DeVry University
ECT215L - DIGITAL AND DATA COMMUNICATIONS LAB
Spring 2005

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TEXT: Wheeler, Laboratory Manual to Accompany Electronic Communications for Technicians (Prentice-Hall)

CREDIT HOURS: 1.0

The following are planned dates for completion of the laboratory experiments of ET215L. Note that the lab reports are due during the lab *section* in that week. Late reports (up to 1 week) are penalized 10%. *Reports more than one week late are not accepted for credit under any circumstances*.

EXPERIMENT SCHEDULE

EXPERIMENT NUMBER	LABORATORY MANUAL PAGE	DESCRIPTION	REPORT DUE (WEEK NUMBER)
1	65	FIBER-OPTIC COMMUNICATIONS LINK	4
2	73	UART DATA TRANSMISSION	6
3	79	UART DATA RECEPTION	8
4	HANDOUT	FULL-DUPLEX UART-FIBER DATA LINK	10
5	87	RS232 INTERFACE	12
6	93	PC-TO-PC FIBER OPTIC DATA LINK	14
7	HANDOUT	WIRELESS DATA TRANSMISSION	15

Lab Reports

Every person will write and turn in a complete lab report for each experiment performed in ET215L. **Each person must write his or her own report, even when working with a partner**. The report format is similar to what might be required of a technician in industry. The general content will be as follows:

a) COVER PAGE -- Must be on UNLINED WHITE paper. Must be typed or computer generated. Refer to the provided example; the following information is required:

YOUR NAME
COURSE NAME AND SECTION (ET215L 3TA)
FOR: SR. PROFESSOR WHEELER
LAB NUMBER AND TITLE
DUE DATE (WEEK #)
THIS IS THE ORIGINAL WORK OF
(*YOUR SIGNATURE*)

OPERATIONAL SIGN OFF_____
FINAL GRADE _____

Hint: Make sure to have a completed cover page when you start each lab.
This makes it easy to get a sign-off when the experiment is completed.

b) SCHEMATIC PAGE: Contains the schematic of the section you constructed in lab. Must be technically correct and neatly drawn. OrCAD or other electronic drawing programs must be used -- no hand drawing is allowed. **Your name must appear on the schematic diagram**.

c) RECORDED DATA PAGES -- All required waveforms, voltage and current readings, and data of any other sort will be NEATLY recorded in this section. Each lab has different requirements for this area; the requirements will be given in a handout for each experiment. **Waveforms must be captured using the digital storage oscilloscopes and incorporated directly into the lab report electronic document using Office, Word Perfect, or other writing tools**.

d) WRITTEN: Contains the answers to the *questions* presented at the end of each experiment. The answers will be word-processed (or typed). They must be written in the form of complete sentences.

Creating Laboratory Reports

All laboratory reports will be created in entirely electronic form. This means that *no* handwriting is allowed (other than your signature on the cover page). All the data of the report will be contained within the document file in accordance with industry standard practice.

Grading

Each report in ECT215L is worth 100 points. A total of 7 reports are required, therefore, 700 points are possible in this course. There is no "extra credit."

Letter grades are assigned as follows. For your reference, the supplied example is typical of work that will score in the 95-100 percentile range. Your efforts should be modeled accordingly.

Letter Grade	Percentile Range	Quality of Work
A	90 - 100 %	Exemplary. Quality far exceeding basic requirements.
B	80 - 89 %	Excellent. Quality exceeds most expectations, with few errors.
C	70 - 79 %	Average. Quality meets basic expectations; all directions have been followed.
D	60 - 69 %	Below expectations. Many errors, instructions sometimes not followed.
F	< 60 %	Failing

GETTING A SIGNOFF

Operational signoffs are normally given during the assigned laboratory period. Your circuit board must be clearly marked with your name in order to receive a sign-off. It is preferred that you mark it on *top*, but if that bothers you while constructing circuits, you may mark it on the side (but not the bottom.) Operational signoffs are given on the laboratory cover page, so you should have this printed and ready.

COURSE POLICIES

I. Lab Partners: There are *no* lab partners allowed in ECT215L, with the exception of experiments 3, 4, and 6, where a partner is required.

II. Handing Work in: Work should be given directly to the instructor or his authorized assistant. Under no circumstances should work be turned in to any other persons (including the office) without advance permission from the instructor.

III. Late Work: **Reports are due during the assigned lab period, and are late when that period is over.** *The laboratory period ends at xx:50 UTC of the second hour of the assigned period.* (UTC=Coordinated Universal Time, Standard World Time). Late reports are assessed a 10% penalty. Reports more than one week late are not accepted.

IV. Lab Success Hints: The successful student will have all circuits built and ready to test before coming to lab. Lab handouts and other information distributed in class are extremely important, and should be studied and understood before attempting the experiment. Try a "dry run" in your mind the day before the experiment to see if you can recall the important steps, setups, and results. SAVE ALL LAB HANDOUTS, YOU WILL NEED THE INFORMATION FROM THEM ALL TERM!

V. Plagiarism: *Copying the work of another, and claiming it to be your own is* **plagiarism**. This includes (but is not limited to) copying others homework, copying from a lab manual or textbook, or collusion. The minimum penalty for cheating in any form is a grade of zero for the element involved; in some cases, failure of the course and/or expulsion from the Institute will also result. **All cases of misconduct will be documented and forwarded to Student Services for disciplinary consideration**. The DeVry Student Handbook contains complete information on this topic.

Please do not turn in any work that is not your own! If in doubt, ask the instructor. Here are some ways to avoid any problems:

- Don't share your computer files (text files, schematics, etc) with anyone else.
- Don't share a diskette (or other media) with another student; it's too easy to get files mixed up.
- Don't copy answers from a neighbor. If you don't understand how to do it, ask!
- Decline any request from fellow students for a copy of your work. Anybody needing this level of help should ask the instructor.

MISCELLANEOUS INFORMATION

Emergency Procedures: There are plaques located in the lab discussing emergency procedures. The instructor will remain in charge of your class group in an emergency.

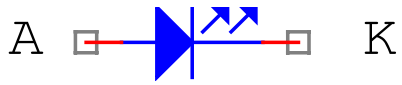
Food and Drink: For your safety (and to protect our investment in laboratory equipment), these are not allowed in the laboratory at any time, even in closed containers. Violators will be expelled from the laboratory.

GOOD DATA PROCESSING PROCEDURES

Computers will be used extensively in this lab. The following tips will help to minimize the chance of losing a project:

- Make frequent backups. These backups should be in at least two different physical locations.
- Always keep schoolwork on two different diskettes. Both of these disks will contain identical information. If a computer damages one diskette, the data can still be recovered from the other during the lab period.
- Don't save your data to the hard disk on the workstation, except in an emergency. The hard disks on lab workstations are periodically "cleaned" of any extra information as part of a housekeeping program.
- Keep the work for each class on a separate disk.
- Write your name, course, section, and professor's name on each disk. This will make it easier for others to return your work to you should you accidentally leave a disk behind. It happens to all of us!
- If you're using a computer at home, an *anti-virus* program is strongly recommended. Use a secured operating system.

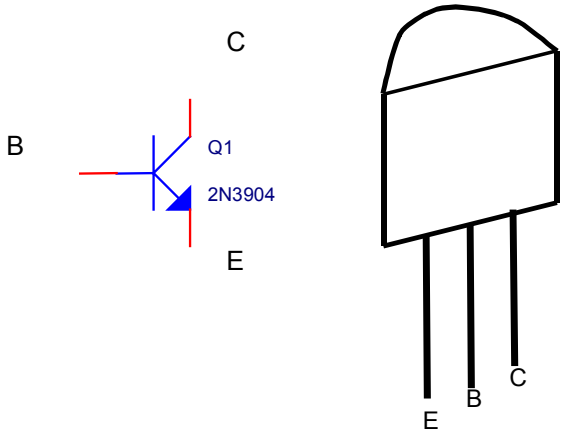
1. The schematic symbol for a light-emitting diode looks like this:



The electrode with the *arrow* is the *anode*, and the other lead (with the line) is the *cathode* (marked "K"). This part is *polarized*. It won't work if it is inserted into the circuit backwards! The two small arrows tell us that this part emits light. The LED in this experiment emits infra-red radiation, which is invisible to the naked eye.

LEDs are very useful animals, and you will see them throughout electronics. A special LED called a "photoemitter" is used in this experiment. It has a plastic fitting that is made to couple directly to a fiber optic cable. When you wire the LED photoemitter (as shown in Figure 9-3, lab manual page 67), pay careful attention to where the *anode* and *cathode* connections are.

2. The schematic symbol for a bipolar transistor looks like this:



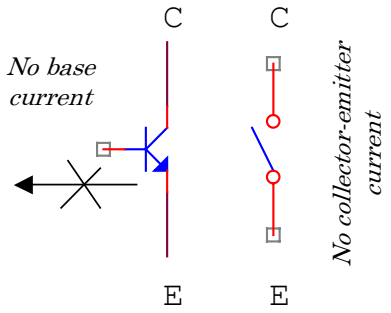
Compare it to its pin-out diagram. Notice that you *must* put it into the circuit correctly. It won't work backwards!

Like LEDs, transistors are everywhere in electronics. It has three terminals, named the *emitter*, *base*, and *collector*. A transistor acts like an electronically-controlled switch (or valve). Transistors can be either NPN or PNP in polarity. The NPN type is shown above.

The PNP type has the opposite polarity, and has the arrow "*Proudly iNward Pointing*."

The main current in a transistor flows between the emitter and collector. But -- this current can only flow when an appropriate current is applied to the *base*.

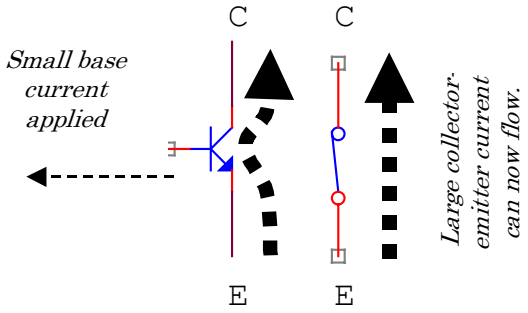
If there's no base current, the transistor doesn't let any current flow between its emitter and collector...just like an open switch. We say that the transistor is "off."



An "off" transistor is just like an open switch. No current can flow.

Applying a base current of sufficient size turns the transistor all the way "on." Now it looks like a closed switch. Only a small base current is needed in order to control a large collector current; for example, a 1 mA base current can switch a 100 mA (or more!) collector current, depending on the transistor's characteristics. The transistor acts like a current *amplifier*.

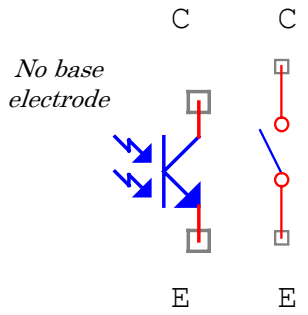
This is how transistor Q2 is being used in Figure 9-2.



An "on" transistor is just like an closed switch. Electron current flows from emitter to collector.

Of course, we can also vary the base current up and down -- which will make the effective "resistance" of the collector-emitter region of the transistor vary in step with the base current. In other words, we can make a *linear amplifier* with the transistor. You will study amplifiers in your other electronics courses.

3. A phototransistor is a special transistor that can be turned on and off by incoming light. Its schematic symbol looks like this:



A phototransistor acts like a light-controlled switch.

Notice anything missing? Yes, the *base* electrode is gone. (In place of the base connecting wire are the arrows, again symbolizing light.) Remember that the base is the "on/off control" input for a bipolar transistor. So how does this guy get turned on and off?

As you have guessed, light does the trick. A phototransistor has a clear plastic (or crystal) window covering its semiconductor junction. Incoming photons of light strike the junction, causing an electrical current to flow. Phototransistors are very sensitive because of the amplifying nature of the transistor.

Think of this device as a light-controlled switch: When there's no light, no current flows (the switch is "open"), and when sufficient light is applied, the device has a low resistance (the switch is "closed").