Extending USB Connections
SMART Board™ 600 and 600i Series
Interactive Whiteboards

SMART
Technologies

Table of Contents

Table of Contents

600 Series Interactive Whiteboard

Extending the USB with a Bus-Powered (Active) Extension Cable (USB-XT)

Basic Application – Single USB-XT Extension Cable

*Computer with
Internal USB Hub*

*16' (5 m) Bus-Powered USB
Extension Cable (USB-XT)*

*Standard 16' (5 m)
USB Cable*

Complex Application – Multiple USB-XT Extension Cables

*Computer with
Internal USB Hub*

*Up to Four 16' (5 m) Bus-Powered
USB Extension Cables (USB-XT)*

*Standard 16' (5 m)
USB Cable*
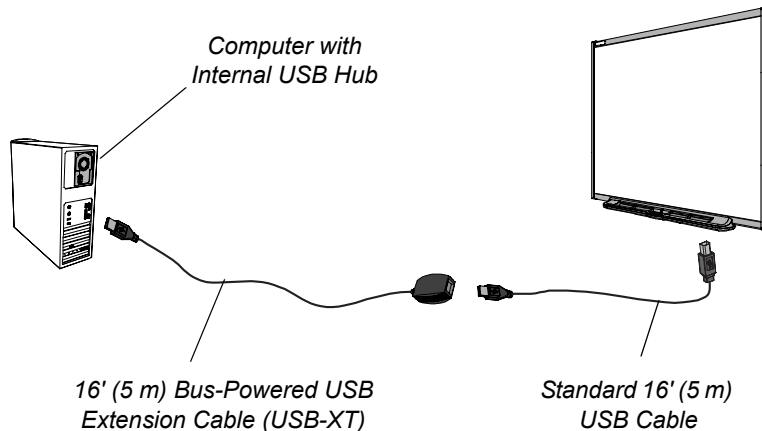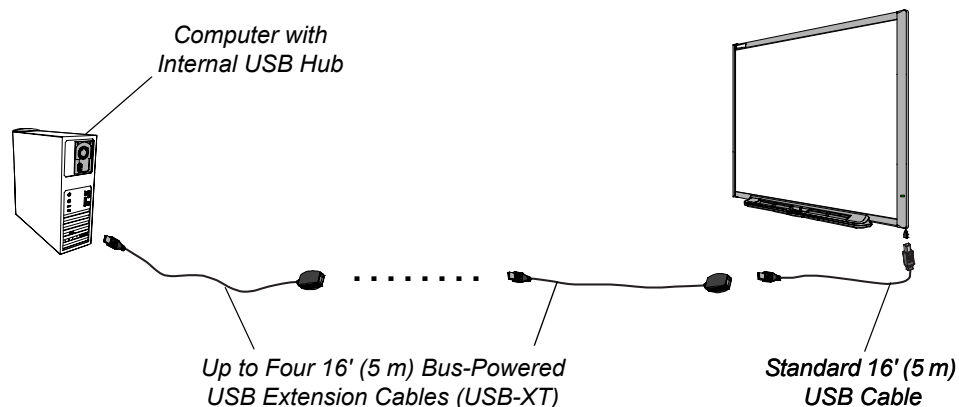
NOTES

• These are not plenum-rated solutions.

• USB cable lengths must not exceed 16' (5 m). For more information, see *USB Connectors and Cables* on page 19.

• The computer's USB port must provide sufficient power for the bus-powered extension cables and the SMART Board™ 600 Series interactive whiteboard. Laptops may not provide sufficient power while running on batteries.

• Don't connect more than four USB-XT extension cables. For more information, see *Extending USB Connections* on page 20.

• Don't route multiple USB-XT extension cables where they aren't accessible, for example, inside walls or ceilings.

• The total number of hubs used doesn't exceed the USB 2.0 specification limit of five hubs: Computer's internal hub + (up to) 4 USB-XT extenders = (up to) 5 hubs

Extending the USB with a Cat 5 Bus-Powered (Active) Extender (CAT5-XT)

Basic Application – CAT5-XT Extender

Cat 5 Cable
(not included)

6' (1.8 m) USB
Cable (included)

Extender Unit B
(included)

Extender Unit A
(included)

6' (1.8 m) USB
Cable (included)
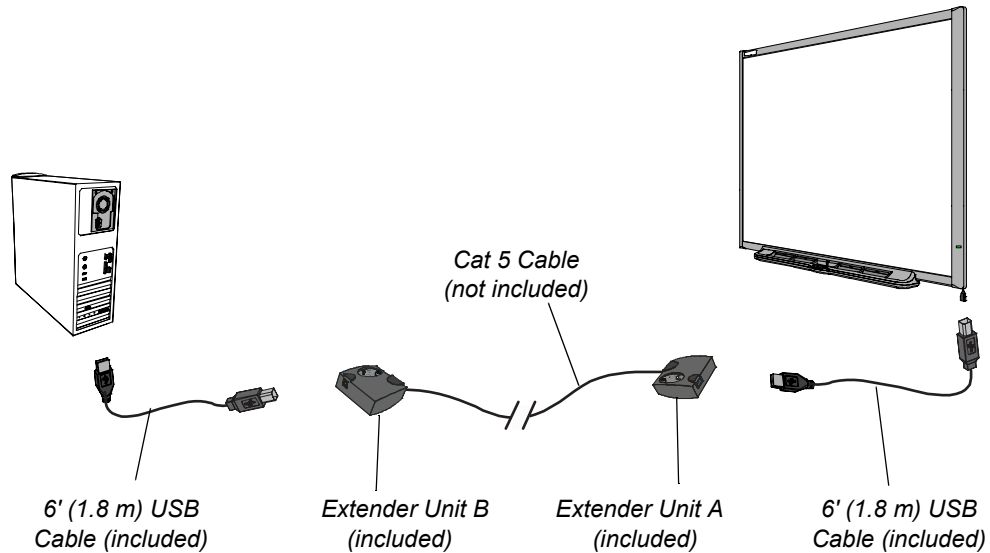
NOTES

- The maximum Cat 5 cable lengths in this configuration are:
    - 120' (36.6 m) when used with computers with Windows operating systems.
    - 90' (27.4 m) when used with Mac computers.
- You can use plenum-rated Cat 5 cable, if required.
- Only use 6' (1.8 m) USB cables (included) to connect the Unit A and Unit B extenders.
    - Don't use USB cables longer than 6' (1.8 m).
    - Don't extend the 6' (1.8 m) USB cables (included) with passive USB extension cables. For more information, see *Prohibited Cable Assemblies* on page 19.
- The computer's USB port must provide sufficient power for the bus-powered CAT5-XT extenders and the SMART Board 600 series interactive whiteboard. Laptops may not provide sufficient power while running on batteries.

Complex Application 1 – CAT5-XT Extender and Self-Powered USB Hub

If you need to extend the cable from CAT5-XT extender Unit A to the interactive whiteboard, you must use a self-powered hub. CAT5-XT extenders don't provide sufficient power for both the interactive whiteboard and a bus-powered USB extender.

Computer with Internal USB Hub

Self-Powered USB Hub (not included)

Cat 5 Cable (not included)

6' (1.8 m) USB Cable (included)   *Extender Unit B (included)*   *Extender Unit A (included)*   *6' (1.8 m) USB Cable (included)*   *Standard 16' (5 m) USB Cable*

NOTES

• Each USB hub or extender used with the CAT5-XT extender reduces the maximum Cat 5 cable lengths by 33' (10 m). The maximum Cat 5 cable lengths in this configuration are:

  – 87' (26.7 m) when used with computers with Windows operating systems.

  – 57' (17.4 m) when used with Mac computers.

• You can use plenum-rated Cat 5 cable, if required.

• Only use 6' (1.8 m) USB cables (included) to connect the Unit A and Unit B extenders.

  – Don't use USB cables longer than 6' (1.8 m).

  – Don't extend the 6' (1.8 m) USB cables with passive USB extension cables. For more information, see *Prohibited Cable Assemblies* on page 19.

• The computer's USB port must provide sufficient power for the bus-powered CAT5-XT extenders. Laptops may not provide sufficient power while running on batteries.

• The self-powered (externally powered) hub supplies power to the interactive whiteboard.

• The length of the USB cable that connects the self-powered hub to the interactive whiteboard must not exceed 16' (5 m). For more information, see *USB Connectors and Cables* on page 19.

• The number of hubs used in this configuration doesn't exceed the USB 2.0 specification limit of five hubs:

  Computer's internal hub + CAT5-XT extenders + self-powered hub = 3 hubs

Complex Application 2 – USB-XT Extension Cable(s), CAT5-XT Extender and Self-Powered USB Hub

You can extend the USB connection from the computer to CAT5-XT extender Unit B using one or two USB-XT extension cables. You can substitute the GoWire™ SMART Board software auto-launch cable in place of the USB-XT extension cable.

NOTE: You can use only one USB-XT extension cable with Mac computers.

Computer with Internal USB Hub

Self-Powered USB Hub (not included)

Cat 5 Cable (not included)

16' (5 m) USB-XT   *6' (1.8 m) USB Cable (included)*   *Extender Unit B (included)*   *Extender Unit A (included)*   *6' (1.8 m) USB Cable (included)*   *16' (5 m) USB Cable*

NOTES

- Each USB hub or extender used with the CAT5-XT extender reduces the maximum Cat 5 cable lengths by 33' (10 m). The maximum Cat 5 cable lengths in this configuration are:

  - 54' (16.5 m) with one USB-XT, or 21' (6.4 m) with two USB-XT units, when used with computers with Windows operating systems.

  - 24' (7.3 m) with one USB-XT, when used with Mac computers.

    NOTE: You can't use two USB-XT units with Mac computers.

- You can use plenum-rated Cat 5 cable, if required.

- Only use 6' (1.8 m) USB cables (included) to connect the Unit A and Unit B extenders.

  - Don't use USB cables longer than 6' (1.8 m).

  - Don't extend the 6' (1.8 m) USB cables with passive USB extension cables. For more information, see *Prohibited Cable Assemblies* on page 19.

- The computer's USB port must provide sufficient power for the bus-powered USB-XT extension cable(s) and the bus-powered CAT5-XT extenders. Laptops may not provide sufficient power while running on batteries.

- The self-powered (externally powered) hub supplies power to the interactive whiteboard.

- The length of the USB cable that connects the self-powered hub to the interactive whiteboard must not exceed 16' (5 m). For more information, see *USB Connectors and Cables* on page 19.

- The number of hubs used in this configuration doesn't exceed the USB 2.0 specification limit of five hubs:

  Computer's internal hub + USB-XT (or GoWire) + CAT5-XT + self-powered hub = 4 hubs

  OR

  Computer's internal hub + (2 × USB-XT) + CAT5-XT + self-powered hub = 5 hubs

---

600 Series Interactive Whiteboard

600 Series Interactive Whiteboard with Speakers (SBA)

Extending the USB with a Bus-Powered (Active) Extension Cable (USB-XT)
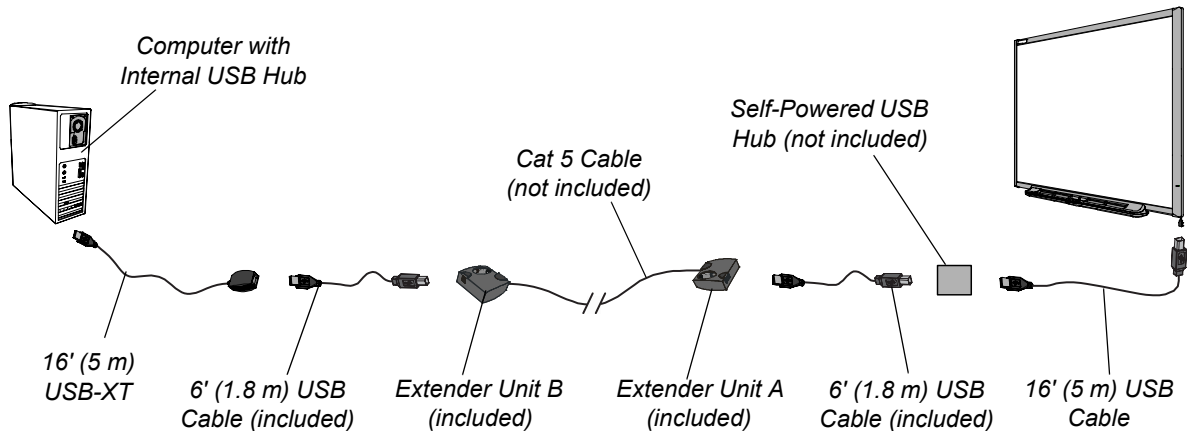
Basic Application – Single USB-XT Extension Cable

Interactive Whiteboard and SBA Speakers with Self-Powered Internal USB Hub

16' (5 m) Bus-Powered USB Extension Cable (USB-XT)

Standard 16' (5 m) USB Cable

NOTES

- This is not a plenum-rated solution.

- USB cable lengths must not exceed 16' (5 m). For more information, see *USB Connectors and Cables* on page 19.

- The computer's USB port must provide sufficient power for the bus-powered extension cable. Laptops may not provide sufficient power while running on batteries.

- The speakers' (SBA) internal USB hub provides power to the interactive whiteboard.

- You can substitute a GoWire auto-launch cable for the USB-XT extension cable.

- The number of hubs used in this configuration doesn't exceed the USB 2.0 specification limit of five hubs:

  Computer's internal hub + USB-XT extender + SBA internal hub = 3 hubs
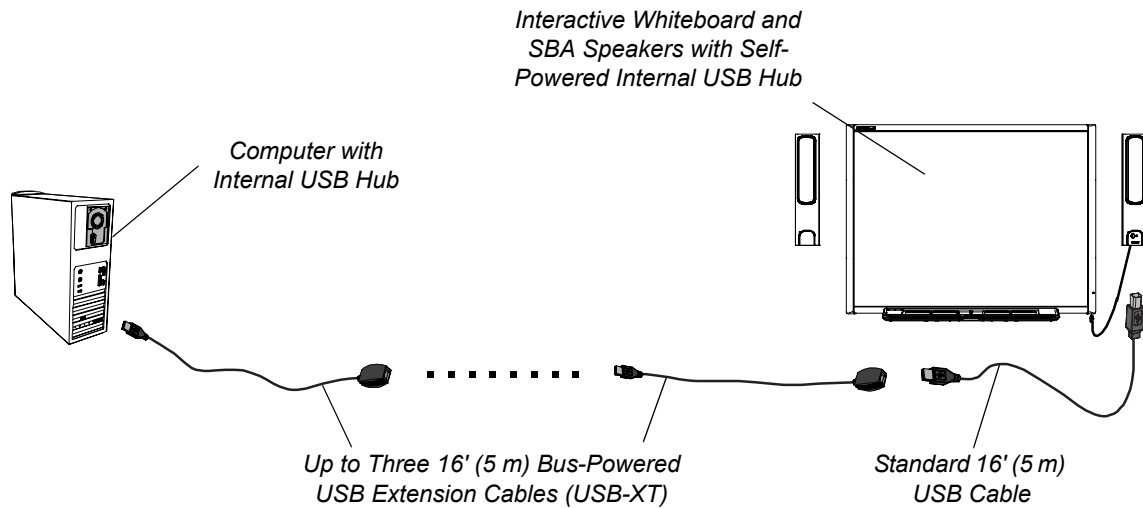
Complex Application – Multiple USB-XT Extension Cables

*Interactive Whiteboard and
SBA Speakers with Self-
Powered Internal USB Hub*

*Computer with
Internal USB Hub*

*Up to Three 16' (5 m) Bus-Powered
USB Extension Cables (USB-XT)*

*Standard 16' (5 m)
USB Cable*

NOTES

- This is not a plenum-rated solution.

- USB cable lengths must not exceed 16' (5 m). For more information, see *USB Connectors and Cables* on page 19.

- The computer's USB port must provide sufficient power for the bus-powered extension cables. Laptops may not provide sufficient power while running on batteries.

- The speakers' (SBA) internal USB hub provides power for the interactive whiteboard.

- Don't use more than three USB-XT extension cables. For more information, see *Extending USB Connections* on page 20. You can substitute a GoWire auto-launch cable for the USB-XT extension cable connected to the computer.

- Don't route multiple USB-XT extension cables where they aren't accessible, for example, inside walls or ceilings.

- The number of hubs used in this configuration doesn't exceed the USB 2.0 specification limit of five hubs:

  Computer's internal hub + (up to) 3 USB-XT extenders + SBA internal hub = (up to) 5 hubs

Extending the USB with a Cat 5 Bus-Powered (Active) Extender (CAT5-XT)

Basic Application – CAT5-XT Extender

Interactive Whiteboard and SBA Speakers with Self-Powered Internal USB Hub

Computer with Internal USB Hub

Cat 5 Cable (not included)

6' (1.8 m) USB Cable (included)

Extender Unit B (included)

Extender Unit A (included)

6' (1.8 m) USB Cable (included)

NOTES

- Each USB hub or extender used with the CAT5-XT extender reduces the maximum Cat 5 cable lengths by 33' (10 m). The maximum Cat 5 cable lengths in this configuration are:

    – 87' (26.7 m) when used with computers with Windows operating systems.

    – 57' (17.4 m) when used with Mac computers.

- You can use plenum-rated Cat 5 cable, if required.

- Only use 6' (1.8 m) USB cables (included) to connect the Unit A and Unit B extenders.

    – Don't use USB cables longer than 6' (1.8 m).

    – Don't extend the 6' (1.8 m) USB cables with passive USB extension cables. For more information, see *Prohibited Cable Assemblies* on page 19.

- The computer's USB port must provide sufficient power for the bus-powered CAT5-XT extenders. Laptops may not provide sufficient power while running on batteries.

- The speakers' (SBA) internal USB hub provides power to the interactive whiteboard.

- The number of hubs used in this configuration doesn't exceed the USB 2.0 specification limit of five hubs:

    Computer's internal hub + CAT5-XT extenders + SBA speaker internal hub = 3 hubs

Complex Application 1 – CAT5-XT Extender and Self-Powered Hub

You can extend the USB connection from the computer to the interactive whiteboard with speaker option (SBA) using the Cat 5 extenders (CAT5-XT) and a self-powered USB hub. The self-powered USB hub allows you to extend the included 6' (1.8 m) USB cable with a standard 16' (5 m) USB cable.

Computer with Internal USB Hub

Interactive Whiteboard and SBA Speakers with Self-Powered Internal USB Hub

Cat 5 Cable (not included)

Self-Powered USB Hub (not included)

6' (1.8 m) USB Cable (included)

Extender Unit B (included)

Extender Unit A (included)

6' (1.8 m) USB Cable (included)
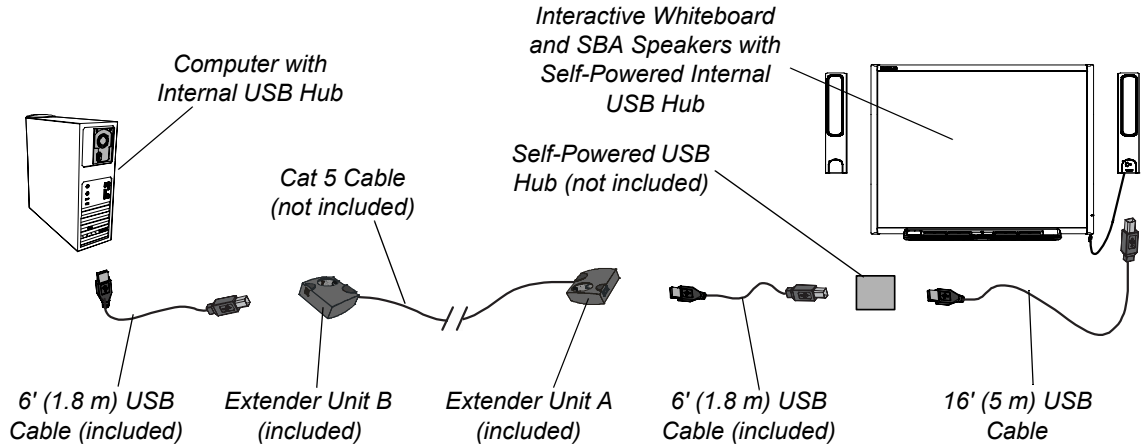
16' (5 m) USB Cable

NOTES

- Each USB hub or extender used with the CAT5-XT extender reduces the maximum Cat 5 cable lengths by 33' (10 m). The maximum Cat 5 cable lengths in this configuration are:

    – 54' (16.5 m) when used with computers with Windows operating systems.

    – 24' (7.3 m) when used with Mac computers.

- You can use plenum-rated Cat 5 cable, if required.

- Only use 6' (1.8 m) USB cables (included) to connect the Unit A and Unit B extenders.

    – Don't use USB cables longer than 6' (1.8 m).

    – Don't extend the 6' (1.8 m) USB cables with passive USB extension cables. For more information, see *Prohibited Cable Assemblies* on page 19.

- The computer's USB port must provide sufficient power for the bus-powered CAT5-XT extenders. Laptops may not provide sufficient power while running on batteries.

- The speakers' (SBA) internal USB hub provides power to the interactive whiteboard.

- The length of the USB cable that connects the self-powered hub to the SBA speakers must not exceed 16' (5 m). For more information, see *USB Connectors and Cables* on page 19.

- The number of hubs used in this configuration doesn't exceed the USB 2.0 specification limit of five hubs:

    Computer's internal hub + CAT5-XT + self-powered hub + SBA internal hub = 4 hubs

Complex Application 2 – USB-XT Extension Cable(s), CAT5-XT Extender and Self-Powered USB Hub

You can extend the USB connection from the computer to CAT5-XT extender Unit B using a USB-XT extension cable.

NOTE: You can't use this configuration with Mac computers.

Interactive Whiteboard
and SBA Speakers with
Self-Powered Internal
USB Hub

Computer with
Internal USB Hub

Cat 5 Cable
(not included)

Self-Powered USB
Hub (not included)

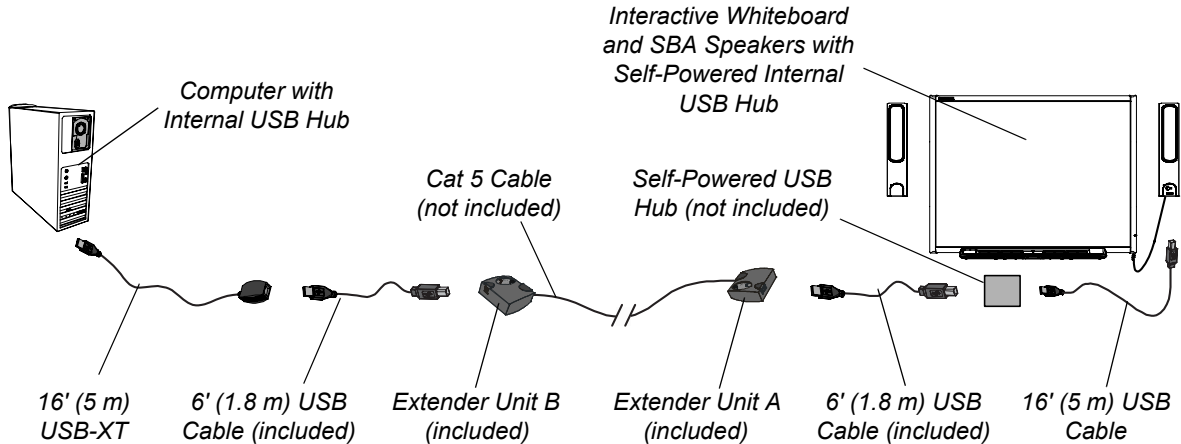| 16' (5 m)
USB-XT | 6' (1.8 m) USB
Cable (included) | Extender Unit B
(included) | Extender Unit A
(included) | 6' (1.8 m) USB
Cable (included) | 16' (5 m) USB
Cable |

NOTES

- Each USB hub or extender used with the CAT5-XT extender reduces the maximum Cat 5 cable lengths by 33' (10 m). The maximum Cat 5 cable length in this configuration is 21' (6.4 m) when used with computers with Windows operating systems.

  NOTE: You can't use this configuration with Mac computers.

- You can use plenum-rated Cat 5 cable, if required.

- Only use 6' (1.8 m) USB cables (included) to connect the Unit A and Unit B extenders.

  – Don't use USB cables longer than 6' (1.8 m).

  – Don't extend the 6' (1.8 m) USB cables with passive USB extension cables. For more information, see *Prohibited Cable Assemblies* on page 19.

- The computer's USB port must provide sufficient power for the bus-powered USB-XT extension cable and the bus-powered CAT5-XT extenders. Laptops may not provide sufficient power while running on batteries.

- You can substitute a GoWire auto launch cable for the USB-XT extension cable connected to the computer.

- The speakers' (SBA) internal USB hub provides power to the interactive whiteboard.

- The length of the USB cable that connects the self-powered hub to the interactive whiteboard must not exceed 16' (5 m). For more information, see *USB Connectors and Cables* on page 19.

- The number of hubs used in this configuration doesn't exceed the USB 2.0 specification limit of five hubs:

  Computer's internal hub + USB-XT (or GoWire) + CAT5-XT + self-powered hub + SBA internal hub = 5 hubs

Basic Application – Connecting to the Extended Connection Panel (ECP) USB Receptacle

Extended Connection Panel (ECP)

Computer with Internal USB Hub

6' (1.8 m) USB Cable (included)
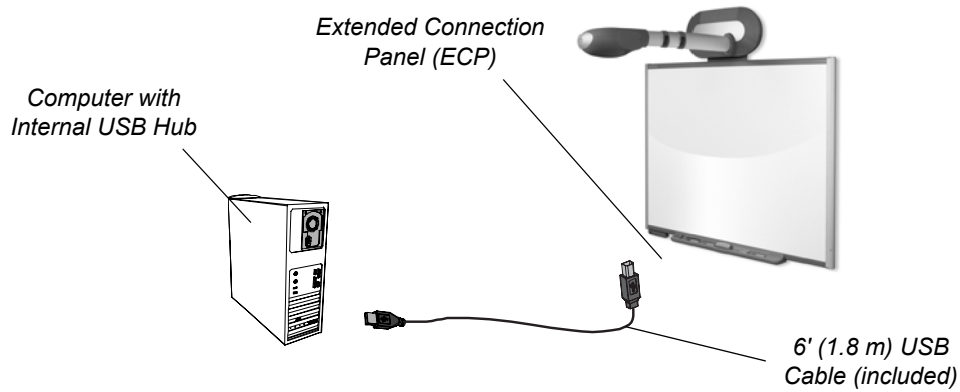
- Only use 6' (1.8 m) USB cables (included) to connect the computer to the extended connection panel (ECP).

   – Don't use USB cables longer than 6' (1.8 m).

   – Don't extend the 6' (1.8 m) USB cables with passive USB extension cables. For more information, see *Prohibited Cable Assemblies* on page 19.

Extending the USB with a Bus-Powered (Active) Extension Cable (USB-XT)

Basic Application – Single Extension Cable
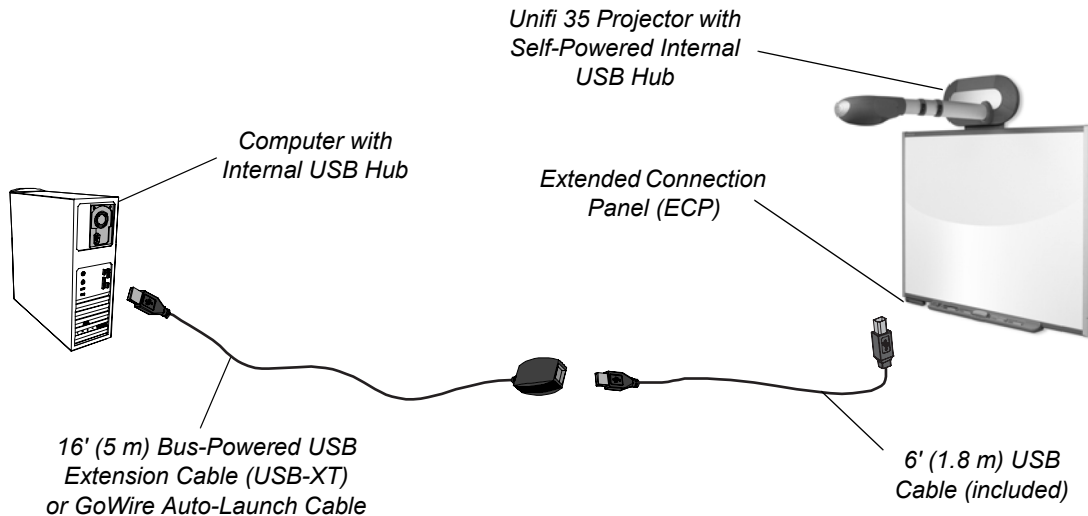
Unifi 35 Projector with Self-Powered Internal USB Hub

Computer with Internal USB Hub

Extended Connection Panel (ECP)

16' (5 m) Bus-Powered USB Extension Cable (USB-XT) or GoWire Auto-Launch Cable

6' (1.8 m) USB Cable (included)

NOTES

• This is not a plenum-rated solution.

• Only use 6' (1.8 m) USB cables (included) to connect the USB-XT extender to the extended connection panel (ECP).

– Don't use USB cables longer than 6' (1.8 m).

– Don't extend the 6' (1.8 m) USB cables (included) with passive USB extension cables. For more information, see *Prohibited Cable Assemblies* on page 19.

• The computer's USB port must provide sufficient power for the bus-powered extension cable. Laptops may not provide sufficient power while running on batteries.

• The Unifi™ 35 projector's self-powered internal USB hub provides power to the interactive whiteboard.

• Don't route the USB-XT extension cable where it isn't accessible, for example, inside walls or ceilings.

• You can substitute a GoWire auto launch cable for the USB-XT extension cable.

• The number of hubs used in this configuration doesn't exceed the USB 2.0 specification limit of five hubs:

Computer's internal hub + USB-XT + Unifi 35 internal hub = 3 hubs

Complex Application – Multiple USB-XT Extension Cables

*Computer with
Internal USB Hub*

*Unifi 35 Projector with
Self-Powered Internal
USB Hub*

*Extended Connection
Panel (ECP)*

*Up to Three 16' (5 m) Bus-Powered
USB Extension Cables (USB-XT)*

*6' (1.8 m) USB
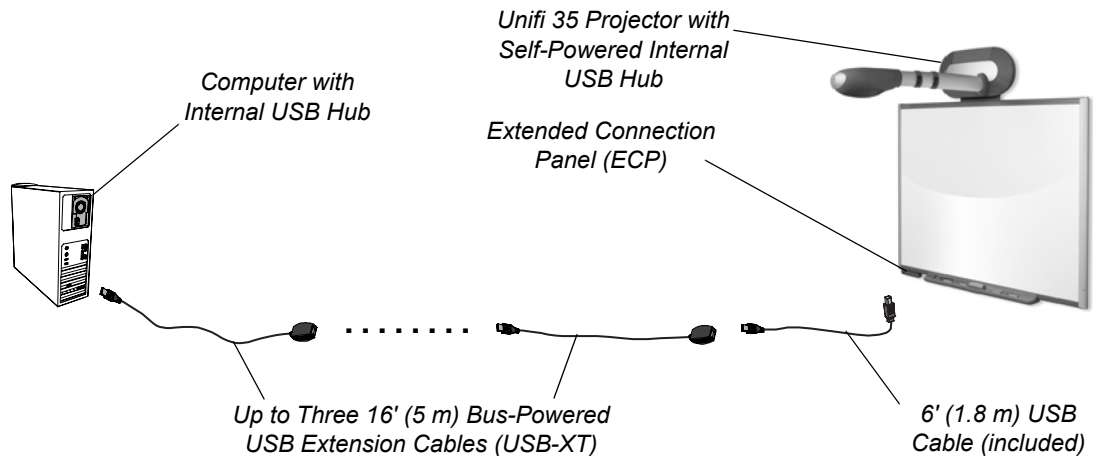Cable (included)*

NOTES

- This is not a plenum-rated solution.

- Only use 6' (1.8 m) USB cables (included) to connect the USB-XT extender to the extended connection panel (ECP).

  – Don't use a USB cable longer than 6' (1.8 m).

  – Don't extend the 6' (1.8 m) USB cables with passive USB extension cables. For more information, see *Prohibited Cable Assemblies* on page 19.

- The computer's USB port must provide sufficient power for the bus-powered extension cables. Laptops may not provide sufficient power while running on batteries.

- The Unifi 35 projector's self-powered internal USB hub provides power for the interactive whiteboard.

- Don't route multiple USB-XT extension cables where they aren't accessible, for example, inside walls or ceilings.

- Don't use more than three USB-XT extension cables. For more information, see *Extending USB Connections* on page 20. You can substitute a GoWire auto-launch cable for the USB-XT extension cable connected to the computer.

- The number of hubs used in this configuration doesn't exceed the USB 2.0 specification limit of five hubs:

  Computer's internal hub + (up to) 3 USB-XTs + Unifi 35 internal hub = (up to) 5 hubs

Extending the USB with a Cat 5 Bus-Powered (Active) Extender (CAT5-XT)

Basic Application – CAT5-XT Extender

Computer with Internal USB Hub

Unifi 35 Projector with Self-Powered Internal USB Hub

6' (1.8 m) USB Cable (included)

Cat 5 Cable (not included)

6' (1.8 m) USB Cable (included)

Extender Unit B (included)

Extender Unit A (included)

NOTES

- Each USB hub or extender used with the CAT5-XT extender reduces the maximum Cat 5 cable lengths by 33' (10 m). The maximum Cat 5 cable lengths in this configuration are:

    – 87' (26.7 m) when used with computers with Windows operating systems.

    – 57' (17.4 m) when used with Mac computers.

- You can use plenum-rated Cat 5 cable, if required.

- Only use 6' (1.8 m) USB cables (included) to connect the Unit A and Unit B extenders.

    – Don't use USB cables longer than 6' (1.8 m).

    – Only connect CAT5-XT Unit A to the Unifi 35 projector base USB B receptacle. Don't connect Unit A to the extended connection panel.

    – Don't extend the 6' (1.8 m) USB cables with passive USB extension cables. For more information, see *Prohibited Cable Assemblies* on page 19.

- The computer's USB port must provide sufficient power for the bus-powered CAT5-XT extenders. Laptops may not provide sufficient power while running on batteries.

- The Unifi 35 projector's self-powered internal USB hub provides power to the interactive whiteboard.

- The number of hubs used in this configuration doesn't exceed the USB 2.0 specification limit of five hubs:

Computer's internal hub + CAT5-XT + Unifi 35 projector internal hub = 3 hubs

Complex Application 1 – CAT5-XT Extender and Self-Powered Hub

You can extend the USB connection from the computer to the 600i interactive whiteboard system using Cat 5 extenders (CAT5-XT) and a self-powered USB hub. The self-powered USB hub allows you to extend the 6' (1.8 m) cable with a standard 16' (5 m) USB cable.

Computer with Internal USB Hub

Cat 5 Cable (not included)

Unifi 35 Projector with Self-Powered Internal USB Hub

Self-Powered USB Hub (not included)

6' (1.8 m) USB Cable (included)

Extender Unit B (included)

Extender Unit A (included)

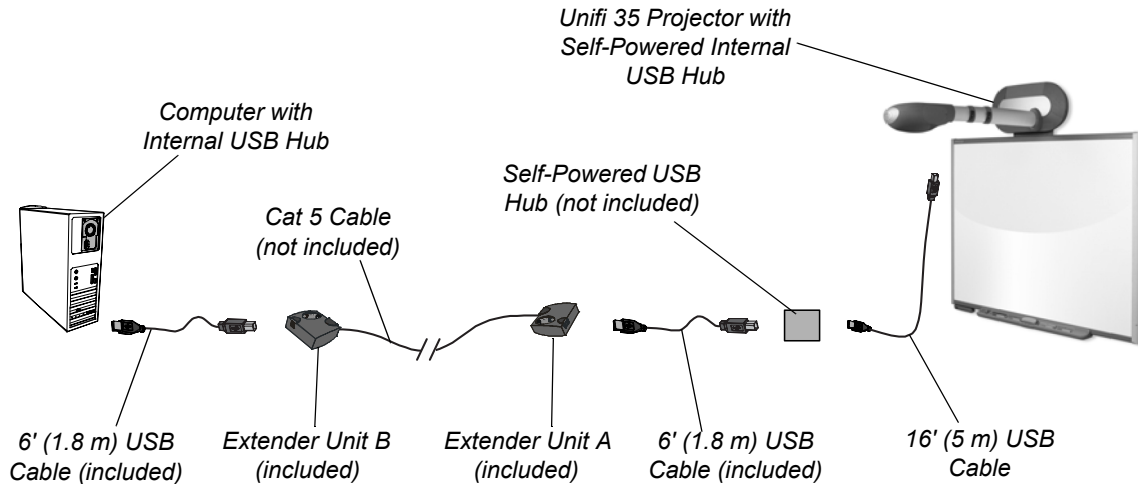*6' (1.8 m) USB Cable (included)*

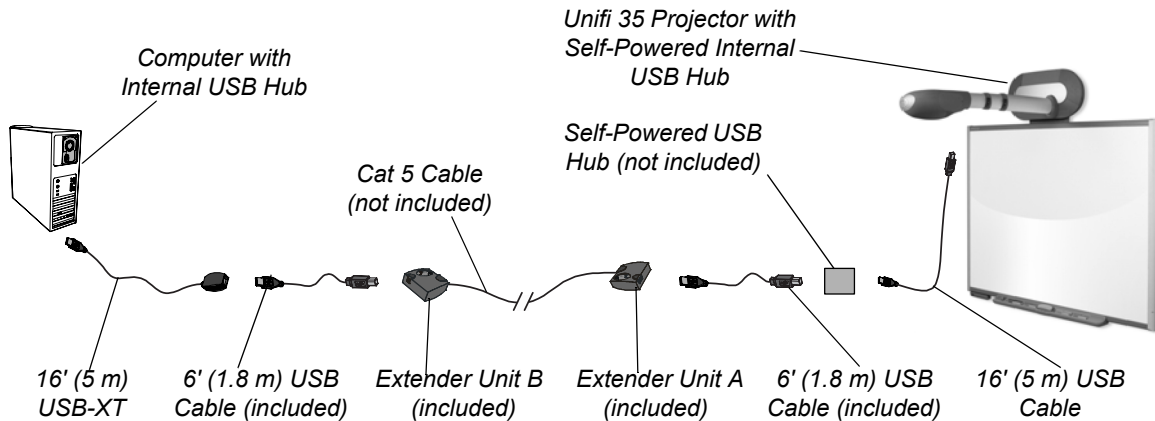*16' (5 m) USB Cable*

NOTES

- Each USB hub or extender used with the CAT5-XT extender reduces the maximum Cat 5 cable lengths by 33' (10 m). The maximum Cat 5 cable lengths in this configuration are:

  – 54' (16.5 m) when used with computers with Windows operating systems.

  – 24' (7.3 m) when used with Mac computers.

- You can use plenum-rated Cat 5 cable, if required.

- Only use 6' (1.8 m) USB cables (included) to connect the Unit A and Unit B extenders.

  – Don't use USB cables longer than 6' (1.8 m).

  – Only connect CAT5-XT Unit A to the Unifi 35 projector base USB B receptacle. Don't connect Unit A to the extended connection panel.

  – Don't extend the 6' (1.8 m) USB cables with passive USB extension cables. For more information, see *Prohibited Cable Assemblies* on page 19.

- The computer's USB port must provide sufficient power for the bus-powered CAT5-XT extenders. Laptops may not provide sufficient power while running on batteries.

- The Unifi 35 projector's self-powered internal USB hub provides power to the interactive whiteboard.

- The length of the USB cable that connects the self-powered hub to the Unifi 35 projector must not exceed 16' (5 m). For more information, see *USB Connectors and Cables* on page 19.

- The number of hubs used in this configuration doesn't exceed the USB 2.0 specification limit of five hubs:

  Computer's internal hub + CAT5-XT + self-powered hub + Unifi 35 projector internal hub = 4 hubs

Complex Application 2 – USB-XT Extension Cable(s), CAT5-XT Extender and Self-Powered USB Hub

You can extend the USB connection from the computer to CAT5-XT extender Unit B using a USB-XT extension cable.

NOTE: You can't use this configuration with Mac computers.

Computer with Internal USB Hub

Unifi 35 Projector with Self-Powered Internal USB Hub

Self-Powered USB Hub (not included)

Cat 5 Cable (not included)

16' (5 m) USB-XT *6' (1.8 m) USB Cable (included)* *Extender Unit B (included)* *Extender Unit A (included)* *6' (1.8 m) USB Cable (included)* *16' (5 m) USB Cable*

NOTES

- Each USB hub or extender used with the CAT5-XT extender reduces the maximum Cat 5 cable lengths by 33' (10 m). The maximum Cat 5 cable length in this configuration is 21' (6.4 m) when used with computers with Windows operating systems.

  NOTE: You can't use this configuration with Mac computers.

- You can use plenum-rated Cat 5 cable, if required.

- Only use the included 6' (1.8 m) USB cables to connect the Unit A and Unit B extenders.

  – Don't use USB cables longer than 6' (1.8 m).

  – Connect the CAT5-XT Unit A to the Unifi 35 projector base USB B receptacle, only. Don't connect the Unit A to the extended connection panel.

  – Don't extend the 6' (1.8 m) USB cables with passive USB extension cables. For more information, see *Prohibited Cable Assemblies* on page 19.

- The computer's USB port must provide sufficient power for the bus-powered USB-XT extension cable and the bus-powered CAT5-XT extenders. Laptops may not provide sufficient power while running on batteries.

- The Unifi 35 projector's self-powered internal USB hub provides power to the interactive whiteboard.

- The length of the USB cable that connects the self-powered hub to the Unifi 35 projector must not exceed 16' (5 m). For more information, see *USB Connectors and Cables* on page 19.

- The number of hubs used in this configuration doesn't exceed the USB 2.0 specification limit of five hubs:

  Computer's internal hub + USB-XT + CAT5-XT + self-powered hub + Unifi 35 projector internal hub = 5 hubs

---

600i Series Interactive Whiteboard System

USB 2.0 Specification Primer

You can use this section as a reference to common Universal Serial Bus 2.0 (USB 2.0) terms, rules and conventions.

USB Terminology

These definitions are derived from the Universal Serial Bus Specification, Version 2.0, and are used within this document.

Term	Definition
Active (device)	A device (hub or extension cable) with circuitry for regenerating the USB signals. For more information, see *Powering USB Devices* on page 18.
Device	A logical or physical entity that performs a function. The actual entity described depends on the context of the reference. At the lowest level, device may refer to a single hardware component, as in a memory device. At a higher level, it may refer to a collection of hardware components that perform a particular function, such as a USB interface device.
	When used in a non-specific reference, a USB device is either a hub or a function.
Downstream	The direction of data flow from the host or away from the host. A downstream port is the port on a hub electrically farthest from the host that generates downstream data traffic from the hub. Downstream interfaces receive upstream data traffic.
Full-speed	USB operation at 12 Mbps
Function	A USB device that provides a capability to the host, such as a keyboard, interactive whiteboard, or speakers.
High-speed	USB operation at 480 Mbps
Host	The host computer system where the USB host controller is installed. This includes the host hardware platform (CPU, bus, etc.) and the operating system in use.
Host controller	The host's USB interface hardware and software.
Hub	A USB device that provides additional connections to the bus.
Low-speed	USB operation at 1.5 Mbps
Passive (extension cable)	An extension cable that has no active electronic components. For more information, see *Prohibited Cable Assemblies* on page 19.
Physical device	A device that has a physical implementation; e.g., speakers, microphones, and CD players.
Port	A USB hub's downstream connection point where a USB device is attached.
Root hub	A USB hub directly attached to the host controller.
Upstream	The direction of data flow towards the host. An upstream connector on a device is electrically closest to the host that generates upstream data traffic from the hub. Upstream interfaces receive downstream data traffic.

USB Topology

The USB physical network is a tiered star topology. A hub is at the center of each star. Each wire segment is a point-to-point connection between the host and a hub or function, or a hub connected to another hub or function. This figure illustrates the topology of a USB network.
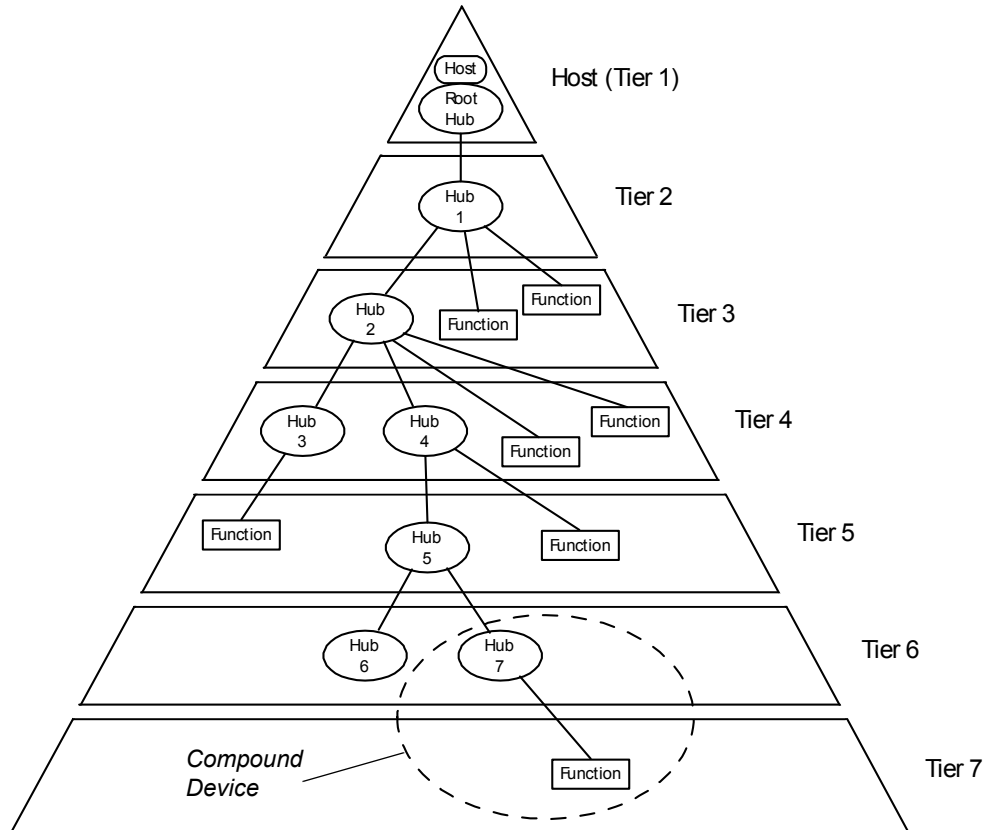
Timing constraints for hub and cable propagation times allow a maximum of seven tiers, including the root tier. In seven tiers, a maximum of five non-root hubs can be supported in a communication path between the host and any device. Note that a compound device occupies two tiers; therefore, it cannot be attached at tier seven where only functions can be used.

Connecting USB Devices

USB attachment points are provided by a special class of USB device known as a hub. The additional attachment points provided by a hub are called ports.

A host includes an embedded hub called the **root hub** that can provide one or more attachment points. Hosts may also have other non-root internal hubs to provide further expansion capability. These internal non-root hubs are tier 2 devices, and limit the number of external hubs that you can use in a path.

Powering USB Devices

A USB host can supply power for USB devices that are directly connected. USB devices that rely on power from the cable are called **bus-powered** devices.

USB devices that have their own externally-connected power supplies are called **self-powered** devices.

USB Connectors and Cables

USB Connectors

There are two types of full-size USB connectors: Series-A and Series-B. Either connector type can be a receptacle or a plug.

- Series-A receptacles are used as outputs from host systems and hubs.

- Series-B receptacles are used as inputs to hubs or devices.

- Series-A plugs are always oriented towards the host system and mate with Series-A receptacles.

- Series-B plugs are always oriented towards a USB hub or device and mate with Series-B receptacles.

NOTE: Smaller versions of the Series-A and Series-B connectors, called Mini-A and Mini-B, and Micro-A and Micro-B, are available and conform to the same rules as full-size USB connectors.

TIP: Although USB 2.0 Specifications requires that USB connectors can be "hot plugged" (i.e., you can insert a USB connector with power on without damage to the circuitry), we recommend that you connect all your devices and cables before you turn on the power. If you connect a device when the power is already on, and the system doesn't work correctly, disconnect the power from all active devices in the USB circuit, and then reconnect the power again.

USB Cables

For full-speed and high-speed connections, USB 2.0 Specifications allow two types of cable assemblies:

- a standard detachable cable that is terminated on one end with a Series-A plug, and terminated on the opposite end with a series "B" plug

- a captive cable that is terminated on one end with a Series-A plug, and has a vendor-specific connection on the opposite end for the peripheral

Any other cable assemblies are prohibited.

Prohibited Cable Assemblies

The USB 2.0 Specifications prohibits specific cable assemblies. Prohibited cable assemblies may work in some situations, but they cannot be guaranteed to work in all instances.

An example of a prohibited cable is the "extension cable". This type of cable assembly has a Series-A plug and a Series-A receptacle or a Series-B plug and a Series-B receptacle. This "passive" extension cable allows you to connect multiple cable segments, possibly exceeding the maximum permissible cable length.

Another example of a prohibited cable is one with both ends terminated in either Series-A plugs or Series-B receptacles, allowing two downstream ports to be connected together.
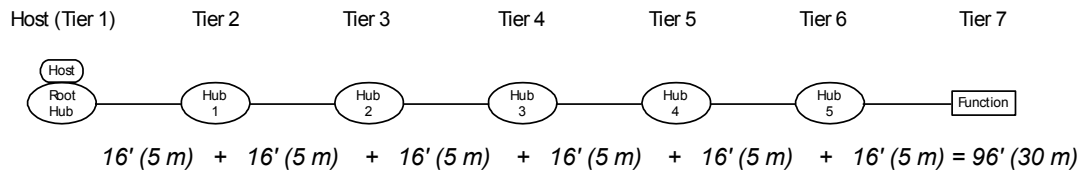
USB Cable Length

The maximum allowable USB cable length is determined primarily by signal attenuation and propagation delay. A USB cable also carries VBUS and GND wires on each segment to deliver power to bus-powered devices. VBUS is nominally +5V at the source, and the GND lead provides a common ground reference between the upstream and downstream devices. The voltage drop across the VBUS and GND leads can also limit the maximum cable length.

You can purchase or manufacture cables using commonly available wire that conforms to USB specifications to a maximum length of approximately 16 feet (5 meters).
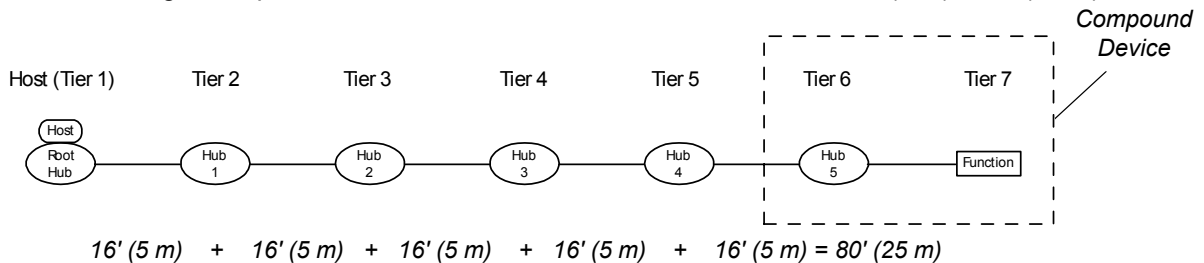
Extending USB Connections

In USB topology, the hub is the only device that you can use to link USB devices. The distance between hosts and devices, therefore, is limited by the maximum USB cable length allowed between devices and the maximum number of hubs allowed in a path.

In the following diagram, you can see that if all USB hub connections use 16' (5 m) cables, the maximum distance between a host's root hub and a function is: 6 × 16' (5 m) = 96' (30 m).
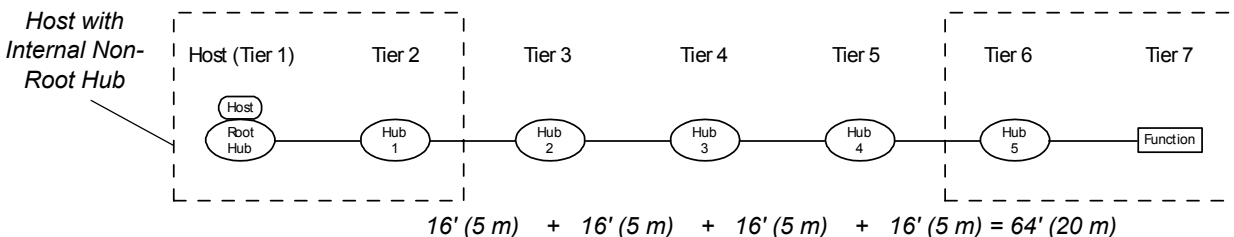
| Host (Tier 1) | Tier 2 | Tier 3 | Tier 4 | Tier 5 | Tier 6 | Tier 7 |

Host
Root Hub — Hub 1 — Hub 2 — Hub 3 — Hub 4 — Hub 5 — Function

16' (5 m) + 16' (5 m) + 16' (5 m) + 16' (5 m) + 16' (5 m) + 16' (5 m) = 96' (30 m)

Connecting a compound device limits the maximum distance to: 5 × 16' (5 m) = 80' (25 m).

Compound Device

| Host (Tier 1) | Tier 2 | Tier 3 | Tier 4 | Tier 5 | Tier 6 | Tier 7 |

Host
Root Hub — Hub 1 — Hub 2 — Hub 3 — Hub 4 — Hub 5 — Function

16' (5 m) + 16' (5 m) + 16' (5 m) + 16' (5 m) + 16' (5 m) = 80' (25 m)

NOTE: SMART Board 600i interactive whiteboard systems and SMART Board 600 series interactive whiteboards with the speaker option (SBA) are compound devices.

Connecting a compound device and a host with an internal non-root hub further limits the maximum distance to: 4 × 16' (5 m) = 64' (20 m).

Host with Internal Non-Root Hub

| Host (Tier 1) | Tier 2 | Tier 3 | Tier 4 | Tier 5 | Tier 6 | Tier 7 |

Host
Root Hub — Hub 1 — Hub 2 — Hub 3 — Hub 4 — Hub 5 — Function

16' (5 m) + 16' (5 m) + 16' (5 m) + 16' (5 m) = 64' (20 m)

SMART
Technologies™

SMART Technologies Inc.
Corporate Headquarters
1207 – 11 Avenue SW, Suite 300
Calgary, AB   T3C 0M5
CANADA

www.smarttech.com/support
www.smarttech.com/contactsupport
Support +1.403.228.5940
Toll Free 1.866.518.6791 (Canada/U.S.)