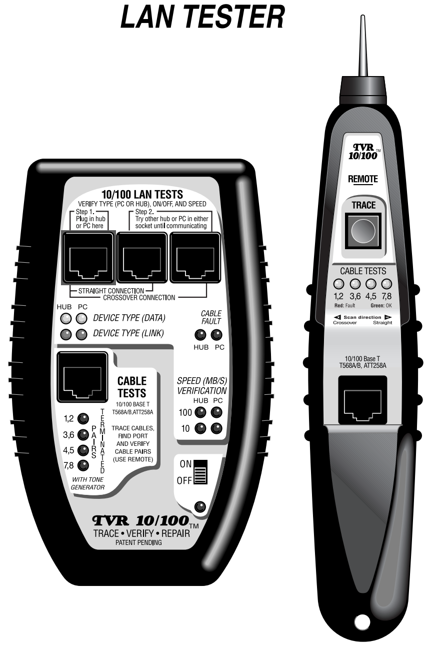
TVR10/100™

TRACE • VERIFY • REPAIR

LAN TESTER



Limited Warranty

The manufacturer warrants to the original consumer that this product is in good working order for a period of one year from the date of purchase. During this period the product will be repaired or replaced without charge for either parts or labor. Repair or replacement as provided under this warranty is the exclusive remedy of the purchaser.

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Section I. Introduction.

The 10 most common LAN install and repair questions answered. The TVR10/100 is a quick and straightforward LAN verification and troubleshooting tool developed by people with expertise in the installation and repair of 10 and 100 Base-T LANs. Although they owned TDRs and other high priced testers, they desired an easy-to-use, low-cost tester pair that would quickly handle everyday installation and repair tasks common with 10 and 100 Base-T LANs. The result is a tester that quickly answers the 10 most common questions that occur during LAN installation and repair.

LAN devices questions answered...

Are my hub or PC ON and transmitting? See example 1.
Do I require a straight thru or crossover patch cable? See example 2.
Is my LAN speed 10 or 100 MB/s? See example 1.
Is the hub or PC reducing my LAN speed to 10 MB/s, See example 1.
Do my hub or PC appear as a hub or PC? See example 1.

LAN cabling questions answered...

Is a hub or PC connected to my cable? See example 4.
Does my hub or PC require 2 or 4 pair cables See example 4.
What pairs are terminated in my cable? See example 6.
Where is my cable in the wiring closet? See example 5.
What hub port is my PC using? See example 5.
Is my cabling straight thru or crossover? See example 6.
Does my cable have inverted pair or other faults? See example 6.

The TVR10/100 is comprised of two units: The “Main unit” and the “Remote Probe.” The Main unit performs the bulk of the tests such as determining the LAN device type (is it a hub or PC?) and the LAN speed (10 or 100 MB/s) without the need of the Remote Probe. The Remote Probe adds the ability to trace cable locations (by audibly tracing tones placed on the cable by the Main Unit) and to test the wiring of the cable (by decoding and displaying wiring information placed on the cable by the Main Unit).

Broad capabilities: TVR10/100 helps you locate faulty hubs, PCs or cable connections that are stopping or limiting the performance of your 10Base-T or 100Base-T LAN. Designed for both the LAN installer and repair person, it is useful documenting legacy LANs, installing and repairing LANs or adding equipment to existing LANs.

Designed specifically for 10 and 100 Base-T LANs: The TVR10/100 has been designed to test LAN devices and cabling designed to the 10 and 100 Base-T standard. This includes wiring paired to EIA(TIA)568B (also called AT&T258A or simply "AT&T"); and EIA(TIA)568A. EIA(TIA)568B is the most popular scheme for 10 and 100 Base-T cabling. EIA(TIA)568A is the most popular scheme for ISDN cabling. USOC pairing (typically used for telephones) is not compatible with the 10 or 100 Base-T standard and is therefore not tested by the TVR10/100.

Multiple test sets in one tester: To accomplish its goals, the TVR10/100 performs tests that, prior to the TVR10/100, required 7 different test sets. Plus, the multi-functionality is integrated to provide a combination of quick results that are not available in any other tester. If the TVR10/100 is divided by function, it yields a:

- **Hub/PC verifier** that indicates the equipment Device Type (is it a hub or PC?).
- **LAN speedometer** that verifies the speed of the link (10 or 100MB/s).
- **Straight thru/crossover cable simulator** that indicates the type of patch cable required.
- **On-line network activity monitor** that indicates when data is

being transmitted (and at what speed, etc).

- **Tone probe and tone generator** for tracing cable locations (and the port used)
- **Cable pairs tester** that verifies what cable pairs are wired and identifies straight thru and crossover configurations.
- **Cable termination tester:** Tests for the existence of a LAN device connected at the end of the cable (determines number of cable pairs required by the device).

It is not only the individual functions of the TVR10/100 that makes it so useful... but the **creative combination of these features** that yield an efficient tester that saves time and gets the LAN working quickly.

About the manual: The manual presumes that you have a basic understanding of Base-T LAN terms such as “hub” and “PC” and are aware that every connection to a hub usually requires the use of a “straight thru” or “crossover" cable. It does not expect you to be a LAN expert. Users might find “The Three Phases of LAN installation”; Appendices A, B, C; and the extra information found in “Learning the Main Unit's Faceplate” helpful.

TVR10/100 List of Functions

The TVR10/100 performs the following functions:

10/100 BASE-T LAN Tests. The TVR10/100 plugs into active hubs and/or PCs to verify 10Base-T or 100Base-T operation. *Only the Main Unit is required for these tests.*

- Verifies if **PC** is ON, if it appears as a PC and maximum speed.
- Verifies if **hub** is ON, if it appears as a hub and maximum speed.
- Verifies **PC to hub** speed and data transmission.
- Verifies **hub to hub** data transmission.
- Checks if straight thru or crossover patch cable is required.
- Finds speed bottlenecks on 10 and 100 Base-T LANs.
- On-line monitors LAN link (between two devices)

Cable Testing. The following tests are performed by the TVR10/100 Main Unit and Remote Unit (except where indicated).

- Locates miswired cables.
- Locates missing cables.
- Locates cables that can not support 100Base-T operation (for LANs that require 4 pair wiring).*
- Tests connection to hub (pairs connected to hub).*
- Tests connection to PC (pairs connected to hub).*
- Tests installed cables (pairs wired and type).
- Tests patch cables (pairs wired and type).
- Remote Probe helps locate and trace inactive cables.
- Remote Probe traces active cables connected to hubs and PC without interfering with LAN performance.

* Test performed by the Main Unit only (does not require the use of the Remote Probe).

Section II. The Three Phases of LAN Installation

For LAN installers and repair personnel. The TVR10/100 is designed for both the LAN installer and the LAN repair person. The tests used during the three phases of LAN installation can just as well be used to repair LANs that are suffering operational problems.

The installation of a LAN is generally handled in phases. The cabling is installed; then the hub(s) and PCs are installed; and then all is connected together. The TVR10/100 plays a role during all three phases, saving countless hours of troubleshooting. Specific examples for using the TVR10/100 can be found in section VI.

Phase I. Using the TVR10/100 during cable installation (before the hub and PCs are installed). After the LAN cable has been pulled through the building and terminated, it is good practice to verify that the cabling is terminated properly. It is also a good time to document where each PC cable is located at the hub (before plugging cabling into a new hub or PC). To do this, use the TVR10/100 Main Unit's Cable Test jack and the Remote Probe to trace the location of each cable (using the Main Unit's tone generator and Remote Probe's trace capability). Once a cable end is located, label it. Now, without unplugging the cable from the Main Unit, plug the newly located cable end into the Remote Probe's RJ45 jack. The Remote Probe LEDs indicate the number of cable pairs (and whether they are straight thru or crossover**). Single Step operation:** The Remote Probe's combination of cable tracing and cable pairs testing makes cable locating and verification a single step operation. See section IV, V and VI (example 6) for additional information.

Phase II. Using the TVR10/100 after the hub and PCs are installed. Before connecting the cables to the hub and PC, verify that each hub port and PC are operational. To do this: Plug the TVR10/100 Main Unit's 10/100 LAN Test jack (green bordered jack) directly into the device (use the supplied straight thru patch cable) and verify the equipment's Device Type (i.e. is it a hub or PC?) and its maximum speed (10 or 100 MB/s). This provides a wealth of information: It verifies that the device is ON (i.e. it is transmitting); the speed of the device (10 or 100 MB/s); and the Device Type (i.e. does a PC port appear as a PC port?). Now, its a good idea to test the hub or PC thru its own connecting cable to determine how many pairs of the cable are terminated in the LAN device (some 100 Base-T devices require 4 pair cable). To do this, connect the Main Unit's Cable Test jack to the device using the cable that was pulled for the device. The number of pairs that are connected to the device will be displayed. The Remote Probe is not required to perform this cable test.

Phase III. Using the TVR10/100 when connecting the cabling to the hub and PCs. With the cabling verified (Phase I) and the hub and PCs checked out (Phase II), all that remains is 1) getting the equipment communicating and 2) verifying each LAN link is performing at the speed expected. To do this, use the Main Unit's Instant Link capability: The "Instant Link" feature (using the 10/100 LAN TESTS jacks) combines the Main Unit's Device Type capability with the simulated straight thru and crossover cables capability to get the two devices communicating quickly (see Section VI, example #2 for a discussion of Instant Link). After the devices start communicating, check the Speed Test LEDs to verify speed (see Section VI, example #1 for a discussion of the Speed Test).

Section III. Faceplate Description.

10/100 LAN TESTS
The following tests utilize these 3 sockets.

INSTANT LINK...Gets hub and PC (or 2 hubs) communicating by matching them with a simulated straight or crossover cable. ①

HUB/PC VERIFICATION...Verifies whether device appears as a HUB or PC (up to two devices simultaneously). ②

SPEED TEST... Indicates 10 or 100 MB/s communication. ③

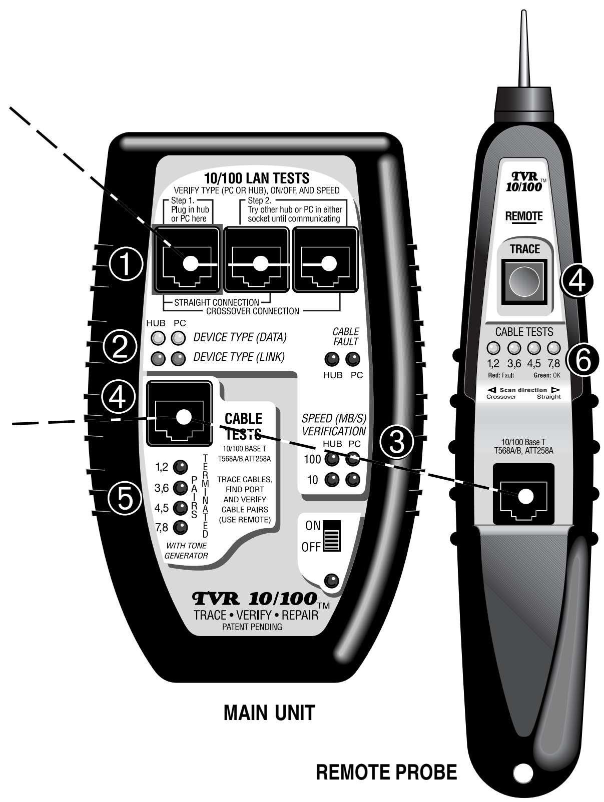
ON-LINE MONITORING... Displays data traffic and speed. ②③

CABLE TESTS
The following tests utilize this socket(s)

TONE GENERATOR/PROBE... Generates a locating tone for use by the Remote probe. The Remote probe finds cables (in crowded wiring closets, etc.) by detecting the tone generated by the main unit. Also useful for locating hub ports. ④

CABLE VERIFICATION (SINGLE SIDED)... (Performed without the need for the Remote probe). Verifies what pairs are connected to the hub or PC. Indicates whether hub or PC expects 2 or 4 pair cable. ⑤

CABLE VERIFICATION (TWO SIDED)...Displays what pairs are wired; whether cable is straight thru or crossover; and whether cable has pair reversals. ⑤⑥



MAIN UNIT

REMOTE PROBE

Section IV. Learning the Main Unit's Faceplate

The TVR10/100 Main Unit can be connected to any 10 or 100 Base-T device; or it can be inserted in a LAN segment without disrupting LAN communications between the two LAN devices; and perform a variety of tests needed for the installation and repair of LANs.

The Main Unit performs the bulk of the tests performed by the TVR10/100. The Remote Probe (detailed later in this manual) adds the ability to trace cable locations and determine the pairs configuration of a cable. It is used with the Main Unit to perform its operations.

Power "ON/OFF"

Turns all of the Main Unit power ON or OFF. This switch must be ON to perform any tests with the TVR10/100 Main Unit. The red power LED should turn ON brightly. If this LED is off or dim replace the Main Unit's 9 volt battery. The microprocessor performs a self-test each time it is powered ON (this is indicated by a series of flashing LEDs). If the TVR10/100 passes the test, all LEDs will be left OFF, except the power ON LED.

"10/100 LAN TESTS" Jacks

The 10/100 LAN TESTS section of the Main Unit performs the following tests (details of the tests follow later in this section):

1) Determines if a device (or devices) is a hub or a PC.
2) Facilitates communication by simulating a straight thru or crossover connection to get two LAN devices communicating quickly (this is known as the "INSTANT LINK" feature).
3) Determines if the speed of a LAN connection is 10 or 100 MB/s.
4) Senses if a cable has inverted pairs (e.g. 1,2 is 2,1) and if so lights the Cable Fault LED.

The TVR10/100 Main Unit performs these tests using the three RJ45 jacks and the LEDs located in the 10/100 LAN TESTS section of the Main Unit. If inserted between two active LAN devices it will perform these tests without disrupting LAN communications between the devices.

Understanding the use of the 10/100 LAN Test's three RJ45 jacks. These three jacks and associated LEDs are the heart of the Main Unit's ability to save you time when installing or repairing a LAN. **GREEN JACK:** The most important jack of the three is the "Green jack" (highlighted by its green border). Although any of the three jacks will verify the Device Type and Speed of the equipment connected to them (a maximum of two devices can be connected at a time), the Green jack is highlighted because it is a "straight thru" connection to the tester's circuitry. In other words, if a device is connected to the Green jack using a straight thru cable and the TVR10/100 indicates that its Device Type is a "hub", you know it is a hub (the Green jack has not inserted any crossover connection, etc). **The two jacks to the right of the green jack:** The first jack to its right (the middle jack) is connected to the green jack with a **straight thru** connection (indicated in this manual by the "=" symbol). The labeling below the 2 leftmost jacks denotes the straight thru wiring ("STRAIGHT CONNECTION"). The jack to the far right is connected to the Green jack by a crossover connection (indicated in this manual by the "X" symbol). Notice the labeling below the jack on the far left and far right ("CROSSOVER CONNECTION") denotes their wiring. These three jacks not only provide input to the LEDs in this section of the tester, but they also enable you to quickly simulate both straight thru (=) and crossover (X) connections (allowing you to determine which style patch cable is required to make a connection between the two LAN devices). Examples of the use of the 3 jacks is found section VI.

Using the Green jack to verify whether the device(s) is a hub or a PC. The first step in determining whether the LAN device is a hub or a PC is to plug the PC or hub into the Green jack. Make the connection using one of the RJ45 straight thru patch cables provided with the TVR10/100. Be sure power is ON for all equipment. Notice the “10/100 LAN TESTS” section of the faceplate has two columns of LEDs labeled “DEVICE TYPE.” These LEDs display whether a pulse received from the device under test is from a hub or PC (the signal can be Data or a Link Pulse). If a "PC" is indicated, it means the Main Unit is receiving signals on pins 1 and 2 (a “PC” is a device that transmits on a pair of wires that use pins 1 and 2 (“1,2”). A “hub” is a device that transmits on pins 3 and 6 (“3,6”). The TVR10/100 bases it’s testing on this standard. Consequently, the configuration of the connecting cables can affect the results of this test. For instance, if a hub is connected to the tester using a crossover cable, the hub will appear as a PC. One of the many features of the TVR10/100 is that it can perform the hub or PC diagnosis of two devices at the same time. This is useful when using the tester’s INSTANT LINK capability to connect two LAN devices together. Note: The TVR10/100 uses the transmission of link pulses or data packets to determine Device Type(s). If there is no such activity, no Device Type LEDs will light. Most LAN devices are configured to constantly be providing this information. If you are not seeing any link pulses or data packets, use the Cable Tests jack to verify that a LAN device is connected to the cable (see section IV "Cable Tests Jack").

A good discussion on the operation of the Data and Link Pulse LEDs can be found in Appendix B ("Link Pulses and Data Packets").

Using the three jacks to get two LAN devices to communicate (“INSTANT LINK”). The TVR10/100 Main Unit facilitates communication of two LAN devices by simulating a straight thru or crossover connection between the devices and displaying the Device Types and Speeds. This is called the "INSTANT LINK" feature because these capabilities normally enable communication immediately. The three RJ45 jacks also determine whether a straight thru (=) or crossover (X) cable is required to get the two LAN devices communicating. Using the two external RJ45 straight thru patch cables provided with the TVR10/100, plug in two LAN devices into the two leftmost jacks (making a straight thru connection between the two devices). Be sure power is ON for all equipment. The left-hand side of the "10/100 LAN TESTS" section has two columns of LEDs that display whether a received DATA Pulse or LINK Pulse is from a hub or PC. Each column indicates the DEVICE TYPE of one LAN device (by lighting either a Data or Link LED. The object is to select jacks such that both columns of DEVICE TYPE LEDs have a LED ON. If both columns do not have a LED ON, move the connector plugged into the center jack to the jack on the far right (making a crossover connection between the two devices). Once both columns have a LED lit, the devices are communicating and the required patch cable has been determined (i.e. if the two leftmost jacks are being used, a straight thru patch cable is required to make the connection).

If only one column of LEDs comes ON in either jack configuration a problem exists. Isolate the problem by plugging one device at a time into the TVR10/100's GREEN Jack (the left jack). The device that does not show any activity on the LEDs is causing the problem. If it is the remote device that is showing no activity, there may be nothing connected at the other end of the cable. See "Cable Tests Jack" later in this section to test for a device on the other cable end.

Using the three jacks for Speed verification. The TVR10/100

Main Unit also tests the data rate of the devices connected to the "10/100 LAN TEST" jacks. Speed is an important consideration because two LAN devices will not to communicate unless they both are operating at the same data rate. The Main Unit displays the speed of both hubs and PCs whether it is connected to only one 10 or 100 Base-T device or in between two 10 or 100 Base-T devices. If two devices are connected, both Speed LEDs will be ON (if two devices are connected, one must be cabled like a hub and the other a PC). Note: The TVR10/100 uses the transmission of link pulses or data packets to determine the speed of the device(s). If there is no such activity, no speed will be displayed. Most LAN devices are configured to constantly be providing this information. If you are not seeing any activity, use the Cable Tests jack to verify that a LAN device is connected to the cable (see section IV "Cable Tests Jack").

Negotiating the speed between two LAN devices. When all devices were 10 Base-T, two LAN devices linked together operated at 10 MB/s. Now there is a mixture of 100 MB/s only devices and devices that can operate at both 10 MB/s and 100 MB/s. To determine the speed of a link, a negotiation may take place between the two LAN devices. The negotiation normally consists of a mixture of link pulses and data packets sent between the two devices. As an example, presume unit A (a 100 MB/s device) is connected to a unit B capable of either a 10 MB/s or 100 MB/s connection. Further presume that when unit B is first turned ON its speed is 10 MB/s (its "default" speed). If typical, unit A will negotiate with unit B and if all is well, unit B will reconfigure itself for 100 MB/s communication. The TVR10/100 displays the link pulses and data packet activity as well as the speed of the link. See Appendix B for further discussion of link pulses and data packets.

Keeping in mind the above, the following applies:

- If the TVR10/100 is connected to only one LAN device, it will display the devices default speed.
- If the TVR10/100 is connected to two devices (placed in between two LAN devices), it will let the two devices determine their own data rate.

If you have 100 MB/s equipment that is communicating at 10 MB/s, the causes could be:

- One or both LAN ports is a 10Base-T port only.
- There is a “Cable Fault.” A cable fault is when a wiring pair is inverted (e.g. pair 1,2 is wired 2,1).
- One or both LAN ports is capable off 100 MB/s but has been initialized to 10 MB/s (slowing down the link).

Important: If testing a PC, be sure to reboot the computer after a 100 Base-T device is connected. Many PCs will only boot up to 100 MB/s if they detect a 100 MB/s connection. If an installed cable is in series with a hub or PC, the cable or the hub and/or PC may be at fault. Determine which by the process of elimination.

Cable Fault LEDs. The Cable Fault LED(s) will light if the Main Unit detects an inverted pair (e.g. pair 1,2 is wired 2,1). Wiring mistakes like inverted pairs can slow and even stop communication. Section V covers how the Main Unit with the Remote Probe can verify the existence of an inverted pair. For an example of testing for inverted pairs see section VI, example 6.

“CABLE TESTS” Jack

The Cable Test section of the Main Unit is an easy-to-use and very powerful part of the TVR10/100. It performs three tasks:

- Tests for the existence of a hub or PC connection on the cable that is plugged into the jack. If a hub or PC exists, the wiring pairs involved are displayed on the adjacent LEDs. See “Cable Tests without the use of the Remote Probe” below.
- Places a tone and a wiring pattern signal on the cable connected to the jack. The Remote Probe uses the tone generated by the Cable Test jack to trace the location of the cable (e.g. in the wiring closet). The Remote Probe uses the wiring pattern placed on the cable by the Cable Test jack to display the pair configuration and other characteristics of the cable on its LED display. Further explanation of the use of the Remote Probe can be found in section V "Learning the Remote Probe's faceplate.”

Cable Tests without the use of the Remote Probe.

The TVR10/100 Main Unit’s Cable Test jack has the capability of sensing whether any 10 or 100 Base-T devices are connected to it (without the use of the Remote Probe). If there is a connection, it is displayed on the LED panel below the jack (e.g. if LEDs “1,2” and “3,6” are lit, it means they are wired). This test is useful as a quick verification of the presence of a device at the end of a cable or to locate cables that cannot support 100Base-T operation (if the LAN device requires 4 pair wiring for 100 Base-T and only 2 connections are displayed… indicating that possibly the cable only has 2 pairs).
In summary, the tests performed by the Cable Test jack (without the use of the Remote Probe) are:

- Tests connection to hub (what cable pairs connected to hub).
- Tests connection to PC (what cable pairs connected to PC).
- Tests number of pairs required by a PC or hub (plug directly into PC or hub).

Section V. Learning the Remote Probe's Faceplate

The TVR10/100's Remote Probe adds cable tracing and pairs testing capability to the TVR10/100. It must be used with the TVR10/100 Main Unit's Cable Tests jack. The Remote Probe traces cables and tests the pairs configuration of the cable by tracing signals placed on the cable by the Cable Tests jack on the TVR10/100 Main Unit. By combining cable tracing and pairs testing in one unit, the TVR10/100 Remote Probe has uniquely turned a two step procedure into a one-step process.

Tests performed by the Remote Probe (using the Main Unit's Cable Tests jack)

- Locates miss-wired cables.*
- Locates missing cables.*
- Tests installed cables (pairs wired and type).
- Tests patch cables (pairs wired and type).
- Locates and traces inactive cables.
- Locates active cables connected to hubs and PCs without interfering with LAN performance.

* Main unit only. Does not require the use of the Remote Probe

Tracing tones. The Remote Probe's pointed tip traces tones transmitted from the TVR10/100 Main Unit's Cable Test jack (over the cable under test). Any tone detected by the Remote Probe is amplified and emitted from the Remote Probe's built-in speaker.

Use this capability to trace the location of wires inside a wiring closet or wherever cables are bundled. For instance, it is very common for hub ports to be mislabeled or not labeled at all. These problems can be solved by placing a tone on the wire of interest (using the Main Unit's Cable Test jack) and tracing it using The Remote Probe. The remote Probe will emit a tone when it is close to (or touching) the cable under test.

Note: The tone generator places a tone on a pair of wires at a time (first 1,2 then 3,6 then 4,5 them 7,8). This is the AT&T 258A wiring scheme. If all 4 pairs are wired, the tone will sound rather steady. If only 1 pair is wired, the tone will only be on for 1/4 of the cycle.

Tips for tracing tones:

- Tracing tones is usually best on wires that are disconnected from any power source. Existing signals on lines can sometimes interfere with the tone signal.
- You will notice that the Main Unit's tone generator circuitry steps the tone from one pair to the next (i.e. "1,2" then "3,6" then "4,5" then "7,8'). Listening to the missing gaps in the tone signal can sometimes be helpful in understanding a problem.
- Maximum sensitivity occurs when the Remote Probe's tip is held parallel to the conductors carrying the tone.

Caution: electrical cables carry a wide variety of signals. They are dangerous. Telephone circuits employ a –48V battery voltage. When ringing, voltages are much higher (90 V RMS on top of the –48V). Telephone signals should not be on the same cables as LAN signals but exercise caution. If you are unsure of safe procedures, do not continue.

Determining the pairs that are wired. Once the cable has been located by tracing the tone, the Remote Probe's RJ45 jack is used to test the wiring of the cable. The Remote Probe decodes the wiring data sent by the TVR10/100 Main Unit's Cable Test jack (the same jack that transmits the tone) and displays the results of the decoding on the Remote Probe's four LEDs. The LEDs meaning is defined by it labeling ("1,2", "3,6", etc); color (Off, Green or Red) and direction of scanning (top-to-bottom or bottom-to-top).

- **Labeling:** If the LED labeled "1,2" is ON, it mean wire pair 1 and 2 are wired. The other LED labeling is the same in function.
- **Color:** If the LED lights green, the pair is OK. If the LED lights red it means there is a wire fault in that pair (most likely that the wires are inverted i.e. pair 1,2 is wired 2,1). This is indicated on the faceplate as "Green OK and "Red Fault."
- **Direction of scan:** If the LEDs are lighting in a top-to-bottom direction (from the tip of the probe toward the base of the probe), the cable pairs are wired in a straight thru pattern. If they are light-ing in the opposite direction, the pairs are wired in a crossover configuration. This is denoted on the faceplate by the "=" symbol for "Straight" and "X" for "Crossover."
- **Shorted pairs:** If a pair is shorted across itself, it will show up as non existent pair (LED will be OFF). If the short is across pairs it will either light one pair red and the other green (simultaneously) or an individual LED will alternate red and green. Summary: Any red color indicates a wiring problem.

See the Appendix A for more information about the subject of wiring.

The Remote Probe's "One-step process." In a ONE-STEP PROCESS, this unique device traces a tone, then displays the pairs configuration of the cable without requiring the substitution of another tester or an additional walking trip to the tone generator location.

Section VI. Performing LAN Tests

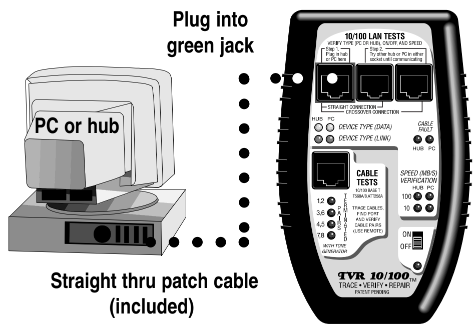
What follows are a few examples of using the TVR10/100 to perform typical network troubleshooting. With a little experience, you will be adding your own new tests. If you are new to LAN testing, please read the “Introduction”, “The TVR10/100 and the Three Phases of LAN installation”, Appendix A, Appendix B and Appendix C of this manual. They will provide you with some basic understanding of LAN networks before you begin testing.

Two methods of connection

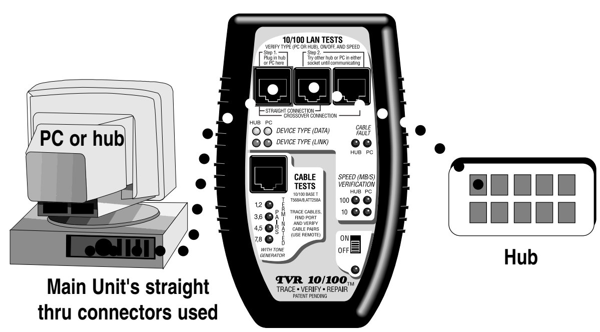
There are two ways to connect the TVR10/100 Main Unit to LAN devices. You choose the method of connection based on what test it is you wish to perform. For instance, if you wish to test the speed and determine the device type of a new unit, the direct connect is the quickest way. If however, you are trying to get two devices to communicate, the "insert between" method is used.

I. **Direct connect to a single device:** the TVR10/100 can be connected directly to any 10 or 100 Base-T device. When the TVR10/100 Main Unit is connected to only one LAN device, it will display the devices Device Type default speed.

II. **Inserted between two LAN devices:** The TVR10/100 can be inserted in a LAN segment without disrupting LAN communications between the two LAN devices. Because TVR10/100 can display the Device Type and speed of both devices plus simulate a straight thru or crossover cable connection, it helps you to quickly sort out problems. It also can be used as an activity monitor of data activity and speed on a LAN link without affecting the link. When the TVR10/100 is connected to two active devices (placed between two LAN devices), it will let the two devices stimulate each other so that they may determine their own common data rate.



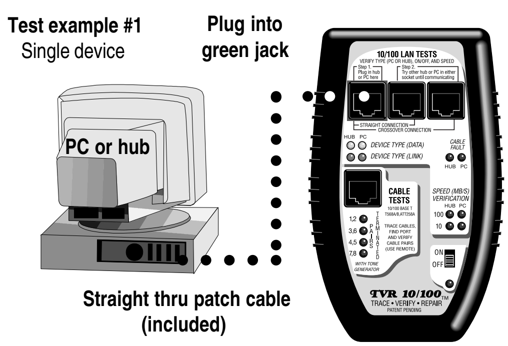
"DIRECT" CONNECTION METHOD



"BETWEEN" CONNECTION METHOD

***Test example #1.* Testing a PC or Hub to verify its DEVICE TYPE (hub or PC) and SPEED (10 or 100 MB/s).** This is a useful first test to see if a LAN device is ON and transmitting; verify its Device Type; and default Speed (see Appendix A for what device type combinations connect together).

Equipment required: TVR10/100 Main Unit and two straight thru RJ45 patch cables (included).
Step 1: Connect the PC or hub port directly to the TVR10/100's GREEN JACK using a straight thru RJ45 patch cable (included).
Step 2: DEVICE TYPE TEST. The DEVICE TYPE is displayed on the "DEVICE TYPE" LEDs to indicate a "HUB" or a "PC". If it indicates what you expect, all is well. If it indicates the opposite, it indicates there is a crossover cable somewhere between the LAN device and the tester. This is not necessarily bad, but it is something to take into consideration when diagnosing problems that might occur. Any activity on these LEDs indicate that the LAN device is ON and transmitting.



Step 3: SPEED TEST: The data rate of 10 MB/s or 100 MB/s is displayed on the Main Unit's "SPEED VERIFICATION" LEDs. This is the speed of the connection. If you are testing a device that is capable of both 10 MB/s and 100 MB/s operation, the speed displayed will be the default speed of the device. Note: The TVR10/100 uses the transmission of link pulses or data packets to determine the speed of the device. If there is no such activity, no speed will be displayed. Most LAN devices are configured to constantly be providing this information. If you are not seeing any activity, use the Cable Tests jack to verify that a LAN device is connected to the cable (see section IV "Cable Tests Jack").

Analysis of test example #1: **Using the Green jack to verify whether the device(s) is a hub or a PC (DEVICE TYPE)**. The first step in determining whether the LAN device is a hub or a PC is to plug the PC or hub into the GREEN JACK. If required, make the connection using one of the RJ45 straight thru patch cables provided with the TVR10/100. Be sure power is ON for all equipment. Notice the "10/100 LAN TESTS" section of the faceplate has two columns of LEDs on the left side labeled "DEVICE TYPE." These LEDs display whether a pulse received from the device under test is from a hub or PC (the pulse can be a Data packet or Link Pulses). A "PC" is a device that transmits on a pair of wires that use pins 1 and 2 ("1,2"). A "hub" is a device that transmits on pins 3 and 6 ("3,6"). The TVR10/100 bases it's testing on this standard. Consequently, the configuration of a cable can affect the results of this test. For instance, if a hub is connected to the tester using a crossover cable, the hub will appear as a PC (useful when diagnosing problems).

Analysis: Using the three jacks for SPEED VERIFICATION. For two LAN devices to operate, they both must be operating at the same data rate. Thus, understanding the speed of LAN devices is very important. The first step in verifying the speed of a LAN device is to plug it into the GREEN JACK of the Main Unit. Because the TVR10/100 does not attempt to influence the speed of the device, the speed displayed is the default speed of the device.

If the data rate is less than you expect (e.g. a 100 MB/s communicating at 10 MB/s), look for one of these problems:

- The LAN device is a 10Base-T port only.
- There is a “Cable Fault.” A cable fault is when a wiring pair is inverted.
- The LAN ports is initialized to 10 MB/s (e.g. the PC was booted while not connected to the 100 MB/s LAN). Many PCs will only boot up to 100 MB/s if they detect a 100 MB/s connection. Test the device while connected to 100 MB/s device. See example #2 for a two unit test.

Test example #2. **Connecting a PC to a Hub (using the INSTANT LINK feature).** The TVR10/100 can be inserted in a LAN segment without disrupting LAN communications between the two LAN devices. Because TVR10/100 can display the Device Type and speed of both devices plus simulate a straight thru or crossover cable connection, it helps you to quickly sort out problems. In this example, the Main Unit will test to determine if both LAN devices are operational and determine what patch cable (straight thru or crossover) is required to make the correct cabling connection. This is called the “Instant Link” feature because these two capabilities normally enable communication immediately. Because the TVR10/100 is connected to two devices, it will let the two devices stimulate each other and determine their own data rate.

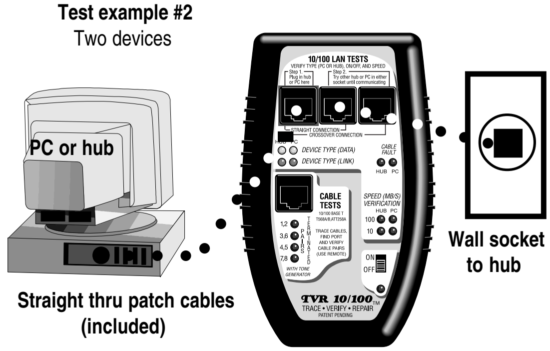
Equipment required: TVR10/100 Main Unit and two straight thru RJ45 patch cables (included).
Step 1: Turn ON all equipment.

Step 2: Plug a straight thru patch cable (provided) between the GREEN JACK and the wall plug that connects to the hub.

Step 3: Plug the other straight thru patch cable (provided) into the middle jack of the TVR10/100 (the middle jack is a straight thru connection to the GREEN JACK) and the LAN port of PC. You now have a straight thru connection created between the PC and the hub (presuming there are no crossover cables in between).

Step 4: Study the "DEVICE TYPE" LEDs on the 10/100 LAN TESTS section of the faceplate. If a LED is not ON in both columns ("HUB" and "PC"), the LAN devices are not communicating. To communicate, one Device Type must look like a hub and the other a PC (a Link or Data LED should be lighted in each Device Type column). If each column does not have a LED lighted, switch the cable in the middle jack to the rightmost jack (the rightmost jack is a crossover connection to the GREEN JACK). You now have a

Test example #2
Two devices



Using 2 leftmost sockets simulates a straight thru connection

crossover connection created between the PC and the hub (presuming there are no other crossover cables in between). Both columns should now have a LED ON. If they do, the devices are communicating.

Step 5: Reboot the PC to make sure it has been initialized with the current cable configuration (some PCs set their data rate based on what is connected to them).

Step 6: SPEED VERIFICATION test: If all is well, a speed LED should be ON for each device (one for the hub and one for the PC). Note: The TVR10/100 uses the transmission of link pulses or data packets to determine the speed of the device(s). If there is no such activity, no speed will be displayed. Most LAN devices are configured to constantly be providing this information. If you are not seeing any activity, use the Cable Tests jack to verify that a LAN device is connected to the cable (see section IV "Cable Tests Jack").

Step 7: If a Cable Fault LED is ON, one of your cable pairs is inverted (e.g. pair 1,2 is 2,1). Section V covers how the Main Unit and Remote Probe can verify the existence of an inverted pair. For an example of testing for inverted pairs see section VI, example 6.

Note: After the testing is complete and you remove the TVR10/100 from the circuit, remember to cable it correctly. For instance, if the two devices are communicating using the GREEN JACK and the rightmost jack, a crossover patch cable is required.

Analysis of test example #2: When you plug the two LAN devices into the TVR10/100, you are allowing each LAN device to stimulate communication between them and you are simulating a straight thru or crossover connection (depending on the jacks you chose). The three RJ45 jacks determine whether a straight thru (=) or crossover (X) patch cable is required to get the two LAN devices communicating. It is best to start using the two external RJ45 straight thru patch cables (provided) to plug the two LAN devices into the two leftmost jacks (making a straight thru connection). Be sure power is ON for all equipment. The left-hand side of the “10/100 LAN TESTS” section has two columns of LEDs that display whether a received DATA or LINK Pulse is from a hub or PC. Each column indicates the DEVICE TYPE of one LAN device. The object is to select jacks such that both columns of LEDs have a LED ON (both hub and PC). If both columns do not have LEDs on, move the connector plugged into the center jack to the jack on the far right (making a crossover connection between the two devices). Once both columns have a LED lit, the devices are communicating and the required patch cable has been determined (i.e. if the two leftmost jacks are being used, a straight thru patch cable is required to make the connection).

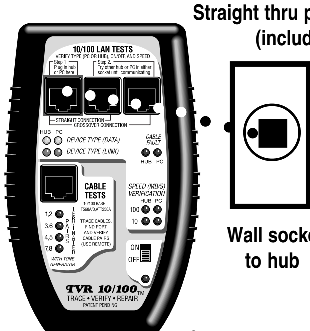
If only one column of LEDs comes on in either jack configuration you are not communicating. If this is the case, plug one device at a time into the TVR10/100’s GREEN JACK (the left jack). The device that does not show any activity on the LEDs is causing the problem. If the remote device is showing no activity, there may be nothing connected at the other end of the cable. See Test Example #4 for a quick test for a device connection on the other end of the cable.

Note: When all devices were 10 Base-T, two LAN devices linked together operated at 10 MB/s. Now there is a mixture of 100 MB/s only devices and devices that can operate at both 10 MB/s and 100 MB/s. To determine the speed of a link, a negotiation may take place between the two LAN devices. The negotiation normally consists of a mixture of link pulses and data packets sent between the two devices. As an example, presume unit A (a 100 MB/s device) is connected to a unit B capable of either a 10 MB/s or 100

MB/s connection. Further presume that when unit B is first turned ON its speed is 10 MB/s (its "default" speed). If typical, unit A will negotiate with unit B and if all is well, unit B will reconfigure itself for 100 MB/s communication. When the Main Unit is inserted in the circuit, it will display the link pulses and data packet activity as well as the speed of the link. See Appendix B for further discussion of link pulses and data packets.

Test example #3. Testing a 100 MB/s hub port for an unknown problem at far end of the cable (not at the hub port). Note: This test uses the 10/100 LAN TESTS section of the Main Unit to test the speed and wiring of the connection.

Test example #3
Testing a remote hub
for activity

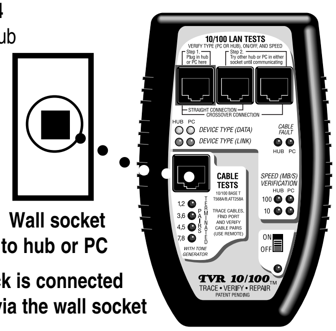


Step 1: Connect the hub outlet (at the remote site) to the TVR10/100's Main Unit GREEN JACK (use the straight thru RJ45 patch cable that is provided).
Step 2: If a Device Type LED a Speed Led lights, presume the hub and the cabling are good. The test is complete. Otherwise, go to step 3.
Step 3: If no Device Type and Speed LEDs light: Plug the Main Unit directly into the hub (without any wall cablingin between) and test. You should see activity (a Device Type LED) and a Speed LED. If you don't, the LAN device is faulty. If you do, the cable is faulty.

Test example #4. TEST for Hub or PC at the far end of a cable using the TVR10/100's Cable Test Jack (continuity test). Note: This test uses the CABLE TESTS section of the Main Unit to perform its tests. It is a quick way to determine the number of cable pairs are connected to the hub or PC (e.g. if you hub requires four pairs and only two are connected). Use this test if no activity has

Test example #4
Testing a remote hub for continuity

Straight thru patch cable (included)



Wall socket to hub or PC

Cable Tests jack is connected to the hub or PC via the wall socket

been detected by the Device Type and Speed Tests from the hub or PC at the far end may not be connected. This lack of activity may be caused by a misplaced or disconnected patch cable or the installed cable may be faulty. The power may be turned OFF as well. This connection test is so quick, it should be used whenever there is a lack of activity. The connection test senses if the far device is connected to the cable by searching for continuity through the device. It does not matter if the far device is powered-up or not.
Step 1: Connect the jack that connects to the hub or PC to the TVR10/100's Cable Tests jack as shown.
Step 2: LEDs "1,2" and "3,6" as a minimum should be blinking, if a PC of hub is connected to the far end of the cable. If all four LEDs "1,2", "3,6", "4,5" and "7,8" are blinking, that is a good indication that a hub or PC is connected to the other end of the cable and that the installed cable is good.

Test example #5. Tracing where a cable is located in the wiring closet (or to which LAN port it is connected). Note: This is a general explanation of using the Remote Probe to trace a tone generated by the Main Unit to locate cables. It is an easy way to determine what hub port your PC's cable is using or to locate a cable in a crowded wiring closet.
Step 1: Insert one end of the cable you wish to trace (and/or test) into the TVR10/100 Main Unit's Cable Test jack (the jack places a tone and a wiring signal code on the wire).
Step 2: Take the Remote Probe to the location where you expect the opposite end of the cable to be located.
Step 3: Press the "TRACE" button of the Remote Probe.
Step 4: Move the Remote Probe over the cable. For best results sweep the probe up and down the cable. Listen for the sound of tracing tones. If you hear them, you have located the cable.

Tracing tones is usually best on wires that are disconnected from any power source. Existing signals on lines can sometimes interfere with the tone signal.

You will notice that the Main Unit's tone generator circuitry steps the tone from one pair to the next (i.e. "1,2" then "3,6" then "4,5" then "7,8'). Listening to the missing gaps in the tone signal can sometimes be helpful in understanding a problem.

Maximum sensitivity occurs when the Remote Probe's tip is held parallel to the conductors carrying the tone. It is normal for the volume to change along a cable's path (volume can change as the cable length changes; as the angle of the probe to the conductor changes; as the signals on or around the cable).

Caution: electrical cables carry a wide variety of signals. They are dangerous. Telephone circuits employ a –48V battery voltage. When ringing, voltages are much higher (90 V RMS on top of the –48V). Telephone signals should not be on the same cables as LAN signals but exercise caution. If you are unsure of safe procedures, do not continue.

Test example #6. Testing the cable's pair configuration (using the Main Unit and the Remote Probe). No other tester provides the ability to locate the cable (see tracing, above) and simply plug it into the Remote Probes jack to determine its pairs configuration. This is called the "One step" feature. Note: With this test you can determine if your cable is straight thru or crossover; if it has inverted pairs (cable fault); and what pairs are terminated. To test a cable's pair configuration:
Step 1: While leaving the far end of the cable plugged into the Main Unit's Cable Test jack, plug the cable end you just located in test

example #5 into the Remote Probe's RJ45 jack.
Step 2: The LEDs on the Remote Probe will tell you the following information about the cable:
PAIRING: If pairs “1,2” “3,6” “4,5” or “7,8” are present and are of correct polarity, the pair's LED will light green. The Remote Probe tests for pairing and polarity according to the AT&T 258A standard (see Appendix A). See note below for required pairs.
INVERTED PAIRS: If any of the pairs are present but have incorrect polarity (i.e. the “1,2” pair is really “2,1”) the pair's LED will light red. A cable with an inverted pair will cause the Main Unit's Cable Fault LED to light when performing tests using the 10/100 LAN TEST jack. Inverted pairs can slow down a link or stop it completely.
PAIR NOT PRESENT: The LEDs will not light, if the pair does not exist or if the pair is shorted across itself.
STRAIGHT THRU OR CROSSOVER: If the LEDs light in a top-down order, the cable is wired in a straight thru configuration (e.g. “1,2” to “3,6” to “4,5” to “7,8” indicates a straight thru cable connection. If the LEDs light in a bottom-up order, the cable is wired crossover configuration (e.g. “7,8” to “4,5” to “3,6” to “1,2”) indicates a crossover cable). LEDs not lighting in order indicates pairs may be swapped.
SHORTED PAIRS: If a pair is shorted across itself, it will show up as a non existent pair (LED will be OFF). If the short is across pairs it will either light one pair red and the other green (simultaneously) or an individual LED will alternate red and green. Summary: Any red color indicates a wiring problem.

Notes: If pairs “1,2” and “3,6” are not both present, 10 Base-T and minimum 100 Base-T communication is impossible. If pairs “4,5” or “7,8” are not present, data rates maybe impaired (some 100 MB/s systems require 4 pairs). The Remote Probe will not interfere with an active LAN.

Appendix A. Wiring Primer.

Star topology and TP Cable: Base-T are LANs based on a star topology (every PC on the network is linked to a central location). The central location is termed a hub. The cabling is twisted pair wire terminated with 8 position modular connectors (RJ45).

PC and Hub defined: A “PC” is a device that transmits on a pair of wires that use pins 1 and 2 (“1,2”). A “hub” is a device that transmits on pins 3 and 6 (“3,6”). The TVR10/100 bases it’s testing on this standard.

Patch cables: A "straight thru" cable is a patch cable that connects a PC to a hub that does not change the wiring of the cable (e.g. pins 1 and 2 are connected to pins 1 and 2, etc). A "crossover cable" swaps the transmit and receive pairs of the connection (pins 1 and 2 are connected to pins 3 and 6). The TVR10/100 includes two straight thru patch cables.

Connecting Base-T Devices Base-T devices (PCs/hubs) are connected together by connecting the "Transmit pair" from one device to the "Receive pair" of the other device. This implies connecting the 1, 2 pair on one device to the 3, 6 pair of the other. The connecting of the pairs in this way is called the crossover function (using crossover patch cable). To make cabling more sensible, the standard allows hubs to make the crossover connections internally (transmit on the 3, 6 pair and receive on the 1, 2 pair). This allows straight thru patch cables to be used from PCs to hubs. The standard suggests the hub ports be labeled with the letter “X” if the crossover connection is made inside the hub. Most 10 and 100 Base-T devices use 2 pairs to function but 100 Base-T TX4 devices require 4 pairs.

Summary Twisted Pair (TP) Wire Connection Chart

TP wires connecting:	Not Marked	Marked with “X”*
PC to Hub	Crossover	Straight thru
PC to PC	Crossover	NA
Hub to Hub	Crossover	Straight thru

*If the hub has an “X” shown near its TP ports, the hub is performing the cable crossover function.

Note: Because the Base-T standard is designed for a crossover function (use of crossover cables or hub switching) to be implemented in every twisted pair link, many opportunities arise for the pairs to get “flipped.” The TVR10/100 3 jacks can quickly simulate a straight thru and crossover connection.

USOC vs AT&T Wiring Configurations Of all the combinations of 8 position modular connector wiring schemes, two have become popular enough to gain name recognition status. Of the two, only “AT&T” can be used for 10 and 100 Base-T systems. The difference is the pairing of signals on the cable (pairs are twisted together noise immunity).

- **USOC paired configuration.** A standard for telephones, this configuration is sometimes used to connect PCs together. The most popular USOC scheme is shown. Other schemes that are somewhat common are “modified USOC” (pin 1 goes to pin 8 and pin 8 goes to pin 1) and the “crosswired USOC” (pin 1 goes to 8; 2 goes to 7; 3 goes to 6; 4 goes to 5, etc.). A diagram of a USOC paired wire is shown on the following page. **USOC wiring is not designed to be used with Base-T equipment.**

PAIR ID #	PIN #	USOC WIRED CABLE (DON'T USE)	PIN
T4	1		1
R4	8		8
T3	2		2
R3	7		7
T2	3		3
R2	6		6
R1	4		4
T1	5		5

• **AT&T paired configuration** (also known as AT&T 258A, EIA (TIA) 568B, Twisted Pair Networks). Although the 10Base-T standard defines and requires pins 1, 2, 3 and 6, the other two pairs are commonly connected (some 100 Base-T schemes use all 4 pairs). A “crossover” version of “AT&T” is also quite common (pairs 1, 2 connected to 3, 6 and 3, 6 connected to 1, 2).

AT&T 258A (EIA/TIA 568B) STRAIGHT THRU

PAIR#	PIN #	PIN#	WIRE COLOR
2	1	1	Orange/White
2	2	2	Orange
3	3	3	Green/White
3	6	6	Green
R1	4	4	Blue
T1	5	5	Blue/White
T4	7	7	Brown/White
R4	8	8	Brown

Colors: First color is the base color of the cable. The second color is the stripe on the cable.

AT&T 258A (EIA/TIA 568B) CROSSOVER

PAIR#	PIN #	PIN#
2	1	3
2	2	6
3	3	1
3	6	2
R1	4	7
T1	5	8
T4	7	4
R4	8	5

AT&T 258A (EIA/TIA 568B) MODIFIED CROSSOVER

PAIR#	PIN #	PIN#
2	1	3
2	2	6
3	3	1
3	6	2
R1	4	7
T1	5	8
T4	7	4
R4	8	5

AT&T 258A (EIA/TIA 568B) Signal Definition in Diagram Form

PIN #		POLARITY	FUNCTION
1	Pair 2	(+)	Transmit Data
2		(-)	Receive Data
3	Pair 3	(+)	Transmit Data
6		(-)	Receive Data
4	Pair 1	(-)	Receive Data
5		(+)	Transmit Data
7	Pair 4	(+)	Transmit Data
8		(-)	Receive Data

What uses what pairs? 10 Base-T and 100 Base-TX uses pairs 2 and 3. 100 Base-T4 uses all 4 pairs (1, 2, 3, 4).

Mixing Telephones and Data In many cases, Base-T networks (also called Twisted Pair and Ethernet Networks) utilize the same cable type common to telephone systems. Because Base-T may use the same connectors, block terminators, and wires that are used in many telephone systems, they are subject to the same types of problems that telephone systems have. They range in difficulty from the typical errors in wiring and connectors to intermittent connections. **Care must be taken to avoid electrical connection between networks and telephone systems.**

Hub/Computer Links TP networks have a Star topology (all PCs connect to a central source called a hub) and are composed of network hubs and PCs. For two PCs to communicate with each other they must use the hub. PCs are normally connected to hubs via two pairs of twisted pair wires (one transmit pair and one receive pair). Some 100 Base-T devices (called "T4") require 4 pairs of wires.

Twisted Pair Cables TP cable is used for Base-T applications because of its excellent noise cancelling capabilities. Two pairs of twisted pair wire are normally required for each computer that hooks to the hub:

- One pair of TP wire to transmit data to the hub.
- One pair of TP wire to receive data from the hub.

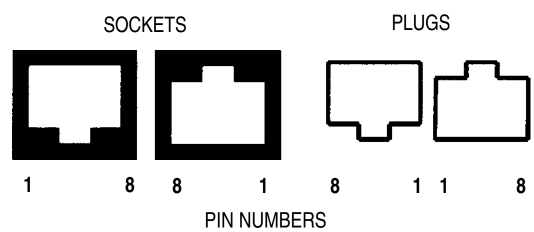
There are exceptions. Some 100 Base-T devices (called "T4") require 4 pairs of wires.

A physical inspection of the TP wires inside the outer insulation jacket of your cables is generally a good idea. Experience has shown that some manufacturers of cable improperly label some cables as being TP when they are not. The longer the cable run, the more likely non-TP cables will cause problems.

Remove the outer jacket of the TP wire exposing about a foot of wire.

- Each pair of wire should be twisted together with at least two twists per foot. The wire should be twisted right up to the connector.
- Pairs should not be twisted together with another pair. Check to see that each pair is easily separated from other pairs, i.e., check to see that each pair is not twisted together with other pairs.
- The pairs of wire should be color coded to establish a plus and a minus wire for each pair.
- The wire should also be color coded to distinguish each pair from the other pairs in the cable.

RJ45 Connectors (sockets and plugs): The Base-T Standard uses RJ45 sockets and plugs. The RJ45 socket has 8 pins. The pins are numbered 1 to 8. Looking at the socket with insertion key facing down, pin number 1 is to the left.



Appendix B. 100Base-T and 10Base-T Basics

Base-T LANs connect PCs to hubs that enable communication with other PCs and hubs using twisted pair cable. 100 Base-T, sometimes referred to as “fast Ethernet”, is an upgrade of 10Base-T LAN networks. 10Base-T has a data rate of 10 Million Bits per second (10 MB/s) and 100Base-T is ten times faster at 100 Million Bits per second.

"Hub" and "PC" defined: A “PC” is a device that transmits on a pair of wires that use pins 1 and 2 (“1,2”). A “hub” is a device that transmits on pins 3 and 6 (“3,6”). When the TVR10/100 senses a link pulse or data packet, it lights the "Device Type" LED on the faceplate to indicate its source (hub or PC) based on the above standard.

Link Pulses and Data Packets: Two LAN devices interact with one another using Link pulses and Data packets. The TVR10/100 can detect and display on LEDs the existence of both of these signals. The Link pulses and Data packets are different depending on whether the devices are 10 Base-T or 100 Base-T devices.

10 Base-T Link pulses and Data packets: 10 Base-T devices synchronize communication with one another first by each sending link pulses (a series of single pulses) followed by any data packets being sent. During quiet time (when there is no data being transmitted) both devices send link pulses causing the Main Unit's Device Type Link Pulse LEDs to flash. The speed of the link is displayed on the Speed Verification LEDs.

100 Base-T Link Pulses and Data packets: In the 100 Base-T environment, the PC sends a burst of Link pulses (containing setup parameters) to the hub. These bursts will continue until acknowledged by a 100 Base-T hub (this is termed "negotiation"). Once the negotiation is complete, data packets are sent back and forth. No more link pulses are required as long as the link is not broken. The existence of Link Pulses and Data packets will cause the Device Type Data and Link LEDs to light. During link pulse and data transmission, the link speed will be displayed on the Speed Verification LEDs. Notes: Some fixed 100 Base-T devices (devices that do not support both 10 and 100 Base-T), do not send link pulses (just data packets). 2) Negotiation can take place quickly (disconnect and reconnect the link to repeat the process for viewing the LEDs).

For two LAN devices to communicate, they both must be operating at the same data rate. 10Base-T devices always operate at 10 MB/s. 100Base-T devices, on the other hand, will first try to communicate at 100 MB/s. Failing that, they will try 10 MB/s. 100Base-T equipment is designed to interface with either 100Base-T or 10Base-T equipment. It takes two 100Base-T ports to establish communication at 100 MB/s. If the hub or the PC has a 10Base-T port, the communications will be set at the slower 10 MB/s data rate.

HUB	PC	DATA RATE
10Base-T	10Base-T	10 MB/s
100Base-T	10Base-T	10 MB/s
10Base-T	100Base-T	10 MB/s
100Base-T	**100Base-T**	**100 MB/s**

Hub and PC speed characteristics vary. Some 10Base-T and 100 Base-T devices have fixed speeds. Others have an initial fixed speed of 10 MB/s. or 100 MB/s and then adjust depending upon what the connected device is doing. It is possible, for instance, for two 100

Base-T ports to erroneously establish communications at 10 MB/s:

- If a computer downshifts to 10 MB/s, before it is connected to a hub, a 10 MB/s connection will be established. When the hub is connected, it will see the PC as a 10Base-T device and will also down shift to 10Base-T operation. This condition may also occur when a patch cable is temporally disconnected.

  This slow data rate will persist until the PC is rebooted. Rebooting the computer will enable the PC's LAN port to retest the LAN and reestablish the connection at 100 MB/s.

- If a cable problem disables data communication at 100 MB/s. The problem could be caused by not enough connected pairs: 10Base-T data communications only requires two pair cables. There are two 100Base-T standards, one requires two pair cables and the other requires four wire pair cables. If a two pair cable is used, when four pair cables is required, a slow 10 MB/s connection will be permanently established. The cable problem could be caused by inverted pairs: A pair exists but the pins are inverted (e.g. 1,2 is 2,1). Or, the problem could be the cabling is not rated for 100 MB/s speeds ("category 5" cable).

LAN type	Cable Pairs Required			
10Base-T	1,2	3,6		
100Base-T (Type 1 or TX)	1,2	3,6		
100Base-T (Type 2 or T4)	1,2	3,6	4,5	7,8

As is shown in the above table, 10Base-T or 100Base-T (Type 1 or TX) LAN ports use two pair cables. 100Base-T (Type 2 or T4) LANs require all four pairs. It is best to use and install Category 5

cables with all four pairs to insure compatibility with all three types
of
Base-T LANs.

If there is a short or open on pairs 1,2 and 3,6 all communications will be prevented. If there is a short or open on pairs 4,5 or 7,8 the data rate may drop to 10 MB/S.

A faulty cable with missing or faulty pairs 4,5 or 7,8 may cause the data rate on that cable to drop to 10 MB/S. If this faulty cable is between a PC and hub, all data going to and from that single PC will be at a slow rate. If the faulty cable is between two hubs then communications will some times be quick and other times it will be slow. Communications between PC connected to the same hub will be quick. Communications between a PC on one hub across a faulty cable to a PC on another hub will be slow.   This type of problem can be very difficult to find without a TVR10/100.

Appendix C. Ways to minimize LAN problems.

- Use Category 5 cable (rated at 100 MB/s).
- Connect all four pairs when installing cables.
- Use straight thru connections for installed cables.
- Install all cables using standardized color code.
- Use color coded patch cables with all four pairs wired.
- Use TVR10/100 to test each cable as it is installed.

Preferred Cables. The preferred wiring configuration for Ethernet connections is based on the AT&T 258A standard (also called EIA/ TIA 568B). See Appendix A for the pinouts of the cable.

Two wrongs do not make a right!

Wire all sockets and cables according to the standards. This will save countless hours of troubleshooting time.

Do not deviate from the standard cable pin outs. i.e. when testing a cable be sure that both ends of the cable adhere to the standard straight thru pin out and standardized wire color code.

When you find a missing wire on an installed cable. Open the nearest wall jack and check that it is wired correctly according to color code. If the nearest wall jack is correct, go to the other wall jack to correct the problem. Be sure both ends are wired correctly.

If the near end wall jack is wired correctly, do not attempt to correct pinout errors made on the other jack by swapping wires on the correct wall jack. This mixes pairs, which makes LANs unreliable may cause LAN ports to drop to low data rates causing bottlenecks in the LAN operation. **Wire both sides of cables correctly and remember "two wrongs do not make a right."**

Appendix D. Self test and battery replacement.

Main Unit: The "10/100 LAN Test" section of the Main Unit is equipped with a Self Test feature that is automatically activated when the unit is energized. After the test is complete, only the Power LED should remain lit.

The "Cable Tests" section is tested by connecting a *Straight thru patch cable* (included) between the Main Unit's "Cable Tests" jack and the Remote Probe's "Cable Tests" jack. The 4 LED's on both units should light in "Straight" order if they are functioning correctly.

If you suspect a problem with the Main Unit, replace the battery (weak tone generator, dim LEDs, etc.). The battery compartment is located in the lower-back of the unit. Remove the snap-fit cover. Use a 9V alkaline battery (NEDA type 1604A).

Remote Probe: To test the Remote Probe's tone detection capability, hold the probe's tip next to the Main Unit's "Cable Tests" jack and depress the "Trace" button. A loud tone should be heard. If weak, replace the battery.

To test the "Cable Tests" jack, perform the same test as described for the Main Unit (above).

To replace the battery, remove the two screws holding the probe's battery cover in place. The battery cover is located on the lower back of the probe. Use a 9V alkaline battery (NEDA type 1604A). When replacing the cover, do not overtighten.