X2 OCS Datasheet

MAN1131_23_EN_X2_DS



HG-470

Part Numbers

Model R: Relay & Solid State Outputs	HE-X2R
Model A: Solid State Outputs	HE-X2A

User Manual and Add-Ons

Find the documents via the Documentation Search.

Part #	Description
MAN1130	HE-X2 User Manual
HE-BAT009	3V Lithium Coin Battery
HE-XCK	Programming Cable Kit
HE-PRGMINI	Mini-B USB' Programming Cable
HE-FBD001	Ferrite core for filtering out electrical noise.
HE200MJ2TRM	Adapter, RJ45 (8P8C) male to 8-position terminal strip.

Battery Maintenance

The X2 OCS has an advanced battery system that uses a packaged lithium coin battery. The battery powers the real time clock when power is removed, and it is needed for register data retention. Please see manual **MAN1130** via the Documentation Search for more details on battery replacement.

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TECHNICAL SPECIFICATIONS

General Specifications

Primary Power Range	24VDC ± 20%
Typical Power-backlight 100%	64mA @ 24V (1.53W)
Power Backlight Off	15mA @ 24V (0.36W)
Inrush Current	30A for < 1ms
Real Time Clock	Battery backed; lithium coin cell CR2450
Clock Accuracy	± 90 Secs/Month
Relative Humidity	5 to 95% Non-condensing
Operating Temperature	-10°C to +60°C
Storage Temperature	-20°C to +70°C
Weight	9.5oz (270g)
Mounting Clips	4 composite type
Housing Material	Polycarbonate, UL rated
Panel Seal	Silicone rubber
Packaging	100% recyclable paper fiber materials
IP Rating	IP66 / NEMA 4X

Control and Logic

Control Language Support	Advanced ladder logic; Full IEC 61131-3 languages
Logic Program Size	256kB (prior to firmware version 15.41) 512 KB (firmware 15.41 and onwards)
Non-Retentive Memory	128kB
Internal Storage Memory	16Mb
Total Program Memory	2.5Mb
Logic Scan Rate	1.2ms/kB
%I (Digital Inputs)	1024
%Q (Digital Outputs)	1024
%AI (Analog Inputs)	256
%AQ (Analog Outputs)	256
%M (Retentive Bits)	1024
%T (Temporary Bits)	1024
%R (Retentive Registers)	5000
%D (Display Bits)	250
%K (Key Bit)	10
%S (Status Bits)	16

User Interface

Display	2.2” Monochrome LCD
Resolution	128 x 64 pixels
Backlight	LED
Backlight Lifetime	50,000 hrs
Backlight Control	Software controlled (ON/OFF)
User-Programmable Screens/Pages	250
Number of Objects/Screens	15
Screen Memory	256kB
Keypad	Membrane type switches w/metal dome
Tactile Feedback	Yes
Number of Keys	4 Soft keys + 16 numeric/function keys

Connectivity

Serial Ports	1 x RS-232, 1 x RS-485
Serial Protocols	Modbus RTU, GE SNP, GPS
RS-485 Terminations	On-board, software controlled
Mini USB	Programming Only
CAN Hardware	Non-isolated
CAN Port Connector	RJ45 (red)
CAN Speeds Support	125kb, 250kb, 500kb, 1Mbps
CAN Port Termination	On-board, software controlled
CAN Protocols	CsCAN
Removable Memory In	microSD, SDHC, SDXC in FAT32 format, support for 32GB max. Application Updates, Datalogging...

Testing

Shock	IEC 60068-2-27
Vibration	IEC 60068-2-6
UL Environmental Ratings	Type 1, 4X indoor use only, 12, 12k & 13
Certifications (UL/CE)	North America Europe

CONTROLLER OVERVIEW

Overview of OCS

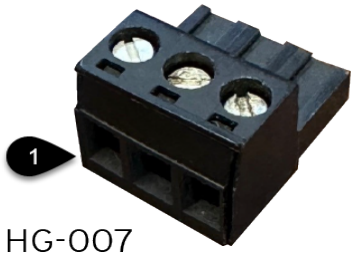
1. Keypad
2. High Capacity microSD slot
3. RS-232/RS-485 Serial Port
4. CAN Port (Via RJ45)
5. USB Mini-B Port
6. Analog I/O
7. DC Inputs
8. DC Outputs
9. DC Power



NOTE: See "Precautions" on page 20 about USB and grounding.

Power Wiring

NOTE: The Primary Power Range is 24VDC ± 20%.



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Primary Power Port Pins		
PIN	**Signal**	**Description**
1	Ground	Frame/Earth Ground
2	DC-	Input Power Supply Ground
3	DC+	Input Power Supply Voltage

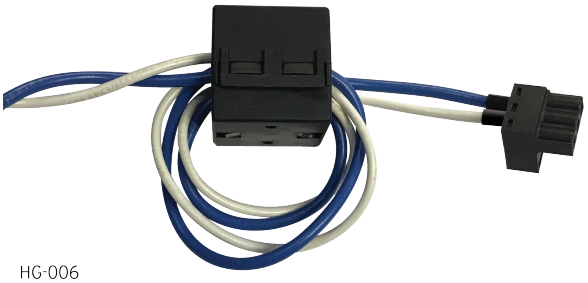
Wiring Details

- Solid/Stranded Wire: 12-24 AWG (2.5-0.2mm²)
- Strip length: 0.28” (7mm)
- Torque, Terminal Hold-Down Screws: 4.5 - 7 in•lbs (0.50 - 0.78 N•m)
- Torque, IO Connector Screws: 1.7 in•lbs (0.2 N•m)

DC- is internally connected to I/O V-, but is isolated from CAN V-. A Class 2 power supply must be used.

Power Up

1. **Optional**: Attach ferrite core with a minimum of two turns of the DC+ and DC- signals from the DC supply that is powering the controllers.



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2. Connect to earth ground.
3. Apply recommended power.

DIGITAL & RELAY I/O SPECIFICATIONS

Digital DC Input: Models R & A

Inputs per Module	12 including 4 configurable HSC inputs	
Commons per Module	1	
Input Voltage Range	12VDC / 24VDC	
Absolute Maximum Voltage	30VDC Max.	
Input Impedance	10kΩ	
Input Current	Positive Logic	Negative Logic
Upper Threshold Lower Threshold	0.8mA 0.3mA	-1.6mA -2.1mA
Maximum Upper Threshold	8VDC	
Min. Lower Threshold	3VDC	
OFF to ON Response	0.1ms	
ON to OFF Response	0.1ms	
Number of Counters	4	
Maximum Counter Frequency	10kHz	
Counter Accumulator Size	32-bits each	
Counter Modes Supported	Totalizer, quadrature, pulse measurement, frequency measurement, set-point controlled outputs	

Model A: Digital DC Outputs, Sourcing

Outputs per Module	12 Including 2 Configurable PWM/HSC Outputs	
Commons per Module	2	
Type	Sourcing	
Absolute Maximum Voltage	28VDC	
Output Protection	Short Circuit, Thermal, Undervoltage	
Maximum Voltage Drop at Rated Current	0.25VDC	
Maximum Output per Point: Sourcing	0.5A @ 24VDC	
	Min	Max
OFF to ON Time (typical)	300ns	500ns + Scan Time
ON to OFF Time (typical)	300ns	475ns = Scan Time
PWM Out Maximum Frequency	65kHz	
Rise Time	150ns Max	
Fall Time	150ns Max	

Model R: Digital DC Outputs, Sinking, Sourcing

Outputs per Module	2 (PWM or HSC)	
Commons per Module	1	
Type	Sinking	
Absolute Maximum Voltage	28VDC	
Output Protection	Short Circuit	
Maximum Output per Point: **Sinking**	0.5A	
Maximum Output per Point: **Sourcing**	2.4mA @ 24V	
Maximum Voltage Drop at Rated Current	0.25VDC	
Max Outrush	650mA	
	Min	Max
OFF to ON Time (typical)	2.2µs	2.2µs + Scan Time
ON to OFF Time (typical)	13µs	13µs + Scan Time
PWM Out Maximum Frequency	10kHz	
Rise Time	2.4µs (typical @ 24V)	
Fall Time	7.5µs (typical @ 24V)	

Relay Outputs: Model R

Outputs per Module	6 Relay
Relay Contact Type	Floating
Maximum Output Current & Voltage per Relay	3A @ 60VAC, resistive 3A @ 30VDC, resistive
Maximum Total Output Current	5A continuous
Maximum Switched Power	150W
Contact Isolation to Ground	1000VAC
Maximum Voltage Drop at Rated Current	0.5V
Expected Life	**No Load**: 10,000,000 cycles **Rated Load**: 100,000 cycles
Maximum 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

ANALOG I/O SPECIFICATIONS

Analog Inputs, Models R & A

Number of Channels	4
Input Ranges	0-20mA; 4-20mA
Nominal Resolution	12 Bits
Safe Input Voltage Range	-0.5V to 12V, protection up to 24V
Input Impedance (clamped @ -0.5VDC to 12VDC)	Current Mode: 100Ω
%AI Full Scale	**20mA**: 32,000 full scale
Maximum Over Current	25mA
Maximum Error at 25˚C (excluding Zero) Adjusting Filtering May Tighten Accuracy To	< 1.5% of full scale
Filtering	160 Hz Hash (noise) Filter, 1-128 Scan Digital Running Average Filter

Analog Outputs, Models R & A

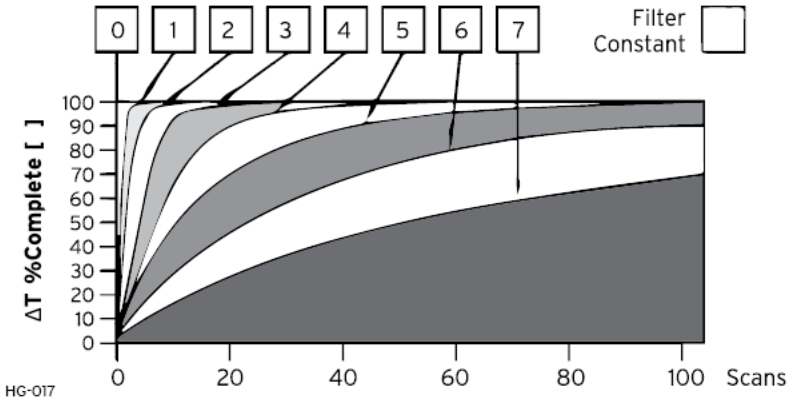
Number of Channels	2
Output Ranges	4-20mA
Nominal Resolution	12 Bits
Update Rate	Once per PLC scan
Maximum Error at 25°C (Excluding Zero)	< 1.5% of full scale
Maximum 20mA Load	500Ω
% AQ Full Scale	32,000
Protection	Protect against miswire up to 24VDC auto-recover

WIRING: INPUTS AND OUTPUTS

CAUTION: Connecting the incoming power in reverse will destroy the negative/positive switch circuitry.

Analog Inputs Information

Raw input values for channels 1-4 are found in the registers as Integer- type data with a range from 0 – 32000. Analog inputs may be filtered digitally with the Filter Constant found in the Cscape Hardware Configuration for Analog Inputs. Valid filter values are 0-7 and act according to the following chart:

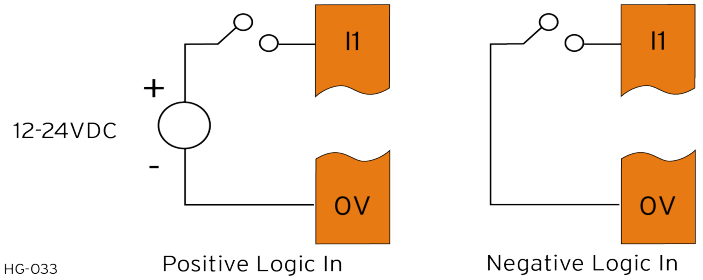


Data Values	
Input Mode:	Data Format, 12-bit INT:
0-20mA, 4-20mA	0-32000

Digital Inputs

Positive Logic vs. Negative Logic

The OCS can be wired for positive logic inputs or negative inputs.



Digital inputs may be wired in either a Positive Logic or Negative Logic fashion as shown. The setting in the Cscape Hardware Configuration for the Digital Inputs must match the wiring used in order for the correct input states to be registered.

Inserting and Removing Connectors

To Insert: Using a small screwdriver, firmly press on connector on one end and then the other until connector clicks into place. Ensure connector is firmly seated.

To Remove: Use a small screwdriver on each side of connector to gently pry up the connector.

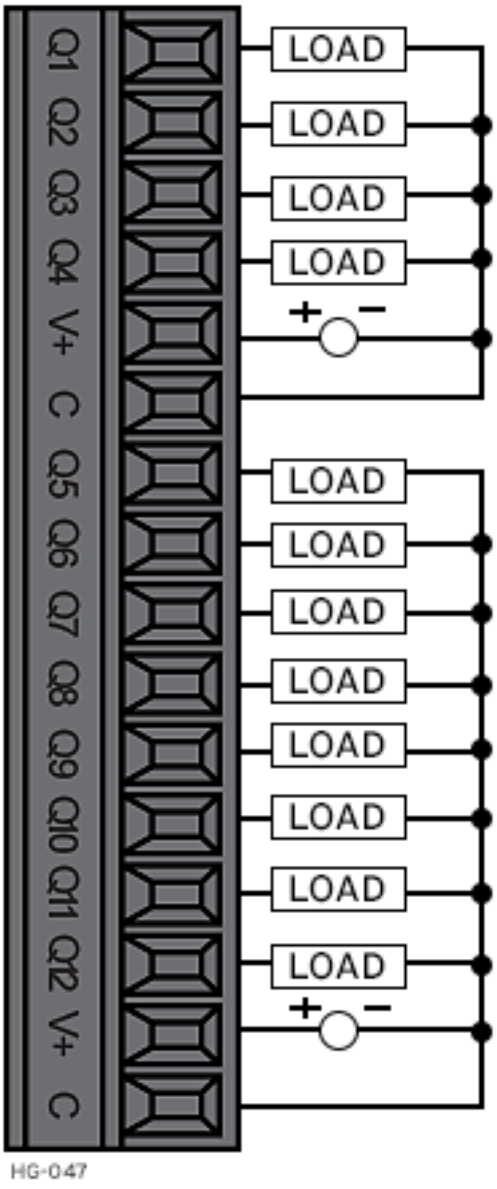
Built-In I/O: Models R & A

Fixed Address	I/O Function	Model R	Model A
%I	Digital Inputs	1-12	1-12
	Reserved	13-32	13-32
%Q	Digital Outputs	1-2	1-12
	Relay Outputs	3-8	--
	Reserved	9-16	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

J1 & J2 WIRING

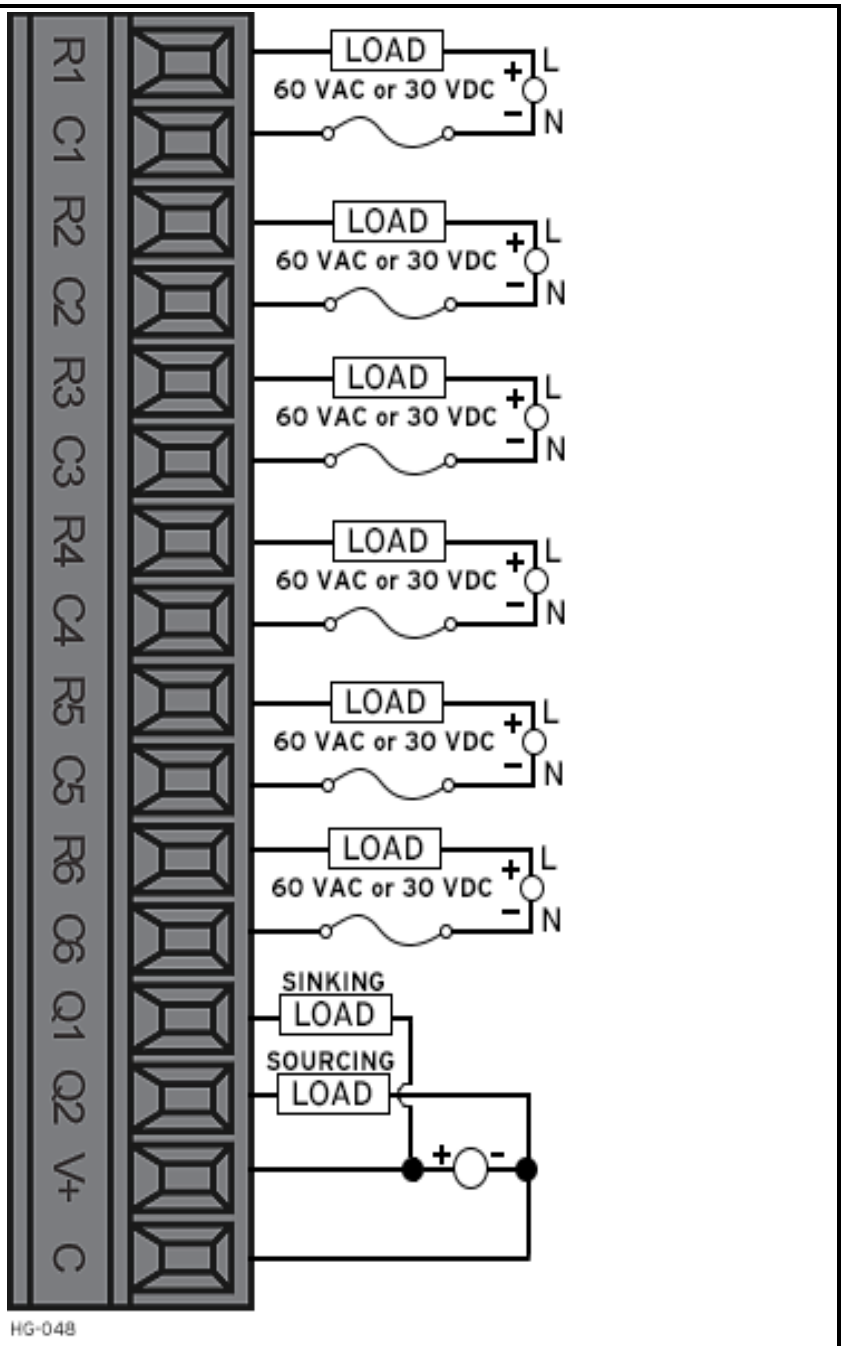
J1 Wiring: Model A - Digital Out

Position	Pin	Digital Model
1	Q1 (%Q1)	Dig. Out 1 (PWM)
2	Q2 (%Q2)	Dig. Out 2 (PWM)
3	Q3 (%Q3)	Dig. Out. 3
4	Q4 (%Q4)	Dig. Out. 4
5	V+	External V+
6	C	Common
7	Q5 (%Q5)	Dig Out. 5
8	Q6 (%Q6)	Dig Out. 6
9	Q7 (%Q7)	Dig Out 7
10	Q8 (%Q8)	Dig Out 8
11	Q9 (%Q9)	Dig Out 9
12	Q10 (%Q10)	Dig Out 10
13	Q11 (%Q11)	Dig Out 11
14	Q12 (%Q12)	Dig Out 12
15	V+	External V2+
16	C	Common

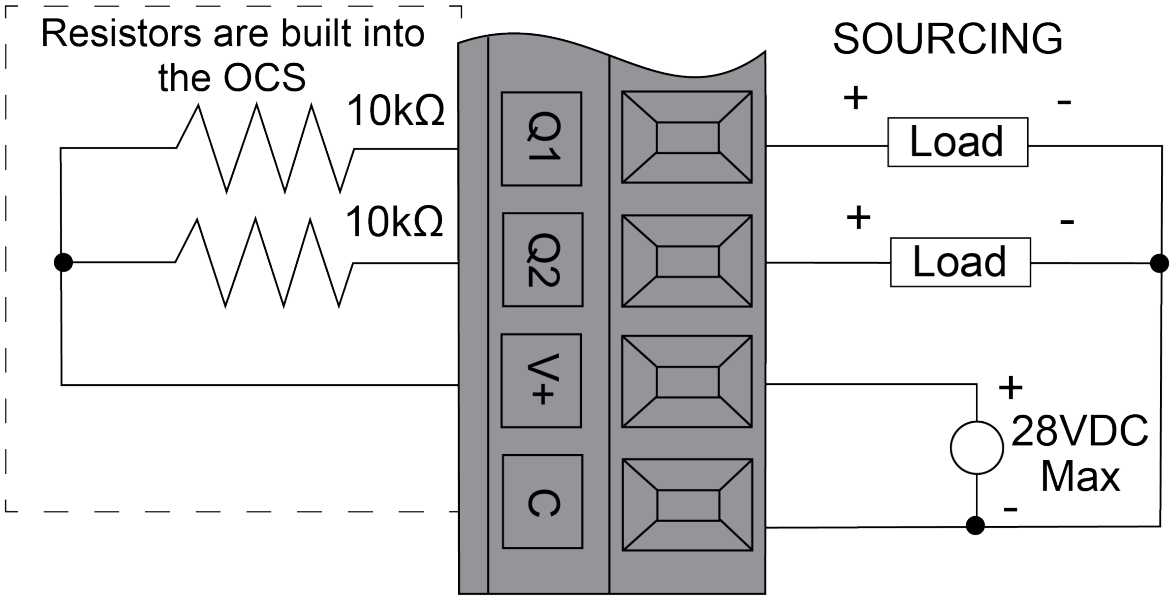


J1 Wiring: Model R - Relay/Digital Out

Position	Pin	Digital Model
1	R1 (%Q3)	Relay 1 N.O.
2	C1	Relay 1 C
3	R2 (%Q4)	Relay 2 N.O.
4	C2	Relay 2 C
5	R3 (%Q5)	Relay 3 N.O.
6	C3	Relay 3 C
7	R4 (%Q6)	Relay 4 N.O.
8	C4	Relay 4 C
9	R5 (%Q7)	Relay 5 N.O.
10	C5	Relay 5 C
11	R6 (%Q8)	Relay 6 N.O.
12	C6	Relay 6 C
13	Q1 (%Q1)	Output 1
14	Q2 (%Q2)	Output 2
15	V+	External V+
16	C	Common



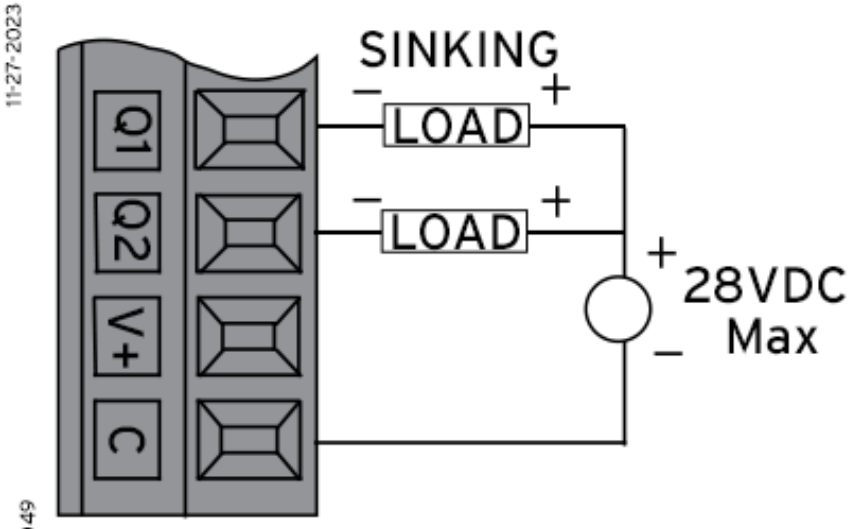
Sinking & Sourcing Wiring on Model R



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Sourcing: 2.4mA sourcing @ 24V

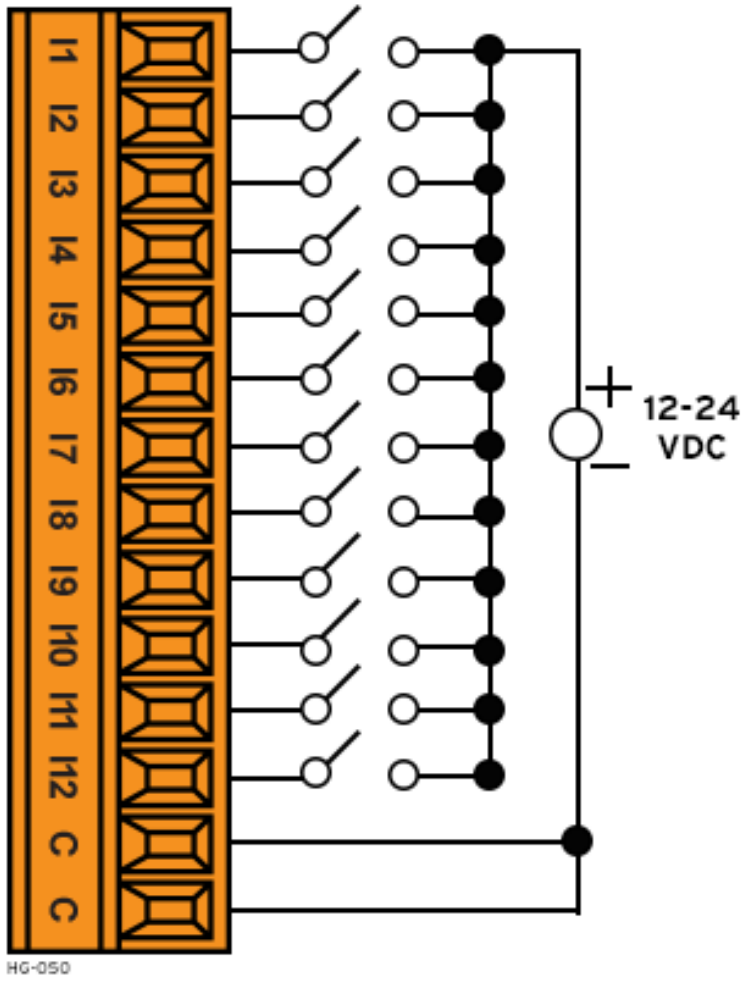
NOTE: Cscape offers a choice to flip the output by selecting "sourcing" as the output mode. This can come in handy when working with certain devices in this setup. It's important to note that this option doesn't alter the kind of output.



Sinking: Outputs can sink 500mA

J2 Wiring: Models R & A - Digital Input

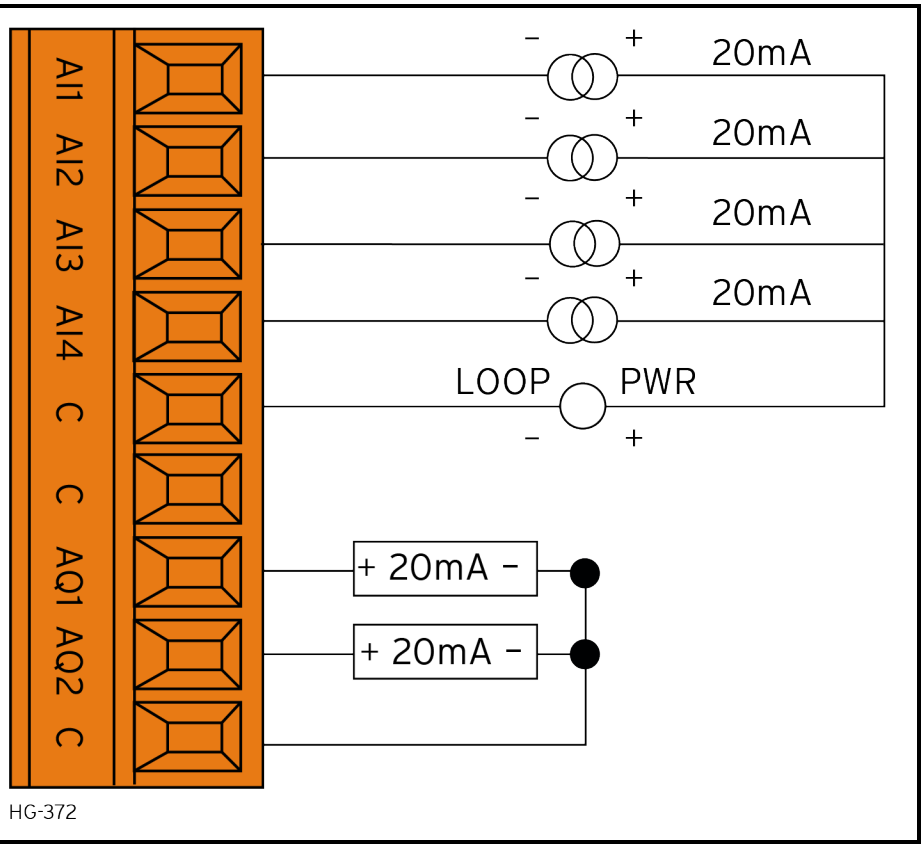
Position	Pin	Digital Model
1	I1 (%I1)	Dig. IN 1 (HSC)
2	I2 (%I2)	Dig. IN 2 (HSC)
3	I3 (%I3)	Dig. IN 3 (HSC)
4	I4 (%I4)	Dig. IN 4 (HSC)
5	I5 (%I5)	Dig. IN 5
6	I6 (%I6)	Dig. IN 6
7	I7 (%I7)	Dig. IN 7
8	I8 (%I8)	Dig. IN 8
9	I9 (%I9)	Dig. IN 9
10	I10 (%I10)	Dig. IN 10
11	I11 (%I11)	Dig. IN 11
12	I12 (%I12)	Dig. IN 12
13	C	Common
14	C	Common



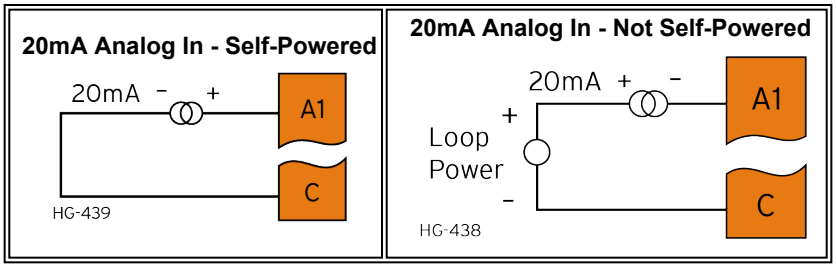
J3 WIRING

Models A & R: Analog I/O

PIN	Wire	Digital Model
1	AI1 (%AI1)	Analog IN 1
2	AI2 (%AI2)	Analog IN 2
3	AI3 (%AI3)	Analog IN 3
4	AI4 (%AI4)	Analog IN 4
5	C	Common
6	C	Common
7	AQ1 (%AQ1)	Analog OUT 1
8	AQ2 (%AQ2)	Analog OUT 2
9	C	Common



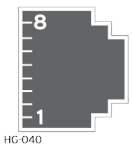
Universal Wiring Schematic



COMMUNICATIONS

Serial Communication

MJ1/2 Serial Ports



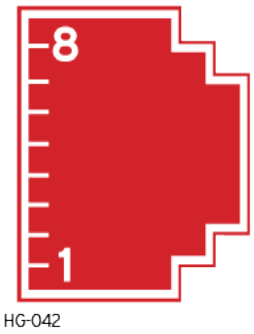
2 Serial Ports on 1 Modular jack (8p8c)

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 (MJ1)	OUT
7	RXD (MJ1)	IN
6	0V	COMMON
5	+5V @ 60mA	OUT
4	RTS (MJ1)	OUT
3	CTS (MJ1)	IN
2	RX-/TX-/- (MJ2)	IN/OUT
1	RX+/TX+/+ (MJ2)	IN/OUT

NOTE: Attach optional Ferrite Core (HE-FBD001) with a minimum of two turns of serial cable.

CAN Communications



Modular jack (8p8c)

CAN Pin Assignments	
PIN	**SIGNAL**
8	No Connection
7	Ground (PCB Ground)
6	[CAN] Shield (Earth Ground)
5	No Connection
4	No Connection
3	Ground (PCB Ground)
2	CAN Data Low
1	CAN Data High

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,, and SmartStixand OCS-I/O 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 X4 is at either end of the CAN network. Only the two devices on either end of the CAN network should be terminated.

Discreet Wiring

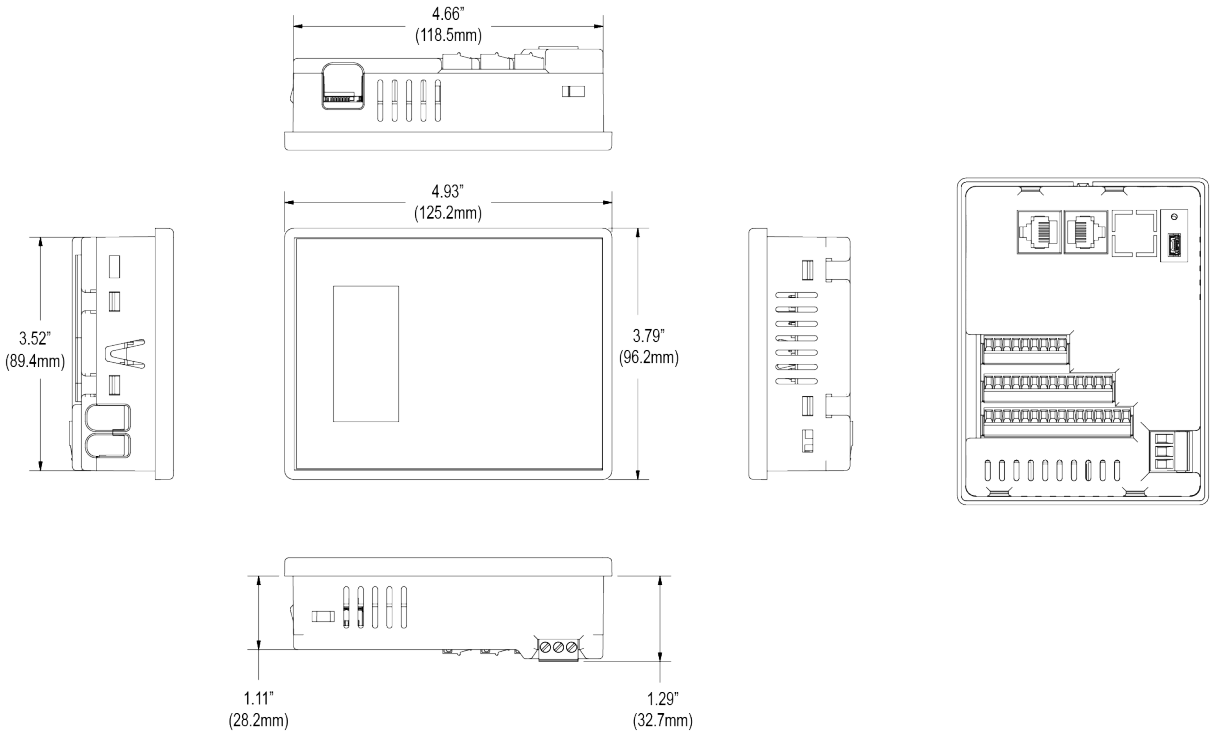
For CAN or serial connections the HE200MJ2TRM accessory will provide a modular connector to wiring block adapter for installations that require descreet wiring.



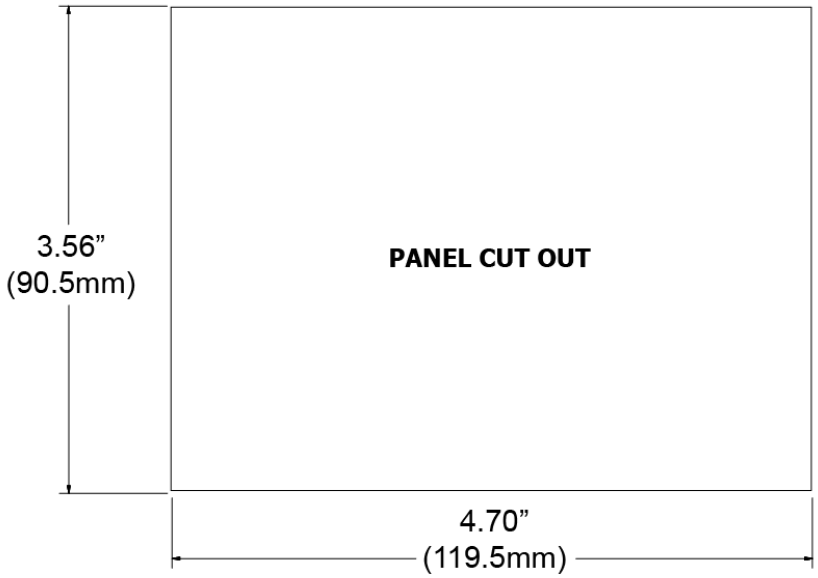
HG-043

DIMENSIONS & INSTALLATION

X2 Dimensions



HG-467



+0.5mm / -0mm Cutout Tolerance

Installation Procedure

- This equipment is panel mounted and is meant to be installed in an enclosure suitable for the environment, such that the back of the equipment is only accessible with the use of a tool.
- Requires a Class 2 power source.
- This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D; Class II, Division 2 Groups F and G; and Class III Hazardous Locations or Non-Hazardous Locations only.
- The X2 utilizes a clip installation method to ensure a robust and watertight seal to the enclosure. Follow the steps below for the proper installation and operation of the unit.

Use the following steps for the correct installation and operation of the unit.

1. 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.
2. Carefully cut the host panel per the diagram, creating a 91mm x 118.75mm +/-0.1mm 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.
3. Remove any burrs/sharp edges and ensure the panel is not warped in the cutting process.
4. Install and tighten the four mounting clips (provided in the box) until the gasket forms a tight seal.

   NOTE: For standard composite mounting clips (included with product), use a torque rating of 2-3 in-lbs (0.23-0.34Nm). For optional metal mounting clips, use a torque rating of 4-8 in-lbs (0.45-0.90 Nm).
5. Connect communications cables to the serial port, USB ports, and CAN port as required.

SAFETY & MAINTENANCE

Warnings

1. To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.
2. 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.
3. Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.
4. 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.
5. 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.
6. 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. **WARNING:** Battery may explode if mistreated. Do not recharge, disassemble, or dispose of in fire.
8. **WARNING:** EXPLOSION HAZARD - Batteries must only be changed in an area known to be non-hazardous.
9. **WARNING:** Do not disconnect while circuit is live unless area is known to be non-hazardous.

FCC Compliance

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

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

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 connections 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.
12. Use caution when connecting controllers to PCs via serial or USB (if present). PCs, especially laptops, may use “floating power supplies” that are ungrounded. This could cause a damaging voltage potential between the laptop and controller. Ensure the controller and laptop are grounded for maximum protection. If USB is present, consider using a USB isolator due to voltage potential differences as a preventative measure.

Technical Support

North America	Europe
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