BLACK BOX® NETWORK SERVICES

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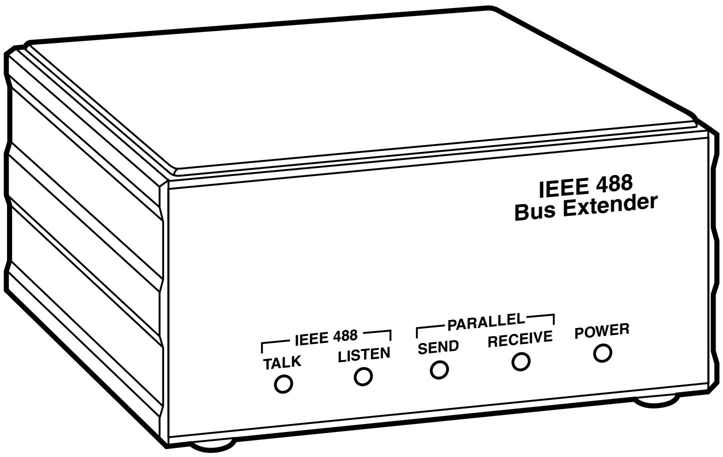
IEEE 488 BUS EXTENDER



Use a pair of these to extend your 488 bus to 1000 meters.

Key Features

- ***Exceeds the 20-meter cable limitations set by the IEEE standard.***
- ***Uses RS-422 drivers for high noise immunity.***
- ***Expands the number of devices allowed on the bus from 15 to 28.***
- ***Operates transparently to the controller.***
- ***Requires no programming changes for most applications.***
- ***Packaged in a rugged metal case.***
- ***115.2-kbps serial transmission.***

Go beyond the IEEE 488 standard's specified 20-meter (65.6-ft.) limit with a pair of IEEE 488 Bus Extenders. These intelligent extenders enable you to control IEEE 488 devices up to 1000 meters (3280.8 ft.) away from the host computer.

What's more, you can expand the number of devices allowed on the bus from 15 to 28—that is, 14 devices on each side (local and remote sides) of the bus plus the extenders, which count as one device each on the bus.

Operating over ordinary RS-422 cable, the IEEE-488 Bus Extender uses 115.2-kbps serial transmission and differential RS-422 drivers and receivers for a full maximum rate of 3400 bytes per second.

RS-422, a differential serial data format, provides high noise immunity and long distances using low-cost twisted-pair wire. (To ensure signal integrity, only use shielded cable for the serial port connections.)

Extender operation is completely transparent to the system because the extenders have no address of their own. The controller can access both local and remote devices just as it could without the extender (with the exception of Parallel Poll).

Packaged in an all-metal case, the extender has a design that makes it convenient for both desktop and rackmount applications.

At power-up, each extender monitors connection for the Attention (ATN) and Remote Enable (REN) lines to ensure that there's a valid communications link with the other extender. The first extender to detect either of these lines asserted declares itself the local extender and commands the other extender to declare itself the remote extender. From this point forward, the local extender will monitor all local bus activity and transmit this activity to the remote extender, and all activity detected by the remote extender is also communicated back to the local extender.

Although each IEEE 488 Bus Extender ships with a default serial baud rate setting of 115.2 kbps, which suits most applications, you can reset the rate lower if you plan to locate the extenders at extreme distances from each other. To change the baud rate and serial data rate format, just adjust an internal DIP switch.

The IEEE 488 Bus Extender contains a 6809 microprocessor that's supported by 8 KB of firmware EPROM and 8 KB of static RAM. The extender performs an internal ROM and RAM self-check at power-up.

Keep in mind that you'll need two IEEE 488 Bus Extenders for bus extension. The bus connecting the host computer, or controller, is the "local" bus. The bus to which control is extended is the "remote" bus.

Technically Speaking

IEEE 488 (also known as GPIB or General Purpose Interface Bus) is an international standard for a parallel interface that has greatly simplified the connection of sensors and programmable instruments to a computer. With it, instruments from different manufactures can be connected by a single standard cable.

Two IEEE 488 standards are in use: the older IEEE 488.1 standard, which deals with the hardware only, and the newer IEEE 488.2 standard, which also addresses software issues like data formats and error handling.

IEEE 488.1 is a clearly defined mechanical, hardware, and electrical protocol specification. It doesn't address data formats, status reporting, message-exchange protocol, or common configuration or device-specific commands.

IEEE 488.2 enhances the IEEE 488.1 standard by specifying data formats, status reporting, error handling, controller functionality, and common instruments commands. It focuses mainly on the software protocol issues and thus maintains compatibility with the hardware-oriented IEEE 488.1 standard. IEEE 488.2 systems tend to be more compatible and reliable.

Most devices can be adapted to the IEEE 488 specification. The specification says nothing about the function of the device itself, or about the form of the device's data. Instead, it defines a separate interface that can be added to the device. Only the signals passing into the interface from the IEEE 488 bus and from the device are defined in the standard.

There are three classes of devices that can be connected to the IEEE 488 bus: *Listeners, Talkers,* and *Controllers.* Some devices include more than one of these functions. The IEEE 488 standard allows a maximum of 15 devices to be connected on one bus. A minimum system consists of one *Controller* and one *Talker* or *Listener* device.

A *Controller* is the device that sends instructions. It's possible to have several *Controllers* on the bus at once but only one may be active at a time. The *Controller* that's in charge at the moment is called the *Active Controller*.

The *Controller* that's in charge of the entire bus is called the *System Controller*. It has several unique capabilities, including the ability to send Interface Clear (IFC) and Remote Enable (REN) commands. IFC clears all device interfaces and returns control to the *System Controller*. REN allows devices to respond to bus data once they are addressed to listen. The *System Controller* may optionally pass control to another *Controller*, which then becomes *Active Controller*.

A *Listener* is a device that can receive data from the bus when instructed by the *Controller*. A *Talker* transmits data on the bus when instructed. The *Controller* can set up a *Talker* and a group of *Listeners* in order to send data between groups of devices.

The IEEE 488 interface system consists of 16 signal lines and 8 ground lines. The 16 signal lines are divided into 3 groups (8 data lines, 3 handshake lines, and 5 interface-management lines).

The lines DIO1 through DIO8 are used to transfer addresses and control information and data. The formats for addresses and control bytes are defined by the IEEE 488 standard. Data formats are undefined and may be ASCII or binary. DIO1 is the Least Significant Bit.

The three handshake lines (NRFD, NDAC, DAV) control the transfer of message bytes among devices and form the method for acknowledging the transfer of data. This handshaking process guarantees that bytes on the data lines are sent and received without any transmission errors. It's one of the unique features of the IEEE 488 bus.

The NRFD (Not Ready for Data) handshake line is asserted by a *Listener* to indicate it is not yet ready for the next data or control byte. Note that the *Controller* will not see NRFD released (meaning the devices are ready for data) until all devices have released it.

The NDAC (Not Data Accepted) handshake line is asserted by a *Listener* to indicate it has not yet accepted the data or control byte on the data lines. Note that the *Controller* will not see NDAC released (i.e., data accepted) until all devices have released it.

The DAV (Data Valid) handshake line is asserted by the *Talker* to indicate that a data or control byte has been placed on the data lines and has had the minimum specified stabilizing time. The byte can now be safely accepted by the devices.

Five interface management lines (ATN, EOI, IFC, REN, SRQ) manage the flow of control.

The ATN (Attention) signal is asserted by the *Controller* to indicate that it is placing an address or control byte on the data bus.

The EOI (End or Identify) signal has two uses. A *Talker* may assert EOI simultaneously with the last byte of data to indicate end-of-data. Or the *Controller* may assert EOI along with ATN to initiate a parallel poll. Although many devices do not use parallel poll, all devices should use EOI to end transfers.

The IFC (Interface Clear) signal is used by the *System Controller* in order to initialize all device interfaces to a known state.

The REN (Remote Enable) signal is used by the *System Controller*. REN enables a device to go into remote mode when addressed to listen. When in remote mode, a device will ignore its local front-panel controls.

The SRQ (Service Request) line is like an interrupt: it may be asserted by any device to request the *Controller* to take some action. The *Controller* must determine which device is asserting SRQ by conducting a serial poll. The requesting device releases SRQ when it's polled.

Specifications

Baud Rate: Selectable 300, 600, 1200, 2400, 4800, 9600, 19,200, 115,200 bps

Cable Distance (Maximum): 3280 feet (1000 meters)

Character Set: Proprietary asynchronous bit serial

Controls: Power switch (external), serial parameter switches (internal)

Data Format: Selectable 7 or 8 data bits; 1 stop bit; odd parity

Connectors: (1) standard IEEE 488 connector with metric studs; (1) DB9 F (RS-422)

Indicators: LEDs for IEEE Talk, Listen, SRQ, Error, Power

Temperature Tolerance: 32 to 122°F (0 to 50°C)

Humidity Tolerance: Up to 70%, noncondensing

Power: 105–125 VAC or 210–250 VAC, 50–60 Hz, 10 VA max.

Size: 2.7"H x 5.5"W x 7.4"D (6.9 x 14 x 18.8 cm)

Weight: 2.1 lb. (1 kg)

Ordering Information

ITEM	CODE
IEEE 488 Bus Extender	IC095A
You may also need…	
IEEE 488 Cable (with Molded Connectors)	
6.6-ft. (2-m)	EXN02M
13.1-ft. (4-m)	EXN04M
Individually Shielded Low-Capacitance Cables, Extra Distance, PVC, 4-Conductor	ERN04A