32 Channel Box

April 9, 2022

**Specifications**:

32 Channels

Bias range 0 to ±1V

Reference electrode range 0 to ±1V

Internal Ramp Generator 0 to ±1.25V p/p triangle wave, 6 Hz.

Gain = -0.5V/nA

-3dB bandwidth 15 kHz

Range = ± 14.5 nA

Peak to Peak noise <10 pA

**Overview**

The system consists of two units, a controller/power supply and the 32 channel transimpedance amplifier box (Fig 1).

A picture containing text, electronics

Description automatically generated

**Fig. 1: The system**

**The Controller**

The front and rear panels are shown in Figs 2 and 3.

A picture containing text, device, meter

Description automatically generated

**Fig. 2 Front Panel**

Graphical user interface

Description automatically generated

**Fig. 3 Rear Panel**

Front Panel controls:

1. Meter switch (center is battery off)
2. Ext Bias source (back panel BNC or internal ramp generator)
3. Ramp gen pwr – turns the power to the ramp generator to avoid stray coupling to bias
4. Push for ramp – gives ramp burst when pushed
5. Ramp amplitude (0 to 1.25V p/p around 0V). CCW is zero volts
6. Select bias source: internal or external/ramp
7. Selects bias polarity
8. Bias 0 to 1V (CCW is zero)
9. Selects reference polarity
10. Reference 0 to 1V (CCW is zero)

Back Panel:

1. Bias output for recording
2. Reference output for recording
3. External bias in
4. Connector to amplifier box.

Note that the meter 9V battery is also replaceable using the back panel battery drawer.

**The Amplifier Box**

The back panel is shown in Fig. 1 (RHS). The internal layout is shown in Fig. 4.

A picture containing text

Description automatically generated

**Fig. 4:** Amplifier box, lid off.

The box is accessed by removing the lid. 8 four channel boards are arranged in stacks of two around the die board. They are connected to the die board via two-wire jumpers terminated in small precidip connectors (amplifier board) and large precidip connectors (die board). Note the interweaving of connectors between the top and bottom boards to minimize lead length.

**To remove/replace the die board:** First note the order of connections (top and bottom) to the die board if you want to maintain the relationship between channel output lables and connections on the die board. Carefully pull the precipdip connectors from the die board (a pair of tweezers helps) but leave the connectors in place on the amplifier board. Unscrew the two knurled knobs and the ref. electrode post. Pull the die board out being careful not to dislodge the connector wires. To replace the board, put it on threaded studs and carefully replace the knurled nuts and ref electrode post. Note the screw threads are plastic and easily damaged.

**Operating**

Make sure the knobs for bias (8) and reference (10) are turned fully CCW. Make sure the ramp is not above the 400mV marker (±200mV). Connect the amplifier box using the 7 wire DIN cable. Turn the controller on (back panel 110V switch). Switch the meter (1) to bias and set the desired bias polarity (7) and value (8) using the meter display. You can flip the switch (1) and do the same for the reference (9,10) when you are ready.

When adjustments are complete on the die board and fluids loaded as needed, place the lid on (this is ***essential*** for low noise). You should be ready to record.

The outputs are ordered by board pairs: 1A 1B 1C 1D bottom first pair, 5A 5B 5C 5D top first pair, etc. Thus the 1 and 5 connections read out all 8 channels on one side of the die board and so on. If you list the lid, you will see labels for each board (top, bottom) on the base of the unit next to each board. The output SMA connectors are fitted with 10 ft long RG174 leads.

**Noise levels**

A typical noise recording is shown in Figure 5.

A screenshot of a computer

Description automatically generated with medium confidence

**Fig. 5 Noise level.** Recorded at 5 mV/div = 10 pA per division (white bar)

**Schematics: Controller Overall**

Diagram, schematic

Description automatically generated

**Schematics: Amplifier box overall**

Diagram

Description automatically generated

**Schematics: Power Supplies**

Diagram, schematic

Description automatically generated

**Schematics: Controls and buffers**

Diagram, schematic

Description automatically generated

Numbers in red refer to panel controls/IO

**Schematics: Ramp Generator**

Diagram, schematic

Description automatically generated

**Schematics: Metering and power connectors**

Diagram, schematic

Description automatically generated

Note, the meter is set to read ±1.999V. The calibration can be adjusted by removing the controller box cover (note the grounding lead connected to the cover!) and adjusting the preset pot on the small circuit board behind the meter.

**Schematics: Four channel boards block diagram**

Diagram

Description automatically generated

**Schematics: One of the Amplifier Channels**

Diagram, schematic

Description automatically generated

**Trouble Shooting**

Voltages can be checked with a meter at each of the terminal strips marked with the blue arrow below:

A picture containing text, electronics

Description automatically generated

The wire color codes are

BIAS Brown

-2.5V Blue

+2.5V Orange

-15V Black

+15V Red

Individual outputs can be checked at the SMA connectors using the SMA to BNC adaptor provided. Note that (power off) the resistance between the SMA connector and ground will be 5.4 kΩ if the board outputs are properly connected.

The gain can be checked by placing one of the 100 MΩ resistors (mounted on a precidip) in the shorting bar slot of the die board. +0.1V bias applied should give -0.5V out.

**Replacing boards:** Spare boards will become available. Take the board stacks apart very carefully. The top board is held by 4 very tight plastic screws. Hold the post underneath the screw as you undo it to avoid rotating the post and stripping the thread. The bottom board is released by undoing the four threaded posts. The output connectors are latched – use a small screwdriver to push the latch in.