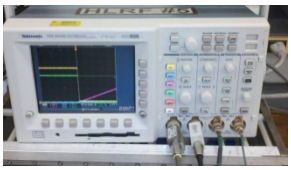
V&I Box Calibration And Pulse Test Procedure

Domeier, September 2012

Equipment List:

- HP 8005A pulse generator

- 4 Channel Oscilloscope



- Power Designs TP1500 Triple Power Supply

- Power Designs 5020 Precision Power Supply

- NIMM Crate, with Extender

- Multimeter

Calibration:

1. **Power the Module.** Connect the V&I module to the NIMM crate using the extender.
2. **Set the Power Inhibit trip level.** Adjust the voltage at TP1 on the Tube Power Dissipation board to 5.000 V using pot R10.
3. **Set the offset for Mod V_{in} From HV Divider.** Adjust the voltage at TP2 on the Tube Power Dissipation board to -0.220 V using pot R11.
4. **Set the Over-Current trip level.** Adjust the voltage at SO38 on the main circuit board to 6.000 V using pot R49.
5. **Set APS V_{in} voltage.** Connect Source A from the triple power supply to J2-B on the back panel of the module. Adjust Source A to read 10.000 V using the multimeter at the output of the power supply.
6. **Set Mod V_{in} From HV Divider.** Connect Source C from the triple power supply to the BNC connector labeled Mod V_{in} From HV Divider on the back panel of the module. Adjust Source C to read 5.000 V using the multimeter at the BNC connector labeled VOLTAGE on the front panel of the module.
7. **Set Current Monitor In.** Connect the precision power supply to J2-F on the back panel of the module. Adjust the power supply to read 1.000 V using the multimeter at the output of the power supply.
8. **Calibrate Voltage Monitor Outputs.** Adjust the voltage at SO12 on the main circuit board to 5.000 V using pot R16. Adjust the voltage at SO15 on the main circuit board to 5.000 V using pot R20. Adjust the voltage at SO19 on the main circuit board to 5.000 V using pot R16.
9. **Calibrate Current Monitor Outputs.** Adjust the voltage at SO25 on the main circuit board to 5.000 V using pot R30. Adjust the voltage at SO31 on the main circuit board to 5.000 V using pot R39. Adjust the voltage at SO34 on the main circuit board to 5.000 V using pot R44.
10. **Calibrate Modulator Voltage Input to Power Inhibit circuit.** Adjust the voltage at pin 11 of U2 on Tube Power Dissipation board to 5.000 V using pot R5.
11. **Test Power Inhibit voltage comparator.** With the multimeter monitoring pin 7 of U4 on the Power Dissipation board, adjust Source C on the triple power supply just until the voltage at pin 7 flips between high and low. The voltage at pin 11 on U2 should read 5.000 V.

Pulse Test:

1. **Create A Ramp.** Using a BNC tee and two BNC cables, connect the output of the pulse generator to the oscilloscope and to the BNC connector labeled Mod V_{in} From HV Divider on the back panel of the module. A good test pulse will have an amplitude of about 4 V, and will be approximately 100 ms long. The rise time should be about 90 ms, with a 5 ms flat top and 5 ms fall time. Frequency should be set to about 2 or 3 Hz.
2. **Check Output of U2.** U2 and its related circuitry tells the inhibit when to turn on on and off. It is triggered by the voltage level – 1 KV (~0.333 V signal) for Main Injector, 3 KV (~1.000 V signal) for Tevatron – of the input to Mod V_{in} From HV Divider on the back panel of the module. The output of U2 should be high when the input is below this level and high when above it.

   Monitor the voltage level U2's output at pin 7 of U2 using a voltage probe and the oscilloscope.

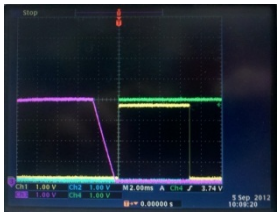
   The output should generate a fairly clean square wave with few oscillations. Excessive oscillations, or pulses can cause the inhibit to glitch or jitter, or may cause the U6 one-shot circuit to misfire.

   R11 provides feedback for the comparator.

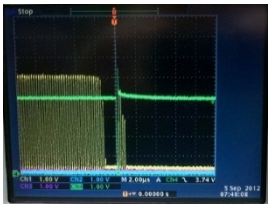
   R5 and C2 act as a low pass filter for the modulator voltage signal.
3. **Check Input and Output of Q1.** Q1 should have a clean signal at pin 2 to turn the base on and off. It's output on the emitter at pin 1 should also be clean and look almost identical to the input.
4. **Check Output of U6.** On a rising edge at the input on pin 5 of U6, U6 generates a high pulse for 10 ms. This should prevent the inhibit output from chattering at the end of the beam cycle, when the inhibit returns.

   C25 and R18 determine the time constant for the pulse.
5. **Check Output of U3A.** U3A inverts the inhibit signal from coming from Q1.
6. **Check Output of U3B, U3C & U3D.** U3B, U3C and U3D once again invert the inhibit signal from 3A, then send it as an output to the multi-pin connector on the back panel.

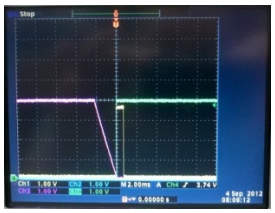
Output of U2: Good



Output of U6: Good

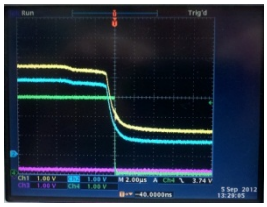


Output of U2: Bad



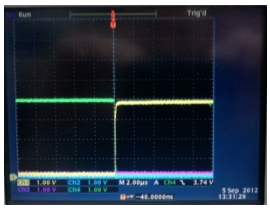
Output of U6: Too short

Output of U2: Bad



Input & Output of Q1

Output of U2: Bad



Output of U3A