220 Lab B
Wiring Standards

Pre-Lab Activities:
None

Purpose
In this lab, you will take care of two separate “work orders”:
1. Install an analog telephone; and
2. Test three recently installed 4-pair connections.
Note: You will work on a functioning PBX. Plan what you are doing and double-check your work.
You will also work with tools, please use appropriate caution!

Smoking and any food or drinks are not permitted in the Applications Lab!

Equipment
- 2500 analog telephone and various station cables
- test telephone set
- tone generator and probe
- cable tester with remote detector and various patch cords
- Punch-down tools
- Screwdriver, wire cutter, knife
- Cross-connect wire and bridge clips

Taking Data
At the end of these instructions, you will find a sheet with several labeled sections. Use this sheet to record data as you take measurements. The lab instructor must initial the data sheet before you leave the lab. You must include the initialed data sheet with your lab report to receive full credit.

Work Order 1 (Install a telephone):

Install Wall Jack to Cable

Insure that the station wire coming out of the cable box is long enough to reach your jack.
Carefully remove a 3” length of the outer insulation. [The nylon thread is intended to help with this.] Look at and identify the wire pairs. There should be a white/blue (mostly white with some blue) and a blue/white wire (mostly blue). This is the "blue pair". There is also an "orange pair". Examine the color coding on the jack provided. One row of colors matches "station cable colors". An older jack is provided on the table so you can examine this color scheme. The second set of colors on the jack matches the coding of your wires. Make sure that the punch-down tool has the "110" blade installed, and connect the wires to the jack using the punch-down tool. Install the protective covers on the jack, snap the jack into the face-plate, and install the face-plate.

IMPORTANT: At this time, switch the punch-down tool to the "66" blade.

Install IDF Connection

The next step is performed at an “Intermediate Distribution Frame”, or IDF. Our overall goal is to connect our station cable to the correct pair of wires from our IDF to the MDF, or Main Distribution Frame. The IDF has three 66 cross-connect blocks on it. The diagram below shows how we will refer to the connector pairs. In this type of block [one of several types in common use], columns 1 and 2 are connected to one another internally, as are columns 3 and 4.
Look at the right-hand block on the IDF. On the right, it has a 25-pair cable punched to the 25 pairs of the block. This cable runs through a hole in the board to the MDF. Note that each pair has a top wire and a bottom wire that complement each other in color. Record the colors of the first 8 pairs for your lab report.

Look at the middle and left-hand blocks on the IDF. On the left side of each block there are a number of cables attached. These cables run to station sets on this floor – usually you’ll see them run up the wall and into the drop ceiling. Some of the pairs on the station set blocks are connected with red & orange or red & blue wire to pairs on the MDF block. These are for existing station sets in use on the floor.

Our first job for our new set is to identify which pair of wires on the station blocks is the pair that run to our newly installed jack. In general, it’s difficult to do this by physically ‘following’ the cable. Few companies keep such good records that they can just look it up. We’ll use a common technician’s tools, a tone generator and a matching probe. We also use a test telephone, also known as a test set or butt set. [I’m not making this up – check Newton’s Telecom Dictionary.]

The strategy is to connect the tone generator to our jack and use the probe to search the punch down block for the pair of wires that give the tone. Plug the tone generator into the jack, and use the probe to locate the other end of your station wire on the middle block; use the test telephone to confirm your choice (sometimes the probe will register on an adjacent pair). Record the pair number on your data sheet.

The next part of our task is to cross-connect the newly detected station pair to the appropriate pair on the MDF blocks. [How do we know which? If our records are good enough or if the MDF/IDF connections are well labeled, we just look. Often we would have another occasion to use our test set and tone generator. Today, we’ll say it’s already done.] We want to connect to column 1 of pair 10 on the right-hand block. To check that this is a live pair, change the lower switch of the test set to “talk,” confirm that the upper switch is at “tone,” and connect the leads to column 4 of pair 10. [It doesn’t matter which is which.] You should hear dial tone in the test set. Place a call from the butt set to a utility phone to make sure that this is a live connection. Place a call to 3129, find the phone in the equipment rack, and record the extension number displayed.

Cut a 2 foot length of “jumper” wire. The wire consists of a single twisted pair, the color does not matter (if you end up with a two-pair wire, separate out one pair). Punch down the two ends of each wire as shown in the table.

<table>
<thead>
<tr>
<th>Wire</th>
<th>From Station Block</th>
<th>To MDF Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Column 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The blade on the punch down tool is sharp and should be on the lower side of the post when you punch down a wire. This trims the excess wire from below the post. There’s a tool that looks like a crochet hook to pull small wire fragments from the block.
At The MDF

In general, there’s a similar cross-connection task at the MDF. We’ll assume it’s been done. This is also sometimes the case: excess capacity has been installed from the MDF to the IDF.

Activate the Phone

Have the lab instructor inspect your wiring, and install bridge clips. These clips will make the circuit complete.

You have a choice of two line cords. Use the cable tester to inspect both and use a good cord to connect your phone. Note: the yellow or red 8-conductor patch cords are known good cables. Use it to become familiar with the operation of the tester.

You should now have dial tone on the telephone. Test the phone by making a call to a utility extension.

Try eavesdropping with the butt set. Try the set in each of its three settings (Monitor, Ring, and Talk). At each switch setting, are you able to hear the conversation? Can the people on the conversation hear you? Speculate on the reasons why the test set has these three settings. You can try to hang up the phone you installed (that is the line your test set is patched into) to get a better idea of how the test set behaves in these settings.

Work Order 2: Test recently installed 4-pair wires:

The following three cable runs have recently been installed:

- Sub-Panel 5, Jack 22 to Sub-Panel 4, Jack 22
- Sub-Panel 5, Jack 23 to Sub-Panel 4, Jack 23
- Sub-Panel 5, Jack 24 to Sub-Panel 4, Jack 24

All runs are to be wired straight through, following EIA/TIA568B specifications (among other things that means that the following pins are paired: 4&5, 1&2, 3&6, 7&8).

Test the wire runs with the tester, record any discrepancy you might encounter. Think carefully how to best use the tester. Yelling across the room is ok, but give some thought to how to do this if the panels were in two different buildings; running back and forth between the two panels would be very inefficient, right?

<table>
<thead>
<tr>
<th>Column</th>
<th>Pair</th>
<th>Connector</th>
<th>Block</th>
<th>Column</th>
<th>Pair</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>red/blue</td>
<td>4</td>
<td>X</td>
<td>top</td>
<td>right</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>blue/red</td>
<td>4</td>
<td>X</td>
<td>bottom</td>
<td>right</td>
<td>1</td>
<td>10</td>
</tr>
</tbody>
</table>

X indicates the pair you located.
Requirements for your lab report

General Rules
Your report must be typed, except that drawings may be made by hand. While your raw data sheet must be attached, all relevant data must be copied into your typed report. Do not put things like “see data sheet" into your typed report.

Things to put into your lab report
A header section with your name, your teammates’ names, group number, and date/time of the lab.
The initialed raw data sheet (always attach this at the end of the report)
Each of the subsections below requires a brief description of what you measured, your results, and – when requested – a reference to and a quote from a reference source that you can compare your measurement to (for example, one of our readings or an internet source).

- Color coding of twisted pair wiring. Provide a reference that lists the codes for 25 pair cable and defines the names of the colors.
- Draw a diagram showing the path from the telephone you installed to the PBX. Make sure to include the extension number and the block designations and pair numbers of all connections you made on the IDF.
- Indicate what you found when testing the line cords (not the installed wire!).
- Summarize the effect and use of the various mode settings on your test telephone.
- For each of the three 4-pair wire runs you tested, draw a diagram showing the pin-to-pin connections. Point out any flaws in the wire runs compared to what they are supposed to be.
- Look up a definition of the EIA/TIA568B wiring standard. List any specifications in this standard that you could not verify with the supplied tester.
- Search on the internet for a tester that might address some of these shortcomings. List where you found it, the make and model, and its cost. (For reference, the tester you are using is rather low-end at $60).
ITS 220 – Lab B – Data Sheet

Name: __________________________________________

Group: ______________________  ______________________  ______________________

Group Number: _______  Date/Time: ________________

Color codes for the first 8 pairs of a 25 pair cable.

Pair number matching the installed wire from the jack.

Extension number for the PBX connection we will install.

Results of the line cord tests.

Effect of the mode setting on the test telephone on an on-going conversation.
Results of the wire tests:

panel 5, jack 22 to panel 4, jack 22:

panel 5, jack 23 to panel 4, jack 23:

panel 5, jack 24 to panel 4, jack 24: