Checkout Procedure for the 2008 Z-Box

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December 11, 2008

This document desribes the checkout procedure for the 2008 Z-Box, the version manufactured in the year 2008.The document does not describe any troubleshooting procedures; for troubleshooting, access to the circuit diagrams is needed.

The checkout procedure tests the following:

1. Initial startup Plus-Z and Minus-Z outputs.
2. Cutoff frequencies of the filters used with the Plus-Z and Set Current inputs.
3. Plus-Z output range for a +/- 10V input to the Plus-Z front panel connector.
4. Plus-Z output offset generated by the DAC.
5. Integrator operation, including -Z ranges.
6. Closed loop operation using the exponential test tool.

For testing the cutoff frequencies, an oscillator and an oscilloscope are required, but all other tests only require a variable DC supply providing 0 to 10 V and the Control Word generator described in "A Serial Control Word Generator for the STM Z-Box".

Three dual BNC input cables are required to provide differential inputs to the Preamp, Set Current, and Plus-Z inputs. The exposed pins on the dual BNC cables connect to the positive inputs of the input amplifiers and the insulated jacks connect to the negative inputs.

1 Initial Startup

When the Z-Box is first powered, both the Plus-Z and Minus-Z output voltages should be zero, as indicated by the front panel meters.

2 Filter Cutoff Frequencies

The filter cutoff frequencies that correspond to the 11 time constants set by the front panel switches are:

Range	Cutoff Frequency
50 usec	3200 Hz
100 ‘‘	1600 ‘‘
200 ‘‘	800 ‘‘
500 ‘‘	320 ‘‘
1 msec	160 ‘‘
2 ‘‘	80 ‘‘
5 ‘‘	32 ‘‘
10 ‘‘	16 ‘‘
20 ‘‘	8 ‘‘
50 ‘‘	3.2 ‘‘
100 ‘‘	1.6 ‘‘

The test procedure consists of applying a sinusoidal input of about 2V p-p to the Plus-Z and Set-Current inputs and then noting the 3dB frequencies for the various ranges. High accuracy in these measurements is not needed. For the Set Current filter, pin 6 of U6 is monitored, and for the Plus-Z filter, pin 6 of U8 is monitored. Signals are monitored using an oscilloscope with dc input. Although the signals are ac, the oscilloscope ac response for the lower cutoff frequencies will be attenuated.

Another test to be performed using an ac input is the inverting function for the preamp input. Apply a 2V p-p 1 kHz ac signal to the preamp input and monitor pin 6 of U4. If the invert bit of the control word is now set to 1, then the 1 kHz signal at this pin should reverse phase.

3 Plus-Z Output ranges

1. Apply +10V dc to the Plus-Z input.
2. Output a control word with the Plus-Z range set to 0 (default).
3. The Plus-Z output should read +5V.
4. Repeat for the other 7 Plus-Z ranges.The obseved Plus-Z output voltages should be close to those listed in the control word document.
5. Reverse the polarity of the applied dc voltage and repeat the above steps. The observed voltages should be the same as before, but negative. Note that the Plus-Z ranges 4 and 5 should show about -75V, since that is the maximum negative output for Plus-Z.

4 DAC Offset of Plus-Z Output

1. Short together the two inputs and the shield of the Plus-Z input.
2. Output the control word with the DAC value set to 0000 (default). The Plus-Z voltage should be essentially 0V.
3. Set the DAC value to 6666 and again output the control word. The Plus-Z voltage should be about 400V .
4. Repeat the above using DAC values of 3FFF (250V), 1FFF (125V), 0FFF (62.5V), and F001 (-62.5V).

5 Integrator

1. While keeping the Plus-Z inputs shorted, also short the Set Current inputs and connect a variable positive dc supply to the Preamp input.
2. With the dc supply at 0 volts, set the integrator gain to 5, the -Z range to 0 (50V), and the Run bit to 1. Output the control word.
3. The Minus-Z output should ramp from 0 V to -50 V in about 5 seconds.

4. The above can be repeated by setting and then clearing the Reset bit, sending the control word after each change.

5. Increase the supply voltage to the Preamp until the Minus-Z starts to increase (less negative). It should stop at +50V.

6. Decrease the supply voltage until the Minus-Z output voltage starts to decrease.

7. Increase and adjust the supply voltage so as to stop further change of the Minus-Z voltage. Make sure the Minus-Z voltage isn't at +50 or -50 V. The voltage read from the preamp panel meter should be in the vicinity of 1 V. The range is probably 0.8 V to 1.2 V

8. Change the -Z range to the other possible values of 1, 2, or 3 and output the control word for each of these. For each value, adjust the supply voltage so as to reach the posistive and negative limits of 100 V, 200 V and 400 V.

6 Closed Loop

1. Connect the exponential test tool to +/-15 V supplies; the +/-15V supplies in the power supply box can be used.

2. Connect the Minus-Z output to either input of the test tool.

3. Connect the output of the test tool to the Preamp input.

4. Keep the Plus-Z inputs shorted, but connect a positive supply to the Set-Current input.

5. With the integrator gain set to 5 and the Run bit set, increase the Set-Current voltage until the Minus-Z output goes slightly negative. The Preamp voltage should vary (and remain live) as the Set-Current voltage is varied, indicating stable closed-loop operation.