

Voltage Divider Storage Unit Assembly V 1.0

Seth Neumann – sales@modelrailroadcontrolsystems.com

Revision History

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Introduction

Energy Storage Units (“Keep- Alives” it’s someone’s trade name but has become like “Kleenex”) are connected to DCC decoders to keep them powered while crossing dirty track, dead frogs etc. This is especially helpful with sound decoders as most sound decoders will stop and then go through a startup sequence if power is lost. **Warning:** There is a danger that the locomotive will not stop if it wanders into a “kill section” of dead track intended to stop the locomotive, say from fouling a yard ladder in hidden staging falling into an open bridge, so be careful what you wish for!

During a PCR Coast Division Zoom meeting in mid 2020, one of the members described a simple storage device published by Larry Puckett and explained how his club had hand built these by space-wiring the components. I offered to design a circuit board as a more solid and hopefully more reliable substrate. This is offered on the Model Railroad Control Systems web site as the “PCR Keep-Alive.” I was later approached by other modelers who are Electrical Engineers with a suggestion to make a similar device using a voltage divider to better protect the super caps and this “Voltage divider Storage Unit” is the result.

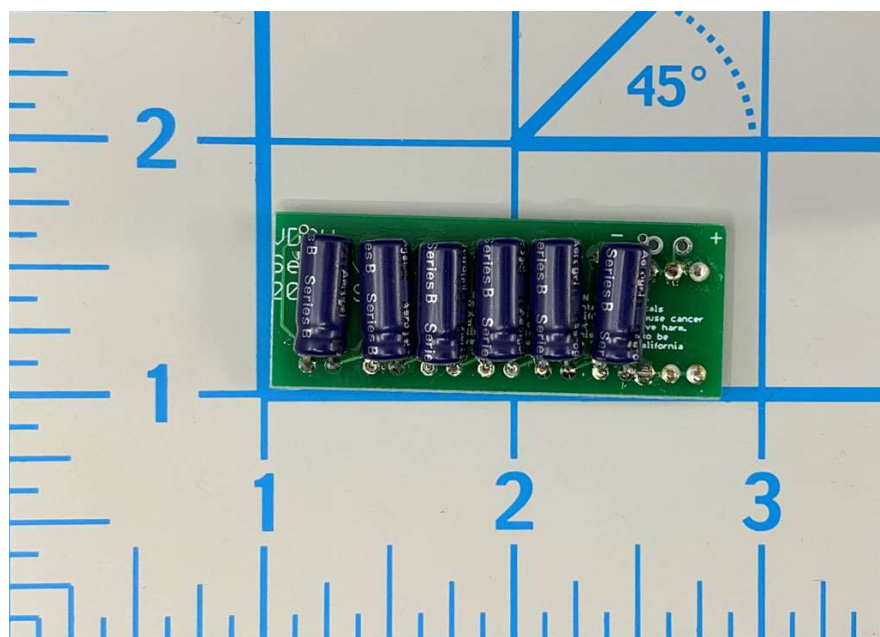


Figure 1- Voltage Divider Storage Unit Cap Side

Bill of Materials

Qty	Value	Device	Package	Parts	Description	Vendor	Part
1		PCB			PCB, VD Storage Unit, 10 up	MRCS	
6	.22F	CPOL-USE2.5-5	E2,5-5	C1, C2, C3, C4, C5, C6	POLARIZED CAPACITOR, American symbol	Newark	504-B0510-2R5224-R
6	10K	RPTH04	AXIAL-0.4-RES	R3, R4, R5, R6, R7, R8	Resistor 1/4W	any	
1	1N5819	DIODEPTH	DIODE-1N4001	D1	Diode	Digikey	497-6610-1-ND
2	220	RPTH04	AXIAL-0.4-RES	R1, R2	Resistor 1/4 W	any	
1	to decoder	CONNECTOR-M021X02-LOCK	1X02_LOCK	CON1	PHOENIX CONNECTOR		

Table 1- Bill of Materials

Schematic Drawing

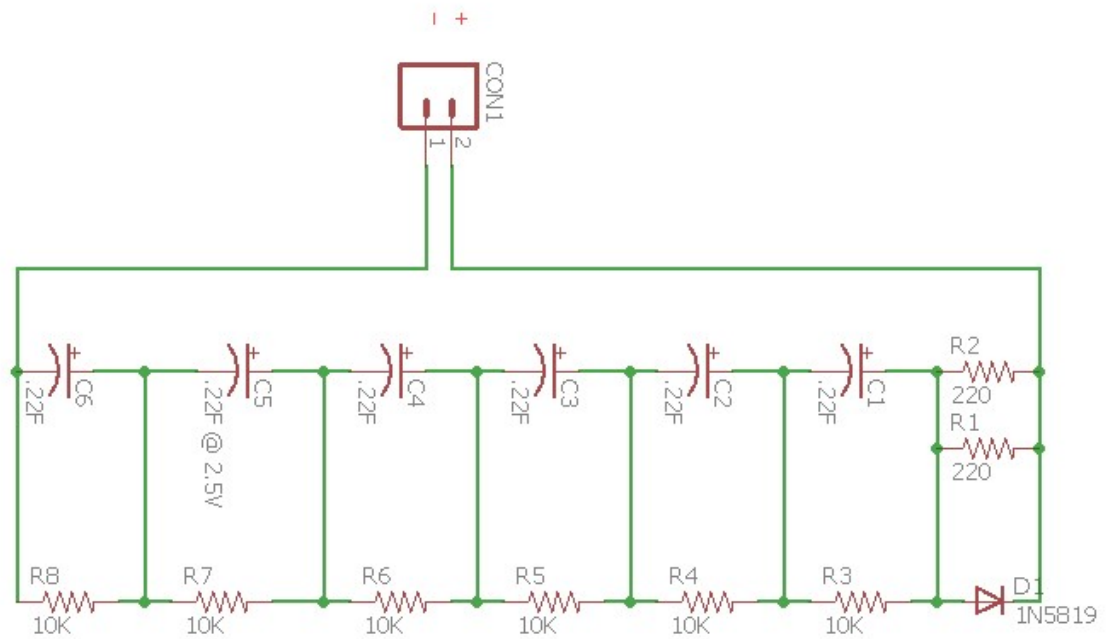


Figure 2- Schematic Drawing

Detailed Assembly

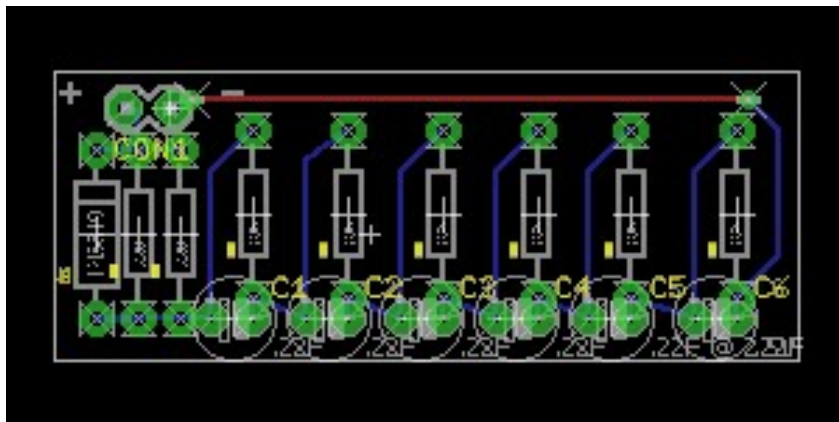


Figure 3- Voltage Divider Storage Unit Parts layout

[] All of the components are through-hole technology with wire leads. A lead bender is a useful tool for forming the leads at 90 degrees for easy insertion into the pad holes. The general rule is installing the lowest components first, working towards components that are higher off the board. This enables you to support the low components as you solder them. To save length, the caps are on the bottom of the board and the axial components (diodes and resistors) on top.

[] Resistors, Diodes

[] Install Resistors R1 and R2 (on the left). Install the gold tolerance band towards the bottom side) for easier reading of values, this is not critical, just be consistent.

[] Install Resistors R3-R8 (the widely spaced ones opposite the caps on the bottom of the board.

[] Install diode D1. Observe polarity – band as marked on the board

[] Consider how you want to connect the storage unit to your decoder, in most cases you will solder directly to the + and – terminals, generally from with wires on the bottom side of the board, you want them on top, or you want to use a connector, this would be a good time to do it. Spacing is 0.100 (2.54 mm),

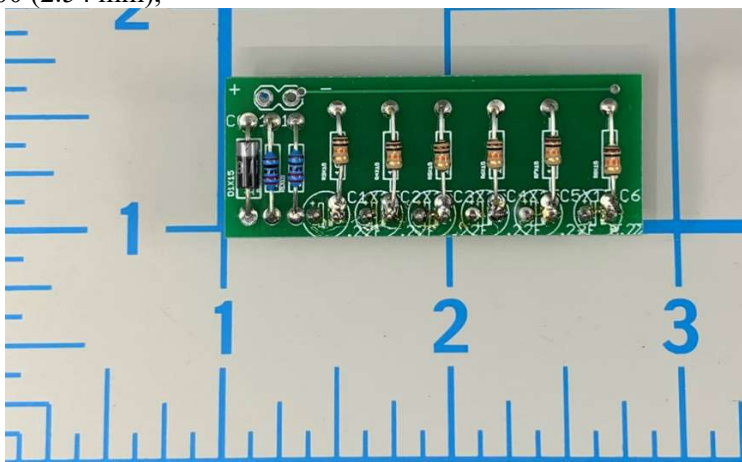


Figure 4- board with axial components (resistors and diodes) installed

[] Capacitors

[] install the capacitors, C1-C6 (they're all the same), on the bottom side of the board. This keeps the board length shorter for easier installation. Polarity is important! The long lead is the “+” side as marked on the board; the negative side is the side with the white band.

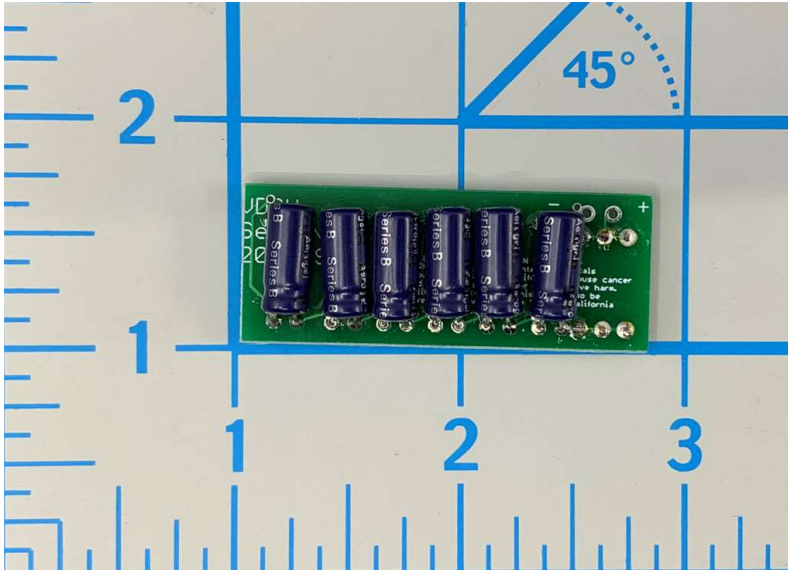


Figure 5 - PCR-KA with Capacitors Installed

[] Header

[] Install wires (or an 0.100 – 2.54 mm header if desired) from the bottom of the board, so that C1 will sit down properly. By convention, Red is positive and Black is negative.

Trim all leads and clean the board, I use 91% Isopropyl and a Q-Tip type swab.

Testing

I test my Voltage Divider Storage Units by wiring a blue LED in series with 3.3 K ohms across the + and – leads and applying 12V across them (being sure to check for polarity). The “Flag” side (short lead) of the LED goes to -.

- If using a bench supply with a current meter or a VOM set to milliamps in series, wait until the supply stabilizes at about 5 mA or a little less.
- At this point the VDSU is charged and you are just drawing about 4 mA through the limiting resistor and LED.
- The LED should be lit.
- Remove power from the input and the LED should stay on for several minutes

The power calculation is $12V - 3.5$ [forward drop on a blue LED, adjust if using some other color] $= 8.5V / 3,300 \text{ ohms} = \sim 3mA$. Modern blue or white LEDs will light up brightly at this value.

Installation

Most modern decoders have a pair of pads for adding storage units. This will vary by manufacturer and model, so check the documentation. Note that adding a 3rd party storage unit (such as this) may void the decoder warranty.

I do not keep a data base of decoders and connections and can't offer a lot of support, but this design is functionally equivalent to most storage units out there.