LAB 0

INTRODUCTION TO EQUIPMENTS

1.INTRODUCTION

This lab is designed to introduce CADET (Complete Analog/Digital Electronic Trainer) kit and it gives information about implementation of future lab experiments. LAB 0 is only introduction.

2.PRELIMINARY

Read information about CADET and 74LS00 datasheet.

3.EQUIPMENTS AND COMPONENTS

- CADET

- 74LS00 NAND GATE

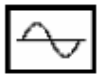
3.1. INFORMATION ABOUT CADET

CADET provides prototype area building and testing analog/digital circuits. CADET has three power supply units. Two of them are adjustable and other is constant. Function generator generates sine, triangle and square wave. Pulse generator frequency is up to 1 MHz. Speaker on CADET is used for analog signals. For digital application, CADET has two TTL level square wave generator, two debounced buttons, eight switches and eight logic displays. Logic displays show logic level of input signal. If input is logic 1, display is on. Otherwise display is off. Logic probe is used to trigger circuits. If your design needs to display numbers, two BCD seven segment displays can be used. Bar graph and digital voltmeter easily shows DC level of signals. Two potentiometers and two SPDT push buttons provide to control your circuit. BNC connector is used to connect your CADET to the other test equipment and signal generator.

3.1.1. Digital Voltmeter

Digital voltmeter automatically selects appropriate input range and displays DC level of input signal. Input ranges are ±0 – 199.9 mV, ±200 mV – 1. 999 V, ±2 V – 19.99 V and ±20 V – 199.9 V. Two BP32 socket provides measurement. If the input voltage is less than 200 mV, display shows one digit and “mV” text. Otherwise, it displays voltage and “V” text. Maximum 200 V can be measured. If your measurement is greater than 50 V, please take precaution. When voltmeter input is floating, the display shows random numbers. If input source is not stable, input ranges can be changed. Hence, number on the display is not constant.

3.1.2. Function Generator



Function generator generates various type of signals. Signal frequency is adjustable between 0.1 Hz and 1 MHz. Frequency of signal easily set desired frequency using coarse and fine adjustment potentiometer. Sine wave has minimum distortion. Triangle wave linearity is enough for your circuit. Normal and TTL square wave outputs are %50 duty/cycle. Fan out capacity of TTL square wave output is up to 10 TTL devices.

3.1.3.Pulse Generator

Pulse generator only generates square wave. Frequency range is starting from 1 Hz and ending up 1 MHz. Output type is both TTL and CMOS.

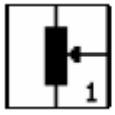
3.1.4. Debounced Button

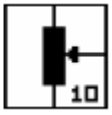
This button eliminates bounce. CADET uses flip-flop eliminating bounce. Each button circuit has open collector output that provides up to 250 mA current. This feature provides sharp and safe trigger operation. Each button has two states that are normally closed (NC) and normally open (NO). If it is necessary, button output can be connected V_{cc} through any resistor (typically 5k).

3.1.5. Switches

There are two types of switch on CADET. Bipolar SPDT switch is used for general purpose. This switch has three pins. If switch is “up” state, middle pin connected to V_{cc}. Otherwise it is connected to ground. Voltage level of logic-0 is always 0 volts. But logic-1 voltage level is adjustable. These are specified +V or 5 Volts.

3.1.6. Potentiometer





There are two potentiometers on CADET. One of them is 10 KΩ and other is 1 KΩ. In digital circuit, potentiometer is only used for adjustable voltage source. **Caution: Do not connect directly middle pin of potentiometer to ground or V_{cc}.**

3.1.7. Speaker

There is a speaker on CADET. Sound of speaker depends on frequency of input signal. Internal resistant of speaker is 8Ω.

3.1.8. BNC Connector

This connector eliminates noise. If your circuit needs high frequency or sensitive input signal, this connecter should be used.

3.1.9. Displays

There are two displays on CADET. First display is seven segment display. This display has four input pin as A, B, C and D. Input pins are BCD (binary coded decimal). For example, when all pin are floating, display shows zero (0). If A=1,B=0,C=1,D=0, it shows five. Another display is bar graph. Bar graph lights each bar by input voltage level of signal. Each bar segment corresponds 0.5 V increment.

3.1.10. Eight Channel Logic Monitor and Logic Probe

Logic monitor has 8 green led for logic-1 and 8 red for logic-0. Before applying signal to the inputs, input configuration should be selected. First option is V_{cc} voltage levels that are 5V or +V. Other option is input signal type that is TTL or CMOS. If TTL input is used, voltage level must be 5 V.

3.1.11. Power Supply

CADET provides 3 DC outputs that are fixed 5V and two adjustable outputs. +V changes between 1.3 V and 15 V. -V changes between -1.3 V and -15 V. AC output changes between effective 6.3V and 12.6V.

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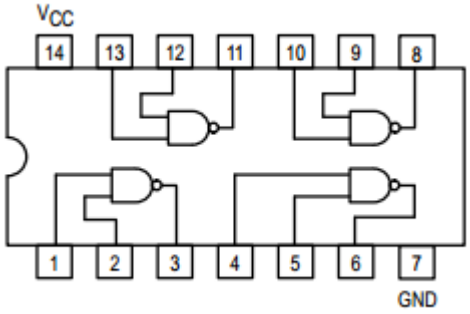
4. EXPERIMENTS

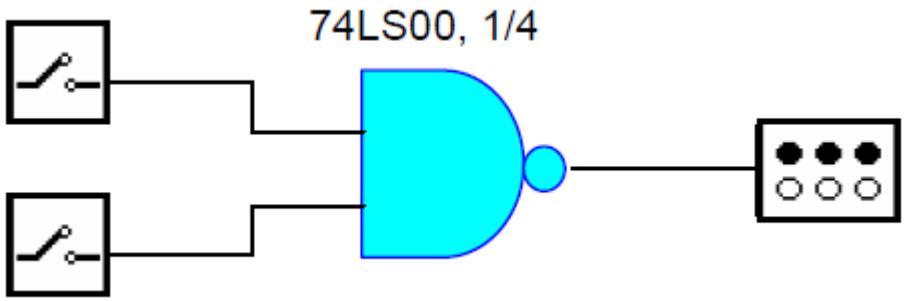
Using of CADET and testing simple NAND gate.

4.1. EXPERIMENT #1

In below, 74LS00 pin out is shown. V_{cc} should be connected to 5 V. GND should be connected to ground.

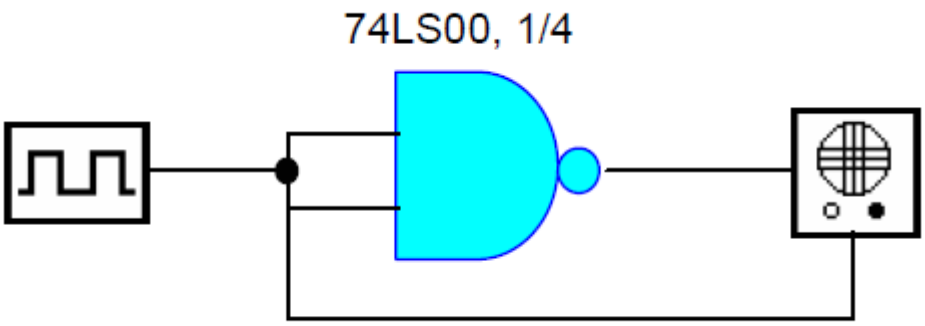


Now select one of the NAND gate. For example; if up-left NAND gate is selected, pin 13-12 are inputs andpin-11 is output. Connect each input of NAND gate to switches. Output of NAND gate is connected to logic probes to observe the changes. Verify truth table of NAND gate.



4.2. EXPERIMENT #2

In this experiment, oscilloscope will be used. Build the circuit shown below. Apply square wave with various frequency and listen speaker sound. Actually below circuit acts like NOT gate. In order to verify this situation, connect one probe to input and connect other probe to output of NAND gate.



Compare both signals.

NO REPORT REQUIRED FOR THIS LAB.