

# User's Guide

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## HE-XL103

Digital DC Inputs,  
12 Digital Outputs,  
2 Analog Inputs  
(Medium Resolution)

## HE-XL104

24 Digital DC Inputs,  
16 Digital Outputs,  
2 Analog Inputs  
(Medium Resolution)



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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	XL103		XL104		Digital DC Outputs	XL103		XL104	
Inputs per Module	12 including 4 configurable HSC inputs		24 including 4 configurable HSC inputs		Outputs per Module	12 including 2 configurable PWM outputs		16 including 2 configurable PWM outputs	
Commons per Module	1		1		Commons per Module	1		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			
<b>Analog Inputs, Medium Resolution</b>	<b>XL103</b>		<b>XL104</b>		ON to OFF Response	1 ms			
Number of Channels	2		2		Output Characteristics	Current Sourcing (Pos logic)			
Input Ranges Safe input voltage range Input Impedance (Clamped @ -0.5 VDC to 12 VDC)	0 - 10 VDC 0 - 20 mA 4 - 20 mA		-0.5 V to +12V <u>Current Mode:</u> 100 Ω <u>Voltage Mode:</u> 500 k Ω		<b>General Specifications</b>				
Nominal Resolution %AI full scale Max. Over-Current	10 Bits 32,000 counts 35 mA				Required Power (Steady State)	500 mA @ 24 VDC			
Conversion Speed	All channels converted once per ladder scan				Required Power (Inrush)	30 A for 1 ms @ 24 VDC - DC Switched 2.5 A for 4 ms @ 24 VDC - AC Switched			
Max. Error at 25°C (excluding zero)	4-20 mA 1.00%		0-20 mA 1.00%		Primary Power Range	10 - 30 VDC			
Additional error for temperatures other than 25°C	0-10 VDC 0.50%		TBD		Relative Humidity	5 to 95% Non-condensing			
Filtering	160 Hz hash (noise) filter 1-128 scan digital running average filter				Operating Temperature	-10°C to +60°C			
					Terminal Type	Screw Type, 5 mm Removable			
					CE	If you require a Compliance Table: 1-888-556-6342			
					UL				
					Weight	26.5 oz. (.751 kg)			
					Clock Accuracy	+/- 35 ppm maximum at 25°C (+/- 1.53 Minutes per Month)			

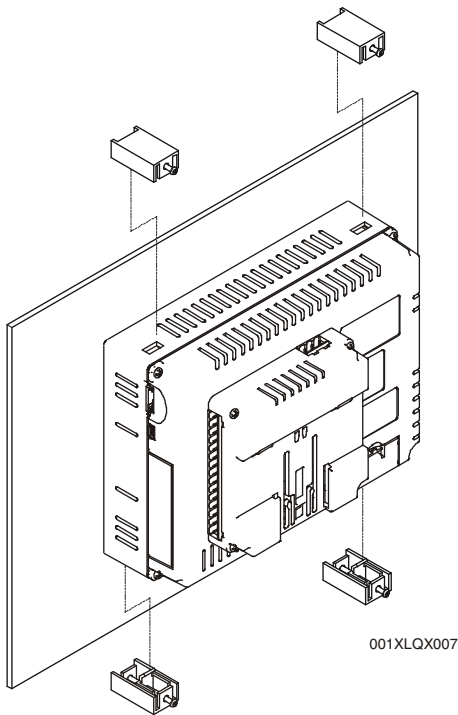
Note: Highest usable frequency for PWM output is 65 KHz

## 2 Installation

1. Prior to mounting, observe requirements for the panel layout design and spacing/clearances in the OCS XL6 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.**

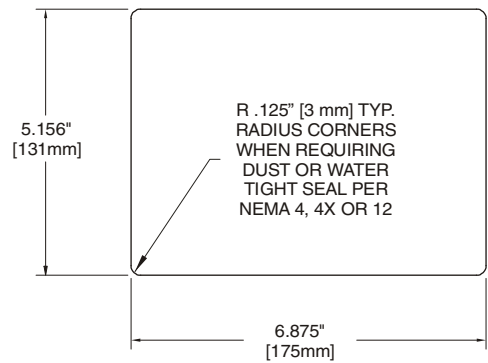
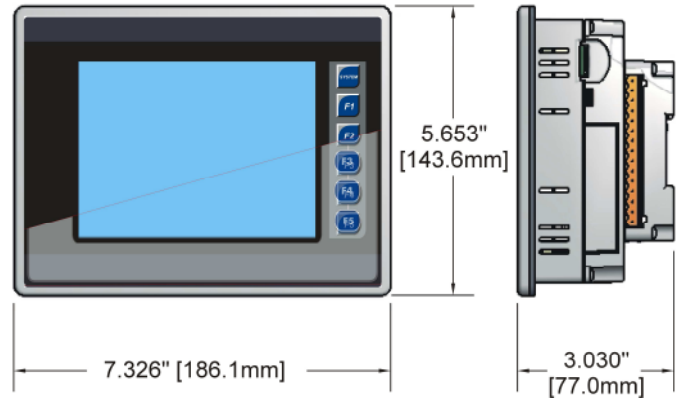
4. Install and tighten the mounting clips (provided with the OCS) until the gasket material forms a tight seal.
5. Connect cables as needed such as communications, programming, power and CsCAN cables to the ports using the provided connectors.
6. Begin configuration procedures.



## 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).

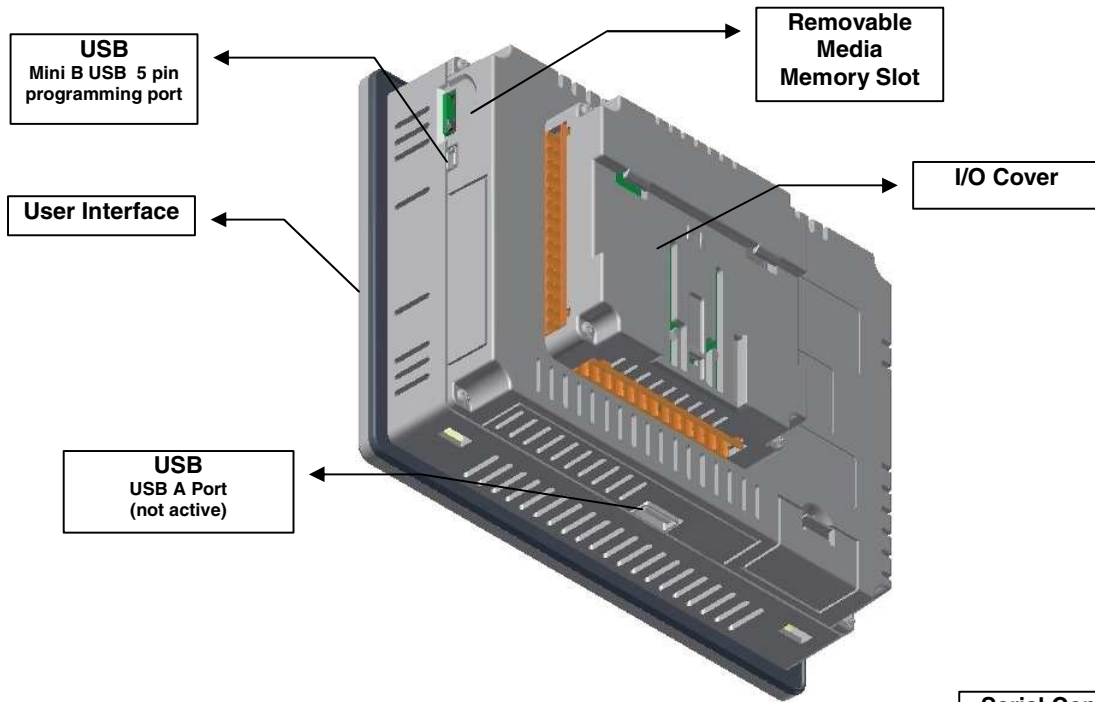


001OCS003-R1



**HE-XL103 and HE-XL104**

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.

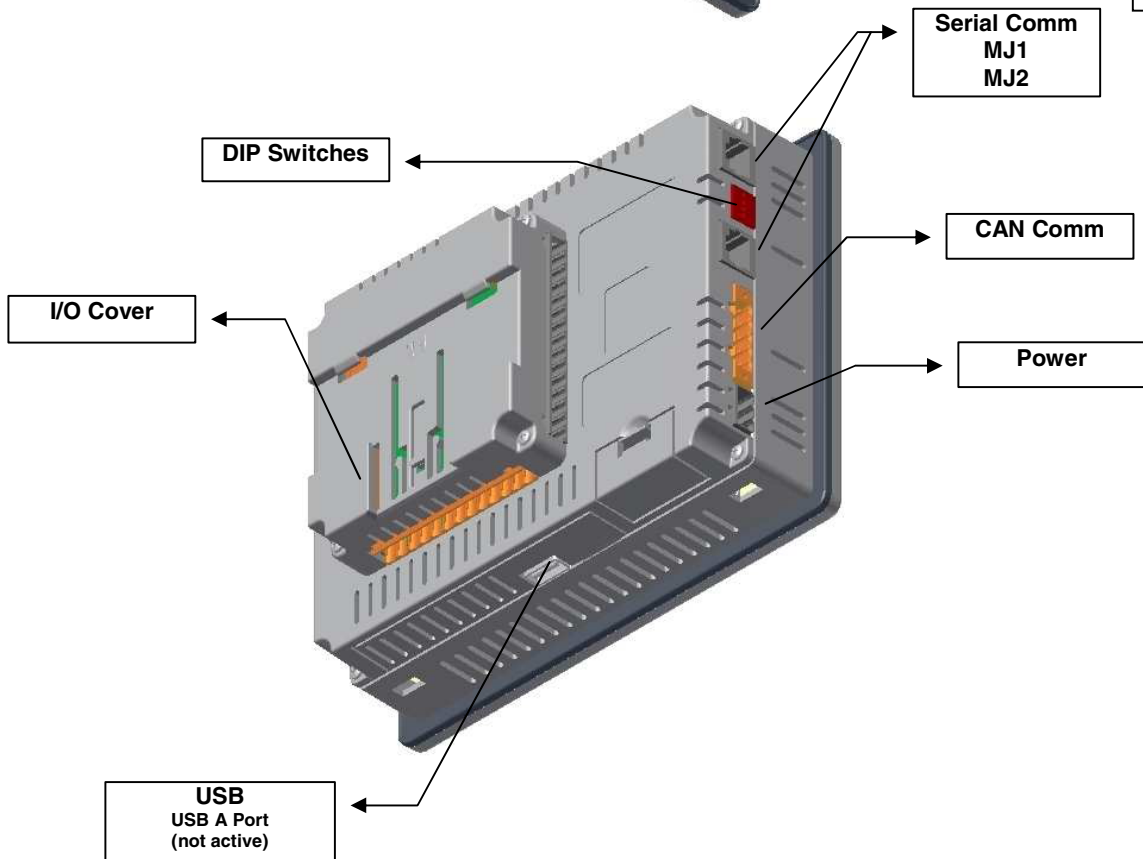
**I/O Jumpers:**  
 I/O Jumpers (JP) are located internally. To access, remove I/O cover of unit.

**Wiring Connectors (J1 / J2 / J3 / J4) and I/O Jumpers (JP1 and JP3)** 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.

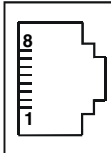
**MJ2:** (RS-232 / RS-485) Use for Application-Defined Communications.



#### 4.1 Serial Communications:

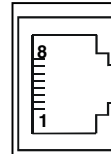
**MJ1:** (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.

**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

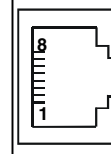
#### MJ2 Pinouts in Half and Full Duplex Modes



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



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

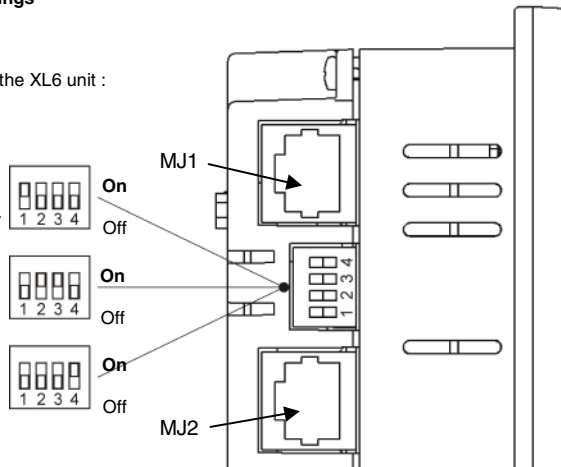
MJ2 Full Duplex Mode

#### 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.



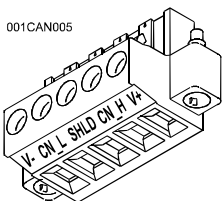
SW1 - ON enables **MJ2** RS485 port termination (121 Ohms). OFF disables **MJ2** RS485 port termination.

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



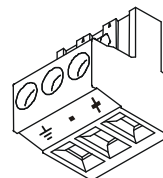
#### CAN Connector

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 Power 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)

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

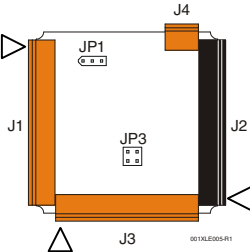
- Wire according to the type of inputs / outputs used and select the appropriate jumper option.

### Wiring Specifications

- For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG (0.8 mm<sup>2</sup>) or larger.
- For shielded Analog I/O wiring, use the following wire type or equivalent: Belden 8441, 18 AWG (0.8 mm<sup>2</sup>) or larger.
- For CAN wiring, use the following wire type or equivalent: Belden 3084, 24 AWG (0.2 mm<sup>2</sup>) or larger.

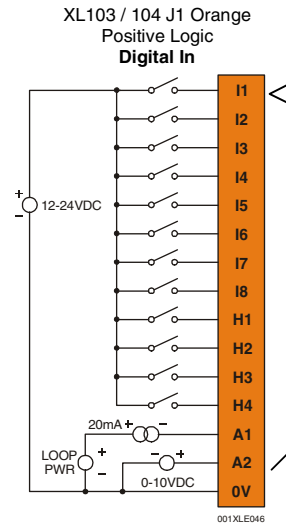
Use copper conductors in field wiring only, 60/75°C

Location of I/O jumpers (JP) and wiring connectors (J1 – J4).



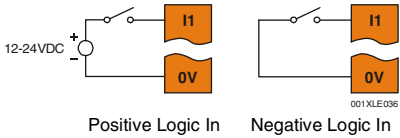
## 5.2 Wiring Examples

J1 Orange	XL103 / XL104 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
A1	Analog IN1
A2	Analog IN2
0V	Ground



### Positive Logic vs. Negative Logic Wiring

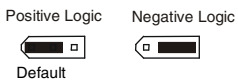
The XL6 can be wired for Positive Logic inputs or Negative Logic inputs.



### 5.1 I/O Jumpers Settings (JP1 – JP3)

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

#### JP1 Digital DC Inputs



#### JP3 CURRENT OR VOLTAGE INPUTS

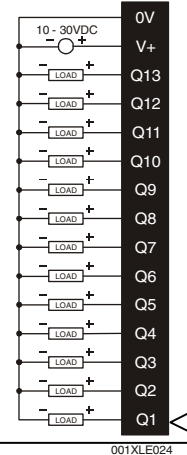


**Note:** When using JP3 (A1-A2), each channel can be independently configured.

J2 Black	XL103	XL104
0V	Ground	
V+	V+ *	
NC	No Connect	OUT13
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	

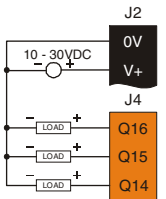
V+\* Supply for Sourcing Outputs

### XL103 / 104 J2 Black Positive Logic Digital Out



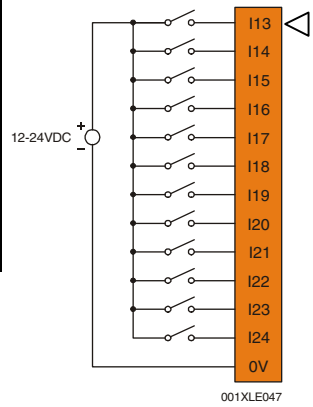
### XL104 J4 Orange Positive Logic Digital Out

J4 Orange	XL104
Q16	OUT16
Q15	OUT15
Q14	OUT14



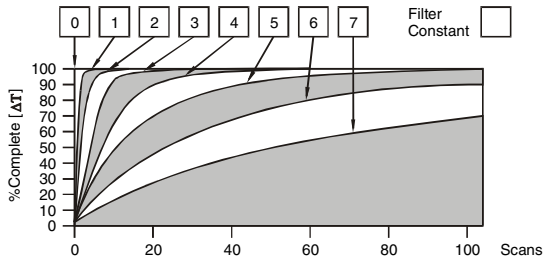
J3 Orange	XT104
I13	IN13
I14	IN14
I15	IN15
I16	IN16
I17	IN17
I18	IN18
I19	IN19
I20	IN20
I21	IN21
I22	IN22
I23	IN23
I24	IN24
0V	Ground

### XL104 J3 Orange Positive Logic Digital In



6 Filter

Filter Constant sets the level of digital filtering according to the following chart.



**Digital Filtering.** The illustration above demonstrates the effect of digital filtering (set with Filter Constant) on module response to a temperature change.

7 I/O Register Map

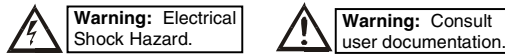
Registers	Description
%I1 to %I24	Digital Inputs
%I32	Output Fault
%I25 to %I31	Reserved
%Q1 to %Q16	Digital outputs
%Q17	Clear HSC1 accumulator to 0
%Q18	Totalizer: Clear HSC2 Quadrature 1-2: Accumulator 1 Reset to max - 1
%Q19	Clear HSC3 accumulator to 0
%Q20	Totalizer: Clear HSC4 Quadrature 3-4: Accumulator 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)		Run Count (32 bit)
%AQ6			Decel Count (32 bit)
%AQ7	PWM Period (32 bit)		Run
%AQ8			Ready/Done
%Q1			Error
%I30			
%I31			

8 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 DECONNECTER 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 (Homer 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 floors 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.

**OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.**

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,
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