Hardware Lab 5 Optocoupler (Rev. 1)

The purpose of this lab is to observe the operation of an optocoupler (optoisolator); in this case, 4N28. Notice that this component has 6 pins, but only pins 1,2, 4 and 5 are used.

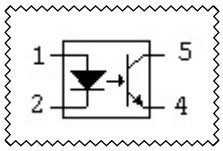


Fig.1 4N28

1. Measure the collector to emitter resistance (the resistance from pin 5 to pin 4;) this should be a very high value because the device is off.

R_{CE} = _____

2. Connect the circuit in Fig. 2 ; this will turn the optocoupler on. Once again measure the collector to emitter resistance (the resistance from pin 5 to pin 4.)

R_{CE} = _____

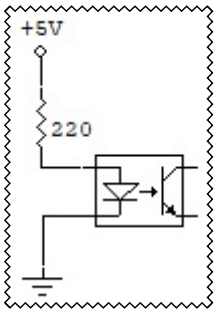


Fig. 2

3. Assemble the circuit in Fig. 3: Connect channel 1 of the oscilloscope to the input from the signal generator and channel 2 to the output of the optocoupler. Inject a square wave of 100Hz and 10 volts peak to peak. Slowly increase the frequency of the signal until the output signal begins to distort. Stop increasing the frequency when the output is 75% of V_P (which is 5V.) This point will be the maximum useful frequency.

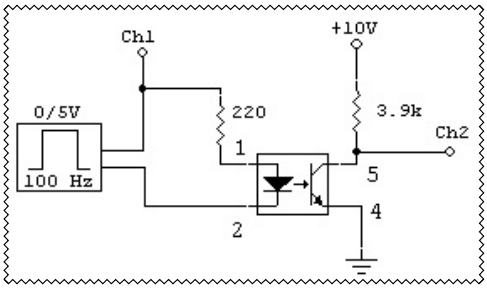
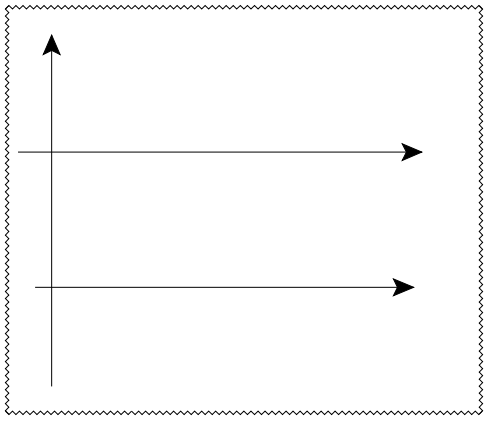


Fig. 3

4. Draw the input and output waveforms in Fig. 3:

5. What is the maximum useful frequency?



6. Assemble the circuit in Fig. 4:

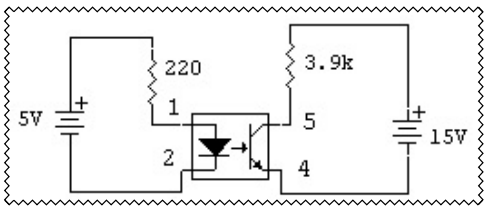


Fig. 4

7. Let "forward current", I_F , be the current in the input or the LED side. Let "collector current" Ic, be the current in the output or the photo transistor side.
Measure these currents:

I_F = _____

I_C = _____

8. "Current transfer ratio" , CTR, is the ratio of collector current to the forward current; calculate this ratio as follows:

$$CTR = \frac{I_C}{I_F}(100\%)$$

9. The data sheet for this device says that CTR should have a minimum value of 10%; is the value calculated in step 8 within specifications?

Questions:

1. True/False: An optocoupler is also called an optoisolator.

2. When the LED in optocoupler is turned on, what happens to the photo transistor?

3. When the optocoupler is turned on, what happens to the resistance of the output side?

4. What is an acceptable output of the optocoupler at the maximum useful frequency?