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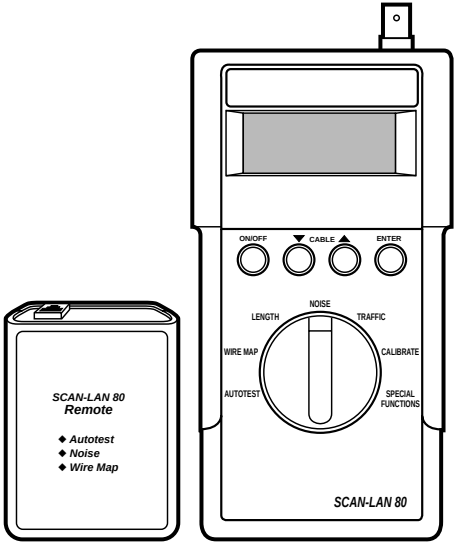
BLACK BOX®
NETWORK SERVICES

SEPTEMBER 1994
TS624A

Scan-LAN 80
Cable Scanner



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CONTENTS

1. Specifications

Cable — Length: 20 to 4000 ft. (6 to 1219 m) coax, 20 to 2000 ft. (6 to 610 m) UTP; Accuracy: ±2 ft. @ 20 to 200 ft. (±0.61 m @ 6 to 61 m), ±1% @ 201 to 4000 ft. (±1% @ 201 to 4000 ft. (±1% @ 61.2 to 1219 m); Resolution: 2 ft. (0.61 m)

Cable Faults — Types: Shorts, opens, 2 intermediate impedance anomalies; Fault reflections threshold: 4% default, 4 to 10% user-selectable

Calibrate cable NVP — 0.50 to 0.99 c, 50 ft. (15.2 m), minimum length

Idle Channel Impulse Noise — Any impulse received within 1 µsec of the first impulse is ignored; User-Selectable: 100 to 500 mV peak; Default: 260 mV peak

Input

Protection — Withstands continuous 56 VDC applied through 400 ohms (telco loop); withstands 175V peak, 20 to 60 Hz through 100 ohms superimposed on 56 VDC for 100 milliseconds (telco ringing)

Nonvolatile

CMOS memory — Current setup parameters and cable NVP values are saved; lithium battery backup

Near-End Crosstalk

(NEXT) — Frequency Range: 5 to 10 Hz sweep in 100 KHz steps, 10 to 16 MHz sweep in 200 KHz steps; Measurement Range: 0 to 40 dB; Accuracy: ±3 dB

Traffic

Monitoring — Ethernet only; Parameters monitored: % Utilization, % Collisions, Peak traffic, Reverse Polarity (10BASE-T only), Link Pulse Detect

	(10BASE-T only), Jabber detect; Other features: Link Pulse Generation to activate hub (10BASE-T only), bar-graph activity indicator
Termination —	Coax only; Range: 40 to 120Ω; Accuracy: ±10Ω
Loopback Attenuation —	Twisted pair only; Frequency Range: 5 to 10 MHz sweep in 100 KHz steps, 10 to 16 MHz sweep in 200 KHz steps; Measurement Range: 0 to 40 dB (0 to 20 dB one way); Accuracy: ±3 dB
Impedance —	Range: 40 to 120Ω (coax), 75 to 180Ω (twisted pair); Accuracy: ±10Ω
Connectors —	RJ-45 and BNC
User Controls —	(5): ON/OFF, Scroll up, Scroll down, Enter, Function Select (7-position rotary switch)
Humidity —	10 to 75%, noncondensing

Storage and Operating Temperature — 32° to 104°F (0° to 40°C)

Indicators — (1) 4-line LCD display with 16 characters per line

Power — Main unit: (2) 9-volt alkaline batteries; Remote unit: (1) 9-volt alkaline battery

Size — Main unit: 1.7"H x 4"W x 7.6"D (4.3 x 10.2 x 19.3 cm); Remote unit: 1.3"H x 2.9"W x 3.8"D (3.3 x 7.7 x 9.7 cm)

Weight — Main unit: 1.1 lb. (0.5 kg); Remote unit: < 0.3 lb. (< 0.1 kg)

2. Introduction

2.1 The Scan-LAN 80 Cable Scanner

The Scan-LAN 80 is an easy-to-use, affordable, battery powered, handheld tester for maintaining and troubleshooting coax and twisted-pair LAN cable installations.

Through Autotest, the Scan-LAN 80 measures critical performance characteristics of LAN cable installations, compares the results against IEEE LAN specifications, and gives a PASS/FAIL indication.

Live network performance may also be monitored and analyzed for Ethernet networks.

Your Scan-LAN 80 should come with the following accessories: an RJ-45 Remote Unit, a 24-inch (61-cm) RJ-45 male to RJ-45 male Category 5 patch cable, and this user's manual. Please contact your supplier if any of these components are missing.

2.2 Features

- *Cable length*—The length of the cable is measured and up to two fault anomalies are displayed, using time-domain reflectometry (TDR).
- *NEXT (Near-end crosstalk)*—NEXT is measured between 5 and 16 MHz on twisted-pair networks.
- *Attenuation*—The cable attenuation is measured between 5 and 16 MHz on twisted-pair networks.
- *Wire Map*—Tests that the UTP cable is wired correctly for the selected network.
- *Traffic Monitoring*—The Scan-LAN 80 continuously displays the percentage of network utilization along with a bar-graph display of network activity.

2.3 Controls

The Scan-LAN 80 is operated with a rotary function selector and four pushbutton switches. See Figure 2-1.

The **Rotary Function Selector** selects the operating mode (Autotest, Wire Map, Length, Noise, Traffic, Calibrate, or Special Functions).

The **ON/OFF Button** turns the power on or off. When no activity has been detected for five minutes, the Scan-LAN 80 will automatically power down to conserve battery power.

The **▼▲ Buttons** select the cable type from a list of preset and user-defined types. The buttons are also used to scroll through a list of selections.

The **ENTER Button** initiates tests. It also can confirm choices.

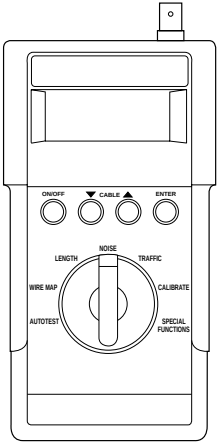


Figure 2-1. The Scan-LAN 80.

2.4 Connectors

The Scan-LAN 80 has two connectors: BNC and RJ-45. BNC is a shielded connector for coax cable, and RJ-45 is a standard 8-pin modular jack for twisted-pair cable. See the figure below.

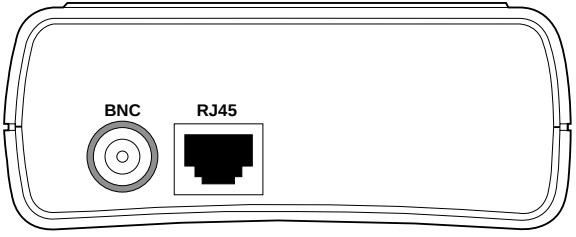


Figure 2-2. BNC and RJ-45 Connectors.

2.5 The Remote Unit

The Scan-LAN 80 Remote Unit is connected at the far end of the cable when using Autotest to test twisted-pair cable. The Remote Unit, when used with the Scan-LAN 80, permits NEXT and attenuation measurements and allows connector wiring to be mapped. Power is supplied by a single 9-volt battery.

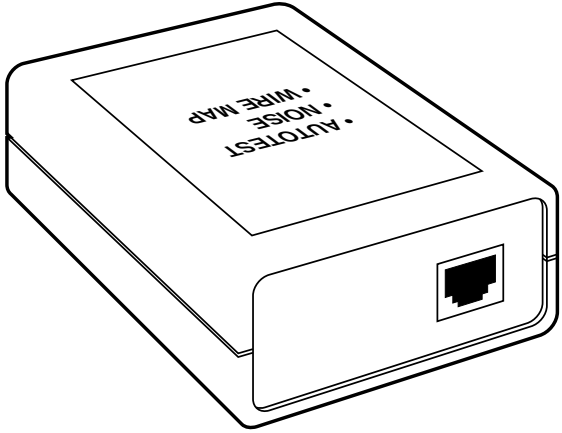


Figure 2-3. The Scan-LAN 80 Remote Unit.

3. Cable Tests

3.1 Autotest

The Autotest function will be the mode used most frequently when testing LAN cabling. Included with Autotest are all the necessary measurements to test the cable type you have selected. Simply select Autotest mode, set the cable type, and plug in the cable to be tested. Any problems encountered will be reported on the Scan-LAN 80's display.

NOTE

The accuracy of cable-length measurements depends upon the NVP value entered for the selected cable type. Although the preset values will give reasonably accurate readings in most cases, the NVP of your cable can be measured to achieve maximum accuracy. See Chapter 5.

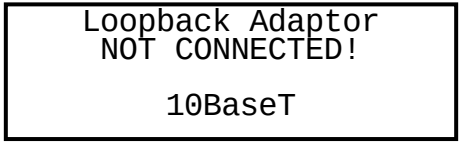
3.1.1 Cable Type Selection

The correct cable type must be selected before performing any tests.

The Scan-LAN 80 is programmed with six preset cable types. See **Appendix A** for more information.

3.1.2 Testing Twisted-Pair Cables

Set the rotary function selector to AUTOTEST. The following display will appear. The currently selected cable type is listed in the bottom line of the display.



Press the ▼ or ▲ button until the desired cable type is displayed.

Plug one end of the cable to be tested into the RJ-45 connector of the Scan-LAN 80.

Plug the other end of the cable into the Remote Unit.

Make sure that no cable is plugged into the BNC connector.

To test a cable that is wired to jacks, use the RJ-45 patch cables between the jacks and the Scan-LAN 80 and/or Remote Unit.

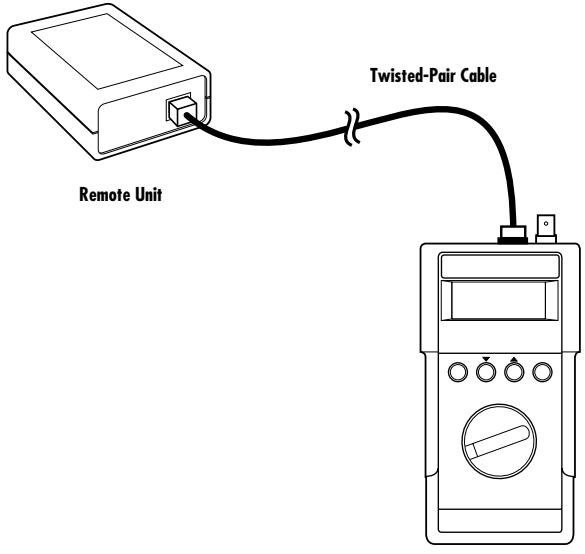
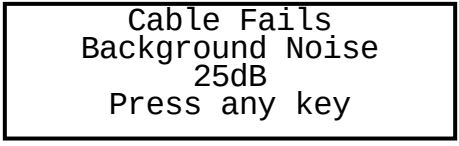


Figure 3-1. Cable Testing.

During Autotest, the Scan-LAN 80 will execute these tests: Background Noise, Wire Map, Length and Anomalies, NEXT, Attenuation, and Characteristic Impedance. Each test is described on the following pages.

Noise

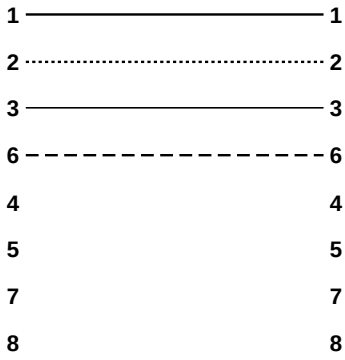
The Noise test determines if background noise is present on the cable. A display of the test results, like the one below, will appear only if the test fails.



Wire Map

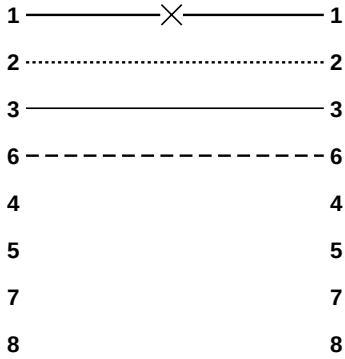
This test verifies a correct wiring of all four pairs in a twisted-pair cable. Any shorts, opens, miswired pairs, crossed pairs, shorted pairs, split pairs (during NEXT), or reverse polarity will be displayed. The next six screens are examples of Wire Map displays.

```
1,2 Straight Thru
3,6 Straight Thru
    4,5 Open
    7,8 Open
```



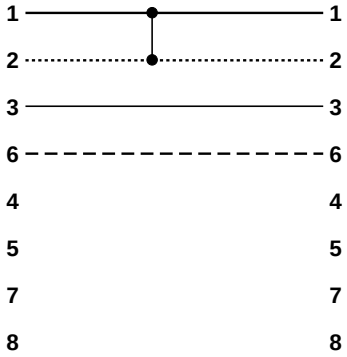
Wiring

```
1,2 Open
3,6 Straight Thru
4,5 Open
7,8 Open
```



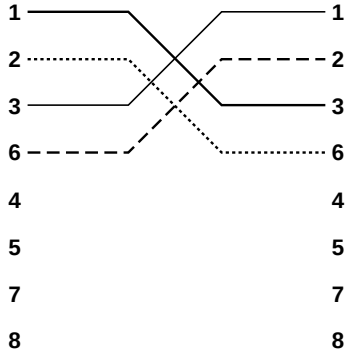
Wiring

```
1,2 Shorted
3,6 Straight Thru
4,5 Open
7,8 Open
```



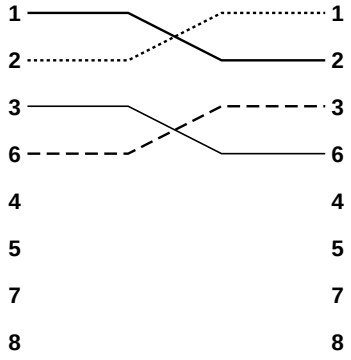
Wiring

```
1,2 Cross to 3,6
3,6 Cross to 1,2
    4,5 Open
    7,8 Open
```



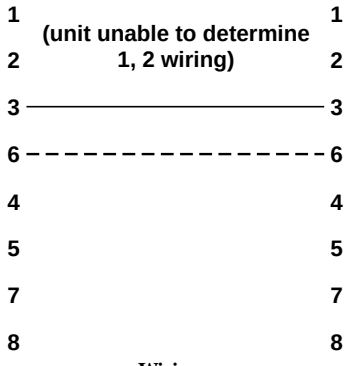
Wiring

```
1,2 Reversed
3,6 Reversed
  4,5 Open
  7,8 Open
```



Wiring

```
1,2 ?????
3,6 Straight Thru
4,5 Open
7,8 Open
```



Wiring

The Scan-LAN 80 verifies that the transmit and receive pairs for the selected LAN environment are present. Listed below are the transmit and receive pairs for Ethernet and Token Ring.

Ethernet: 1,2 and 3,6

Token Ring: 3,6 and 4,5

If the wiring is incorrect for the selected LAN environment, this screen will appear:

```
FAILS WIRE MAP
Unit cannot
measure SNR
Press any key
```

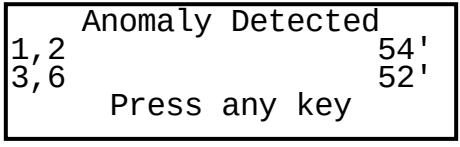
This display means that because of faulty wiring, the Scan-LAN 80 cannot measure Signal to Noise Ratio, Near-End Crosstalk, or Attenuation. Length and characteristic impedance will be measured. Press any key to continue with Autotest.

Length

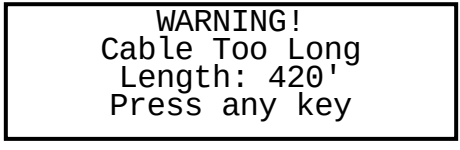
The length of each pair, including the distance to any anomalies, is measured using the NVP setting for the selected cable type.

```
TDR Scanning
NVP: 78.0%
STANDBY...
```

If any anomalies are found, the anomalies and the cable length will be alternately flashed on the display. Anomalies are reflections from impedance mismatches located between the Scan-LAN 80 and the end of the cable. They can be caused by a faulty punchdown-block connection (twisted-pair networks) or badly crimped cables (coax networks).

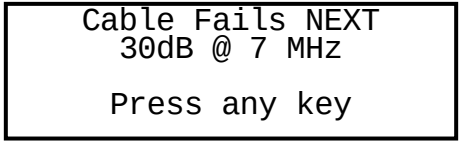


The display below will appear if the cable length exceeds the specified limit.

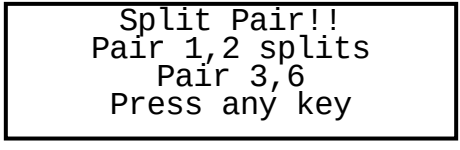


Near-end crosstalk (NEXT)

This test measures crosstalk between pairs from 5 to 16 MHz. If excessive crosstalk is detected between any pairs in the cable, the following screen appears.



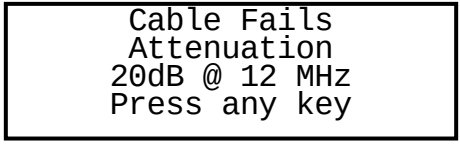
If the Scan-LAN 80 measures crosstalk indicative of a split pair in the cable, the following screen appears.



Attenuation

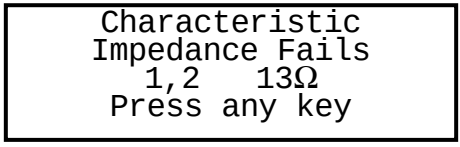
Signal loss over the length of the cable is measured between 5 and 16 MHz. The highest attenuation (greatest loss) over the frequency range will be displayed. Attenuation is measured in a loopback mode between the transmit and receive pairs, but is displayed as end-to-end loss.

If excessive attenuation is measured, the following screen appears.



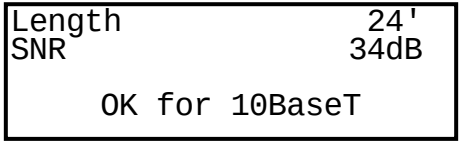
Characteristic Impedance

Approximate characteristic impedance of the cable is measured. If the tests fails, the screen at the top of the next page will appear.



Test Results

After the Scan-LAN 80 has completed its cable tests, the unit displays a final screen containing important measurements for twisted-pair cables.



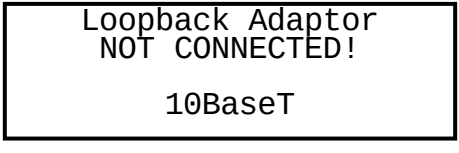
Cable Length is displayed in either feet or meters on the top line of the display. If the length fails to meet IEEE specifications, the length display will blink. The units of length may be changed with the Special Setup function. See **Chapter 6**.

The **SNR (Signal-to-Noise Ratio)** measurement is displayed in dB units. A larger number is better, indicating lower noise. A flashing SNR reading indicates a failing Signal-to-Noise Ratio. If the Scan-LAN 80 was unable to measure NEXT and attenuation because of a faulty wire map, SNR will be displayed as "N/A."

The bottom line of the display indicates whether the cable will work in the selected LAN environment.

3.1.3 Testing Coax Cables

Set the rotary function selector to AUTOTEST. The following display will appear. The currently selected cable type will be shown in the bottom line of the display.



Press the ▼ or ▲ button until the desired cable type is displayed.

Attach one end of the cable to the BNC connector on the Scan-LAN 80. Do not locate the Scan-LAN 80 in the middle of the cable.

Attach a terminator of the correct value for the cable type to the other end of the cable.

Make sure that no cable is plugged into the RJ-45 connector.

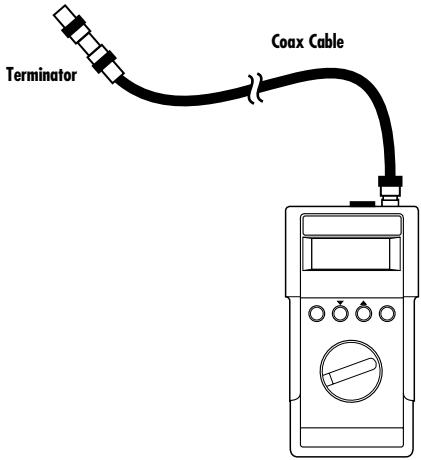


Figure 3-2. The Scan-LAN 80 with Attached Terminator.

The Scan-LAN 80 performs the following tests during Autotest of coaxial cables: Background Noise, Characteristic Impedance, Termination Resistance, and Length and Anomalies. Each test is described on the following pages.

Background Noise

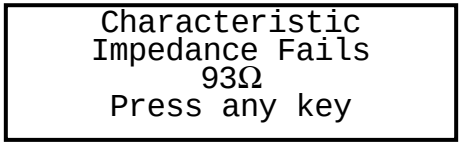
The Noise test is performed first to determine if background noise is present on the cable. If there is too much noise, the following display will appear.

```
Cable Fails
Background Noise

Press any key
```

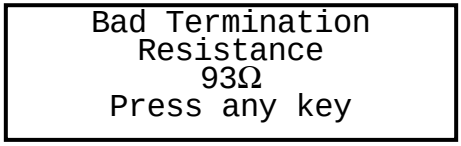
Characteristic Impedance

The characteristic impedance of the cable is measured. If the impedance exceeds specified limits set by the user or by factory default the screen at the top of the next page appears.



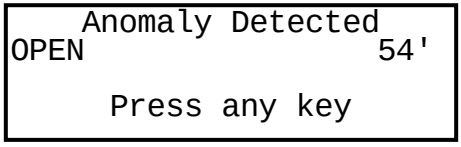
Termination Resistance

Termination resistance at the end of the cable is measured. The display below will appear if the termination resistance exceeds specified limits.



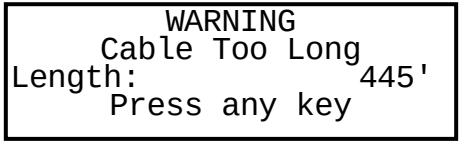
Length and Anomalies

The distance to opens, shorts, or anomalies is located. If an anomaly is located on the cable, the display will look like this:



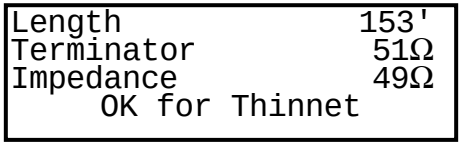
The display will alternate between the anomaly and the cable length. Anomalies could be caused by cable stubs, damaged cables, or cable type mismatches.

If the cable length exceeds the specified limit for the type of cable selected, the following display will appear.



Test Results

At the conclusion of the Autotest, the Scan-LAN 80 will display the following important measurements for coaxial cables.



Cable Length is displayed in either feet or meters on the top line of the display. If the length fails to meet IEEE specifications, the length display will blink.

The units of length may be changed with the Special Setup function. See **Chapter 6**.

No Reflections will be displayed on the top line if the cable is terminated properly and no cable anomalies are present.

Terminator value in ohms is displayed. A flashing "Terminator" indicates a bad terminator. If the termination resistance is outside the range of the Scan-LAN 80, "OPEN" will be displayed.

Impedance value in ohms is displayed. A flashing impedance value indicates a characteristic impedance value that does not meet specifications for the selected cable type. If the measured impedance is outside the range of the Scan-LAN 80, "OPEN" will be displayed.

Checking Multiple Cables

The Scan-LAN 80 senses when a change occurs in the cable connection and restarts the test. Use this feature to easily test many cables—just plug in the new cable, and the test results will appear in several seconds.

When no activity has been detected for five minutes, the Scan-LAN 80 will automatically power down.

3.2 Individual Cable Tests

Wiring, Cable Length, and Noise can each be tested separately by the Scan-LAN 80. The individual tests run faster than the full Autotest function. These functions are especially useful when you need to check only wiring or cable length for a number of cables.

3.2.1 Wire Map (Twisted-Pair Cables Only)

Set the rotary function selector to Wire Map.

Press the ▼ or ▲ button until the desired cable type is displayed.

Connect the cable to the RJ-45 connector on the Scan-LAN 80.

Plug the other end of the cable into the Remote Unit.

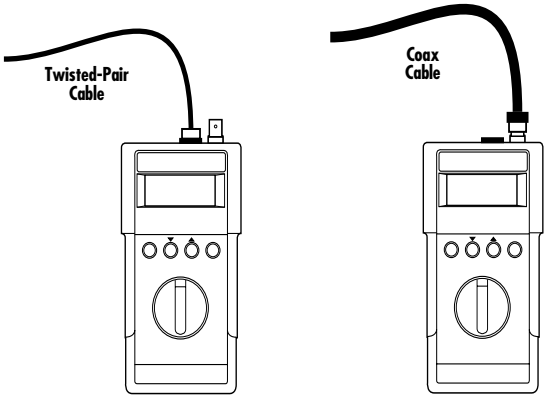
Test results will be shown in the display, with the location of any wiring errors noted (refer to **Section 3.1**). The Scan-LAN 80 will rerun the Wire Map test and update the display every two seconds.

3.2.2 LENGTH TEST

NOTE

The accuracy of cable-length measurements depends upon the NVP value entered for the selected cable type. Although the preset values will give reasonably accurate readings in most cases, the NVP of your cable can be measured to achieve maximum accuracy. See Chapter 5.

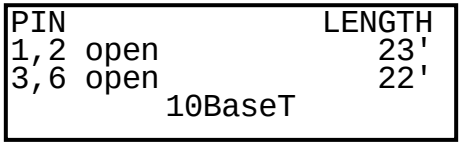
Connect the cable to the appropriate connector on the Scan-LAN 80.



Set the rotary function selector to LENGTH.

Press the ▼ or ▲ button until the desired cable type is displayed.

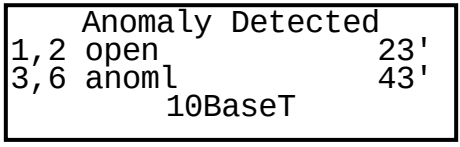
Make sure that any terminators are disconnected when testing coax cable. The Remote Unit is not required for testing length of twisted-pair cable. At the completion of the Length measurement, the length of the cable will be displayed.



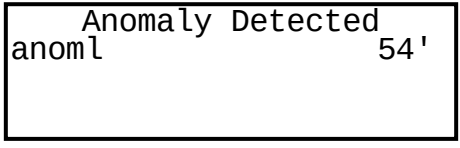
(Twisted Pair)

(Coax)

Any anomalies found will be flashed on the display. Anomalies are reflections from impedance mismatches located between the Scan-LAN 80 and the end of the cable. They can be caused by a faulty punchdown-block connection (twisted-pair networks) or badly crimped cables (coax networks).



(Twisted Pair)



(Coax)

3.2.3 Noise Test

This test counts noise impulses (spikes) above a preset minimum threshold on an idle cable segment. The default noise-threshold setting is 260 mV; refer to **Chapter 6** if you want to change this value.

Connect the cable to the appropriate connector on the Scan-LAN 80. The cable should not be connected to an active network; the test will record network traffic as noise impulses.

For most accurate measurements, the cable should be properly terminated. If testing twisted-pair cable, plug the far end of the cable into the Remote Unit. For coax cable, connect a terminator to the far end of the cable.

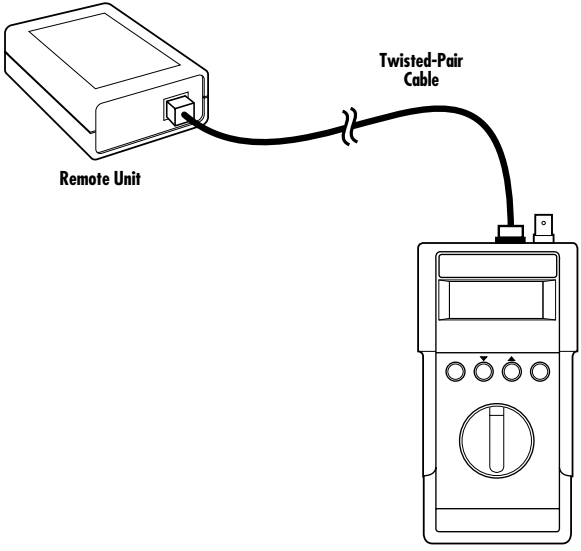
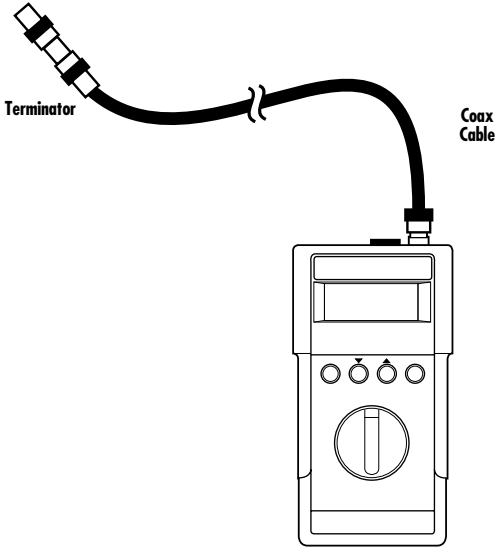


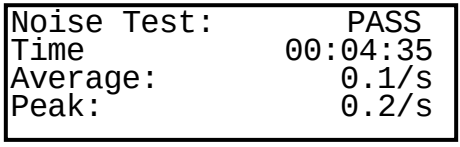
Figure 3-3. Testing Twisted-Pair Cable.



Set the rotary function selector to NOISE.

Press the ▼ or ▲ button until the desired cable type is displayed.

After 10 seconds, the display will give a PASS or FAIL result for the test.



Time shows the elapsed test time.

Average shows the average noise impulses per second.

PK (Peak) shows the worst-case 1-second average noise.

NOTE

For 10BASE-T cable, the maximum allowable impulse noise rate is 0.2/s with a 260-mV noise threshold.

4. Traffic Measurement

Live network-traffic monitoring on 10BASE-T or coax Ethernet networks can be performed by the Scan-LAN 80. Percentage of network utilization, peak traffic, and collisions are continuously shown in the display, along with a bar-graph display of network activity. The unit also provides audio feedback of network activity.

NOTE

The traffic test runs continuously. The Scan-LAN 80 will automatically power down after 5 minutes.

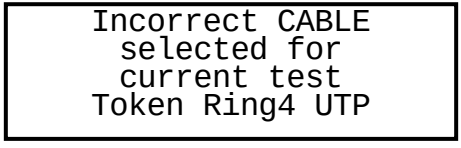
For 10BASE-T networks, the Scan-LAN 80 automatically generates link pulses to activate the hub and reports whenever a link with the hub is lost.

To perform a traffic test, do the following.

1. Set the rotary function selector to TRAFFIC.

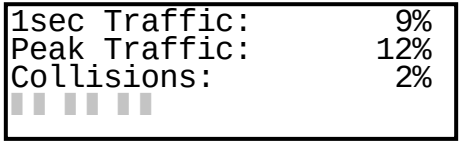
2. Attach the network cable to the appropriate connector on the Scan-LAN 80.
3. If the presently selected cable type is Token Ring

4 UTP, Token Ring 16 UTP, or Token Ring STP (non-Ethernet), the Scan-LAN 80 will display the following message:



4. If the correct cable type hasn't been previously selected, press the ▲ or ▼ button until the correct cable type is shown at the bottom of the display, then press the ENTER button.

5. The following message is displayed during the Traffic test.



Whenever there is traffic detected, an audible tone is generated. The higher the pitch, the more traffic on the network. The tone may be disabled using Custom Setup.

The display will show a continuous reading of traffic conditions on the network. Listed below are explanations of the information that will appear in the display window.

1sec Traffic shows the average network utilization over the last second and gives an indication of current traffic levels.

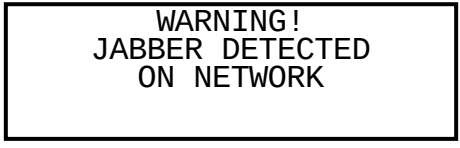
Peak Traffic is the highest one-second average traffic over the duration of the test.

Collisions shows the current collision rate over the last second, expressed as a percentage of total packets transmitted. Collisions are counted when runt packets (shorter than a valid minimum packet length) are detected.

The **Bar Graph** displays the instantaneous traffic level, scaled from 0 on the left side of the display to 60% on the right side.

For 10BASE-T networks, the bottom line will display "No link pulse" whenever link to the hub is lost, and will display "Wrong polarity" when reverse-polarity link pulses are detected.

If packets are detected which are longer than 20 ms, this display will remain until the problem is resolved.



6. Select another test or turn the unit off when you want to stop the traffic test. The unit will automatically power down after five minutes.

NOTE

Network throughput may be impaired when traffic levels exceed 25-28%. Collision rates exceeding 3% indicate possible network problems.

5. Cable Calibration

Any of the six supported cable types may be calibrated for a specific cable spool. The Calibrate Cable function lets you measure the NVP of a known length of cable and save it for additional measurements.

NOTE

The accuracy of cable-length measurements depends upon the NVP value entered for the selected cable type. Although the preset values will give reasonably accurate readings in most cases, the NVP of your cable can be measured to achieve maximum accuracy.

Connect an unterminated sample cable of known length to the appropriate connector on the Scan-LAN 80. The cable must be at least 50 feet (15.2 m) in length to get an accurate measurement. Longer lengths improve accuracy. See Figure 5-1.

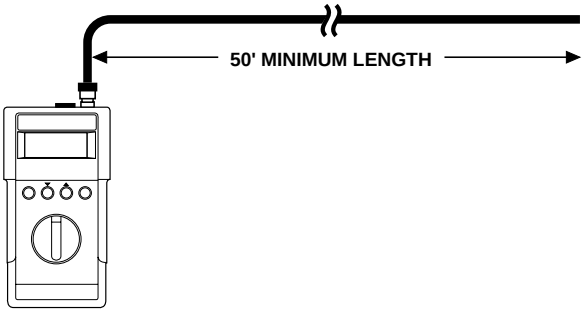
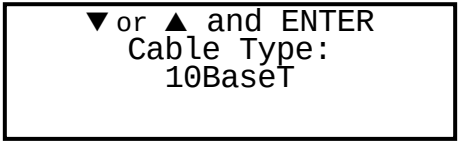


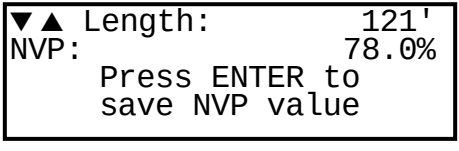
Figure 5-1. Connecting Unterminated Cable.

Set the rotary function selector to CALIBRATE.

Press the ▼ or ▲ button to select the correct cable type, then press the ENTER button.



When the display below appears, set the actual length of the cable with the ▼ or ▲ button, then press the ENTER button. The NVP setting is stored in nonvolatile memory and will be used for all subsequent tests of the selected cable type.

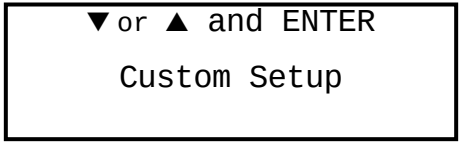


6. Custom Setup

6.1 Where to Begin

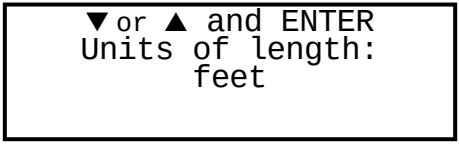
The units of length measurement, minimum fault threshold, and minimum noise threshold can be changed by the user. In addition, the audible tone can be enabled or disabled from the Custom Setup mode. Changes are retained after the unit is powered down.

Set the rotary function selector to SPECIAL FUNCTIONS. Press the Enter button to select Custom Setup.



6.2 Units of Length

The currently selected units, *feet* or *meters*, will be shown in the display.



Press the ▼ or ▲ button until the display shows the desired length units.

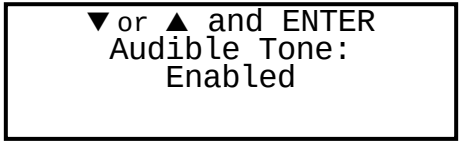
Press the Enter button to store the length units setting.

6.3 Audible Tone

An audible tone can be enabled to alert the operator to test failures, network traffic during traffic tests, and noise during noise tests.

The current state of the audible tone, Enabled or Disabled, is shown in the display.

Press the ▼ or ▲ button to enable or disable the audible tone.



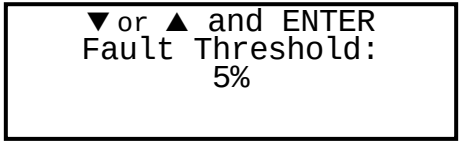
Press the Enter button to store the audible-tone setting.

6.4 Fault Threshold

The fault threshold is the minimum reflection level detected as an anomaly in the AUTOTEST or LENGTH test. Any reflections less than this threshold will be ignored by the Scan-LAN 80. The threshold is expressed as a percentage of the incident test pulse.

The currently selected fault threshold will be shown in the display. The default value is 7%, which corresponds to the worst-case allowable impedance mismatch specified in IEEE 802.3 for coax cable. Anomalies greater than this threshold may impair network transmission.

Press the ▼ or ▲ button until the display shows the desired fault threshold.



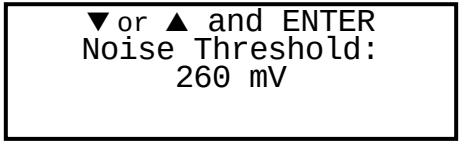
Press the Enter button to store the fault threshold setting.

6.5 Noise Threshold

The noise threshold is the minimum detection level for noise impulses measured in the NOISE test.

The currently selected noise threshold will be shown in the display. The default value is 260 mV, which corresponds to the impulse noise specification for 10BASE-T.

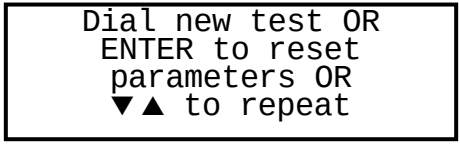
Press the ▼ or ▲ button until the display shows the desired noise threshold.



Press the Enter button to store the noise threshold.

6.6 Saving/Resetting Changes

After all of the user-selectable settings have been entered, the Scan-LAN 80 will display the following:



Set the rotary selector to a new test function to save the entered settings.

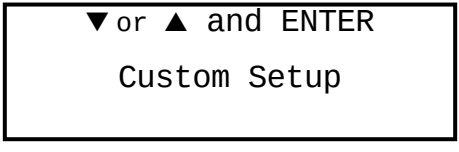
Press the Enter button to abort any changes and begin again.

Press the ▼ or ▲ button to re-run Custom Setup without deleting the changes just entered.

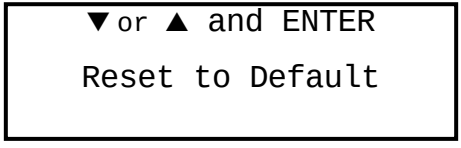
6.7 Resetting to the Factory Settings

The Scan-LAN 80 may be reset to factory settings using the RESET TO DEFAULT function. All settings, including audible tones, the units of length, minimum fault threshold, minimum noise threshold, NVP, and characteristic impedance values for all cable types, are reset to factory settings.

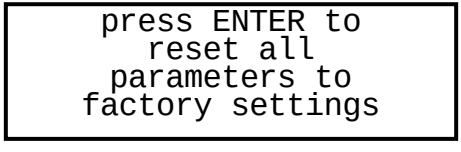
Set the rotary selector to SPECIAL FUNCTIONS.



Press the ▼ or ▲ button to select the RESET TO DEFAULT function.



Press the Enter button.



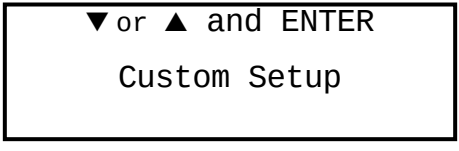
Press the Enter button to reset the Scan-LAN 80 to factory settings, or select another function using the rotary selector to abort.

7. Maintenance

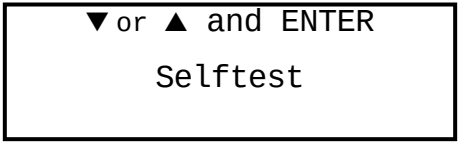
7.1 Self-Test

The Scan-LAN 80 includes a self-test function. Disconnect all cables and run this test periodically to assure that the unit is functioning properly.

1. Set the rotary function selector to SPECIAL FUNCTIONS.



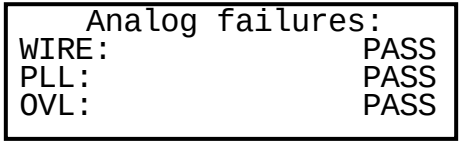
2. Press the ▲ or ▼ button until Selftest is displayed.

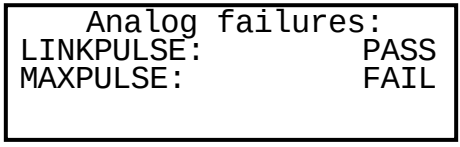


3. Press the ENTER button to start the self-test.

The display below will appear if all tests pass.

4. If any test fails, the unit will beep twice, then display the fault.





5. If the unit fails the self-test, replace the unit's batteries and rerun the test. If the unit continues to fail the self-test, note which test fails and call your supplier.

7.2 Power

7.2.1 The Scan-LAN 80

Power to the Scan-LAN 80 is supplied by the two 9-volt alkaline batteries. The battery compartment is accessed by sliding off the cover on the bottom of the unit. The Scan-LAN 80 will typically operate for at least 8 hours on a pair of batteries. The unit continuously monitors battery voltage and will give the user a warning when the battery voltage is low.

7.2.2 The Remote Unit

The Remote Unit, used during twisted-pair cable tests, requires one 9-volt alkaline battery. Slide off the cover to change the battery.

Power to the Remote Unit is applied only for brief intervals during cable tests, for minimal battery drain. The Scan-LAN 80 periodically tests remote operation and will warn the user when the remote battery needs replacement.

If the units will remain unused for an extended period, remove the batteries to prevent damage from possible leakage.

Appendix A: Standard Cable Types

The following cable types are included in the standard cable library resident in the Scan-LAN 80. Default NVP values may be altered with the CALIBRATE CABLE function.

Designation	NVP	Impedance	Connector/Pairs	Description
10BASE-T	72%	100 ohms	RJ-45 1,2–3,6	Cat. 5 unshielded twisted pair for 10BASE-T
Token Ring 4 UTP	62%	100 ohms	RJ-45 3,6–4,5	Cat. 3 unshielded twisted pair for Token Ring
Token Ring 16 UTP	66%	100 ohms	RJ-45 3,6–4,5	Cat. 4 unshielded twisted pair for Token Ring
Token Ring STP	78%	150 ohms	RJ-45 3,6–4,5	Shielded twisted pair for Token Ring
ThinNet	80%	50 ohms	BNC	Thin Ethernet coax
Thicknet	78%	50 ohms	BNC	Non-plenum solid polyethylene core coax

Appendix B: Cable Test Pass/Fail Limits

B.1 Twisted-Pair Cables

The Scan-LAN 80 tests cables against IEEE specifications for the selected LAN environment (10BASE-T or Token Ring). The Autotest Results screen presented at the conclusion of Autotest indicates whether the cable meets IEEE specifications. See **Chapter 3** for more information.

The next four pages contain the IEEE test limits used by the Scan-LAN 80 while testing twisted-pair cabling.

10BASE-T Pass/Fail Limits

	10BASE-T Test Limits
Length	Length < 100 meters
Required Wire Pairs	1,2 and 3,6
Background Noise	Background Noise > NEXT + 6 dB
SNR	Between 5 and 10 MHz, SNR > 15 dB
Characteristic Impedance	100±25 ohms
NEXT	Between 5 and 10 MHz, NEXT > 26–15 log (freq/10)
Attenuation	Between 5 and 10 MHz, Atten < 11.5 dB
Split Pair	NEXT < 20 dB

Token Ring 4 UTP Pass/Fail Limits

	Token Ring 4 UTP Test Limits
Length	Length < 100 meters
Required Wire Pairs	3,6 and 4,5
Background Noise	Background Noise > NEXT + 6 dB
SNR	Between 5 and 10 MHz, SNR ≥ 15 dB
Characteristic Impedance	100±25 ohms
NEXT	Between 5 and 10 MHz, NEXT < 26–15 log (freq/10)
Attenuation	Between 5 and 10 MHz, Atten ≤ 7 dB @ 5 MHz 9 dB @ 8 MHz 10 dB @ 10 MHz
Split Pair	NEXT < 20 dB

Token Ring 16 UTP Pass/Fail Limits

	Token Ring 16 UTP Test Limits
Length	Length < 100 meters
Required Wire Pairs	3,6 and 4,5
Background Noise	Background Noise > NEXT + 6 dB
SNR	Between 5 and 16 MHz, SNR ≥ 24 dB
Characteristic Impedance	100±25 ohms
NEXT	Between 5 and 16 MHz, NEXT ≥ 58–15 log (f/0.772) + 5 dB (equivalent to Category 4)
Attenuation	Between 5 and 16 MHz, Atten ≤ 5 dB @ 5 MHz 6 dB @ 8 MHz 7 dB @ 10 MHz 9 dB @ 16 MHz (equivalent to Category 4)
Split Pair	NEXT < 20 dB

Token Ring STP Pass/Fail Limits

	Token Ring STP Test Limits
Length	Length < 100 meters
Required Wire Pairs	3,6 and 4,5
Background Noise	Background Noise > NEXT + 6 dB
SNR	Between 5 and 16 MHz, SNR ≥ 24 dB
Characteristic Impedance	100±25 ohms
NEXT	Between 5 and 16 MHz, NEXT≥ 35 dB
Attenuation	Between 5 and 16 MHz, Atten < 10 dB
Split Pair	NEXT < 20 dB

B.2 Coaxial Cables

The following charts show the Pass/Fail limits used by the Scan-LAN 80 while testing coaxial cables.

ThinNet Pass/Fail Limits

	ThinNet Test Limits
Length	Length < 185 meters
Background Noise	Background Noise < 400 mV
Characteristic Impedance	50±12 ohms
Termination Resistance	50±20 ohms

Thicknet Pass/Fail Limits

	Thicknet Test Limits
Length	Length < 500 meters
Background Noise	Background Noise < 400 mV
Characteristic Impedance	50±12 ohms
Termination Resistance	50±15 ohms

Glossary

10BASE2 — An IEEE standard for Thin Coax Ethernet networks; specifies 10-Mbps transmission, baseband signaling, 185 meters per coax segment. Also known as ThinNet or Cheapernet.

10BASE-T — An IEEE standard for unshielded twisted-pair Ethernet networks; specifies 10-Mbps transmission, baseband signaling, unshielded twisted-pair cable. Maximum allowable cable length is 100 meters.

Anomaly — An impedance mismatch causing an undesired signal reflection on a transmission cable.

> *Inverted Anomaly* — A reflection caused by a lower-impedance mismatch, such as a short.
>
> *Non-inverted Anomaly* — A reflection caused by a higher-impedance mismatch, such as an open.

Attenuation — A reduction in the strength of a signal, the opposite of gain; expressed in dB.

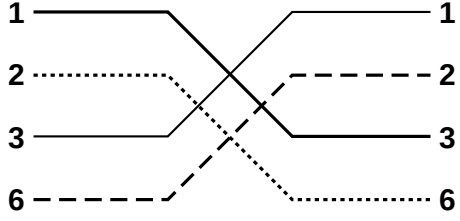
BNC — A coaxial cable connector, used with 10BASE-T Ethernet networks.

Characteristic Impedance — Resistance to AC current flow presented by a long cable. An AC parameter; not related to DC resistance.

Coaxial Cable — A type of cable in which the inner conductor is surrounded by a tubular conductor, which acts as a shield. Coaxial cables typically have a wide bandwidth.

Collision — The result of two stations simultaneously attempting to transmit data, resulting in a runt packet.

Crossed Pair — A wiring error in twisted-pair cabling where a pair on one connector of the cable is wired to a different pair on the other end of the cable.



Crossed Pairs

Crosstalk — Noise coupled between pairs of wire in twisted-pair cable.

dB — Abbreviation for "decibel," a logarithmic unit of measure expressing the amplitude ratio between two signals.

$$dB=20\log\left(\frac{Vout}{Vin}\right)$$

Ethernet — A high-speed LAN using Carrier Sense Multiple Access with Collision Detection (CSMA/CD). Ethernet is available with four cabling alternatives: thin coaxial cable, standard (thick) coaxial cable, twisted pair, and fiberoptic cable.

Jabber — A network fault condition where one station is continuously transmitting data (>20 milliseconds).

Link Pulse — A single-bit test pulse transmitted by stations every 2 to 150 milliseconds during idle periods on 10BASE-T link segments. Used to verify link integrity.

Near-end Crosstalk (NEXT) — Noise coupled between two twisted pairs measured at the same end of the cable as the disturbing signal source.

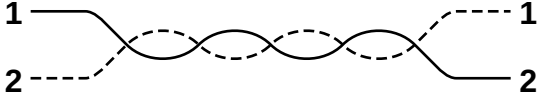
Nominal Velocity of Propagation (NVP) — The speed of signal propagation through a cable, expressed as a percentage of the speed of light in a vacuum.

Open — A break in the continuity of a circuit, preventing signal transmission.

Packet — A group of bits in a defined format, containing a data message that is sent over a network.

Plenum Cable — Cable that has been certified for installation in air ducts and open spaces over suspended ceilings without conduit. Plenum cable is fire-resistant and does not emit toxic fumes when burned.

Reversed Pair — A wiring error in twisted-pair cabling where the pins on a pair are reversed between connectors on each end of the cable.



Reversed Pair

RJ-45 — An 8-position telephone-type modular connector used with twisted-pair cable.

Runt Packet — An Ethernet data packet which is shorter than the valid minimum packet length (64 bytes). Usually caused by a collision.

Segment — A network cable terminated at both ends.

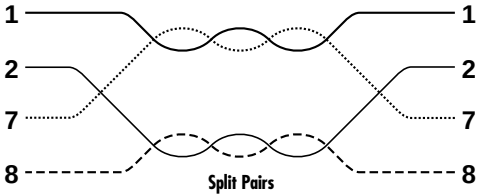
Shielded Twisted Pair (STP) — Twisted-pair cable encased in an outer metallic sheath. The sheath is grounded to shield the wire pairs from external noise.

Short — A near-zero resistance connection between two wires of a circuit.

Signal/Noise Ratio — The ratio of received signal level to noise level, measured at the receiver input (expressed in dB). The S/N ratio may be expressed as NEXT (dB)-Attenuation (dB), provided idle channel background noise is low. Higher S/N ratios provide better channel performance.

Split Pair — A wiring error in twisted-pair cabling where a balanced circuit uses one wire from one pair and the other wire from a different pair. The cable may have correct pin-to-pin continuity between ends,

but because the transmission circuit is split between two twisted pairs, excessive crosstalk occurs.



TDR (Time-Domain Reflectometry) — A technique for measuring cable lengths by timing the duration between an incident test pulse and the reflected pulse from an impedance mismatch on the cable (such as an open at the end of the cable). The length of the cable may be calculated by knowing the velocity of propagation of the pulse through the cable:

$$\text{Length} = 1/2t \times \text{NVP} \times C$$

Where: t=round-trip time between incident and reflected pulses.

NVP=nominal velocity of propagation of electrical signals in the cable.

C=speed of light in a vacuum.

Terminator — A resistor connected to the end of a coax cable that is intended to match the characteristic impedance of the cable. Signals propagating down the cable are dissipated in the terminator, eliminating reflections from the end of the cable.

Token Ring — A LAN with ring topology, which uses token passing to control access.

Twisted Pair — A communication cable using a pair of wires that are twisted together. The twist reduces susceptibility to external interference.

UTP (Unshielded Twisted Pair) — Twisted-pair cable without an outer metallic sheath. Unshielded pairs are more susceptible to external noise pickup.

Index