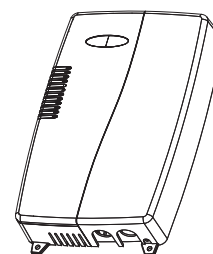


Network Controller with Integral I/O

T-202-XPR-24 / T-602-XPR-24

MOUNTING AND WIRING GUIDE

This document covers the mounting and wiring of the Tridium® T-202 and T-602 Express series (T-202-XPR-24 and T-602-XPR-24 models) of JACE® controllers. It assumes that you are an engineer, technician, or service person who is performing control system installation. Instructions in this document apply to the following products:



Model	Description
T-x02-XPR-24 T-202-XPR-24 ¹ or T-602-XPR-24 ²	Base unit including two Ethernet ports, one RS-232 port, one RS-485 port, integral power supply for 24Vac/dc input, and 16 onboard I/O points (8 universal inputs, 4 digital outputs, 4 analog outputs).
T-x02-XPR-24-GW	T-202-XPR-24 or T-602-XPR-24 with factory-installed wireless GPRS modem module and a SIM card for use on the Wyless Network.

1. T-202 models: PowerPC 405EP processor @250 MHz, 64MB Flash, 128MB SDRAM
2. T-602 models: PowerPC 440 processor @ 524 MHz, 128MB Flash, 256MB DDR RAM



Note Not covered in this document is the Niagara^{AX} software installation and configuration required for a functioning unit. Refer to the *JACE NiagaraAX Install and Startup Guide*, *GPRS Modem Option - Engineering Notes*, and *NiagaraAX NRIO Guide* documents for this information.

These are the main sections in this document:

- [Product Description](#), page 1
- [Preparation](#), page 4
- [Mounting](#), page 7
- [Board Layout](#), page 12
- [About Expansion Options](#), page 13
- [Wiring Summary](#), page 15
- [Earth Ground and 24V Input Power](#), page 16
- [I/O Wiring](#), page 17
 - [Inputs](#), page 17
 - [Outputs](#), page 20
- [Nrio16Module \(Software\) Representation](#), page 21
- [External 12V Backup Battery](#), page 24
- [Wiring to Remote I/O Modules](#), page 25
- [Power Up and Initial Checkout](#), page 25

Also included in this document are several appendixes:

- [About LEDs](#), page 28
- [Maintaining the T-x02-XPR-24](#), page 29
- [Replacement Parts](#), page 32
- [Certifications](#), page 35

Product Description

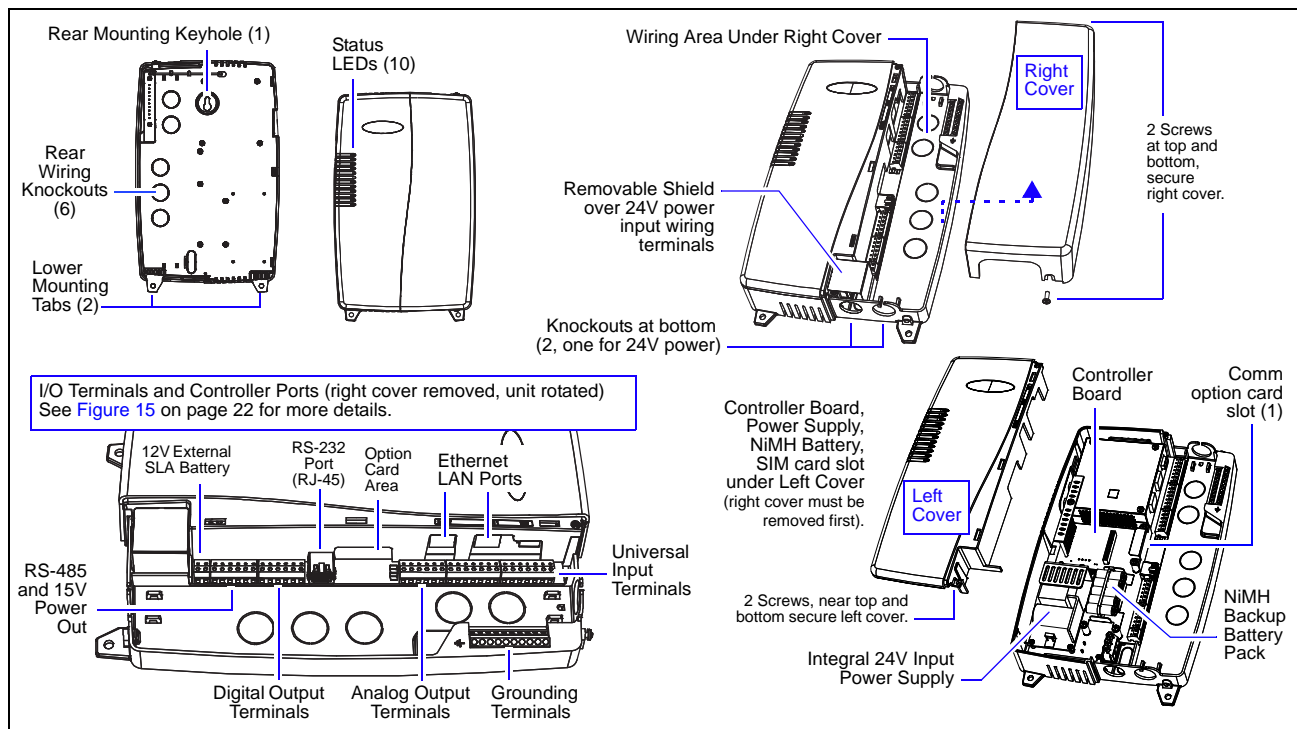
The T-x02-XPR-24 Express JACE controller is an embedded controller/server for remote monitoring and control applications. Included are 16 points of on-board I/O with removable screw terminals, a built-in power supply (24VAC or 24VDC input), an optional onboard GPRS modem, and one expansion slot for a communications option card. Flash memory is used for storage, and an integral NiMH battery provides shutdown/database backup and real-time clock support for power loss scenarios.

Designed for use in commercial environments, the T-x02-XPR-24 runs the NiagaraAX Framework to provide integrated control, supervision, and network management solutions for wide variety of networked field devices. NiagaraAX-3.4.51 or later is required.

Packaging and Features

The T-x02-XPR-24 has a plastic chassis designed for wall mounting by using 3 screws; one in a rear keyhole slot, and two into lower mounting tabs. Vents at the top and bottom of the unit allow cooling by air convection. The front cover is split in two halves, each secured by 2 screws, where the right cover overlaps the left cover. The right side provides access to all wiring terminals, including controller communications ports, I/O point terminals, and 24V power input terminals. See [Figure 1](#) for the location of important features.

Figure 1 Features of T-x02-XPR-24 controller.



The wiring area under the right cover provides knockouts at the back, bottom and top holes, and a grounding terminal strip. For wiring ease, the controller uses removable screw terminal blocks, using 0.2" (5mm) spacing. Typically, the left-side cover needs removal only if replacing the NiMH battery pack, installing a SIM card in the onboard GPRS modem (if model so equipped), or if installing an option card on the controller. One option card is supported, to provide additional communications, e.g. LonWorks FTT-10, or another RS-232 port. Controller models are available with a pre-installed GPRS modem (does not consume option card slot).

Sixteen (16) integral I/O points include 8 universal inputs (UIs), compatible with 0–10Vdc, 4–20mA, dry contacts, pulsing dry contacts, or Type 3 thermistor sensors. Four (4) digital outputs with Form-A relay contacts provide on/off control of loads up to 30Vac or Vdc, at 0.5A maximum. Four (4) 0–10Vdc analog outputs provide analog control of loads at 2.5K ohm minimum, or 4mA drain maximum.

Ten (10) LEDs are visible atop the left cover, indicating the state of each of the four digital outputs, along with the status of the controller, Ethernet, and wireless options (if installed). A GSM/GPRS quad-band antenna can be mounted on the left side, if a GPRS-equipped model. A rechargeable NiMH battery pack is included inside the unit. Separate terminals support an external 12V sealed lead-acid (SLA) backup battery, if desired.

As a Tridium-2/6 series device, the controller uses a PowerPC processor with Flash memory for storage and has either SDRAM or DDR RAM. TCP/IP access is via two standard Ethernet ports, and two serial ports (RS-232, RS-485) are also standard. The T-x02-XPR-24 uses the QNX RTOS operating system, along with the IBM J9 JVM. For a complete listing, see the next section [“Technical Specifications.”](#)

Technical Specifications

T-x02-XPR-24 Platform

- **T-202-XPR-24 models:**
 - PowerPC 405EP @ 250 MHz processor.
 - 128 MB SDRAM and 64 MB Serial Flash.
- **T-602-XPR-24 models:**
 - PowerPC 440 @ 524 MHz processor.
 - 256 MB DDR RAM and 128 MB Serial Flash.
- Real-time clock.
- Two (2) Ethernet ports, 10/100 Mbps (RJ-45 Connectors).
- One (1) RS-232 port, using an RJ-45 Connector.
- One (1) isolated RS-485/15Vdc power on a 6-position connector. Usable as a standard non-powered isolated RS-485 port on 3 terminals, or to support remote I/O modules—available in a later release. (A *maximum of three* T-IO-16-485 modules is recommended, due to platform resource considerations).
- One (1) available comm option card slot for a communications option card, such as LonWorks FTT-10, an additional RS-232 port, or two more isolated RS-485 ports.
- One (1) USB port for future use (T-602-XPR models only)
- LEDs on front of unit to monitor controller power, system status, and digital output states.

Onboard I/O Points

- 16 total points of I/O, using removable screw terminals (spacing 0.2" or 5mm centers) for all inputs and outputs, in connector blocks of 6 or more screws each.
- **8 Universal Inputs (UI)**, with types supported:
 - Type 3 (10K) Thermistors; Thermistor Sensor Range -23.3°C to +115.5°C (-10°F to +240°F). Input accuracy is in the range of $\pm 2\%$ of span. Other types may be supported by entering custom non-linear curve interpolation points for each unique non-linear input.
 - 0–10 Vdc; accuracy is $\pm 2\%$ of span, without user calibration.
 - 4–20 mA current loop; accuracy is $\pm 2\%$ of span, without user calibration. Self-powered or board-powered sensors accepted; uses an external resistor for current input (four provided, mounted by installer on input terminal connections).
 - Dry contact; 3.3V open circuit, 300uA short-circuit current.
 - Pulsing dry contact, at rate up to 20Hz; 50% duty cycle.
- **4 Digital Outputs (DO)**, using Form A relay contacts; suitable for on/off control only (no floating control). Maximum load voltage is 30V DC or AC; with 0.5A maximum current rating per contact.
- **4 Analog Outputs (AO)**, providing 0–10Vdc signal, at 4mA drain maximum (controlled load must have resistance of 2500 ohms or higher).

Power Input

- Integrated power supply for 24V input, using either a dedicated, external, Class-2, 24Vac transformer *or* a 24Vdc power supply, 40W maximum.
- Includes integral rechargeable NiMH backup battery pack, for short duration AC power fail operation.
- Connection for external, rechargeable, 12V sealed lead-acid battery, for continuous system operation over longer power outages. Provides trickle charge and monitoring support to customer-supplied battery.

GPRS Modem (for models ordered with it)

- Factory-installed GSM cellular modem using GPRS (General Packet Radio Service) data technology. An LED on the front left cover indicates modem status.

Included in this Package

- Uses GSM/GPRS quad-band SMA coax-mounted stub antenna, mounted on left side of unit. If needed, an extension SMA coax cable can be used to the antenna, or another external antenna used instead.
- T-x02-XPR-24-GW models include a Wyless SIM.

Operating System

- QNX RTOS, IBM J9 Java Virtual Machine (if T-602-XPR-24 with AX-3.6 or later, Sun Hotspot JVM).
- JACE (Java Application Control Engine) NiagaraAX software (AX-3.4.51 or later required).

Chassis and Enclosure

- Plastic wall mount chassis, with two removable front covers secured by screws.
- Cooling by internal air convection.
- Dimensions: 12.625" (320.7mm) tall x 7.5" (190.5mm) wide x 2.25" (57.2mm) deep.
- Weight: Net 2.1 lbs. (0.95 kg), Gross 3 lbs. (1.36 kg)

Environment

- Operating temperature range: 0°C to 50°C (32°F to 122°F).
- Storage temperature range: 0°C to 70°C (32°F to 158°F).
- Relative humidity range: 5% to 95% at 25°C (77°F), non-condensing.

Agency Listings

- UL 916.
- C-UL listed to Canadian Standards Association (CSA) C22.2 No. 205-M1983 "Signal Equipment".
- CE, FCC part 15 Class A
- BTL B-BC BACnet Building Controller listed when the BACnet driver is installed and configured.

Preparation

Unpack the T-x02-XPR-24 and inspect the package contents for damaged or missing components. If damaged, notify the appropriate carrier at once and return any damaged components for immediate repair or replacement. See ["Returning a Defective Unit"](#) on page 34.

- [Included in this Package](#)
- [Material and Tools Required](#)

Included in this Package

Included in this package you should find the following items:

- the T-x02-XPR-24 controller, with both cover halves fastened.
- This *T-x02-XPR-24 Mounting and Wiring Guide*, Part Number 11338 Rev 3.2
- a hardware bag containing the following items:
 - Two (2) 7-position screw terminal blocks, for UIs (universal inputs).
 - Three (3) 6-position screw terminal blocks, one for AOs (analog outputs), one for DOs (digital outputs), one for RS-485/15V power to optional remote modules (3 terminals RS-485, 3 for power).
 - One (1) 2-position screw terminal block for external 12V sealed lead-acid battery (not provided).
 - A GSM/GPRS coax-mounted stub antenna (for units ordered with integral GPRS modem).
- if a T-x02-XPR-24-GW model controller, a SIM card provisioned by the Wyless Group.

Material and Tools Required

The following supplies and tools are typically required for installation:

- Suitable tools and fasteners for mounting unit and accessories.

- #1 Phillips screwdriver: used to remove and replace cover screws.
 - #2 Phillips screwdriver: used to install optional communications card.
 - Small flat-blade screwdriver: used for making wiring connections to removable screw terminal plugs.
- To power the unit, either one of the following:
 - UL listed, Class 2, 24Vac transformer, rated at minimum of 40VA. Note that a *dedicated* transformer is required (does not also power additional equipment).
 - 24Vdc power supply, capable of supplying at least 1.5A (36W).
- (Optional) One or two 12V sealed-lead-acid (SLA) rechargeable backup batteries, with wire harness for connecting to the 2-position connector on the unit. Should be sized as required by the system. See [“External 12V Backup Battery,”](#) page 24.

Related Documentation

For more information on configuring and using the T-x02-XPR-24 controller, consult the following documents:

- *JACE NiagaraAX Install and Startup Guide*
- *GPRS Modem Option - Engineering Notes*
- *T-IO-16-485 Installation and Configuration Instructions*
- *NiagaraAX Nrio Guide*
- *NiagaraAX User Guide*

Precautions

This document uses the following warning and caution conventions:



Caution

Cautions remind the reader to be careful. They alert readers to situations where there is a chance that the reader might perform an action that cannot be undone, might receive unexpected results, or might lose data. Cautions contain an explanation of why the action is potentially problematic.



Warning

Warnings alert the reader to proceed with extreme care. They alert readers to situations where there is a chance that the reader might do something that can result in personal injury or equipment damage. Warnings contain an explanation of why the action is potentially dangerous.

Safety Precautions

The following items are warnings of a general nature relating to the installation and start-up of the controller. Be sure to heed these warnings to prevent personal injury or equipment damage.



Warning

- A 24Vac or 24Vdc circuit powers the T-x02-XPR-24. Disconnect power before installation or servicing to prevent electrical shock or equipment damage.
- Make all connections in accordance with national and local electrical codes. Use copper conductors only.
- To reduce the risk of fire or electrical shock, install in a controlled environment relatively free of contaminants.
- This device is only intended for use as a monitoring and control device. To prevent data loss or equipment damage, do not use it for any other purpose.

NiMH Battery Precautions

Observe the following NiMH (Nickel Metal Hydride) battery precautions:



Warning

- **Overcharging, short circuiting, reverse charging, mutilation, or incineration of the cells and the batteries must be avoided to prevent one or more of the following occurrences:**
Release of toxic materials, release of hydrogen and/or oxygen gas, rise in surface temperature.
- **If a cell or battery has leaked or vented, replace it immediately using protective gloves.**
- **If and when necessary, these cells or batteries must be replaced with identical new ones from the same manufacturer. If a cell or a battery to be replaced is connected with other cells or batteries in series, it is recommended that the other cells or batteries be replaced with new ones at the same time.**
- **Reverse polarity installation of the cell or the battery in the end product must be avoided.**

Static Discharge Precautions

Static charges produce voltages high enough to damage electronic components. Circuitry within the controller is sensitive to static discharge. Follow these precautions when installing or servicing the unit:



Caution

- **Work in a static-free area.**
- **Discharge any static electricity you may have accumulated. Discharge static electricity by touching a known, securely grounded object.**
- **Do not handle printed circuit boards (PCBs) without proper protection against static discharge. Use a wrist strap when handling PCBs. The wrist strap clamp must be secured to earth ground.**

WEEE (Waste of Electrical and Electronic Equipment)



Recycling of Electronic Products: (International Installations)

In 2006 the European Union adopted regulations (WEEE) for the collection and recycling of all waste electrical and electronic equipment. It is no longer allowable to simply throw away such equipment. Instead, these products must enter the recycling process.

To properly dispose of this product, please return it to your local authority collection point. If such a facility is not available, please send it to one of these offices:

Tridium Europe Ltd
1, The Grainstore
Brooks Green Road
Coolham, West Sussex
RH138GR United Kingdom

Tridium Asia Pacific Pte Ltd
17 Changi Business Park Central 1
Honeywell Building
Singapore 486073

Tridium Inc.
2256 Dabney Road, Suite C
Richmond, VA 23230

Mounting



Note This product is intended for indoor use only. The unit should not be exposed to ambient conditions outside of the range of 0°C (32°F) to 50°C (122°F), or relative humidity outside the range of 5 to 90% at 25°C (77°F), non-condensing. Refer to the “[Environment](#)” section on page 4 for further details on storage specifications.



Note Before mounting the unit:

- Remove any wiring knockouts needed. See “[Locate and remove chassis knockouts](#),” page 10.
- Install the SIM card for the integral GPRS modem (if applicable). See “[Inserting a SIM card and attaching GPRS antenna](#),” page 11.
- Install any option card (if applicable). See “[About Option Cards](#),” page 13.

Mount the T-x02-XPR-24 controller in a location that allows clearance for wiring, servicing, and removal of covers. Additional mounting information applies, as follows:

- [Environmental Requirements](#)
- [Physical Mounting](#)

Environmental Requirements

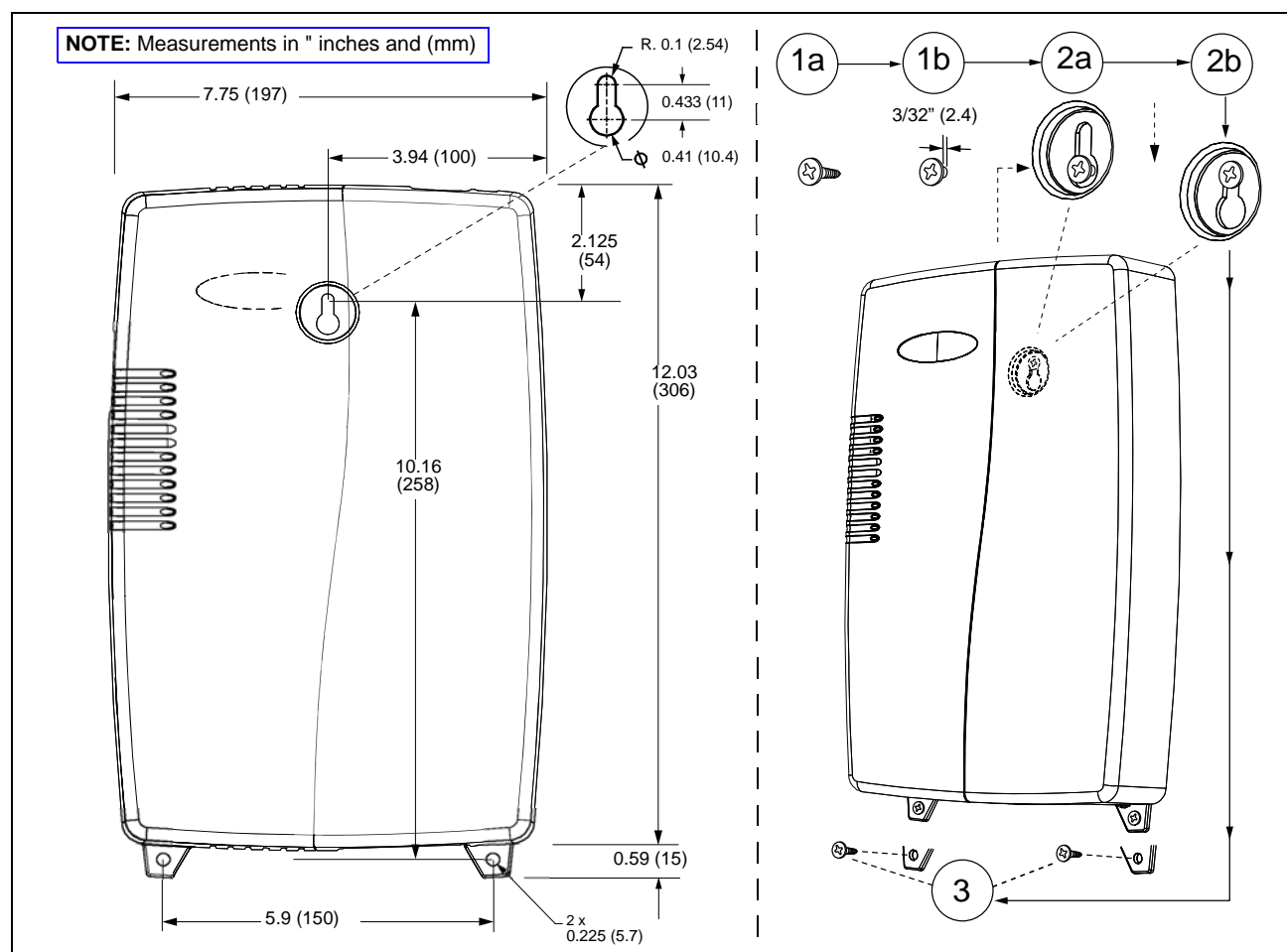
Note the following requirements for the T-x02-XPR-24 mounting location:

- If mounting inside an enclosure, that enclosure should be designed to keep the unit within its required operating range considering a 20-watt dissipation by the controller, plus dissipation from any other devices installed in the same enclosure. This is especially important if the controller is mounted inside an enclosure with other heat producing equipment.
- Do not mount the unit:
 - in an area where excessive moisture, corrosive fumes, or explosive vapors are present.
 - where vibration or shock is likely to occur.
 - in a location subject to electrical noise. This includes the proximity of large electrical contractors, electrical machinery, welding equipment, spark igniters, and variable frequency drives.

- For proper cooling, mount the T-x02-XPR-24 vertically, with the two screw mounting tabs at the bottom of the unit. It is not necessary to remove the covers before mounting.
- Dimensions of the rear keyhole slot and lower mounting tabs are shown in the following [Figure 2](#), along with a step-by-step wall mounting procedure.



Figure 2 T-x02-XPR-24 controller wall mounting dimensions and details.



Procedure 1 **To mount unit on wall.**

- | | |
|---------------|--|
| Step 1 | For the rear center keyhole slot, install a pan head screw into the wall. Do not tighten completely—leave the back of the screw head about 3/32" (2.4mm) from the wall (1b in Figure 2). |
| Step 2 | Position the unit over the screw, entering the screw head into the keyhole slot in the back of the unit. Pressing the unit against the wall, slide it down so the screw is captured by the slot (2b in Figure 2). |
| Step 3 | Level the unit, and install a screw into each of the two lower mounting tabs (3 in Figure 2). |

Removing and Replacing the Covers

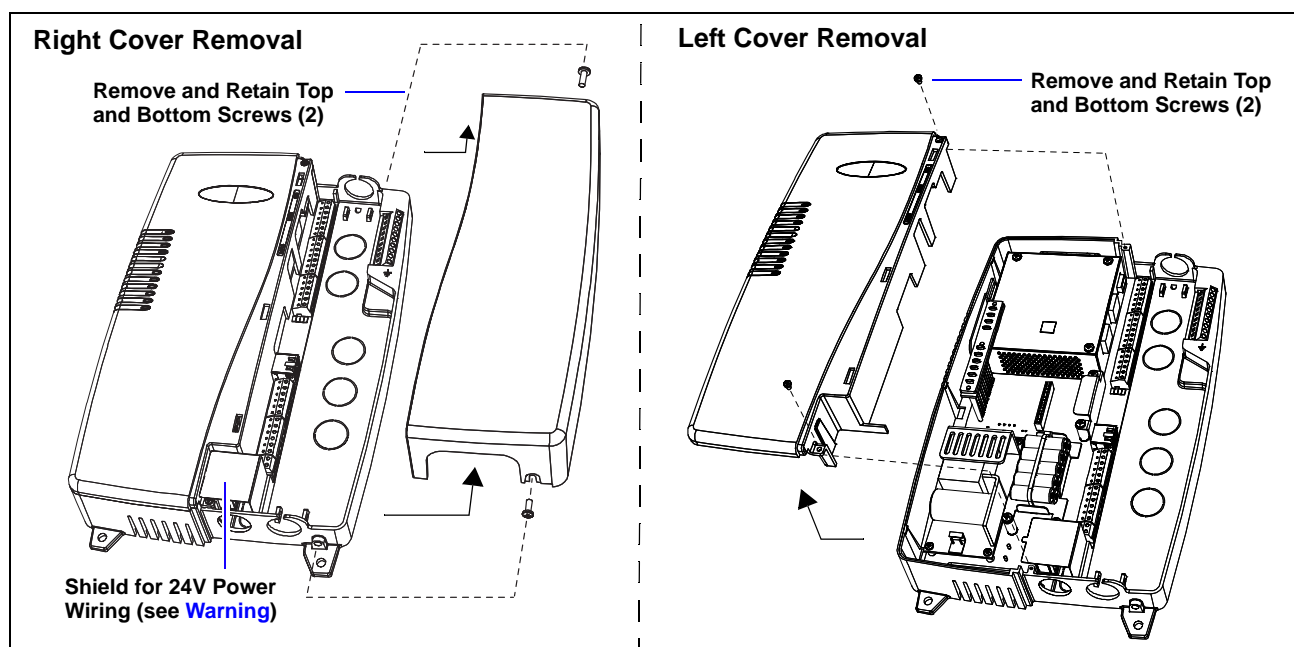
The T-x02-XPR-24 controller has two plastic covers, each is secured by two #1 phillips head screws:

- **Right cover** — Must be removed first, provides access to all wiring terminals (controller and I/O wiring).
- **Left cover** — Remove only to install a SIM card (if a model with GPRS modem), install an option card, or to replace the controller's NiMH battery pack.

See [Figure 3](#) for locations of the screws that secure each of the two covers.

 **Warning** Remove 24V power before removing power wiring shield, **before making any wiring terminations, or before removing the left cover!**

Figure 3 T-x02-XPR-24 controller cover removal.



Procedure 2 To remove the right cover.

- Step 1** Using a #1 Phillips screwdriver, remove the two screws in the right cover as shown in [Figure 3](#), left. Carefully set the screws aside to reuse.
- Step 2** Slide the cover towards the right to disengage.
- Step 3** Lift the right cover away from the unit, and set aside. Replace by simply reversing this procedure.

Procedure 3 To remove the left cover.

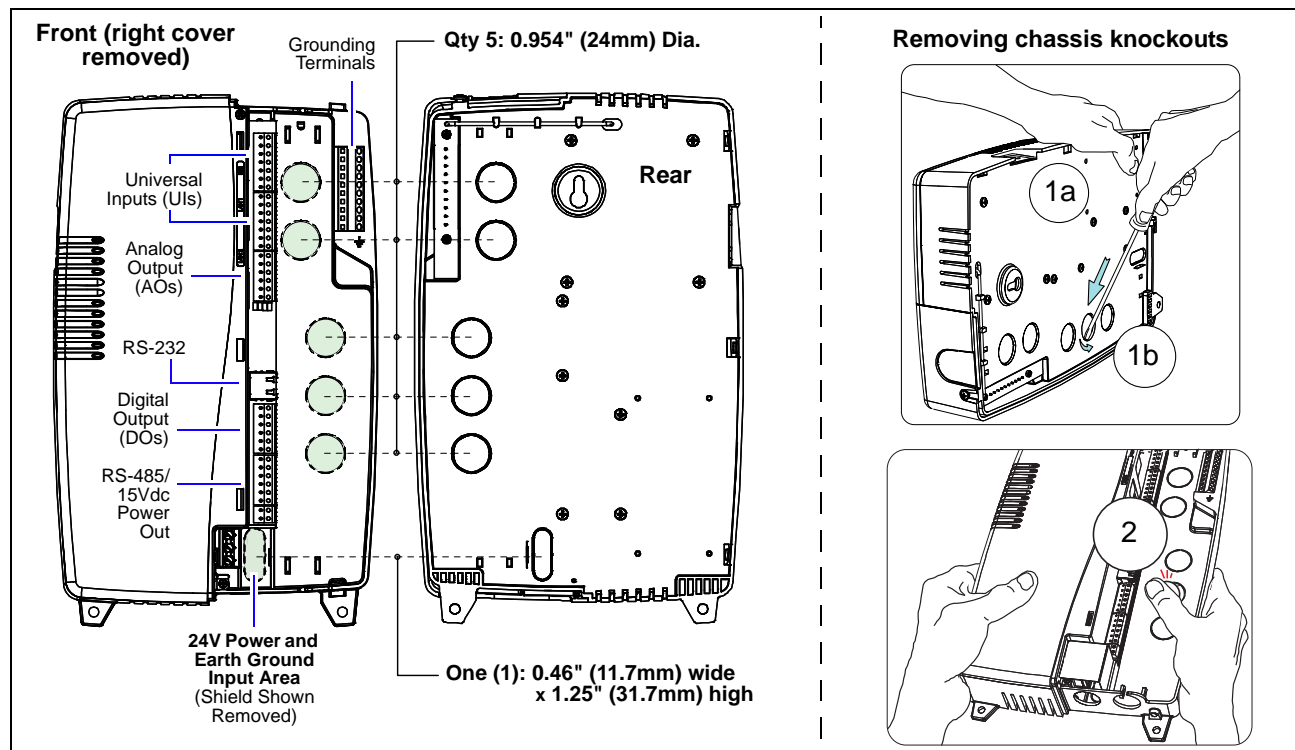
- Step 1** Remove the right cover (see previous [Procedure 2](#)).
- Step 2** Using a #1 Phillips screwdriver, remove the two screws as shown in [Figure 3](#), right. Carefully set the screws aside to reuse.
- Step 3** Lift the left cover away from the unit, and set aside. Replace by simply reversing this procedure.

Locate and remove chassis knockouts

The T-x02-XPR-24 has six (6) wiring knockouts on the back of the plastic chassis (see [Figure 4](#)):

- **Five (5) round**, 0.945" (24mm) diameter, for general wiring of controller terminals and I/O points.
- **One (1) oval**, 0.46" (11.7mm) wide x 1.25" (31.7mm) high, for wiring 24V input power and ground.

Figure 4 Wiring knockout details.



Note In addition to these rear knockouts, there are two wiring holes, 0.845" (21.5mm) for general wiring—one on the top side, one on the bottom side. The top hole has an associated “U-shaped knockout” atop the right cover. Also, an additional wiring hole is at the bottom 0.865" (22mm), available for wiring 24V input power and ground. Usage of wiring knockouts and holes will vary by installation.

Remove the appropriate knockouts, as needed, before mounting to the wall. Note that the shielded 24V power input wiring area has a hole on the bottom side, as well as an oval-shaped knockout on the rear of the chassis. If necessary, install any conduit or cable clamps to knockout holes.

Procedure 4 Locate and remove chassis knockouts.

- Step 1** To remove a rear knockout:
- Hold the unit with its knockout side on flat work surface, as shown in [Figure 4](#) (1a).
 - From the back, wedge a straight-blade screwdriver into the knockout edge, and twist to pry open as shown in [Figure 4](#) (1b).
- Step 2** Remove the right-side cover (see “[Removing and Replacing the Covers](#),” page 9). Press up each opened knockout with your finger and thumb ([Figure 4](#), 2), then twist and remove.

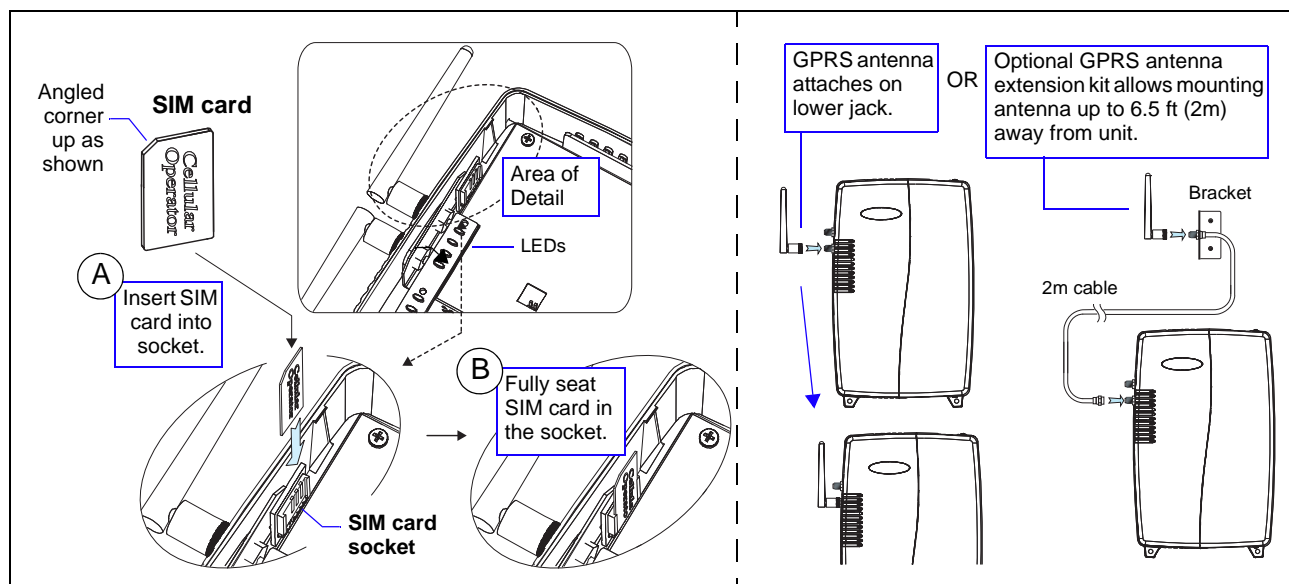
Inserting a SIM card and attaching GPRS antenna

For any controller ordered with the integral GPRS modem, you must insert a SIM card in its SIM card socket for GPRS operation. You must remove both covers to access the socket. Given the tight working area, this is easiest to do *before* mounting the unit.



Note A T-x02-XPR-24 ordered *without* the integral GPRS modem does not have the circuit board with the SIM card socket installed in the controller. In this case, this small circuit board may be “left over” in the included hardware bag. If so, you may safely discard it and skip the remainder of this section.

Figure 5 Inserting SIM in T-x02-XPR-24's SIM card socket, attaching antenna (GPRS equipped units only).



Note The *lower* antenna jack is for the integral GPRS modem, where the antenna attaches using a standard SMA coax connector. Note the GPRS antenna is *not* interchangeable with one for the upper antenna jack (future use), which uses a “reverse polarity SMA” type connector.

Procedure 5 Inserting a SIM card and mounting the GPRS stub antenna.

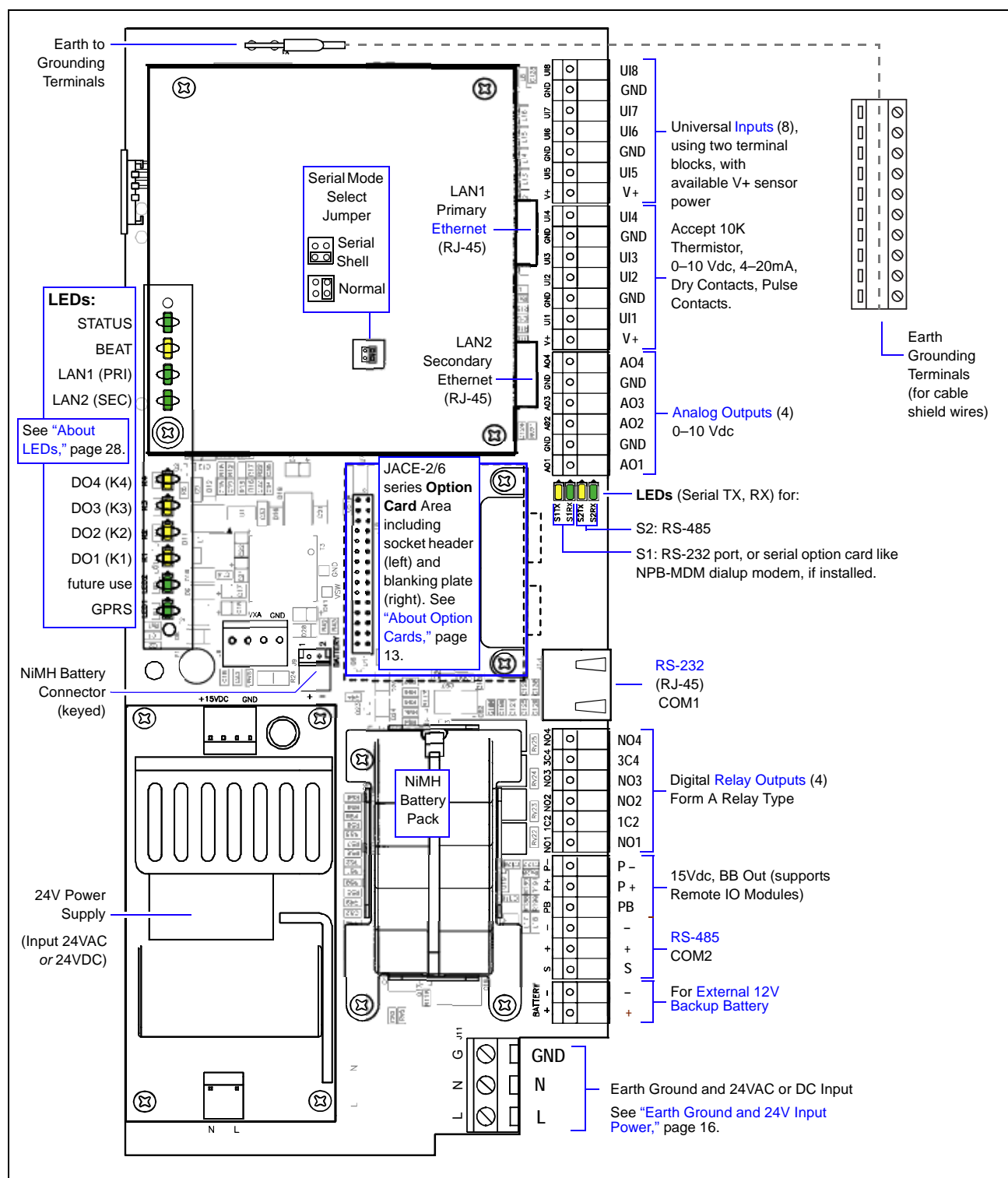
- Step 1** Remove both covers (see “[Removing and Replacing the Covers](#),” page 9).
- Step 2** Locate the SIM card socket near the upper left corner of the controller, above the LEDs ([Figure 5](#)).
- Step 3** Orient the SIM with its angled corner up, foil connectors facing the socket (writing side towards metal shield as shown in [Figure 5](#)), and slide down fully into the socket connector.
- Step 4** Replace the left cover, then the right cover (see “[Removing and Replacing the Covers](#),” page 9).
- Step 5** To attach the GPRS antenna, simply insert it into the SMA coax jack on the left side (lower jack) and finger tighten the knurled nut, as shown in [Figure 5](#).
Optionally, order and install the GPRS antenna extension kit (part GPRS-CBL-EXT, includes cable and antenna bracket). This lets you mount the GPRS antenna up to 6.5 feet (2m) away from the unit.

Inserting a SIM card and attaching GPRS antenna

Board Layout

Figure 6 shows the location of the option card slot, LEDs, I/O terminals, communications ports and other controller features. For a side view of communications ports and other features, see Figure 15 on page 22.

Figure 6 T-x02-XPR-24 main board layout details.



About Expansion Options

The T-x02-XPR-24 provides for *field-installable* expansion with these kinds of options:

- **Option card**—Install on connectors inside the controller's base unit. See [“About Option Cards,”](#) page 13.
- **Remote I/O modules**—To wire to the controller's 6-pin RS-485/Power connector. See [“About Remote I/O Modules,”](#) page 14.

About Option Cards

The T-x02-XPR-24 has one (1) available option slot to accept a custom option card, from among the Tridium-2/6 series options cards (30-pin, 2 row connector). See [Figure 6](#) on page 12. Installing an option card is recommended before mounting the unit. See [“Installing an Option Card,”](#) page 14.



Warning

Power to the controller must be OFF, and all LEDs out, when installing or removing an option card, or else damage will occur! Be sure to properly align pins when plugging an option card into the connector.

[Table 1](#) lists types of option cards for a T-x02-XPR-24 controller, with additional types in development.

Table 1 T-x02-XPR-24 option cards.

Model	Description	Notes
NPB-LON	FTT-10A LON (LonWorks) adapter with a 2-position removable screw-terminal connector plug.	Port operates in the hosted Niagara station as LON1 .
NPB-2X-485	Dual, optically-isolated, RS-485 adapter with two 3-position removable screw-terminal connector plugs.	Ports operate in the hosted Niagara station as COM7 and COM8 .
NPB-232	Single port RS-232 adapter, with a DB-9M connector. Uses its own on-board UART. Supports baud rates up to 115200.	Port operates in the hosted Niagara station as COM7 .
NPB-MDM	56Kbps Auto-dial/Auto-answer Modem with one RJ-11 connector for phone line. Note: This option is <i>not supported</i> if the unit has the integral GPRS modem.	Operates as COM1 . This disables the RS-232 base serial port (RJ-45 connector) on the T-x02-XPR-24 during normal operation. Note: If a NPB-MDM is installed, and the “mode jumper” (see Figure 6) is put in “Serial Shell” position, the unit's base RS-232 port becomes active immediately following a reboot. This allows an RS-232 connection to the “serial shell” for debugging purposes. To re-enable the modem, you must put the mode jumper back in the “Normal” position, and reboot again.
T-GPRS-XPR	GSM cellular modem card using GPRS (General Packet Radio Service), with onboard socket for SIM card, and a Wyless SIM. Kit includes a coax cable and an external antenna with bracket. Note: This option is <i>not supported</i> if the unit has the integral GPRS modem.	In general, ordering a T-x02-XPR-24 with the onboard GPRS modem (T-x02-XPR-24-GW) is recommended over installing this GPRS modem option card kit. A special mounting and wiring document covers installation. See the <i>T-GPRS-XPR Modem Option Installation Sheet</i> .
NPB-SED-001	Sedona Framework™ option card with Jennic JN5139 microcontroller and Sedona module for 802.15.4 wireless network and 6LoWPAN support. An RS-485 port is for future MSTP networking.	Operates as COM7 . Includes RP-SMA mounted stub antenna. Requires the antenna extension kit with 5.56 ft (2m) RP-SMA cable and mounting bracket (CBL-SED-EXT).

Table 1 T-x02-XPR-24 option cards. (continued)

Model	Description	Notes
NPB-ZWAVE -US or -EU	Z-Wave wireless serial gateway between the JACE's NiagaraAX station and an RF wireless Z-Wave domain. Includes RP-SMA antenna.	-US model is 908.42 MHz for U.S. usage -EU model is 868.42 MHz for European usage. Operates as COM7 . Includes RP-SMA mounted stub antenna. Requires the antenna extension kit with 5.56 ft (2m) RP-SMA cable and mounting bracket (CBL-SED-EXT).

Installing an Option Card

For complete details, see the mounting & wiring instructions document that accompany the specific option card. The following procedure provides a basic set of steps.

Procedure 6 Mounting an option card in a T-x02-XPR-24.

- Step 1** Remove power from the controller and wait for all LEDs to turn off—see the previous [Warning](#).
- Step 2** Remove both covers. See [“Removing and Replacing the Covers,”](#) page 9.
- Step 3** Locate and remove the blanking plate for the option slot (see [Figure 6](#) on page 12). Retain the blanking plate in case the option card must be removed at a later date.
- Step 4** Carefully insert the pins of the option card into the socket headers of the option card slot. The mounting holes on the option board should line up with the standoffs on the base board. If they do not, the connector is not properly aligned. Press until the option card is completely seated.
- Step 5** Place the custom end plate that came with the option card over the connector(s) of the option card.
- Step 6** With the mounting holes aligned with the standoffs, place the two screws through the end plate, and into the standoffs on the controller's base board. Using a screwdriver, hand tighten these screws.
- Step 7** Replace both covers on the controller.

About Remote I/O Modules

The T-x02-XPR-24 has an integral 6-pin connector to support remote I/O modules. The connector provides both 15Vdc power and RS-485 communications to modules on that connected trunk, and is located below the 6-position Digital Output (DO) I/O connector (see [Figure 6](#) on page 12).

Each remote I/O module has a DIN-mount base, and provides two (2) 6-pin connectors that allow you to “chain” multiple modules together into one assembly. [Table 2](#) lists the currently available modules.



Note The *maximum* number of supported T-IO-16-485 modules varies by platform, as follows:

- 3 *maximum* T-IO-16-485 modules if a T-202-XPR-24.
- 15 *maximum* T-IO-16-485 modules if a T-602-XPR-24.

The actual maximum number *may be less*, as resource usage varies with each application database.

Table 2 Remote I/O modules compatible with the T-x02-XPR-24.

Model	Description	Notes
T-IO-16-485	Remote I/O RS-485 Module DIN-mountable RS-485 comm module that provides 16 points I/O, with I/O point types as noted.	Provides the following I/O points: <ul style="list-style-type: none"> • 8 - Universal Inputs (UIs). • 4 - Digital Outputs (DOs), SPST-relay type. • 4 - Analog Outputs, 0–10Vdc type. Wiring is covered in the <i>T-IO-16-485 Installation and Configuration Guide</i> .

Wiring Summary

See [Figure 6](#) on page 12 to locate connectors and other components on the controller.

Make connections to the controller in the following order.

1. Install any option board (LON, RS-485, RS-232) in the available option slot. See [“Installing an Option Card,”](#) page 14 for general procedures. For complete details, refer to the specific documentation that accompanied the option.
2. If applicable, insert the SIM card for the unit’s GPRS modem, and attach the GPRS antenna if not already attached (see [“Inserting a SIM card and attaching GPRS antenna”](#) on page 11).
3. After mounting, wire earth ground and 24V power (circuit de-energized). See [“Earth Ground and 24V Input Power,”](#) page 16.
4. Wire I/O points to the controller’s I/O terminals and earth ground terminal strip (for cable shield wires). See [“I/O Wiring,”](#) page 17, for more details.
5. Connect communications cables. See [“Communications Wiring,”](#) page 22 for ports available on the T-x02-XPR-24 base unit. For ports on any installed option board (LON, RS-485, RS-232, modem) see the specific mounting and wiring guide for any additional details.
6. Apply power to the unit. See [“Power Up and Initial Checkout,”](#) page 25.

Earth Ground and 24V Input Power

After mounting the unit, wire earth ground and 24VAC or 24VDC to the terminals under the power input shield.

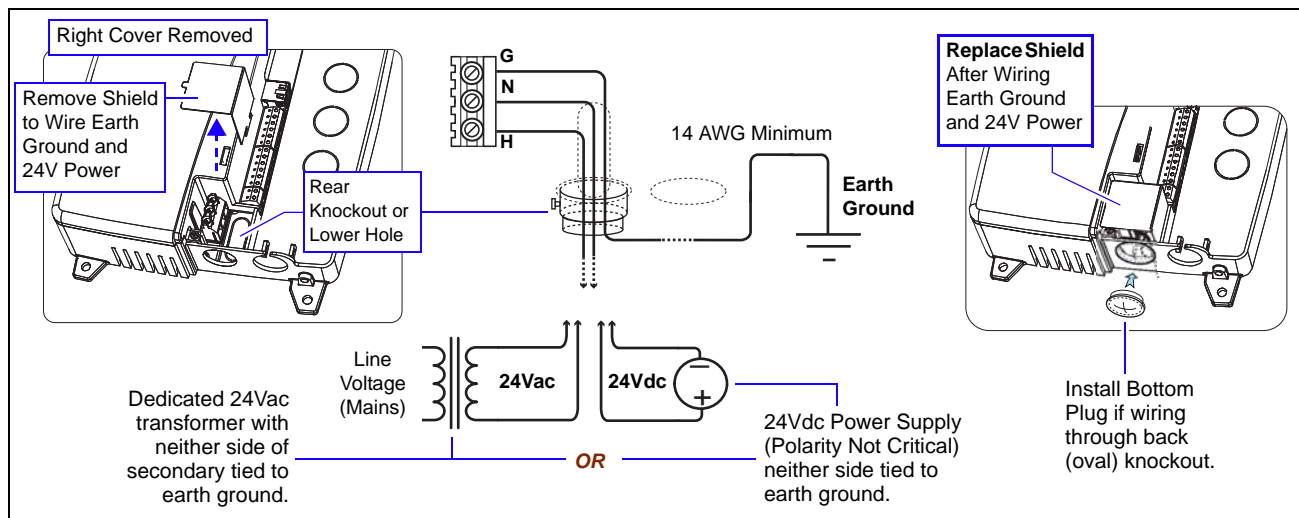


Note If powering from a 24V transformer, do not power any other equipment with it. Otherwise, conducted noise problems may result. Also, do not ground either side of the transformer's 24V secondary.



Warning Disconnect power from the 24V input source before making wiring terminations. Do not reconnect power until other wiring is complete.
Note this device has no power-on switch. See “Power Up and Initial Checkout,” page 25.

Figure 7 Wire Earth Ground and 24VAC or 24VDC to power input terminals.



Procedure 7 Wiring earth ground and 24V power to T-x02-XPR-24 power supply.

- Step 1** If not already removed, remove the right cover. See “Removing and Replacing the Covers,” page 9.
- Step 2** Remove the shield over the 3-position terminal block (see Figure 7, left) and carefully set it aside.
- Step 3** Route 24V power and ground wiring either through the rear (oval) knockout, or through the hole directly below the 3-position terminal block.
 - a. Wire nearby earth ground to the “G” (ground) terminal, using 14 AWG or larger wire.
 - b. Wire 24V power to the “N” (neutral) and “L” (line) terminals.
- Step 4** Replace the shield over the 3-position terminal block.
If wiring is through the back oval knockout, install an end plug into the hole below the terminal block.
- Step 5** Replace the right cover when finished with all wiring.



Note After connecting earth ground to the “G” terminal, earth ground is available on the 10-position grounding terminal strip, located near the top of the wiring area. See Figure 6 on page 12.
Use this 10-position strip for terminating the shield (drain) wire on shielded cables that connect I/O sensors and remote communications ports.

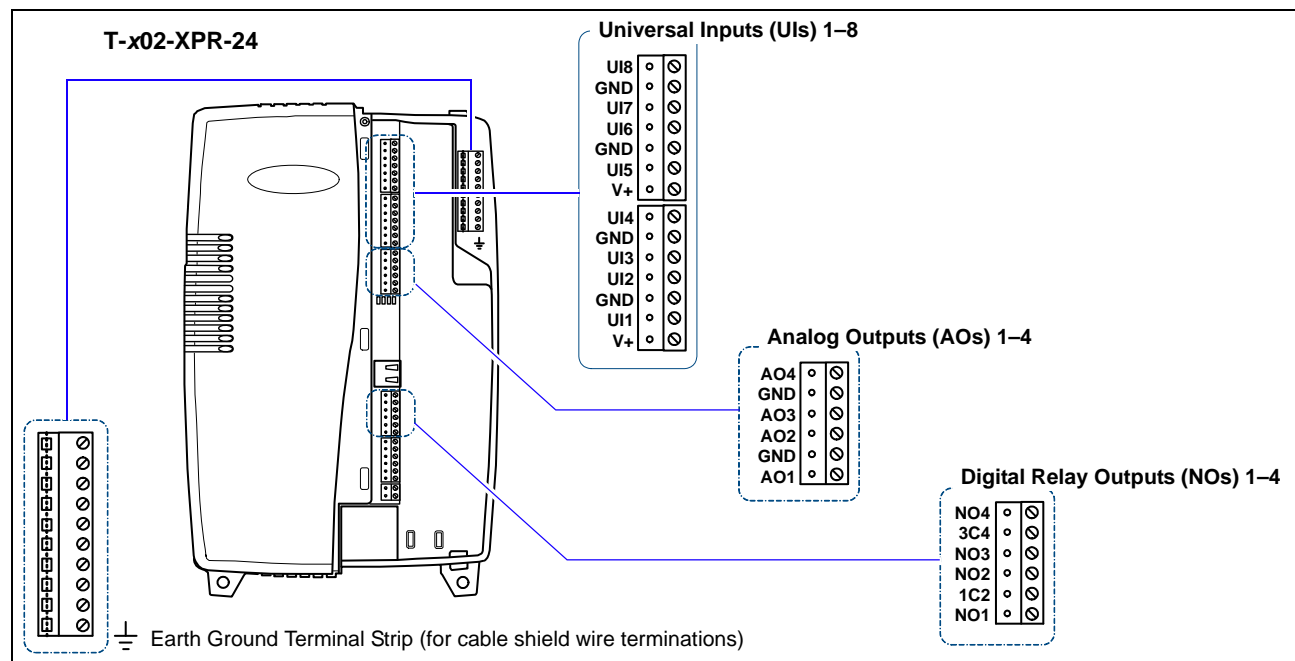
I/O Wiring

The T-x02-XPR-24 has 16 on-board I/O points that include:

- Universal **Inputs** (8) that support analog inputs (temperature, resistance, voltage, and current) and digital inputs (contact closure, pulse count).
- **Outputs** (8) that include 4 analog outputs (0–10 Vdc) and 4 relay (24Vac/dc, 0.5A max.) digital outputs.

See [Figure 8](#) for location of I/O terminals.

Figure 8 Input and Output terminal locations on T-x02-XPR-24 controller.



Inputs

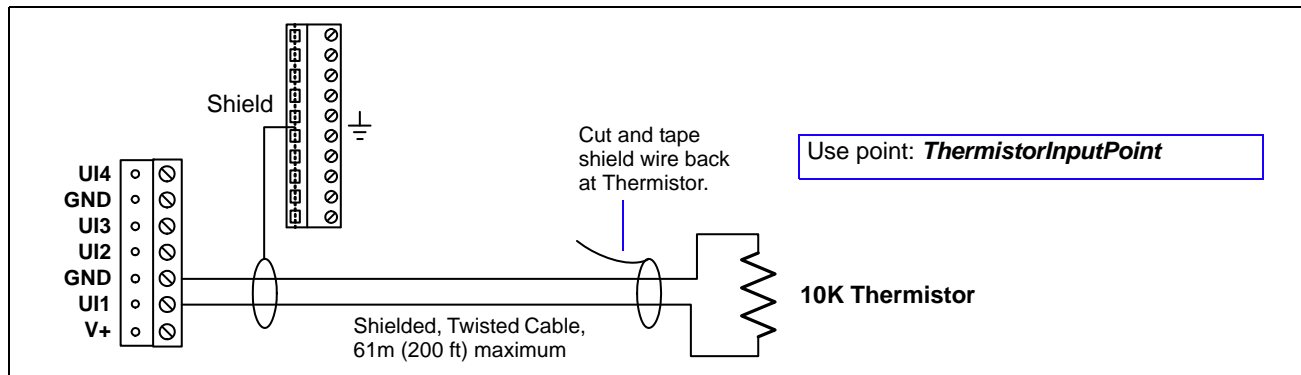
Each of the 8 universal inputs (UI) can support any one of the following:

- Type-3 10K ohm **Thermistor** (also see [Caution](#) on page 18)
- **Resistive** 0—100K ohms
- 0–10 Vdc
- 4–20 mA
- **Binary Input** (Contacts or Pulse)

Thermistor

Inputs support 10K Thermistor temperature sensors. Input accuracy is in the range of $\pm 1\%$ of span. By default, conversion is for a standard Type 3 thermistor sensor, with a sensor range of -10° to 135°F (23.3° to 57.2°C). Using a conversion type of "Tabular Thermistor," you can specify a different thermistor response curve, by importing a thermistor curve .xml file. Currently, the *kitIo* module contains an xml folder with thermistor curves for a various thermistor temperature sensors. You can also edit and export (for reuse) *customized* thermistor curve xml files. See the *NiagaraAX NRIO Guide* for details.

[Figure 9](#) on page 18 shows the wiring diagram for a Thermistor sensor.

Figure 9 Thermistor sensor wiring.

Resistive 0—100K ohms

Inputs can read a resistive signal within a range from 0 to 100,000 ohms. Wiring is the same as shown for a Thermistor temperature sensor (Figure 9). Resistive signals require a **ResistiveInputPoint**.

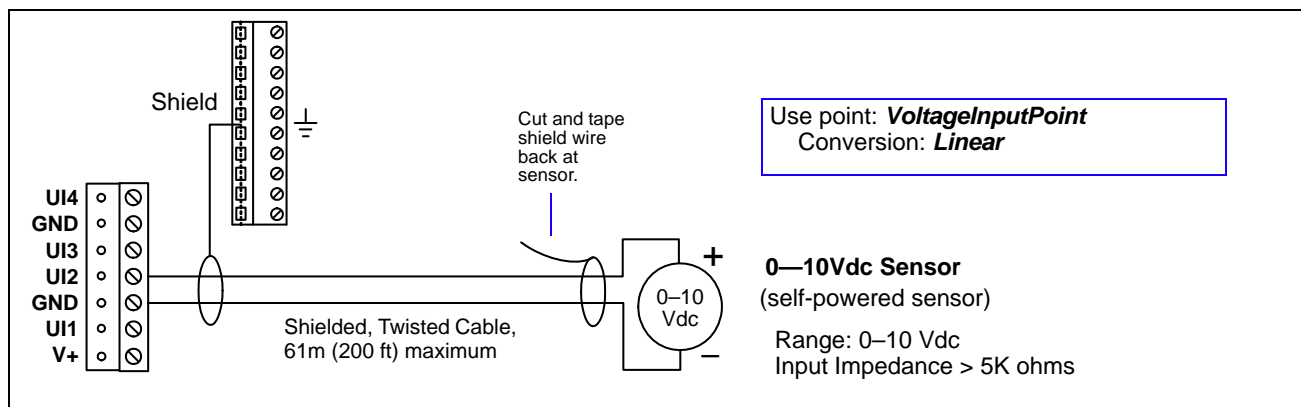


Caution

UI inputs provide optimum resistive-to-temperature resolution in the 10K ohm range. For a sensor with a range far from 10K ohms (such as a **100-ohm** or **1000-ohm sensor**), resolution is **so poor as to be unusable!** To successfully use such a sensor, install a *transmitter* that produces a Vdc or mA signal, and then wire the transmitter to the UI according to the **0–10 Vdc** or **4–20 mA** instructions.

0–10 Vdc

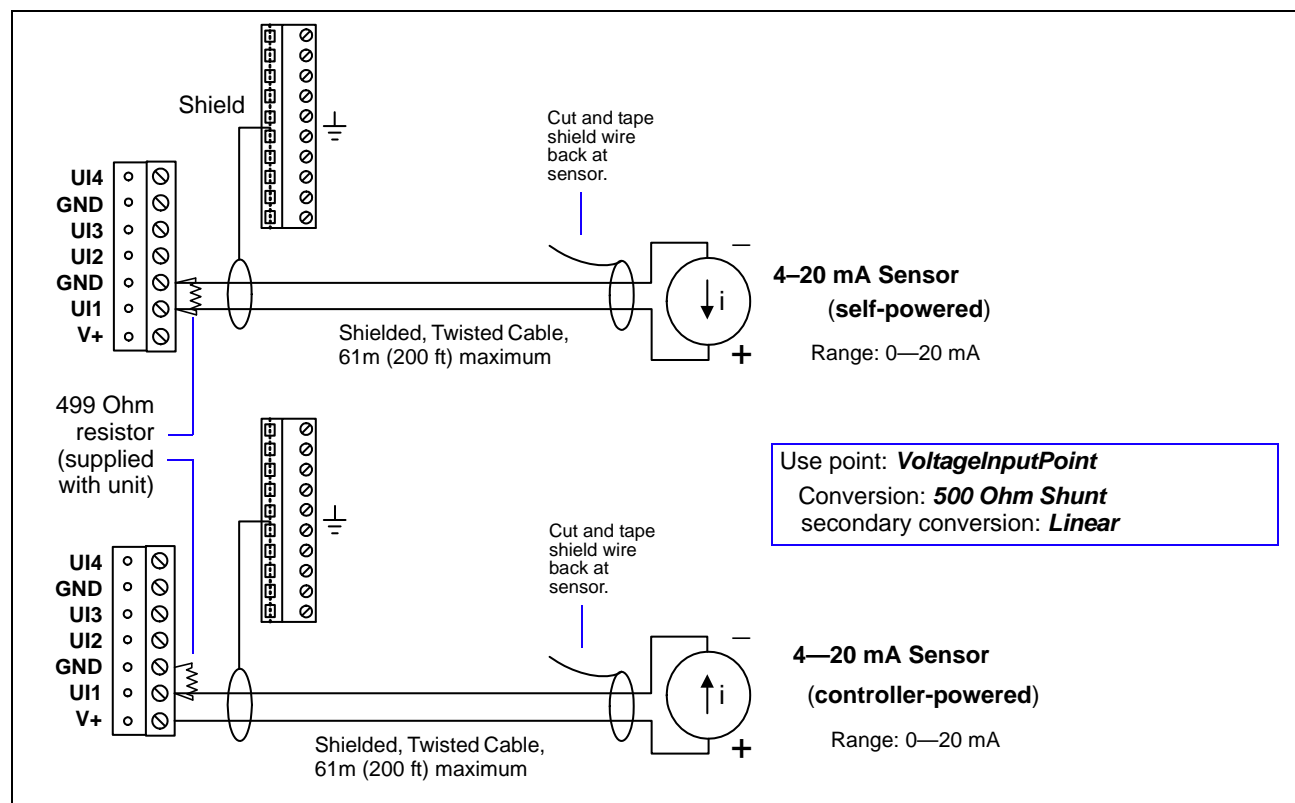
Inputs support self-powered 0–10 Vdc sensors. Input impedance is greater than 5K ohms. 0–10 volt accuracy is $\pm 2\%$ of span, without user calibration. Figure 10 shows the wiring diagram for a 0–10 Vdc sensor.

Figure 10 0–10 Vdc sensor wiring.

4–20 mA

Inputs support self-powered or controller-powered 4–20 mA sensors. The input requires an external 499-ohm resistor for current input (four resistors are supplied). For controller-powered sensors, the controller's two V+ terminals supply 24 Vdc, at up to 80 mA combined. Input accuracy is $\pm 2\%$ of span, without user calibration.

Figure 11 on page 19 shows wiring used for a self-powered sensor (top) and a 2-wire controller-powered sensor (bottom).

Figure 11 4 to 20 mA sensor wiring.

A 4–20 mA sensor requires a **VoltageInputPoint**, using conversion type **500 Ohm Shunt**, and secondary conversion type **Linear**.

Binary Input

Inputs support both pulse contacts and normal dry (equipment status) contacts.

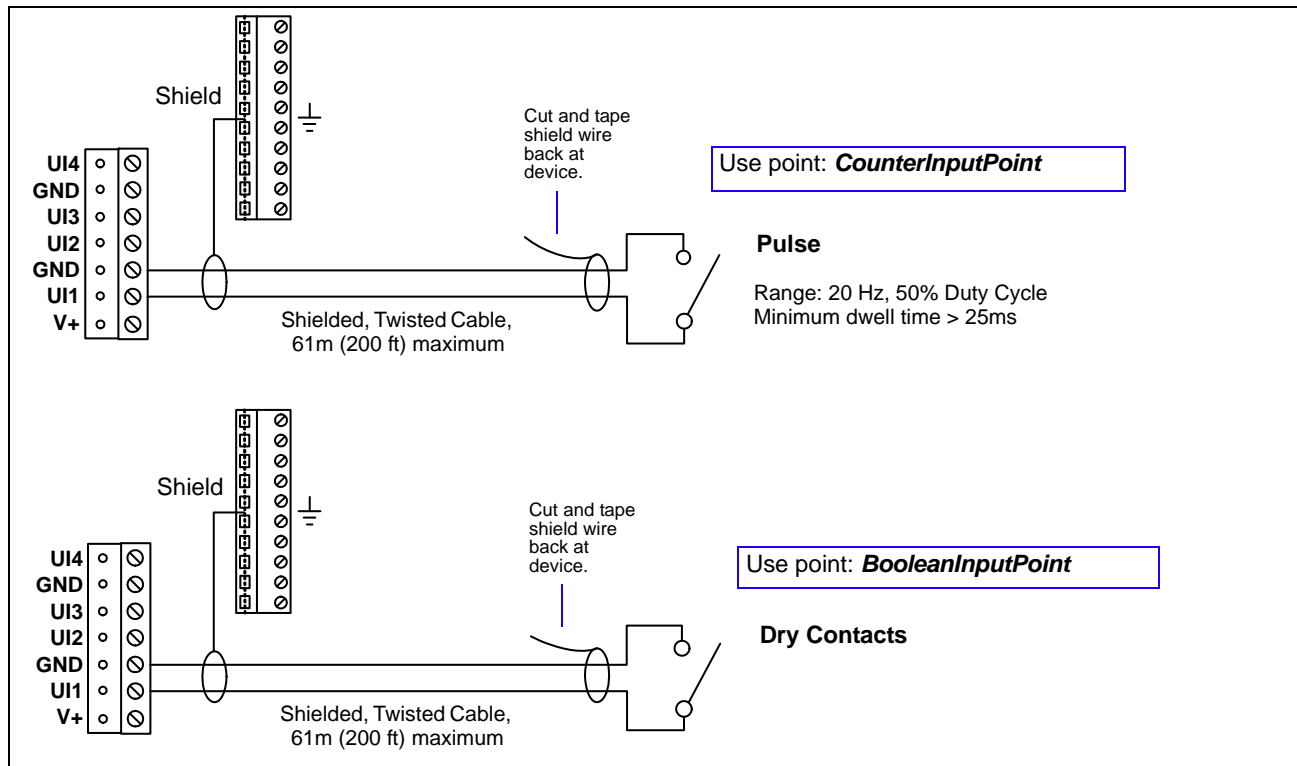
- Pulse contacts may have a change-of-state (COS) frequency of up to 20 Hz with a 50% duty cycle.
Note: Minimum dwell time must be > 25ms.
(Contacts must remain open at least 25ms and be closed at least 25ms.)
- Standard dry contacts must have a 1 Hz. (or less) COS frequency, with minimum dwell time > 500ms.
(Contacts must remain open at least 500ms and be closed at least 500ms.)

Both types of dry contacts support 3.3 Vdc open circuits or 330 μ A short-circuit current.

[Figure 12](#) on page 20 shows the wiring diagram. For a pulse contact, use the **CounterInputPoint** in the station database.

For other dry contacts, use the **BooleanInputPoint**.

Figure 12 Binary input wiring.



Outputs

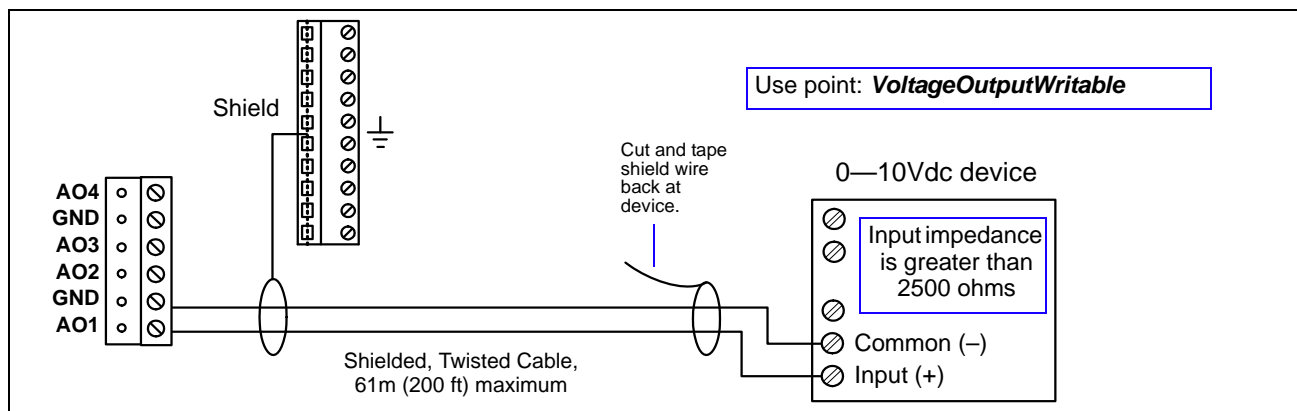
The T-x02-XPR-24 has four (4) 0–10 volt [analog outputs](#) and four (4) digital [relay outputs](#). See [Figure 8](#) on page 17 for location of the output terminals.

Analog Outputs

Analog outputs (AO) are referenced by the terminals labeled A_n and GND (ground). Each AO can supply a maximum of 4 mA over the entire 0 to 10Vdc range. The minimum input impedance of a device controlled by an AO must be greater than 2500 ohms. Typical wiring for an AO is shown in [Figure 13](#).

For each AO, use a **VoltageOutputWritable** in the station database.

Figure 13 Analog output wiring diagram.



Relay Outputs

Each relay output is rated at 24 Vac or Vdc at 0.5A. Relay outputs have MOV (metal oxide varistor) suppressors to support inductive-type loads such as heavy-duty relay coils.

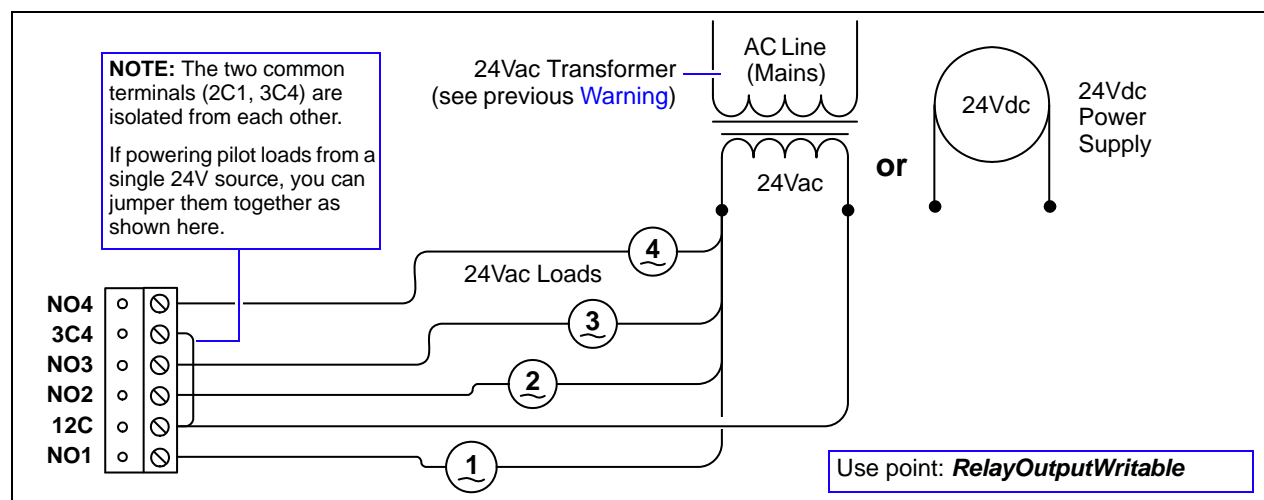


Warning

Relays are not rated for AC mains (line level) powered loads—instead, 24V @ 0.5A is the maximum. Use an external 24V transformer or a 24Vdc power supply to power loads.

Use a **RelayOutputWritable** in the station for each output. Figure 14 shows an example wiring diagram.

Figure 14 Relay output wiring diagram.



Note that the two common DO terminals (2C1, 3C4) are isolated from each other. This is useful if controlled loads 1 and 2 are powered from a different circuit/source than loads 3 and 4.

An LED status indicator for each relay output (K1–K4) is visible on the left cover, and also on the board. Under normal operation, an **On** status indicates that the load is powered. See “About LEDs,” page 28 for more details.

Nrio16Module (Software) Representation

In the NiagaraAX station interface to the T-x02-XPR-24 (or “M2M JACE”), the controller’s onboard I/O is modeled in the station’s **M2mIoNetwork** (copied from the *nrio* palette), under a child **Nrio16Module** “device level” component. This Nrio16Module has a default name of “LocalIo16”.

- If there are no *remote* I/O modules (T-IO-16-485) this is the only Nrio network needed in the station. The M2mIoNetwork has a fixed “Port Name” property of **COM3**, and a “Trunk” property of **1**.
- If any *remote* I/O modules are connected to the controller’s RS-485 port, the station needs an *additional* **NrioNetwork**, with a “Port Name” property of **COM2**, and “Trunk” property of **2**. For more details, see the *NiagaraAX NRIO Guide*. For wiring details, see “Wiring to Remote I/O Modules,” page 25. Note that a *maximum of three* T-IO-16-485 modules is recommended, due to platform resource considerations.

After remote I/O modules are discovered and added to the station under this separate NrioNetwork (each as one as an Nrio16Module), the serial status LEDs for the controller’s RS-485 port (S2TX, S2RX) continually flash, reflecting polling activity. See “About LEDs,” page 28 for more details. Also, the “STATUS” LED on each remote I/O module lights solid green.

Outputs

**Note**

Any time a remote I/O module's status LED is *not lit solid green*, all of its outputs are in “failsafe” state (all relay outputs OFF, and all AOs are at a 0-volt level).

Blinking of a remote I/O module's status LED occurs for two reasons, shown at different rates:

- Rapid flash (low duty cycle), meaning the unit is *unconfigured*. Discovery and addition to the station database is required.
- Equal time on and off (50% duty cycle), meaning the unit is configured, but currently *offline* with the T-x02-XPR-24 controller. Check RS-485 wiring between the controller and remote I/O module.

For both local and remote I/O, each input or output used requires a special Niagara Remote Input/Output (Nrio) point to be added in the station database. These components act as the station interface to the physical I/O points. The Nrio points you need for each input or output type are noted in previous wiring sections in **boldface**.

For Nrio software details, see the *NiagaraAX NRIO Guide* in Workbench online Help, or the same document in PDF.

Communications Wiring

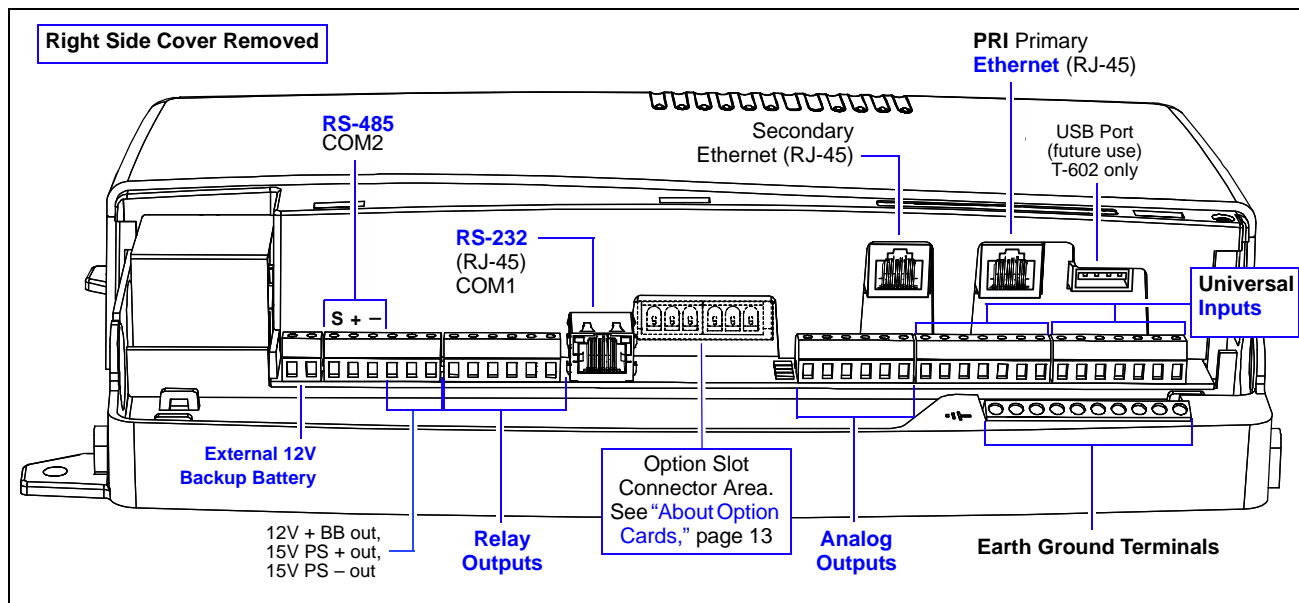
Communications ports on the controller are alongside the edge of the controller board, accessible with the right cover removed (Figure 15). Communications port types include:

- Ethernet
- Serial

**Note**

Prior to connecting cables, provide strain relief for them to prevent damage to the controller.

Figure 15 T-x02-XPR-24 communications ports and other connectors.



Ethernet

Two, female 10/100 Mbps Ethernet connections are provided on the controller. These are RJ-45 connectors labeled **PRI** and **SEC**. Use a standard Ethernet patch cable for connecting to a hub or Ethernet switch.

The controller's factory-default IP address for **PRI** (NET1) is **192.168.1.12n**, where the last numeral **n** in the address matches the last digit in the controllers's serial number, and the subnet mask is **255.255.255.0**.

By default, SEC (NET2) on the unit is disabled.

Refer to the *JACE NiagaraAX Install and Startup Guide* for details on changing IP address.



Note Typically, you *only use PRI* (primary port), unless you have a specific application for isolating a driver's network traffic to a separate LAN, using SEC. Do *not* use SEC as the primary port.

Serial

There are two "RS" serial ports on the T-x02-XPR-24 base board. Each has a UART capable of operation up to 115,200 baud. An **RS-232** port uses an RJ-45 socket connector, and operates as COM1. An isolated **RS-485** port is on three terminals of a 6-position screw-terminal connector, and operates as COM2 (by default).



- Notes**
- An additional serial port may be added with an option card in Option Slot 1, such as an NPB-232 card (port operates as COM7) or NPB-2X-485 card—note this option actually adds *two* serial ports, which operate in the controller as COM7 and COM8.
 - If a dialup modem option card (NPB-MDM) is installed in the T-x02-XPR-24, this effectively *disables* the onboard **RS-232** port, and the modem operates as COM1. Note this option card is not supported if the T-x02-XPR-24 is equipped with the onboard GPRS modem.

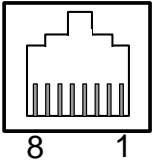
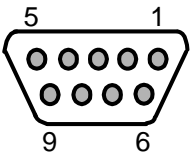
RS-232—RS-232 serial port connections can be made to the female (socket) RJ-45 connectors using an 8-conductor flat "silver satin" stranded cable with standard male (plug) RJ-45 connectors. Connect the flat satin cable (maximum distance 50 feet) through the enclosure knockout nearest the port. This "straight-through" cable is then connected to a socket-to-socket type RJ-45-to-DB-9 adapter.

The controller is a serial DTE device, such another DTE device (PC, for example) requires a "null modem" adapter (part number 10148, optional item). If connecting the controller to a DCE device (modem, for example), a straight-through adapter may be used. [Table 3](#) provides pinouts for both types of RJ-45 to DB-9 adapters.



- Notes**
- Silver satin cable is not standard Ethernet UTP cable, in which the pairs are twisted around each other. The twisting of the pairs may cause undesirable effects on the serial communication, therefore we recommend the use of flat silver satin cable instead. Note that flat silver satin cable is unshielded. If installing this cable in a noisy electrical environment, run the cable through conduit.
 - If you need a temporary serial shell connection from your PC to the controller, and you have the necessary RJ-45 to DB-9 null modem adapter (part number 10148), but you have no silver satin cable, you can substitute an ordinary Ethernet patch cable. However, using silver satin cable is recommended for any permanent RS-232 connection, for reasons mentioned above.
 - If rebooted with the mode jumper in the "Serial Shell" position (see [Figure 6](#) on page 12), the RS-232 port provides "system shell" access. See the *JACE NiagaraAX Install and Startup Guide* for related details about system shell. Note that if a dialup modem option card (NPB-MDM) is installed, this *modem is disabled* during this "serial shell" access. NPB-MDM operation resumes only after putting the mode jumper back to the "Normal" position, and then rebooting the controller.

Table 3 RJ-45 to DB-9 adapter pinouts.

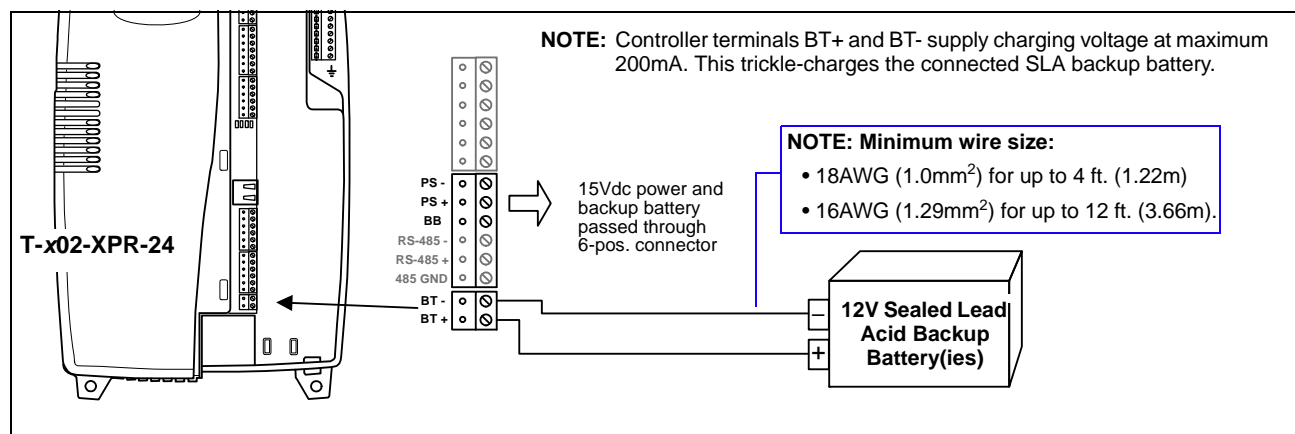
RJ-45 and DB-9 Pinout References	Type of Adapter	RJ-45 Socket Pin	Signal		DB-9 Socket Pin
RJ-45 Socket (female) 	Null Modem (for connecting to another DTE device) Part number 10148	5	DCD	Data carrier detect	1
		3	TXD	Transmit data	2
		6	RXD	Receive data	3
		8	DSR	Data set ready	4
		4	GND	Ground	5
		1	DTR	Data terminal ready	6
		7	CTS	Clear to send	7
		2	RTS	Request to send	8
		—	not used on the JACE		9
DB-9 Socket (female) 	Straight-through (for connecting to a DCE device)	5	DCD	Data carrier detect	1
		6	RXD	Receive data	2
		3	TXD	Transmit data	3
		1	DTR	Data terminal ready	4
		4	GND	Ground	5
		8	DSR	Data set ready	6
		2	RTS	Request to send	7
		7	CTS	Clear to send	8
		—	not used on the JACE		9

RS-485—An RS-485, optically isolated port is available on 3 pins of a 6-position connector, and operates by default as COM2. As shown in [Figure 15](#), the screw terminals are minus (–), plus (+), and shield. Wire in a continuous multidrop fashion to other RS-485 devices, meaning “minus to minus”, “plus to plus,” and “shield to shield.” Connect the shield to earth ground at one end only, such as at the T-x02-XPR-24. For wiring to one or more remote I/O modules (T-IO-16-485), see [“Wiring to Remote I/O Modules,”](#) page 25.

External 12V Backup Battery

The T-x02-XPR-24 controller provides a 2-position connector for support of an external 12V sealed lead-acid (SLA) type rechargeable battery. Usage is optional. For more details, see [“Backup Battery,”](#) page 27.

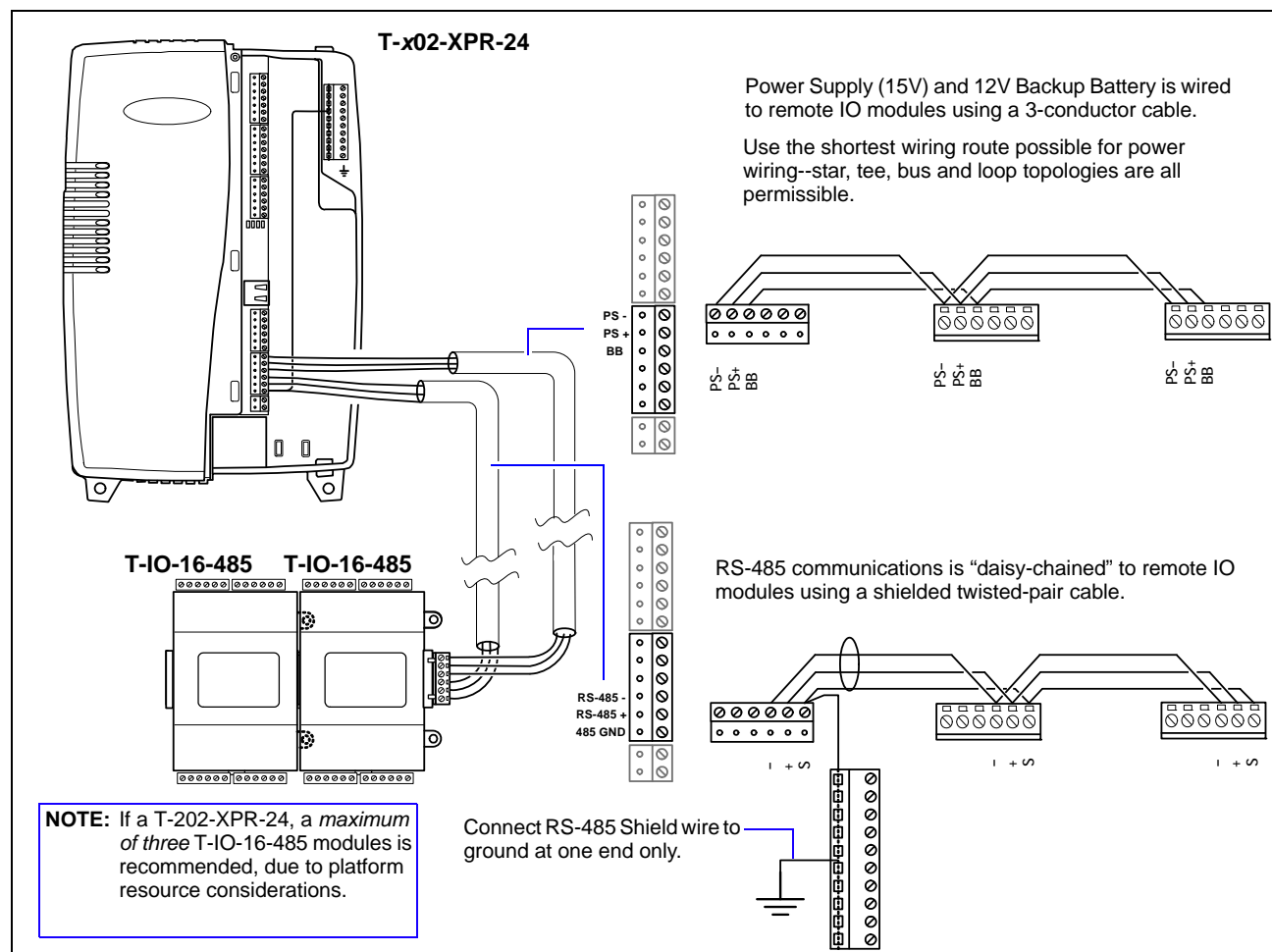
Figure 16 Sealed lead-acid backup battery connection on T-x02-XPR-24.



Wiring to Remote I/O Modules

Wiring to remote I/O modules (T-IO-16-485) typically provides both 15Vdc power and 12V battery backup to the modules, along with RS-485 communications. See [Figure 17](#).

Figure 17 RS-485 cabling between T-x02-XPR-24 and remote I/O modules.



For related information, see the *T-IO-16-485 Installation and Configuration Instructions* document.

Power Up and Initial Checkout

Following all mounting and wiring ([I/O Wiring](#), [Communications Wiring](#), [External 12V Backup Battery](#), [Wiring to Remote I/O Modules](#)), perform the following:

Procedure 8 Initial power up and checkout

Step 1 [Apply Power](#).

Step 2 [Check the Status LEDs](#).

Also see the section "[About the Backup Batteries](#)" on page 26.

Apply Power

The T-x02-XPR-24 controller does not include an on/off switch. To apply power, you simply energize the 24Vac transformer (or 24Vdc power supply) wired to its 3-position power input terminals.

If remote I/O modules are wired to the unit, they are also typically powered by the controller as well.

Check the Status LEDs

When power is applied, the (top) green LED “STATUS” will light. This indicates that the system is OK and that power is applied. Once the controller boots, the yellow “BEAT” (heartbeat) LED under it will begin a steady blink, with a typical rate of about 1 Hz. Blinking should begin within 30 seconds after power is applied.

If after applying power, the STATUS LED goes out, or if the yellow BEAT LED comes on (steady) and stays lit longer than two minutes, contact Systems Engineering for technical assistance. Also see the “[About LEDs](#)” section on page 28.

About the Backup Batteries

The T-x02-XPR-24 controller can have two different backup batteries:

- The standard on-board [NiMH battery pack](#), and
- An *optional* external, sealed lead-acid, rechargeable [backup battery](#) (or batteries)

For continuous system operation during loss of primary AC power, unless power loss is only a few seconds, both batteries should be installed. Station alarms are generated if either battery is uncharged or unable to hold a sufficient charge, as well as whenever primary power is lost. You should always investigate any alarm related to backup batteries.

NiMH battery pack



Note See the “[NiMH Battery Precautions](#)” section on page 6.

A custom 10-cell NiMH (nickel metal hydride) battery pack is mounted inside the T-x02-XPR-24, under the cover atop a metal shield plate—see [Figure 1](#) on page 2. This battery allows the JACE to continue station operation (only) through very short power bumps, meaning a few seconds in duration. If a longer outage, the NiMH battery provides enough run time for the unit to backup data and then shutdown. Typically, this process takes about one minute. Shutdown occurs automatically, after data is backed up to on-board flash memory.

Upon startup (boot), a test of the NiMH battery is performed. A system alarm is generated if the NiMH battery voltage level is found to be bad. A charge is also initiated upon startup, which lasts from 3 hours minimum, and can range up to 18 hours if the battery is completely discharged.

During this NiMH battery charge period, neither the NiMH battery or the external [Backup Battery](#) (if installed) is tested. After the startup NiMH charge period, a periodic test occurs of the NiMH battery (and if the JACE platform is so configured), the other backup battery is periodically tested too. The appropriate battery alarm is generated if either battery is found to be bad.



- Notes**
- If the last NiMH battery test was “bad,” upon loss of primary power the JACE performs an immediate shutdown, backing up data and powering off (including attached readers, and expansion modules).
 - A NiMH battery characteristic is to lose charge if not left in charge mode (trickle charge). Leaving the battery unconnected, or in the unit powered off will cause the battery to fully discharge in a matter of weeks. Note that in the case of a new JACE, it ships from the factory with a completely discharged battery. Therefore, allow at least 18 hours for the battery to charge if it has not been in a powered unit.

You should replace the NiMH battery pack approximately every three years, or more often if the unit is in a high temperature environment. For more information on the use and replacement of the battery, refer to the [“Required NiMH Battery Maintenance”](#) section on page 30.

Backup Battery

The optional sealed lead-acid backup battery is an external, 12V, rechargeable battery (or multiple batteries) sized to operate the system during loss of primary power, for some duration. This includes the T-x02-XPR-24 controller, as well as power to attached remote I/O expansion modules.

You connect the backup battery to the controller using a 2-position connector—see [Figure 16](#) on page 24. Whenever primary-powered, the controller supplies a constant “trickle” charge to this battery, at 200mA maximum.



- Note** Commonly used 12V batteries for this application include 7Ahr types, such as the Yuasa NP7-12 or Panasonic LC-R127R2P1, or equivalents.

Providing the JACE platform is so configured, at startup (boot), a test of the backup battery is performed, as well as a periodic test. A system alarm is generated if a battery test deems the backup battery to be bad. If the backup battery has tested good, upon loss of primary power the system operates from this backup battery power until the charge level of the on-board [NiMH battery pack](#) reaches 0. Note that both batteries discharge in parallel. However, as the sealed lead-acid backup battery capacity is much greater, the [NiMH battery pack](#) discharges much slower than if these backup battery(ies) were bad or not present.



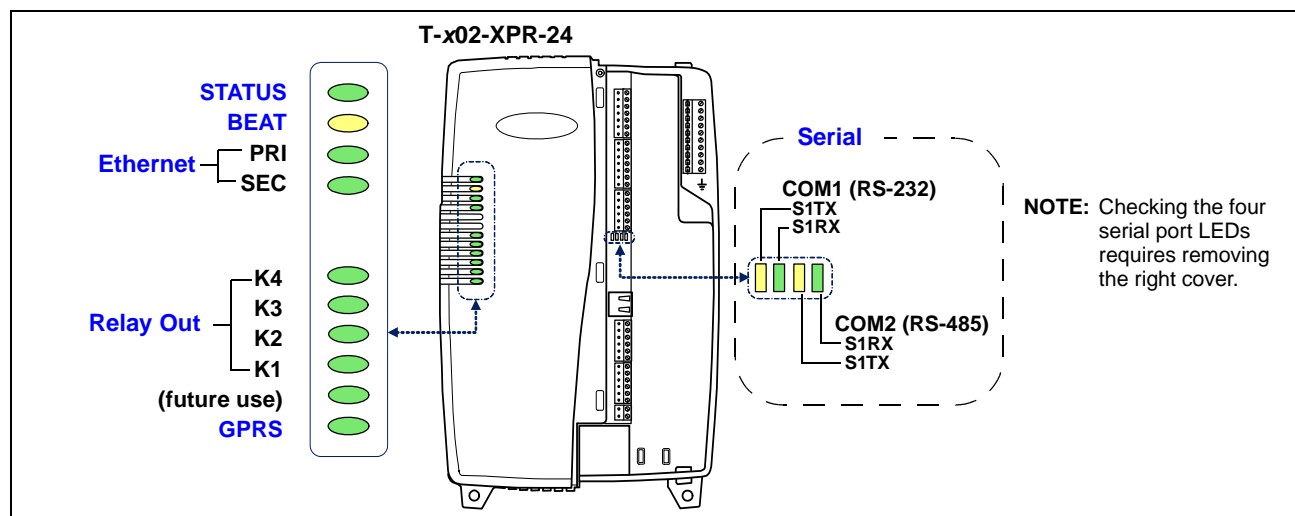
- Note** If the backup battery test was “bad,” upon loss of primary power, the JACE performs an immediate shutdown, backing up data and powering off (including attached readers, expansion modules).

You should replace the sealed lead-acid backup battery(ies) approximately every three years, or more often if the unit is in a high temperature environment.

About LEDs

The T-x02-XPR-24 provides a number of LEDs, most of which are visible on the left cover. Figure 18 shows LED locations, along with following descriptions.

Figure 18 LEDs on the T-x02-XPR-24.



STATUS

The green “STATUS” LED is located on the cover. The status LED should remain lit whenever the controller is *powered*, or else be blinking during the boot sequence. If the status LED *does not light* while power is applied, contact System Engineering for technical support.

BEAT

The yellow heartbeat “BEAT” LED is located on the cover. Following bootup, the heartbeat LED blinks about once per second. If the heartbeat LED stays *on constantly*, *does not light*, or blinks *very fast* (more than once per second), contact System Engineering for technical support.

Ethernet

A green “activity” LED for each of the two LAN ports (**PRI**mary for LAN1, **SE**Condary for LAN2) is located on the cover under the STATUS and BEAT LEDs, and operate as follows.

- **Off**—No Ethernet link is made
- **On**—Ethernet link is present, but no activity on the LAN
- **Blinking**—Ethernet link is present with data activity on the LAN.

Relay Out

Each of the four relay outputs has an associated green LED on the cover, “K4” to “K1” (from top-to-bottom). Under normal operation, each digital status LED indicates activity as follows:

- **Off**—relay open / no current flows.
- **On**—relay closed / load current flows.

Therefore, an **On** status indicates that the load is powered.

GPRS

The GPRS LED provides status of the onboard GPRS modem (for controller models so equipped), and is visible on the cover. It flashes various LED patterns based on the state of the modem. This LED is directly under control of the modem itself, versus NiagaraAX software.

Upon initial power up, the GPRS LED pattern is typically 600ms On / 600ms Off, and may change depending on various modem state changes. If the controller does not have the integral GPRS modem, this LED should remain Off without activity.

Serial

LEDs for the two serial ports are located on the controller's main board, near the Analog Output terminals (Figure 18 on page 28). Board markings "S1" and "S2" correspond to the software configuration of the COM1 and COM2 ports. LEDs show the transmit (TX) and receive (RX) activity for the two serial ports.

You must remove the right cover to see the serial port LEDs. See ["Removing and Replacing the Covers,"](#) page 9.

- The yellow TX (transmit) LED indicates that the controller is sending data out the serial port over a communications line to a connected device.
- The green RX (receive) LED indicates that the controller is receiving data from a connected device.

These LEDs provide a fixed on-time when data is detected on the port. If the receive LED is on constantly, this indicates a problem with the communications channel, such as a shorted wire or reversed wiring.



Note If the RS-485 port is connected to configured remote I/O modules (T-IO-16-485), during normal operation the COM2 LEDs both continuously flash about 3 times a second, indicating ongoing polling.

Maintaining the T-x02-XPR-24

This section provides information on the following topics:

- [Cleaning](#)
- [Required NiMH Battery Maintenance](#)
- [Replacement Parts](#)
- [Replacing the T-x02-XPR-24](#)
- [Returning a Defective Unit](#)

Cleaning

If dust or metal filings are present inside the unit, clean with vacuum or compressed air. Otherwise, no cleaning inside the unit is required. Optionally, if the covers become dirty, you can wipe them with a damp cloth and mild detergent.

Required NiMH Battery Maintenance



Note See the [“NiMH Battery Precautions”](#) section on page 6.

Battery life expectancy is a function of its discharge cycles (the number of discharges and their depth) and the ambient temperature of the battery during normal operation. In most applications, the NiMH battery should see relatively few discharges. Therefore, ambient temperature has more to do with determining the life expectancy of the battery than does any other factor. If the controller is installed in a conditioned space, this battery should provide dependable service for approximately three years (average). In an environment where the operating temperature is higher (that is, 50°C or 122°F), you should only expect the battery to last approximately one year.

The NiMH battery in the controller is fully discharged when factory shipped. Additionally, NiMH batteries lose charge over time if not kept trickle-charged (for more details, see [“NiMH battery pack,”](#) page 26). Therefore, even a new unit (or replacement battery) will require up to 18 hours of powered operation before it can provide reliable backup power (is at full charge).

The controller monitors the NiMH battery and periodically loads the battery to test its ability to maintain battery-backed functions. Investigate any battery trouble message, and check the battery connections to the unit. Replace the battery as required. To order a new battery, see the [“Standard Replacement Parts”](#) section on page 32. See the next section [“Replacing the NiMH Battery”](#) for a replacement procedure.

Replacing the NiMH Battery

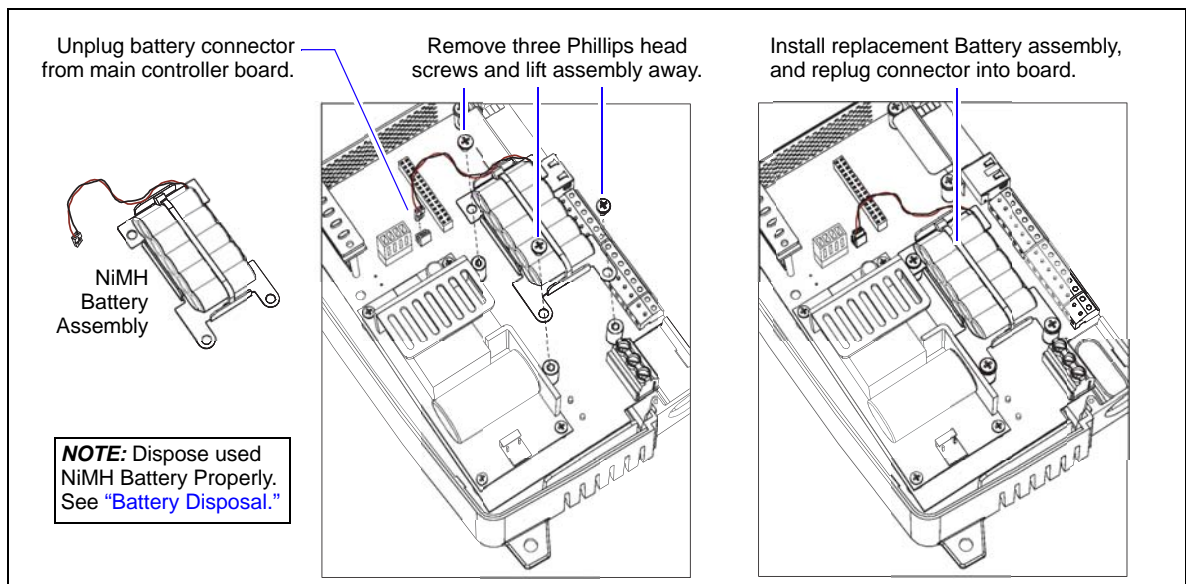
The replacement NiMH battery is an assembly, that is a custom battery pack mounted on a bracket, with an attached cable and connector plug. See [Figure 19](#). To replace the battery, you must remove power to the unit and remove both covers.



Caution Only use the NiMH battery pack approved for use with the T-x02-XPR-24, part NPB-XPR-BATT.

Procedure 9 Replacing NiMH battery assembly in a T-x02-XPR-24.

- Step 1** Backup the controller’s configuration to your PC using the appropriate NiagaraAX software tool (for example, Workbench).
- Step 2** Remove all power from the T-x02-XPR-24, including disconnecting any sealed lead-acid battery. Wait for LED activity to stop—after a couple of minutes, all LEDs on the unit should be off.
- Step 3** Remove both covers. See [“Removing and Replacing the Covers,”](#) page 9. At this point you have access to the NiMH battery assembly ([Figure 19](#)).

Figure 19 Replacing NiMH battery pack in T-x02-XPR-24.

- Step 4** Unplug the NiMH battery from the main board connector (see [Figure 19](#)).
- Step 5** Remove the three Phillips head screws fastening the battery bracket, and set aside. Remove the NiMH battery assembly.
- Step 6** Plug the battery connector plug of the *replacement* battery assembly into the NiMH battery connector on the controller's main board. The connector is keyed—you cannot plug the battery in reversed.
- Step 7** Set the replacement battery/bracket assembly in place, with the three mounting holes aligned with the standoffs on the controller board.
- Step 8** Place the three screws through the holes in the bracket and into the standoffs. Using a Phillips head screwdriver, hand tighten these screws.
- Step 9** Replace the covers.
- Step 10** Restore power to the T-x02-XPR-24 and verify normal operation.

Battery Disposal

Please dispose of the used JACE NiMH battery in accordance with local, state, and federal regulations.



Warning Do not incinerate or mutilate the battery, as this may cause it to burst or release toxic materials.

If regulations specify returning the old battery to a recycling center, but no acceptable recycling center can be found, please return the old JACE NiMH battery pack to Tridium for proper disposal.

Replacement Parts

Servicing the T-x02-XPR-24 may call for replacement parts. There are three categories of parts:

- [Non-replaceable Parts](#)
- [Standard Replacement Parts](#)
- [New Replacement Unit](#)

Non-replaceable Parts

Fuse

The controller contains a non-user replaceable fuse, soldered on the main circuit board. This fuse provides protection from internal shorts or connection to incorrect power supplies. If the fuse circuitry is suspect, contact your regional Tridium office for technical support. See the [“Returning a Defective Unit”](#) section on page 34.

Standard Replacement Parts

Standard replacement parts are listed in [Table 4](#) and can be ordered from stock without restriction. Standard replacement parts cannot be returned for credit and should be disposed of in an appropriate manner.

Table 4 Standard replacement parts for a T-x02-XPR-24.

Part Number	Description
NPB-XPR-BATT	NiMH Battery Pack Assembly—see “Replacing the NiMH Battery,” page 30
11364	Hardware Bag for T-x02-XPR-24, containing removable screw terminal connector blocks (two 7-position, three 6-position, one 2-position).
11166	Replacement right-angle GSM/GPRS quad-band SMA coax-mounted stub antenna.
GPRS-CBL-EXT	6.56 ft. (2m) SMA-type coax extension cable, with mounting bracket. See Figure 5 on page 11.
10148	Adapter, RJ-45 to DB-9 null modem, for onboard RS-232 serial port to connect to DTE device.
10180	Silver satin patch cable, 4 feet (used between adapter and serial port)
10181	Silver satin patch cable, 10 feet (used between adapter and serial port)
10182	Silver satin patch cable, 25 feet (used between adapter and serial port)

New Replacement Unit

To replace an entire unit, order and install a *new* T-x02-XPR-24. If the faulty controller is *still in warranty*, you may receive credit by returning it the vendor. Be sure to contact the vendor for a return material authorization (RMA) number before shipping an item for return credit. See [“Returning a Defective Unit,”](#) page 34, for details.



Note Before ordering a new replacement unit, it is strongly recommended that you contact your normal technical support resource to eliminate the possibility of a software issue or mis-configuration problem.

Replacing the T-x02-XPR-24



Warning

Before replacing, power to the controller must be OFF, and all LEDs out! In addition, power must be removed to any I/O devices wired back to the controller. Failure to do so may result in electrical shock or equipment damage.



Caution

Before handling circuit boards, discharge any accumulated static by touching a nearby grounded object. For details, see the “[Static Discharge Precautions](#)” section on page 6.

To replace a T-x02-XPR-24 with a new replacement unit, proceed as follows:

Procedure 10 Replacing a T-x02-XPR-24 controller.

- Step 1** If possible, use the appropriate NiagaraAX software tool to back up the controller’s configuration to your PC.
- Step 2** Disconnect power to the controller, including the disconnection of an external 12V battery, if used. The unit should power down automatically. Wait for all LEDs to remain off.
- Step 3** Disconnect all power to any I/O devices wired to the controller.



Note

Typically, if I/O wiring is routed through rear knockouts, you must remove it from the controller’s screw terminal blocks, so that the wiring can pass through the knockouts. In this case, it is extremely important to remove all related power sources, in order to prevent electrical shock and equipment damage.

- Step 4** Remove both covers. See “[Removing and Replacing the Covers,](#)” page 9.
- Step 5** Note positions of all communications and other wiring cables going to the controller. Label cables and wires to avoid mis-connection later, when re-terminating to the replacement controller.
- Step 6** Unplug all Ethernet, serial, LON, and I/O connectors from the controller. If needed, remove wiring from I/O terminal blocks, carefully labeling conductors for proper retermination.
- Step 7** Remove all cable shield wire terminations to the earth grounding terminal strip.
- Step 8** Remove the AC line and neutral (mains) and earth ground terminations from the 3-position screw terminal block.
- Step 9** Loosen any conduit clamps to the unit.
- Step 10** Remove the two mounting screws in the lower mounting tabs.
- Step 11** Slide the unit up for the top mounting screw to clear the keyhole slot, and move the unit away from the wall, working the cables and wiring out through the wiring holes and knockouts. Free the unit from all wiring and place on a flat work surface.
- Step 12** If applicable, remove any option card installed in the old T-x02-XPR-24 controller, and install the card into the replacement controller. See “[Installing an Option Card,](#)” page 14 for more details.

Returning a Defective Unit

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- Step 13** Reroute the removed power, communications, and I/O wiring through the knockouts and wiring holes in the replacement T-x02-XPR-24 (as done previously), and position the unit in place on the wall. Place it over the top mounting screw and slide down to hook into the keyhole slot.
- Step 14** Replace the two mounting screws in the lower mounting tabs.
- Step 15** Tighten any conduit clamps on the unit.
- Step 16** Reconnect the earth ground wire and the AC line and neutral wires (mains) to the 3-position terminal block in the unit.
- Step 17** Replace the left cover and metal shield over the AC/earth ground terminals.
- Step 18** As needed, reconnect any I/O wiring to terminal blocks, and replug I/O terminal blocks onto the replacement controller board.
- Step 19** Reconnect all Ethernet, serial, and LON wiring to the controller.
- Step 20** Reconnect all cable shield wire terminations to the earth grounding terminal strip.
- Step 21** If power was disconnected to remote I/O devices wired to the controller, restore that power.
- Step 22** Restore power to the unit. It should boot up as a new unit (see [“Check the Status LEDs,”](#) page 26).
- Step 23** Replace the right cover. See [“Removing and Replacing the Covers,”](#) page 9
- Step 24** Using the NiagaraAX platform tools, re-commission the T-x02-XPR-24, and install the saved station database. For more details, see the *JACE NiagaraAX Install and Startup Guide*.
-

Returning a Defective Unit

For proper credit on an in-warranty unit, ship the defective unit per the vendor’s return material procedure.



- Note** If the defective unit is under warranty, please follow return instructions provided in this section. If the unit is *out of warranty*, please discard it, observing all recycling regulations (see [“WEEE \(Waste of Electrical and Electronic Equipment\),”](#) page 6).
- Do not return an out-of-warranty T-x02-XPR-24 controller.
-

Prior to returning the unit, contact your vendor to obtain a return materials authorization (RMA) number and other instructions.

Please provide:

- Product model
- Serial number
- Nature of defect
- PO number to secure the RMA

Certifications

Federal Communications Commission (FCC)

This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause interference with radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference, in which case, users at their own expense will be required to take whatever measures may be required to correct the interference. Any unauthorized modification of this equipment may result in the revocation of the owner's authority to continue its operation.

Canadian Department of Communications (DOC)

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

RoHS Compliance

This product meets RoHS (Restriction of Hazardous Substances) requirements of Directive EU 2002/95/EC.

CE Declaration of Conformity

Date: February, 2009			
Application of Council Directive: 89/336/EEC, 92/31/EEC, 73/23/EEC, 93/68/EEC			
Manufacturer: Tridium Inc. 3951 Westerre Parkway, Suite 350 Richmond, Virginia 23233 United States of America			
Manufacturer's Representative: Steve Fey, President Tridium Inc.			
Product Model Numbers: T-202-XPR-24, T-202-XPR-24-GW, T-602-XPR-24, T-602-XPR-24-GW			
Type of Equipment: Electrical Equipment for Measurement, Control and Laboratory Use			
EMS Standards Applied:	Standard	Description	Criteria Met
	CISPR 16-2-3:2006	Radiated Emissions - Class A	Complies
	IEC 61000-4-2	Electrostatic Discharge Immunity	PASS Class B
	IEC 61000-4-3	Radiated Electromagnetic Field Immunity	PASS Class A
	IEC 61000-4-4	Electrical Fast Transient / Burst Immunity	PASS Class B
	IEC 61000-4-6	Conducted Radio-Frequency Immunity	PASS Class A
	IEC 61010-1:2001 rev. 9/19/03	Safety requirement for electrical equipment For measurement, control and laboratory use	PASS

I, **Steve Fey**, President of Tridium Inc., hereby declare that the equipment specified above conforms to the above Directives and Standards.

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