



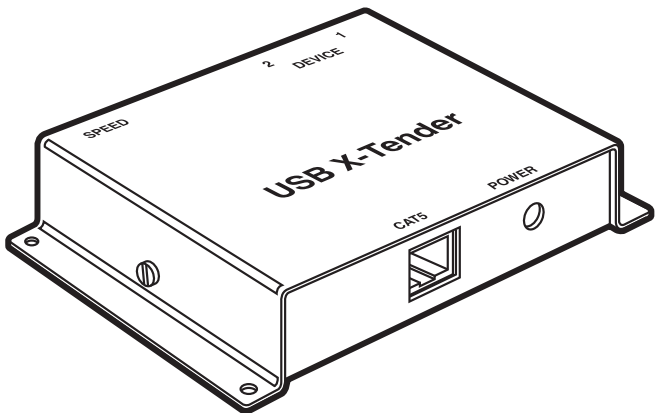
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1000 Park Drive • Lawrence, PA 15055-1018 • 724-746-5500 • Fax 724-746-0746



# USB X-Tender



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## CUSTOMER SUPPORT INFORMATION

Order **toll-free** in the U.S.: Call **877-877-BBOX** (outside U.S. call **724-746-5500**)  
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## **FEDERAL COMMUNICATIONS COMMISSION AND INDUSTRY CANADA RADIO-FREQUENCY INTERFERENCE STATEMENTS**

**Class B Digital Device.** This equipment has been tested and found to comply with the limits for a Class B computing device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. If this equipment does cause harmful interference to radio or telephone reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an experienced radio/TV technician for help.

### **Caution:**

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

To meet FCC requirements, you must use shielded cables and power cords with this device. (This includes the CAT5 cable you'll use to interconnect the Host-and Device-Interface modules.)

*This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.*

*Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.*

**EUROPEAN UNION DECLARATION OF CONFORMITY**

The USB X-Tender complies with the requirements of the EMC Directive 89/336/EEC. The product was tested in a typical configuration.



## **NORMAS OFICIALES MEXICANAS (NOM) ELECTRICAL SAFETY STATEMENT**

### **INSTRUCCIONES DE SEGURIDAD**

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

10. El equipo eléctrico debe ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
  - A: El cable de poder o el contacto ha sido dañado; u
  - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
  - C: El aparato ha sido expuesto a la lluvia; o
  - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
  - E: El aparato ha sido tirado o su cubierta ha sido dañada.

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# 1. Specifications

**Compliance** — CE; FCC Class B, IC Class/classe B

**Standard** — USB 1.1 (see **Appendix C**)

**Interfaces** —

Both Modules: Proprietary dual-channel USB composite;

Host-Interface Module: USB Type B;

Device-Interface Module: USB Type A

**Data Rate** — Up to 12 Mbps on each channel that's set for full speed; up to 1.2 Mbps on each channel set for low speed

**Maximum Distance** —

USB cable from either Module to attached equipment:

6 ft. (1.8 m) to a computer's USB port;

9.8 ft. (3 m) to a low-speed device;

16.4 ft. (5 m) to a full-speed device;

Total USB cable and CAT5 cable, end to end (from computer to farthest peripheral):

150 ft. (45.7 m) if a USB hub or other full-speed device is attached to the Device-Interface Module;

1000 ft. (304.8 m) if only low-speed devices are attached to the Device-Interface Module;

For more information, see **Appendixes B and D**

**User Controls** — (2) Rear-mounted DIP switches on each Module for channel speed

**Indicators** — None

**Connectors** —

Both Modules: (1) Front-mounted RJ-45 female for CAT5 link;

Host-Interface Module: (2) Rear-mounted USB Type B female for computer/host connection;

Device-Interface Module:

(2) Rear-mounted USB Type A female for peripheral/hub connection;

(1) Front-mounted 5.5-mm barrel jack for power;

See also **Appendix A**

**Temperature Tolerance** —

Operating: 5 to 95°F (-15 to +35°C);

Storage: -4 to +140°F (-20 to +60°C)

**Humidity Tolerance** — 20% to 90% noncondensing

**Maximum Altitude** — 10,000 ft. (3048 m)

## USB X-TENDER

### **Power** —

Through desktop power supply:

Input: 100 to 240 VAC, 47 to 63 Hz (autosensing);

Output: 9 VDC at up to 2.1 amps;

Consumption: 7.2 watts maximum

**Size** — 1.1"H x 3.9"W x 3.4"D (2.8 x 9.9 x 8.6 cm); width does not include bottom flanges

**Weight** — 1 lb. (0.5 kg)

## 2. Introduction

The USB X-Tender is designed to connect computers to Universal Serial Bus (USB) peripherals across much longer distances than USB would normally allow: up to 150 ft. (45.7 m) if any high-speed devices are involved, or up to 1000 ft. (304.8 m) to low-speed devices only.

The X-Tender comes from the factory with all of the components shown in Figure 2-1. If anything is missing or damaged, call Black Box Technical Support.

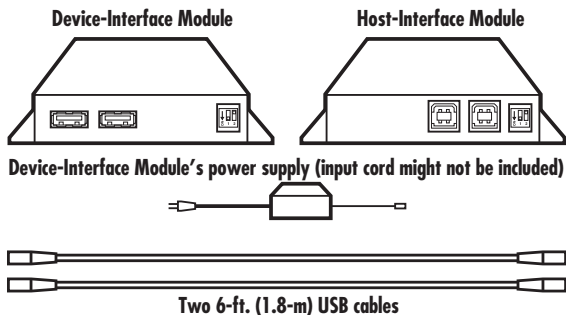


Figure 2-1. What you get with the USB X-Tender.

The X-Tender comes in two different versions (IC169A and IC169AE). Both versions include a 100–240-VAC inline power supply with an IEC 320 C7 connector. The IC169A includes a U.S. power cord. The IC169AE does not include a power cord.

The only thing you'll need to make your USB X-Tender system work that isn't included is a Category 5 twisted-pair extension cable that will run between the Host-Interface Module and the Device-Interface Module. (See **Appendix B** for specifications of this cable.) The maximum distance it can run will be determined by the types of USB devices you're using (see **Appendix D**): If any of your peripherals are “full speed,” the total end-to-end cable length (including both this cable and the USB cables) between the computer and any peripheral can't be more than 150 ft. (45.7 m), but if all of the devices are “low speed,” the total cable length can be as much as 1000 ft. (304.8 m).

## 3. Configuration

Configuring the USB X-Tender is easy, because it only involves setting one pair of rear-panel DIP switches on the two Interface Modules, and the settings on both Modules should be the same.

The USB X-Tender has two independent channels, “channel 1” and “channel 2.” If you’re only connecting a single USB device to the host computer, or if you’re connecting a USB hub to the computer, you’ll only need to use channel 1. But if you’re connecting a pair of non-hub devices, you’ll need to use both channels.

As shown in Figure 3-1 on the next page, DIP switch 1 applies to channel 1 and DIP switch 2 is for channel 2. If you’ll be attaching a full-speed USB device (including a USB hub) to one of the channels, leave that channel’s switch set to OFF (up) on both Modules. If you’ll only be attaching a single low-speed device to a channel, move that channel’s switch to ON (down) on both Modules.

If you set the two channels differently because you’ll have a full-speed device on one channel and a low-speed device on the other, make sure that you connect the devices to the correct channel when you actually install your system.

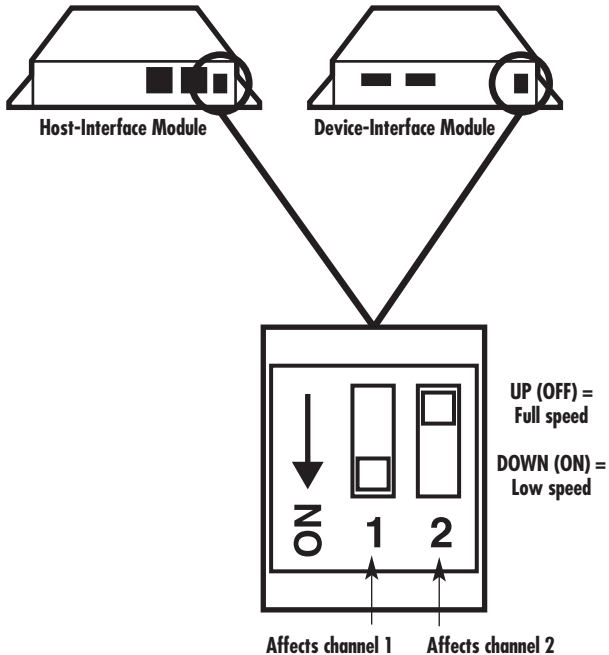


Figure 3-1. The channel-speed DIP switches.



## 4. Installation

### 4.1 Attaching USB Equipment

#### NOTES

For more information about the USB X-Tender's data connectors, see **Appendix A**.

Before you attach any USB peripheral device to the USB X-Tender's Device-Interface Module, we *strongly recommend* that you plug it directly into the computer that will be attached to the X-Tender's Host-Interface Module and make sure that the device works properly.

The USB X-Tender has two independent USB channels. You can attach USB equipment to these channels in any of three ways:

- Connect a single USB device to a single USB-host port through X-Tender channel 1 (see **Section 4.1.1**).
- Connect a pair of USB devices to a pair of USB-host ports through X-Tender channels 1 and 2 (see **Section 4.1.2**).
- Connect multiple USB devices to a USB hub, which is in turn connected to a single USB-host port through X-Tender channel 1 (see **Section 4.1.3**).

### 4.1.1 APPLICATIONS WITH A SINGLE USB PERIPHERAL

Attach the peripheral device to the “channel 1” port on the rear of the USB X-Tender’s Device-Interface Module, as shown in Figure 4-1. (If the device has a nondetachable USB cable, plug the device directly into the X-Tender. If the device has a USB port only, run one of the X-Tender’s included USB cables between the device and the X-Tender.)

Use one of the X-Tender’s included USB cables to attach one of the host computer’s USB ports to the “channel 1” port on the rear of the X-Tender’s Host-Interface Module.

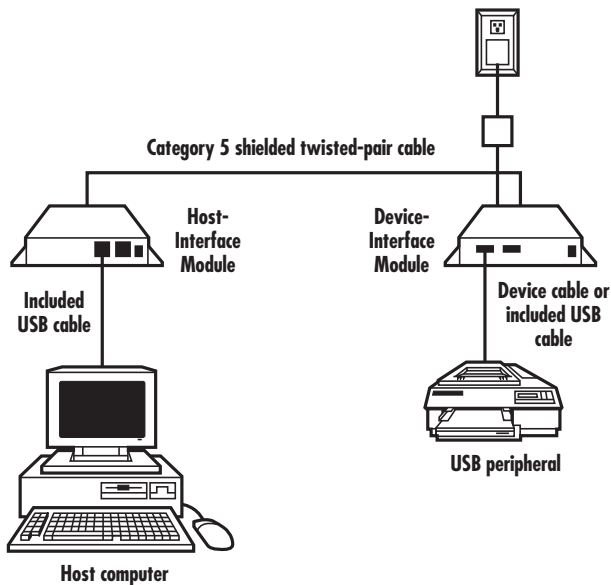


Figure 4-1. A single-device application.

### 4.1.2 APPLICATIONS WITH TWO USB PERIPHERALS ON SEPARATE CHANNELS

This type of installation is particularly useful if you want to connect a pair of low-speed devices to a computer, because it will allow you to run your cables across a full 1000 ft. (304.8 m)—which would not be the case if you connected both devices through a hub. See **Section 4.2** and **Appendix D**.

Attach one peripheral device to each of the channel ports on the rear of the USB X-Tender's Device-Interface Module, as shown in Figure 4-2. (If a device has a nondetachable USB cable, plug the device directly into the X-Tender. If a device has a USB port only, run a standard USB cable—*not* one of the ones included with the X-Tender!—between the device and the X-Tender.)

Use both of the X-Tender's included USB cables to attach two of the host computer's USB ports to the channel ports on the rear of the X-Tender's Host-Interface Module.

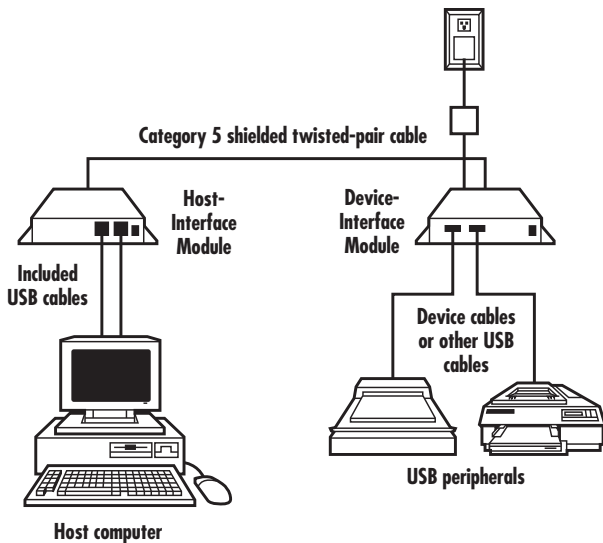


Figure 4-2. A dual-device application.

### **4.1.3 APPLICATIONS WITH MULTIPLE USB PERIPHERALS CONNECTED THROUGH A HUB**

Attach the USB hub to the “channel 1” port on the rear of the USB X-Tender’s Device-Interface Module, as shown in Figure 4-3. (If the hub has a nondetachable USB cable, plug the hub directly into the X-Tender. If the hub has a USB port only, run one of the X-Tender’s included USB cables between the hub and the X-Tender.)

Use one of the X-Tender’s included USB cables to attach one of the host computer’s USB ports to the “channel 1” port on the rear of the X-Tender’s Host-Interface Module.

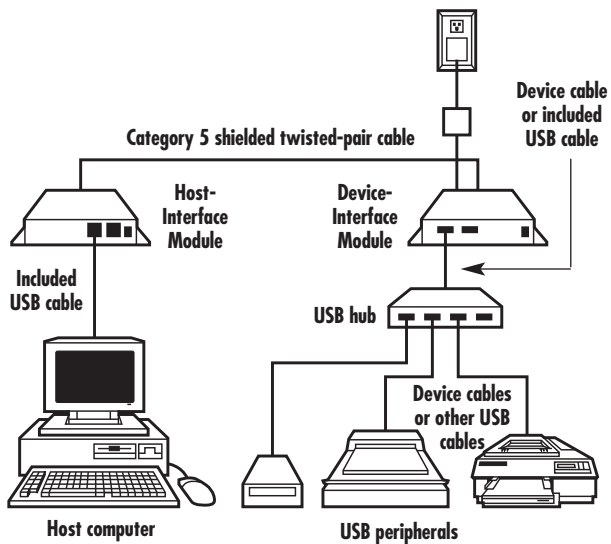


Figure 4-3. An application with multiple devices and a hub.

## **4.2 Attaching CAT5 Cabling**

If you want to, you can connect the Host-Interface Module to the Device-Interface Module with a dedicated Category 5 (CAT5) extension cable. Run this cable directly from the RJ-45 jack on the front of the Host-Interface Module to the matching jack on the front of the Device-Interface Module.

However, it's probably more likely that the site or building in which you're installing the X-Tender has a lot of Category 5 (or higher) wiring already installed in it that you'll want to use. If this is the case, run patch cables from the Modules' RJ-45 jacks to a pair of interconnected jacks in wiring closets in your site. (Figure 4-4 on the next page shows an example of such an installation.) If you're using both of the USB X-Tender's channels, you'll need all four pairs of wires in a run of 4-pair cable. If you're only using channel 1, you'll be able to use 2-pair cable, or just pairs 1 and 2 of a run of 4-pair cable.

In either case, keep in mind that if there are any full-speed USB devices attached to your system, including any USB hubs, the total length of CAT5 cable and USB cable between the computer and any peripheral must not exceed 150 ft. (45.7 m). But if there are only one or



two low-speed devices attached to your system, the total cable length can be as much as 1000 ft. (304.8 m). For a discussion of full-speed versus low-speed devices, see **Appendix D**.

For a more detailed description of the necessary specifications for the CAT5 cable, see **Appendix B**.

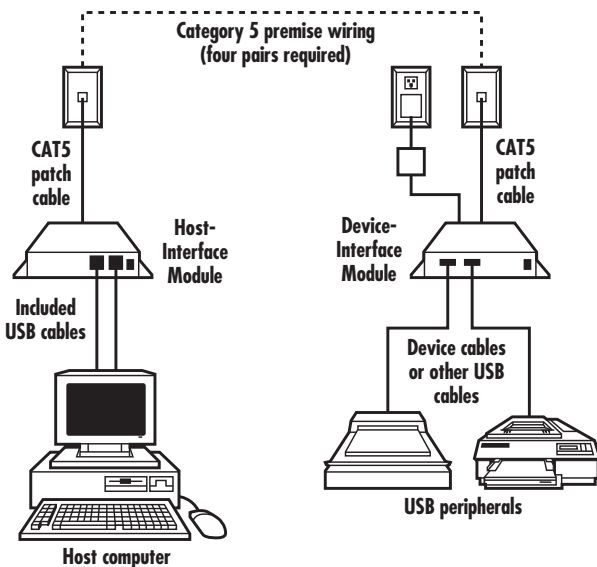


Figure 4-4. A multiple-device installation using existing premise wiring.

### **4.3 Attaching Power**

The USB X-Tender's Host-Interface Module gets all the power that it needs to operate from the voltage present on the host computer's USB port. The Device-Interface Module, however, requires an AC power source, not only to operate itself but also to operate any bus-powered USB devices that might be attached to it.

Take the X-Tender's included power-supply transformer and plug its output cord into the 5.5-mm barrel jack on the front of the Device-Interface Module. Both the IC169A and the IC169AE include a 100–240-VAC inline power supply with an IEC320 C7 male inlet. The IC169A includes a C7 U.S. power cord; the IC169AE does not include a power cord.

The Module should power up and begin operating immediately; it has no ON/OFF switch. Refer to **Chapter 5** for instructions on powering up the rest of the system.

## 5. Operation

After you've pre-checked your USB equipment and verified that it works when everything's directly connected (see the Note at the start of **Section 4.1**), then configured your Modules and installed everything, you're ready to power up the system. (At this point, the X-Tender's Remote Module should be plugged in and powered ON, but all devices attached to the X-Tender should be powered OFF.)

1. Turn ON the host computer attached to the Host-Interface Module.
2. Turn ON any powered peripherals attached to the Device-Interface Module.

The computer should detect the USB peripherals and the system should then operate transparently, just as if the X-Tender weren't even there. If you have any problems, see **Chapter 6**.

## 6. Troubleshooting

### 6.1 Things to Try

If you have any problems operating your USB peripherals through the USB X-Tender, here are a few possible solutions you can try:

- **Disconnect/reconnect:** Your first step should be to unplug and replug your peripherals one at a time: first the device on channel 1, then the device (if there is one) on channel 2. Within a few seconds, the host computer might recognize the peripherals.
- **Reset the system:** If that doesn't work, reset the USB X-Tender system by disconnecting the Host-Interface Module from the host computer. (If both channels are being used, disconnect both USB cables, starting with the channel 1 cable.) Wait 10 seconds and then reconnect the cables. This procedure will reset all connections; hopefully, the peripherals will now work.

- **Check the speed settings:** If the reset doesn't help, verify that the channel-speed settings are correct on both the Host-Interface and Device-Interface Modules (see **Chapter 3**). If they aren't, correct the problem and perform another reset.
- **Check the cable:** If the speed settings aren't the problem, confirm that your cable is not the issue. If possible, move both X-Tender Modules and the attached equipment into a single room. Attach the Modules to each other with a short (not more than 20 ft./6.1 m), known-good CAT5 cable.

If the system works normally with a short cable, then the cable you *were* using is probably either faulty or too long. The maximum length for this cable is 150 feet (45.7 m) if there are any full-speed USB devices attached to the system.

If the system *doesn't* work, even with a short CAT5 cable, try plugging the USB peripherals directly into the computer. If it still doesn't work, either the computer or the peripherals are malfunctioning. If the equipment *does* operate correctly when the X-Tender's not involved at all, call Black Box Technical Support.

If none of these procedures solve the problem, call Black Box Technical Support as described in the next section.

## **6.2 Calling Black Box**

If your USB X-Tender seems to be malfunctioning, *do not attempt to alter or repair the unit*. It contains no user-serviceable parts. Call Black Box Technical Support at 724-746-5500; the problem might be solvable over the phone.

Before you call, make a record of the history of the problem. We will be able to provide more efficient and accurate assistance if you have a complete description, including:

- the nature and duration of the problem;
- when the problem occurs;
- the components involved in the problem;
- any particular application that, when used, appears to create the problem or make it worse; and
- the results of any testing you might have already done.

### **6.3 Shipping and Packaging**

If you need to transport or ship your USB X-Tender:

- Package it carefully. We recommend that you use the original container.
- If the shipping is return- or repair-related, include everything you received with the X-Tender when you pack it. Contact Black Box to get a Return Authorization (RA) number.

## Appendix A: The USB X-Tender's Connectors

The USB X-Tender has three different types of data connectors: USB Type A, USB Type B, and RJ-45.

### USB Type A

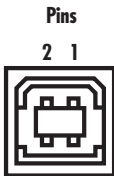
USB hosts, and the ends of USB cables that attach to hosts, have Type A connectors. The USB ports on the X-Tender's Device-Interface Module are Type A female (shown here), just like those on a host computer. The cables from USB peripherals have matching Type A male plugs.



1 2 3 4  
Pins

### USB Type B

USB peripherals, and the ends of USB cables that attach to peripherals, have Type B connectors. The USB ports on the X-Tender's Host-Interface Module are Type B female (shown here), just like the "To Computer" ports on a USB hub. The cable from the USB host computer has a matching Type B male plug.



Pins  
2 1

3 4

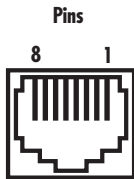


The USB cables supplied with the USB X-Tender, like all USB cables used for normal host↔peripheral communication, have a Type A plug on one end and a Type B plug on the other.

Both types of USB connector have four pins, although the pins are arranged differently. In each case, Pin 1 carries +5 VDC, Pin 2 carries the negative data signal (“-Data”), Pin 3 carries the positive data signal (“+Data”), and Pin 4 carries ground.

### RJ-45

8-pin RJ-45 connectors are currently the most widely used connectors in computer networks, largely because they're modular (easy to plug and unplug) and they're ideally suited for use with Category 5 (CAT5) wiring. The Host-Interface and Device-Interface Modules both have a single RJ-45 female jack (shown here); you'll run a CAT5 cable terminated with matching RJ-45 male plugs between these jacks on the two Modules.



For a pinout of this connector and the CAT5 cabling, see **Appendix B**.

## Appendix B: Extension-Cable Requirements

The extension cabling that you'll use to interconnect the USB X-Tender's Host-Interface and Device-Interface Modules must be Category 5 solid-core twisted-pair cable, pinned and paired according to TIA-568A or (preferably) -568B, terminated with standard RJ-45 plugs. To maintain compliance with FCC Part 15 Class B regulations, this cable should be *shielded*. Unshielded twisted-pair cabling will work, but should only be considered for commercial environments where interference is less likely to be a problem.

If you're using both of the USB X-Tender's channels, you'll need all four pairs of wires in a run of 4-pair cable. If you're only using channel 1, you'll be able to use 2-pair cable, or just pairs 1 and 2 of a run of 4-pair cable. (Pairs 1 and 2 correspond to pins 1, 2, 3, and 6. These are the same pins that 10BASE-T uses, so you can use 10BASE-T cable for this purpose. However, under *no circumstances* should you ever connect the USB X-Tender to any 10BASE-T equipment! This could damage the X-Tender, the attached USB equipment, and your 10BASE-T network!)

This cable should be pinned “straight through” (Pin 1 on the Host-Interface Module to Pin 1 on the Device-Interface Module, Pin 2 to Pin 2, and so on). The pinout of the RJ-45 connectors on the front of the Modules is shown in Figure B-1 on the next page.

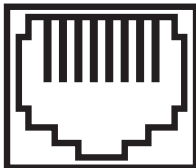
The color-coding of the twisted pairs in standard TIA-568A and -568B compliant 4-pair CAT-5 cables is also shown in Figure B-1. This information will be important if you are using existing premise wiring as an extension-cabling component. The X-Tender can be used with cables compliant with either standard, but the same standard must be used from one end of your X-Tender cabling to the other.

As noted elsewhere in this manual, the maximum length of the extension cable is determined by the speed of the USB peripheral devices that must be supported (see **Appendix D**). Full-speed devices such as cameras and scanners will limit total cable length (including CAT5 and USB cable) between the computer and any peripheral to a maximum of 150 ft. (45.7 m). But if you’re only attaching one or two low-speed devices such as mice, the total cabling can be as long as 1000 ft. (304.8 m).

## RJ-45 Female

### Pins

8 7 6 5 4 3 2 1



Pin	Pair	TIA-568A Color	TIA-568B Color	X-Tender Channel
1	2	White/Green	White/Orange	1
2	2	Green/White	Orange/White	1
3	3	White/Orange	White/Green	1
4	1	Blue/White	Blue/White	2
5	1	White/Blue	White/Blue	2
6	3	Orange/White	Green/White	1
7	4	White/Brown	White/Brown	2
8	4	Brown/White	Brown/White	2

The cable shield is normally attached to a shielded connector housing at one end of the cable.

**Figure A-1. Pinning of the RJ-45 connectors and pinning/pairing of the Category 5 cables.**

## Appendix C: USB 1.1 Compliance

The USB X-Tender is designed to extend the maximum connection distance between host computers and peripheral devices that conform to the USB 1.1 specification. This includes simple USB devices such as mice, cameras, printers and scanners; USB hubs; and compound USB devices such as keyboards with built-in hubs.

Under USB 1.1, the maximum connection distance for a USB device is 5 meters (16.4 feet) for full-speed devices or 3 meters (9.8 feet) for low-speed devices. It is also possible to connect up to five USB hubs in a daisychain configuration to achieve an extended connection distance of up to 25 meters (82 feet).

Using the USB X-Tender, you can connect any USB-1.1-compliant device to a host computer with a USB-1.1-compliant port over an extended distance without needing to daisychain hubs.

## Appendix D: Device Speeds

USB devices can communicate at either of two top speeds. “Low-speed” devices communicate at up to 1.2 Mbps, while “full-speed” devices communicate at up to 12 Mbps. Manufacturers of USB devices will typically implement a device as “low-speed” or “full-speed” depending on what they’re designed to do:

- **Low-speed**

A mouse, for example, will always be implemented as a “low-speed device” because it only needs to communicate the coordinates of a single point or the status of a few buttons. This can be done easily at 1.2 Mbps. Most other pointing devices, including keyboards, touchscreens, trackballs, and joysticks, will also be implemented as low-speed devices.

- **Full-speed**

A video camera, on the other hand, will always be implemented as a full-speed device, because it must communicate the status of a large array of video pixels points up to 30 times each second, which can easily require 12 Mbps (and strain even that limit). Other devices that have to send or receive massive amounts of video, audio, or other information in real time—including scanners,

printers, headsets, microphones, and sound systems—will also be implemented as full-speed devices.

There are two other specialized devices that are always implemented as full-speed devices: USB hubs and USB “compound devices” such as keyboards with built-in hubs.

If you are not sure of the speed of your USB device, consult its manual. If that doesn't tell you, check with the device's manufacturer. You will need this information to set up the USB X-Tender.

## Glossary

USB, like most other standards, has its own set of buzzwords. Here are definitions for a few of them.

### **USB**

The “Universal Serial Bus” communication interface.

### **USB device**

A computer peripheral such as a keyboard, mouse, printer, scanner, camera, etc., that outputs or inputs data on USB. A USB hub functions as a “USB device” to a computer, but as a “USB host” to peripherals.

### **USB host**

A computer or other central piece of equipment with USB ports to which USB devices can be attached. A USB hub functions as a “USB host” to peripherals, but as a “USB device” to a computer.

### **USB hub**

A concentrator that allows one or more USB devices to be connected to a single USB port on a host. For example, a 4-port hub can connect up to four USB devices to one USB-host port. All USB hubs are full-speed devices “upstream” and support any combination of full-speed and low-speed devices “downstream.”



**Compound USB device**

A compound USB device is a piece of equipment that includes more than one USB Device or a combination of USB Device(s) and USB Hub(s). For example, a USB keyboard that includes a built-in USB Hub is a compound USB device. Note that compound USB devices are always full speed on the “upstream” side.

**Upstream**

Toward the host. Data passed from a device to a host travels “upstream.”

**Downstream**

Toward a device. Data passed from a host to a device travels “downstream.”

**Full-speed**

Describes a device that communicates with the host at the full speed of the Universal Serial Bus, up to a maximum of 12 Megabits per second (12 Mbps).

**Low-speed**

Describes a device that communicates with the host using a special low-speed protocol, up to a maximum of only 1.2 Megabits per second (1.2 Mbps).

## NOTES

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