

User's Guide

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HE-XL105

12 Digital DC Inputs,
12 Digital DC Outputs,
2 Analog Inputs Including
T/C & RTD (High Resolution),
2 Analog Outputs



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It is the policy of OMEGA Engineering, Inc. to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

WARNING: These products are not designed for use in, and should not be used for, human applications.

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
Upper Threshold	0.8 mA	-1.6 mA	0.5 A
Lower Threshold	0.3 mA	-2.1 mA	Max. Total Current
Max Upper Threshold	8 VDC	30 VDC	4 A Continuous
Min Lower Threshold	3 VDC	10 VDC	Max. Output Supply Voltage
OFF to ON Response	1 ms	0.25 VDC	Minimum Output Supply Voltage
ON to OFF Response	1 ms	650 mA per channel	Max. Voltage Drop at Rated Current
HSC Max. Switching Rate	10 kHz Totalizer/Pulse, Edges 5 kHz Frequency/Pulse, Width 2.5 kHz Quadrature	Max. Inrush Current	None
		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)
Nominal Resolution	10V, 20mA, 100mV: 14 Bits RTD, Thermocouple: 16 Bits	Thermocouple Common Mode Range	±10V
Input Impedance (Clamped @ -0.5 VDC to 12 VDC)	Current Mode: 100 Ω, 35mA Max. Continuous Voltage Mode: 500 kΩ, 35mA Max. Continuous	Converter Type	Delta Sigma
		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 °C 0-100 mV ±0.05%
%AI full scale	10 V, 20 mA, 100 mV: 32,000 counts full scale. RTD / T/C: 20 counts / °C	Max Thermocouple Error (After Warm Up Time of One Hour)	±0.2% (±0.3% below -100°C)
Max. Over-Current	35 mA	Conversion Speed, Both Channels Converted	10V, 20mA, 100mV: 30 Times/Second RTD, Thermocouple: 7.5 Times/Second
Open Thermocouple Detect Current	50 nA	Conversion Time per Channel	10V, 20mA, 100mV: 16.7mS RTD, Thermocouple: 66.7mS
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°C)
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	If you require a Compliance Table: 1-888-556-6342
		UL	
		Clock Accuracy	+/- 35 ppm maximum at 25° C (+/- 1.53 Minutes per Month)

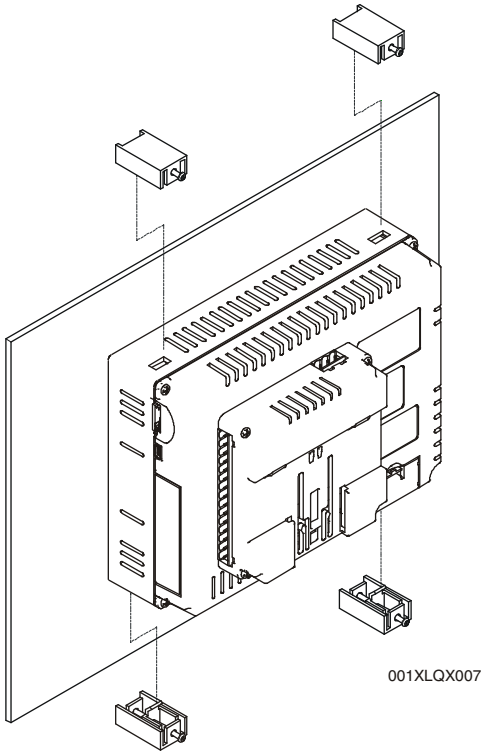
Note: Highest usable frequency for PWM output is 65 KHz

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.

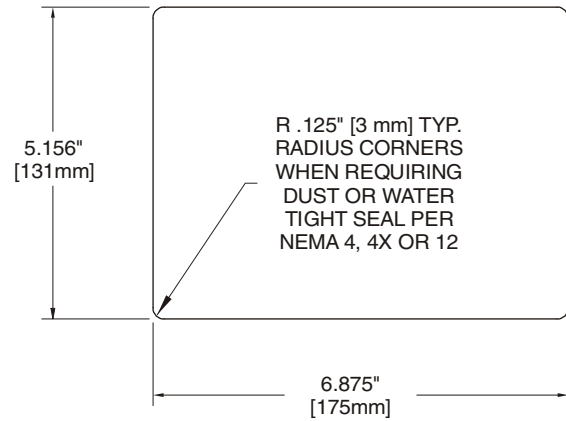
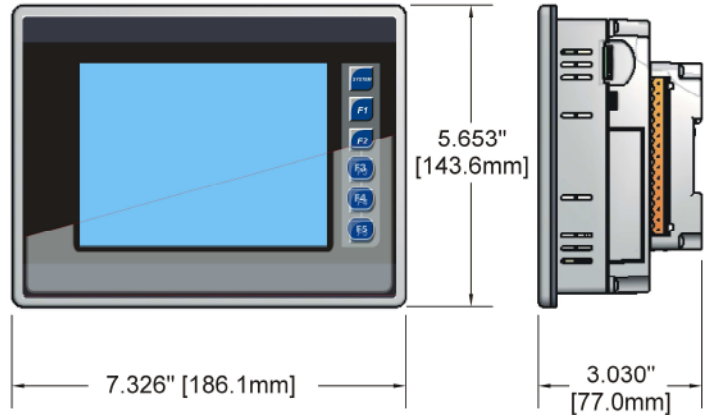
4. Install and tighten the mounting clips (provided with the OCS) until the gasket material forms a tight seal.
5. Connect cables as needed such as communications, programming, power and CsCAN cables to the ports using the provided connectors.
6. Begin configuration procedures.



3 Panel Cut-Out and Dimensions

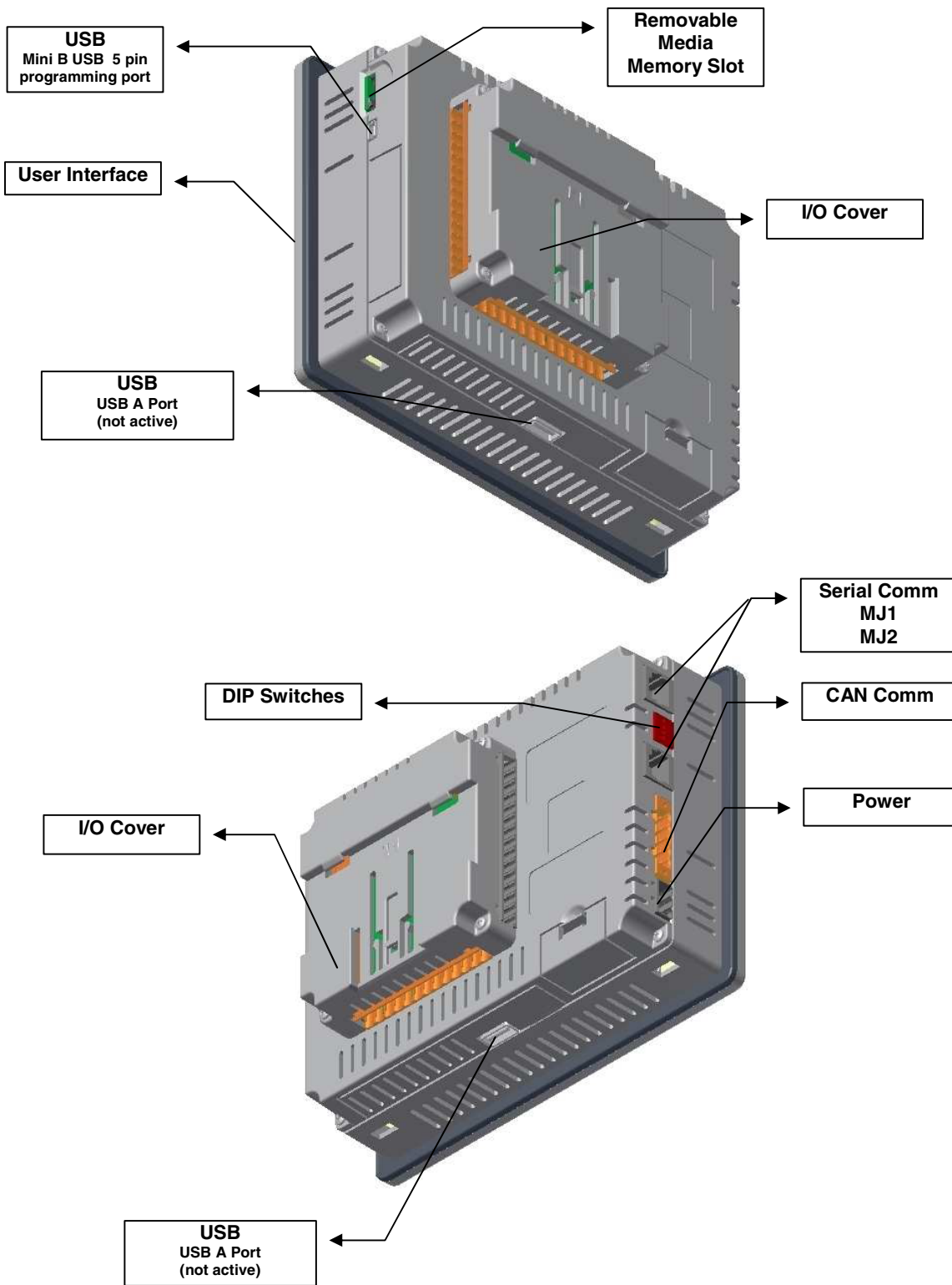
Note: Max. panel thickness: 5 mm.

Note: The tolerance to meet NEMA standards is $\pm 0.005"$ (0.1 mm).



001OCS003-R1





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.

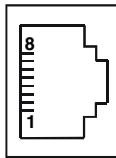
Memory Slot:
Uses **Removable Memory** for data logging, screen captures, program loading and recipes.
Horner Part No.: HE-MC1

Serial Communications:
MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.
MJ2: (RS-232 / RS-485) Use for Application-Defined Communications.

4.1 Serial Communications

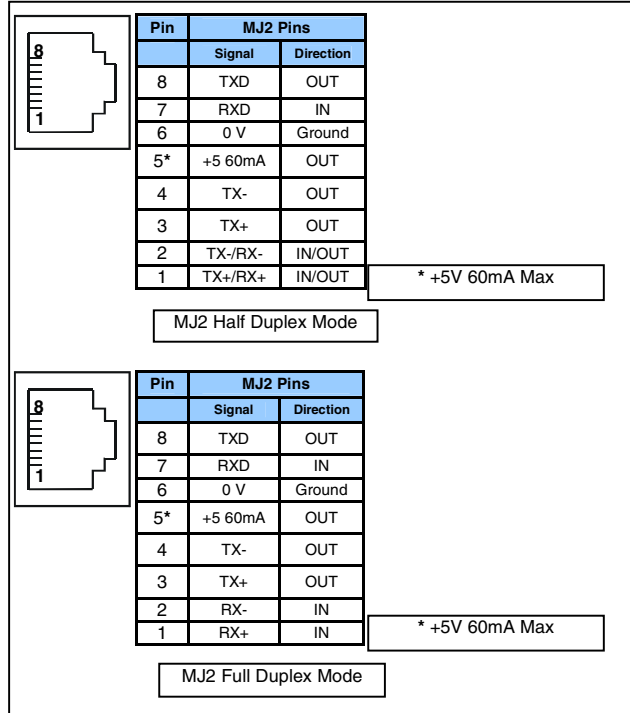
MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.

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



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

MJ2 Pinouts in Half and Full Duplex Modes

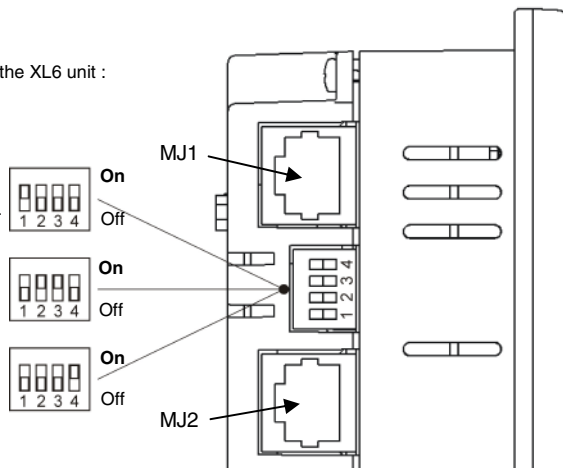


4.2 External DIP Switch Settings

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

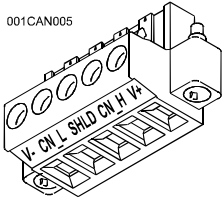
The DIP Switches are used for termination of the RS-485 ports. The XL6 is shipped un-terminated.

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



- 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



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	–

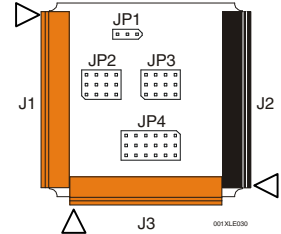
5 Wiring and Jumpers

- 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

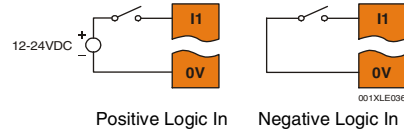
- For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG (0.8 mm²) or larger.
- For shielded Analog I/O wiring, use the following wire type or equivalent: Belden 8441, 18 AWG (0.8 mm²) or larger.
- For CAN wiring, use the following wire type or equivalent: Belden 3084, 24 AWG (0.2 mm²) or larger.

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

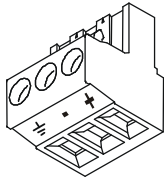


Positive Logic vs. Negative Logic Wiring

The XL6 can be wired for Positive Logic inputs or Negative Logic inputs.



4.4 Power Port and Wiring



Power Connector

Power Up:

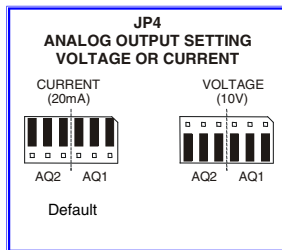
Connect to Earth Ground.
Apply 10 - 30 VDC.
Screen lights up.

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

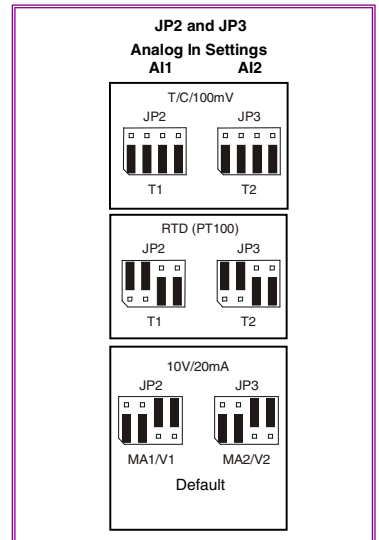
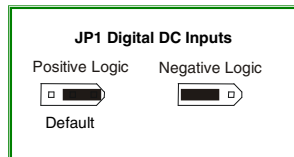
Primary Power Port Pins		
Pin	Signal	Description
1	Ground	Frame Ground
2	V-	Input Power Supply Ground
3	V+	Input Power Supply Voltage

5.1 I/O Jumpers Settings (JP1 – JP4)

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

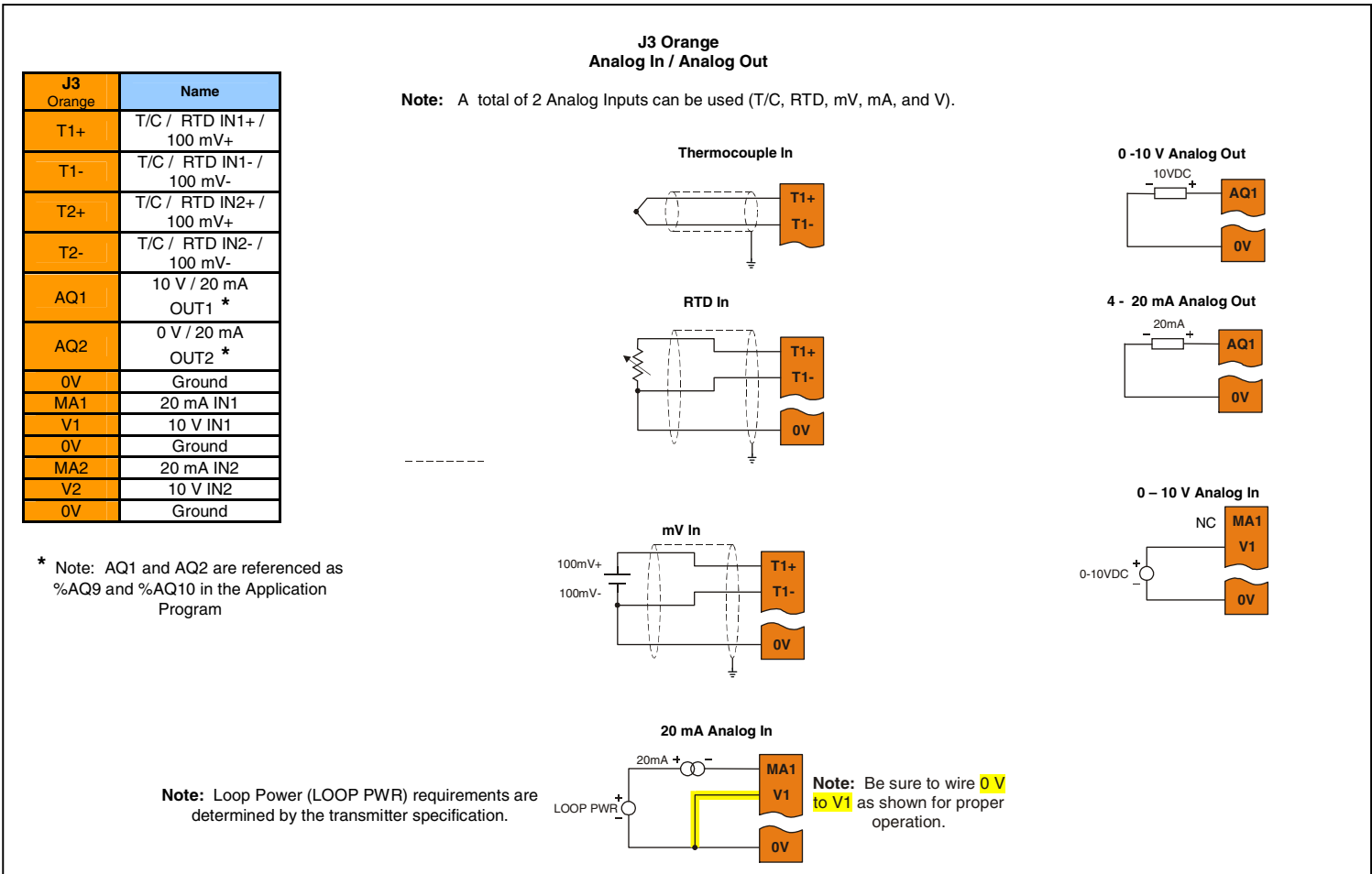
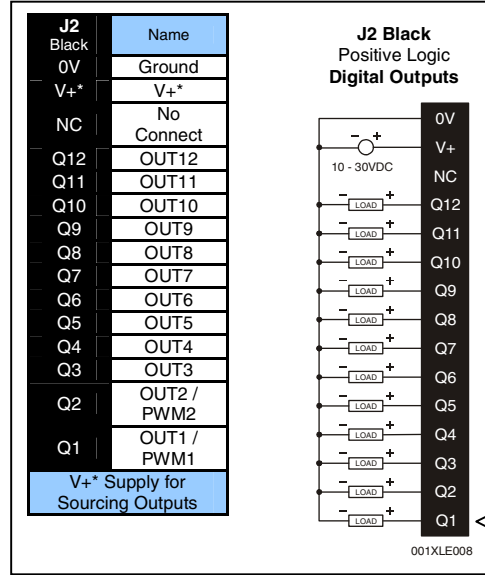
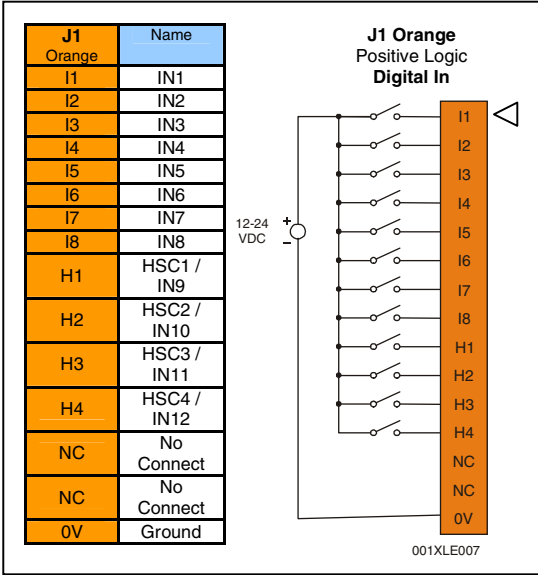


Note: When using JP4 (output) or JP2 / JP3 (inputs), each channel can be independently configured. For example, JP2 can be configured for 10 V and JP3 can be configured as an RTD.



5.2 Wiring Examples

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



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: Not 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			Run Count (32 bit)
%AQ5	PWM Prescale (32 bit)		Decel Count (32 bit)
%AQ6			
%AQ7	PWM Period (32 bit)		
%AQ8			
%Q1			Run
%I30			Ready/Done
%I31			Error

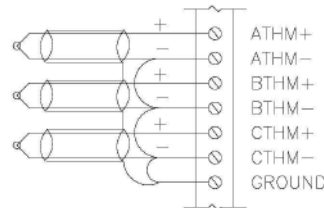
7 Digital Filtering for Analog Inputs

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.)			
Filter Constant	Total Conversion Time in Seconds		
	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

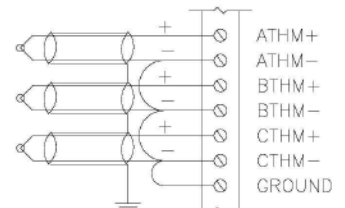
* No filter delay, reading is unfiltered conversion value

8 Thermocouple Grounding Schemes



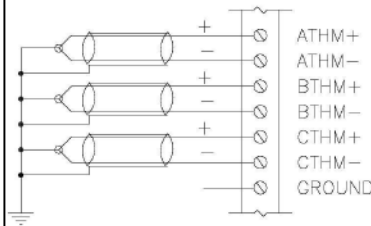
Ungrounded Thermocouples

Alternate Shield Connection for Ungrounded Thermocouples.



Ungrounded Thermocouples

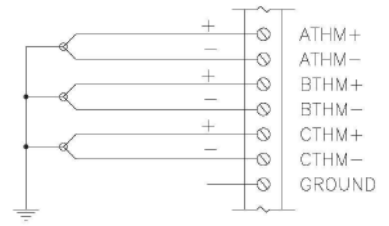
Preferred Shield Connection for Ungrounded Thermocouples.



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:



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 DESIGNÉ 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 EMBLEMES 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 DESIGNÉ 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 (Hornor 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



WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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