



XLE & XLT OCS DATASHEET

MODEL 5

Rev T or Later [Europe: XLE - Rev R or later, XLT - Rev K or Later]
12 DC In, 12 DC Out, 2 - 14/16-bit Analog In (mA/V/Tc/mV/RTD), 2 - 12-bit Analog Out

1 TECHNICAL SPECIFICATIONS

XLEe and XLTe = Ethernet Versions

1.1 General

Primary Pwr. Range	10-30VDC
Required Power (Steady State)	130mA @ 24VDC
-22 Heater Option	250mA @ 24VDC with Heater Operating *Heater Option - Model# plus "-22"
Typical power-backlight 100%	339mA @ 10V (3.39W) 182mA @ 24V (4.36W)
Power Backlight Off	15mA @ 24V (0.36W)
Power Ethernet Models	35mA @ 10V (0.35W) 20mA @ 24V (0.48W)
Inrush Current	30A for < 1ms
Real Time Clock	Battery backed; lithium coin cell CR2450
Clock Accuracy	+/- 90 Secs/Month at 25°C
Relative Humidity	5 to 95% Non-condensing
Operating Temp.	-10°C to +60°C
-22 Heater Option	-40°C to +50°C
Storage Temp.	-20°C to +60°C
Weight	0.75 lbs / 340 g (without I/O)
Altitude	Up to 2000m
Rated Pollution Degree	Evaluated for Pollution Degree 2 rating
Certifications (UL/CE)	North America Europe

XLE/XLT User Manual [MAN0878]

The User Manual includes extensive information on:

- Built-in I/O
- Common %S & %SR Registers
- HSC/PWM/Totalizer/Quadrature & Accumulator Registers
- Resource Limits

1.2 User Interface

Display Type	Transflective LCD Sunlight Readable
Resolution	128 x 64 pixels (XLE) 160 x 128 pixels (XLT)
Color	Monochrome
Built-In Storage	16MB
User-Program. Screens	1023 max pages; 50 objects per page
Backlight	LED
Backlight Lifetime	30,000+ hrs
Brightness Control	0-100% (XLT) On/Off (XLE) via %SR57
Number of Keys	20 (XLE) 5 (XLTe)
Touchscreen (XLTe)	Resistive 1,000,000+ touch life

1.3 Connectivity

Serial Ports	RS-232 full handshaking or RS-485 half duplex on first Modular Jack (MJ1) RS-232 or RS-485 on second Modular Jack (MJ2)
USB Micro-B	Programming only
CAN	1x CAN Port, Isolated 1kV
CAN Protocols	CsCAN, CANopen, DeviceNet, J1939
Ethernet	Ethernet versions only
Ethernet Protocols	TCP/IP, Modbus TCP, FTP, SRTP, EGD, ICMP, ASCII
Remote I/O	SmartRail, SmartStix, SmartBlock, SmartMod
Removable Memory	microSD, SDHC, SDXC IN FAT32 format, support for 32GB max. Application Updates, Datalogging, and more
Audio (XLTe only)	Beeper, System or Software Controlled

1.4 Control & Logic

Control Lang. Support	Advanced Ladder Logic Full IEC 61131-3 Languages
Logic Program Size	256kB
Logic Scan Rate	0.7ms/kB (XLE) 0.8ms/kB (XLT)
Digital Inputs	2048
Digital Outputs	2048
Analog Inputs	512
Analog Outputs	512
Gen. Purpose Registers	9999 (words) Retentive 2,048 (bits) Retentive 2,048 (bits) Non-retentive

1.5 High-Speed Inputs

Number of Counters	4
Maximum Frequency	500kHz each
Accumulator Size	32-bits each
Modes Supported	Totalizer, quadrature, pulse measurement, frequency measurement, set-point controlled outputs

1.6 High-Speed Outputs

Modes Supported	Stepper, PWM
Output Frequency	10kHz or 65kHz with HE-XHSQ

Wiring Details:

Solid/Stranded Wire: 12-24 awg (2.5-0.2mm²).
Strip Length: 0.28" (7mm).
Torque Rating: 4.5 - 7 in-lbs (0.50 - 0.78 N-m).

technical specifications continued...

1.7 Digital DC Inputs

Inputs per Module	12 Including 4 Configurable HSC Inputs	
Commons per Module	1	
Input Voltage Range	12VDC / 24VDC	
Absolute Max. Voltage	30VDC Max.	
Input Impedance	10kΩ	
Input Current	Positive Logic:	Negative Logic:
Upper Threshold	0.8mA	-1.6mA
Lower Threshold	0.3mA	-2.1mA
Max. Upper Threshold	8VDC	
Min. Lower Threshold	3VDC	
OFF to ON Response	1ms	
ON to OFF Response	1ms	
High Speed Counter Max Freq*	500kHz .	

*See I/O info below for detail regarding HSC and PWM

1.8 Digital DC Outputs

Outputs per Module	12 Including 2 Configurable PWM Outputs and 1 Stepper
Commons per Module	1
Output Type	Sourcing / 10kΩ Pull-Down
Absolute Max. Voltage	28VDC Max
Output Frequency	10kHz or 65kHz with HE-XHSQ
Output Protection	Short Circuit
Max. Output Current per Point	0.5A
Max. Total Current	4A Continuous
Max. Output Supply Voltage	30VDC
Min. Output Supply Voltage	10VDC
Max. Voltage Drop at Rated Current	0.25VDC
Max. Inrush Current	650mA per Channel
Min. Load	None
OFF to ON Response	1ms
ON to OFF Response	1ms
Output Characteristics	Current Sourcing (Pos. Logic)
PWM Out	≈ 10kHz
Rise Time	50 - 115μs
Fall Time	8 - 20μs

1.9 Analog Inputs, High Resolution

Number of Channels	2	Thermocouple: B / R / S E T J K / N	Temperature Range: 32°F to 2,912°F (0°C to 1,600°C) -328°F to 1,652°F (-200°C to 900°C) -400°F to 752°F (-240°C to 400°C) -346°F to 1,382°F (-210°C to 750°C) -400°F to 2,498°F (-240°C to 1,370°C)
Input Ranges (Selectable)	0-10VDC; 0-20mA; 4-20mA; 100mV; RTD: PT100; and J, K, N, T, E, R, S, B Thermocouples	Thermocouple Common Mode Range	+/- 10V
Safe Input Voltage Range	10VDC: -0.5V to +15V 20mA: -0.5V to +6V RTD / T/ C: +/- 24VDC	Converter Type	Delta Sigma
Nominal Resolution	10V, 20mA, 100mV: 14 Bits RTD, Thermocouple: 16 Bits	Max. Error at 25°C (*excluding zero)	*4-20mA +/- 0.10% of full scale *0-20mA +/- 0.10% of full scale *0-10VDC +/- 0.10% of full scale RTD (PT100) +/- 1.0°C of full scale 0-100mV +/- 0.05% of full scale
Input Impedance (Clamped @ -0.5VDC to 12VDC)	Current Mode: 100Ω, 35mA Max. Continuous Voltage Mode: 500kΩ, 25mA Max. Continuous	Max. Thermocouple Error (After Warm up Time of One Hour)	+/-0.2% (+/-0.3% below -100°C) of full scale
%AI Full Scale	10V, 20mA, 100mV: 32,000 counts full scale RTD / T/C: 20 Counts / °C	Conversion Speed, Both Channels Converted	10V, 20mA, 100mV: 30 Times/Second RTD Thermocouple: 7.5 Times/Second
Max. Over-Current	35mA	Conversion Time per Channel	10V, 20mA, 100mV: 16.7ms RTD, Thermocouple: 66.7ms
Open Thermocouple Detec Current	50nA	RTD Excitation Current	250μA

1.10 Analog Outputs

Number of Channels	2	Minimum 10V Load	1kΩ
Output Ranges	0-10VDC 0-20mA	Minimum Resistance Load	500Ω
Nominal Resolution	12 Bits	Analog Outputs; Output Points Required	2
Update Rate	Once per PLC scan	Additional Error for Temp. Other than 25°C	20mA 0.000143%/C° 0-10V 0.000151%/C°
Max. Error at 25°C (Excluding Zero)	0-20mA 0.1% of full scale 0-10V 0.1% of full scale		

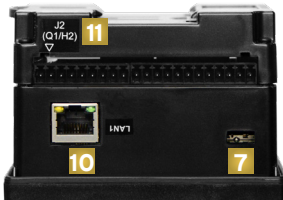
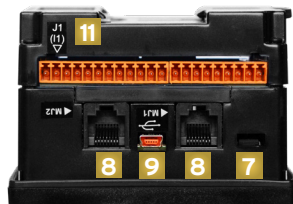
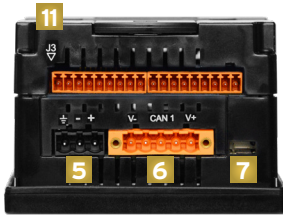
2 CONTROLLER OVERVIEW

3 Wiring: Inputs and Outputs

2.1 - Overview of XLE and XLT



1. Function Keys
2. Softkeys
3. Navigation Keys
4. Touchscreen
5. Wide Range DC Power
6. CAN Port
7. Mounting Clip Locations
8. RS232/RS485 Serial Ports (2)
9. USB Micro-B Port
10. Ethernet LAN Port (optional)
11. Optional Built-In I/O
12. Configuration Switches
13. High Capacity microSD Slot
14. DIN Rail Clip

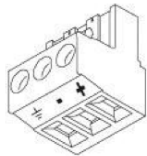


NOTE: See Precaution #12 on page 6 about USB and grounding.

2.2 - Power Wiring

Primary Power Port Pins

PIN	SIGNAL	DESCRIPTION
1	Ground	Frame Ground
2	DC-	Input Power Supply Ground
3	DC+	Input Power Supply Voltage



DC Input / Frame

Solid/Stranded Wire: 12-24 awg (2.5-0.2mm).

Strip length: 0.28" (7mm).

Torque, Terminal Hold-Down Screws: 4.5 - 7 in-lbs (0.50 - 0.78 N-m).

DC- is internally connected to I/O V-, but is isolated from CAN V-. A Class 2 power supply must be used.

POWER UP

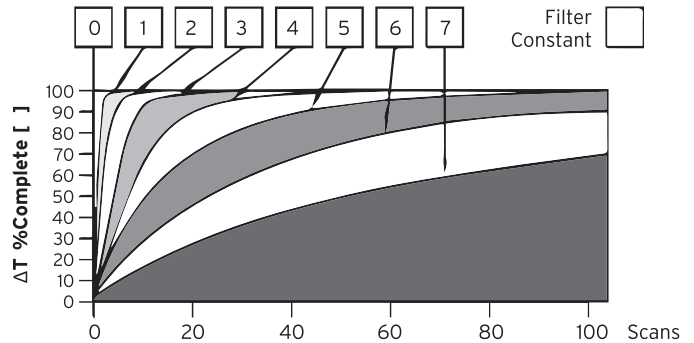
1. OPTION: Attach ferrite core with a minimum of two turns of the DC+ and DC- signals from the DC supply that is powering the controllers.
2. Connect to earth ground.
3. Apply recommended power.



3.1 - Analog Inputs

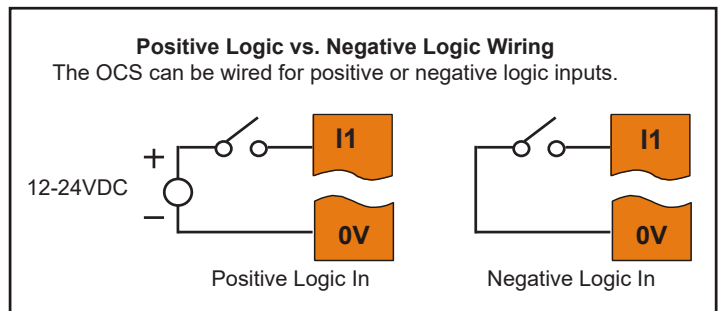
Raw input values for channels 1-2 are found in the registers as Integer-type data with a range from 0 - 32000.

Analog inputs may be filtered digitally with the Filter Constant found in the Cscape Hardware Configuration for Analog Inputs. Valid filter values are 0 - 7 and act according to the following chart.



Data Values	
INPUT MODE:	DATA FORMAT, 12-bit INT:
0-20mA, 4-20mA	0-32000
0-10V	0-32000
T/C & RTD	Temperature in °C to 1 decimal place (xxx.y) NOTE: The value in the %AI is an integer. The value should be divided by 20 to get temperature in °C..

3.2 - Digital Inputs



Digital inputs may be wired in either a Positive Logic or Negative Logic fashion as shown. The setting in the Cscape Hardware Configuration for the Digital Inputs must match the wiring used in order for the correct input states to be registered. P1 jumper settings are required for Pos/Neg setup. When used as a normal input and not for high speed functions, the state of the input is reflected in registers %I1 - %I12.

Digital inputs may alternately be specified for use with High Speed Counter functions, also found in the Hardware Configuration for Digital Inputs. Refer to the XLE/XLT User Manual (MAN0878) for full details.

wiring: I-O

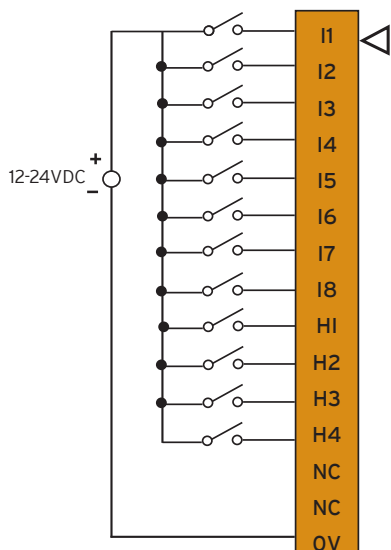
J2 (Black) Positive Logic: Digital Outputs

3.3 - Wiring Connectors

J1 (Orange) Positive Logic: Digital Inputs

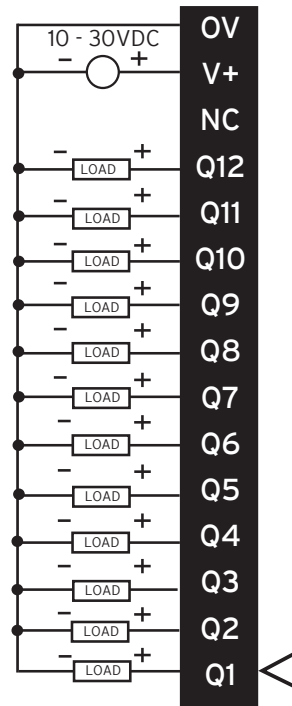
J1 (Orange) Name

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
NC	No Connect
NC	No Connect
OV	Common



J2 (Black) Name

OV	Common
V+	V+
NC	No Connect
Q12	OUT 12
Q11	OUT 11
Q10	OUT 10
Q9	OUT 9
Q8	OUT 8
Q7	OUT 7
Q6	OUT 6
Q5	OUT 5
Q4	OUT 4
Q3	OUT 3
Q2	OUT 2/PWM2
Q1	OUT 1/PWM1

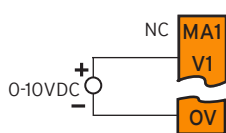


Model 5 - TC & RTD - J3 Wiring

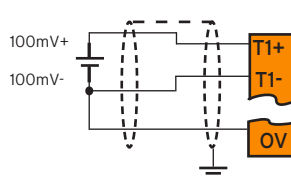
J3 (Orange) Name

T1+	TC (1+) or RTD (1+) or 100 mV (1+)
T1-	TC (1-) or RTD (1-) or 100 mV (1-)
T2+	TC (2+) or RTD (2+) or 100 mV (2+)
T2-	TC (2-) or RTD (2-) or 100 mV (2-)
AQ1	10V or 20mA OUT (1)
AQ2	10V or 20mA OUT (2)
OV	Common
MA1	0-20mA IN (1)
V1	0-10V IN (1)
OV	Common
MA2	0-20mA IN (2)
V2	0-10V IN (2)
OV	Common

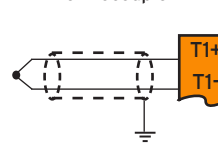
0-10V Analog In



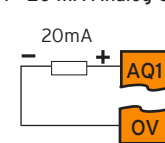
mV In



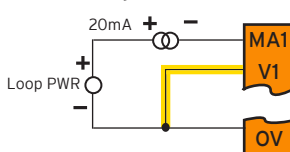
Thermocouple In



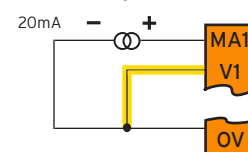
4 - 20 mA Analog Out



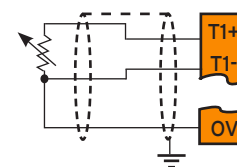
20mA Analog In - Not Self Powered



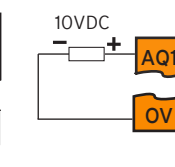
20mA Analog In - Self Powered



RTD In



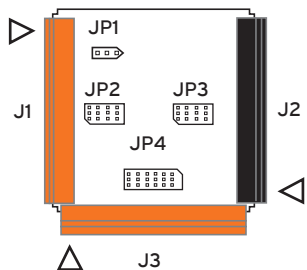
0 - 10V Analog Out



NOTE: Loop power requirements are determined by the transmitter specification.

NOTE: Be sure to wire OV to V1 as shown for proper operation.

3.4 - Jumper Setting Details

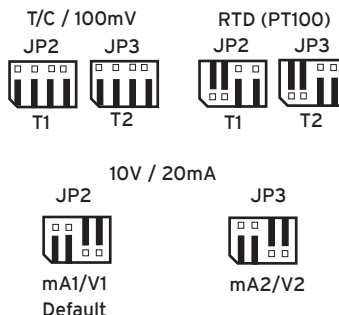


Location of I/O jumpers (JP1 - JP4) and wiring connectors (J1 - J3) with back cover removed.

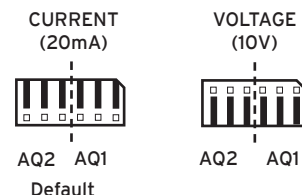
JP1 Digital DC Inputs



JP2 & J3 Analog Input Settings



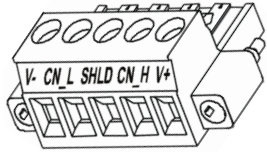
JP4 - Analog Output Setting



Back Panel Torque Rating for XLE/XLT: 3.0 - 4.0 in-lbs (0.34 - 0.45 N-m)

4 COMMUNICATIONS

4.1 - CAN Communications



CAN Pin Assignments		
PIN	SIGNAL	DESCRIPTION
1	V-	CAN Ground - Black
2	CN L	CAN Data Low - Blue
3	SHLD	Shield Ground - None
4	CN H	CAN Data High - White
5	V+ (NC)	No Connect - Red

Solid/Stranded Wire: 12-24 awg (2.5-0.2mm).

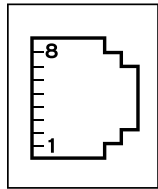
Strip Length: 0.28" (7mm).

Locking spring-clamp, two-terminators per conductor.

Torque, Terminal Hold-Down Screws: 4.5 - 7 in-lbs (0.50 - 0.78 N-m).

V+ pin is not internally connected, the SHLD pin is connected to Earth ground via a 1 MΩ resistor and 10nF capacitor.

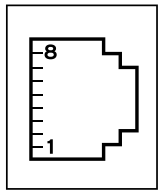
4.2 - Serial Communications



MJ1: RS-232 w/full handshaking or RS-485 half-duplex

RS-485 termination via switches; biasing via software

MJ1 PINS		
PIN	SIGNAL	DIRECTION
8	TXD	OUT
7	RXD	IN
6	0V	GROUND
5	+5V @ 60mA	OUT
4	RTS	OUT
3	CTS	IN
2	RX-/TX-	IN/OUT
1	RX+/TX+	IN/OUT



MJ2 SERIAL PORT

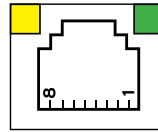
MJ2: RS-232 or RS-485 half or full-duplex, software selectable

RS-485 termination via switches; biasing via software

MJ2 PINS		
PIN	SIGNAL	DIRECTION
8	232 TXD	OUT
7	232 RXD	IN
6	0V	Ground
5	+5V @ 60mA	OUT
4	485 TX-	OUT
3	485 TX+	OUT
2	485 RX- or RX/TX-	IN or IN/OUT
1	485 RX+ or RX/TX+	IN or IN/OUT

Attach optional ferrite core with a minimum of two turns of serial cable. See website for more details. [Part #: HE-FBD001]

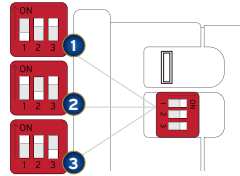
4.3 - Ethernet Communications



Green LED indicates link - when illuminated, data communication is available.

Yellow LED indicates activity - when flashing, data is in transmission.

4.4 - Dip Switches



DIP SWITCHES			
PIN	NAME	FUNCTION	DEFAULT
1	MJ1 RS-485 Termination	ON = Terminated	OFF
2	MJ2 RS-485 Termination	ON = Terminated	OFF
3	Bootload	Always Off	OFF

The DIP switches are used to provide a built-in termination to both the MJ1 port and MJ2 port if needed. The termination for these ports should only be used if this device is located at either end of the multidrop/daisy-chained RS-485 network.

5 BUILT-IN I/O for Model 5

The I/O is mapped into OCS Register space, in three separate areas Digital/Analog I/O, High-Speed Counter I/O, and High-Speed Output I/O. Digital/Analog I/O location is fixed starting at 1, but the high-speed counter and high-speed output references may be mapped to any open register location. For more details, see XLE/XLT OCS User's Manual (MAN0878).

Digital and Analog I/O Function	
Digital Inputs	%I1-12
Reserved	%I13-31
ESCP Alarm	%I32
Digital Outputs	%Q1-12
Reserved	%Q13-24
Analog Inputs	%AI1-2
Reserved	%AI3-12
Analog Outputs	%AQ9-10
Reserved	%AQ1-8

Wiring Details:

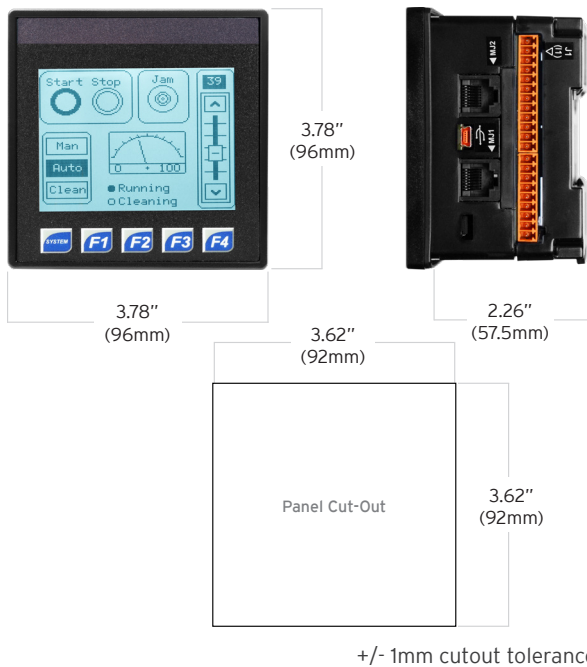
Solid/Stranded Wire: 12-24 awg (2.5-0.2mm²).

Strip Length: 0.28" (7mm).

Torque, Terminal Hold-Down Screws: 4.5 - 7 in-lbs (0.50 - 0.78 N-m).

6 INSTALLATION & DIMENSIONS

6.1 - Dimensions

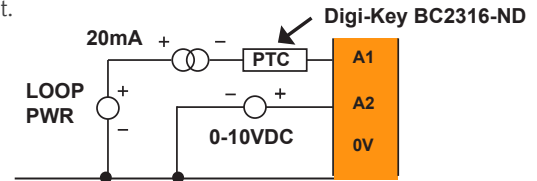


6.2 - Installation Procedure

- The XLE/XLT utilizes a clip installation method to ensure a robust and watertight seal to the enclosure. Please follow the steps below for the proper installation and operation of the unit.
 - This equipment is suitable for Class I, Division 2, Groups A, B, C and D or non-hazardous locations only.
 - Digital outputs shall be supplied from the same source as the operator control station.
 - Jumpers on connector JP1 shall not be removed or replaced while the circuit is live unless the area is known to be free of ignitable concentrations of flammable gases or vapors.
- Carefully locate an appropriate place to mount the XLE/XLT. Be sure to leave enough room at the top of the unit for insertion and removal of the microSD™ card.
 - Carefully cut the host panel per the diagram, creating a 92mm x 92mm +/-0.1mm opening into which the XLEe/XLTe may be installed. If the opening is too large, water may leak into the enclosure, potentially damaging the unit. If the opening is too small, the OCS may not fit through the hole without damage.
 - Remove any burrs and or sharp edges and ensure the panel is not warped in the cutting process.
 - Remove all Removable Terminals from the XLE/XLT. Insert the XLE/XLT through the panel cutout (from the front). The gasket must be between the host panel and the XLE/XLT.
 - Install and tighten the four mounting clips (provided in the box) until the gasket forms a tight seal (**NOTE: Max torque 0.8 to 1.13 Nm or 7-10 in-lbs**)
 - Reinstall the XLE/XLT I/O Removable Terminal Blocks. Connect communications cables to the serial port, USB ports, Ethernet port, and CAN port as required.

7 ANALOG IN TRANZORB FAILURE

A common cause of Analog Input Tranzorb Failure on Analog Inputs Model 2, 3, 4 & 5: If a 4- 20mA circuit is initially wired with loop power, but without a load, the analog input could see 24VDC. This is higher than the rating of the tranzorb. This can be solved by NOT connecting loop power prior to load connection, or by installing a low-cost PTC in series between the load and analog input.



8 BATTERY MAINTENANCE

The XLE/XLT uses a replaceable non-rechargeable 3V Lithium coin-cell battery (CR2450) to run the Real-Time Clock and to keep the retained register values. This battery is designed to maintain the clock and memory for 7 to 10 years. Please reference MAN0878 providing instructions on how to replace the battery.

9 ACCESSORIES

9.1 Backup Battery: HE-BAT009

The XLE and XLT use a lithium battery [CR2450] to run the Real-Time Clock and to maintain the retained register values. This battery is designed to maintain the clock and memory for 7-10 years.

9.2 Programming Cables Kit: HE-XCK

This programming cable kit includes the following adapter cables:

- USB to MiniUSB
- USB to RS-232 Serial
- RS-232 Serial to RJ45 Ethernet

9.3 2/4 Channel Analog Output Kit

- HE-XDAC007 - 2 Channel Analog Output I/O Kit
- HE-XDAC107 - 4 Channel Analog Output I/O Kit

Visit the Horner Website to purchase accessories.

10 SAFETY

10.1 - WARNINGS

- To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.
- 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.
- Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.
- In the event of repeated failure, do NOT replace the fuse again as repeated failure indicates a defective condition that will NOT clear by replacing the fuse.
- 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 before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.
- WARNING** - Battery may explode if mistreated. Do not recharge, disassemble, or dispose of in fire.
- WARNING - EXPLOSION HAZARD** - Batteries must only be changed in an area known to be non-hazardous.

10.2 - FCC COMPLIANCE

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference
- This device must accept any interference received, including interference that may cause undesired operation

10.3 - PRECAUTIONS

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 the electric circuits or pulse-initiating equipment, open their related breakers.
- Do NOT make connection 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.
- Use caution when connecting controllers to PCs via serial or USB. PCs, especially laptops, may use "floating power supplies" that are ungrounded. This could cause a damaging voltage potential between the laptop and controller. Ensure the controller and laptop are grounded for maximum protection. Consider using a USB isolator due to voltage potential differences as a preventative measure.

11 PART NUMBER BUILDERS

GLOBAL MODEL NUMBERS

	screen	Ethernet	I/O
HE-XL	<input type="text"/>	<input type="text"/>	<input type="text"/>
	E (no touchscreen)	O (no Ethernet)	0 (model 0)
	T (touchscreen)	E (Ethernet)	2 (model 2)
			3 (model 3)
			4 (model 4)
			5 (model 5)
			6 (model 6)

EUROPEAN MODEL NUMBERS

	screen	Ethernet	CAN option	I/O	overlay type
HEX	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	E22 (no touchscreen)	0 (no Ethernet)	0 (no CAN*)	00 (model 0)	00 (dark colour)
	T24 (touchscreen)	1 (Ethernet)	1 (CsCAN)	12 (model 2)	01 (light colour)
			2 (CANopen)	13 (model 3)	02 (blank)
			4 (DeviceNet)	14 (model 4)	03-99 (custom)
			5 (J1939)	15 (model 5)	
				16 (model 6)	

*No CAN is only available on XLE

12 TECHNICAL SUPPORT

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

North America

+1 (317) 916-4274
 (877) 665-5666
www.hornerautomation.com
techspt@heapg.com

Europe

+353 (21) 4321-266
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