PM8500/N Electronics Repair / Servicing

Product Training

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Agenda

- Scope
- System Overview
- Functional Blocks
  - Hardware
    - System
    - Power Supply
    - Amplifiers
    - Digital
    - PMESPLink
  - Firmware / Software
- Troubleshooting

Scope

- This training to include:
  - Functional technical overview
  - Location of critical parts on layout
- Additional documentation not covered here:
  - Schematics
  - Theory of Operations manual / training
  - TAP Commands
  - User Interface Specification
  - Latest Owner's manual
- If you want to see something not covered, we can always schedule another session!

System Overview

PM8500 Basics

Features

- **Class-D Amplifier** –with voltage and current monitoring
- **QuadBridge™ Output Mode** – Outputs can be configured as single, dual, or quad channel modes, which allows 4 kW of power to be allocated between 2 to 8 channels.
- **8 x 500 W from Single Household AC Mains** – The PM8500 delivers 4 kW rated power from a single AC mains outlet, with greater than 75% conversion efficiency.
- **Integrated Digital Signal Processing** for loudspeaker EQ, crossover, delay, and limiting.
- **Software Setup and Network Monitoring** –using Bose ControlSpace® Designer PC software over USB or Ethernet.

Applications

- Theaters
- Houses of worship
- Auditoriums
- Performing arts venues
- Arenas
- Hospitality venues

Two Product Models

PM8500 (USB only)

PM8500N (USB+Ethernet)

Front Panel

1. LED Indicators: Fault, Clip, Limit, Signal
2. LCD Display
3. Navigation Soft Key
4. Rotary Encoder
5. Menu Soft Keys (1-5)
6. USB connector
7. Front airflow vents
8. Front rack-mount ears

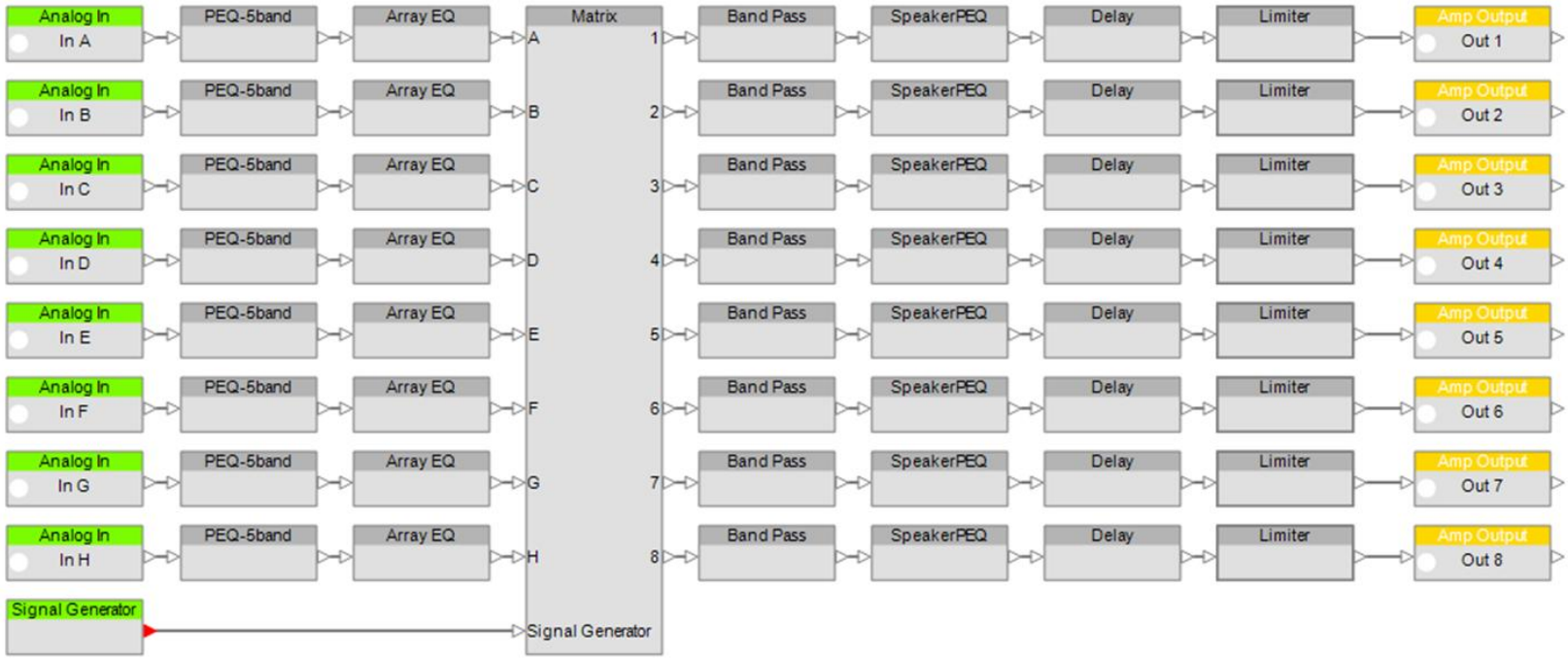
Rear Panel

1. Analog Input connectors (A-H)
2. Fault-Notification Output
3. Ethernet RJ-45 network connector (PM8500N only)
4. Rear airflow vents
5. Digital input card slot cover
6. Output connectors (1-4 and 5-8)
7. AC Mains receptacle
8. AC Mains retention clip
9. Power Switch
10. Rear rack-mount support tabs

ControlSpace Software

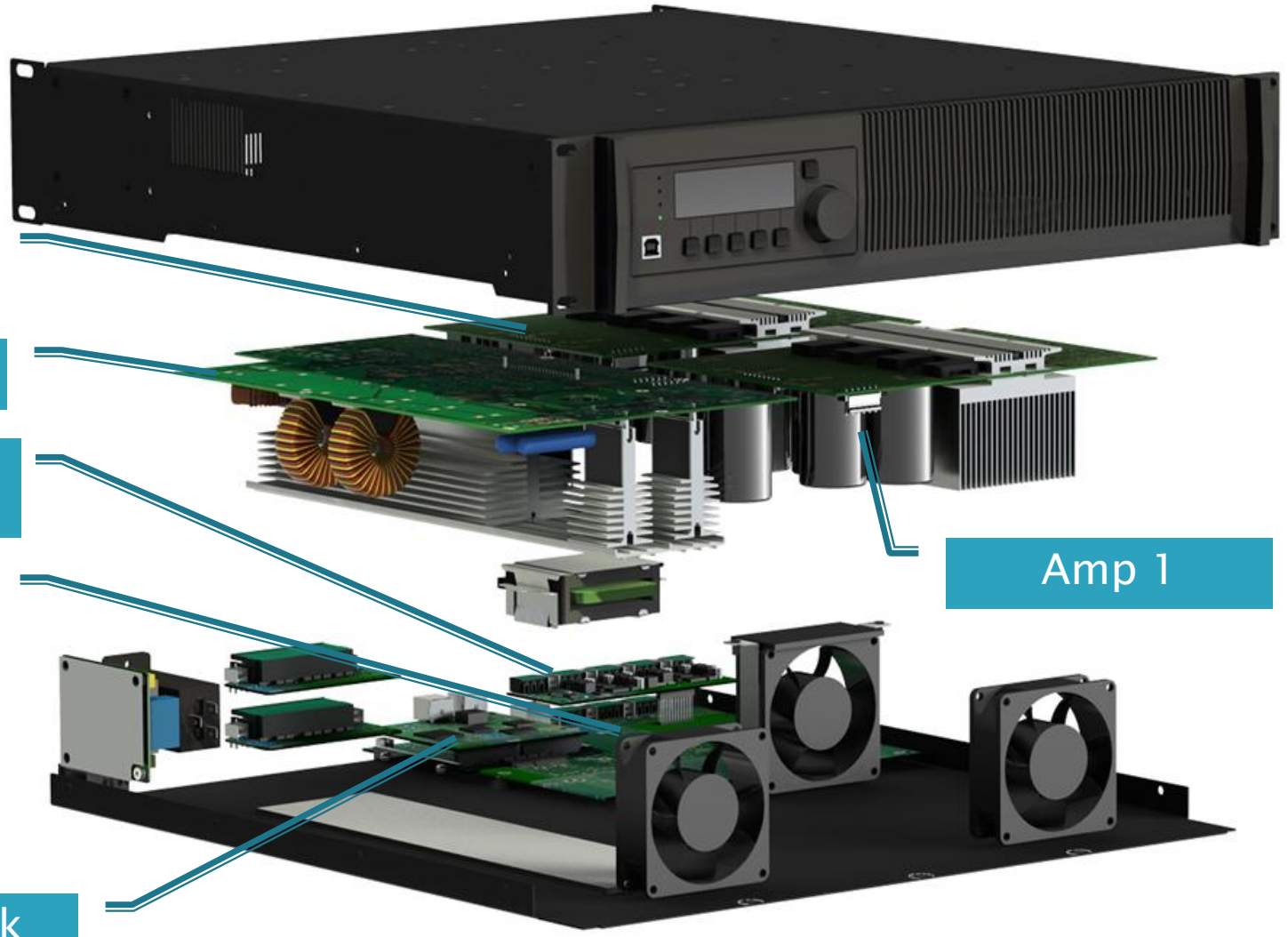
- Configure PM8500
- Upgrade Firmware
- Monitor input and output levels
- Retrieve alarm logs
- Retrieve debug log (in debug mode)

ControlSpace Software

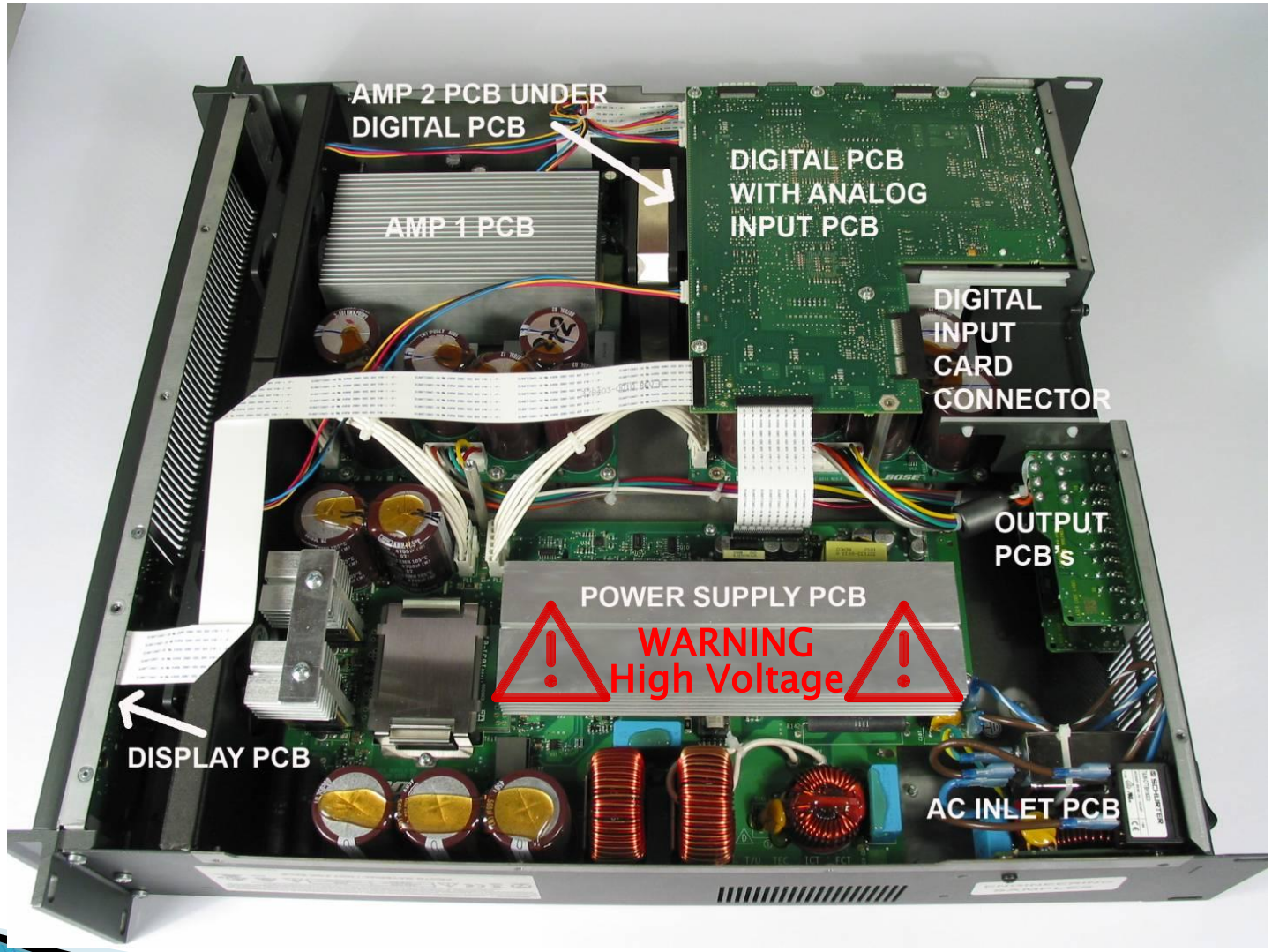


Functional Blocks: System

Inside the PM8500



Amp with bottom cover removed



PM8500 Disassembly Procedure

PM8500(N) Amplifier Disassembly Procedure

CAUTION: SHOCK HAZARD

The PM8500(N) amplifier has high voltage (400 VDC) on the heatsink and much of the circuitry on the power supply PCB during operation. In addition, the power amplifier PCBs have a large amount of capacitance on the boards that retain a dangerous charge for a significant period of time.

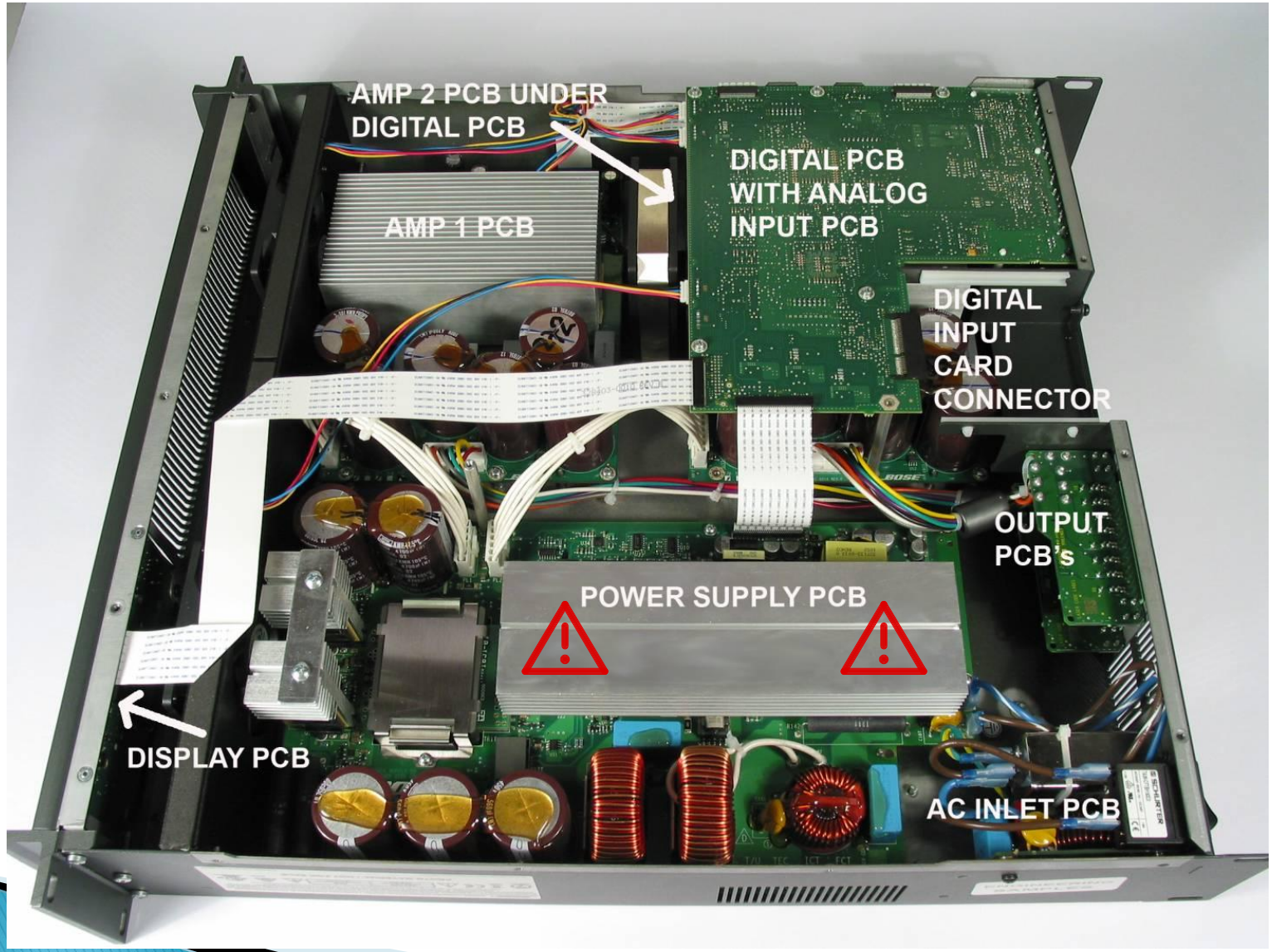
- **DO NOT touch the power supply heatsink when the amplifier is operating.**
- **DO NOT use the power supply heatsink as a ground point for test equipment.** Damage to your equipment could result.
- Allow at least five (5) minutes after operation before removing the cover or attempting to replace a PCB assembly.

1. **Cover Removal**

Note: The PM8500(N) amplifier is constructed differently than a typical amplifier chassis. What would normally be the top cover is on the bottom of the chassis. To remove this cover, you must place the unit upside-down on your bench.

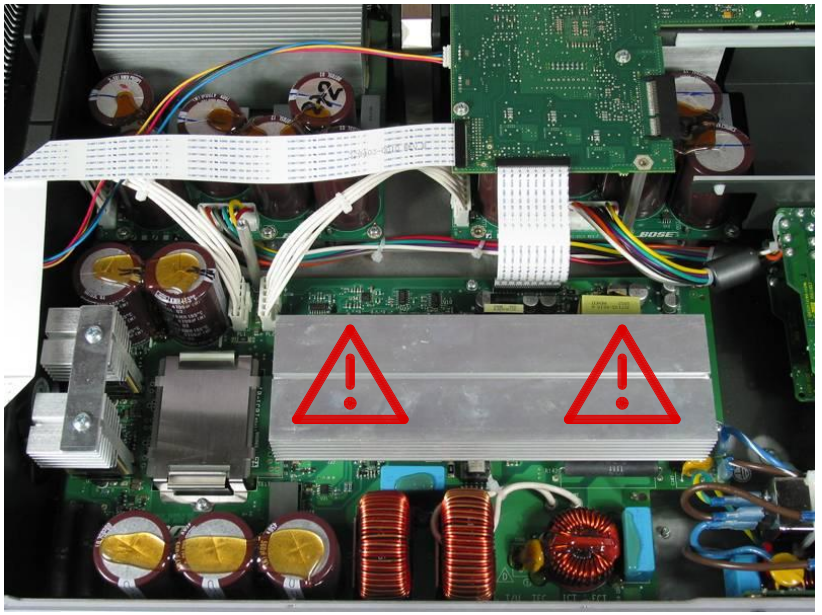
- Disconnect the chassis from AC mains.
- Wait at least five (5) minutes to allow the power supply capacitors to discharge.
- Remove the 17 screws that secure the cover to the chassis. Be sure to use the correct screwdriver size to avoid stripping the screw heads. Be sure to remove the 2 screws located in the middle of the cover.
- Lift off the cover.

Amp with bottom cover removed



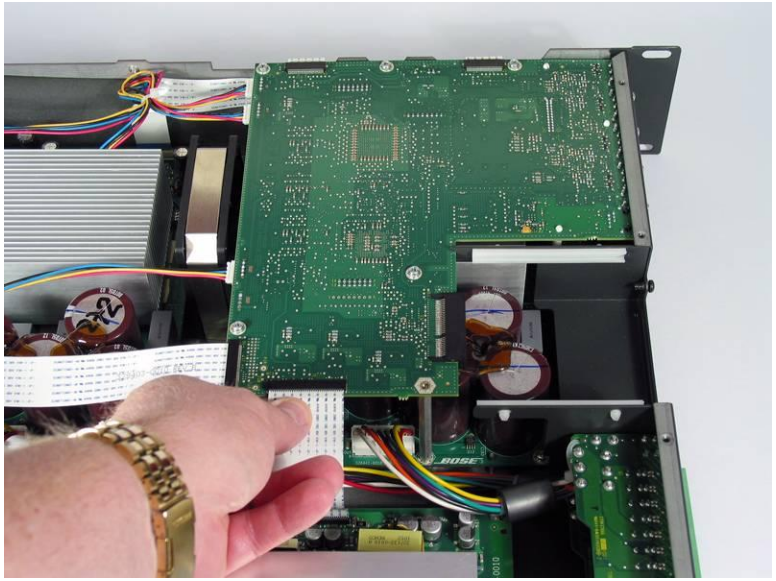
2. Power Supply PCB Removal

- Disconnect the chassis from AC mains.
- Wait at least five (5) minutes to allow the power supply capacitors to discharge. Perform procedure 1.
- Unplug the Faston connectors at locations P1 and P2 that run from the AC inlet PCB. Unplug the connectors that connect to the amplifier PCBs at connectors PL1 and PL2. Unplug the ribbon cable that runs to the digital PCB at connector SK1.
- Lift off the plastic shield that covers the power supply heatsink. Lift off the plastic heatsink tunnel located at the front of the board. Retain for re-use on the replacement board.
- Remove the six screws and one standoff that secure the power supply PCB to the chassis. Slide the board off of the slotted head standoffs and carefully lift the board out of the chassis. Take care to not flex the board during removal.



3. Digital PCB Removal

- Remove the bottom cover.

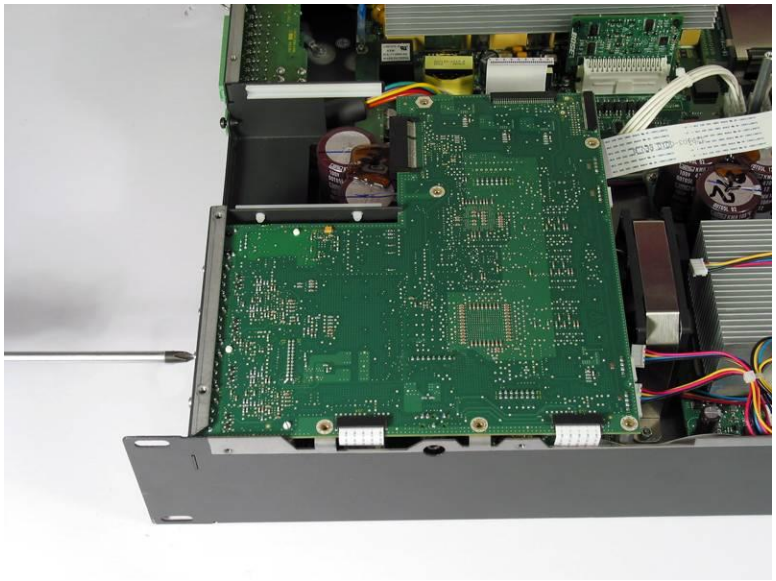


- If the unit is a network capable unit (PM8500N) and has a digital audio card installed, remove the two screws at the rear of the chassis that secure it and slide out the digital audio card.

- Unplug the ribbon cable to the power supply PCB at connector J8. Unplug the two ribbon cables to the amplifier PCBs at J13 and J14. Unplug the wiring harnesses to the three fans at J9, J10 and J11. Unplug the ribbon cable to the display board at J17.

- On the back of the chassis, remove the eight screws that secure the digital PCB and the analog input PCBs to the chassis.

- Remove the five screws on the top of the digital board that secure the digital / analog input PCB subassembly to the chassis. Slide them forward off of the chassis locating tab and lift out the boards.



Re-assembly Note: When mounting the digital / analog board subassembly back in the chassis, do not install a screw in the location nearest the output boards. This is where the screw that goes through the cover is installed.

4. Analog Input Board Removal

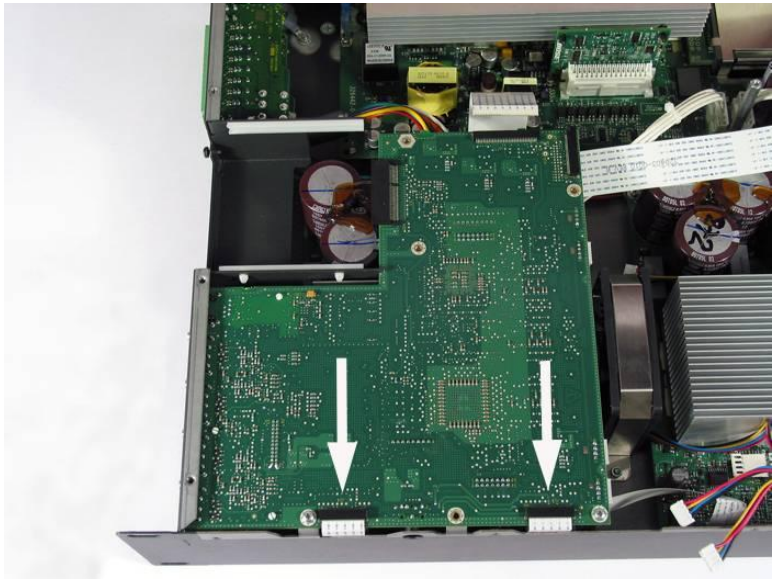
- Remove the digital PCB.

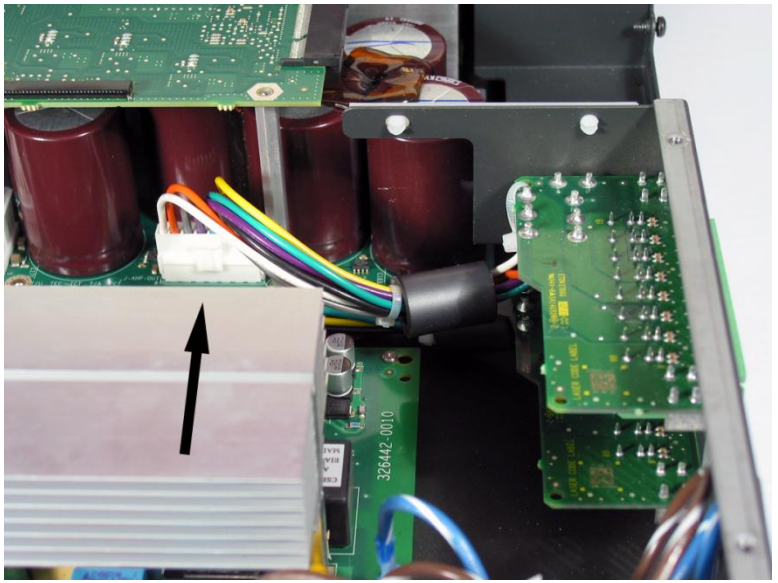
- Compress the ends of the three plastic standoffs that secure the analog board to the digital board. Slide the analog board off of the connector to the digital board.

5. Amplifier Board Removal

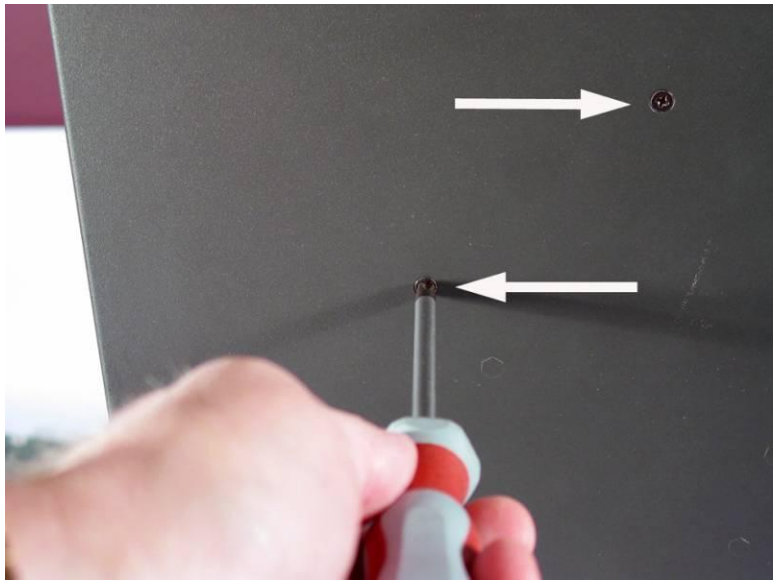
Note: There are 2 amplifier boards located in the chassis Amp 1 is located at the front of the chassis and Amp 2 is located directly behind it. It is not necessary to remove the digital board to remove amp 1.

- If removing Amp 2, remove the digital board and to allow access to the Amp 2 board.
- Unplug the ribbon cable to the digital board at J-IN-1 and the wiring harness from the power supply PCB at J-HV.
- Unplug the output wiring harness as shown at right.

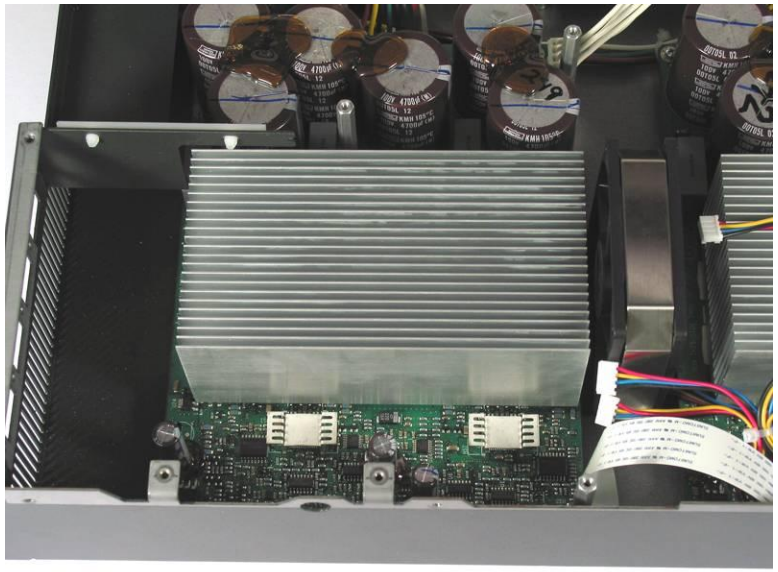




- On the outside of the unit remove the two screws that secure the amplifier PCB / heatsink assembly to the chassis.

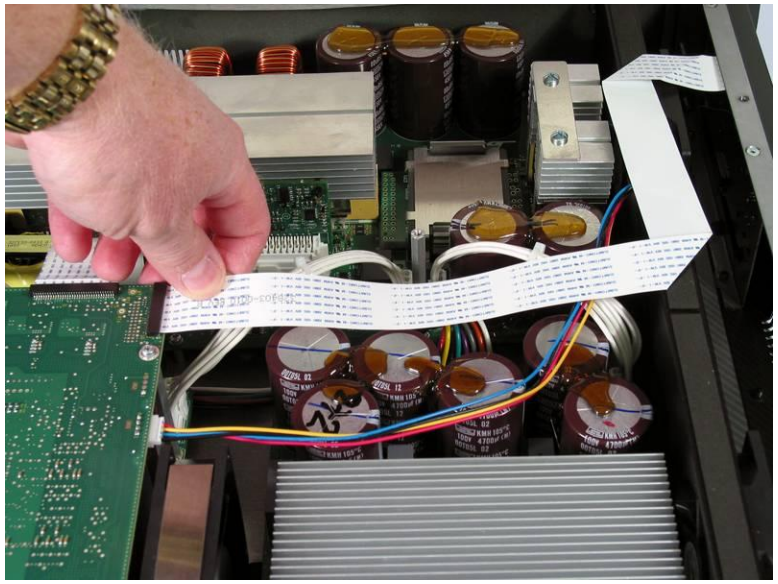


- Inside the chassis, remove the six screws (Amp 1) or two screws and four standoffs (Amp 2) that secure the amplifier PCB. Lift out the PCB with the heatsink.



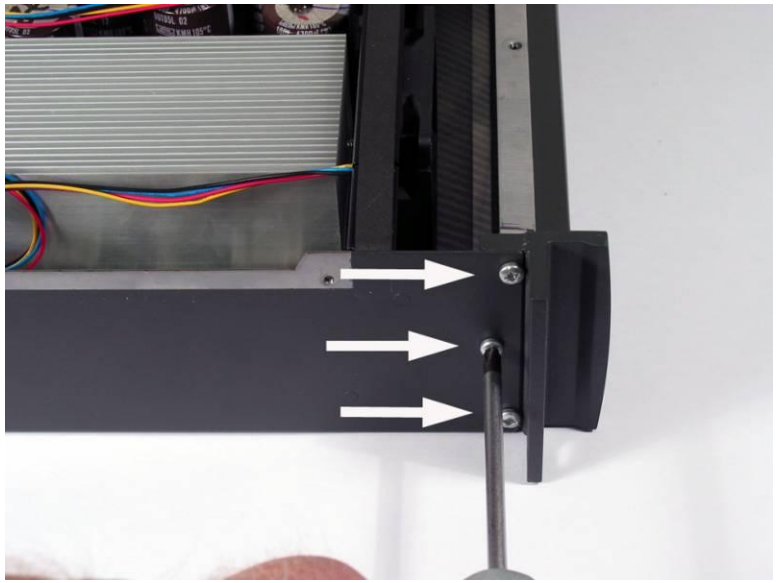
6. Display PCB Removal

- Unplug the ribbon cable on the digital PCB at J17.



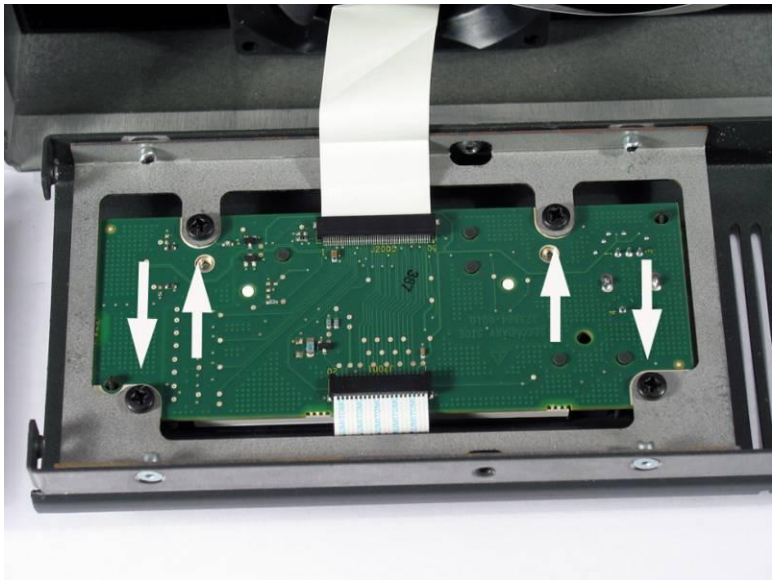
- On the outside top front edge of the chassis, remove the three screws that secure the front panel to the chassis.

- Remove the six screws that secure the front panel assembly to the chassis at the front rack ears.



- Lift off the front panel assembly.

- Remove the four screws that secure the keypad / display subassembly to the front of the chassis. Lift out the display subassembly through the front panel.

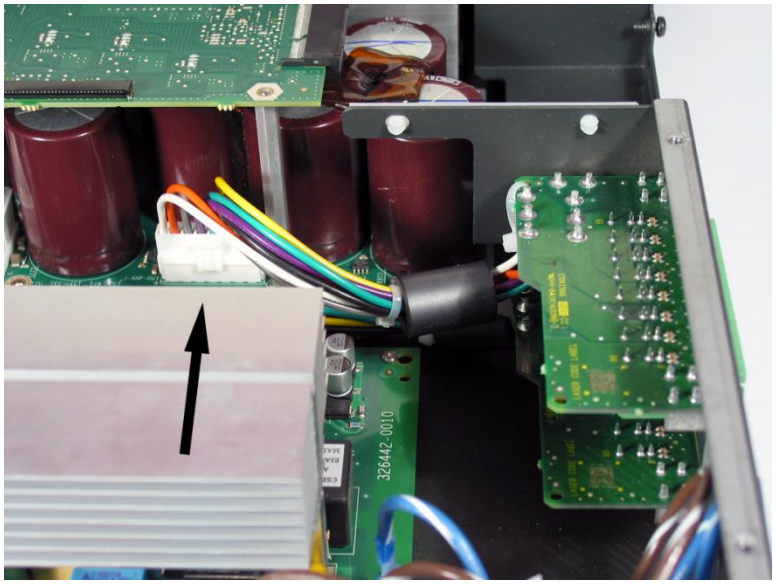


7. Output PCB Removal

Note: There are 2 different versions of the output PCB, one with a long wiring harness to Amp 1 and one with a short wiring harness to Amp 2. Be sure to order the correct version when ordering a replacement PCB assembly.

- Unplug the wiring harness from the amplifier PCB at J-AMP-OUT.

- On the back of the amplifier, remove the two screws that secure the output PCB to the chassis. Lift out the output PCB.



8. AC Inlet PCB Removal

- Disconnect the two wires at the power supply PCB at Faston connectors P1 and P2.
- Remove the nut, lock washer and washer that secure the green ground wire to the chassis.
- On the side of the chassis, remove the one screw that secures the AC inlet PCB assembly to the chassis. Slide the AC inlet PCB off of the slotted standoffs. Lift out the board.

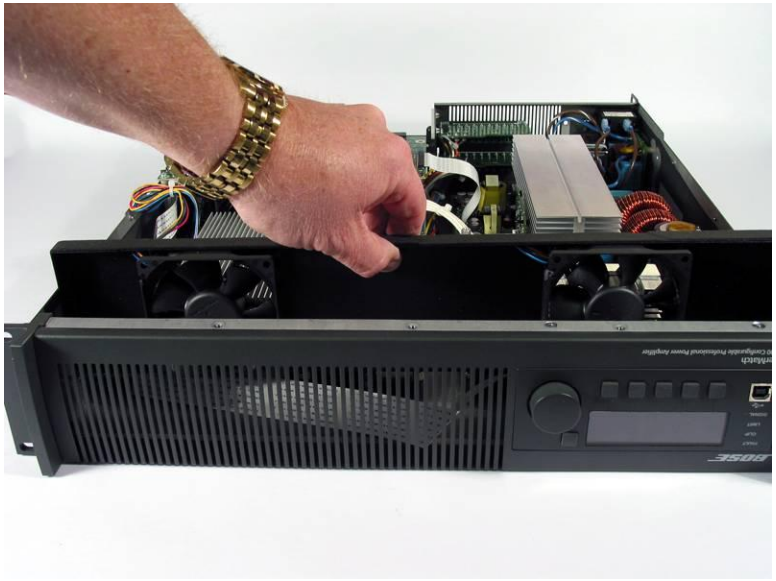
9. Amp 1 / Power Supply Fan Removal

Note: The fans located on the mounting plate at the front of the chassis cool both Amp 1 and the Power Supply PCB.

- Unplug the wiring harness at J9 on the digital board. This harness powers both of the fans that are mounted on the mounting plate .

- Lift out the mounting plate with the fans mounted to it. Remove the two screws that secure the fan to the mounting plate . Lift off the fan.

  Re-assembly Note: Be sure to install the replacement fan so that it blows air from the front of the chassis to the rear.

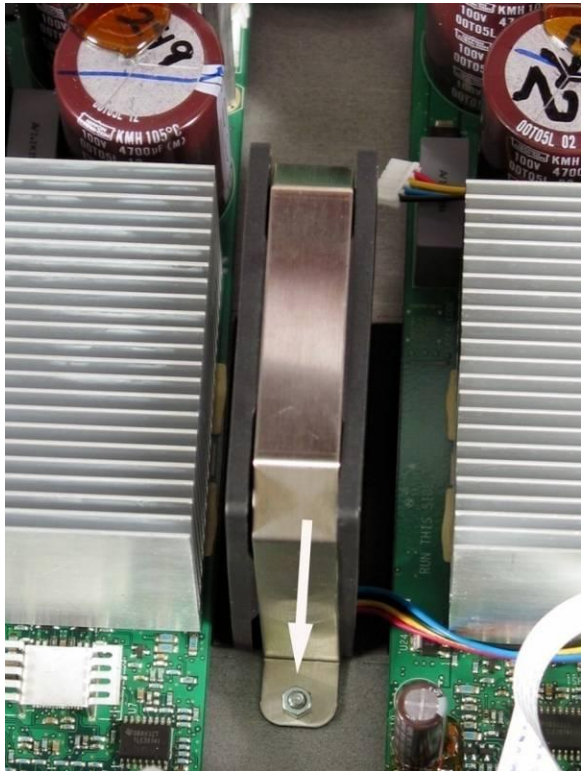


10. Amp 2 Fan Removal

- Unplug the fan wiring harness from the digital PCB at J10.

- Remove the two nuts that secure the fan to the chassis. Lift off the metal bracket that surrounds the fan. Lift out the fan.

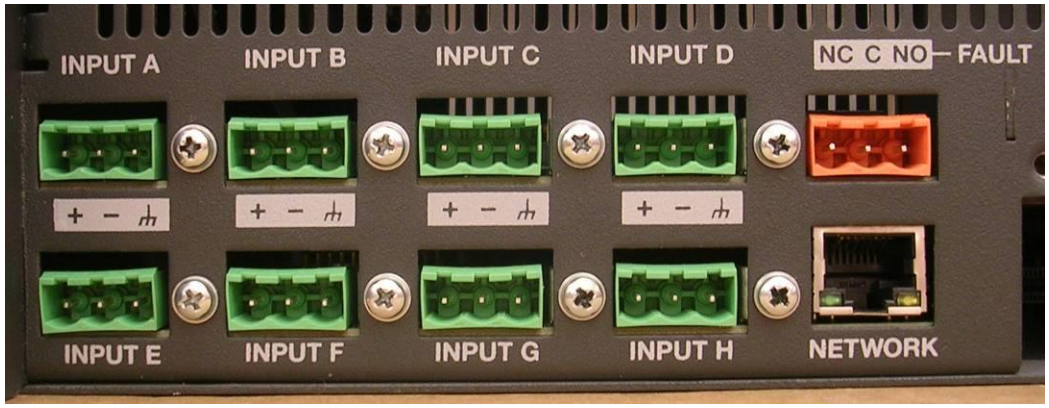
  Re-assembly Note: Be sure to install the replacement fan so that it blows air from the front of the chassis to the rear.

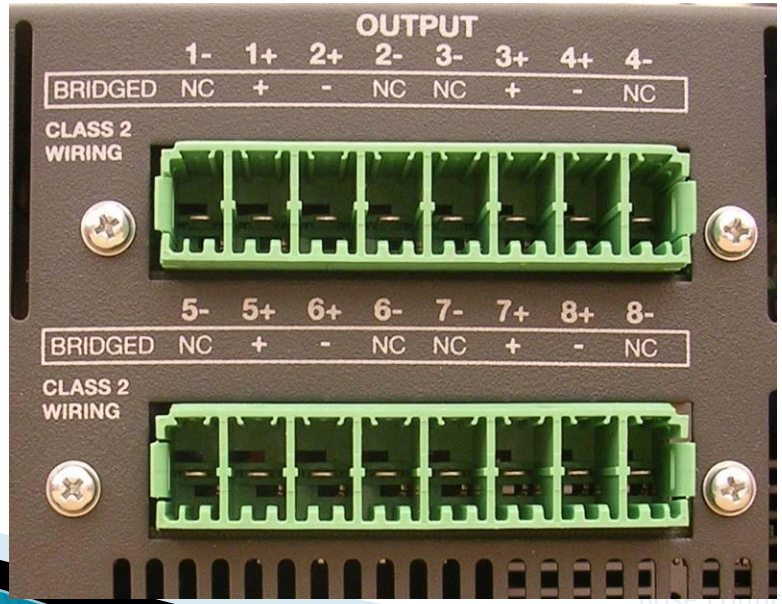


PM8500 Architecture

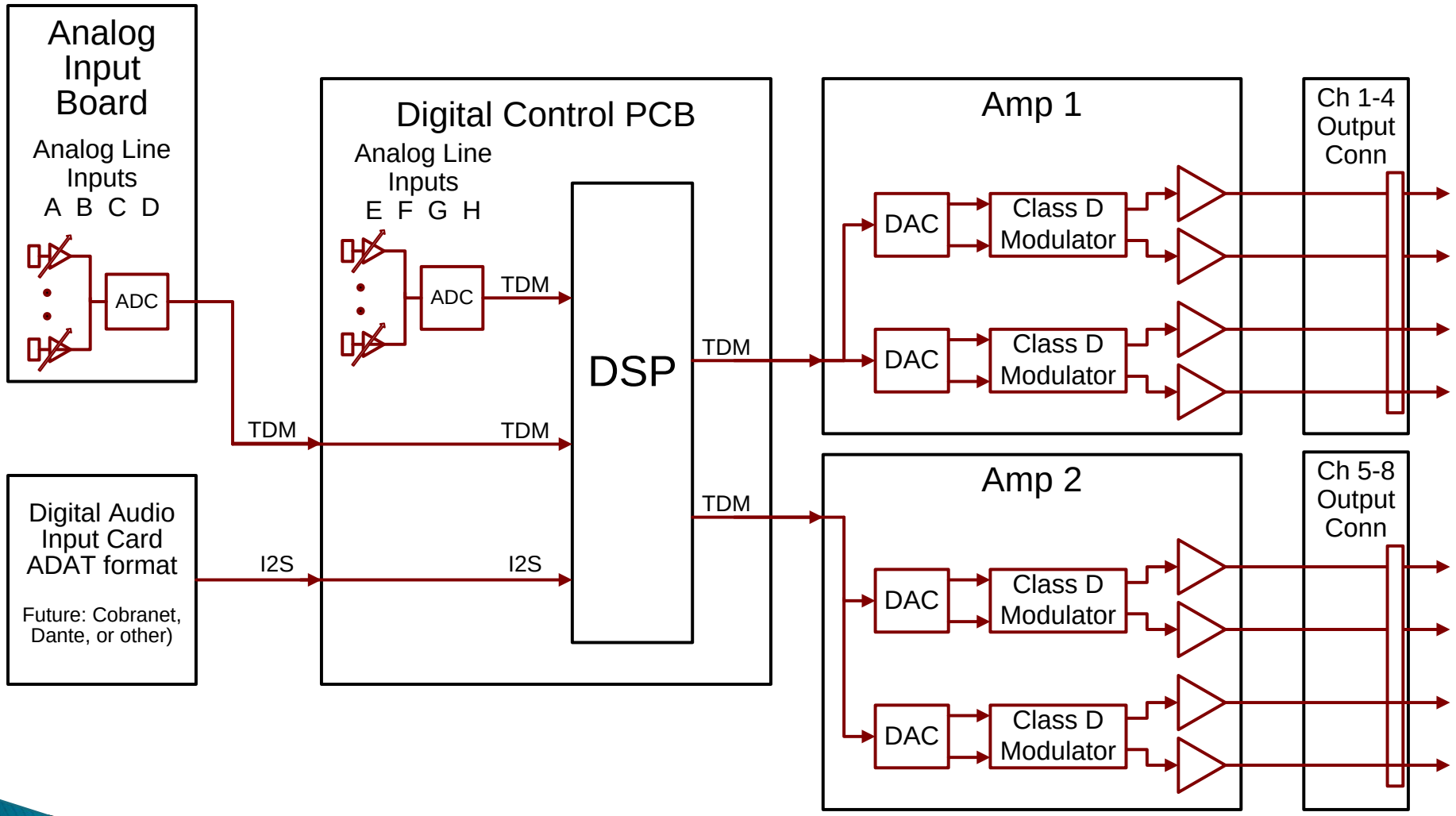
Inputs A B C D E F G H

Outputs 1 2 3 4 5 6 7 8

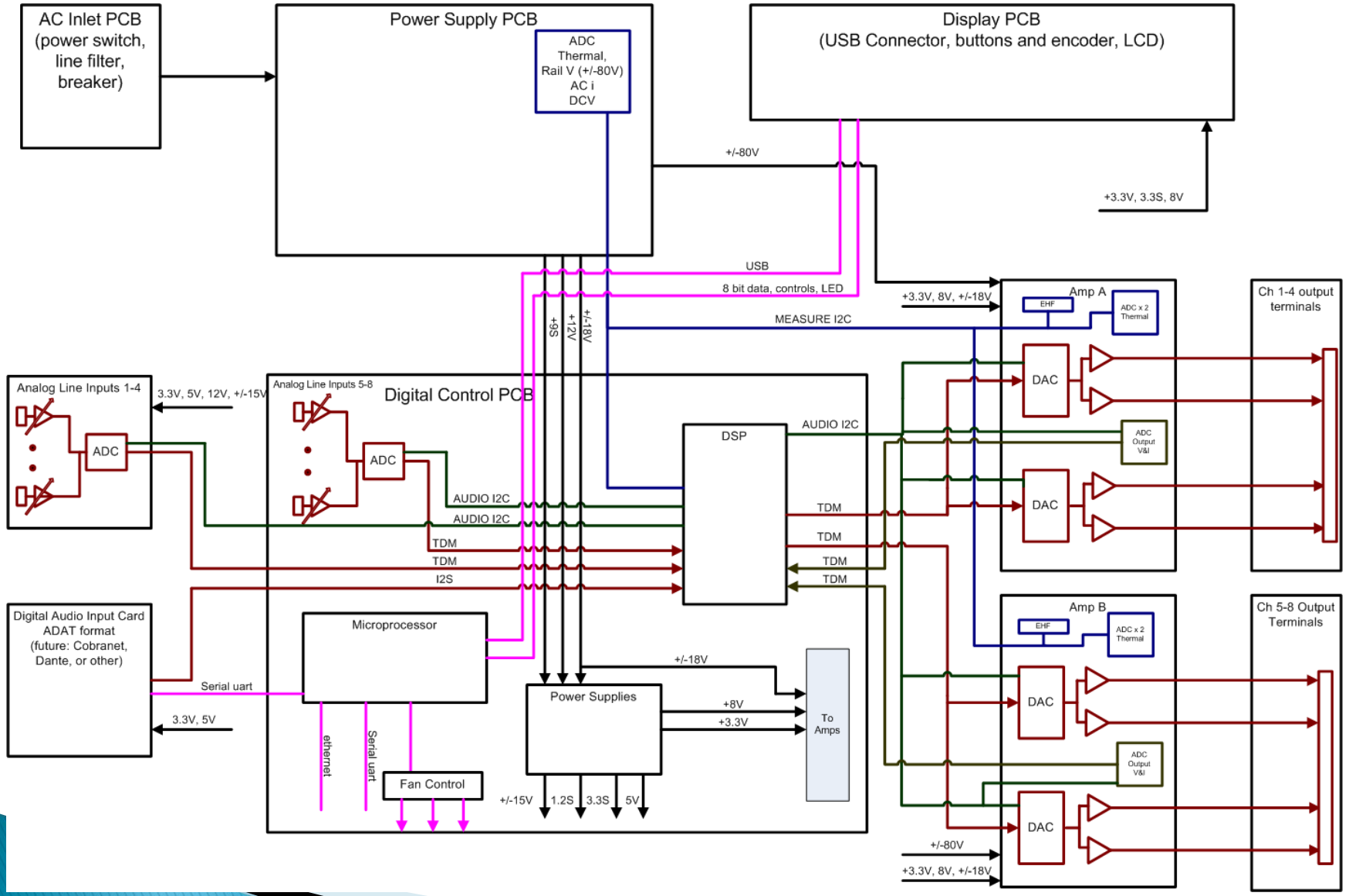




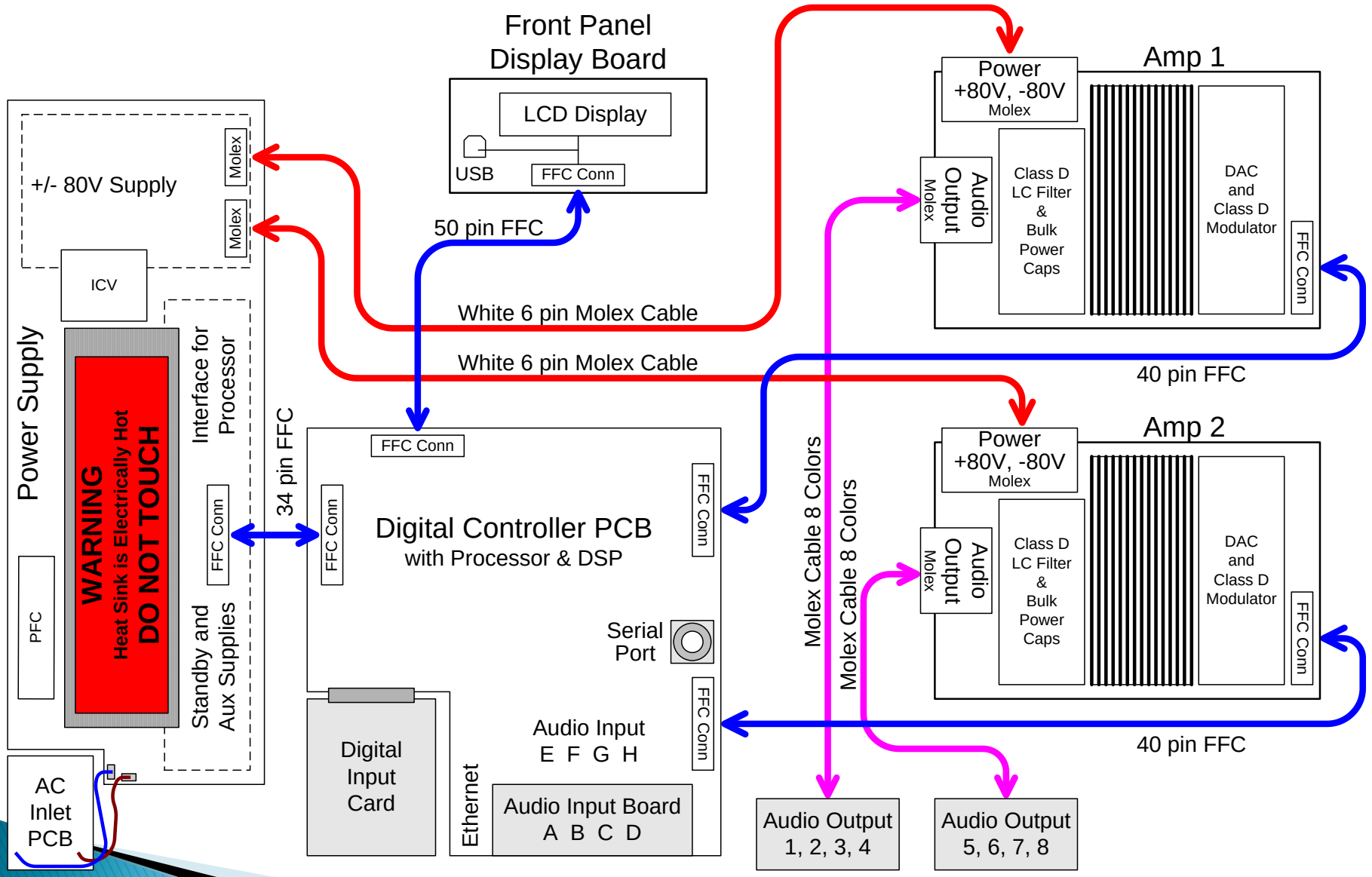
Audio Paths


Analog Input Board
Analog Line Inputs
A B C D
ADC
Digital Audio Input Card ADAT format
Future: Cobranet, Dante, or other)
TDM
I2S
Digital Control PCB
Analog Line Inputs
E F G H
ADC
TDM
DSP
TDM
TDM
I2S
I2S
TDM
Amp 1
DAC
Class D Modulator
DAC
Class D Modulator
Amp 2
DAC
Class D Modulator
DAC
Class D Modulator
Ch 1-4 Output Conn
Ch 5-8 Output Conn

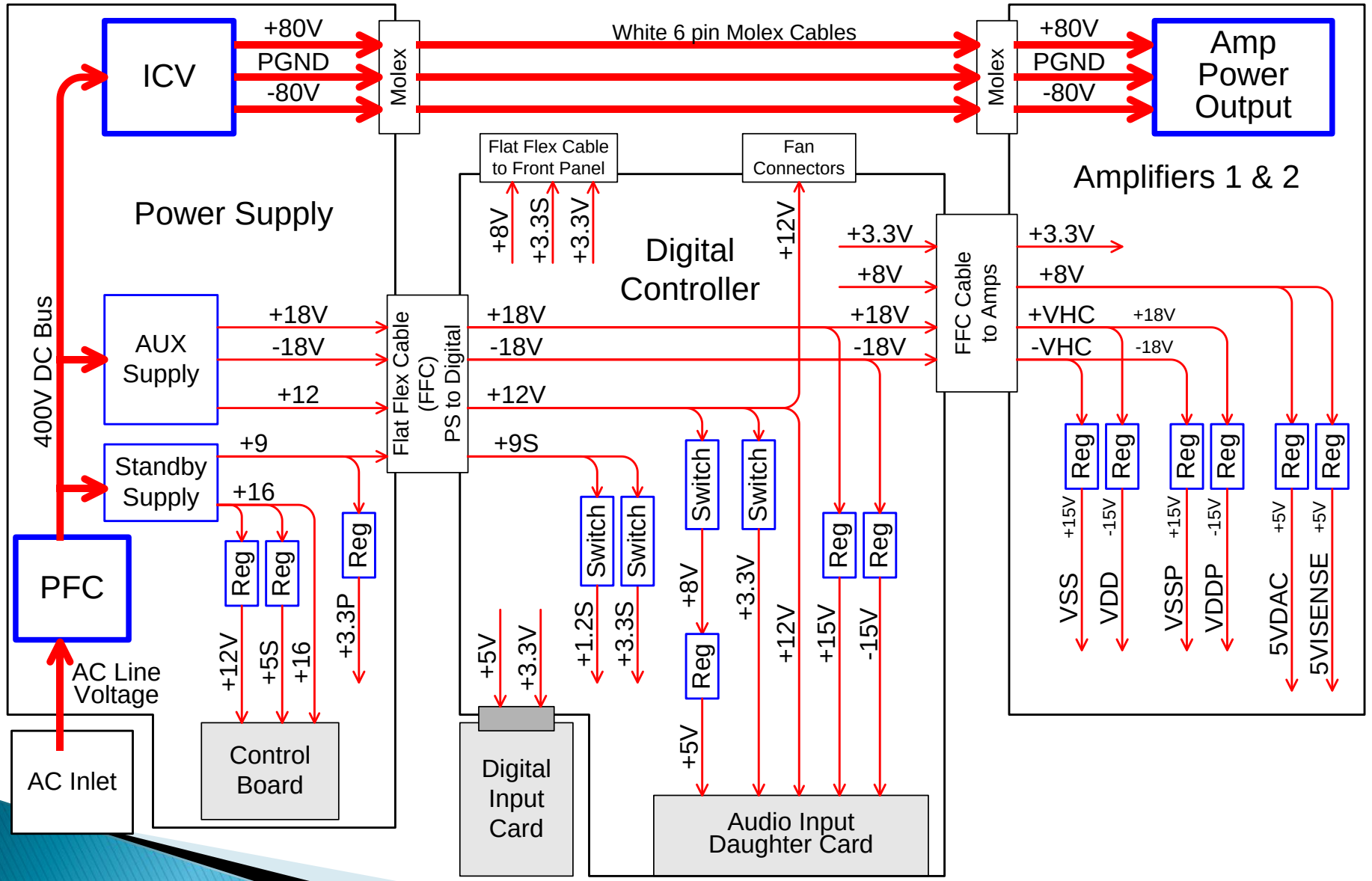
PM8500 Chassis Overview

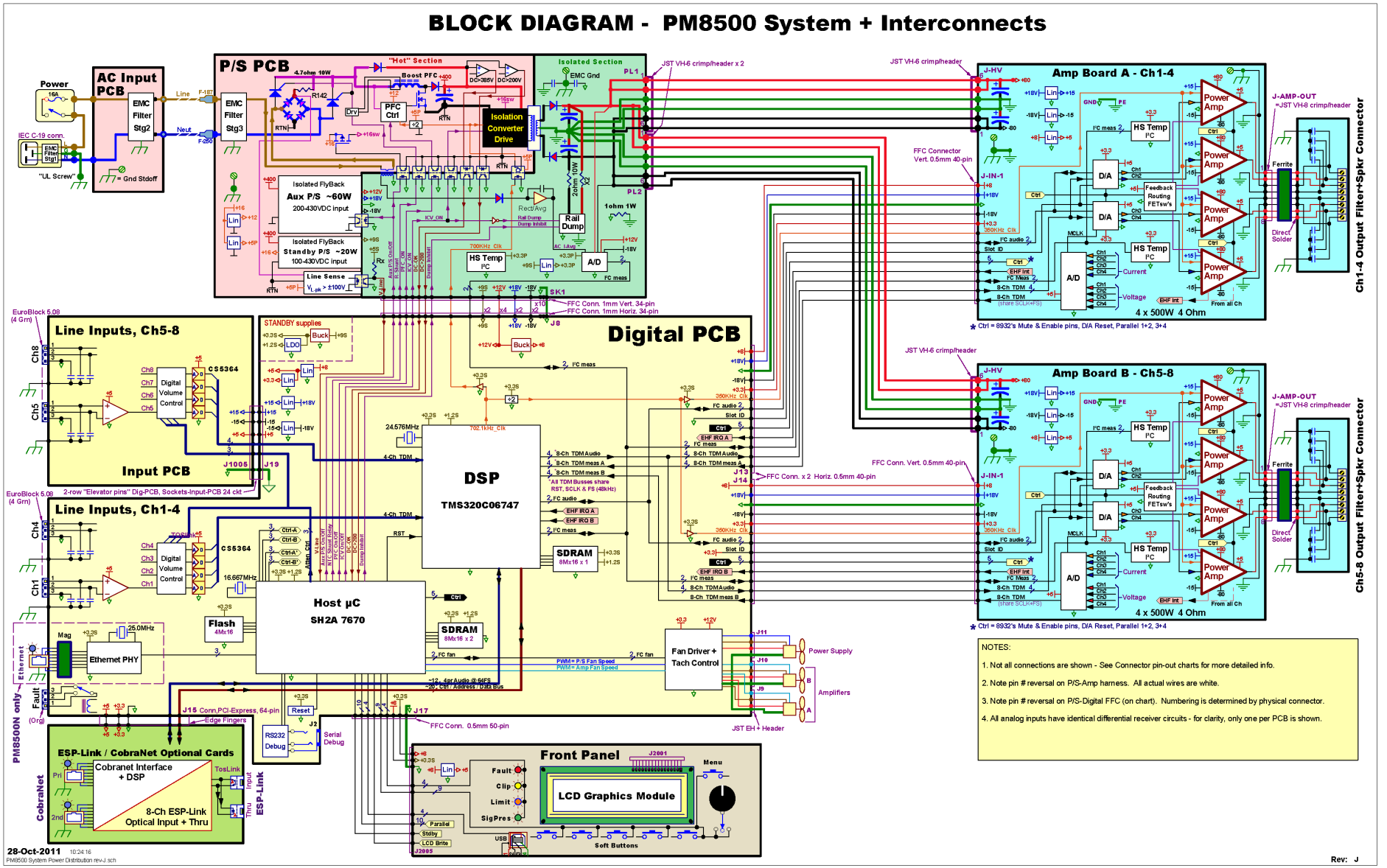


PM8500 Cable Interconnects



PM8500 Voltage Supplies





File: PM8500 System Block Diagram

InterBoard Connector Spreadsheet

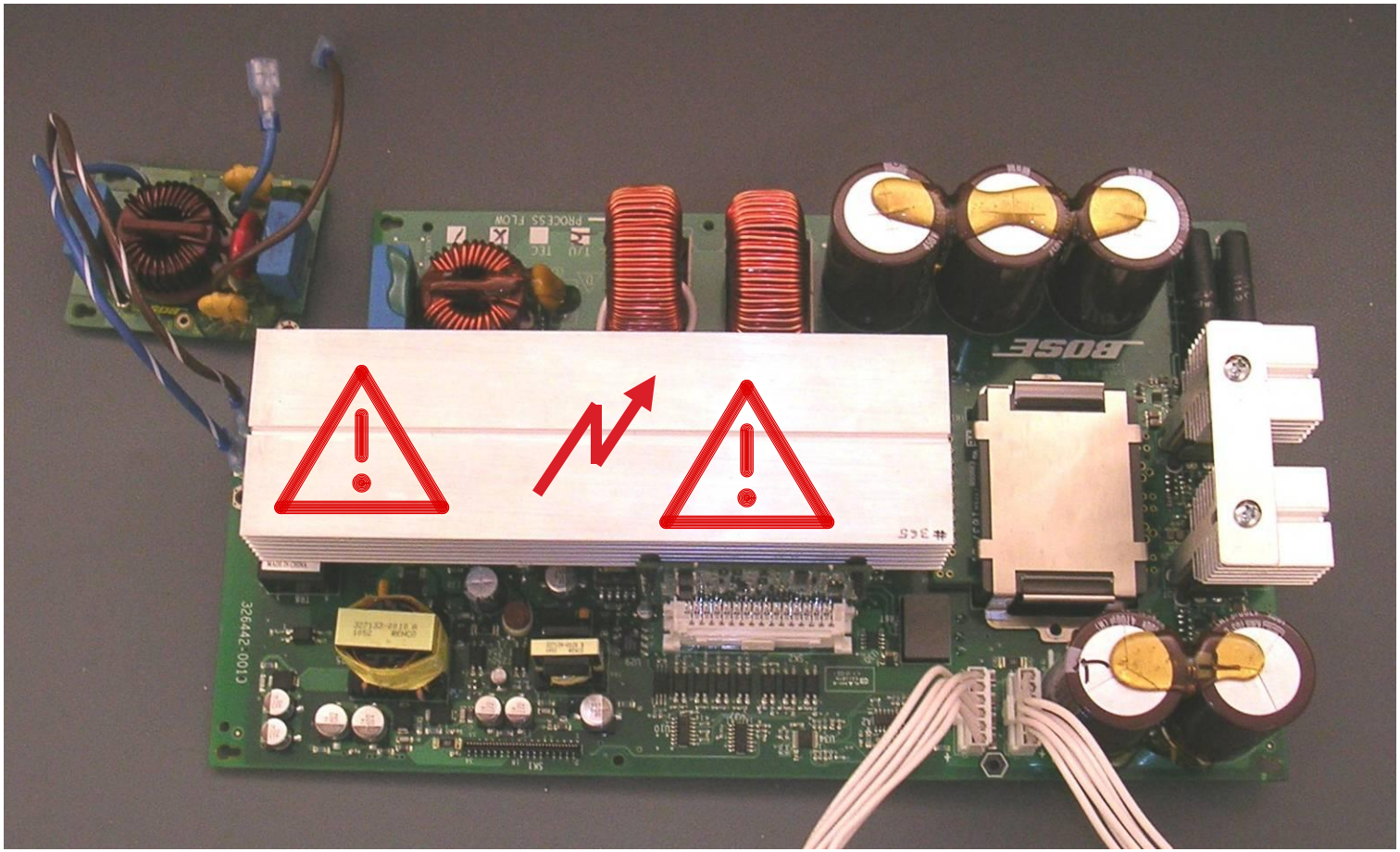
FFC Cable, Digital Board to Amplifier Boards A & B (0.5mm pitch) 10/21/2011 11:07

Digital Pin # J13&14	Signal on Digital Board Conn **J13** to **Amp A** Conn **J14** to **Amp B**	Direction <-- -->	Signal on Amp Board Connector **J-IN-1**	Amp Pin # J-IN-1	Description of Signal NOTE: All logic signals are 1 = 3.3V ref. *** Note pin # reversal ***
1	GND	- - -	PE	40	System low-level ground reference
2	MEASURE_SDA	<--Both-->	MEAS_I2C_SDA	39	Data for Measurement I2C Bus - Reads Temperature of Main Heat Sink
3	MEASURE_SCL	To-->	MEAS_I2C_SCL	38	Clock for Measurement I2C Bus - Reads Temperature of Main Heat Sink
4	GND	- - -	PE	37	System low-level ground reference
5	AMP_ENABLE_A AMP_ENABLE_B	To-->	ENABLE_IN	36	Enables Class D Amp Modulator (TDA8932) to start *switching* Note: _A or _B designator - A is signal going to Amp A, B to Amp B
6	GND	- - -	PE	35	System low-level ground reference
7	GND	- - -	PE	34	
8	GND	- - -	PE	33	
9	EHF_IRQ_A EHF_IRQ_B	From<--	ENF_INT	32	Interrupt (Open Collector) to Digital Controller when and EHF (Eccessive High Frequency) from a channel is detected
10	+3.3V	To-->	+3.3V	31	+3.3V Power to DACs, ADC, & I2C Interface Devices
11	AMP_MUTE	To-->	MUTE	30	0 = Enables Class D Amp Modulator (TDA8932) to start *modulating*
12	+8V	To-->	+8V	29	+8V Power regulated to provide 5VISENSE and 5VDAC
13	GND	- - -	PE	28	System low-level ground reference
14		- - -	DSP_SPARE	27	Spare Connection - not currently used
15	GND	- - -	PE	26	System low-level ground reference
16	PARA34_A PARA34_B	To-->	PARA34	25	High (+3V) puts Channels 3&4 (7&8 for Amp B) in Current Share Mode
17	PARA12_A PARA12_B	To-->	PARA12	24	High (+3V) puts Channels 1&2 (5&6 for Amp B) in Current Share Mode
18	SLOT_ID_A SLOT_ID_B	To-->	SLOT_ID	23	Address Bit for I2C Bus to Select between Amp A and Amp B GND'ed for Slot A, +3.3V for Slot B
19	DSP_RESET_OUT_L	To-->	RSTB	22	Reset (Low True) from Processor to DACs and ADC
20	GND	- - -	PE	21	System low-level ground reference
21	-18V	To-->	-VHC	20	-18V Power regulated to provide VSS (-15 Power for OP Amps)

File: PM8500 Connector Pin-Outs

PM8500 Boards

PM8500 PCBs – Power Supply & AC Inlet



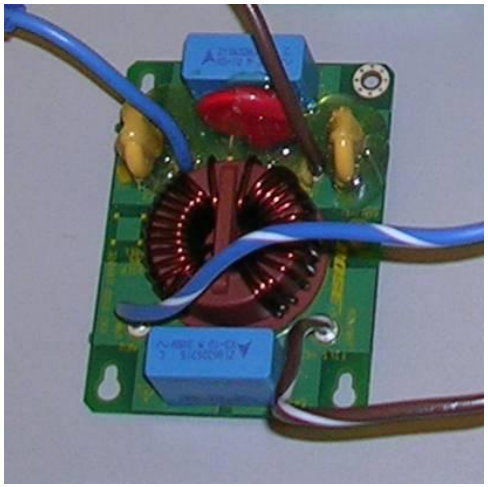
Power Supply Features

- **AC Line Filters**
- **Housekeeping Supplies**
  - **Standby Power Supply** – Provides Power to the processor whenever AC Power is applied (and Switch is ON)
  - **AUX Power Supply** – Provides several regulated DC voltages
- **Power Factor Correction (PFC)**
  - **Universal AC Input** 100V to 240V AC Input → powers 400 VDC Bus
- **Isolation Converter (ICV)** – 400 VDC to ±80V Power for Amp
- **Power Supply Protection**
  - Hardware & Firmware-based
  - Inrush Limiting
  - ±80V Rail Discharge
  - Measurements using I²C A/D converter

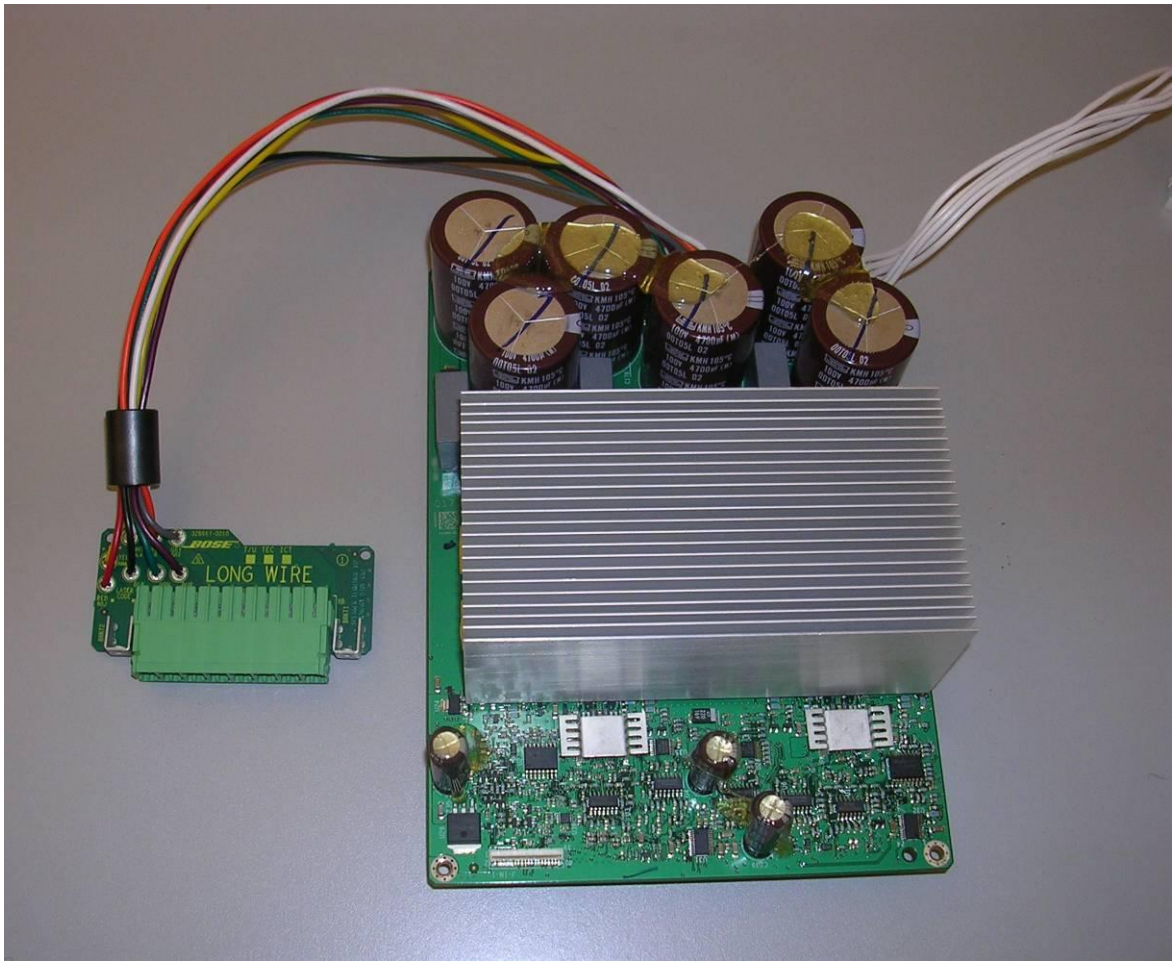
PM8500_PwrSupply_Theory_of_Operation for more details

PM8500 AC Inlet PCB

- AC Power In from IEC Connector and Switch
  - IEC Connector has additional Line Filter
- AC Line Filter
  - works with filter on Power Supply PCB
- Over Voltage Protection



PM8500 PCBs – Amplifier & Audio Output



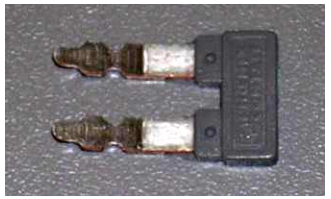
PM8500 Amplifier PCB

- Audio Output Drive 500W per Channel
- Two Amplifier Boards – Note: These boards are identical
  - Amp 1 with Outputs 1-4
  - Amp 2 with Outputs 5-8
- EHF (Excessive High Frequency 40-80KHz) Detect
- Heatsink Temperature Sensors read by processor
- Output Voltage & Current read by processor thru ADC
- Voltage and Current Clipping Hardware 71V_{peak} & 24A_{peak}
- Four Output Configurations:

  Mono, I-Share, Bridged, Quad

PM8500 Output Configurations

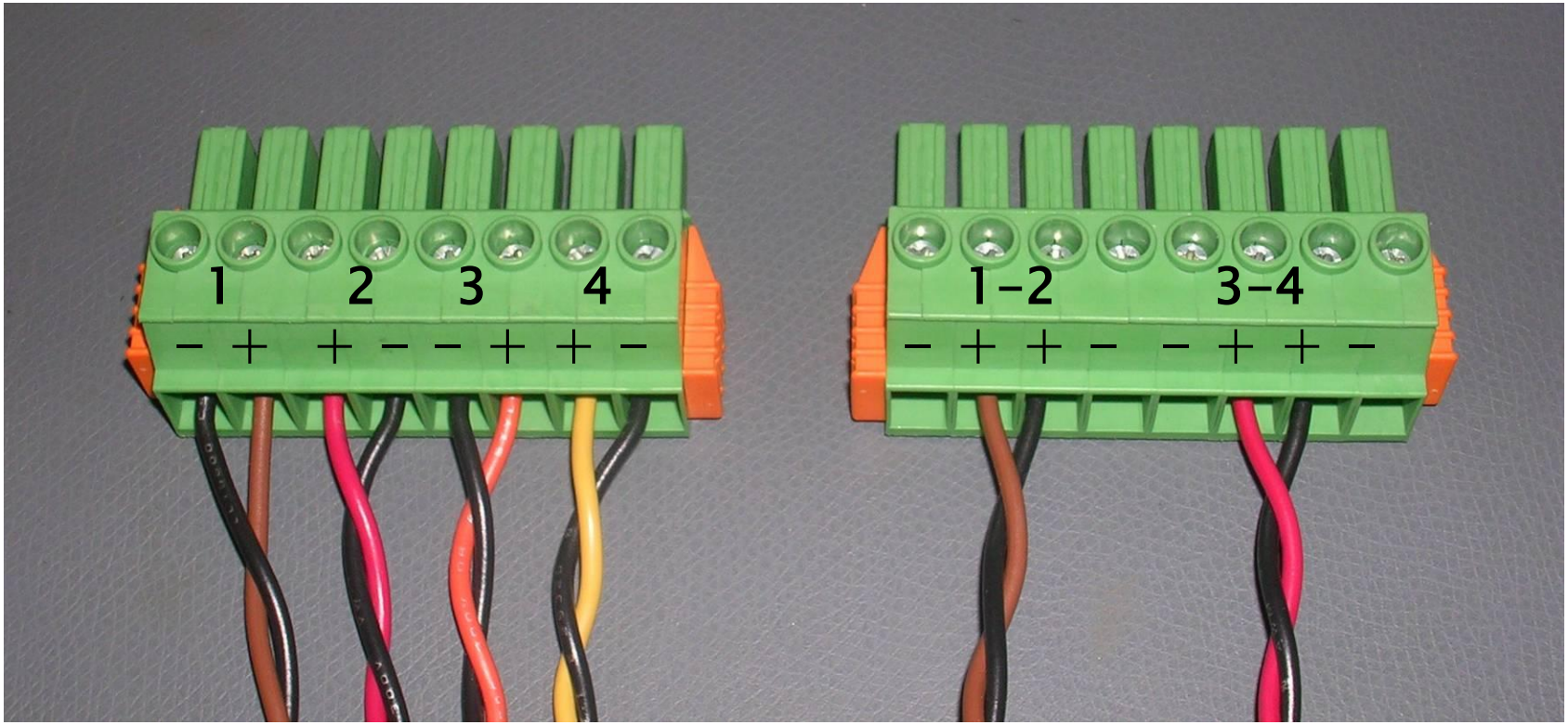
- Mono: Each Amplifier Operates Independently
  Four channels each at 500W into 4 to 2 Ohms
- Bridged: Channels 1&2 and/or 3&4 may be bridged to
  provide 1000W into 8 to 4 Ohms
- I-Share: Channels 1&2 and/or 3&4 may be connected together
  and provide 1000W into 2 to 1 Ohms
  A Jumper is provided for this →



- Quad: Channels 1&2 and 3&4 are connected together and
  then Bridged to provide 2000W into 4 to 2 Ohms

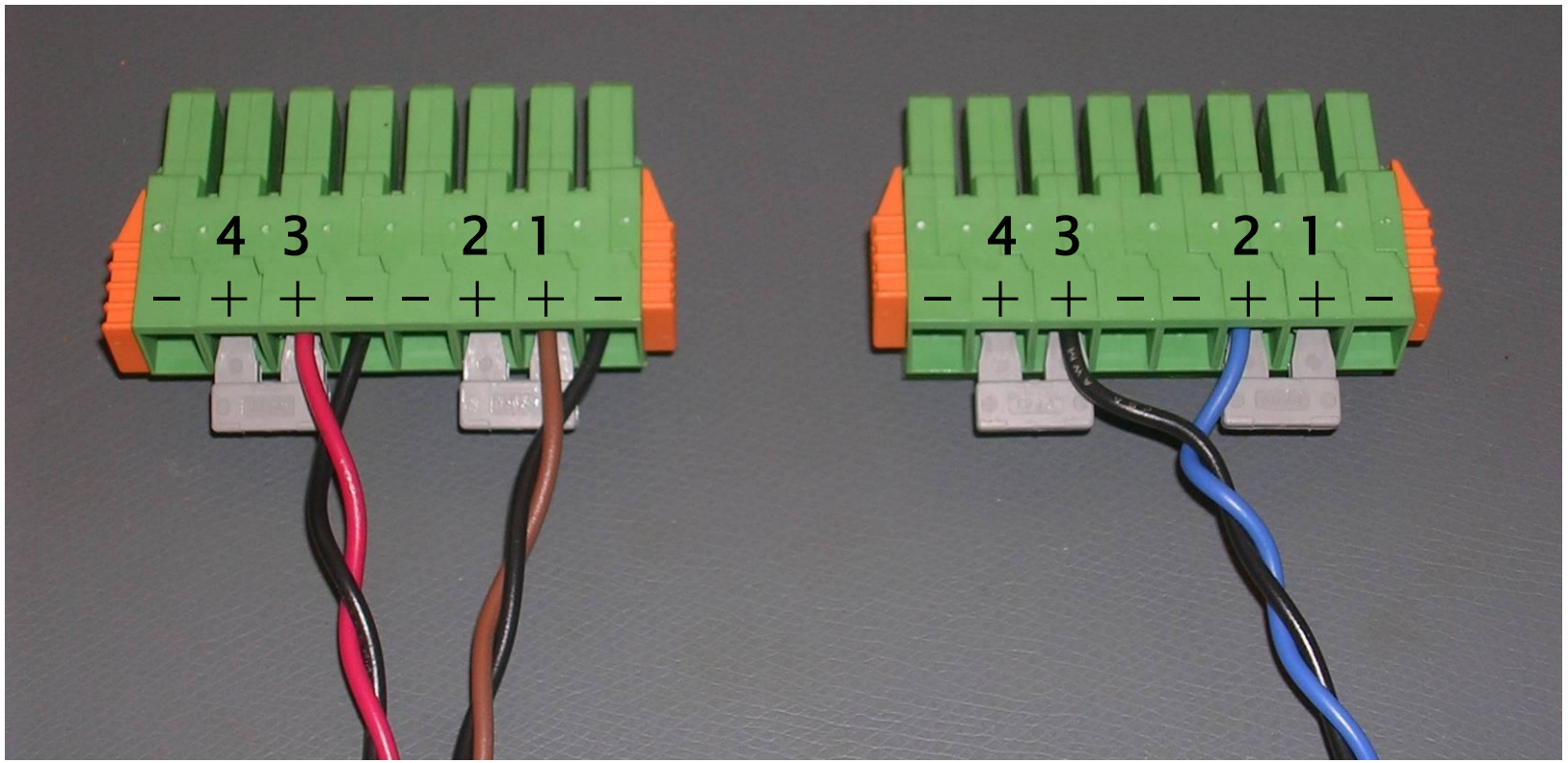
PM8500 Output Configurations

Mono **View from Top** **Bridged**



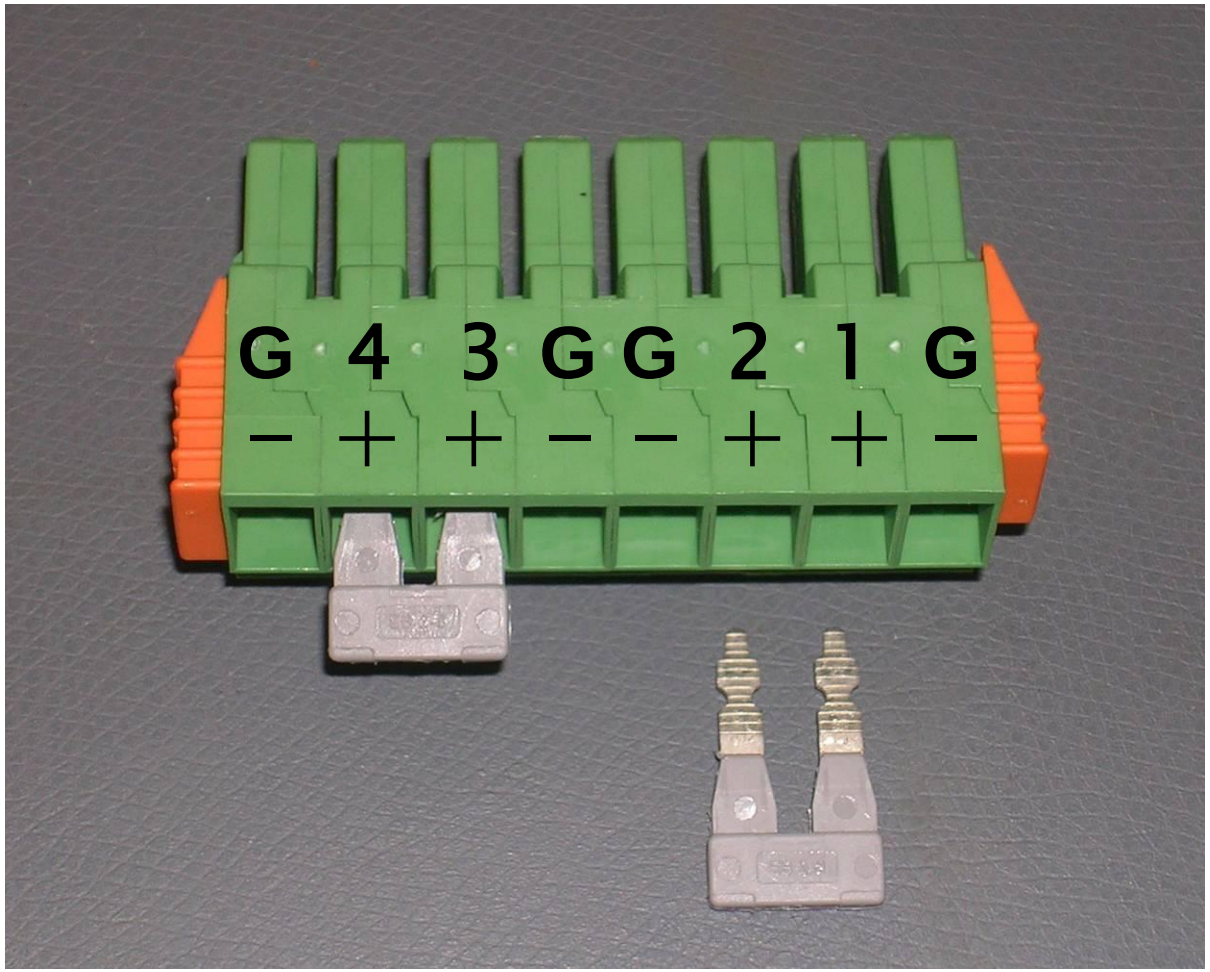
PM8500 Output Configurations

I-Share **View from Back** **Quad**



PM8500 Connector Jumper

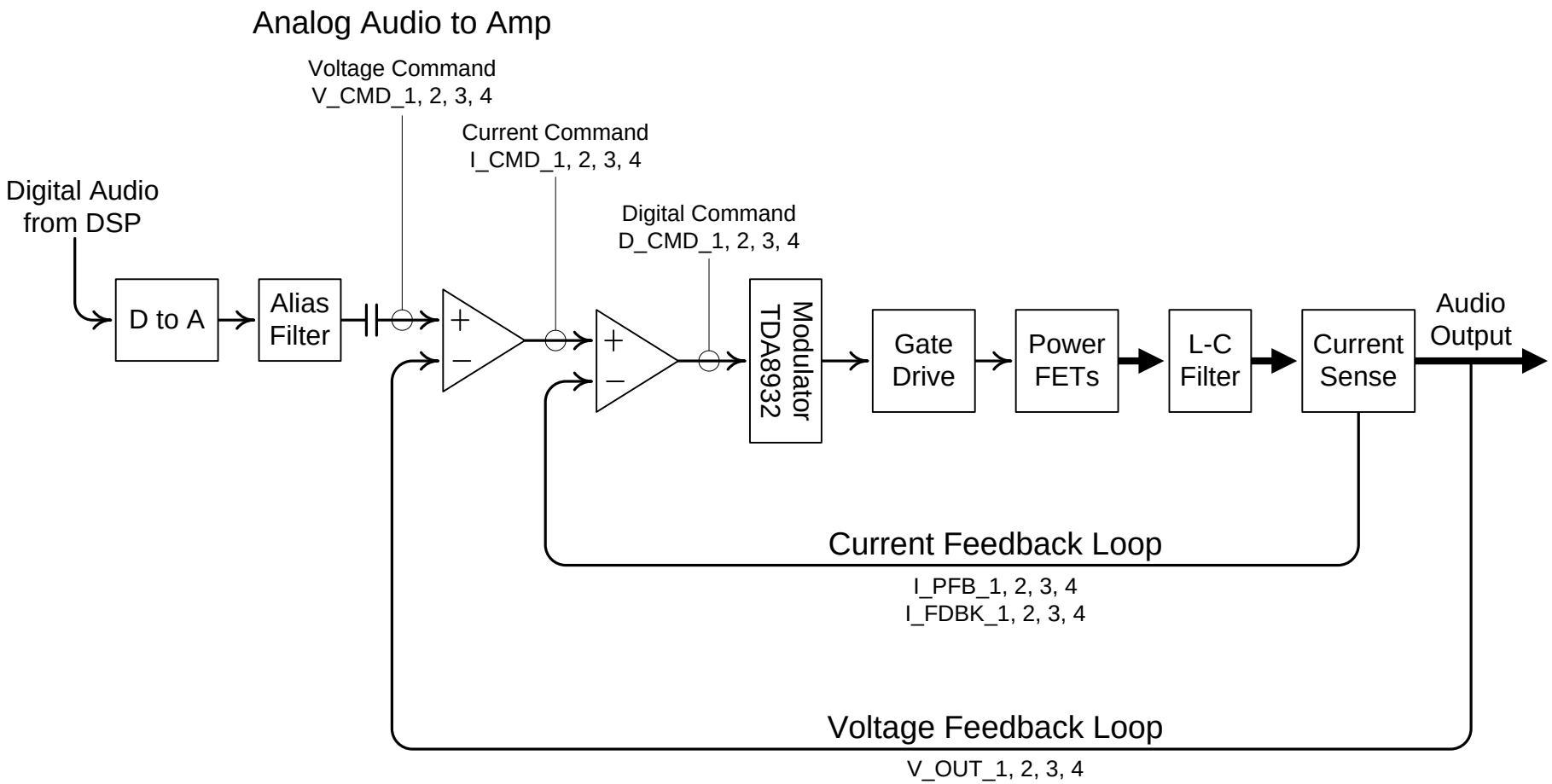
View from Back



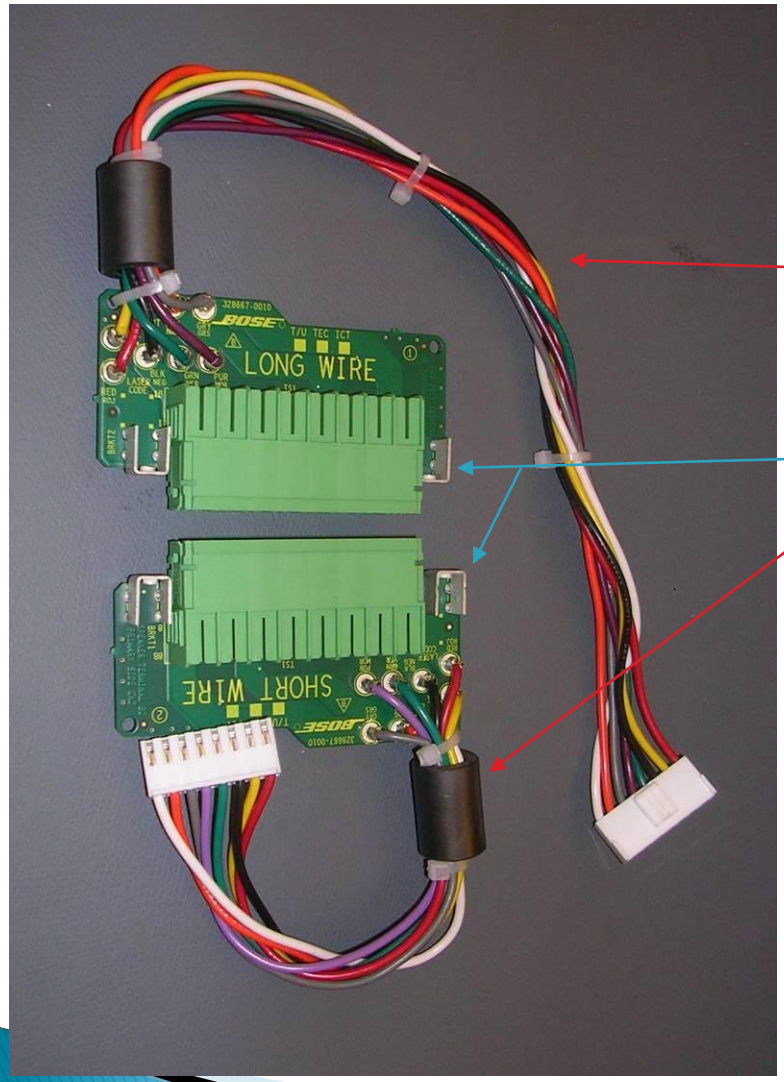
+ Amp Output

– GND, Chassis

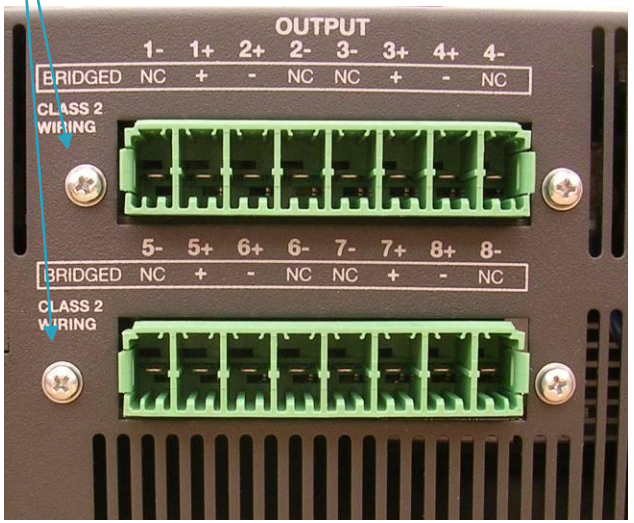
Amplifier Channel Block Diagram



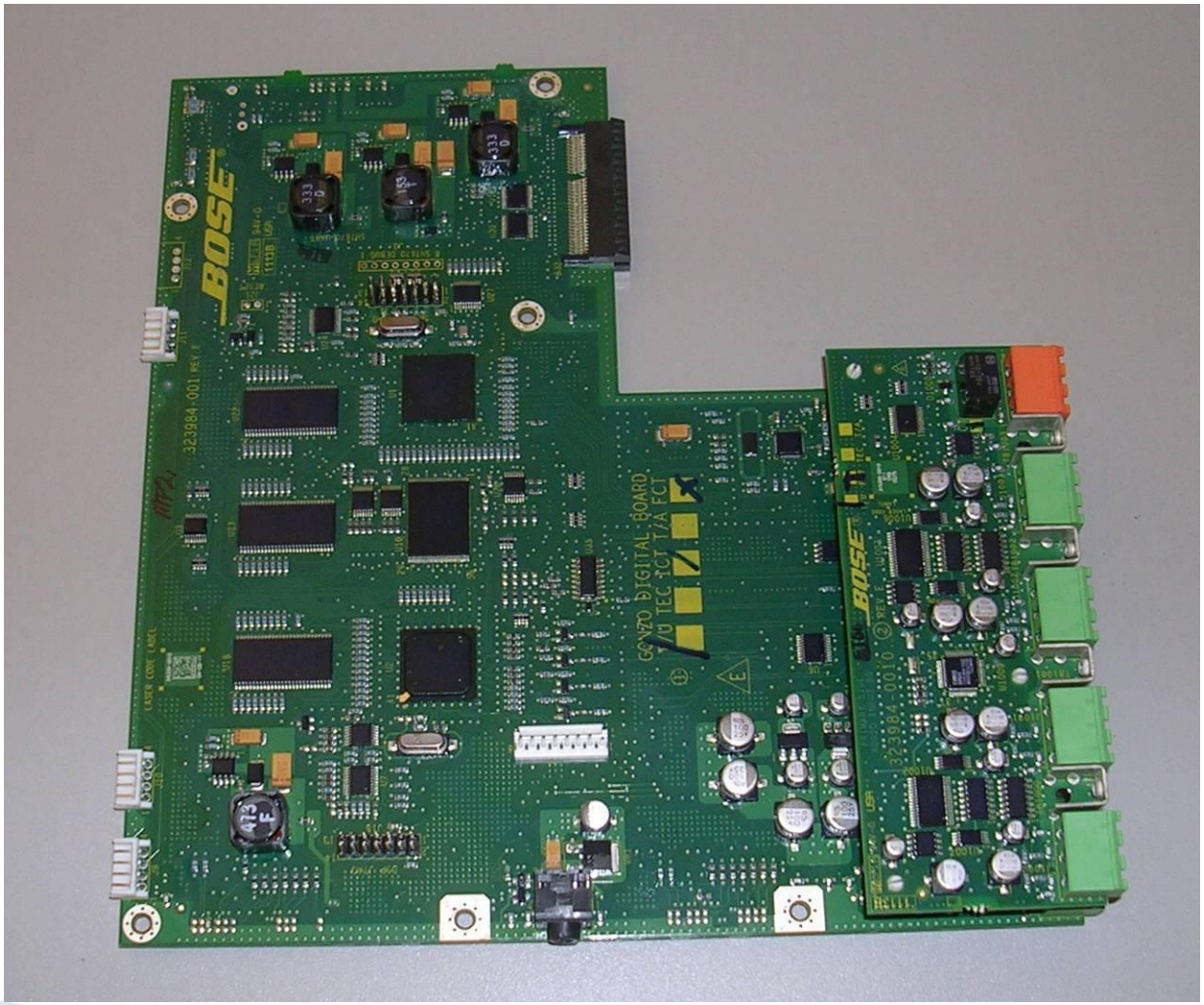
PM8500 Audio Output PCB



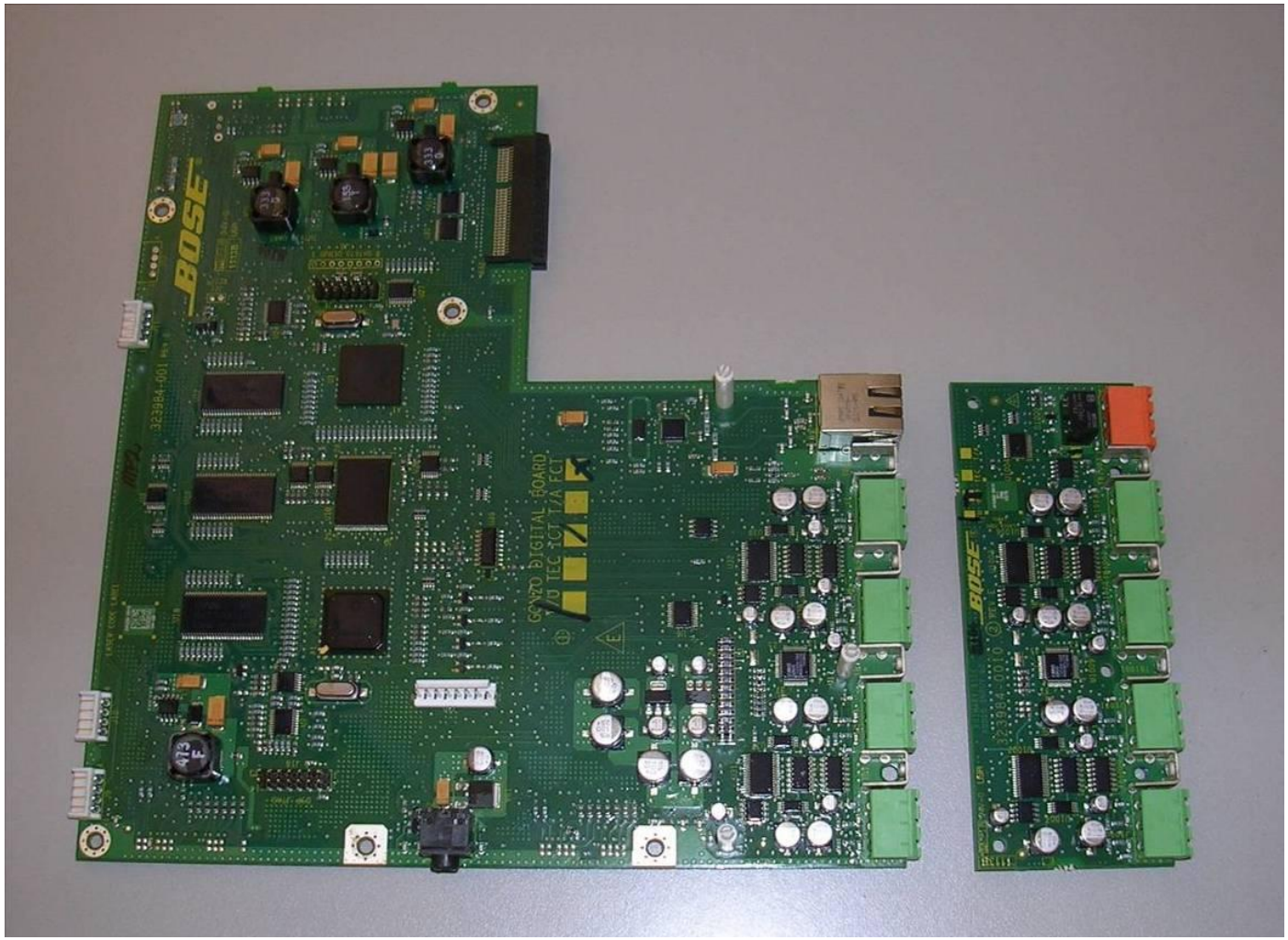
- Audio Output Connector
- Two Different Boards
  - 1-4 with Long Wire
  - 5-8 with Short Wire
  - Different Screw Offset



PM8500 PCBs – Digital



PM8500 PCBs – Analog Input Board Removed

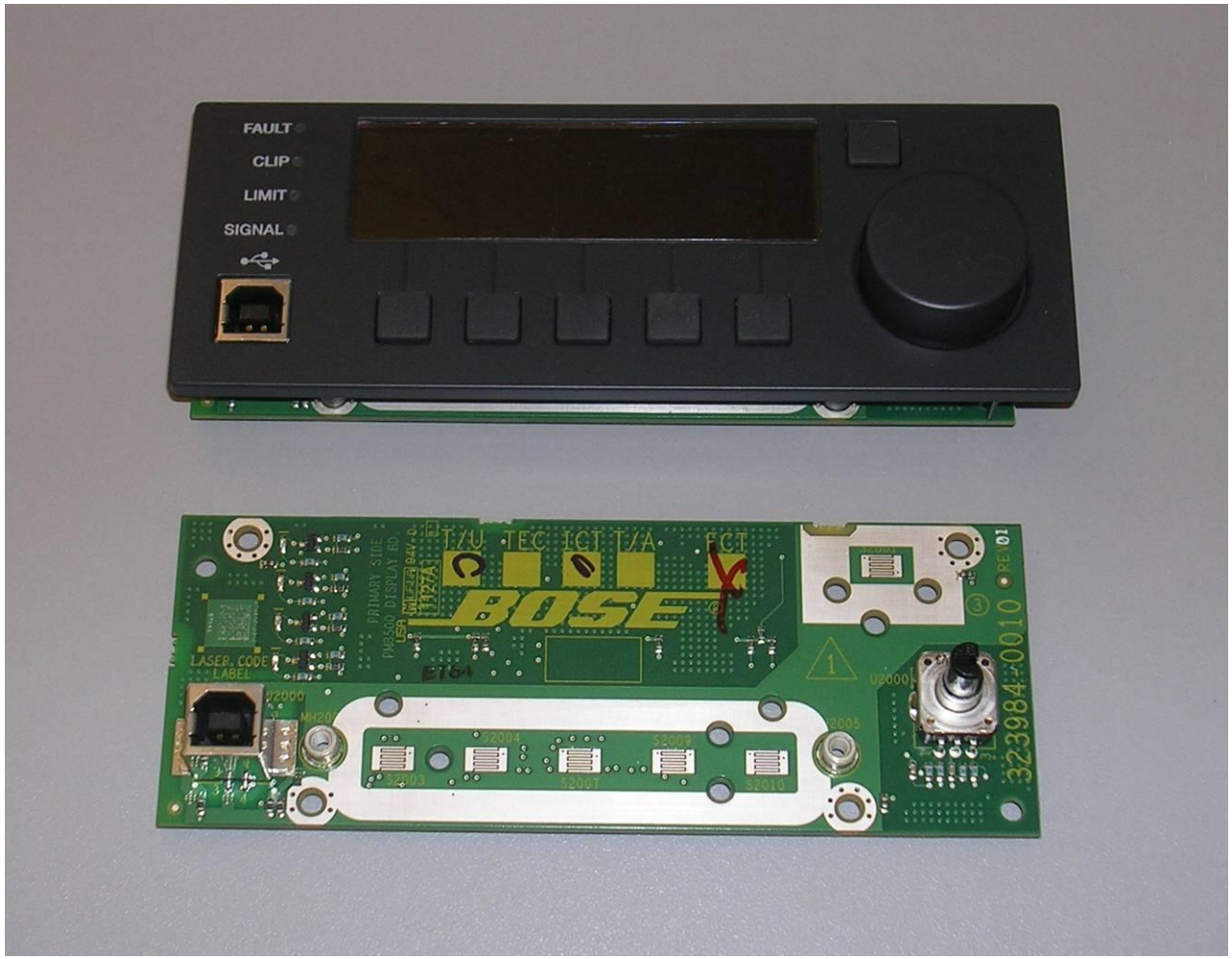


PM8500 PCBs – Digital

- Main Processor with USB and Ethernet Interfaces
- DSP for all Audio Processing
- Passes +/-15V, +8V, +3.3V to Amplifier PCBs
- Analog Audio Inputs and ADCs
  - Inputs A, B, C, D on Analog Input PCB daughter-board
  - Inputs E, F, G, H on main Digital PCB
- Flat Flex Cable for Front Panel PCB
- Flat Flex Cable for Amp 1 & 2
- Connector for Optional Digital Input Card
- Power and Control for Fans

PM8500 Front Panel Display

PM8500 Front Panel Display

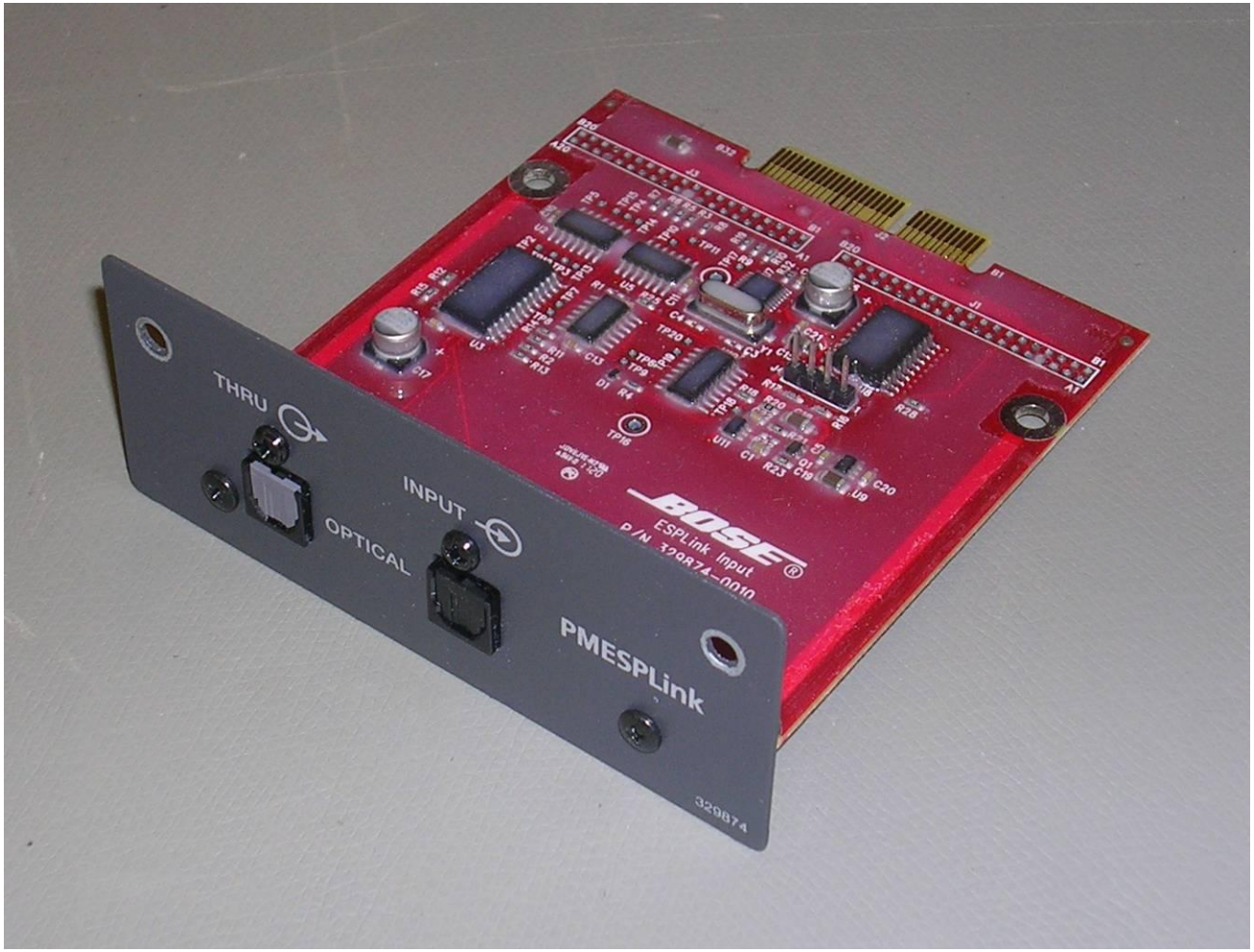


PM8500 Front Panel Display

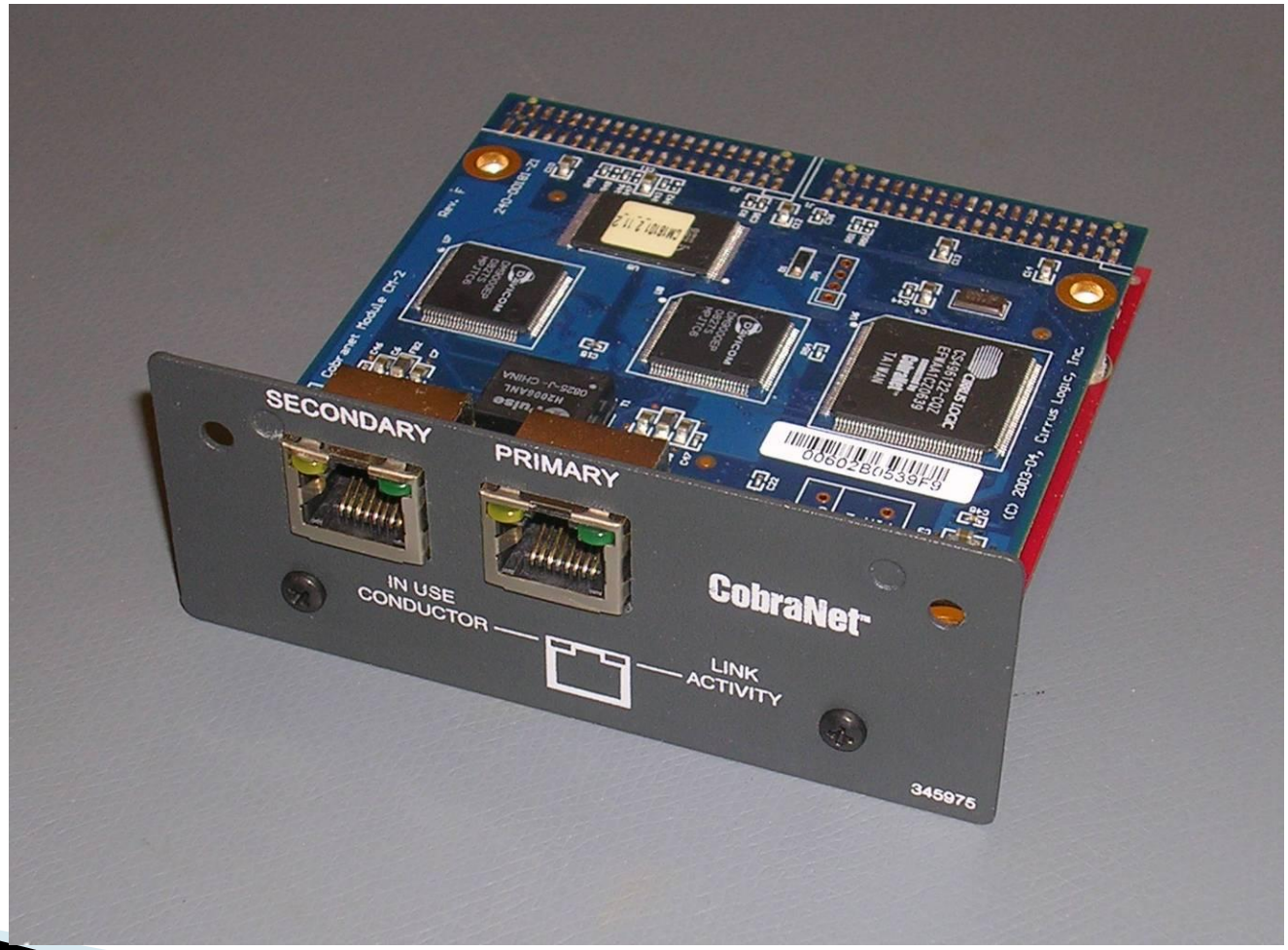
- Provides Local User Interface
- Default Display – Bar Graph of Audio Channels
- Access to Fault Log
- USB Interface
- LEDs Powered from +9S Standby Power Supply

  Give immediate display of AC Power ON

Digital Option Card: PMESPLink

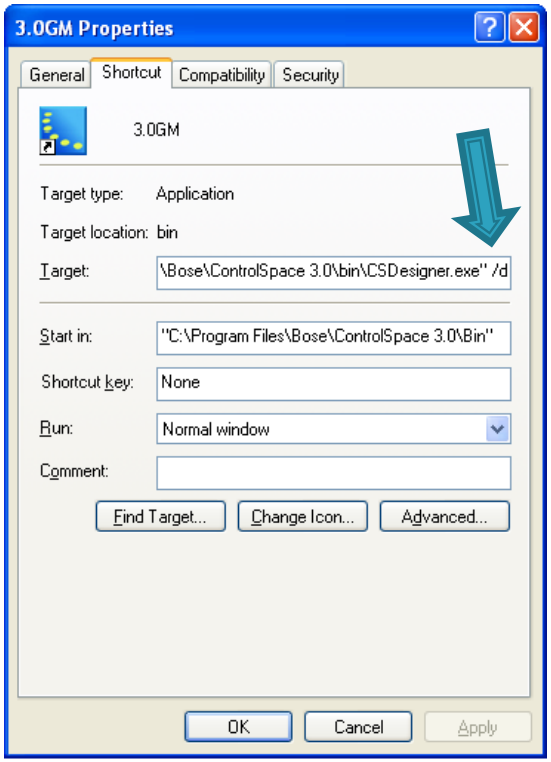


Digital Option Card: CobraNet



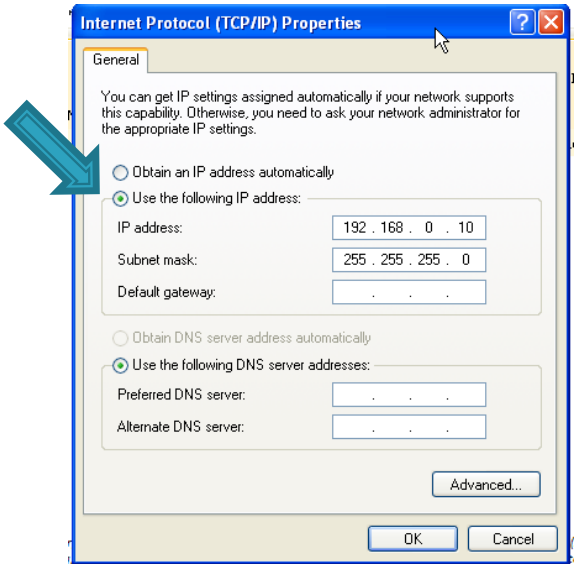
ControlSpace Software

- Download and install the latest version of ControlSpace Designer from pro.Bose.com.
- Create a shortcut and add “/d” to Target.
- Use this shortcut icon to start CSD to and always be in debug mode
- Download and checkout the User’s guide/Help file – lots of helpful information.



ControlSpace Software

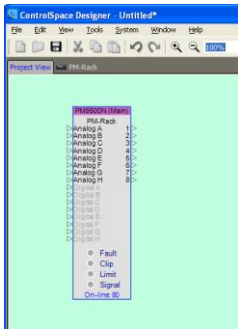
- Connect to PM8500 with USB or Ethernet.
- For Ethernet, must be on the same network as PM8500, i.e., you have to change your IP address to match PM8500



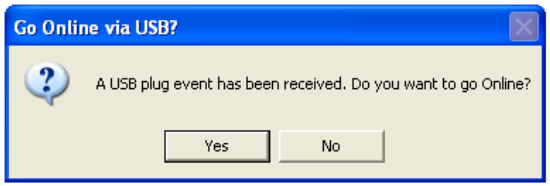
- Highly recommended you use a 2nd Ethernet port, e.g., a CardBus wired adapter ($20 at Amazon)

ControlSpace Software, USB

- Connect w/ USB, CSD should “go-online automatically” (green screen).



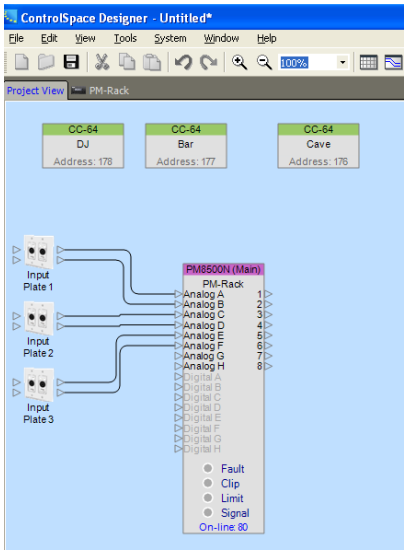
- If you reconnect or power cycle the PM8500 you will see:



- Select yes, then “Get from Device” at the Settings Transfer

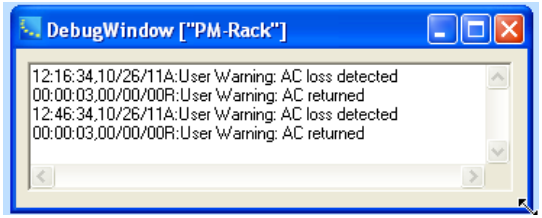
ControlSpace Software, Ethernet

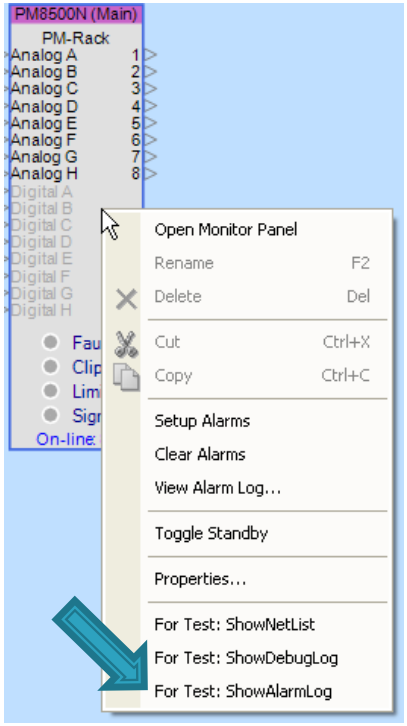
- Must have USB disconnected
- No “plug event” when connected
- Press “Go on-line”
- Select “Get from Device” at the Settings Transfer
- On-line with Ethernet has a blue background
- Note other devices may appear. These are part of the customer’s “design file”.



CSD: Alarm Log

- Right click on the PM8500 and select “ShowAlarmLog”
- Example AlarmLog:

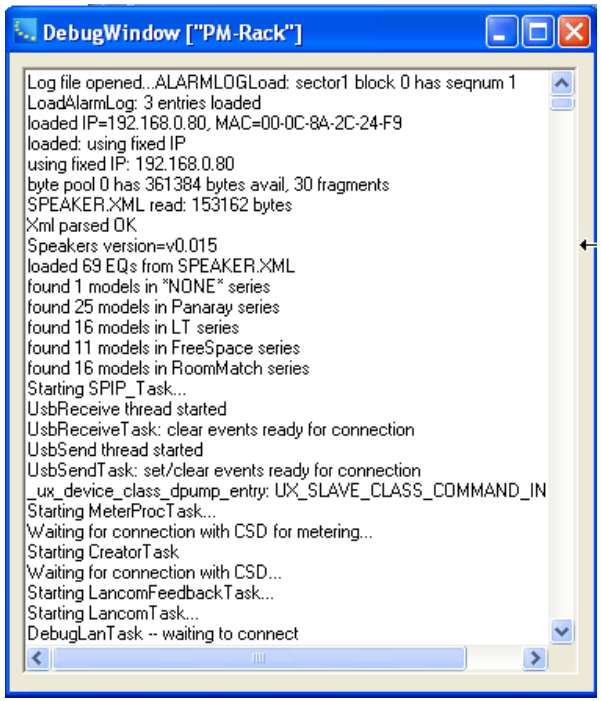


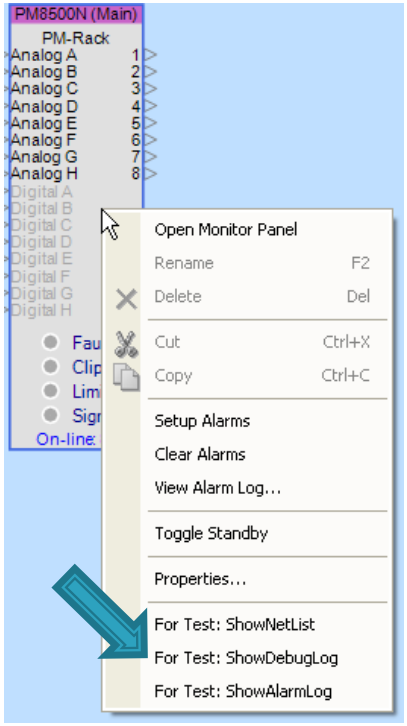


- See PM8500 Alarm Log v1.0.pdf for full description of alarm log format, all alarms and suggested troubleshooting

CSD: Debug log

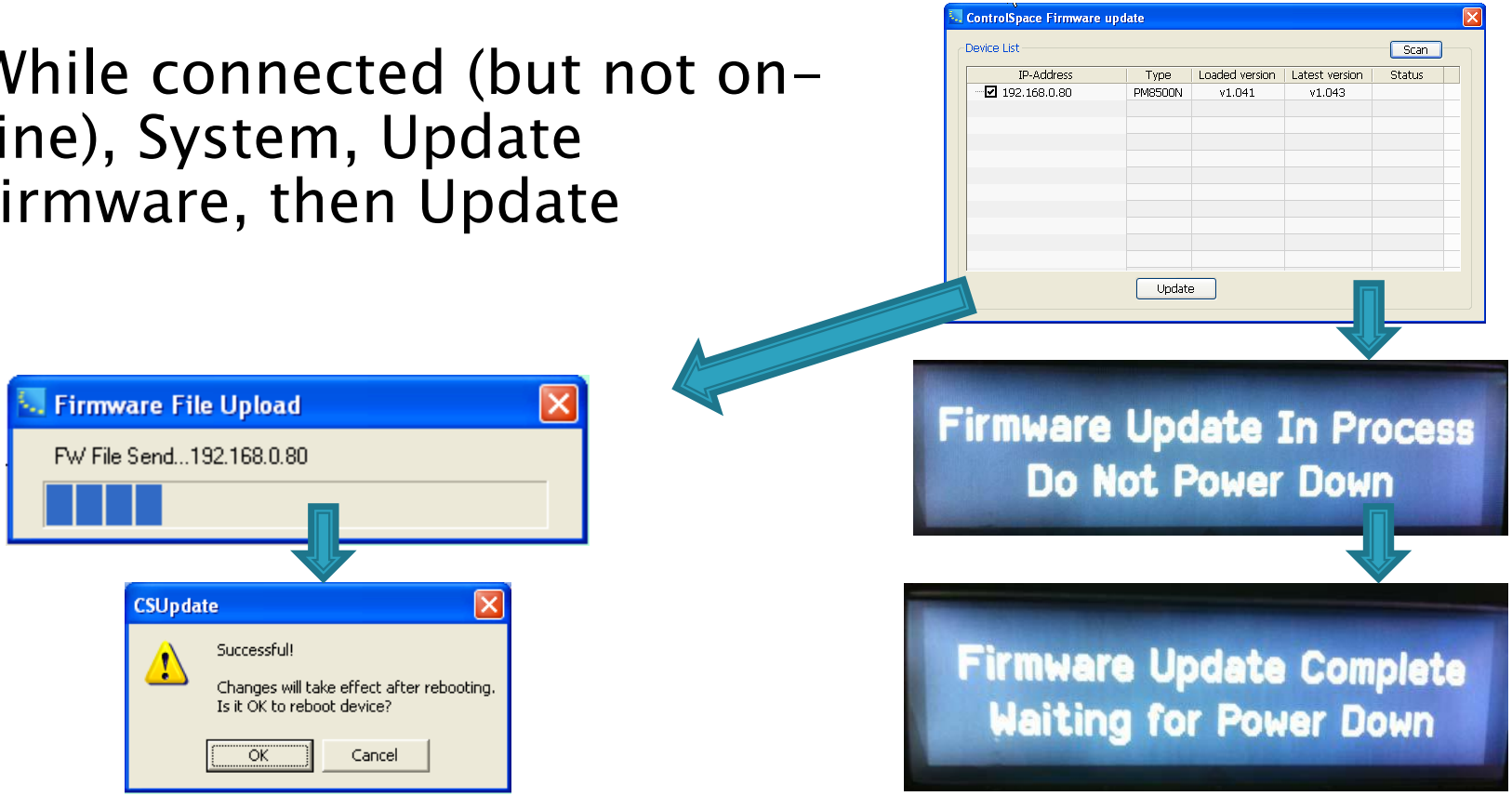
- Right click on the PM8500 and select “ShowDebugLog”
- Debug log valid only for current boot.
- Example Debug log: (much bigger!)
- Can be used to see IP address, MAC address, if the PM8500 fails to boot, etc.





CSD: Firmware update

- While connected (but not on-line), System, Update firmware, then Update



- See PM8500 Firmware updating v1.0.pdf for complete details.

CSD: Firmware update

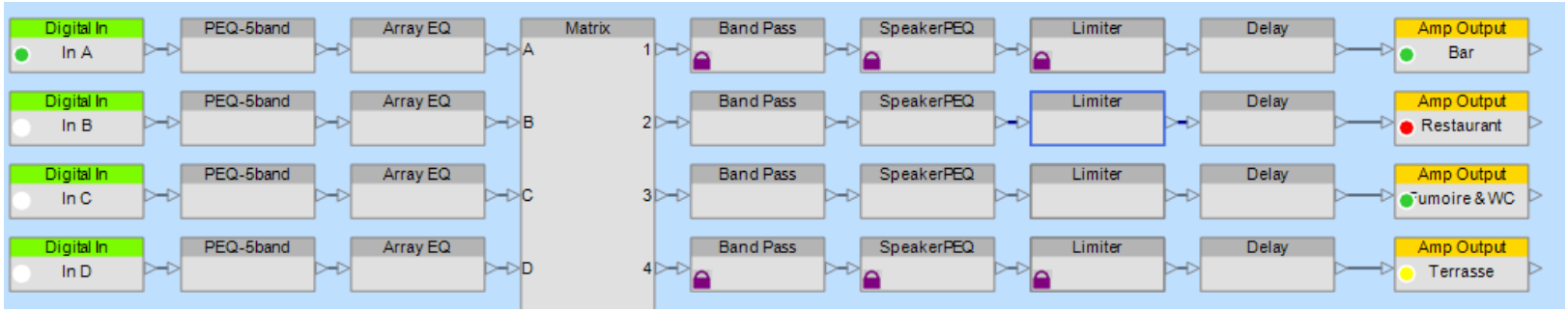
Recovery mode, AKA debricking

- Turn off the power
- Press buttons 1, 3, 5 below the LCD
- Apply power, release buttons when you see RECOVERY MODE
- Repeat Update firmware process

- See PM8500 Firmware updating v1.0.pdf for complete details.

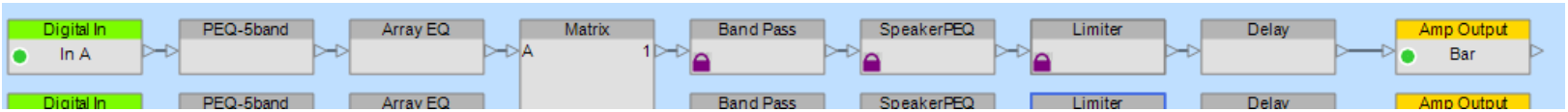
CSD: signal monitoring

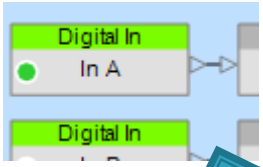
- Example, 1signal (‘A’) to 4 outputs



- Why are the outputs green, yellow or red?
- Follow the signal path.

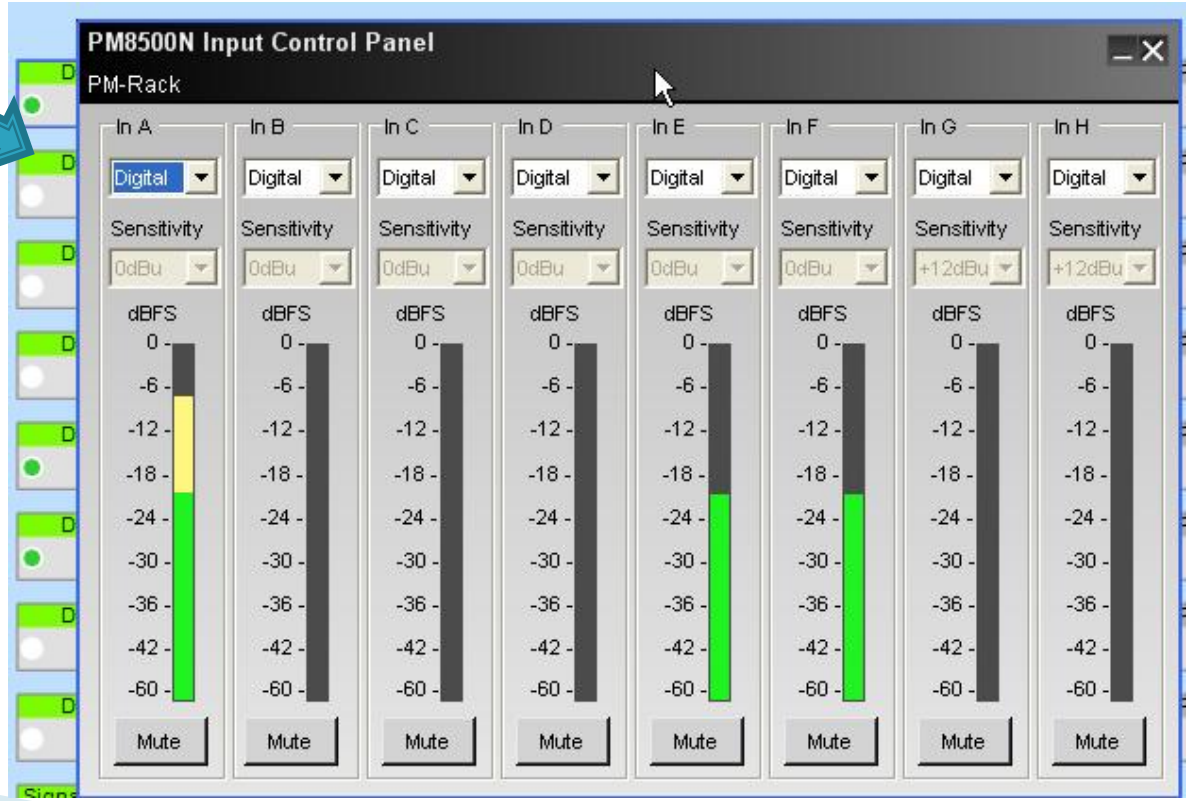
CSD: signal monitoring



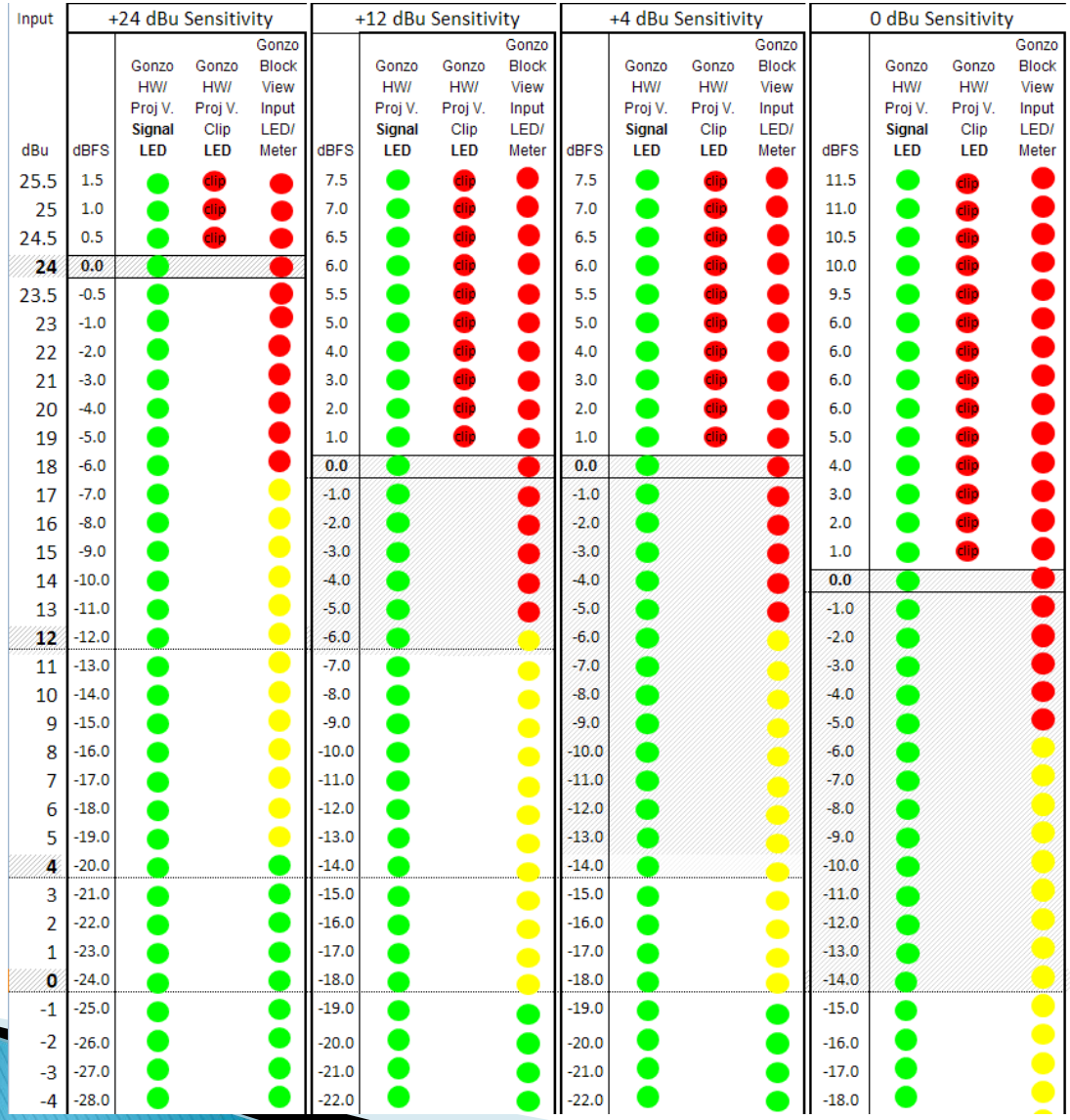


- Input "LED" (Green: >-60dBFS, yellow > -20dBFS, red -6dBFS)

- Double click on input to see input meter

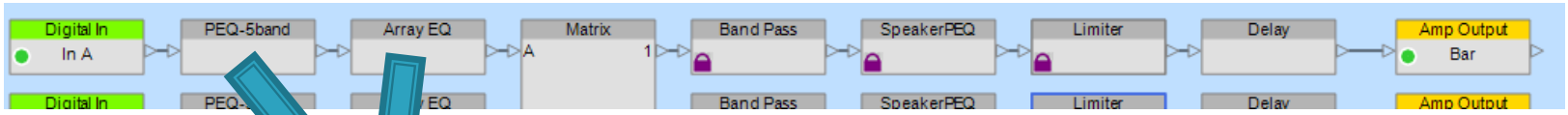


CSD: signal monitoring

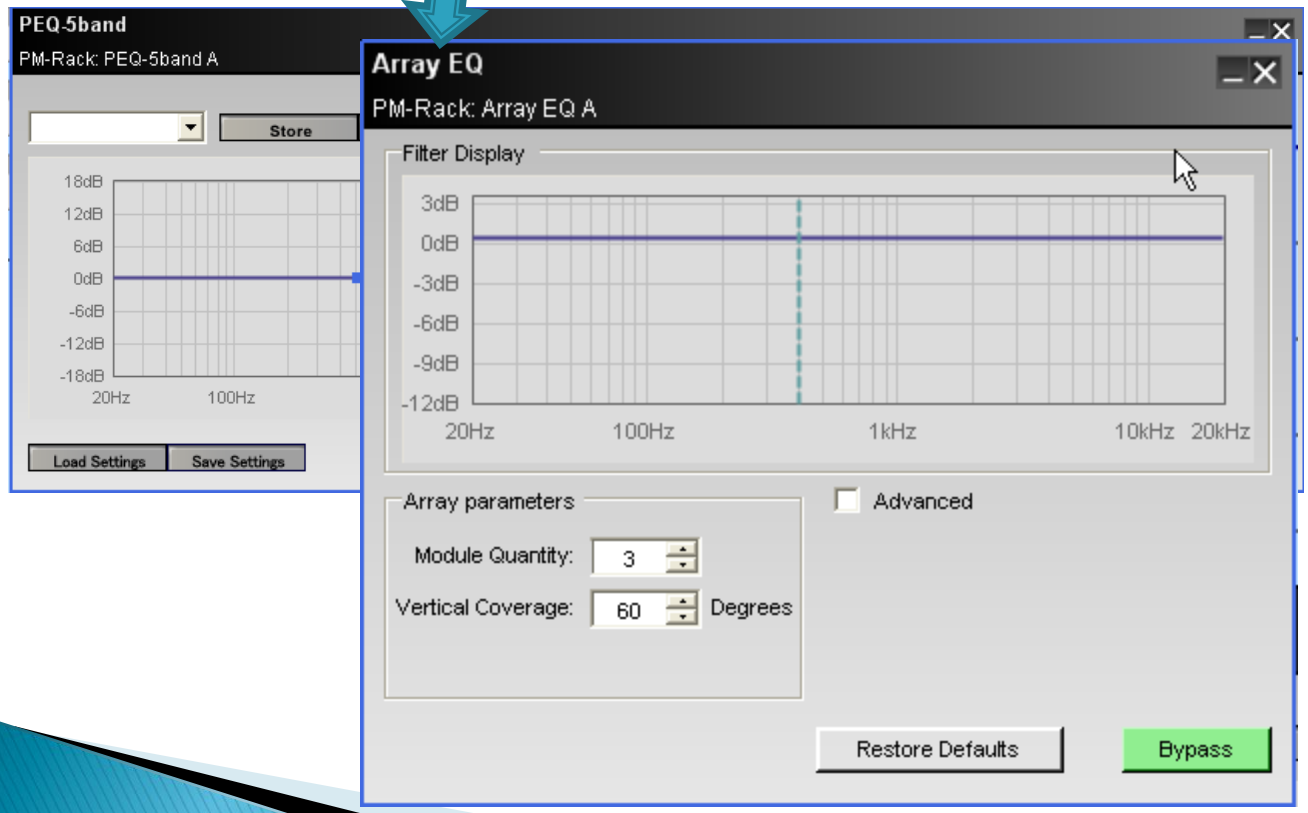


Input	+24 dBu Sensitivity				+12 dBu Sensitivity				+4 dBu Sensitivity				0 dBu Sensitivity			
dBu	dBFS	Gonzo HW/ Proj V. **Signal LED**	Gonzo HW/ Proj V. Clip **LED**	Gonzo Block View Input LED/ Meter	dBFS	Gonzo HW/ Proj V. **Signal LED**	Gonzo HW/ Proj V. Clip **LED**	Gonzo Block View Input LED/ Meter	dBFS	Gonzo HW/ Proj V. **Signal LED**	Gonzo HW/ Proj V. Clip **LED**	Gonzo Block View Input LED/ Meter	dBFS	Gonzo HW/ Proj V. **Signal LED**	Gonzo HW/ Proj V. Clip **LED**	Gonzo Block View Input LED/ Meter
25.5	1.5		clip		7.5		clip		7.5		clip		11.5		clip	
25	1.0		clip		7.0		clip		7.0		clip		11.0		clip	
24.5	0.5		clip		6.5		clip		6.5		clip		10.5		clip	
24	**0.0**				6.0		clip		6.0		clip		10.0		clip	
23.5	-0.5				5.5		clip		5.5		clip		9.5		clip	
23	-1.0				5.0		clip		5.0		clip		6.0		clip	
22	-2.0				4.0		clip		4.0		clip		6.0		clip	
21	-3.0				3.0		clip		3.0		clip		6.0		clip	
20	-4.0				2.0		clip		2.0		clip		6.0		clip	
19	-5.0				1.0		clip		1.0		clip		5.0		clip	
18	-6.0				**0.0**				**0.0**				4.0		clip	
17	-7.0				-1.0				-1.0				3.0		clip	
16	-8.0				-2.0				-2.0				2.0		clip	
15	-9.0				-3.0				-3.0				1.0		clip	
14	-10.0				-4.0				-4.0				**0.0**			
13	-11.0				-5.0				-5.0				-1.0			
12	-12.0				-6.0				-6.0				-2.0			
11	-13.0				-7.0				-7.0				-3.0			
10	-14.0				-8.0				-8.0				-4.0			
9	-15.0				-9.0				-9.0				-5.0			
8	-16.0				-10.0				-10.0				-6.0			
7	-17.0				-11.0				-11.0				-7.0			
6	-18.0				-12.0				-12.0				-8.0			
5	-19.0				-13.0				-13.0				-9.0			
4	-20.0				-14.0				-14.0				-10.0			
3	-21.0				-15.0				-15.0				-11.0			
2	-22.0				-16.0				-16.0				-12.0			
1	-23.0				-17.0				-17.0				-13.0			
0	-24.0				-18.0				-18.0				-14.0			
-1	-25.0				-19.0				-19.0				-15.0			
-2	-26.0				-20.0				-20.0				-16.0			
-3	-27.0				-21.0				-21.0				-17.0			
-4	-28.0				-22.0				-22.0				-18.0			

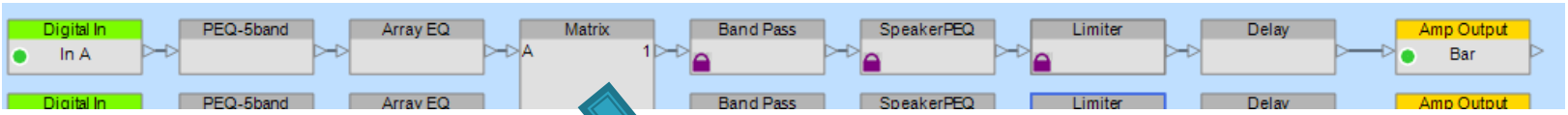
CSD: signal monitoring



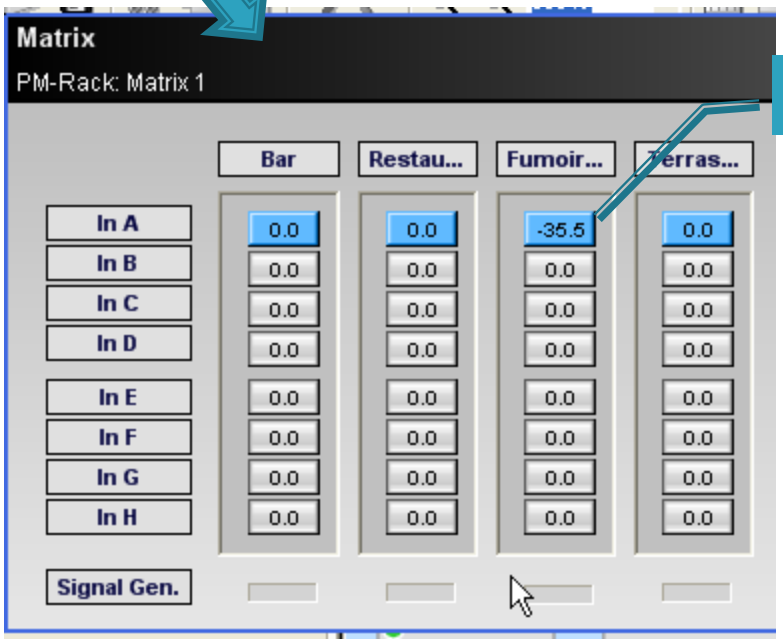
- Double click PEQ
- Double click ArrayEQ



CSD: signal monitoring

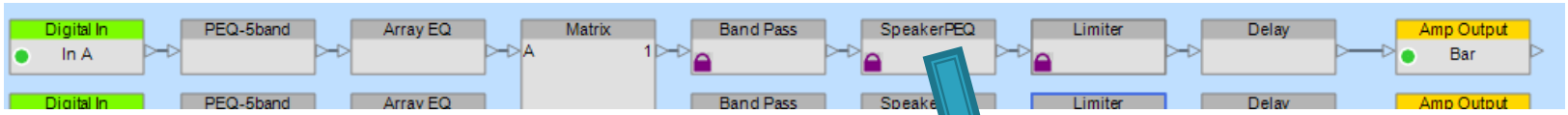


- Double click on Matrix to check routing

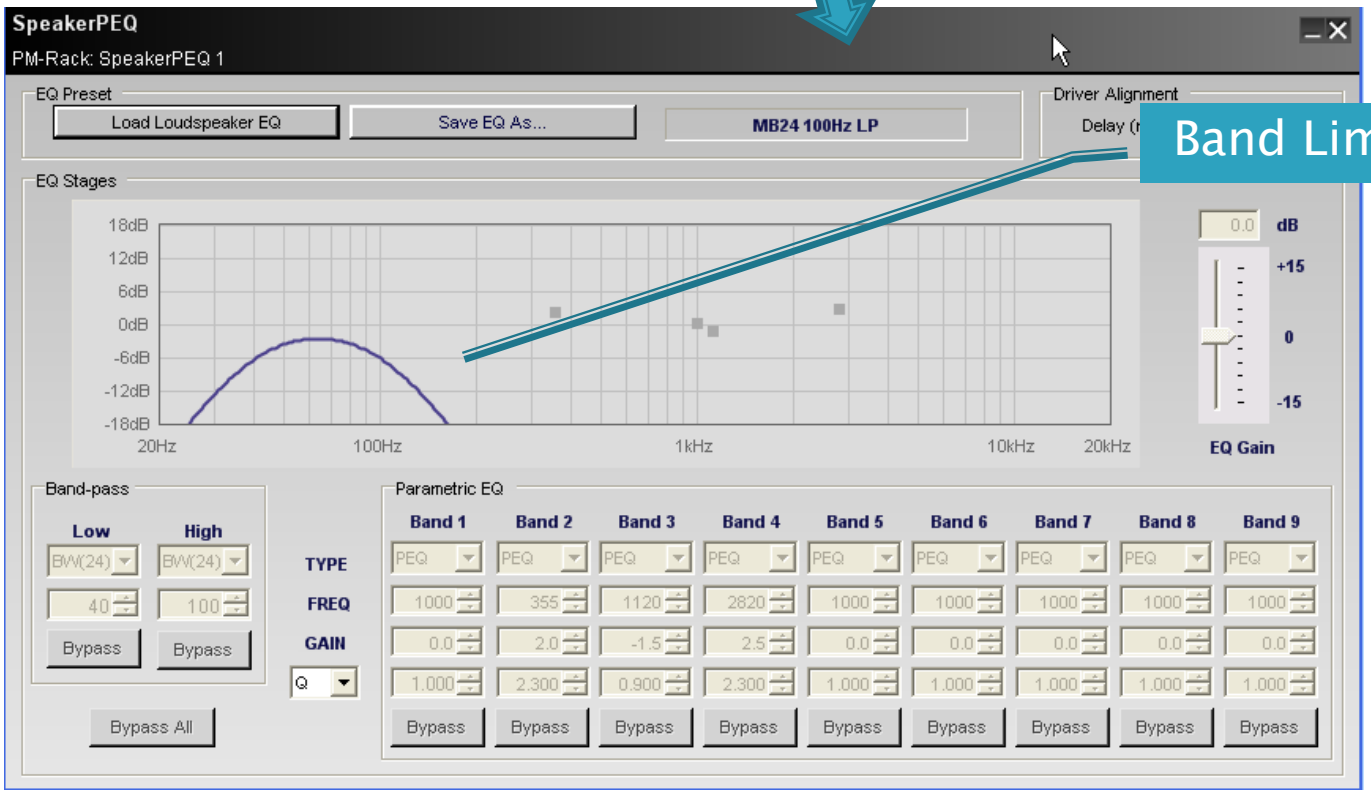


Attenuation

CSD: signal monitoring

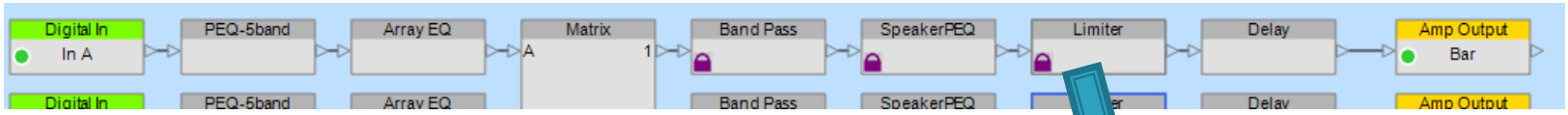


- Double click SpeakerPEQ

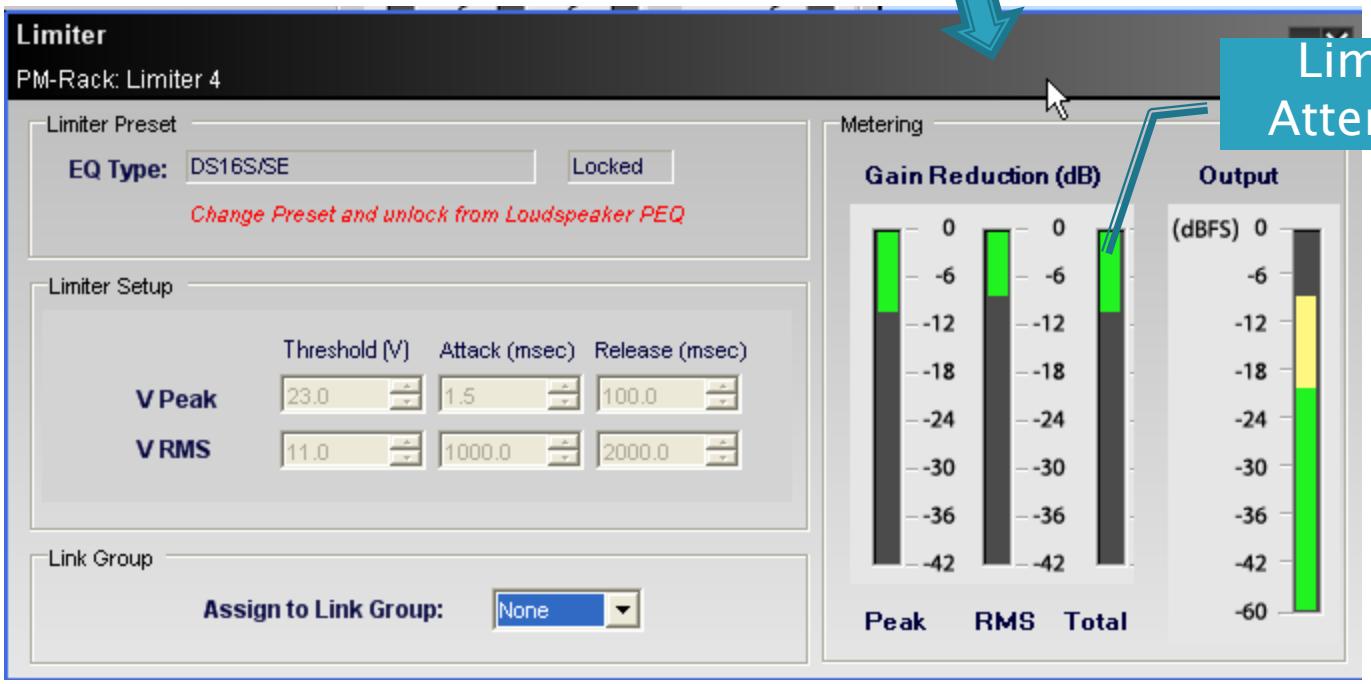


Band Limited

CSD: signal monitoring

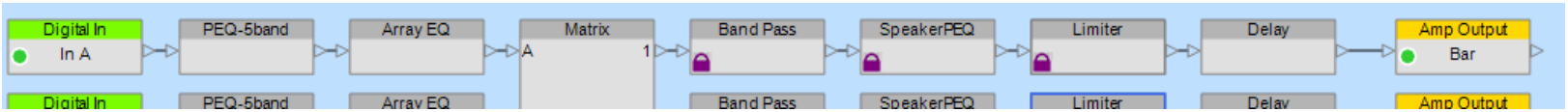


- Double click Limiter

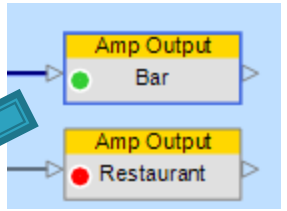


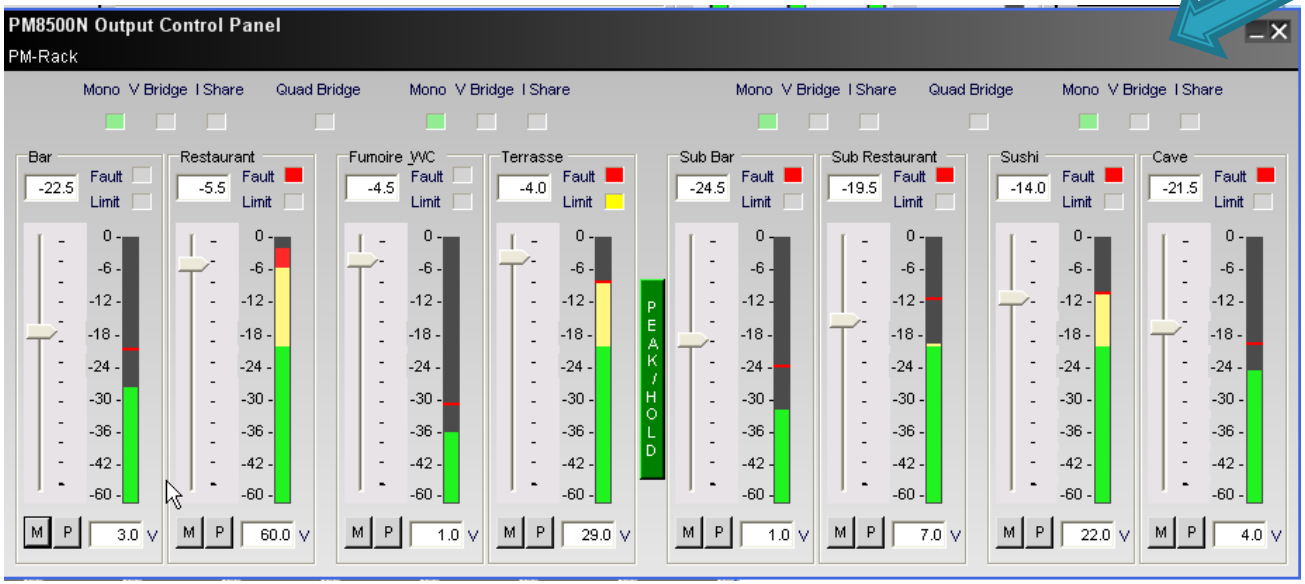
Limiting/ Attenuation

CSD: signal monitoring



- Output “LED” (Green: >-60dBFS, yellow > -20dBFS, red -6dBFS)

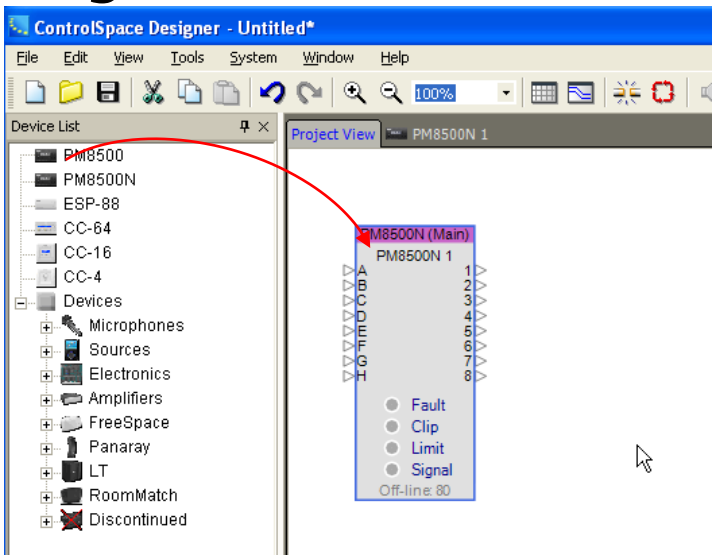




- Double click on output to see input meter

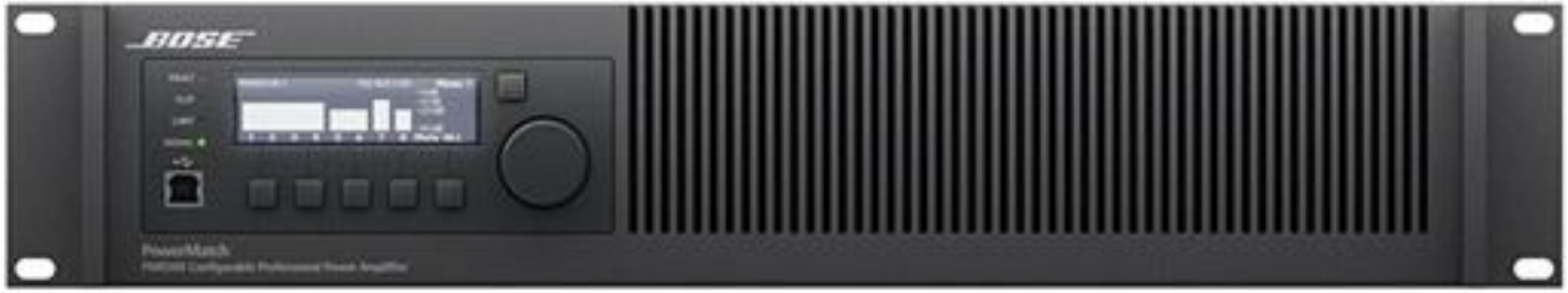
Restore factory defaults

- From CSD, drag in “blank” PM8500, upload



- From PM8500, Utility, Restore Factory Settings, Confirm

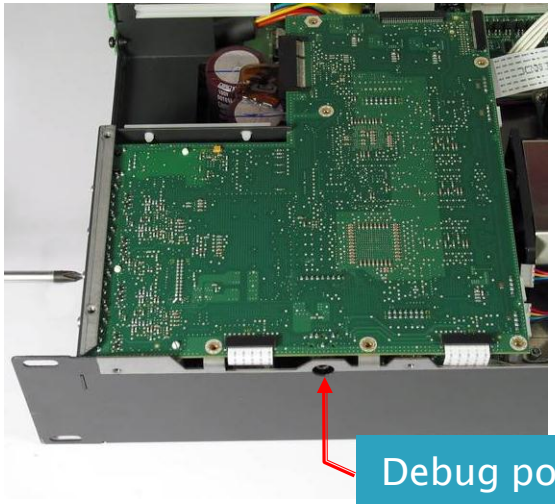
Front panel

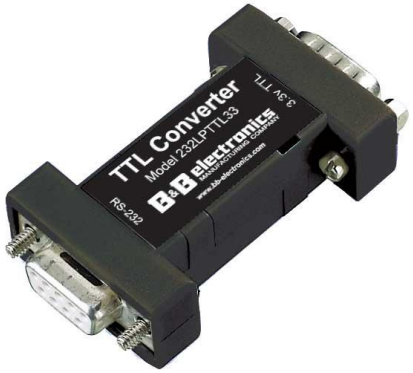


- Most conditions can be observed on front panel
  - Input Clip (LED & per channel indication)
  - Limiting (LED & per channel indication)
  - Input level per channel
  - Output level per channel
  - Alarm log status

Debug/"TAP" port

- 3.5mm/Stereo jack on side
- Use PN 264565 DB9 to 3.5mm (used on other Bose products)
- Not RS232. Requires "3.3V to RS232 converter"
- See B&B Electronics http://www.bb-elec.com/bb-elec/literature/232LPTTL-3406ds.pdf
- Use Hypeterm or other, N,8,1,115000





Troubleshooting

- Model: “Board level” replacement
  - Determine which, if any, board has failed
  - Replace board
  - Test
- No problem Found
  - Environmental
  - Software/configuration
  - Communications
  - Intermittent

Troubleshooting

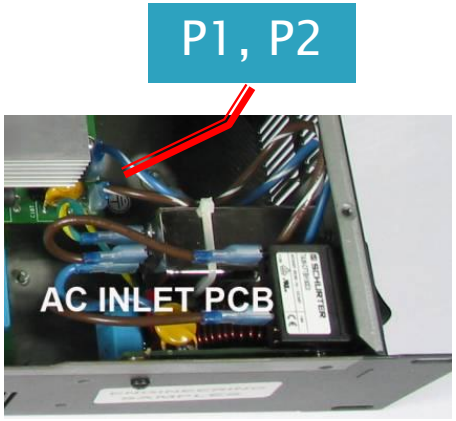
- Start w/ Customer complaint
- Observe power up
- Retrieve information (especially alarm log, FW ver)
- LUAP test fixture
  - Designed to confirm working PM8500
  - Do not use until “major” issues resolved:
    - Smoking
    - Weird noises
    - Unexplained LEDs
    - Faults
  - Use LUAP fixture to isolate further
- Replace board if obvious
- Or, replace w/ known good board to further isolate

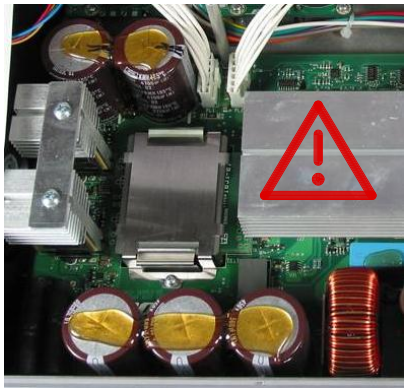
Troubleshooting

- Customer complaint
  - Audio
  - Communication (USB, Ethernet)
  - Fault
  - Dead
- Check firmware
  - Sometimes issues solved w/ latest firmware
- Audio
  - “Hard”: clicks, full blast, “motorboating”, screeching
  - “Soft”: no audio, distortion at high volumes

Troubleshooting: Dead or No LEDS

- Open chassis
  - Check AC input wires connect to PS PCB and wires are not loose
  - Check FFC from PS to Digital board
  - Check FFC from front panel to Digital board
- Apply power
  - Check for AC at P1 & P2
  - Check for 165VDC (120VAC input) or 320VDC(230VAC input) at "RTN" and "+400". *MUST be measured with a floating battery-powered voltmeter*
  - If little or no voltage appears, the most likely cause is a failed R142. Replace the P/S board.
- Check for 9-10VDC at the Digital/PS FFC connectors (PS-pins 19,20; Digital pins 15,16).
  - If OK, the Digital board is defective – replace it.
  - If not OK, standby P/S is malfunctioning or shorted
    - Remove the FFC from the P/S connector, Apply power – If +9-10V appears, the Digital board is defective – replace it.
    - If +9S is not present, the standby P/S is malfunctioning. Replace the P/S board.

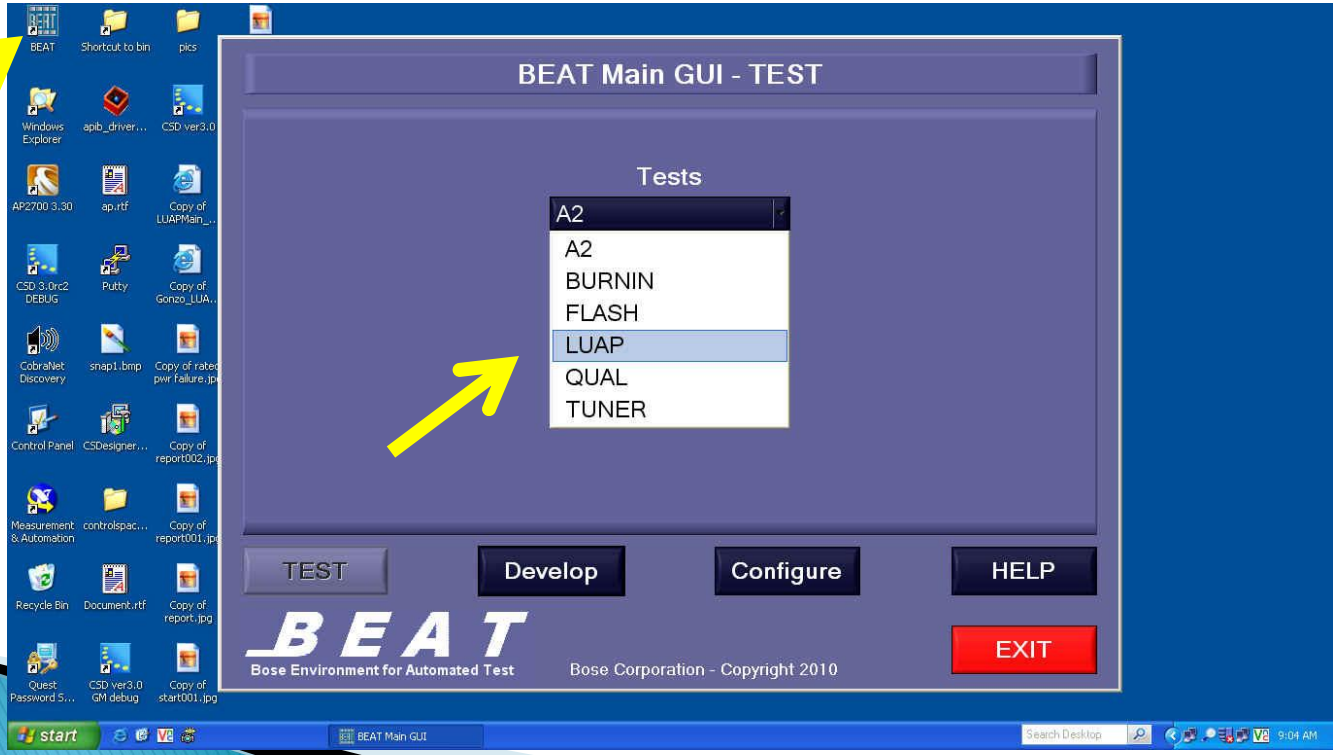




Troubleshooting: LUAP

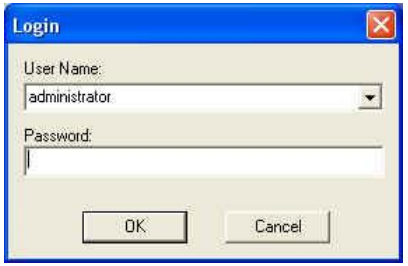
- Always retrieve Alarm Log & config before LUAP
- LUAP requires Factory Defaults

1. Login: ‘rnduser’, ‘medetest’
2. Click on BEAT then select LUAP

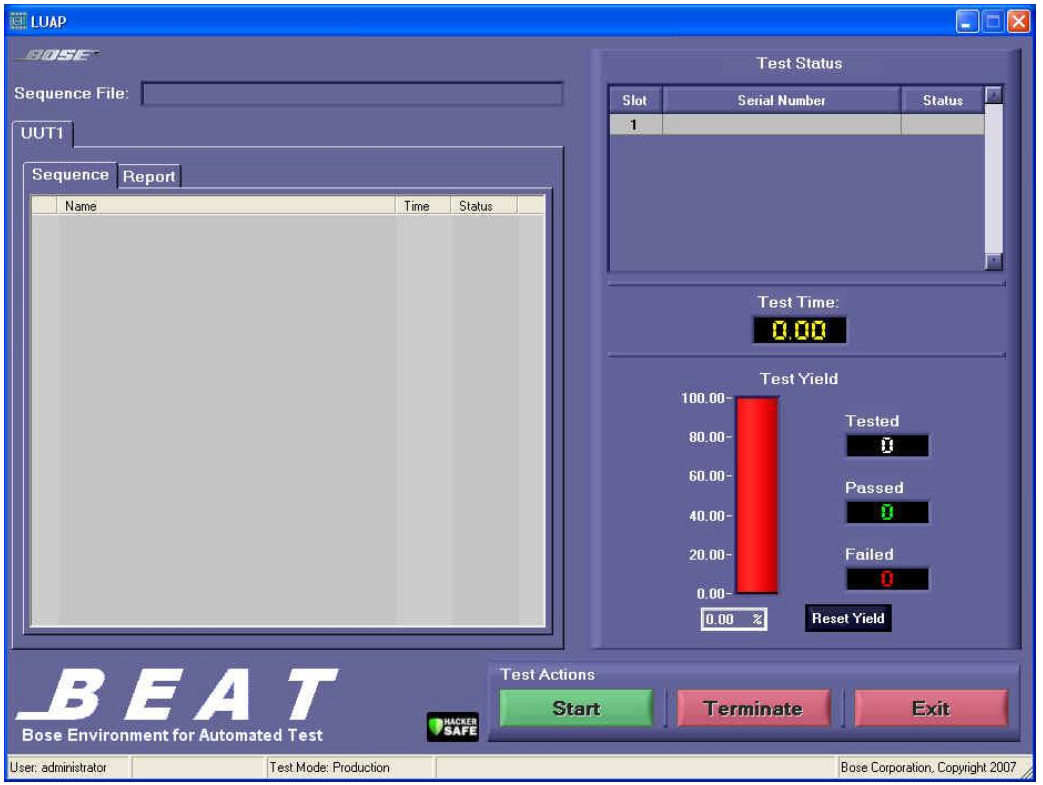


Troubleshooting: LUAP

3. At Login, Press OK

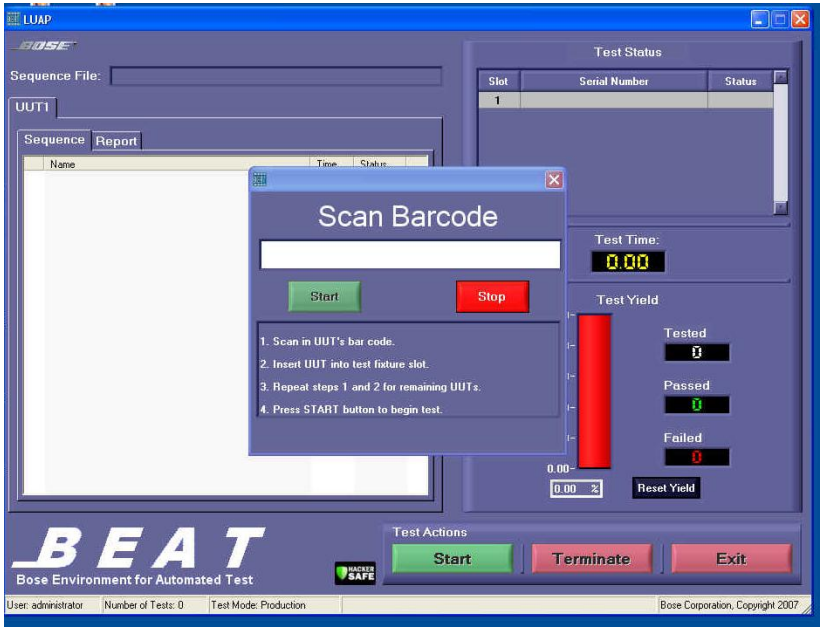


4. Press Start



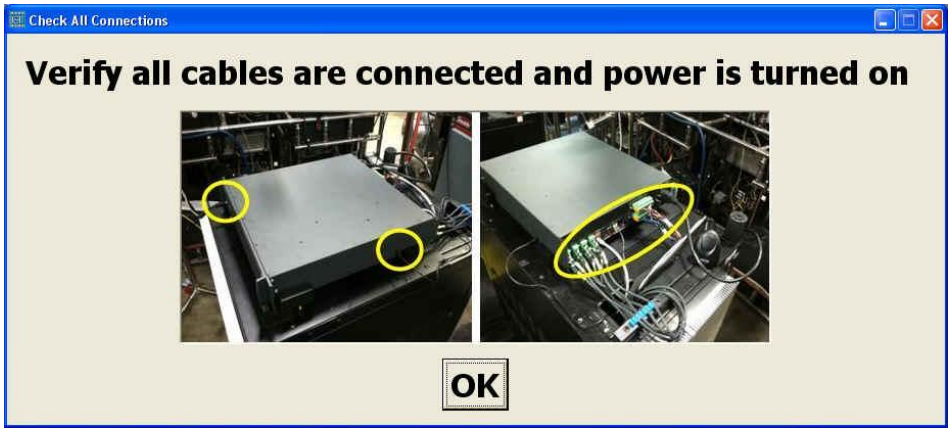
Troubleshooting: LUAP

5. Scan barcode



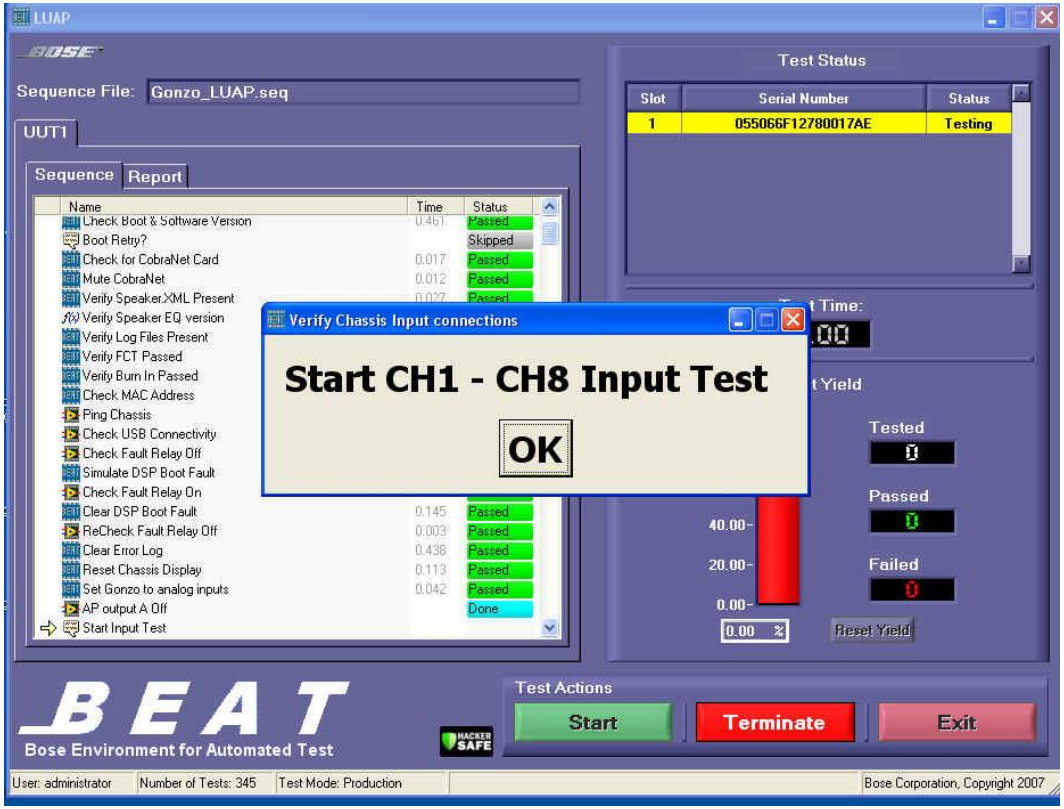
6. Press Start

7. Press OK



Troubleshooting: LUAP

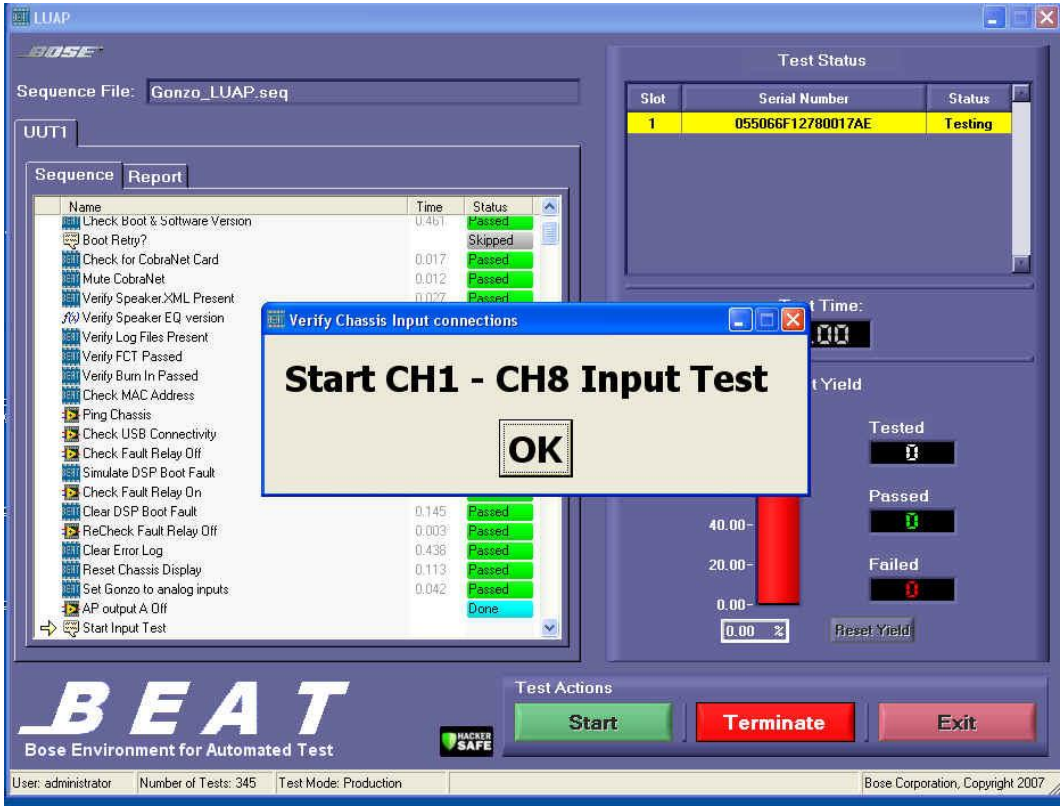
8. Ping, USB, error log, FW version



- Most connection & version problems are found here.
- *Tests must be modified for new firmware versions*

Troubleshooting: LUAP, Input Test

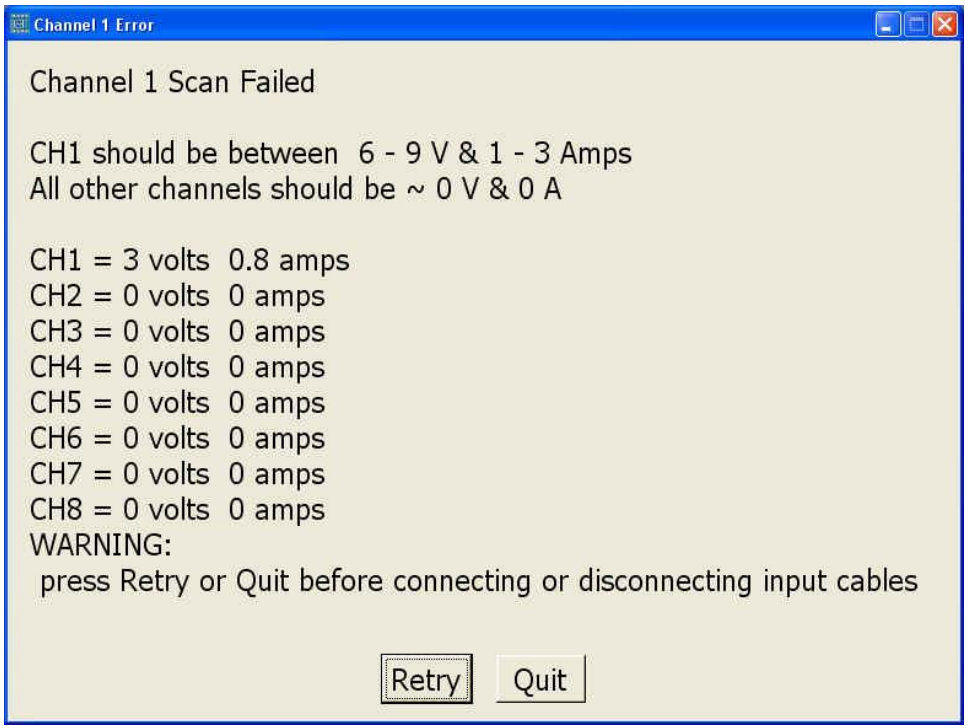
9. Input Test



- Most audio problems are found here

Troubleshooting: LUAP, Input Test

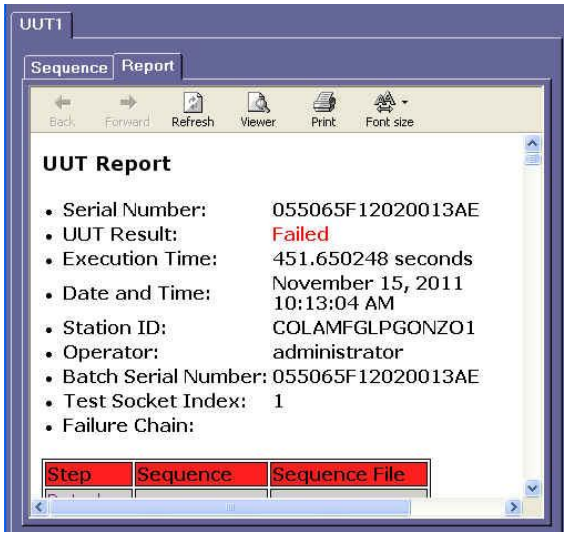
- Example
  - EQ selected on channel 1 (not “flat”)
  - Caused audio output to be lower than expected
- Restore Factory Defaults before LUAP

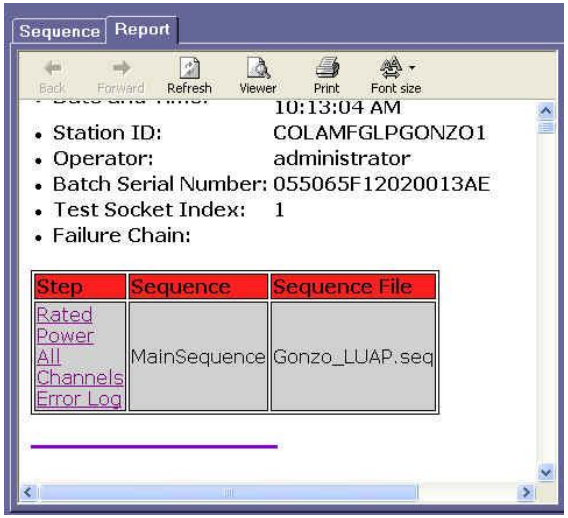


Troubleshooting: LUAP, Failures

- After Input Test many failures do not halt the test
- When the test is complete, click on link in Report tab to see details of the failure
- E.g.:

  Ch1 THDN @ 500W Status: Failed Measurement: Measurement[0] (Full Power THDN CH1):



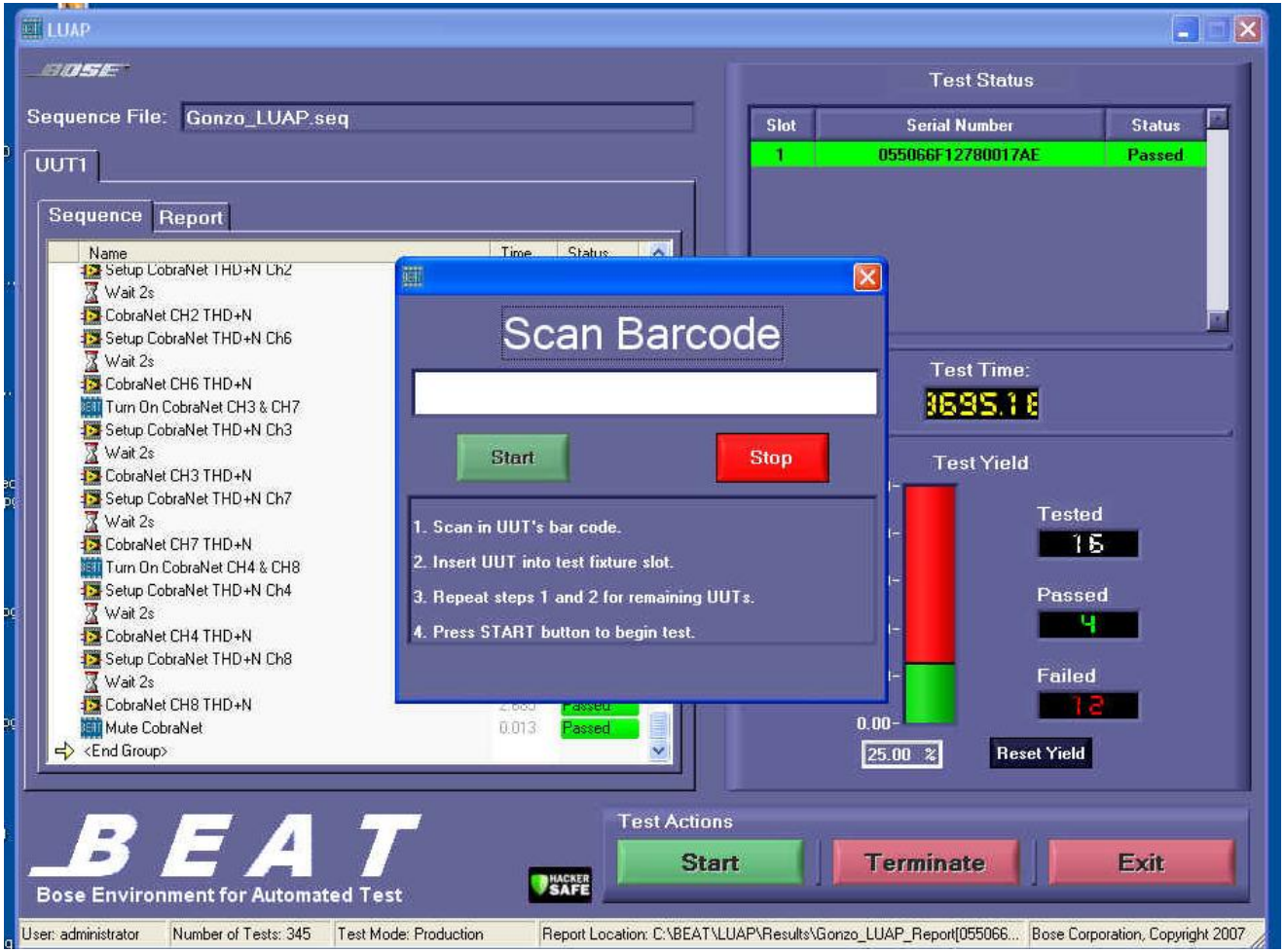


Troubleshooting: LUAP, Failures

- Failures occur when measurement is outside bounds of a parameter
- E.g Full power THD+N failure on Ch1

Ch1 THDN @ 500W
Status: Failed Measurement: Measurement[0] (Full Power THDN CH1):
Limits:
Low: 0.004
High: 0.4
Comparison Type: GELE (>= <=)
Data: ***7.32***
Status: Failed Measurement[1] (Full Power Watts CH1):
Limits:
Low: 470
High: 510
Comparison Type: GELE (>= <=)
Data: ***450.25***

Troubleshooting: LUAP, Passes



Troubleshooting: LUAP failures

Ping Chassis	Check IP address = 192.168.0.80 Replace digital PCB
Check for USB connectivity	Reseat or replace display FFC cable Replace display board Replace digital board
Scan/Verify Inputs	Check input and output cables installed in the correct locations Restore factory Defaults Replace input board (ch 1 – 4) or digital board (ch 5 – 8) Replace Amp A (ch 1 – 4) or Amp B (ch 5 -8)
Ch 1 – 4:	
• THD + N • Power, • Freq Response • Noise	Reseat or replace Amp A FFC cable replace Input board replace Amp B
Ch 5 – 8:	
• THD + N • Power, • Freq Response • Noise	Replace Digital to Amp B FFC cable Replace Digital board Replace Amp B

Notes:

1. In all cases, first check test cables are connected and not worn
2. See TS326114_ Fault Tree.xlsx for full description.

Troubleshooting: LUAP failures

Phase: Ch 1 – 4	Check that input and output wiring harnesses were not changed or wired incorrectly
Phase: Ch 5 – 8	Check that input and output wiring harnesses were not changed or wired incorrectly
All Channels On Power Test	Replace Power Supply PCB Replace amp PCBS

Troubleshooting: Example 1

- Customer Complaint:

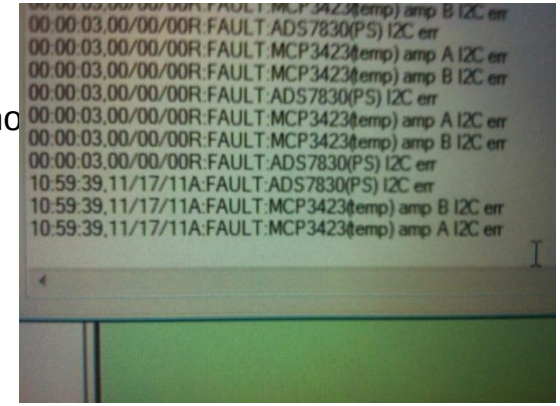
  "Channel 1 & channel 2 didn't work anymore. They were connected to one MB24 (voltage bridge mode – 4ohm load). One could hear (and see on the VU) a very small signal, even with output channels muted. It was not hum or hiss, but irregular noise. There was no "FAULT" on the display, and the other channels continued to operate."
- Powered up
  - Examined alarm log (no faults)
  - FW up-to-date
  - No "phantom audio" observed
- LUAP test fixture
  - Failed Ping: had to change IP address
  - Scan:

    CH1 should be between 6 - 9 V & 1 - 3 Amps
    All other channels should be ~ 0 V & 0 A
- Replaced Amp A (matched customer complaint)
- LUAP Passed

Troubleshooting: Example 2

- Customer Complaint:

  "The amp is getting input signal, but no output meter movement and no audio out."

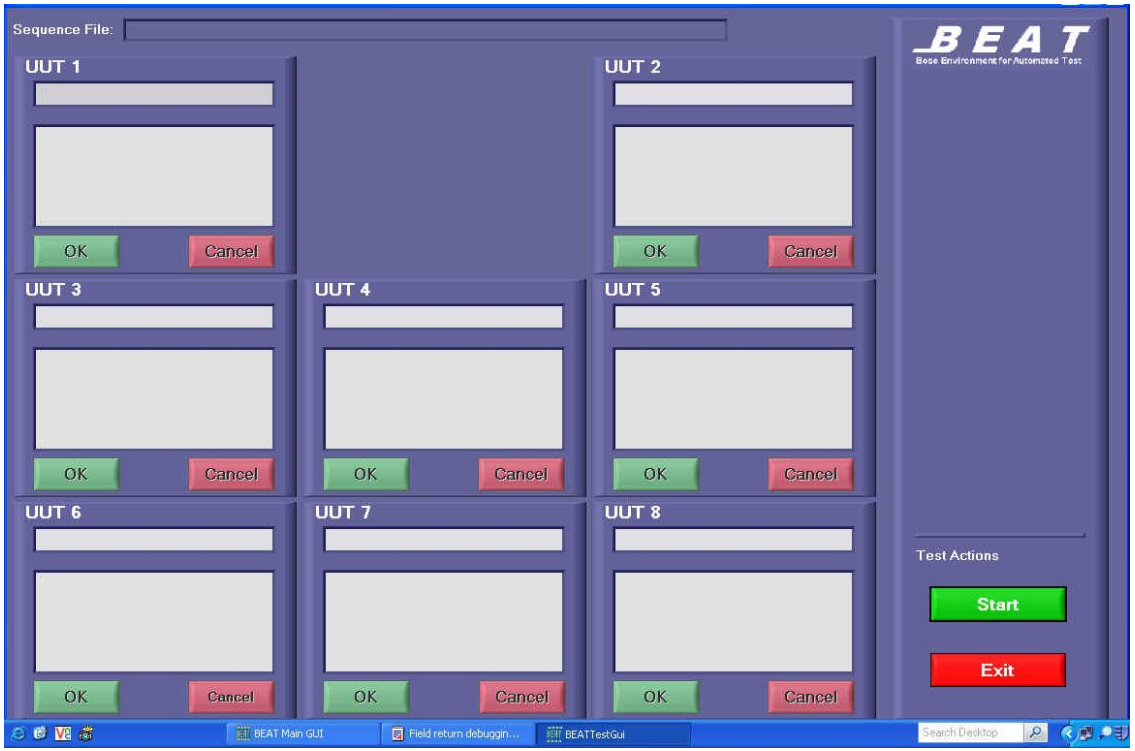


- Powered up
  - FAULT: non-recoverable …
  - Examined alarm log
    - "PS I2C err"
    - "Amp B I2C err"
    - "Amp B I2C err"
  - FW out-of-date

- Updated FW: same fault
- Can't run LUAP
- Opened unit, Reseated amp FFC cables: fixed problem
- LUAP Passed

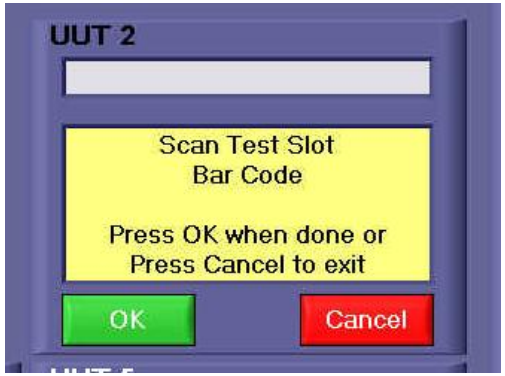
Troubleshooting: Burn-in

- Burn-in after unit passes LUAP
- Select BURNIN instead of LUAP at BEAT Main GUI



Troubleshooting: Burn-in

- Press Start
- Scan UUT2 barcode, press OK



- Scan UUT barcode, press OK

- Test started, shows time remaining

Conclusion

- Complex product
  - Many PCBs
  - Internal FW/DSP
- Many tools to debug
  - CSD
  - Front panel
  - “TAP”
  - LUAP
- Many more documents on ProjectLink may help
- Record all failures and resolution and create a list of symptoms and causes.
- Provide information back to design team whenever possible