SLAC Resonance Control Chassis has controls for both slow and the fast tuners. Stepper motor is the slow tuner and the piezo is the fast tuner.

Resonance Control Chassis has following boards

1. BMB7 with kintex7 fpga
2. FMC breakout board with IDC connectors for stepper control and piezo control boards
3. Piezo controllers (4 identical boards)
4. Stepper controller
5. Power breakout board that distributes power in the chassis
6. LED board on the front panel

Chassis testing procedure

Once the chassis is powered make sure to check the power on the power breakout board

1. Input power to the board are +6 V, +15 V and +16.3 V
2. Output to BMB7 is +5 V (header??)
3. Output to Piezo controllers is ±16 V (headers??)
4. Output to Stepper controller is +15 V (header??)

**Piezo Controller testing procedure**

Testing piezo controller 1

Connect the monitor port 1 on the front panel to a multimeter. Connect the piezo output on the back panel to a 2-4 uF capacitor. Connect the terminals of the capacitor also to a multimeter. Front panel voltmeter should read around “??” V. Voltage across the capacitor is around 0 V. Set the control bit 0 to ‘1’ and then set the control bit 2 to ‘1’ in piezo\_cntl1 register. This initializes the piezo DACs. Enter the value of 0 in the piezo\_dac1 and that would set the piezo output to the mid-scale and the monitor port should read around 2.8 V. Voltage across the capacitor should be around +48 V. Piezo control is bipolar and its range is ±48 V. To test the piezo dac1 please use the following table and record the values from the monitor port and across the capacitor

Set bit 0 in the control register (PIEZO1\_CNTL) to ‘1’ and then set bit 2 to ‘1’. This sequence is important.

Write value of 10 to registers PIEZO\_DAC1 and PIEZO\_DAC2 and then write 0 to it. If you connect a multimeter to the ADC outputs on the front, they should be reading cloes to 2.5 V (±0.2 V). If there is a differential probe, piezo drive outputs can be connected to a scope or measure with a meter

Range for PIEZO\_DAC1 and PIEZO\_DAC2 is -131072 to +131071

For -131072 ADC output on the front should go towards 0 V and for +131071 ADC value will be more than 5.5 (somewhere around 5.6 V). This should be repeated for both ADCs and the piezo drive output on the back panel should go from -50 V to +50 V. For the drive output a differential probe is needed to measure the differential output

|  |  |  |
| --- | --- | --- |
| Piezo dac1 input | Monitor port | Capacitor voltage |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Please repeat the step for testing dac2 on piezo controller 1

Connect the monitor port21 on the front panel to a volt meter. Connect the piezo output on the back panel to a 2-4 uF capacitor. Connect the terminals of the capacitor also to a volt meter. Front panel voltmeter should read around “??” V. Voltage across the capacitor is around 0 V. Enter the value of 0 in the piezo\_dac2 and that would set the piezo output to the mid-scale and the monitor port should read around 2.8 V. Voltage across the capacitor should be around +48 V. Piezo control is bipolar and its range is ±48 V. To test the piezo dac2 please use the following table and record the values from the monitor port and across the capacitor

|  |  |  |
| --- | --- | --- |
| Piezo dac2 input | Monitor port | Capacitor voltage |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

The above mentioned procedure should be repeated for testing piezo controllers 2, 3 and 4

**Stepper Motor controller testing procedure**

By default the controller is in disabled state and the current is set to zero

Please set the current motor1\_DRVI to 11 (maximum current is 2.8 A for the setting of 31. Value of 11 is 1.05 A. Math ((11+1)/(31+1))\*2.8 A). The drive current specification is from Fermilab

\*Enable the motor using the control bit motor1\_en in the motor1\_cntl register (not yet implemented)

Enter the following values in the registers

Acceleration (MOTOR1\_ACC) 4000

Velocity (MOTOR1\_VLCTY) 20000

Steps (MOTOR1\_STEPS) 2,560,000

LCLS-II motor has a gear down ratio of 50:1 and requires 50 times more steps for one complete rotation

Normally the number of steps required for one rotation is 200 full steps and 256 micro steps per full step, which is 51200 microsteps for one complete rotation. Multiplying this by 50 will give us the number for the LCLS-II motor

Make sure both limit switches are closed. Open one limit switch at a time and make sure the corresponding limit switch status bit updates on the EPICS. Motor shouldn’t move when both limit switches are open. Connect a multimeter in series with the motor to measure the phase current. Close the limit switches and move the motor in one direction for 2,560,000 steps and make sure it completes one full rotation. Motor current is also measured during the operation and idle states. Record the current measured using the multi meter during the motion and when the motor is idle. In the idle state current should be zero and during operation it should be close to an amp. Move the motor in the other direction by changing the direction bit in the control register or entering negative number of steps and the top level. Once motor’s operation is verified in both directions, move on to testing the limit switches. Move the motor in clockwise direction and open the clockwise limit switch. This should stop the motor and motor shouldn’t move in the same direction any more. Reverse the direction and the motor should move in the opposite direction. Please repeat this step for the counterclockwise limit switch. This verifies the functionality of the stepper motor drive controller

Please repeat the above procedure for other three stepper motor drivers and record all the values