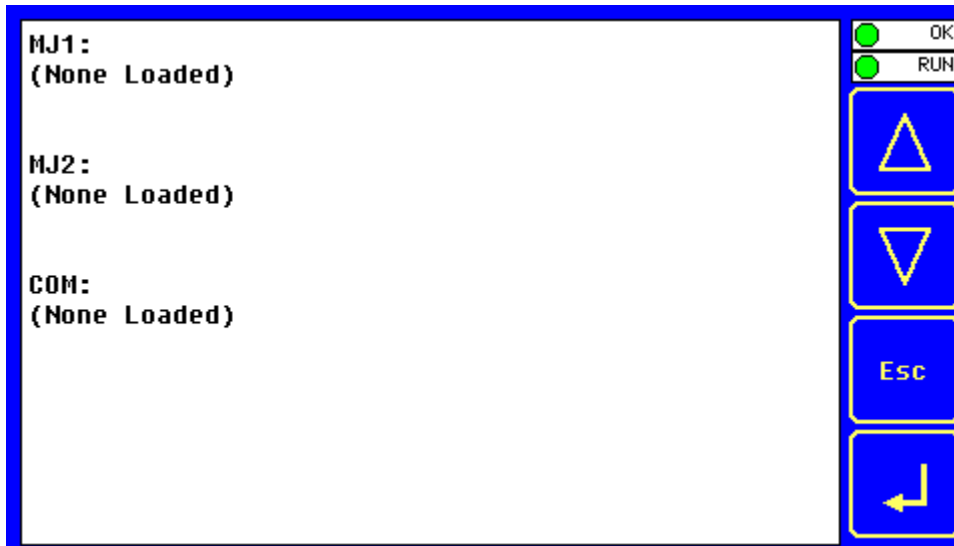
Network State: Ok = At least one other node was found on the CAN network

| | | |
|---------------------|---------|---|
| | Warning | = No other nodes were found on the CAN network |
| Network ID: | Ok | = This node's CAN Network ID is in the range 1 to 253 |
| | Warning | = This node's CAN Network ID was out of range at power-up |
| Dup Net ID: | Ok | = This node's Network ID is unique on the CAN network |
| | Warning | = This node's Network ID is duplicated in another node |
| Clock Error: | Ok | = Time and date have been set |
| | Warning | = Time and date need to be set |
| I/O System: | Ok | = I/O configuration matches the installed I/O and COM modules |
| | Warning | = I/O configuration needs updating to match installed modules |
| Battery: | Ok | = Backup battery operating properly |
| | Warning | = Backup battery needs to be replaced |

View I/O Slots



The View I/O Slots Sub-Menu displays three System Settings, all of which are not editable.

View Protocols

The View Protocols Sub-Menu displays protocols used on the ports, none of which are editable here.

As mentioned in 0, both the MJ1 (Port 1) and MJ2 (Port 2) serial ports support downloadable protocols. To assign a downloadable protocol to an X5 OCS serial port, select the **Protocol Config** item in Cscape's Program menu and then setup a protocol for Port 1 or Port 2 (or both).

In the View Protocols Sub-Menu, the currently downloaded protocol, if any, and its version number are displayed for both Port 1 and Port 2.

Port 1:

Protocol name
Protocol version

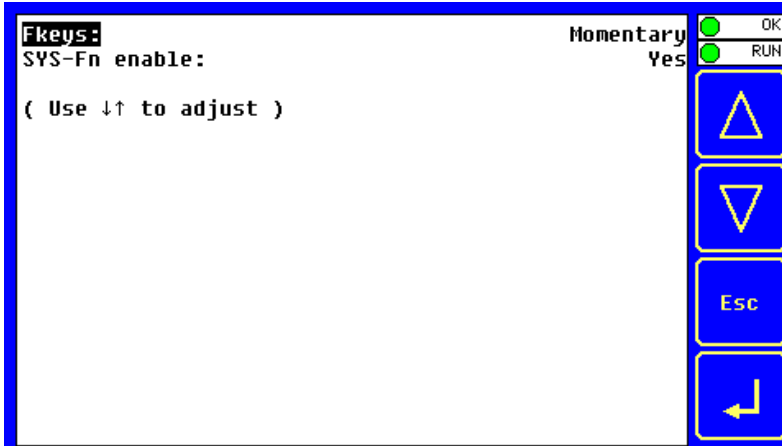
= **(None Loaded)** or name of the protocol assigned to MJ1
= Blank or version of the protocol assigned to MJ1

Port 2:

Protocol name
Protocol version

= **(None Loaded)** or name of the protocol assigned to MJ2
= Blank or version of the protocol assigned to MJ2

Set Fkeys Mode



The Set Fkeys Sub-Menu displays two System Settings, both of which are editable.

- Fkeys:**
 - Momentary = %K1-4 bits go On & Off as F1-F4 are pressed & released
 - Toggle = %K1-4 bits toggle each time F1-F4 are pressed

- SYS_Fn enable:**
 - Yes = Reset and all clear system functions enabled
 - No = Reset and all clear system functions disabled

Set Serial Ports

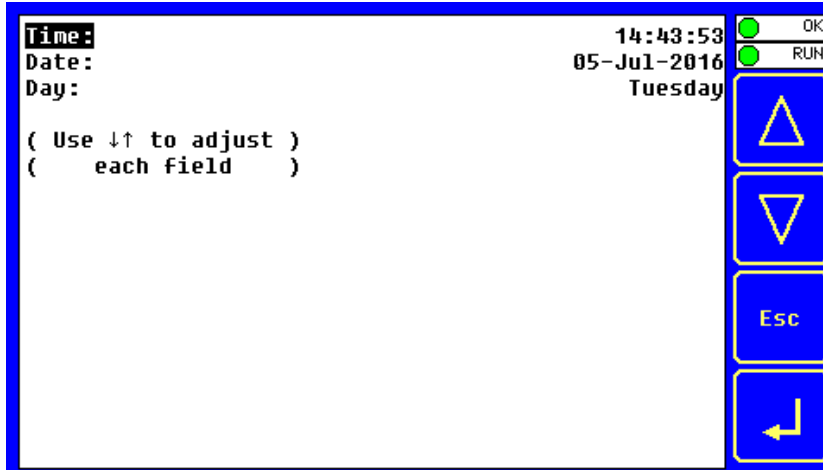


The Set Serial Ports Sub-Menu displays two System Settings, all of which are editable, and one optional item. For the **Dflt Pgm Port** System setting, only MJ1-232 can be selected.

- Dflt Pgm Port:**
 - MJ1-232 = MJ1 RS232 port is the default programming port

- MJ2 RS485 Bias:**
 - No = MJ2 RS485 bias resistors are not switched in
 - Yes = MJ2 RS485 bias resistors are switched in

Set Time/Date



The Set Time/Date Sub-Menu displays three System Settings. **Time** and **Date** are editable, and **Day** is automatically calculated from the **Date** setting. Note that **Time** and **Date** are split into three editable fields each. Use ← or → to select a field and then use ↓ or ↑ to edit the field.

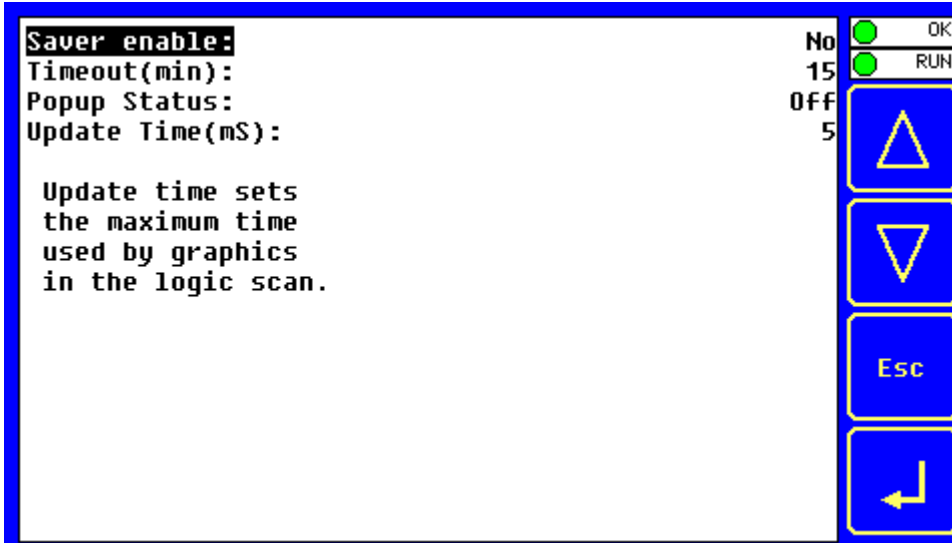
| | | |
|--------------|-------------|--|
| Time: | 16:09:49 | = Current time (hours:minutes:seconds in 24-hour format) |
| Date: | 10-Jul-2008 | = Current date (day-month-year) |
| Day: | Thursday | = Current day of week calculated from the Date setting |

Set Beeper



The Set Beeper Sub-Menu displays one System Setting, which is editable

Beeper enable (inactive in this hardware): **Yes (default)** = Enables beeper No = Disables beeper (does NOT affect ladder access)

Set Screen

The Set Screen Sub-Menu displays four System Settings, all of which are editable

Saver enable: **Yes** = Enable screen saver
 No (*default*) = Disable screen saver

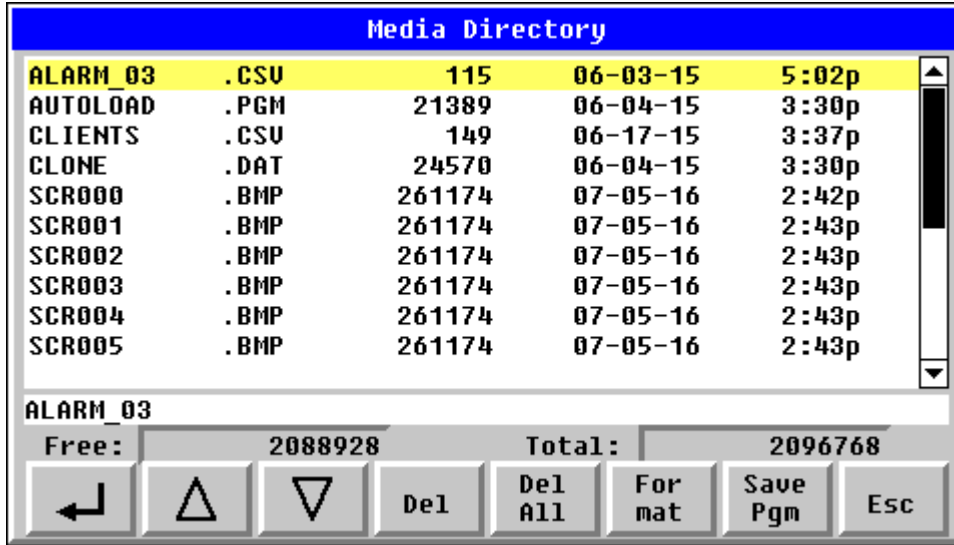
Timeout (min): **5 - 1200** = Amount of time in minutes to expire with NO touch activity before activating screen saver (black screen)

Important note: The built-in screen saver function will not re-light the screen unless the touchscreen is actually touched. There is no automatic re-light of the screen in case of alarms or other conditions that may need to be enunciated on the screen. For these instances, the application code may generate a positive-transition "1-shot" to %SR57.16 (1 bit only) to re-light the screen in case of alarms or other notifications.

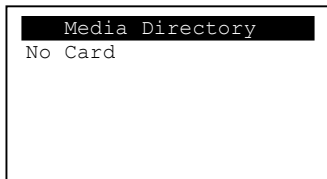
Popup Status: **Off** (*default*) = Disable popup status
 Warning = Display popup status only if controller status changes to NOT Ok or NOT Run mode.
 ON = Display popup status on any controller status change.

Update Time (mS): **2 - 50** = Maximum amount of time to allow for graphics update per scan

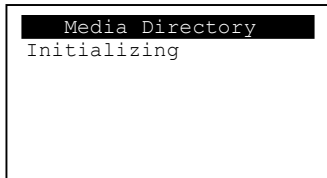
Removable Media



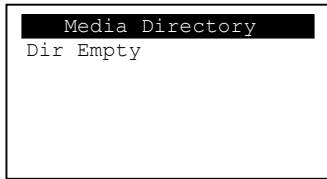
The Removable Media Sub-Menu displays the Removable Media Manager. After selecting Removable Media from the Main Menu, one of four Sub-Menu screens will appear:



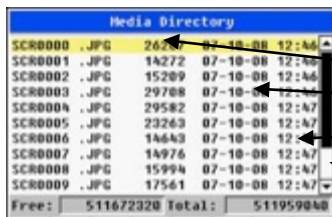
= No Micro SD card has been installed in the Memory slot



= Micro SD card is installed, but it is still initializing



= Micro SD card is installed and initialized, but contains no files



= Micro SD card is installed and initialized, and it contains files

Shows size of highlighted file or shows <DIR> if directory is highlighted

Shows the date file or directory was created or last modified

Shows the time file or directory was created or last modified

Scrollbar.

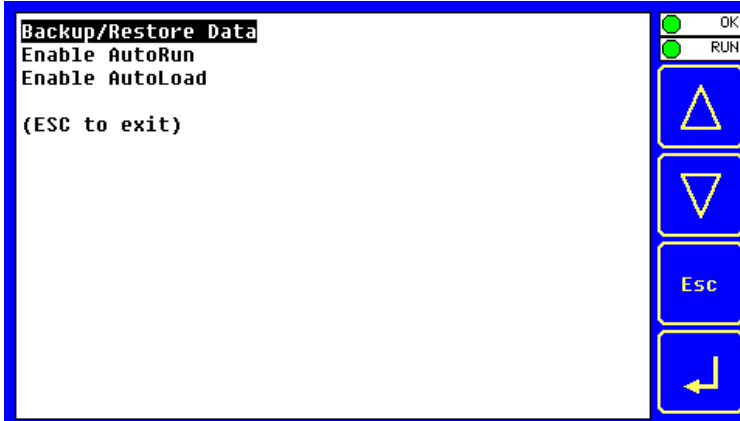
If a directory name is highlighted, pressing **Enter** will switch to that directory showing its files and sub-directories. In a sub-directory, highlighting **..** (dot dot) and pressing **Enter** will move up one directory.

Fail – Safe System

The Fail-Safe System is a set of features that allow an application to continue running in the event of certain types of "soft" failures. These "soft" failures include:

- Battery power loss
- Battery-Backed Register RAM or Application Flash corruption due to, for example, an excessive EMI event.

Selecting “Fail-Safe System” menu will open the following menu screen:

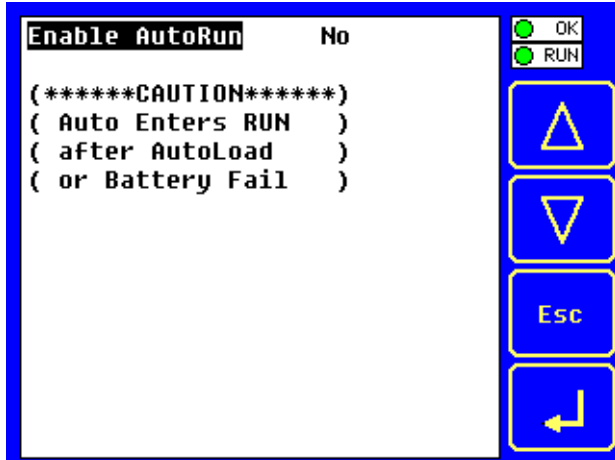


Selecting Backup/Restore Data displays the following screen in:



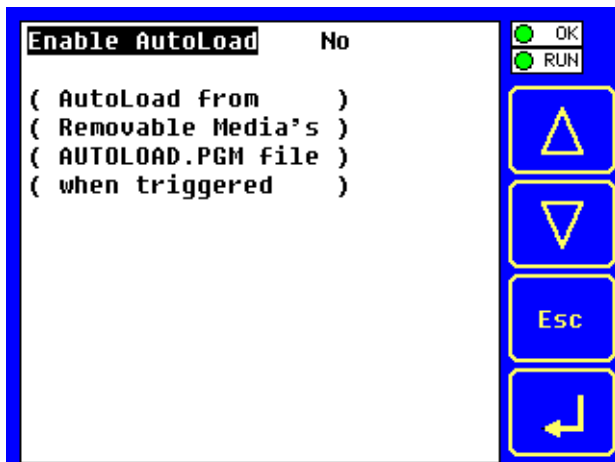
- Backup = Copies Battery Backed RAM contents on to the onboard FLASH memory of the OCS.
- Restore = Copies the backed up data from onboard FLASH to the battery backed RAM.
- Clear Backup = The backup data will be erased from the onboard FLASH.
- Exit = Goes back to previous menu.

“Enable AutoRun” displays the following options which can be selected:



Enable AutoRun No = OCS will be in IDLE mode after AutoLoad or Automatic Restore.
 Yes = OCS will be automatically placed into RUN mode after AutoLoad or Automatic Restore.

“Enable AutoLoad” displays the following options which can be selected:



Enable AutoLoad No = Does not load AUTOLOAD.PGM automatically when application program is absent or corrupted.
 Yes = Loads AUTOLOAD.PGM file automatically from RM when application program is absent or corrupted.

Clone Unit

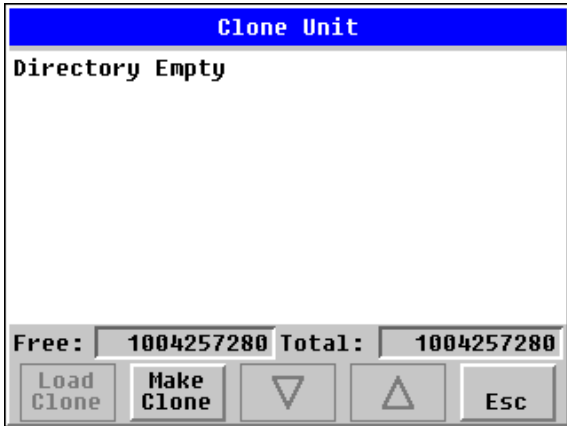
‘Clone Unit’ feature allows the user to “clone” the OCS of the exact same model. This feature “clones” application program and unit settings stored in Battery backed RAM of an OCS into the RM (refer Removable Media [Chapter 9](#) for details on using RM). It can then be used to clone a different OCS (exact same model).

This feature can be used for:

- Replacing an OCS by another unit of the same model.
- Duplicating or “clone” units without a PC.

Clone

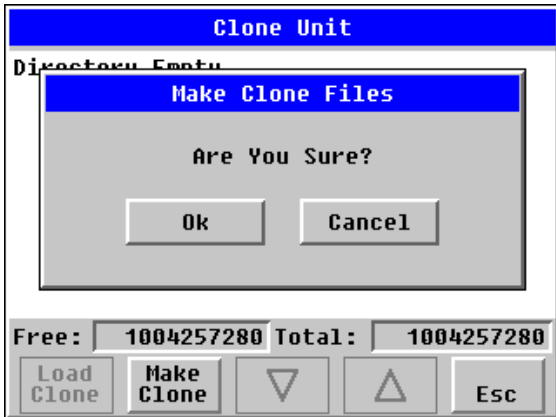
Selecting “Clone Unit” menu will open the following menu screen:



Note:

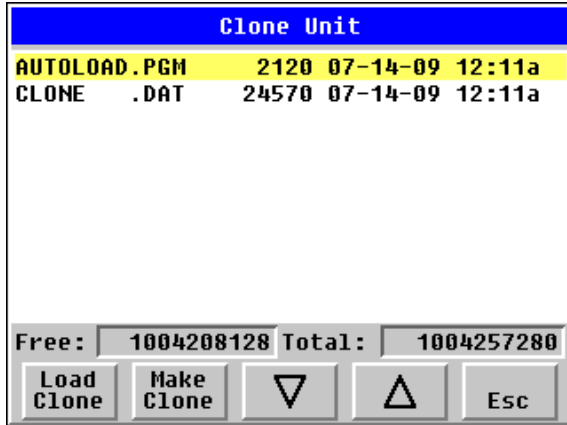
Free/Total – displays number of free and total bytes in Removable Media.

Selecting Make Clone brings up the screen below for the user:



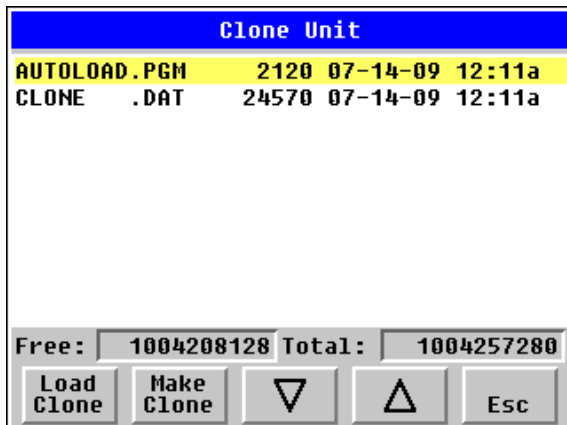
After confirmation, the OCS will create two new files in the root directory of the Removable Media Drive as shown below:

- AUTOLOAD.PGM** Application file
- CLONE.DAT** File having all unit settings and register values from Battery Backed RAM



Load Clone

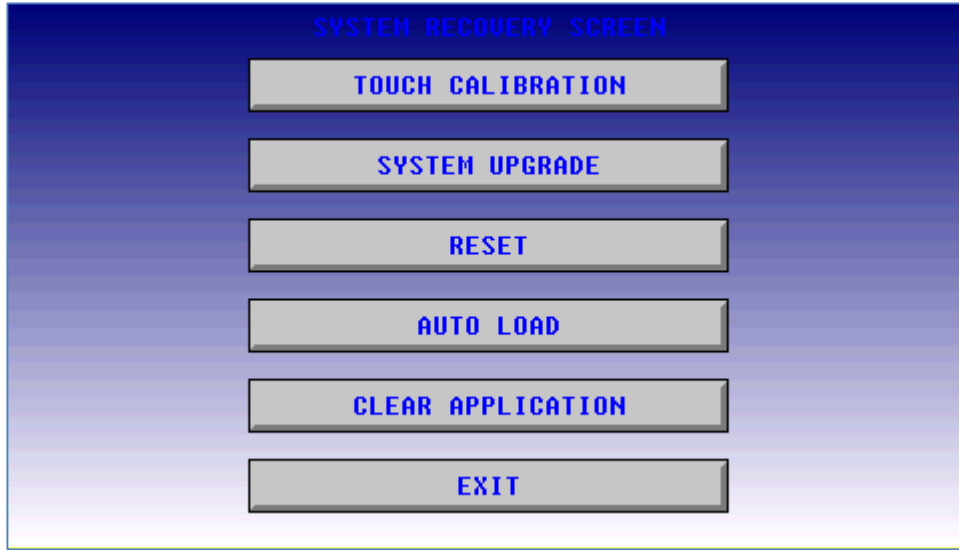
Selecting “Clone Unit” menu will open the following menu screen. Select “Load Clone”.



NOTE: For security enabled files, Load clone asks for password validation before loading the application.

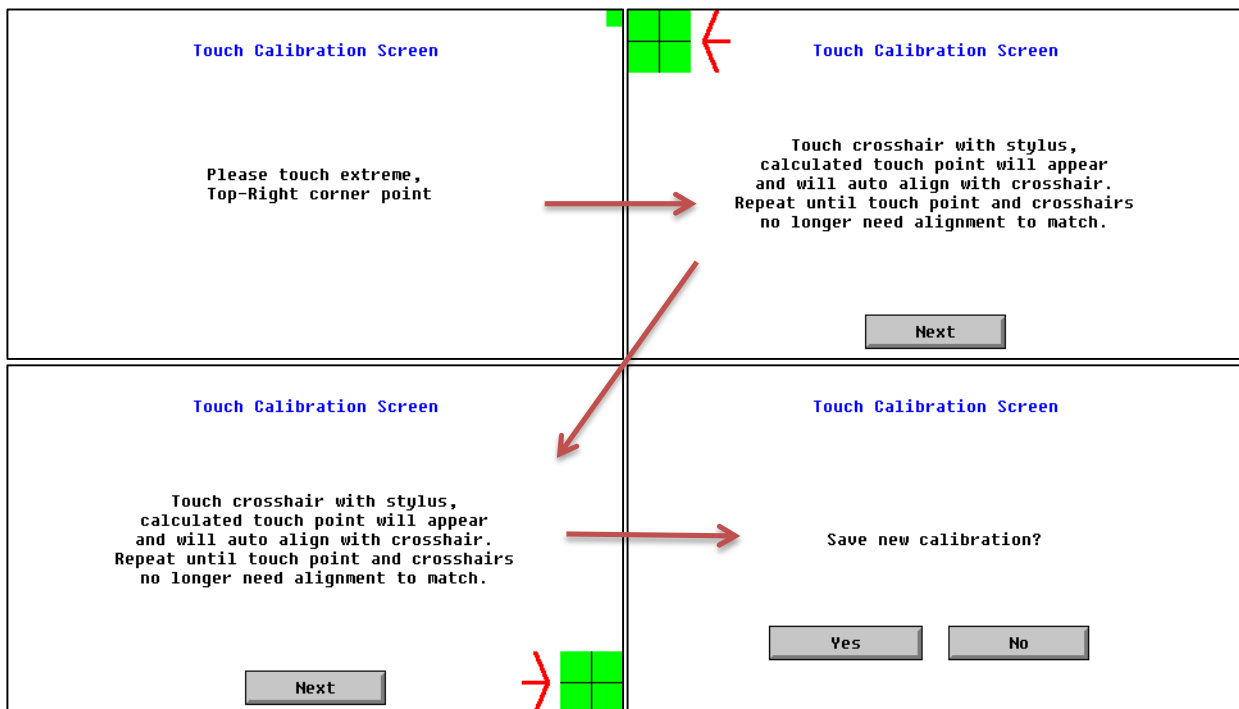
11.4 Touch screen calibration

The touch screen is calibrated at the factory and rarely needs modification. However, if actual touch locations do not appear to correspond with responding objects on the display, field adjustment is available. To access the field adjustable touch screen calibration dialog, press the far upper right corner of the touchscreen to bring out the function keys, then press and hold the SYSTEM key for longer than 5 seconds and a menu with several advanced functions will appear. Select TOUCH CALIBRATION to calibrate the touch screen.



Note that advanced options, accessed by holding the system key down, may be locked out from user access. If holding the SYSTEM key does NOT respond, verify that the system menu's Set Fkeys sub-menu's parameter SYS_Fn is enabled.

For best results in screen calibration, use a plastic tip stylus. On crosshair screens, touch the center of the crosshair as exactly as possible and release. A small "+" should appear and will move to the center of the crosshair. Once it has done so and disappeared again, repeat the process. Keep pressing in the same place until the "+" appears in the center of the crosshair to start with and doesn't have to move any more. Then move on to the next step.



CHAPTER 12: USER INTERFACE

12.1 Overview

This chapter presents the user interface (or operator view) of the X5 and some of the model specific characteristics of the X5 as compared to the rest of the OCS line. This chapter does NOT cover building screens or using the CSCAPE graphics editor. For instructions on creating screens and using the graphics editor, refer to the graphics editor help file.

The following aspects are discussed:

- Displaying and entering data
- Alpha-numeric data entry
- Navigating around screens
- Beeper acknowledgement
- Touch (slip) sensitivity
- Alarm log dialog
- RM dialog
- Screen Saver
- Dimmer

12.2 Displaying and entering Data



Figure 12.1 – Example Screen (X5 only)

Multiple objects are provided for displaying data such as virtual panel lights, push buttons, numeric value displays, bar graphs, meters, graphs and animated bitmaps. On the X5, these graphical objects (through ladder manipulation of attribute bits) can change color, flash or change visibility to attract operator attention.

On objects that accept user input, the input is provided by touching the object or alternately changing an OCS register (i.e. Function key registers). Objects that allow input generally have a raised 3D appearance. An exception is the binary type objects, such as buttons, which are shown in a depressed 3D appearance when in the ON state. Objects that normally accept touch input may be disabled through

program control (through ladder manipulation of an attribute bit). If an object is disabled, the object's representation changes to a 2D appearance.

On objects that represent non-discrete information, more action may be required beyond that of simply touching the object. For example, the slider object requires the operator to touch and *slide* the control in the direction desired. Alternately, alpha-numeric entry objects invoke a pop-up alpha-numeric keypad for additional user input. The alpha-numeric keypad is discussed below.

Note that if the numeric entry object displays >>>>>>, the value is too big to display in the field or is above the maximum for an editable field. Likewise, if the numeric entry object displays <<<<<< in a numeric field, the value is too small to display or is below the minimum for an editable field.

12.3 Numeric keypad

To allow entry of a specific number, several of the input objects invoke a pop-up numeric keypad when the object is touched. An example of the numeric keypad invoked from a numeric input object is shown in Figure 12.2. Once invoked, the operator may touch the appropriate keys to enter a specific value. When entering a value, the numeric keypad is in one of two modes [new-value or edit-value].

New-value mode

Generally, when the numeric keypad is first invoked, it is placed in new-value mode. Initially, the numeric keypad displays the current value with all the digits being highlighted. Once the first digit is entered, the current value is erased from the display and the new digit is placed in the first location. Thereafter, no digits are highlighted and new digits are added to the rightmost position while the other digits are shifted left.

Edit-value mode

Edit-value mode may be entered from the initial new-value mode by pressing either the left or right arrow key before any digit key is pressed. The result will be a single character highlighted. The user may then either touch a key to change the digit at the selected position or the up and down arrows may be used to add or subtract (respectively) from the selected digit. The user may then use the left or right arrow keys to select a new position.

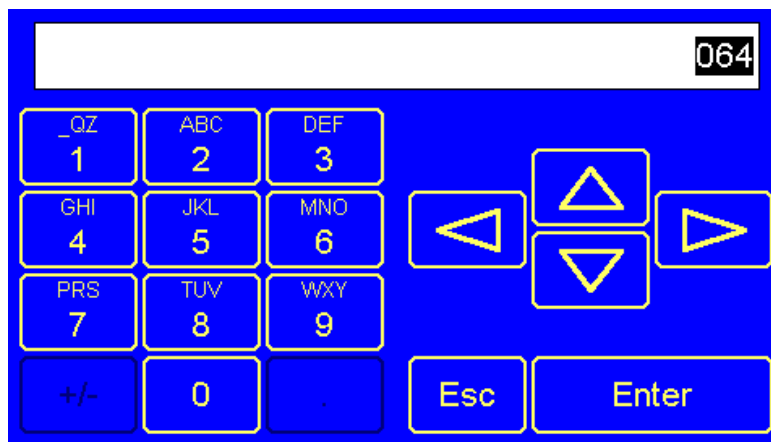


Figure 12.2 – Numeric Keypad

Once the desired value is entered, pressing the *Enter* key moves that value into the object (and the corresponding OCS register) and the alpha-numeric keypad disappears. Alternately, pressing the *ESC* key any time before the *Enter* key cancels the operation, leaves the objects current value unchanged, and the alpha-numeric keypad disappears.

Note: Each numeric entry object has a configured minimum and maximum value. If the operator enters a value outside of the configured range, the new value is ignored when *Enter* is pressed and the current object value is NOT changed.

Since the alpha-numeric keypad services several different graphical objects, certain keys on the alpha-numeric keypad may be disabled (grayed) when the keypad is invoked for certain objects. The following describes the alpha-numeric keypad variation based on object.

Numeric Object

When editing a numeric value, the [+/-] or the [.] key are disabled (grayed) if the object is NOT configured for floating-point value or a signed value.

Password Object

When editing a password value, the arrow keys, [+/-], and the [.] keys are disabled. Additionally, overwrite mode is disabled. When entering digits, the pop-up keypad hides the value by displaying "*" alternately for each digit.

ASCII Object

When editing an ASCII value, an ASCII keypad is displayed as shown figure 12.3. The ASCII keypad has 3 modes, numeric, symbols and alpha. In Alpha mode the Caps Lock button may be pressed to access capital letters. When you first enter this editor typing a character will overwrite the entire old string and start a new entry. You may press the back space arrow to delete the previous character. Pressing Enter will save the entry, filling any unused space beyond the last character entered with NULL characters. Pressing ESC will cancel the edit and return the string to the previous value.

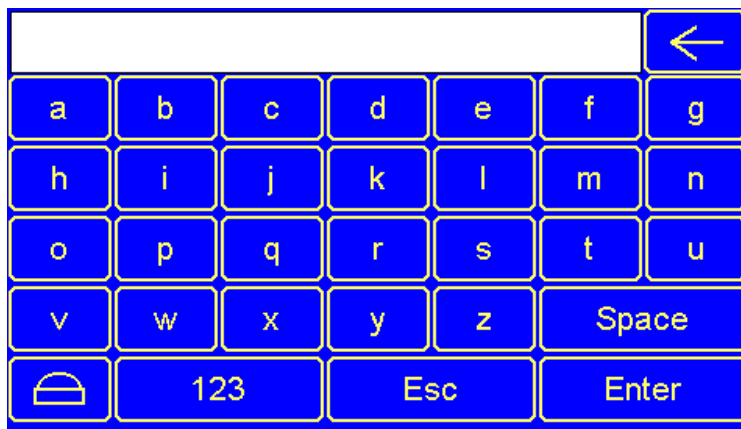


Figure 12.3 –ASCII Keypad

Text Table Object

When editing a Text Table Object, all of the keys except the Up and Down arrow keys are grayed and disabled. The next text selection is made by pressing either the Up or Down arrow.

Time/Date Object

When editing a Time/Date Table Object, all the keys except the Up, Down, Left and Right arrow keys are grayed and disabled. The specific field (i.e. hour or minutes) is selected using the Left and Right arrows. The value in the selected field is changed by pressing either the Up or Down arrow.

12.4 Screen Navigation

To allow the operator to change screens, a **screen jump object** is generally used. This object may be visually **represented as a 3-D button** (responding to touch) or remain invisible and logically tied to an OCS register. An optional system ICON may be configured for display along with the legend, which aids in identifying the object as one that causes a screen change (shown below in figure 12.3)

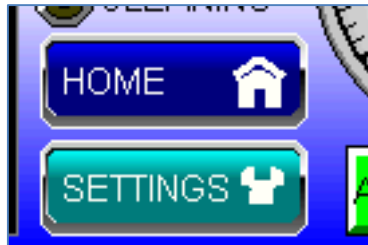


Figure 12.4 – Typical Screen Jump Objects (X5)

Screen jumps can also be triggered on other keys or based on control logic for more advanced applications. To allow the operator to change screens, a **screen jump object** is generally used. This object may be visually **represented as a button** (responding to touch) or remain invisible and logically tied to an OCS register. An optional system ICON may be configured for display along with the legend, which aids in identifying the object as one that causes a screen change.

12.5 Ladder Based Screen Navigation

Ladder logic can use several techniques to control screen navigation. Coils can be tied to %D registers to make them screen coils. These coils have two modes, switch and alarm. If the ladder program energizes an alarm display 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.

The switch display coil switches to the associated screen when it is energized. Once it is de-energized the screen remains until it is switched by the user or ladder.

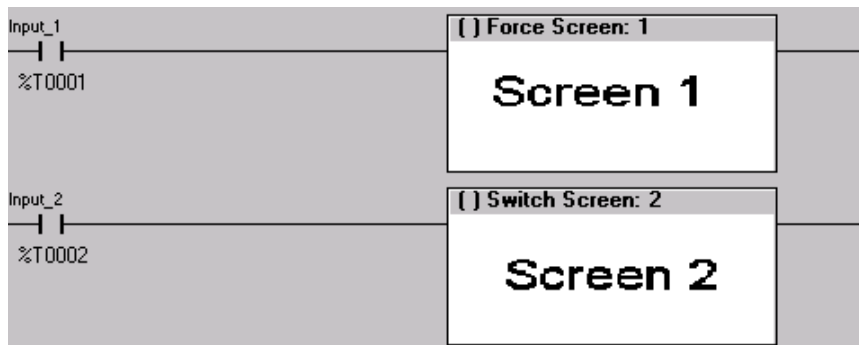


Figure 12.5 – Force and Switch Coils in Ladder Programming

There is also a system register that can be used to for control based screen navigation. %SR1 can be read to determine the current screen or written to change the current screen.

Refer to the on-line help in Cscape for more information on control-based screen navigation.

12.6 Touch (Slip) Sensitivity

Touch *slip* sensitivity is preset to meet most applications; however, adjustment is available to reduce the sensitivity for touch release. That is, once a graphical object (button) is touched and held by a finger, the default touch *slip* sensitivity allows for a slight *slip* of the finger on the graphical object before the X5 assumes touch been released (equates to approximately a quarter inch of movement with a stylus).

In some applications (such as jog buttons) where the operator is pushing a button for a period of time, the amount of *slip* while holding a button pressed may exceed the default sensitivity. To increase the amount of tolerable *slip* and prevent false releases of the button, the X5 allows adjustment of the allowable *slide* up to 5x the default value.

To enable the touch (slip) sensitivity, first an OCS data register must be allocated through the Graphics editor Configuration menu for Display Settings. Once a Touch Sensitivity register is assigned, that register may be modified [range = 1(Low) to 5 (High)] to the desired slide amount. If a value outside the valid range is entered in the touch sensitivity register, it is ignored and the last valid value is used.

12.7 Alarms

Alarm presentation to the operator is highly configurable and beyond the scope of this document to describe fully. For more information refer to the graphics editor help file. This section presents a typical configuration thereby providing an introductory description on what the operator should expect.

The alarm object is generally used to enunciate alarms to the operator. While the display characteristics of this object is configurable, it is generally displayed as a button that changes colors to indicate the highest state of the alarm(s) in the alarm group it is monitoring. The following indicates the priority of the alarm states and the default colors associated with these states.

- Highest (Red) - Unacknowledged Alarms Exist
- - (Yellow) - Acknowledged Alarms Exist
- Lowest (Green) - No Alarms Exist

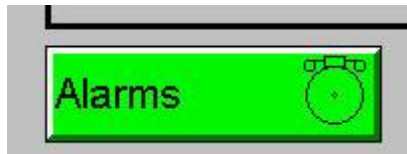


Figure 12.6 – Alarm Object

To view, acknowledge and/or clear alarms, the operator must access the alarm viewer. This is accomplished by touching an (enabled) alarm object. When accessed, the alarm viewer is displayed as pop-up alarm viewer dialog similar to that shown in Figure 12.7.



Figure 12.7 – Alarm Viewer

The currently selected entry is indicated by a yellow highlight which can be moved up or down by touching the arrow buttons or by directly touching an entry. If more entries exist than can fit on the page, a scroll bar is displayed on the right side that also indicates the current relative position.

The current state of the displayed alarm is indicated by its color and optionally by an abbreviated indicator after the date/time stamp (ALM, ACK, RTN). The operator can acknowledge an alarm by selecting it from the list and touching the ACK button. The operator can also clear an alarm if that function is enabled in the alarm object. If not enabled, the **C**lear buttons are grayed and do not respond to touch. Once view operations are complete, simply touch the *Esc* button to remove the pop-up alarm viewer.

Note that OCS registers %SR181 and %SR182 are available for ladder use, which indicate presence of unacknowledged or acknowledged alarm (respectively). The screen designer may implement these registers to switch screens or activate the beeper to attract the operator's attention.

12.8 Removable Media

The removable media object is generally used to inform the operator on the current state of the removable media device and allow access to its file structure. The removable media object is displayed as a button that changes colors to indicate the current state of the removable media device. The following indicates the device states and the default colors associated with these states.

- Highest (Red) - Device Error
- - (Yellow) - Device Full (threshold adjustable)
- Lowest (Green) - Device OK

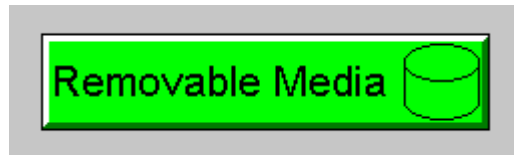


Figure 12.8 – Removable Media Object

To view and perform file operations, the operator must access the removable viewer. This is accomplished by either touching an (enabled) removable media object or through the system menu. When accessed, the removable media viewer is displayed as pop-up removable media dialog similar to that shown in Figure 12.9.

Note that the removable media object can be configured to open the removable media viewer at a certain directory complete with restrictions on transversing back up the file path. This may be used to restrict operator access to non-critical files.

| Media Directory | | | |
|-----------------|--------|----------|-------|
| SCREEN00.BMP | 153654 | 01-13-96 | 1:10p |
| SCREEN01.BMP | 153654 | 01-13-96 | 1:13p |
| SCREEN26.BMP | 153654 | 01-13-96 | 1:08p |

| | | | |
|-------|-----------|--------|-----------|
| Free: | 992247808 | Total: | 992739328 |
|-------|-----------|--------|-----------|

| | | | | | | | |
|---|---|---|-----|---------|---------|----------|-----|
| ⏪ | ⏩ | ⏴ | Del | Del All | For mat | Save Pgm | Esc |
|---|---|---|-----|---------|---------|----------|-----|

Figure 12.9 – Removable media viewer

The currently selected entry is indicated by a yellow highlight which can be moved up or down by touching the arrow buttons or by directly touching an entry. If more entries exist than can fit on the page, a scroll bar is displayed on the right side that also indicates the current relative position.

File operations are accomplished by pressing the appropriate button at the bottom of the removable media viewer. The configuration of the removable media object that invokes the removable media viewer

defines what buttons are enabled and available to the user. A button is grayed and does not respond to touch if configured as disabled.

The  (Enter) button (if enabled) performs certain operations based on the selected file's type:

| | |
|-----------|--|
| .. | - change display to parent directory |
| <DIR> | - change display to child directory |
| bmp, jpeg | - display bitmap (if compatible format) |
| pgm | - load application (if compatible model and version) |

Alternately, the (enter) button can be configured to simply load the ASCII representation of the file path (including the file name) to a group of OCS registers. That pathname can then be used by ladder for opening and manipulating that file.

Once view operations are complete, simply touch the *Esc* button to remove the pop-up removable media viewer.

If the removable media is used in an application, the removable media device requires changing by the operator, and the application is attempting to write to the removable media when it is removed, the screen designer should create objects that allow the operator to temporarily halt access to the removable media. This prevents corruption to the file system if the removable media is removed during a file write sequence. The graphic objects should set OCS register %SR174.1 (when requesting the card be removed) and provide an indicator based on OCS register %SR174.2 (which indicates that it is safe to remove the removable media).

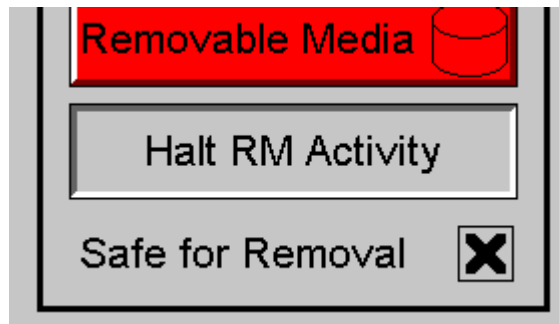


Figure 12.10 – Example application segment for safe removal of removable media

12.9 Screen Saver

The X5 screen backlight life is typically 5 years when in continuous use. If the application does not require interaction with the X5 for long periods of time, the backlight life can be extended by using the screen saver function. When enabled through the system menu, the backlight is shut off (screen goes black) after a specified time of no touch activity on the screen. When the screen saver shuts off the backlight, any operator touch on the screen or function keys reactivates the backlight.

Note that when the screen saver is active (backlight shut off), any initial touch activity on the screen (or function key) to reactivate the backlight is otherwise ignored by the X5. Any additional touch activity is also ignored by the X5 for approximately one second thereafter.

It is possible for the application code to bring the controller out of the screen saver state by generating a positive transition to %SR57.16 (1 bit only). It is also possible for the application to temporarily disable the screen saver by generating a positive transition to %SR57.16 (1 bit only) at a rate faster than the screen saver timeout value. This may be desired while waiting for alarm acknowledgement.

12.10 Screen Brightness

The X5 provides a feature that allows screen dimming for night operation. To enable this feature, the application must access and control system register %SR57 (Display Backlight Brightness). Screen brightness is continuously variable by driving %SR57 through the range of 100 (full bright) to 0 (full off). It is left to the screen designer on if and how to present a Screen Brightness control to the user.

Note that backlight life may be shortened when the screen is dimmed or screen brightness is varied on a repetitive basis.

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CHAPTER 13: REGISTERS

13.1 Register Definitions

When programming the X5 OCS, data is stored in memory that is segmented into different types. This memory in the controller is referred to as registers. Different groups of registers are defined as either bits or words (16 bits). Multiple registers can usually be used to handle larger storage requirements. For example 16 single bit registers can be used to store a Word or two 16 bit registers can be used to store a 32-bit value.

Below is a list of the type of registers found in the X5 OCS.

%AI Analog Input

16-bit input registers used to gather analog input data such as voltages, temperatures, and speed settings coming from an attached device.

%AQ Analog Output

16-bit output registers used to send analog information such a voltages, levels or speed settings to an attached device.

%D Display Bit

These are digital flags used to control the displaying of screens on a unit which has the ability to display a screen. If the bit is SET, the screen is displayed.

%I Digital Input

Single-bit input registers. Typically, an external switch is connected to the registers.

%K Key Bit

Single-bit flags used to give the programmer direct access to any front panel keys appearing on a unit.

%M Retentive Bit

Retentive single-bit registers.

%Q Digital Output

Single-bit output registers. Typically, these bits are connected to an actuator, indicator light or other physical outputs.

%R General Purpose Register

Retentive 16-bit registers. By far, the largest area of register memory. Use for Timers, Counters, floating point and other math conversions, PID controls, recipe storage, datalogging, status registers, etc.

%S System Bit

Single-bit bit coils predefined for system use.

%SR System Register

16-bit registers predefined for system use.

%T Temporary Bit

Non-retentive single-bit registers. Not to be confused for Timer registers.

13.2 Useful %S and %SR registers

| Table 13.1 – Common %S Register Definitions | |
|---|---------------------------|
| Register | Description |
| %S1 | Indicate First Scan |
| %S2 | Network is OK |
| %S3 | 10mS timebase |
| %S4 | 100mS timebase |
| %S5 | 1 second timebase |
| %S6 | I/O is OK |
| %S7 | Always ON |
| %S8 | Always OFF |
| %S9 | Pause 'n Load soon |
| %S10 | Pause 'n load done |
| %S11 | I/O being forced |
| %S12 | Forcing is enabled |
| %S13 | Network I/O is OK |
| %S16 | Ethernet COM module is OK |

| Table 13.2 – %SR Registers | | | | |
|----------------------------|-------------|---|---------|--------------------|
| Register | Name | Description | Min Val | Max Val |
| %SR1 | USER_SCR | Current User Screen Number | 1 | 1023 |
| %SR2 | ALRM_SCR | Current Alarm Screen Number (0=none) | 0 | 1023 |
| %SR3 | SYS_SCR | Current System Screen Number (0=none) | 0 | 14 |
| %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 (/ 10) | - | 1000 |
| %SR7 | MIN_RATE | Minimum Scan Rate (/ 10) | - | 1000 |
| %SR8 | MAX_RATE | Maximum Scan Rate (/ 10) | - | 1000 |
| %SR9-10 | EDIT_BUF | Data Field Edit Buffer | 0 | 2 ³² -1 |
| %SR11-12 | LADDER_SIZE | Ladder Code Size | 2 | 256K |
| %SR 13-16 | Reserved | - | - | - |
| %SR17-18 | IO_SIZE | I/O Configuration Table Size | 16 | 127K |
| %SR19-20 | NET_SIZE | Network Configuration Table Size | 34 | 1K |
| %SR21-22 | SD_SIZE | Security Data Table Size | - | - |
| %SR23 | LADDER_CRC | Ladder Code CRC | 0 | 65535 |
| %SR 24-25 | Reserved | - | - | - |
| %SR26 | IO_CRC | I/O Configuration Table CRC | 0 | 65535 |
| %SR27 | NET_CRC | Network Configuration Table CRC | 0 | 65535 |
| %SR28 | SD_CRC | Security Data Table CRC | 0 | 65535 |
| %SR29 | NET_ID | This Station's Primary Network ID (CsCAN) | 1 | 253 |
| %SR30 | NET_BAUD | Network Baud Rate (CsCAN) (0=125KB; 1=250KB; 2=500KB; 3=1MB) | 0 | 3 |
| %SR31 | NET_MODE | Network Mode (0=network <u>not</u> required; 1=network) | 0 | 3 |

| Table 13.2 – %SR Registers | | | | |
|----------------------------|-------------|---|---------|--------------------|
| Register | Name | Description | Min Val | Max Val |
| | | required; 2=network optimized; 3=network required and optimized) | | |
| %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 | Firmware Rev Number (/ 100) | 0000 | 9999 |
| %SR39 | CPLD_REV | BIOS Rev Number (/ 100) | 000 | 255 |
| %SR40 | FPGA_REV | FPGA Image Rev Number (/ 10) | 000 | 255 |
| %SR41 | LCD_COLS | Vertical Pixel Count | | |
| %SR42 | LCD_ROWS | Horizontal Pixel Count | | |
| %SR43 | KEY_TYPE | Keypad Type | | |
| %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 Dimmer Register 0 = 0% On; 25=25% On; 100-255 = 100% On | 0 | 255 |
| %SR58 | USER_LEDS | User LED Control / Status | 0 | 65535 |
| %SR59-60 | Reserved | - | - | - |
| %SR61 | NUM_IDS | This Station's Number of Network IDs | 1 | 253 |
| %SR62 | NUM_IDS | This Station's Number of Network IDs | 1 | 253 |
| %SR63 | SS_BASE | SmartStack I/O Base Selector | 0 | 7 |
| %SR64 | SS_STATUS | SmartStack I/O Base Status | 0 | 2 |
| %SR65-76 | SS_INFO_1 | SmartStack I/O Module #1 Information Structure | - | - |
| %SR77-88 | SS_INFO_2 | SmartStack I/O Module #2 Information Structure | - | - |
| %SR89-100 | SS_INFO_3 | SmartStack I/O Module #3 Information Structure | - | - |
| %SR101-112 | SS_INFO_4 | SmartStack I/O Module #4 Information Structure | - | - |
| %SR113-114 | GOBJ_SIZE | Graphics Object Table Size | 8 | 256K |
| %SR115-116 | GSTR_SIZE | Graphics String Table Size | 8 | 128K |
| %SR117-118 | GBMP_SIZE | Graphics Bitmap Table Size | 4 | 256K |
| %SR119-120 | GTXN_SIZE | Graphics Text Table Size | 8 | 128K |
| %SR121-122 | GFNT_SIZE | Graphics Font Table Size | 8 | 256K |
| %SR123-124 | PROT_SIZE | Protocol Table Size | 16 | 64K |
| %SR125 | GOBJ_CRC | Graphics Object Table CRC | 0 | 65535 |
| %SR126 | GSTR_CRC | Graphics String Table CRC | 0 | 65535 |
| %SR127 | GBMP_CRC | Graphics Bitmap Table CRC | 0 | 65535 |
| %SR128 | GTXN_CRC | Graphics Text Table CRC | 0 | 65535 |
| %SR129 | GFNT_CRC | Graphics Font Table CRC | 0 | 65535 |
| %SR130 | PROT_CRC | Protocol Table CRC | 0 | 65535 |
| %SR131-163 | Reserved | - | - | - |
| %SR164.3 | | Read bit indicating Auto Restore of Register Data | | |

| Table 13.2 – %SR Registers | | | | |
|----------------------------|-----------------|---|---------|-----------------|
| Register | Name | Description | Min Val | Max Val |
| | | has been performed (Fail Safe) | | |
| %SR164.4 | | Read bit indicating Backup of Register Data has been performed (Fail Safe) | | |
| %SR164.5 | | Enable AUTORUN (Fail Safe) | | |
| %SR164.6 | | Enable AUTOLOAD (Fail Safe) | | |
| %SR164.7 | | Backup trigger bit | | |
| %SR164.8 | | Clear Backup trigger bit | | |
| %SR164.9 | | MAKE_CLONE trigger bit | | |
| %SR164.10 | | LOAD_CLONE trigger bit | | |
| %SR164.11 | | Status indicating Make Clone Fail (This bit goes high when Make / Create clone fails) | | |
| %SR164.12 | | Status indicating Load Clone Fail (This bit goes high when Load clone fails) | | |
| %SR165-174 | Reserved | | | |
| %SR175 | Removable Media | Current Removable Media interface status | 0 | 6 |
| %SR176-177 | Removable Media | Indicates free space on the Removable Media card in K bytes. | 0 | 2 ³¹ |
| %SR178-179 | Removable Media | Indicates the total card capacity in K bytes. | 0 | 2 ³¹ |
| %SR180 | Reserved | - | - | - |
| %SR181 | ALM_UNACK | Unacknowledged Alarm (high bit indicates what group #) | | |
| %SR182 | ALM_ACT | Active Alarm (high bit indicates what group #) | | |
| %SR183 | SYS_BEEP | System Beep Enable (0=disabled; 1=enabled) | | |
| %SR184 | USER_BEEP | Software configurable (0=OFF; 1=ON) | | |
| %SR185 | SCR_SAVER | Screen Saver Enabled (0=disabled; 1=enabled) | | |
| %SR186 | SCR_SA_TM | Screen Saver Time in minutes (delay) | | |
| %SR187 | NET_USE | Average Net Usage of all units on the CAN network | | |
| %SR188 | NET_MIN | Minimum Net Usage of all units on the CAN network | | |
| %SR189 | NET_MAX | Maximum Net Usage of all units on the CAN network | | |
| %SR190 | NT_TX_AVG | Average Net Usage of this unit | | |
| %SR191 | NT_TX_MIN | Minimum Net Usage of this unit | | |
| %SR192 | NT_TX_MAX | Maximum Net Usage of this unit | | |

For additional information on system bits and registers, refer to the on-line help found in Cscape.

13.3 Register Map for X5 OCS I/O

| Fixed Starting Address | Digital/Analog I/O Function | X5 |
|------------------------|-----------------------------|------|
| %I1 | Digital Inputs | 1-4 |
| | Reserved | 5-16 |
| %Q1 | Digital Outputs | 1-4 |
| | Reserved | 5-16 |
| %AI1 | Analog Inputs | 1-4 |
| | Reserved | n/a |

13.4 Resource Limits

| Table 13.4 – Resource Limits | |
|------------------------------|---|
| Resource | Value |
| %S | 13 |
| %SR | 192 |
| %T | 2048 |
| %M | 2048 |
| %R | 8192 (%R1 - %R1024 Retentive) |
| %K | 4 |
| %D | 1023 |
| %I | 2048 |
| %Q | 2048 |
| %AI | 512 |
| %AQ | 512 |
| Ethernet | CsCAN, Ping, EGD, SRTP, Modbus TCP Master & Slave, Ethernet IP, FTP, HTTP, SMTP @ 10 Mbps or 100 Mbps |
| CsCAN | 125 kbps, 250 kbps, 500 kbps, or 1 Mbps |
| Serial Ports | 1 RS-232, 1 RS-485 Ports |
| IDs Per CsCAN Network | 64 w/o repeaters (253 w/ 3 repeaters) |
| Keypad | 5 virtual keys (4 function keys and a System Key) |
| Display | 480 x 272 4.3" Widescreen TFT, 64K colors |
| Screen Memory | 64 MB |
| User Screens | 1023 |
| Data Fields Per User Screen | 50 |
| Ladder Code | 1024 kB |

NOTES

CHAPTER 14: CSCAPE CONFIGURATION

14.1 Overview

X5 OCS hardware is programmed with a Windows based PC application called Cscape. This application can be used to program, configure, monitor and debug all aspects of the X5 OCS unit. Please see the on-line help provided with Cscape for additional details.

14.2 Cscape Status Bar

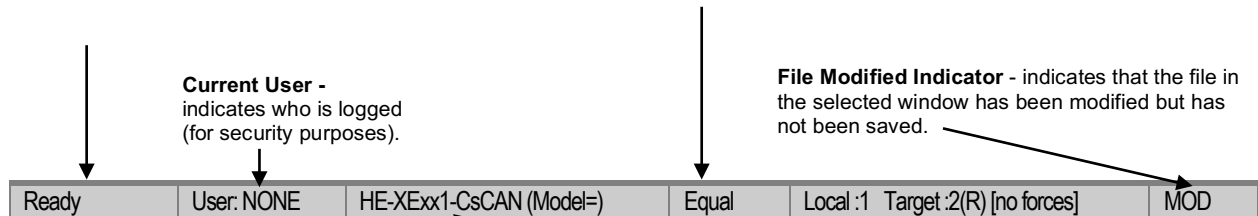
When the X5 OCS is connected to a PC using Cscape software a Status Bar appears at the bottom of the screen. The Cscape Status Bar can be used to determine if communications have been established between the X5 OCS and the Cscape program. Components of the Cscape Status Bar are explained below.

Message Line -

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.



Controller Model - Network (Model Confirmation)

- **Controller Model** indicates the controller model 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).
- **(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 OCS 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 device 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.

14.3 Establishing Communications

The preferred method of communicating between Cscape and an X5 OCS is via USB port. The X5 OCS can communicate with Cscape using USB to USB, USB to serial adapters, serial port communications via MJ1 Port, Ethernet, CAN (CsCAN) or modems. For communications other than USB or the MJ1 port please refer to the manual which ships with the communications adapter hardware being used for programming.

To communicate with the X5 via USB you will need the automated driver installer located on the Horner APG web site.

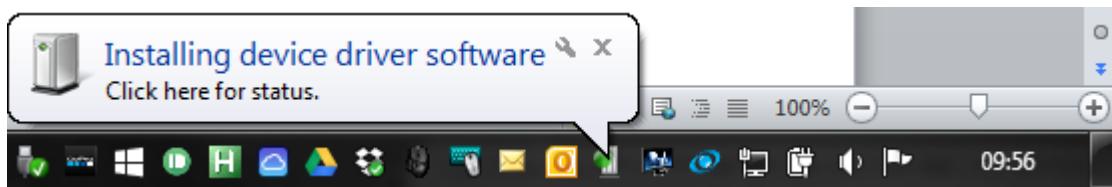
For X5 use Cscape Ver 9.7 SP1 or newer.

Next, connect a PC's (Personal Computer running a Windows Microsoft operating system) USB port via USB cable to the USB mini B port on the X5 OCS.

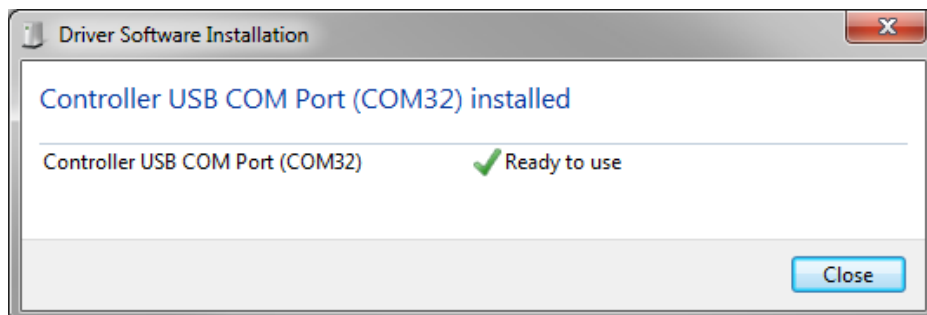


Figure 14.1 – USB Programming Connector

The PC will detect a new device has been plugged into the USB port. A message may appear in the tool tray area.

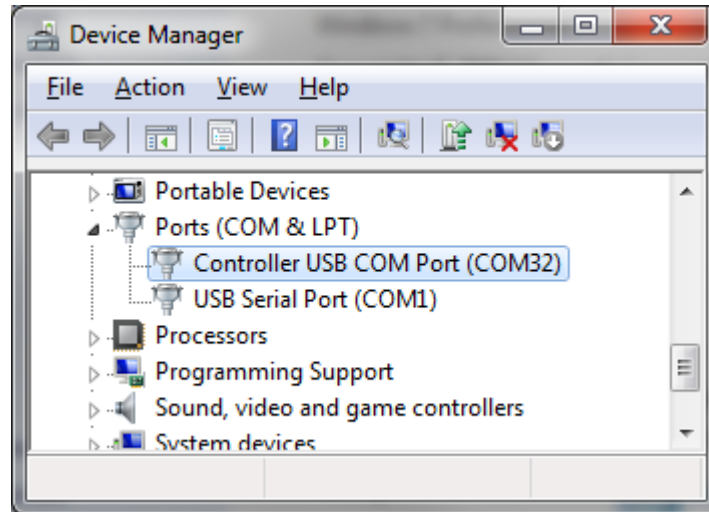


Clicking on this message will bring up the driver installation progress. If the Cscape installation has been completed, the PC should find the drivers automatically and the OCS will be successfully installed as a "Controller USB COM Port".

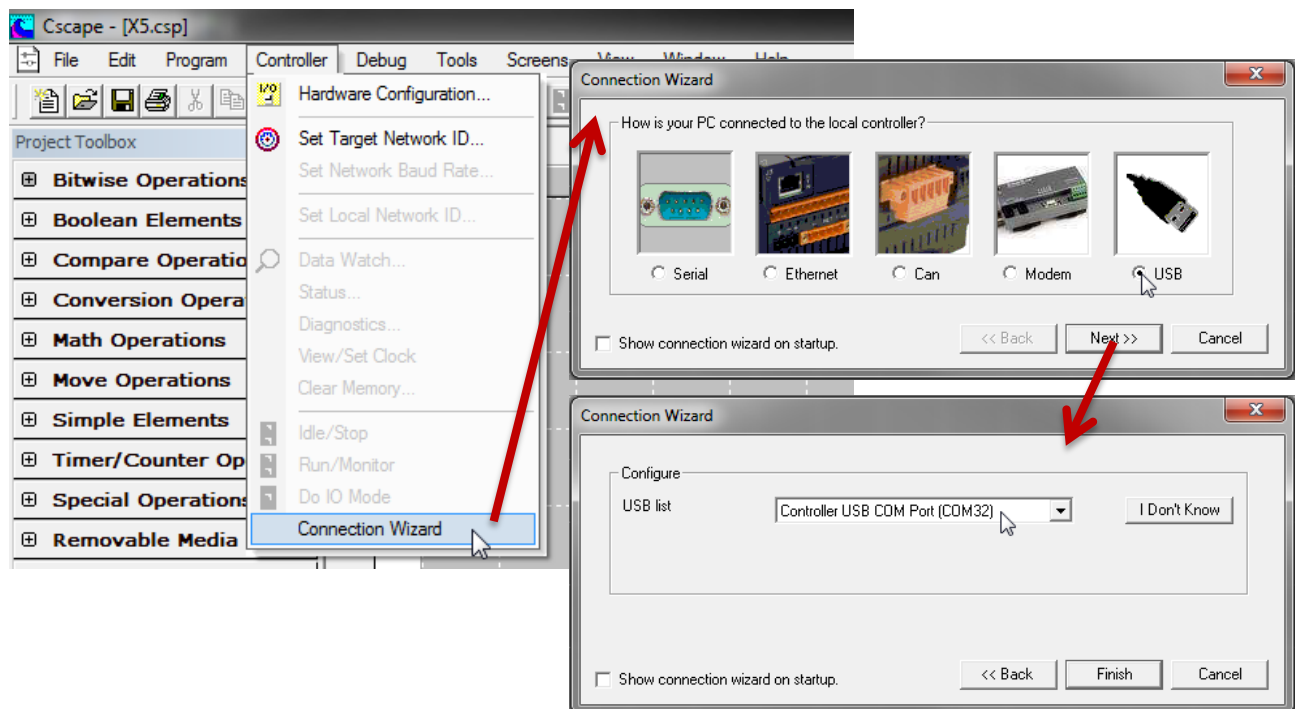


To confirm the OCS has been successfully installed and is recognized by the Windows operating system, the Windows Device Manager may be consulted. Press the Windows key and type “Device Manager”, then select that entry from the results. Find the **Ports (COM & LPT)** section and expand it.

If installed properly, the OCS should show up as **Controller USB COM Port** here.

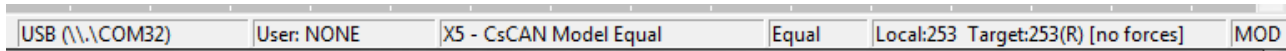


Now that the X5 is plugged in, go to the Cscope menu **Controller > Connection Wizard**, choose USB as the type of connection, then select the **Controller USB COM Port** entry in the dropdown list. Click **Finish** to initialize communications to the X5



If **Controller USB COM Port** is not present in the dropdown list, the Windows operating system has not yet recognized the OCS as an installed device. Be sure the installation process is complete and that the correct drivers are installed

If communications are successful, the target indicator should show the mode of the controller **Target: yy(R)** as shown in the status section [above](#) in this chapter, section [Cescape Status Bar](#).

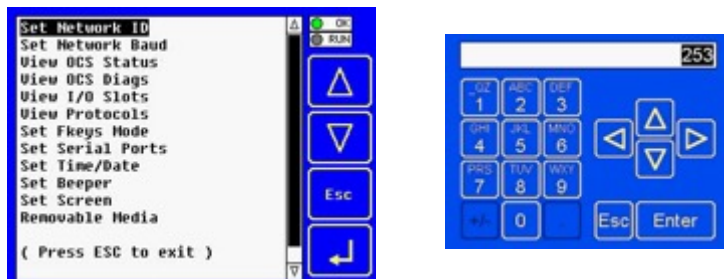


When connected directly to the controller to which Cescape communications are required, the **Local ID** and the **Target ID** should match. If the controller is not communicating you may need to set the Target ID of the controller in Cescape or change the controller's ID on the unit itself. The **Target ID** allows directing communications to a particular unit when multiple units are connected via a CsCAN network.

To check or change the ID on the X5 OCS, press in the far upper right corner of the touch screen to bring out the function keys, then press the system menu key.



The first item in the menu is **Set Networks**. Pressing **Enter** allows you to view or modify the ID of the unit.



To point Cescape at the correct controller, change the Target ID using the **Controller > Set Target Network ID** dialog.

14.3.1 Communicating via MJ1 Serial Port

Start by configuring Cescape to use the correct communications port. This can be done using the Tools | Options | Communication Port dialog in Cescape.

Next connect the PC's serial port to the port labeled MJ1 on the X5.

If communications are successful, the target indicator should show the mode of the controller Target: yy(R) as shown in the status section above.

If the controller is not communicating you may need to set the target ID of the controller in Cescape or on the unit. The Target ID allows directing communications to a particular unit when multiple units are connected via a CsCAN network. Units without CsCAN network ports respond to any network ID and do not require the ID to be configured.

To check or change the ID on the X5 OCS, press in the far upper right corner of the touch screen to bring out the function keys, then press the system menu key.



Select **Set Networks** and press Enter.

Select **CAN ID:** and press Enter allows you to view or modify the ID of the unit.

To point Cescape at the correct controller, change the Target ID using the **Controller | Set Target Network ID** dialog.

14.3.2 Communicating via On Board Ethernet Port


The X5 Ethernet address may be set from the System menu depending on the program currently loaded into the X5. To check or change the Ethernet address on the X5 OCS, press in the far upper right corner of the touch screen to bring out the function keys, then press the system menu key.



Select **Set Networks** and press Enter.

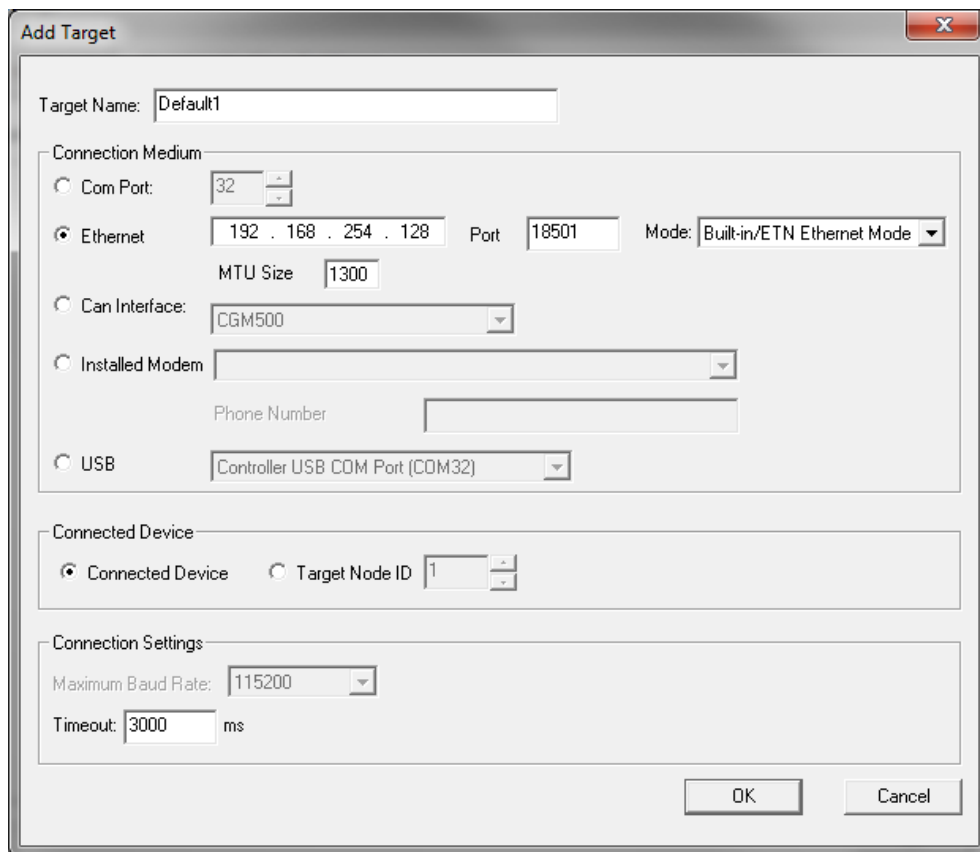
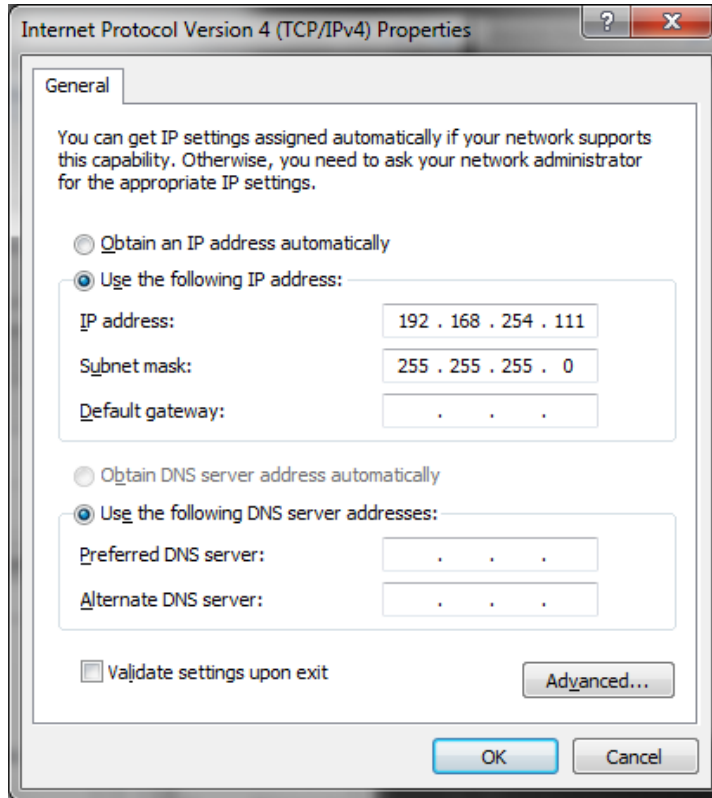
At a bare minimum, the **IP** (IP Address) and **NetM** (NetMask) settings must be configured in order to communicate via Ethernet. Depending on how the network is setup, the **GatWy** (Gateway) may also need to be configured.

From the factory, the X5 OCS is set to the IP Address 192.168.254.128. To obtain Ethernet communications between Cscape and the X5 OCS using a single Ethernet cable between a PC and the X5, or through an unmanaged Ethernet Switch, the PC will also need to be manually configured as follows (may require Administrator access on PC):

1. Access the Network Connections in the Control Panel (Shortcut: Press the Windows key  and type Network Connections... select the resulting filtered link).
 2. Double-click the connection being used to directly connect to the X5 OCS to bring up the Connection Status
 3. Click **Properties**
 4. Double-click **Internet Protocol Version 4 (TCP/IPv4)** in the list of available protocols
 5. The PC may normally be set to "Obtain an IP address automatically". Click next to **Use the following IP address:**
 6. Use the IP address 192.168.254.111 or something other than that of the X5 OCS.
 7. The Subnet Mask (255.255.255.0) should fill in automatically once the IP address has been entered.
 8. The Default Gateway is not required for a direct connection.
 9. Click OK all the way back to the Network Connections dialog.
 10. Confirm the X5 OCS is set to the default 192.168.254.128 address or something on the same network.
 11. In Cscape, click **Tools > Application Settings > Communications > Configure**
 12. Select Ethernet, then enter the IP address of the X5 OCS.
- IMPORTANT:** The MTU setting defaults to the maximum 1500. It needs to match the PC's MTU setting for the best results. A PC may be set to an MTU of 1300 or something other than the default maximum setting by a network administrator.
13. The **Port** for CsCAN over Ethernet is **18501**.
 14. The **Mode** for any controller with built-in Ethernet is **Built-in/ETN Ethernet Mode**.
 15. Change the **Timeout** value to **3000** for direct connections. Timeout values of 5000-30000+ may be common for access over the internet or via VPN or other more complex networks.
 16. Click **OK** all the way back to the main Cscape window. It may take a moment to initialize the communications.
 17. Check the status bar for successful communications.

| | | | | | |
|-----------------------|------------|------------------------|-------|-------------------------------------|-----|
| ETN : 192.168.254.128 | User: NONE | X5 - CsCAN Model Equal | Equal | Local:253 Target:253(R) [no forces] | MOD |
|-----------------------|------------|------------------------|-------|-------------------------------------|-----|

See the next page for examples of the PC Ethernet setup and the Cscape Ethernet setup mentioned in the above steps.



To configure the Ethernet settings of the X5 OCS using Cscape, go to **Controller > Hardware Configuration**. If not already done, select the correct connected controller, or use the **Auto Config** button to automatically recognize a controller that is already successfully connected to Cscape.

Below the main controller configuration, under **Network Ports**, find **LAN1** and click on the **Config** button to the right of the greyed-out ETN300.

In the LAN1 Configuration, fill in the network setup for the X5 OCS. It may be required to consult IT personnel to determine proper settings if connection to a corporate network is required.

LAN1 Configuration

Register Usage

| | Default Settings | Register | Name: | Get settings from | |
|-------------|-----------------------|----------|-------|----------------------|--|
| IP Address: | 192 . 168 . 254 . 128 | | | 32-BIT Configuration | <input type="checkbox"/> Use CAN ID for last Octet |
| Net Mask: | 255 . 255 . 255 . 0 | | | 32-BIT Configuration | |
| Gateway: | 0 . 0 . 0 . 0 | | | 32-BIT Configuration | |
| Status: | | | | 16-BIT | |
| Version: | | | | 16-BIT | |

Protocol Support

Resident Protocols

- ICMP (Ping)
- EGD (Ethernet Global Data)
- SRTP Slave (90-30 Service Request)
- Modbus Slave
- Ethernet/IP
- FTP (File Server)
- HTTP (Web Server)
- ASCII Over TCP/IP

Configure Selected Protocol

Downloadable Protocols

| | | | | |
|--------|------------|---------|---------|-----------|
| ETN1/1 | -- None -- | Network | Devices | Scan List |
| ETN1/2 | -- None -- | Network | Devices | Scan List |

OK Cancel

If **Get settings from** is set to **Configuration** for any parameter, the addresses in the **Default Settings** column will take place when this program is loaded and every time this controller enters RUN mode. Registers may optionally be defined that will reflect the settings. These settings may temporarily be changed via the SYSTEM menu, but will revert to the Cscape-configured settings at any transition into RUN mode, i.e. a program download or at power-up.

If **Get settings from** is set to **Register** for any parameter, the addresses in the **Default Settings** column are ignored entirely. The addresses instead must come from the configured registers. It is not possible to change these settings via the SYSTEM menu in this case.

14.5 Configuration

An overview of configuration:

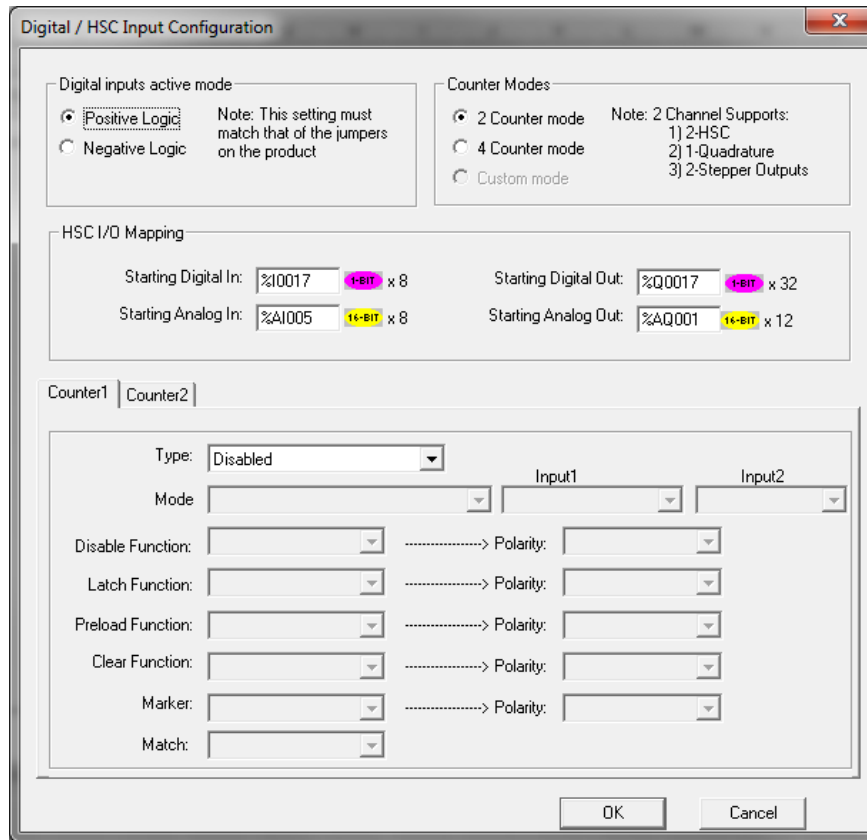
- (1) Start the configuration by selecting the **Controller | I/O Configure** menu item.
- (2) If the X5 OCS is connected to the PC press the **Auto Config System** button to automatically detect the Base model, I/O and any communication options.
- (3) If the X5 OCS is not connected press the **Config** button to the right of the top of the unit. This allows the base CPU to be selected.
- (4) Select either **X5 OCS Cscan** from the type drop down box.
- (5) Once the type of X5 OCS is selected, the model # drop down box will provide the X5 OCS model numbers from which to choose from.
- (6) Once the X5 OCS CPU is selected, press **OK** to exit the dialog and configure the I/O that is present in the first slot.
- (7) The I/O configure dialog (Specifically the **Module Setup** tab) provides 4 buttons to configure all of the I/O. Go through each area of I/O and configure it.
- (8) Once done configuring the I/O OK out of configuration dialogs.

Configuring the X5 OCS I/O has four main portions that are covered in this chapter. For additional information on I/O, refer the chapters covering General I/O or High Speed I/O in this manual.

The four areas of I/O configuration are:

- Digital In / HSC
- Digital Out / PWM
- Analog In

14.6 Digital In / HSC Configuration



The Digital / HSC Input configuration allows the multi-mode digital inputs to be configured as either standard digital inputs or a high-speed inputs. Please note that early versions of Cscape with X5 support may mistakenly remind that jumper settings must match configuration settings. The X5 does not have any jumpers that need to match the configuration.

The **Digital inputs active mode** configuration allows the user to select if inputs are active high (Positive logic, voltage triggers input high) or active low (Negative logic, 0V triggers input high). For the X5 controller, there are no jumpers to set.

The **Counter Modes** configuration allows the inputs to be configured as high-speed counter inputs. Two modes are available, each with a unique set of functions that are allowed.

| Mode | High Speed Counters | Quadrature | Stepper Outputs |
|----------------|---------------------|------------|-----------------|
| 2 Counter Mode | 2 | 1 | 2 |
| 4 Counter Mode | 4 | 0 | 1 |

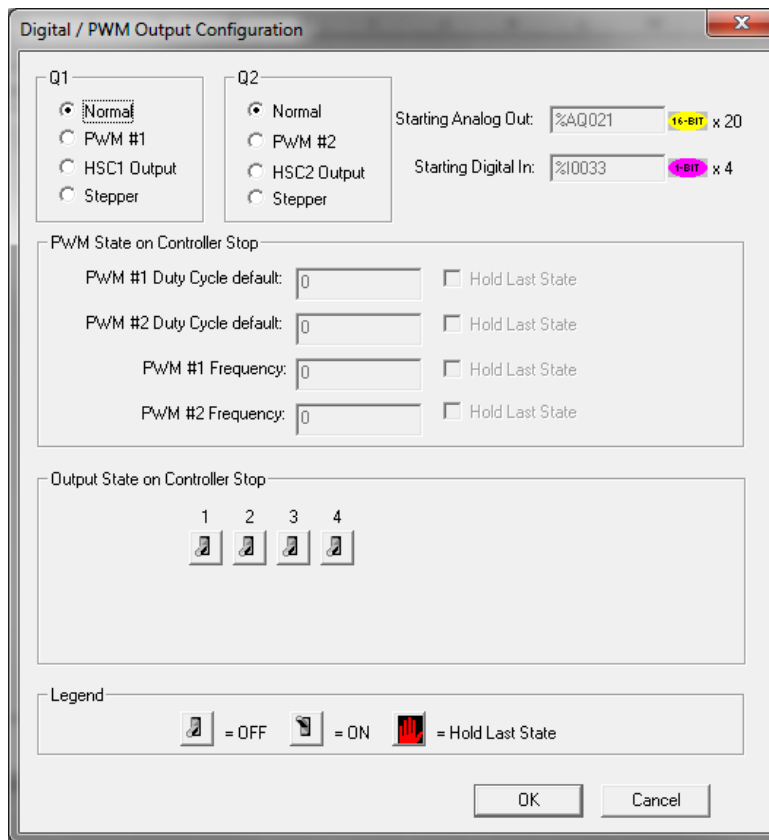
By default, 2 Counter Mode is selected but Counter1 and Counter2 are both disabled. This allows all digital inputs to function as standard digital inputs addressed at %I1 - %I4.

The **HSC I/O Mapping** section allows specification of register usage for high speed counter functions. The register specified is the first of multiple consecutive registers used. The type of register and the number of registers used is noted to the right of each starting address configuration.

The **Counter1** and **Counter2** (and, if configured for 4 Counter mode, **Counter3** and **Counter4**) tabs allow configuration of each of the high speed counters.

See the High Speed I/O Chapter for more details on configuring the high speed counter inputs.

14.7 Digital Out / PWM Configuration



The Digital / PWM Output Configuration allows multi-mode digital outputs Q1 and Q2 to be configured as Normal solid state digital outputs, Pulse-Width Modulation (PWM) outputs, outputs that are triggered by High Speed Counter functions, or Stepper outputs.

By default, both Q1 and Q2 are configured as **Normal**. This allows the application code to use them as digital outputs assigned to %Q1 and %Q2.

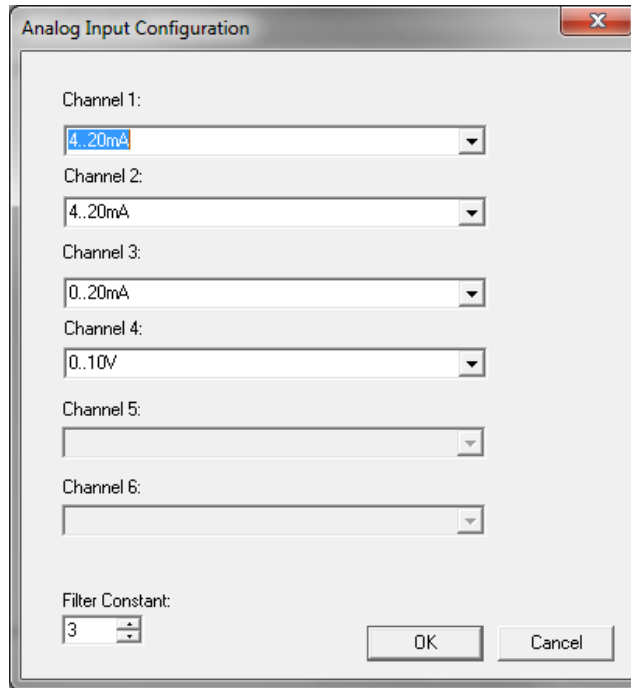
Setting Q1 to **PWM #1** and/or Q2 to **PWM #2** allows those outputs to function as a Pulse Width Modulation output. Duty Cycle and Frequency are configured via registers assigned next to the Q1 and Q2 configuration boxes. See the High Speed I/O Chapter for more details on configuring PWM outputs.

The **PWM State On Controller Stop** box contains items that allow the user to specify how the PWM outputs behave when the controller is stopped. These items can either hold their value or default to some value when the controller is stopped.

Note that the PWM outputs are set to the OFF state at power-up and during program download and remain in that state until the unit is placed in RUN

The **Output State On Controller Stop** box contains items to allow the user to specify how Normal digital outputs behave when the controller is stopped. These items can either hold their value or default to some value when the controller is stopped.

14.8 Analog In Configuration

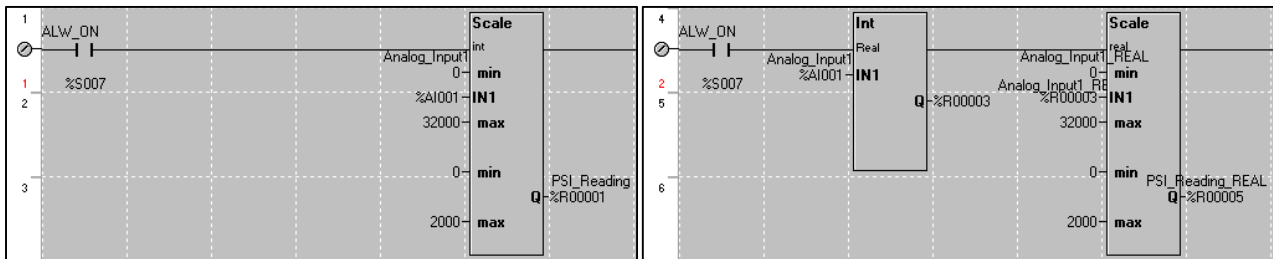


Each analog input may be configured for one of three modes by selecting the mode from the dropdown menu for that channel:

- 0..10V
- 0..20mA
- 4..20mA (default)

For each range selected, the raw value in the corresponding register (%AI1 - %AI4) will be a range of 0 to 32000. For example, Channel 1 set to 4..20mA would show a 0 in %AI1 for 4mA on the input, 32000 in %AI1 for 20mA (and -8000 in %AI1 for 0mA).

The Cscope Scale function, found in the Advanced Math functions, allows for very easy conversion of the raw input value into a meaningful reading. For example, a pressure transducer may be specified as a 4-20mA output corresponding to a 0-2000psi reading. Set the channel to the 4..20mA range. Use the Scale function to easily obtain an Integer pressure reading using the 0 – 32000 raw input range and the sensor’s 0-2000psi output range. The additional use of a Conversion function to convert the raw INT value to REAL format before scaling would allow decimal places in the reading, or a floating-point value. Be sure the Scale function and all other functions used are set to the same data format.



The **Filter Constant** provides digital filtering to all channels. Valid filter values are 0-7. Refer to the datasheet for more information on digital filtering.

CHAPTER 15: FAIL – SAFE SYSTEM

15.1 Overview

The Fail-Safe System is a set of features that allow an application to continue running in the event of certain types of "soft" failures. These "soft" failures include:

- Battery power loss
- Battery-Backed Register RAM or Application Flash corruption due to, for example, an excessive EMI event.

The Fail-Safe System has the following capabilities:

- Manually backup the current Battery-Backed RAM Register Settings into Flash memory.
- Manually restore Register Settings from the values previously backed up in Flash to Battery-Backed RAM.
- Detect corrupted Register Settings at power-up and then automatically restore them from Flash.
- Detect corrupted or empty application in Flash memory at power-up and then automatically load the AUTOLOAD.PGM application file from Removable Media (Compact Flash or MicroSD).
- If an automatic Register Restore or Application Load occurs, the OCS can automatically be placed in RUN mode

The fail-safe system can be accessed by going to the system menu of the controller. A new menu "Fail-Safe System" has been added at the end of the main system menu for this. Selecting "Fail-Safe System" menu will open the following menu screen:

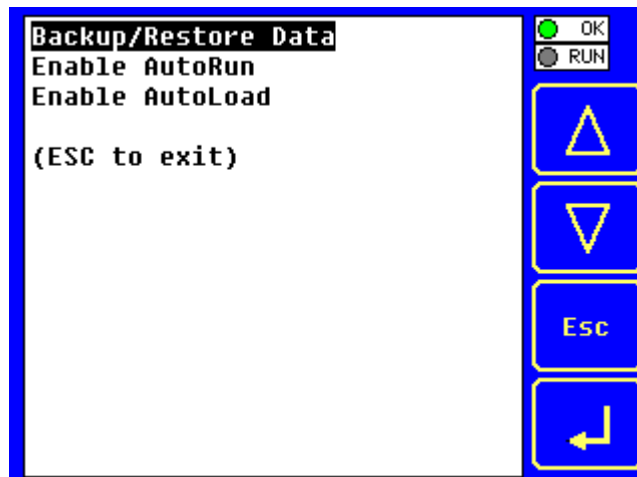


Figure 15.1 – Fail – Safe System Menu

15.2 Settings

To use the fail – safe feature, the user needs to do the following:

1. Backup the current Battery-Backed RAM Register contents in On-Board Flash memory using System Menu options.
2. From Cscope, create AUTOLOAD.PGM for the application program using 'Export to Removable Media'.
3. Place the Removable Media with AUTOLOAD.PGM in the device.
4. Set the 'Enable AutoLoad' option in the device to YES.
5. Set the 'Enable AutoRun' option to YES if the controller needs to be placed in RUN mode automatically after automatic restore of data or AutoLoad operation.

15.3 Backup / Restore Data

Selecting this option brings up a screen having four operations:

- Backup OCS Data.
- Restore OCS Data.
- Clear Backup Data.
- Exit



Figure 15.2 – Backup / Restore Data

Backup OCS Data:

When initiated, this will allow the user to manually copy Battery-Backed RAM contents on to the onboard FLASH memory of the OCS. This will have the effect of backing up all the registers and controller settings (Network ID, etc.) that would otherwise be lost due to a battery failure.

%SR164.4 is set to 1 when backup operation is performed.



Figure 15.3 – Backup Registers

Restore OCS Data:

When initiated, this will allow the user to manually copy the backed up data from the onboard FLASH to the Battery-Backed RAM.

A restore operation will be automatically initiated if a backup has been previously created and on power-up the Battery-Backed RAM registers fail their check.

The following process will be followed for restoring data:

- The controller will be placed in IDLE mode.
- Data will be copied from onboard FLASH to OCS Battery-Backed RAM
- The controller will reset.
- The controller will be put in RUN mode if the AutoRun setting is 'Yes' else it will remain in IDLE mode.



Figure 15.4 – Restore OCS Data

%SR164.3 is set to 1 only when an automatic restore operation is performed - not on a manual one. This bit is reset to 0 when a new backup is created.

Restoring of data can be manually performed by selecting RESTORE option from the Backup / Restore Data menu. This will cause the controller to reset.

Clear Backup Data:

When initiated, the backup data will be erased from the onboard Flash and no backup will exist. %SR164.4 and %SR164.3 is reset to 0 when backed up data is erased.



Figure 15.5 – Clear Backup Data

Exit: Goes back to the previous screen.

The OCS follows the following sequence in execution of Automatic Restore:

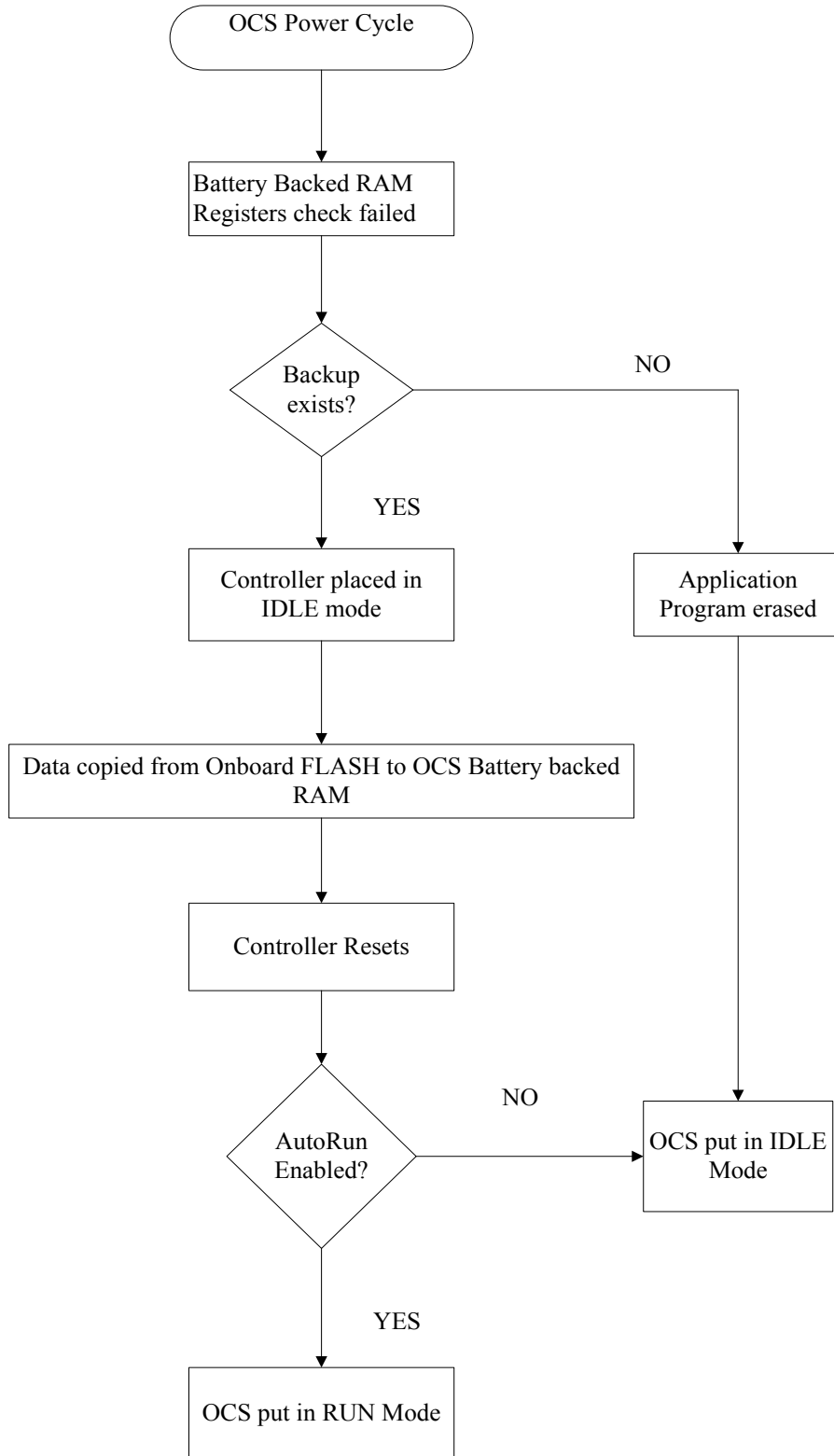


Figure 15.6 – Flow Chart for Automatic Restore

15.4 AutoLoad

This system menu option allows the user to specify whether the OCS automatically loads the application AUTOLOAD.PGM located in Removable Media.

When the AutoLoad setting is enabled (set to YES), it can either be manually initiated or automatically initiated at power-up.

The automatic initiation will happen only in the following two cases:

- When there is no application program in the OCS and a valid AUTOLOAD.PGM is available in the removable media of the device.
- When the program residing in onboard memory is corrupted and a valid AUTOLOAD.PGM is available in the removable media of the device.

AutoLoad can be manually initiated when the SYS-F3 key is pressed (OCS can be in any of the following mode – Idle / Run / DOIO). This also requires a valid AUTOLOAD.PGM to be present in the removable media of the device.

When the AutoLoad setting is not enabled (set to NO), OCS will be in IDLE mode and the application is not loaded.

If the AUTOLOAD.PGM is security enabled, the user will be prompted to enter the password before loading the application. The application will be loaded from the Removable media only after getting the correct password.

%SR164.6 can be set to enable AutoLoad feature.

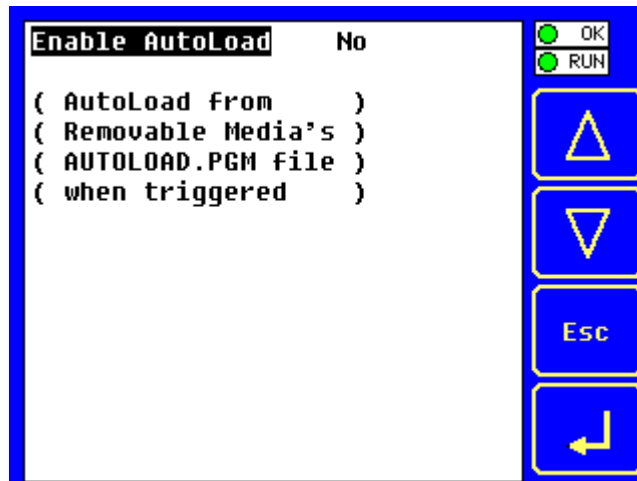


Figure 15.7 – AutoLoad Menu

The OCS follows the following sequence in execution of AutoLoad:

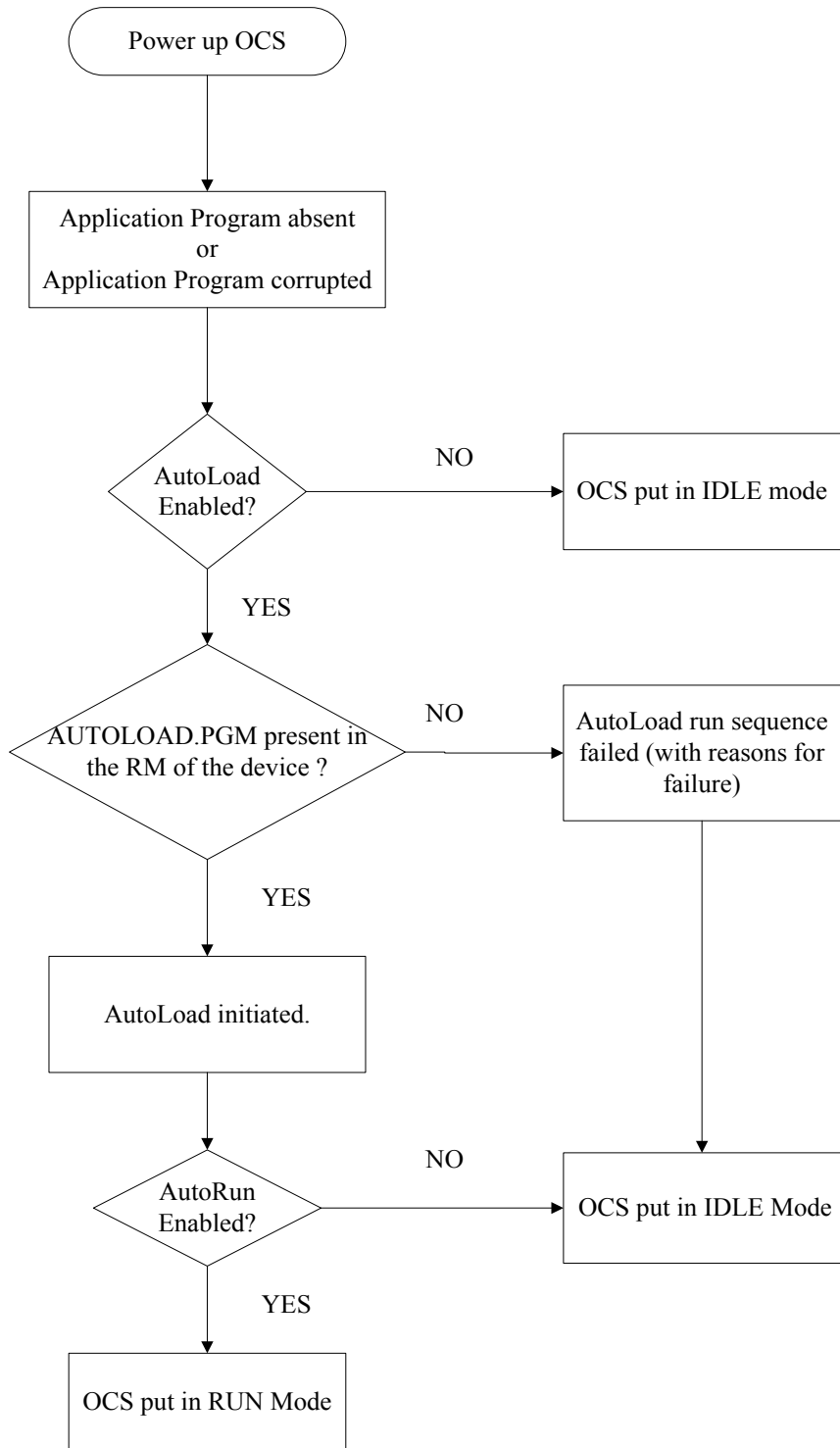


Figure 15.8 – Flow Chart for AutoLoad

15.5 AutoRun

This system menu option, when enabled (YES), allows the user to automatically place the OCS into RUN mode after the AutoLoad operation or automatic Restore Data operation.

When the AutoRun setting is disabled (NO), the OCS remains in the IDLE mode after a Restore Data or AutoLoad operation.

%SR164.5 can be set by putting the system into RUN mode automatically, once an AutoLoad has been performed or an Automatic Restore has occurred.

If for any reason the AutoLoad-Run (Loading the AUTOLOAD.PGM automatically and OCS put in RUN mode) sequence does not succeed, a pop-up message box saying "AUTO-LOAD-RUN SEQUENCE FAILED" will be displayed. It will also show the reason for its failure. On acknowledging this message box the AutoLoad-Run sequence will be terminated, controller will return to the first user-screen and will be placed in IDLE mode.

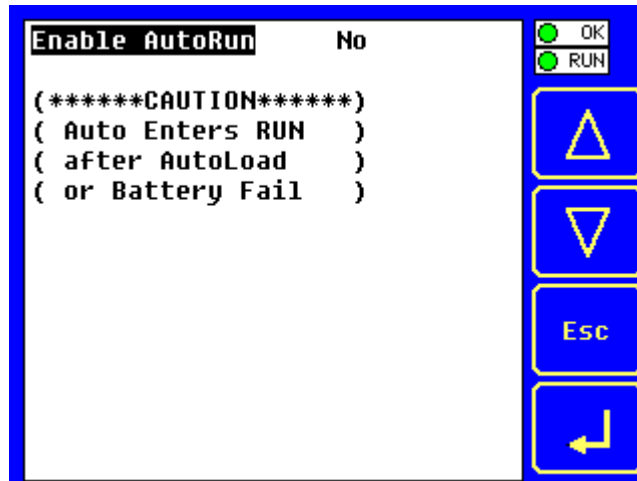


Figure 15.9 – AutoRun Menu

CHAPTER 16: CLONE UNIT

16.1 Overview

'Clone Unit' feature allows the user to "clone" the OCS of the exact same model. This feature "clones" application program and unit settings stored in Battery backed RAM of an OCS into the RM (refer Removable Media [Chapter 9](#) for details in using RM). It can then be used to clone a different OCS (exact same model).

This feature can be used for:

- Replacing an OCS by another unit of the same model.
- Duplicating or "clone" units without a PC.

16.2 Clone:

User needs to perform the following to Clone:

1. The 'Clone Unit' can be accessed by going to the 'System Menu' of the OCS. A new menu "Clone Unit" has been added at the end of the main system menu as shown below:

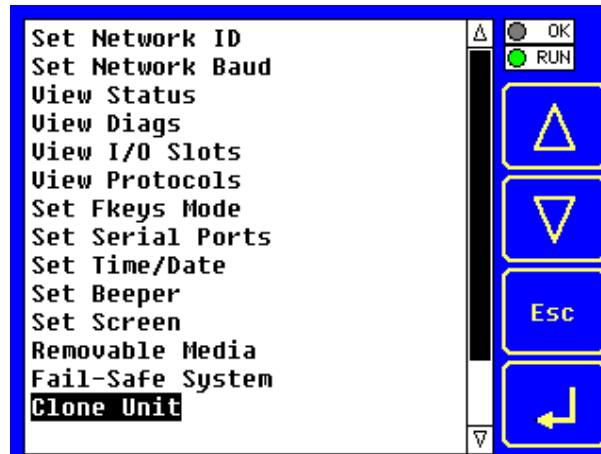


Figure 16.1 – System Menu

2. Selecting "Clone Unit" menu will open the following menu screen:

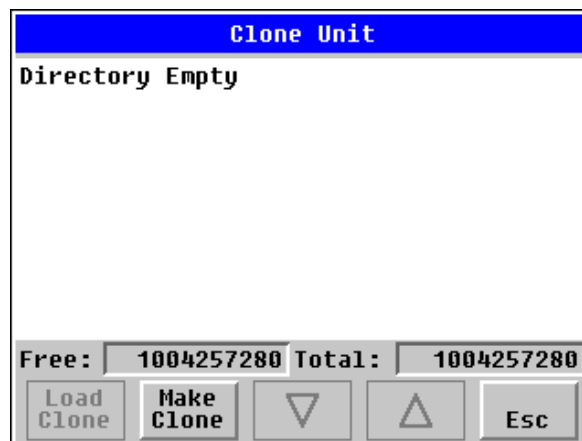


Figure 16.2 – Clone Unit Menu before Cloning

Note:

Free/Total – displays number of free and total bytes in Removable Media.

3. Make/Create Clone option enables user to duplicate / Clone application file, all unit settings and all register values from Battery Backed RAM.

Selecting Make Clone brings up the screen below for the user:

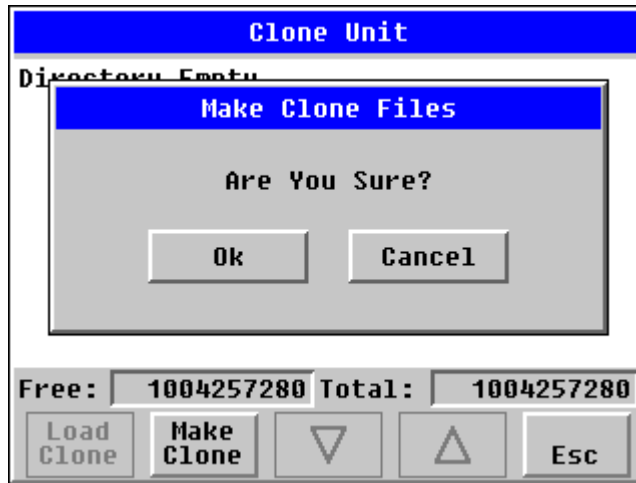


Figure 16.3 – Clone Unit Confirm Screen

After confirmation, the OCS will create two new files in the root directory of the Removable Media Drive as shown below:

AUTOLOAD.PGM
CLONE.DAT

Application file
File having all unit settings and register values from Battery Backed RAM

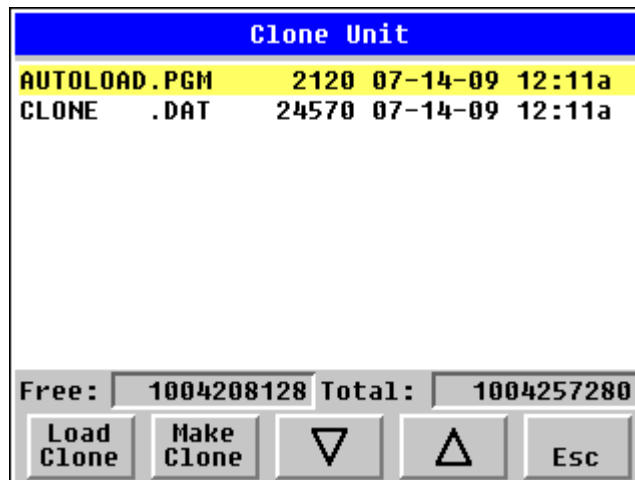


Figure 16.4 – Clone Unit Files

NOTE: Make/Create clone operation automatically includes the security in \AUTOLOAD.PGM file for security enabled files.

4. Once the cloning is successful, OCS gives a message as below:

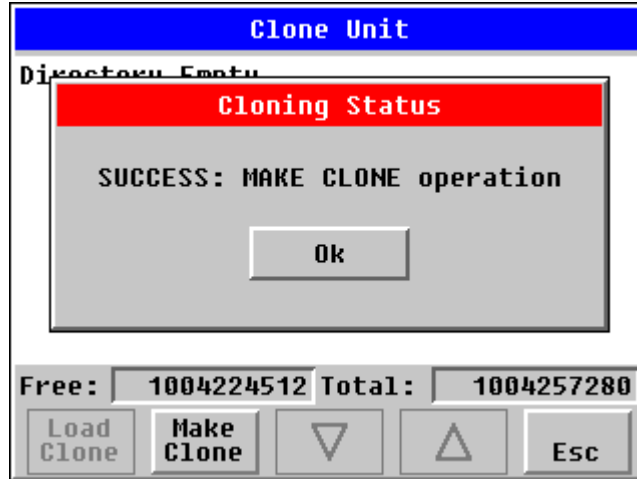


Figure 16.5 – Cloning Status

Make/Create clone can also be triggered by setting %SR164.9 bit to “1” from Ladder program or graphics. Once the operation is completed, this bit is made zero by the firmware. When Make clone operation is triggered by this SR bit, it does not ask the user for confirmation for making clone. The success / failure of the operation is also not notified on screen to the user.

In case of failure of “Make Clone” operation, %SR164.11 bit is set to “1” by the firmware and never reset.

NOTE: Backup of registers in flash memory is not performed by Clone Feature. If user desires, Backup should be done as explained in [Chapter 16](#) (Fail Safe System).

16.3 Load Clone

This option loads the application, all unit settings and register values from Removable media to the Battery backed RAM (Regardless of AutoLoad settings) and then resets the OCS for the settings to take effect.

User needs to perform the following to Load Clone:

1. Select “Clone Unit” from main system menu of OCS as shown below:

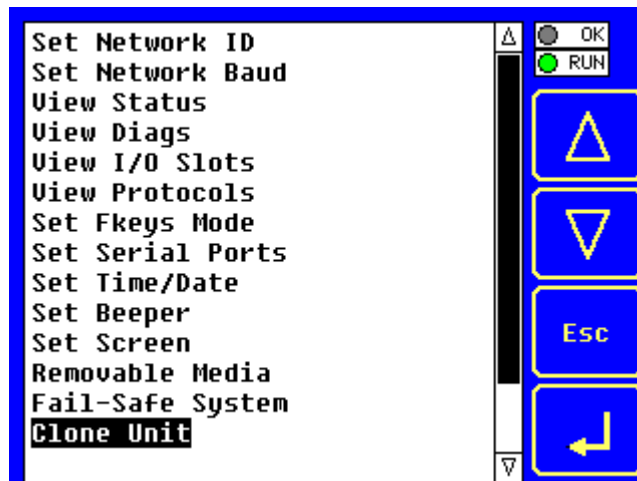


Figure 16.6 – System Menu

2. Selecting “Clone Unit” menu will open the following menu screen. Select “Load Clone”.

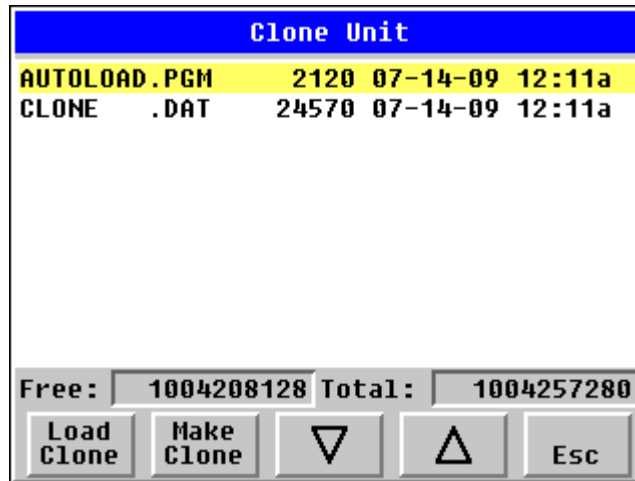


Figure 16.7 – Clone Unit Menu after Cloning

3. User needs to confirm Load Clone as shown below:

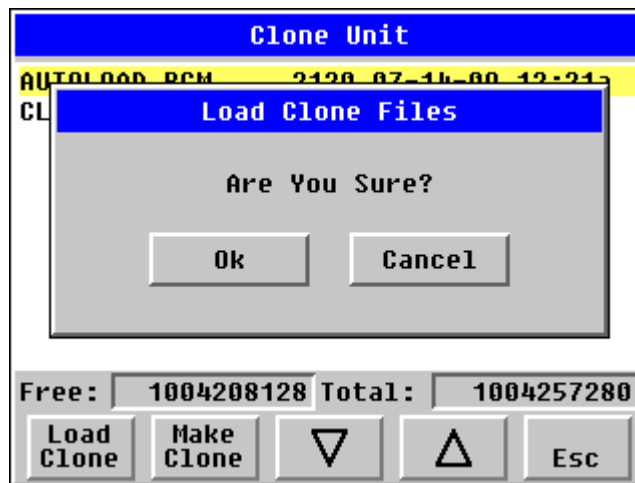


Figure 16.8 – Load Clone Confirm Screen

4. After confirmation, all unit settings and register values will be loaded from Removable media to the Battery backed RAM (Regardless of AutoLoad settings) and then OCS resets for the settings to take effect.

NOTE: For security enabled files, Load clone asks for password validation before loading the application.

Load clone can also be triggered by setting %SR164.10 bit to “1” from Ladder program or graphics. Once the operation is completed, this bit is made zero by the firmware. When Load clone operation is triggered by this SR bit, it does not ask the user for confirmation for loading clone. The success / failure of the operation is also not notified on screen to the user.

In case of failure of “Load Clone” operation, %SR164.12 bit is set to “1” by the firmware and never reset.

CHAPTER 17: MAINTENANCE

17.1 Firmware Updates

The X5 OCS products contain field updatable firmware to allow new features to be added to the product at a later time. Firmware updates should only be performed when a new feature or correction is required.

Warning: Firmware updates are only performed when the equipment being controlled by the X5 OCS is in a safe, non-operational state. Communication or hardware failures during the firmware update process can cause the controller to behave erratically resulting in injury or equipment damage. Make sure the functions of the equipment work properly after a firmware update before returning the device to an operational mode.

Steps for updating the firmware:

1. Loading new firmware will erase any program stored in the OCS for safety and compatibility reasons. Please backup the application prior to doing a firmware update.
2. Copy the supplied files onto a FAT32 formatted micro SD or USB based flash device.
3. Insert the flash device into the X5 making sure no other memory or drives are connected to the device.
4. Touch the far upper right corner of the touchscreen to bring out the function keys, then press and hold the SYSTEM key at least 5 seconds. You will be presented with a System Recovery menu.
5. Press the SYSTEM UPGRADE button. You will be presented with a Boot Installer Screen.
6. If you are just updating the firmware, press the "Update Firmware" button. This will take a few seconds to complete. Follow the prompts after the firmware update has completed.
7. If you are updating the bootloader, firmware and FPGA, or are changing the power-up splash screen, press the "Update Bootloader" button. This may take 30 or more seconds to complete. Follow the prompts after the bootloader update has completed.

17.2 Backup Battery

Under normal conditions the battery in the X5 OCS should last 5-10 years. Higher operating temperatures or variations in batteries may reduce this time.

17.2.1 *Indications the battery needs replacing*

The X5 OCS indicates the battery is low, failed or missing in a variety of ways. At power-up, an error message is displayed indicating the low or missing battery. The user program can monitor the battery using %SR55.13. This bit will turn on if the battery is low.

CHAPTER 18: TROUBLESHOOTING / TECHNICAL SUPPORT

Chapter 18 provides commonly requested **troubleshooting information and checklists** for the following topics.

- Connecting to the X5 OCS controller
- Local controller and local I/O
- CsCAN Network
- Removable media

In the event that this information is not what you need, please contact Technical Support at the locations indicated at the end of this chapter.

18.1 Connecting to the X5 OCS

Cscape connects to the local controller automatically when the serial connection is made. The status bar below shows an example of a successful connection. This status bar is located in the bottom right hand corner of the Cscape window.

Local:253 Target:253(R) [no forces]

In general the **Target** number should match the **Local** number. The exception to this is when the controller is being used as a "pass through" unit where other controllers on a CsCAN network could be accessed through the local controller.

Determine connection status by examining feedback next to **Local & Target** in the status bar of Cscape.

| | |
|-------------------------|---|
| Local: ### | If a number shows next to Local then communication is established to the local controller. |
| Local: No Port | Cscape is unable to access the COM port of the PC. This could mean that Cscape is configured for a COM port that is not present or that another program has control of the COM port. Only one Cscape window can access a port at a time. Subsequent instances of Cscape opened will indicate No Port. |
| Local: No Com | Cscape has accessed a PC COM port, but is not communicating with the controller. This typically occurs when the controller is not physically connected. |
| Local: ??? | Unknown communication error. Close Cscape, power cycle the controller and reopen Cscape with a blank project. Check Local. |
| Target: #(I,R,D) | If I (idle), R (run), or D (do I/O) shows next to Target number then communication is established to the target controller. |
| Target: #(?) | Communication is not established to the target controller. Check node ID of controller and set Target to match. Make sure local connection is established. |

18.1.1 Connecting Troubleshooting Checklist (serial port – MJ1 Programming)

1. Programming and debugging must use MJ1 or USB Mini B Port.
2. Controller must be powered up.
3. Ensure that the correct COM port is selected in Cscope: Tools/Editor Options/Communications Port.
4. Ensure that a straight through (non null modem) serial cable is being used between PC and controller port MJ1.
5. Check that a Loaded Protocol or ladder is not actively using MJ1. Taking the controller out of run mode from the System Menu on the controller will make MJ1 available to Cscope.
6. Make sure the COM port of the PC is functioning. An RS-232 serial loopback and Microsoft HyperTerminal can determine positively if the COM port is working. Or connect to an alternate device to determine if the port is working.
7. Successful communications with USB-to-serial adapters vary. If in doubt, Horner APG offers a USB to serial adapter. Part number HE500USB600.
8. X5 OCS units without Ethernet must use MJ1 or the Mini B USB Port for programming and debugging. If Ethernet is installed it can be selected as the programming port. The selection is made in the controller's System Menu. If there are difficulties connecting, make sure that the default programming port is set correctly with the connection method being attempted.

18.1.2 Connecting Troubleshooting Checklist (USB Port - Mini B Programming)

1. Programming and debugging must use Mini B USB Port or MJ1.
2. Controller must be powered up.
3. Ensure that the correct COM port is selected in Cscope: Tools/Editor Options/Communications Port
4. Be sure that the USB cable is connected between the PC and controller and check the Windows Device Manager to find out if the USB driver is properly installed and which port it set itself up on..
5. Make sure the USB port of the PC is functioning and/or connect to an alternate device to determine if the port is working.
6. X5 OCS units without Ethernet must use the Mini B USB Port or MJ1 for programming and debugging. If Ethernet is installed it can be selected as the programming port. The selection is made in the controller's System Menu. If there are difficulties connecting, make sure that the default programming port is set correctly with the connection method being attempted.

18.1.3 Connecting Troubleshooting Checklist (ETN port programming)

1. Programming and debugging must use MJ1 or Ethernet Port.
2. Controller must be powered up.
3. Ensure that correct IP address is given in the Ethernet field and correct Mode is selected, in Cscope: Tools/Editor Options/Communications Port
4. Ensure that the Ethernet Cable is connected between the controller and the Ethernet Hub.
5. Make sure the Ethernet cable is functioning properly.

18.2 Local Controller and Local I/O

The system menu provides the following status indications that are useful for troubleshooting and system maintenance.

- Self-test results, diagnostics.
- RUN and OK status
- Network status and usage
- Average logic scan rate
- Application memory usage
- Loaded firmware versions

- Loaded protocols
- Removable media access

To view the system menu, press the System key.



18.2.1 Local I/O Troubleshooting Checklist

1. Verify the controller is in RUN mode.
2. Check diagnostics to insure controller passed self-tests.
View diags in System Menu or in Cscape, click; Controller/Diagnostics
3. Check data sheets to insure proper wiring.
4. Insure that hardware jumpers and software configuration for I/O match.
5. Check data sheets for voltage and current limits.
6. Take ladder out of the picture. From Cscape set controller to "Do I/O" mode. In this mode inputs can be monitored and outputs set from a data watch window in Cscape without interference from the ladder program. Some I/O problems are only a result of a mistake in the ladder program.

WARNING: Setting outputs ON in Do I/O mode can result in injury or cause machinery to engage in an unsafe manner depending on the application and the environment.

18.3 CsCAN Network

For complete information on setting up a CsCAN network, refer to CAN Networks manual (MAN0799) by visiting our website for the address to obtain documentation and updates.

Network status, node ID, errors, and baud rate in the controller system menu are all in reference to the CsCAN network. These indications can provide performance feedback on the CsCAN network and can also be used to aid in troubleshooting.

18.3.1 CsCAN Network Troubleshooting Checklist

1. Use the proper Belden wire type or equivalent for the network as specified in MAN0799.
2. The X5 OCS does not provide 24VDC to the network. An external voltage source must be used for other devices such as SmartStix I/O.
3. Check voltage at both ends of the network to insure that voltage meets specifications of attached devices.
4. Proper termination is required. Use 121-ohm (or 120-ohm) resistors at each end of the network. The resistors should be placed across the CAN_HI and CAN_LO terminals.
5. Measure the resistance between CAN_HI and CAN_LO. If the network is properly wired and terminated there should be around 60 ohms.
6. Check for duplicate node ID's.
7. Keep proper wires together. One twisted pair is for V+ and V- and the other twisted pair is used for CAN_HI and CAN_LO.
8. Make sure the baud rate is the same for all controllers on the network.
9. Assure shields are connected at one end of each segment -- they are not continuous through the network.
10. Do not exceed the maximum length determined by the baud rate and cable type.
11. Total drop length for each drop should not exceed 6m (20 feet). A drop may include more than one node. The drop length adds to the overall network length.
12. Network should be wired in "straight line" fashion, not in a "star" pattern.
13. In applications requiring multiple power supplies, make sure the V- of all supplies is connected together and to earth ground at one place only.

14. In some electrically noisy environments it may be necessary to add repeaters to the network. Repeaters can be used to add additional nodes and/or distance to the network and protect the signal against noisy environments. The Horner APG repeater is part # HE200CGM100.

18.4 Removable Media

18.4.1 Basic Troubleshooting

| Description | Action |
|--|---|
| X5 OCS does not read media card. | The media card should be formatted with the X5 OCS. |
| X5 OCS will not download project file. | Make sure the project file is saved as a .pgm file and not a .csp file. In addition to file must be .pgm, the file's I/O configuration must match the X5 configuration for it to download. |

18.5 Technical Support Contacts

For manual updates and assistance, contact Technical Support at the following locations:

North America:

Tel: (317) 916-4274

Fax: (317) 639-4279

www.heapg.com

Email: techspt@heapg.com

Europe:

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

Fax: (+353)-21-4321826

www.horner-apg.com

Email: tech.support@hornerapg.com

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