# Week 10 Lab:
# Physical Layer – Twisted pair and RS232C connections

**Due Date:** Saturday November 21, 11:55pm
**Submission Requirement:** Submit Lab10_AnswerSheet **via Blackboard**
**ONLY 1 Lab** per pair of lab partners (ie. a team of 2)
**RENAME** the file as: **Lab10_Surname1Surname2**
**Marking Scheme:** Normal lab; marks as indicated on Lab10_AnswerSheet

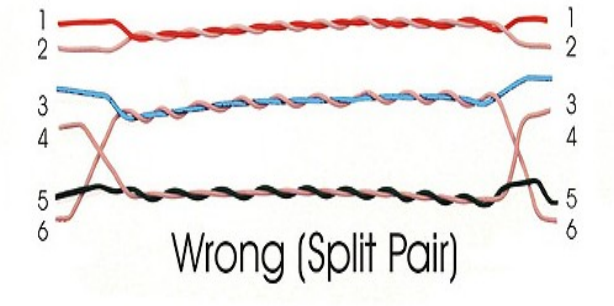
## Learning Objectives

Upon completion of this lab, you will be able to:

- Use a Fluke Qualification tester to test network cables
- Physically recognize various faults in network cables
- Know how to determine the data carrying capacities of network cables
- Know how to read and understand the manufacturer's markings on cables
- Understand how RS232C connections are made
- Be able to determine if a device is DTE or DCE

## References

Learn about Cable Testing
- http://www.flukenetworks.com/fnet/en-us/learnAbout/Cable%20Testing




This error occurs when one wire from each of two different pairs gets swapped on both ends of the cable. In our example above, you can see that the white wire of the blue & white twisted pair (pin 4) and the white wire of the black & white twisted pair (pin 6) have been swapped on both ends. The result is a cable that will pass a standard continuity test, but will have serious cross-talk problems. Split pair errors can easily happen in twisted pair cables where one wire of each pair is the same color. Some twisted pair cables have wires of all the same color, making this type of error even easier to produce and harder to find. Even when all the colors are different, it is not that hard to make a mis-wire on one end that is caught during a continuity test and then "fix it" at the other end so that the continuity test passes but a split pair error now exists.

## Background

In order to prepare of this lab you will be required to read and use the manual(s) for the test meter you'll be using and then complete a small quiz based on your reading. You will have to read and understand the slide set on making a cable to be able to visually inspect a cable.

## Scenario

In this lab you will be required to check 5 network cables for faults. You will check these cables one at a time using visual inspection and the Fluke Qualification meter.

## Equipment Required

1. Fluke CableIQ  Qualification Tester (provided)
2. Digital Volt Meter (DVM) (provided)
3. Test plugs (provided)
4. Twisted pair cables for testing (provided)
5. Cisco rollover cables (provided )
6. DB9 to RJ45 connector (provided)

### Task 1 – Do this before the lab

The following questions are based on the Fluke meter manuals located in the Blackboard folder for this lab and the reference site given above. **You will be required to show a hand-written copy of correct answers to all 10 questions before you will be admitted to this lab.**

Q1. The Fluke CableIQ Qualification Tester is used to test wiring and qualify transmission capabilities of what types of cables?

Q2. The testing instruments can be divided into three hierarchical types of testers. What are the three types?

Q3. What is the difference between certification and qualification?

Q4  What type of tester is the Fluke CableIQ Qualification Tester and what types of tests can it do?

Q5  What frequency range is used for testing for crosstalk?

Q6  What is the accuracy of length measurements?

Q7  Can the tester test for faults on crossover cables? (you may need to determine the answer to this in the lab)

Q8  How would you use the meter to check for crosstalk and what types of results could you receive?

Q9  What is the difference between “Discovery” mode and “Autotest” mode?

Q10 When using the tester to test a port on a switch how do you know if the switch is full duplex or half duplex?

#### Task 2

Test one cable from each of the following groups

Group 1 (cables 1, 5, 7, 8, 14 and 17)

Group 2 (cables 2, 3, 10, 11, 12, 16 and18)

Group 3 (cables 4, 6, 9, 13, 15, 19 and 20)

For each cable you test record the following. Each cable labeled with a number and each of the cable is labeled be sure to label diagrams and faults according to the labels

**First Cable Group # ____ Cable # ____**

**Visual inspection**

Type of cable (straight, cross-over, roll-over other etc):_____

Draw a diagram of the pin connections

Estimate cable length (do not undo the coiled cables): _____

Visual faults found (wrong wiring, improper connections, pins not connected etc):

_____
_____
_____

Cable Markings:

Who made the cable?_____
What standard is the cable made to? _____
What is the Category of the cable?_____
Does the cable contain length markings?_____
Is the cable made of solid wire or stranded wire?_____
Is the cable plenum rated?_____

**Testing with the meter**

What is the length of the cable?_____
Draw a wire map of the cable? _____
Type of cable (straight, cross-over etc)_____
What speeds is the cable useable at?_____
Does the cable have any crosstalk or impedance faults?_____
What if anything, can this cable be used for?_____

**Second Cable Group # ____ Cable # ____**

**Visual inspection**

Type of cable (straight, cross-over, roll-over other etc):_____

Draw a diagram of the pin connections

Estimate cable length (do not undo the coiled cables): _____

Visual faults found (wrong wiring, improper connections, pins not connected etc):

_____
_____
_____

Cable Markings:

Who made the cable?_____
What standard is the cable made to? _____
What is the Category of the cable?_____
Does the cable contain length markings?_____
Is the cable made of solid wire or stranded wire?_____
Is the cable plenum rated?_____

**Testing with the meter**

What is the length of the cable?_____
Draw a wire map of the cable? _____
Type of cable (straight, cross-over etc)_____
What speeds is the cable useable at?_____
Does the cable have any crosstalk or impedance faults?_____
What if anything, can this cable be used for?_____

**Third Cable Group # ____ Cable # ____**

**Visual inspection**

Type of cable (straight, cross-over, roll-over other etc):_____

Draw a diagram of the pin connections

Estimate cable length (do not undo the coiled cables): _____

Visual faults found (wrong wiring, improper connections, pins not connected etc):

_____
_____
_____

Cable Markings:

Who made the cable?_____
What standard is the cable made to? _____
What is the Category of the cable?_____
Does the cable contain length markings?_____
Is the cable made of solid wire or stranded wire?_____
Is the cable plenum rated?_____

**Testing with the meter**

What is the length of the cable?_____
Draw a wire map of the cable? _____
Type of cable (straight, cross-over etc)_____
What speeds is the cable useable at?_____
Does the cable have any crosstalk or impedance faults?_____
What if anything, can this cable be used for?_____

**Task 3**

For one of the networks jack on your desk

1. What room are you in?
2. What is the number and colour of the jack you are going to test
3. What length do you think this cable is (make an educated guess)
4. Draw a diagram of the cable run from you desk to the patch panel
5. Measure the length of the cable run using the Fluke meter
6. Test the cable for faults and report your findings
7. With your desktop jack plugged into a switch determine if the switch is operating full or half duplex.

**Task 4** RS-232C Serial Connections

Refer to this table as necessary:

| **Mnemonic** | **Usage** | **DTE** | **DCE** | **DB9** | **RJ-45** |
|---|---|---|---|---|---|
| Tx | Transmit Data | OUT | IN | 3 | 3 |
| Rx | Receive Data | IN | OUT | 2 | 6 |
| RTS | Request to Send | OUT | IN | 7 | 1 |
| CTS | Clear to Send | IN | OUT | 8 | 8 |
| DSR | Data Set Ready | IN | OUT | 6 | 7 |
| Gnd | Ground | === | === | 5 | 4 & 5 |
| CD | Carrier Detect | IN | OUT | 1 | --- |
| DTR | Data Terminal Ready | OUT | IN | 4 | 2 |
| RI | Ring Indicator | IN | OUT | 9 | --- |

The console port on most Cisco networking devices is represented as an RJ-45 jack (female), following the RS-232C standard of serial communications. The serial port of a PC, typically a DB9 plug (male) following the same standard, is often used with a *terminal emulation* program to connect to the "console" port of such devices (e.g. a router) for the purpose of configuration or management.

Two common ways to effect this serial connection are:

a) a DB9 socket (female) to RJ-45 jack (female) adapter, plus a rollover cable (where the adapter makes the PC's serial port available as an RJ-45 and the rollover cable accounts for the fact that **both ports are DTE**)
**OR**
b) a special-purpose console cable with a DB9 socket on one end and an RJ-45 plug on the other

1. Using the information given above and your knowledge of the functions of the RS-232C pins on the various connector types, neatly draw the pin-connections that would be necessary in the DB9 to RJ-45 adapter. (Hint: It may help to write the signal mnemonic beside each pin number.)

DB9 female

```
1 (CD)
2
3
4
5
6
7
8
9
```

RJ-45 female

```
1 (RTS)
2
3
4
5
6
7
8
```

2. For completeness, document below, the pin-outs on a rollover cable.

| RJ-45 male | RJ-45 male |
|---|---|
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |
| 4 | 4 |
| 5 | 5 |
| 6 | 6 |
| 7 | 7 |
| 8 | 8 |

3. Combining the results of 1 & 2 above, predict the configuration of the special-purpose console cable.

| DB9 female | RJ-45 male |
|---|---|
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |
| 4 | 4 |
| 5 | 5 |
| 6 | 6 |
| 7 | 7 |
| 8 | 8 |
| 9 | |

4. Obtain a special-purpose console cable and using a DVM, check to see if the actual cable matches your prediction. Note, and explain, any differences:

5. Obtain 50-60 cm of UTP with an RJ45 connector installed at one end. This will be used as your test plug.

6. Obtain a DB9 to RJ-45 adapter. Using a DVM and your test plug, check to see if the pin-outs of this adapter match your design from step 1. Note, and explain, any differences:

7. Most Cisco routers have both a console (CON) and an auxiliary (AUX) serial port. You have already been told that the CON port is configured as DTE. How would you tell if the AUX port is DTE or DCE? (Hint: You have a DVM and the test plug you made in step 5.) Record the results of the test, and your conclusions about whether the AUX port is DTE or DCE.

---