



XL T OCS Model: HE-XT102-10
12 Digital DC Inputs
2 10k Thermistors , 2 Analog Inputs (Medium Resolution)
6 Digital Relay Outputs

Want More Information?
 To download the XL T User Manual (MAN0863), refer to Technical Support in this document.

1 Specifications

HE-XT102 Specifications		
Digital DC Inputs		
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	Positive Logic	Negative Logic
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	
Digital Relay Outputs		
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	
Analog Inputs, Medium Resolution		
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 12 VDC)	Current Mode: 100 Ω	Voltage Mode: 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%
*can be made tighter (~0.25%) by adjusting the digital filter setting to 3.	0-20 mA	1.00%
	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	
Clock Accuracy	+/- One Minute/Month at 20C	

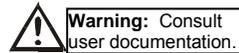
Thermistor Inputs, Medium Resolution	
Number of Channels	2
Input Ranges	10K OHM Thermistor
Input Impedance (Clamped @ -0.5 VDC to 12 VDC)	Half Bridge 9.59K ohm pulled up to 4.8 VDC
Nominal Resolution	10 Bits
%AI at 10K Ohm	15,008 counts
Conversion Speed	All channels converted once per ladder scan
Max. Error at 25°C reading / ambient	±0.5°F or ±0.3°C Using specified linearization in ladder program
Additional error for reading / ambient temperatures other than 25°C	TBD
Filtering	160 Hz hash (noise) filter 1-128 scan digital running average filter

General Specifications	
Required Power (Steady State)	150 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	-10°C to +60°C
Terminal Type	Screw Type, 5 mm Removable
Weight	12 oz. (340.19 g)
CE	See Compliance Table at http://www.heapg.com/Support/compliance.htm
UL	

Note: The highest usable frequency is 65 KHz for the PWM output

2 Safety

When found on the product, the following symbols specify:



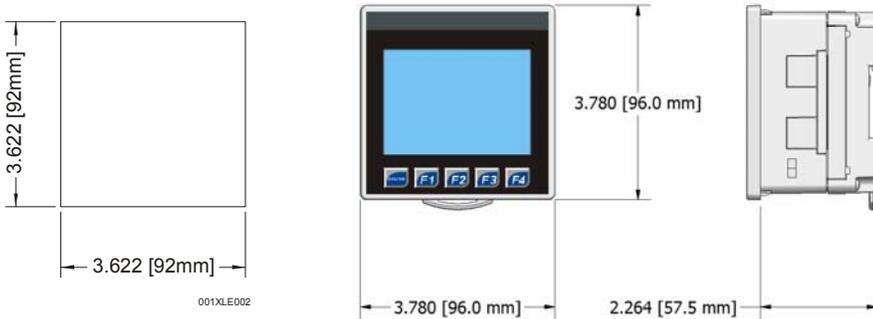
WARNING: To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.
WARNING: To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses 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.

3 Panel Cut-Out and Dimensions

Note: Max. panel thickness: 5 mm.

Refer to XLT User Manual (MAN0863) for panel box information and a handy checklist of requirements.

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



4 Ports / Connectors / Cables

Note: The case of the XLT 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 overtighten 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.

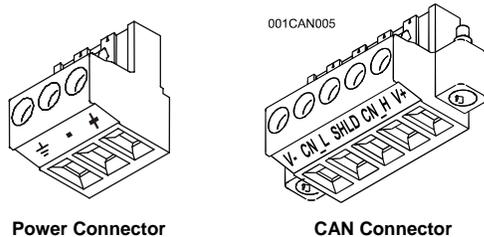
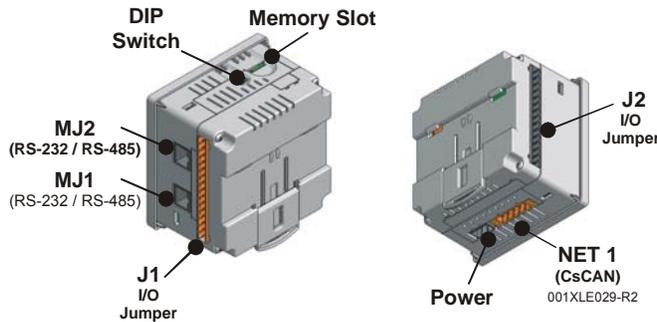
Wiring Connectors (J1 / J2):
I/O Jumpers (JP1 / JP2), and DIP Switches (RS-485) are described in the **DIP Switches, Wiring and Jumpers** section of this document.

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



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

Use the CAN Connector when using CsCAN network.

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

5 DIP Switches, Wiring and Jumpers

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

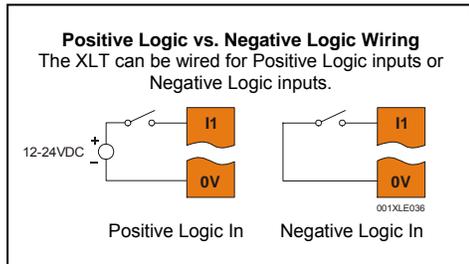
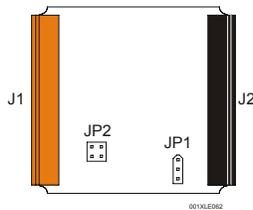
Wiring Specifications

•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.

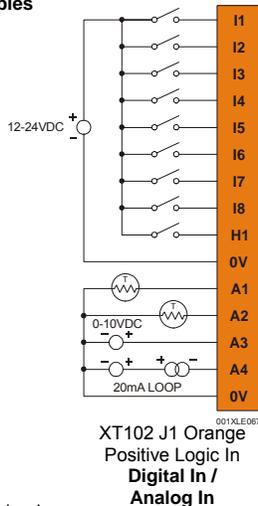
•For CAN wiring, use the following wire type or equivalent: Belden 3084, 24 AWG or larger.

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



5.1. Wiring Examples

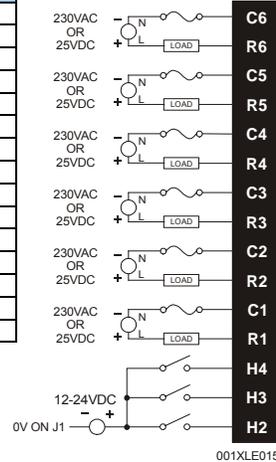
J1 Orange Terminal Connector	XT102 Name
I1	IN1
I2	IN2
I3	IN3
I4	IN4
I5	IN5
I6	IN6
I7	IN7
I8	IN8
H1	HSC1 / IN9
0V	Ground
A1	Thermistor 1
A2	Thermistor 2
A3	Analog IN3
A4	Analog IN4
0V	Ground



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

J2 Black Terminal Connector	XT102-10 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

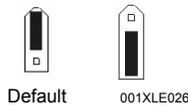
XT102-10 J2 Black Positive Logic Digital In / Relay Out



5.2 I/O Jumpers Settings (JP1 - JP2)

JP1 Digital DC In / HSC

Positive Logic Negative Logic



JP2 Analog In (A3 - A4) Current Voltage (20 mA) (10 V)

A3 Default A4

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



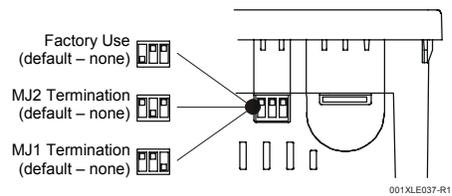
Note: The Cscape Module Setup configuration must match the selected I/O (JP) jumper settings.

5.3 DIP Switch Settings

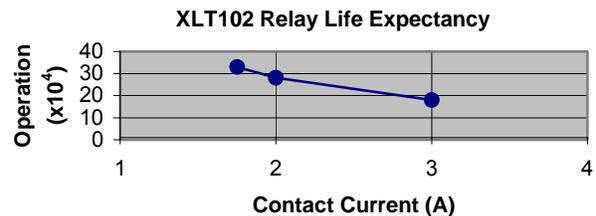
The DIP Switches are used for termination of the RS-485 ports. The XLE is shipped un-terminated.

As seen when looking at the top of the XLT unit:

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



6 Derating



WARNING: EXPOSURE TO SOME CHEMICALS MAY DEGRADE THE SEALING PROPERTIES OF MATERIALS USED IN THE Tyco relay PCJ

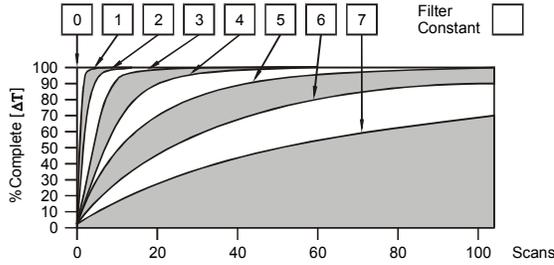
Cover / case & base: Mitsubishi engineering Plastics Corp.
5010GN6-30 or 5010GN6-30 M8 (PBT)
Sealing Material: Kishimoto 4616-50K (I part epoxy resin)

It is recommended to periodically inspect the relay for any degradation of properties and replace if degradation is found

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-XT102-10 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 Thermistor Linearization

Thermistors are measured using a half-bridge circuit that exhibits variable resolution and the associated increased measurement range.

Temperature, degrees C	Resolution, degrees C
-55	1.05
-35	0.36
-15	0.17
5	0.11
25	0.1
45	0.13
65	0.22
85	0.30
105	0.55
125	0.85
145	1.35

Best resolution is at 25°C, 77°F. With a constant 0.1°C resolution circuit, the measurement range would only extend from -26°C to +76°C.

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 C	Degrees F
R0011	-1.94454e-028	-3.50017e-028
R0013	2.40268e-023	4.32483e-023
R0015	-1.24101e-018	-2.23381e-018
R0017	3.46655e-014	6.23979e-014
R0019	-5.69403e-010	-1.02493e-009
R0021	5.62368e-006	1.01226e-005
R0023	-0.0353121	-0.0635617
R0025	163.878	326.981

- 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.

The expression rung may be copied, substituting %AI0002 and %R00011 for %AI0001 and %R0007, and used to linearize the second channel. Contact Horner APG Technical Support for an example file containing the above program.

7.3 Thermistor types

The HE-XE102-10 with the given example ladder code supports Kele Engineering Precon Type III, 10 KΩ thermistors. It also directly supports the following 10 KΩ (Beta=3574) thermistors from Yellow Springs Instruments (YSI).

- 44006 46006
- 44106 46031
- 44406 46041
- 44031 44907
- 45006 44908

8 I/O Register Map

Registers	Description
%I1 to %I12	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
%AQ9 to %AQ14	Analog outputs
%AQ1, %AQ2	PWM1 Duty Cycle
%AQ3, %AQ4	PWM2 Duty Cycle
%AQ5, %AQ6	PWM Prescale
%AQ7, %AQ8	PWM Period

Note: Not all XLT units contain the I/O listed in this table.

9 Technical Support

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

North America:
(317) 916-4274
www.heapg.com
email: techsppt@heapg.com

Europe:
(+) 353-21-4321-266
www.homer-apg.com
email: techsupport@homerirl.ie

10 Safety Precautions for Installation and Connections to XLe

- 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.**