7. What part of a sample and hold circuit performs the hold function?

_____

_____

8. Give two reasons for using sample and hold circuits in data acquisition.

_____

_____

9. Explain the difference between analog and digital multiplexers.

_____

_____

_____

LAB EXERCISE 10.1
D/A Converters

Objectives

In this lab exercise you will learn about D/A converters. You will study the DAC 0808 digital to analog converter IC. You will use this IC to form a simple D/A converter.

Materials

LD-2 Logic Designer

DAC 0808 Digital to Analog Converter IC

LF 353 Dual Bifet Op-Amp

4700 Ohm Resistors (3)

20 Kohm Potentiometer

Capacitor 0.1 Microfarrad

Digital Multimeter

Jumper Wires

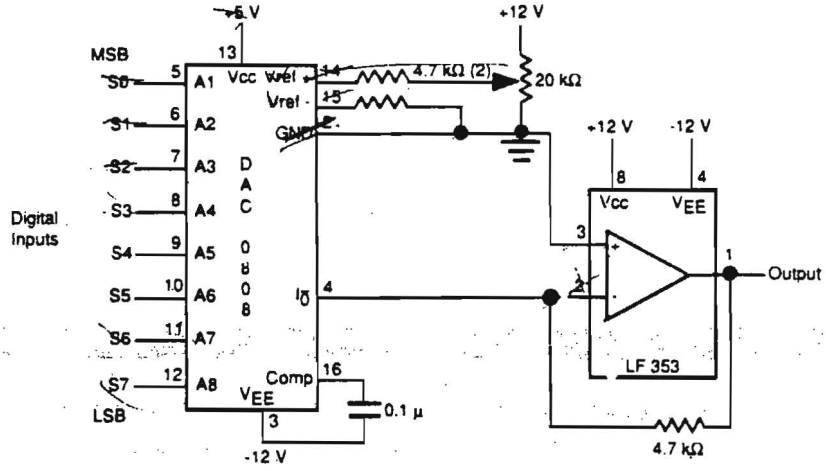
Procedure

1. Place the DAC 0808 and the LF 353 onto the LD-2 breadboard.

2. Wire power and ground to the ICs. +12 VDC should go to pin 8 of the LF 353. -12 VDC should go to pin 4 of the LF353 and to pin 3 of the DAC 0808. +5 VDC should go to pin 13 of the DAC 0808. Ensure that you have wired the power correctly to both of these circuits.

3. Wire the circuit shown in Figure 10-10. This is a simple D/A converter with a 10 V maximum output.

FIGURE 10-10. Simple D/A Converter.



4. Place S0-S7 to LO. Turn power on. D1 should light. Use the DMM to adjust the wiper of the potentiometer to a level of 10 VDC. Connect the DMM to the output of the op-amp. Place S0 to HI. The DMM should read about 5 VDC. If it doesn't check the wiring of your circuit.

5. Use the switches S7-S0 as the digital inputs. Observe the circuit output on the DMM. Observe the operation of this circuit and record your observations. Pay particular attention to determining the resolution of the D/A converter.

6. Leave this circuit assembled while you answer the following questions.

Questions

1. What is the theoretical resolution of this D/A converter? Did your circuit exhibit this resolution.

2. What is the purpose of the op-amp in the circuit of Figure 10-10?

3. What is the maximum output of the ~~A~~/~~D~~ converter?

4. What type of output does the D/A provide? Could you use this output directly or would you need some filtering to make this a usable output?

LAB EXERCISE 10.2
A/D Converters

Objectives

In this lab exercise you will begin your study of the A/D converter. You will study the ADC 0809 which is a monolithic CMOS device with an eight-bit A/D converter, an eight input analog multiplexer. The A/D converter uses the successive approximation technique for conversion and provides an eight-bit three-state latched output. You will use this device to convert a 0-5 V signal to a digital output. A converter can accurately reproduce signals inside the converter's range with frequencies up to 1/2 of the converter sampling frequency. The ADC 0809 can normally complete a conversion in 100 microseconds with a 640 KHz clock input. This means that the ADC 0809 requires 64 clock pulses to complete a conversion. In this lab exercise you will use a 100 KHz clock so 64 clock pulses will require 640 microseconds.

Materials

LD-2 Logic Designer

ADC 0809 8-Bit A/D Converter with 8-Channel Multiplexer

20 Kohm Potentiometer

Digital Multimeter

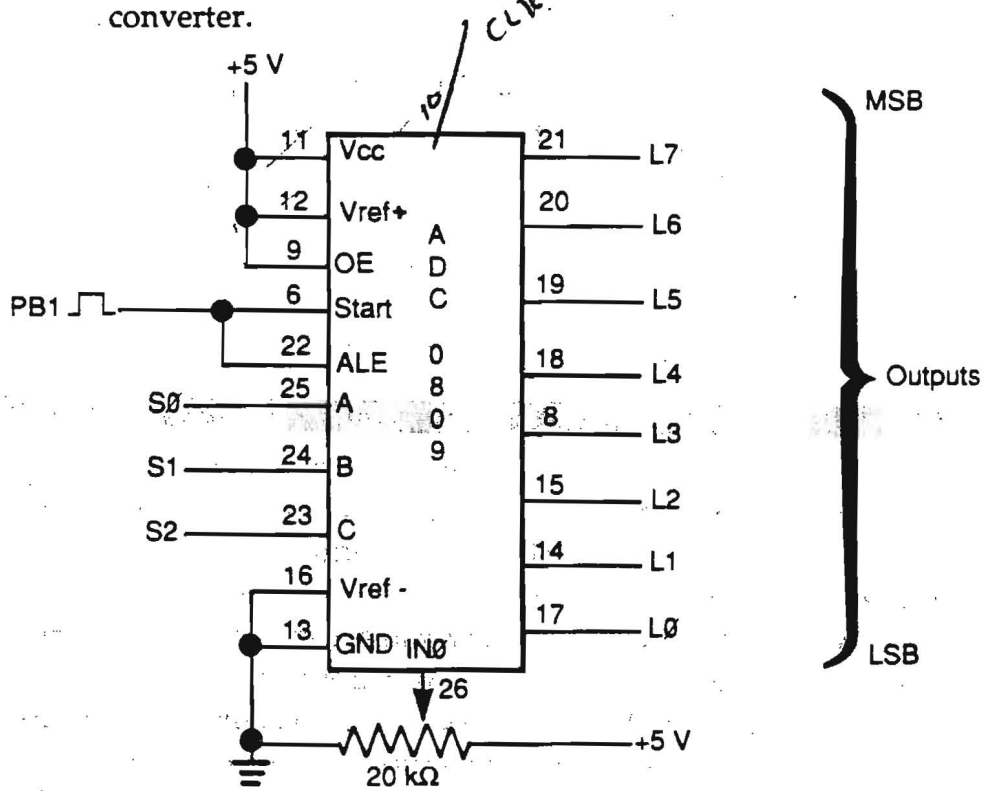
Jumper Wires

Procedure

1. Place the A/D converter onto the LD-2 breadboard. Wire pin 11 to +5 VDC. Wire pin 13 to ground. Use static precautions when handling the ADC 0809.

2. Wire the circuit shown in Figure 10-11. This is an A/D converter.

FIGURE 10-11. A/D Converter.



3. Place S0-S2 to LO. Set the clock frequency to 100KHz. Connect the voltmeter to monitor the voltage on pin 26 of the ADC 0809.

4 Turn on the power. D1 should light. Use the

potentiometer to adjust the voltage on pin 26 of the ADC 0809 TO 2.50 VDC. Press PB1. L7 should be lit. If L7 is not lit then the count on the L0-L7 LEDs should be close to 128. If this is not the case check the wiring to your circuit.

5. Use the potentiometer as the analog input and L0-L7 as the digital output. Use PB1 to start the conversion process. Observe the operation of this circuit and record your observations. Determine the resolution of this A/D converter.

6. Turn off power to the LD-2. Leave this circuit connected. It will be used in the next lab exercise.

Questions

1. What is the theoretical resolution of this type of converter? How does this compare with the value that you measured?

_____

_____

2. What is the maximum frequency of the analog signal that the lab exercise circuit can convert?

_____

3. How many clock cycles are required for the ADC 0809 to complete a conversion?

_____

LAB EXERCISE 10.3 The Analog Multiplexer

Objective

In this lab exercise you will study the use of an analog multiplexer in conjunction with an A/D converter. This analog multiplexer will allow several inputs to be monitored with a single A/D converter. The mux in the ADC 0809 provides 8 input channels. The input channel is selected by the inputs present on lines A-C of the IC.

Materials

LD-2 Logic Designer

ADC 0809 A/D Converter with 8-Channel Multiplexer

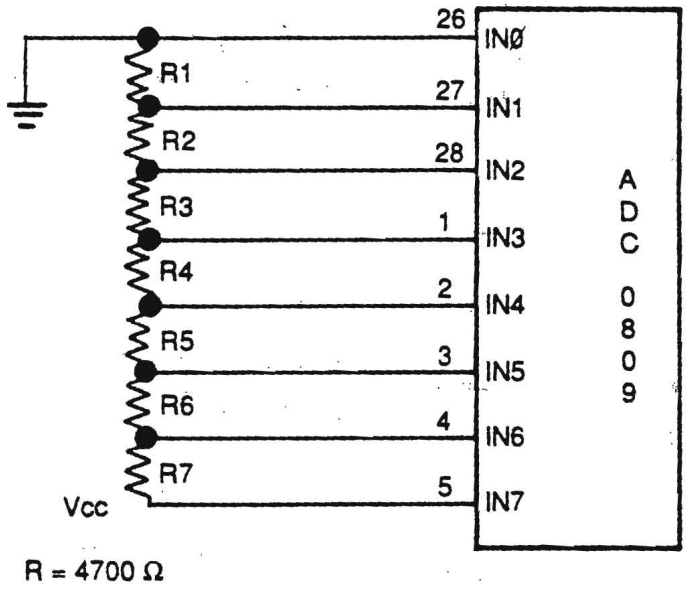
Resistors

Jumper Wires

Procedure

1. Wire the additional circuitry shown in Figure 10-12. This circuit will provide inputs to the multiplexer channels.

FIGURE 10-12. MUX Circuitry.



2. Place S0-S2 to LO. Turn on power. Only D1 should be lit. If other lights are lit check the wiring of your circuit.

3. The seven resistors form a voltage divider. The number input on A-C is the number of resistors between the chosen input and ground. The voltage at this point will be (n/7) X 5V where n is the number input on A-C.

4. Use the A-C inputs to select the junction of the voltage divider. Use L0-L7 as the digital outputs. Observe the operation of this circuit and record your observations.

5. Leave this circuit assembled while you answer the following questions.

Questions

1. Explain the difference between an analog multiplexer and a digital multiplexer?

2. How much does the count change on L0-L7 when the input on A- C is changed by one.