User Manual for XL7 OCS

MAN0974-12-EN_XL7_UserManual

HE-XW1E0 / HEXT391C100
HE-XW1E2 / HEXT391C112
HE-XW1E3 / HEXT391C113
HE-XW1E4 / HEXT391C114
HE-XW1E5 / HEXT391C115
HE-XW1E6 / HEXT391C116

PREFACE

This manual explains how to use the XL7 OCS.

For user manual updates, please visit our website:

North America:
Tel: (+) (317) 916-4274
Fax: (+) (317) 639-4279
Website: https://hornerautomation.com
Email: techsppt@heapg.com

Europe:
Tel: (+) 353-21-4321-266
Fax: (+) 353-21-4321-826
Website: http://www.hornerautomation.eu
Email: technical.support@horner-apg.com

LIMITED WARRANTY AND LIMITATION OF LIABILITY

Horner APG, LLC, ("HE-APG") warrants to the original purchaser that the XL7 (HE-XW/HEXT391) 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 XL7 OCS module. THIS WARRANTY SHALL NOT APPLY TO THIS XL7 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 XL7 OCS module IS ORIGINALLY INSTALLED. THIS WARRANTY SHALL APPLY ONLY WITHIN THE BOUNDARIES OF THE CONTINENTAL UNITED STATES.

In no event, whether as a result of breach of contract, warranty, tort (including negligence) or otherwise, shall HE-APG or its suppliers be liable of any special, consequential, incidental or penal damages including, but not limited to, loss of profit or revenues, loss of use of the products or any associated equipment, damage to associated equipment, cost of capital, cost of substitute products, facilities, services or replacement power, down time costs, or claims of original purchaser's customers for such damages.

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

ABOUT PROGRAMMING EXAMPLES

Any example programs and program segments in this manual or provided on accompanying media 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 XL7 OCS module to appropriately design the end system, to appropriately integrate the XL7OCS 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.

VISUAL MAP OF CHAPTERS

FIRST STEP of ANY TASK: DATASHEET
Each XL7 OCS unit is sent with a datasheet in the box. **The datasheets are the <u>first</u> documents to refer to for model-specific information related to XL7 OCS models for specific installation information.** To obtain updates to datasheets, manuals and user documentation, visit a Horner website. **North America** https://hornerautomation.com   **Europe** http://www.hornerautomation.eu

QUICK START	INSTALLATION	PROGRAMMING	TROUBLESHOOTING
Safety / Compliance	Mechanical Installation	System Settings	Modbus Communications
Introduction	Electrical Installation	Registers	Back-up Battery
		Cscape Configuration	Maintenance
		General I/O	Troubleshooting
		High-Speed I/O	
		Serial Communications	
		CAN Communications	
		Ethernet Communications	
		Downloadable Communications	
		User Interface	
		Audio Object	
		Video Object	
		Removable Media	
		Clone Unit	
		Fail-Safe System	

TABLE OF CONTENTS

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 <u>not</u> replace the fuse again as a repeated failure indicates a defective condition that will <u>not</u> 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.

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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 <u>not</u> 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 floors are 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 Compliance

To check for compliance and updates, visit the Horner website.

North America   https://hornerautomation.com
Europe   http://www.hornerautomation.eu

CHAPTER 2: INTRODUCTION

2.1 Visual Overview of XL7 OCS

1. Touchscreen
2. Function Keys
3. MJ1: RS232/ MJ2: 1/2 duplex RS485
4. Dip Switches
5. MJ3: RS-232/485 Serial Port
6. CAN1 Port
7. PWR: 10-30VDC In
8. Audio In & Out Ports
9. USB 2.0 "A": Flash Drive
10. LAN 1 & 2 Ports
11. CAN2 Port
12. USB mini "B": Programming
13. microSD: Data Storage
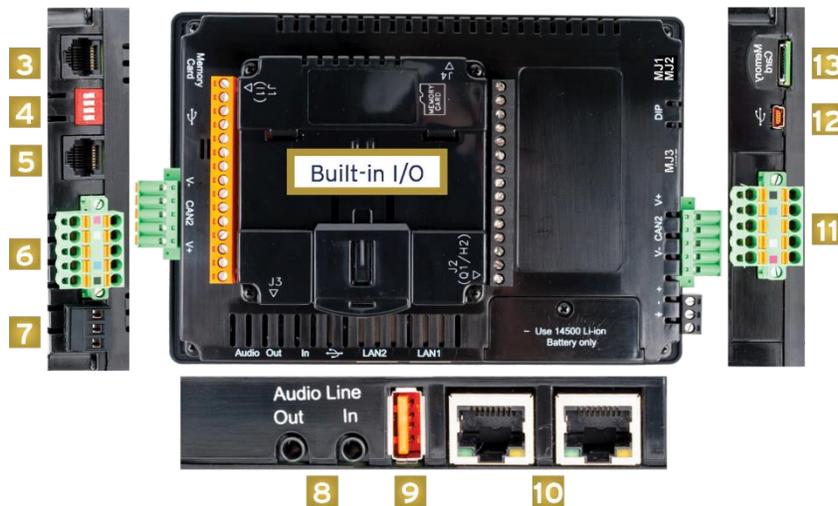
Figure 2.1 – Overview of the XL7

2.1.1   Where to Find Information about the XL7 OCS

a. **Datasheet** - The **datasheet is the first document to refer to for key information** related to specific XL7 OCS models. The datasheets for all XL7 OCS models are available on the Horner websites and contain pin-outs, jumper settings and other model specific information.

Table 2.1 – Datasheet Manual Numbers	
Model 0	MAN1161
Model 2	MAN1162
Model 3	MAN1163
Model 4	MAN1164
Model 5	MAN1165
Model 6	MAN1166

b. **User Manual** -This manual provides general information that is common to XL7 OCS models and can be downloaded from our web. Visit the Horner website to obtain user documentation and updates.

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Europe   http://www.hornerautomation.eu

2.1.2   Four main types of information are covered in this 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 XL7 OCS
d) Maintenance and Support

2.1.3   Manual Index

Major topics of interest may be found in the Index towards the end of this manual.

2.1.4   Table of Figures

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

2.2   Connectivity to the XL7 OCS

The XL7 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 XL7 OCS.
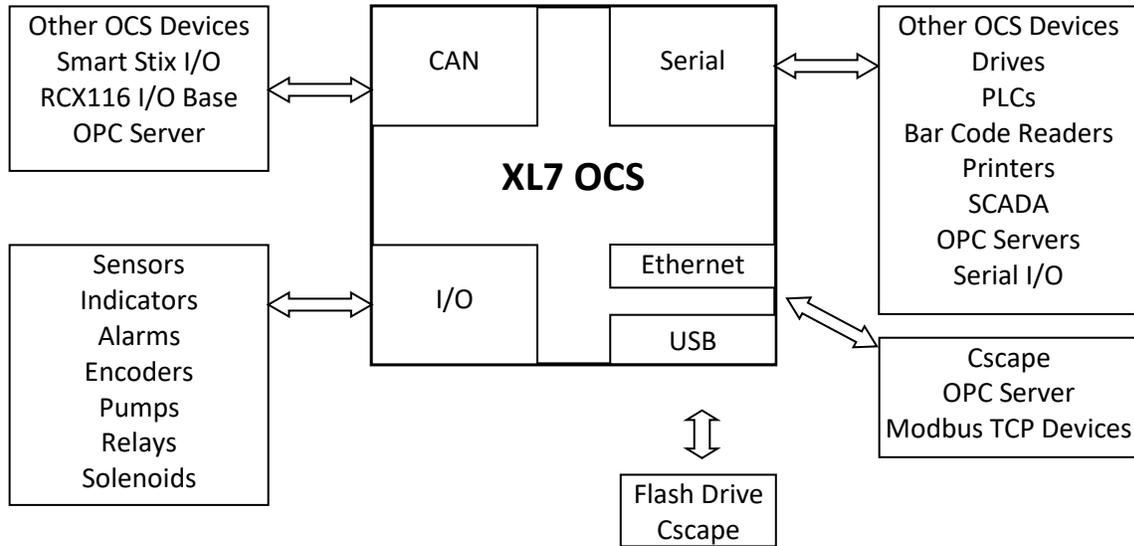
Figure 2.2 – Visual Overview of Types of Devices that can be connected to XL7 OCS

2.3   Features of XL7 OCS

The XL7 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 XL7 OCS include:

- Bright, 65,536 color graphical touch sensing LCD display in all models of XL7.
- 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 32GB 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, thermocouple, RTD, high speed counters, PWM outputs and relays (depending upon the XL7 OCS model used).
- Advanced high speed I/O capabilities.
- Cscape programming software that allows all aspects of the XL7 OCS to be programmed and configured from one integrated application.
- Optional communication add-on modules.
- On board Ethernet port (10/100Mbps) for Cscape programming and application defined communication, with Auto MDI/MDI-X.

2.4   Accessories

Please visit the Horner Control Accessories website for communication, programming, and I/O accessories.

North America   http://hornerautomation.com/product-category/home/control-accessories/
Europe   https://www.hornerautomation.eu/product-overview/

2.5   Useful Documents and References

Visit our website to obtain user documentation, supplemental documents, certificates, and other documentation.

North America   https://hornerautomation.com
Europe   http://www.hornerautomation.eu

2.6   Opening Cscape Help File

After opening the Cscape Help file, either use the Contest, Index or Search tabs to located information. The Cscape Help file has more information than the scope of this user manual.

Select "Index" tab.
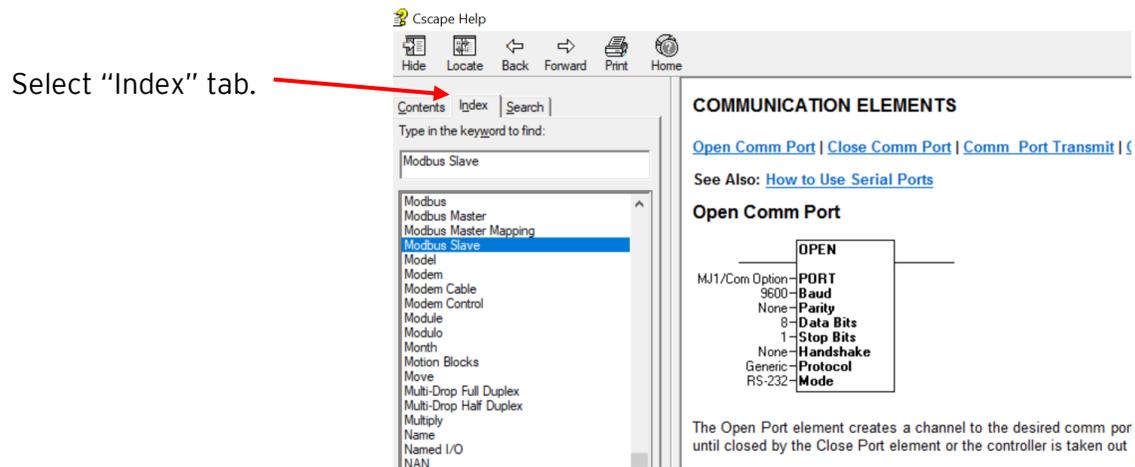
CHAPTER 3: MECHANICAL INSTALLATION

NOTE: The datasheet is the first document to refer to for model-specific information related to XL7 OCS models such as pin-outs, jumper settings, and other key installation information. Visit the Horner websites to obtain datasheets, user documentation, and updates.

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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)
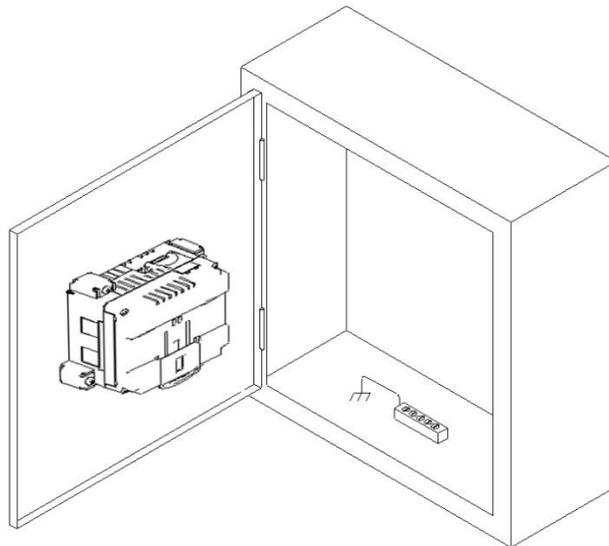
Figure 3.1 – Panel Mounting of an XL7 Series OCS

Once the panel design has been completed using the criteria and suggestions in the following sections, use the following steps to panel mount the XL7 OCS.

1. Remove all connectors from the XL7 OCS unit.
    2. Make sure the gasket is installed on the XL7 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 each of the four (**4**) mounting clips into the slots in the XL7 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 7-10 in-lbs (0.8-1.13 Nm).

3.3   Mounting Orientation

3.3.1   XL7 OCS Mounting Clip

Slots for mounting clips

Figure 3.2 – XL7 OCS with Mounting Clips

3.3.2 XL7 OCS Mounting Orientation
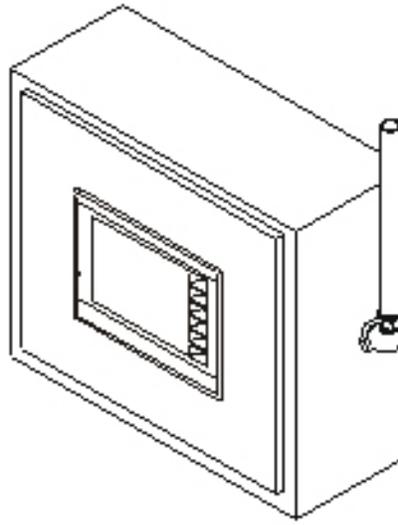
Figure 3.3 – Orientation of XL7 OCS

NOTE: There are no orientation restrictions on the XL7 OCS. However, the above orientation provides for optimum readability of the screen and ease of use of the keypad.

3.4 XL7 Back Cover Dimensions

Standard Back Cover Dimensions:
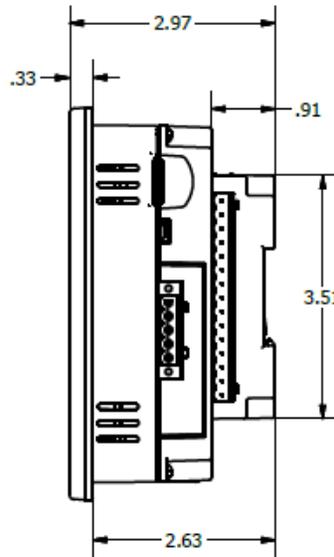
Figure 3.4 – Standard Back Cover Dimensions

Extended I/O Back Cover Dimensions
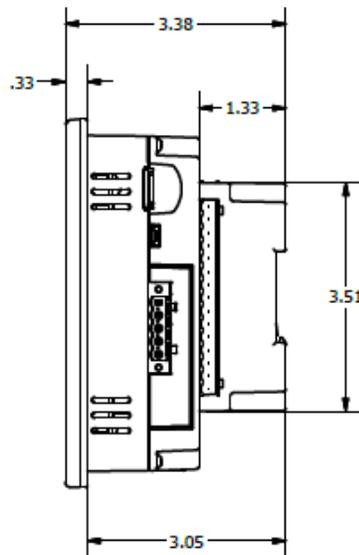
Figure 3.5 – Extended I/O Back Cover Dimensions

3.5   Panel Cut-Out

For installations requiring NEMA 4X liquid and dust protection the panel cutout should be cut with a tolerance of +1mm / -0mm.
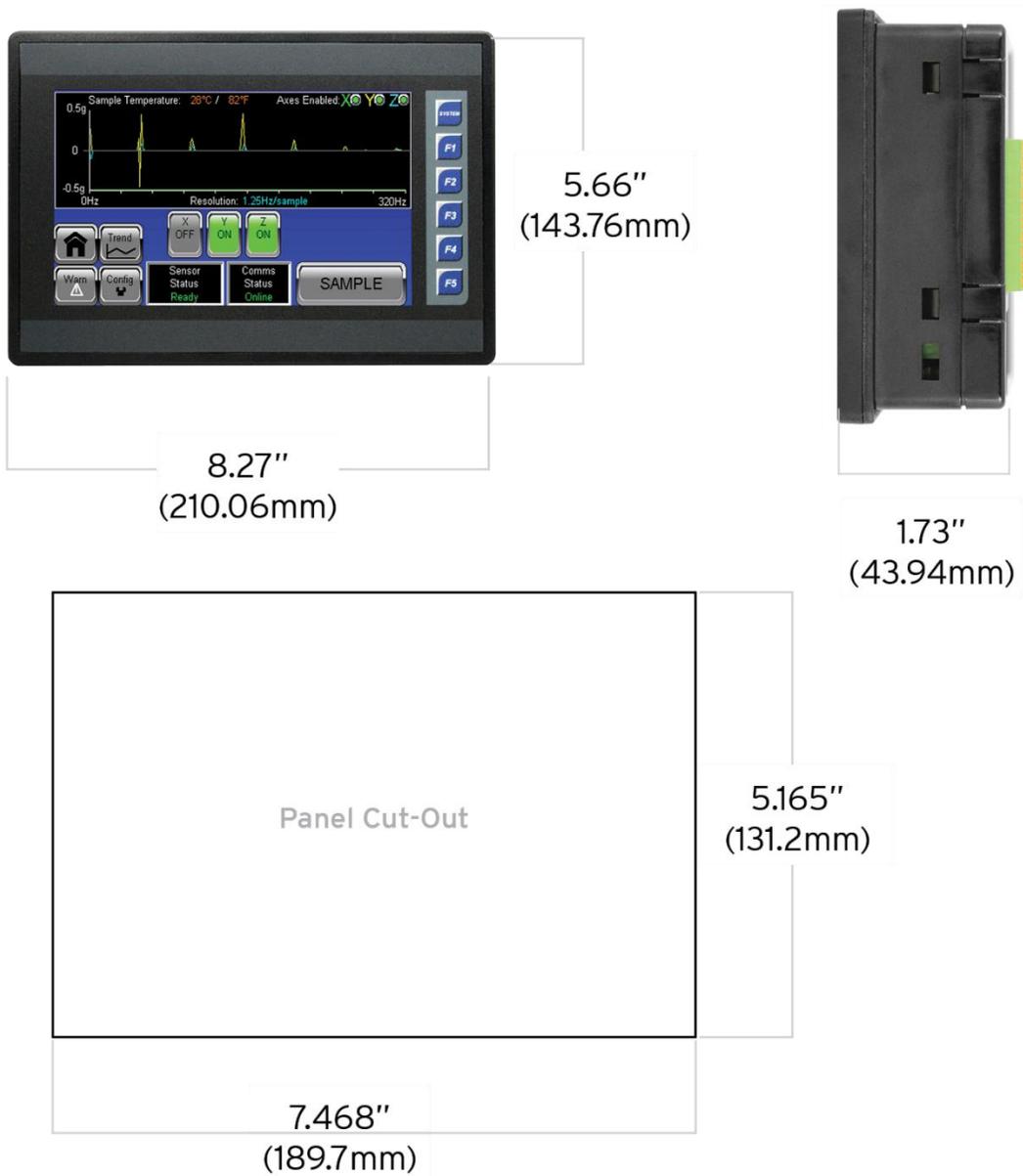
Figure 3.6 – XL7 OCS Dimensions

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" (50.80mm)
Minimum Distance between base of device and wiring ducts	1.5" (38.10mm)
If more than one device installed in panel box (or on door): Minimum Distance between bases of each device	4" (101.60mm) between bases of each device
When door is closed: Minimum distance between device and closed door *(Be sure to allow enough depth for the OCS.)*	2" (50.80mm)

3.6.2   Grounding

> **WARNING: Be sure to meet the ground requirements of the panel manufacturer and meet applicable electrical codes and standards.**

Panel box: The panel box must 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 XL7 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 XL7 OCS and noisy devices such as relays, motor starters, etc.

For details on output protection, especially when using contactors, solenoids, etc., see **MAN0962.**

3.6.6 Shock and Vibration

The XL7 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 XL7 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 <u>box</u> properly connected to earth ground? Is the panel <u>door</u> properly grounded? Has the appropriate procedure been followed to properly ground the <u>devices</u> 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 XL7 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 XL7 OCS and noisy devices such as relays or motor starters? Ensure that power and signal wires are <u>not</u> routed in the same conduit.
☐	Are there other requirements that impact the particular system, which need to be considered?

CHAPTER 4:   ELECTRICAL INSTALLATION

NOTE: The datasheets are the first documents to refer to for model-specific information related to XL7 OCS models such as pin-outs, jumper settings, and other key installation information. Visit the Horner websites to obtain datasheets, user documentation, and updates.

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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). Grounding is also for the safety of the user.

4.2   Ground Specifications

Ideally, a ground resistance measurement from equipment to earth ground is 0Ω. In reality, it typically is higher. The U.S. National Electrical Code (NEC) states the resistance to ground shall not exceed 25Ω. Horner APG recommends less than 15Ω resistance from our equipment to ground. Resistance greater than 25Ω 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.
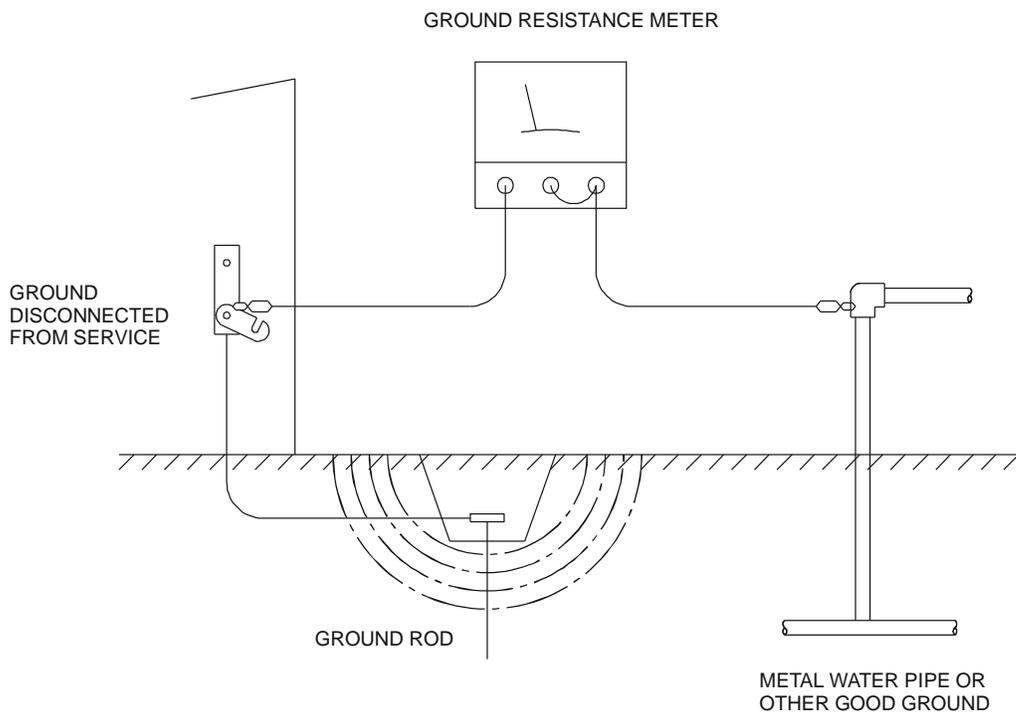
Figure 4.1 – Two-Point Ground Connection Test

4.4   Primary Power Port

Table 4.1 – Primary Power Port Pins		
PIN	**Signal**	**Description**
⏚	⏚	Frame Ground
-	0V	Input power supply ground
+	+24V	Input power supply positive voltage
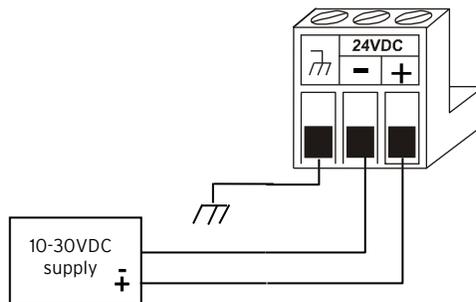
Figure 4.2 – Power Connector (Primary Power Port)
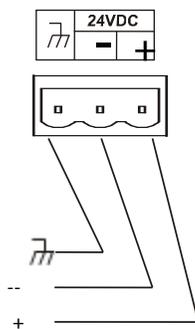
DC INPUT / FRAME

Solid/Standard Wire: 12-24 awg (2.5-0.2mm).
Strip Length: 0.28″ (7mm).
Torque Rating: 4.5 – 7 in-lbs (0.50 – 0.78 N-m).

DC- is internally connected to I/O, but is isolated from CAN-V.

A Class 2 power supply must be used.

Figure 4.3 – Primary Power Port

CHAPTER 5:   SYSTEM SETTINGS AND ADJUSTMENTS

> Press the upper right corner to bring out the function keys and SYSTEM key in order to access the Main Menu.

5.1   System Menu - Overview

The XL7 has a built-in System Menu, which lets the user view System Settings and makes adjustments. To start the System Menu, 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.
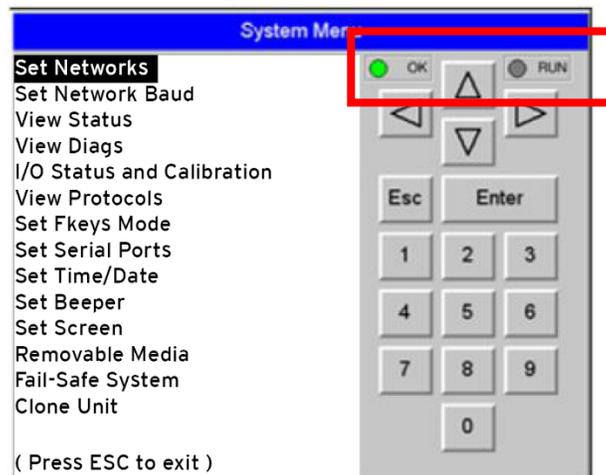
See table below for RUN and OK LED information.

Figure 5.1 – System Menu (XL7) Screenshot

Table 5.1 - OCS LEDs	
RUN	• OFF indicates OCS is in IDLE/STOP mode. • Flashing indicates DO / IO mode or RUN with no ladder program. • ON indicates ladder code running.
OK	• OFF indicates one or more self-tests failed. • ON indicates all self-tests passed.

5.2   System Menu – Navigation and Editing

As mentioned above, the System Menu is started by pressing the System key on the XL7. 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.
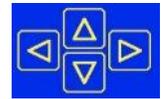
The arrow keys are used to edit System Settings that have just a few possible values. Each time the arrow key is pressed, a new possible value is displayed. When the desired value appears, press the **Enter** key to save it; otherwise press the **ESC** key to cancel the edit.

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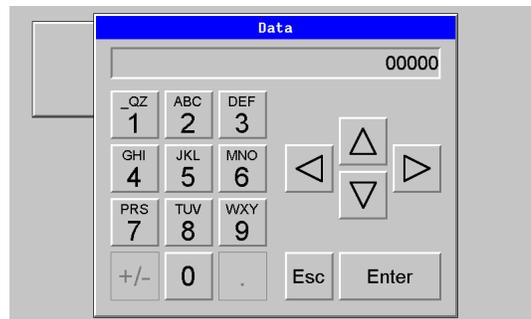
In addition, to edit a single numeric digit, use the ← or → key to select the digit and then either press a numeric key or use ↓ or ↑ to modify the digit. In any case, after entering the new desired value, press the **Enter** key to save it; otherwise press the **ESC** key to cancel the edit.

Sub-Menus

```
Network Ok?              No
Network ID               1
CAN                      No
Termination
MAC ID:       00:E0:C4:04:C7:
                            35
IP Address:   192.168.254.1
                            28
Network       255.255.255.0
Mask:
Gateway          0.0.0.0
NetM2:        255.255.255.0
GatW2            0.0.0.0
```

```
 Network Baud:      125 KB
  ( Use ↑↓ to adjust )
```

```
 Model:           HE-X7R
 Mode:               Run
 Scan Rate(mS):      2.4
 Lcl Net Use(%):     0.0
 All Net Use(%:)     0.0
 Ladder Size:       7724
 Config Size:        648
 Graphics Size:    76164
 String Size:      18996
 Bitmap Size:    1812850
 Text Tbl Size:      152
 Font Tbl Size:   130984
 Protocol Size:       16
 SMS File Size:       16
 Firmware Rev:     14.15
 BIOS Rev:          0.22
 itRD Rev:          1.06
 OS Ver:        2.6.35.44
 Self-Test:           OK
```

```
 Logic Error:        Ok
 User Program:       Ok
 User Graphics:      Ok
 W-Dog Trips:         2
 Net Errors:          0
 Network State:      Ok
 Network ID:         Ok
 Dup Net ID:         Ok
 Clock Error:        Ok
 I/O System          Ok
 Battery:            Ok
```

```
CPU Temperature (C)     57
Battery Voltage (mV)  3046
CPU Frequency (MHz)    996
MAX Temperature (C)     61
```

```
 Slot 1: I/O: Xex02
 Slot 2: I/O: Empty
 Slot 3: I/O: ETN300
```

```
MJ1:
 (None Loaded)
MJ2:
 (None Loaded)
COM:
 (None Loaded)
MJ3:
 (None Loaded)
```

```
XL7 System
Menu Map
```

```
Set Networks
View Status
View Diags
View Battery
Status
View I/O Slots
View Protocols
Set Fkeys Mode
Set Serial Ports
Set Time/Date
Set Beeper
Set Screen
Removable Media
Fail-Safe System
Clone Unit
License Details
(Press ESC to
Exit)
```

Figure 5.2 - System Menu

Sub-Menus

```
 Fkeys:       Momentary
 SYS-Fn enable:     Yes

 ( Use ↑↓ to adjust )
```

```
 Dflt Pgm Port   MJ1-232
 MJ2 RS485 Bias       No
 MJ3 RS485 Bias       No
 ( Use ↑↓ to adjust )
```

```
 Time:          14:58:03
 Date:        08-Sep-2015
 Day:           Tuesday
  UTC/Daylight Savings Time
 ( Use ↑↓ to adjust )
 (    each field     )
```

```
 Beeper            No
 enable:

 ( Use ↑↓ to adjust )
```

```
 Server enable:     No
 Timeout(min):      15
 Popup Status:     Off
 Update Time(mS):    5

 Update time sets
 the maximum time
 used by graphics
 in the logic scan.
```

```
     Media Directory
 Media Card Not Present
```

```
Backup/Restore Data
Enable AutoRun
Enable AutoLoad
(ESC to exit)
```

```
       Clone Unit
 Media Card Not Present
```

```
    License Details
 Server/ Users/ Pages/Data
 Points/ Exp. Date/User
 Logged In
```

5.3   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	125kB = 125kBd CAN network 250kB = 250kBd CAN network	500kB = 500kBd CAN network 1MB = 1MBd CAN network
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 and are reverted to whenever the unit goes from idle to run mode.

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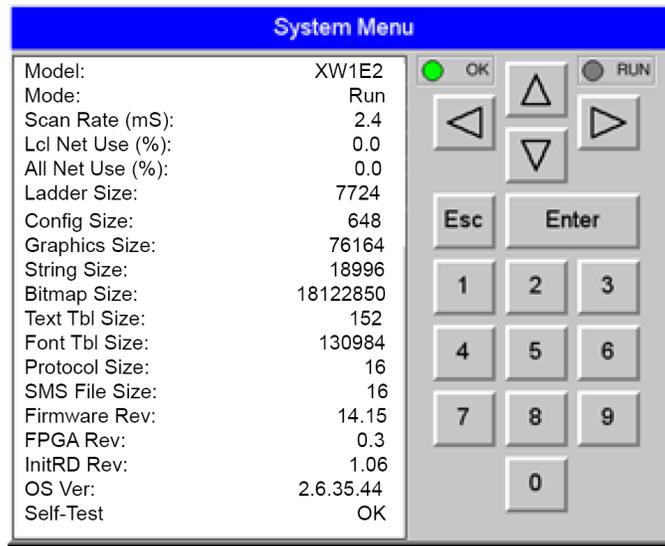
The View Status Sub-Menu displays up to 19 System Settings. Only the **OCS Mode** System Setting is editable.

Model	**XW1yz**= Model number of this XL7 OCS unit **1yz** = indicates the installed I/O module **00** = no I/O module
OCS Mode	**Idle** = XL7 OCS is in Idle mode **DoIO** = XL7 OCS is in Do I/O mode **Run** = XL7 OCS is in Run mode
Scan Rate(mS)	**0.0** = XL7 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 XL7 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
OS Ver	**a.b.cd.yz** = Current Operating System version
FPGA Rev	**x.y** = Current FPGA version (High Speed IO Sub System)
InitRD Rev	**x.yz** = Bootloader version
Self-Test	**Ok** = All power-on self-tests passed **Fault** = One or more power-on self-tests failed

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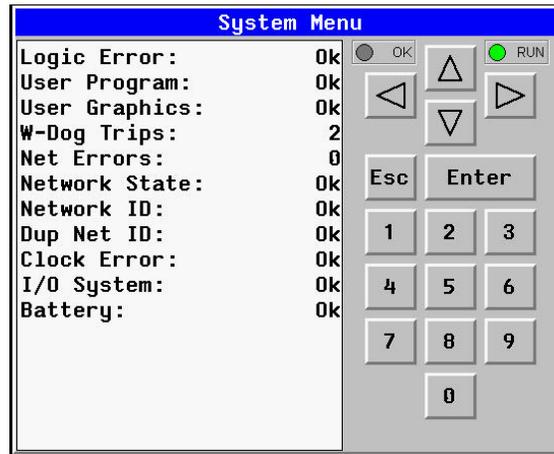
The View Diags Sub-Menu displays up to 11 System Diagnostics, none of which are editable.

The first two System Diagnostics are critical. If either of these indicate a Fault condition, the XL7 OCS will <u>not</u> 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 <u>not</u> 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 these indicate a warning condition, the XL7 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

5.6   View Battery Status
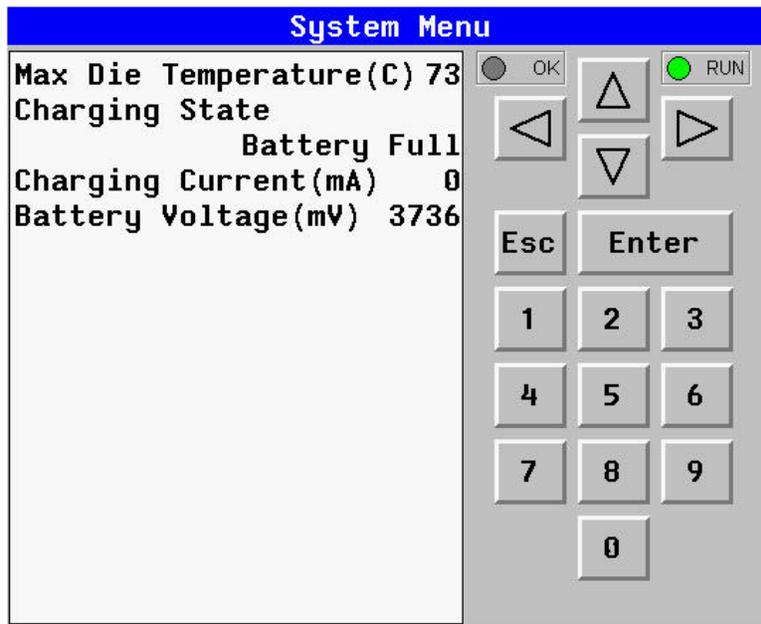
The View Battery Status displays the following information.

Waiting	The charging system is waiting for voltages and temperatures to stabilize.
Battery Charging	The battery is charging.
Battery Full	Shows at the end of a charge cycle. Remains in this state until the battery is steadily discharging.
Battery Discharging	The battery is steadily discharging.

5.7   View I/O Slots
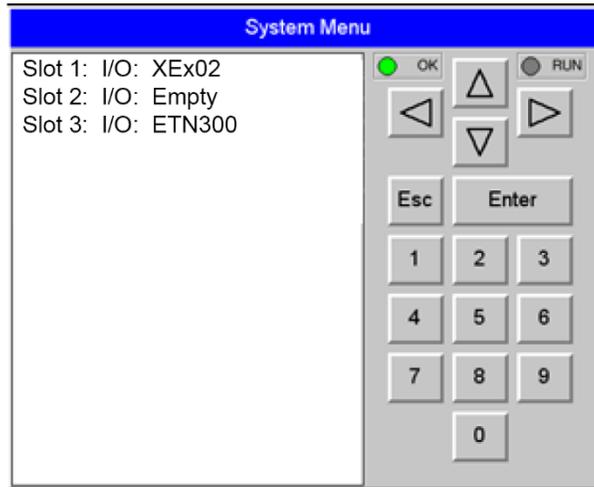
The View I/O Slots Sub-Menu displays three System Settings, none of which may be edited.

Internal to the XL7 OCS, there is a CPU board, and up to two installed modules. Model 0 has no installed I/O or COM modules. All other models have an I/O module and can have a user-installed COM module.

Depending on which I/O module is installed and which I/O module has been configured by Cscape, one of the following six System Settings should appear for Slot 1:

Slot 1: I/O: Empty	= No I/O module installed or configured
Slot 1:*Unsupported	= Unsupported I/O module installed
Slot 1:-I/O Missing	= No I/O module installed but an I/O module is configured
Slot 1:+I/O: XExyy	= yy I/O module installed but no I/O module configured
Slot 1:?I/O: XExyy	= yy I/O module installed but another I/O module configured
Slot 1: I/O: XExyy	= yy I/O module installed and configured properly

Depending on the COM module that is installed and the COM module that has been configured by Cscape, one of the following six System Settings appears for Slot 2:

Slot 2: I/O: Empty	= No COM module installed or configured
Slot 2:*Unsupported	= Unsupported COM module installed
Slot 2:-I/O Missing	= No COM module installed but a COM module is configured
Slot 2:+I/O: XzC	= z COM module installed but no COM module configured
Slot 2:?I/O: XzC	= z COM module installed but another COM module configured
Slot 2: I/O: XzC	= z COM module installed and configured properly

Slot 3: I/O: ETN300	= ETN300 has been configured through Cscape

5.8   View Protocols
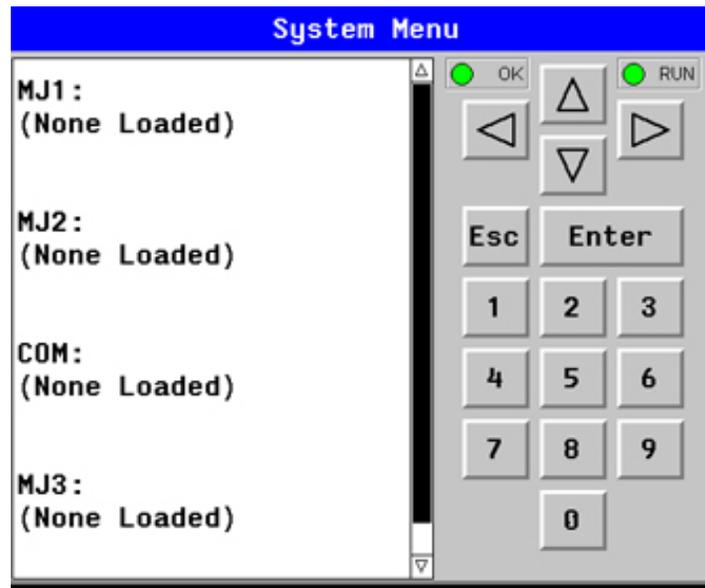
The View Protocols Sub-Menu displays two System Settings, neither of which may be edited.

As mentioned in 0, both the MJ1/MJ2 (Port 1) and MJ3 (Port 2) serial ports support downloadable protocols. To assign a downloadable protocol to an XL7 OCS serial port, select the **Protocol Config** item in Cscape's Program menu and then set up 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 each of MJ1, MJ2 COM board and MJ3.

5.9   Set Fkeys Mode
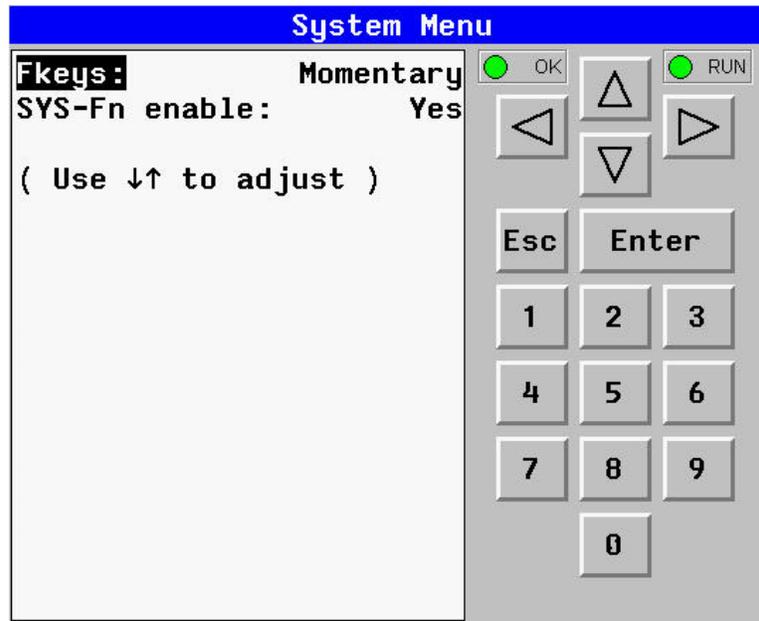
The Set Fkeys Sub-Menu displays two System Settings, both of which may be edited.

Fkeys	**Momentary**= %K1-5 bits go On & Off as F1-F5 are pressed & released **Toggle**= %K1-5 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

5.9   Set Serial Ports
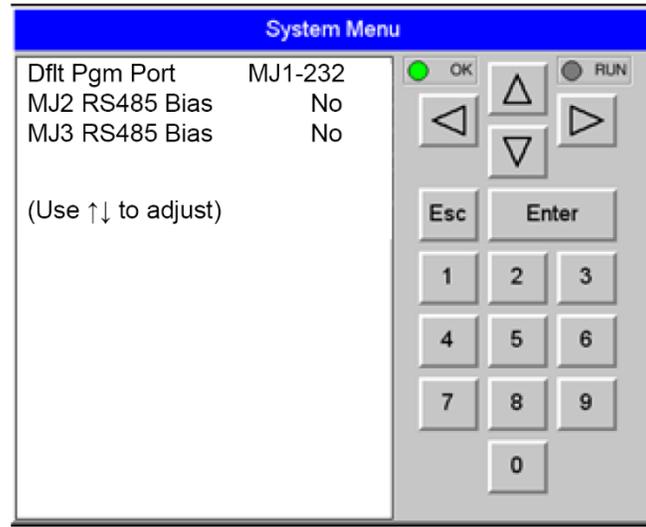
The Set Serial Ports Sub-Menu displays three System Settings, all of which may be edited, and one optional item. For the **Dflt Pgm Port** System setting, only MJ1-232 can be selected, unless a Modem (XMC) COM module is installed.

Dflt Pgm Port	**MJ1-232**= MJ1 RS232 port is the default programming port **Modem**= Modem COM module is the default programming port
MJ2 RS485 Bias	**No** = MJ2 RS485 bias resistors are <u>not</u> switched in **Yes** = MJ2 RS485 bias resistors are switched in
MJ3 RS485 Bias	**No** = MJ3 R5485 bias resistors are <u>not</u> switched in **Yes** = MJ3 R5485 bias resistors are switched in

5.10   Set Time/Date

The following instructions are to set and display the real-time clock in the controller. More details can be found in the **Help File** in Cscape.

Table 5.2 Clock and Time Setting Terms	
Coordinated Universal Time (UTC)	Abbreviated to **UTC**, Coordinated Universal Time is the primary time standard by which the world regulates clocks and time.
Time Offset	In order to obtain the local time (anywhere in the world), user needs to subtract / add a certain number of hours from UTC depending on how many time zones user is away from Greenwich.
Network Time Protocol (NTP)	A Networking Time Protocol (NTP) for clock synchronization between computer systems over packet-switched, variable latency data networks.
Daylight Saving Time	Time as adjusted to achieve longer evening daylight, especially in summer, by setting the clocks an hour ahead of the standard time.
Apply Daylight Saving (DST)	Daylight Saving Time (DST) is the practice of setting the clocks forward one hour from standard time during the summer months, and back again in the fall, in order to make better use of natural daylight. Selecting this option increases the Time offset by 1 hour.

NOTE: Not all controllers contain real-time clocks.

NOTE: Controller Time Zone (UTC time): From Cscape 9.70 SP2 and FW 14.22 onwards, UTC time is supported.

Table 5.3 – System Registers for UTC (Coordinated Universal Time)	
%SR210 (R/W)	Time Zone: set in hours + / - UTC.
%SR211 (R/W)	Daylight Saving: YES = 1 Daylight Saving: NO = 0 (If daylight saving is enabled, one hour will be added to the local time).
%SR212 (R)	UTC – Seconds
%SR213 (R)	UTC – Minutes
%SR214 (R)	UTC – Hours
%SR215 (R)	UTC – Date
%SR216 (R)	UTC – Month
%SR217 (R)	UTC – Year
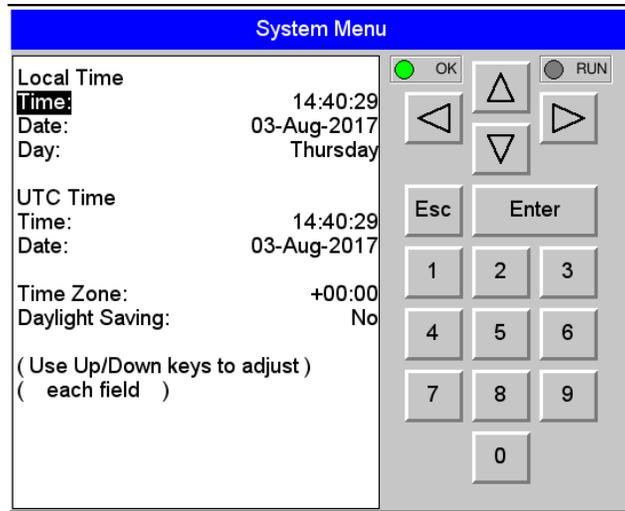
To Set Time Zone: The Time Zone setting is an hourly offset from UTC time. If using the Time Zone setting, set it first, then set the local time. UTC time will be automatically set based on the time zone and local time settings.

If using NTP: NTP utilizes UTC time, therefore when using NTP, the appropriate hourly offset from UTC time must entered into the time zone setting.

Daylight Saving Time: If currently observing Daylight Saving Time, set to **Yes**. If not currently observing Daylight Saving Time, set to **No**. The OCS controller does not automatically switch to daylight saving time; however, program logic can be written to accomplish an automatic switchover using system register %SR211. In program logic, move a "1" (INT) into %SR211 to enable Daylight Saving Time. Move a "0" (INT) into %SR211 to disable Daylight Saving Time. Trigger the move to %SR211 based on a compare function to the RTC date according to daylight saving practices in your desired region.

To Set Local Time: The **Set Time/Date** sub-menu displays three system settings. **Time** and **Date** may be edited, and **Day** is automatically calculated from the **Date** setting.

NOTE: Time and **Date** are split into three fields each, all of which may be edited. Touch the field or use ↓ or ↑ buttons to select a field, then use the ↓ or ↑ buttons to edit the field.

Time	**16:09:49** = Current time (hours:minutes:seconds in 24-hour format)
Date	**10-Jun-2013** = Current date (day-month-year)
Day	**Monday** = Current day of week calculated from the Date setting

5.11   Set Beeper
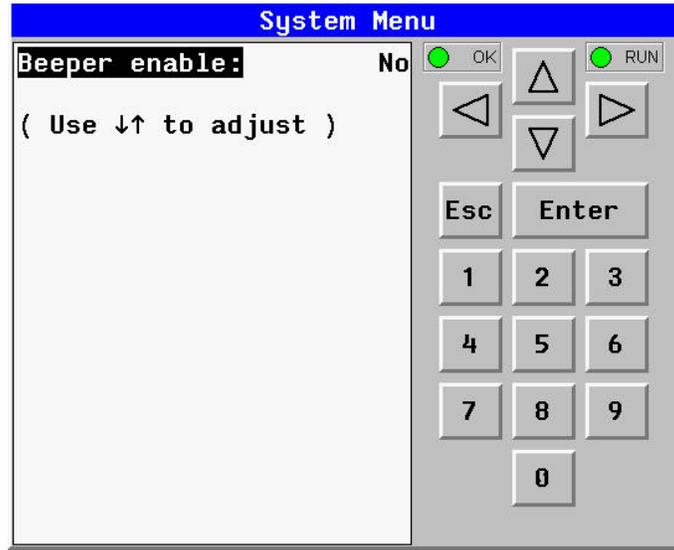
The Set Beeper Sub-Menu displays one System Setting, which may be edited.

Beeper Enable	Yes *(default)* = Enables beeper No = Disables beeper *(does NOT affect ladder access)*

5.12 Set Screen

The Set Screen Sub-Menu displays four System Settings, all of which may be edited.
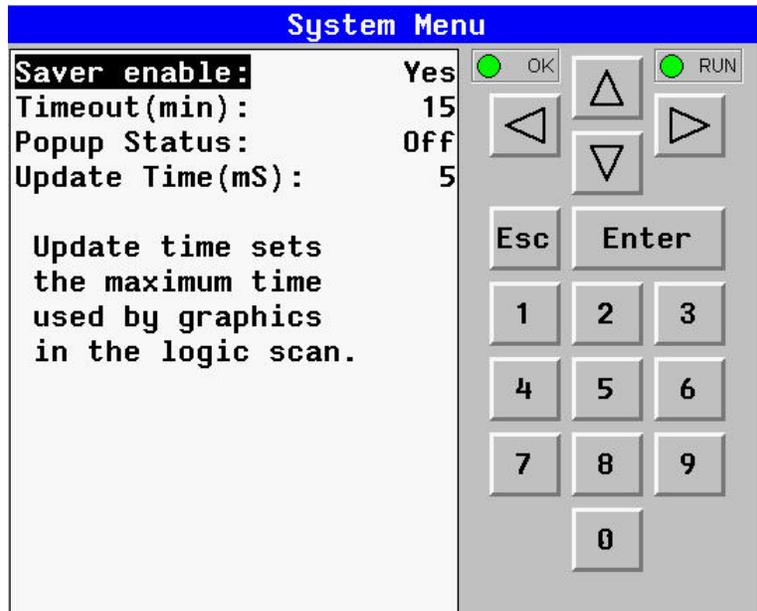
Saver enable	**Yes** = Enable screen saver **No** *(default)* = Disable screen saver
Timeout (min)	**5 - 1200** = Amount of time in minutes to expire with NO touch activity before activating screen saver (black screen)
Popup Status	**Off** *(default)* = Disable popup status **Warning** = Display popup 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

5.13 Removable Media

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

  = No microSD card has been installed in the memory slot
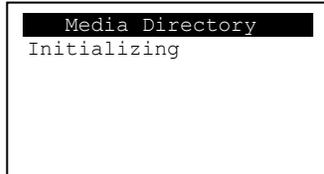
  = microSD card is installed, but it is still initializing
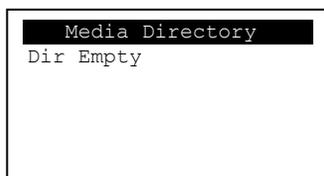
  = microSD card is installed and initialized, but contains no files

  = microSD card is installed and initialized, and it contains

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

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.

5.14 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 memory to the battery backed RAM.
Clear Backup	= The backup data will be erased from the onboard flash memory.
Exit	= Goes back to previous menu

5.15   Enable AutoRun

"Enable AutoRun" displays the following options which can be selected:
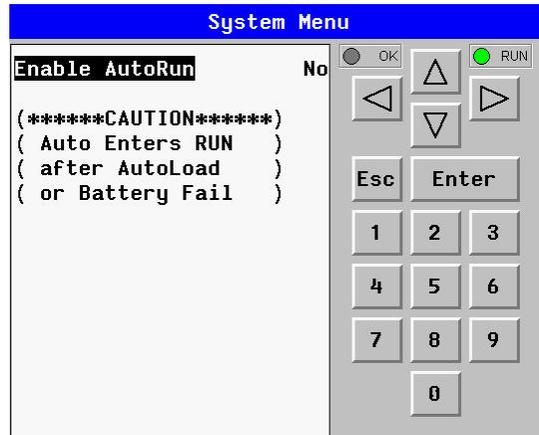
Enable AutoRun	**No** = OCS will be in IDLE mode after AutoLoad or Automatic Restore. **Yes** = OCS will automatically be placed into RUN mode after AutoLoad or Automatic Restore.

5.16 Enable AutoLoad

"Enable AutoLoad" displays the following options which can be selected:
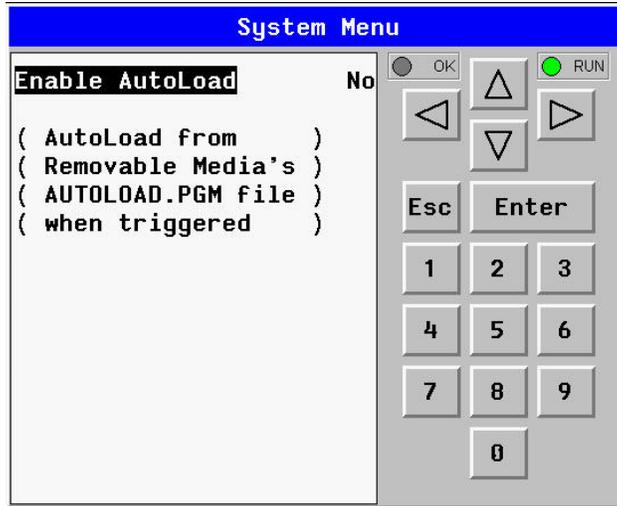
Enable AutoLoad	**No** = Does not load AUTOLOAD.PGM automatically when application program is absent or corrupted. **Yes** = Loads AUTOLOAD.PGM file automatically from RM when application program is absent or corrupted.

5.17 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 to the Removable Media Chapter for details on using RM). It can then be used to clone a different OCS (exact same model).

This feature can be used when:

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

Make Clone

Selecting "Clone Unit" menu will open the following menu screen:
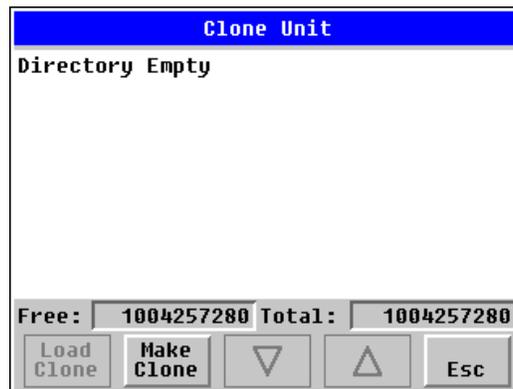
NOTE: Free/Total – displays number of free and total bytes in Removable Media.

Selecting Make Clone brings up the confirmation screen. Upon confirmation, the OCS will create two new files in the root directory of the Removable Media Drive as shown below:
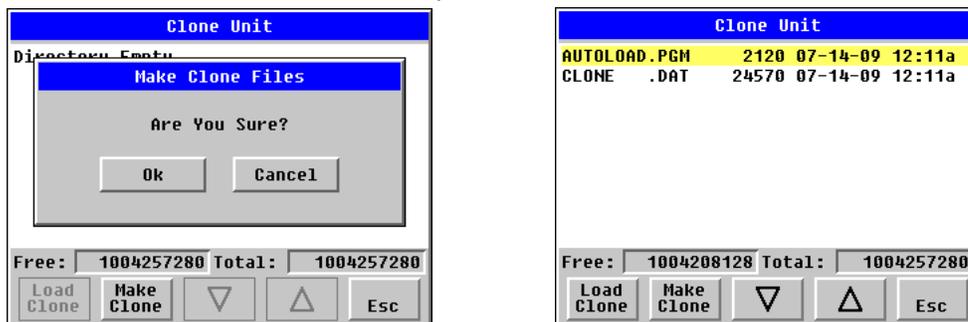
AUTOLOAD.PGM	Application file
CLONE.DAT	File having all unit settings and register values from Battery Backed RAM

5.18 Load Clone

Selecting "Clone Unit" menu will open the following menu screen. Select "Load Clone".
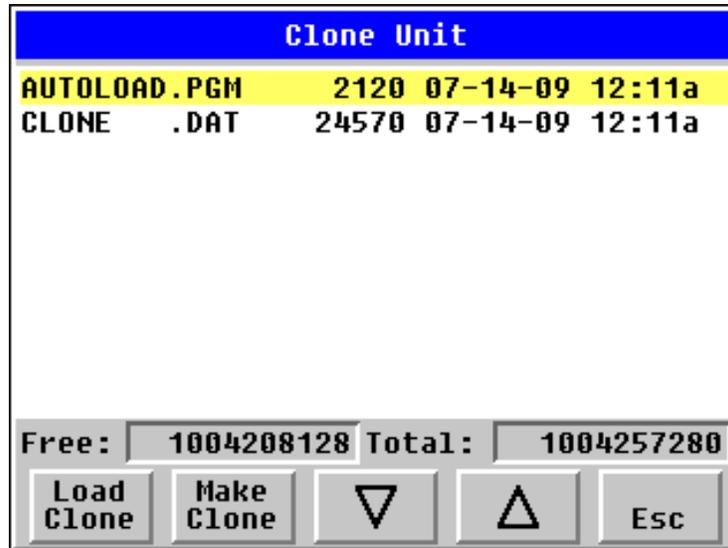
NOTE: For security enabled files, Load clone asks for password validation before loading the application.

5.19   WebMI License Details
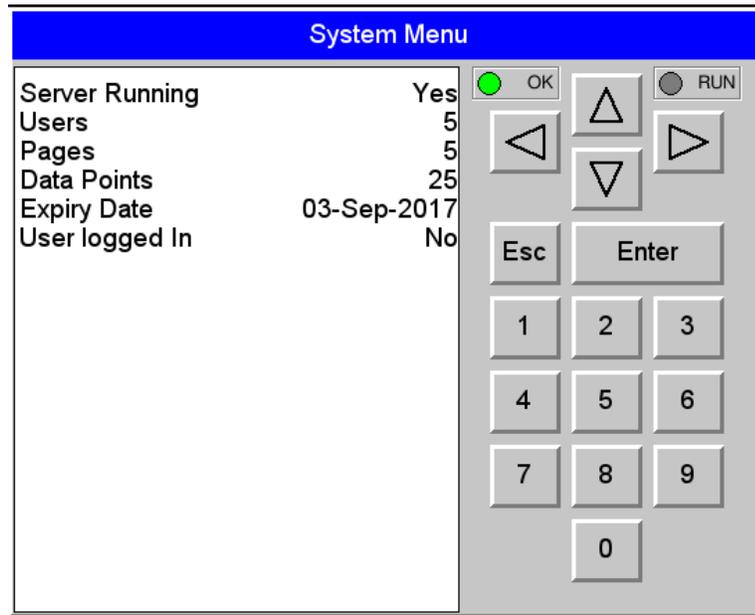
License details page displays the information about the WebMI license. Refer to MAN1036 for the WebMI Manual for more details. The information can also be viewed from Cscape using the following %SR registers:

%SR209.3	WebMI server status
%SR209.4	WebMI user logged in status
%SR209.8 to SR209.16	Number of Users
%SR218	Number of Webpages
%SR219	Number of Data Points
%SR220-SR222	Expiry Date of WebMI License

5.20 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. Ensure SYS_fn Enable is set to YES in the System Menu. To access the field adjustable touch screen calibration dialog, press and hold both the SYS and F1 key for longer than 2 seconds and a dialog similar to Figure 5.3 should appear. Thereafter, use a plastic tip stylus and follow the dialog instructions.

For best results in screen calibration, use a stylus with a plastic tip. When the crosshair appears, touch the center of the crosshair as exactly as possible and release. A small "+" should appear and will move closer to the center of the crosshair. Once it has done so and disappeared again, repeat the process until "+" appears in the center of the crosshair. Then move on to the next step.
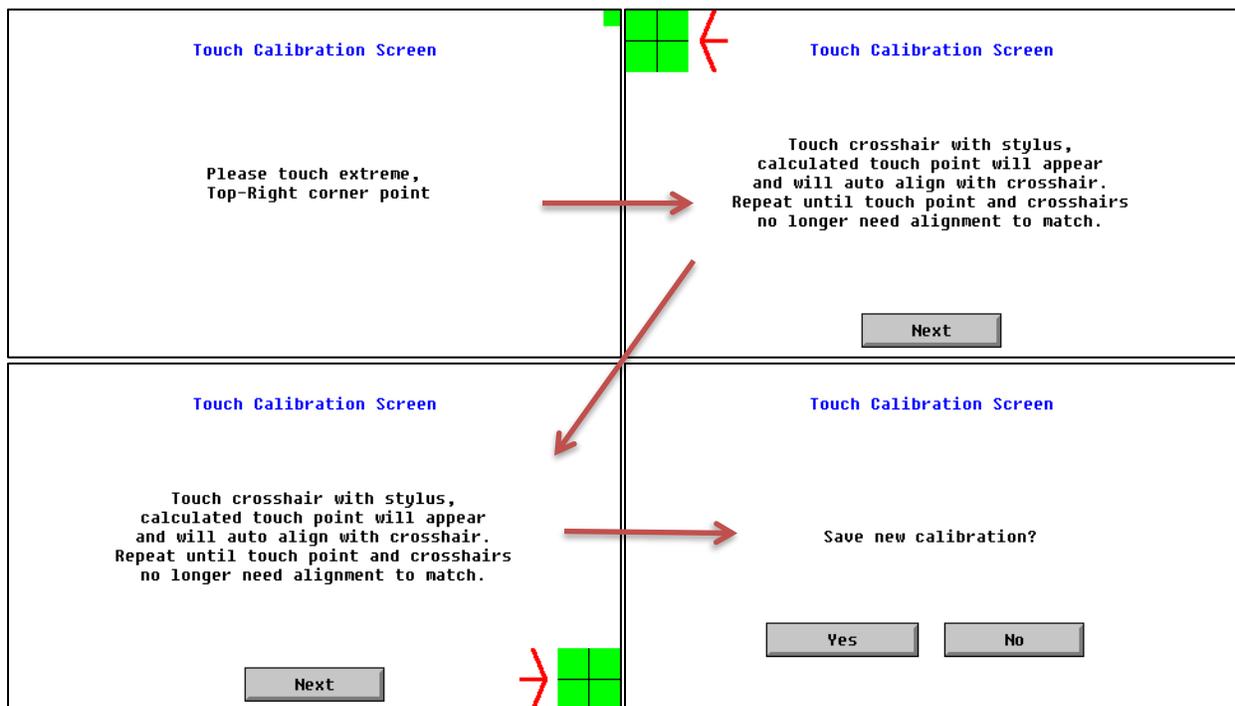
Figure 5.3–Screen Calibration

CHAPTER 6: REGISTERS

6.1   Register Definitions

When programming the XL7 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.

Table 6.1 - Types of Registers found in the XL7 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
%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

6.2   Useful %S and %SR registers

Table 6.2 – Common %S Register Definitions		
Register	**Name**	**Description**
%S1	FST_SCN	Indicate First Scan
%S2	NET_OK	Network is OK
%S3	T_10MS	10mS timebase
%S4	T_100MS	100mS timebase
%S5	T_1SEC	1 second timebase
%S6	IO_OK	I/O is OK
%S7	ALW_ON	Always ON
%S8	ALW_OFF	Always OFF
%S9	PAUSING_SCN	Pause 'n Load soon
%S10	RESUMED_SCN	Pause 'n load done
%S11	FORCE	I/O being forced
%S12	FORCE_EN	Forcing is enabled
%S13	NET_IO_OK	Network I/O is OK

		Table 6.3 – %SR Registers – Master %SR Table			
Register	**Default I/O Name**	**Description**	**Min-Max Values**	**Program (Read/Write)**	**Display (Read/Write)**
%SR1	USER_SCR	User Screen Number ***Excludes RCC Units**	0 to 1023	Read/Write	Read/Write
%SR2	ALRM_SCR	Alarm Screen Number (0=none) ***Excludes RCC Units**	0 to 1023	Read Only	Read Only
%SR3	SYS_SCR	System Screen Number 1 = Main System Menu 2= Set Network ID, Network Status, (%SR29) 3= Set Network Baud (%SR30) 4= Set Contrast (%SR32) 5= View OCS Status 6= View OCS Diagnostics 7= View I/O Slots 8= Set Function Key Mode (%SR33) 9= Set Serial Ports (%SR34) 10= Set Time/Date (%SR44-%SR50) 11= Set Beeper (%SR183) 12= Set Screen (%SR185) 13= Removable Media 14= View Protocols 15= IP Address (ETN I/O Board) 16= Fail Safe System 17= Backup / Restore Data 18= Enable AutoRun 19= Enable AutoLoad 20= Clone Unit - 21= Touch Calibration 24= License Details ***Excludes RCC Units**	0 to 24	Read/Write	Read/Write
%SR4	SELF_TST	Self-Test Results		Read Only	Read Only
%SR4.1		Self-Test Results – BIOS Error		Read Only	Read Only
%SR4.2		Self-Test Results – Engine Error		Read Only	Read Only
%SR4.3		Self-Test Results – Ladder Error		Read Only	Read Only
%SR4.4		Self-Test Results – RAM Error		Read Only	Read Only
%SR4.5		Self-Test Results – Duplicate ID Error		Read Only	Read Only
%SR4.6		Self-Test Results – Bad ID Error		Read Only	Read Only
%SR4.7		Self-Test Results – I/O Configuration Error		Read Only	Read Only
%SR4.8		Self-Test Results – Bad Network Error		Read Only	Read Only
%SR4.9		Self-Test Results – Bad Logic Error		Read Only	Read Only
%SR4.10		Self-Test Results – Bad Clock Error		Read Only	Read Only
%SR4.11		Self-Test Results – DeviceNet Error		Read Only	Read Only
%SR4.12-.16	**Reserved**				
%SR5	CS_MODE	Control Station Mode 0= Idle 1= Do I/O 2= Run 3= Online Change ***Supported in Linux and XL+ units only**	0 to 3	Read Only	Read/Write
%SR6		Average Scan Rate ms (/ 10)		Read Only	Read Only
%SR7		Minimum Scan Rate ms (/ 10)		Read Only	Read Only

Table 6.3 – %SR Registers – Master %SR Table					
Register	**Default I/O Name**	**Description**	**Min-Max Values**	**Program (Read/Write)**	**Display (Read/Write)**
%SR8		Maximum Scan Rate ms (/ 10)		Read Only	Read Only
%SR9	TCH_PRESSURE	Current Touch Pressure	0 to 3000	Read Only	Read Only
%SR10	TCH_PRESSURE _TSH	Threshold Touch Pressure	0 to 3000	Read/Write	Read/Write
%SR11-12		Ladder Size (32-Bit DINT)		Read Only	Read Only
%SR13-14		User Text Screen Size (32-Bit DINT) ***Excludes RCC Units**		Read Only	Read Only
%SR15-16		System Text Screen Size (32-Bit DINT) ***Excludes RCC Units**		Read Only	Read Only
%SR17-18		I/O Configuration Table Size (32-Bit DINT)		Read Only	Read Only
%SR19-20		Network Config Table Size (32-Bit DINT)		Read Only	Read Only
%SR21-22		Security Data Table Size (32-Bit DINT)		Read Only	Read Only
%SR23		Ladder Code CRC		Read Only	Read Only
%SR24		User Text CRC		Read Only	Read Only
%SR25		System Text CRC		Read Only	Read Only
%SR26		I/O Configuration Table CRC		Read Only	Read Only
%SR27		Network Configuration Table CRC		Read Only	Read Only
%SR28		Security Data Table CRC		Read Only	Read Only
%SR29	NET_ID	**Network ID**		Read Only	Read / Write
		CsCAN Mode	1 to 253		
		DeviceNet Mode	0 to 63		
		CANOpen Mode	1 to 127		
%SR30		Network Baud Rate 0=125KB 1= 250kB 2= 5000KB 3= 1MB 4=50K	0 to 4	Read Only	Read/Write
%SR31		Network Required 0= Network <u>not</u> required 1= Network required; 2= Network optimized; 3= Network required and optimized	0 to 3	Read Only	Read Only
%SR32		LCD Display Contrast setting ***Excludes RCC Units**	0 to 255	Read Only	Read/Write
%SR33		Function Key Toggle Mode 0= Momentary 1= Toggle ***Excludes RCC Units**	0 to 1	Read/Write	Read/Write
%SR34		RS232 Serial Protocol Mode 0= Firmware Update (RISM) 1= CsCAN 2= Generic (Ladder- Controlled) 3= Modbus RTU 4= Modbus ASCII		Read Only	Read Only
%SR35-36		Unique Serial Number / Hexadecimal LAN1 MAC ID		Read Only	Read Only

Table 6.3 – %SR Registers – Master %SR Table

Register	Default I/O Name	Description	Min-Max Values	Program (Read/Write)	Display (Read/Write)
%SR37		Model Number		Read Only	Read Only
%SR38		Engine Version (/100)		Read Only	Read Only
%SR39		BIOS Rev Number (/ 100)		Read Only	Read Only
%SR40		FPGA Image Rev Number (/ 10)		Read Only	Read Only
%SR41		Vertical Pixel Count ***Excludes RCC Units**		Read Only	Read Only
%SR42		Horizontal Pixel Count ***Excludes RCC Units**		Read Only	Read Only
%SR43		Keypad Type ***Excludes RCC Units**		Read Only	Read Only
%SR44	RTC_SEC	Real-Time-Clock Second	0 to 59	Read Only	Read Only
%SR45	RTC_MIN	Real-Time-Clock Minute	0 to 59	Read Only	Read Only
%SR46	RTC_HOUR	Real-Time-Clock Hour	0 to 23	Read Only	Read Only
%SR47	RTC_DATE	Real-Time-Clock Date	1 to 31	Read Only	Read Only
%SR48	RTC_MON	Real-Time-Clock Month	1 to 12	Read Only	Read Only
%SR49	RTC_YEAR	Real-Time-Clock Year	1996 to 2095	Read Only	Read Only
%SR50	RTC_DAY	Real-Time-Clock Day (1=Sunday)	1 to 7	Read Only	Read Only
%SR51		Network Error Count		Read Only	Read Only
%SR52		Watchdog-Tripped Error Count		Read Only	Read Only
%SR53-54	**Reserved**				
%SR55.13		Self-Test: Battery Low or Missing		Read Only	Read Only
%SR56	LAST_KEY	Key Currently Pressed No key = 0 (No key pressed since power-up) F1 = 1 F2= 2 F3= 3 F4 = 4 F5= 5 F6= 6 F7=7 F8= 8 F9= 9 F10 = 10 F11= 11 F12 = 12 Enter = 13 +/ - = 14 . (dot) = 15 0 = 16 1 = 17 2 = 18 3 = 19 4 = 20 5 = 21 6 = 22 7= 23 8 = 24 9 = 25 System = 26 Escape = 27 Left = 28	0 to 255	Read Only	Read Only

Table 6.3 – %SR Registers – Master %SR Table

Register	Default I/O Name	Description	Min-Max Values	Program (Read/Write)	Display (Read/Write)
		Right = 29 Up = 30 Down = 31 Shift = 32 Soft Key 1 = 34 Soft Key 2 = 35 Soft Key 3 = 36 Soft Key 4 = 37 Soft Key 5 = 38 Soft Key 6 = 39 Soft Key 7 = 40 Soft Key 8 = 41 Release = 255 (Keys pressed since power-up but not currently) ***Excludes RCC Units**			
%SR57		LCD Backlight Dimmer Register 0-100 = 0% to 100% On 100-255 = 100% On ***Excludes RCC Units**	0 to 255	Read/Write	Read/Write
%57.16		Temporarily disable Screen Saver ***Excludes RCC Units**		Read/Write	Read/Write
%SR58	USER_LEDS	User LEDs		Read/Write	Read/Write
%SR59		Engine Build Number (Only last three numbers displayed)		Read Only	Read Only
%SR60		Build Option Build Test = 0 Build Beta = 1 Build Product = 2	0 to 2	Read Only	Read Only
%SR61	NUM_IDS	Number of CsCAN Network IDs		Read Only	Read Only
%SR62-100	**Reserved**				
%SR101.3		WebMI License Details – WebMI server status ***XLEe, XLTe, X2, X4, & X7 only**		Read Only	Read Only
%SR101.4		WebMI License Details – WebMI user logged in status ***XLEe, XLTe, X2, X4, & X7 only**		Read Only	Read Only
%SR101.8-101.16		WebMI License Details – Number of users ***XLEe, XLTe, X2, X4, & X7 only**		Read Only	Read Only
%SR102-107	**Reserved**				
%SR108		WebMI License Details – Number of webpages ***XLEe, XLTe, X2, X4, & X7 only**		Read Only	Read Only
%SR109		WebMI License Details – Number of datapoints ***XLEe, XLTe, X2, X4, & X7 only**		Read Only	Read Only
%SR110-112		WebMI License Details – Expiry date of WebMI license ***XLEe, XLTe, X2, X4, & X7 only**		Read Only	Read Only
%SR113-130	**Reserved**				
%SR131-135		OCS Model: ASCII, 10 characters		Read Only	Read Only

Table 6.3 – %SR Registers – Master %SR Table					
Register	Default I/O Name	Description	Min-Max Values	Program (Read/Write)	Display (Read/Write)
%SR136		Communication Download Timeout		Read Only	Read Only
%SR137		Communication Idle Timeout		Read Only	Read Only
%SR138-148	Reserved				
%SR149-150		Free-running 10kHz count: 1 count = 0.1ms (32-Bit DINT)		Read Only	Read Only
%SR151	Reserved				
%SR152		RS-485 Termination		Read / Write	Read / Write
%SR152.1		MJ2 Termination Enable ***Excludes RCC972**		Read / Write	Read / Write
%SR152.2		MJ3 Termination Enable ***XL+ Only** RS485 Termination Enable *** X4 & X7 Only**		Read / Write	Read / Write
%SR152.3*		MJ1 Termination Enable ***XL+, XLE, XLT, RCC2414 Only**		Read / Write	Read / Write
%SR152.4*		MJ1 Biasing ***XL+ Only** CAN Termination Enable ***X4 & X7 Only**		Read / Write	Read / Write
%SR153-163	Reserved				
%SR164		FailSafe / Clone			
%SR164.1		RS485 Port Biasing #1 (MJ1 or MJ2)		Read / Write	Read / Write
%SR164.2		RS485 Port Biasing #2 (MJ2 or MJ3)		Read / Write	Read / Write
%SR164.3	AUTO_RESTRD	Indicates Automatic Restore Operation has been performed		Read Only	Read Only
%SR164.4	BCKUP_TAKN	Indicates Backup of Registers has been taken		Read Only	Read Only
%SR164.5	EN_AUTO_RN	Enable AUTORUN – Sets "Enable AutoRun" to "Yes" or "No"		Read / Write	Read / Write
%SR164.6	EN_AUTO_LD	Enable AUTOLOAD – Sets "Enable AutoLoad" to "Yes" or "Not"		Read / Write	Read / Write
%SR164.7	STRT_BCKUP	Start Backup trigger bit – Setting TRUE starts backup of all register data		Read / Write	Read / Write
%SR164.8	CLR_BACKUP	Clear Backup trigger bit – Setting TRUE clears backup of all register data (if a backup was done previously)		Read / Write	Read / Write
%SR164.9	MAKE_CLONE	MAKE_CLONE trigger bit = Setting TRUE does a Load Clone (if a media card is present)		Read / Write	Read / Write
%SR164.10	LOAD_CLONE	LOAD_CLONE trigger bit – Setting TRUE does a LOAD CLONE (if a media card is present that contains clone files)		Read / Write	Read / Write
%SR164.11	MK_CLN_FL	Make Clone Fail (This bit goes high when Make/Create Clone fails)		Read / Write	Read / Write
%SR164.12	LD_CLN_FL	Load Clone Fail (This big goes high when Load Clone fails)		Read / Write	Read / Write
%SR164.14		Set to 1 to restore data manually, and this in turn sets %SR164.15 to 1. Set to 0 to abort restore operation.		Read / Write	Read / Write

Table 6.3 – %SR Registers – Master %SR Table					
Register	Default I/O Name	Description	Min-Max Values	Program (Read/Write)	Display (Read/Write)
		*RCC Units Only			
%SR164.15		Set to 1 for manual restore of data. Set to 0 to complete the restore operation. ***RCC Units Only**		Read / Write	Read / Write
%SR165-166	Reserved				
%SR167		Screen Update Time, Default= 5 ***X4 & X7 Only** – Default = 10	2 to 50	Read/Write	Read/Write
%SR168-170	Reserved				
%SR171		X-Coordinate Touched		Read Only	Read Only
%SR172		Y-Coordinate Touched		Read Only	Read Only
%SR173		System-Function Disable,	0 to 1	Read / Write	Read / Write
%SR174		Removable Media Protect		Read/Write	Read/Write
%SR174.1		Request Media Card be Removed		Read / Write	Read / Write
%SR174.2		Indicates safe to remove Media		Read / Write	Read / Write
%SR175		Removable Media - Status		Read Only	Read Only
%SR176-177		Removable Media Free Space (32-Bit DINT)		Read Only	Read Only
%SR178-179		Removable Media Total Space (32-Bit DINT)		Read Only	Read Only
%SR180	Reserved				
%SR181	ALM_UNACK	Bits 1-16 indicate Unacknowledged in Alarm Groups 1-16		Read Only	Read Only
%SR182	ALM_ACT	Bits 1-16 indicate Active in Alarm Groups 1-16		Read Only	Read Only
%SR183	SYS_BEEP	Beep on Keypress Enable 0= Disabled 1= Enabled	0 to 1	Read / Write	Read / Write
%SR184	USER_BEEP	Internal Beeper 0=OFF 1=ON	0 to 1	Read/Write	Read/Write
%SR185		Screen Saver Enabled 0= Disabled 1= Enabled **NOTE**: See %SR57.16	0 to 1	Read Only	Read Only
%SR186		Screen Saver Time in minutes (delay)	5 to 1200	Read Only	Read Only
%SR187	NET_USE	Network Usage (Avg)	0 to 1000	Read Only	Read Only
%SR188		Network Usage (Min)	0 to 1000	Read Only	Read Only
%SR189		Maximum Net Usage of all units on the CAN network	0 to 1000	Read Only	Read Only
%SR190	NT_TX_AVG	Network TX Usage % (/ 10) (Avg)	0 to 1000	Read Only	Read Only
%SR191		Network TX Usage % (/ 10) (Min)	0 to 1000	Read Only	Read Only
%SR192		Network TX Usage % (/ 10) (Max)	0 to 1000	Read Only	Read Only
EXTENDED SYSTEM REGISTERS					
%SR193	ONLINE_CHG	Online Change			
%SR193.1		TRUE if 2 programs in target FLASH		Read Only	Read Only
%SR193.2		TRUE to switch programs, FALSE when complete		Read Only	Read Only
%SR193.3		TRUE if executing program is temporary test		Read Only	Read Only
%SR193.4		TRUE during last scan of switched-from program		Read Only	Read Only

Table 6.3 – %SR Registers – Master %SR Table

Register	Default I/O Name	Description	Min-Max Values	Program (Read/Write)	Display (Read/Write)
%SR193.5		TRUE during first scan of switched-to program		Read Only	Read Only
%SR193.6		TRUE to revert to FLASH and delete all RAM; FALSE when complete		Read Only	Read Only
%SR193.9		TRUE if error in temporary program		Read Only	Read Only
%SR194		Battery Charge Temp Low ***XL+ Only** – Frequency in MHz		Read Only	Read Only
%SR195		Battery Charge Temp High ***XL+ Only** – in degree centigrade		Read Only	Read Only
%SR196		Charging State **NOTE**: Refer to MAN1142 for more details on Rechargeable Batteries 0=Waiting 1=Normal Charging 2=Hot Charge 3=Hot Charge 4= Battery Hot 5= Cold Charge 6=Battery Cold 7=No Battery 8= Not Charging (after 8 hours of charging) 9= CPU Hot, not charging 10 Battery voltage <2V, not charging 11= First 2 minutes Init Wait (Not Charging)	0 to 11	Read Only	Read Only
%SR197		Charging Current Max mA		Read Only	Read Only
%SR198		Battery Voltage is mV		Read Only	Read Only
%SR199	**Reserved**				
%SR200		InitRD Version (/100)		Read Only	Read Only
%SR201-205		Linux Kernel version: ASCII, 10 characters		Read Only	Read Only
%SR206-208	**Reserved**				
%SR209.3		WebMI Server Status. Bit 3 is ON if server running.		Read Only	Read Only
%SR209.4		WebMI User Logged in Status. Bit 4 is ON if 1 or more users logged in.		Read Only	Read Only
%SR209.8-209.16		Number of Users. Shows in upper byte in decimal format.		Read Only	Read Only
%SR210		Time Zone: set in minutes + / - UTC. (Ex: EST is -4 hours = -240 minutes)		Read/Write	Read/Write
%SR211		Daylight Saving: YES = 1 Daylight Saving: NO = 0 (If daylight saving is enabled, one hour will be added to the local time).		Read/Write	Read/Write
%SR212		UTC – Seconds		Read Only	Read Only
%SR213		UTC – Minutes		Read Only	Read Only
%SR214		UTC – Hours		Read Only	Read Only
%SR215		UTC – Date		Read Only	Read Only
%SR216		UTC – Month		Read Only	Read Only

Table 6.3 - %SR Registers - Master %SR Table					
Register	Default I/O Name	Description	Min-Max Values	Program (Read/Write)	Display (Read/Write)
%SR217		UTC - Year		Read Only	Read Only
%SR218		Number of Webpages, license detail (**XLE/XLT, X2, X4, & X7** use %SR101 & %SR108-112 for WebMI License Details.)		Read Only	Read Only
%SR219		Number of Data Points, license detail. (**XLE/XLT, X2, X4, & X7** use %SR101 & %SR108-112 for WebMI License Details)		Read Only	Read Only
%SR220-222		Expiration Date of WebMI License, license detail. (**XLE/XLT, X2, X4, & X7** use %SR101 & %SR108-112 for WebMI License Details)		Read Only	Read Only

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

6.3   Register Map for XL7 OCS I/O

Table 6.4 - I/O Register Map						
Registers	Description					
	XL7 with no I/O	XL7 with 102 I/O	XL7 with 103 I/O	XL7 with 104 I/O	XL7 with 105 I/O	XL7 with 106 I/O
%I1-%I12	Unused	Digital Inputs				
%I13-%I16	Unused	Reserved		Digital Inputs	Reserved	
%I17-%I24	Unused		Reserved	Digital Inputs	Reserved	
%I25-%I29	Unused		Reserved			
%I30-%I31	Unused	PWM Table (Below)				
%I32	Unused	ESCP Alarm*				
%Q1	Unused	PWM Table (Below)				
%Q1-%Q6	Unused	Digital Outputs				
%Q7-%Q12	Unused	Reserved	Digital Outputs			
%Q13-%Q16	Unused	Reserved		Digital Outputs	Reserved	
%Q17-%Q20	Unused	HSC Table (Below)				
%Q21-%Q24	Unused	Reserved				
%AI1-%AI2	Unused	HSC Table (Below)				
%AI33 - %AI38	Unused					Analog Inputs
%AQ1-%AQ8	Unused	PWM Table (Below)				
%AQ9-%AQ10	Unused		Analog Outputs			
Unused = These registers can be used as general purpose registers						

*Electronic Short Circuit Protection [ESCP]

NOTE: The ESCP bit is set high when the output current is too high, and the output driver has shut down for thermal protection. This typically happens when outputs are shorted, or they are driving loads that are higher than the output rating.

Table 6.5 – PWM Function Registers Map			
Register	PWM	HSC	Stepper
%AQ1	PWM1 Duty Cycle (32-bit)	HSC1 Preset Value	Start Frequency
%AQ2			Run Frequency
%AQ3	PWM2 Duty Cycle (32-bit)	HSC2 Preset Value	Accel Count (32-bit)
%AQ4			
%AQ5	PWM Prescale (32-bit)	--	Run Count (32-bit)
%AQ6			
%AQ7	PWM Period (32-bit)	--	Decel Count (32-bit)
%AQ8			
%Q1	--	--	Run
%I30	--	--	Ready/Done
%I31			Error

Table 6.6 – HSC Functions Register Map				
Register	Frequency	Totalize	Pulse	Quad
%AI5-6	HSC1 (function) Accumulator			Quad 1 Acc
%AI7-8	HSC2 (function) Accumulator			
%AI9-10	HSC3 (function) Accumulator			Quad 2 Acc
%AI11-12	HSC4 (function) Accumulator			
%AQ1-2		HSC1 Preset		
%AQ3-4		HSC2 Preset		
%Q17		Clear HSC1		Clear Quad 1
%Q18		Clear HSC2		Set Quad 1
%Q19		Clear HSC3		Clear Quad 2
%Q20		Clear HSC4		Set Quad 2

6.4   Resource Limits

Table 6.5- Resource Limits				
Resource	Value	Resource	Value	
%S	13	Ethernet	CsCAN, Ping, EGD, SRTP, Modbus TCP Master (Downloadable protocol) & Slave, Ethernet IP, FTP, or HTTP @ 10MBd or 100MBd	
%SR	448	CsCAN	125kBd, 250kBd, 500kBd, or 1MBd	
%T	16000	Serial Ports	1 RS232, 1 RS485 Ports	
%M	16000	IDs Per CsCAN Network	64 w/o repeat (253 w/ 3 repeaters)	
%R	49999	Keypad	5 keys (4 fn keys and a System Key)	
%K	5	Display	800 x 480 7" TFT, 65K colors	
%D	1023	Screen Memory	64MB	
%I	2048	User Screens	1023	
%Q	2048	Data Fields Per User Screen	1023	
%AI	512	Ladder Code	1024kB	
%AQ	512			

CHAPTER 7: CSCAPE CONFIGURATION

7.1 Overview

XL7 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 XL7 OCS unit. Please see the on-line help provided with Cscape for additional details.

7.2 Cscape Status Bar

When the XL7 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 XL7 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.

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

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

Ready	User:	HE-XExx1-CsCAN (Model=)	Equal	Local :1 Target :2(R) [no forces]	MOD

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.

Figure 7.1 - Cscape Status Bar

7.3   Establishing Communications

The XL7 OCS can communicate with Cscape using USB to USB, USB to serial adapters, serial port communications via MJ1 Port, Ethernet, CAN (CsCAN) or modems.

To communicate with the XL7 via USB you will need the automated driver installer located on the Horner APG web site. The drivers may be loaded from the **HE-XEC Ethernet Utility / HTTP Web Server Demo / Communications Drivers** section of the support files page on the Horner website: https://hornerautomation.com/support-files/ .

For XL7, use Cscape Version 9.30 SP6 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 XL7 OCS.
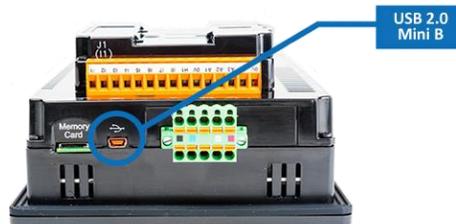
Figure 7.2 – USB Programming Connector

The PC will detect a new device has been plugged into the USB port.

The PC will detect a new device has been plugged into the USB port.

Now that the XL7 is plugged in, go to **Cscape → Controller → Connection Wizard.** If you are just opening Cscape, Connection Wizard usually opens by default.

Select USB and click **Next >>.**
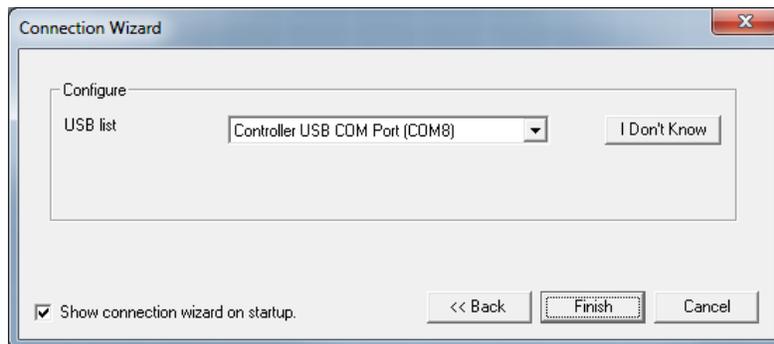
If the Connection Wizard does not pop up upon opening Cscape, then select **Controller** (in the Cscape tool bar) ➔ **Connection Wizard**, choose your connection method. If you are connecting for the first time, we suggest connecting via USB.
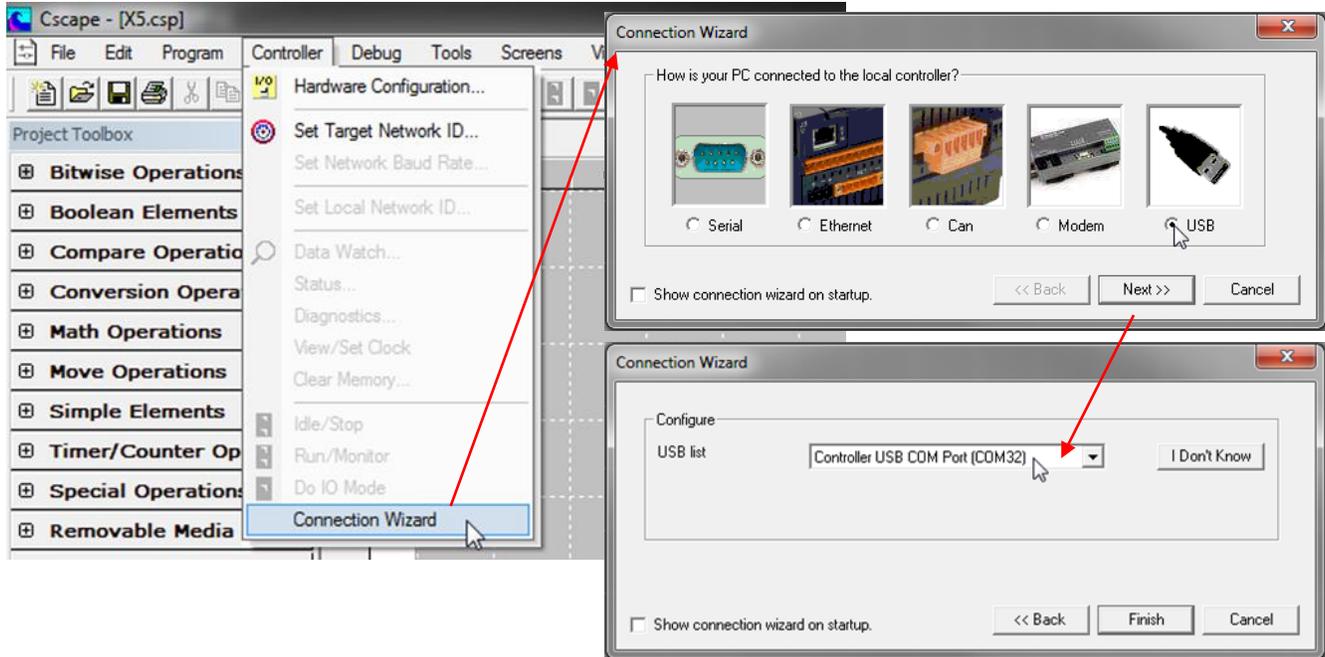
Figure 7.3 – Cscape Connection Wizard Screenshots

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. The Connection Wizard must be completely closed and reopened to refresh the USB dropdown list.

An alternate way to select the COM setting is to go to **Cscape → Tools → Application Settings → Communications → Configure** and choose connection method in **Add Target**.
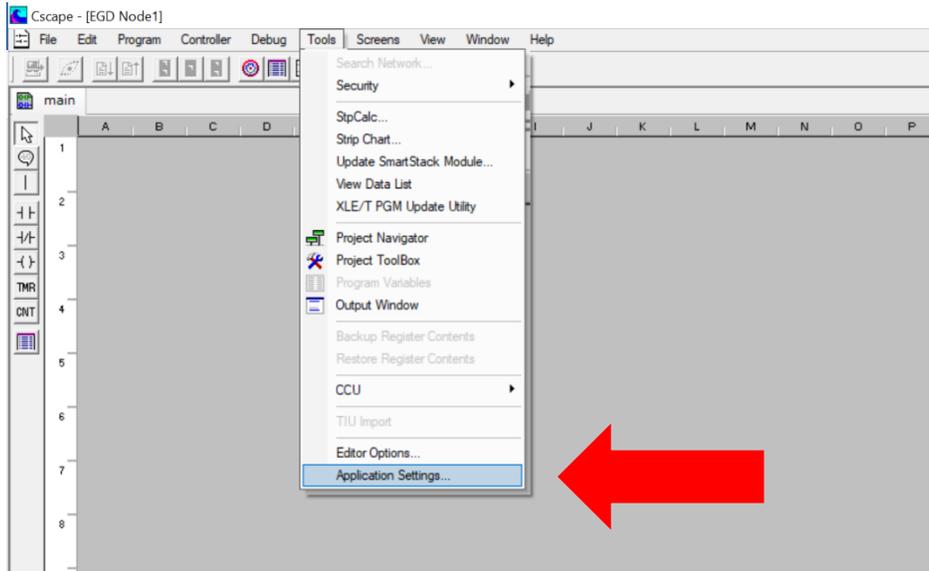
Figure 7.4 – Cscape: Alternative Connection Method Screenshot
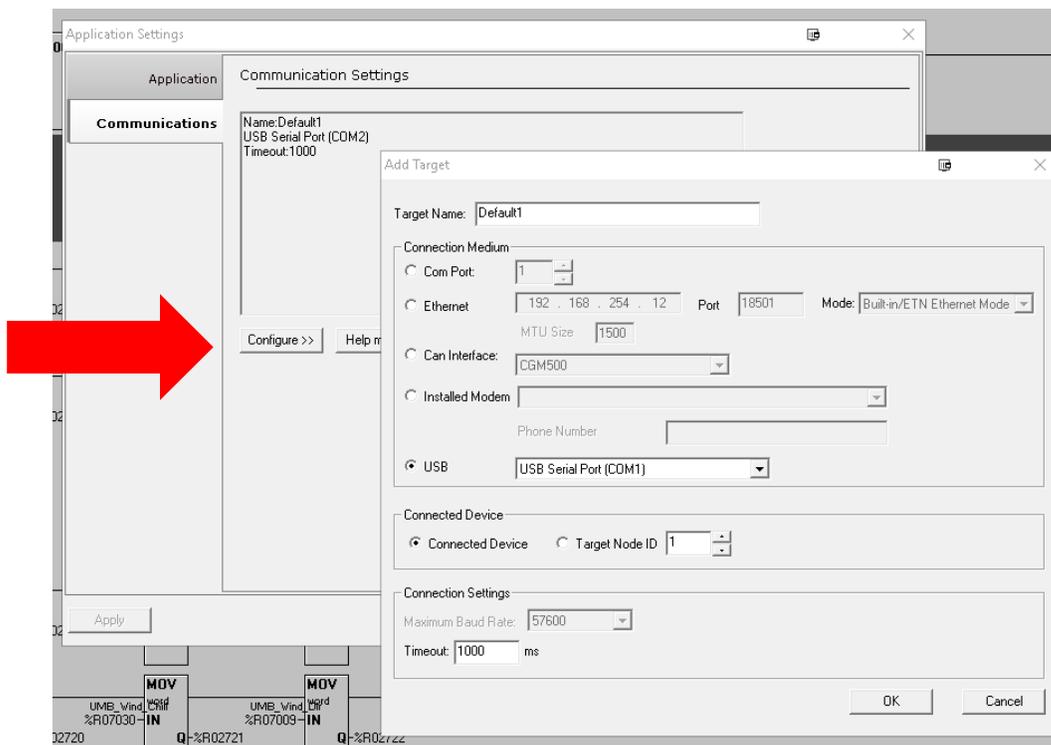
Figure 7.5 – Add Target Screenshot in Cscape

NOTE: The following fields, Target Name, Connection Medium, Connected Device, and Connection Settings, need to be filled for communication configuration if Cscape Connection Wizard was not used. Table 7.1 below explains the information needed in each field.

Table 7.1 – Communication Configuration Dialog	
Target Name	Name for connection. This is not a mandatory column to be filled, by default Cscape will populate 'Default1' in edit box.
Connection Medium	
Com Port	Select this option to communicate over serial communication with the device. The port number can be configured here.
Ethernet	Select this option to communicate over Ethernet. Provide the IP address of the device and select the mode: HE GSM GPRS mode, Built in/ ETN Ethernet mode, or HE XEC Ethernet mode. Select **HE GSM GPRS mode** if communication with XL series controller on GPRS is required and the device has GSM modem installed in XL series controller. Select **Built in/ ETN Ethernet mode** if the device has on-board Ethernet port. Select **HE XEC Ethernet mode** if the device has Ethernet comm. option board installed in XL series controller. **NOTE:** For GPRS connectivity, GPRS configuration from **Programs → Messaging → GPRS** needs to be done. **NOTE:** The controller should support the type of connectivity selected and configured for Ethernet communication.
CAN Interface	Select this option to communicate over CAN. This option requires additional hardware to be installed with the PC to be able to do so. Select the type of hardware installed from the dropdown.
Installed Modem	Select this option to communicate to the device through the internal modem of the computer. Cscape will automatically detect the internal modem attached with PC and list in the attached drop down. User can select modem and telephone number for target controller. **NOTE:** Cscape will do necessary initialization for the selected internal modem.
USB	Select this option to communicate over USB. Now Horner devices and Horner USB to serial converters are recognized and can be specifically selected.
Connected Device	
NOTE: This configuration is required if the controller to which Cscape is communicating is connected to a CsCAN network.	
Connected Device	By default this option is selected and networking feature of Cscape is disabled.
Target Node ID	On selecting this option, Networking feature of Cscape is enabled. CsCAN ID for the target controller to be provide here.
Connection Settings (General Communication Settings)	
Maximum Baud Rate	Select the baud rate for serial communication.
Timeout	Select the communication timeout. **NOTE:** Select a larger timeout for GPRS and installed modem communication configuration

If communications are successful, the message line should show "USB (COM8)" for this example, and an (R) should follow the Target number. For more information on the status bar, see the Cscape Status Bar section.

| ETN : 192.168.254.128 | User: NONE | XL7 CsCAN Model Equal | Equal | Local:253 Target:253(R) [no forces] | MOD |

When connected directly to the controller to which Cscape communications are required, the **Local ID and the Target ID should match.**

Local ID and Target ID Match

If the controller is not communicating, ensure the target ID is set correctly. If not, set the target ID of the controller in Cscape 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 XL7 OCS, press the System Menu key.

The first item in the menu is **Set Networks**. Pressing **Enter** allows the ID of the unit to be viewed or modified.
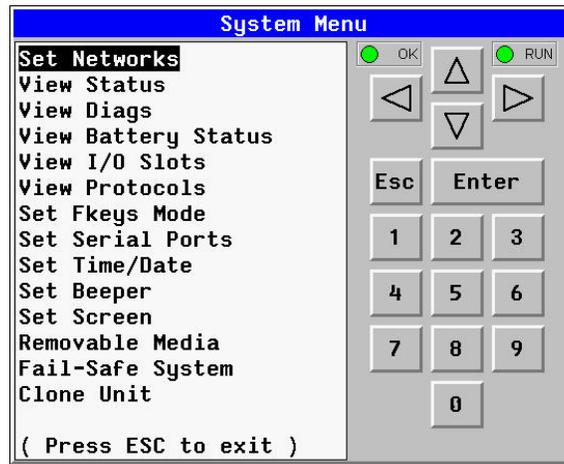
```
                    System Menu
Set Networks              ○ OK        ○ RUN
View Status
View Diags                      △
View Battery Status        ◁         ▷
View I/O Slots                  ▽
View Protocols
Set Fkeys Mode            Esc    Enter
Set Serial Ports
Set Time/Date              1    2    3
Set Beeper
Set Screen                 4    5    6
Removable Media
Fail-Safe System           7    8    9
Clone Unit
                                0
( Press ESC to exit )
```

To change the Target ID of Cscape use the **Controller → Set Target Network ID** dialog.

```
                    Data
                         00000
  _QZ  ABC  DEF
   1    2    3           △
  GHI  JKL  MNO
   4    5    6     ◁         ▷
  PRS  TUV  WXY          ▽
   7    8    9
  +/-   0    .    Esc   Enter
```

7.3.1   Communicating via MJ1 Serial Port

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

Next, connect the PC's serial port to the port labeled MJ1 on the XL7.

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, it may be required to set the target ID of the controller in Cscape 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 XL7, press the System Button to enter the System Menu. The first item in the menu is Set Network ID.

Pressing Enter allows the ID of the unit to be viewed or modified.

To change the Target ID of Cscape use the **Controller → Set Target Network ID** dialog.

7.3.2 Communicating via On Board Ethernet Port

From Cscape go to **Controller → Hardware Configure** and do auto configuration for the connected controller, Click on **Config of Ethernet** and select **Module Setup.**

The IP address, Net Mask, and Gateway of the controller may be temporarily set from the System Menu under the Set Networks menu item. Once running or power cycled the configuration will come from the Cscape configuration stored in the unit.

In Module Configuration dialog go to IP Address field enter unused IP Address and configure unused registers in Register field & then click OK. Screen shot for the same as follows:
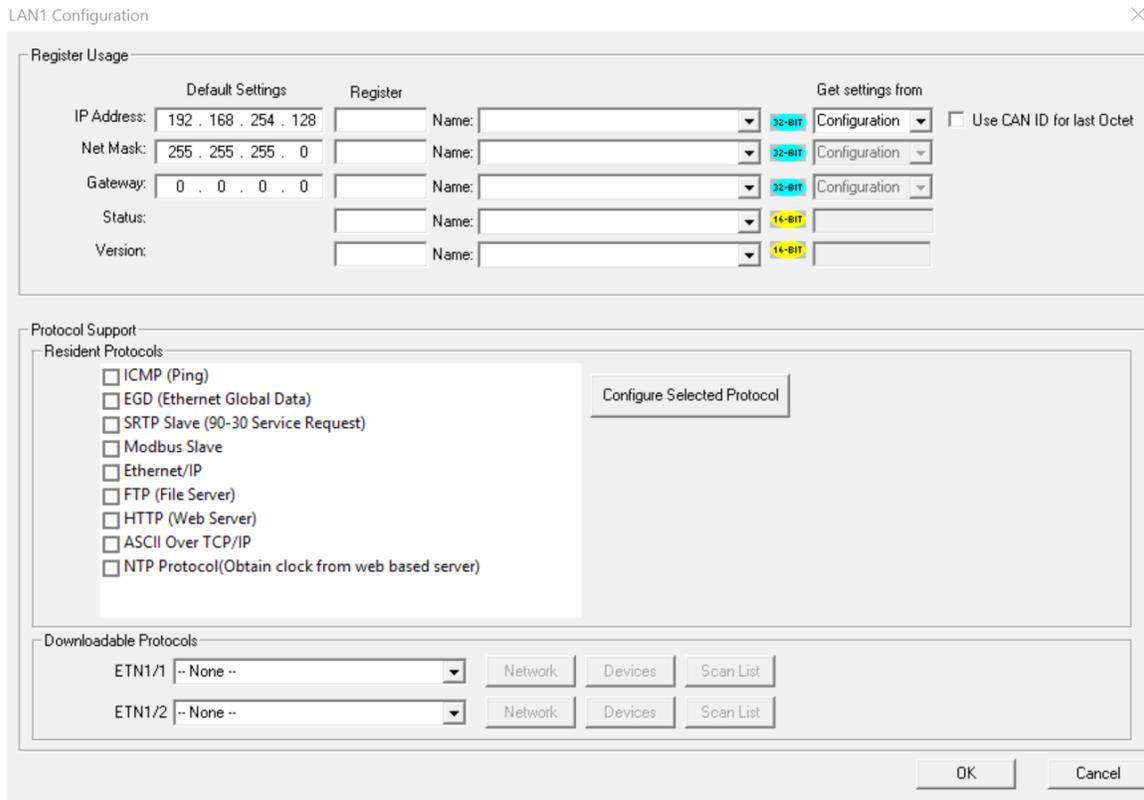
Figure 7.6 – LAN1 Configuration Dialog

Download the configuration in to Controller. Connect LAN cable to the Controller in default LAN Port.

From Cscape go to **Tools → Editor Options → Communication Port → Hardware Configuration.** Select Ethernet and enter IP address which is configured in the file. Select mode as XL Series mode from drop down list.

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

7.4 Configuration

An overview of configuration:

1. Start the configuration by selecting the **Controller → Hardware Configuration** menu item.
2. If the XL7 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 XL7 OCS is <u>not</u> 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 **XL7 OCS CsCAN** from the type drop down box.
5. Once the type of XL7 OCS is selected, the model # drop down box will provide the XL7 OCS model numbers from which to choose from.
6. Once the XL7 OCS CPU is selected, press **OK** to exit the dialog and configure the I/O that is present in the first slot.
7. The Hardware configure dialog (specifically the **Module Setup** tab) provides four 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 XL7 OCS I/O has four main portions that are covered in this chapter. For additional information on I/O, refer to the General I/O or High Speed I/O chapters.
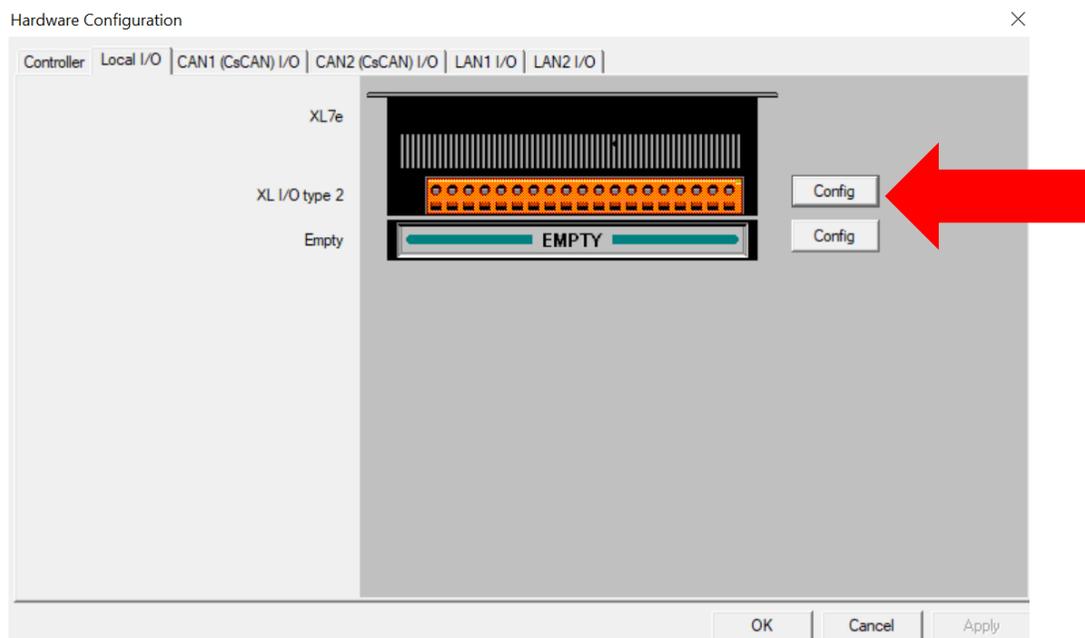
To access the I/O Setup Screen, select Config from the Hardware Configuration/ Local I/O dialog. Then select the Module Setup tab, see screenshot below.
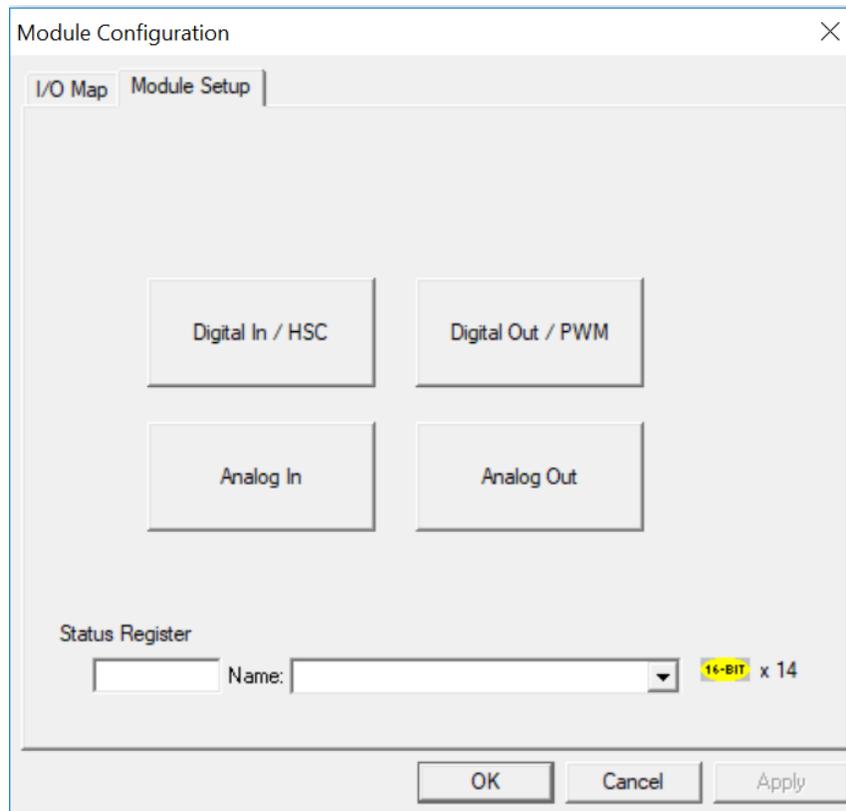
7.5 Digital / HSC Input Configuration

The following figure illustrates the **Digital → HSC Input Configuration** dialog.
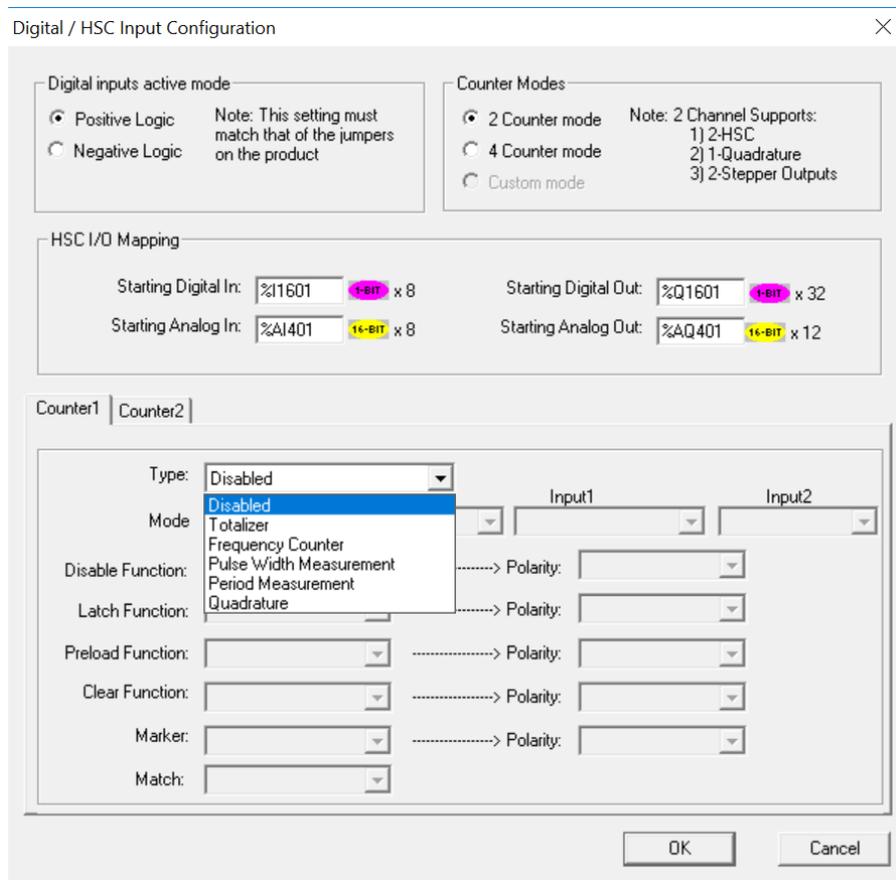
Figure 7.7 – Digital / HSC Input Configuration Dialog

The Active mode group box allows the user to select if inputs are active high (Positive logic) or active low (Negative logic). It is important that this setting match what the jumper settings are on the hardware.

The High-Speed Counters group box contains all of the windows that are used for configuring the 4 available high-speed counters on the XL7 OCS. In configuring a counter, the user needs to set the type, mode, and counts per rev.

The type drop down includes the following options: Disabled, Totalizer, Frequency Counter, Pulse Width Measurement, Period Measurement, and Quadrature.

For detailed descriptions of the High-Speed Counter types available within the drop-down menu, refer to the High Speed I/O Chapter.

7.6 Digital / PWM Output Configuration

The following figure illustrates the **Digital / PWM Output Configuration** dialog.
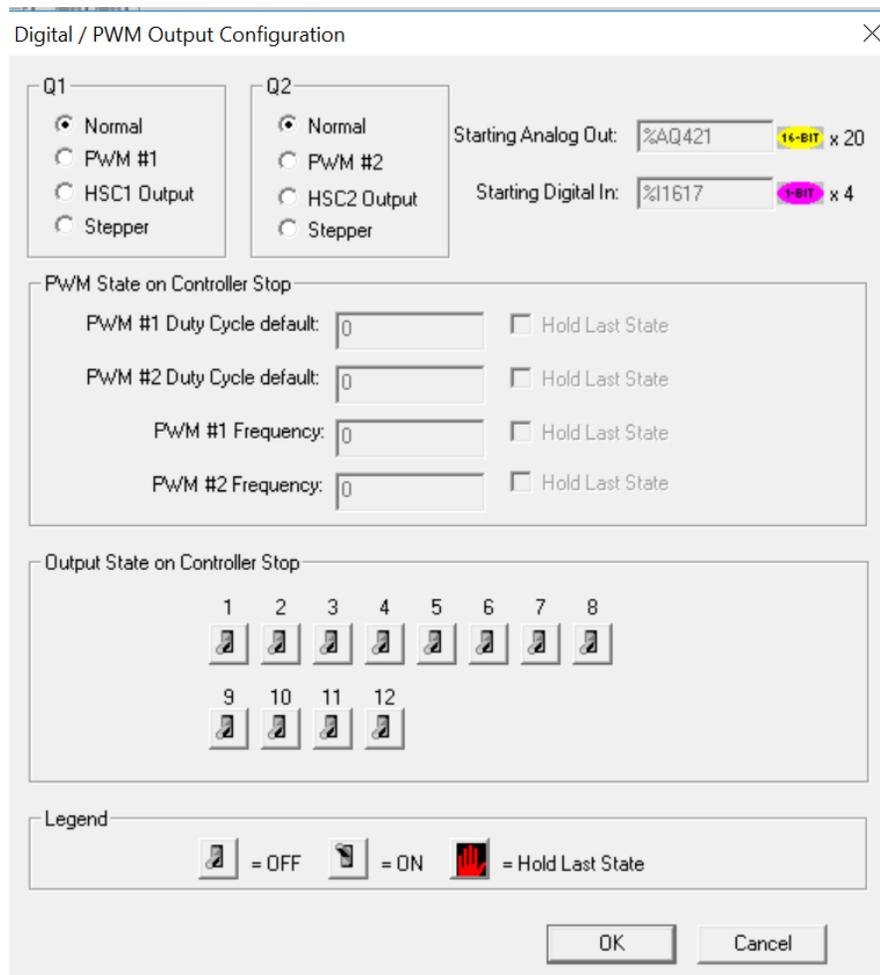
Figure 7.8 – Digital / PWM Output Configuration Dialog

The **Q1** and **Q2** group boxes allow the user to specify the operation of the multi-function outputs.

The **PWM State On Controller Stop** group 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: 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** group box contains items to allow the user to specify how the remaining 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.

7.7 Analog Input Configuration

The following figure illustrates the **Analog Input Configuration** dialog.
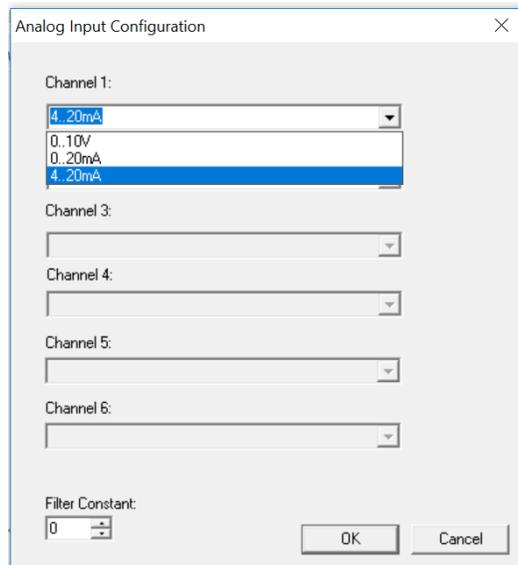
Figure 7.9 – Analog Input Configuration Dialog

The **Channel x** drop down windows allow the user to specify the mode for each analog input to operate. The **Channel x** drop down windows are enabled/disabled according to which model is being configured. All the models have the following modes available:
- 0..10V
- 0..20mA
- 4..20mA

On Model 5 and Model 6 I/O, other options on channels are outlined below:

Table 7.2 – Analog In for Models 5 & 6	
Model 5	Model 6
Channels 1 & 2	Channels 1-6
0..10V	0..10V
0..20mA	0..20mA
4..20mA	4..20mA
100mV	Disable
PT100 DIN RTD, 1/20°C	0-60mV
Type J Thermocouple, 1/20°C	PT100 DIN RTD, 1/10°C
Type K Thermocouple, 1/20°C	PT1000 DIN RTD, 1/10°C
Type N Thermocouple, 1/20°C	Type J Thermocouple, 1/10°C
Type T Thermocouple, 1/20°C	Type K Thermocouple, 1/10°C
Type E Thermocouple, 1/20°C	Type N Thermocouple, 1/10°C
Type R Thermocouple, 1/20°C	Type T Thermocouple, 1/10°C
Type S Thermocouple, 1/20°C	Type E Thermocouple, 1/10°C
Type B Thermocouple, 1/20°C	Type R Thermocouple, 1/10°C
* The **Filter Constant** provides filtering to all channels.	Type S Thermocouple, 1/10°C
	Type B Thermocouple, 1/10°C

7.8   Analog Output Configuration

The following figure illustrates the **Analog Output Configuration** dialog.
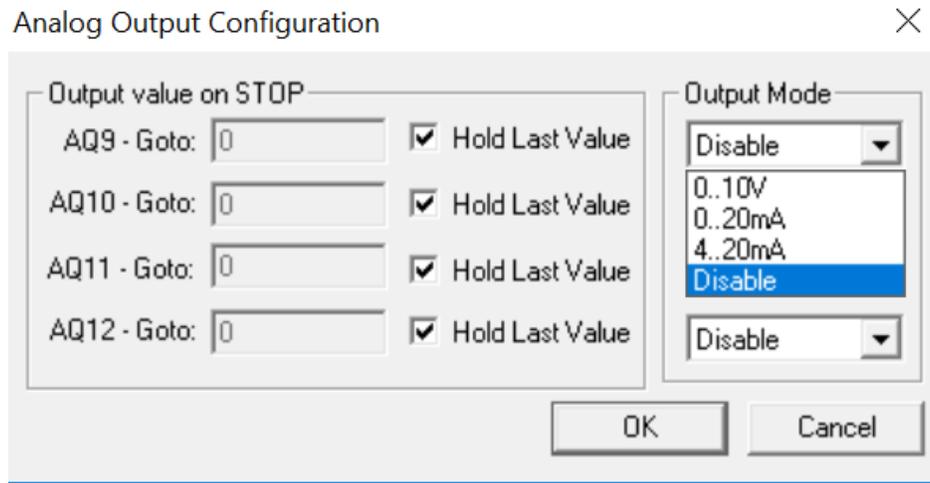
Figure 7.10 – Analog Output Configuration Dialog

The **Output value on Stop** group box contains items that allow the user to specify how the analog output channels behave when the controller is stopped. The outputs can either hold their value or default to a value when the controller is stopped.

The **Output Mode** group box allows the user to select the operating modes for each of the analog outputs. The modes include the following:

- 0..10V
- 0..20mA
- 4..20mA
- Disable

CHAPTER 8: GENERAL I/O

NOTE: The datasheet is the first document to refer to for model-specific information related to XL7 OCS models such as pin-outs, jumper settings, and other key installation information. Visit the Horner websites to obtain datasheets, user documentation, and updates.

8.1 Overview

The XL7 OCS is a compact unit that contains high density, very versatile I/O. Using the I/O properly requires wiring to the proper terminals, configuring jumpers inside the XL7 OCS unit 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, refer to the Index at the end of this manual for the pages referencing register mapping.

8.2 Removing the XL7 OCS I/O Cover

> **WARNING: Power, including I/O power, must be removed from the unit prior to removing the back cover. Failure to do so could result in electrocution and/or damage to equipment.**

Some I/O configurations require jumper settings to be changed in the XL7 OCS unit. Examples of these settings are setting positive or negative logic on digital inputs or setting current or voltage on analog inputs.

Each XL7 OCS I/O jumper is set to a factory default. Refer to the XL7 datasheet to find the default setting to determine if a jumper change is necessary for a particular application.

To remove the I/O cover of the XL7 OCS, remove the four (4) Phillips screws from the I/O back. It may help to place the XL7 OCS unit face down on a clean work surface. Once the four screws are removed the I/O cover can be lifted straight off.

Wiring Details
Solid/Stranded Wire: 12-24 awg (2.5 – 0.2mm^2) **Strip Length**: 0.28″ (7mm) **Torque Rating:** 4.5 – 7 in-lbs (050 – 0.78 N-m)
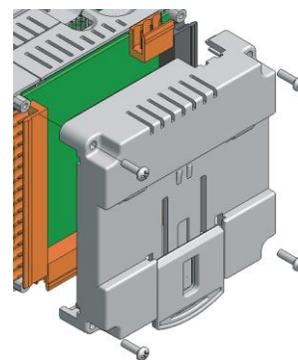
Figure 8.1 – Removing the I/O Cover
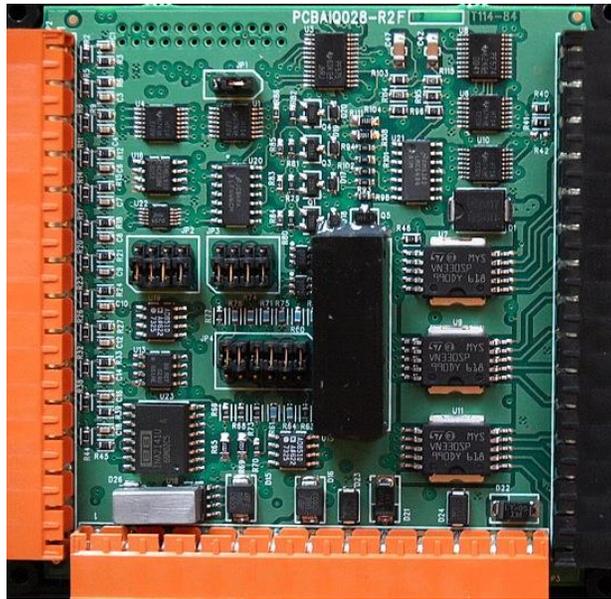
Figure 8.2 – XL7 I/O Cover Removed (sample I/O board)

Once the back is removed the jumper selection can be changed. The jumper settings are documented on each data sheet using a diagram such as Figure 8.3 below and a description of the jumper settings.
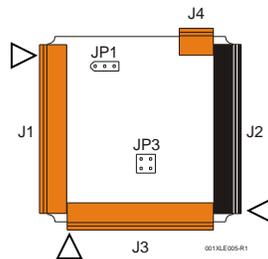

Figure 8.3 – Example Jumper Diagram

To re-install the cover, place the I/O cover back on the unit.

Place the screw back into the hole and turn the screw slowly counterclockwise until it clicks into the threads. This prevents the screw from being cross-threaded. Now turn the screw clockwise until the cover is firmly secured. Repeat this process for all four (4) screws. Ensure not to exceed the recommended max torque of 7-10 in-lbs [0.8 – 1.13 Nm].

8.3   Model and I/O Overview

Table 8.1 – I/O and Model Overview							
XL7 Models	DC In	DC Out	Relays	HS In	HS Out	mA/V In	mA/V RTD/TC	mA/V Out
HE-XW1E0 / HEXT391C100								
HE-XW1E2 / HEXT391C112	12		6	4		4		
HE-XW1E3 / HEXT391C113	12	12		4	2	2		
HE-XW1E4 / HEXT391C114	24	16		4	2	2		
HE-XW1E5 / HEXT391C115	12	12		4	2		2	2
HE-EXV1E6/ HEXT505C116	12	12		4	2		6	4

8.4   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 XL7 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.
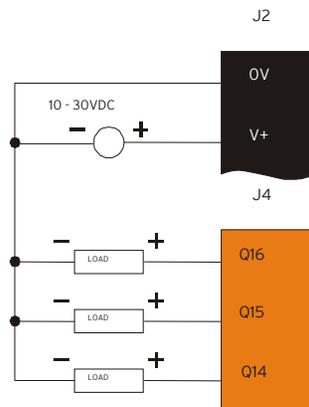
Figure 8.4 – Typical Output Wiring

The digital outputs used in the XL7 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 XL7 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 stop state see the Index to find pages referencing Cscape settings.

The digital outputs feature an output fault bit. %I32 will turn on if any of the outputs experience a short circuit, over-current or the output driver overheats.

8.5   Relay Outputs

Relay outputs are designed to switch loads that typically have high voltage or current requirements or require the isolation that relays provide.

NOTE: The design of the XL7 OCS does not require external coil power for the relays to function. The relays will activate anytime the XL7 OCS is powered.

There are several factors that should be considered when using relays:

Relay Life – Relays are mechanical devices that have a long but limited life. Typically, switching more current limits the life of relays. Please check the data sheets at the end of this manual for expected relay life.

Current / Temperature Derating – Products containing relays often have total current limits based on the ambient temperature of the application. Please see the product data sheet for current / temperature derating information for relays.

Fusing – External fusing is generally required to protect the relays, devices and wiring from shorts or overloads.

Warning: To protect the module and associated wiring from load faults, use external **(5A)** fuse(s) as shown. Fuses of lower current or fusing for the entire system need to be in place to assure the maximum current rating of the unit is <u>not</u> exceeded.

Warning: Connecting high voltage to any I/O pin can cause high voltage to appear at other I/O pins.
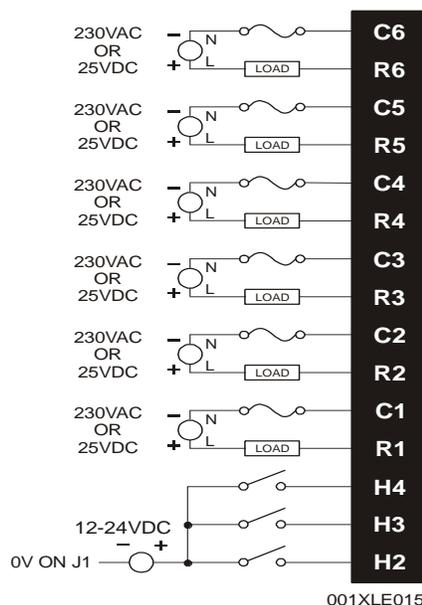
Figure 8.5 – Relay Fusing

Protection for Inductive Loads

Inductive loads can cause reverse currents when they shut off that can shorten the life of relay contacts. Some protective measures need to be determined by an engineer. If you have questions on protection from inductive load, consult Horner Automation Technical Support. Details on devices that may protect outputs can be found in the Spark Quencher Datasheet, MAN0962.

Output State on Controller Stop

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, relay outputs turn off. For more information on stop state see the Index for Cscape settings pages.

8.6 Digital Inputs

NOTE: Refer to the datasheet for XL7 OCS model being used for details on jumper settings.

NOTE: The digital inputs on the XL7 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 jumper setting and a configuration parameter in Cscape. All the inputs on the unit must be configured to the same mode.
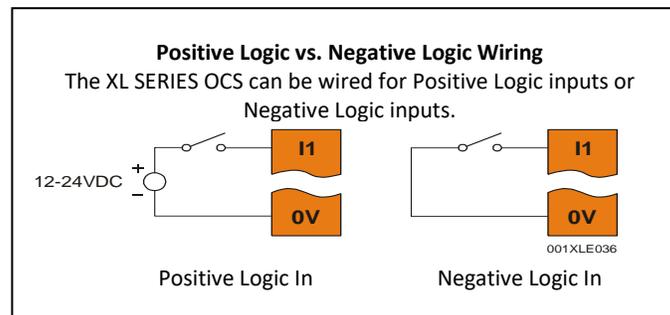
Figure 8.6 – Positive and Negative Inputs

In positive logic mode a positive voltage applied to the input will turn the input. 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 12V or 24V). This mode is sometimes called "sinking".

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

8.7   Analog Inputs

NOTE: See the data sheet for the XL7 OCS model being used for jumper settings and see the appropriate page in this manual (see Index) for details on how to use Cscape to configure the digital filtering.

The analog inputs on the XL7 OCS allow voltage or current measurement from a variety of devices. The voltage or current mode is set though jumpers on the unit and settings in Cscape. Each channel can be separately configured for voltage or current mode.

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.

8.7.1   Thermistor Option for Special Orders

NOTE: The standard unit does NOT support thermistor.

Thermistor support is a factory option for Models 2, 3, and 4 only. Model 2 can support a two-channel and four-channel thermistor. Models 3 & 4 support the two-channel thermistor only. Please refer to the Thermistor Supplement, SUP0797, for thermistor specifications and implementation details.

8.7.2 Common Cause of Analog Input Tranzorb Failure, Models 2, 3, 4, & 5

If a 4-20mA circuit is initially wired with loop power but without a load, the analog input could see 24VDC. This is higher than the rating of the tranzorb.

This can be solved by not connecting loop power prior to load connection or by installing a low-cost PTC in series between the load and the analog input.
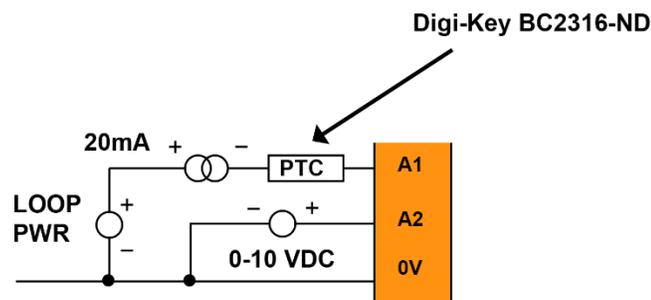
Figure 8.7 – Analog Input Tranzorb - Troubleshooting

8.8 Universal Analog Inputs

NOTE: See the data sheet for the XL7 OCS model being used for jumper settings and see the appropriate pages in this manual (see Index) for details on how to use Cscape to configure the digital filtering.

The universal analog inputs provide a high resolution, very flexible interface for a variety of analog inputs. These inputs include voltage, current, thermocouple, RTD, and millivolt. Each channel can be configured separately using jumpers and configuration settings in Cscape.

Like the standard analog inputs, these 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.

The Universal Analog Inputs on the Model 6 I/O board are unique from other Horner XL-series input/output cards in that they are configurable through the module configuration instead of having to change jumper settings in order to setup the input type.

To configure the Universal Analog input type:

1) Select **Analog In** to access the Analog Input Configuration menu.
2) Select any of the Analog input types from the dropdowns by clicking the down arrow beneath each corresponding Channel, as seen below:
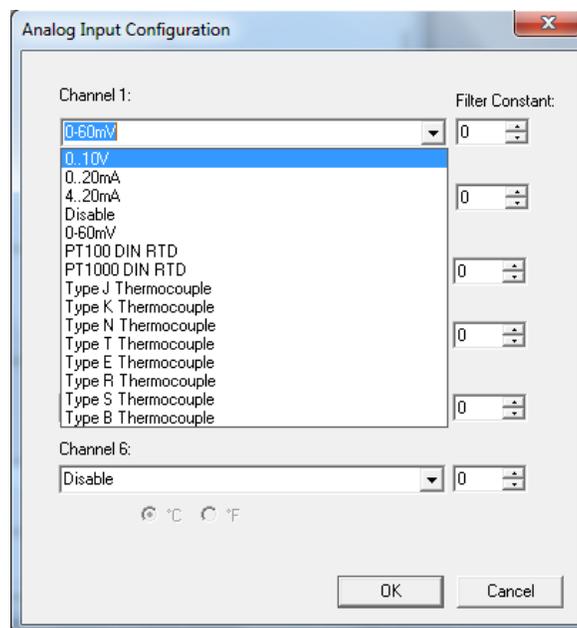
Figure 8.8 – Analog Input Configuration Screen

3) Ensure the proper wiring is used for each of the 3 pins **A** , **B**, and **C** on the Universal Analog Inputs as seen in the reference image below:
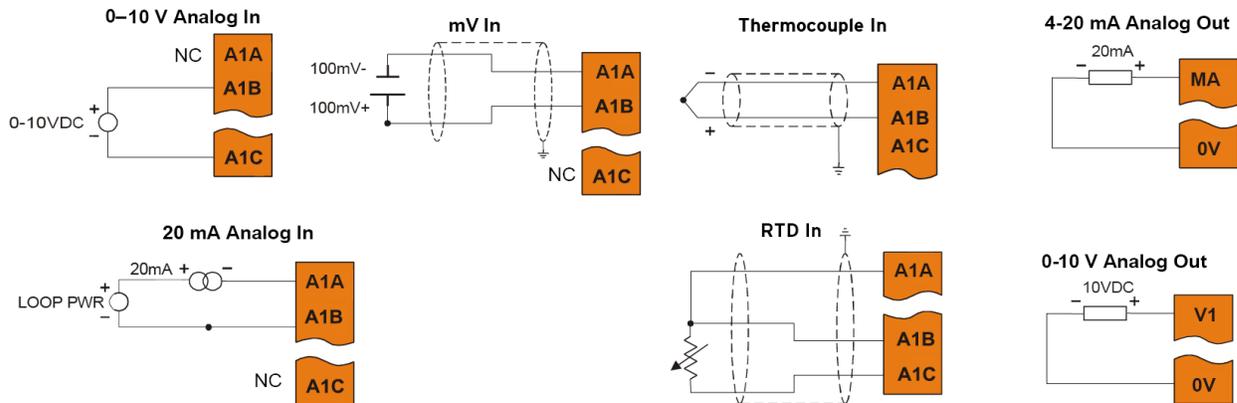
NOTE: Depending on the transmitter, isolated loop power may be required.

Figure 8.9 – Loop Power Requirements

8.9   Analog Outputs

NOTE: Refer to the datasheet for XL7 OCS model being used for details on jumper settings.

The analog outputs on XL7 OCS devices provide high-resolution voltage or current outputs. The voltage or current selection is controlled with jumpers and configuration settings in Cscape.

NOTE: Each channel can be separately configured for voltage or current mode.

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 value. By default, analog outputs are set to a value of zero. For more information on Stop State, refer to the appropriate pages (see Index) for the configuration chapter for Cscape settings.

CHAPTER 9:   HIGH SPEED I/O (HSC / PWM)

9.1   Overview

In addition to the compliment of simple analog and digital I/O, several of the XL7 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).

The OCS contains a **Field-Programmable Gate Array** (**FPGA**), which is an integrated configurable circuit that allows the XL7 to be programmed to have either two high-speed counters or four high-speed counters. The XL7 ships with two high-speed counters, but a customer can contact Horner Technical Support to receive a file that will configure the unit to have four. These modes are not supported simultaneously. Two counter mode supports Quadrature mode and two stepper outputs, while four counter mode does not support Quadrature mode and supports only one stepper output.

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

9.2   Glossary

Table 9.1 – Glossary of High Speed I/O Terms	
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
FPGA	An integrated, configurable circuit that allows the controller to be programmed to have either two high-speed counters or four high-speed counters.
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.

9.3   High Speed Counter (HSC) Functions

The XL7 supports two very high speed, configurable counters. There are four dedicated inputs that can be configured to a number of different options. Each of the two counters can run in one of five modes. Those modes are Totalizer, Frequency Counter, Pulse Width Measurement, Period Measurement and Quadrature measurement. For some modes, more than one HSC input may be consumed. The measurement values are provided to ladder in a %AI register. Refer to the Registers chapter for more details.

9.3.1   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: 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. Refer to the HSC Glossary for a description of these functions.

9.3.2 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:** 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:** 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.

Table 9.2 – Modes supported by Totalizer

NOTE: The totalize mode enables the Disable, Latch, Preload, and Clear special functions. Refer to the HSC Glossary for a description of these functions.

NOTE: Counter triggers off the **rising edge** of the signal.

Rising Edge Signal   Falling Edge Signal

Three different options are available to reset the current count. They are:

- **Configured reset value**
  When configuring the Totalize function, a value may be specified under the *Counts per Rev* column. When the totalizer accumulator reaches this value - 1, the accumulator will reset to zero on the next count. Specifying zero for this value allows the totalizer to count through the full 32-bit range before resetting.

- **Ladder control**
  Setting registers %Q17-20 reset HSC1-4 (respectively) with no additional configuration. When these registers are asserted, the associated totalizer accumulator is reset and held at zero (level sensitive).

- **Direct digital input control** (HSC1 and HSC2 only)
  HSC3 (%I11) and HSC4 (%I12) may be configured as hardware digital reset signals for HSC1 and HSC2 (respectively). To enable these inputs as reset signals, specify the type as *Totalize Reset* (**NOTE:** The corresponding Totalize HSC must be previously configured before this option is available). The direct digital reset controls are edge sensitive with the edge polarity configurable.

Maximum direct digital reset latency is 100µs.

The totalize function also supports an option which compares the current accumulator value with a supplied Preset Value (PV), which is provided through a %AQ, and drives a physical digital output based on the that comparison.

- This option (available for HSC1 and HSC2 only) drives Q1 or Q2 output point (respectively) once the associated totalizer accumulator reaches (or exceeds) the PV value. To enable this function, the corresponding PWM function output (Q1 or Q2) must be configured for *HSCx Output*.

NOTE: Q1 and Q2 are PWM function outputs that may be configured independently as one of the following: standard digital output, PWM, HSCx or stepper output.

Preset values may be modified during run-time. A preset value of zero disables (resets) the totalizer compares function output causing the output to remain low.

9.3.3 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. Refer to the HSC Glossary for a description of these functions.

Width High 1 μs Counts – In this sub-mode the accumulator value will contain the number of 1 μs counts the pulse is high.
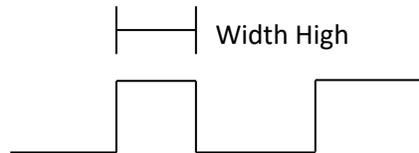
Width Low 1 μs Counts - In this sub-mode the accumulator value will contain the number of 1 μs counts the pulse is low.
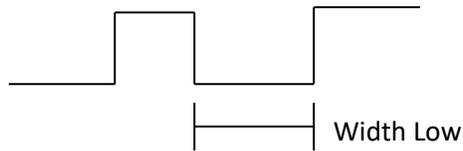
Figures 9.1-9.2 - Pulse Width Measurements, High & Low

9.3.4 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. Refer to the HSC Glossary for a description of these functions.

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

Period from Rising Edge
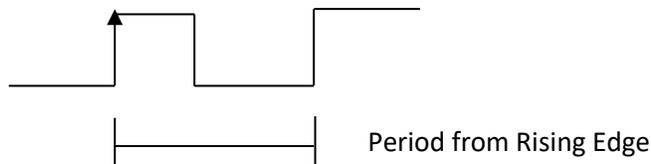
Period Falling Edges 1 μs Counts – In this sub-mode the period of the input signal is reported in 1 μs units. The period measurement will start on the falling edge of the input.

Period from Falling Edge
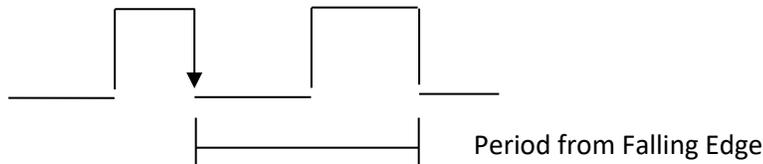
Figures 9.3-9.4 – Period Measurement, Rising Edges & Falling Edges

9.3.5 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 your encoder's documentation to determine the output form it uses or try both modes to determine if the encoder counts up when expected.
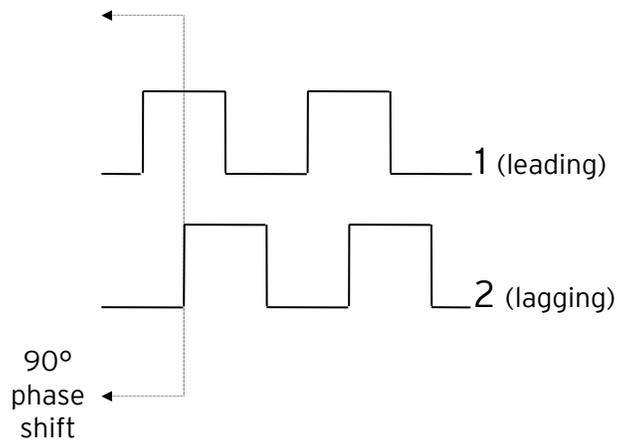
Figure 9.5 – Quadrature

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. Refer to the HSC Glossary for a description of these functions.

9.3.6 Register Match

Totalizer & Quadrature counter modes support a register match function. When the accumulator value matches either the Match 1 or Match 2 value configured in the corresponding %AQ registers, a high-speed output can Turn On, Turn Off, or Toggle. An internal %I register mirrors the output state whether the high-speed output is configured or not. The output can be reset in program logic using the corresponding %Q registers.

1. 2-Counter Mode has Register Match support for both counters.
2. 4-Counter Mode has Register Match support only for counters 1 and 2.
3. The High-Speed Outputs are %Q1 for Counter 1 and %Q2 for Counter 2. They operate as high-speed outputs, independent of the controller scan rate, when configured as 'HSC Output' in the Digital Out/PWM configuration in Cscape.
4. The High-Speed Output state reflects in the status register "High Speed Out", e.g. %I1603 for Counter 1 (the update speed of the status bit is scan rate dependent)
5. The High-Speed Output can be reset through ladder with the assigned output, e.g. %Q1606 for Counter 1
6. Both Match 1 and Match 2 values will trigger the match function.
7. If the output is already triggered by any Match register while using 'Turn On' or 'Turn Off' modes, subsequent matches will not affect the output.
8. If using 'Toggle' mode, every match of either Match value will toggle the output to the opposite state.

9.3.7 HSC Functions

The high-speed input on the XL7 contains many optional tasks. All of which can be disabled, or set to an internal pre-assigned register (Assigned %Q) or to one of the external high speed inputs (External Input #1, 2, 3, or 4), or they can be set as an "overflow interrupt" or "underflow interrupt" meaning that they will occur when either the Overflow or Underflow input has been activated.

Disable: When the Disable function is active, it will "disable" the high-speed inputs and no longer count pulses until it is re-enabled

Latch: When the Latch function is active, it takes the current value of the Accumulator and moves it into the "Latch Value" register

Preload: When the pre-load function is active, it will take the value from the "Preload" register and put it into the "Accumulator" for the corresponding Counter.

Clear: When the clear function is active, it will move a value of 0 into the "Accumulator" for the corresponding counter.

Marker: When the marker function is enabled, it acts as a dynamic enable/disable for the Disable, Latch, Preload, and Clear functions. If the marker is enabled and "Assigned %Q" is selected, then both the "Disable" and the "Disable Marker" bits need to be set high in order to disable the high-speed input. If the Marker is set for one of the inputs, then the input will need to be "High" in order to use any of the Disable, Clear, Preload, or Latch functions.

9.3.8 Status Bits

There are three status bits (%I registers for each high-speed counter).

Overflow Flag: This status bit turns high when the Accumulator "overflows", it moves from 4,294,967,295 (-1 if Signed) to 0, this bit can be reset with the "Output Reset Bit". See Table 9.4.

Underflow Flag: This status bit turns high when the Accumulator "underflows", it moves from 0 to 4,294,967,295 (-1 if Signed), this bit can also be reset with the "Output Reset Bit".

NOTE: For the Overflow and Underflow flag registers, if using some sort of counter that counts both up and down, going over the threshold to go negative, triggers the underflow, and then going back over the threshold back into positive numbers will trigger the positive register to go active.

High Speed Out: This register will follow the high-speed output assigned to the counter, it is important to note that this register is still populated within the scan time so the value in this register may not be up to date depending on the timing of the output (it should be up to date within one scan).

9.4 HSC Functions Register Map

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

Register	Frequency	Pulse	Totalize	Quad
		Table 9.3 – HSC Functions Register Map for 2 HSC Configuration		
%AI401-402		Accumulator - Counter 1		
%AI403-404		Latch Value – Counter 1		
%AI405-406		Accumulator – Counter 2		
%AI407-408		Latch Value – Counter 2		
%AQ401-402				Preload – Counter 1
%AQ403-404		Match1 – Counter 1		
%AQ405-406		Match2 – Counter 1		
%AQ407-408				Preload – Counter 2
%AQ409-410		Match1 – Counter 2		
%AQ411-412		Match2 – Counter 2		
%AQ413-424		Reserved		
%Q1601		Latch – Counter 1		
%Q1602				Preload – Counter 1
%Q1603				Clear – Counter 1
%Q1604		Disable – Counter 1		
%Q1605			Direction – C 1	
%Q1606				Output Reset – Counter 1
%Q1607				Preload Disable – Counter 1
%Q1608				Latch Disable – Counter 1
%Q1609				Disable Marker – C1
%Q1610				Latch Marker – C1
%Q1611				Preload Marker – C1
%Q1612				Clear Marker – C1
%Q1613-1616		Reserved		
%Q1617		Latch – Counter 2		
%Q1618				Preload – Counter 2
%Q1619				Clear – Counter 2
%Q1620		Disable – Counter 2		
%Q1621			Direction – C2	
%Q1622				Output Reset – Counter 2
%Q1623				Preload Disable – Counter 2
%Q1624				Latch Disable – Counter 2
%Q1625				Disable Marker – C2
%Q1626				Latch Marker – C2
%Q1627				Preload Marker – C2
%Q1628				Clear Marker – C2
%I1601		Overflow Flag – Counter 1		
%I1602		Underflow Flag – Counter 1		
%I1603		High Speed Out 1		
%I1604		Reserved		
%I1605		Overflow Flag – Counter 2		
%I1606		Underflow Flag – Counter 2		
%I1607		High Speed Out 2		
%I1608		Reserved		

NOTE: Four Count Mode requires FPGA update.

Table 9.4 – HSC Functions Register Map for 4 HSC Configuration			
Register	Frequency	Pulse	Totalize
%AI401-402	Accumulator - Counter 1		
%AI403-404	Latch Value – Counter 1		
%AI405-406	Accumulator – Counter 2		
%AI407-408	Latch Value – Counter 2		
%AI409-410	Accumulator – Counter 3		
%AI411-412	Latch Value – Counter 3		
%AI413-414	Accumulator – Counter 4		
%AI415-416	Latch Value – Counter 4		
%AQ401-402			Preload – Counter 1
%AQ403-404		Match1 – Counter 1	
%AQ405-406		Match2 – Counter 1	
%AQ407-408			Preload – Counter 2
%AQ409-410		Match1 – Counter 2	
%AQ411-412		Match2 – Counter 2	
%AQ413-414			Preload – Counter 3
%AQ415-416		Match1 – Counter 3	
%AQ417-418		Match2 – Counter 3	
%AQ419-420			Preload – Counter 4
%AQ421-422		Match1 – Counter 4	
%AQ421-424		Match2 – Counter 4	
%Q1601	Latch – Counter 1		
%Q1602			Preload – Counter 1
%Q1603			Clear – Counter 1
%Q1604	Disable – Counter 1		
%Q1605			Direction – C1
%Q1606			Output Reset – Counter 1
%Q1607			Preload Disable – Counter 1
%Q1608			Latch Disable – Counter 1
%Q1609-1616	Reserved		
%Q1617	Latch – Counter 2		
%Q1618			Preload – Counter 2
%Q1619			Clear – Counter 2
%Q1620	Disable – Counter 2		
%Q1621			Direction – C2
%Q1622			Output Reset – Counter 2
%Q1623			Preload Disable – Counter 2
%Q1624			Latch Disable – Counter 2
%Q1625-1632	Reserved		
%Q1633	Latch – Counter 3		
%Q1634			Preload – Counter 3
%Q1635			Clear – Counter 3
%Q1636	Disable – Counter 3		
%Q1637			Direction – C3
%Q1638			Output Reset – Counter 3
%Q1639			Preload Disable – Counter 3
%Q1640			Latch Disable – Counter 3
%Q1641-1648	Reserved		
%Q1649	Latch – Counter 4		
%Q1650			Preload – Counter 4

%Q1651			Clear – Counter 4
%Q1652	Disable – Counter 4		
%Q1653			Direction – C4
%Q1654			Output Reset – Counter 4
%Q1655			Preload Disable – Counter 4
%Q1656			Latch Disable – Counter 4
%Q1657-1664	Reserved		
%I1601	Overflow Flag – Counter 1		
%I1602	Underflow Flag – Counter 1		
%I1603	High Speed Out 1		
%I1604	Reserved		
%I1605	Overflow Flag – Counter 2		
%I1606	Underflow Flag – Counter 2		
%I1607	High Speed Out 2		
%I1608	Reserved		
%I1609	Overflow flag – Counter 3		
%I1610	Underflow flag – Counter 3		
%I1611	High Speed Out 3		
%I1612	Reserved		
%I1613	Overflow flag – Counter 4		
%I1614	Underflow flag – Counter 4		
%I1615	High Speed Out 4		
%I1616	Reserved		

9.5 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.

9.5.1 Normal

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

9.5.2 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. Zero (0) turns the output off, 32,000 turns the output on.
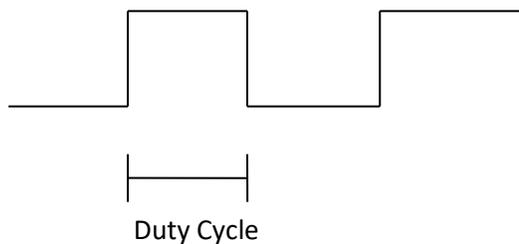
Duty Cycle

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

Period
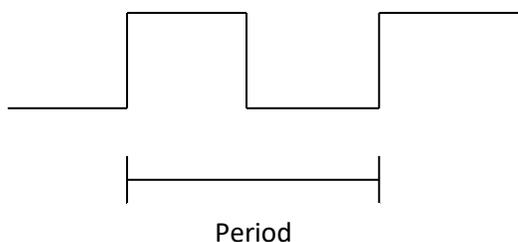
Figures 9.6 & 9.7 – PWM, Two parameters, Duty Cycle & Frequency

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: For standard I/O models (1E3, 1E4, 1E5, and 1E6) the maximum recommended PWM frequency is 10kHz, due to the limitations of built-in output circuitry. The **HE-XHSQ** generates 24V pulse outputs with a recommended max of 400kHz. The **HE-XHSQ-5** generates 5V pulse outputs with a recommended max of 1.0MHz. The add-on HSQ and HSQ-5 module can be added to the 1E2 unit for HSC function.

9.5.3 PWM Output Waveform
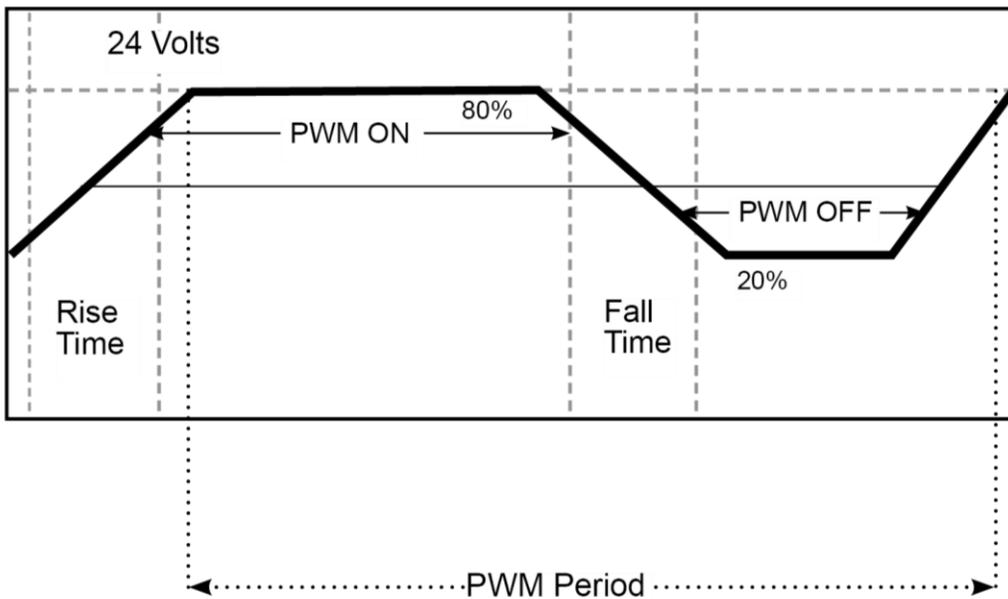
Figure 9.8 – PWM Output Waveform

Table 9.5 – PWM Output Waveform Table	
Rise Time	150ns Max
Fall Time	150ns Max
PWM Period	Frequency = $\dfrac{1}{Period}$

9.5.4 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. Refer to the HSC Functions section for more details.

9.5.5 Stepper Function

The XL7 supports two stepper functions, one on each high-speed output when in two counter mode. In four counter mode, the XL7 supports one stepper function

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 1.0MHz (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.

Table 9.6 – Five Parameters for Stepper Function

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.

Table 9.7 – Boolean Registers

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.

9.6 High Speed Output Functions Register Map

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

Table 9.8 – PWM Functions Register Map, Two Counter		
Register	PWM	Stepper
%AQ421-422	PWM 1 Duty Cycle (32-bit)	Start Frequency – Stepper 1
%AQ423-424	PWM 1 Frequency	Run Frequency – Stepper 1
%AQ425-426		Acceleration Count – Stepper 1
%AQ427-428		Run Count – Stepper 1
%AQ429-430		Deceleration Count – Stepper 1
%AQ431-432	PWM 2 Duty Cycle (32-bit)	Start Frequency – Stepper 2
%AQ433-434	PWM 2 Frequency	Run Frequency – Stepper 2
%AQ435-436		Acceleration Count – Stepper 2
%AQ437-438		Run Count – Stepper 2
%AQ439-440		Deceleration Count – Stepper 2
%Q1*		Start Move Bit – Stepper 1
%Q2*		Start Move Bit – Stepper 2
%I1617		Ready/Done – Stepper 1
%I1618		Error – Stepper 1
%I1619		Ready/Done – Stepper 2
%I1620		Error – Stepper 2

Table 9.9 – PWM Functions Register Map, Four Counter		
Register	PWM	Stepper
%AQ451-452	PWM 1 Duty Cycle (32-bit)	Start Frequency – Stepper 1
%AQ453-454	PWM 1 Frequency	Run Frequency – Stepper 1
%AQ455-456		Acceleration Count – Stepper 1
%AQ457-458		Run Count – Stepper 1
%AQ459-460		Deceleration Count – Stepper 1
%AQ461-462	PWM 2 Duty Cycle (32-bit)	
%AQ463-464	PWM 2 Duty Frequency	
%AQ465-469	Reserved	
%Q1*	PWM1 Out	Stepper On
%Q2*	PWM2 Out	
%I1649		Stepper Ready/Done
%I1650		Stepper Error

*Q30 and Q31 for model 2 using HSQ or HSQ-5 add-module (necessary to start move)

9.7   PWM Examples

Example 1	Duty Cycle	Frequency
To get a 50% Duty Cycle @ 10kHz waveform on PWM1:	Set %AQ421-422 = 16,000	Set %AQ423-424 = 10,000

Example 2	Duty Cycle	Frequency
To get a 50% Duty Cycle on PW1 and 90 % Duty Cycle on PWM2 @ 1kHz waveform:	Set %AQ421-422 = 16,000 Set %AQ431-432 = 28,800 *(duty cycle (32000 * 0.9))*	Set %AQ423-424 = 1,000 Set %AQ433-434 = 1,000

Example 3	Duty Cycle	Frequency
To turn PWM 1 output ON all the time	Set %AQ421-422 = 32,000	Set %AQ423-424 = Any Value

Example 4	Duty Cycle	Frequency
To turn PWM 1 output OFF all the time	Set %AQ421-422 = 0	Set %AQ423-424 = Any Value

Table 9.10 – PWM Examples

9.8   STP Examples

Example 1	Start Frequency	Run Frequency	Accel Count	Run Count	Decel Count
10,000,000 steps control sequence	Set %AQ421 = 2500 (Hz)	Set %AQ422 = 5000 (Hz)	Set %AQ423-4 = 1,000,000 (Steps)	Set %AQ425-6 = 8,000,000 (Steps)	Set %AQ427-8 = 1,0000,000 (Steps)

When the start bit is energized, the example starts at 2.5kHz and ramps up to 5kHz during the first 1,000,000 steps. Then, it runs at 5kHz 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 %AQ421 = 500 (Hz)	Set %AQ422 = 1000 (Hz)	Set %AQ423-4 = 2,000,000 (Steps)	Set %AQ425-6 = 2,000,000 (Steps)	Set %AQ427-8 = 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 %AQ421 = 50 (Hz)	Set %AQ422 = 250 (Hz)	Set %AQ423-4 = 150,000 (Steps)	Set %AQ425-6 = 5,500,000 (Steps)	Set %AQ427-8 = 350,000 (Steps)

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

Table 9.11 – STP Examples

NOTE: Prior to the start of a move, the Ready/Done bit for that channel must be ON (%I1617 or %I1619 for channel 1 and 2 respectfully). 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 XL7 can generate any frequency that can be evenly divided into 10MHz (10,000,000Hz) 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.

9.9   HSC I/O Filtering

This feature is used to enable digital Filter for HSC Inputs.

Selecting Digital In/HSC configuration opens up the following dialog where in HSC I/O Filtering is available.
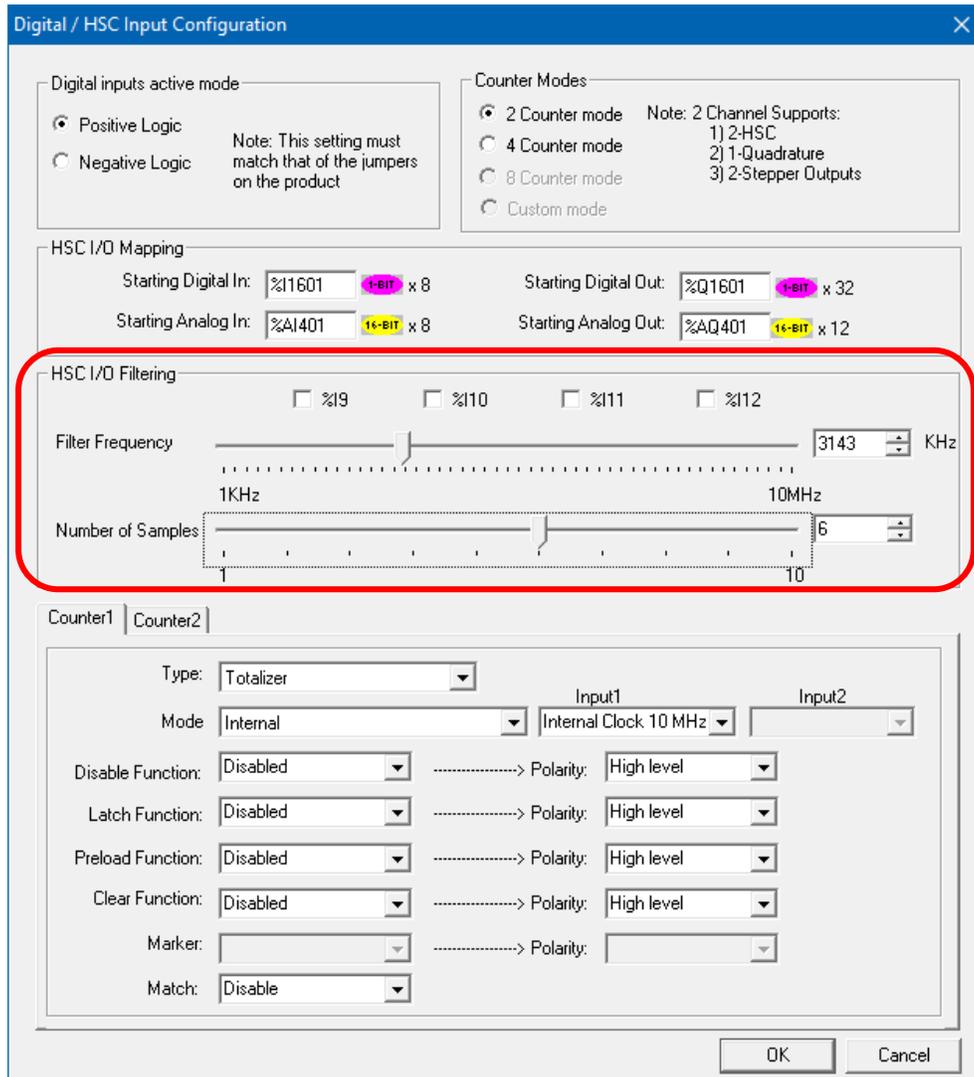
Input signal is filtered based on the filter frequency and Number of samples selected.
User has to select Filter Frequency and Number of samples based on the frequency of the Input signal.

Filter Frequency: To set the filter, choose a value that is: 4*Number of Samples*Expected Max Hz on the high-speed inputs.

Number of samples: The input must be stable for this many samples before the HSC accumulator is affected by any change.

The state (high or low) of the high-speed input is sampled with every rising input edge of the filter frequency. The rising edges of the filter frequency are totaled in a sample counter, and when that total equals the number of samples configured, the sample counter is reset. If the high-speed input state did not change by the time of the sample counter reset, that state, high or low, is passed on to the high-speed accumulator. If the high-speed input state changes during the sample counting, the sample counter is reset to zero and the process starts over.

Figure 1: Input Signal
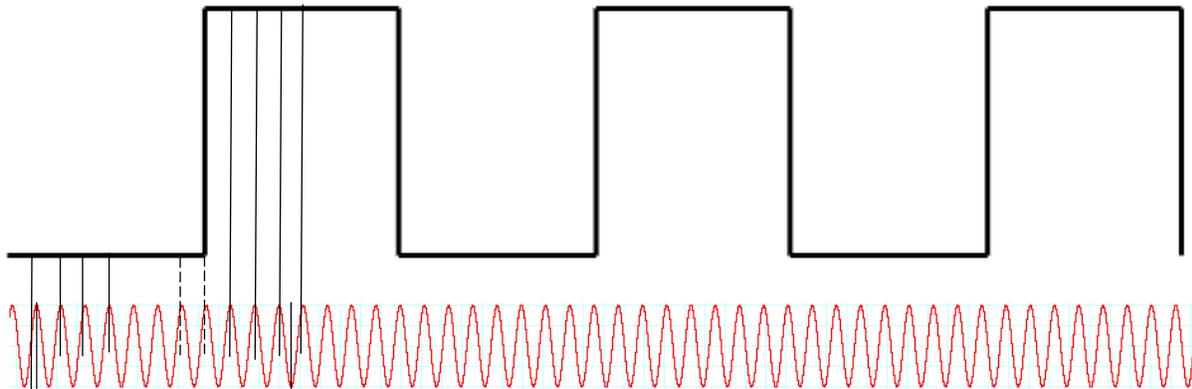
Figure 2: Filter Frequency: Example 1MHz

Number of samples: 4

If user selects filter frequency as 1MHz and Number of samples as 4, then Input signal is sampled for 4 samples and if the signal is stable for 4 samples i.e. 4µs then the signal is passed to Accumulator.

If the Input state is changed in between the sampling counts, then the count is reset, and the Input state is again checked for given number of samples.

Refer to Dotted lines in the Figure 2, after 2 samples the state of input signal changes to 1, so the counter is again started to count 4 samples, to pass the signal to accumulator.

There will be a delay in passing the input signal to accumulator since we are filtering the Input signal and the delay is based on the selected filter frequency and Number of samples. In the above example filter frequency is 1MHZ (1µs) and number of samples: 4, so the minimum delay in input signal will be 4µs.

Figure 3: Input signal before filtering
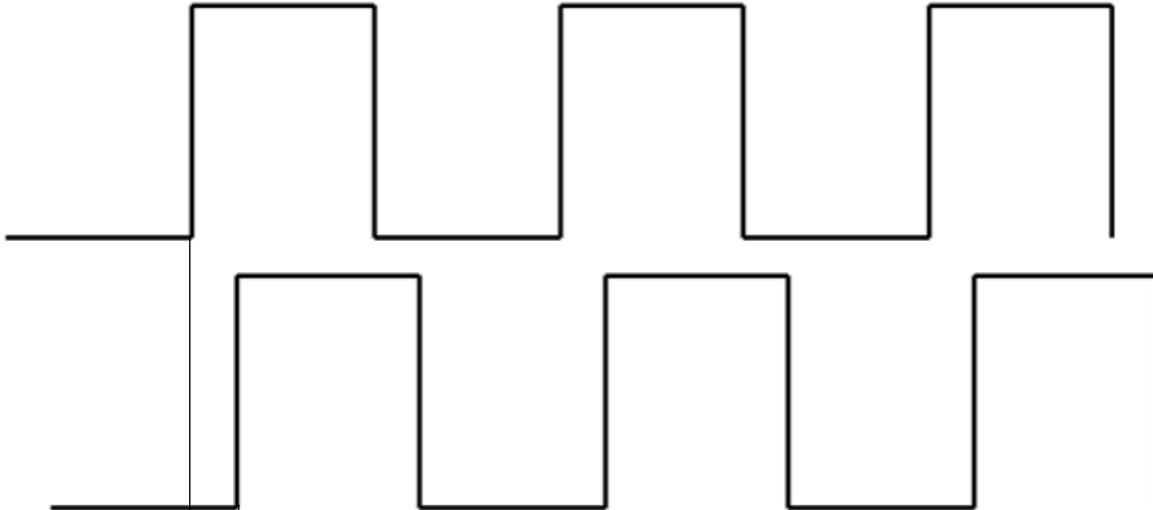
Figure 4: Input signal after filtering

This delay will be 4µs.

CHAPTER 10: SERIAL COMMUNICATIONS

10.1   Overview

All XL7 OCS models provide two independent serial ports, on the first 8-pin modular RJ45 connector, which is labeled **MJ1/MJ2**. The MJ1 serial port is RS232 while the MJ2 port is RS485. By default, MJ1 can be connected to the COM port of a PC running Cscape, for OCS programming. In addition, both MJ1 and MJ2 can be used for application-specific communication, using a variety of standard data exchange protocols.

The second 8-pin modular RJ45 connector, which is labeled **MJ3**, provides a multiplexed serial port, which can be configured for either RS232 or RS485. MJ3 can be optionally set for OCS programming via the System Menu for connection to the COM port of a PC running Cscape.

10.2   Port Descriptions

The MJ1 serial port contains an RS232 interface with RTS/CTS handshaking. The MJ2 serial port contains a half-duplex RS485 interface with no handshaking. The MJ3 serial port can be configured as either RS232 or RS485. The MJ2 and MJ3 RS485 interfaces provide switchable termination and bias resistors internally, which can be enabled/disabled with DIP switches.

10.3   Wiring and Dip Switches

MJ1/2 SERIAL PORTS

Two Serial Ports on One Module Jack (8posn)

MJ1: RS-232 w/Full Handshaking

MJ2: RS-232 Half-Duplex

	MJ1 PINS		MJ2 PINS	
PIN	SIGNAL	DIRECTION	SIGNAL	DIRECTION
8	TXD	OUT	--	--
7	RXD	IN	--	--
6	0V	GROUND	0V	GROUND
5	+5V @ 60mA	OUT	+5V @ 60mA	OUT
4	RTS	OUT	--	--
3	CTS	IN	--	--
2	--	--	RX- / TX-	IN / OUT
1	–	--	RX+ / TX+	IN / OUT

MJ3 SERIAL PORT

2 Multiplexed Serial Ports on One Modular Jack (8posn)

	MJ3 PINS	
PIN	SIGNAL	DIRECTION
8	TXD RS232	OUT
7	RXD RS232	IN
6	0V	GROUND
5	+5V @ 60mA	OUT
4	TX- RS485	OUT
3	TX+ RS485	OUT
2	RX- RS485	IN
1	RX+ RS485–	IN

Figure 10.1 – Serial Ports

DIP SWITCHES			
PIN	NAME	FUNCTION	DEFAULT
1	MJ3 RS485 Termination	ON = Terminated	OFF
2	MJ3 Duplex	ON = Half OFF = Full	OFF
3			OFF
4	MJ2 RS485 Termination	ON = Terminated	OFF

The DIP switches are used to provide a built-in termination to both the MJ1, MJ2 & MJ3 ports if needed. The termination for these ports should only be used if this device is located at either end of the multidrop/ daisy-chained RS-485 network.

Figure 10.2 – Dip Switches

10.4 RS485 Termination

Proper RS485 termination minimizes signal reflections and improves reliability.

Both the MJ2 and MJ3 serial ports allow an internal 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 RS485 network should be terminated.

10.5 RS485 Biasing

RS485 biasing passively asserts a line-idle state when no device is actively transmitting, which is useful for multi-drop RS485 networking.

Both the MJ2 and MJ3 serial ports allow internal bias resistors to be switched in, pulling pin 1 up to 3.3 V and pulling Pin 2 down to ground. The Set Serial Ports item in the System Menu can be used to enable RS485 biasing. Also, an application graphics screen that writes to %SR164 can do the same thing. Setting %SR164.1 enables MJ2 biasing and setting %SR164.2 enables MJ3 biasing.

If biasing is used, it should be enabled in only one of the devices attached to the RS485 network.

10.6 Cscape Programming via Serial Port

The XL7 OCS MJ1 and MJ3 serial ports support CsCAN Programming Protocol. If a PC COM port is connected to the XL7 OCS MJ1 or MJ3 serial port, Cscape can access the XL7 OCS for programming and monitoring. Programming can also be done via the CAN port, USB A port, or Ethernet.

10.7 Ladder-Controlled Serial Communication

Using Serial Communication function blocks, MJ1, MJ2, and MJ3 serial ports 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.

10.8 Configuration via Mini-B USB

NOTE: The unit must be connected via the mini-USB port to the PC or laptop.

It is possible to load the program and monitor data via the Mini-B USB. To load via Mini-B USB, configure the communications port in Cscape as follows:
Select **Tools** from the toolbar → **Application Settings** → **Communications** → **USB** button

It is possible to download or upload and use the data monitoring functions once connected.

NOTE: It is advisable to use an isolated USB cable between the PC or laptop and the XL7 when third party devices are connected to the XL7 to avoid damage to the PC or laptop and/or the XL7

CHAPTER 11:   CAN COMMUNICATIONS

NOTE: For additional CAN information, refer to the CAN Networks manual (MAN0799) on the Horner websites.

11.1   Overview

All XL7 OCS models provide two CAN network ports, which are implemented with 5-pin connectors. The connectors are labeled **CAN1 and CAN2**.

CAN1   **CAN2**

Figure 11.1 – CAN1 & CAN2 Connector Locations

The CAN1 port allows the XL7 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).

The CAN1 port also supports pass-through communications for programming multiple OCS controllers over the CsCAN network.

CAN2 port supports CsCAN, CANopen, J1939 and DeviceNet Master (layer 3 as a selectable option – one only).

11.2   Port Description

The XL7 OCS CAN ports implement the ISO 11898-2 physical layer and the CAN 2.0 A data link layer standards. Also, since the CAN ports are powered by an internal isolated power supply, external CAN power is not required.

NOTE: The CAN ports do not supply power to the network.

11.3   CAN Port Wiring

CAN Connector

Use the CAN Connector when using CsCAN or other CAN network.

Torque rating 4.5 – 7 in-lbs (0.50 – 0.78 N-m)

CAN1 & CAN2 Port Pins		
Pin	Signal	Signal Description
1	V-	Power - Black
2	CN_L	CAN Data Low - Blue
3	SHLD	Shield – No color
4	CN_H	CAN Data High - White
5	V+	Power + Red
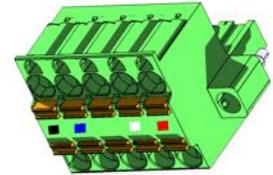
Figure 11.2 – CAN1 / CAN2 Port Pins

11.4   Cscape Programming via CAN

The CAN1 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 XL7 OCS CAN1 port, Cscape can access the XL7 OCS for programming and monitoring.

In addition, the XL7 OCS supports single-point-programming of all XL7 OCS and other OCS/RCS devices that are connected to the CAN1 port network. If the PC COM port is connected to the XL7 OCS MJ1 serial port, the XL7 OCS can act as a pass-through gateway allowing Cscape to access all XL7 OCS and OCS/RCS devices that are attached to the CAN1 port network.

11.5   Ladder-Controlled CAN Communication

Using Put and Get Network Words function blocks, the CAN 1 port can exchange digital and analog global data with other XL7 OCS or OCS/RCS devices (nodes) attached to the CAN1 port network.

In addition, Put and Get Network Heartbeat function blocks allow nodes on the CAN 1 port network to regularly announce their presence and to detect the presence (or absence) of other nodes on the network.

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

Connecting Network I/O devices (SmartStix, SmartBlock, SmartMod or SmartRail) to the XL7 OCS CAN1 or CAN2 port, allows the XL7 OCS I/O to be economically expanded and distributed. A variety of modules are available for this purpose.

CHAPTER 12: ETHERNET COMMUNICATION

12.1   Ethernet Module Protocols and Features
The following table describes the Ethernet Module Protocols and features supported by XL7.

Table 12.1 – Ethernet Module Protocols & Features	
Protocol / Feature	Protocol / Feature Description
ICMP (Ping)	Internet Control Message Protocol
EGD	Ethernet Global Data
SRTP (Slave 90-30 Service Request)	Service Request Transfer Protocol
CsCAN TCP Server	Horner APG CsCAN over Ethernet (for Cscape to OCS programming)
Modbus Slave	Modbus over Ethernet
Ethernet / IP	ODVA CIP over Ethernet
FTP (File Server)	File Transfer Protocol
ASCII over TCP/IP	ASCII Data over Ethernet
NTP (File Server)	Network Time Protocol (Obtain clock from web-based server)
HTTP (Web Server)	Hypertext Transfer Protocol (Web Server)

12.2   Ethernet System Requirements

Full Ethernet functionality requires:
-    PC running Cscape Programming Software Version 9.3 SP6 or later (for configuration).
-    XL7 controller with onboard Ethernet port.

12.3   Ethernet Module Specifications

Table 12.2 – Ethernet Module Specifications	
Speeds	10 BaseT Ethernet (10Mbps) 100 BaseTx Fast Ethernet (100Mbps)
Modes	Half or Full Duplex
Auto-Negotiation	Both 10/100Mbps and Half/Full Duplex
Connector Type	Shielded RJ-45
Cable Type (Recommended)	CAT5 (or better) UTP
Port	Auto MDI/MDI-X (Auto Crossover)

12.4 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 → Hardware Configuration** sub-menu to open the **Hardware Configuration** dialog (Figure 12.1).
2. If configuring a different OCS Model than the one shown in the Hardware Configuration dialog, click on the topmost **Config** button, select the desired OCS Model, and then click **OK.**
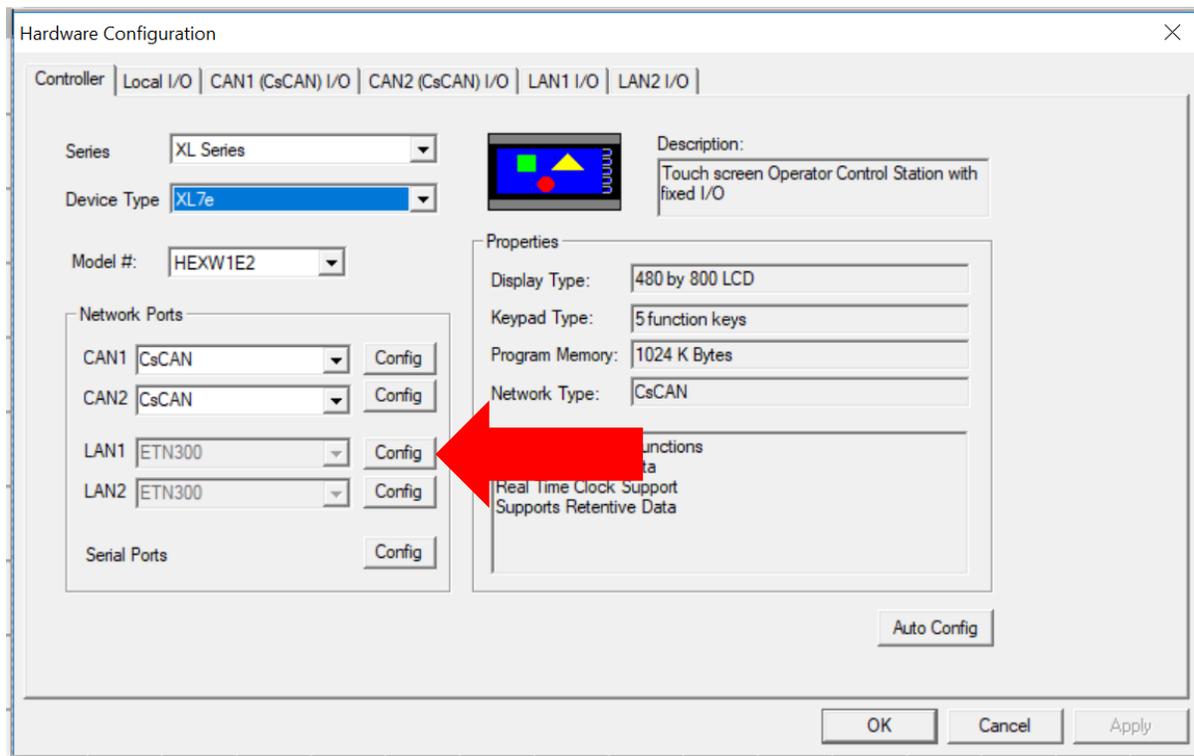
Figure 12.1 – Hardware Configuration Dialog

3. Click the **Config** button to the right of LAN1 for LAN 1 or LAN2 for LAN2, revealing the Ethernet Module Configuration dialog as shown in Figure 12.2
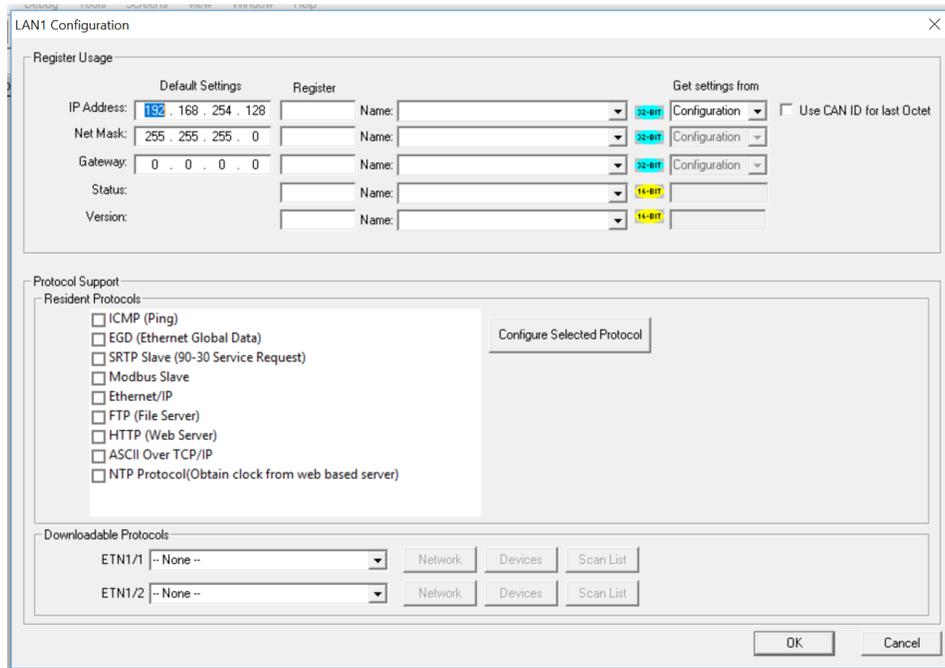
Figure 12.2 – Ethernet Module Configuration

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: 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 12.3 shows how this register value is formatted and explains the meaning of each bit in the Status Word.

Table 12.3 - 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	
		Minimum	Maximum
0	Reserved	Always 0	
Dup	Link Duplex (Auto-Negotiated)	0 = Half Duplex	1 = Full Duplex
Spd	Link Speed (Auto-Negotiated)	0 = 10MHz	1 = 100MHz
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, SRTP, Modbus, EIP, FTP, HTTP)	0	40

Version Register – Enter an OCS Register reference (such as %R101) to indicate which 16-bit OCS register will have the Ethernet Firmware Version written to it. The value stored in the Version Register is (Ethernet Firmware Version * 100). For example, for Ethernet Firmware Version 4.30, the Version register will contain 430.

Get Settings From – "Get settings from" allows the programmer to configure either the IP Address, Net Mask, or Gateway for 2 functions: Configuration or Register

Configuration – The configuration for the IP Address, Net Mask, or the Gateway will be assigned using the value in the Default Settings in this window.

Register – The configuration for the IP Address, Net Mask, or the Gateway will be assigned using the values in the registers assigned.

NOTE: The low octet of the IP Address can be replaced with the unit's CAN Network ID, by checking the **Use CAN ID for last Octet** checkbox.

12.5   Ethernet Configuration – IP Parameters

For primary operation, the IP address, Net Mask, and Gateway should be set in the LAN config of the **Cscape Hardware Configuration**. There are options to get IP parameters from the LAN Config or to get parameters from registers. It is possible to set the Ethernet IP parameters from the OCS System Menu, but only as a temporary measure. The following points on IP parameter configuration should be considered.

- **IP Parameters in Non-Volatile RAM:** The IP parameters of the Cscape LAN Config are written to non-volatile RAM on power down. IP parameter settings made in the System Menu are not written to non-volatile RAM. Any IP parameters settings made in the System Menu will be lost after cycling power to the unit. It will revert back to the last downloaded Cscape LAN Config that was loaded into non-volatile RAM at power down.

- **"Cscape LAN Config"/ "Get Settings from" Configuration**: When 'Get settings from' is set to Configuration, the IP parameters specified under 'Default Settings' is used after downloading to the controller. The IP parameters are represented in System Menu / Set Networks and can be edited. However, any edits made from System Menu / Set Networks is not retained through a power cycle. After power cycle, the unit reverts to the last downloaded Cscape LAN Config that was loaded into non-volatile RAM at power down.

- **"Cscape LAN Config" / "Get Settings from" Register**: When 'Get settings from' is set to Register, the IP parameters are retrieved from the OCS registers assigned in LAN Config. Configured registers must be populated with the desired IP parameters.
  The IP parameters are represented in System Menu / Set Networks.
  The IP parameters cannot be edited from System Menu / Set Networks while the unit is in run mode.
  The IP parameters always follow the values in the registers unless the OCS unit is placed in idle mode. Then the IP parameters can be edited in System Menu / Set Networks. When the OCS is placed back into run mode, it reverts to the registers for IP parameters.

12.6   Ethernet Module Protocol Configuration

The Protocol Support area contains a list of all the 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 latest version of ETN 300 Manual SUP0740.

CHAPTER 13: DOWNLOADABLE COMMUNICATION PROTOCOLS

13.1 Overview

Through loadable protocol device drivers, certain models of the OCS family can provide the ability to exchange data with remote devices such as variable-frequency drives, PLCs, and remote I/O devices. This feature greatly expands the OCS 's control capability with negligible effect on the OCS 's ladder scan time.

Remote devices that communicate serially must do so under certain rules of data transfer known as a protocol. Many device manufactures have created their own protocol for communications with their device. For an OCS to communicate with a specific device, it must be loaded with the corresponding serial communications protocol device driver that supports that protocol.

A limited number of protocol device drivers are packaged with the Cscape distribution; however, as more are developed, they will be made available as add-on packages. A device driver is typically distributed as a Windows module, which contains the Configuration Menus, Help Files and the Target Executable Driver Code. When updating device drivers, an install routine loads the device driver to the Cscape directory structure and makes that driver available to Cscape applications.

Once installed, the protocol device driver can be included as part of a Cscape application by selecting it from a list of installed protocol device drivers and attaching it to the desired serial port (Program > Protocol Config menu). Only one protocol device driver can be associated with a serial port, though some OCS models support multiple protocols on a single Ethernet port.

Once the protocol is selected for a specific port, that port must be configured to match the bit transfer size and rate of the target device(s). This is configured under the **Network Config** menu, which contains port specific information such as the basic serial port parameters (i.e. baud rate, stop bits parity, retries, etc.). In addition to the serial port parameters, this menu also contains the transaction scan update control configuration and any network level protocol specific configuration.

Once the network is configured, each device on the serial communications network must be configured. For some communications (i.e. RS232), the network can be limited to one device. The devices are configured under the **Device Config** menu, which contains an arbitrary device name, the device ID and optionally an OCS status register that contains any device fault information.

Once each device(s) is configured, a **Scan List** of entries must be created which defines the transfer of data between a local (OCS) register(s) and a remote device register(s). These entries are created under the **Data Mapping** menu, which contains an OCS register, a target device ID, a target device register address, the number of registers to transfer, and update type.

Each entry can be configured for one of two types of initiating a transaction: **Polled and Triggered.** Polled type entries initiate a transaction with the remote device on every transaction scan. Triggered type entries only initiate a transaction when a corresponding local (OCS) binary trigger register is *set*. Once a triggered type transaction completes, the protocol device driver **resets** the local (OCS) binary register to indicate completion. Refer to the Scan List Section for more details on Polled and Triggered entries.

These basic types are also subdivided into Read or Write operations. For polled operations, a Read operation only reads from a remote device. Likewise, a Read/Write operation continuously reads from the remote device unless the target OCS register value changes from one ladder scan to another. In this case, the new OCS value is written to the target device. For triggered operations, only a Read or Write action is available.

When downloaded to the OCS, the Scan List is scanned sequentially to generate data transactions with the remote device. This transaction scanning can be on a continual basis (**automatic**) or controlled from ladder logic (**manual**) once a complex connection is programmatically created (i.e., dialup modem). The specific transaction-scanning mode is selected from the **Network Config** menu.

The following Horner Automation websites offer OCS Protocol Software Downloads.

North America   http://hornerautomation.com/support-files/

Europe   https://www.hornerautomation.eu/support/

Please refer to the Cscape Help file for more information on Downloadable Protocols Configuration. After opening the Cscape Help file, select **Contents → Networking and Communications → Protocol Configuration.**

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Protocol Configuration

Overview | Automatic Update Scanning | Manual Update Scanning | Data Consistency Protocol Device Driver Selection | Network Configuration | Device List | Device Configura

Overview

Through loadable protocol device drivers, certain models of the OCS family can provide the ability to PLCs and remote I/O devices. This feature greatly expands the OCS 's control capability with neglig

Remote devices that communicate serially must do so under certain rules of data transfer known as for communications with their device. For a OCS to communicate with a specific device, it must be driver that supports that protocol.

A limited number of protocol device drivers are packaged with the Cscape distribution; however, as r device driver is typically distributed as a Windows module, which contains the configuration mer device drivers, an install routine loads the device driver to the Cscape directory structure and makes

Once installed, the protocol device driver can be included as part of a Cscape application by selec the desired serial port (**Program > Protocol Config** menu). Only one protocol device driver can multiple protocols on a single Ethernet port.

Once the protocol is selected for a specific port, that port must be configured to match the bit tran **Network Config** menu, which contains port specific information such as the basic serial port para serial port parameters, this menu also contains the transaction scan update control configuration an

13.2 Protocol Config

After opening Cscape, choose **Program → Protocol Config**, and select the port drop-down box to select a protocol device driver. All protocol device drivers currently loaded in Cscape are displayed in the dropdown selection. Some OCS models can be limited in the number of ports or number of protocol device drivers that can be selected. Once a protocol is selected, the Network, Devices, and Data (Scan List) must be configured through corresponding dialogs accessible through the respective buttons (Network, Device, and Scan List.)
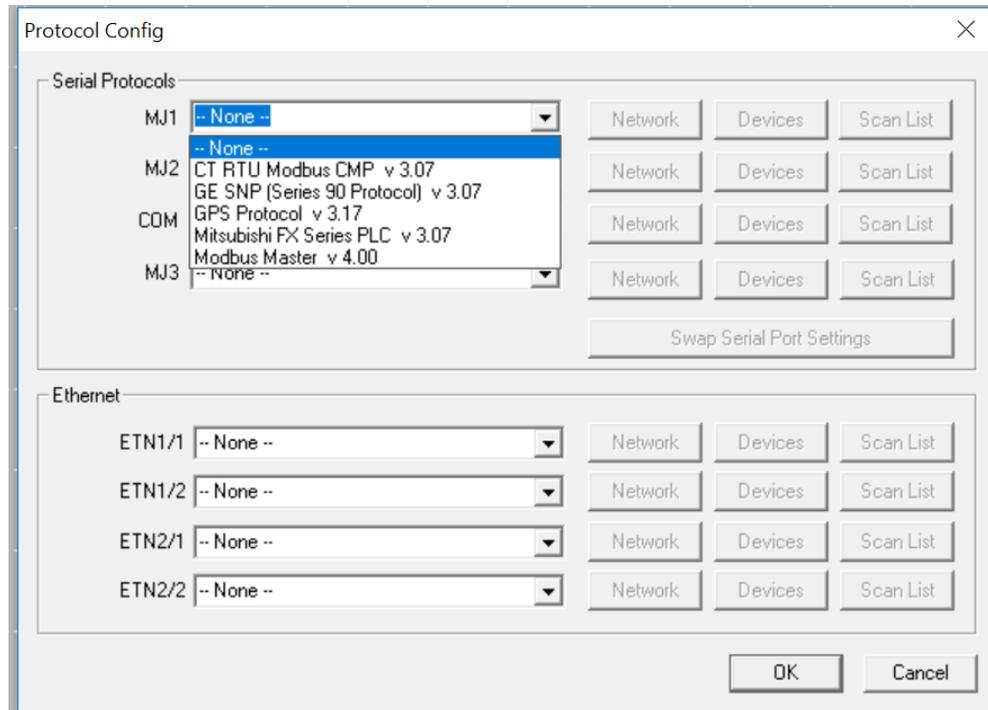
Figure 13.1 – Protocol Config Dialog

Three fields must be configured after a protocol is selected:
1. Network
2. Devices
3. Scan List

13.3   Network Configuration

Network Configuration provides the required parameters to configure the network. Each protocol is different and may not require all the Network Config field. Please refer to the table below for the options in the Network Config field.

Table 13.1 – Network Protocols		
Baud Rate, Data Bits, Stop Bits, Parity	These field define the bit level transfer over the serial port.	
Handshake	**None** – No handshake lines are used **Multidrop Full** – Rx remains active while Tx is occurring. **Multidrop Half** – Rx is shut off while Tx is occurring. **Radio Modem** – Wait for CTS acknowledgement before transmitting (legacy radio modem support).	
Protocol	If a driver supports multiple protocols, it is selected here, (i.e. Modbus supports RTU or ANSI).	
Mode	Specifies if port operates in RS232 or RS485 mode.	
Retries	Specifies number of times a transaction is retried on a failed response.	
Timeout	Specifies the amount of time for a device to wait for a valid response.	
Update Scan	**Automatic**	**Update Interval** – Specifies the update interval at which all the mapped entries are executed.
		Reacquire Time – Specifies the amount of time to wait before attempting communications with an offline device.
	Manual	**Trigger** – Specifies the binary register that a single transaction scan of the Scan List.
		ID Select – If an analog is specified in the field, the ID Select filter is enabled.
Status Register	Specifies the starting OCS register of eight (8) consecutive registers (4-32bit counters), which provide an indication of the network health.	
Scanner Address	Specifies the OCS's device (network) ID if a master ID is required by the protocol.	
Protocol Help	Provides protocol specific help.	

13.4   Device List and Device Configuration

Device List
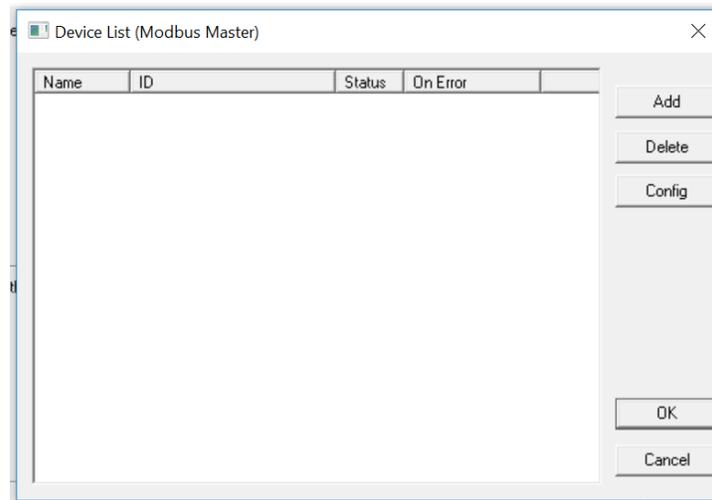
The Device List is reached from the Device button on the Protocol Config screen and provides a list of the configured devices on the Network. Devices must be created and exist in this list before corresponding Scan List entries can be created for this device. Typically, the number of entries is limited to **64 devices**.

Device Configuration
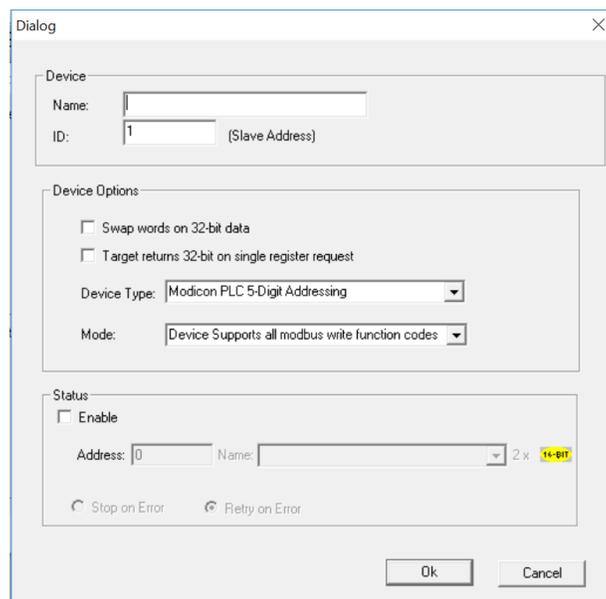
This configuration is reached from the Device List when adding or modifying an existing device.

13.5 Scan List
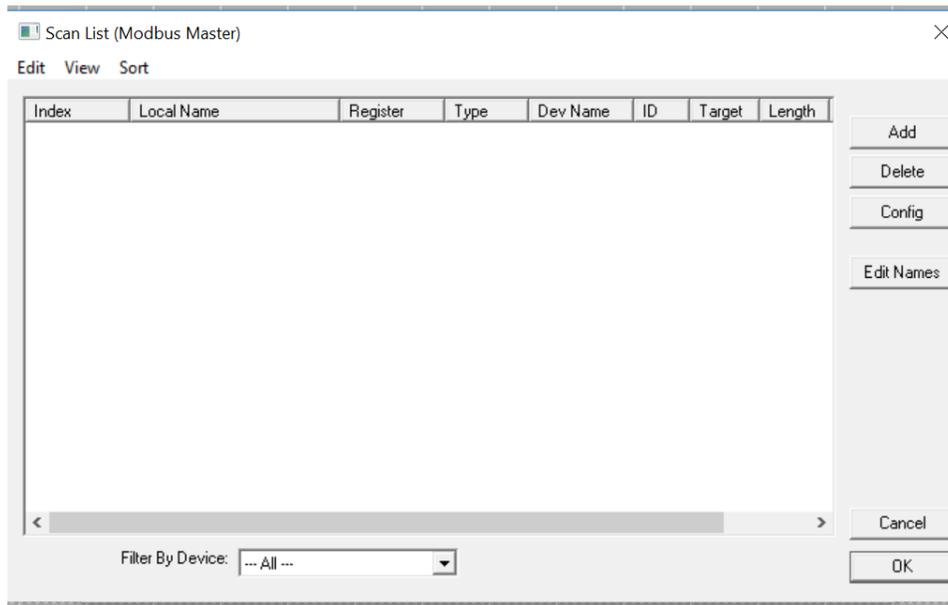
This can be accessed from the Scan List button on the Protocol Config screen or the Mapping button on the Device List screen and provides a Scan List of the Data Mapping entries. To transfer data between the OCS and remote target, a Scan List must be created that defines each transaction. Each mapping entry (transaction) contains the source and destination registers, the number of consecutive registers transferred, the direction of the transfer and what triggers the transfer. Typically, the number of entries is **limited to 512**.

NOTE: The order of the Scan List is the order in which the transactions occur. Sort functions are provided to change the order of the list. Each entry also has an identifying index. If the device status register is enabled and a transaction failure occurs, the status register indicates the index number of the transaction that has failed.

13.6 Data Mapping Configuration (Scan List Entry)
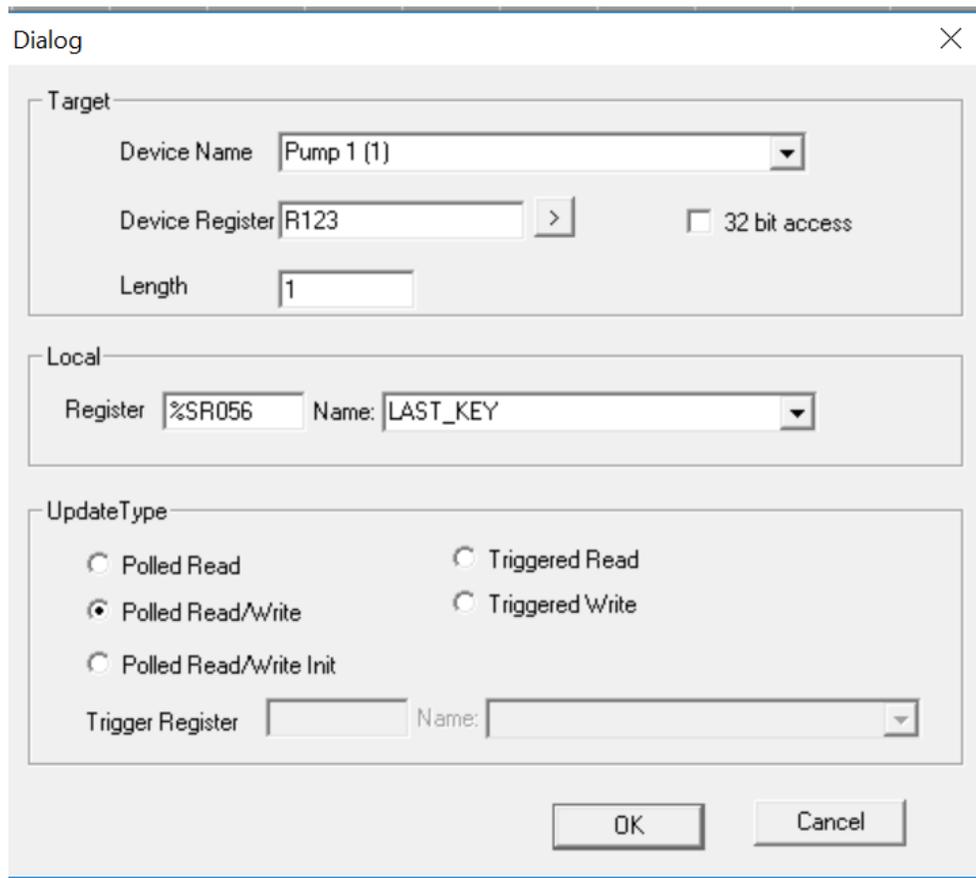
Update Type
This field specifies the direction and what triggers the transfer of data between the OCS and target device for a mapping entry.

Polled Read
On every transaction scan, a read-only target device register(s) transaction occurs.

Polled Read/Write
On every transaction scan, a read target device register transaction occurs unless a local register value has changed. The write transaction only updates those local registers that have changed in value. If several non-consecutive local registers (contained in a single mapping entry) change value between transaction scans, it takes several consecutive transaction scans to write each changed register.

When the OCS is placed in RUN mode, **the initial action for this mapping type is a read target register transaction.** This transaction initializes the local (OCS) register(s) to match that of the remote device register(s). Thereafter, any change to the corresponding OCS register(s) triggers a write operation to the remote device.

Polled Read/Write/Init

On every transaction scan, a read target device register transaction occurs unless a local register value has changed. The write transaction only updates those local registers that have changed in value. If several non-consecutive local registers (contained in a single mapping entry) change value between transaction scans, it takes several consecutive scans to write each changed register.

When the OCS is placed in RUN mode, **the initial action for this mapping type is a write target register transaction.** This transaction initializes the target device register(s) to match that of the local (OCS) register(s). Thereafter, any change to the corresponding OCS register(s) triggers a write operation to the remote device.

The initial write transaction does <u>not</u> occur until after the first logic scan of the OCS. This allows registers to be initialized locally before Writing to the target device register(s).

Triggered Read

A read transaction is triggered by a high level on a separately designated OCS (binary) trigger register. Once the read transaction is complete (or the device is offline), the OCS trigger register is cleared by the OCS. This update type can be used for occasion data accesses such as retrieving trend data.

NOTE: This operation increases the associated transaction scan time and can cause the **Update Interval Exceeded Counter** to increment on a tightly adjusted update interval.

Triggered Write

A write transaction is triggered by a high level on a separately designated OCS (binary) trigger register. Once the write transaction is complete (or the device is offline), the OCS trigger register is cleared by OCS. This function can be used for occasion data accesses such as sending recipe data.

NOTE: This operation increases the associated transaction scan time and can cause the **Update Interval Time Exceeded Counter** to increment on a tightly adjusted update interval.

CHAPTER 14: USER INTERFACE

14.1   Overview

This chapter presents the user interface (or operator view) of the XL7 and some of the model specific characteristics of the XL7 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.

14.2   Screen Specifications

Display Type	7" TFT Color
Screen Brightness	800cd/m² (nits)
Resolution	QVGA (800x480)
Color	16-bit (65,535)
Screen Memory	17MB
User-Programmable Screens	1023
Backlight	LED – 50,000-hour life
Brightness Control	0-100% via System Register %SR57
Number of Keys	6

14.3   Displaying and Entering Data
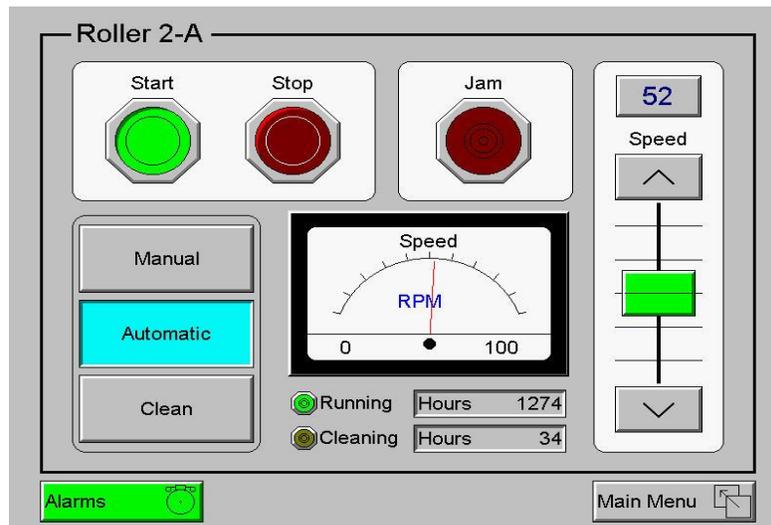
Figure 14.1 – Example Screen

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 XL7, 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: 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.

14.4 Alpha-numeric Keypad

To allow entry of a specific number or text, several of the input objects invoke a pop-up alpha-numeric keypad when the object is touched. An example of the alpha-numeric keypad invoked from a numeric input object is shown in Figure 14.2. Once invoked, the operator may touch the appropriate keys to enter a specific value. When entering a value, the alpha-numeric keypad is in one of two modes [new-value or edit-value].

New-value Mode
Generally, when the alpha-numeric keypad is first invoked, it is placed in new-value mode. Initially, the alpha-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.
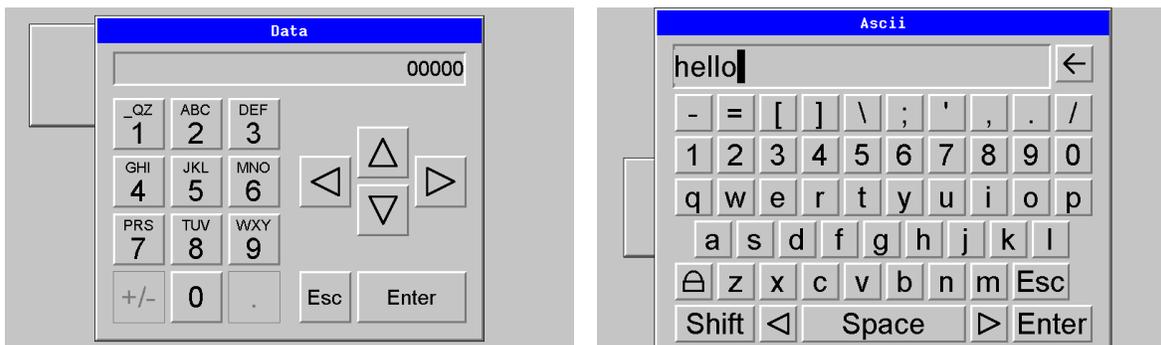
Figure 14.2 – Alpha-numeric Keypad and ASCII Keypad

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.

Table 14.1 – Alpha-Numeric Keypad Variations	
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 13.2. 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, pressing ESC will cancel the edit and return the string to the previous value.
Text Table Object	When editing a Text Table Object, all 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.

14.5 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 14.3)

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.
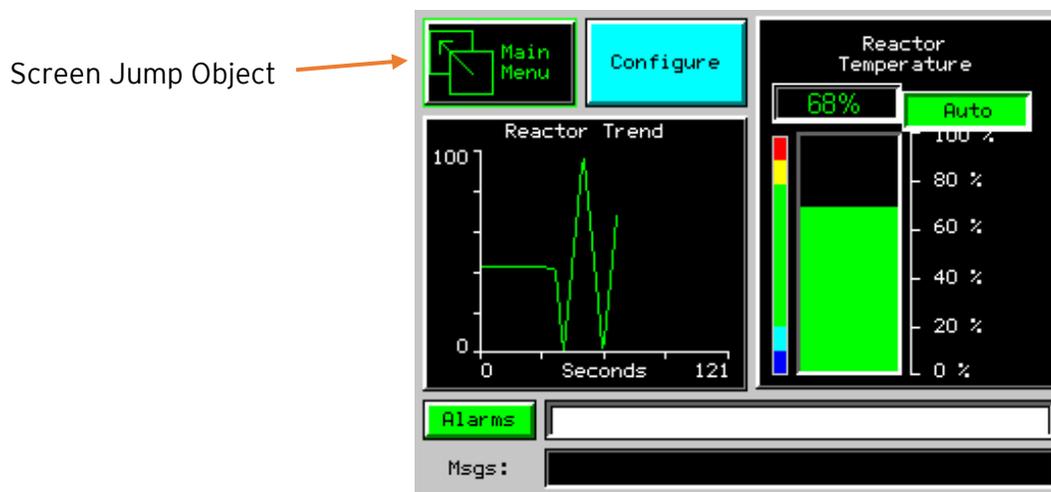
Screen Jump Object

Figure 14.3 – Typical Screen Jump Object

14.6 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
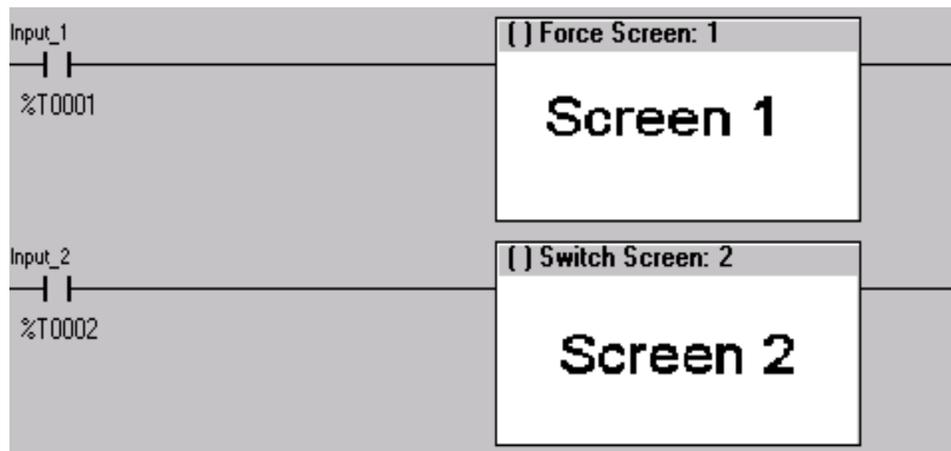
Figure 14.4 – Force and Switch Coils in Ladder Programming

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.

14.7 Beeper Acknowledgement

The XL7 contains an internal beeper that provides an audible acknowledgment when an operator touches a graphic object that accepts touch input. When the graphic object is enabled, a short 5ms tone is emitted. When the graphic object is disabled, a longer 100ms tone is emitted to enounce that graphical object is not currently accepting the touch input.

If beep acknowledgement is not desired, the beeper function can be disabled from the System Menu.

14.8 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 XL7 assumes touch has 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 XL7 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.

14.9 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

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 14.6.

Figure 14.5 – Alarm Object
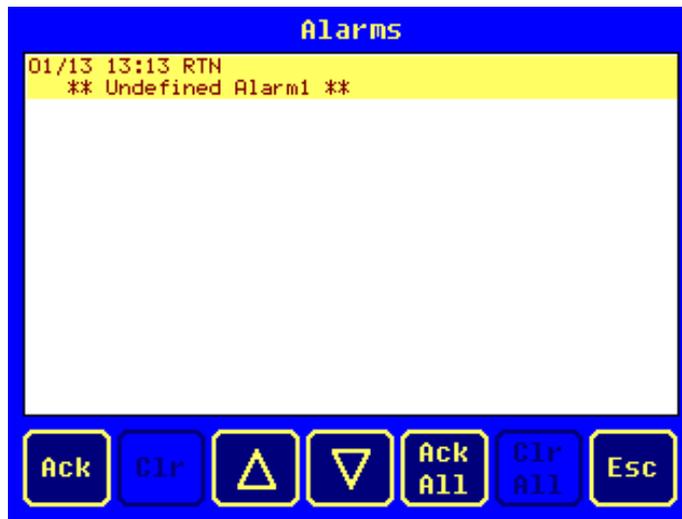
Figure 14.6 – Alarm Viewer

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 Clear 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: 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.

14.10 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 14.7 – 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 14.8.

NOTE: 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.
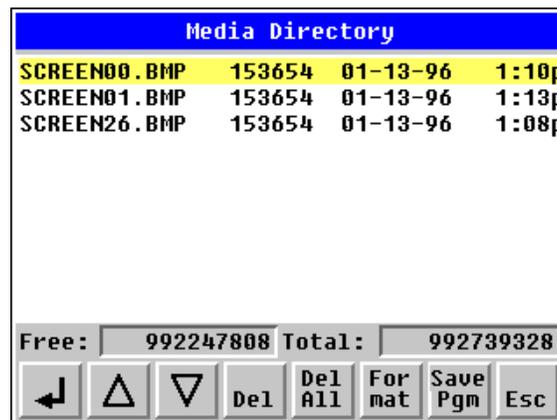
Figure 14.8 – Removable media viewer

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 temporally 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).
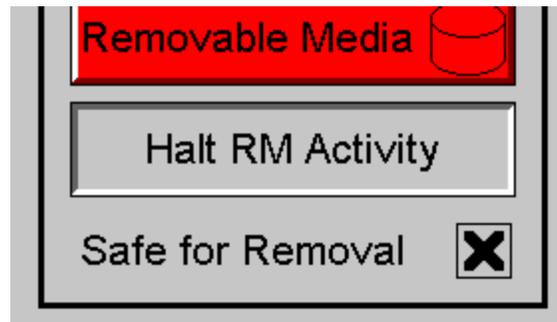
Figure 14.9 – Example application segment for safe removal of removable media

14.11 Screen Saver

The XL7 screen backlight life is typically five (5) years when in continuous use. If the application does not require interaction with the XL7 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: 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 XL7. Any additional touch activity is also ignored by the XL7 for approximately one second thereafter.

It is possible for the application to temporarily disable the screen saver by generating a positive transition to %SR57.16 (coil only) at a rate faster than the screen saver timeout value. This may be desired while waiting for alarm acknowledgement.

14.12 Screen Brightness

The XL7 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 how to present a Screen Brightness control to the user, if required.

NOTE: The backlight life can be extended by dimming or powering off the backlight.

14.13 Touch Screen Pressure

The Horner XL series OCS controllers have a resistive touch screen that allows mechanically detecting touch events. The resistive touch screen works by measuring the resistance between two layers of conductive film.

The following are required for this feature:

Minimum Firmware Version: 15.xx or later
Minimum OS Version: 2.6.35.49
Minimum Cscape Version: 9.80 SP1
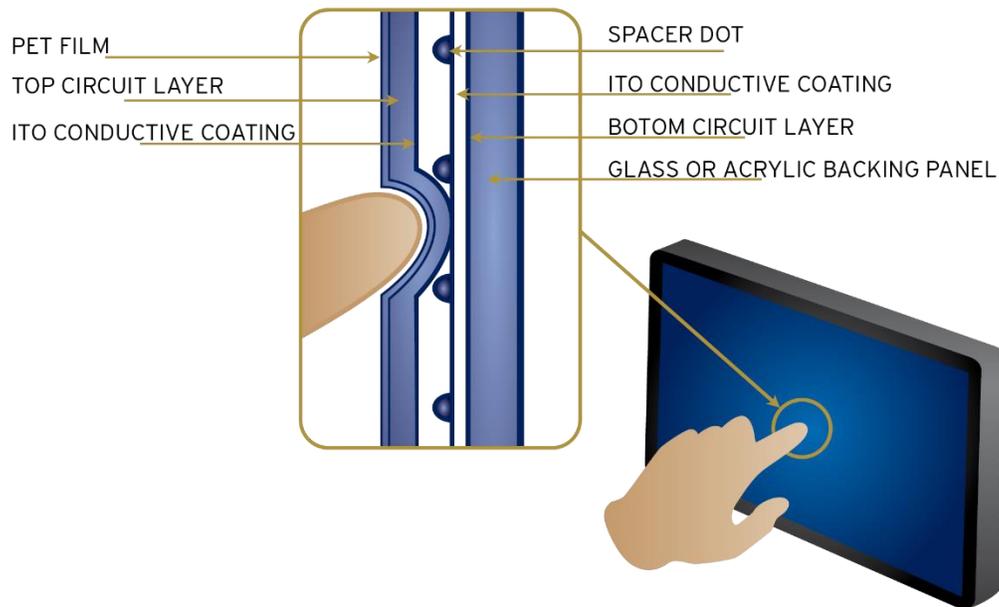
Figure 14.10 – Touch Screen Pressure

NOTE: Touch creates contact between resistive circuit layers, closing a switch.

With a unique change to the touch monitoring firmware user can measure the pressure being exerted on the touch screen. This feature has been added in some Horner XL series controllers. This allows the OCS programmer to be notified of the touch pressure and it can configure the pressure required to accept a touch event.

There are two system registers that provide this touch feature:

%SR9 (I/O Name - TCH_PRESSURE)
> Records the highest pressure level of the last touch on the screen that exceeds the threshold value set in %SR10. This is a range of 0 to 3000. Zero (0) indicates no pressure and 3000 is the maximum amount of pressure that can be measured.

%SR10 (I/O Name - TCH_PRESSURE_TSH)
> This register sets the pressure threshold to indicate a touch. A value of 200 is typically the lightest touch, 600 is moderate and 1000+ is a heavy touch.

These new features allow customizing the feel of the touch screen and can be used to add unique user interface features such as having different operations depending on the force of the touch.

CHAPTER 15: AUDIO PLAYBACK CONFIGURATION

15.1   Audio Overview

Audio Files Specifications	
Formats Supported	.MP3 & .WAV
Audio Channel Type Supported	Stereo
# of Files Supported	256 Audio Files can be configured
Bit Rates Supported	64kbps, 128kbps (recommended), 192kbps, 256kbps, 1411kbps
.MP3 Format Bit Rate Range	96 to 320kbps
.WAV Bit Rate	Usually 1411kbps
Sampling Rate Supported	24000Hz to 44100Hz
Audio Playback	- Only one audio file can be played at a time. - If multiple bits are simultaneously triggered, only the least significant bit will be acted upon. After completing playback, the next least significant bit will be acted upon.
File Location	Files must be present in Removable Media for playback and are NOT downloaded from Cscape.

15.2   Audio Configuration in Cscape

1. In Cscape, select the XL7 and model number by selecting **Controller → Hardware Configuration** from the toolbar. Click **OK**.

2. Next select **Program** from the toolbar and then **Audio Config.**
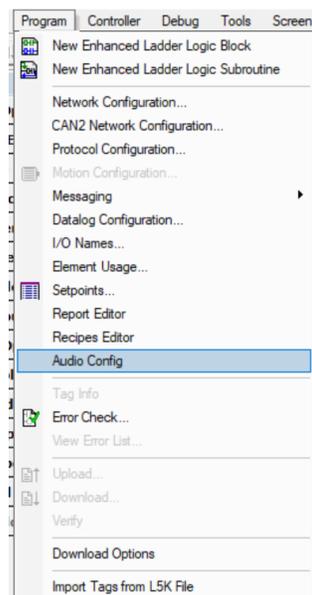
The following dialog will open.
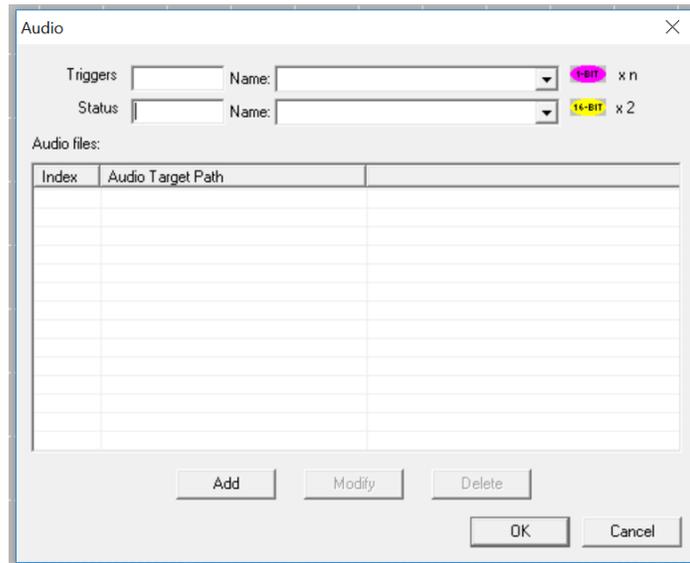
Figure 15.1 - Audio Config Dialog

15.3   Audio Config Details

Triggers – Set the trigger bit high to play the audio file. **NOTE:** The bit needs to be left on to continue playing. The bit will be set to low after the file is finished laying.
Status – This register gives the status of the audio files, see table below.

Table 15.1 - 1st and 2nd Status Registers		
	Bit Number	**Description**
1st Status Register	Bit 1 to Bit 8	Volume Control (0-100)
	Bit 9	Play Control (1=Pause, 0=Play)
	Bits 10-16	Not Used
2nd Status Register	Bit 1	Cannot open ALSA Lib
	Bit 2	Cannot open MP3 Lib
	Bit 3	Audio output device cannot be setup
	Bit 4	Cannot open input Audio Stream
	Bit 5	Memory allocation failed
	Bit 6	Buffer is not free
	Bit 7	Write Fail
	Bit 8	Short Write
	Bit 9	Recover Error
	Bit 10	Filename Error
	Bits 11-16	Not Used

15.4 Audio Files

Index – Index of all the audio files will be assigned automatically when audio files are added.
Audio Target Path – This gives information about the path of the audio file, audio filename, and format of the audio files added to the list.
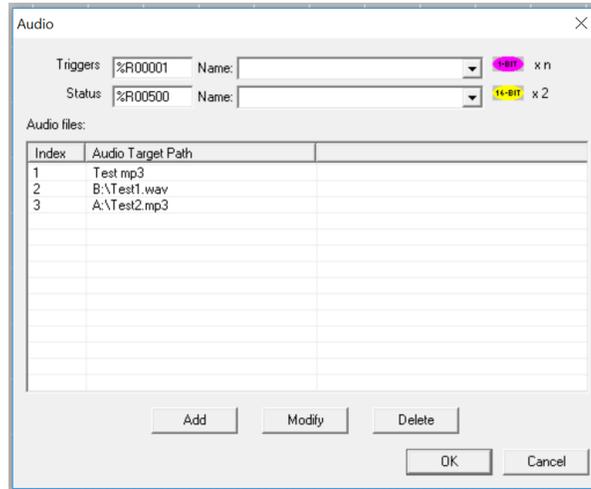
Add – Selecting this button display the following window, where an audio filename with full path needs to be configure. The **Modify** and **Delete** button are also available in the Audio Config dialog.
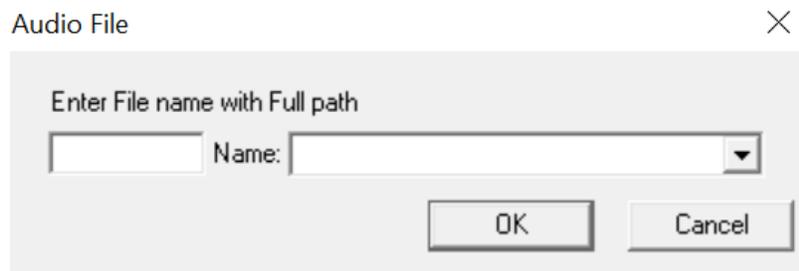
IMPORTANT:
1. Audio files are not downloaded from Cscape; they must be present
2. Only one audio file can be played at a time. If multiple bits are simultaneously triggered, only the least significant bit will be acted upon.
3. Only MP3 and WAV formats are supported.
4. 256 audio files can be played

CHAPTER 16: VIDEO OBJECT

16.1   Video Object Overview

The Video Object feature allows two options for video type: Stream and Playback. The Video Object trigger is used to start, stop, and pause video, and the System Register provides the status of the video object, which supports various resolutions and frames per second.
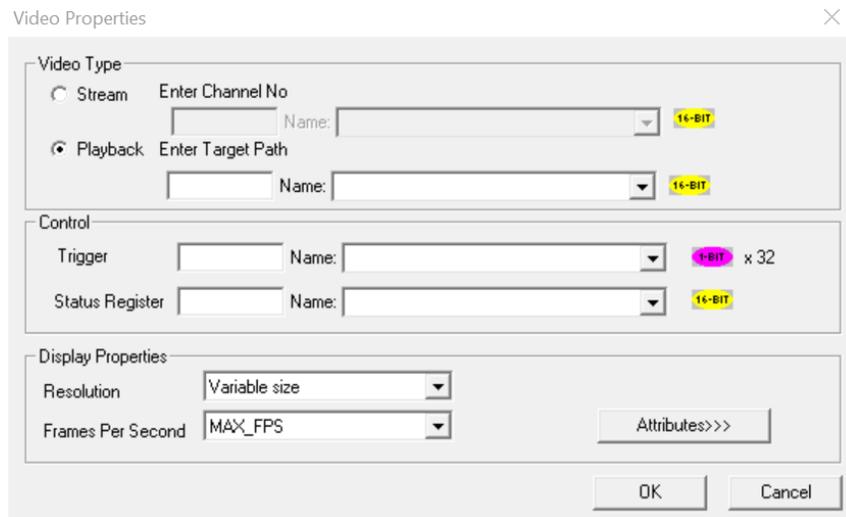
Table 16.1 – Features and Specifications of Video Properties	
Streaming Channels	4 channels supported through USB hub
	1 channel can be viewed at a time
Playback Formats	.mp4
	.mov
	.mpg
	.wmv
Resolution	320x240 (QVGA)
Frames per Seconds	10, 15, 20, 24, 30 & MAX_FPS

16.2 Opening Video Object in Cscape

NOTE: Video Object requires Firmware 14.03 or newer to use with the XL7 devices.

In Cscape, select the XL7 and model number by selecting **Controller → Hardware Configuration** from the toolbar.

1.   Open the Graphics Editor by selecting the "T" button from the toolbar.
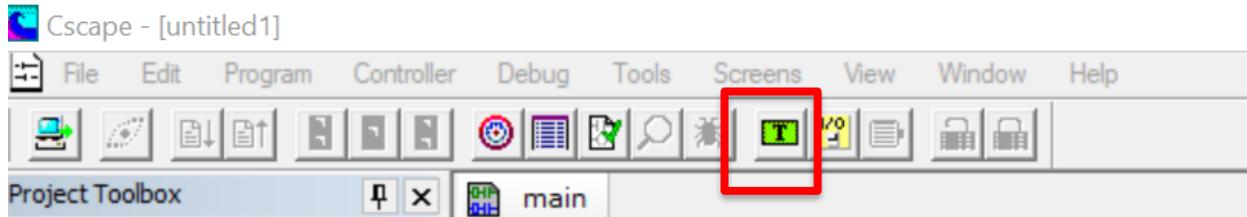
2.   In Graphic Editor, select the video button from the toolbar.
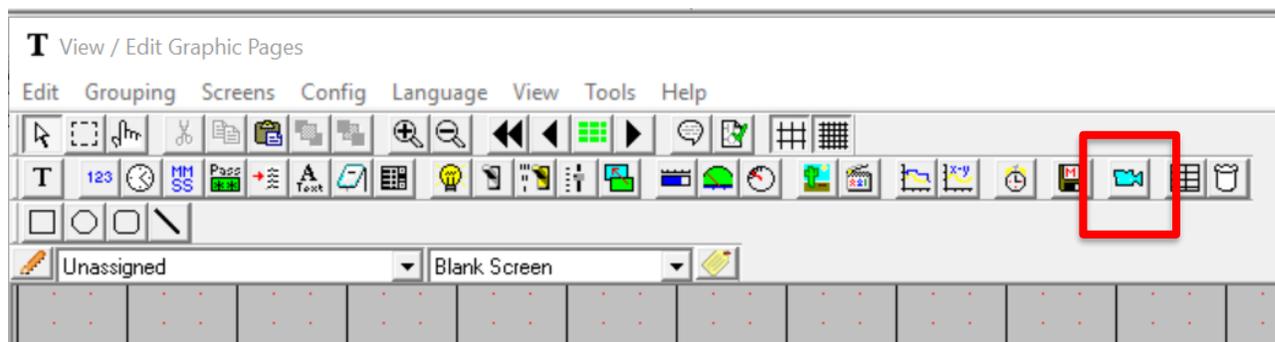
3.   Then click in the grid.
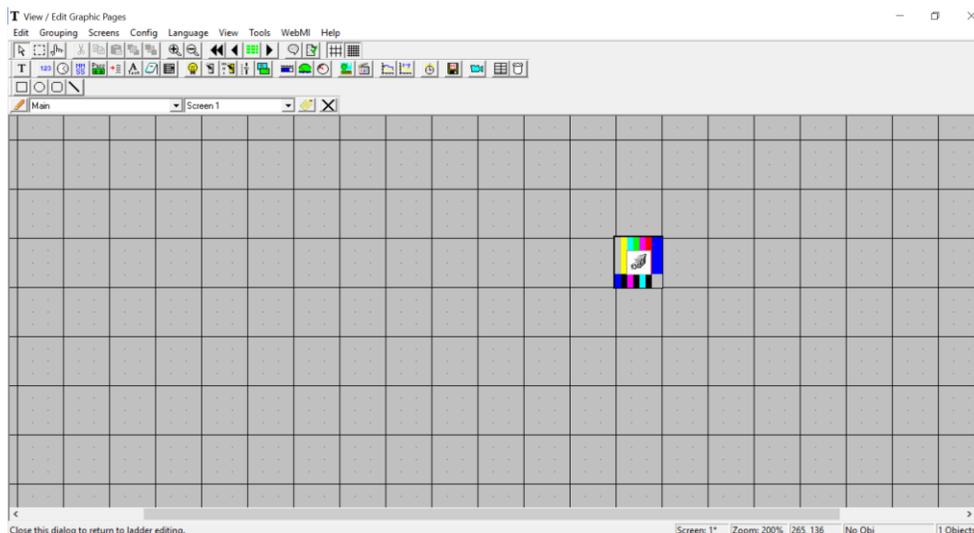
4.   Then double click on the icon in the middle to open the Video Properties dialog.
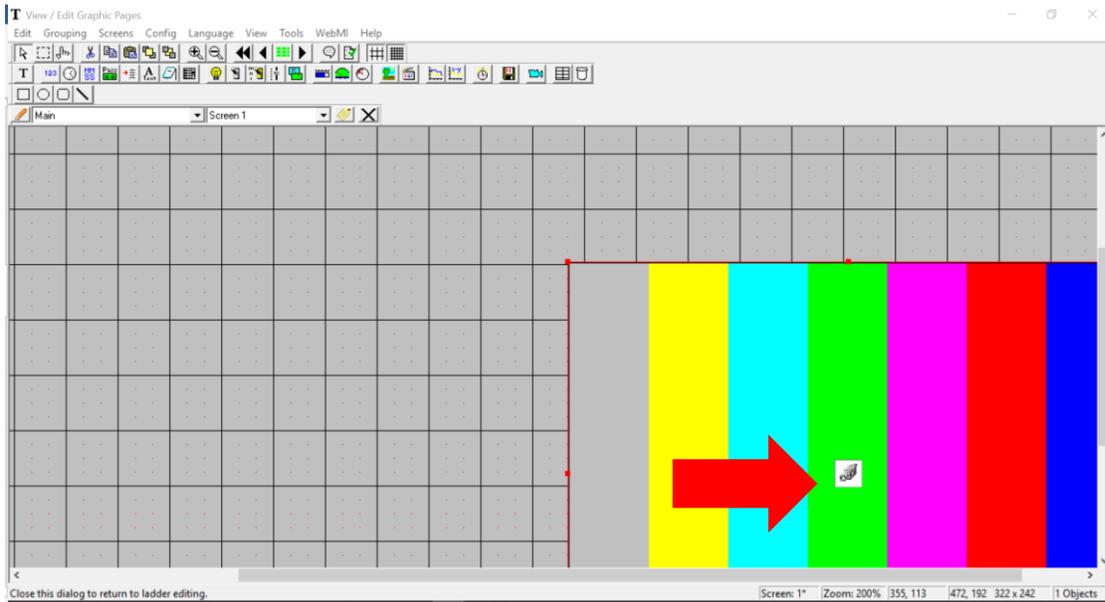
16.3 Video Properties: Video Type
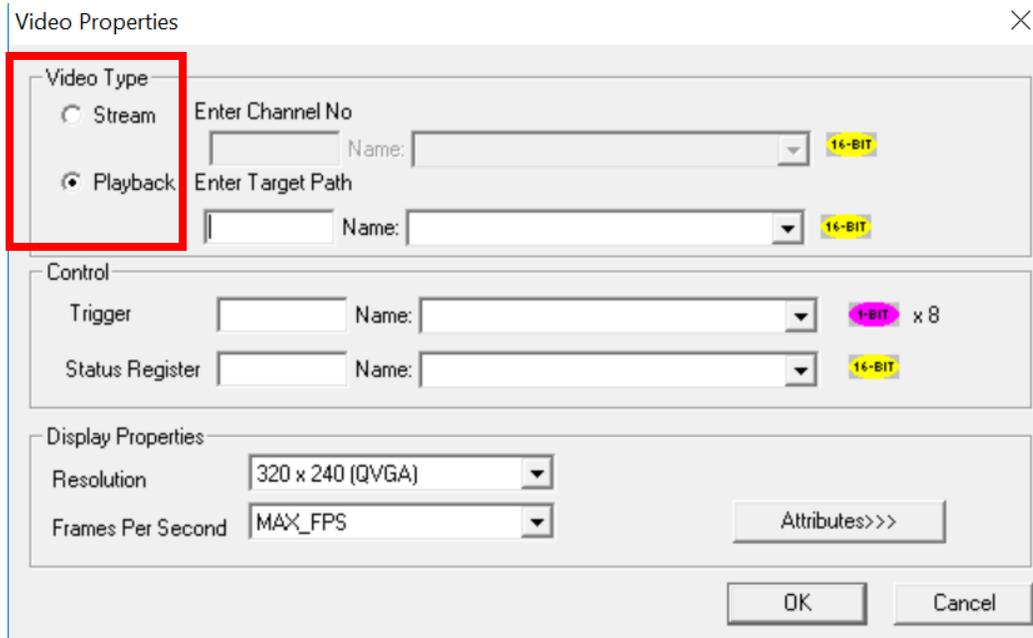
Figure 16.1 – Configuring Video Type

There are two options for video type: **Stream** and **Playback**

Stream – This option can be selected to view live video from a web cam. Four channels are supported through the USB hub. Only one channel can be viewed at a time. Enter **Channel Number** directly or through registers in the Enter **Channel No** field.

Playback – This option can be selected to view videos that are stored in Removable Media on the controller. Videos present in both A (microSD) and B (USB) drives are supported and can be viewed. Supported formats including .mp4, .mov, .mpg, and .wmv, can be played.

Select **Playback** and enter video name in the **Enter Target Path** field either directly or through registers.

For example: Test1.mp4 (from microSD) or B:\Test2.mp4 (from USB). Refer to the Video Properties Section.

16.4 Video Properties: Control
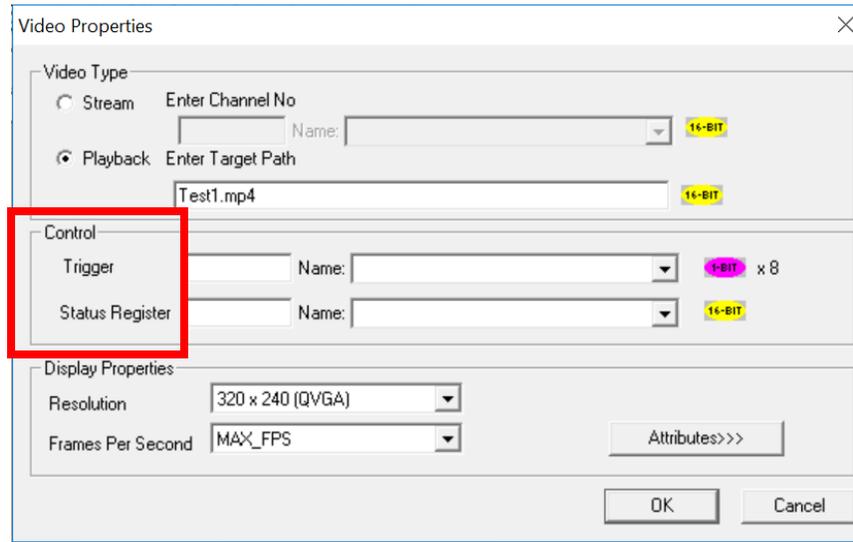
Figure 16.2 – Configuring Control

Trigger

The Video Properties: The video control trigger is used to start, stop and pause video. Video trigger is done by bit level addressing. The trigger reserves eight (8) bits and uses the first two (2) bits.

NOTE: The least significant bit is Bit 1.

Definitions are as follows:

Bit 1	High = Start Low = Stop
Bit 2	High = Pause Low = Play

System Register

The Video Control System Register provides the status of the Video Object. The status word is 16-bits and should be viewed in hexadecimal format.

The status definitions are as follows:

0x0001	Video is currently playing
0x0002	Video is paused
0x00010	Channel number cannot be greater than 4
0x0020	File not present or corrupted
0x0040	Frame per second not supported or not compatible

16.5   Configuring Display Properties
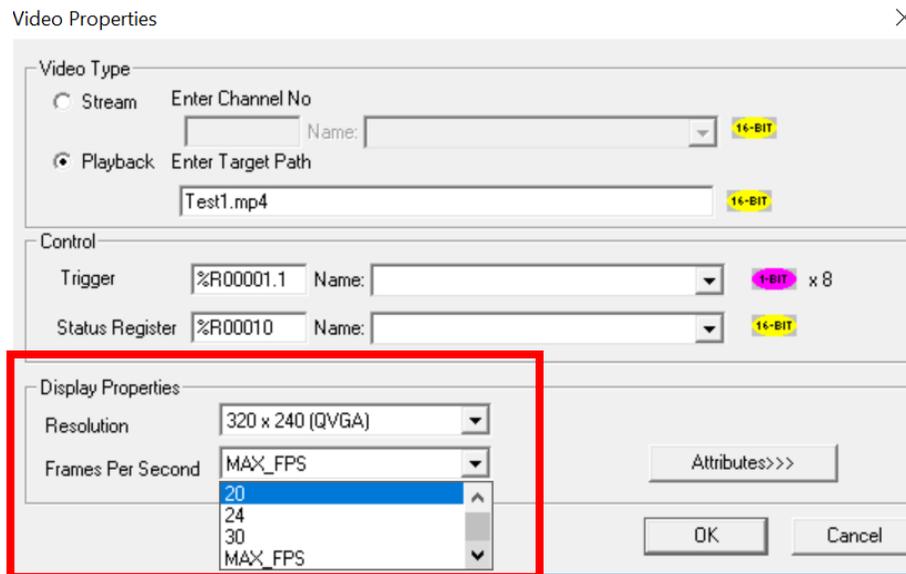
Figure 16.3 – Configuring Display Properties

Resolution Options	320x240 (QVGA)
Frames per Seconds	10, 15, 20, 24, 30 & MAX_FPS

16.6   Video Object Performance

1. When Video Object is active, navigating to System Menu or any popup window, causes Video Object to be inactive.
2. Video Object can be made active in both Idle and Run modes.
3. If actual Frames Per Second of the configured video is different from the one that is configured in Cscape, few frames will be missed when video is played.

16.7   Web Cameras

If multiple web cameras are directly connected to the XL7, then only one web cam will be considered. If user needs to connect multiple web cams, USB hub needs to be used. A maximum of four channels (web cameras) are supported.

CHAPTER 17: REMOVABLE MEDIA

17.1 Overview

All XL7 OCS models provide a Removable Media slot, labeled **Memory Card**, which supports standard microSD flash memory cards. The microSD cards can be used to save and load applications, to capture graphics screens and to log data for later retrieval.
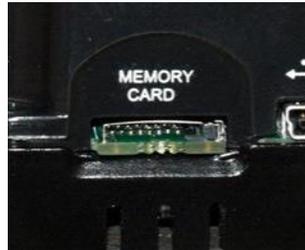
Figure 17.1 – Removable microSD Memory Card Slot

17.2 microSD Cards

When the microSD card format was introduced, it was originally called TransFlash. Cards labeled either microSD or TransFlash, with up to 32GB of flash memory, are compatible with the XL7 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 microSD card can be safely inserted into the Memory slot whether the XL7 OCS power is On or Off.

To install a microSD card: Align its 8-pin gold edge connector down, facing the front of the XL7 OCS unit; then carefully push it all the way into the Memory slot. Ensure that it clicks into place.

To remove the microSD card: Push in on the top of the card gently to release the spring. The card pops out for removal.

17.3 microSD File System

The microSD memory card slot uses the PC-compatible FAT32 File System. This means that a PC, with a microSD-compatible card reader, can read files that have been written by the XL7 OCS and can write files that can be read by the XL7 OCS.

However, the XL7 OCS does <u>not</u> support long filenames, but instead implements the 8.3 filename format. This means that all file and directory names <u>must</u> consist of up to eight (8) characters, followed by an optional dot, and an optional extension with up to three (3) characters.

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

17.4 Using the Removable Media Manager

The Removable Media Manager is an interactive XL7 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 microSD 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 Cscape to place a Removable Media Manager object on an application graphics screen.

Figure 17.2 – Removable Media Submenu

17.5 Using Removable Media to Log Data

Using Read and Write Removable Media function blocks, an application ladder program can read and write XL7 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.

17.6   Using Removable Media to Load and Save Applications

A special file type, with a .PGM extension, is used to store XL7 OCS application programs on microSD.

To load an application from microSD to the XL7 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 XL7 to microSD, 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 microSD root directory.

NOTE: Saving an application to microSD can <u>only</u> be done from the Removable Media System Menu and is <u>not</u> available on a Removable Media Manager object that was placed on an application graphics screen by Cscape.

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

17.7   Using Removable Media to View and Capture Screens

The XL7 OCS File System uses bitmap files with the .BMP extension or JPEG files with the .JPG extension to store XL7 OCS graphic screen captures.

To view a captured XL7 OCS screen, use the Removable Media Manager to find and highlight the desired .BMP or .JPG file, and then press Enter.

Before capturing an XL7 OCS screen, Cscape 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 Cscape **Screens** menu. Next, select the **Screen Capture** item of the Graphics Editor Config menu and then enter a **Control Register** and **Filename**.

To capture an XL7 OCS screen, turning On the assigned **Screen Capture Control Register** will capture the current XL7 OCS graphics screen and write it to the microSD card using the assigned **Screen Capture Filename.** To view a captured XL7 OCS screen, use the Removable Media Manager to find and highlight the desired .BMP or .JPG file, and then press Enter.

17.8   Configuration of a Removable Media

The configuration of the Removable Media Object that loads the Removable Media Viewer defines what buttons are enabled and available to the user.

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

..	- change display to parent directory
\<DIR>	- change display to child directory
pgm	- load application (if compatible model and version)

Alternately, by checking the 'Write Selected Filename' option, the RM Manager object will load the currently displayed path and filename into a block of registers for use with other Removable Media functions. The register block is assigned in the 'File Select' config found in the Config menu of the graphic/screen editor.

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

17.9   Removable Media (RM) Function Blocks in Cscape

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

The following RM functional blocks are available in Cscape Software. These function blocks will reference
- microSD when filename is prefixed with 'A:' or nothing OR
- USB A flash Drive when filename is prefixed with 'B:'.

Read RM csv	Allows reading of a comma-separated value file from the microSD interface into the controller register space.
Write RM csv	Allows writing of a comma-separated value file to the microSD interface from the controller register space.
Rename RM csv	Allows renaming a file on the RM card. The data in the file is not changed.
Delete RM csv	Allows deleting a file on the RM card
Copy RM csv	Allows copying a file on the RM card. The data in the file is not changed.

Table 17.1 – RM Functional Blocks

17.10 Removable Media (RM) Features—Program Features

a. Datalog Configuration—This feature allows the controller to periodically log register values to Removable Media. The register data is stored in **.csv** (comma separated value) format, which is compatible with 3rd party PC applications, such as Microsoft Excel.

b. Report Editor—This feature allows the OCS to be configured to generate text printouts which incorporate data from the registers embedded in the text. The reports can be printed using a serial interface printer through any of the serial ports of the OCS or can be saved on the removable media of the device.

c. Recipes Editor—Recipes allow the user to send or update multiple registers simultaneously.

17.11   Removable Media (RM) Features—Graphic/Screen Editor

a. Trends—The historic support feature in the trend object utilizes Removable Media.

b. Removable Media—This is a graphic object used to access files and functions pertaining to Removable Media.

c. Recipes—This is a graphic object that is used in conjunction with the recipe editor which is mentioned above.

17.12 Removable Media (RM) Features—Additional Configuration

a. Alarms—Alarm data can be logged to a .csv file stored on Removable Media.

b. Screen Capture—The screen capture function allows a bitmap or jpeg image of the displayed OCS screen to be written to the Removable Media card.

c. Filename Counters— The filename counters can be accessed wherever Removable Media functions require a path name. A typical application is the auto-incrementing of a file name when doing screen captures.

d. File Select— File Select is used to specify the register block that is used with the Removable Media Manager object 'Write Selected Filename' option.

17.13 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. There are six special symbols that can be entered into a filename that are replaced by the OCS with current time and date information.

Table 17.2 – Filename Special Symbols		
Symbol	Description	Example
$Y	Substitutes the current 2 digit year	2015 = 15
$M	Substitutes the current month with a 2 digit code	March = 03
$D	Substitutes the current day	22nd = 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

NOTE: 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, 2013 3:45:34 PM
Filename: Data$M$D.csv	= Data0301.csv
Filename: Year$Y\Month$M\aa$D_$h.csv	= Year04\Month03\aa01_15.csv
Filename: Month_$M\Day_$D\$h_$m_$s.csv	= Month_03\Day_01\15_45_34.csv

Table 17.3 – Filename Examples

17.14 System Registers used with RM

Table 17.4 – System Registers used with RM	
%SR174 Removable Media Protect	Write a 1 to %SR174 to prohibit read/write access to the removable media card. Write a zero (0) to allow access.
%SR175 Status	This shows the current status of the RM interface
%SR176 Free Space	This 32-bit register shows the free space on the RM card in bytes
%SR178 Card Capacity	This 32-bit register shows the total card capacity in kilobytes

Possible status values are shown in the table:

Table 17.5 – 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

For additional status information, consult the Cscape Help file.

CHAPTER 18: CLONE UNIT

18.1   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 to the Removable Media chapter 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.

18.2   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:
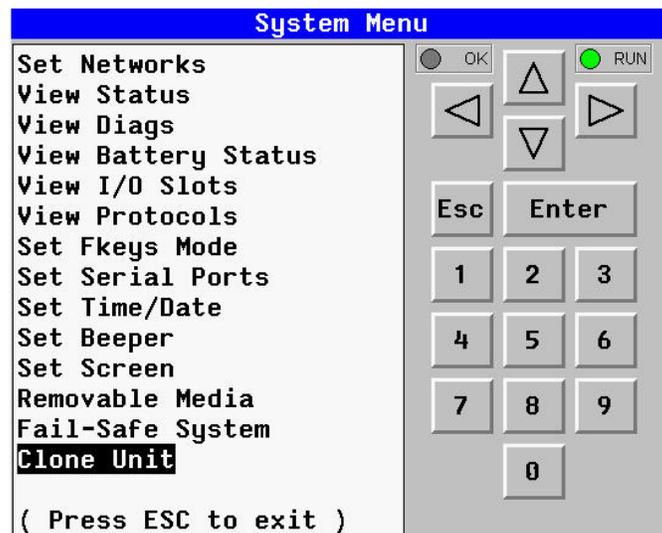
Figure 18.1 – System Menu

2. Selecting "Clone Unit" menu will open the following menu screen:
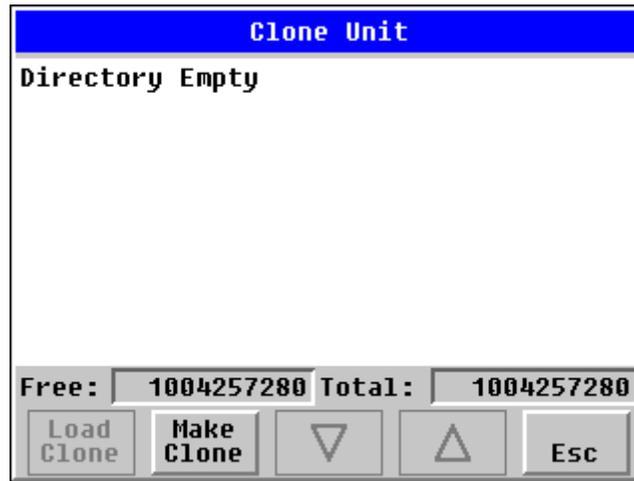
Figure 18.2 – Clone Unit Menu before Cloning

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:
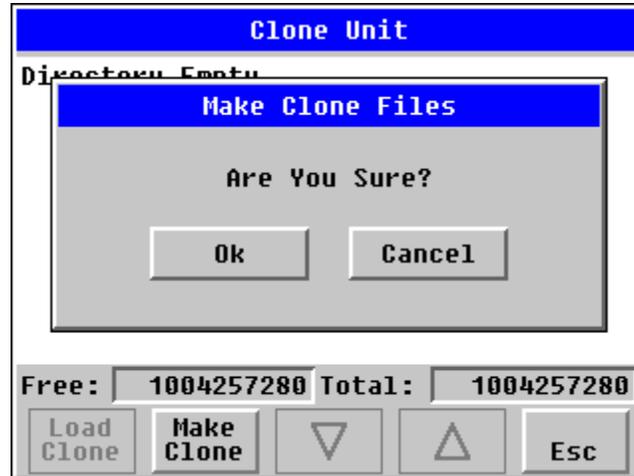
Figure 18.3 – Clone Unit Confirm Screen

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

AUTOLOAD.PGM   Application file
CLONE.DAT   File having all unit settings and register values from Battery Backed RAM
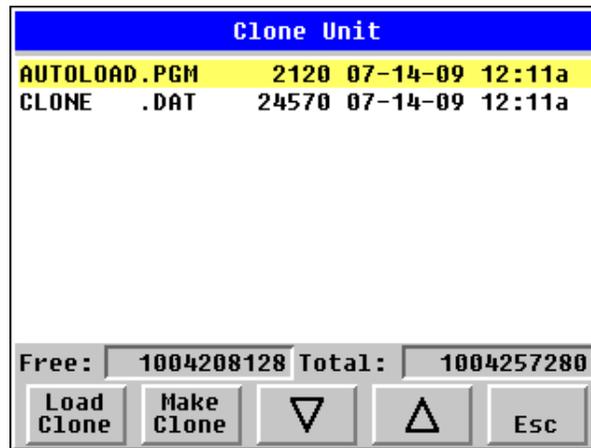
Figure 18.4 – Clone Unit Files

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:
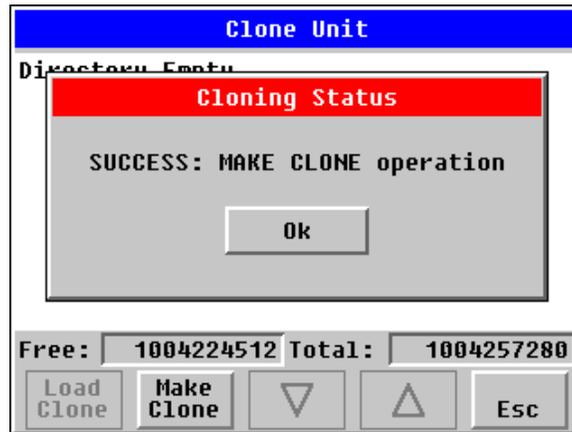
Figure 18.5 – Cloning Status

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 the Fail-Safe System chapter.

18.3 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:
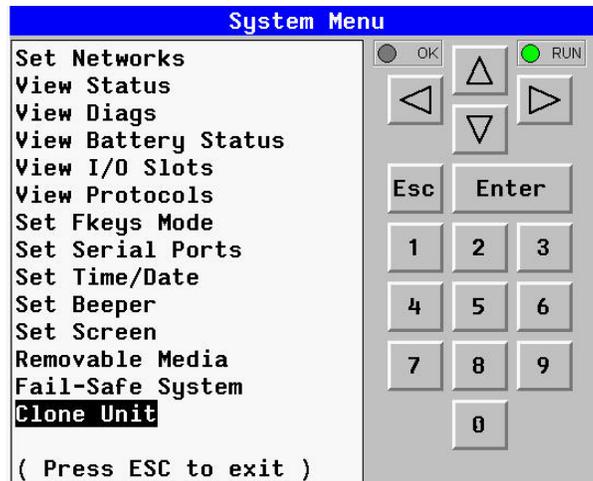
Figure 18.6 – System Menu

Selecting "Clone Unit" menu will open the following menu screen. Select "Load Clone".
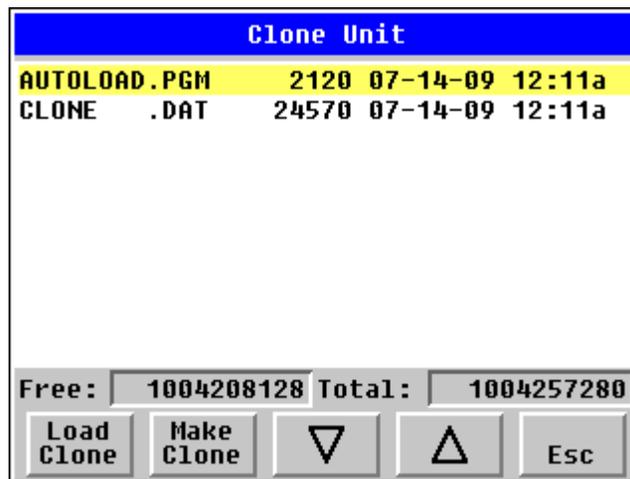
Figure 18.7 – Clone Unit Menu after Cloning

2. User needs to confirm Load Clone as shown below:
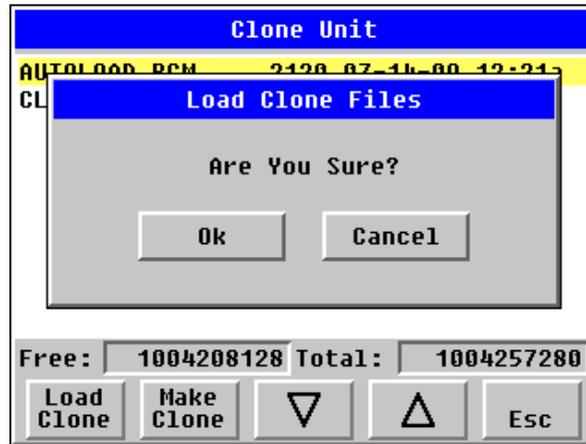
Figure 18.8 – Load Clone Confirm Screen

3. 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 19: FAIL – SAFE SYSTEM

19.1 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 memory 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:
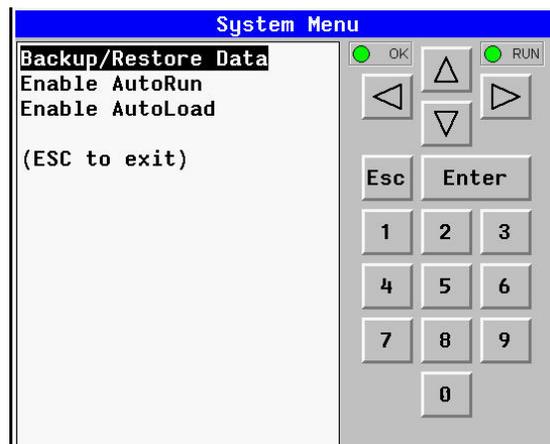
Figure 19.1 – Fail – Safe System Menu

19.2 Settings

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

1. From Cscape, create AUTOLOAD.PGM for the application program using 'Export to Removable Media'.
2. Place the Removable Media with AUTOLOAD.PGM in the device.
3. Set the 'Enable AutoLoad' option in the device to YES.
4. 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.
5. Backup the current Battery-Backed RAM Register contents in On-Board flash memory using System Menu options.

19.3 Backup / Restore Data

Selecting this option brings up a screen having four operations:
- Backup OCS Data.
- Restore OCS Data.
- Clear Backup Data.
- Exit

Figure 19.2 – Backup / Restore Data

Backup OCS Data:
When initiated, this will allow the user to copy manually 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 the value of 1 when backup operation is performed.

Figure 19.3 – Backup Registers

Restore OCS Data:
When initiated, this will allow the user to manually copy the backed-up data from the onboard flash memory 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 memory 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 19.4 – Restore OCS Data

%SR164.3 is set to the value of 1 only when an automatic restore operation is performed - not on a manual one. This bit is reset to the value of 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 memory and no backup will exist. %SR164.4 and %SR164.3 is reset to 0 when backed up data is erased.

Figure 19.5 – Clear Backup Data

Exit: Goes back to the previous screen.

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

```
                    ┌─────────────────────┐
                    │   OCS Power Cycle   │
                    └─────────────────────┘
                              │
                              ▼
                    ┌─────────────────────┐
                    │ Battery Backed RAM  │
                    │ Registers check     │
                    │ failed              │
                    └─────────────────────┘
                              │
                              ▼
                          ╱───────╲              NO
                         ╱ Backup  ╲─────────────────────┐
                         ╲ exists? ╱                     │
                          ╲───────╱                      │
                              │                          │
                            YES                          │
                              ▼                          ▼
                    ┌─────────────────────┐    ┌─────────────────────┐
                    │ Controller placed   │    │    Application      │
                    │ in IDLE mode        │    │  Program erased     │
                    └─────────────────────┘    └─────────────────────┘
                              │                          │
                              ▼                          │
          ┌───────────────────────────────────┐         │
          │ Data copied from Onboard FLASH to │         │
          │ OCS Battery backed RAM            │         │
          └───────────────────────────────────┘         │
                              │                          │
                              ▼                          │
                    ┌─────────────────────┐              │
                    │  Controller Resets  │              │
                    └─────────────────────┘              │
                              │                          │
                              ▼         NO               ▼
                          ╱───────╲           ┌─────────────────────┐
                         ╱ AutoRun ╲──────────▶│  OCS put in IDLE    │
                         ╲Enabled? ╱           │      Mode           │
                          ╲───────╱            └─────────────────────┘
                              │
                            YES
                              ▼
                    ┌─────────────────────┐
                    │ OCS put in RUN Mode │
                    └─────────────────────┘
```
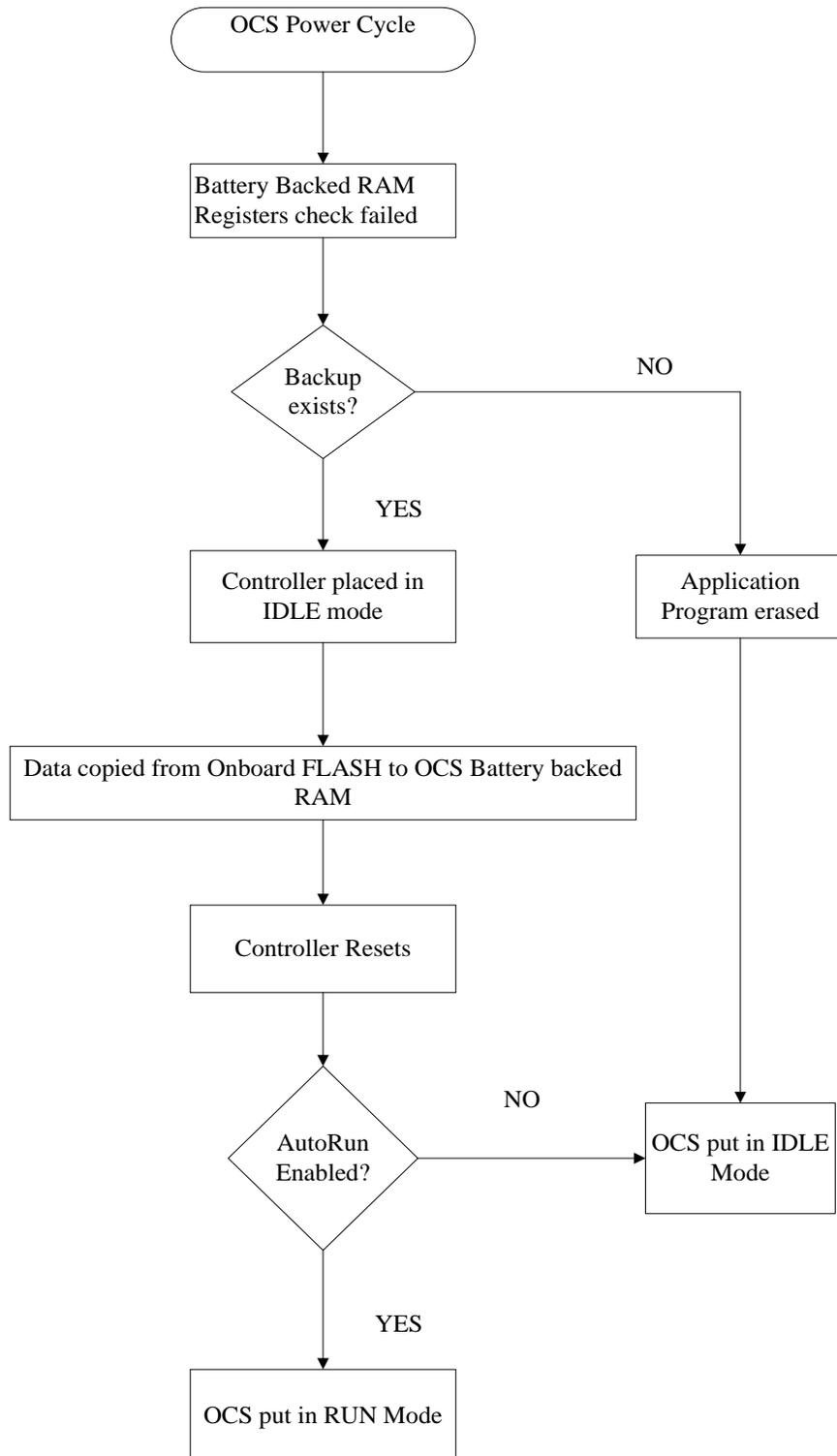
Figure 19.6 – Flow Chart for Automatic Restore

19.4 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.
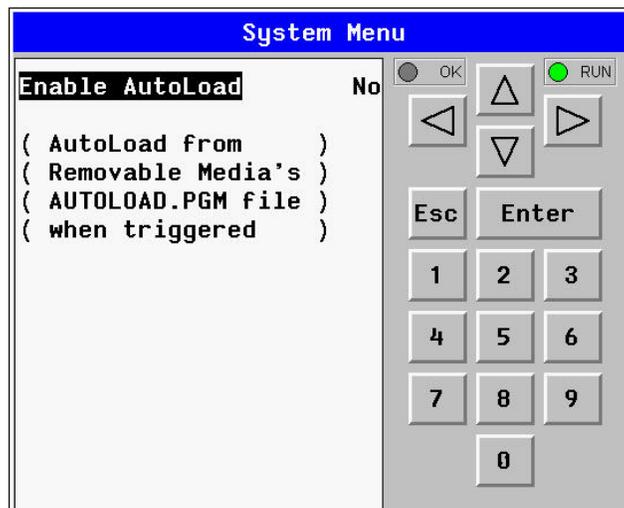
Figure 19.7 – AutoLoad Menu

The OCS follows the following sequence in execution of AutoLoad:
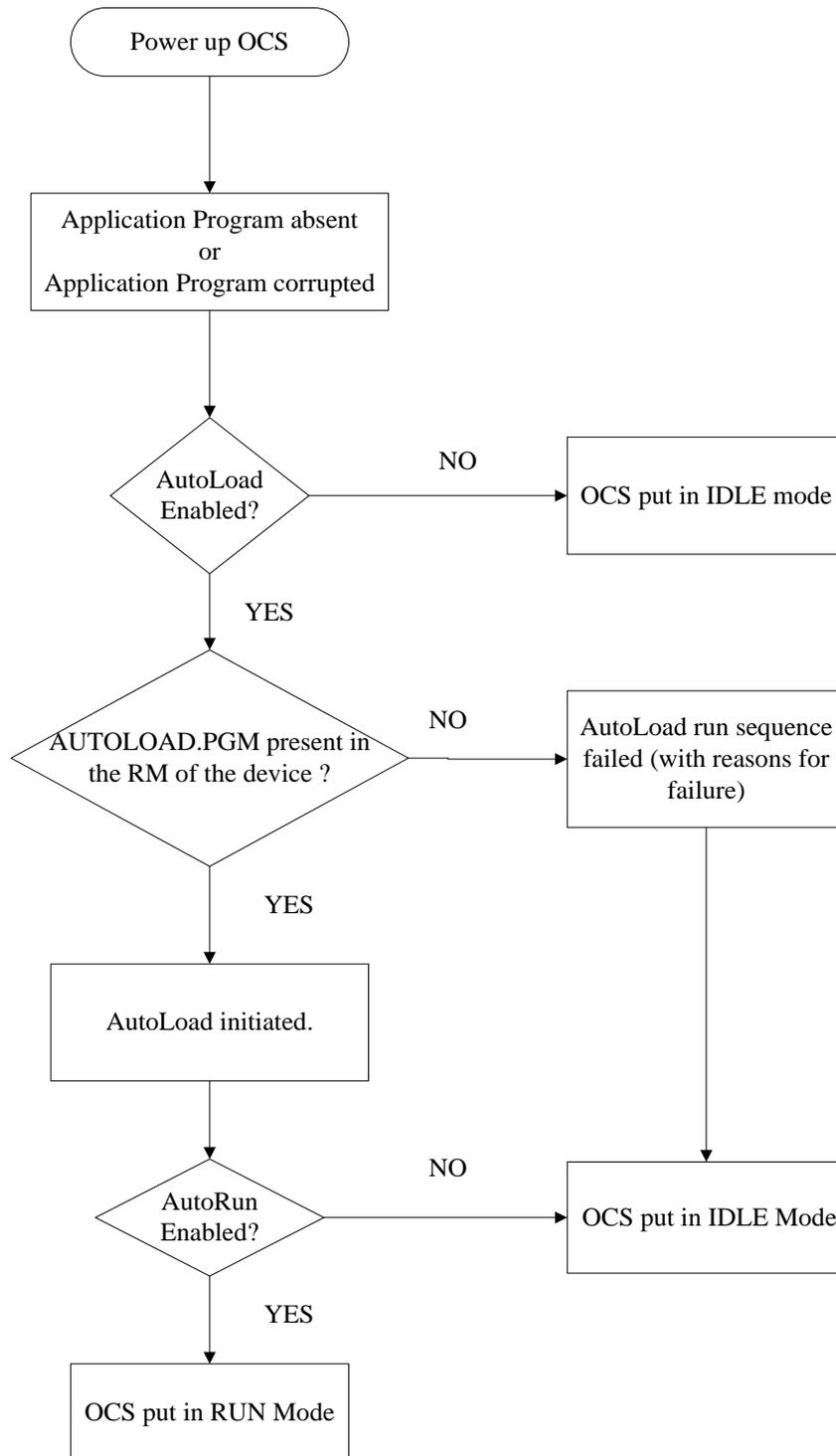
Figure 19.8 – Flow Chart for AutoLoad

19.5 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 19.9 – AutoRun Menu

CHAPTER 20: MODBUS COMMUNICATIONS

20.1 Modbus Overview

For complete Modbus instructions, please refer to the Help file in Cscape.

Modbus (serial) is a popular, de-facto standard protocol that allows industrial devices from multiple manufacturers to easily share data in real-time. For Modbus serial communications, the XL7 can act as either a Master or a Slave.

Modbus protocol (serial) allows for one master and multiple slaves. The master always initiates the conversation by sending a request to a particular slave. Only the addressed slave will send a response when the request is completed. Should the slave be unable to complete the request, it returns the appropriate error response. Should the slave be unable to respond, the master's timeout timer expires to provide an indication of **No Response**.

20.2 Modbus Slave Overview

For complete Modbus Slave instructions, please refer to the Help file in Cscape.

The Modbus slave function block, when used with the appropriate Modem and/or Open function blocks, allows the primary serial port on the controller to act as a Modbus slave. The Modbus function supports both ASCII and RTU modes of operation across a range of baud rates and protocol frames. Also supported is port activity status, an inactivity timer, support for call-on exception, and support for store and forward (repeater) operation for radio modems.

The Modbus Addressing Section describes the supported Modbus Commands as well as the Modbus Map for XL7 References (%R, %M, etc.).

20.3 Modbus Master Overview

For complete Modbus Master instructions, please refer to the Help file in Cscape.

When acting as a Modbus master, there are two primary mechanisms used by the XL7 to allow the user to specify the data to be read/written from/to the slaves.

Modbus Master Function Block—This is for serial only. This is an advanced feature that should only be used in rare occasions.

Protocol Config—The Protocol Config is configured in the Hardware Configuration dialog box in Cscape (serial). Refer to the Modbus Addressing Section. This is the preferred method in most applications.

After the protocol has been selected from the dropdown menu, the **Network**, **Devices**, and **Scan List** become available. The Protocol Config is configured on three different levels:
- **Network**—Parameters, such as the polling rate of the data scan, are specified along with timeout values, retry, and re-acquisition settings. Serial configuration, baud rate, parity, etc. are also set here.
- **Devices**—For every slave to be polled, configuration details are added in the Devices dialog box. This includes Slave ID (serial). Under Device Type, the Modbus addressing style matching that specified in the slave's user documentation may be selected. For instance, some slaves specify Modbus addresses (i.e. 40,001), and others specify offsets (i.e. 0000).
    - ○ **Hex or Decimal**—Some specify addresses in hex, and others in decimal. By allowing the user to select the Modbus addressing style for each slave on the network, minimal address conversion is required. Also, if the slave is another Horner product (i.e. another OCS), the "Native Addressing" option can be selected (i.e. %R1, %M17, etc.), and this skips the conversion to Modbus style altogether.
- **Scan List**—This is where the specific Modbus addresses to be read/written from/to each slave are specified. Up to 32 words of data can be read at the same time.

    NOTE: Once configuration has been completed on the Network and Devices level, Modbus data can be directly read/written from graphics objects in the Cscape screen editor. This is available even if the Modbus register is not listed on the scan list.

The above information is just an introduction to the topic. For more detailed information, please consult the Cscape Help file.

20.4 Modbus Addressing Table

To access XL7 registers, a Modbus Master must be configured with the appropriate register type and offset. This is usually accomplished with one of two methods:

Method 1: The first method uses **Traditional Modbus References**, in which the high digit represents the register type and the lower digits represent the register offset (starting with Register 1 for each type). Since only four register types can be represented in this manner, XL7 Modbus Function Blocks pack several XL7 register types into each Modbus register type. Starting addresses of each XL7 register type are shown in the **Traditional Modbus Reference** column of the table.

Method 2: The second method requires the Modbus Master to be configured with a specific **Modbus Command** and **Modbus Offset.**

Table 20.1 – Modbus Master Mapping					
XL7 Reference	Maximum Range	Trad. Modbus Ref. (5 Digits)	Expanded Modbus Ref. (6 Digits)	Modbus Commands	Modbus Offset
%I1	2048	10001	010001	Read Input Status (2)	0
%IG1	256	13001	013001		3000
%S1	256	14001	014001		4000
%K1	5	15001	015001		5000
%Q1	2048	00001	000001	Read Coil Status (1) Force Coil (5) Force Multiple Coils (15)	0
%M1	2048	03001	003001		3000
%T1	2048	06001	006001		6000
%QG1	256	09001	009001		9000
%AI1	512	30001	030001	Read Input Register (4)	0
%AIG1	32	33001	033001		3000
%SR1	256	34001	034001		4000
%AQ1	512	40001	040001	Read Holding Register (3) Load Register (6) Load Multiple Registers (16)	0
%R1	2488	40513	040513		512
%R1	2048	43001	043001		3000
%AQG1	32	46001	046001		6000
%R1	9999	--	410001		10000

CHAPTER 21: BACK-UP BATTERY

The following information pertains to the XL and RCC OCS units running 14.24 Firmware and later.

NOTE: For more details on the back-up battery, refer to the Battery Manual [MAN1142].

21.1   Overview

The XL7 has an advanced battery system that uses a rechargeable lithium-ion battery. The battery powers the real time clock when power is removed and is needed for register data retention.

21.2   Storing Register Contents

The OCS controllers with rechargeable batteries write register data to high speed RAM when connected to DC power. When this power is lost, critical circuits switch over and run on batter power for about 1/10 of a second. During this time, register and other retentive data is saved away to flash memory. The clock continues to run on the battery at a much lower power. The battery is designed to last well over a year in this state. Once power is restored, the battery recharges in eight (8) hours or less.

21.3   Battery Life

The battery is designed to last 300 full charges to 1000 partial charge cycles or 7 to 10 years. Because typical operation does not drain the battery, the 1000 charge cycles should never be reached and the 7 to 10-year aging of the battery would limit its useful life. The battery is designed to be replaced.

21.4   Lithium Battery Safety

Many of the publicized battery issues are a result of using multiple batteries of flexible battery packs. The OCS uses a small, single cell in a metal enclosure. The battery is UL recognized and comes from quality suppliers. The OCS has safety circuitry built into the charging IC and additional external protection including fusing. These circuits were closely evaluated by UL and Horner engineering for use in hazardous environments.

21.5   Battery Charging Cycle

1. The battery is charged at unit power up. The first two minutes after boot there is a wait period before charging begins.
2. In all charge cycles, battery is charge fully to 4.2V (4200mV).
3. Charging mA should be 100 mA.
4. Maximum charge time is eight (8) hours. (In some low conditions, it can theoretically take a battery eight (8) hours to fully charge.)
5. When the battery voltage drops below 4000mV, a charging cycle is triggered.
6. Again, battery is fully charged to 4.2V at a maximum of eight (8) hours.

NOTE: The controller will not charge the battery when it is outside. Its charging range is typically -10°C to 35°C.

21.6   Battery Charging Status

Viewed in the System Menu under "View Battery Status":

Table 21.1 – Charging State Table	
Waiting	The charging system is waiting for voltages and temperatures to stabilize.
Battery Charging	The battery is charging.
Battery Full	Shows at the end of a charge cycle. Remains in this state until the battery is steadily discharging.
Battery Discharging	The battery is steadily discharging.

21.7   Battery Charging State

In the RCC, XL4, XL7, EXL6, and EXL10, the program downloaded from Cscape is not battery backed. The program is stored in flash memory RAM at the time of download. The battery plays no part in program retention.

21.8   Battery Status in System Registers

Table 21.2 – Battery Status	
%SR195	Max CPU temperature
%SR196	Charge State 0 = Waiting 1 = Normal >1 = Special Condition
%SR197	Charging Current Max mA
%SR198	Battery Volt in mV

CHAPTER 22: MAINTENANCE

22.1 Firmware Update Overview

The XL7 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 should only be performed when the equipment being controlled by the XL7 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.

22.2 How to Check for Current Firmware Revision

To check the firmware revision on a controller, open **System Menu** → **View Status**.
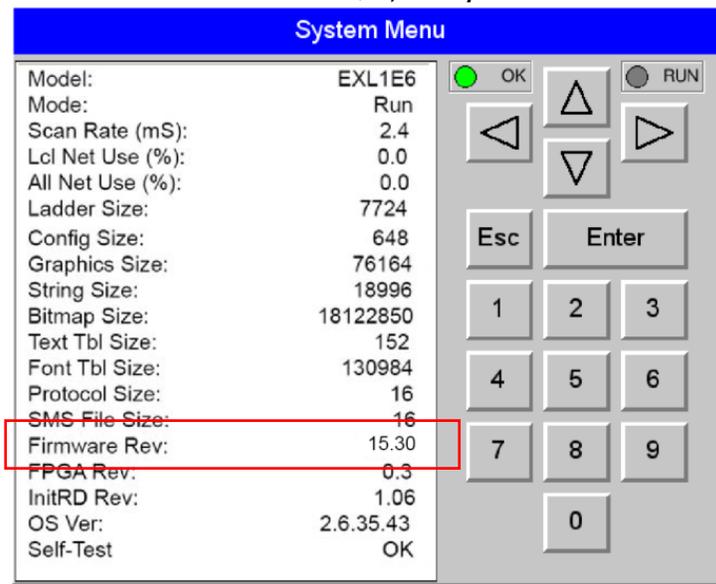
22.3 Details

> **Note: Updating firmware will clear the application program, screens, configurations, and register data.** If required, make sure to backup program and register data before updating firmware. The controller's User Manual has instructions for doing backups.

There are two methods for updating firmware. The method used depends on the type of controller being updated.

Method A: Removable Media Method – The controller firmware is updated by a bootloader, using a microSD card or USB Flash drive **(not through the Cscape Firmware Update Wizard)**. To update or change firmware:
1) Download desired Firmware set from the Horner APG website. (Verify CsCAN or CANopen communications.)
2) Save Firmware files to microSD card or USB, these are the removable media devices.
3) Update the firmware through the controller's Firmware Update function

NOTE: Files from the Horner website come as a .ZIP file which need to be unzipped and placed in the root of the drive for them to function properly.

Method B: RS232 Serial Connection – Serial firmware updates are done from Cscape software to the controller's primary serial port, MJ1 in most cases.

STEP ONE:

In North America, visit https://hornerautomation.com Then click **Support** ➔ **Downloads** ➔**Controller Firmware** and download the most recent firmware set with the correct communication protocol.

-OR-

In Europe, visit http://www.hornerautomation.eu and click **Support** ➔ **Firmware** tab and download the desired firmware (an account is required to access firmware updates, create one if necessary).

22.4 Firmware Update for the XL7

Update firmware in an XL7 by completing the following steps:

a. Unzip all files from downloaded .zip file onto removable media see previous page.
b. Plug the removable media into a powered-up OCS controller.
c. Press and hold the **SYSTEM** key until the **Boot Installer Screen** appears.
d. Press the **Install Bootloader** button and then press **Yes**.
   NOTE: DO NOT press the "Install Firmware" option. This has the potential to create a scenario where the unit will not boot up. If this is pressed by mistake, contact Tech Support for the recovery procedure.
e. When **Operation Completed** appears, press **OK**.
f. Power-cycle the OCS controller and wait for it to boot up.
g. Press **SYSTEM** key, select **View Status** and press the **Enter** button.
h. Scroll down to see the version numbers.
i. If any of the version numbers are incorrect, verify the correct files were copied to the removable media device and repeat the steps above.

22.5 Backup Battery

The XL7 has an advanced battery system that uses a rechargeable lithium-ion battery. The battery powers the real time clock when power is removed. To store registers, the battery continues to power the OCS for less than a second after external power is removed. In this time the registers and other retentive data is saved to internal flash memory. This battery will need about eight (8) hours of charging to last approximately two (2) years when powered off.

NOTE: For the registers to be retentive the battery only needs to be charged and present at power down.

The battery will generally last seven (7) to ten (10) years. Environmental conditions, including extreme temperatures and humidity, can affect battery life. If the battery is older than seven (7) to ten (10) years old, it is recommended that it be replaced as preventative maintenance.

NOTE: Do not use an alkaline AA battery; only use the proper battery type listed.

WARNING: DO NOT USE IF BATTERY IS LEAKING OR HAS BEEN DAMAGED.

WARNING: LITHIUM BATTERIES MAY EXPLODE OR CATCH FIRE IF MISTREATED.
DO <u>NOT</u> RECHARGE, DISASSEMBLE, HEAT ABOVE 100° C (212° F) INCINERATE, OR PUNCTURE.

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

WARNING: Disposal of lithium batteries must be done in accordance with federal, state, and local regulations. Be sure to consult with the appropriate regulatory agencies *before* disposing batteries. In addition, do <u>not</u> recharge, disassemble, heat or incinerate lithium batteries.

WARNING: Do <u>not</u> make substitutions for the battery. Be sure to only use the authorized part number to replace the battery.

Below are the steps to replace the lithium-ion battery, part no. **BAT00019**, available from Horner APG.

1. Make sure the user program and any data stored in retentive memory is backed up.
2. Disconnect all power from the XL7 OCS unit including I/O power.
3. On the back of the XL7 OCS, unscrew the battery plate cover using a Phillips head screwdriver.
4. Slide battery plate off the bottom of the unit.
5. Remove the old battery.
6. Dispose of the old battery properly; see the above warning on disposal regulations.
7. Insert new battery by aligning the positive (+) end of the battery with the positive (+) sign on the board.
8. Slide battery plate cover back on the unit from the bottom up and re-tighten the screw in place.
9. Apply power and restore program and registers if necessary.
10. Allow the unit to remain powered near room temperature (10-35°C) for 6 to 8 hours. This will ensure the battery is fully charged properly for the first time.
11. Once the battery is charged, test the battery function by removing power and re-applying. Registers and clock function should be retained and there are no error messages on power up.
12. Once charged, the battery management system will maintain the battery at optimal charge depending on use and temperature.

CHAPTER 23: TROUBLESHOOTING & TECHNICAL SUPPORT

23.1 Connecting to the XL7 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.

Table 23.1 – Cscape Target & Local Numbers	
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.

23.1.1 Connecting Troubleshooting Checklist (serial port – MJ1 Programming)

1. Controller must be powered up.
2. Ensure that the correct COM port is selected in Cscape. **Tools → Applications Settings → Communications**.
3. Ensure that a cable with proper pinout is being used between PC and controller port MJ1.
4. 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 Cscape.
5. Successful communications with USB-to-serial adapters vary. If in doubt, Horner APG offers a USB to serial adapter. Part numbers HE-XCK and HE-CPK.

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

1. Controller must be powered up.
2. Ensure that the correct COM port is selected in Cscape. **Tools → Applications Settings → Communications**.
3. Be sure that the USB cable is connected between the PC and the controller. Check Windows Device Manager to ensure that the USB driver is properly installed and to verity the port number.

23.1.3 Connecting Troubleshooting Checklist (ETN port programming)

1. Controller must be powered up.
2. Ensure that the correct IP address is given in the Ethernet field and correct Mode is selected, in Cscape: **Tools → Application Settings → Communications Port**.
3. Ensure that an Ethernet connection has been established by pinging the controller from the Windows DOS prompt.

23.2 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.

23.2.1 Local I/O Troubleshooting Checklist

1. Verify the controller is in RUN mode.
2. Check diagnostics to ensure controller passed self-tests.
   View Diags in System Menu or in Cscape → Controller/Diagnostics
3. Check data sheets to ensure proper wiring.
4. Ensure 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.

23.3 CsCAN Network

For complete information on setting up a CsCAN network, refer to CAN Networks manual (MAN0799) by visiting the Horner websites 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.

23.3.1 CsCAN Network Troubleshooting Checklist

1. Use the proper Belden wire type or equivalent for the network as specified in MAN0799.
2. The XL7 OCS <u>does not</u> 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 ensure that voltage meets specifications of attached devices.
4. Proper termination is required. Use 121Ω (or 120Ω) 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 60Ω.
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'). 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 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.

23.4 Removable Media - Basic Troubleshooting

Table 23.2 – Removable Media Troubleshooting	
Description	**Action**
XL7 OCS does not read media card.	The media card should be formatted with the XL7 OCS.
XL7 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 XL7 configuration for it to download.

23.5 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
Website: https://hornerautomation.com
Email: techsppt@heapg.com

Europe:
Tel: (+) 353-21-4321-266
Fax: (+353)-21-4321826
Website: http://www.hornerautomation.eu
Email: technical.support@horner-apg.com

CHANGE LOG

Change Log			
Date	Rev #	Description of Revision	Location in Doc
4/22/2020	11	- Updated Firmware Update Steps per new Firmware Update Manual (Mantis 2209) -Added Revised Audio Chapter (Mantis 2588) -Rearranged Chapter Order (Mantis 3029) -Updated Model 6 and RTC/TC Formula (Mantis 1528)	Firmware Updates Audio Chapter Throughout Cscape Config/Analog In/Table 7.2
8/10/2020	12	-Added back cover dimensions for standard and extended. (Mantis 3487)	3.4 XL7 Back Cover Dimensions

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