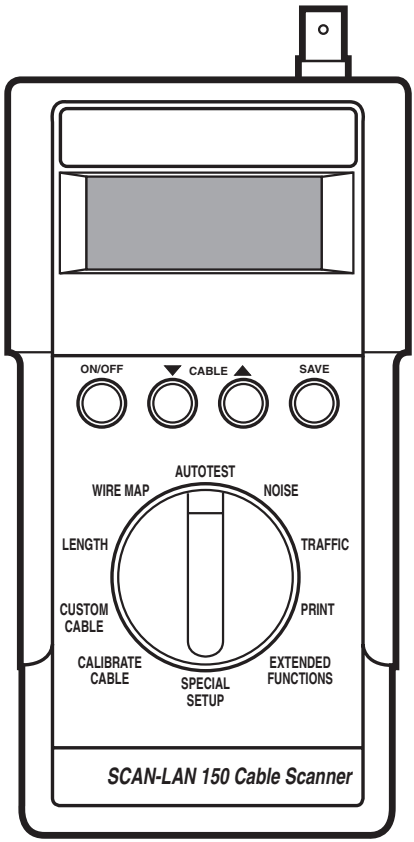
BLACK BOX®
NETWORK SERVICES

JULY 1993
TS625A

SCAN-LAN 150 Cable Scanner



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RADIO FREQUENCY INTERFERENCE STATEMENTS

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

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NORMAS OFICIALES MEXICANAS (NOM) ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objectos liquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
    - A: El cable de poder o el contacto ha sido dañado; u
    - B: Objectos han caído o líquido ha sido derramado dentro del aparato; o
    - C: El aparato ha sido expuesto a la lluvia; o
    - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
    - E: El aparato ha sido tirado o su cubierta ha sido dañada.

Contents

Chapter **Page**

1. Specifications

Network Connectors — RJ-45 and BNC, IEEE 802.3 electrical interface

Cable Length Measurement — Coax cable length: 20-4000 ft.(6.1-1219.2 m);
UTP Cable Length: 20-2000 ft.(6.1-609.6 m);
Accuracy: 1%; Resolution: 2 ft. (0.6 m)

Impedance Anomalies — Up to 3 anomalies reported. Adjustable threshold from 4-10% of incident pulse.

Near-end crosstalk and attenuation — Level: 0-40 dB, ±2 dB;
Frequency Range: 5-10 MHz sweep;
Frequency Steps: 100 kHz

Characteristic Impedance — Accuracy: ±10 ohms

Input Protection — Withstands continuous 56 VDC applied through 400 ohms (telco loop). Withstands 175 V peak, 20-60 Hz through 100 ohms superimposed on 56 VDC for 100 ms (telco ringing). Audible and display alarms on overvoltage fault.

Nonvolatile CMOS Memory — User-defined cable types: 4;
Cable test results: 50;
Network use traffic report: 1;
Backup: Lithium battery Current setup parameters are saved

Printer Interface — Interface type: RS-232;
Connector: DB9 P, IBM AT serial pinout;
Speed: 1200-19,200 bps, user-selectable, 8 bits, no parity, 2 stop bits;
Signals supported: TD, RD, CTS, DTR

Display — 4 line LCD with 16 characters per line

Environment — Operating: 32 to 122°F (0 to 50°C);
Storage: -4 to 140°F (-20 to 60°C);
Humidity: 10 to 90%, non-condensing

Power — Main unit: 9 VDC, 300 mA (min.), plug-in power supply or two 9-volt alkaline batteries;
Remote unit: one 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: 1.0"H x 2.4"W x 3.7"D (2.5 x 6.1 x 9.4 cm)

Weight — Main unit: 7 lb. (3.2 kg)

2. Introduction

The SCAN-LAN 150 Cable Scanner is an easy-to-use, handheld tester for qualifying and troubleshooting coax and twisted-pair local area network cable installations.

It measures critical performance characteristics of LAN cable installations and correlates the results to applicable specifications.

It can also monitor and analyze live network performance for Ethernet networks.

The Autotest function automatically performs all critical tests. The test results are compared to the appropriate LAN cable specifications, and a simple PASS/FAIL indication is displayed.

2.1 Features/Functions

- **Cable length** (feet or meters)—The Scanner measures the length of the cable and displays up to three fault anomalies, using time-domain reflectometry (TDR).
- **NEXT**—The Scanner measures near-end crosstalk (NEXT) on twisted pair networks, and displays it with an incremental frequency sweep between 5 and 10 MHz. The tester reports any split pairs found.
- **Attenuation**—The Scanner measures and displays attenuation with an incremental frequency sweep between 5 and 10 MHz.
- **Wire Map**—The Scanner tests all the cabling connections required for successful network operation.
- **Characteristic impedance**—The Scanner displays the measured impedance for coax cables and prints it on all cable test reports.
- **Terminators** — The Scanner measures and displays terminator values for coax cables.
- **Noise**—The Scanner measures background noise and reports it only if it could be a problem for network operation (otherwise, the Scanner stores it for a printed report). The Scanner can also measure idle channel impulse noise over an extended time period.
- **Traffic monitoring**—The Scanner displays the continuous percentage of use along with a bar graph display of network activity. It reports collisions and jabbers, and provides audible feedback of network activity. The Scanner produces a printed report showing average network use, peak use, percent collisions, packet count, and jabber detect.

For 10BASE-T networks, the Scanner automatically generates and detects link pulses.

- **Printed reports—**The Scanner can store up to 50 cable tests and one traffic test for printing.
- **Custom Cables—**The Scanner can define the connector arrangement, characteristic impedance, and nominal velocity of propagation (NVP) for up to four custom cable types. It can measure and save NVP for all cable types.
- **"Live" Cable Warning—**The Scanner automatically detects telephone and other overvoltage signals on a cable and warns the user so that neither the Scanner nor other equipment on the line is damaged.

NOTE

Use the RJ-45 strain relief cable (12" plug to jack) or the RJ-45F/RJ-45F coupler and RJ-45/RJ-45 patch cable instead of directly plugging into the unit. The RJ-45 cables and coupler supplied for this purpose do not affect the accuracy of the device.

2.2 Connectors

- **BNC—**shielded connector for coax cable.
- **RJ-45—**standard 8-pin modular jack for twisted-pair cable.
- **PRINTER—**DB9 P connector to interface to a printer via a standard IBM® AT® RS-232 serial cable, which you can obtain from your dealer.
- **9VDC 300mA—**power connector for the plug-in wallmount power supply that comes with the Scanner.

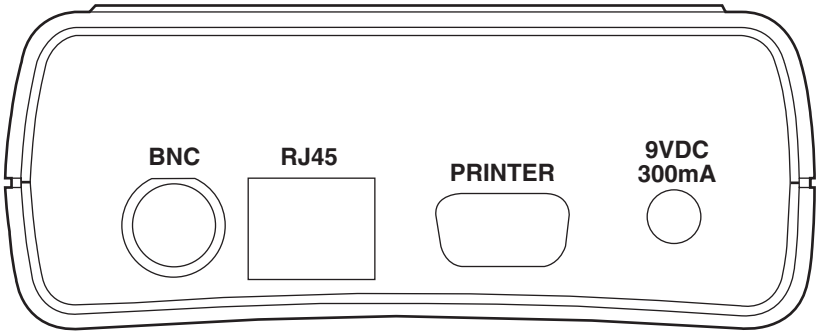

Fig. 2-1. Connectors on the Top of the Scanner.

2.3 Controls

The SCAN-LAN 150 Cable Scanner is operated with a rotary function selector and four pushbutton switches.

- **Rotary Function Selector—**selects the operating mode: Autotest, Noise, Traffic, Print, Extended Functions, Special Setup, Calibrate Cable, Custom Cable, Length, or Wire Map.

- **ON/OFF Button—**turns the power on or off to the Scanner. When no activity has been detected for five minutes, the Scanner will automatically power down to conserve battery power. This does not apply to the Traffic and Noise tests, which run continuously until stopped by the user.

- **▼▲Buttons—**selects the cable type from a list of preset and user-defined types. These buttons are also used by some functions for selection scrolling, such as test number or printer speed.

- **SAVE Button—**saves the results of an Autotest in the Scanner's memory.

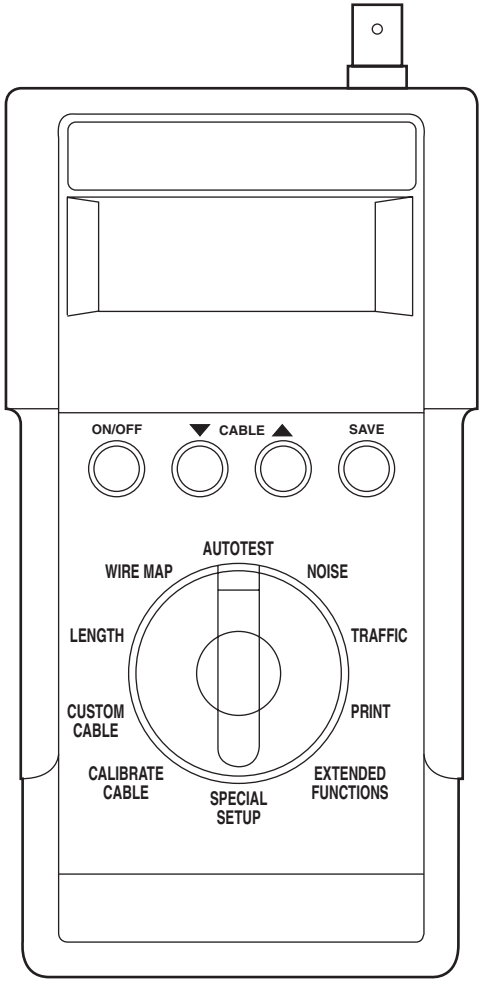

Fig. 2-2. SCAN-LAN 150 Cable Scanner.

2.4 Remote Unit

The SCAN-LAN 150 Cable Scanner is connected at the far end of the cable when using Autotest to test twisted-pair cable. The Remote Unit, when used with the Scanner, permits NEXT and attenuation measurements and allows connector wiring to be mapped.

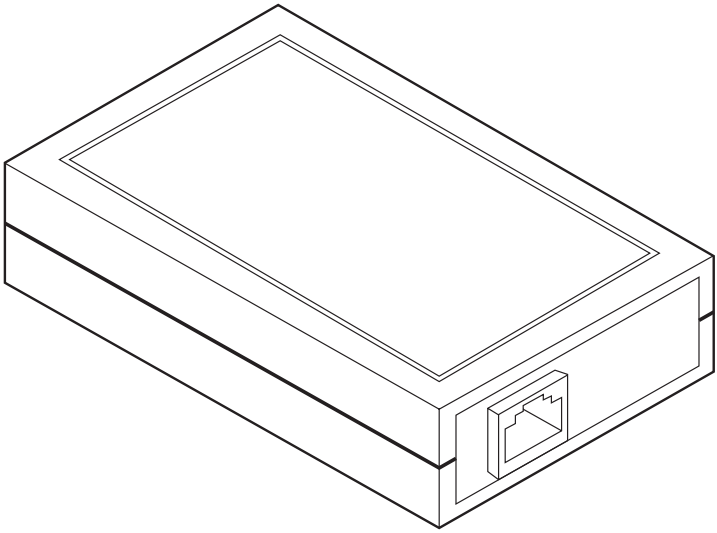

Fig. 2-3. Remote Unit.

3. Getting Started

3.1 Power

Power to the Scanner is supplied by two 9-volt alkaline batteries. You can access the battery compartment by sliding off the cover on the bottom of the unit. The Scanner will typically operate for at least ten 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.

The supplied wall plug-in power supply can power the Scanner to preserve battery life. Use the external supply when running long tests, such as traffic monitoring or noise.

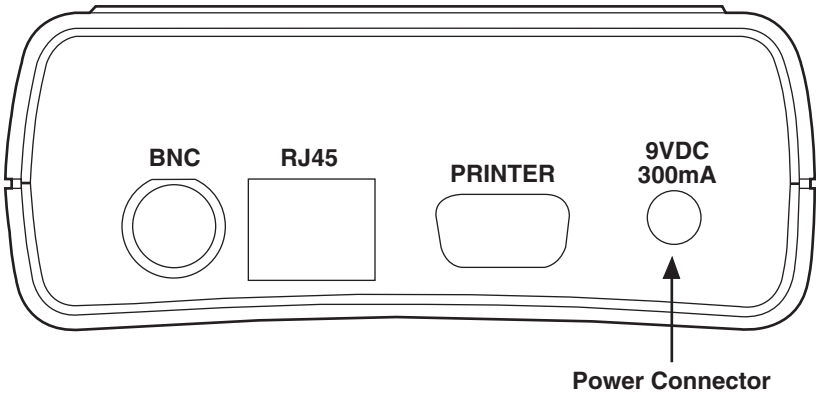

Fig. 3-1. Power Connector on the Scanner.

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, causing minimal battery drain. The Scanner periodically tests remote operation and will warn the user when the remote battery needs replacement.

3.2 Self-Test

The Scanner includes a self-test function. This test assures that the unit is functioning properly.

- Press the ON/OFF button, and set the rotary function selector to EXTENDED FUNCTIONS.
- Press the SAVE button to start the self test. Disconnect all cables from the Scanner, then press the SAVE button. The display shown in Fig. 3-2 will appear if all tests pass.

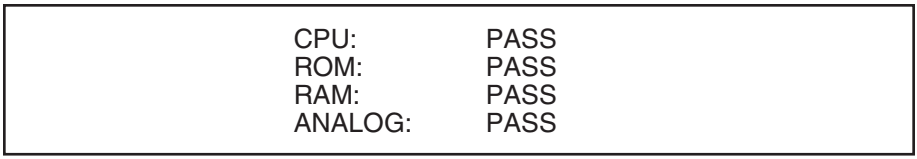

Fig. 3-2. Self-Test Passed.

- 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 tests fail and call Technical Support for further assistance.

4. Cable Tests

4.1 Autotest

The Autotest function will be the mode you use most frequently when testing LAN cabling. Included with Autotest are all the necessary tests to qualify the cable type you have selected. Simply select Autotest mode, set the cable type, and plug in the cable to be tested. Any problems the Scanner encounters will be reported on the Scanner's display. The unit can save extended test results for up to 50 cable tests for printing.

Results for the following tests are shown in the display.

- **Pass/Fail—**The Scanner displays the overall pass/fail status for the test in the top left corner of its display. It checks each test parameter against the appropriate test specification for the selected cable type (in other words, 10BASE-T cable types are tested to meet 10BASE-T/EIA 568 parameters, RG-58 or 10BASE2 to meet 802.3 parameters, etc.).

- **Cable length—**The Scanner verifies connector crimping and correct wiring of the four pairs. It detects and reports shorts, opens, crossed pairs, and reversed pairs.

Twisted pair Cables:

- **Wire Map—**The Scanner verifies crimping and correct wiring of the four pairs. It detects and reports shorts, opens, crossed pairs, and reversed pairs.

- **Anomalies—**The Scanner locates reflections from impedance anomalies that could be caused by bridge taps or faulty punch down block connections.

- **Near End Cross Talk (NEXT)—**The Scanner measures crosstalk between cable pairs. It tests crosstalk over a frequency range of 5 MHz to 10 MHz in 100-kHz steps. The highest measured crosstalk over the frequency range is recorded for the primary transmit and receive pair. All other pairs are tested for excessive crosstalk due to possible split pairs. You can view the frequency at which the highest NEXT is measured in the printed test report.

  Attenuation is expressed in dB. Lower values for Attenuation indicate lower signal attenuation.

Coax Cables:

- **Anomalies—**The Scanner locates reflections from impedance anomalies that could be caused by cable stubs or cable-type mismatches.
- **Termination resistance—**The Scanner measures the resistance of the terminator at the end of the cable, and checks for shorts and opens.
- **Impedance—**The Scanner measures the characteristic impedance of the cable.

In addition to the above items, the Scanner may print a report that also contains:

- separate transmit and receive cable lengths, impedance, and the location of up to three impedance anomalies
- split pair check
- background noise
- signal/noise ratio

For each item, the Scanner prints pass/fail results with comments to aid in troubleshooting.

4.1.1 Using the Autotest Function

Selecting the Cable Type

You must select the correct cable type before performing any tests.

The SCAN-LAN 150 Cable Scanner is programmed with several preset cable types, which are listed in Appendix B. You may custom-define four additional cable types and store them in nonvolatile memory—instructions for entering cable data are in **Chapter 7**, **Custom Cable Types.**

NOTE

Length measurements are only as accurate as the NVP setting for the cable the Scanner is measuring. NVP values can vary dramatically between cables from different manufacturers (especially on twisted-pair cable) and sometimes even between different cable lots. Default NVP values in the Scanner are only representative of commonly available values and may not be accurate for your specific cable. Before any installation, measure and mark the NVP on each cable spool. As a minimum, measure and record the NVP of a representative known length of cable for each different cable manufacturer. Use the Calibrate Cable function described in Section 7.1 to measure and set the NVP for a particular cable type.

- 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.

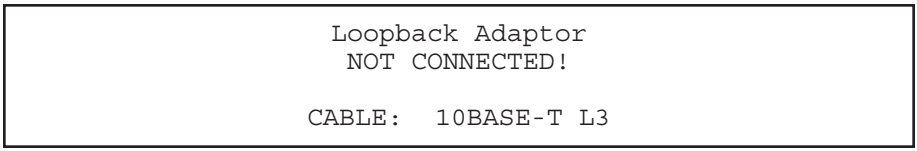

Fig. 4-1. AUTOTEST Display.

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

Testing Twisted-Pair Cables

- Plug one end of the cable to be tested into the RJ-45 connector on the Scanner.
- Plug the other end of the cable into the Remote Unit.
- Make sure that no other 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 Scanner and Remote Unit.

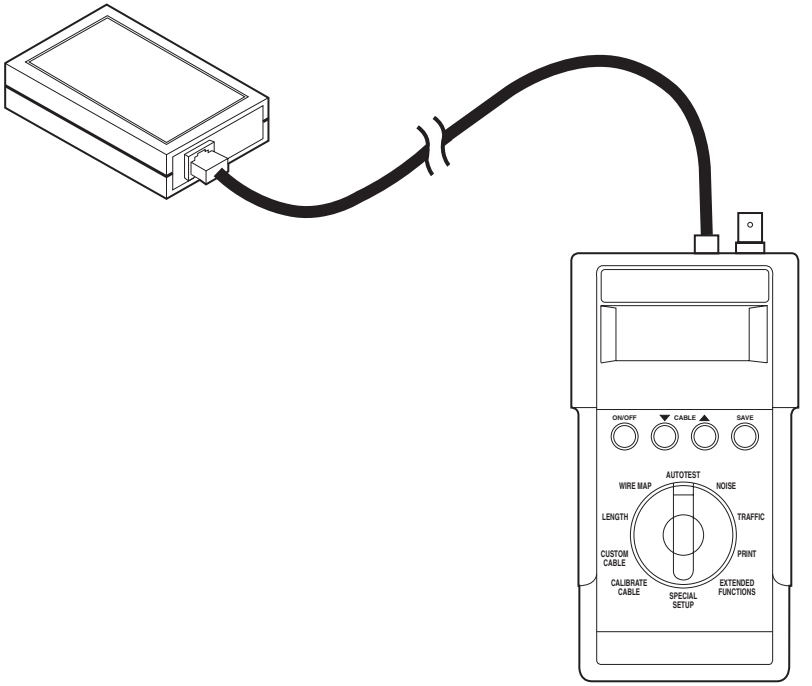

Fig. 4-2. Testing Twisted-Pair Cables.

The tests begin with the wire map. All four pairs are tested; if any pair is open, shorted, or incorrectly wired, the display indicates the problem found and no further tests are performed.

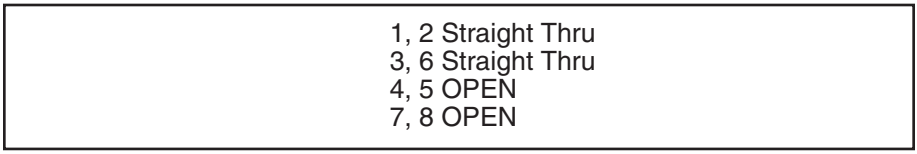

Fig. 4-3. Transmit and Receive Pairs Passed the Wiring Check.

If the transmit and receive pairs pass the wiring check, "Straight Thru" is displayed for a few seconds. The cable length is then measured.

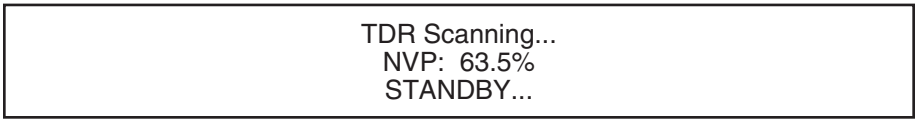

Fig. 4-4. Measuring the Cable Length.

Using the Nominal Velocity of Propagation (NVP) indicated in the display, the length of each pair is measured. The length of each pair, including any fault conditions present, is displayed.

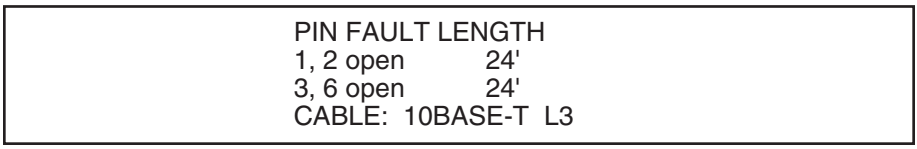

Fig. 4-5. Length of Each Pair and Fault Conditions.

After measuring the length of the cable, the Scanner measures NEXT and attenuation on the cable. Final results are shown in the display when the Scanner completes the tests.

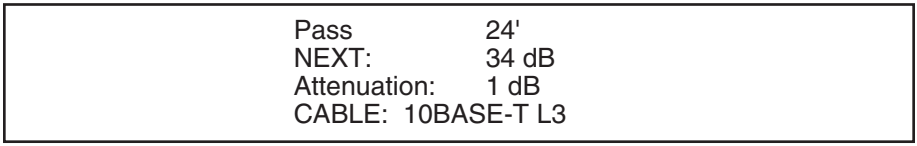

Fig. 4-6. Final Test Results.

Pass will be displayed at the upper left if all tests pass.

Fail indicates that one or more tests did not meet the requirements for the selected cable type. The test value causing the failure will flash in the display.

Cable length is displayed in either feet or meters on the top line of the display. You may change the units of length with the Special Setup function—see **Chapter 8, Special Setup**.
The **NEXT** measurement is displayed in dB units. A larger number is better, indicating lower crosstalk. If the Scanner detects excessive crosstalk between any of the other pairs in the cable, it will display a split pair warning screen.

The maximum measured cable **Attenuation** is displayed in dB. A smaller number is better, indicating lower attenuation.

Testing Coax Cables

- Attach one end of the cable to the BNC connector on the Scanner. Do not locate the Scanner 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 other cable is plugged into the RJ-45 connector.

The cable is tested for proper termination and any cable anomalies present, which could be caused by reflections from taps or cable mismatches.

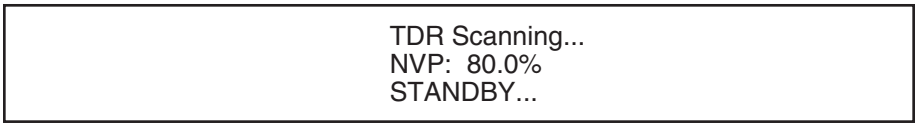

Fig. 4-7. TDR Scanning Screen.

The Scanner displays results for the tests when it completes the tests.

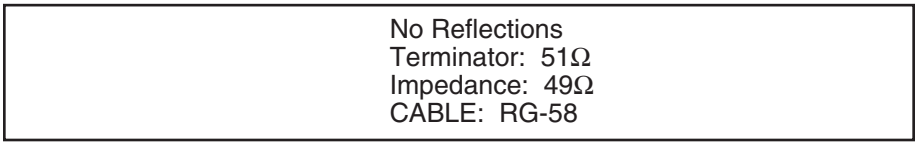

Fig. 4-8. Test Results.

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

Fail indicates that one or more tests did not meet the requirements for the selected cable type. The test value causing the failure will flash in the display.

If the cable is improperly terminated, or a cable anomaly is present, **Cable Length** is displayed in either feet or meters.

The **Terminator** value in ohms is displayed. **OPEN** indicates a defective or missing terminator. **SHORT** will be displayed if the cable is shorted.

The cable's characteristic **Impedance** in ohms is displayed.

Saving Test Results

Extended test results from up to 50 cable tests can be stored in the Scanner's non-volatile memory and recalled later for printing.

- Press the SAVE button.

  The display will initially show a report number one higher than the last number used. If you want to save this test report with a different number, press the ▼ or ▲ button until the desired report number is displayed.

Fig. 4-9. Saving Test Reports.

- Press the SAVE button to store the test results.

Use the Print function to produce hard copies of test results. Refer to **Chapter 6**, **Printing Test Reports**.

4.1.2 Checking Multiple Cables

The Scanner 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 Scanner will automatically power down.

4.2 Individual Cable Tests

Wiring, cable length, and noise can each be tested separately by the Scanner. The single wiring and length tests run faster than the Autotest function. These functions are especially useful when you need to check only wiring or cable length for a number of cables.

4.2.1 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 appropriate connector on the Scanner.
- 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. The Scanner will rerun the Wire Map test and update the display every two seconds.

Twisted-pair cable is tested for correct pair wiring and continuity.

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

Fig. 4-10. Wire Map Test Results.

Multiple cables may be tested without pressing any switches on the unit. The Scanner automatically senses when a new cable is connected and performs another test.

4.2.2 Length Test

NOTE

The accuracy of cable-length measurement depends upon the NVP value entered for the selected cable type. Although the preset values will give reasonably accurate readings in most cases, set the NVP for a known length of the cable type being tested. Refer to the Calibrate Cable function in Chapter 7, Custom Cable Types.

- Set the rotary function selector to LENGTH.
- Press the ▼ or ▲ button until the desired cable type is displayed.
- Connect the cable to the appropriate connector on the Scanner. Only one cable may be connected to the unit (either BNC or RJ-45) at a time.
- If the cable has no connector, use the RJ-45 clip lead adapter cable to connect to the Scanner. Pinout of the clip lead is shown in **Appendix B**.
- Make sure that any terminators are disconnected when testing coax cable. The remote unit is not required for testing length of twisted-pair cable.

  The length of the transmit and receive pairs will be displayed for twisted-pair cable, along with any pair anomalies found.

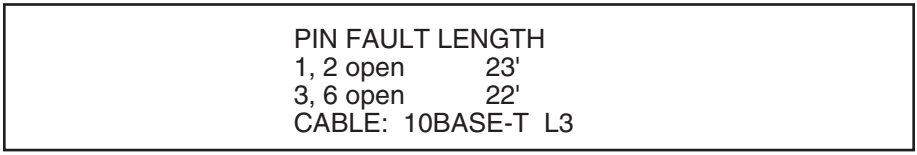

Fig. 4-11. Length and Fault Screen.

Cable length and short/open conditions will be displayed for coax cable, along with any anomalies found.

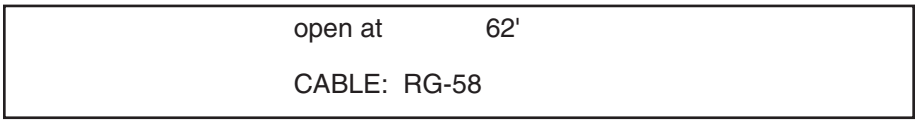

Fig. 4-12. Short/Open Conditions.

Multiple cables may be tested without pressing any switches on the unit. The Scanner automatically senses when a new cable is connected and performs another test.

4.2.3 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 8**, **Special Setup**, if you want to change this value.

The Noise Test runs continuously until stopped by the user. Use the plug-in wallmount supply if you plan to run the test for an extended period.

- Set the rotary function selector to NOISE.
- Press the ▼ or ▲ button until the desired cable type is displayed.
- Connect the cable to the appropriate connector on the Scanner. 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.

  After 10 seconds the display will give a PASS or FAIL result for the test, the elapsed time, average impulse counts per second, and peak counts per second with the time of occurrence of the peak in hh:mm format.

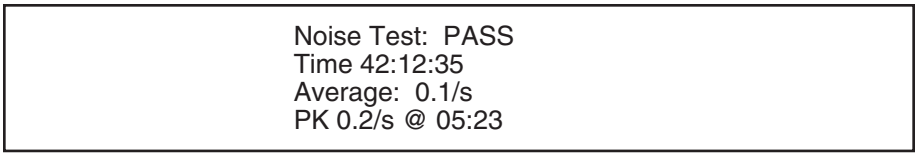

Fig. 4-13. Noise Test Screen.

NOTE

For 10BASE-T cable, the maximum allowable impulse noise rate is 0.2/s with a 260 mV noise threshold. Pass/fail indication is valid only with this noise threshold setting.

5. Traffic Measurement

Live network traffic monitoring on 10BASE-T or coax Ethernet networks can be performed by the Scanner. Percentage of network use, 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.

The traffic test runs continuously. Use the plug-in wallmount supply if the test will be run for an extended period of time. Test results are saved in the Scanner's memory and can be printed when the test is completed. The printout includes a graph of network activity over time, showing average use, peak use, percentage of collisions, packet counts, and jabber conditions.

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

- Attach the network cable to the appropriate connector on the Scanner.
- Set the rotary function selector to TRAFFIC.

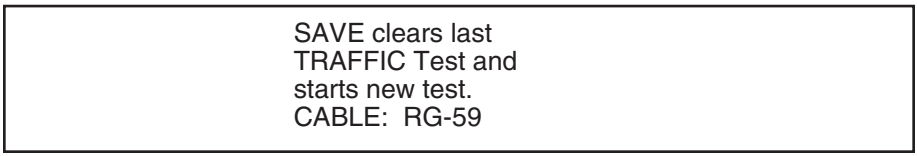

Fig. 5-1. TRAFFIC Screen.

- Press the ▼ or ▲ button until the correct cable is shown at the bottom of the display.
- Press the SAVE button to clear the previous traffic test from memory and start a new test. Whenever there is traffic detected, an audible tone is generated; the pitch of the tone is proportional to the level of network use.

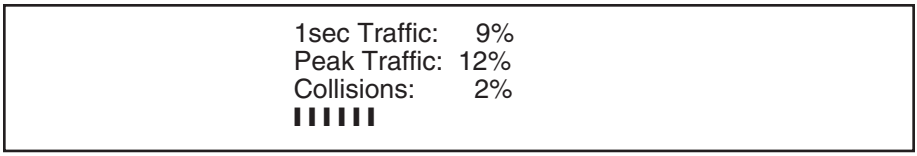

Fig. 5-2. Network Use Screen.

The display will show a continuous reading of traffic conditions on the network.

The top line of the display shows the average network use over the last second and indicates current traffic levels.

The second line shows the highest one-second average traffic over the duration of the test.

The third line 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 bottom line shows a bar graph of the instantaneous traffic level, scaled from 0 on the left side of the display to 50% 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 that are longer than the maximum legal packet length, the display will change to "WARNING! JABBER DETECTED ON NETWORK" until the problem is cleared.

- Select another test or turn the unit off when you want to stop the traffic test. The traffic measurements will be automatically stored in memory and can be printed at a later time.

NOTE

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

6. Printing Test Reports

One traffic report and 50 cable test reports can be printed from the Scanner's nonvolatile memory. The printed reports provide more extensive test results than are available from the display screen during the tests.

The printer must have an RS-232 serial interface. Connect the printer to the Scanner with the included standard IBM AT serial printer cable (equipped with a female DB9 connector at the Scanner end).

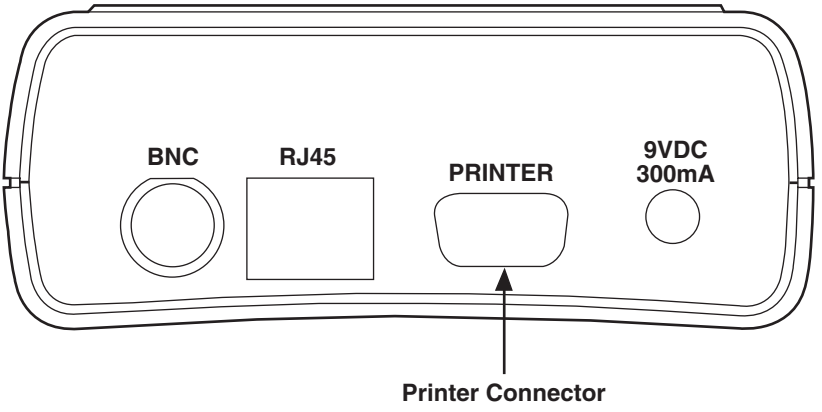

Fig. 6-1. Printer Connector on the Scanner.

- Set the rotary function selector to PRINT. The screen shown in Fig. 6-2 appears.

Fig. 6-2. Print Screen.

- Press the ▼ or ▲ button to select Traffic Report, an individual Auto Test, or All Reports.
- Press the SAVE button.
- Press the ▼ or ▲ button to select the bit rate that matches the setting on the printer (typically 9600 bps).

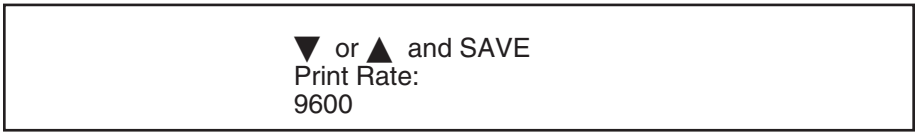

Fig. 6-3. Print Rate Screen.

- Press the SAVE button. Print data will be sent to the serial printer. To abort a printout, press any key.

After printing is completed:

- Press the SAVE button to delete all test reports from memory, or press the ▼ or ▲ button to print another report.

NOTE

Make sure that the printer is set to the selected bit rate: 8 data bits, no parity, one or two stop bits, and DTR (hardware) flow control.

Typical Printed Reports

AUTOTEST reports list the measured values for each test, with a PASS/FAIL result and comments to assist in locating any problems found. The first line of the report shows the test number that was selected during the SAVE operation in AUTOTEST. A typical coax cable report is reproduced in Fig. 6-4, and a twisted-pair cable report in Fig. 6-5.

```
                SCAN-LAN 150 AUTOTEST REPORT #1

  SETUP:
       Cable:  RG-58
       Connector:  BNC
       NVP:  67.0%
       Fault Anomaly Threshold:  7%

  RESULTS:           COMMENTS:
  Length:  300 ft.   PASS:  600 ft max 802.3 cable segment
  ^ Cable Shorted:     300 ft     FAIL:  Check cable
connections
  ^ Inverted Anomaly:  100 ft.    FAIL:  Possible bridge tap
  ^ Non-inverted Anomaly: 120 ft    FAIL: Possible cable type
  mismatch

  Cable Impedance:  49 ohmsPASS:  50 ohms nominal
  Termination Resistance:  open  PASS:  Unterminated cable
  Background Noise:  200 mVPASS:  900 mV max

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<FAIL>>>>>>>>>>>>>>>>>>>>>>>>>
>>>>>>
                     ^ Indicates failed test

  Date:                                    Operator:

  Notes:
```

Fig. 6-4. Autotest Report #1.

```
                    SCAN-LAN 150 AUTOTEST REPORT #2

  SETUP:
  Cable:  10BASE-T L3
  Connector:  RJ-45 (10BASE-T) Tx=1,2  Rx=3,6
  NVP:  66.0%
  Fault Anomaly Threshold:  7%

  RESULTS:                              COMMENTS:
  ^ Tx Length: 300 ft  PASS: 100 meters max cable segment
                       recommended per IEEE specification
  ^ Tx Inverted Anomaly:100 ftFAIL:  Possible bridge tap
  ^ Tx Non-Inverted Anomaly: 120 ft   FAIL: Possible cable type
mismatch
  ^ Tx Cable Impedance:  93 ohms      PASS:  85 to 111 ohms

  Rx Length:   301 ft  PASS:  100 meters max cable segment
                              recommended per IEEE specification
  ^ Rx Inverted Anomaly:  102 ft      FAIL:  Possible bridge tap
  ^ Rx Cable Impedance:  97 ohms      PASS:  85 to 111 ohms

  Wire Map:
  Pair 1,2 Straight-Through   PASS:  Required pair
  ^ Pair 3,6 Reversed         FAIL:  Required pair
  Pair 4,5 Short to 7,8               Not used
  Pair 1,2 Cross to 4,5               Not used

  ^ Attenuation:  12 dB @ 10.0 MHz    FAIL:  11.5 dB max
  ^ NEXT:  25 dB @ 9.8 MHz    FAIL:  30.5 dB @ 5 MHz, 26 dB @ 10MHz
min
  ^ Split Pair Check:  22 dB  FAIL:  1,2 split with 7,8
  Background Noise:    35 dB  PASS:  Greater than 6 dB above NEXT
  ^ Signal/Noise Ratio:       13 dB   FAIL:  10 dB min

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<FAIL>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
>>>>>>
                        ^ Indicates failed test

  Date:                               Operator:

  Notes:
```

Fig. 6-5. Autotest Report #2.

TRAFFIC reports feature a graphic display of network activity. Each horizontal line represents traffic with the percentage of average use, peak use, and collisions shown. Jabber conditions, loss of link connection (for 10BASE-T networks), and the number of packets detected are reported at the end of each line. The time scale is automatically compressed when a traffic test exceeds six hours so that the test report will never exceed seven pages.

A typical traffic report is reproduced in Fig. 6-6.

```
                        SCAN-LAN 150 Cable Scanner

  Start Time:                    Date:          Operator:

  Notes:


  Cable:  10BASE-T

  ^^^ Average Utilization ---Peak Utilization      C = % Collisions

                          Percent Network Utilization
  Time      0    5    10   15   20   25   30   35   40   45   50   75   100
Packet
  HH:MM:SS  +----+----+----+----+----+----+----+----+----+----+----+----+   Rate
  00:00:00  ^                                                C              1
  00:00:01  --                                                              0
  00:00:02                                                                  0
  00:00:03                                                                  0
  00:00:04                                                                  0
  00:00:05  ^--                                                            42
  00:00:06  ^--                                                            12
  00:00:07                                                                  0
  00:00:08                                                                  0
  00:00:09                                                                  0
  00:00:10  --                                                              0
  00:00:11                                                                  0
  00:00:12                                                                  0
  00:00:13                                                                  0
  00:00:14^-                                                                1
  00:00:15^^--C----------                                                  51
  00:00:16^^-------------                                                  48
  00:00:17                                                                  0
  00:00:18                                                                  0
  00:00:19--                                                                0
  00:00:20                                                                  0
  00:00:21                                                                  0
  00:00:22                                                                  0
  00:00:23^-                                                                1
  00:00:24^^^----------                                                    52
  00:00:25^C^^^^^^^^--------                                              211
  00:00:26^^^C^^^^^^--------                                              198
```

Fig. 6-6. SCAN-LAN 150 Network Traffic Report.

```
00:00:27^^^^C^^^^^^--------                                          180
00:00:28^^^^^^^^^^------------  C                                    219
00:00:29^^^^^--------------                                          143
00:00:30                                                               0
00:00:31^-                                                             1
00:00:32^-                                                             1
00:00:33                                                               0
00:00:34                                                               0
00:00:35 --                                                            0
00:00:36                                                               0
00:00:37 ^--                                                          22
00:00:38 ^--                                                          10
00:00:39                                                               0
00:00:40                                                               0
00:00:41 ^-                                                            1
```

Fig. 6-6. SCAN-LAN 150 Network Traffic Report (continued).

7. Custom Cable Types

The Nominal Velocity of Propagation (NVP), characteristic impedance, and connector type for custom cables may be defined and stored in nonvolatile memory.

7.1 Calibrate Cable

Any custom or standard cable type may be calibrated for a specific cable spool. The calibrate cable function allows you to measure the NVP and characteristic impedance for a known length of cable and save it for additional measurements.

NOTE

Length measurements are only as accurate as the NVP setting for the cable being measured. NVP values can vary dramatically between cables from different manufacturers (especially on twisted-pair cable) and sometimes even between different cable lots. Default NVP values in the Scanner are only representative of commonly available values and may not be accurate for your specific cable. Measure and mark the NVP on each cable spool before installing the cable. As a minimum, measure and record the NVP of a representative known length of cable for each different cable manufacturer.

- Connect a sample cable of known length to the appropriate connector on the Scanner. The cable must be at least 50 feet (15.2 m) long to get an accurate measurement. Longer lengths improve accuracy.
- Set the rotary function selector to CALIBRATE CABLE.
- When the display in Fig. 7-1 appears, set the actual length of the cable with the ▼ or ▲ button.

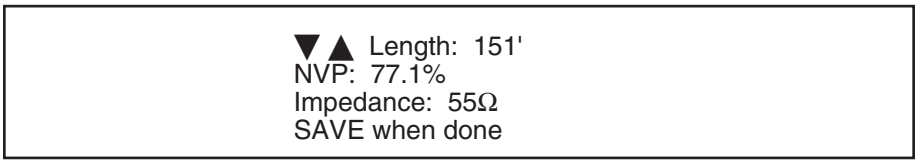

Fig. 7-1. Setting the Cable Length.

- Press the ▼ or ▲ button to enter the known length of cable, then press the SAVE button.
- Press the ▼ or ▲ button to select the correct cable type, then press the SAVE button. The NVP and characteristic impedance settings are stored in nonvolatile memory and will be used for all subsequent tests of the selected cable type.

7.2 Custom Cables

- Set the rotary function selector to CUSTOM CABLE.
- Press the ▼ or ▲ button until the display shows the desired cable type.

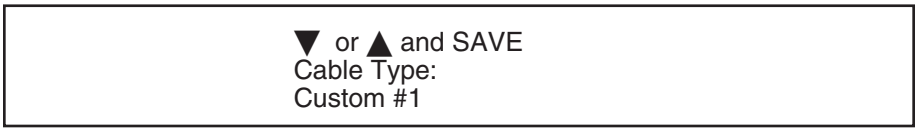

Fig. 7-2. Setting the Cable Type.

Press the SAVE button. The currently selected connector type will be shown in the display. Pin numbers for the transmit and receive pairs will be shown in the display if the RJ-45 connector type is selected.

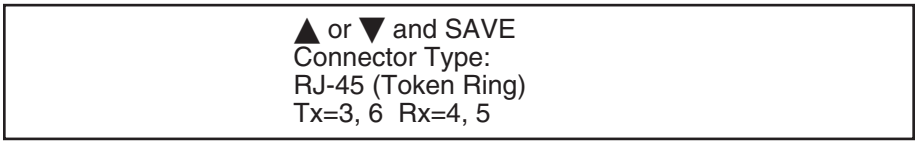

Fig. 7-3. Selecting the Connector Type.

- Press the ▼ or ▲ button until the display shows the desired connector type: RJ-45 (10BASE-T), RJ-45 (Token Ring), or BNC.
- Press the SAVE button. The current characteristic impedance setting will be shown in the display.

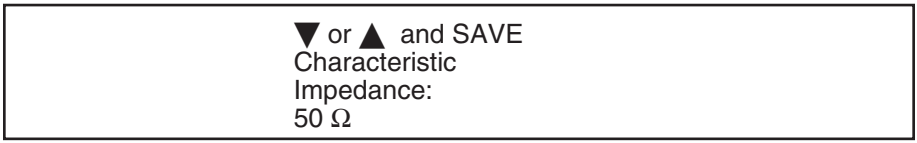

Fig. 7-4. Selecting the Impedance Setting.

- Press the ▼ or ▲ button to enter the correct characteristic impedance value.
- Press the SAVE button. The current NVP setting will be shown in the display.

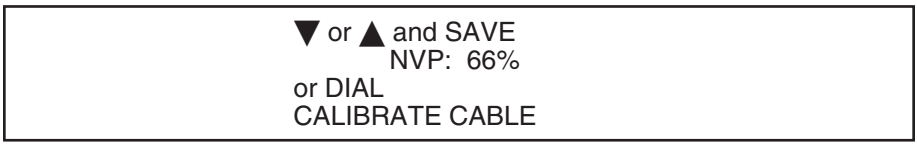

Fig. 7-5. Selecting the NVP Setting.

- If you know the correct NVP value for your cable type, press the ▼ or ▲ button to change the NVP value. Press the SAVE button to store the NVP setting.

  Alternately, the Scanner can measure the cable's NVP using the CALIBRATE CABLE function.

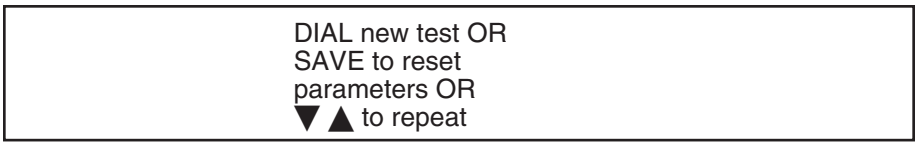

Fig. 7-6. Rotary Selector Screen.

- Set the rotary selector to a new test function to store the changes, press SAVE to abort any changes, or press the ▼ or ▲ button to change the settings again.

8. Special Setup

The units of length measurement, minimum fault threshold, and minimum noise threshold can be changed by the user if the default settings are not suitable for the cables being tested. Changes are stored in nonvolatile memory.

8.1 Units of Length

- Set the rotary function selector to SPECIAL SETUP. The currently selected units, feet or meters, will be shown in the display.

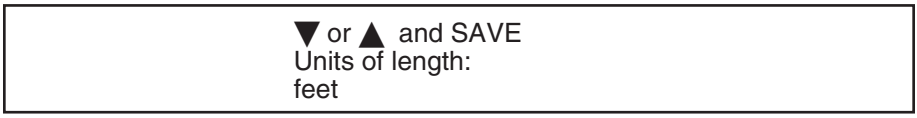

Fig. 8-1. Selecting the Units of Length.

- Press the ▼ or ▲ button until the display shows the desired length units.
- Press the SAVE button to store the length units setting.

8.2 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 Scanner. It 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 discontinuity specified in IEEE 802.3 for coax cable. Anomalies that are greater than this threshold may impair network transmission.

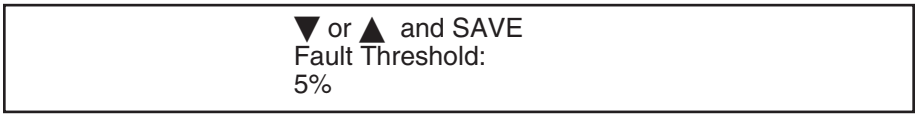

Fig. 8-2. Fault Threshold Screen.

- Press the ▼ or ▲ button until the display shows the desired fault threshold.
- Press the SAVE button to store the fault threshold setting.

8.3 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.

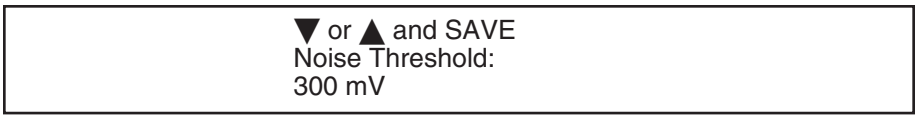

Fig. 8-3. Noise Threshold Screen.

- Press the ▼ or ▲ button until the display shows the desired noise threshold.
- Press the SAVE button to store the noise threshold setting.

8.4 Saving/Resetting Changes

- Set the rotary selector to a new test function to continue with another test, press SAVE to abort any changes, or press the ▼ or ▲ button to change the settings again.

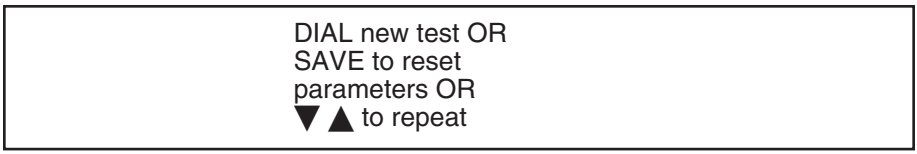

Fig. 8-4. Saving/Resetting Changes.

8.5 Resetting the SCAN-LAN 150 Cable Scanner to Factory Settings

The Scanner may be reset to factory settings using the RESET TO DEFAULT function. All settings including the units of length, minimum fault threshold, minimum noise threshold, NVP, and characteristic impedance values for all cable types are reset to factory settings. In addition, all custom cable types are destroyed.

- Set the rotary selector to EXTENDED FUNCTIONS. Press the ▼ or ▲ button to select the RESET TO DEFAULT function. Press the SAVE button.

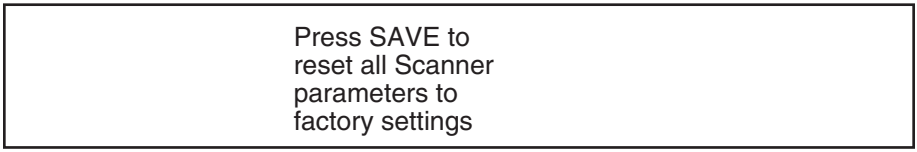

Fig. 8-5. Resetting the Scanner Screen.

- Press the SAVE button to reset the Scanner to factory settings, or select another function using the rotary selector to abort.

Appendix A. Standard Cable Types

The following cable types are included in the standard cable library resident in the SCAN-LAN 150 Cable Scanner. Default NVP values may be altered with the CALIBRATE CABLE function.

Table A-1. Standard Cable Library Contents of the Scanner.

Designation	NVP	Impedance	Connector/Pairs	Description
10BASE-T L3	62%	100 ohms	RJ-45 1,2-3,6	Level 3 unshielded twisted pair for 10BASE-T
10BASE-T L4	66%	100 ohms	RJ-45 1,2-3,6	Level 4 unshielded twisted pair for 10BASE-T
10BASE-T L5	72%	100 ohms	RJ-45 1,2-3,6	Level 5 unshielded twisted pair for 10BASE-T
802.5 L3	60%	100 ohms	RJ-45 3,6-4,5	Level 3 unshielded twisted pair for Token Ring
802.5 L4	69%	100 ohms	RJ-45 3,6-4,5	Level 4 unshielded twisted pair for Token Ring
802.5 L5	72%	100 ohms	RJ-45 3,6-4,5	Level 5 unshielded twisted pair for Token Ring

Table A-1. Standard Cable Library Contents of the Scanner (continued).

Designation	NVP	Impedance	Connector/Pairs	Description
10BASE2	80%	50 ohms	BNC	Thin Ethernet coax
RG-58	66%	50 ohms	BNC	Non-plenum solid polyethylene core RG-58 coax
RG-58 Foam	78%	50 ohms	BNC	Foamed (cellular) polyethylene core RG-58 coax
RG-59	66%	75 ohms	BNC	Non-plenum solid polyethylene core RG-59 coax
RG-59 Foam	78%	75 ohms	BNC	Foamed (cellular) polyethylene core RG-59 coax
RG-62	84%	93 ohms	BNC	Semi-solid polyethylene core RG-62 (ARCNET®) coax

Appendix B. Pinouts

B.1 Printer Connector

Figure B-1 shows a pin layout of the printer connector on the SCAN-LAN 150 Cable Scanner.

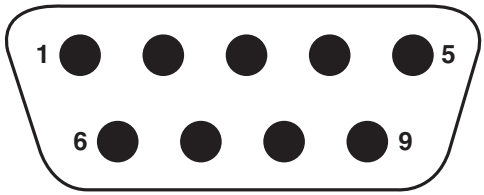

Fig. B-1. Printer Connector.

1 *no connection*
2 Receive Data (input)
3 Transmit Data (output)
4 Data Terminal Ready (output)
5 Signal Ground
6 *no connection*
7 *no connection*
8 Clear to Send (input)
9 *no connection*

B.2 Serial Printer Cable

This cable is equivalent to a standard AT serial printer cable.

Scanner End DB9S (female)		Printer End DB25P (male)
Receive Data	2 <----------	2 Transmit Data*
Transmit Data	3 ---------->	3 Receive Data
DTR	4 ---------->	5 CTS*
CTS	8 <----------	20 DTR
Signal Ground	5 ----------	7 Signal Ground

Fig. B-2. Serial Printer Cable Pinout.

You can obtain the serial printer cable from your Scanner dealer.

B.3 RJ-45 Clip Lead Cable

10BASE-T pair designations are shown in Fig. B-3. Pins 4 and 5 are not connected.

Pin #	Wire Color	Pin #	Wire Color
1	Green	1	Orange
2	Red	2	Orange white
3	Black	3	Blue
6	Yellow	6	Blue white

Fig. B-3. 10BASE-T Pair Designations.

Appendix C. Glossary

10BASE2—An IEEE standard for Thin Coax Ethernet networks—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—10-Mbps transmission, Baseband signaling, unshielded twisted-pair cable. Maximum allowable cable length is 100 meters.

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

ARCNET—Acronym for Attached Resource Computer NETwork. A token-bus local area network standard developed by DATAPOINT CORPORATION. ARCNET runs on RG62 coax, twisted pair, or fiberoptic cable with a basic signalling rate of 2.5 Mbps.

Attenuation—A reduction in the strength of a signal.

BNC—A coaxial cable connector, used with ThinNet (10BASE2) Ethernet networks.

Characteristic Impedance—The total opposition (resistance and reactance) to the flow of AC current that a transmission line would have if it were infinitely long.

Coax—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 on a shared network transmission medium (such as Ethernet).

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. (See Fig. C-1.)

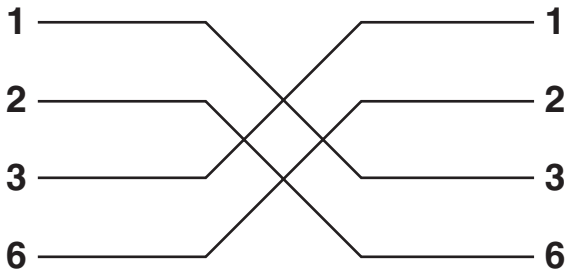

Fig. C-1. Crossed Pairs.

Crosstalk—The introduction of unwanted signals from a nearby communication pair. Cables with multiple pairs are particularly susceptible to crosstalk.

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

EIA568—An Electronic Industries Association commercial building telecommunications wiring standard. Specifies maximum cable lengths, installation practices, and performance specifications for generic building wiring.

Ethernet—A high-speed local area network 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). Ethernet protocol specifies a maximum packet length that any one station may transmit before other stations are allowed to access the network.

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

NEXT—Near-end crosstalk; crosstalk between two twisted pairs measured at the same end of the cable as the disturbing signal source.

NVP—Nominal Velocity of Propagation—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. (See Fig. C-2).

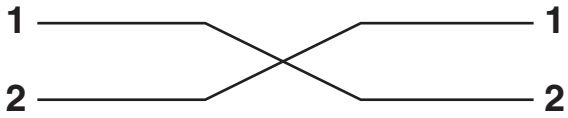

Fig. C-2. Reversed Pair.

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

Runt Packet—An Ethernet data packet that is shorter than the valid minimum packet length, usually caused by a collision.

Segment—A network cable terminated at both ends.

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

Signal/Noise Ratio—The ratio of worst-case 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. (See Fig. C-3).

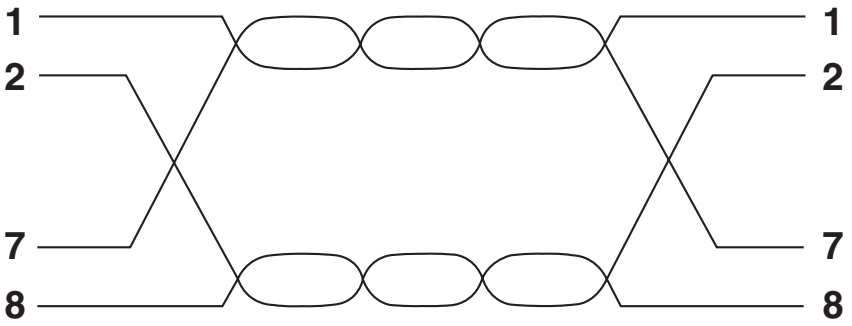

Fig. C-3. Pair 1,2 Split With Pair 7,8.

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 discontinuity 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:

length=1/2t x NVP x 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 local area network with ring topology that 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.

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NOTES

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