XL6/XL6e OCS Models
HE-XL105 / HEXT350C115
HE-XL1E5 / HEXT351C115
12 Digital DC Inputs / 12 Digital DC Outputs
### 2 Analog Inputs (High Resolution) / 2 Analog Outputs

1   Specifications

Specifications				
Digital DC Inputs			**Digital DC Outputs**	
Inputs per Module	12 including 4 configurable HSC inputs		Outputs per Module	12 including 2 configurable PWM outputs
Commons per Module	1		Commons per Module	1
Input Voltage Range	12 VDC / 24 VDC		Output Type	Sourcing / 10 K Pull-Down
Absolute Max. Voltage	35 VDC Max.		Absolute Max. Voltage	28 VDC Max.
Input Impedance	10 kΩ		Output Protection	Short Circuit
Input Current	Positive Logic	Negative Logic	Max. Output Current per point	0.5 A
Upper Threshold	0.8 mA	-1.6 mA	Max. Total Current	4 A Continuous
Lower Threshold	0.3 mA	-2.1 mA	Max. Output Supply Voltage	30 VDC
Max Upper Threshold	8 VDC		Minimum Output Supply Voltage	10 VDC
Min Lower Threshold	3 VDC		Max. Voltage Drop at Rated Current	0.25 VDC
OFF to ON Response	1 ms		Max. Inrush Current	650 mA per channel
ON to OFF Response	1 ms		Min. Load	None
HSC Max. Switching Rate	10 kHz Totalizer/Pulse, Edges 5 kHz Frequency/Pulse, Width 2.5 kHz Quadrature		OFF to ON Response	1 ms
			ON to OFF Response	1 ms
			Output Characteristics	Current Sourcing (Positive Logic)
Analog Inputs, High Resolution				
Number of Channels	2		Thermocouple	Temperature Range
Input Ranges (Selectable)	0 - 10 VDC 0 – 20 mA 4 – 20 mA 100mV PT100 RTD, and J, K, N, T, E, R, S, B Thermocouples		B / R / S	2912°F to 32.0°F (1600°C to 0°C)
			E	1652°F to -328°F (900°C to -200°C)
			T	752.0°F to -400.0°F (400°C to -240°C)
Safe input voltage range	10 VDC: -0.5 V to +15 V 20 mA: -0.5 V to +6 V RTD / T/C: ±24 VDC		J	1382.0°F to -346.0°F (750°C to -210°C)
			K / N	2498.0°F to -400°F (1370°C to -240°C)
			Thermocouple Common Mode Range	±10V
Nominal Resolution	10V, 20mA, 100mV: 14 Bits RTD, Thermocouple: 16 Bits		Converter Type	Delta Sigma
Input Impedance (Clamped @ -0.5 VDC to 12 VDC)	Current Mode: 100 Ω, 35mA Max. Continuous Voltage Mode: 500 kΩ, 35mA Max. Continuous		Max. Error at 25°C (*excluding zero)	*4-20 mA ±0.10%* *0-20 mA ±0.10%* *0-10 VDC ±0.10%* RTD (PT100) ±1.0 ℃ 0-100 mV ±0.05%
			Max Thermocouple Error (After Warm Up Time of One Hour)	±0.2% (±0.3% below -100°C)
%AI full scale	10 V, 20 mA, 100 mV: 32,000 counts full scale. RTD / T/C: 20 counts / ℃		Conversion Speed, Both Channels Converted	10V, 20mA, 100mV: 30 Times/Second RTD, Thermocouple: 7.5 Times/Second
Max. Over-Current	35 mA		Conversion Time per Channel	10V, 20mA, 100mV: 16.7mS RTD, Thermocouple: 66.7mS
Open Thermocouple Detect Current	50 nA		RTD Excitation Current	250 µA
Analog Outputs			**General Specifications**	
Number of Channels	2		Required Power (Steady State)	500 mA @ 24 VDC
Output Ranges	0-10 VDC, 0-20 mA		Required Power (Inrush)	30 A for 1 ms @ 24 VDC – DC Switched 2.5 A for 4 ms @ 24 VDC - AC Switched
Nominal Resolution	12 Bits		Primary Power Range	10 - 30 VDC
Update rate	Once per PLC scan		Operating Temperature	-10° to 60° Celsius
Minimum 10 V load	1 kΩ		Storage Temperature	14 to 140°F (-10 to 60℃)
Maximum 20 mA load	500 Ω		Relative Humidity	5 to 95% Non-condensing
Analog Outputs; Output Points Required	2		Filtering	15Hz hash (noise) filter 1-128 scan digital running average filter
Maximum Error at 25°C (excluding zero)	0.1%		Terminal Type	Screw Type,5 mm Removable
			Weight	12.5 oz. (354.36)
Additional error for temperatures other than 25°C	0.01% / °C		CE	See Compliance Table at http://www.heapg.com/Pages/TechSupport/ProductCert.html
			UL	
			Clock Accuracy	+/- 35 ppm maximum at 25° C (+/- 1.53 Minutes per Month)
Connectivity				
Serial Ports	2 Serial Ports – RS232 & RS485			
Ethernet	10/100-Mbps (XL6e models only)			
USB	USB Networking Port for communication with PCs and programming Port			
Removable Media	Removable Media for upto 2 GB of storage for programs, data logging or screen capture			
Smartstix	Remote IO modules communicating on CAN			
Note: Highest usable frequency for PWM output is 65 KHz				

2   Installation

1. Prior to mounting, observe requirements for the panel layout design and spacing/clearances in the OCS XL Series Manual (MAN0883).

2. Cut the host panel.

3. Insert the OCS through the panel cutout (from the front). The gasket material needs to be between the host panel and the OCS.

> **Caution: Do not force the OCS into the panel cutout. An incorrectly sized panel cutout can damage the touch screen.**

4. Install and tighten the mounting clips (provided with the OCS) until the gasket material forms a tight seal.

5. Connect cables as needed such as communications, programming, power and CsCAN cables to the ports using the provided connectors.
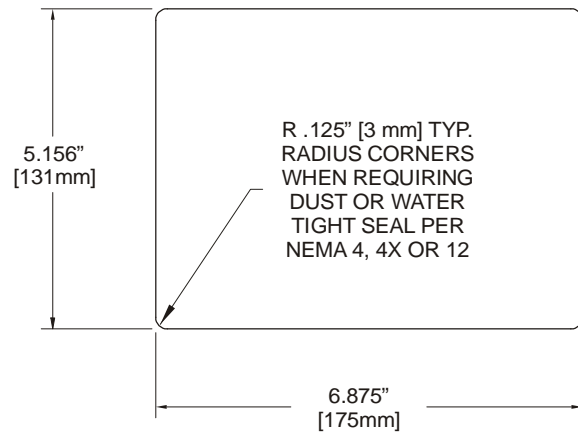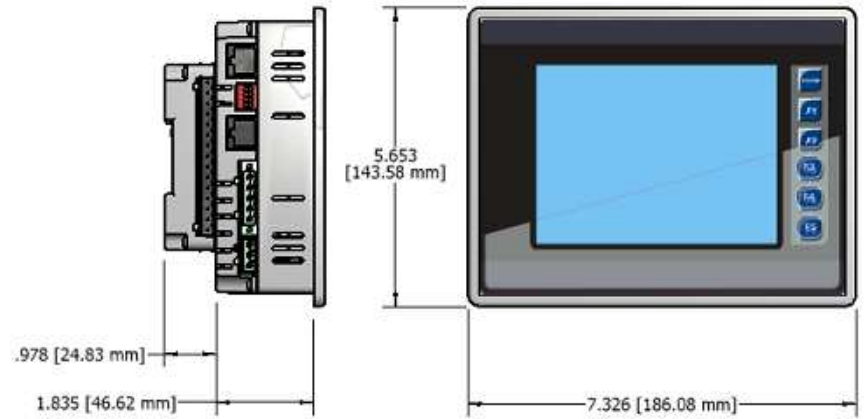
6. Begin configuration procedures.

001XLQX007
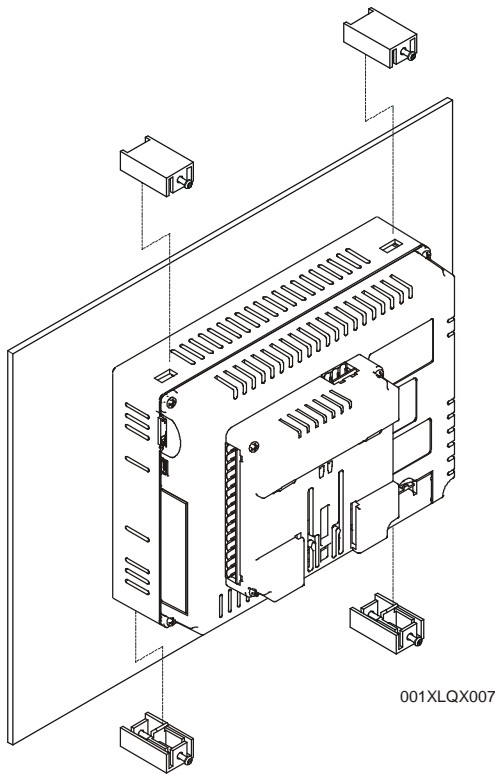
3   Panel Cut-Out and Dimensions

Note: Max. panel thickness: 5 mm.

Refer to the XL6 User Manual (MAN0883) for panel box information and a handy checklist of requirements.

> **Note:** The tolerance to meet NEMA standards is ± 0.005" (0.1 mm).

5.653 [143.58 mm]

.978 [24.83 mm]

1.835 [46.62 mm]

7.326 [186.08 mm]

5.156" [131mm]

R .125" [3 mm] TYP. RADIUS CORNERS WHEN REQUIRING DUST OR WATER TIGHT SEAL PER NEMA 4, 4X OR 12
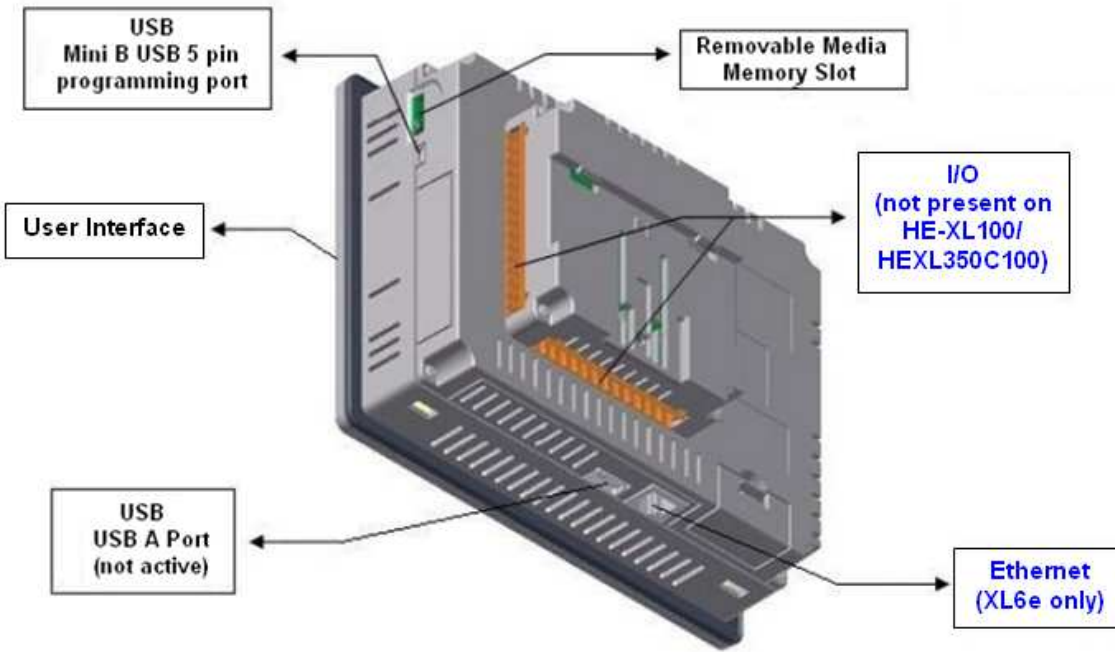
6.875" [175mm]

001OCS003-R1

HE-XL105/HE-XL1E5

4   Ports and Connectors

To Remove I/O Cover:
Unscrew 4 screws located on the cover.
Remove cover.

CAUTION: Do not over tighten screws when replacing the back cover.

I/O Jumpers:
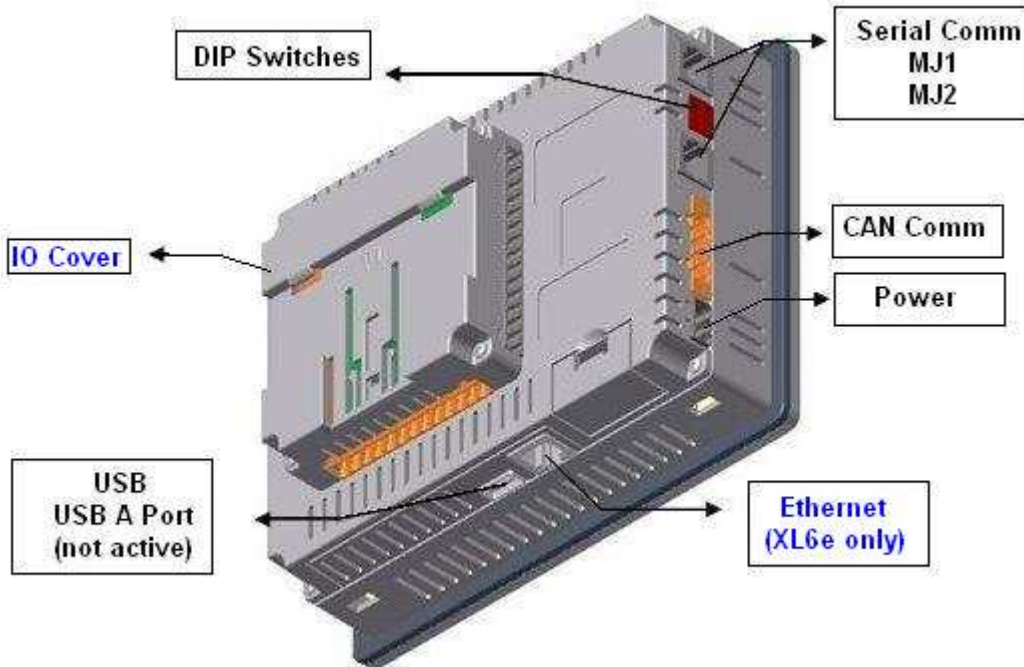I/O Jumpers (**JP**) are located internally. To access, remove I/O cover of unit.

Wiring Connectors (J1 / J2 / J3) and I/O Jumpers (JP1 / JP2 / JP3 / JP4) are described in the *Wiring and Jumpers* section of this document.

Memory Slot:
Uses **Removable Memory** for data logging, screen captures, program loading and recipes.
Horner Part No.: HE-MC1

Serial Communications:
MJ1: (RS-232 / RS-485) Used for Cscape programming and Application-Defined Communications.

**MJ2:** (RS-232 / RS-485) Used for Application-Defined Communications.

Ethernet: Used for Cscape programming and Application-Defined Communications.

USB
Mini B USB 5 pin
programming port

Removable Media
Memory Slot

I/O
(not present on
HE-XL100/
HEXL350C100)

User Interface

USB
USB A Port
(not active)

Ethernet
(XL6e only)

DIP Switches

Serial Comm
MJ1
MJ2

IO Cover

CAN Comm

Power

USB
USB A Port
(not active)

Ethernet
(XL6e only)

4.1 Serial Communications

MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.

MJ2: (RS-232 / RS-485) Use for Application-Defined Communications.

MJ2 Pinouts in Half and Full Duplex Modes
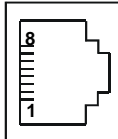
Pin	MJ1 Pins		MJ2 Pins	
	Signal	Direction	Signal	Direction
8	TXD	OUT	TXD	OUT
7	RXD	IN	RXD	IN
6	0 V	Ground	0 V	Ground
5*	+5 60mA	OUT	+5 60mA	OUT
4	RTS	OUT	TX-	OUT
3	CTS	IN	TX+	OUT
2	RX- / TX-	IN / OUT	RX-	IN
1	RX+ / TX+	IN / OUT	RX+	IN
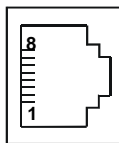
Pin	MJ2 Pins	
	Signal	Direction
8	TXD	OUT
7	RXD	IN
6	0 V	Ground
5*	+5 60mA	OUT
4	TX-	OUT
3	TX+	OUT
2	TX-/RX-	IN/OUT
1	TX+/RX+	IN/OUT

* +5V 60mA Max

MJ2 Half Duplex Mode

Table - Ports and Functions		
Functions	Port 1 (MJ1)	Port 2 (MJ2)
RS-232	✔	✔
Hardware Handshaking	✔	X
Programming	✔	X
Ladder function controlled	✔	✔
Serial Downloadable Protocols	✔	✔
RS 485 Full duplex	✔	✔
RS485 Half duplex	✔	X
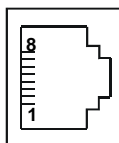
Pin	MJ2 Pins	
	Signal	Direction
8	TXD	OUT
7	RXD	IN
6	0 V	Ground
5*	+5 60mA	OUT
4	TX-	OUT
3	TX+	OUT
2	RX-	IN
1	RX+	IN

* +5V 60mA Max

MJ2 Full Duplex Mode

4.2 External DIP Switch Settings

As seen when looking at the side of the XL6 unit :

The DIP Switches are used for termination of the RS-485 ports. The XL6 is shipped un-terminated.

To terminate, select one of the DIP Switches and configure it based upon the option that is desired.

MJ1

MJ2

On / Off
1 2 3 4
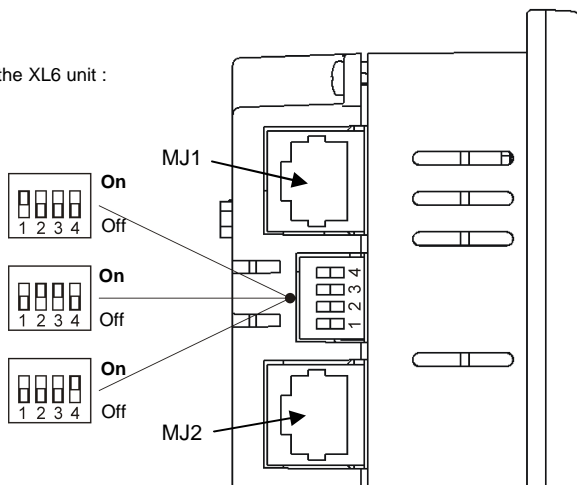
SW1 -   ON enables **MJ2** RS485 port termination (121 Ohms).
        OFF disables **MJ2** RS485 port termination.

SW2 & SW3 - ON places **MJ2** RS485 port in half-duplex mode.
             OFF places **MJ2** RS485 port in full-duplex mode.

SW4 -   ON enables **MJ1** RS485 port termination (121 Ohms).
        OFF disables **MJ1** RS485 port termination.

4.3   CAN Network Port and Wiring

001CAN005
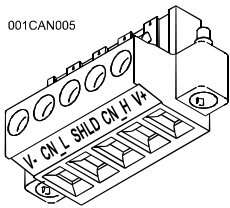
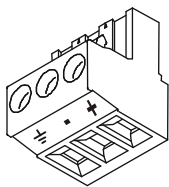**CAN Connector**

Use the CAN Connector when using CsCAN network.

Torque rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)

NET1 Port Pin Assignments			
Pin	Signal	Signal Description	Direction
1	V-	CAN Ground	–
2	CN_L	CAN Data Low	In/Out
3	SHLD	Shield Ground	–
4	CN_H	CAN Data High	In/Out
5	NC	No Connect	–

4.4   Ethernet Port

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

4.5   Power Port and Wiring

Power Connector

Power Up:

Connect to Earth Ground.
Apply 10 - 30 VDC.
Screen lights up.

Torque rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)

| Primary Power Port Pins		
Pin	Signal	Description
1	Ground	Frame Ground
2	V-	Input Power Supply Ground
3	V+	Input Power Supply Voltage

5   Wiring and Jumpers

- Wire according to the type of inputs / outputs used and select the appropriate jumper option.

- Use Copper Conductors in Field Wiring Only, 60/75° C

Wiring Specifications

♦For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG (0.8 mm^2) or larger.

♦For shielded Analog I/O wiring, use the following wire type or equivalent: Belden 8441, 18 AWG (0.8 mm^2) or larger.

♦For CAN wiring, use the following wire type or equivalent: Belden 3084, 24 AWG (0.2 mm^2) or larger.

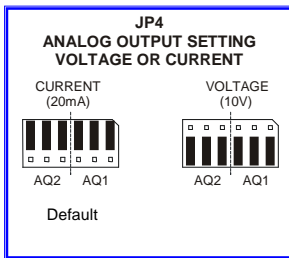Location of I/O jumpers (JP) and wiring connectors (J1 – J3).

JP1
JP2   JP3
J1   J2
JP4
J3   001XLE030
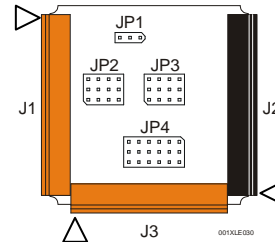
Positive Logic vs. Negative Logic Wiring
The XL6 can be wired for Positive Logic inputs or Negative Logic inputs.

12-24VDC

I1
0V

I1
0V
001XLE036

Positive Logic In   Negative Logic In
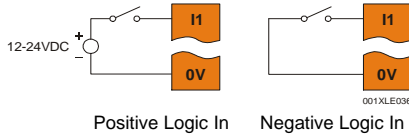
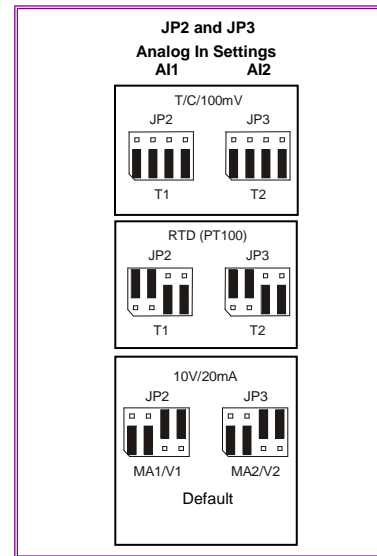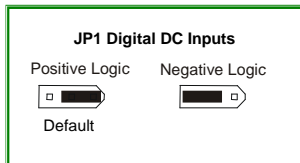### 5.1   I/O Jumpers Settings (JP1 – JP4)

Note: The Cscape Module Setup configuration must match the selected I/O (JP) jumper settings.

JP4
ANALOG OUTPUT SETTING
VOLTAGE OR CURRENT

CURRENT
(20mA)

VOLTAGE
(10V)

AQ2   AQ1   AQ2   AQ1

Default

Note: When using **JP4** (output) *or* **JP2 / JP3** (inputs), each channel can be independently configured. For example, JP2 can be configured for 10 V and JP3 can be configured as an RTD.

JP1 Digital DC Inputs

Positive Logic   Negative Logic

Default

JP2 and JP3
Analog In Settings
AI1   AI2

T/C/100mV
JP2   JP3

T1   T2

RTD (PT100)
JP2   JP3

T1   T2

10V/20mA
JP2   JP3

MA1/V1   MA2/V2

Default

5.2   Wiring Examples

Note: The wiring examples show **Positive Logic** input wiring.

J1 Orange	Name
I1	IN1
I2	IN2
I3	IN3
I4	IN4
I5	IN5
I6	IN6
I7	IN7
I8	IN8
H1	HSC1 / IN9
H2	HSC2 / IN10
H3	HSC3 / IN11
H4	HSC4 / IN12
NC	No Connect
NC	No Connect
0V	Ground

J1 Orange
Positive Logic
Digital In

001XLE007

J2 Black	Name
0V	Ground
V+*	V+*
NC	No Connect
Q12	OUT12
Q11	OUT11
Q10	OUT10
Q9	OUT9
Q8	OUT8
Q7	OUT7
Q6	OUT6
Q5	OUT5
Q4	OUT4
Q3	OUT3
Q2	OUT2 / PWM2
Q1	OUT1 / PWM1
V+* Supply for Sourcing Outputs	

J2 Black
Positive Logic
Digital Outputs

001XLE008

J3 Orange
Analog In / Analog Out

Note: A total of 2 Analog Inputs can be used (T/C, RTD, mV, mA, and V).

J3 Orange	Name
T1+	T/C / RTD IN1+ / 100 mV+
T1-	T/C / RTD IN1- / 100 mV-
T2+	T/C / RTD IN2+ / 100 mV+
T2-	T/C / RTD IN2- / 100 mV-
AQ1	10 V / 20 mA OUT1 *
AQ2	0 V / 20 mA OUT2 *
0V	Ground
MA1	20 mA IN1
V1	10 V IN1
0V	Ground
MA2	20 mA IN2
V2	10 V IN2
0V	Ground

* Note: AQ1 and AQ2 are referenced as %AQ9 and %AQ10 in the Application Program

Thermocouple In

RTD In

mV In

20 mA Analog In

Note: Loop Power (LOOP PWR) requirements are determined by the transmitter specification.

0 -10 V Analog Out

4 - 20 mA Analog Out

0 – 10 V Analog In

Note: Be sure to wire 0 V to V1 as shown for proper operation.

6　　　I/O Register Map

Registers	Description
%I1 to %I24	Digital Inputs
%I32	Output Fault
%I25 to %I31	Reserved
%Q1 to %Q16	Digital outputs
%Q17	Clear HSC1 accumulator to 0
%Q18	Totalizer: Clear HSC2 Quadrature 1-2: Accumulator 1 Reset to max − 1
%Q19	Clear HSC3 Accumulator to 0
%Q20	Totalizer: Clear HSC4 Quadrature 3-4: Accumulator 3 Reset to max − 1
%Q21 to %Q32	Reserved
%AI1 to %AI4	Analog inputs
%AI5, %AI6	HSC1 Accumulator
%AI7, %AI8	HSC2 Accumulator
%AI9, %AI10	HSC3 Accumulator
%AI11, %AI12	HSC4 Accumulator
%AQ1, %AQ2	PWM1 Duty Cycle
%AQ3, %AQ4	PWM2 Duty Cycle
%AQ5, %AQ6	PWM Prescale
%AQ7, %AQ8	PWM Period
%AQ9 to %AQ14	Analog outputs
Note: <u>Not</u> all XL6 units contain the I/O listed in this table.	

| Registers	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

7　　　Digital Filtering for Analog Inputs

The digital filter is updated once per conversion. It is an "IIR" running average filter that emulates a simple RC filter. The equivalent time constant is determined by the Filter Constant and the sum of the conversion times for the two channels. The Filter Constant determines the weight given to the most recent conversion. The following table lists the equivalent time constant for the three possible total conversion times, which are dependent upon the two input mode selections. This filter delay is in addition to the PLC scan delay.

| Equivalent RC Time Constant in Seconds (Nominal time to reach 63% of final value.)			
	Total Conversion Time in Seconds		
Filter Constant	0.03	0.09	0.13
0*	0.03*	0.09*	0.13*
1	0.07	0.18	0.27
2	0.13	0.35	0.53
3	0.27	0.71	1.07
4	0.53	1.41	2.13
5	1.07	2.83	4.27
6	2.14	5.65	8.54
7	4.28	11.30	17.08
* No filter delay, reading is unfiltered conversion value			

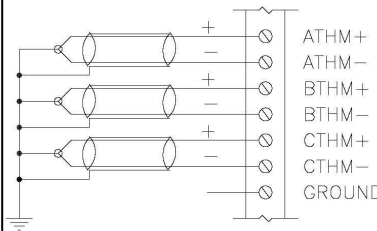**8　　　Thermocouple Grounding Schemes**
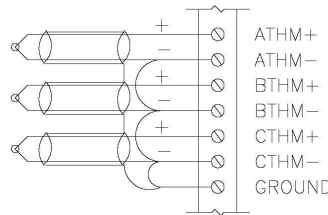
Ungrounded Thermocouples

Alternate Shield Connection for Ungrounded Thermocouples.
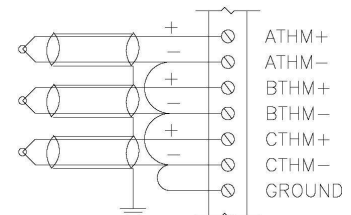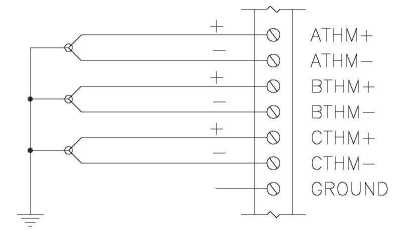
Ungrounded Thermocouples

Preferred Shield Connection for Ungrounded Thermocouples.

Grounded Thermocouples

Field Ground Potential Less Than Seven Volts AC

Typical Shield Connection for Grounded Thermocouples

Grounded Thermocouples

Field Ground Potential Less Than Seven Volts AC

Shields Connected at One End Only May be Used to Reduce Noise

Grounded Thermocouples May Use the Ungrounded Thermocouple Shield Connections if the Shield is not Grounded at the Field End

Note: The examples for thermocouple grounding schemes above are generic illustrations. The XL6 model XL105 has *two* thermocouple inputs.

9   Safety

When found on the product, the following symbols specify:

| ⚠ | **Warning:** Electrical Shock Hazard. | ⚠ | **Warning:** Consult user documentation. |
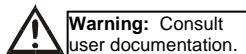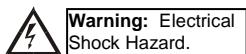
This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D or Non-hazardous locations only.

WARNING – **EXPLOSION HAZARD** – Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
AVERTISSEMENT - RISQUE D'EXPLOSION - AVANT DE DECONNECTOR L'EQUIPMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX.

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

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

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

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

WARNING – EXPLOSION HAZARD – Substitution of components may impair suitability for Class I, Division 2.
AVERTISSEMENT - RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIAL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE 1, 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
AVERTISSEMENT - RISQUE D'EXPLOSION - AFIN D'EVITER TOUT RISQUE D'EXPLOSION, S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX AVANT DE CHANGER LA BATTERIE.

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.

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.

Radiated Emission Compliance: For compliance requirement, a ferrite (Horner P/N FBD006 supplied with the unit) needs to be placed on the AC/DC line with one loop.

◆ 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:

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

10   Technical Support

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

North America:
Tel: 317 916-4274
Fax: 317 639-4279
Web: http://www.heapg.com
Email: techsppt@heapg.com

Europe:
Tel: +353-21-4321266
Fax: +353-21-4321826
Web: http://www.horner-apg.com
Email: tech.support@horner-apg.com