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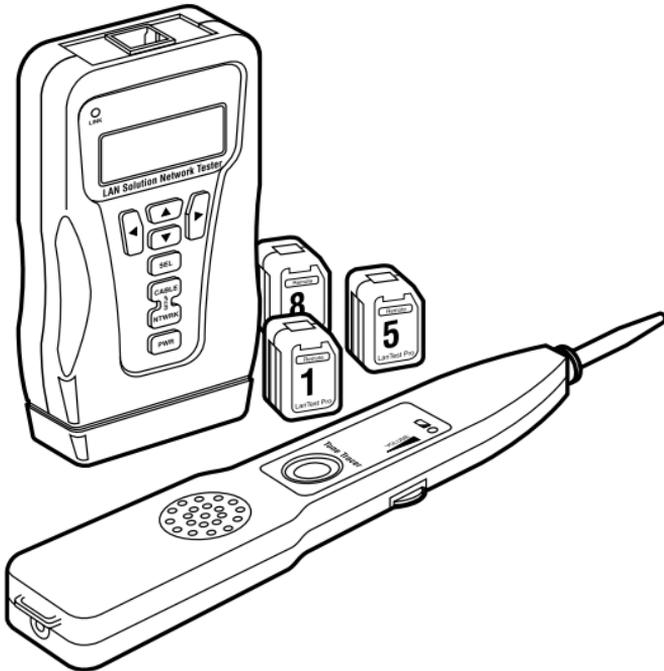
TS560A

TS565A

TS086

TS087

LAN Solution Network Tester



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Contents

Chapter	Page
1. Specifications	5
2. Introduction	7
2.1 Description	7
2.2 The Tester Illustrated	8
2.3 Warnings/Cautions	9
2.4 What the Package Includes	10
2.5 Features	12
2.6 Network Connectivity	13
3. Operation	14
3.1 To ID an Unknown Jack or Plug	14
3.2 To Test Cables Only	15
3.3 To Place Tone on a Cable	16
3.4 To Measure the Length of a Cable	16
3.5 To Locate an Ethernet Port	17
3.6 To PING Devices on a Network	18
3.7 To Validate a Cable Link by Functional Testing	20
3.8 To Change PING Addressing Mode	21
3.9 To Connect the Modular Adapter (TS086 or TS087) to a Jack	22

Chapter	Page
4. Functional Description	23
4.1 Voltage Check	25
4.2 Cable Test Modes	26
4.2.1 Jack ID	26
4.2.2 Cable Test	27
4.2.3 Cable Length	29
4.2.4 Tone Generator	30
4.3 Network Test Modes	30
4.3.1 Flash Link LED	30
4.3.2 PING Test	31
4.3.3 Validate Link	41
5. Setup Mode	43
5.1 Target Setup Sub-Menu	43
5.2 PING Setup Sub-Menu	45
5.3 Last DHCP	47
5.4 DHCP On/Off	48
5.5 MAC Add	49
5.6 Units—Feet/Meters	49
6. Status and Error Messages for Network Test Modes	50

Contents (continued)

Chapter	Page
7. Interpreting Cable Test Results	56
8. Maintenance	62
8.1 Replacing the Battery	62
8.2 Resetting the Processor	63
9. Troubleshooting	64
9.1 Calling Black Box	64
9.2 Shipping and Packaging	65

1. Specifications

Cable Types: Shielded or unshielded, CAT5e, CAT5, CAT4, CAT3, and coax

Minimum Cable Length for Testing for Split Pairs: 3 ft. (0.9 m)

Minimum Cable Length for Single-Ended Cable Test: 4 ft. (1.2 m)

Length Measurement Range (CAT5 or CAT6): Up to 1500 ft. (457.2 m)

Temperature Tolerance:

Operating: 32 to 122°F (0 to 50°C);

Storage: -20 to +176°F (-29 to +80°C)

Humidity: 10 to 90%, non-condensing

Battery Life: 9V alkaline battery, typical; times are for the full capacity of the battery used continuously in one of the following modes:

Standby: 2.5 years;

Cable Testing: 50 hours, no backlight;

27 hours, 50% backlight;

Network Testing: 15 hours, no backlight;

14 hours, 50% backlight

Size: 5.9"H x 2.9"W x 1.25"D (15 x 7.4 x 3.2 cm)

Weight: 7 oz. (199 g) with battery

2. Introduction

2.1 Description

The LAN Solution Network Tester is a jack identifier, cable tester, and PING tester all in one.

When working as a jack identifier, it allows you to determine what equipment, if any is connected to the other end of the cable or jack you are testing.

As a cable tester, the LAN Solution Network Tester displays a wire map, ID, and any cable faults.

If you use the tester as a PING (Packet INternet Grouper) tester, it lets you request an echo back from an addressed device (called a target device, usually a router). The LAN Solution Network Tester uses this to verify IP (Internet Protocol, actually TCP/IP) connectivity between itself and another device.

The LAN Solution Network Tester has a backlit LCD and eight buttons. The tester has eight test modes and a setup function. The test modes include Voltage Check, four Cable Test modes (Jack ID, Cable Test, Cable Length, and Tone Generator), and three Network Test modes (Flash Link LED, PING test, and Validate Link).

2.2 The Tester Illustrated

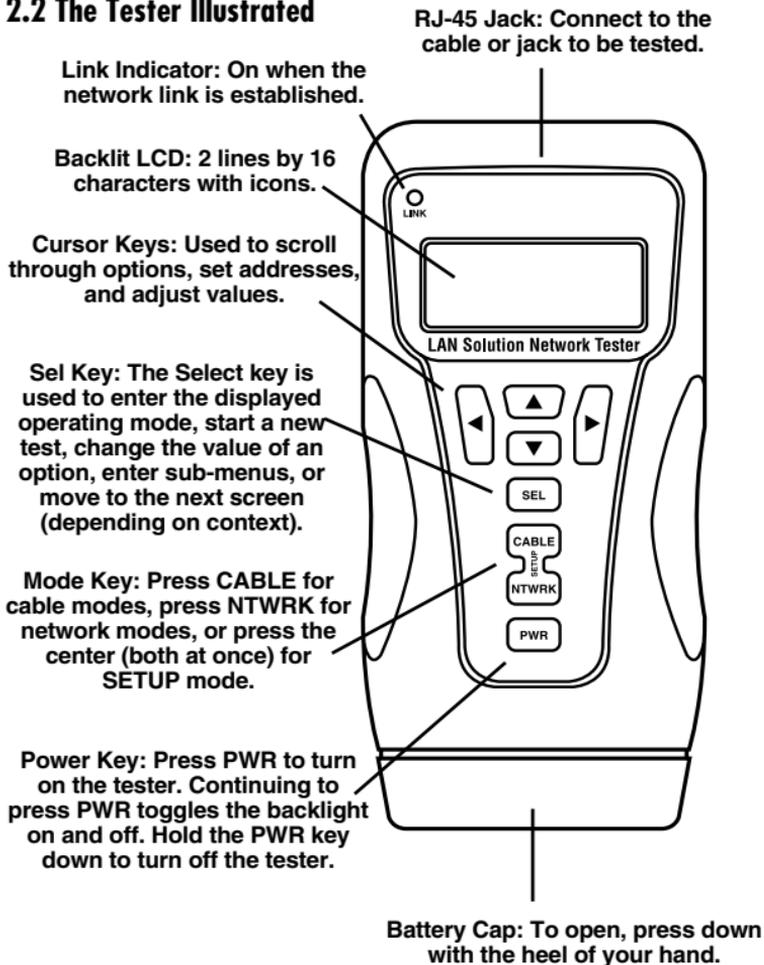


Figure 2-1. The LAN Solution Network Tester's components.

2.3 Warnings/Cautions

WARNING

Do not attach the LAN Solution Network Tester to primary power lines. The tester may be damaged and cause a safety hazard. When connecting to an unknown jack or plug, the tester should be off. Once connected, press the CABLE button to ID the connection.

CAUTION

Improperly crimped, damaged, or uncrimped plugs can damage the LAN Solution Network Tester's jack. Inspect plugs for proper termination and crimping before inserting anything into the tester. Plug contacts should always be recessed into the plastic grooves. Do not use with standard 6-position plugs (RJ-11/RJ-12). This might damage the tester. Use the provided "no fault" (green transparent plugs) 6-position RJ cable, which can be connected to a 6- or 8-position jack without causing any damage.

NOTE

The screen comes with a clear, peel-off protective coating over the LCD screen. Remove it for the clearest view of the display.

2.4 What the Package Includes

The TS560A comes with the following items:

- (1) LAN Solution Network Tester main unit
- (1) remote
- (2) 12" (30.5-cm) RJ-45/alligator-clip cable assemblies
- (2) 12" (30.5-cm) UTP cables with RJ-45 connectors
- (2) 7.5" (19.1-cm) cable assemblies with no-fault RJ-12 connectors for RJ-11 and RJ-45 jacks
- (1) carrying case
- (1) 9-V alkaline battery
- This users' manual

The TS565A comes with the following items:

- (1) LAN Solution Network Tester main unit
- (8) remotes

- (1) tone tracer
- (2) RJ-45-to-F coax connectors
- (2) 12" (30.5-cm) RJ-45/alligator-clip cable assemblies
- (2) 12" (30.5-cm) UTP cables with RJ-45 connectors
- (2) 7.5" (19.1-cm) cable assemblies with no-fault RJ-12 connectors for RJ-11 and RJ-45 jacks
- (1) carrying case
- (1) 9-V alkaline battery
- This users' manual

The TS086 (purchased separately) is the Banjo Modular Adapter, 4-wire.

The TS087 (purchased separately) is the Banjo Modular Adapter, 6-wire.

If anything is missing or damaged, please contact Black Box at 724-746-5500.

2.5 Features

- **Jack ID mode:** Capable of identifying many of the possible conditions of an RJ-45 jack. Automatically runs cable test if no active devices are found.
- **Cable Test mode:** Single-ended testing of cables for shorts, opens, and split pairs (no remote on the other end). Full cable test finds all wiring faults including split pairs with a remote connected. Results display in wiremap format with a message line for shorts and split pairs. It also displays a PASS icon for T568A/B passing cables and reports cable length.
- **Length measurement** in feet or meters using cable capacitance method.
- **Tone Generator mode** for use with tone tracers.
- **Flash Link LED mode** sends tone while the LED blinks when finding a hub or switch port.
- **PING mode:** Simultaneously PINGs three devices at once: a target, a router, and a DNS server. DHCP protocol support allows for PINGing of a router and DNS server with no setup.

- Auto-MDI/MDI-X-like protocol makes it possible to connect to a hub, switch, or NIC with any patch cable.
- Two-line by 16-character full alphanumeric backlit LCD with icons displays clear test results.
- Auto-off in any mode and low power consumption for long battery life.

2.6 Network Connectivity

The LAN Solution Network Tester uses IP address protocol and recognizes auto-negotiation using fast link pulses to report advertised Ethernet capability. The tester also supports a modified version of auto-MDI/MDI-X to allow for connection to a hub, switch, or NIC with a straight-through cable.

The tester uses 10BASE-T for all network transmissions. The vast majority of 100BASE-T Fast Ethernet products support 10BASE-T. However, if a hub or switch is 100BASE-T only, you'll need a different port, a change of settings, or you'll have to insert an inexpensive 10/100 hub in line with the tester.

3. Operation

To power on the tester, press any one of these three buttons: PWR, CABLE, or NTRK. The tester will turn on in the last mode used if you press the PWR button. If you press the CABLE button, the tester immediately starts executing the Jack ID test. Pressing the NTRK button causes the Flash Link LED test to begin.

To turn the tester off after any test, press and hold the PWR button until the display turns off. All functions except the Tone Generator and the Flash Link LED shut down in 15 minutes. The Flash Link LED shuts off after 30 minutes, and the Tone Generator shuts off after 60 minutes.

When connecting to unknown jacks or cables, begin with the power off and turn the tester on after the connection is made. This ensures that the voltage check will run first before any other testing.

3.1 To ID an Unknown Jack or Plug

1. With the LAN Solution Network Tester powered off, connect to an unknown jack or plug.

2. Press the CABLE button. The tester will power on in Jack ID mode and determine what device is connected to the other end of the cable. It will test the cable if no connection is found.

3.2 To Test Cables Only

NOTE

This test skips the ID portion of the Jack ID test above. Use this if you have a known good cable.

1. Connect one end of the cable run you want to test to the LAN Solution Network Tester. Press the CABLE button repeatedly until Cable Test is displayed (press the CABLE button twice if the unit was off). Press the SEL button to enter Test mode.
2. If the cable is connected while the tester is on, a single-ended test for shorts, opens, and split pairs will probably have already started. Press the SEL button to force a new test to begin.
3. For a complete test, connect a remote to the other end of the cable.

APPLICATION HINTS

Any patch cables used to connect the tester and remote to a cable run must be “short” compared to the cable run for accurate open and split pair indication. “Short” patch cables must be no more than 10% of the total run length or 3 feet (0.9 m), whichever is less. A cable must be at least 4 feet (1.2 m) long for a single-ended test to work properly.

3.3 To Place a Tone on a Cable

1. Connect the cable you want to trace to the main unit. Press the CABLE button to turn on the tester. Press the CABLE button again until Tone Generator is displayed, then press the SEL button.
2. Press the SEL button until the desired tone is selected. Use the up/down arrow keys to select the pin or pair(s) to carry the tone.
3. For the strongest signal, do not connect the remote. Since twisted pairs have a shielding effect, the strongest signal is obtained by having only one wire of a pair carry a tone. Selecting a single pin instead of a pair will do this.

3.4 To Measure the Length of a Cable

1. Connect the cable to the main unit. A remote may be at the other end, but it's not required.

2. Press the CABLE button to turn on the tester. Press the CABLE button again until Cable Length is displayed, then press the SEL button. To change length units between feet and meters, press the SETUP button.
3. Press the up/down arrows to adjust the length constant (a known length of cable that you will use as a reference). If the length constant is unknown for a particular cable, you can use a known length of cable to set the constant. The known cable should be 50 ft. (15.2 m) or longer to minimize the resolution error. Connect the known length of cable to the tester and change the cable constant using the up/down arrows until the length reads correctly.

3.5 To Locate an Ethernet Port

1. With the LAN Solution Network Tester powered off, connect the tester to a jack or plug at the workstation location for which the Ethernet port is to be located.
2. Press the NTWRK button. The tester will power up in the Flash Link LED mode and connect to the Ethernet port on a hub, switch, or NIC. Even if no connection is made, tone is generated on the cable to help find the cable with a tone tracer at the other end (in the equipment closet).

3. If an Ethernet link is active on the cable, the tester turns on its Link LED and begins flashing it in unison with the Link indicator on the hub, switch, or NIC at the other end. Tone is also generated on the cable in this condition, but at a different cadence to indicate having established a link.

3.6 To PING Devices on a Network

If the jack or plug is unknown, press the CABLE button to run the Jack ID test first (refer to **Section 3.1**). The PING function operates in two modes: DHCP On and Off (manual). Select this in Setup by the DHCP On/Off option. (To get to Setup, press the SETUP button.) No other entries are required to establish communication with a router and a DNS server on a DHCP network. To PING a specific target (Tg1–4), you must enter the address and select the desired target address in Setup before starting the PING test. In DHCP OFF mode, all IP configuration information must be entered in Setup first (PING Setup option).

1. With the LAN Solution Network Tester powered off, connect to the network.

2. Press the NTWRK button repeatedly until the PING test is displayed on the screen (if the tester is turned off, press the NTWRK button twice). Press the SEL button to enter the test. Several status screens will be displayed while establishing a link and negotiating the DHCP configuration. Once PINGing begins, a PING status screen will be displayed, showing acronyms for each active conversation.
3. Press the left or right arrows to move the cursor next to a device acronym. Press the SEL button to advance to the next screen or the screen will advance automatically after 10 seconds.

3.7 To Validate a Cable Link by Functional Testing

You can use two LAN Solution Network Testers to exercise a cable link without requiring additional equipment. You can also do this through a hub or switch with or without any other equipment being present. We'll refer to the two testers as the Validator and the PING Generator. The Validator uses the Validate Link mode, and the PING Generator uses the PING Test mode.

1. Connect the Validator to one end of the link you want to test.
2. Press the NTWRK button until Validate Link is displayed. Press the SEL button to activate the test.
3. To get to Setup mode, press the SETUP button. In Setup, set the PING Generator to DHCP Off (see **Section 3.8**). A specific manual address does not need to be set. The PING Generator will recognize the Validator and assign addressing.
4. Connect the PING Generator to the other end of the link.

5. On the PING Generator, press the NTWRK button until PING Test is displayed. Press the SEL button to begin.
6. The target or router acronym will change to Val on the PING Generator when the Validator is found and addressing has been assigned. The PING Generator operates and accumulates information like a normal PING test. The Validator displays only the packet count on its screen.

3.8 To Change PING Addressing Mode

1. Turn on the LAN Solution Network Tester by pressing the PWR button, then the SETUP button (in between the CABLE and NTWRK buttons). The Percent Battery Remaining screen will appear briefly.
2. Press the down arrow button three times. DHCP On or DHCP Off should be displayed.
3. Press the SEL button to toggle between On and Off. The displayed value is the current setting.

4. Press the CABLE or NTWRK button to exit to a test, or press and hold the PWR button to power off the tester.

3.9 To Connect the Modular Adapter (TS086 or TS087) to a Jack

Plug a 6- or 8-position adapter into a corresponding straight-pinned cable from the wall jack to the adapter. Attach the clip leads (only available with the TS565A kit) of the test equipment to the side contacts on the Modular Adapter. Modular connector pin members are engraved in the case near the side contacts. Other equipment may be attached to the remaining jack on the Modular Adapter for inline testing or to extend a cable run by connecting two cords together.

CAUTION

Improperly crimped or un-crimped plugs can damage the jacks on the Modular Adapter. Inspect plugs for proper termination and crimping before inserting them into the adapter. Contacts should always be recessed into the plastic grooves of the plug.

4. Functional Description

The LAN Solution Network Tester is a jack identifier, cable tester, and PING tester in one. It has a backlit LCD display and eight buttons. The rubber end cap at the bottom is the battery compartment cover.

To power on the tester, press any one of these three buttons: PWR, CABLE, or NTRK. The tester will turn on in the last mode used if you press the PWR button. If you press the CABLE button, the tester immediately starts executing the Jack ID test. Pressing the NTRK button causes the tester to go into Flash Link LED mode.

To turn the tester off after any test, press and hold the PWR button until the display turns off. All functions except the Tone Generator and the Flash Link LED shut down in 15 minutes. The Flash Link LED shuts off after 30 minutes, and the Tone Generator shuts off after 60 minutes.

Briefly pressing the PWR button toggles the backlight on and off. The backlight turns off automatically about 5 minutes after being turned on. Using the backlight increases power consumption 20 to 50%.

The tester has eight test modes and a Setup function. The test modes include Voltage Check, four Cable Test modes (Jack ID, Cable Test, Cable Length, and Tone Generator), and three Network Test modes (Flash Link LED, PING Test, and Validate Link). For more information about the test modes, see **Sections 4.1 through 4.3**. For information about the Setup mode, see **Chapter 5**.

The mode switch is the double button above the PWR button. The top button is labeled CABLE, the bottom button is labeled NTWRK, and the area bridging the two buttons is labeled SETUP. Pressing a mode button will immediately end any currently running task and either begin executing the first task of a new category (cable or network) or display the next mode in the same category, waiting for SEL to be pressed in order to begin the testing. Subsequent presses in the same category advances to the next mode, and cycling back to the first mode when the end is reached. Again, press SEL to begin.

4.1 Voltage Check

All tests, except Jack ID, start with a check for voltages on the pins on the tester's jack. If voltage is found, the message "Voltage Found—SEL Jack ID" is displayed. You must press the SEL key to start the Jack ID test; this will determine what type of interface or what voltages are present on the jack.

The tester monitors the jack to see if the voltage is removed for five minutes. The selected test will continue if the voltage is removed, and the tester will shut itself off after the five minutes.

The exception to this behavior is in the network modes (Flash Link LED, PING Test, and Validate Link). When voltage is found in these modes, the tester checks to see if it is Ethernet phantom power. This is a voltage that is connected to the center taps of the Ethernet interface transformers of some network equipment to power remote devices like IP phones or wireless transceivers. This power is seen by the LAN Solution Network Tester as voltage between the 1–2 and 3–6 pin pairs. The voltage found is reported as "Enet Pwr Source Found = xV" for several seconds, then the test proceeds automatically.

4.2 Cable Test Modes

In most modes, the tester is constantly testing and reporting results. While we recommend that an unknown jack connection always be verified by connecting to the tester while it is powered off, you can attach a known dead network cable or jack to the tester while it is running. In that case, a test will most likely be in progress when a cable connection is made.

The results of the test in progress at connection time are unreliable. You should press the SEL button to terminate the current test and initiate a new test.

4.2.1 JACK ID

The Jack ID test identifies what equipment, if any, is connected to the other end of the jack or cable you are testing. The test first looks for voltages present on the connector pins. If voltages are found in typical phone locations, tests for current levels and dial tone are run. From these tests, the LAN Solution Network Tester will report voltage or phone type found.

If no voltages are present, testing for Ethernet link pulses begins. If link pulses are found, the advertised capability, the pairs with link pulses, and the polarity of link pulses are displayed. The pairs with link pulses are indicated by reference to the device that would normally present pulses on those pairs (the hub, switch, or NIC, assuming straight-through cabling. With a cross-over cable present, an NIC would be labeled as a hub, etc.) The AUTO indication is displayed if the device connected is capable of auto-MDI/MDI-X. If no pulses are found, but the pattern of termination of the cable is that of an inactive Ethernet device, it will be displayed as such.

If the tester does not find any of the conditions described in this section, it invokes the cable test as described in **Section 4.2.2**, displaying any single-ended cable test, full cable test, or “No I/O or Cable” results.

4.2.2 CABLE TEST

If it senses a remote, the tester performs a full cable test. When the test is complete, the wire map display, ID, and any faults are displayed. The top line of numbers on the display represents the connector pins on the main unit. The second line of pin numbers shows the connector

pin numbers of the remote, which are normally the same as the top line for a normal data cable. If there is a miswire, the numbers of the second line will indicate the pin numbers detected. If no connection was detected for some of the pins, the second line will be blank in those pin locations. If a short is detected, the second line will have a flashing “x” in that position, and the specific short condition will be displayed on the third line. If multiple errors need to be displayed on the third line, the messages will display in sequence until all have been displayed. The ID icon will have a number directly below it indicating the remote ID number. If no faults are found on the cable, the length of the cable is displayed.

If it does not sense a remote, the tester uses the length and cable test capability to measure a cable for shorts, opens, and split pairs (single-ended test), and the pin number icons for the pairs being tested will appear on the LCD to indicate a test in progress. The results are displayed as messages on the LCD. Because a test can take up to about 5 seconds to complete, you should press the SEL button, which immediately starts a new test whenever a new cable is connected. Partial and erroneous results will be displayed until a complete test cycle runs on a cable.

4.2.3 CABLE LENGTH

The length mode measures the length of a cable by measuring its capacitance and using the capacitance per unit length (length constant) to calculate the length. The length is displayed on the LCD along with the current value of the length constant.

The SEL button changes the pair being measured in a 1-2, 3-6, 4-5, 7-8, and auto-select sequence. The pair number is displayed next to the length except in auto-select mode. If a selected pair has a fault, the fault replaces the length reading on the LCD. In auto-select mode, the tester automatically selects a pair without a fault.

You can use the up/down arrows to change the length constant. If network termination patterns are found in the length mode, the tester will display “T Ring Network??,” “xbase-T Network?,” or “Network?” (all four lines terminated). If the tester senses a remote, the ID Number is displayed.

4.2.4 TONE GENERATOR

The tone mode generates audio tones for use with tone tracers on all pairs, a selected pair, or a selected pin. The signal generated on a pair has the signal on one pin and the complement of the signal on the other pin of the pair, yielding a nominal 10 volts peak-to-peak across the pair. The SEL button selects one of the four tone sounds provided. Use the up/down arrows to scroll through the pairs and pins that have signals on them. All pins not being driven are held at tester ground. The LAN Solution Network Tester will automatically turn off in 30 minutes.

4.3 Network Test Modes

4.3.1 FLASH LINK LED

The Flash Link LED mode starts with the Voltage Check test (see **Section 4.1**), then searches for link pulses on the tester's jack, automatically configuring the interface to connect to a hub, switch, or NIC (similar to auto-MDI/MDI-X) if one is found. An audio tone signal is sent down the cable, so the cable can be located at the other end with a tone-tracer-established link to indicate the link status. Once a link is established, the Link LED on the tester will light and begin blinking at the same

rate as the link indicator on the device at the other end. The tester will automatically turn off in 30 minutes.

While the tester is searching for incoming link pulses, it displays the message “Find Active Link.” Once it finds link pulses, the tester displays “Link Found,” and the Link LED flashes. If the tester detects that the incoming link pulses stop, it reports “Lost Link” for several seconds, then returns to the search for link pulses.

4.3.2 PING TEST

When you use the tester as a PING (Packet INternet Grouper) tester, it lets you request an echo back from an addressed device (called a target device, usually a router). The LAN Solution Network Tester uses this to verify IP (Internet Protocol, actually TCP/IP) connectivity between itself and another device.

In the PING protocol, an IP address must be selected to receive an echo request. This address is the “target” address for that PING. While using the LAN Solution Network Tester, you must select a target manually in Setup mode. This target can be on the LAN, or anywhere else accessible through a router connected to the LAN. If the target is not on the LAN, the router IP

address must be known so that the PING can be sent to the router, which forwards it to the ultimate location.

The PING Test operates in DHCP On or DHCP Off (Manual) IP address configuration modes. DHCP (Dynamic Host Configuration Protocol) is the protocol used when a new device is added to a LAN and it needs to get information about the IP addresses on that LAN. One DHCP server must be present on the LAN to provide a response to the DHCP request transmitted to a broadcast address and inform the new device of several configuration details. A DHCP server is not required on a LAN, but if it does not exist, all the devices on the LAN must be manually configured. Much information can be provided by the DHCP server. The LAN Solution Network Tester requests and uses:

- an IP address for itself (myIP)
- the IP address of the DHCP server on the LAN
- the Netmask in use
- the IP address of the Router on the LAN
- the IP address of the DNS server accessible from the LAN

The address configuration mode is a setup option (see **Section 5.1**). In either case, a target device must be selected in Setup mode and its IP address confirmed. If

the target address is on the LAN segment, as determined by Netmask*, the target will be addressed directly on the Ethernet. If the target is not local, PINGs will be directed to the Router for forwarding on the WAN side of the Router. When running in this mode, the tester will respond to PINGs addressed to it from any other device.

*Netmask or Network Mask (Subnet Mask) is an IP addressing scheme that divides the entire IP address network into smaller sections (Subnets), In the LAN Solution Network Tester, the Netmask is used to identify an IP address as being located either on the LAN (local subnet) or on the Internet, and therefore accessed over the WAN.

In the PING test, the LAN Solution Network Tester checks for voltages, then searches for link pulses on its jack, automatically configuring the interface to connect to a hub, switch, or NIC. Once an active link is found, the tester configures its IP address parameters as selected by you. Once the parameters are set, the tester starts sending out PING packets to the selected target, the router, and (in DHCP mode) the DNS server. The PINGs continue for 15 minutes after the last button press, after which the tester will automatically turn off.

DHCP On Mode

After detecting incoming link pulses, the tester requests IP address parameters using the DHCP protocol. The tester displays the message “DHCP Request” and a count of attempts to detect link pulses.

This protocol requires a response from a DHCP server accessible on the LAN. If no response to its request is received after 10 seconds, the tester will repeat its request, and increment the count on the screen. Once the tester gets a response from a server, it displays the message “Successful.”

No manual configuration is required for the DHCP protocol to work. If the tester continues to count requests, the most likely problem is that a DHCP server is not available on the LAN. In that case, the tester must be manually configured. For information on that mode, see the DHCP Off (Manual) Mode section on the next page.

Once the DHCP server has provided the tester with a value for the address that the tester will use (MyIP), that address is checked for conflict. The tester issues an Address Resolution Protocol (ARP) request directed to

its proposed MyIP address. A response to the ARP tells the tester that some other device on the LAN is already using that IP address.

The DHCP protocol specification (RFC 1541) says that when a server offers an address already in use, the receiver of that address should reject it and request another. The LAN Solution Network Tester does not inform the server about the conflict, but it does report it on the LCD: “My IP in use on this network.” If this is found, the tester will not continue into the PING state because using another device’s IP address is not permissible on a LAN. This condition shows that the DHCP server is misconfigured. The tester will restart from this state automatically after one minute, or it can be manually restarted to retry the test. If multiple retries end up unsuccessful, the tester must be manually configured and used in the DHCP Off mode. In this case, the LAN configuration parameters can be seen in Setup mode in the Last DHCP submenu. This will also include the IP address offered to the tester.

After successfully receiving a valid IP address, the operation of the tester continues with the PING state (see page 37).

DHCP Off (Manual) Mode

The tester uses the manually entered PING Setup information. To determine the IP parameter configuration of the LAN, the configuration of another device on that LAN must be checked. On a Windows® PC, the command “IPconfig” can be used to determine the IP addresses, Netmask, and Default Gateway (router) being used. On a Linux® computer, the same information can be found using the “ifconfig” and “route” commands. The Netmask and router information can be entered just as displayed on the PC.

The value entered for MyIP must be similar, but not identical to the PC’s IP address. The Netmask defines the addresses that must be common between the PC and the tester so they can communicate directly on the same LAN segment. Use an IP address different by just a few low-order digits in the low-order byte of the IP address.

Once all the manual parameters are set up, start the PING test by pressing the NTWRK button twice. Then press the SEL button. Once an active link is found, the value entered for MyIP is checked for conflict. The tester issues an ARP request directed to its proposed MyIP address. A response to the ARP tells the tester that

some other device on the LAN is already using that IP address, and it reports “My IP in use on this network.”

The LAN Solution Network Tester will not continue the PING test because using another device’s IP address is not permissible on a LAN. The tester will restart from this state automatically after one minute, but the value entered for MyIP must be manually changed to try a different IP address to prevent conflict.

PING State

Once MyIP has been verified as available (in either DHCP On or Off modes), the next step is to enter the active PING conversation state. The tester LCD displays the PING Status screen, “Tg1–4” (unless disabled), “Rtr,” and “DNS” (if DHCP On) acronyms on the top line of the LCD. Directly under the associated acronym, the status of each PING conversation appears.

To select any of the conversations, use the left/right arrow buttons to move the cursor that’s on the top line of the LCD. Press the SEL button for more detail about that conversation. Pressing SEL once will display the value of MyIP currently in use. Pressing SEL twice (or a delay of three seconds) will drop into the second page of

Status. Pressing SEL three times (or after 10 seconds) will drop into a third page of Status (if available) or return to the main PING display. If the third page is displayed, pressing SEL once more (or another 10 seconds) will return to the main PING display.

The first step in establishing the conversations is trying locate the router on the LAN segment. The LAN Solution Network Tester does this using the Address Resolution Protocol (ARP).

The tester sends out an ARP packet directed to the router and needs a response from the router (informing the tester of the router's MAC address). During this phase, "ARP" will flash under the "Rtr" acronym. If no response to the ARP request is received, the tester will repeat the request at varying intervals (1–3 seconds). No response to ARP can mean that the IP address assigned to the router is not correct, the router is non-functional, or that it is not accessible on the LAN because of some other problem. If you select the Rtr conversation and press the SEL button, the status displayed is "No ARP response."

Once the router MAC address is found, the LAN Solution Network Tester begins sending ICMP echo request (PING) packets to the router. The status displayed under the Rtr acronym changes to **◆|◆** with the **◆** symbol bouncing back and forth across the net (**|**). Each time the tester sends a PING request, the **◆** is shown on the left side of the net. Each time a response is received, the **◆** bounces to the other side. If no **◆** appears on the right while it is blinking on the left, it means that the tester is sending but the router is not answering.

Selecting the Rtr acronym and pressing SEL twice will show the present IP address for the router on the top line and the count of the X (transmit) and R (receive) packets. If no PING response has been received, the status is “No PING Response.” Missing Receive packets can mean that the LAN or the router is busy, or that there is some other problem on the LAN. Pressing the SEL button again will drop down to the third Status screen, which shows the time between the transmission of the last received PING packet and its reception time on the top line of the LCD, and the average time between transmission and reception of all PING packets to the router in this conversation on the bottom line.

The target IP address can be either on the LAN segment or remote. If the target is on the LAN, the status of the LAN Solution Network Tester will be as described for the router above. In the off local segment case, where the PING packets need to be sent to the router to be forwarded, there is an additional step necessary and status displayed. When the router is required for target conversation, the status shown for the target is “—” while the tester is attempting to contact the router. The detailed status for the target is “No Rtr response.” When the target is remote and an ARP response has been received from the router, the target PING packets are sent to the router. The router, in turn, is expected to forward them on to the target. If no response is returned from the target, possible causes are the target cannot be reached due to network problems, the target is not responsive, or that the device that is active at the IP address selected for the router is not a router and is not forwarding the packets.

The DNS conversation is only active when the PING test is run in the DHCP On mode because the DNS IP address is only available from the DHCP server.

NOTE

If the DNS server IP address is known, you can enter it as a target and PING it like any other target.

The DNS server can be local or remote (like a target). The DNS conversation status is similar to a target conversation status. In most small LAN configurations, the DNS server will be a remote device, and successful PINGing to it will verify proper LAN operation and Internet connectivity.

The tester will shut off automatically about 15 minutes after the last button press. You can also terminate the test by pressing the CABLE, NTRK, or PWR buttons. In any of these cases, the LAN Solution Network Tester will issue a DHCP release request to the DHCP server when in DHCP On mode. This is preferable to simply disconnecting the cable to terminate the test because the address assigned to the tester will not be available for assignment to another device.

4.3.3 VALIDATE LINK

This mode allows two LAN Solution Network Testers to be connected directly to each other on a cable with no other equipment required. No special configuration of the testers is required other than to put them into the test modes as described. This allows a cable run to be verified after installation.

One tester is put into Validate Link mode (Validator), while the other one is put into PING test with DHCP Off (PING Generator). The Validator will be locked in NIC mode, generating link pulses that the PING Generator can receive to allow it to take on the hub cable configuration.

Once the PING Generator detects the Link pulses, it will go into the active PING state and start generating ARP packets, attempting to connect to both the manually configured target and router IP addresses. The Validator will then assume that IP address and respond to the ARP. The PING Generator then starts to PING the IP address that the Validator has responded to. The Validator responds to the PING, but it modifies the packet instead of merely copying it so that the PING Generator can recognize when it is communicating with a Validator. When the PING Generator recognizes the Validator's response, it will change its PING status acronym display to "Val" and terminate the PING conversation to the other IP address it is configured for. Once this negotiation is complete, the Validator will show a count of PINGs received, and the PING Generator will display the normal PING status screens for monitoring the progress of the test.

5. Setup Mode

Use the Setup mode to set user-selectable options and present information that's helpful to the user. Enter Setup mode by pressing the center of the CABLE/NTWRK buttons (labeled "SETUP"), which activates both buttons simultaneously. The estimated battery life remaining is displayed briefly when entering Setup mode. Scroll through the main menu by using the up/down arrow buttons. There are several sub-menus that are accessed by pressing the SEL button when the sub-menu title is displayed. These are discussed in **Sections 5.1 through 5.6.**

5.1 Target Setup

In the PING protocol, an IP address must be selected to receive an echo request. This address is the "target" address for that PING. While using the LAN Solution Network Tester, you must select a target manually in Setup mode. This target can be on the LAN, or anywhere else accessible through a router connected to the LAN. If the target is not on the LAN, the router IP address must be known so that the PING can be sent to the router, which forwards it to the ultimate location.

Target Setup is the sub-menu title screen used when selecting and configuring IP addresses for the four available target IP address storage locations. For the PING test mode, only one target can be active at a time. Pressing the SEL button moves the LAN Solution Network Tester into the target selection screen. The up/down arrow buttons scroll through the five available options. You can select one of the four stored target addresses or disable the target PING. To exit this sub-menu, press SEL (this takes the tester back to the sub-menu title screen), or press CABLE or NTWRK (to enter a test mode). Exiting this menu will leave the displayed target as the active one.

When one of the four targets is displayed on the screen, press the SEL button to drop into the edit IP address screen for that target. Edit the IP address by moving the cursor left and right (use the left/right arrow buttons) and then change the digit above the cursor (use the up/down arrow buttons).

NOTE

The IP address is displayed in the typical decimal dot format.

Each of the four decimal numbers (values between 0–255) separated by periods represents one hexadecimal byte of the four-byte IP address. Each digit in the decimal number can only be set to a value valid for that position. Thus, the high-order (leftmost) digit in any of the decimal numbers can be set to 0, 1, or 2. In addition, each digit can only be set to a valid value in relation to the low-order digits in that number. The high-order digit can only be set to 2 if the low-order digits are less than 55. You may have to enter the desired IP address from right to left to allow the low-order digits to be set before the high-order digit. Any IP addresses can be entered for a target, either on or off the LAN segment; even “reserved” IP addresses can be entered. To exit this sub-menu, press SEL (this takes the tester back to the sub-menu title screen), or press CABLE or NTWRK to enter a test mode. Exiting this menu will leave the displayed target as the active one.

5.2 PING Setup

This is the sub-menu title screen for configuring the IP address configuration for the DHCP Off (Manual) PING test mode. The settings of these values interact with each other to force the router IP address to be accessible on

the same LAN segment as the LAN Solution Network Tester. A off-LAN router cannot be addressed by the tester, and therefore is not a useful setup option. Pressing the SEL button drops the tester into the manual IP configuration screens. The up/down arrow buttons scroll through the options in this sub-menu. To exit this sub-menu, scroll to the “Sel to go to Main Menu” screen and press SEL, or press CABLE or NTRWK to exit to a test mode.

When one of the option screens is displayed, pressing the SEL button drops the tester into the edit IP address screen for that option.

NOTE

The tester's IP address, MyIP, can only be set to non-reserved IP addresses. This is any address other than 0.0.0.0 or 224-255.x.x.x

MyIP is edited in a similar fashion to the target IP addresses described on the previous pages. The router IP address is also edited in a similar fashion to the target's IP address. In addition, the router IP address is forced to be on the same LAN segment as MyIP. This means that the Netmask, whose bits define the LAN segment, is compared with MyIP, and the bits that must be common between MyIP and the router IP are forced

to the correct state. The check of the router's address is done whenever MyIP, the router IP, or the Netmask are edited.

The Netmask is a special set of numbers that are similar to an IP address. It must be a string of 1s, from the highest order bit down, defining the bits that must match between MyIP and any devices it tries to access on the LAN segment. If the IP address bits match, the device is on the LAN segment and can be addressed directly. If they do not match, the tester must redirect its IP packet to the router for forwarding. Editing the Netmask is limited to setting valid bit combinations that allow for LAN segments with 5 to 253 possible devices.

5.3 Last DHCP

This sub-menu allows you to view the results of the most recent DHCP negotiation between the LAN Solution Network Tester and a DHCP server. The values displayed cannot be modified, only viewed to determine the configuration of the LAN segment under test. Pressing the SEL button drops the tester into the DHCP display screens. The up/down arrow or SEL buttons scroll through the screens in this sub-menu. To view the information obtained for each item in the sub-menu, press the SEL button.

Any 000.000.000.000 entries mean that the last DHCP server did not provide the requested information. If all entries are 000.000.000.000, the most likely cause is that DHCP On mode was selected, but the LAN did not provide a DHCP server.

To exit this sub-menu, scroll to the “Sel to go to Main Menu” screen and press SEL, or press CABLE or NTRWK to exit to a test mode.

5.4 DHCP On/Off

This is a simple on/off selection made using the SEL button. The last displayed state is the selected state. DHCP is a protocol negotiation used to automatically configure the IP parameters of the LAN Solution Network Tester on a specific LAN segment. With DHCP On, the next time the PING test is started, the tester will request the IP parameters it needs for LAN communication from a DHCP server on that LAN segment. If a response from a server is received, the tester will configure itself with the acquired parameters and start to PING.

NOTE

The only IP parameter not received from the host is the target IP address, which is always manually entered.

If no response is received from the server, the tester cannot do any PINGing on that LAN. In that case, you must manually enter the PING setup and select the DHCP Off state. The next PING test will then attempt to communicate with the manually entered parameters. When used as a source for PINGs to another LAN Solution Network Tester in the Validator mode, the PING Generator LAN Solution Network Tester must be in DHCP Off (manual) mode.

5.5 MAC Add

This is a display of the factory-set Media Access Control number for the specific LAN Solution Network Tester. All Ethernet-interfaced devices must have a universally unique identifier to be used as their address.

5.6 Units—Feet/Meters

This is a simple selection made with the SEL button to choose whether the tester displays the measured cable length in feet or meters. The length constant is converted to the new units.

6. Status and Error Messages for Network Test Modes

ARP Received—In Validate Link mode, this status shows that the tester has detected another active LAN Solution Network Tester trying to start a PING conversation. This status flashes for a few seconds while the testers negotiate an IP address they can use to PING each other.

DHCP Request—In the PING test with DHCP On, the LAN Solution Network Tester displays this message on the first line while it is trying to get the required information from a DHCP server. The second line displays:

Attempt: Count of DHCP requests sent out. If this number continues to grow, no response is being received.

Successful: Shows for a short time after the server responds to the request.

Find Active Link—The tester is searching for incoming Link pulses while waiting to start an active test. Flash Link LED and PING test modes need to be connected to an active network in order to run. In these modes, this status is displayed while the tester is searching both the 1–2 and 3–6 pairs for incoming Ethernet Link pulses. In the Validate Link mode, the LAN Solution Network Tester assumes an active NIC configuration, generating Link pulses on the 1–2 pair. This allows another tester to be connected directly to it.

Link Found—Status displayed while searching for Link pulses after an incoming signal has been detected.

Link Not Found—Status displayed while searching for Link pulses and nothing has been detected.

Link Word Err—The Link word (captured by the LAN Solution Network Tester during the Jack ID test from an attached 100-Mbps Ethernet device) decoded an unrecognized value. This may indicate a cable or hardware problem with the connected device.

Lost Link—A test was active after finding incoming Link pulses, but they stopped being received. The cable might be disconnected or the connected device might be shut off.

NIC Init Err—The Ethernet interface chip used in the LAN Solution Network Tester reported a problem to the CPU during internal initialization. This may be caused by a hardware problem inside the tester.

NIC Rx Overrun—The Ethernet interface chip used in the LAN Solution Network Tester provides internal buffering for multiple packets. If new packets are received faster than they can be processed, the Ethernet chip discards the new packets and sets the Overrun error flag. The tester detects and reports this error. This may be caused by excessive broadcast traffic on the LAN, or by externally generated packets addressed to the tester's IP address.

NIC Tx Timeout—The Ethernet interface chip used in the LAN Solution Network Tester was not able to transmit a packet within the time allowed. This may be caused by a hardware problem inside the tester, a problem with the attached cable, hardware problems with the connected device, excessive LAN traffic, or collisions on the LAN.

No IP Address—The DHCP server responded to the tester DHCP request but did not provide an IP address for MyIP.

Packet Rcv Err—An Ethernet packet was received by the LAN Solution Network Tester with errors in the header or packet data. This may be caused by excessive signal noise on the Ethernet cable or a hardware problem with the device transmitting to the tester.

PING Test Detailed Status Messages—These messages may be displayed when the SEL button is used to access the status details during active PINGing.

IP Add—DNS Add: The active target IP address is the same as the DNS Server IP address, so the target PING is automatically disabled.

IP Add—Rtr Add: The active target IP address is the same as the router IP address, so the target PING is automatically disabled.

No ARP Response: The IP address active for this conversation is being ARPed but is not responding. The IP address may be unused, or the device may be powered off or not connected.

No PING Response: The IP address active for this conversation is not responding to PING requests. If the addressed device is on the LAN segment, it may be powered off or not connected. If the addressed device is remote, it may be inaccessible because of WAN problems, it may be powered off, or the device at the router IP address may not be forwarding the PING packets.

No router IP: The DHCP server did not provide an IP address for the router.

No Rtr Response: The IP address is off the LAN, requiring the PING to go through the router, but the router IP address is not responding to ARP.

Rtr must be on MyIP LAN segment—This is displayed in Setup while setting the Manual router IP address. The LAN Solution Network Tester requires that the router be at an IP address on the LAN segment as defined by the Netmask and MyIP addresses. Setup will not allow the router IP address to be set to an off-LAN address.

Voltage Found, SEL Jack ID—The tester does not operate in Network modes when voltage, and possibly destructive power, is found. Voltages found will terminate the test in progress and the only option is to run the Jack ID test (by pressing SEL). The only exception to this is the possibility of an Ethernet power source providing power between the 1–2 and 3–6 pairs. In that case, the following message will be displayed:

Enet Pwr source found = xV—Some devices provide power for IP phones or wireless transceivers on the same wires that carry the Ethernet data signals. They do this by connecting a voltage to the center taps of each transformer in their Ethernet interface. The LAN Solution Network Tester reports this and allows the network testing to continue.

7. Interpreting Cable Test Results

The PASS icon will be on if the cable has all pins properly connected per T568A/B (see Figure 7-1). Neither icon will be on if the cable is a crossover (uplink) cable. The FAIL icon will be on if there is any other condition. See Figures 7-1 through 7-5 for examples of wiring errors.

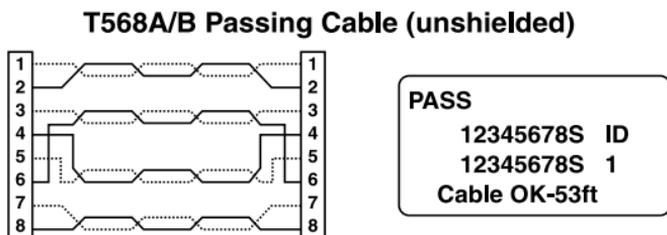


Figure 7-1. T568/A PASS.

DEFINITION OF ERRORS

The four types of faults (listed in order of severity) include opens, shorts, miswires, and split pairs. A more severe error can mask lower severity errors. For example, if there is a short in the cable, miswires and split pairs may not be detected for the pairs involved in the short fault.

Open

A pair with an *open* has an incomplete circuit, or the cable is broken. See Figure 7-2.

If an open is detected while testing with a remote, the FAIL icon will be on. The pin positions where the open is detected will be missing from the second line of pin numbers. While testing without a remote, these types of errors are not detectable.

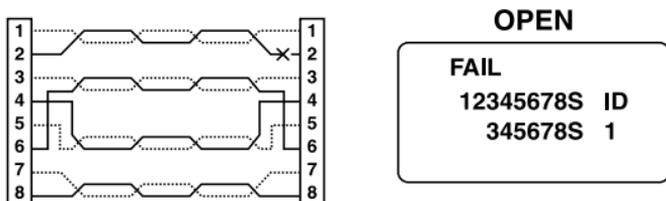


Figure 7-2. Open.

Short

A pair with a *short* has a low-resistance connection from one wire of the pair to the other wire of the pair, to any other wire in the cable or the shield. If a short is detected while testing with a remote, the FAIL icon will be on. Flashing x's will appear in the second line of pin numbers in the appropriate pin position. Also, one or more error message lines listing all the pins shorted together will appear on the LCD. If a short is detected while testing without a remote, only the error messages are displayed. See Figure 7-3.

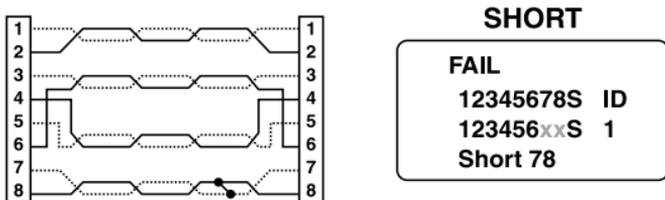


Figure 7-3. Short.

Miswire

A *miswire* exists when a wire or both wires of a pair are not connected to the correct pins at the other end of the cable. If a miswire is detected while testing with a remote, the wire map shows the pin numbers from line 1 (main) to line 2 (remote). A *reverse pair* is a special miswire situation in which the pair is wired to the correct pair of pins or to another designated pair of pins, but the two leads are reversed. While testing without a remote, these types of errors are not detectable. See Figure 7-4.

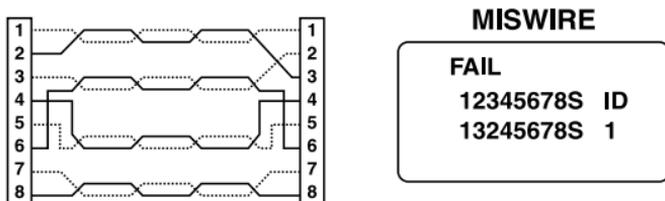


Figure 7-4. Miswire.

Split Pair

A *split pair* is an error in the twisting of the wires within the cable. The cables are generally made up of eight wires twisted together in 4 pairs. These 4 pairs are designated as pairs by the wiring standards and are intended to carry a signal and its return. 1&2, 3&6, 4&5, and 7&8 are the pairs designated by T568A/B for an RJ-45 jack or plug. A cable can be wired with correct continuity but not with correct pairing. This most often happens when the cable is terminated consistently at both ends, but in the wrong order. A dynamic or AC test is required to detect this type of error. *If the only error is a split pair error, the cable has correct continuity. If crosstalk is not a concern, as in flat satin cable, the cable is good.* If a split pair is detected while testing with a remote, the pin numbers on the second line of the wire map with split pairs flash, and an error message lists the pin numbers of the pairs involved in the error. If a split pair is detected while testing without a remote, only the error message is displayed. See Figure 7-5.

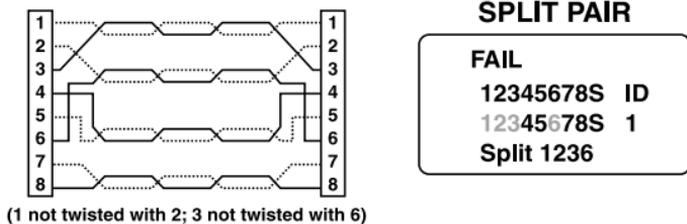


Figure 7-5. Split pair.

8. Maintenance

8.1 Replacing the Battery

When the Battery Low icon is on, replace the battery as soon as possible. The testing results become unreliable when the battery reaches 5.0 volts.

NOTE

When installing a new battery or resetting the processor, disconnect any cables connected to the tester. The Length and Single-Ended test modes will be improperly calibrated if a cable is present when the battery is connected.

To replace the battery:

1. Make sure that the tester is off.
2. To remove the rubber battery cap, press on the edge of the cap with the heel of your hand until the cap pops off.
3. Pull the battery out of the cavity and remove the battery snap.
4. Connect a new alkaline 9-volt battery to the battery snaps within one minute.

NOTE

To preserve the user-set data, the tester must be off and the battery disconnected for no more than one minute.

5. Slide the battery into the cavity and snap the cap in place.

8.2 Resetting the Processor**NOTE**

When resetting the processor, all user data will be lost.

1. Turn on the tester in any mode.
2. Remove the battery cap and disconnect the battery.
3. Wait about 10 seconds and reattach the battery leads. The Length screen will appear briefly, then the tester will shut down.

NOTE

When installing a new battery or resetting the processor, disconnect any cables connected to the tester. The Length and Single-Ended test modes will be improperly calibrated if a cable is present when the battery is connected.

9. Troubleshooting

9.1 Calling Black Box

If you determine that your LAN Solution Network Tester is malfunctioning, do not attempt to alter or repair the unit. It contains no user-serviceable parts. Contact Black Box at 724-746-5500.

Before you do, make a record of the history of the problem. We will be able to provide more efficient and accurate assistance if you have a complete description, including:

- the nature and duration of the problem.
- when the problem occurs.
- the components involved in the problem.
- any particular application that, when used, appears to create the problem or make it worse.

9.2 Shipping and Packaging

If you need to transport or ship your LAN Solution Network Tester:

- Package it carefully. We recommend that you use the original container.
- If you are shipping the LAN Solution Network Tester for repair, make sure you include everything that came in the original package. Before you ship, contact Black Box to get a Return Authorization (RA) number.