XLT OCS Model: HE-XT103-10
12 Digital DC Inputs / 12 Digital Outputs
2 10K Thermistor Inputs

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

1 Specifications

| HE-XT103-10 Specifications				
Digital DC Inputs	**XLT103-10**		**Digital DC Outputs**	**XLT103-10**
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
Thermistor Inputs, Medium Resolution	**XLT103-10**		ON to OFF Response	1 ms
Number of Channels	2		Output Characteristics	Current Sourcing (Pos logic)
Input Ranges Safe input voltage range Input Impedance (Clamped @ -0.5 VDC to 12 VDC)	10K OHM Thermistor Half Bridge 9.59K ohm pulled up to 4.8 VDC		General Specifications	
Nominal Resolution	10 Bits		Required Power (Steady State)	150 mA @ 24 VDC
%AI at 10K Ohm	15,008 counts		Required Power (Inrush)	30 A for 1 ms @ 24 VDC
Conversion Speed	All channels converted once per ladder scan		Primary Power Range	10 – 30 VDC
Max. Error at 25°C reading / ambient	±0.5°F or ±0.3°C Using specified linearization in ladder program		Relative Humidity	5 to 95% Non-condensing
Additional error for reading / ambient temperatures other than 25°C	TBD		Operating Temperature	-10°C to +60°C
			Terminal Type	Screw Type,5 mm Removable
Filtering	160 Hz hash (noise) filter 1-128 scan digital running average filter		CE / UL	See Compliance Table at http://www.heapg.com/Support/compliance.htm
			Weight	12.5 oz. (354.36 g)
Clock Accuracy	+/- One Minute/Month at 20C			
Note: The highest usable frequency is 65 KHz for the PWM output				

2 Panel Cut-Out and Dimensions
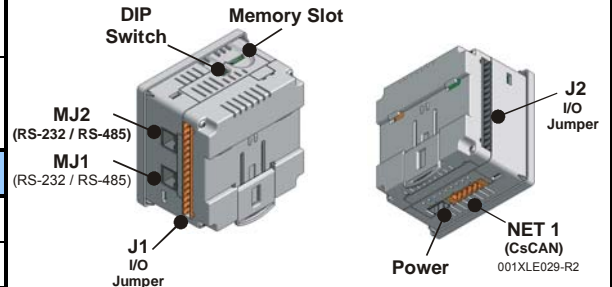
Note: Max. panel thickness: 5 mm.

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

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

3.622 [92mm]

3.622 [92mm]

001XLE002

3.780 [96.0 mm]

3.780 [96.0 mm]

2.264 [57.5 mm]
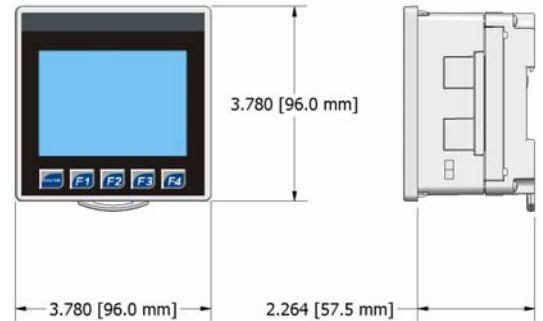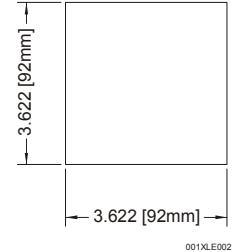
3 Ports / Connectors / Cables

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

DIP Switch   Memory Slot

MJ2 (RS-232 / RS-485)

MJ1 (RS-232 / RS-485)

J1 I/O Jumper

J2 I/O Jumper

NET 1 (CsCAN)

Power

001XLE029-R2

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 – J4**), **I/O Jumpers** (**JP1-3**), and **DIP Switches** (**RS-485**) are described in the **DIP Switches,** *Wiring and Jumpers* section of this document.

001ACC009

001CAN005
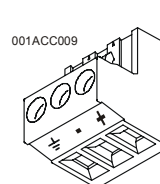
Power Connector   **CAN Connector**

Power Up:
Connect to Earth Ground. Apply 10 – 30 VDC. Screen lights up.
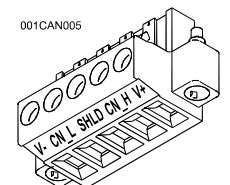
Use the CAN Connector when using CsCAN network.

Section 3 continued

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.

Pin	MJ1 Pins		MJ2 Pins	
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

4   DIP Switches, Wiring and Jumpers

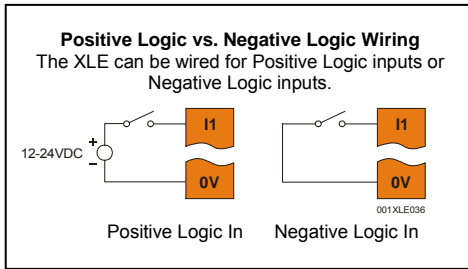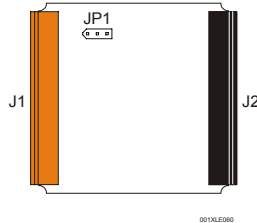Wire according to the type of inputs / outputs used and select the appropriate jumper option.

Wiring Specifications

Location of I/O jumper (JP1) and wiring connectors (J1 & J2).

◆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.

001XLE060

Positive Logic vs. Negative Logic Wiring
The XLE can be wired for Positive Logic inputs or Negative Logic inputs.

001XLE036

Positive Logic In   Negative Logic In

4.1.   I/O Jumper Setting (JP1)

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

JP1 Digital DC Inputs

Positive Logic   Negative Logic

Default
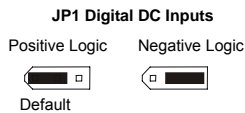
4.2.   DIP Switch Settings (RS-485)

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

As seen when looking at the top of the XLT unit.
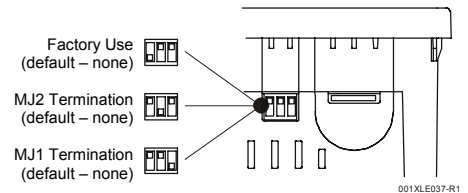
To terminate, select one of the DIP Switches and configure it based upon the option that is desired.

Factory Use (default – none)
MJ2 Termination (default – none)
MJ1 Termination (default – none)
001XLE037-R1

4.3.   **Wiring Examples**

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

J1 Orange	XT103-10 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	Thermistor 1
A2	Thermistor 2
0V	Ground

XT103-10 J1 Orange Positive Logic **Digital In**
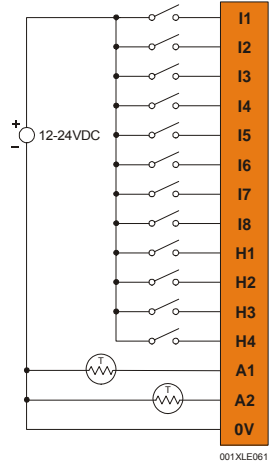
001XLE061

J2 Black	XE103-10 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	

XT103-10 J2 Black Positive Logic **Digital Out**
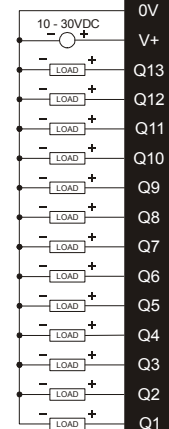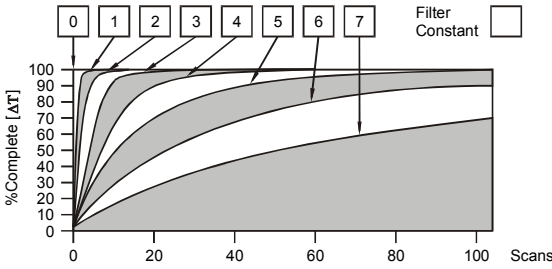

001XLE024

5   Analog Conditioning

5.1   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-XT103-10 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.

5.2   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
%R3 = (((%R11*%R1+%R13)*%R1+%R15)*%R1+%R17)

4. Perform the Real Math Expression %R5 =
(((%R3*%R1+%R19)*%R1+%R21)*%R1+%R23)*%R1+%R25

5. Load %R0005 result into another register such as %R0007 to save the temperature value.

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 for an example file containing the above program.

5.3   Thermistor types

The HE-XT103-10 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

6   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.

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. 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 <u>not</u> replace the fuse again as a repeated failure indicates a defective condition that will <u>not</u> 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.

◆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 <u>not</u> 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.

8 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.horner-apg.com
email: techsupport@hornerirl.ie

Notes