

Cables necessary to interconnect the various components of a TDR system are described here. Cable model codes appearing in this text are those assigned by the author. These codes are in many ways similar to those used by Dynamax, Inc. However, there may be differences between the cables described here and those sold by Dynamax.

TR-1058

A 50-ohm coaxial cable (RG58) is used to connect the primary multiplexer to the BNC connector of the cable tester and the primary multiplexer to secondary multiplexers. These should have male BNC connectors on both ends. A 50-ohm RG8 cable may be used, and will slightly lessen signal attenuation.

Materials:

Coaxial cable, type RG58/U, tinned braided outer conductor with at least 95% coverage, tinned stranded inner conductor. Allied product no. 708-9855, Alpha 9058AC RG58A/U coaxial cable; or Belden #8219 RG58A/U.

Male, clamp type BNC connectors. Altex part no. 9021, BNC male solder & clamp connector.

Rosin core solder, small diameter.

Attaching BNC connectors (clamp/solder type) to RG58 cable:

Place the nut, metal washer and rubber washer on the cable (Fig. 3-1 and 3-2).

Strip the end of the cable using a coaxial cable stripper (Fig. 3-3) that has been set to cut through the outer insulation on one side and the inner insulation on the other (side closest to the end). The deep cut should be about 3 mm from the cable end, while the shallow cut should be about 9 mm from the end.

Place the metal cone over the outer braid and slide until it seats against the end of the outer insulation. Then fold the outer braid over the cone, holding it in place at the end of the outer insulation (Fig. 3-2).

Twist the center conductor strands together and tin them with solder (Fig. 3-4).

Place the center pin in a vise and tin it with solder (Fig. 3-5).

Solder the center conductor into the center pin (Fig. 3-6).

Release the vise and place the body of the connector over the pin (Fig. 3-7).

Screw the nut into the body of the connector using pliers to get a tight connection (Fig. 3-8).

Repeat until all connectors are on.

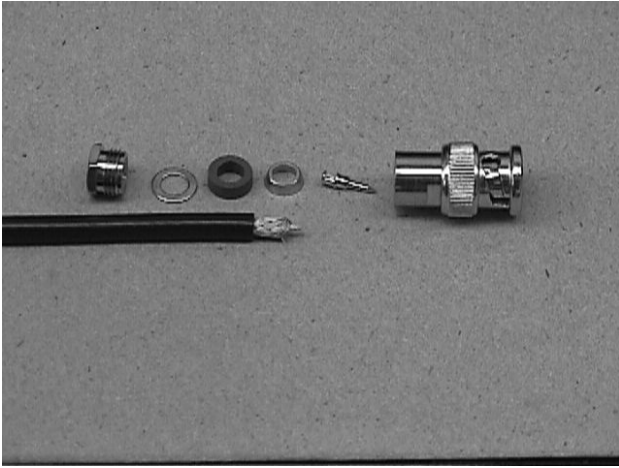


Fig. 3-1. A stripped cable end and components of the BNC connector, from left to right: nut, washer, rubber compression ring, cone, center pin, and connector body. A 3-mm long section of the cable is stripped to the inner conductor, and an additional 6-mm length has the outer insulation stripped from the outer braid.

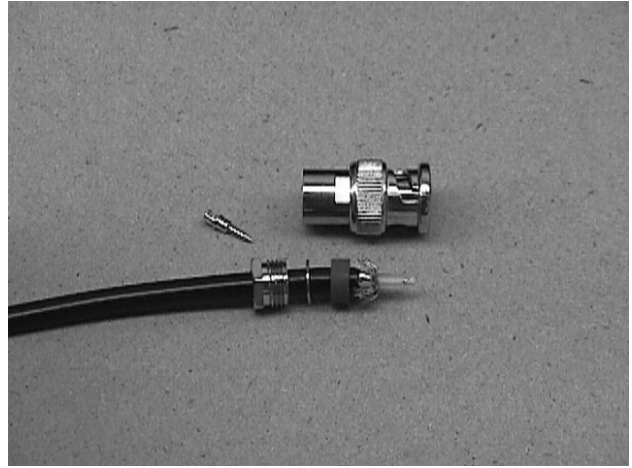


Fig. 3-2. The nut, washer, and red rubber ring have been placed on the cable. Then, the cone was placed over the braid until it seated against the cut edge of the outer (black) insulation, and the braid was folded back, covering the cone.



Fig. 3-3. A coaxial cable stripper sold by Radio Shack. The blade on the left side (visible on top of stripper in this view) is set to cut through only the outer cable insulation. The blade on the right side (not visible here) is set to cut through the outer insulation, cable braid, and inner insulation, but not through the center wire of the cable.

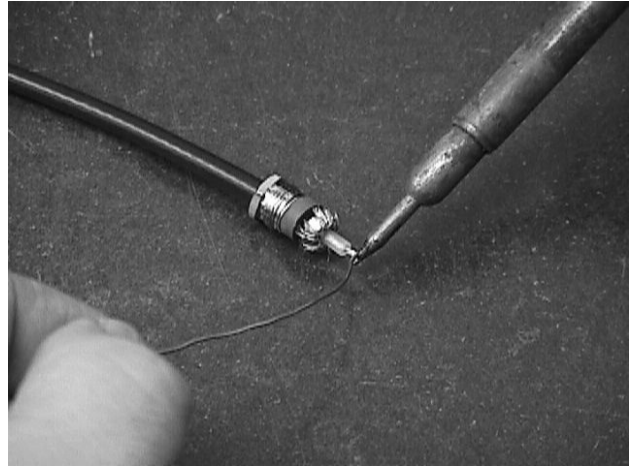


Fig. 3-4. Tinning the center conductor.

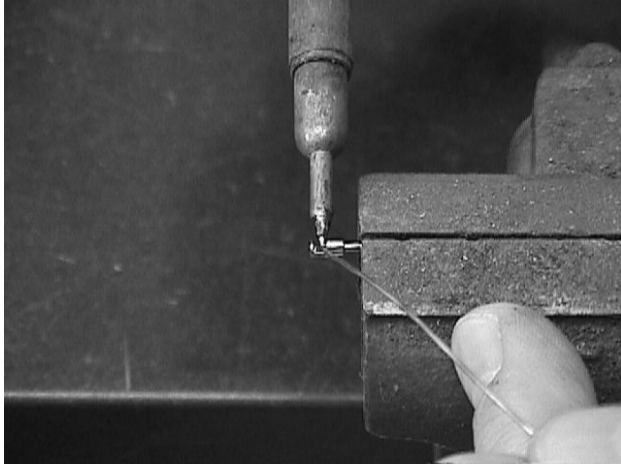


Fig. 3-5. The center pin has been secured in the vise and is being tinned.

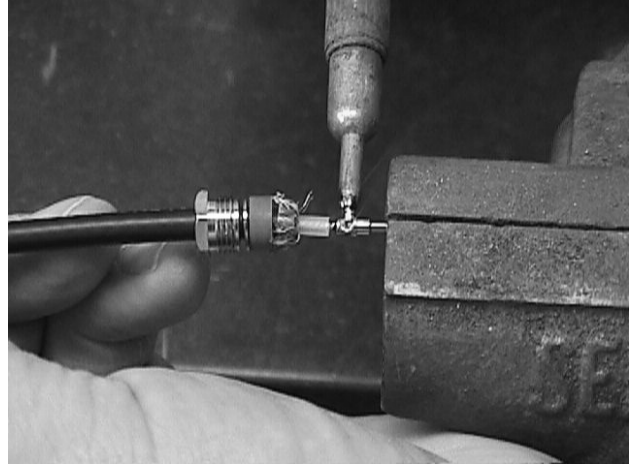


Fig. 3-6. Soldering the center conductor inside the center pin. The solder in the center pin is melted first, then the cable end is pushed into the hole in the end of the pin.



Fig. 3-7. The cable with components in place for final assembly during which the nut at left is screwed into the body at right.

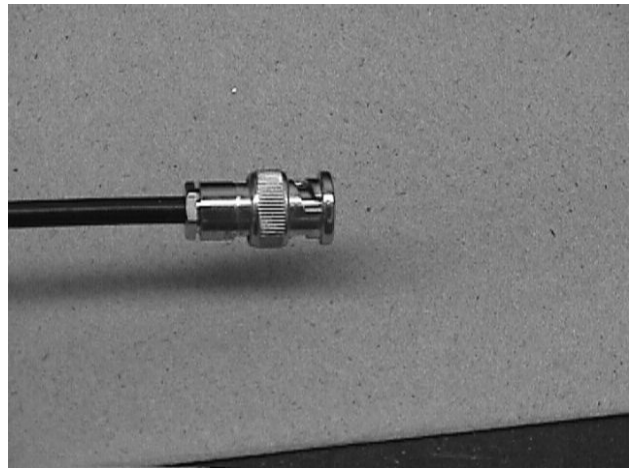


Fig. 3-8. The finished connector.

TR-2000

The most basic system requires a modem type serial cable to connect the computer and cable tester for computer control of the Tektronix 1502B/C series TDR cable tester. This shielded cable has a 9 pin female connector that plugs into the serial port of an IBM PC/AT compatible computer. The other cable end has a 25 pin male connector that plugs into the SP-232 module installed in the Tektronix 1502B cable tester. The standard 6 foot length is adequate for installations in which the cable tester and computer are housed together. A modem type serial cable may be purchased at most computer accessory outlets or can be built as indicated in the next section.

TR-2001

For computer control of the Tektronix 1502B/C series TDR cable tester in situations in which the cable tester is located a substantial distance from the computer. Like the TR-2000 this shielded cable has a 9 pin female connector that plugs into the serial port of an IBM PC/AT compatible computer. However, the conductors are 18 gage. We have tested this cable up to 150 m. At 50 m it works at all baud rates from 1200 to 19200. At 150 m it works at all baud rates up to 9600.

9 pin connector:

<u>Number</u>	<u>Color</u>	<u>Function/Connection</u>
2	white	RXD
3	black	TXD
5	green	signal ground
7	red	RTS
8	orange	CTS
6	blue	DSR (connected to V+ at 1502B/C)

25 pin connector:

<u>Number</u>	<u>Color</u>	<u>Function/Connection</u>
2	black	TXD
3	white	RXD
4	red	RTS
5	orange	CTS
6	blue	DSR (connected to V+ at 1502B/C)
7	green	signal ground

TR-2002

For connection between the computer's serial port and the Dynamax-modified Tektronix 1502 cable tester. This link runs at a fixed 9600 baud. A round DIN socket is mounted in the X-Y output module of the 1502 and connects internally to an analog to digital converter. A 9 pin female D-shell connector plugs into the computer's serial port.

9 pin Connector:

<u>Pin Number</u>	<u>Color</u>	<u>Function/Connection</u>
2	White	RXD
4	Black	DTR
5	Green	Ground
7	Red	RTS

Switchcraft DIN plug:

Pin numbers correspond to the positions shown for the DIN socket (Fig. 3-9).

<u>Pin Number</u>	<u>Color</u>	<u>Function/Connection</u>
1	White	RXD
3	Green	Ground
4	Red	RTS
5	Black	DTR

Switchcraft DIN straight cord plug type 05CL5M with 30° locking ring, 5 pins at 180°. Allied Electronics, Inc., Tel:800-433-5003, part no. 932-0154.

Switchcraft DIN socket (receptacle) type 57HA5F, for locking ring plug, 5 contacts at 180°. Allied, part no. 932-0185. See page 308 in Allied catalog no. 956.

Backside of DIN socket

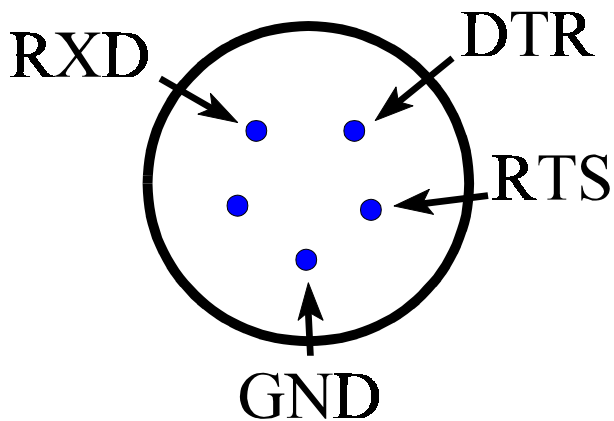


Fig. 3-9. Back side of DIN socket.

TR-2200

The TR-2200 cable set consists of a 25 pin parallel port connector from which issue three cables: TR-2200 A, TR-2200 B, and TR-2200 C. There are two situations that require the TR-2200 cable set. First, control of multiplexers requires this cable to carry both the control signals and the 12 VDC power to the multiplexer (TR-2200 B). Second, even if multiplexers are not used, the TR-2200 is required if it is desired to turn off power to the cable tester when measurements are not being made (usually desired for solar powered systems) (TR-2200 A). The power cable (TR-2200 C) connects to a 12 VDC power source. The connectors are numbered and the wires are color coded as follows:

25 pin parallel port connector:

<u>Number</u>	<u>Color</u>	<u>Function/Connection</u>
24	green	Ground side of 12 VDC power cable or negative pole of 12 VDC battery; and pin 24 of PC's parallel port. There are two green wires. One goes to the 5 pin connector at the multiplexer via cable TR-2200B, and the other to the stub connector, TR-2200A. Both are soldered to the smooth (ground) side of the power cable, TR-2200C. A third short, 24 gage green wire goes from this soldered connection to pin 24 of the parallel port to provide a reference ground for control signals.
none	red	12 VDC power. There are two of these. One goes to the 5 pin connector at the multiplexer and the other to the stub connector. Both are soldered to the ribbed (+12 VDC) side of the power cable and insulated with heat shrink tubing.
4	brown	SDE (serial device enable, pin 4 of PC's parallel port). This connects to pin 3 of the 5 pin connector at the multiplexer.
2	black	DATA (pin 2 of PC's parallel port). This connects to pin 4 of the 5 pin connector at the multiplexer.
3	white	CLK (clock, pin 3 of PC's parallel port). This connects to pin 5 of the 5 pin connector at the multiplexer.
9	purple	Control of DC power to TDR cable tester through the TR-302 power supply/control module (see Chapter 6). This wire goes to the stub cable, TR-2200A. Or Control AC power to cable tester through the TR-304 AC power supply/control module (see Chapter 6). When pin 9 is high then AC power is turned off; when pin 9 is low AC power is on. This allows elimination of noise that is sometimes introduced to the cable tester through the AC line. The TACQ program can turn off AC power during data acquisition (See parallel port settings in Software Setup). For this to work, the cable tester must have an internal or external battery to power it while the AC power is off. Since the noise, when present, is often on the ground line, all three AC power wires are disconnected: power, common and ground.
5	-----	Not connected, but may be connected to a three-wire cable similar to the TR-2200A for control of power using either the TR-302 or TR-304 (see Chapter 6).

TR-2200 A, Stub Cable Connector for cable tester DC or AC power supply/control:

This plugs into the TR-2201 cable which in turn plugs into the TR-302 or TR-304.

<u>Number</u>	<u>Color</u>	<u>Function/Connection</u>
1	purple	Power control signal , pin 9 of PC's parallel port.
2	green	Ground side of 12 VDC power supply or negative pole of 12 VDC battery; and pin 24 of PC's parallel port.
3	red	12 VDC power.

TR-2200 B, terminating in a 5 pin connector plug at the multiplexer:

<u>Number</u>	<u>Color</u>	<u>Function/Connection</u>
1	green	Ground side of 12 VDC power supply or negative pole of 12 VDC battery; and pin 24 of PC's parallel port.
2	red	12 VDC power.
3	brown	SDE (serial device enable, pin 4 of PC's parallel port).
4	black	DATA (pin 2 of PC's parallel port).
5	white	CLK (clock, pin 3 of PC's parallel port).

TR-2200 C, Power cable connector:

This is a standard plug for automobile cigarette lighter outlets. The inner pin is +12 VDC and is connected to the ribbed side of the duplex cable. The outer shell is ground and is connected to the smooth side of the duplex cable.

If you do not have a compatible 12 VDC socket, you may cut off the plug and connect the wires directly to your power supply or to another connector as may be necessary. The wire with the ribbed insulation is the +12 VDC side. This is connected to the two red wires inside the 25 pin connector. **It is not connected to the parallel port.** The wire in the power cable that has smooth insulation is the negative or ground side and is connected to the two green wires and to pin 24 of the parallel port. There is about a 0.3 VDC drop over 50 m in this cable when one multiplexer is connected and the multiplexer is switched to input 16 (highest power use). This should be a small enough voltage drop to power any multiplexing system.

TR-2201

This is a three conductor shielded cable that supplies power and a power control signal to the TR-302 power supply/control module that fits into the Tektronix 1502B cable tester; or, to the TR-304 AC power supply/control module. This cable has a three pin male plug that connects to cable TR-2200C. The other end has a three pin connector that plugs into the TR-302 or -304 module.

Connector to Stub Cable at TR-2200 end:

This plugs into the stub cable connector of the TR-2200.

<u>Number</u>	<u>Color</u>	<u>Function/Connection</u>
1	white	Power control signal , pin 9 of PC's parallel port.
2	green	Ground side of 12 VDC power supply or negative pole of 12 VDC battery; and pin 24 of PC's parallel port.
3	black	12 VDC power.

Connector at TR-302 or TR-304 end:

Pins numbered as seen when looking at face plate of TR-302 from left to right.

<u>Number</u>	<u>Color</u>	<u>Function/Connection</u>
1	white	Power control signal , pin 9 of PC's parallel port.
2	green	Ground side of 12 VDC power supply or negative pole of 12 VDC battery; and pin 24 of PC's parallel port.
3	black	12 VDC power.

TR-250

This is simply a 5 wire cable used to extend cable TR-2200B when more than one multiplexer is used. A separate length of TR-250 is used to connect each multiplexer to the end of TR-2200B. The power, ground and three control signal wires are present. Wires should be stripped 6 mm (1/4 inch) from the end and tinned. The tinned ends (distal ends) should be clamped into the five pole connectors at each multiplexer according to the table below. The proximal ends should be stripped about 20 mm from the ends and twisted together with the appropriate wire from cable TR-2200B (all wires of one color in one pigtail). Each pigtail should be soldered and insulated with PVC electrical tape or heat shrink tubing. For reliability this connection should be made inside a weather tight enclosure.

5 pin connector at multiplexer:

<u>Number</u>	<u>Color</u>	<u>Function/Connection</u>
1	green	Ground side of 12 VDC power supply or negative pole of 12 VDC battery; and pin 24 of PC's parallel port.
2	red	12 VDC power.
3	brown	SDE (serial device enable, pin 4 of PC's parallel port).
4	black	DATA (pin 2 of PC's parallel port).
5	white	CLK (clock, pin 3 of PC's parallel port).