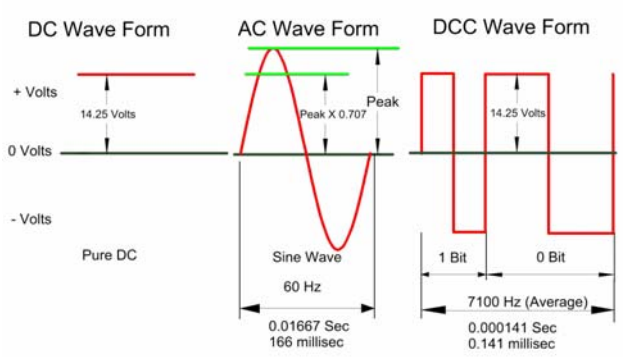
Power Shield X Series
Hints and Tips

by Don Fiehmann

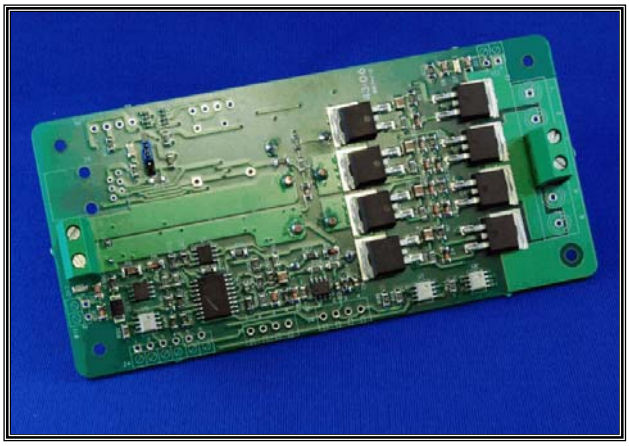
The PSX Series:
The X series of Power Shields provide an intelligent circuit breaker that can analyze and determine the difference between a real short circuit and the capacitors in a cluster of sound equipped locomotives. This advance system solves the false overload problems that occurr in DCC Boosters and other circuit breakers that see the sound locomotive capacitors as a short circuit. Added to this is the adjustable short circuit range from 1.27 amps to 17 amps. This covers the low currents of Z and Nn3 up to the high current needs of G scale. The **PSX** series comes with a default setting of 3.81 amps that should work with most of the scales between N and O scales. The PSX-AR is an auto reverser that includes the PSX circuit breaker function. all of the PSX series is are ***self powered*** and take their power from the input DCC signal.

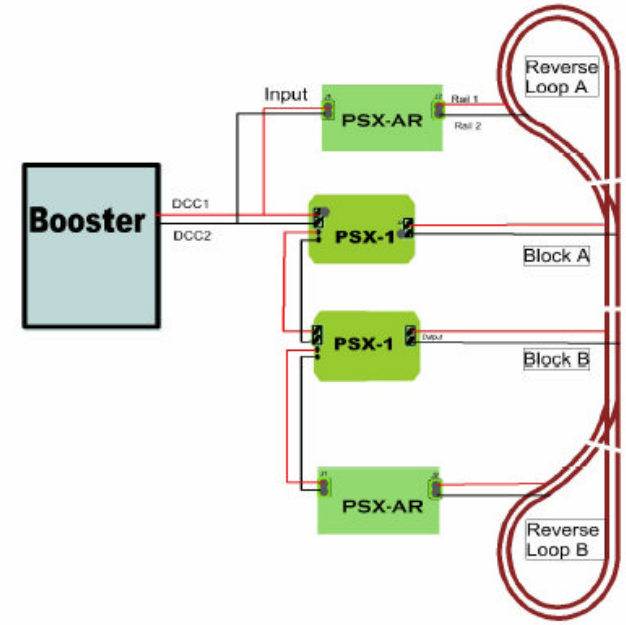
Polarity or Phase
With DC power there is two wires and the polarity of the power controls the locomotive's direction. With DCC we still have the two wires, but the power is more like an AC signal. When wiring the circuit breakers, you need to keep the correct wires feeding the rails. Just like with DC, if you get the polarity reversed, you can have a short circuit when a train passes over a gap from one block to the next block. To avoid this maintain the polarity as shown in the diagram below and to the right.



Wiring the PSX series
These diagrams use two colors to define the two wires in and out of the PSX units. To keep it clear the wires are called **DCC1 (Red)** and **DCC2 (Black).** The output also uses the **red** and **black** colors to show the exit paths through the breakers, called **Rail1(red)** and **Rail2(black).** The colors on the PSX-AR show the paths when power is first applied.

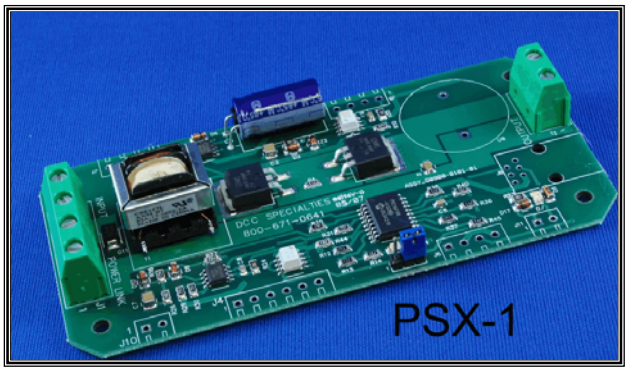
The PSX-AR "circuit breaker" function opens up both lines (the **red** and **black**) when a short is detected. The PSX-1, 2,3, 4 opens the circuit on the **black** wire when a short occurs. A way to remember this is "***break the black***".





PSX-AR "Double Reverse"

On some layouts there are situations that require **two** PSX-AR's be connected back to back. This can cause a condition where both reveres try to fix the short by reversing the lines. They both keep trying to fix the problem and continue to flip back and forth, causing a delay. The newer PSX-AR's have a CV that can be set to delay the action of the reverser. Only **one** of the two reversers needs to have this CV set to ***on.*** This allows the other reverser to change status during the short delay and resolve the conflict.



PSX Series Input Voltage

The onboard processors derive their power from the input power to the PSX units. To prevent any unpredictable operation the input voltage should be kept above 10 volts. If the input voltage drops to below 10 volts the processor can go into a reset status. If you are testing an existing layout for voltage drop, you need to have some current flowing to develop voltage drop. One handy way to check voltage drop is to use an RRampmeter with an auto lamp as a load. The lamp provides a steady load instead of a locomotive that is constantly changing. See photo below.

Wire Sizes and Types

The wire size used depends on the amount of *current* and the length of wire that will feed the circuit breakers. Small scales use smaller wire and large scales, larger wire. On long runs of wire, increase the size used.

The input and output connectors on the PSX series work best with stranded wire. If the wire is too large to fit into the connectors, larger than 14 AWG, then solder a short piece of smaller wire to the end of the larger wire, then connect the short piece to the PSX connector.

Length in Feet for a 1/2 Volt Drop					
Wire Size	1 Amp	2 Amps	3 Amps	5 Amps	10 Amps
8	796	398	265	159	80
10	501	250	167	100	50
12	314	157	105	63	31
14	198	99	66	40	20
16	124	62	41	25	12
18	78	39	26	16	8
20	50	25	17	10	5
XX	= Exceeds Recommended Current				

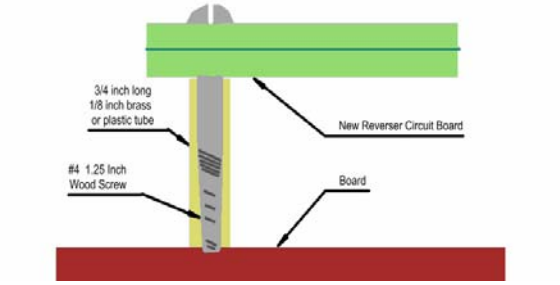
Installing the PSX Series

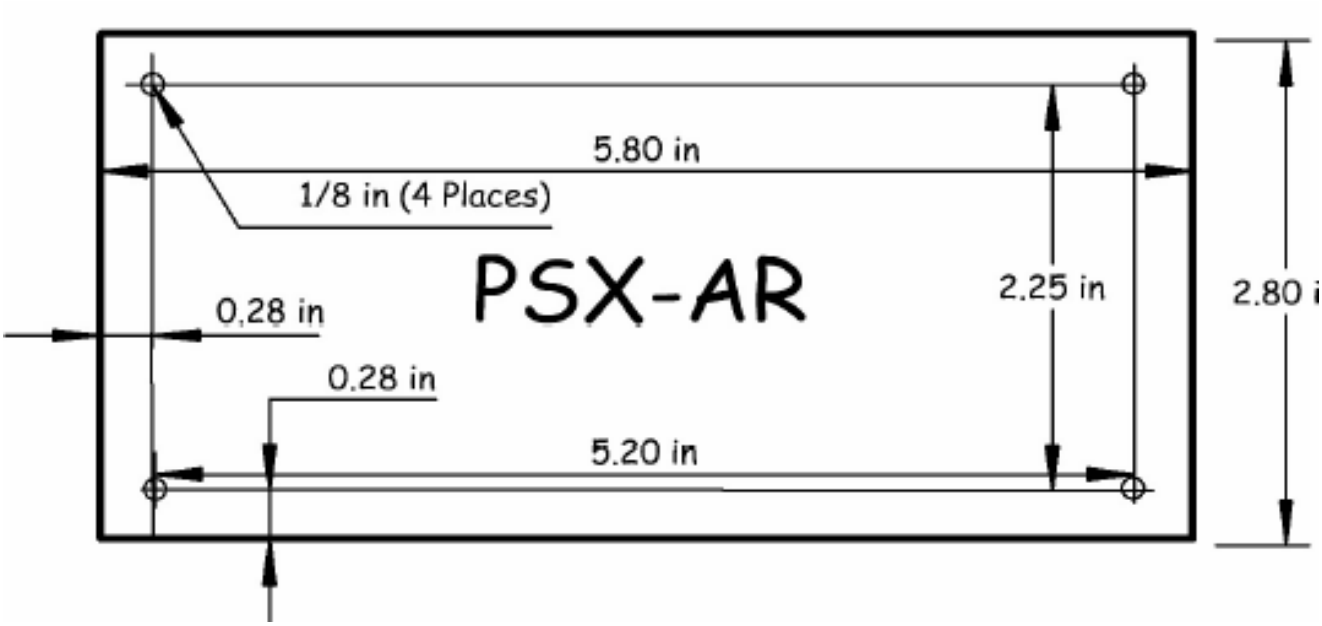
The PSX series can be mounted anywhere between the booster and the track they control. If you do not add remote LEDs for status indication, they should be located so you can see the onboard LEDs. Either of two logical locations will work. One is to have them all in one area so it is easy to see the LEDs. They can also be located near the track that they feed. On my layout all of the breakers are in one locations and a row of LEDs above a layout map show the status of all of the breakers and reversers. On a large layout this may not be the most logical way to go. Placing either the PSX in a viewable area near the controlled tracks or using remote LEDs might work better. Remote LEDs can be installed any time after the breakers and reversers are installed, resistors are nor needed for the LED's.

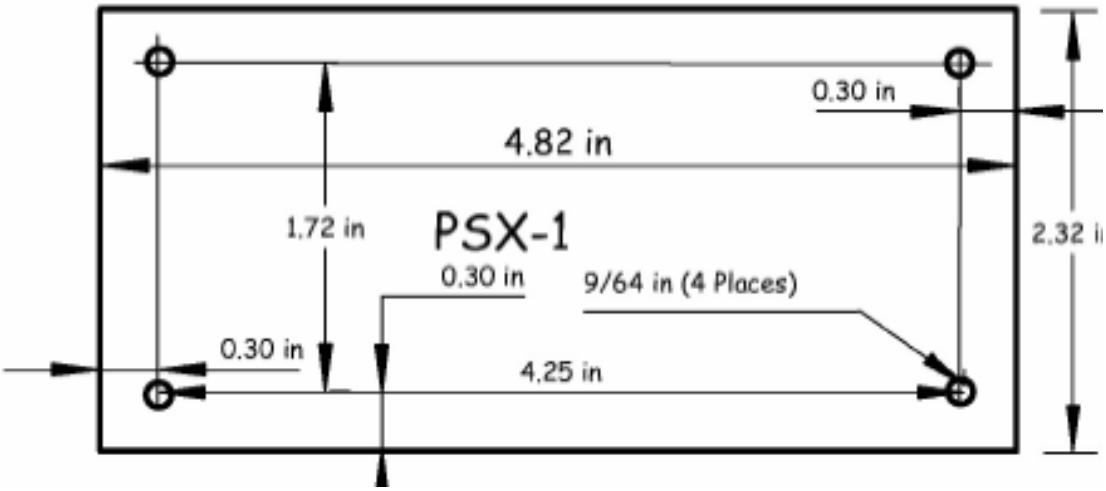
Mounting the PSX Breakers and Reversers

There are holes in each of the units that are intended for use mounting on a non-conductive surface. The holes will fit a number 4 screw. It is best to pre-drill a starting hole before mounting. If you are going to do any programming, consider doing it on the "bench" and checking it before mounting on the layout. Earlier PSX-AR's had transformers on the back of the PC board. Newer releases will have the transformers mounted on the front.

Depending on how this document is printed. The templates below may not be to scale? Use a #4 screw mounting all of the PSX cards. The earlier PSX-AR's need a standoff due to the transformer on the back of the card. When mounting the all the PSX Series, **do not over tighten the screws** as this can warp the card and possibly cause a crack in the board. The crack can lead to a break in the printed circuits and a failure of the board.







Why Divide my Layout? (Courtesy of Kalmbach Publications)

Though DCC offers a more realistic type of train control – being able to run multiple locomotives independently on the same track – the electricity running through the rails of your layout still needs to be properly managed and distributed. Since one of the big selling points of DCC is that you don't need to divide your layout into individual electrical blocks for independent train control, you're probably asking yourself, "why should I do it?" In addition to minimizing operating disruptions, power districts are also a key to DCC power regulation. If you're running a lot of trains, you'll need to make sure your DCC system can supply all your power needs efficiently and safely. Adding power districts to your layout can help with that. By separating your layout into districts, you divide the total track power available into smaller, more manageable units.

How do I Determine Power Districts?

There are really two types of power districts: those that are circuit-breaker protected zones on the layout and those that have their own independent Booster (also breaker protected). Probably the best way to determine where to place power districts is to take a look at the expected current draw, (Traffic), for each operating location on the layout. For example, a busy yard might have two switchers, one or more trains on the arrival and departure tracks, another train or two passing the yard on the main, and maybe a peddler working nearby local industries. If some or all of these trains have more than one locomotive, you could have 10 to 15 current-drawing units all competing for power in a fairly small area. Even assuming that the locomotives have efficient motors, this type of load may be heavy enough to slow down a DCC system running on a common 5A booster. Generally, our experience has shown that in HO if you have for a 12-14 Awg buss and 20 Awg feeders, that a 5 Amp system can support up to 10 0perators. Many users overestimate the amount of Booster power needed. Try using the PSX Series first, then if your trains start to slow down you may need to add extra Booster to support the concentration of trains in this location. By dividing a layout into power districts in this manner, and using a combination of boosters and circuit