

EXL10 OCS DATASHEET

MODEL 6

12 DC In, 12 DC Out, 6 - 14/17-bit Analog In (mA/V/Tc/mV/RTD), 4 - 12-bit Analog Out

1 TECHNICAL SPECIFICATIONS

1.1 General Specifications

| | |
|-------------------------------|---|
| Required Power (Steady State) | 650mA @ 24VDC |
| Required Power (Inrush) | 25A for < 1ms @ 24VDC, DC switched |
| Primary Power Range | 10 - 30VDC |
| Relative Humidity | 5 to 95% non-condensing |
| Typical Power Backlight 100% | 12.432W @ 24VDC |
| Power Backlight 50% | 9.312W @ 24VDC |
| Power Backlight OFF | 6.048W @ 24VDC |
| Clock Accuracy | + / - 20 ppm maximum at 25°C (+/- 1 min/month) |
| Real Time Clock | Battery Backed, Rechargeable Lithium |
| Operating Air Temp | -10°C to +60°C |
| Storage Temp | -20°C to +60°C |
| Weight (without I/O) | 3.9375 lbs (1786g) |
| Altitude | Up to 2000m |
| Rated Pollution Degree | Evaluated for Pollution Degree 2 Rating |
| Certifications (UL/CE) | North America: https://hornerautomation.com/certifications/ Europe: http://www.horner-apg.com/en/support/certification.aspx |

1.2 Control & Logic

| | |
|--------------------------|--|
| Control Language Support | Advanced Ladder Logic Full IEC 61131-3 Languages Tag-Based Editor |
| Logic Program Size | 1 MB, maximum |
| Logic Scan Rate | 0.013ms/kB |
| Digital Inputs | 2048 |
| Digital Outputs | 2048 |
| Analog Inputs | 512 |
| Analog Outputs | 512 |
| Gen. Purpose Registers | 50,000 (words) Retentive 16,384 (bits) Retentive 16,384 (bits) Non-retentive |

1.3 Connectivity

| | |
|------------------------|---|
| Serial Ports | 1 RS-232 and 1 RS-485 on first Modular Jack (MJ1/2) 1 RS-232 or 1 RS-485 on second Modular Jack |
| USB mini-B | USB 2.0 (480MHz) Programming & Data Access |
| USB A | USB 2.0 (480MHz) for USB flash drives (2TB) |
| CAN Port Isolated 1 kV | Remote I/O, Peer-to-peer Comms, Cscape |
| CAN Protocols | CsCAN, CANopen, DeviceNet, J1939 |
| 2 x Ethernet | 10/100 Mb (Auto-MDX) |
| Ethernet Protocols | TCP/IP, Modbus TCP, FTP, SMTP, EGD, ICMP, ASCII, Cscape, Ethernet IP, HTTP |
| 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 | Mic In, Line In, Line Out |

1.4 User Interface

| | |
|-----------------------|--|
| Display Type | 10.4" VGA TFT (550 nit typical) |
| Resolution | 640 x 480 |
| Color | 16-bit (65,536) |
| Screen Memory | 27MB |
| User-Program. Screens | 1023 max pages; 1023 objects per page |
| Backlight | LED - 50,000 hour life |

1.5 High-Speed Inputs

| | |
|--------------------|---|
| Number of Counters | 4 |
| Maximum Frequency | 1MHz Max |
| 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 | 500kHz |

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 | 35VDC 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 | |
| Galvanic Isolation | None | |
| Logic Polarity | Selectable in Cscope | |
| I/O Indication | 9 (In 9-12) | |
| Connector Type | 3.5mm Pluggable Cage Clamp Connector | |
| High Speed Counter Max Freq* | 1MHz | |

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

1.8 Digital DC Outputs

| | |
|---|---|
| Outputs per Module | 12 |
| Commons per Module | 1 |
| Output Type | Half-Bridge |
| Absolute Max. Voltage | 30VDC Max. |
| Output Frequency | 500kHz |
| Output Protection | Short Circuit & Overvoltage |
| Max. Output Current per Point | 0.5A |
| Max. Total Current per Driver (Q1-4, Q5-8, Q9-12) | 2A Total Current (All Drivers) UL-Rated, 6A UL Pending |
| Max. Output Supply Voltage | 30VDC |
| Min. Output Supply Voltage | 10VDC |
| Max. Voltage Drop at Rated Current | 0.25VDC |
| Min. Load | None |
| I/O Indication | None |
| Galvanic Isolation | None |
| OFF to ON Response | 150ns |
| ON to OFF Response | 150ns |
| Output Characteristics | Current Sourcing (Pos. Logic) |
| PWM Out* | 500kHz Max |
| Rise Time | 150ns Max |
| Fall Time | 150ns Max |
| Modes Supported | Stepper, PWM |

1.9 Analog Inputs

| | | | |
|---------------------------|--|--|---|
| Number of Channels | 6 | Absolute Max. Input Voltage | -0.5 to -12VDC (+/- 30VDC) |
| Input Ranges (Selectable) | 0-20mA; 4-20mA DC; 0-60mV; 0-10VDC; T/C: J, K, N, T, E, R, S, B RTD: PT100, PT1000 | Input Impedance (Clamped @ -0.5 to 10.23VDC) | T/C / RTD / mV > 2MΩ mA: 15Ω + 1.5V V: 1.1MΩ |
| | | Galvanic Isolation | None |
| Nominal Resolution | 17 Bits | Conversion Speed | Min. All Channels Converted in app. < 250ms or 41ms per channel enable. |
| Sensor Range and Accuracy | Input Type: | Range: | Accuracy: |
| | TC J | -120 to 1000°C / -184 to 1832°F | +/- 0.2% of full scale +/- 1°C |
| | TC K | -130 to 1372°C / -202 to 2501.6°F | +/- 0.2% of full scale +/- 1°C |
| | TC T | -130 to 400°C / -202 to 752°F | +/- 0.2% of full scale +/- 1°C |
| | TC E | -130 to 780°C / -202 to 1436°F | +/- 0.2% of full scale +/- 1°C |
| | TC N | -130 to 1300°C / -202 to 2372°F | +/- 0.2% of full scale +/- 1°C |
| | TC R, S | 20 to 1768°C / 68 to 3214.4°F | +/- 0.2% of full scale +/- 3°C |
| | TC B | 500 to 1820°C / 212 to 3308°F *Functions below 500°C with reduced accuracy. | +/- 0.2% of full scale +/- 3°C |
| | PT100/1000 | -200 to 850°C / -328 to 1562°F | +/- 0.15% of full scale |
| | 0-20mA | 0-20mA | +/- 0.15% of full scale |
| 0-60mV | 0-60mV | +/- 0.15% of full scale | |
| 0-10V | 0-10V | +/- 0.15% of full scale | |

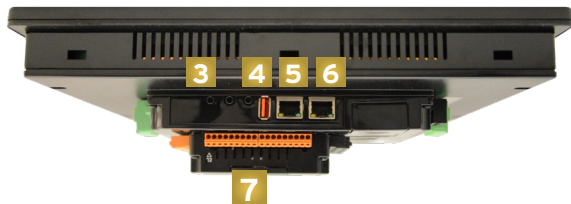
1.10 Analog Outputs

| | | | | |
|-------------------------------------|----------------|-------------------------|-----------------------------------|--------------|
| Number of Channels | 4 | Response Time | One Update per program logic scan | |
| Output Ranges | 0-10VDC | Minimum Resistance Load | 500Ω | |
| | 0-20mA, 4-20mA | Conversion Speed | Min. All Channels Once per Scan | |
| Nominal Resolution | 12 Bits | Galvanic Isolation | None | |
| Max. Error at 25°C (Excluding Zero) | 0-20mA | Temperature Drift Error | 20mA | 0.000143%/°C |
| | 0-10V | | 0-10V | 0.000151%/°C |
| Maximum Loop Voltage | 27V | | | |

2 CONTROLLER OVERVIEW

controller overview continued...

2.1 - Overview of EXL10

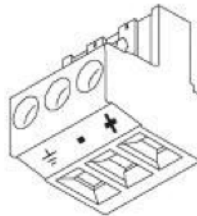


1. Touchscreen
2. Function Keys
3. Audio Out/In
4. USB 2.0 'A': Flash Storage
5. LAN1 Port
6. LAN2 Port
7. Built-In I/O
8. MJ1/MJ2: RS-232 & 1/2 Duplex RS-485
9. Dip Switches
10. MJ3: RS-232/485
11. CAN1: Can I/O & Fieldbus Port
12. Power: 10-30VDC In
13. microSD: Data Storage
14. USB mini 'B': Programming
15. CAN 2: CAN I/O

NOTE: See Precaution #12 on page 8 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 Rating: 4.5 - 7 in-lbs (0.50 - 0.78 N-m).

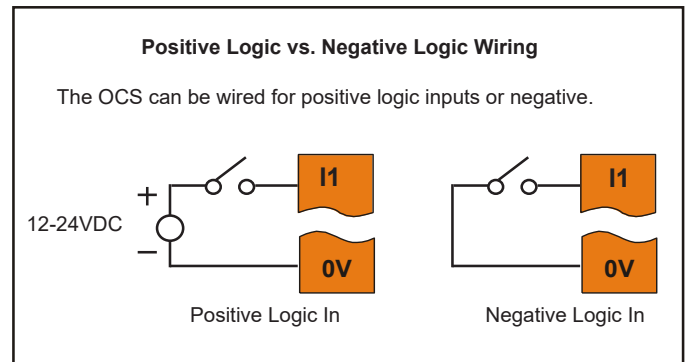
DC- is internally connected to I/O V-, but is isolated from CAN V-. A Class 2 power supply must be used.

POWER UP

1. Attach included ferrite core with a minimum of two turns of the DC+ and DC- signals from the DC supply that is powering the controller.
2. Connect to Earth Ground
3. Apply recommended power.

3 WIRING: INPUTS AND OUTPUTS

3.1 - Digital Input & Output Information



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. 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 EXL10 User Manual [MAN1032] for full details.

wiring: I-O continued...

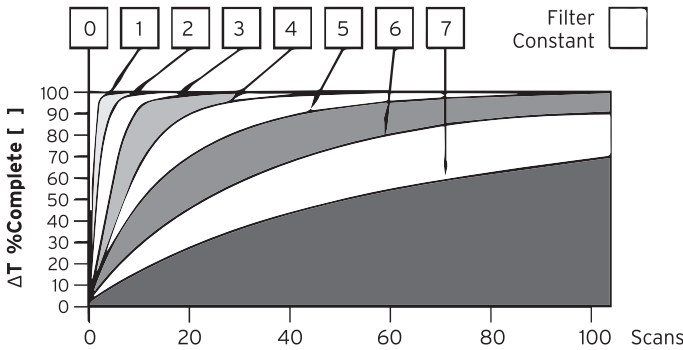
3.4 - I/O Wiring

3.2 - Analog Inputs

Analog Input Information

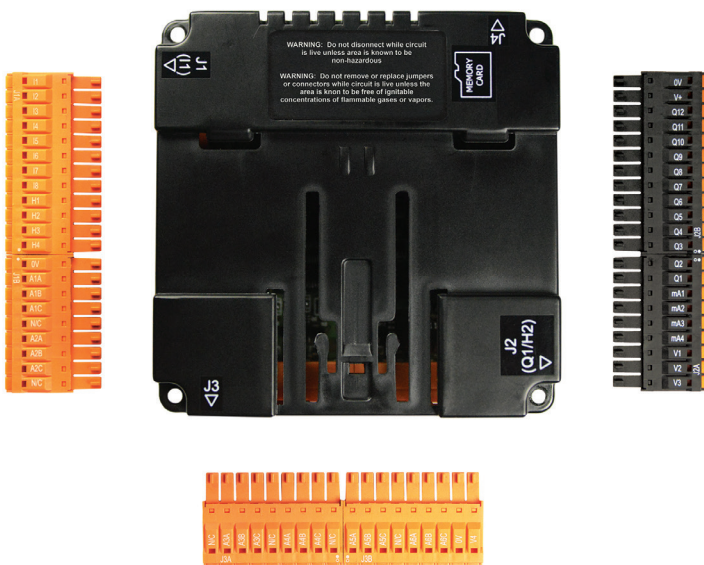
Raw input values for channels 1-4 are found in the registers as Integer-type data with a range from 0 - 32000.

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.

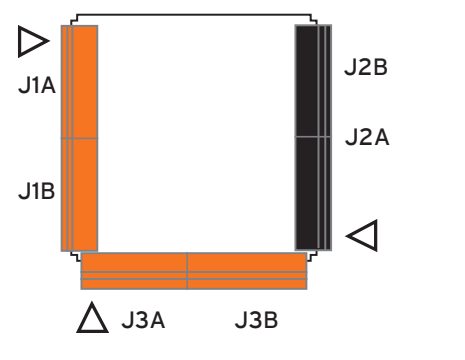
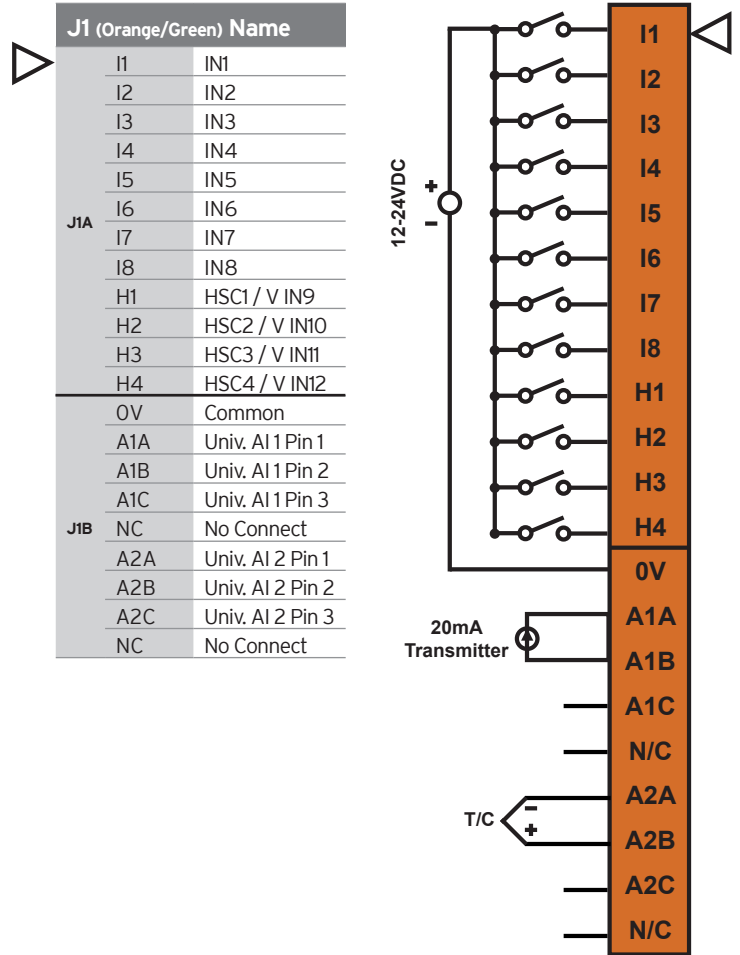


| Data Values | |
|----------------|---|
| INPUT MODE: | DATA FORMAT, 12-bit INT: |
| 0-20mA, 4-20mA | 0-32000 |
| 0-10V | 0-32000 |
| T/C & RTD | Temperature in °C or °F to 1 decimal place (xxx.y) NOTE: °C or °F may be selected in the Hardware Configuration section in Cscape. The value is an integer, so the user should divide by 10. |

3.3 - Connector Overview



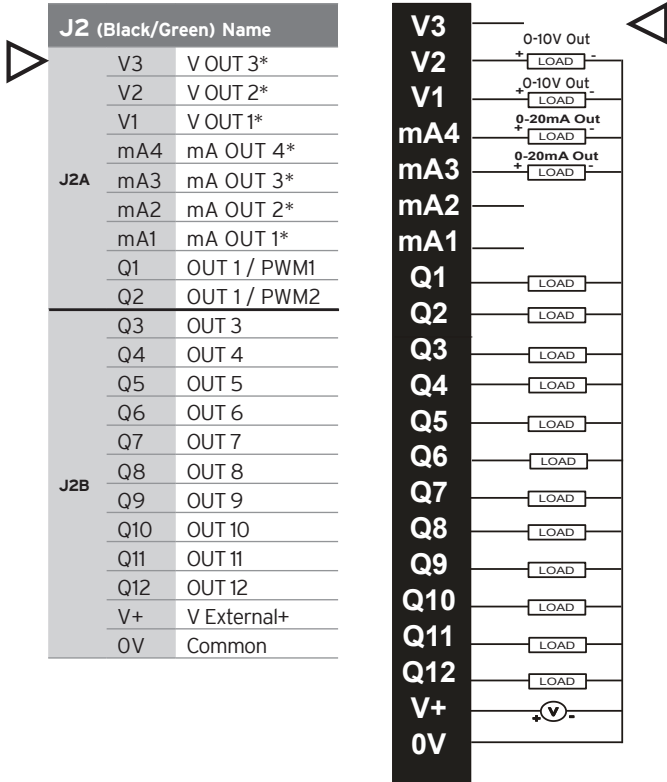
J1 Wiring



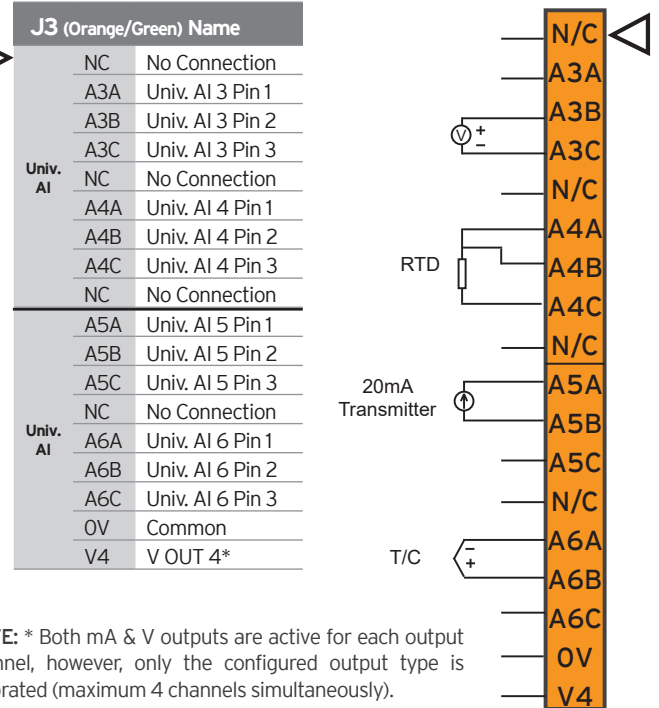
For ease of operability, the high density terminals are divided into more manageable pairs of connectors (J1A + J1B, J2A + J2B, J3A + J3B). To ensure proper installation, connector symbols must match.

wiring: I-O continued...

J2 Wiring



J3 Wiring

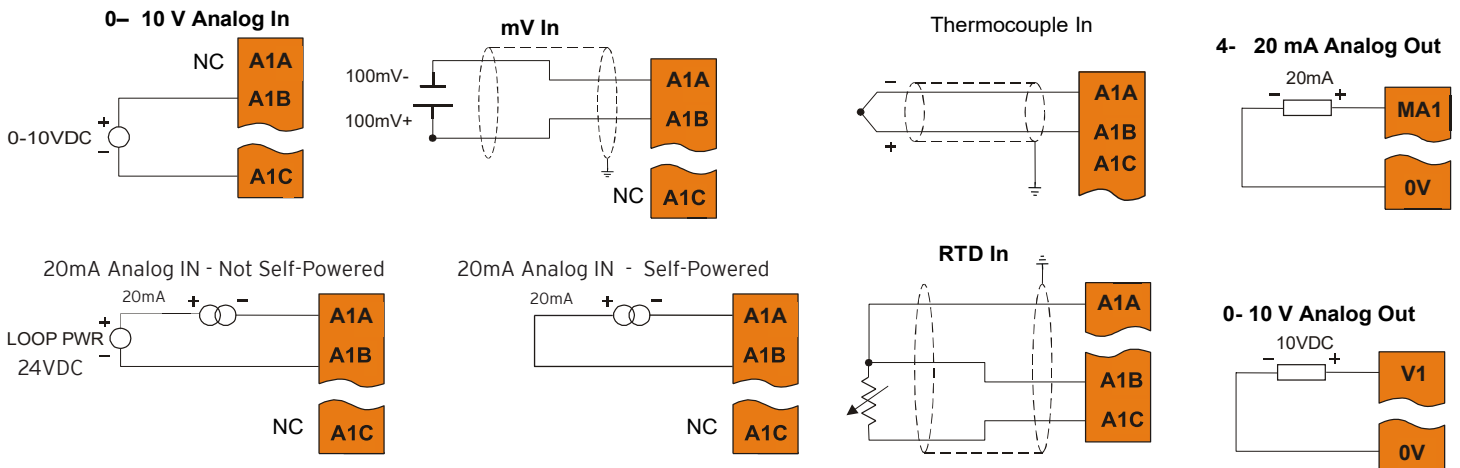


NOTE: * Both mA & V outputs are active for each output channel, however, only the configured output type is calibrated (maximum 4 channels simultaneously).

Wiring Details:

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

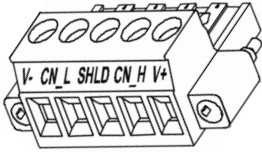
Ex: Universal Input Wiring Schematic



NOTE: Depending on the transmitter, isolated loop power may be required.

4 COMMUNICATIONS

4.1 - CAN Communications

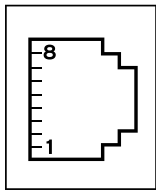


| CAN Pin Assignments | | |
|---------------------|---------|-----------------------|
| PIN | SIGNAL | DESCRIPTION |
| 1 | V- | CAN Ground - Black |
| 2 | CN L | CAN Data Low - Blue |
| 3 | SHLD | Shield Ground - None |
| 4 | CN H | CAN Data High - White |
| 5 | V+ (NC) | No Connect - Red |

CAN

Solid/Stranded wire: 12-24 awg (2.5-0.2mm).
 Strip length: 0.28" (7mm).
 Locking spring-clamp, two-terminators per conductor.
 Torque Rating: 4.5 in-lbs (0.50 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



MJ1/2 SERIAL PORTS

Two Serial Ports on One Module Jack (8posn)

MJ1: RS-232 w/Full Handshaking
MJ2: RS-485 Half-Duplex

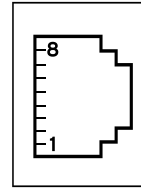
| MJ1 PINS | | | MJ2 PINS | |
|----------|------------|-----------|------------|-----------|
| PIN | SIGNAL | DIRECTION | SIGNAL | DIRECTION |
| 8 | TXD | OUT | -- | -- |
| 7 | RXD | IN | -- | -- |
| 6 | 0V | GROUND | 0V | GROUND |
| 5 | +5V @ 60mA | OUT | +5V @ 60mA | OUT |
| 4 | RTS | OUT | -- | -- |
| 3 | CTS | IN | -- | -- |
| 2 | -- | -- | RX- / TX- | IN / OUT |
| 1 | -- | -- | RX+ / TX+ | IN / OUT |

EXL10 User Manual [MAN1029]

The User Manual includes extensive information on:

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

serial communications continued...

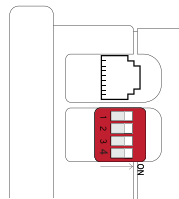


MJ3 SERIAL PORT

2 Multiplexed Serial Ports on One Modular Jack (8posn)

| MJ3 PINS | | |
|----------|------------|-----------|
| PIN | SIGNAL | DIRECTION |
| 8 | TXD RS232 | OUT |
| 7 | RXD RS232 | IN |
| 6 | 0V | GROUND |
| 5 | +5V @ 60mA | OUT |
| 4 | TX- RS485 | OUT |
| 3 | TX+ RS485 | OUT |
| 2 | RX- RS485 | IN |
| 1 | RX+ RS485- | IN |

4.3 - Dip Switches

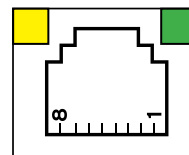


DIP SWITCHES

| PIN | NAME | FUNCTION | DEFAULT |
|-----|-----------------------|-----------------|---------|
| 1 | MJ3 RS485 Termination | ON = Terminated | OFF |
| 2 | MJ3 Duplex | ON = Half | OFF |
| 3 | | OFF = Full | OFF |
| 4 | MJ2 RS485 Termination | ON = Terminated | OFF |

The DIP switches are used to provide a built-in termination to both the MJ1, MJ2 & MJ3 ports 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.

4.4 - Ethernet Communications



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

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

5 BUILT-IN I/O

5.1 Built-in I/O (EXL10, Model 6)

All EXL10 models (except the Model 0) feature built-in I/O. 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 the EXL10 OCS User's Manual [MAN1029].

5.2 Digital and Analog I/O Functions

| | |
|-----------------|----------|
| Digital Inputs | %I1-12 |
| Reserved | %I13-31 |
| ESCP Alarm | %I32 |
| Digital Outputs | %Q1-12 |
| Reserved | %Q13-24 |
| Analog Inputs | %AI33-38 |
| Reserved | %AI1-32 |
| Analog Outputs | %AQ9-12 |
| Reserved | %AQ1-8 |

6 BATTERY MAINTENANCE

The EXL10 has an advanced battery system that uses a rechargeable lithium battery. The battery powers the real time clock when power is removed, and it is needed for register data retention. Please reference the EXL10 User Manual [MAN1029] which provides instructions on how to replace the battery.

NOTE: For detailed rechargeable battery information, refer to the Battery Manual [MAN1142].

EXL10 User Manual [MAN1029]

The User Manual includes extensive information on:

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

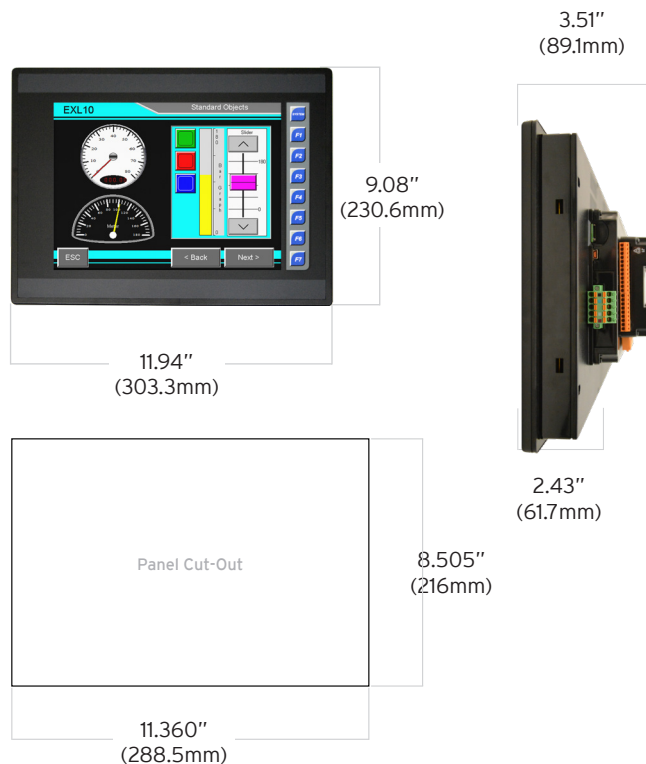
5.3 Status Registers

| Selectable Range | Description | | | | | | | |
|------------------|---|---------------|-------------|-------------|------------------|---------------|-------------|-------------|
| %Rx* | Bit-wise status register enable: Set %Rx.1 - %Rx.9 high to enable for registers %R(x+1) to %R(x+9). | | | | | | | |
| %R(x+1) | Firmware version | | | | | | | |
| %R(x+2) | Watchdog count - cleared on power-up. | | | | | | | |
| %R(x+3) | Status Bits: | | | | 16...4 | 3 | 2 | 1 |
| | | | | | Reserved | Normal | Config | Calibration |
| %R(x+4) | Scan rate of the 106 board (average) in units of 100 µs. | | | | | | | |
| %R(x+5) | Scan rate of the 106 board (max) in units of 100 µs. | | | | | | | |
| %R(x+6) | Channel Status: Channel 2 | | | | Channel 1 | | | |
| | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| | Open RTD | Out of Limits | Shorted RTD | Open Sensor | Open RTD | Out of Limits | Shorted RTD | Open Sensor |
| %R(x+7) | Channel Status: Channel 4 | | | | Channel 3 | | | |
| | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| | Open RTD | Out of Limits | Shorted RTD | Open Sensor | Open RTD | Out of Limits | Shorted RTD | Open Sensor |
| %R(x+8) | Channel Status: Channel 6 | | | | Channel 5 | | | |
| | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| | Open RTD | Out of Limits | Shorted RTD | Open Sensor | Open RTD | Out of Limits | Shorted RTD | Open Sensor |
| %R(x+9...14) | Reserved | | | | | | | |

*Example: %Rx= %R500, %R(x+1) = %R501, %R(x+2) = %R502, ...

7 INSTALLATION & DIMENSIONS

7.1 Dimensions



7.2 - Installation Procedure

- The EXL10 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 JPI 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 EXL10. 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 216mm x 288.5mm +/-0.1 mm opening into which the EXL10 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 EXL10. Insert the EXL10 through the panel cutout (from the front). The gasket must be between the host panel and the EXL10.
 - Install and tighten the four mounting clips (provided in the box) until the gasket forms a tight seal.
NOTE: Max torque is 0.8 to 1.13 N m, or 7-10 in-lbs.
 - Reinstall the EXL10 I/O Removable Terminal Blocks. Connect communications cables to the serial port, USB ports, Ethernet port, and CAN port as required.

8 SAFETY & WARNINGS

8.1 - 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. 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.
- 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.**

8.2 - 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

8.3 - 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.

9 PART NUMBER

| | Global | European |
|---------|-----------|-------------|
| Model 6 | HE-EXVIE6 | HEXT505C116 |

10 TECHNICAL SUPPORT

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

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

Europe
(+) 353-21-4321-266
www.hornerautomation.eu
technical.support@horner-apg.com