Data Comm for Business, Inc.
2949 County Road 1000 E
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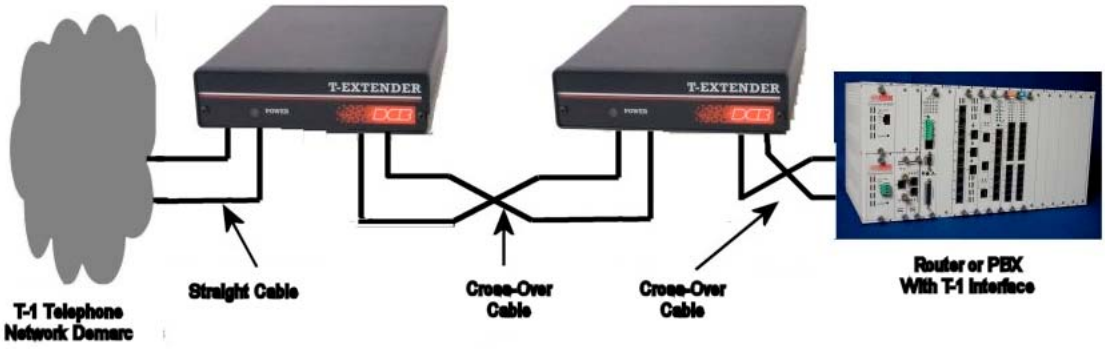
Solving T-1 Problems with the T-Extender

The DCB T-Extender is a small, no-configuration T-1 repeater used to extend T-1 lines from the standard length of 655 feet up to 4,000 to 5,000 feet or more. T-Extenders are often used in large shopping malls, high-rise buildings, military bases, and college campus environments. There are no configuration switches or settings because it is an electrical level amplifier which does not modify the T-1 clocking, framing, or management bits. The T-Extender has two identical ports. Either port may be used as the telco interface or the customer equipment interface. The two ports may be used with an RJ-45 cable connector or screw-down block. Unless otherwise specified, each T-Extender is shipped with two screw block connectors and one RJ-45 connector. Additional connectors of both types are available. T-Extenders do not use span-power. They are powered by 12 VDC, 24 VDC, -48 VDC, or 120 VAC. The power supply must be specified when ordering.

Since a T-1 line is bi-directional, T-extenders are most always used in pairs. When the length of line is greater than about 5,000 feet, additional T-extenders are inserted along the line each 4,000 to 5,000 feet.



Typical Application

Simple Application Example

The most common application is to simply extend the demarc from a telephone interface room to a remote location several thousand feet away. This is also the easiest application to install. Simply use a straight through cable between the T-Extender and the telco demarc (or smart-jack), a cross-over cable between two T-extenders, and a cross-over RJ-45 cable between the far-end
T-Extender and customer equipment.

Normally, customer equipment uses a straight-through cable to connect to the telephone company demarc. In the rare cases where the customer equipment uses a cross-over cable to connect to a close-by demarc (some customer equipment is wired with Tx and Rx reversed, ie. wired the same way as the telco interface), then a straight-through cable is used between the customer equipment and the T-Extender.

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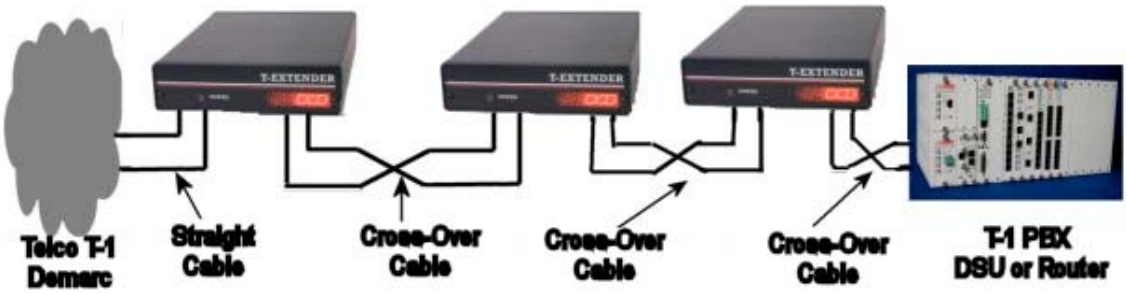
Longer Runs

For cable runs longer than about 5,000 feet, multiple T-Extenders are used, with an additional T-Extender inserted in the line every 5,000 feet. Remember to use a cross-over cable between each pair of T-Extenders.



Longer Run Using Three T-Extenders

Higher Density Installations

Many T-Extenders are mounted to phone room walls or simply placed on a shelf. If there are several T-1 lines extending from a single location, the T-Extenders at the main wiring closet may be installed in a 19" rack mount unit. Rack mounting units are available in sizes for one or three T-Extenders, and a 20 slot chasis unit is availabe. This chassis will power to up to 20 T-Extenders from a single power feed.

One and Three Unit Rack Mounting

20 Unit Rack Chassis

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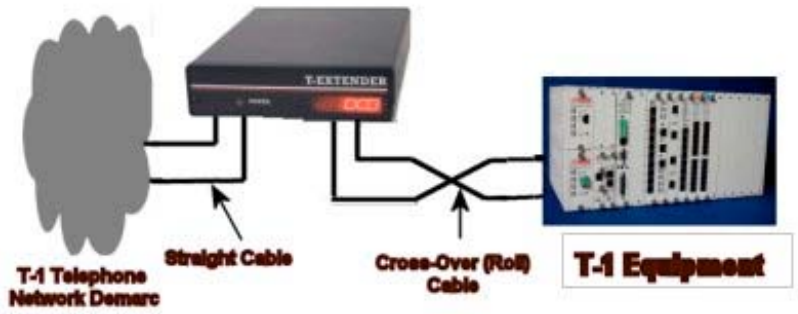
Innovative Installations, low line levels



Single T-Extender Application

Some cell phone base station units require a more stable T-1 signal at a higher signal level than is provided by the local telco provider. The T-Extender is sometimes used as a simple repeater to maintain a valid DSX-1 level T-1 signal. This is the only installation in which a single T-Extender is recommend to be installed; as all other applications require at least a pair of T-Extenders.

Powering a Remote T-Extender

The T-Extender does not use “span-power”, the dc voltage sometimes applied to T-1 lines. It is always powered from an external source. In installations where a T-Extender must be located away from a power source in a long cable run, a separate pair of telco wire may be dedicated to providing DC power to the T-extender. In these cases, the most commonly used power supply option is the 48VDC version. This unit works well with a wide range of input voltages (36-72 VDC), and an appropriate power supply may be selected which allows for voltage drop in the cable feeding power to the remote T-Extender.

Cable

The T-Extender works best using standard T-1 telephone cable such as 22 guage solid copper shielded twisted pair. Like most T-1 equipment, it does not always work well using Category 5 or 6 Unshielded Twisted Pair (common LAN “Cat 5 UTP” cable). We recommend the installation of only T-1 telephone cable such as Belden #7838A, Comm Scope # 21102D, General Cable # 7056880, or Madison Cable # 14035.

The T-Extender has a –36 dB dynamic range. That is, it will work well when the received signal level is between 0 dB and –36 dB. Since the transmit level is 0 dB, it will tolerate as much as 36 dB of loss between two units. Good engineering practice requires somewhat less than 36 dB of signal loss between two T-extenders to allow for degradation of the installed cable over time.

Cross-Over Cable or Straight-Through Cable

Most standard T-1 cabling uses a four pair cable terminated in an 8-position RJ connector or punch-down block. The telco interface wire pair that transmits is on pins 1 and 2, and is labeled

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Rx. The telco interface wire pair that receives is on pins 4 and 5,labeled Tx. Pairs should be wired according to spec EIA/TIA 568A, keeping the transmit pair twisted together and the receive pair twisted together.

A **straight-through** cable is one in which the pins correspond on both ends of the cable… pin 1 connects to pin 1 on the other end of the cable, pin 2 to pin 2, etc.

A **Cross-over** cable is one in which the transmit pair on one end of the cable connects to the receive pair on the other end of the cable. Pin 1 connects to pin 4 on the other end of the cable, pin 2 to pin 5, pin 4 connects to pin 1, pin 5 to opposite pin 2. See below…

Straight-through Cable

Connector A		Connector B
Pin 1	-----	Pin 1
Pin 2	-----	Pin 2
Pin 4	-----	Pin 4
Pin 5	-----	Pin 5

Cross-over Cable

Connector A		Connector B
Pin 1	-----	Pin 4
Pin 2	-----	Pin 5
Pin 4	-----	Pin 1
Pin 5	-----	Pin 2

Cable Length limits

T-1 lines are normally terminated using the DSX or DSX-1 interface standards. This standard requires the interface to operate correctly with cable lengths up to 655 ft. Since T-1 lines are bi-directional, the T-Extender must be located within 655 cable feet of both devices it's connect with (other than another T-Extender). The distance between two T-Extenders may be up to 5,000.

T-1 Line Framing and Coding

The T-Extender operates as an electrical repeater, raising signal levels to DS-1 or DSX-1 levels. As such, it has no bearing upon the framing or line coding. Because it is transparent to framing or coding, there is no setup or configuration required. B8ZS, ESF, SF, D4-AMI, and other framing or coding standards are all passed through the T-Extender unchanged.

ISDN and T-1 Lines

The T-Extender only works with T-1 lines. T-1 lines use a DSX or DSX-1 interface. ISDN PRI rate circuits MAY be delivered using T-1 or via a DSL line. If your ISDN PRI circuit uses a T-1 for delivery, then the T-Extender will work with it. If the ISDN PRI circuit is delivered using a DSL circuit, then the T-Extender will not work. If line distance is a problem, ask the ISDN provider which technology is used to deliver the ISDN PRI rate circuit to your premises.