

PHYSICS 1409/1430 EXPERIMENT 1 – THE CATHODE–RAY OSCILLOSCOPE ALTERNATIVE PROCEDURES FOR USE WITH GWINSTEK OSCILLOSCOPES

The newer GWINSTEK Digital Storage Oscilloscopes function in the same way as the older oscilloscopes, but the controls and the way settings are viewed are different, in the same way that volume and channel settings are done differently on newer models of television sets. The older models have knobs that are turned to a desired setting and the value of the setting is seen on the knob itself. Newer models may still have a knob to turn (or a button to push) but the value of the setting is viewed digitally on the screen.

In the same way, the newer oscilloscopes must be turned on in order to see what the values of the settings are. Below is a picture of the control panel on the GWINSTEK scope:



If you look closely you can see many of the same controls as on the older scopes but the knobs do not have value labeling on them. In addition, some of the controls have multiple functions depending on the way the scope is set. The VARIABLE knob visible in the upper left is a knob that increases or decreases settings (like VOLUME or BRIGHTNESS on a television) but exactly what it increases depends on the “active function” of the scope. The five buttons along the left side are adjacent to the screen and they also change functionality depending on what you are trying to do. The immediate right side of the screen (barely visible in the picture) will contain labels for each of the five buttons that indicates the current functionality for each button. You may have seen similar applications on a computer where the function keys change

functionality and a legend appears at the bottom of the screen showing current functionality for each key.

The procedure for experiment 1 in the lab manual starts with a setup step to configure the scope before turning on the power. That won't work with the new scopes because of what is discussed above. So the following steps 1 – 10 should be used in place of steps 1 – 4 in the lab manual and the following steps 11 – 18 should be used as supplements to the rest of the steps in the lab manual.

PROCEDURE FOR GWINSTEK SCOPES

1. Turn on the oscilloscope by pressing the power button in the lower left hand corner of the scope. After a power up sequence and display of the manufacturer's title page, the scope will display a screen which looks somewhat like an x - y plane from algebra. Notice the values displayed around the screen and the labels for the five buttons on the right of the screen.
2. Reset the scope to its default state. To do this press the *Save/Recall* button on the upper right portion of the control panel. Next push the button (it's the top one of the 5) labeled *Default Setup* (see how the button functionality works?). This resets the scope to its default state. Notice that there are two lines (one yellow/one blue) on the screen. The yellow line is for channel 1 (note that the *ch 1* button on the control panel is yellow) and the blue line is for channel 2 (note that the *ch 2* button on the control panel is blue). Both channels are set for 2 volts per division (note the display that tells us this in the lower left corner of the screen) and the horizontal scale is set to 2.5 microseconds (μs ; see display bottom center).
3. Assuming that you are working from a printed copy of these instructions, draw a circle around all of the previous step that shows how to reset the scope to its default state and save this page when you are done with it. You will use the oscilloscope in two other experiments and those instructions will get you started by setting the scope to its "standard" state. You can then set the scopes for use in those experiments using the lab manual instructions and your TA's help should you need it.
4. We're not going to use channel 2 so you need to get rid of it. Do this by pushing the blue *ch 2* button. When you push it once notice that the 5 button labels change since pushing the *ch 2* button once sets the functionality to channel 2. Push the button again to turn off channel 2. Note that the blue line goes away. You can push *ch 2* repeatedly to turn channel 2 on and off, but eventually leave it off.
5. The yellow channel 1 line is not at the center of the screen. You can adjust its position by turning the channel 1 vertical position knob just above the yellow *ch 1* button. Adjust the line up and down and you will see that the offset will display on the screen while you are

adjusting the position. The offset is in volts because that is the unit of measure for the y-axis on the scope. You will find that the initial offset is around 4 volts. Note that the original position of the line was 2 graph divisions above the center line on the screen. Remember that we noted that the volts/div setting was 2? That means that each graph line on the screen represents 2 volts, so an offset of 2 graph lines corresponds to 4 volts. Adjust the position of the yellow line (use the knob right above the *ch 1* button) so that it reads an offset of minus 2 volts. That's going to put the yellow line one graph line below the center line. Now adjust the line so that it is along the center line (offset zero volts).

6. Next adjust the *volts/div* to 1 volt instead of 2. Do this by turning the *volts/div* knob and note the change in reading in the lower left hand corner of the screen.
7. Change the *time/div* setting to 2.5 milliseconds (*ms*) by adjusting the *time/div* knob located just to the right of the *volts/div* knobs. It is originally set on 2.5 microseconds (*μs*). Notice that this doesn't change the display at all. Try turning the horizontal position knob (the knob under the word "HORIZONTAL" with the left and right arrows. Note that this doesn't change the display either but the indicator at the top shows that you're basically moving the straight line back and forth. Make sure you reset it to 0.000 seconds (*s*).
8. Change the *time/div* setting to 2.5 seconds (*s*) and you'll see something different. Estimate the velocity of the end of the line as it moves across the screen in *cm/sec* (each box on the screen is about 1 cm) and compare it to the setting (2.5). At this slow setting you can see the sweep move across the screen. If you need to restart it, just move the *time/div* to another setting and then back to 2.5 seconds. At settings faster than 1/4 second (250 milliseconds) the scope waits until the sweep goes all the way across before it displays the line. Try moving the *time/div* setting up and down to see various sweep velocities and the faster settings where the scope does not display the sweep until it has gone all the way across. Leave the *time/div* setting at 2.5 milliseconds (*ms*).
9. On your data sheet, enter *Not Applicable* to the question about the FOCUS knob (there's not a FOCUS knob on these scopes), and describe what happens when the VERTICAL POSITION and HORIZONTAL POSITION knobs are turned.
10. On your data sheet, cross through the word *Highest* in *Highest Sweep Setting* and enter 2.5 seconds for the sweep setting you observed. Then enter your velocity estimate and comparison in the appropriate spaces. Enter *Not Applicable* in the blanks asking for *can't distinguish direction* and *can't observe flickering* because these scopes operate differently as the sweep time is decreased.
11. Now return to the lab manual and start at step 5 to continue the rest of the experiment, using the additional notes following as clarification.

12. **For lab manual step 6:** On the digital scope with the five buttons set to the CHANNEL 1 menu (if you're not sure, turn CHANNEL 1 off and back on using the yellow *chl* button), the VARIABLE knob changes the Voltage setting for button 4 (originally set at *1x*, meaning one times) to a higher or lower multiplier. This is compensated for by adjusting the VOLTS/DIV setting automatically as shown on the lower left of the screen. So if you change the button 4 setting to 2X it will compensate by changing VOLTS/DIV from 1 to 0.5. Make sure when you stop it is set on Voltage 1X and that the VOLTS/DIV is back to 1 Volt.
13. **For lab manual step 8c:** The equivalent of the AC-GND-DC switch is button 1 on the CHANNEL 1 menu labeled COUPLING. The AC setting has a picture of a sine wave, the GND setting has a picture of a pitchfork-looking thing, and the DC setting has a picture of a straight line above a dashed line.
14. **For lab manual step 17b:** Instead of the instructions in the lab manual, do this instead: Change the heading on the data sheet to read *Horizontal Position* rather than *Horizontal VAR* and record what happens when you adjust the horizontal position knob.
15. **For lab manual step 17d:** Instead of the instructions in the lab manual, do this instead: Describe on the data sheet what happens when the VARIABLE knob is turned. With the sine curve on the screen it is easier to see what happens with this knob than with the straight line.
16. **For lab manual step 18:** Ignore the comment about the VAR controls.
17. **For lab manual step 19:** See above for instructions regarding the AC-GND-DC settings.
18. **For lab manual step 20f:** See above for instructions regarding the AC-GND-DC settings.
19. **For lab manual step 21:** See above for instructions regarding the AC-GND-DC settings.