



# X2 OCS MODEL: HE-X2

## 1 TECHNICAL SPECIFICATIONS

### 1.1 General

Primary Pwr. Range	24 VDC +/- 20%
Typical power-backlight 100%	64 mA @ 24V (1.53 W)
Power Backlight Off	15 mA @ 24 V (0.36 W)
Inrush Current	30A for < 1 ms
Real Time Clock	Battery backed; lithium coin cell CR2450
Clock Accuracy	+/- 90 Secs/Month
Relative Humidity	5 to 95% Non-condensing
Operating Temp.	-10°C to +60°C
Storage Temp.	-20°C to +70°C
Weight	0.75 lb/340 g
Mounting Clips	4 composite type
Housing Material	Polycarbonate, UL rated
Panel Seal	Silicone rubber
Packaging	100% Recyclable paper fiber materials
Included in Box	Controller, 3 x I/O connectors, 4 x mounting clips, 1 x power connector, Quick Reference Guide

### 1.2 User Interface

Display	2.2" Monochrome LCD
Resolution	128 x 64 pixels
Backlight	LED
Backlight Lifetime	50,000 hrs
Backlight Control	Yes, software controlled (ON/OFF)
User-Programmable Screens/Pages	250
No. of Objects/Screens	15
Screen Memory	8 Mb
Keypad	Membrane type switches w/metal dome
Tactile Feedback	Yes
Number of Keys	4 Soft keys + 16 numeric/function keys

### 1.3 Connectivity

Serial Ports	1 x RS232, 1 x RS485
485 Terminations	On-board, software controlled
USB	Mini-B
USB Programming Support	Yes
USB Type	USB 2.0
CAN Hardware	Non-isolated
CAN Port Connector	RJ45 (red)
CAN Port Speeds Support	125 K, 250 K, 500 K, 1 Mb/sec.
CAN Port Termination	On-board, software controlled
CAN Protocols	CsCAN
Removable Memory In	MicroSD (SDHC, SDXC IN FAT32 format, support for 32 GB max. Application Updates, Datalogging, more)

### 1.4 Control & Logic

Control Language Support	Advanced ladder logic Full IEC 61131-3 languages
Logic Program Size	256 KB
Non-Retentive Memory	128 Kb
Program Memory Size	1 Mb
Scan Rate	1.2 mS/K logic
%AI (Analog Inputs)	512
%AQ (Analog Outputs)	512
%D (Display bits)	250
%I (Digital Inputs)	1024
%M (Retentive Bits)	1024
%Q (Digital Outputs)	1024
%R (Retentive Registers)	5000
%SR (System Registers)	255
%T (Temporary Bits)	1024

### 1.5 I/O Connections

Terminal Type	Removable 3.5 mm color-coded
I/O Options	Onboard + Remote-- SmartMod, SmartRail, SmartBlock, SmartStix
Remote I/O	SmartRail, SmartStix, SmartBlock, SmartMod

### 1.6 Testing

Shock	IEC 60068-2-27
Vibration	IEC 60068-2-6
Washdown	NEMA 4X
Certifications (UL/CE)	USA: <a href="https://hornerautomation.com/certifications/">https://hornerautomation.com/certifications/</a> Europe: <a href="http://www.horner-apg.com/en/support/certification.aspx">http://www.horner-apg.com/en/support/certification.aspx</a>

### 1.7 Inputs/Outputs Model Overview

	MODEL R	MODEL A
DC In	12	12
DC Out	2	12
Relays	6	-
HS In	4	4
HS Out	2	2
mA In	4	4
mA Out	2	2

There are four high-speed inputs of the total DC Inputs. There are two high-speed outputs of the total DC outputs.

Model A supports sourcing outputs. Model R DC outputs are sinking with integral pull up resistors.

## technical specifications continued...

### 1.8 Digital DC Inputs: Models R & A

Inputs per Module	12 Including 4 Configurable HSC Inputs
Commons per Module	1
Input Voltage Range	12 VDC / 24 VDC
Absolute Max. Voltage	35 VDC Max.
Input Impedance	10 k $\Omega$
Input Current: Upper Threshold Lower Threshold	Positive Logic / Negative Logic 0.8 mA / -1.6 mA 0.3 mA / -2.1 mA
Max. Upper Threshold	8 VDC
Min. Lower Threshold	3 VDC
OFF to ON Response	0.1 ms
ON to OFF Response	0.1 ms
Number of Counters	4
Maximum Frequency	2.5 kHz, Quadrature 5 kHz, Per Frequency 10 kHz, Totalize
Accumulator Size	32-bits each
Modes Supported	Totalizer, quadrature, pulse measurement, frequency measurement, set-point controlled outputs

### 1.10 Digital DC Outputs, Sinking: Model R

Outputs per Module	2 (PWM or HSC)
Commons per Module	1
Type	Sinking w/optional 10 k $\Omega$ pull-up
Absolute Max. Voltage	28 VDC
Output Protection	Short circuit
Max. Output per Point	0.5 A
Max. Voltage Drop at Rated Current	0.25 VDC
Max Inrush	650 mA
OFF to ON Time	20 $\mu$ s
ON to OFF Time	10 $\mu$ s
PWM Out	65 kHz
Rise Time	10 $\mu$ s
Fall Time	20 $\mu$ s

### 1.12 Analog Inputs: Models R & A

Number of Channels	4
Input Ranges	20 mA, 4-20 mA
Nominal Resolution	12 Bits
Safe Input Voltage Range	-0.5 V to 12 V, protection up to 24 V
Input Impedance (clamped @ -0.5 VDC to 12 VDC)	Current Mode: 100 $\Omega$
Nominal Resolution	12 Bits
%AI Full Scale	32,000
Max. Over Current	35 mA
Max Error at 25°C (excluding Zero) Adjusting Filtering may Tighten	< 1.5%
Filtering	160 Hz Hash (noise) Filter, 1-128 Scan Digital Running Average Filter

### 1.9 Relay Outputs: Model R

Outputs per Module	6 Relay
Commons per Module	6
Max. Output Current per Relay	3 A @ 250 VAC, resistive
Max. Total Output Current	5 A continuous
Max. Output Voltage	275 VAC, 30 VDC
Max. Switched Power	150 W
Contact Isolation to Ground	1000 VAC
Max. Voltage Drop at Related Current	0.5 V
Expected Life (see below derating chart for detail)	No Load: 5,000,000 Rated Load: 100,000
Max. Switching Rate	300 CPM at no load 20 CPM at rated load
Type	Mechanical Contact
Response Time	One update per ladder scan plus 10 ms

### 1.11 Digital DC Outputs, Sourcing: Model A

Outputs per Module	12 Including 2 Configurable PWM Outputs
Commons per Module	2
Type	Sourcing / 10 k $\Omega$ Pull-Down
Absolute Max. Voltage	28 VDC
Output Protection	Short circuit
Max. Output per Point	0.5 A
Max. Voltage Drop at Rated Current	0.25 VDC
Max Inrush	650 mA
OFF to ON Time	1 $\mu$ s
ON to OFF Time	1 $\mu$ s
PWM Out	65 kHz
Rise Time	150 ns
Fall Time	150 ns

### 1.13 Analog Outputs: Models R & A

Number of Channels	2
Output Ranges	0-20 mA
Nominal Resolution	12 Bits
Update Rate	Once per PLC scan
Max. Error at 25°C (Excluding Zero)	< 1.5%
Maximum 20 mA Load	500 $\Omega$
% AQ Full Scale	32,000
Protection	Protect against miswire up to 24 VDC auto-recover

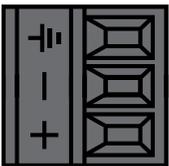
## 2 WIRING & CONNECTORS

### 2.1 - Port Connectors



- 1. Function Keys
- 2. High Capacity microSD Slot
- 3. RS232/RS485 Serial Connector
- 4. CAN Port (via RJ45)
- 5. USB Mini-B Port
- 6. Analog I/O
- 7. DC Inputs
- 8. DC Outputs
- 9. DC Power

### 2.2 - Power Wiring



Primary Power Port Pins		
PIN	SIGNAL	DESCRIPTION
1	Ground	Frame Ground
2	DC-	Power Supply Common
3	DC+	Power Supply Voltage

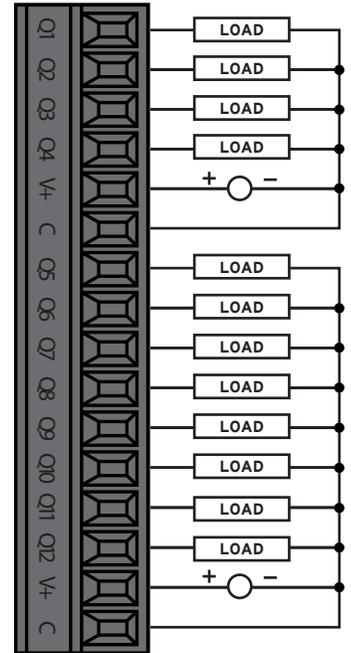
#### DC Input / Frame

Solid/Stranded wire; 12-24 awg (2.5-0.2 mm). Strip length - 0.28" (7 mm).  
 Torque rating: 4.5 - 7 in lb (0.50 - 0.78 Nm).  
 DC- is internally connected to I/O V-.  
 A Class 2 power supply must be used to meet UL requirements.

### 2.3 - Wiring Connectors

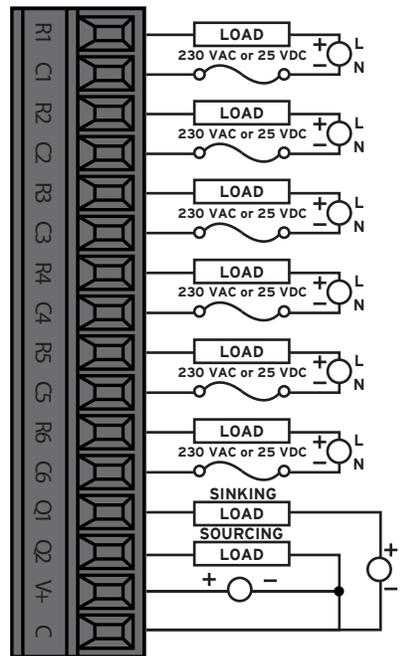
Model A Digital Out

POSITION/PIN	DIGITAL MODEL
1	Q1 Output 1 (PWM)
2	Q2 Output 2 (PWM)
3	Q3 Output 3
4	Q4 Output 4
5	V+ External V+
6	C Common
7	Q5 Output 5
8	Q6 Output 6
9	Q7 Output 7
10	Q8 Output 8
11	Q9 Output 9
12	Q10 Output 10
13	Q11 Output 11
14	Q12 Output 12
15	V+ External V 2 +
16	C Common



Model R Relay and Digital Out

POSITION/PIN	DIGITAL MODEL
1	R1 Relay 1 N.O.
2	C1 Relay 1 C
3	R2 Relay 2 N.O.
4	C2 Relay 2 C
5	R3 Relay 3 N.O.
6	C3 Relay 3 C
7	R4 Relay 4 N.O.
8	C4 Relay 4 C
9	R5 Relay 5 N.O.
10	C5 Relay 5 C
11	R6 Relay 6 N.O.
12	C6 Relay 6 C
13	Q1 Output 1
14	Q2 Output 2
15	V+ External V+
16	C Common



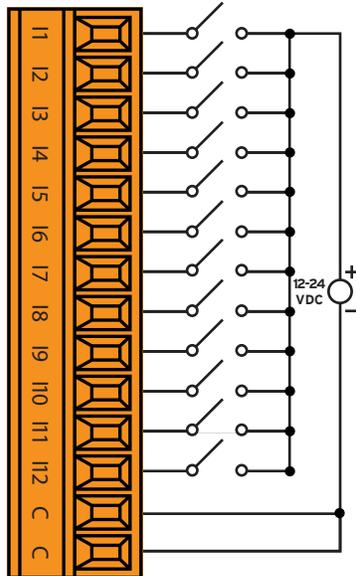
NOTE: Internal 10 kΩ resistors between: V+ and Q1; V+ and Q2

wiring & connectors continued...

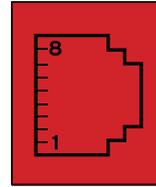
3 COMMUNICATIONS

Model R and A Digital Input

POSITION/PIN	DIGITAL MODEL	DIGITAL MODEL
1	I1	Input 1 (HSC)
2	I2	Input 2 (HSC)
3	I3	Input 3 (HSC)
4	I4	Input 4 (HSC)
5	I5	Input 5
6	I6	Input 6
7	I7	Input 7
8	I8	Input 8
9	I9	Input 9
10	I10	Input 10
11	I11	Input 11
12	I12	Input 12
13	C	Common
14	C	Common



3.1 - CAN Communications



**CAN**  
Modular jack (8 posn RJ45)

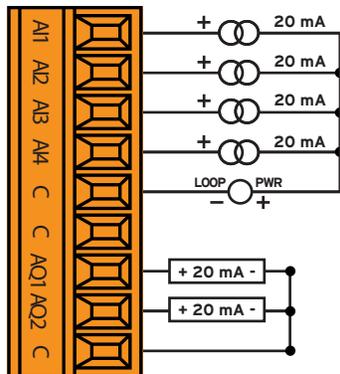
CAN Pin Assignments		
PIN	SIGNAL	DIRECTION
8	No Connection	-
7	Ground	0 V
6	Shield	-
5	No Connection	-
4	No Connection	-
3	Ground	0 V
2	CAN Data Low	IN/OUT
1	CAN Data High	IN/OUT

The CAN port is provided via the single 8-position modular jack labeled "CAN". It may be used to communicate with other OCS products using Horner's CsCAN protocol. Additionally, remote expansion I/O such as SmartRail, SmartBlock, and SmartStix may be implemented using the CsCAN protocol.

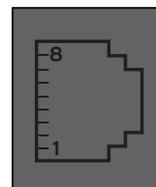
Termination for the CAN port may be enabled from the System Menu or System Register. This should only occur if the X2 is at either end of the CAN network. Only the two devices on either end of the CAN network should be terminated.

Model R and A Analog Input and Output

POSITION/PIN	DIGITAL MODEL	DIGITAL MODEL
1	AI1	Analog Input 1
2	AI2	Analog Input 2
3	AI3	Analog Input 3
4	AI4	Analog Input 4
5	C	Common
6	C	Common
7	AQ1	Analog Output 1
8	AQ2	Analog Output 2
9	C	Common



3.2 - Serial Communications



**MJ1:** RS-232 w/full handshaking  
**MJ2:** RS-485 half-duplex  
RS-485 termination and biasing via System Menu or System Register

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

## 4 BUILT-IN I/O

## installation dimensions continued...

### 4.1 - Built-in I/O (Model R & Model A)

Both X2 feature built-in I/O. The I/O is mapped into OCS Register space, in three separate areas - Digital/Analog I/O, High-Speed Counter I/O, and High-Speed Output I/O. Digital/Analog I/O location is fixed starting at 1, but the High-Speed Counter and High-Speed Output references may be mapped to any open register location. For more details on using the High-Speed Counter and High-Speed Outputs, see the X2 OCS User's Manual (MAN1130).

FIXED ADDRESS	DIGITAL/ANALOG I/O FUNCTION	MODEL R	MODEL A
%I	Digital Inputs	1-12	1-12
	Reserved	13-32	13-31
%Q	Digital Outputs	1-6	1-12
	Reserved	7-16	13-16
%AI	Analog Inputs	1-4	1-4
	Reserved	5-12	5-12
%AQ	Analog Outputs	1-2	1-2
	Reserved	3-6	3-6

Reserved areas maintain backward compatibility with other XL Series OCS models

### 5.1 - Installation Procedure

The X2 utilizes a clip installation method to ensure a robust and watertight seal to the enclosure. Please follow the steps below for the proper installation and operation of the unit.

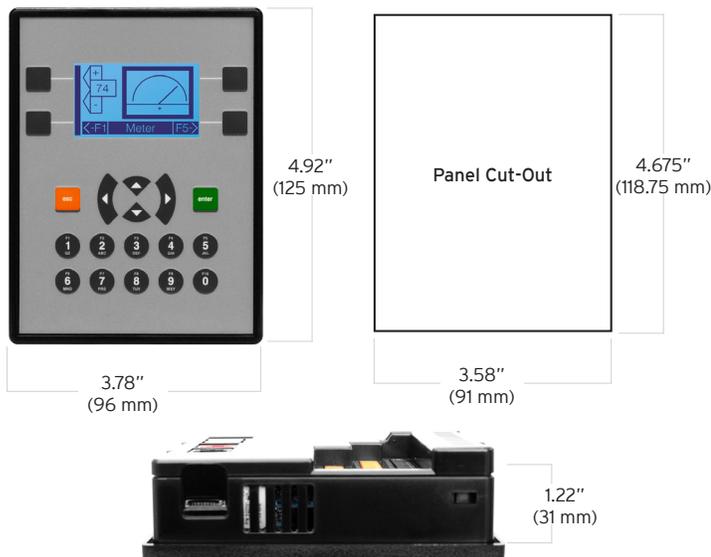
- Carefully locate an appropriate place to mount the X2. Be sure to leave enough room at the top of the unit for insertion and removal of the microSD™ card.
- Carefully cut the host panel per the diagram on Page 1, creating a 91 mm x 118.75 mm +/-0.1 mm opening into which the X2 is to be installed. If the opening is too large, water may leak into the enclosure, potentially damaging the unit. If the opening is too small, the OCS may not fit through the hole without damage.
- Remove any burrs/sharp edges and ensure the panel is not warped in the cutting process.
- Install and tighten the four mounting clips (provided in the box) until the gasket forms a tight seal. For standard composite mounting clips (included with product), use a torque rating of 2-3 in lb (0.23-0.34 Nm). For optional metal mounting clips, use a torque rating of 4-8 in lbs (0.45-0.90 Nm).
- Connect communications cables to the serial port, USB ports, and CAN port as required.

## 5 INSTALLATION DIMENSIONS

## 6 BATTERY

The X2 uses a replaceable non-rechargeable 3 V Lithium coin-cell battery (CR2450) to run the Real-Time Clock and to maintain the retained register values. This battery is designed to maintain the clock and memory for 7-10 years. Please reference MAN1130 for instructions on how to replace the battery.

## 7 SAFETY



### 7.1 - WARNINGS

- To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.
- 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.
- Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.
- In the event of repeated failure, do NOT replace the fuse again as repeated failure indicates a defective condition that will NOT clear by replacing the fuse.
- 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.

### 7.2 - FCC COMPLIANCE

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference
- This device must accept any interference received, including interference that may cause undesired operation

## safety continued...

### 7.3 - PRECAUTIONS

All applicable codes and standards need to be followed in the installation of this product. Adhere to the following safety precautions whenever any type of connection is made to the module:

1. Connect the safety (earth) ground on the power connector first before making any other connections.
2. When connecting to the electric circuits or pulse-initiating equipment, open their related breakers.
3. Do NOT make connection to live power lines.
4. Make connections to the module first; then connect to the circuit to be monitored.
5. Route power wires in a safe manner in accordance with good practice and local codes.
6. Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.
7. Ensure hands, shoes, and floor are dry before making any connection to a power line.
8. Make sure the unit is turned OFF before making connection to terminals.
9. Make sure all circuits are de-energized before making connections.
10. Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.
11. Use copper conductors in Field Wiring only, 60/75° C.

## 8 TECHNICAL SUPPORT

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

#### North America

(317) 916-4274  
[www.hornerautomation.com](http://www.hornerautomation.com)  
[techspt@heapg.com](mailto:techspt@heapg.com)

#### Europe

(+) 353-21-4321-266  
[www.horner-apg.com](http://www.horner-apg.com)  
[techspt@horner-apg.com](mailto:techspt@horner-apg.com)

## 9 PART NUMBER BUILDER

### EXAMPLE PART NUMBERS

GLOBAL MODEL NUMBERS

model

HE-X2

- R relay and solid state outputs
- A solid state output