CCI-2 Preamplifier Testing

May 30, 2012

Purpose

The purpose of this document is to aid in the testing and assembly of the preamplifier boxes for CCI-2. Sections include using the preamplifier testing box (figure 1) and installing and testing the preamps in the CCI-2 preamplifier housing (figure 2).

Equipment

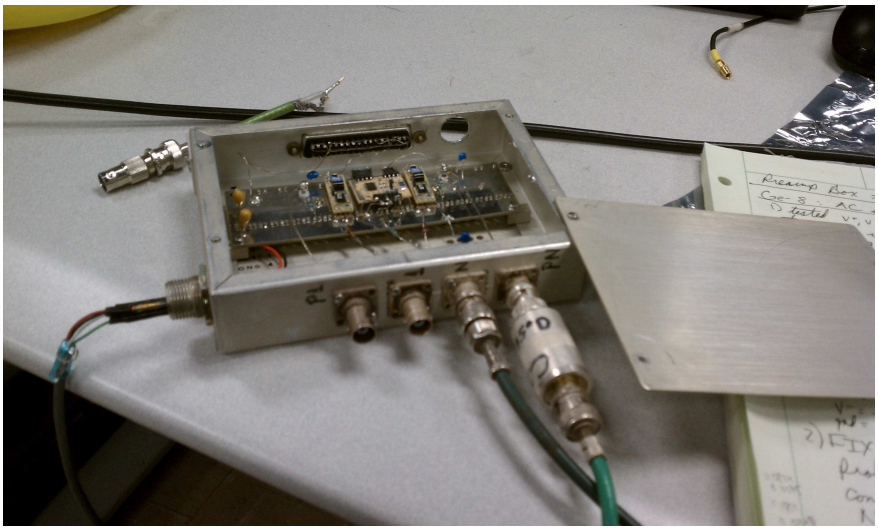


Figure 1: Individual preamplifier testing box. Note the signal in is on the right, signal out next to the input on the left, and the power cord is on the left side of the box. The configuration of the power cord is described in table 2.

Required
NIM preamp power supply (3)
preamp test box (1)
preamp test box power cable
BNC cables
preamp housing (2)
preamp housing power cable
preamp housing readout cable
preamp housing test probe
BNC capacitor attachment
pulse generator (short pulse width preferable)
Oscilloscope
Nitrile Gloves
Tweezers (preferably rubber-tipped)
Multimeter
Recommended
Grounding Bracelet
Grounded Workstation
Attenuator (for pulse generator)
Magnifying Glass
Flashlight

Table 1: Required and Recommended Equipment for Preamp Testing and Installation

Preparation

In order to avoid the possibility of frying a preamp from static discharge, it is strongly recommended that the user be working at a grounded workstation with a grounding bracelet.

If you are starting with a new batch of preamps and don't know if they work, it is recommended that you test them individually before installing them in the preamp box.

Preamplifiers

The preamplifiers are 2-stage charge sensitive preamplifiers with one 8-pin connector on the power side and two 4-pin connectors on the readout side.

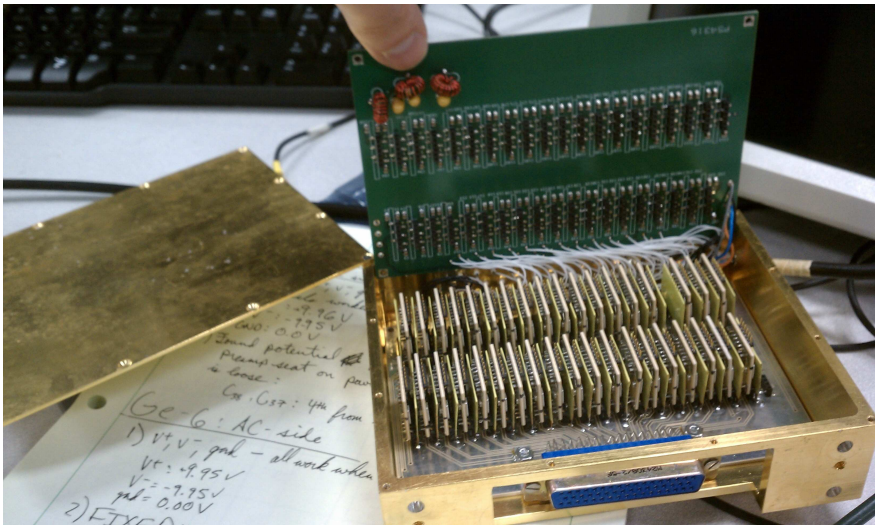


Figure 2: Picture of the preamplifier housing box with the cover removed and the top board (power side) disconnected. All 37 preamps are installed in this picture. Notice the power cable on the upper right of the box. The blue strip on the front of the box is the d-pin connector which is where the input signal goes.

Handling

The preamplfiers are very sensitive and should not be handled without nitrile gloves in a grounded environment. There are two elements on the preamplifiers that you should avoid contacting in particular:

1. The readout pins - these are the most susceptible to static discharge
2. The resistor - Getting any grease/dust/dirt on this element (white box with a blue resistor symbol on it) can break the preamp.

Preamp Testing (Individual)

Voltage	Power Cord Wire Colors	Box Wire Colors
GND	GREEN	GRAY
V+	RED/BLACK	RED
V-	WHITE	BLACK

Table 2: How to connect the test box to the power supply

1. Connect all the equipment as shown in figure 4. The power cord should have 3 individual connectors that connect to 3 individual pins

Figure 3: Picture of the preamp power supply with preamp power cables attached.

on the box power input according to table 2.

2. Insert the preamp according to the diagram attached at the end of the document.

3. Turn on the pulser and set up the input pulse. It should be as low in amplitude and as short in time as possible. Previously, a roughly square pulse 6 mV in amplitude (with capacitor attached) and 50 ns in width was achieved using the brown LBL pulser in conjunction with an attenuator box (in 1110B, 5-12).

4. Close the box top. There is a ton of noise if the box is not closed (doesn't have to be screwed shut, just make sure it's a faraday cage).

5. Double-check to make sure everything is connected properly and you have a good input pulse from the pulser; then turn the preamp power supply on. You should observe the appropriate output pulse from the

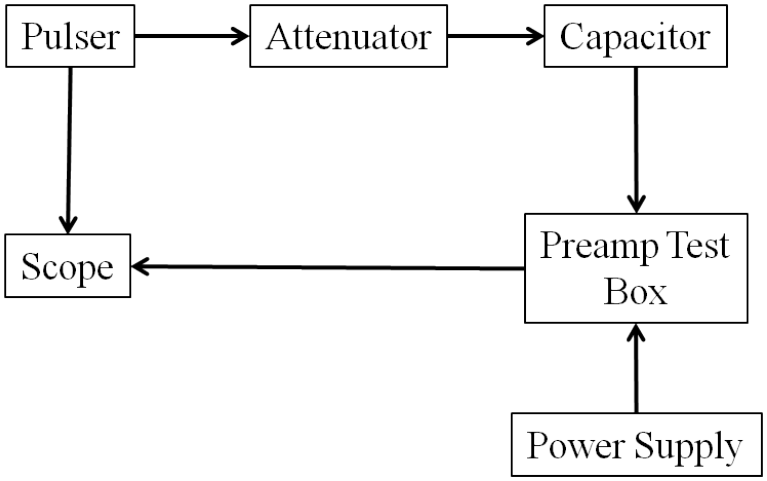


Figure 4: Block diagram showing the setup for testing individual preamps. The attenuator is optional depending on the pulser. The pulser signal is sent to the scope to monitor for changes in the pulse shape.

box in the oscope, although we observed some ringing at the tail end of the pulse.

6. Make sure to turn off the power supply before attempting to remove or switch out the preamp from the box.

Preamp Installation

Once you know you have working preamplifiers, you can install them into the preamplifier housing box that connects to CCI-2 (figure 2).

1. Unscrew the top of the box and gently lift back the top board (power side). Don't do this too quickly or forcefully or you run the risk of breaking one of the power connection wires.

2. Begin placing the preamps in the box by connecting the 2-pin side of the preamp to the base board. Make sure the preamps are separated by the fins and that the fins are properly covered with insulating tape. Take care not to touch the readout pins or the resistor on the preamps themselves.

3. Once all the preamps are connected to the base board, the fun part begins. Attaching the top board to all the preamps is a pain and more of an art than anything. The important thing is to make sure that every single preamp is properly connected to the shoe on the power board. Since there are 37 preamps, it is very easy for a single one to

miss (especially in the corners, where it is very difficult to see). Here's what ended up working best for me:

(a) Start from the top left corner keeping the board relatively flat (it might be easier to sit on the floor to get a good visual angle) and ensure you have the first 2 or 3 fit properly.

(b) Work to the right by slowly tilting the board down and fitting the next consecutive preamps individually. You will need to use tweezers or something to gently manipulate the preamps to get them to slide into the shoes.

(c) Once you get the back row fitted, start working on the front row by slowly tilting the board forward and repeating the above step. Make sure to keep enough pressure on the back row so that none of the ones you have already fit will pop out.

This is not gospel, just what worked best for me. Make sure the board is pressed down so that the preamp pins are all the way in the shoes.

4. Once you think you have got all the preamps into their shoes, double check yourself by inspecting with a magnifying glass. In my experience, the misfits tend to occur in the corners where your view is most obstructed. You may need to use the magnifying glass to look through the screw holes to see the preamps most in the corner.

5. After visually inspecting your work, you can test it with a voltmeter. Connect the power cord to the box and turn on the power supply. Use a voltmeter to test the terminals labelled "V-", "GND", "V+" and "V_FET+". You should read voltages of about -10.0, 0.0, 10.0 and 10.0 volts respectively. If one or more of the voltages is not what you expect, this is most likely caused by one or more of the preamps not being properly connected. *Before disassembling - check these:*

   (a) Make sure the power is properly connected and turned on

   (b) If you are getting opposite readings from the terminals (e.g. -10.0 V from the "V+" terminal), make sure you don't have the voltmeter probes switched.

If the above test checks out, you can be relatively confident that the preamps are connected properly. You are now ready to test them in-box.

In-Box Preamp Testing

This section details how to test the preamps that are already installed in the preamp box. Make sure you do the voltage test described in the previous

section before this test to make sure all the preamps are properly connected.

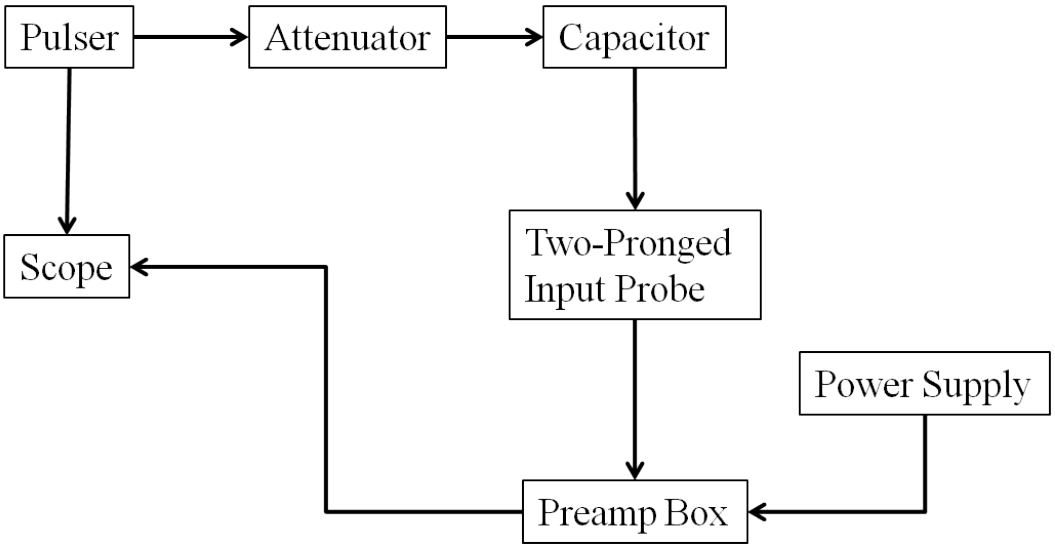


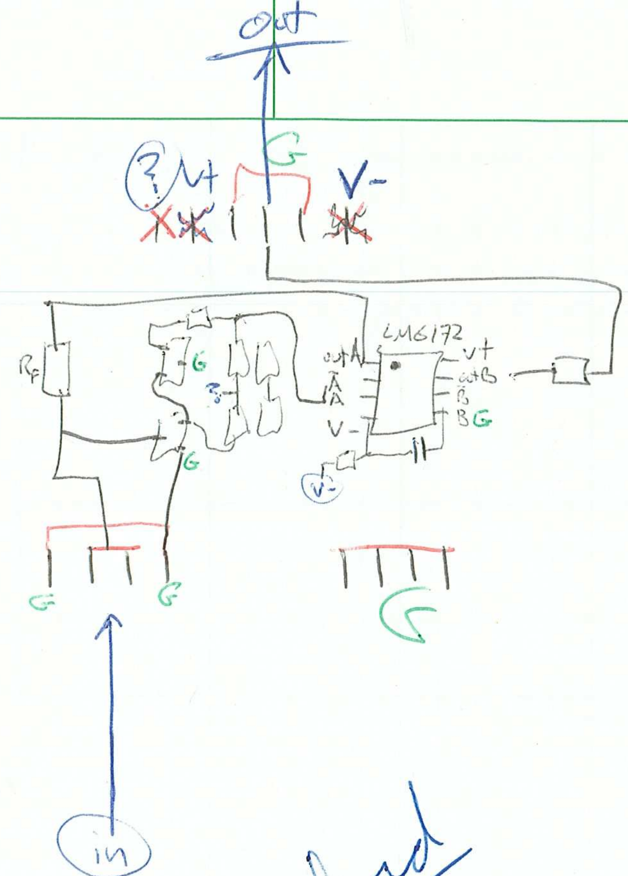
Figure 5: Block diagram showing the setup for testing the preamplifiers in-box.

1. Set everything up according to the diagram in figure 5.
2. Set up the pulser (see previous testing section for details). Make sure the capacitor is attached to the input probe. Turn the power on.
3. Attach one of the leads from the input probe into the desired channel. Make sure the other lead is touching the case or else grounded some other way. Attach the output probe to the appropriate readout channel. The diagrams for the input and output arrangements are attached at the end of the document.
4. You should see pulses similar to the ones seen from the individual testing in the oscope. There may be a lot of DC noise due to the frayed cables or depending on whether the box is open or closed.
5. Turn off the power when testing is complete.

Additional Comments

After testing, if everything works and you are ready to screw together the preamp box, don't forget to put the screws/spacers in there as well!

4/23/12
P.B.

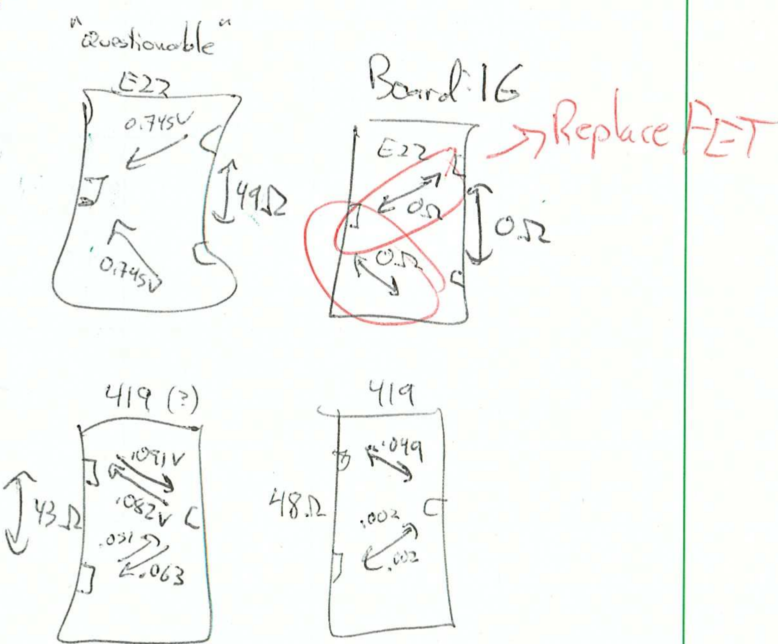


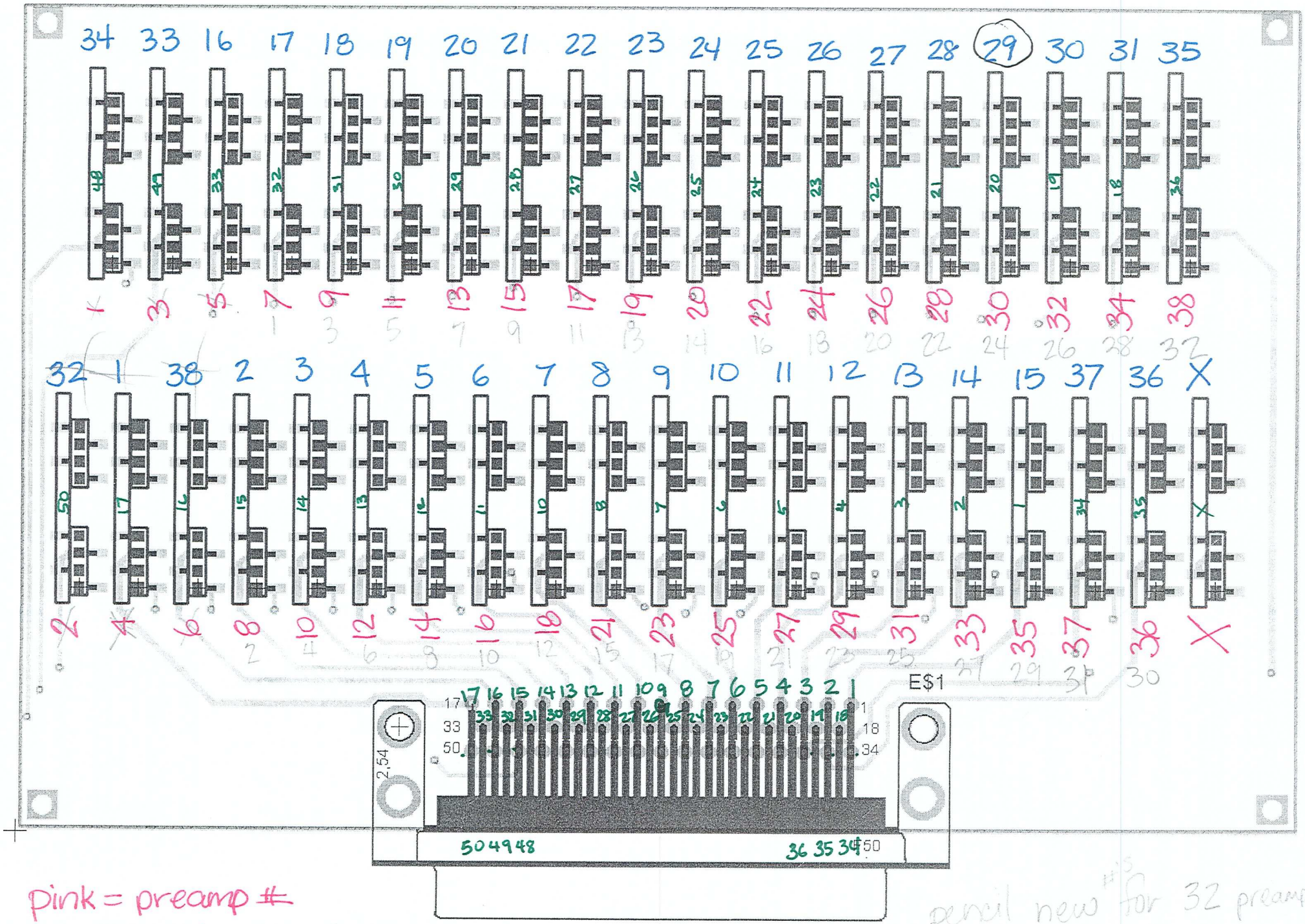
in

Capacitor code

Vy12c
3r3b
8451a

Inbox		chord
gray	= gnd =	green
red	= V+ =	red/black
black	= V- =	white





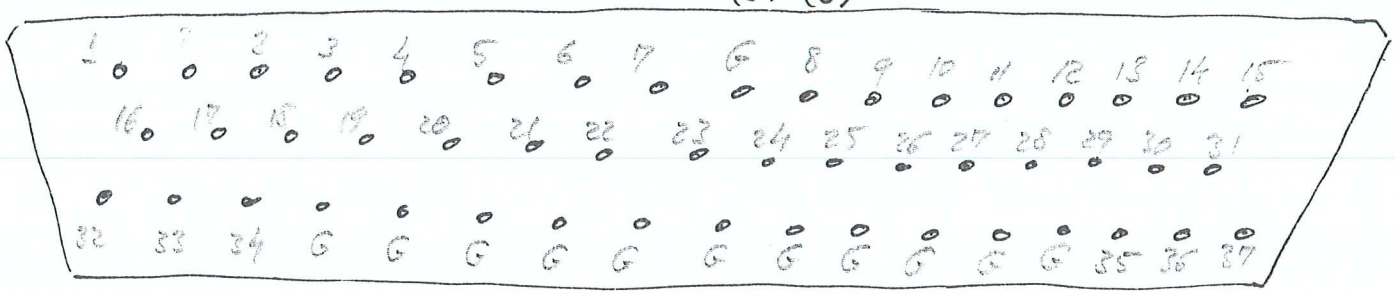
pink = preamp #

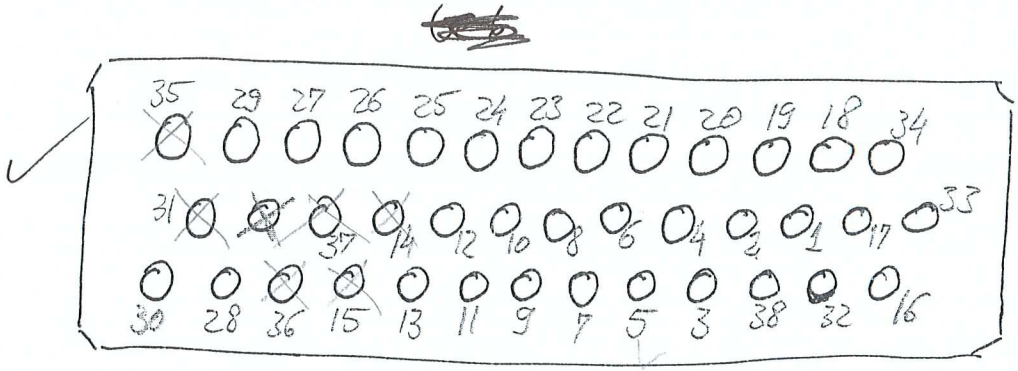
green = 'D' connector pin #

blue = Lorenzo's preamp #'s

pencil new #'s for 32 preamp

(8) (G)





Ge = 8