



# XLE OCS Model: HE-XE102-62

12 Digital DC Inputs

ES2T-250/300 Temperature Sensor, ESP-100 Pressure Sensor, 2 Analog Inputs (Medium Resolution)

6 Digital Relay Outputs

## 1 Specifications

HE-XE102 Specifications		
<b>Digital DC Inputs</b>		
Inputs per Module	12 including 4 configurable HSC inputs	
Commons per Module	1	
Input Voltage Range	12 VDC / 24 VDC	
Absolute Max. Voltage	35 VDC Max.	
Input Impedance	10 kΩ	
Input Current	<b>Positive Logic</b>	<b>Negative Logic</b>
Upper Threshold	0.8 mA	-1.6 mA
Lower Threshold	0.3 mA	-2.1 mA
Max Upper Threshold	8 VDC	
Min Lower Threshold	3 VDC	
OFF to ON Response	1 ms	
ON to OFF Response	1 ms	
HSC Max. Switching Rate	10 kHz Totalizer/Pulse, Edges 5 kHz Frequency/Pulse, Width 2.5 kHz Quadrature	
<b>Digital Relay Outputs</b>		
Outputs per Module	6 relay	
Commons per Module	6	
Max. Output Current per Relay	3 A at 250 VAC, resistive	
Max. Total Output Current	5 A continuous	
Max. Output Voltage	275 VAC, 30 VDC	
Max. Switched Power	1250 VA, 150 W	
Contact Isolation to XLE ground	1000 VAC	
Max. Voltage Drop at Rated Current	0.5 V	
Expected Life (See Derating section for chart.)	No load: 5,000,000 Rated load: 100,000	
Max. Switching Rate	300 CPM at no load 20 CPM at rated load	
Type	Mechanical Contact	
Response Time	One update per ladder scan plus 10 ms	
<b>Analog Inputs, Medium Resolution</b>		
Number of Channels	2	
Input Ranges	0 - 10 VDC, 0 - 20 mA, 4 - 20 mA	
Safe input voltage range	-0.5 V to +12V	
Input Impedance (Clamped @ -0.5 VDC to 12VDC)	<b>Current Mode</b> 100 Ω	<b>Voltage Mode</b> 500 k Ω
Nominal Resolution	10 Bits	
%AI full scale	32,000 counts	
Max. Over-Current	35 mA	
Conversion Speed	All channels converted once per ladder scan	
Max. Error at 25°C (excluding zero)	4-20 mA 1.00%	0-20 mA 1.00%
*can be made tighter (~0.25%) by adjusting the digital filter setting to 3.	0-10 VDC 1.50%*	
Additional error for temperatures other than 25°C	TBD	
Filtering	160 Hz hash (noise) filter 1-128 scan digital running average filter	
<b>Temperature/Pressure Sensor</b>		
	ES2T - 250/300	ESP-100
Channel	1	2
Range	5°F - 300°F	0-100 PSIG
Input Im	2.49 K ohms	249 ohms
Nominal Res	10 bits	
Nominal %AI = 15000	2.49K ohms	249 ohms
Conversion Speed	All channels converted once per scan	
Typical Error Including Linearization	2°F	1 PSIG
Additional error for reading / ambient temperatures other than 25° C	TBD	
Filtering	160 Hz has (noise filter) 1-128 scan digital running average filter	
<b>General Specifications</b>		
Required Power(Steady State)	130 mA @ 24 VDC	
Required Power (Inrush)	30 A for 1 ms @ 24 VDC	
Primary Power Range	10 - 30 VDC	
Relative Humidity	5 to 95% Non-condensing	
Operating Temperature	0°C to +50°C	

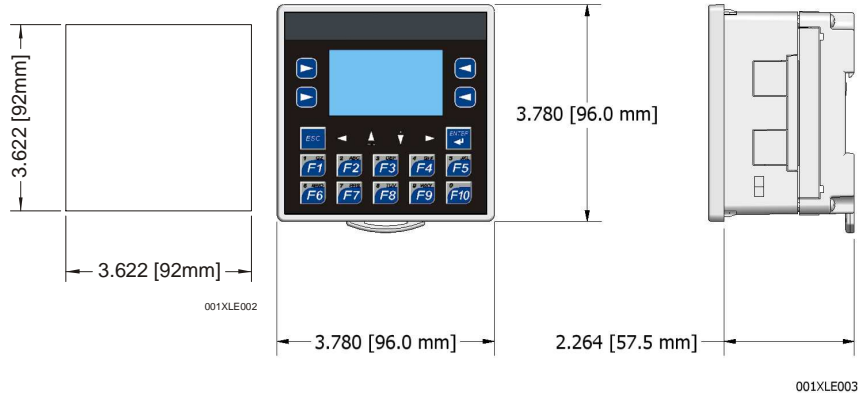
General Specifications	
Terminal Type	Screw Type, 5 mm Removable
Weight	12 oz. (340.19 g)
CE	See Compliance Table at <a href="http://www.heapg.com/Pages/TechSupport/ProductCert.html">http://www.heapg.com/Pages/TechSupport/ProductCert.html</a>
UL	
Clock Accuracy	+/- 7 Minute/Month at 20°C
Highest usable frequency for PWM output is 65 KHz	

## 2 Panel Cut-Out and Dimensions

Note: Max. panel thickness: 5 mm.

Refer to XLE User Manual (MAN0805) for panel box information and a handy checklist of requirements.

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



## 3 Ports / Connectors / Cables

Note: The case of the XLE is black, but for clarity, it is shown in a lighter gray color.

**To Remove Back Cover:**  
Unscrew 4 screws located on the back of the unit. Lift lid.

**CAUTION:** Do not over tighten screws when screwing the lid back on.

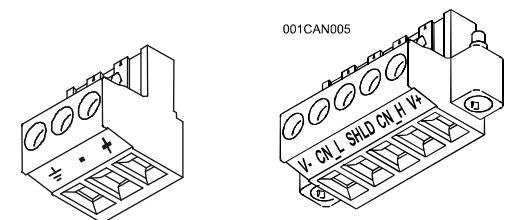
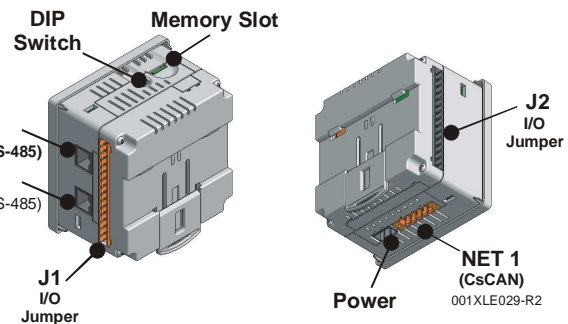
**I/O Jumpers: (Not Shown):**  
I/O Jumpers (JP) are located internally. To access, remove back cover of unit.

**Wiring Connectors (J1 / J2):**  
I/O Jumpers (JP1 / JP2), and External Jumpers (RS-485) 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.  
**Hornier 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.



Power Connector

CAN Connector

**Power Up:**  
Connect to Earth Ground. Apply 10 - 30 VDC. Screen lights up.

Use the CAN Connector when using CsCAN network.

4 Serial Communications

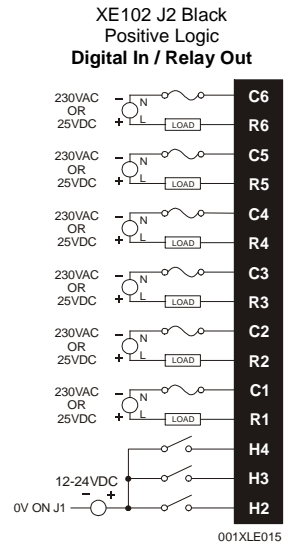
Serial Communications:

**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	NC	No Connect	NC	No Connect
4	RTS	OUT	TX-	OUT
3	CTS	IN	TX+	OUT
2	RX- / TX-	IN / OUT	RX-	IN
1	RX+ / TX+	IN / OUT	RX+	IN

J2 Black Terminal Connector	XE102 Name
C6	Relay 6 COM
R6	Relay 6 NO
C5	Relay 5 COM
R5	Relay 5 NO
C4	Relay 4 COM
R4	Relay 4 NO
C3	Relay 3 COM
R3	Relay 3 NO
C2	Relay 2 COM
R2	Relay 2 NO
C1	Relay 1 COM
R1	Relay 1 NO
H4	HSC4 / IN12
H3	HSC3 / IN11
H2	HSC2 / IN10



5 Wiring and Jumpers

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

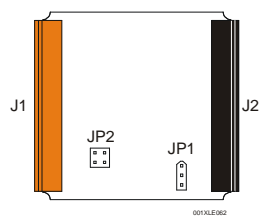
Wiring Specifications

•For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG or larger.

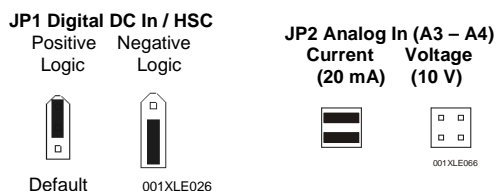
•For shielded Analog I/O wiring, use the following wire type or equivalent: Belden 8441, 18 AWG or larger.

•For CAN wiring, use the following wire type or equivalent: Belden 3084, 24 AWG or larger.

Location of I/O jumpers (JP) and wiring connectors (J1 and J2).



5.2. I/O Jumpers Settings (JP1 - JP2)



**Note:** When using JP2 (A3-A4), each channel can be independently configured.

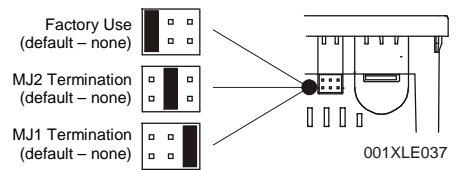
**Note:** The Cscape Module Setup configuration must match the selected I/O (JP) jumper settings.

5.3. External DIP Switch Settings (or Jumpers Settings)

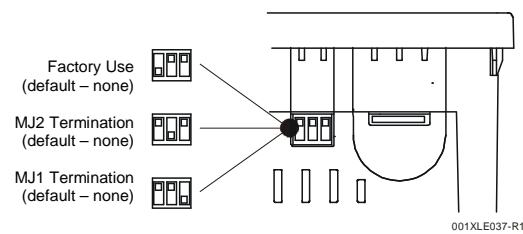
Some XLEs have jumpers to set RS-485 port termination, though most use DIP Switches.

The External Jumpers or DIP Switches are used for termination of the RS-485 ports. The XLE is shipped un-terminated.

As seen when looking at the top of the XLE unit: Refer to Section 3 for the location of the External Jumpers.

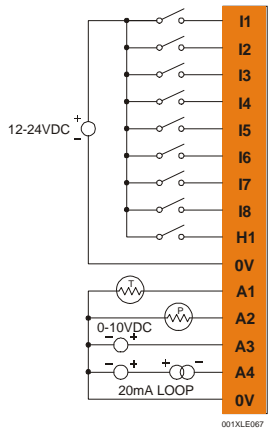


To terminate, select one of the jumpers shipped with the product and insert it based upon the option that is desired or, select the switch and configure based upon the option that is desired.



5.1. Wiring Examples

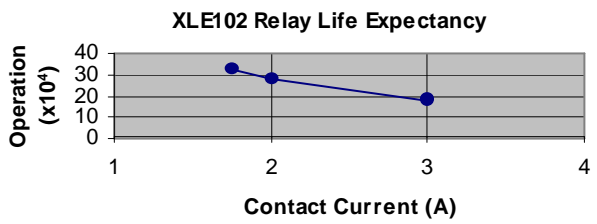
J1 Orange Terminal Connector	XE102 Name
I1	IN1
I2	IN2
I3	IN3
I4	IN4
I5	IN5
I6	IN6
I7	IN7
I8	IN8
H1	HSC1 / IN9
0V	Ground
A1	ES2T-250/300
A2	ESP-100
A3	Analog IN3
A4	Analog IN4
0V	Ground



XE102 J1 Orange Positive Logic in Digital In / Analog In

**Note:** Loop Power requirements are determined by the transmitter specification.

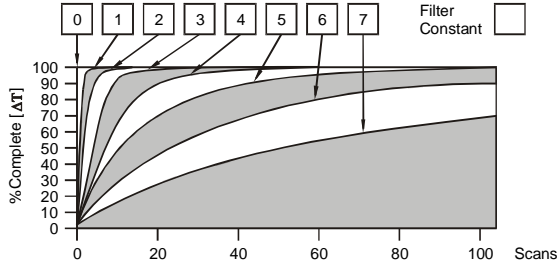
6 Derating



7 Analog Conditioning

7.1 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.

It is recommended that the filter constant for the HE-XE103-10 be set to a value of 7. This will minimize noise and jitter, improve effective resolution, and provide adequate speed for most temperature monitor and control applications.

7.2 Sensor Linearization

7.2.1 ES2T-250/300 Channel 1

Linearization must be performed by the user in the ladder application code, using 26 internal %R registers per channel. The example below uses %R1-26 to linearize one channel - %AI1. Linearization consists of the following example steps.

- 1) Load the desired linearization coefficients into a table on first scan using a Move Constant Data block.

Registers (Real)	Degrees F
R0011	-1.56518643899245e-27
R0013	+1.85504500007145e-22
R0015	-8.93939520118636e-18
R0017	+2.24997847156420e-13
R0019	-3.16779760556092e-09
R0021	+2.49133478160033e-05
R0023	-1.08497438404356e-01
R0025	+3.42114564669736e+02

- 2) Load %AI0001 into %R0001 as a Real.
- 3) Perform the Real Math Expression
- 4)  $\%R3 = (((\%R11 * \%R1 + \%R13) * \%R1 + \%R15) * \%R1 + \%R17)$
- 5) Perform the Real Math Expression  $\%R5 = (((\%R3 * \%R1 + \%R19) * \%R1 + \%R21) * \%R1 + \%R23) * \%R1 + \%R25$
- 6) Load %R0005 result into another register such as %R0007 to save the temperature value.
- 7) Steps 2 though 5 can be on a single rung.

7.2.2 ESP-100 Channel 2

Linearization must be performed by the user in the ladder application code, using 26 internal %R registers per channel. The example below uses %R31-57 to linearize one channel - %AI2. Linearization consists of the following example steps.

- 1) Load the desired linearization coefficients into a table on first scan using a Move Constant Data block.

Registers (Real)	PSIG
R0031	+3.78384517359524e-28
R0033	-1.95900825431083e-23
R0035	+4.60841168052757e-19
R0037	-5.69061024051414e-15
R0039	+4.02188808100642e-11
R0041	-2.87389870540659e-07
R0043	-6.13292635022654e-03
R0045	+1.28157611098246e+02

- 2) Load %AI0002 into %R00051 as a Real.
- 3) Perform the Real Math Expression
- 4)  $\%R53 = (((\%R31 * \%R51 + \%R33) * \%R51 + \%R35) * \%R51 + \%R37)$
- 5) Perform the Real Math Expression  $\%R55 = (((\%R53 * \%R51 + \%R39) * \%R51 + \%R41) * \%R51 + \%R43) * \%R51 + \%R45$
- 6) Load %R00055 result into another register such as %R00057 to save the temperature value.
- 7) Steps 2 though 5 can be on a single rung.

Contact Horner APG Technical Support for an example file containing the above program.

8 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 XLe units contain the I/O listed in this table.

9 Safety

When found on the product, the following symbols specify:



**Warning:** Electrical Shock Hazard.



**Warning:** Consult user documentation.

**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:** 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.

For detailed installation and a [handy checklist](#) that covers panel box layout requirements and minimum clearances, refer to the hardware manual of the controller you are using. (See the **Additional References** section in this document.)

- 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:

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.

## 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](mailto:techsppt@heapg.com)

### Europe:

Tel: +353-21-4321266

Fax: +353-21-4321826

Web: <http://www.horner-apg.com>

Email: [tech.support@horner-apg.com](mailto:tech.support@horner-apg.com)

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