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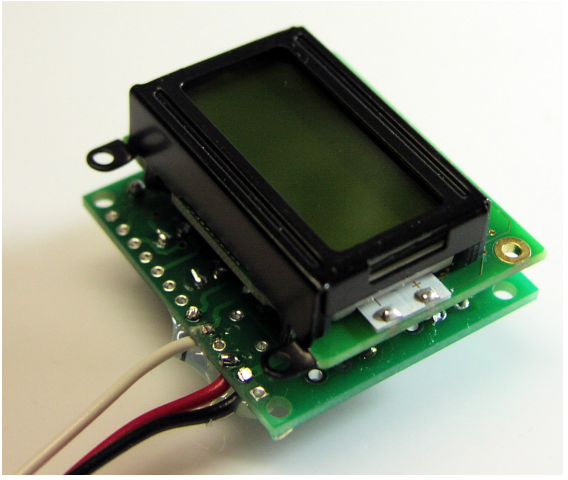
Construction Manual & Users Guide Model ADM-01 Analog Digital Radiation Meter



The Analog Digital Radiation Meter counts the pulse output of a standard analog Geiger counter to provide a visual readout of the CPS, approximate radiation level (imperial/metric) and analog radiation field strength meter.

Features:

- **7-12VDC or 5VDC power supply input**
- **Counts TTL pulses from Analog Geiger Counter**
- **Outputs Digital Counts Per Second (CPS) value**
- **Outputs radiation level (imperial / metric)**
- **LCD Backlight**
- **Available as a kit or assembled**

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Features

The Analog Digital meter alternates the first line of its display between Counts Per Second (CPS) and then approximate radiation level in either imperial measurements (mR/hr) or metric measurements (mSv/hr). The top line of the display alternates its display every second. The 2nd LCD line is a analog radiation field strength meter that provides a quick visual indication of the current CPS reading. Figure 1 displays the reading in CPS, while Figure 2 shows the approximate radiation level.

To fit nicely on the 8 character display line the imperial measurement of mR/hr is abbreviated to mR. Likewise the metric measurement of mSv/hr is abbreviated to mS.

The second line of the 8x2 LCD is a dedicated analog power meter to read a

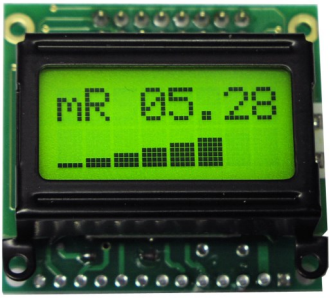


Figure 1

Figure 2

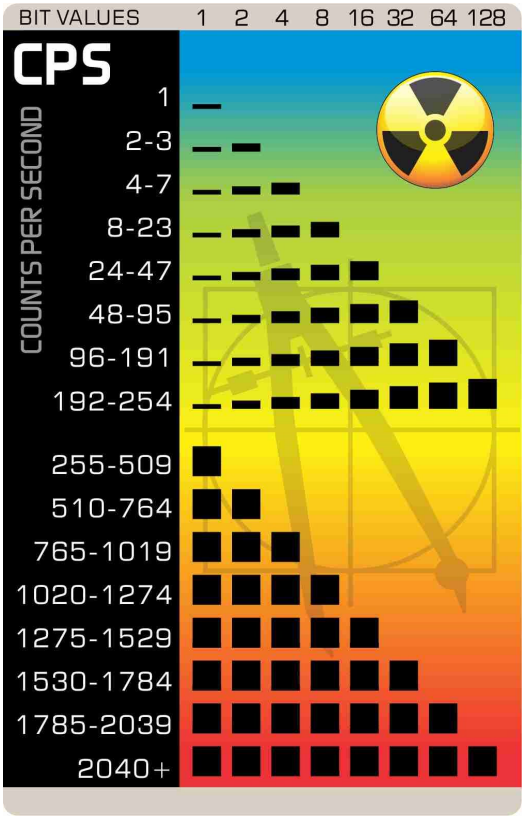
reasonable approximation of CPS from 1 CPS to 2040 CPS.

* The LCD alternates between display the mR/hr value and CPS. The CPS

value used for the power meter display portion is update on each display screen.

The following table illustrates the relationship between the analog power graphic and the CPS value.

Using the Analog Digital Meter



Images' Analog Digital Meter allows you to add a digital display to your analog Geiger counter. The default display will provide readings in CPS and mR/hr.

The ADM-01 has two switches on the right hand side of the board. The bottom switch is the power switch. The top switch allows you to turn the backlight on the LCD on and off.

Powering the unit:

The ADM-01 may be powered by a 7-12V (transistor) battery or by a regulated 5 volt power supply. When powered by the 7-9 volt battery the ADM-01 board may source 5 volts 50 mA of 5V current, off its 5V in/out line. Units that are purchased assembled are set up for 5VDC.

The PCB connection pads, are .100 spaced and you can connect to the board using female /male headers or 22ga. wires depending upon your application. In this example we are connecting to the ADM-01 using wires.

In our example we are powering the ADM-01 board using a 5 volt power supply (red wire), Ground (GND black wire) and the B0 (white wire) soldered on the PCB as shown below in figure 4. For additional wiring options see page 9.

Selecting Imperial (mR/hr) or Metric (mSv/hr) Radiation

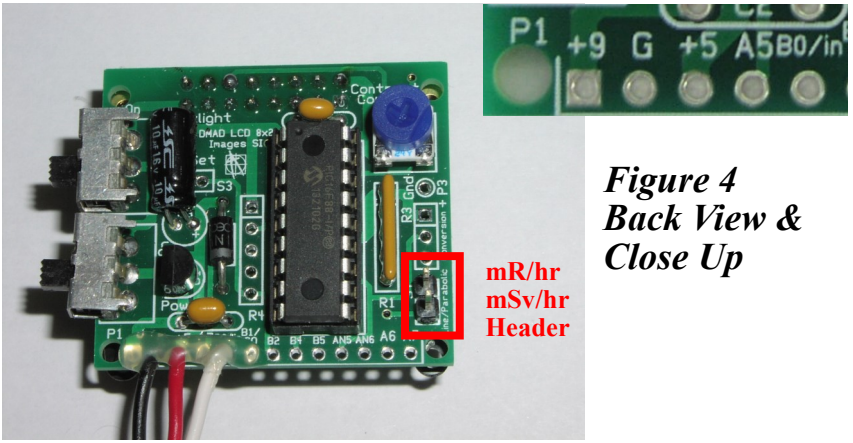


Figure 4
Back View & Close Up

Measurement:

Figure 4 also shows a two pin header, outlined using a red box. Placing a jumper on this two-pin header will change the radiation reading from imperial mR/hr to metric mSv/hr radiation measurement.

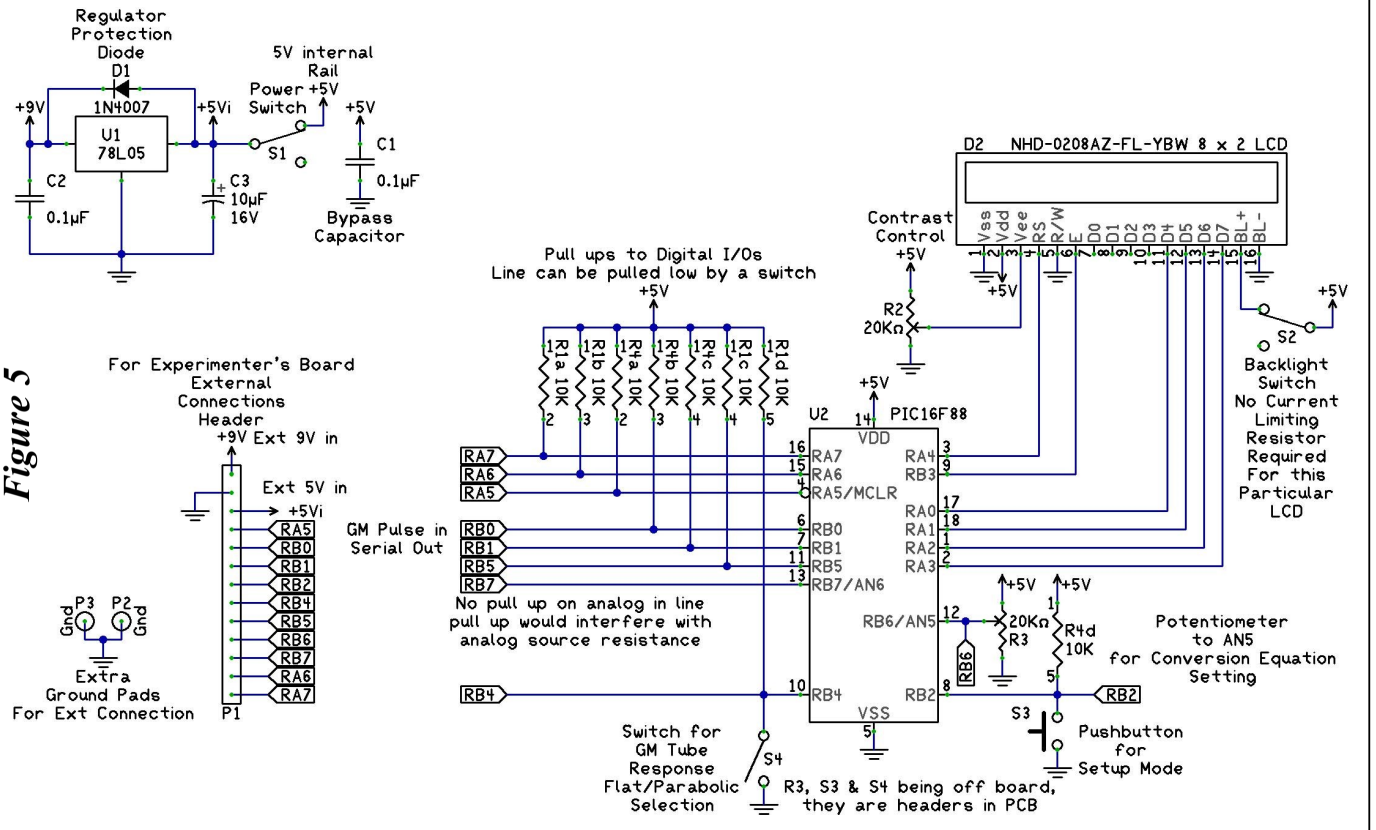

Regulator Protection Diode
D1
1N4007
+9V
+5Vi
U1
78L05
C2
0.1µF
C3
10µF
16V
5V internal Rail
Power Switch
+5V
S1
C1
0.1µF
Bypass Capacitor
For Experimenter's Board External Connections Header
+9V Ext 9V in
Ext 5V in
+5Vi
RA5
RB0
RB1
RB2
RB4
RB5
RB6
RB7
RA6
RA7
P1
P3
P2
Gnd
Gnd
Extra Ground Pads For Ext Connection
Pull ups to Digital I/Os
Line can be pulled low by a switch
+5V
R1a 10K
R1b 10K
R4a 10K
R4b 10K
R4c 10K
R1c 10K
R1d 10K
RA7
RA6
RA5
GM Pulse in Serial Out
RB0
RB1
RB5
RB7
No pull up on analog in line pull up would interfere with analog source resistance
RB4
U2
PIC16F88
VDD
RA5/MCLR
RB0
RB1
RB5
RB7/AN6
RB6/AN5
RB4
VSS
RA4
RB3
RA0
RA1
RA2
RA3
RB2
D2 NHD-0208AZ-FL-YBW 8 x 2 LCD
Vss
Vdd
Vee
RS
R/W
E
D0
D1
D2
D3
D4
D5
D6
D7
BL+
BL-
Contrast Control
+5V
R2
20Kn
S2
Backlight Switch No Current Limiting Resistor Required For this Particular LCD
20Kn
R3
R4d 10K
RB6
RB2
Potentiometer to AN5 for Conversion Equation Setting
S3
Pushbutton for Setup Mode
Switch for GM Tube Response Flat/Parabolic Selection
S4
R3, S3 & S4 being off board, they are headers in PCB

Figure 5

Construction

Figure 5 shows the schematic for the Analog Digital Radiation Meter (ADM-01). Figure 6 is the blank PCB. All components are mounted and soldered to the top silkscreened side of the board unless otherwise noted.

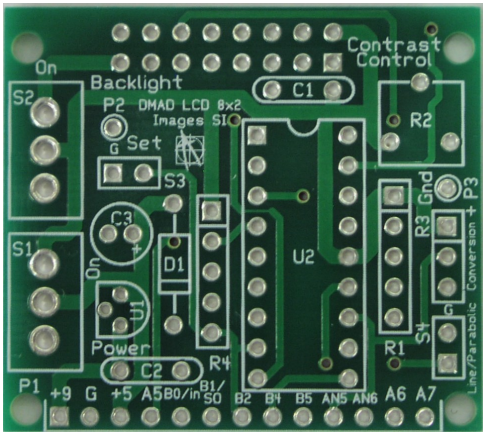


Figure 6

To begin mount and solder the 5-pin 10K resistor pack (R1). Pin 5 (last pin when reading the text on the resistor) should go in the top hole of R1 on the PCB. Mount and solder the 20K potentiometer at R2. Next mount and solder the two .1uf 50V capacitors (C1 & C2), followed by C3, the 10uf 16V capacitor. Depending on your casing of the unit, this capacitor may need to bent flat prior to soldering, as shown in the completed circuit, Figure 7 on the next page.

Now mount and solder the 1N4007 diode, D1. Be sure to align the markings on the diode with the silkscreened outline on the pcb. Next mount and solder the voltage regulator, 78L05 at U1, again, making sure to align it with the printed silkscreen outline.

Mount and solder the 18-pin IC socket at U2. Align the notch on the IC socket with the notch on the silkscreened outline. This will aid in the proper installation of the microcontroller. Next mount and solder the two right angle slide switches, S1 & S2. S4 is a 2-pin header. Adding a jumper to this header allows

one to switch the unit from mR/hr to mSv/hr.

The two 8-pin headers should be mounted and soldered to the underside of the pcb at D2, as shown in Figure 7 at the right. Place the LCD down onto the headers and solder into place.

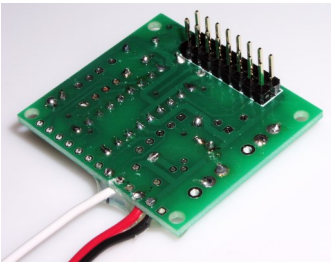


Figure 7

Insert the preprogrammed 16F88 microcontroller into the IC socket. Be sure to line up the notch in the chip with the notch in the socket.

You need to think about how you want to connect the ADM-01 to your circuit and what power supply you want to use. The ADM-01 is a versatile development board for the 16F88 PIC microcontroller. Figure 8 below illustrates the lines available to the user. In this application we are using it as an Analog-Digital-Meter and we only need to use three lines.

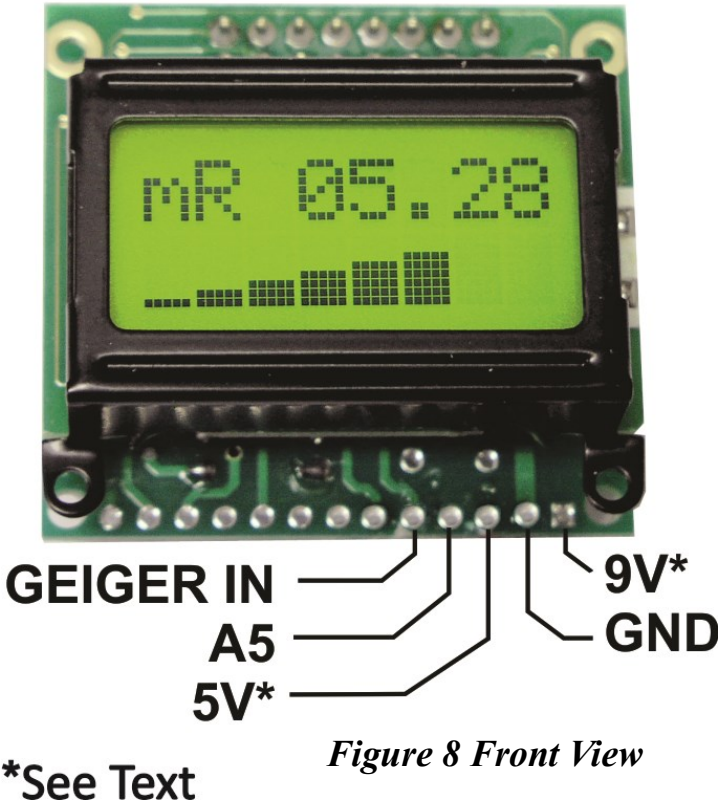


Figure 8 Front View

*You are now ready to connect the Analog Digital Radiation meter to an analog Geiger counter. Connect the white wire to the pulse output of the Geiger counter. Make sure both the Geiger counter and ADM-01 meter share a common ground. Various wiring diagrams are included on the following pages.

Mounting the Meter

The mounting outline measurements for the ADM-01 are shown in Figure 9. These measurements are taken in millimeters.

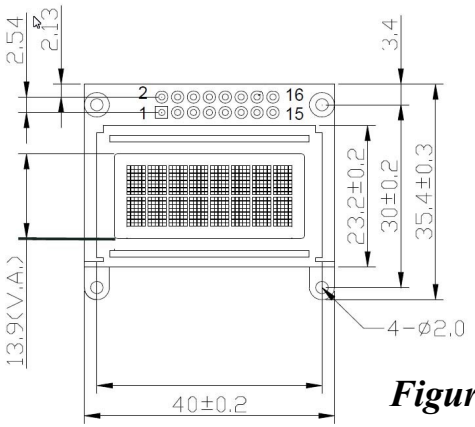


Figure 9

ADM-01 Parts List

(1) PCB-73	
(2) CAP-.1uf-50V	C1 C2
(1) CAP-10uf-16V	C3
(1) RES -10K-5pin	R1
(1) POT-20K-Top	R2
(1) 1N4007	D1
(1) 78L05	U1
(1) PIC16F88	U2
(1) ICS-18	
(2) SW-27	
(1) LCD-01-8x2	
(2) SMH-08	
(1) SMH-02	
(1) Jumper	
(1) Manual	

Misc. Materials - 3 feet of stranded wire (each in different color)

Wiring Options for ADM-01
Analog / Digital Meter

The following images show a variety of wiring options available for our Analog Digital Meter.

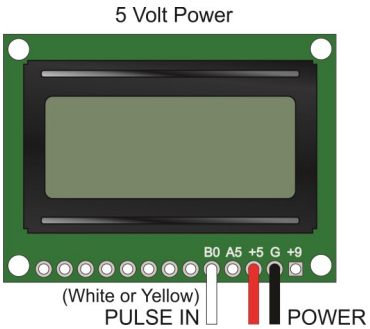


Figure 10

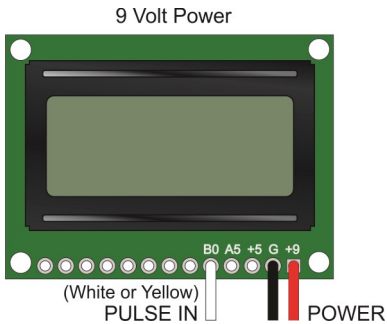
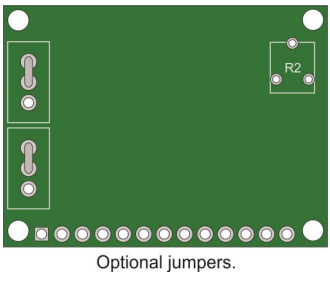


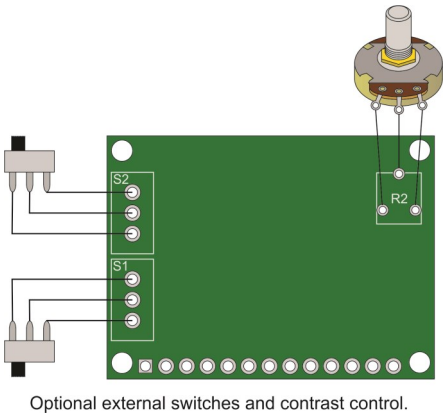
Figure 11

Figure 10 outlines wiring connections for supplying the unit with 5V power. Figure 11 outlines the wiring for 9V.



Optional jumpers.

Figure 12



Optional external switches and contrast control.

Figure 13

Jumping the switch controls, as in Figure 12, would supply the unit with constant power and backlight. Power is supplied by either 5 or 9 volts, and is constant when your Geiger counter is turned on.

Figure 13 outlines how to wire the unit if you choose to use external switches and/or contrast control.

Wiring Options for ADM-01
Analog / Digital Meter

The following images shows power and pulse connections to GCK/GCA-01.

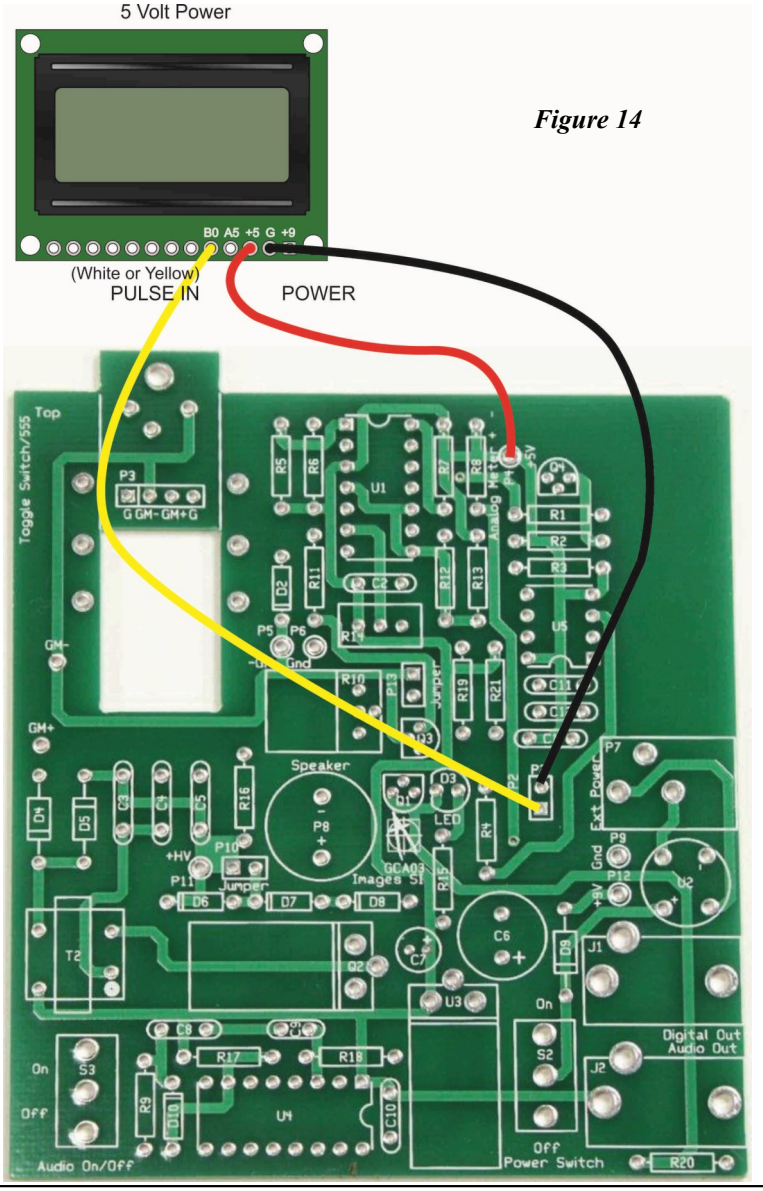


Figure 14

Wiring Options for ADM-01
Analog / Digital Meter

The following images shows power and pulse connections to GCK-02.

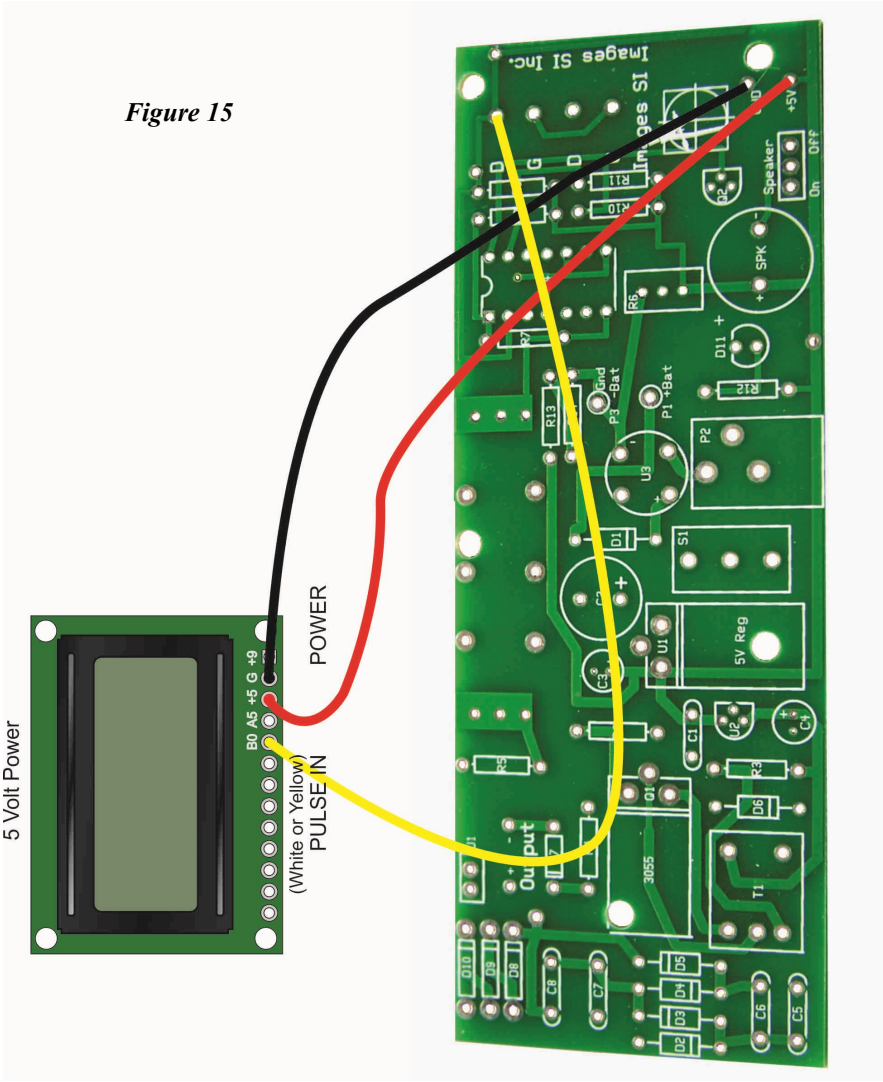



Figure 15