A Possible ShumaTech® 350 with 550 Daughterboard Power Up Fix, version 1.1

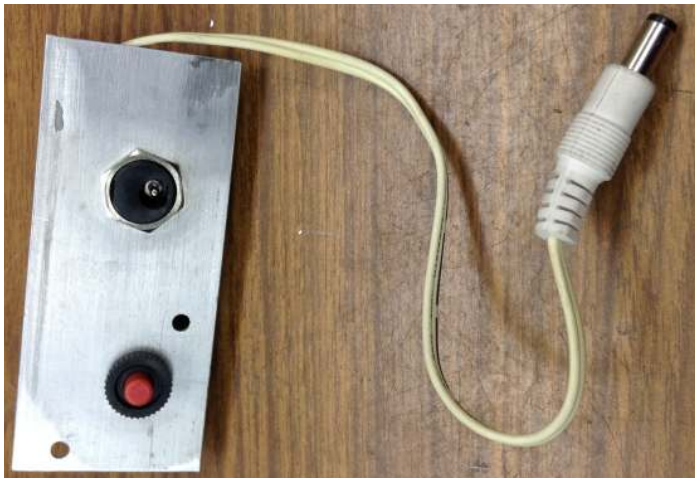
By R. G. Sparber

Conclusion

I own a ShumaTech 350 with 550 daughterboard plus Chinese scales. My Z axis display freezes 75% of the time that I power up by plugging my wall mounted power supply ("wall wart") into the wall. After making a simple modification, I saw no frozen displays while doing 15 consecutive power ups.

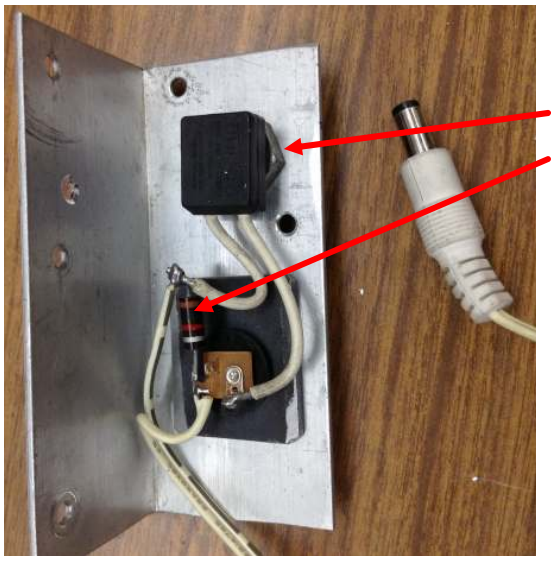
The Modification

The circuit that seems to correct this problem can be built into the DRO enclosure or outside of it. My original plan was to build it inside. But when I opened up the case of the DRO, I was quickly reminded how cramped it is in there.

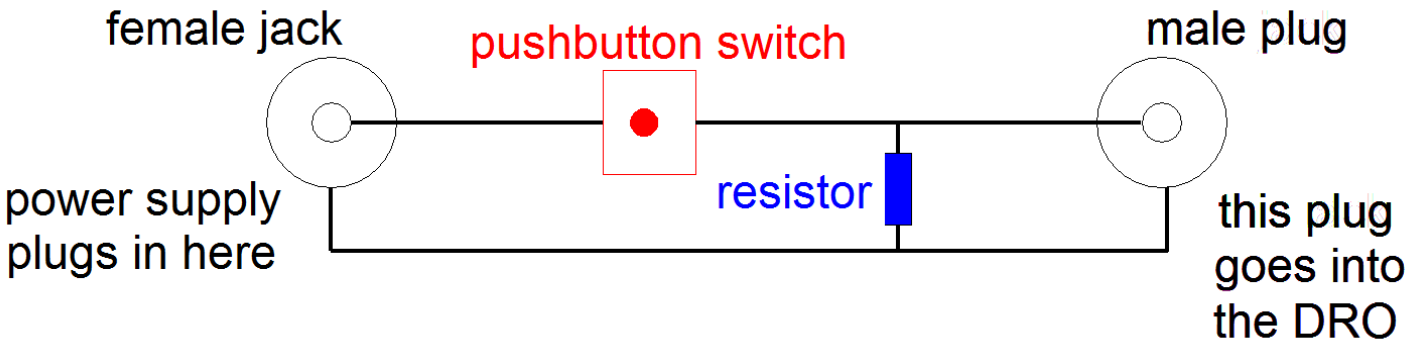


So I ended up building the circuit as a separate unit. This approach also lets me change the circuit later without opening up the DRO.

[1] You are free to copy and distribute this document but not change it.



Two components are needed plus a jack and plug if desired. The first component is a pushbutton that is normally closed.
The second is a resistor. I happen to have a 1K ohm 1/2W resistor. Power dissipation is around 100 mW so an 1/8W should be fine too. The exact value is not important.
The resistor is soldered across the output to DRO. Its only job is to discharge filter capacitors inside the DRO quickly.



Starting on the left in the pictorial wiring diagram shown above, I have a female jack that matches the one on the back of the DRO. The center connection of this jack is wired to one side of the pushbutton switch. The switch must be ***normally closed***. Most of these switches are normally open and that won't work here.

Coming out of the pushbutton switch, the second wire goes to the center conductor of the male plug. Then the barrel of the female jack is connected to the barrel of the male plug. The resistor connects from the center of the male plug to the barrel of the male plug.

When the DRO powers up correctly, power flows into the female jack, through the normally closed switch, and out the male plug. The male plug has been fitted into the back of the DRO. The resistor just sits there burning a small amount of power.

If the DRO powers up and one or more scales freeze, the button is briefly pushed and released. While the button is pushed, power from the power supply is stopped and the resistor quickly drains the DRO of its power. Then when the button is released a fraction of a second later, power is applied in one clean and quick step. This has so far enabled my scales to all come up without freezing.

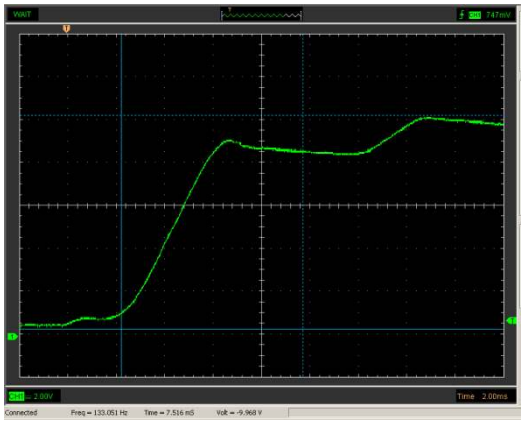
The entire power up sequence is then:

1. Apply AC power to the wall wart
2. If the scales on the DRO are all working, then you are done.
3. If one or more scales are frozen, push and release the button. The scale(s) should then un-freeze.

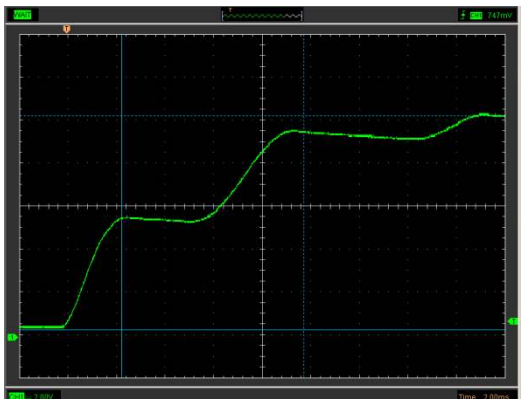
Background

For a very long time it has bothered me that my Z axis scale froze on AC power up. The DRO displayed a large number that did not change as I moved the quill. The slider on the Z axis showed a fixed number. This implied that the slider was frozen, not the corresponding scale processing hardware and software inside the DRO. Besides, the other two axes were fine during this failure mode.

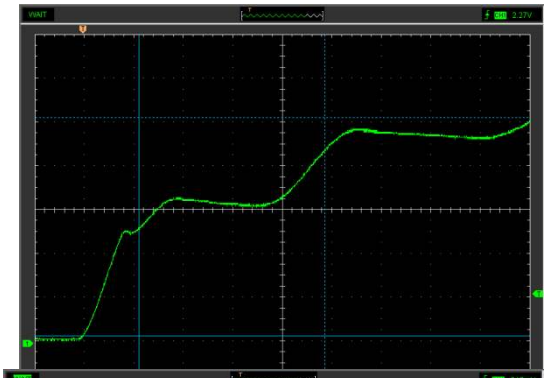
One solution to this frozen scale problem was to repeatedly bring up AC power and when it did un-freeze, leave AC power on all of the time. I did that for many years. But then I needed to move my power wiring around and it became better to have a master AC power switch. So I finally took out my test equipment in order to look for a hints of what was going on here.



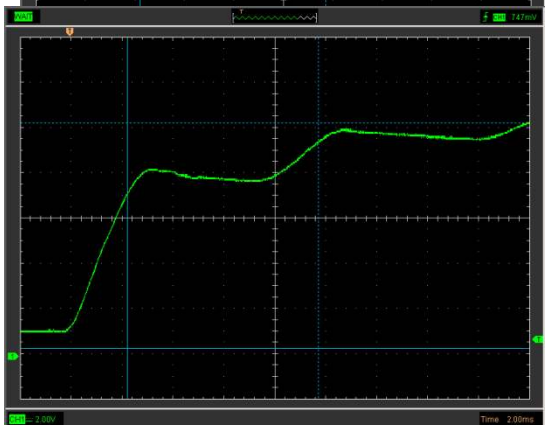
This is a typical rise in the wall wart's output voltage when the Z scale does ***not*** lock up. The horizontal is 2 ms/div and the vertical is 2V/div. it is hard to see the vertical divisions but the total rise is around 10 volts.



This is the rise in wall wart's output voltage when the Z scale ***did*** locks up. You can see an initial rise. Then it stops rising for less than 2 ms. The voltage at this first plateau is about 5.5V.



This time the Z scale did ***not*** lock up. That first plateau is slightly higher so you might be tempted to think this is the root cause of the problem.



But in this case the scale ***did*** lock up and the step is even higher. So there is more to this problem than just the height of that first step.

These pictures imply that the rise time of the wall wart's output voltage might be causing scale lock up. If true, one work-around is to unplug and plug back in at the DRO with the wall wart left powered up. Then the rise time of the input power is much less than 1 ms and is a smooth transition. The trick is to wait long enough for the capacitors inside the DRO to fully discharge before re-applying power. If you don't wait long enough, the scales remain powered and they can't break out of being frozen.

Test Results

My first test was to just power cycle the DRO at the AC input to the wall wart. There was no 1K resistor. Out of 20 test cycles, 15 of them caused the Z axis scale to freeze. The other 5 were fine. This is a failure rate of 75%.

My second test was to again power cycle the DRO at the AC input to the wall wart but have the 1K resistor connected at the DC input to the DRO's circuit board. Out of 20 test cycles, 11 of them caused the Z axis scale to freeze. The other 9 were fine. This is a failure rate of 55%.

My third test was to leave in the 1K resistor connected and have the wall wart powered up. I cycled DRO power by unplugging and plugging in the connector on the back of the DRO. Out of 15 test cycles, none caused the Z axis scale to freeze.

Future Improvements

It is hard to beat the simplicity of a single resistor and a single pushbutton. But it would not be difficult to develop a circuit that only applies power to the DRO when the wall wart's output voltage was stable.

I welcome your comments and questions.

Rick Sparber
Rgsparber@aol.com
Rick.Sparber.org