Southern Polytechnic State University

Electrical and Computer Engineering Technology

ECET 4820 Laboratory Exercise: UTP LAN Media

Objective:

The student will examine the characteristics of unshielded twisted pair (UTP) LAN cabling. It will also introduce the operation and benefits of the LANTech 100 LAN Telecom Cable Tester and the Fluke NetTool network connectivity tester.

Introduction:

Your instructor will organize groups of 3 to 5 students. Since there is only one LANTech 100, and one Fluke NetTool, the groups will perform the procedure one at a time. If necessary, refer to the LANTech 100 manual for descriptions of the tests. **Note: when performing the procedure, be careful to keep cables off the floor and out of the way of feet and chairs.**

Procedure:

Logistics

1. Each person should prepare a data sheet with the following information at the top:

   - Name of laboratory exercise

   - Your name

   - Your lab partner(s) name

   - Today's date

   Your instructor will divide the class into teams to perform the exercise

Part 1: Using the LANTech 100

2. a) Locate the wall jack number assigned by your instructor. If necessary, unplug the RJ-45 cable from the jack.

   b) From the TDR case remove the AXT-111 NEXT Signal Injector, the 6-foot DB25 to RJ-45 patch cable, one AC wall adapter, the charging interconnect cable, the RJ-45 Patch cable, and the LANTech 100.

3. a) Plug the AC adapter into the front of the AXT-111 slot labeled 9V DC.

   b) Connect the charging interconnect cable between the LANTech 100 and the AXT-111.

   c) Insert the 6-foot patch cable in between the wall jack and the AXT-111.

   d) Connect the RJ-45 to RJ-45 patch cable between the LANTech 100 and the AXT-111.

   e) Now switch on the AXT-111.

4. a) From the TDR case, remove the AXT-110 Smart Terminator, the 3-foot DB25 to RJ-45 patch cable, and the AC wall adapter.

b) Locate the number corresponding to your wall jack on the patch panel located on the top of the equipment rack.

c) Place the AXT-110 on a flat surface within 3 ft. of the patch panel.

d) Plug the AC adapter in to the front of the AXT-110 and into the wall outlet.

e) If necessary, carefully remove the RJ-45 cable from the front of the patch panel and plug in the 3-foot DB25 to RJ-45 patch cable.

f) Plug the other end into the AXT-110. Now switch on the AXT-110.

5. a) Switch on the LANTech 100 by pushing the button labeled **ON/OFF**.

b) Push the **SETUP** button and choose menu item **3-Twisted Pair**. Then choose **4-EIA/UL Cat 5.**

6. The LANTech-100 should now be configured for the proper cable being tested.

a) **Have your instructor verify the test configuration**.

b) Run the automatic test by pressing the **AUTOTEST** button. This may take a few seconds. Scroll through the test results using the up and down arrow keys.

- Which tests passed? Which failed?

7. We will test the Attenuation losses in the cable at different frequencies.

a) Reconnect the AXT-110, terminating the cable at the patch panel.

b) Press the **ATTENUATION** button. Select cable pair 3,6.

c) Press **ENTER** to start the test. Using the arrow key, scroll up/down to locate the attenuation at 10 MHz, 20 MHz, 39.8 MHz, and 100 MHz. Record the results in a table.

d) Repeat for pairs 1,2.

e) Compare the attenuation values for the two wire pairs

8. Use the LANTech 100 to check the length of the cable under test.

a) Disconnect the AXT-110, leaving an open circuit at the patch panel.

b) Disconnect the AXT-111 DB25 to RJ-45 patch cable from the wall.

c) Disconnect the RJ-45 to RJ-45 patch cable from the AXT-111 and plug it directly into the wall jack.

d) Press the **LENGTH** button on the LANTech 100. Record the lengths measured for each cable pair.

9. Your instructor will provide you with a length of Cat 3 cable.

a) What is the length of the cable as listed on the box? _____

b) Convert this to meters. _____

c) Repeat the measurements above to determine the cable length, attenuation as a function of frequency and crosstalk for the Cat 3 cable.

Note: you must select Cat 3 cable in the LANTech setup.

Part 2: UTP Cable Identification

10) Your instructor will give you 3 Ethernet patch cables. The EIA/TIA 568A and 568B standards relate wire color wire to pin number. For most networking applications, you will use straight through cables to connect devices, i.e. for connections between workstations and hubs (or switches). For other applications, you will use a crossover cable. This cable reverses the transmit and receive pairs on one end. By analyzing the location of the wires in the RJ-45 connector shells, fill in the table below.

Cable Number or Color	Cable Category	Connector 1 Configuration (EIA/TIA 568A or 568B)	Connector 2 Configuration (EIA/TIA 568A or 568B)	Crossover or Straight-Through?

Part 3: Using the Fluke NetTool

11. The Fluke NetTool combines cable, network, and PC configuration testing functions in a single unit. It includes a cable-testing capability, eliminating the need for a separate basic cable tester. It can operate single-ended and inline between a PC and the network. Only the single-ended capability will be used here. Additional benefits include:

- A Problem Log that concisely lists problems detected on the PC and network such as addressing issues, email and web problems.

- Simultaneously monitoring network health (frames sent, utilization, broadcasts, errors, collisions) for full-duplex connections.

- Individual frame counts for both the desktop and the network conversations.

- Showing protocol mismatches between the PC and the network, and identifying unwanted protocols.

Copies of the NetTool Quick Start Guide are available for reference. Read pages 12 and 13 of the NetTool Quick-Start Guide for an explanation of the display icons and menu. From this you will note:

- The top portion of the display shows the network connectivity diagram. Three icons can appear in the diagram, one for the NetTool itself (middle of diagram),

one or two for a PC (either end of diagram) or one or two for a hub (either end of diagram).

- You can navigate to the network icons and select them to reach additional information and menus.

- Below the network diagram is a menu that you can navigate and select.

- Note: to exit a **menu, scroll up until the X in the upper right part of the display is highlighted. Then press select.**

12. You will now perform some cable testing functions. Note: to turn the NetTool on or off, press the green button for at least 2 seconds.

   a) Turn off the NetTool.

   b) Select a straight through, open-circuited cable at least 3 feet long and connect it to the NetTool (See page 4 of the Quick Start Guide).

   c) Turn on the NetTool.

   d) Select the **AutoTest** function. You should see the NetTool icon and an icon that looks like a spool of cable in the network diagram. The cable length should be noted.

      - What is the cable length? Is it accurate?

      - Select the spool icon using the arrow keys and the **Select** button. What does the NetTool say about the connectivity of the cable?

   e) Turn off the NetTool.

   f) Place the NetTool wiremap adapter (actually a terminator) on the end of the cable.

   g) Turn on the NetTool.

   h) Select the **AutoTest** function. When it is complete, position the cursor on the terminator icon using the arrow buttons and press the **Select** button.

      - What does the NetTool say about the connectivity of the cable?

   i) Repeat the connectivity measurement using a crossover cable.

      - What does the NetTool say about the connectivity of the cable?

13. You will not use the NetTool to examine network activity.

   a) Turn off the NetTool.

   b) Connect it to a wall jack that is connected to a hub with workstations on it.

   c) Turn on the NetTool.

   d) Select the **AutoTest** function.

   e) After the test finishes, place the cursor on the hub or PC icon and press **Select**.

   f) Record the measured data under the **Link Config**, **Health**, and **Addresses Used** menu items.

g) Return to the main menu and place the cursor on the **Protocols** menu item. Determine which **IP Protocols** were found and record the results.

h) Also look for devices on the network.

Questions:

Answer the following questions.

1. Using the results from your attenuation and cable-length tests, compute the cable attenuation in dB/ft at both 10 MHz and 100Mhz.
2. How does the LANTech 100 measure cable length? What is the accuracy?
3. If you were checking the cabling in a large network, discuss the advantages of having the LANTech 100 or the NetTool.
4. When might you perform individual tests instead of using the LANTech Quicktest and Autotest functions?
5. What is the specification for the maximum UTP cable length of LAN segments using for 10BaseT and 100BaseTX installations? From your results measuring the Cat 5 and Cat 3 cables, is this specification reasonable? Why or why not?
6. Give one application where you would use a crossover Ethernet cable.
7. Can Cat 3 cable be used for 100BaseTX installations?
8. Which instrument, the LANTech 100 or NetTool is the most versatile?
9. Which instrument is the best for cable measurements? Justify your answer.

Report:

Summarize your results in a memo-style lab report of no more than 2 pages, excluding plots and attachments. Include a plot showing the attenuation vs. frequency for both cable pairs measured. Place the curves on the same graph. Answer all questions in the lab procedure and the Questions section. Make any conclusions you feel are appropriate.
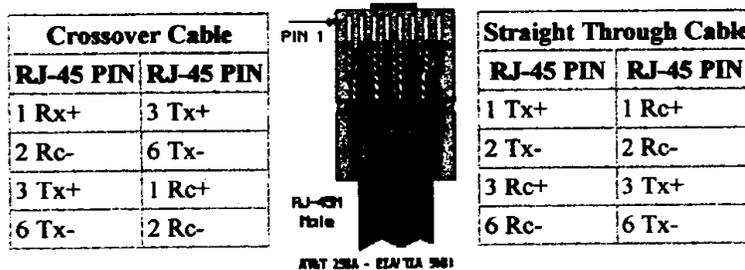
The following information was obtained from a web page that no longer exists. However, the information is correct.

RJ-45 Crossover Cable and Straight Through Pinouts

Overview
This article provides connectivity examples for hub-to-hub, hub-to-transceiver, transceiver-to-transceiver, pinouts and color coding for standard ethernet cabling.

Discussion

Crossover Cable	
RJ-45 PIN	RJ-45 PIN
1 Rx+	3 Tx+
2 Rc-	6 Tx-
3 Tx+	1 Rc+
6 Tx-	2 Rc-

PIN 1

RJ-45H
Male

AT&T 258A - EIA/TIA 568

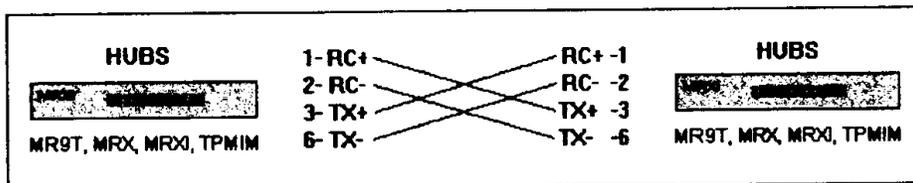| Straight Through Cable	
RJ-45 PIN	RJ-45 PIN
1 Tx+	1 Rc+
2 Tx-	2 Rc-
3 Rc+	3 Tx+
6 Rc-	6 Tx-

Please Note: The standard connector view shown is color-coded for a straight thru cable assembly, when connecting Hub to Xcvr or DNI Card. When connecting hub to hub, Xcvr to Xcvr, or DNI to DNI, the wires must crossover at the opposite end of the cable assembly.

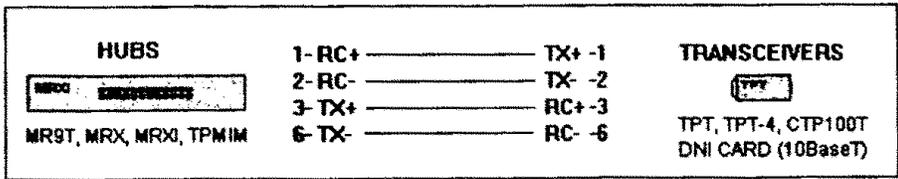Interconnecting Your Hubs, Transceivers, and DNI Cards

As noted in the illustrations below, a crossover cable is required when connecting a Hub to a Hub, or a Transceiver to Transceiver, or DNI to DNI card, or Transceiver to DNI card. When connecting a Hub to a transceiver or DNI card, a straight through cable is always used.

In these illustrations a Hub can refer to any standalone product, such as the SEHI or MicroMMAC; or concentrator modules in MMAC-FNB or MMACPLUS hubs, such as a TPMIM-xx, TPRMIM-xx or 9E132-15. To note the differences between Ethernet, Token Ring and FDDI/ATM connectivity, refer to the Wiring Color Code Standards.

Hub to Hub Connectivity
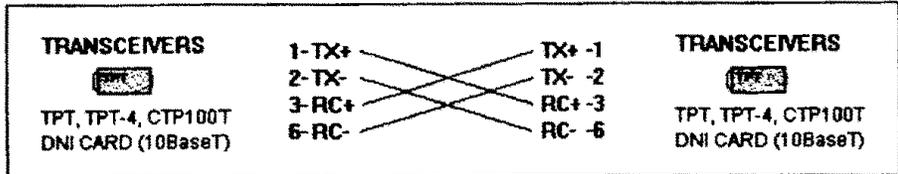
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HUBS            1- RC+        RC+ -1     HUBS
                2- RC-        RC- -2
                3- TX+        TX+ -3
MR9T, MRX, MRXI, TPMIM  6- TX-    TX- -6   MR9T, MRX, MRXI, TPMIM
```

Hub to Transceiver or DNI Card Connectivity

```
HUBS                    1- RC+ ——————— TX+ -1      TRANSCEIVERS
[MRCO  COMPONENTS]       2- RC- ——————— TX- -2          [TPT]
                        3- TX+ ——————— RC+ -3
MR9T, MRX, MRXI, TPMIM   6- TX- ——————— RC- -6      TPT, TPT-4, CTP100T
                                                    DNI CARD (10BaseT)
```

Transceiver to DNI Connectivity

```
TRANSCEIVERS            1- TX+ \   / TX+ -1        TRANSCEIVERS
   [TPT]                2- TX-  \ /  TX- -2           [TPT]
                        3- RC+  / \  RC+ -3
TPT, TPT-4, CTP100T     6- RC- /   \ RC- -6        TPT, TPT-4, CTP100T
DNI CARD (10BaseT)                                 DNI CARD (10BaseT)
```

Standard Ethernet Cable Part Numbers

9360005-xx	Straight Through Cable, Cat 5	Hub to Xcvr or DNI
9360141-xx	Straight Through Cable, Cat 3	Hub to Xcvr or DNI
9360034-xx	CrossOver Cable, Cat 3	Hub-Hub, Xcvr-Xcvr, DNI-DNI
9360169-xx	CrossOver Cable, Cat 5	Hub-Hub, Xcvr-Xcvr, DNI-DNI

Category 5 wiring standards:

EIA/TIA 568A/568B and AT&T 258A define the wiring standards and allow for two different wiring color codes.

Pin #	EIA/TIA 568A	AT&T 258A, or EIA/TIA 568B	Ethernet 10BASE-T	Token Ring	FDDI, ATM, and TP-PMD
1	White/Green	White/Orange	X		X
2	Green/White	Orange/White	X		X
3	White/Orange	White/Green	X	X	
4	Blue/White	Blue/White		X	
5	White/Blue	White/Blue		X	
6	Orange/White	Green/White	X	X	
7	White/Brown	White/Brown			X
8	Brown/White	Brown/White			X