

## Cornerstone Electronics Technology and Robotics I Week 21 Oscilloscope Tutorial 2 and Function Generator Tutorial

- Administration:
  - Prayer
  - Turn in quiz
- Function Generator:
  - A function generator is a device that can produce various patterns of voltage at a variety of frequencies and amplitudes.
  - Our function generator generates sine, triangle & square waveforms from 0.5Hz to 4MHz.
  - The basic controls on a function generator vary the amplitude and frequency of the output waveform.
  - Basic Operation: Perform Oscilloscope/Function Generator Lab 1 – Basic Operation of a Function Generator
- Electricity and Electronics, **Section 10.5**, Oscilloscope Continued:
  - Perform Oscilloscope/Function Generator Lab 2 – Displaying a DC Voltage and Dual Display.
  - Perform Oscilloscope/Function Generator Lab 3 – Other Dual Displays

## Electronics Technology and Robotics I Week 21

### Oscilloscope/Function Generator Lab 1 – Basic Operation of a Function Generator

- **Purpose:** The purpose of this lab is having the student learn the basic controls of a function generator.
- **Apparatus and Materials:**
  - 1 – Oscilloscope
  - 1 – Function Generator
  - 1 – BNC Male to BNC Male Cable
- **Procedure:**
  - Select the type of waveform by rotating the **Function Switch** (FG2). See the Figure 21 – 1 for the function generator control locations.
  - Select the frequency range by rotating the **Frequency Range Selector Switch** (FG).
  - Connect the function generator **Main Output** (FG6) to the **CH1 Input Jack** (O10) on the oscilloscope. See the Figures 21 – 2 and 21 - 3 for the oscilloscope control locations.
  - Set the oscilloscope **Vertical Mode Control** (O13) to CH 1.
  - Set the **CH 1 Input Coupling Switch** (O9) to AC.
  - Adjust the oscilloscope **CH 1 Variable Attenuator** (O11) to the full clockwise position.
  - Set the oscilloscope **CH 1 Volts/Div Control** (O12) to 5.
  - Set the oscilloscope **CH 1 Input Coupling Switch** (O9) to AC.
  - Turn on both the oscilloscope **Power Switch** (O1) and the function generator **Power Switch** (FG4).
  - Select different types of waveforms by rotating the function generator **Function Switch** (FG2).
  - Adjust the amplitude of the waveform by rotating the function generator **Amplitude Control** (FG3).
  - Adjust the frequency by changing the function generator **Frequency Control** (FG5) and **Frequency Range Selector Switch** (FG1).

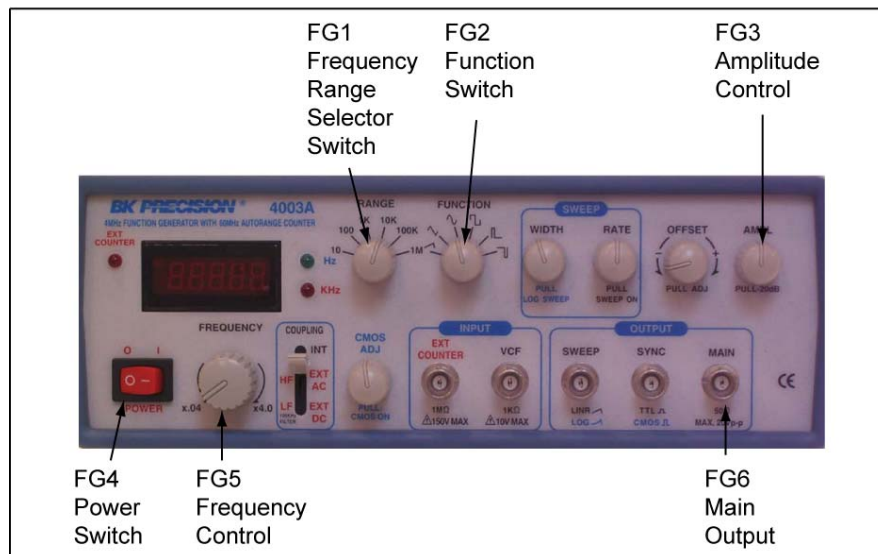
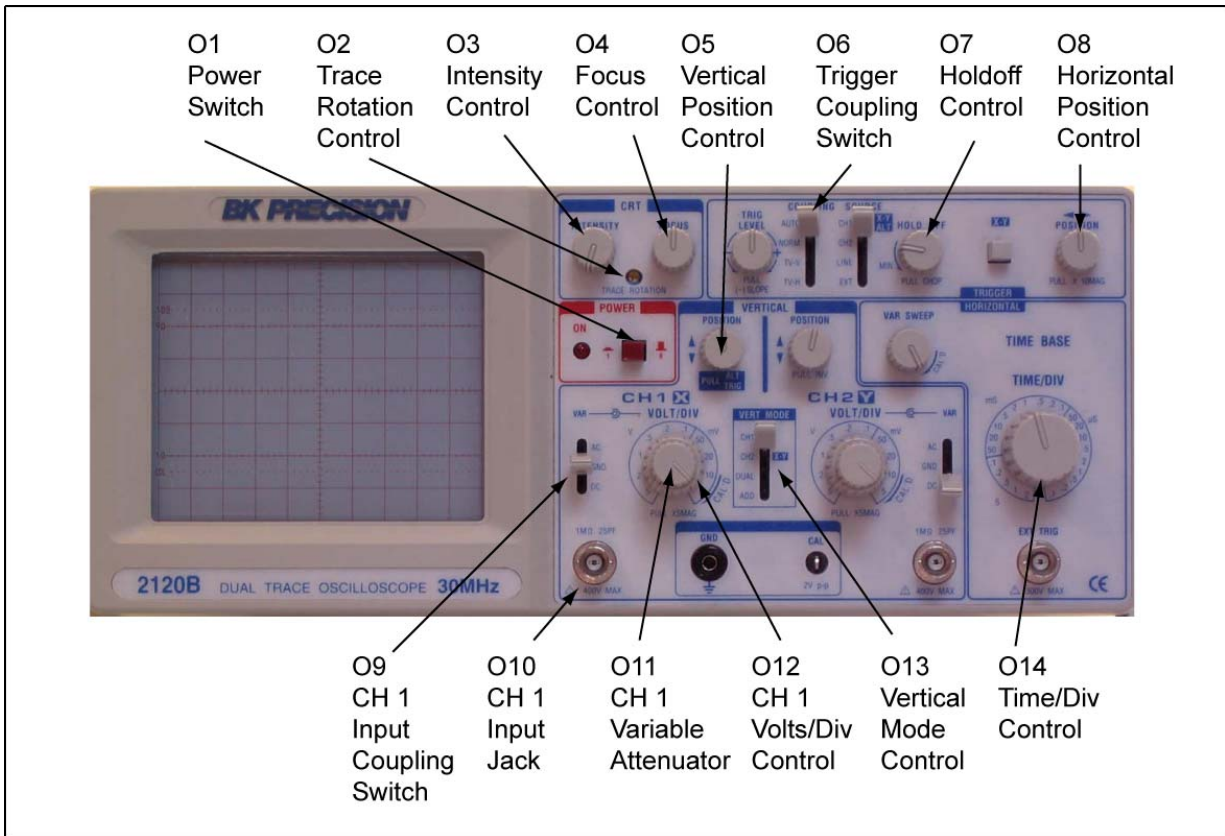
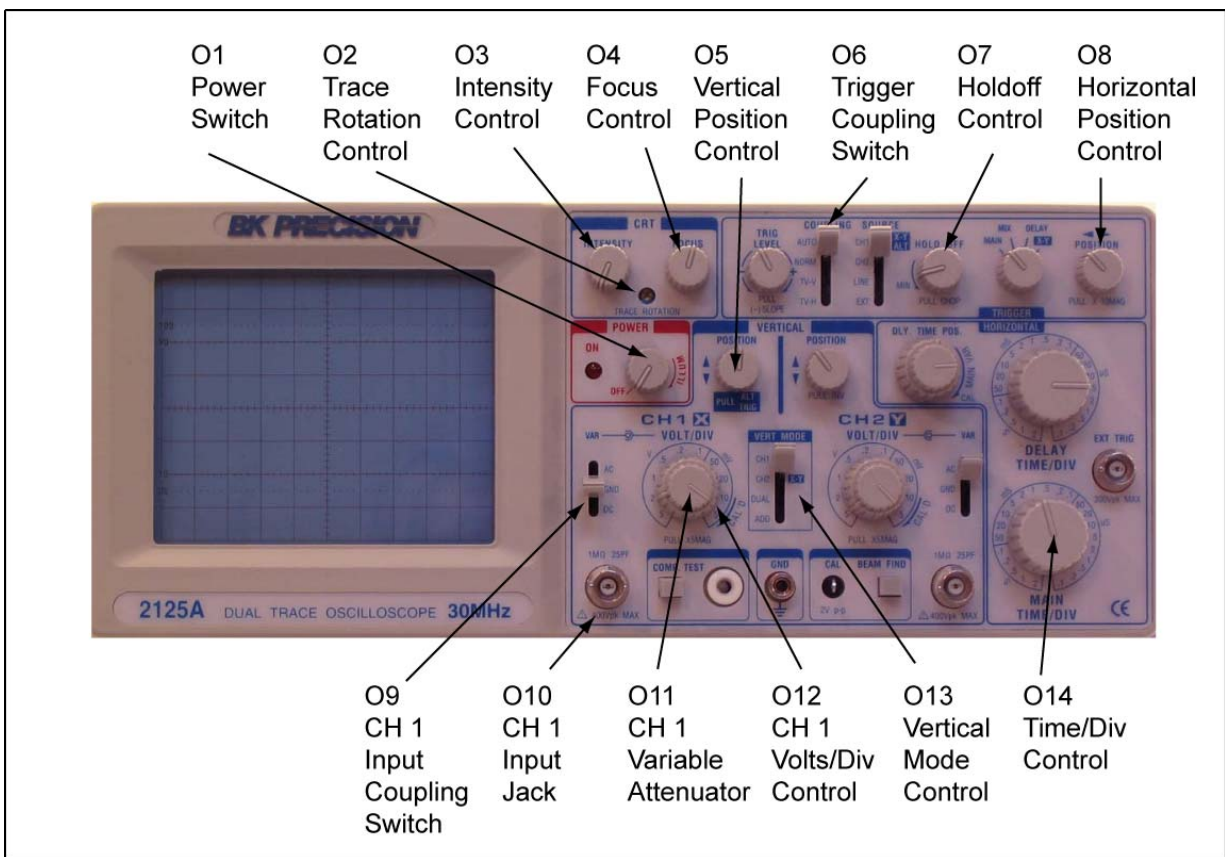


Figure 21 – 1 BK Precision 4003A Function Generator Controls for Lab 1



**Figure 21 – 2 BK Precision 2120B Oscilloscope Controls for Lab 1**



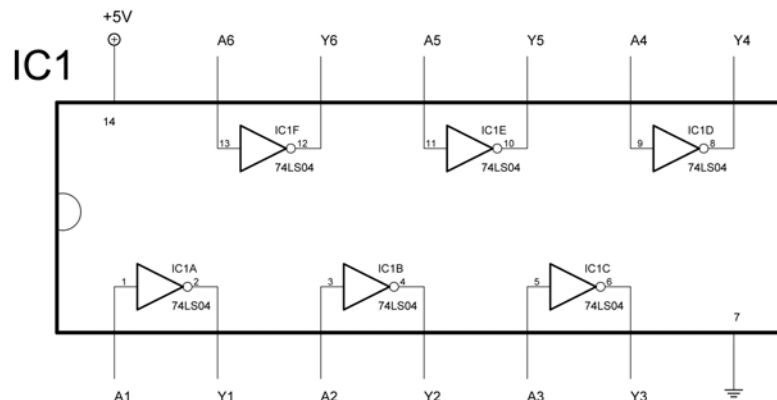
**Figure 21 – 3 BK Precision 2125A Oscilloscope Controls for Lab 1**

**Electronics Technology and Robotics I Week 21**  
**Oscilloscope Lab 2 – Displaying a DC Voltage and Dual Display**

- **Purpose:** The purpose of this lab is to display a dc voltage and a dual voltage trace on an oscilloscope.
  
- **Apparatus and Materials:**
  - 1 – Oscilloscope
  - 1 – Function Generator
  - 1 – BNC Male to BNC Male Cable
  - 1 – 9 V Battery
  
- **Procedure:**
  - Leave the function generator **Main Output** connected to the **CH1 Input Jack** on the oscilloscope.
  - Set the **Vertical Mode Control** to Dual.
  - Connect a scope probe to the **CH 2 Input Jack**. The Channel 2 controls are identical to the Channel 1 controls except they are to the right of the **Vertical Mode Control**.
  - Adjust the **CH 2 Variable Attenuator** to the full clockwise position.
  - Set the **CH 2 Volts/Div Control** to 5.
  - Set the **CH 2 Input Coupling Switch** to DC.
  - Connect the probe's ground clip to the (–) terminal of the battery.
  - Set the probe slide switch to x1.
  - Connect the probe tip to the (+) terminal of the battery.
  - Turn on both the oscilloscope **Power Switch** and the function generator **Power Switch**.
  - Adjust the **CH 1 Vertical Position Control** and the **CH 2 Vertical Position Control** such that the ac signal is above the dc signal.

## Electronics Technology and Robotics I Week 21 Oscilloscope Lab 3 – Other Dual Displays

- **Purpose:** The purpose of this lab is to display circuit inputs and outputs as a dual voltage trace on an oscilloscope.
- **Apparatus and Materials:**
  - 1 – Oscilloscope
  - 1 – Function Generator
  - 1 – BNC Male to BNC Male Cable
  - 1 – 9 V Battery
- **Procedure:**
  - **Inverter Circuit:**
    - Wire the 74LS04 below. Use a function generator set at a 1 KHz square wave as the input signal. Connect one of the six inverter inputs, e.g. A1, to the **CH 1 Input Jack** on the oscilloscope and one of the inverter outputs, e.g. Y1, to the **CH 2 Input Jack**.
    - Connect the input from the inverter circuit to channel 1 and the output from the inverter to channel 2.



**Figure 21 – 4 74LS04 Hex Inverter**

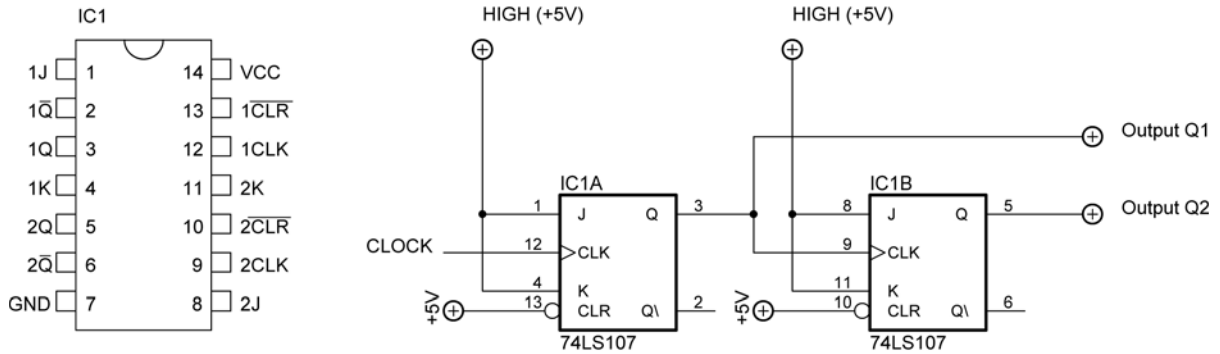
$Y = \bar{A}$	
Input A	Output Y
L	H
H	L

H = High Logic Level (+5 V)  
L = Low Logic Level (0 V)

**Figure 21 – 5 Inverter Truth**

○ **Binary Count Circuit:**

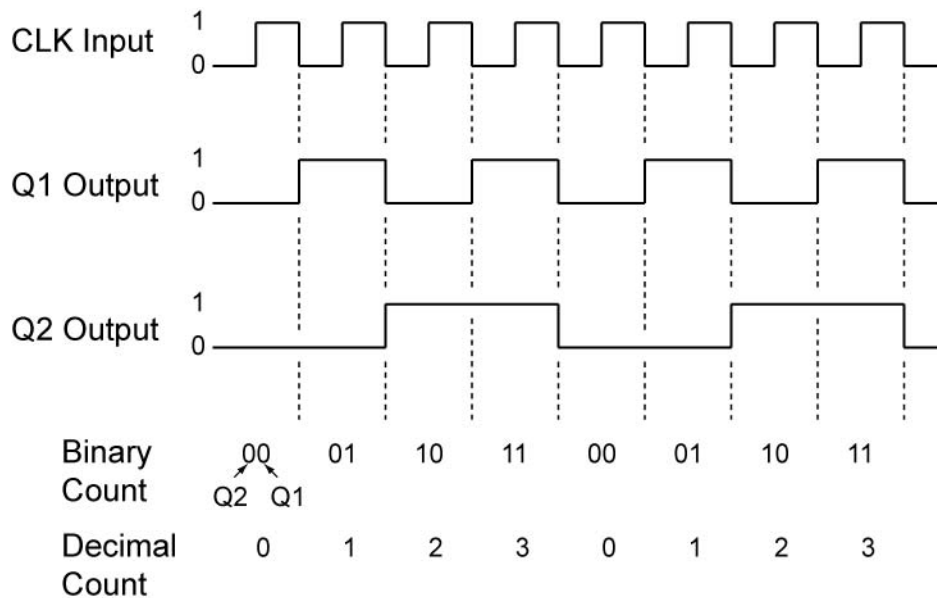
- Wire the following dual J-K flip-flop circuit.
- Use a function generator set at a 1 KHz square wave as the clock input.
- Connect Q1 to **CH 1 Input Jack** and Q2 to **CH 2 Input Jack** on the oscilloscope.



**Figure 21 – 6 74LS107 Flip-Flop Pin Layout and Binary Counting Circuit**

Decimal	Binary
0	00
1	01
2	10
3	11

**Figure 21 – 7 Counting to 3 in Binary**



**Figure 21 – 8 Q1 and Q2 Outputs**