XL4 Datasheet - Model 5

12 DC In, 12 DC Out, 2 - 14/16-bit, Analog In (mA/V/TC/mV/RTD), 2 - 12-bit Analog Out
MAN1147_23_EN-XL4-Mod5

Part Numbers

Global Part Number	HE-XC1E5
European Part Number	HEXT251C115

User Manual and Add-Ons

Find the documents via the Documentation Search.

Part #	Description
MAN0964	XL4 & XL4 Prime User Manual
MAN1142	Rechargeable Battery Manual
HE-BAT019	Rechargeable 3.6V Lithium Battery
HE-XCK	Programming Cables
HE-XDAC	2 channel Analog Output I/O option kit, selectable 0-10V, +10V, and 4-20mA
HE-XDAC107	4 channel Analog Output I/O option kit, selectable 0-10V, +10V, and 4-20mA
HE-XKIT	Blank I/O Board
HE200MJ2TRM	Adapter, RJ45 (8P8C) male to 8-position terminal strip
HE-FBD001	Ferrite core for filtering out electrical noise

Battery Maintenance

The XL4 has an advanced battery system that uses a rechargeable lithium battery. The battery powers the real time clock when power is removed, and it is needed for register data retention. Manual **MAN0964** via the Documentation Search for more details on battery replacement.

Table of Contents

TECHNICAL SPECIFICATIONS

General Specifications

Typical Power Backlight 100%	239mA @ 10V (2.39W); 103mA @24V (2.47W)
Power Backlight Off	18mA @ 24VDC (0.43W)
Power Backlight @ 50%	24mA @ 24VDC (0.58W)
Required Power (Steady State)	189mA @ 24VDC (4.54W); 426mA @ 10VDC (4.26W)
Required Power (Inrush)	2A for < 1ms @ 24VDC, DC switched
Heater Option*	250mA with heater* (24VDC)
Primary Power Range	10 - 30VDC; 10 - 24VDC (with heater*)
Max. Current	500mA, Class 2; 750mA, Class 2 (with heater*)
Relative Humidity	5 to 95%, Non-Condensing
Clock Accuracy	± 20 ppm maximum at 25°C (± 1 min/month)
Real Time Clock	Battery Backed. Rechargeable Lithium
Operating Temperature	-10°C to +60°C; -40°C to +60°C (with heater*)
Storage Temperature	-20°C to +60°C
Weight	12 oz/340g (without I/O)
Altitude	Up to 2000m
Pollution Degree	Degree 2 Rating
Certifications (UL/CE)	North America or Europe
Enclosure Type	1, 3R, 4, 4X, 12, 12K & 13

*Heater Option (Model # plus "-22")

Control and Logic

Control Language Support	Register-Based Advanced Ladder Logic; Variable-Based Advanced Ladder; IEC 61131-3 Languages
Logic Program Size	2MB, maximum
Scan Rate	0.04ms/kB
Digital Inputs	2048
Digital Outputs	2048
Analog Inputs	512
Analog Outputs	512
General Purpose Registers	50,000 (words) Retentive 16,384 (bits) Retentive 16,384 (bits) Non-retentive

User Interface

Display Type	3.5" TFT Color
Screen Brightness	640cd/m² (nits)
Resolution	QVGA (320 x 240)
Color	16-bit (65,535)
User-Program. Screens	1023 max pages; 1023 objects per page
Backlight	LED - 50,000 hour life
Brightness Control	0-100% via System Register %SR57
Number of Keys	5

Connectivity

Serial Ports	1 RS-232 and 1 RS-485 on singular Modular Jack
USB mini-B	USB 2.0 (480MHz) Programming & Data Access
USB A (500mA max)	USB 2.0 (480MHz) for USB flash drives (± 2TB)
CAN Port Isolated 1kV	Remote I/O, Peer-to-peer Comms, Cscape
CAN Protocols	CsCAN, CANopen, DeviceNet, J1939
Ethernet	10/100 Mb (Auto-MDX)
Ethernet Protocols	TCP/IP, Modbus TCP, FTP, SMTP, EGD, ICMP, ASCII
Remote I/O	OCS-I/O
Removable Memory	microSD, SDHC, SDXC in FAT32 format, support for 32GB max. Application Updates, Datalogging

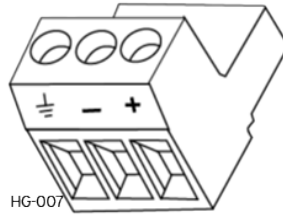# CONTROLLER OVERVIEW

Overview of OCS

1. Touchscreen
2. Function Keys
3. High Capacity microSD Slot
4. Configuration Switches
5. USB Mini-B Port
6. Wide-Range DC Power
7. CAN Port
8. Ethernet LAN Port
9. USB A Port
10. RS232/RS485 Serial Port

NOTE: See "Precautions" on page 21 about USB and grounding.

Power Wiring

NOTE: The Primary Power Range is 10VDC to 30VDC.

HG-007

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

DC Input/Frame

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

Power UP

1. **OPTION**: Attach ferrite core with a minimum of two turns of the DC+ and DC- signals from the DC supply that is powering the controllers. Horner part number HE-FBD001.

HG-006   07-14-2023

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

MODEL 5 SPECIFICATIONS

Digital DC Input

Inputs per Module	12 Including 4 Configurable HSC Inputs	
Commons per Module	1	
Input Voltage Range	12VDC/24VDC	
Absolute Maximum Voltage	30VDC	
Input Impedance	10kΩ	
Input Current	Positive Logic	Negative Logic
Upper Threshold	0.8mA	-1.6mA
Lower Threshold	0.3mA	-2.1mA
Maximum Upper Threshold	8VDC	
Minimum Lower Threshold	3VDC	
OFF to ON Response	1ms	
ON to OFF Response	1ms	
High Speed Counter Max Frequency	1MHz (Quadrature Frequency 500kHz)	

Digital DC Outputs

Outputs per Module	16 Including 2 Configurable PWM Outputs
Commons per Module	1
Output Type	Sourcing/10kΩ Pull-Down
Output Frequency	500kHz
Absolute Maximum Voltage	28VDC
Output Protection	Short Circuit
Maximum Output Current/Point	0.5A
Maximum Total Current	4A Continuous
Maximum Output Supply Voltage	30VDC
Minimum Output Supply Voltage	10VDC
Maximum Voltage Drop at Rated Current	0.25VDC
Maximum Inrush Current	650mA per Channel
Minimum Load	None
OFF to ON Response	1ms
ON to OFF Response	1ms
Output Characteristics	Current Sourcing (Positive Logic)
Stepper Frequency	≈ 10kHz (adder option HEXHSQ 500kHz)
Rise Time	50 - 115µs
Fall Time	8-20µs

Analog Inputs, High Resolution

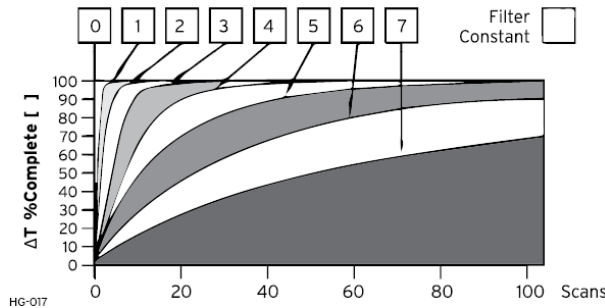|	
Number of Channels	2
Input Ranges (Selectable)	0-10VDC; 0-20mA; 4-20mA; 100mV; PT100 RTD (-200 to 850˚C); J, K, N, T, E, R, S, B Thermocouples
Safe Input Voltage Range	10VDC: -0.5V to +15V; 20mA: -0.5V to +6V; RTD/T/C: +/- 24VDC
Nominal Resolution	10V, 20mA, 100mV: 14 Bits; RTD, Thermocouple: 16 Bits
Input Impedance (Clamped @ -0.5VDC to 12VDC)	**Current Mode:** 100Ω , 35mA Max. Continuous **Voltage Mode:** 500kΩ, 25mA Max. Continuous
%AI Full Scale	**10V, 20mA, 100mV**: 32,000 counts full scale **RTD/TC**: 20 Counts / ˚C
Max. Over-Current	35mA
Open Thermocouple Detec Current	50nA
Thermocouple: B/R/S E T J K/N	**Temperature Range**: 32˚F to 2,912˚F (0˚C to 1,600˚C) -328˚F to 1,652˚F (-200˚C to 900˚C) -400˚F to 752˚F (-240˚C to 400˚C) -346˚F to 1,382˚F (-210˚C to 750˚C) -400˚F to 2,498˚F (-240˚C to 1, 370˚C)
Thermocouple Common Mode Range	+/- 10V
Converter Type	Delta Sigma
Max. Error at 25˚C **(*excluding zero)**	*4-20mA +/- 0.10% of full scale *0-20mA +/- 0.10% of full scale *0-10VDC +/- 0.10% of full scale RTD (PT100) +/- 1.0 C˚ of full scale 0-100mV +/- 0.05% of full scale
Max. Thermocouple Error (After Warm up of 1 Hour)	+/-0.2% (+/-0.3% below -100°C) of full scale
Conversion Speed, Both Channels Converted	**10V, 20mA, 100mV:** 30 Times/Second **RTD Thermocouple:** 7.5 Times/Second
Conversion Time per Channel	**10V, 20mA, 100mV**: 16.7 ms; **RTD, Thermocouple**: 66.7 ms
RTD Excitation Current	250µA

Analog Outputs

Number of Channels	2
Output Ranges	0-10VDC , 0-20mA
Nominal Resolution	12 Bits
Update Rate	Once per PLC scan
Max. Error at 25°C (Excluding Zero)	20mA 0.1% of full scale; 0 - 10V 0.1% of full scale
Minimum 10V Load	1kΩ
Maximum 20mA Load	500Ω
Analog Outputs; Output Point required	2
Addt'l Error for Temp. Other Than 25°C	20mA...... 0.000143%/ °C; 0 - 10V.... 0.000151%/ °C

WIRING: INPUTS AND OUTPUTS

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:
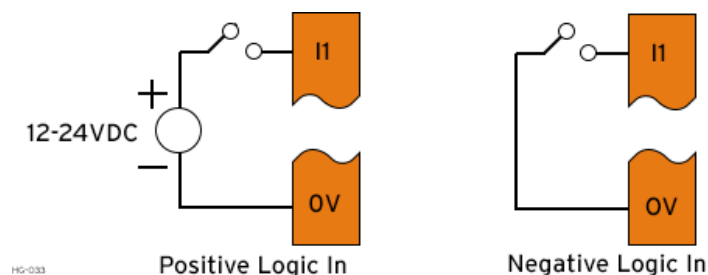

Data Values	
Input Mode:	Data Format, 12-bit INT:
0-20mA, 4-20mA	0-32000
0-10V	0-32000
T/C & RTD	Temperature in °C to 1 decimal place (xxx.y) **NOTE:** The value in the %AI is an integer. The value should be divided by 20 to get temperature in °C.

Digital Inputs

Positive Logic vs. Negative Logic

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

Positive Logic In   Negative Logic In

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. When used as a normal input and not for high speed functions, the state of the input is reflected in registers %I1 – %I12. Digital inputs may alternately be specified for use with High Speed Counter functions, also found in the Hardware Configuration for Digital Inputs.
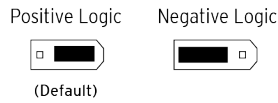
Jumper Settings for Model 5

Location of I/O jumpers (JP1 - JP4) and wiring connectors(J1 -J3) with back cover removed:
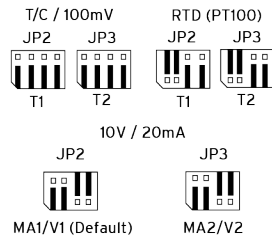
HG-076
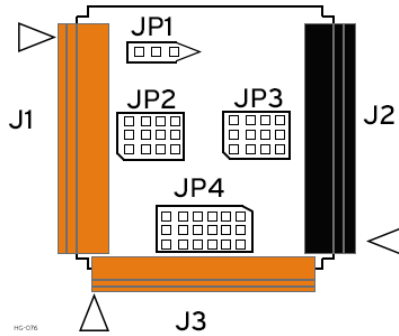
JP1 - Digital DC Inputs

JP1 Digital DC Inputs

Positive Logic   Negative Logic

(Default)

HG-077

JP2 & JP3 - Analog Input Settings

JP2 & J3
Analog Input Settings

T/C / 100mV   RTD (PT100)
JP2   JP3   JP2   JP3

T1   T2   T1   T2

10V / 20mA
JP2   JP3

MA1/V1 (Default)   MA2/V2

HG-078

JP4 - Analog Output Setting

JP4 - Analog Output Setting

CURRENT   VOLTAGE
(20mA)   (10V)

AQ2   AQ1   AQ2   AQ1
(Default)
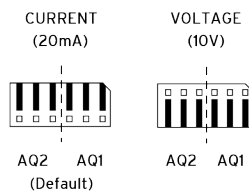
HG-079

Back Panel Torque Ratings

XLE/XLT: 3.0 - 4.0 in-lbs (0.34 - 0.45 N-m)

XL4/XL4 Prime: 3.0 - 4.0 in-lbs (0.34 - 0.45 N-m).

**EXL6/XL6 Prime**: 3.0 - 4.0 in-lbs (0.34 - 0.45 N-m)

EXLW/ XLW Prime: 3.0 - 3.5 in-lbs (0.34 - 0.40 N-m)

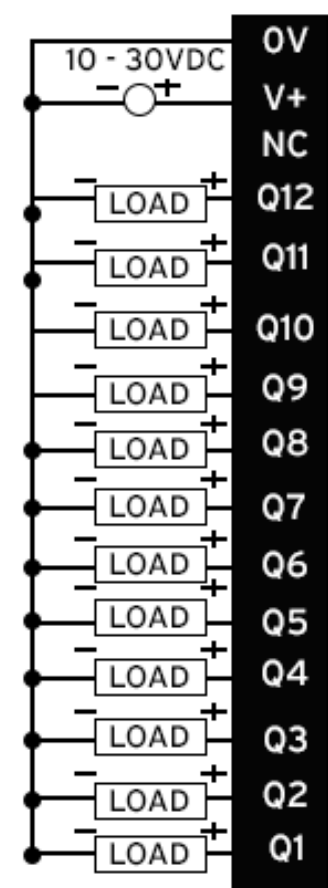**XL7/XL7 Prime**: 3.0 - 3.5 in-lbs (0.34 - 0.40 N-m)

J1 (Orange) Wiring - Positive Logic - Digital Inputs

Pin	Digital Model
I1 (%I1)	Digital In 1
I2 (%I2)	Digital In 2
I3 (%I3)	Digital In 3
I4 (%I4)	Digital In 4
I5 (%I5)	Digital In 5
I6 (%I6)	Digital In 6
I7 (%I7)	Digital In 7
I8 (%I8)	Digital In 8
H1 (%I9)	HSC1/Digital In 9
H2 (%I10)	HSC2/Digital In 10
H3 (%I11)	HSC3/Digital In 11
H4 (%I12)	HSC4/Digital In 12
NC	No Connect
NC	No Connect
0V	Common

HG-083
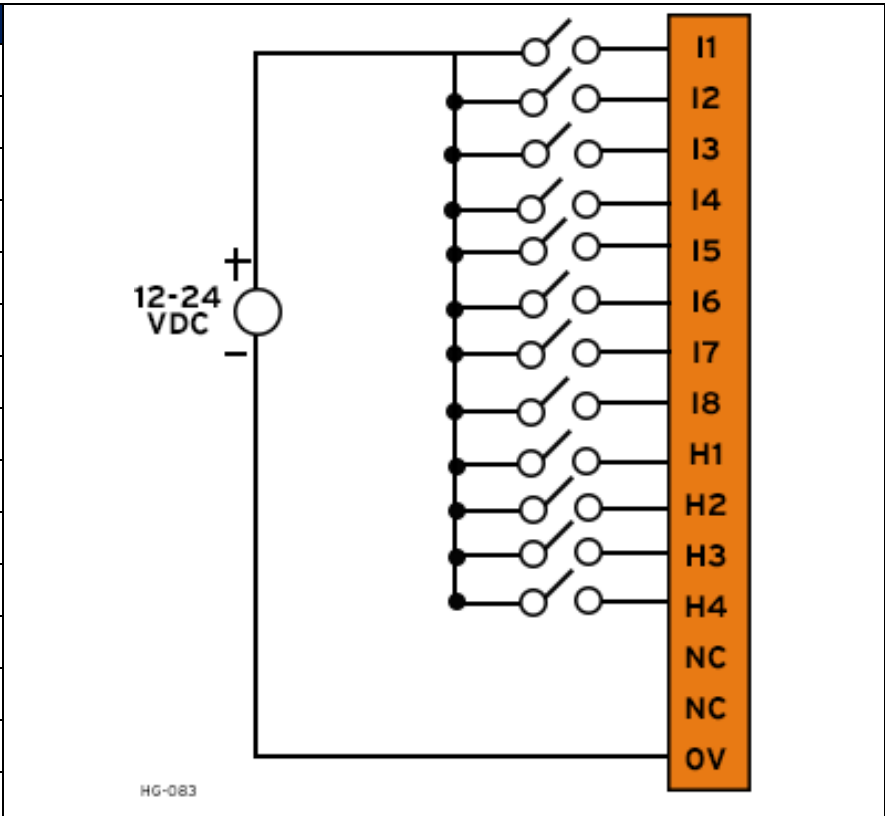
J2 (Black) Wiring - Positive Logic - Digital Outputs

Pin	Digital Model
0V	Common
V+	Output Power
NC	No Connect
Q12 (%Q12)	Digital Out 12
Q11 (%Q11)	Digital Out 11
Q10 (%Q10)	Digital Out 10
Q9 (%Q9)	Digital Out 9
Q8 (%Q8)	Digital Out 8
Q7 (%Q7)	Digital Out 7
Q6 (%Q6)	Digital Out 6
Q5 (%Q5)	Digital Out 5
Q4 (%Q4)	Digital Out 4
Q3 (%Q3)	Digital Out 3
Q2 (%Q2)	Digital Out/PWM2
Q1 (%Q1)	Digital Out/PWM1

HG-072

J3 (Orange) Wiring - TC & RTD

Pin	Digital Model
T1+ (%AI1)	TC (1+) or RTD (1+) or 100mV (1+)
T1- (%AI1)	TC (1-) or RTD (1-) or 100mV (1-)
T2+ (%AI2)	TC (2+) or RTD (2+) or 100mV (2+)
T2- (%AI2)	TC (2-) or RTD (2-) or 100mV (2-)
AQ1 (%AQ9)	10 V or 20mA OUT (1)
AQ2 (%AQ10)	10 V or 20mA OUT (2)
0V	Common
MA1 (%AI1)	0-20mA IN (1)
V1 (%AI1)	0-10V IN (1)
0V	Common
MA 2(%AI2)	0-20mA IN (2)
V2 (%AI2)	0-10V IN (2)
0V	Common

0-10 V Analog In

mV In

20mA Analog In - Not Self-Powered

20mA Analog In - Self-Powered

Thermocouple In

RTD In

4 - 20mA Analog Out

0-10 V Analog Out
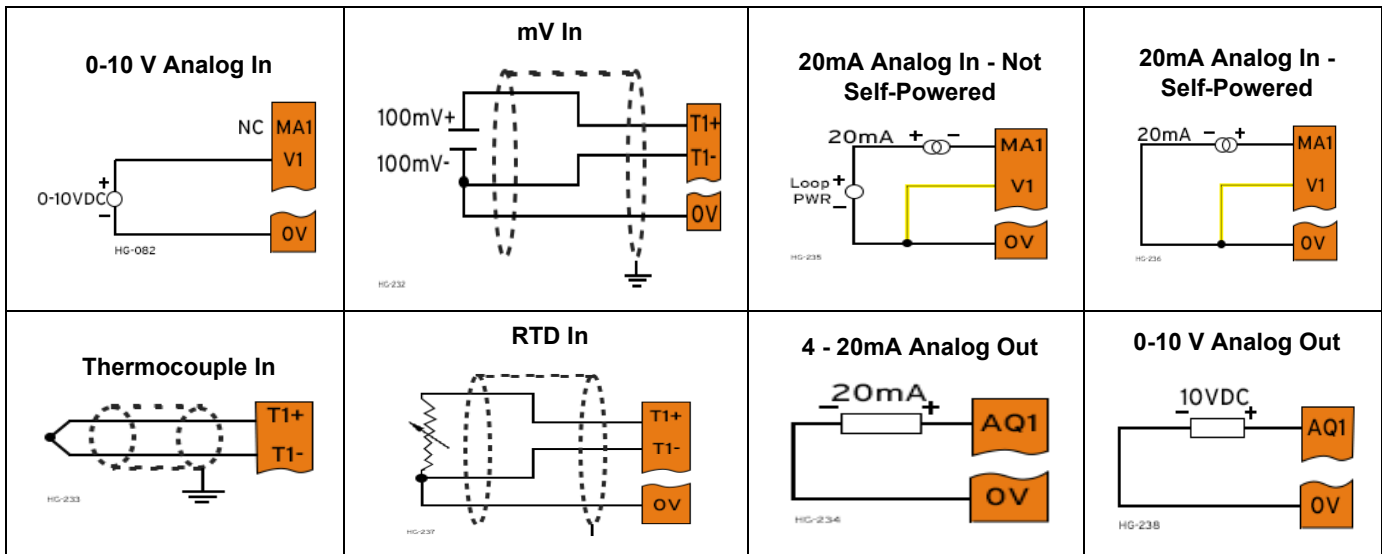
Wiring Details

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).

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 .

Digital and Analog I/O Function Registers	
Digital Inputs	%I1-12
Reserved	%I13-31
ESCP Alarm	%I32
Digital Outputs	%Q1-12
Reserved	%Q13-24
Analog Inputs	%AI1-2
Reserved	%AI3-12
Analog Outputs	%AQ9-10
Reserved	%AQ1-8

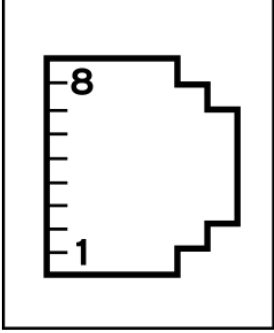## Analog Input Transient-Voltage-Suppression Diode Failure

A common cause of Analog Input Transient-Voltage-Suppression Diode Failure on Analog Inputs Model 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 Transient-Voltage-Suppression Diode. 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 analog input.
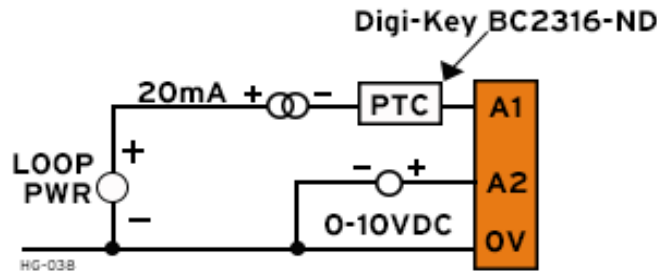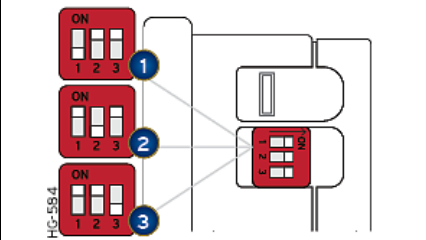
COMMUNICATIONS

Serial Communication

MJ1/2 Serial Ports

<table>
<tr><td rowspan="2"></td><td rowspan="2" colspan="2">2 Serial Ports on 1 Module Jack (8position)

MJ1: RS-232 w/Full Handshaking

MJ2: RS-485 Half-Duplex</td><td colspan="2">MJ1 Pins</td><td colspan="2">MJ2 Pins</td></tr>
<tr><td>PIN</td><td>SIGNAL</td><td>DIRECTION</td><td>SIGNAL</td><td>DIRECTION</td></tr>
</table>

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

HG-008
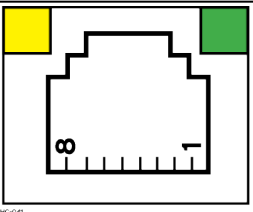
NOTE: Attach optional ferrite core with a minimum of two turns of serial cable.

DIP Switches

HG-584

DIP Switches			
PIN	**NAME**	**FUNCTION**	**DEFAULT**
1	RS-485 Termination	ON = Terminated	OFF
2	Spare	Always OFF	OFF
3	Factory Use	Always OFF	OFF

The DIP switches are used to provide a built-in termination to the MJ2 port 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.

Ethernet

HG-041

Green LED indicates link - when illuminated, data communication is available.

Yellow LED indicates activity - when flashing, data is in transmission.
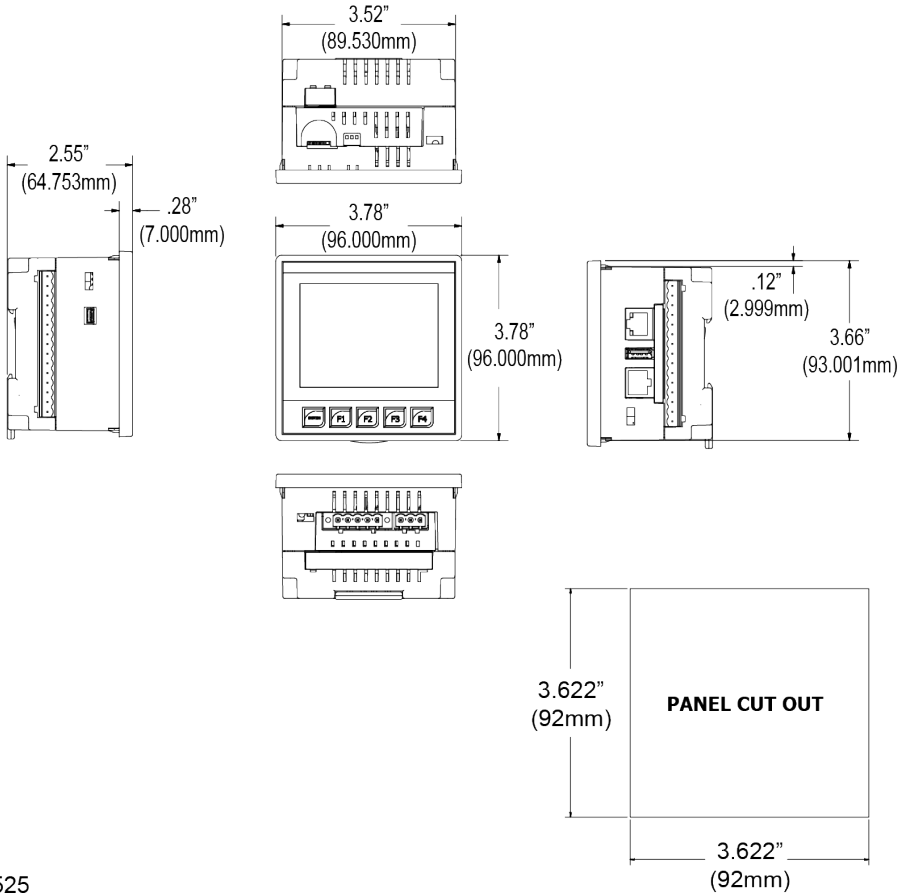
CAN Communications
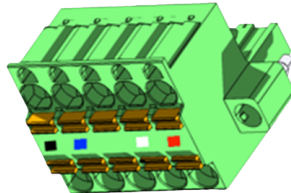
HG-001

CAN Network & Power Port Pin Assignment		
Pin	Signal	Signal Description
1	V-	CAN Ground – Black
2	CN_L	CAN Data Low – Blue
3	SHLD	Shield Ground – None
4	CN_H	CAN Data High – White
5	V+ (NC)	No Connect – Red

- **Solid/Stranded Wire**: 12-24 AWG (2.5-0.2mm²).
- **Strip Length**: 0.28" (7mm).
- Locking spring-clamp, two-terminators per conductor.
- **Torque, Terminal Hold-Down Screws**: 4.5 – 7 in•lbs (0.50 – 0.78 N•m).
- V+ pin is not internally connected, the SHLD pin is connected to Earth ground via a 1MΩ resistor and 10 nF capacitor.

DIMENSIONS & INSTALLATION

XL4 & XL4 Prime Dimensions

3.52"
(89.530mm)

2.55"
(64.753mm)

.28"
(7.000mm)

3.78"
(96.000mm)

3.78"
(96.000mm)

.12"
(2.999mm)

3.66"
(93.001mm)

3.622"
(92mm)

PANEL CUT OUT

3.622"
(92mm)

HG-525

* ± 0.1mm cutout tolerance

Installation Information

- The XL4/XL4 Prime 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.
- This equipment is suitable for Class I, Division 2, Groups A, B, C and D or non-hazardous locations only.
- Digital outputs shall be supplied from the same source as the operator control station.
- Jumpers on connector JP1 shall not be removed or replaced while the circuit is live unless the area is known to be free of ignitable concentrations of flammable gases or vapors.
- The USB ports are for operational maintenance only. Do not leave permanently connected unless area is known to be non-hazardous.

Installation Procedure

1. Carefully locate an appropriate place to mount the OCS 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 92mm x 92mm ±0.1mm opening into which theOCS may 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 and or sharp edges and ensure the panel is not warped in the cutting process.
4. Remove all Removable Terminals from the OCS. Insert the OCSthrough the panel cutout (from the front). The gasket must be between the host panel and the OCS.
5. Install and tighten the four mounting clips (provided in the box) until the gasket forms a tight seal.

    NOTE: Max torque is 0.8 to 1.13N•m, 7 to 10 in•lbs.

6. Reinstall the I/O Removable Terminal Blocks. Connect communications cables to the serial port, USB ports, Ethernet port, 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 are is know 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. 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. Consider using a USB isolator due to voltage potential differences as a preventative measure.

Technical Support

North America	Europe
1 (317) 916-4274 1 (877) 665-5666 www.hornerautomation.com APGUSATechSupport@heapg.com	+353 (21) 4321-266 www.hornerautomation.eu technical.support@horner-apg.com