

# Theory of Operation - Central Power Status

## Background:

Our club moved from PM42 to PSX products for circuit breaker protection of our 48 power districts in 2009. At the time we added a Sonalert type device to each PSX board so it would make a noise when a short occurred. Two lessons: 1. Not all of our members could hear the high pitch Sonalert device (Sonalert brand is very expensive, others are available). 2. You could not localize the tone with a full room of engineers during Operating Sessions. The result was a needle in a hay stack. Our PSX products are distributed around the layout in 15 clusters between two levels plus staging.



## Solution:

Add Red LED's for local and central display of shorts. Local display required 3-4 LED's near the PSX products. Central display meant two locations where all power district LED's would display. I built the two central panels with 60 LED's). Next pictures you see are the local and central displays. The green LED is a power light.

Local Power District status



DCC Power



## CPS Display



### Architecture:

The PSX product drives an Opto-isolator IC and in turn drives a Transistor that in turn drives the three LED's per PSX circuit (one local and two central). This is very basic. Parts are cheap (\$2 per circuit). Most clubs will have parts around. I chose not to build a multiplexed system, instead I use wire to interconnect the large panels. We happened to have 48 pair phone cable around. This needs to be something other members can maintain. I'm an EE, enough said.

As of 8/16/2020 we have 60 PSX products in use on the HO layout and 6 on the Hon3 layout.

## **Design:**

You say why not drive the LED's from the PSX directly. Well, the board comes with a built-in resistor to drive one LED, so three would not work. Second, (I was not happy about this) the PSX and the PSX-AR have a different common wire voltage. I mean the un-switched terminal on one is GND and on the other is +5V. This means they cannot share a common ground. I decided to use an opto-isolator IC to address this problem and protect the PSX boards.

I used a 2N3904 NPN transistor to drive the three LED's in the status displays. You can use whatever you have in stock. The 2N3904 is a work horse (150ma) and cheap.

The Power Supply needs to be 30ma per circuit. I used 5VDC at 500ma.

You also get another bonus, the PSX-AR LED will flash when it's reversed. Both the PSX and PSX-AR are on solid when shorted.

I added a two-pin terminal to the PSX boards to avoid soldering wires and make changing easy. Less chance of damage. Jameco 2094506. The connector goes on the Remote Status connections. PSX J5 Pins 1&2. PSX-AR J5 Pins 3&4. Not the same.

## **Construction:**

I used proto-board for each of the 15 circuit boards. I built them all identical except for the number of circuits. Pictures are included. Each LED needs a resistor, remember you cannot put LED's in parallel. All my parts come from Jameco. I will include a parts list. Be careful if you use small solid copper wire, it can break easily. Once installed it reliable.

Parts List per circuit:

- 15K resistor ½ or ¼ watt (\$0.04)
- 470 resistor ½ or ¼ watt (\$0.04)
- 2N3904 transistor (\$0.06) (178597)
- H11A1 or equivalent (\$0.29) (878286)
- Connectors – euro style (\$1.15 for 12 connections) (215011)
- LED's (red) (3) (\$0.24)
- 5VDC 500ma wall wart (one for project)
- Buzzer (\$2.95) (1956696)
- 2 pin terminals (\$.39) (2094506)
- 6 pin IC socket (\$0.13) (683091)

The H11A1 does one circuit. If you need four then use the 16pin DIP package. Jameco 878286 LTV-847 \$0.69 for quad unit. Add a 6 pin or 16 pin IC socket. Jameco has them.

The Buzzer for each PSX product is 1956696, prices have gone up (\$1.25-2.95). The PSX puts out 5VDC max. You may need to bend the leads to fit the holes in the board. You will want the buzzer.



