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Service Manual v1.4

Delta-Series Amplifiers:

CA 2100 Stereo Amplifier
CAP 2100 Integrated Stereo Amplifier

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PCB list

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Testing Procedures

Production testing:

Individual testing for the following boards:
- AUX power supplies
- Capacitor boards
- Neutral Filter boards
- AC-sensor boards
- Main (plug-in amp) boards
- Heatsink boards

Calibration and testing for the following boards:
- Sensor/control boards
- AC-control boards

"Group" testing of the following board assembly:
- AC-sensor boards
- AC-control boards
- Sensor/control boards
- Front panel boards
- Communications boards
- Trigger/IR boards

Start-up testing (complete amplifier):

Visual inspection (EVERYTHING !) and basic checks (modifications etc)
50 ohms check
Software version check
AC-control calibration check
AUX Power Supply voltages
Current sensor zero calibration check
Main power supply and MOSFET rail voltages
Main plug-in board rails
Bias check on heatsinks
Output DC offsets
Soft-start and bias relays check
Signal and mute check (both balanced and single-ended, ALL channels)
Full power + oscillation check (with load)
Current sensor calibration check 2
Noise (listening with AND WITHOUT terminated inputs)
Power-up pop (cold start and warm-start)
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RS-232 functions (including calibration checks, parameter settings, etc)
DIM levels check
All button functions
Trigger function
Remote control and IR functions
DC protection
Polarity
Short-circuit protection
CAN-bus communication

Audio Precision measurements (results logged in computer database)

Final testing:

Burn-in 1 (open unit on idle, 2 nights at 120Vac)

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Final Test Part 1 (open unit):
Visual inspection (everything !) & modifications check
Final bias adjustment (at 120V)
Software versions check
AC-control calibration check
AUX power supply voltages
Current sensor zero calibration check
Main power supply and MOSFET rail voltages
Main plug-in board rails
Bias verification
Output DC offsets
Soft-start and bias relays check
Signal through (both balanced and single-ended, all channels)
Full power + oscillation check (with load)
Current sensor calibration 2
Noise (listening with terminated and unterminated inputs, BAL and SE)
Trigger function
Remote control and IR functions
DC protection
Short-circuit protection
CAN-bus communication
Voltage Selection (final)
Internal fuses change (if needed)

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Close unit (shipping guys install wrap and top cover)

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Burn-in 2 (music & load, 3 nights at final AC)

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Final Test Part 2 (closed unit)
Visual inspection (everything !)
Full power + oscillation check (with load)
Noise (listening with terminated and unterminated inputs, BAL and SE)
RS-232 functions (including calibration checks, parameter settings)
DIM levels test
All button functions
Audio Precision final testing (both balanced and single-ended, all channels)
Main fuse change (new)

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Last Test (Vladimir)
Power-up and power-down noises check
Listening (both BAL and SE, + Mute check)
Function test (buttons only)
LED level check
Final data logging (via RS-232) and printout

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Shipping (unit packed)

Programming Procedures

Production:

The processors on the following boards need to be programmed:

AC-control	(PIC16F819)
Sensor/control	(PIC16F819)
Front panel	(PIC18F258)

Please see Appendix F for the latest software revisions.

The Front Panel board needs to be defaulted (its memory cleared completely) immediately after its FIRST programming (during the “group” testing of the control board assembly). Please see Appendix B.

Aux Power Supplies and Capacitor Boards

CA2100:

Testing the AUX Power supply Board (B3A5XR02)

Perform a detailed visual inspection of the Aux Power Supply. Check all capacitor directions (polarity). Check if all capacitors are standing up properly. Verify (measure if necessary) that the Voltage Selector (CON1) resistors are:

0 ohms for the 100Vac setting,
75 ohms for the 120Vac setting,
182 ohms for the 230Vac setting,
511 ohms for the 240Vac setting.

Use your multimeter on its diode setting to verify that all four voltage-select LEDs as well as the "bad_power" LED are installed with the correct polarity and are working (each LED should light-up). You will have to move the voltage-select jumper to all four positions to check this.

Verify jumper setting for 120V AC. Apply 120V AC between LIN2 and N.
Verify voltage before regulator (on C104) around 20Vdc and after regulator (on C105) around 12Vdc.

Change jumper setting to 240V AC. Apply 240V AC between LIN2 and N.
Verify voltage before regulator (on C104) around 20Vdc and after regulator (on C105) around 12Vdc.

Change jumper setting back to 120V AC.
For the following tests use a "bypassed" power-supply jig powered from a variac.
Install Temporary jumper under the relay K101 and K201 (short the relay).
Connect the secondary winding of the transformer to AC101 and AC103 and the Center Tap to AC102.
Bring up the AC gradually (in 15V steps) while measuring the MOSFET supplies at +M101 and –M101 relative to ground at AC104. Keep a close eye on the circuits, listen for frying or popping noises, and feel the variac for vibration caused by excess current. If you hear a capacitor pop, mark the board and replace it. Raise the variac voltage until you measure +/-66Vdc on the DC voltage rails (about 70Vac on the variac, depending on the transformer on the jig).

Now do the same way on other side of board as follows.
Connect the secondary winding of the transformer to AC201 and AC203 and the Center Tap to AC202.
Bring up the AC gradually (in 15V steps) while measuring the MOSFET supplies at +M201 and –M201 relative to ground at AC204. Keep a close eye on the circuits, listen for frying or popping noises, and feel the variac for vibration caused by excess current. If you hear a capacitor pop, mark the board and replace it. Raise the variac voltage until you measure +/-66Vdc on the DC voltage rails (about 70Vac on the variac, depending on the transformer on the jig).

Disconnect the capacitor board and discharge the capacitors on both sides.
Also remove the temporary jumper from relays K101 and K201 and re-solder relay pins properly.

Testing Capacitor Board (B3A1XR00)

For the following tests use a "bypassed" power-supply jig powered from a variac.
Connect the secondary of transformer to AC2 and AC4 and Center Tap at AC6.

Bring up the AC gradually (in 15V steps) while measuring the main DC rails at +V201 and –V201 relative to ground at GND201. Keep a close eye on the circuits, listen for frying or popping noises, and feel the variac for vibration caused by excess current. If you hear a capacitor pop, mark the board and replace it. Raise the variac voltage until you measure +/-66Vdc on the DC voltage rails (about 70Vac on the variac, depending on the transformer on the jig).

Now do the same thing to other side of the board.
Connect the secondary of transformer to AC1 and AC3 and Center Tap at AC5.
Bring up the AC gradually (in 15V steps) while measuring the main DC rails at +V101 and –V101 relative to ground at GND101. Keep a close eye on the circuits, listen for frying or popping noises, and feel the variac for vibration caused by excess current. If you hear a capacitor pop, mark the board and replace it. Raise the variac voltage until you measure +/-66Vdc on the DC voltage rails (about 70Vac on the variac, depending on the transformer on the jig).

Disconnect the capacitor board and discharge the capacitors.

CAP2100:

Testing the Input Board (B3F1XR04)

Perform a detailed visual inspection of the board. Check all capacitor directions (polarity). Verify that all the modifications have been implemented (see Appendix F).

Connect the Input board to the test jig and verify the following voltages:

Before regulator Q101 (one side of diode D101): about 17Vdc
After regulator Q101 (other side of diode D101): 12Vdc
Before regulator Q102 (pin3): 12Vdc
After regulator Q102 (pin1): 5.8Vdc

Set the volume to 86 (unity gain). Pass a 1Vpeak, 1kHz signal (sine-wave, then square wave) through ALL the inputs (both left and right: BAL, LIN1, LIN2, LIN3, and TAPE-IN) and check that it appears on ALL the outputs (both left and right: LINout and TAPEout). In each case repeat with 10Hz and 10kHz signals and make sure the output levels are the same as the input level and the same for all frequencies. Verify that the square wave signal shows no signs of ringing, oscillation, or other deformation.

With the volume still at 86 confirm that the DC offsets on the Line and Tape outputs do not exceed +/-4mV.

Testing the AUX Power supply Board (B3F2XR04)

Perform a detailed visual inspection of the Aux Power Supply. Check all capacitor directions (polarity).

Connect AUX transformer (TC0600-0040) to U101.
Verify the following voltages:

Before regulator Q201 (right side of diode D201) about 17.5Vdc
After regulator Q201 (left side of diode D201) 12Vdc.
Before regulator Q101 (right side of diode D101) about 17.5Vdc
After regulator Q101 (left side of diode D101) 12Vdc.

Before regulator Q301 (left side of diode D301) about 20Vdc
After regulator Q301 (right side of diode D301) 12Vdc.
Before regulator Q302 (right side of diode D302) about -20Vdc
After regulator Q302 (left side of diode D302) -12Vdc.
Before regulator Q401 (pin 1) 12Vdc
After regulator Q401 (pin 3) 5Vdc.

Testing Capacitor Board (B3F3XR00)

For the following tests use a “bypassed” power-supply jig powered from a variac.
Connect the secondary of transformer to AC2 and AC4 and Center Tap at AC6.
Bring up the AC gradually (in 15V steps) while measuring the main DC rails at +V201 and –V201 relative to ground at GND201. Keep a close eye on the circuits, listen for frying or popping noises, and feel the variac for vibration caused by excess current. If you hear a capacitor pop, mark the board and replace it. Raise the variac voltage until you measure +/-66Vdc on the DC voltage rails (about 70Vac on the variac, depending on the transformer on the jig).

Now do the same thing to other side of the board.
Connect the secondary of transformer to AC1 and AC3 and Center Tap at AC5.
Bring up the AC gradually (in 15V steps) while measuring the main DC rails at +V101 and –V101 relative to ground at GND101. Keep a close eye on the circuits, listen for frying or popping noises, and feel the variac for vibration caused by excess current. If you hear a capacitor pop, mark the board and replace it. Raise the variac voltage until you measure +/-66Vdc on the DC voltage rails (about 70Vac on the variac, depending on the transformer on the jig).

Disconnect the capacitor board and discharge the capacitors.

Sensor / Control Board

Before you begin, perform a detailed visual inspection of the board. Check for missing components, missing solder or accidental solder bridges (especially under surface-mount ICs). Check direction of all ICs, capacitors, and diodes, and other visible problems.

Calibrating the Sensor / Control Board (PCB B3B1XR04)

Check all components.
Turn trimpots R3, R4, R15 and R16 CCW to end (minimum).
Short (with a jumper) the two rightmost pins (looking from the top) on connector TO-OP.
Connect a tested PROGRAMMER ADAPTER to connector TO-MAIN-CTR on the control board.
Power-up.

Use local ground on test-point T2 (on the control/sensor board)
Verify local supply voltage: 5.0 Vdc on tab of regulator Q3, and 12Vdc on the left pin of the same

Adjust current zero reference:

- Probe test point T1 and trim R15 CW until voltage on T1 rises to 250mVdc.
- Probe test point T3 and trim R3 CW until voltage on T3 rises to 250mVdc.

Adjust current max reference:

Connect a variac AC power supply to the control board test fixture. Tweak the variac down to minimum, connect the resistor load to the test fixture and power it on. While monitoring the DC output of the fixture increase the variac supply until the output reaches 80Vdc across the load (with the load connected). Disconnect the load, place the control board on the calibration fixture (with mechanical extension to match the new sensor spacing), and reconnect the load. Power up the test fixture and:

- Probe test point T1 and trim R16 CCW until voltage on T1 rises to 500mVdc.
- Probe test point T3 and trim R4 CCW until voltage on T3 rises to 500mVdc.

Power-off the load and re-adjust current zero reference (re-trim T1 and T3 to 250mVdc). Re-adjust current max reference (re-trim T1 and T3 to 500mVdc). Repeat if necessary.

Testing the Sensor / Control Board (PCB B3B1XR04)

After calibration (see above) use the same setup to check the following:

Use local ground on test-point T2 (on the control/sensor board)
Verify local supply voltage: 5.0 Vdc on tab of regulator Q3, and 12Vdc on the left pin of the same
Verify the dc-protection reference voltage: 1.84Vdc on test-point T4
Verify the floating output voltage: 1.72Vdc on test-point T5
Verify the output of the optocoupler (pin 3 on Q6). It should be high (5Vdc)
Connect a 10k (code 1002) resistor from ground to the top middle pin of connector TO-OP. The voltage on test-point T5 should change to 0.92Vdc.
Connect a 10k (code 1002) resistor from the 5V supply to the top middle pin of connector TO-OP. The voltage at the output of the optocoupler (pin 3 of Q6) should go low (under 0.5Vdc)

AC Boards

Before you begin, perform a detailed visual inspection of the AC-sensor and AC-control boards. Check for missing components, missing solder or accidental solder bridges (especially under surface-mount ICs). Check direction of all ICs, capacitors, and diodes, and other visible problems.

Testing the AC-Sensor board (PCB B3A7XR00)

Check all components.
Connect a tested mini-toroid transformer (ToroidTech TR0005-0015) to CON1 (primary) and CON2 (secondaries)
Insert 400mA fuse at F1
Connect Earth from AC plug to MH1
Connect 120Vac between N4 (neutral) and N5 (line)
Power-up
Verify that the voltage on pin 3 of the voltage regulator is 5.0Vdc
Verify that the first secondary of the mini-toroid (on BR1) measures 11.5Vac
Verify that the second secondary of the mini-toroid (on BR2) measures 3.3Vac
Use your oscilloscope to look at the voltage on pin6 of IC1. It should be a 60Hz square wave with 5V peaks.
Use your oscilloscope to look at the voltage on pin6 of IC2. It should be 5Vdc.

Testing and calibrating the AC-Control board (PCB B3B3XR02)

Check all components.
Turn trimpot R7 CCW to end (minimum).
Connect the AC-Control board to a tested AC-Sensor board with mini-toroid transformer (see above)
Power-up the assembly and adjust your variac to precisely 120Vac
Connect your voltmeter's ground probe to pin5 of IC2 on the AC-Sensor board
Probe test point T1 on the AC-Control board
Turn trimpot R7 CW until the voltage on T1 rises to 1.43Vdc
To test the digital portion of the circuitry on this board, refer to the following section.

Testing the complete control assembly

Assemble the following boards: AC-Sensor (with mini-toroid), AC-control, AUX power supply, Front Panel (for your amp model), Sensor/Control boards (as many as required for your amp model), Communications board, Trigger & IR board.

Interconnect as follows:

Mount the AC-control board on the AC-Sensor board
Plug the mini-toroid connectors into the AC-Sensor board
Connect a 10-pin cable from the AC-control board to FROM_AC_CTR on the AUX power supply
Connect a 10-pin cable from the Trigger & IR board to TO_IR on the Communications board
Connect a 10-pin cable from TO_FRONT on the Com board to FROM_COMM on the Front Panel
Connect a 10-pin cable from FROM_AUX on the Front Panel to TO_FRONT on the AUX PS
Connect 10-pin cables from each Sensor/Control board to the AUX power supply
Insert a shorting plug between pins 1 and 2 of connector TO_OP on each Sensor/Control board
Connect a blue line from terminal N on the AC-Sensor board to terminal N on the AUX power supply
Connect a brown line from terminal L2 on the AC-Sensor board to terminal LIN2 on the AUX power supply
Connect Earth to post MH1 on the AC-Sensor board
Connect 120Vac between terminals N4 (neutral) and N5 (live) on the AC-Sensor board

RS-232 setup:

Connect an RS-232 cable from the serial port of a computer to your Delta series amplifier.
Start HyperTerminal on the computer and configure the serial port to which you connected as follows:

Baud rate:	9600 bits per second
Data bits:	8
Parity:	none
Stop bits:	1
Flow control:	hardware

Please refer to Appendix B for a complete description of the available RS-232 command set.

Factory data:

Before you begin, the Front Panel board needs to be defaulted (its memory cleared completely).

While the assembly is in standby mode, type in "fac" (followed by the Enter key.) The system will display the factory data. For example:

D-AMP Ver: 1.0 Copyright (c) 2003 Classe Audio

Model: CAM400, Amp# 1
OK
AC Control: 2E, Heatsink 1: L1, Heatsink 2: L1,

Verify the version of software loaded into the front-panel board and the control/sensor modules (see Appendix F for latest software versions). If these are not up-to-date, you should load the latest software versions using the MPLAB ICD 2 "hockey-puck" programmer.

Set the model number of the amplifier according to which front panel you are testing (see Appendix B).

AC power check:

Type in "sdp" (followed by the Enter key). You will get a response detailing the AC power parameters. For example:

> *AC Setting = 120*
> *Line V = 122 V*
> *Current = 0.0 A*
> *Line Freq. = 61 Hz*
> *Internal Temp. = 25 C*
> *Ground is OK.*
> *Line Phase is OK.*
> *OK*

Verify that all the readings are correct (especially the AC line voltage and the temperature).

If your AC voltage from your variac does not agree with the setting of the Voltage Selector jumper (CON 1) on the AUX power supply, the "bad power" LED (D404) on the AUX PS will go on. The AUX PS transformer will NOT power up (so the front panel and RS-232 will NOT work) until this condition is cleared. You should test this function by unplugging the system and switching the voltage select jumper (ONLY) to 240V. The "bad power" LED will be on and the Standby LED on the Front Panel will be off (no power to the AUX PS). Switch the voltage selector jumper back to 120V when you're done.

The acceptable voltage ranges are:

> 240VAC setting: accept over 185Vac an under 260Vac
> 230VAC setting: accept over 185Vac an under 260Vac
> 120VAC setting: accept over 95Vac and under 135Vac
> 100VAC setting: accept over 90Vac and under 110Vac

If the voltage is out of the specified range, the unit will NOT turn on.
If the voltage goes out of range while the unit is ON then:

> If the voltage is OVER for more than 10 seconds the unit will shutdown, an AC fault will be recorded in the fault log, and the Standby LED will flash fast (2 blue flashes per second).
> If the voltage is UNDER the unit will remain on (keep playing) but the Standby LED will flash fast (2 blue flashes per second).

Unplug the AC and remove the Earth pin. Reconnect the AC (without the Earth pin) and repeat the "sdp" command. You should see an error message indicating this fault.

Unplug the AC, reconnect the Earth terminal, but reverse the line and neutral terminals. Again, when you do an "sdp" you should see an error message indicating this fault.

Sensor/Control module check 1:

Type in "LPI" (list programmable items). You will get the following type of response depending on the amplifier model and the number of sensor/control boards attached:

INP1 = B | RTP1 = 6 | RTN1 = 6 | TTP1 = 90
FBI1 = 90 | RFT1 = 30 | LFE1 = 0
INP2 = B | RTP2 = 6 | RTN2 = 6 | TTP2 = 90
FBI2 = 90 | RFT2 = 30 | LFE2 = 0
OK

The above reply indicates that there are two sensor/control boards recognized by the system and the specific parameters of each are listed. The meaning of each of these is as follows:

INPx = B	(B=balanced, S=single-ended)
RTPx = 6	slow-blow positive rail current trip point (2 digit from 05 to 75)
RTNx = 6	slow-blow negative rail current trip point (2 digit from 05 to 75)
RFTx = 30	fast-blow trip delay in ms (3 digit from 10 to 255)
TTPx = 90	temperature trip point in degrees Celsius (2 digit from 25 to 99)
FBIx = 90	fast-blow current trip point (3 digit from 090 to 190)
LFEx = 0	DC-protection tripping delay (each unit equals 5ms, Limits 0 to 99)

For now, all you need to check is that all the sensor/control boards respond and they return a reasonable list of values (no zeros or weird values anywhere). These parameters will be reprogrammed before shipping.

Power-up sequence check:

Type in "PWR" (followed by the Enter key) to power up the system. You will get the following response:

Power up in process.

When the power-up is complete, it will display:

Amplifier now ON.

Type in "PWR" again to power down and then repeat the power-up sequence. Make sure that the system powers up properly. Follow the timing diagram (see Appendix D) and listen for the relay clicks at the right times (ignore the front panel LEDs).

Front Panel check:

Verify that the front panel you are testing corresponds to the amplifier model where it will be used (see Appendix F for a listing of the various versions of this board).

Check that the "Standby" LED is solid blue (and NOT red) when the system is in Standby mode. All other LEDs should be off at this time. Press button S4 (immediately above the Standby button). This reverses the logic state of all the channel LEDs so they should all glow pink (both blue and red at the same time). If any LEDs are not pink they will need to be repaired or replaced.

Repeat the power-up sequence as above and observe the Front Panel LEDs. As the system powers up the LEDs corresponding to each of the "channels" will flash blue and then turn solid blue. The upper row LEDs are active if the corresponding channel is in Balanced mode while the lower row LEDs are active if the corresponding channel is in Single-ended mode. For each channel, only one of the two LEDs should be active (upper of lower, depending on the selected mode for that channel). A red LED indicates a fault condition. Note that the timing of these LEDs does NOT correspond to the timing of the relays. When the system is powered-up, all channel LEDs (either upper OR lower) should be solid blue.

With the boards powered up (LEDs on) verify the dimming of the front-panel LEDs using the DIM command via RS-232 (check ALL LEDs, both balanced and single ended mode).

Input type selection:

To program the input type (Balanced or Single-ended) for each channel, briefly press the SELECT button while the unit is in Standby. The channel LEDs will light up in blue to display the current configuration (upper LED ON means Balanced, lower LED ON means Single-ended). The LED for channel 1 will be flashing to indicate that you can modify the input type for this channel. You may switch the input type by pressing the MODE button (this will also change the blinking LED). You may move on to the next channel by pressing SELECT again. To finish the input configuration press SELECT until the LEDs are all off (after channel 5).

Amp-number selection:

The AMP-number is a unique ID (from 1 to 15) assigned to each amplifier in a multi-amplifier system. This number is also equal to the delay (in seconds) the amplifier waits (from the time you press the Standby button) before it starts powering-up. This delay ensures that multiple amplifiers do start powering up at the same time.

To change the AMP-number press and hold the MODE button while the unit is in Standby. After about 3 seconds the channel LEDs will ALL go ON at the same time. If you let go the MODE button (without pressing anything else), the LEDs will go off briefly and then blink (all together) to indicate the currently programmed AMP-number. The number of times the LEDs flash ON is the current AMP-number. To change the AMP-number, press and hold the MODE button. After 3 seconds, when the unit turns ON all the channel LEDs, press the SELECT button as many times as the wanted AMP-number (while still holding the MODE button). When you are done, let go the MODE button. The unit will flash the LEDs as many times as the new AMP-number to confirm your entry.

Mute function:

The amplifier can be muted via RS-232 or remote control. All channels are muted together (see Appendix B). When the unit is in mute mode, the corresponding active channel LEDs (either balanced OR single-ended for each channel) flash blue.

Timer function:

A global timer keeps track of the time the unit has operated since shipping. This timer is activated every time the unit is powered up (from Standby), and it stops when the unit is powered down (back to Standby). It is updated every hour to prevent missed counts due to power failures etc. This timer can be read (and cleared with the proper password) via RS-232 (see Appendix B).

Fault logging function:

The amplifier keeps a log of the faults (protection conditions) that have occurred since shipping. This log is updated every time an amp module reports a fault to the front panel. This log can be read (and cleared with the proper password) via RS-232 (see Appendix B). 128 entries are kept in the log. When the log is full the oldest entry is deleted.

Sensor/Control module check 2:

Once the system is powered on, type in “sda” (follower by the Enter key). The sensor/control modules will return a real-time snapshot of current and temperature values as follows:

> *AMP1: POS 0A | NEG 0A | TEMP 10C*
> *AMP2: POS 0A | NEG 0A | TEMP 6C*
> *OK*

Ignore the temperature readouts at this point – they are incorrect because the sensors are on the heatsinks which are not present. The thing to check here is that there are no error messages (DC protects etc.) To trigger a DC fault you can simply pull off the jumper between pins 1 and 2 on connector TO_OP on one of the sensor/control modules.

DC-protection check:

Repeat the following procedure on each of the sensor/control modules:

Use a 10k ohm resistor to jumper a variable DC voltage to pin 5 of connector TO_OP. Raise the DC voltage slowly from zero to 2.5Vdc. The DC protection should trigger when you exceed +2Vdc. When the module enters protection mode, the corresponding channel LED should flash red AND the module should NOT restart until the AC has been unplugged (or an “rff” command has been issued via the RS-232 port).
Repeat as above but lower the DC from zero to –2.5Vdc. The DC protection should trigger when you exceed -2Vdc. Again, the corresponding channel LED should flash red AND the module should NOT restart.

Trigger function check:

Connect a switched +5Vdc signal to the trigger-in input on the Trigger/IR board. When this signal pulses positive, the output of optocoupler U101 (pin 3) will pulse positive also (it is normally low). If the amp was on Standby it should respond by powering up. If the amp was already ON, the trigger will be ignored. When you switch the trigger signal off, the amp will power-down (back to Standby).

The trigger-out signal is just a loop-through of the trigger-in signal. Measure it to verify that it is the same as the trigger-in (actually about 0.2 Volts lower).

IR function check:

Check all the IR functions. To do this, connect the IR-out from an IR receiver (IR/Trigger test jig) to the IR-in of the amplifier and use the amplifier remote to control the amp. Verify that all IR commands work as expected.

When external IR-in signal is plugged in (as above), the IR-out is a loop-through of this signal. Verify that there is signal present on this output when a button is pressed on the remote control. Note that this line is normally “high” (close to 5V) and it pulses “low” when a signal is present.

Testing the main amp plug-in board

B3B6XR04 (modified for CA2100/CAP2100)

Perform a detailed visual inspection of the main amp plug-in board. Verify that the board has been updated as listed in Appendix F.

Check the types and orientations of the transistors, the polarity of the caps, and the values of the resistors. The orientation of the little red LEDs cannot be checked after installation but will become obvious when the board is powered up (all LEDs should be ON).

Connect the board to the test jig. Gradually bring up the variac AC powering the board (in 15 Volt steps). In each case monitor the voltage on both sides of resistors R140 and R141 (relative to ground). Verify that these voltages are always the same (if you have 10V on the left side of R140 you should also see 10V on the left side of R141). When you reach full power you should see 54Vdc on the left side of R140 (and the left side of R141) and 66Vdc on the right side of R140 (and the right side of R141). Check that all the LEDs are ON.

Verify the following voltages:

Voltage on TP10 (relative to ground) should be +54Vdc (when the main rails are at 66Vdc)
Voltage on TP9 (relative to ground) should be -54Vdc (when the main rails are at 66Vdc)
Voltage on TP4 (relative to GND) should be 8.64Vdc
Voltage on TP3 (relative to GND) should be 8.61Vdc

Voltage on TP1 (relative to +54Vdc rail) should be 0.361Vdc
Voltage on TP6 (relative to +54Vdc rail) should be 2.00Vdc
Voltage on TP8 (relative to +54Vdc rail) should be 1.335Vdc
Voltage on TP11 (relative to +54Vdc rail) should be 1.548Vdc

Voltage on TP2 (relative to -54Vdc rail) should be 0.362Vdc
Voltage on TP5 (relative to -54Vdc rail) should be 2.02Vdc
Voltage on TP7 (relative to -54Vdc rail) should be 1.342Vdc
Voltage on TP12 (relative to -54Vdc rail) should be 1.550Vdc

Measure output DC offset: it should be <u>less</u> than +/-8mVdc
Make sure that a test signal passes to the output with a gain of 29dB.

Testing the Heatsink

Before you begin, turn trimpot RV101 (or RV201 depending on the orientation of the board) on the heatsink board all the way CCW. This will bring the biases on the output transistors to zero.

Perform a detailed visual inspection of the heatsink board. Verify that the board revision is up-to-date (the board number can be found on the bottom side of the board just beside the break-away portion and can only be seen with a mirror). Check the types of the MOSFETs: they should be (2S)K216 on the positive output side of each board and (2S)J79 on the negative output side, and the types of the bipolar transistors: they should be (2S)C3263 on the positive output side of each board and (2S)A1294 on the negative output side. Verify that R114 is 4.7 ohms and that it doesn't touch the relay next to it. Also verify that all the relays are 12V type (and NOT 5V type). Finally, verify that the temperature compensation transistor (Q101 or Q201) is well glued to the heatsink.

DO NOT power-up the heatsink without a tested main amp plug-in board. Make sure that the main amp plug-in board is seated properly on the heat-sink board connectors.

For the following tests use a "bypassed" power-supply jig powered from a variac. Make sure that the capacitors on the supply are discharged before you connect the heatsink to the jig.

Bring up the AC gradually (in 15V steps) while measuring the main DC rails (on the big brass binding posts) and the MOSFET supplies (+V202 and –V202) relative to ground (GND or GND201). The MOSFET supplies should be at the same voltage as the respective DC rails. Keep a close eye on the circuits, listen for frying or popping noises, and feel the variac for vibration caused by excess current. If you hear a capacitor pop, mark the board and replace it. Raise the variac voltage until you measure +/-66Vdc on the DC voltage rails. Check the biases on the output transistors. They should still be zero. If not, trim them down to zero and if that doesn't work then power off immediately.

While the heatsink is on, verify that the Zener supplies for the DC-protect circuit are +/-12Vdc (measure the voltages on the accessible ends or resistors R201 and R203 under the main board, relative to ground). Verify that these resistors are 3kohms. Verify also that resistor R119 is 10k ohms (RN55D1002). If the code is not visible then measure it.

Finally, with the heatsink off and disconnected from power, check for shorts between the chassis of the heatsink and digital ground (on the tab of temperature sensor Q8).

Preliminary bias adjustment

If everything went well you can now proceed to a preliminary adjustment of the bias. Re-adjust the variac until you have exactly 66.0Vdc on the DC-rails. Connect the ground probe of your voltmeter to the middle point between resistors R108 and R113 (output) and probe the other end of either resistor. Trim RV101 CW until the bias rises to 7mV. This should eventually bring the bias to 10mV which is the desired final value.

Output DC offsets

Measure the DC offset voltage on the output of the heatsink board (relative to ground) and verify that it does NOT exceed +/-10mVdc.

Signal pass-through and oscillation check

Connect a modified 10-pin plug to the connector next to R119 on the heatsink board. On this10-pin plug short pins 7 and 8 to pin 9 (on the heatsink side) to activate the O/P and Mute relays. Also add a wire on pin 4 to switch from Balanced (default) to Single-ended input later. On the top end of the plug cut off all pins except 1 and 9) and plug in the 10-pin cable from CH1 on the AUX power supply on your test jig. Once the MUTE and O/P relays have been activated, send a balanced test signal (sine-wave) to the balanced input of the heatsink and observe the output of the heatsink board on an oscilloscope. Verify that there is no oscillation on any portion of the output waveform and that the gain is 29dB. Repeat with the single-ended input (you will have to switch the input-select relay from balanced to single-ended by shorting pin 4 on the 10-pin connector to pin 9).

Bias re-trim after warm-up

About 15 minutes after initial adjustment the bias voltages should be settled. Probe pin3 of each bipolar transistor on the heatsink board to verify that the bias voltages are all within 1mVdc (between lowest bias and highest bias). If they are not, some output transistors will need to be replaced. Mark the transistors that need to be changed and the direction they need to go (up or down), and return the heatsink to production. If all the bias voltages are with 1mVdc, then put the heatsink on the burn-in bench.

Heatsink burn-in and bias re-adjustment

As the heatsink warms up on the burn-in bench, the bias voltages will rise and the differences in bias between individual transistors will increase. The bias will need to be re-trimmed after the initial warm-up and then monitored for 48 hours. The target is to get a TOTAL bias of 50mV on each side of the heatsink. The “nominal” bias value of 10mV (ignoring any variations between devices) will add up to these target values.

Re-adjust the variac until you have <u>exactly +/-66.0Vdc</u> on the DC-rails. Measure all the bias values (ignoring polarity) on each side of the heatsink. Enter the measured values in the provided spreadsheet on your computer. Use the resulting calculated “next trim value” to re-trim the bias until the sum of the values is within 2mV of the target 50mV and let the heatsink burn-in some more. This readjustment will have to be repeated at least four times over the 48-hour burn-in period.

Bias confirmation after burn-in

Re-adjust the variac until you have <u>exactly +/-66.0Vdc</u> on the DC-rails and re-measure the bias on all the bipolar transistors (pin3 relative to heatsink output). Confirm that the bias voltages are within 1.5mVdc of one another. Enter the measured values in the provided spreadsheet on your computer. If the sum of the values is within +/-2mV of the target 50mV then the adjustment is complete. Measure and note down the temperature of the heatsink (on the head of the screw that holds the LM35D temperature sensor), and the dc rails (in case the drifted a touch during your measurement).

Note down (on a sticker) the bias voltage on the resistor that will be accessible to the tester after the amp is assembled. This resistor is R2 (on a “normal” 5-device heatsink), and R109 (on an “inverted” 5-device heatsink).

Start-up Testing (complete amplifier)

Checklist:

Test	CA2100	CAP2100
Visual inspection (EVERYTHING !) and basic checks (modifications etc)		
50/100 ohms check		
Software version check		
AC-control calibration check		
AUX power supply voltages		
Current sensor zero calibration check		
Main and MOSFET power supply voltages		
Main plug-in board rails		
Bias check on heatsinks		
Output DC offsets (ALL outputs)		
Soft-start and bias relays check		
Signal and mute check (ALL inputs, ALL outputs)		
Full power + oscillation check (with load, ALL inputs, ALL outputs)		
Current sensor calibration check 2		
Phono board detection and gain test	N/A	
Noise (listening with AND WITHOUT terminated inputs)		
Power-up pop (cold start and warm-start)		
Power-down whistling		
Volume chip noises check	N/A	
RS-232 (calibration checks, parameter settings, serial number, intro, etc)		
DIM / TFT brightness levels check		
All button functions		
Trigger function		
Remote control and IR functions		
Teach IR function	N/A	
DC protection		
Short-circuit protection		
Polarity phase / Ground detection test CAN-BUS communication		
Dielectric strength test Protective earthing connection test Audio Precision measurements		

Basic Checks

Verify that the paperwork (traveler sheet, heatsink burn-in sheets, work orders, etc.) all have the same serial number. Verify also that on the heatsink burn-in sheets, the maximum difference in bias does NOT exceed 2.0mV, and that no single transistor sticks out.

Verify that all the boards are the correct (latest) revisions.

Check that the main fuse and the internal fuses are correct for 120Vac operation (see Appendix A). Also verify that the internal fuse-holders are tight.

If you are using 120Vac power, verify that the first and last (but no other) jumpers are present on Voltage Selector (VS connector) on the AUX Power Supply board. Verify that the single jumper on connector CON1 is in the 120Vac position.

Verify the wiring on the push-on terminal wiring on the AUX PS. The wire colors and their corresponding connections (for 120Vac, from left to right) are:

Connector	Color	To or From	Description
LIN2	White	From L2 on AC-sensor board	Line for AUX PS
X4	Orange	Main transformer primary	Primary A: Top
X3	White	Main transformer primary	Primary B: Top
NEU	Blue	Neutral Filter board	Filtered main power neutral
NEU1	Blue	Neutral Filter board	Filtered main power neutral
N	Blue	AC-sensor board	Neutral for AUX PS
X1	Blue	Main transformer primary	Primary A: 115V
X2	Black	Main transformer primary	Primary B: 115V
R0	Black	To 10ohm soft-start resistor	
X9	Brown	Main transformer primary	N/C
X8	Yellow	Main transformer primary	N/C
X7	Grey	Main transformer primary	N/C
X6	N/C		Tied to X5
X5	N/C		Tied to X6
R1	Black	To 10ohm soft-start resistor	
LIN1	Brown	From N6 on AC-sensor board	Line for main transformer
LIN	Brown	From N6 on AC-sensor board	Line for main transformer

NOTE: Cable colors DO NOT uniquely identify the cables. Please use the cable colors in conjunction with the "To or From" wiring information.

NOTE2: To reconfigure for 230Vac operation, move the blue connector from X1 (not just ANY blue connector) to X6 and the orange connector from X4 to X5. On the AUX PS board switch the single jumper on CON1 to the 230Vac position. Also remove the two jumpers from connector VS and place a single jumper in the middle position on the same connector. This unit will protect itself from a wrong AC voltage but for this protection to work you must ALWAYS match the settings on connector VS with the setting on connector CON1.

Before you power-up the unit check that the DC cables (main rails, MOSFET rails, and grounds) on the heatsink boards are correctly plugged in. Also, measure the 10-ohm soft-start resistor (on the chassis) to confirm its value.

50/100 ohm check

With the unit unplugged, measure the resistance between analog ground (output ground) and chassis ground (AC plug GND). It should measure 50 ohms (it's a 49.9 ohm resistor). Make sure it is NOT a short. Also, make sure that your RS-232 cable is not connected to the unit; in this case, it will short the ground and gives 5.5 ohms For the CAP-2100, check the impedance between the ground from the output and the metal casing of the TFT. You should measure open or not defined resistance. If you have a short, change the TFT right away.

Software version check/factory data

Plug the unit (at this time your unit should be set at 240Vac) on a 240Vac line, but don't power up. Plug the RS-232 cable into the unit.

For a CA2100

Open the DCI software and select AMPLIFIER. After, click on the FAC command ton see the factory data. You should see:

D-AMP Ver: 1.1 Copyright (c) 2003 Classe Audio
Sr No:0123456789ABCDEF
Model: CA2100, Amp# 1
OK
AC Control: 4A, Heatsink 1: M1, Heatsink 2: M1 → These are the latest version of the software
OK

After this, you have to enter the serial number of the unit. Click on the **Enter the factory data** command, and scan (with the scanner) the serial number of your unit. Next click on the **FAC** again to see if the serial number has been programmed.

Then, click on the **LPI** command, you should see:

```
1/27/2005 1:49:59 PM
INP1 = B | RTP1 = 10 | RTN1 = 10 | TTP1 = 90
     FBI1 = 90 | RFT1 = 30 | LFE1 = 0
INP2 = B | RTP2 = 10 | RTN2 = 10 | TTP2 = 90
     FBI2 = 90 | RFT2 = 30 | LFE2 = 0
OK
```

These are the protection parameters for the unit. For a CA2100 and CAP2100, you have to set the RTP and RTN parameters to 07. To change the parameters of the CA2100, click on CHANGE SLOW BLOW Settings, and select the model you are testing, it will automatically change the setting. Click again on LPI to see if the parameters have been changed.

For a CAP2100

Open the DCI software and select CAP2100. After, click on the INFO command ton see the factory data. You should see:

```
Classé CAP-2100 firmware version 1.2.1, build 0154 (2004-11-02)
Device: CAP-2100
Version: 1.2.1
Build: 0154
Date: 2004-11-02
Serial Number:
```

After this, you have to enter the serial number of the unit. Click on the Enter Serial command, and scan (with the scanner) the serial number of your unit. Next click on the INFO again to see if the serial number has been programmed.

Then click on the LPI command, you should see:

```
INP1 = . | RTP1 =   10 | RTN1 =   10 | TTP1 =  90
           FBI1 =  90 | RFT1 =  30 | LFE1 =   0
INP2 = . | RTP2 =   10 | RTN2 =   10 | TTP2 =  90
           FBI2 =  90 | RFT2 =  30 | LFE2 =   0
```

Like the CA2100, RTP and RTN should be set to 07. To do it just clicks on CHANGE SLOW BLOW Settings. It will automatically change the RTP and RTN. See appendix B for description of the parameters.

CA2100 AUX Power Supply

From this test, be sure you unplugged your RS-232 cable from your uni until the procedure tell you to plug it back

Plug in the unit but do not power-up (leave it in Standby). Verify the AUX power supply voltages: you should see +19Vdc before the 7812 voltage regulator and +12Vdc after this regulator (relative to ground on the tab of the 7812).

CAP2100 AUX Power Supply

Plug in the unit but do not power-up (leave it in Standby). Verify the AUX power supply voltages:

Before regulator Q201 (right side of diode D201) about 17.5Vdc
After regulator Q201 (left side of diode D201) 12Vdc.
Before regulator Q101 (right side of diode D101) about 17.5Vdc
After regulator Q101 (left side of diode D101) 12Vdc.
Before regulator Q301 (left side of diode D301) about 20Vdc
After regulator Q301 (right side of diode D301) 12Vdc.
Before regulator Q302 (right side of diode D302) about -20Vdc
After regulator Q302 (left side of diode D302) -12Vdc.
Before regulator Q401 (pin 1) 12Vdc
After regulator Q401 (pin 3) 5Vdc.

Current sensor zero calibration check

Inspect the mechanical alignment of the control/sensor boards on the heatsinks. Make sure that they are seated correctly and that the bias resistors under the boards do NOT touch the Hall-effect sensors (rings). The current calibration of the control/sensor boards is sensitive to mechanical tolerances (namely the exact placement and orientation of the sensor transistors relative to the Hall-effect sensors) that can be easily affected during installation.

With the amplifier still in standby, measure the current calibration test points (T1 and T3) on the sensor/control modules on each heatsink. The calibration points should measure 250mVdc (+7mV/ -2mV).

Main and MOSFET power supplies

Power-up the unit. Measure the following voltages: with exactly 120Vac power you should see +66Vdc on one of the bronze nuts on the heatsink PCB and -66Vdc on the other bronze nut (relative to analog ground on the backplate). The same goes for the MOSFET supplies on the push-on terminals on each heatsink.

Also check the voltage between the chassis ground (take from a screw hole on Heatsink) and analog ground (Output post). Be sure that you don't have more than 4.0mVdc.

Main plug-in board rails

Measure the voltages on the accessible ends of R140 and R141 on each of the main boards. The values of R140 and R141 on one main board should be exactly the same. With the main supplies at +/-66.0Vdc, you should see a value between +/-53.4Vdc and +/-54.6Vdc (relative to analog ground on the backplate) for CA2100 and CAP2100. (relative to any ground on Aux. Power Supply. See appendix H for full specifications.

Bias check

Measure the bias voltage on resistor R116 (or Q1) on the left ("inverted") 5-device heatsink (relative to the left output), and on R111 (or Q 11) on the right ("non-inverted") 5-device heatsink (relative to the right output).

Exactly 12 minutes after first power-up (from completely cold) the bias should have risen to within 1.0 mV of the target value (as indicated on the heatsink burn-in sheet). Note that the target value for a Left heatsink is labeled "next Q1 trim", whereas the target value for a Right heatsink is labeled "next Q11 trim" (because this heatsink is negative-side-up).

If the bias is NOT within 1mV of the target at the 12-minute mark, then turn trimpot RV101 clockwise to trim it up to 1mV under the target value. Make a note of this on the back of the "traveler" sheet (under the checklist) with your initials.

For a final BIAS check, set your voltage to 66.0 Vdc. Leave your unit ON for about 1 to 3 hours. After this time check and adjust your BIAS perfectly. Then start the Final test procedure.

Output DC offsets

Measure the DC offset voltages on the output posts (still relative to the same ground).
They should NOT exceed +/-10mVdc.

On the **CAP2100** unit, measure the DC offsets on the speaker terminals as above with the volume set to zero. They should NOT exceed +/-10mVdc. You will also need to check the DC offsets on the main (line) and tape outputs. The tape output is not affected by the volume setting. Make sure it is under +/-4mVdc. The main (line) output must be checked at **volume 86.0** and give +/-4mVdc <- (enter this value on the start-up sheet)

Soft-start and bias relays check

Make sure that the big 50W soft-start resistor is 10 ohms. Monitor the AC voltage across this resistor (be careful – both sides can be at 120Vac) as you start up the unit. During the start-up you should see a lot of AC flowing through this resistor (current spikes as the relays click on). 8 seconds into the start-up sequence this soft-start resistor is shorted out and you should see only a couple of mVac (around 6 to 9mVac).

Observe the bias as you power on the amplifier (from Standby). It should be zero until about 7.5 seconds after the start of the power-on sequence. Verify this on all the heatsinks. In other words, make sure that all the biases are zero in the first 7.5 seconds after you power-up the unit.

Signal and mute check

Connect an input test signal from your function generator and observe the output of the unit on the oscilloscope as soon as you power it up. Verify that the signal passes (check both balanced and single-ended inputs on ALL channels. On CAP2100, just check **Balanced and Line 1 input only with volume set to 86dB**, all of the inputs are tested upstairs). Make sure that the phase of the output is exactly the same as the phase of the input. Check that the gain is correct (29dB) and that there is no oscillation on any portion of the output waveform. Also verify that the mute function works on all channels (See RS-232 function test and Appendix B).

Full power & oscillation check

NOTE: For CAP2100 do these following tests with volume 86dB, that is the unity gain of the CAP.
Connect a 2kHz sine wave signal from your function generator and observe the output of the unit on the oscilloscope. Check the polarity ("phase") of the output relative to the input (they should be the same polarity).

Connect an 8-ohm load (that can handle at least 100 Watts) to each output. Increase the signal level until you reach clipping. Verify that clipping occurs at the correct level (30.0Vrms output at 2kHz). Verify that there is no oscillation on any portion of the waveform. Bring the signal level down a bit and change the waveform to square-wave. Look for anomalies like ringing, slew-rate limiting at 20kHz, slanted waveform tops, or oscillation. Check with frequencies from 20Hz to 20kHz.

Connect a 4-ohm load (that can handle at least 200 Watts) to each output. Increase the signal level until you reach clipping. Verify that clipping occurs at the correct level (28.0Vrms output at 2kHz). Verify that there is no oscillation on any portion of the waveform. Bring the signal level down a bit and change the waveform to square-wave. Look for anomalies like ringing, slew-rate limiting at 20kHz, slanted waveform tops, or oscillation. Check with frequencies from 20Hz to 20kHz.

Connect a 2-ohm load (that can handle at least 400 Watts) to each output. Increase the signal level until you reach clipping. Verify that clipping occurs at the correct level (24.5Vrms output at 2kHz). Verify that there is no oscillation on any portion of the waveform. Also verify that the unit does NOT go into protection from over-current before you reach full level output (with RTP and RTN limits set to 7A). Bring the signal level down a bit and change the waveform to square-wave. Look for anomalies like ringing, slew-rate limiting at 20kHz, slanted waveform tops, or oscillation. Check with frequencies from 20Hz to 20kHz.

Current sensor calibration check 2

Connect an RS-232 cable from the serial port of a computer to the amplifier, open the Delta Classé Interface and click on the SDA button.
The amplifier should reply with the following:

Heatsink 1: POS 0A | NEG 0A | TEMP 31C
Heatsink 2: POS 0A | NEG 0A | TEMP 30C

Make sure that the current readings are all zero (as long as the unit is cold – this reading is temperature dependent). If the CURRENT SENSOR ZERO CALIBRATION CHECK was good, you shouldn't have problem at this test.
Power up the amplifier, connect a 2-ohm load on each channel, and input a 20Hz, 350mVac square wave (output should measure 20Vrms). Click on the SDA button as above. For CAP set volume to 86dB. The reply should be:

Heatsink 1: POS 10A | NEG 0A | TEMP 31C
Heatsink 2: POS 10A | NEG 0A | TEMP 30C

...or:

Heatsink 1: POS 0A | NEG 10A | TEMP 31C
Heatsink 2: POS 0A | NEG 10A | TEMP 30C

…depending on the timing. Make sure that both heatsinks read 10A.

CAP2100: Phono board detection and gain test

Plug in two phono test circuits and make sure they are detected by the unit (the display will show "phono" instead of "Line 1". (If one of the test circuits is not detected then there will be an error message). In the menu got to "system setup" and select the "phono gain" option. When you select HIGH gain the LED on the plug-in jig should light up (there will be 6Vdc on pin 5 of J102 and J301 relative to ground). When you select LOW gain the LED on the plug-in jig should go off (the voltage on pin 5 will go to zero).

Listening for noise

These tests will require some ear-training. If in doubt, compare your noise level with a "reference" unit or ask a "reference technician.

For a CA2100

Insert 50-ohm terminators into the XLR inputs of the amplifier and listen closely to all the outputs with a 4-ohm speaker (with the amplifier ON). The noise floor should be barely audible when the speaker almost touches your ear. If you hear anything it should be very low-level white noise (no power related artifacts like hum or buzz). Repeat the same test in single-ended mode (power-down, switch the input selection, insert 25 ohm terminators into the RCA inputs of the amplifier, and power back up).

Repeat both tests without input terminators. There will be more noise but make sure it is not power-related hum or buzz and at about the same level in all channels.

For a CAP2100

Be sure that your RS-232 cable is unplug from the unit during the noise/pop test.

Connect a 4 ohms speaker to the unit. Turn on the unit. Put volume to 40dB. Press MUTE button. You shouldn't hear anything or just a little volume chip noise (a kind of tic tic tic…). If you think is too much, try with a B&W speaker. Listen to the noise from about 1 foot from the speaker, if you still can hear something, change the volume chip of the related channel. Repeat the test but, by pressing another line selection (exemple: Line 1 to Balanced). After, redo the test for the other channel.

Pops and whistles check

Connect a B&W speaker to one output. Power-up the unit from cold (caps fully discharged) and verify that the speakers don't pop during the power-up sequence. Power-down and listen for pops and/or whistling sounds (like caps discharging) on the speaker. Repeat the test with a "warm" start (don't discharge the caps). After, redo the test with the other output channel.

CA2100: RS-232 function test

Connect an RS-232 cable from the serial port of a computer to the amplifier. Start DCI (Delta Classé Interface) on the computer. As soon as you power up the unit, the DCI window will display the state of the unit. As soon as this communication is established, you can check some circuits with the software. Use the following commands:

Click on FAC to see the factory data.

Click on SDP to check the AC power. Make sure that all the readings are reasonable (e.g. current at zero while in standby) and stable, and that there are no error messages.

Click on LPI to see the programmable limit data. If a control module does not communicate with the front panel then you will see an error here.

Click on PWR to start (or stop) the amplifier.

Click on **sdp** again to check the AC power when the amp is ON (notice the current reading and make sure it is the same as for other amps of this model).
Click on **sda** to check the status of the sensor/control modules on each heatsink. Make sure that the current readings are zero (as long as there is no signal) and that the temperature readings are reasonable and stable.
Click on **tim** to see for how many hours the amplifier has operated. (day/hours/min)
Click on **sfl** to see the amplifier error log.
Click on **PWR** again (followed by the Enter key) to shut down the amplifier.

The complete RS-232 command set is listed in Appendix B.

CAP2100: RS-232 function test

Connect an RS-232 cable from the serial port of a computer to the amplifier. Start **DCI** (Delta Classé Interface) on the computer. As soon as this communication is established, use the following commands:

With the amp in standby:

Click on **INFO** to see the factory data (serial number, etc).
Click on **sdp** to check the AC power. Make sure that all the readings are reasonable (e.g. current at zero while in standby) and stable, and that there are no error messages.
Click on **LPI** to see the programmable limit data. If a control module does not communicate with the front panel then you will see an error here.
Click on **POWER ON** to start the amplifier.
Click on **sdp** again to check the AC power when the amp is ON (notice the current reading and make sure it is the same as for other amps of this model).
Click on **sda** to check the status of the sensor/control modules on each heatsink. Make sure that the current readings are zero (as long as there is no signal) and that the temperature readings are reasonable and stable.
Click on **sfl** to see the amplifier error log.
Click on **POWER OFF** to shut down the amplifier.

The complete RS-232 command set is listed in Appendix B2.

CA2100: DIM levels test

With the amplifier on Standby vary the brightness level of the Standby LED by click on **DIM** on **DCI** interface. Make sure there is a clear distinction between the three brightness levels. Power up the amp and repeat this test while observing the channel LEDs. Again, make sure there is a clear distinction between the three brightness levels and that both channels LEDs are the same brightness on all DIM levels. Check ALL front panel LEDs at all DIM levels for matching (both BAL and SE modes). Also make sure that all the leds have the same intensity from one channel to an other. When you finish this test make sure to reset the DIM setting to max (full brightness) and power down the amplifier (from ON to Standby). NOTE that the DIM level is save by the amp when it goes from ON to Standby (so don't power-down by pulling the plug).

CAP2100: Display brightness levels test

Go to the brightness menu and change it from high to medium and to low. In each case observe the display. Verify that there is no flickering and no scrolling bars moving on the display.

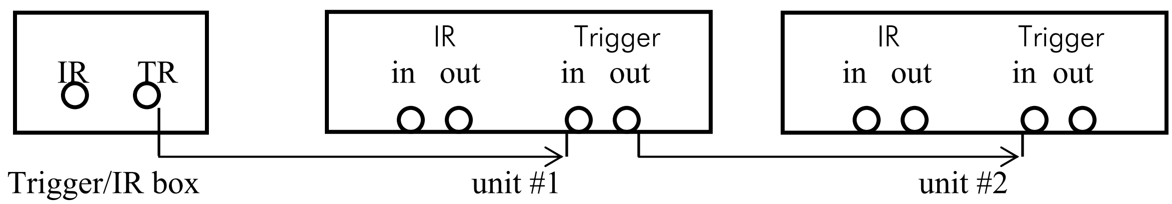
Button function test

Verify that all the front panel buttons work well. See section on Input Selection and AMP# selection. Verify that the Input type (Bal or S/E) and AMP# (1-15) are reflected in the RS-232 communication.

Trigger function test

For a CA2100

For this test you will need another CA(M)-XX00. Connect a switched +5Vdc signal (Trigger/IR box) to the trigger-in input on the Trigger/IR board and from the trigger-out input connect a cable to the trigger-in input of another unit. If the 2 amps were on Standby it should respond by powering up. If the 2 amps was already ON, the trigger will be ignored. When you switch the trigger signal off, the both amps will power-down (back to Standby). The trigger-out signal is just a copy of the trigger-in signal, it should measures about 0.2 volts lower.



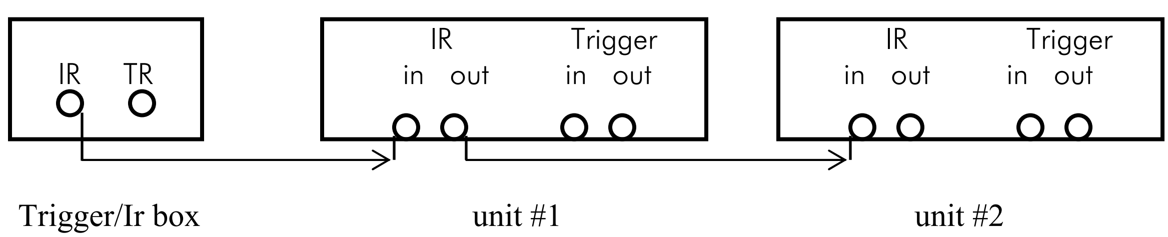
For CAP2100

Turn the CAP2100 on. Connect the Trigger out from the IR/Trigger box to the Trigger in from the unit. Connect a 1/8 cable to your Trigger out of the unit. Put you multimeter to the other end of the of the 1/8 cable, you should see 0Vdc (relative to the output ground or the ground of the 1/8 cable) if your unit is OFF. Turn on the IR/Trigger box. You should see on your meter about 10Vdc and see the unit turn ON. By switching OFF the IR/Trigger box, the unit should turn OFF and your voltage should drop to 0Vdc. Repeat 2-3 times.

IR function test

For a CA2100

For this test you will need another CA(M)-XX00 and a Delta Classé remote control. Connect a cable from the IR out from the trigger/IR box to the IR-in input of the unit and then, from the IR-out input connect another cable to the IR-in input of another unit. Target the remote control to the IR/TRIGGER box IR eye and test some IR functions (Power toggle, DIM, MUTE). Both of the unit should perform the asked IR function.



For a CAP2100

Turn the CAP2100 on. Connect the IR out from the IR/Trigger box to the IR in from the unit. Connect a 1/8 cable to your IR out of the unit. Turn on the Trigger/IR box. Put you multimeter to the other end of the of the 1/8 cable, you should see about 5Vdc (relative to the output ground or the ground of the 1/8 cable). Take the CAP2100 remote control and press the MUTE button. You should see a drop of about 0.4-0.5Vdc (4.60Vdc) on your meter and hear the mute relay. Repeat 2-3 times.

Teach IR procedure with the wrap on. (CAP2100 only)

The CAP2100, can be use with a universal remote control. This means that you can program a universal remote with the CAP 2100 function. This test can be done only when the wrap is on after the starup. Just follow the next step:

1- On the Universal remote, press **AMP** and **RECORD** button and keep it pressed until the LEARN led turn **green**. This will turn the remote in learning mode.

2- Press one key (anyone) that you want to program. By pressing a key, the learning led will turn **orange**. That means that the remote is ready to receive code.

3- On the CAP2100, press MENU→TEACH IR, then choose the function you want to assigned to the key of the remote. Example: DISPLAY.

4- Target the IR eye (from remote control) on the IR eye of the CAP2100. Then press the TEACH IR button on the screen. You should see the **orange** led flashes 1 second and turn green. **If the orange led turns to RED or stay orange go back to step 2.**

5- After it turns green, press again the AMP button to close de learning mode and try the key you programmed.

CA2100 DC protection test

Once the heatsink assembly is connected, you should NOT apply any external voltage (or ground) directly to the output posts of the amplifier. To test the DC protection circuitry you should apply a DC voltage (or offset) to the input of the amplifier.

Adjust your function generator to get a +160mVdc offset (turn-off the AC signal or switch it to 2kHz at minimum level). Switch the amp to single-ended input and power it up. Plug-in the signal from the function generator to each input (one at a time). The unit should enter protection mode, and the corresponding LED should flash red. The CAP2100 will automatically shut-down and should not restart until the AC has been unplugged (or the RFF command has been sent via DCI).

Repeat this test with a –160mVdc offset.

Repeat with a +140mVdc offset and again with a –140mVdc offset and make sure the unit does NOT go into protection.

CAP2100 DC protection test

As above, but use any single-ended input (only one per side) and set volume to 80.

Note: For the DC protection test, you can accept a difference of +/-5mVdc to trigger the protection

Short-circuit protection test

Apply a 75mVrms / 2kHz signal (sinewave) to the single-ended input of the amplifier. Short the output with a jumper wire. This will trigger the protection circuits as above. Repeat this test for all inputs. For the CAP2100, do the test at volume 80.

Polarity phase / Ground detection test

For a CA2100

This test will tell you if the ac sensor board detects the ground and the polarity phase.
For this test you will need the Palm PDA with a RS-232 cable, an inverted polarity phase ac cable and an ac cable without ground. Be sure that you perform this test when your unit is 120Vac wired because when using a step-up transformer, your ground will never be there.

First, plug your unit with your ground missing cable. After, plug the Palm PDA to your RS-232 connector. From the PDA menu, open the ONLINE program. Click on the ON button, after from MACRO button, select the SDP command. If everything is ok you should see:

AC Setting = 120
Line V = 123 V
Current = 0.1 A
Line Freq. = 59 Hz
Internal Temp. = 30 C
*Ground is **defective***
OK

After this test, perform the same step, but plug the inverted phase ac cable to the unit.
If everything is ok you should see:
AC Setting = 120
Line V = 123 V
Current = 0.1 A
Line Freq. = 59 Hz

Internal Temp. = 30 C
Ground is ok
*Line phase is **wrong***
OK

After the test plug back the normal AC cable.

For a CAP2100
For this test, you will need a reverse phase AC cable and a ground missing AC cable. First of all, disconnect the RS-232 cable from your unit. Plug the reverse phase AC cable to your unit with a 120Vac line (do this test only at 120Vac because if you are a 240Vac your step up transformer will always say "ground missing"). Turn on the unit. From the CAP2100 front panel: Press MENU → STATUS → SENSOR. At the AC line phase you should see: "Inverted phase".
Now repat the test but with the Ground missing Ac cable. You should see at the AC Ground: "Ground Missing" and the line phase should be not defined.

CA2100 CAN-BUS function test

Connecting a CAN-BUS cable from the amplifier's CAN BUS IN connector to the parallel-port adapter. Connect the adapter to your computer with a normal parallel cable and power it up. Run file "CAN BUS Monitor" on your computer. Locate the Universal Page window and press the "send" button. The amplifier should respond by powering up. As soon as the power-up is complete the amp will begin sending messages on the CAN bus (which you will see in the Output window). A new message should appear every second. Press the "send" button again to power-down the amp. Repeat this test using the CAN BUS OUT connector on the amplifier (nothing else needs to be changed). See Technical Manual for more details.

CAP2100 CAN-BUS function test

Connecting a CAN-BUS cable from the amplifier's CAN BUS IN connector to the parallel-port adapter. Connect the adapter to your computer with a normal parallel cable and power it up. Run file "CAN BUS Monitor" on your computer. As soon as the power-up is complete the amp will begin sending messages on the CAN bus (which you will see in the Output window). A new message should appear every three seconds. Repeat with the CAN BUS OUT connector on the amplifier (nothing else needs to be changed).

Dielectric strength test

Step 1

1. Hook up DUT Adapter as per Figure 1.
2. Plug the 02100A-13 cable with the attached IR cable to IR IN of the EUT (equipment under test) and the other end to the RETURN receptacle of the HYPOT III.
3. Plug in an AC power cord (3-Prong Plug) to the Device Under Test Adapter (DUT) and EUT,
4. Make sure the display of the HYPOT III shows M0-1. If not push MENU and then MEMORY to step to the correct location.
5. Push "exit" then "TEST".
6. Press TEST on the HYPOT III.

7. Record the results.

Step 2

1. Disconnect the cable in the IR IN receptacle on the EUT
2. Connect the 02100A-13 (with no attachments) to the RETURN receptacle of the HYPOT III and make sure the aluminum ground bar is securely attached to the EUT heat sink with two standoffs. Then attached the alligator clip of the 02100-13 cable to the bar.
3. Power on the HYPOT III.
4. Push the “Menu” button on the HYPOT III.
5. Push the “Memory” button once. The location should read M1-1. If not push MENU and then MEMORY to step to the correct location.
6. Push “exit” then “TEST”.
7. Record the results.

Protective earthing connection test

Step 1

1. Hook up DUT Adapter as per Figure 2.
2. Plug in an AC power cord (3-Prong Plug) to the Device Under Test Adapter (DUT) and EUT,
3. Power on the HYAMP III.
4. Make sure the display of the HYAMP III shows M0-1. If not push MENU and then MEMORY to step to the correct location.
5. Push “TEST”.

Record the results

Audio Precision Testing

Run the application “Classe Testing Procedure S1” on Audio Precision System One or “Classe Testing Procedure S2” on Audio Precision System Two Cascade Plus. Select the “Startup Testing” option and enter the amplifier’s serial number. Select the AUTOMATIC testing option and connect the balanced inputs and speaker outputs as indicated on the pop-up window. Save all test results when prompted.

When finished, run the Power-Bandwidth (4 ohms) test and save the results.

Verify that all measurement results are within the acceptable limits.

Balanced input:

Gain:	29.1dB
Bandwidth:	<10Hz-22kHz (-0.1dB)
	<10Hz-148kHz (-3dB)

THD+N:	0.002% at 1kHz (unweighted, 1Vrms input, 10Hz-500kHz bandwidth)
FFT:	with the inputs terminated (50ohms) the noise peaks should all be lower than -95dBV.

See Appendix D for full specifications.

Appendix A: Fuses

Internal:

On AC-Sensor board (B3A7XR01):
    400mA/250Vac for 120Vac and 240Vac (slow-blow, GDC or T400)

On Voltage Selector board (B3F4XR00):
    800mA/250Vac for 120Vac (slow-blow, GDC or T800)
    400mA/250Vac for 240Vac (slow-blow, GDC or T400)

External:

Model	120Vac	240Vac
CA 2100	6A	4A
CAP 2100	6A	4A

Appendix B: CA2100 RS-232 Interface

Connect an RS-232 cable from the serial port of a computer to your Delta series amplifier.
Start HyperTerminal on the computer and configure the serial port to which you connected as follows:

Baud rate:	9600 bits per second
Data bits:	8
Parity:	none
Stop bits:	1
Flow control:	hardware

Use the following RS-232 command set to communicate with the Delta amplifier:

All command are case sensitive.
Text in italics *denotes replies from the amplifier*

Commands available at all times

PWR Toggles power (see responses below)

PW0 Turns power OFF
Amplifier now OFF. OR *Amp already off.*

PW1 Turns power ON
Power up in process.
Amplifier now ON. OR *Amp already on.*
OR *A fault prevents power up.*

DIM Cycles through front panel dimming settings (on power-up these are: full brightness, medium high brightness, medium low brightness, and low brightness).

rff Does clear of all fault conditions.

sdp Displays a snapshot of AC module parameters.
AC Setting = 120
Line V = 122 V
Current = 0.0 A
Line Freq. = 61 Hz
Internal Temp. = 25 C
Ground is OK.
Line Phase is OK.
OK

fac Displays version, factory data, model number and amp number. For example:
D-AMP Ver: 1.0 Copyright (c) 2003 Classe Audio
Sr No:1580011
Model: CA2100, Amp# 1
OK
AC Control: 2E, Heatsink 1: L1, Heatsink 2: L1,

Note: the last line is omitted when the amp is on.

chk Snapshot of AC module and AMP module parameters.
Heatsink 1: CURRENT is Normal, Temp is Normal (or *High,* or *WARNING Temp is VERY HIGH*).
Heatsink 2: CURRENT is Normal, Temp is Normal (or *High,* or *WARNING Temp is VERY HIGH*).
Heatsink 3: CURRENT is Normal, Temp is Normal (or *High,* or *WARNING Temp is VERY HIGH*).
Heatsink 4: CURRENT is Normal, Temp is Normal (or *High,* or *WARNING Temp is VERY HIGH*).
Heatsink 5: CURRENT is Normal, Temp is Normal (or *High,* or *WARNING Temp is VERY HIGH*).
AC Setting = 120
Line Freq. = 60 Hz
Internal Temp. = 33 C
Ground is OK.
Line Phase is OK.
Line Voltage is in spec.
OK

Note: the AMP lines (first five in the example above) only appear if the amp is ON (otherwise the first line reads "*This Amplifier is OFF*"). The number of AMP lines depends on the model of the amplifier (5-channel amp in example above).

Commands available when the amp is ON

MUT Toggles mute (see responses below)

MU0 Turns mute OFF
Mute off. OR *Mute already off.*

MU1 Turns mute ON
Mute on. OR *Mute already on.*

sda Displays snapshot of all heatsink module parameters.
Heatsink 1: POS 0A | NEG 0A | TEMP 31C
Heatsink 2: POS 0A | NEG 0A | TEMP 30C
OK

Commands available when the amp is OFF

amp=x sets the logical amp number for power-up delay, valid data is 1 to 15.

tim Displays the total run time data.
Total ON time = 10 days, 18 hours, 22 minutes

sfl Displays the total number of faults, fault time, amp number and fault code. For example:
There are 7 faults recorded.
D-AMP Ver: 1.0 Copyright (c) 2003 Classe Audio
Sr No:1580006
Model: CA2100, Amp# 1
OK
AC Control: 2E, Heatsink 1: L1, Heatsink 2: L1,
#007: TT 0:00:30 | OT 0:00:00 | Heatsink 1: DC Output,
#006: TT 0:00:27 | OT 0:00:00 | Heatsink 2: Fast +POS+ Rail,
#005: TT 0:00:09 | OT 0:00:01 | AC Line Fault.
#004: TT 0:00:27 | OT 0:00:00 | Heatsink 1: Slow –NEG- Rail
#003: TT 0:00:07 | OT 0:00:00 | AC Line Fault.
#002: TT 0:00:07 | OT 0:00:00 | AC Line Fault.
#001: TT 0:00:07 | OT 0:00:01 | AC Line Fault.

LPI returns a list of programmable items as follows (see explanation below):

INP1 = B | RTP1 = 6 | RTN1 = 6 | TTP1 = 90
FBI1 = 90 | RFT1 = 30 | LFE1 = 0
INP2 = B | RTP2 = 6 | RTN2 = 6 | TTP2 = 90
FBI2 = 90 | RFT2 = 30 | LFE2 = 0
OK

Entry of programmable items as follows:

Note all entries must be two or three digit numeric within the limits shown above (enter 7 as 07).

'x' is the target heatsink module number (1 or 2, or 'A' to set all available modules at once).

INPx=* Input Configuration (1 character B = Balanced S = Single Ended)
RTPx=** Rail Positive Current Trip point in AMPS (2 digit, Limits 05 to 75)
RTNx=** Rail Negative Current Trip point in AMPS (2 digit, Limits 05 to 75)
TTPx=** Temperature Trip point in degrees Celsius (2 digit, Limits 25 to 99)
FBIx=*** FAST Blow current setting (3 digit, Limits 090 to 190)
RFTx=*** Rail Fault Timer hold-off in milliseconds (3 digit, Limits 10 to 255)
LFEx=** DC-protection tripping delay (each unit equals 5ms, Limits 0 to 99)

Factory Commands available only with a password

Typing in %(+PASSWORD) returns the following menu and allows access to protected functions.

Enter 1 to change factory data
Enter 2 to change password.
Enter 3 to set model number.
Enter 4 to reset fault count.

'1' Allows entry of up to a 16 printable character factory data string.
'2' Allows entry of up to a 16 printable character password.
'3' Allows entry of model type (see model chart below).
'4' Will clear the fault counter to 0.

There are 2 hidden commands that are not meant for field use.

'&' Will reset the running total time counter to zero (rolls back the odometer)
'!' Will do a total factory reset to default model (CAM400), password to default, fault counter to 0, running total time counter to 0, and blank the factory data.

MODEL CHART

x	Model	Configuration
1	CAM400	2 HS 1 LED (default)
2	CA2200	2 HS 2 LED
3	CA3200	3 HS 3 LED
4	CA5200	5 HS 5 LED
5	CA2100	2 HS 2 LED

Appendix B2: CAP2100 RS-232 Interface

Rev 1.91 (19 April 2004)

Revision History:

1.1	added IR code command and LCD low power control, selectable baud
1.2	added amplifier fault times status and tape monitor control
1.3	changed fault time status to include days, added running time status
1.4	modified IRC spec for 3 digit IR code
1.5	modified thermal values returned in status to match amplifier standard
1.6	removed tech items
1.7	added DC and internal comms faults in SYS FAULT status
1.8	updated the STAT FAULT code letters
1.9	added the T1_0, T1_1, T2_0, T2_1

Data format

The RS232 communication with the CAP-2100 operates with a UART configuration for 9600 baud, 8 bits, no parity, with one stop bit. System setup for the CAP-2100 allows for other baud selections. There is no minimum time between bytes required, as the CAP-2100 allows for a 16 byte FIFO. The PC or home controller system similarly must accept status data without delays between bytes from the CAP-2100. All command and status data are ASCII bytes.

Command structure

All commands and status strings follow a format which include 4 leading bytes which serve as the address of the command. The address and command fields are separated by a period and zero or more space characters. The end of the command line is identified by a carriage return/line feed.

For the CAP-2100, the address field is “AP21”. The address data and the period delimiter may be omitted if the controller/PC uniquely connects to the CAP-2100. Any commands that are received without an address field are interpreted for local operation.

Command strings

The command strings consist of all ASCII characters between the period and carriage return. Leading blanks in the command string are ignored. The following list of commands are recognized by the CAP-2100:

MAIN n	change main input to input number n
INP+	steps to the next input
INP-	steps to the previous input
VOLM vv.v	sets volume to vv.v, or the nearest possible value, mute disengaged
VOL+	*steps the volume up from current, mute disengaged
VOL-	*steps the volume down from current, mute disengaged
MUTE	if not muted, engage mutes and adjusts volume
UNMT	if muted, disengages mute and returns to premute volume level

BALL	shift balance ½ dB to left
BALC	recenter to even balance
BALR	shift balance ½ dB to the right
STBY	puts CAP-2100 into standby.
OPER	puts CAP-2100 into operate mode
T1_0	turns off trigger 1
T1_1	turns on trigger 1
T2_0	turns off trigger 2
T2_1	turns on trigger 2
LCD0	sets the front panel LCD to low power "screen saver" mode
LCD1	sets the front panel LCD to low intensity
LCD2	sets the front panel LCD to medium intensity
LCD3	sets the front panel LCD to high intensity
IRC nnn	passes IR code nnn (the code identified in the CAP-2100 IR code table)
TAP0	turns off the tape monitor output
TAP1	turns on the tape monitor output
STAT MAIN	request for main volume and input selection
STAT AMP	request status for amplifier heatsink temperatures
STAT AUTO	status requests for automatic status updates
STAT OFF	disables automatic status updates

* note that in order to use the system acceleration mode, the VOL +/- commands must be received within 200ms of the system's reply (see below).

Replies and Status

The CAP-2100 will send a 3 character reply to acknowledge each recognized command. The acknowledgement character is an exclamation point (!) followed by a carriage return and line feed. There is no leading address field for this reply. If the command received by the CAP-2100 is not recognized, a question mark character replaces the exclamation point. The reply is generated within 100ms of the receipt of the last command termination character (line feed). If no reply is received at the PC/controller host after 100ms., the command should be reissued.

The following status strings are returned by the CAP-2100:

SY STBY	CAP-2100 is in standby
SY VOLM vv.v	Volume is at vv.v. If mute engaged the string "muted" is appended.
SY MAIN n NN	CAP-2100 is selected to input number n, named NN
SY HEAT x	x is N for normal, H for high, V for very high, F for Fault
SY FAULT z n	z is fault condition (N - none, C - Current limit exceeded, T -

Temperature limit exceeded, D - DC limit exceeded, I - Internal communication error, A – AC Line Fault) for amplifier n where n=1 for left, n=2 for right.

This will be available in CAP/CP v1.0.8 (released tonight or tomorrow morning). Please let me know if it sounds good and looks like what you guys wanted and expected. Thanks !

<u>SDA: (CAP-2100 only)</u>

```
> SDA

Heatsink 1: POS 00 A | NEG 01 A | TEMP 33 ˚C
Heatsink 2: POS 00 A | NEG 01 A | TEMP 32 ˚C
```

<u>SDP: (CAP-2100 and CP-500)</u>

```
> SDP

Line V = 100 V
Current = 0.0 A
Temperature = 30 ˚C
Ground is OK.
Line Phase is OK.
```

<u>LPI: (CAP-2100 only)</u>

```
> LPI

INP1 = . | RTP1 =  10 | RTN1 =  10 | TTP1 =  45
           FBI1 =  90 | RFT1 =  30 | LFE1 =   0
INP2 = . | RTP2 =  10 | RTN2 =  10 | TTP2 =  45
           FBI2 =  90 | RFT2 =  30 | LFE2 =   0
```

<u>SPI: (CAP-2100 only)</u>

```
> SPI RTP1 11
> SPI RTP2 12
> SPI RTN1 13
> SPI RTN2 14
> SPI RFT1 31
> SPI RFT2 32
> SPI TTP1 92
> SPI TTP2 94
> SPI FBI1 91
> SPI FBI2 92
> SPI LFE1 1
> SPI LFE2 2
```

The one thing I noticed about SPI XXX# is that it seems to set the parameter only if # is "1" and then sets the same value for both heatsinks. I'll check that out with Richard.

<u>SFL --or-- STAT FTIME: (CAP-2100 only)</u>

```
> SFL

#003: TT 0:04:44 | OT 0:00:00 | Heatsink 2: Temperature limit exceeded
#002: TT 0:04:44 | OT 0:00:00 | Heatsink 2: Temperature limit exceeded
#001: TT 0:00:00 | OT 0:00:00 | Heatsink 1: Current limit exceeded
There are 3 faults recorded.
```

Appendix D: Typical Specifications

Balanced inputs:

Voltage gain: 29.1dB

Bandwidth: 155kHz (-3dB)
22kHz (-0.1dB)

Phase: -8 degrees (22kHz)
-50 degrees (155kHz)

Power: (at 120Vac, 1kHz signal, resistive load)

CA5200: All 5 channels driven at the same time:

8 ohms	4 ohms
247 Watts	400 Watts

CA3200: All 3 channels driven at the same time:

8 ohms	4 ohms
253 Watts	420 Watts

CA2200: Both channels driven at the same time:

8 ohms	4 ohms
259 Watts	445 Watts

Noise: (10Hz-80kHz bandwidth)
FFT: noise floor peaks all below –95dBV
SNR: -108dB relative to full level output

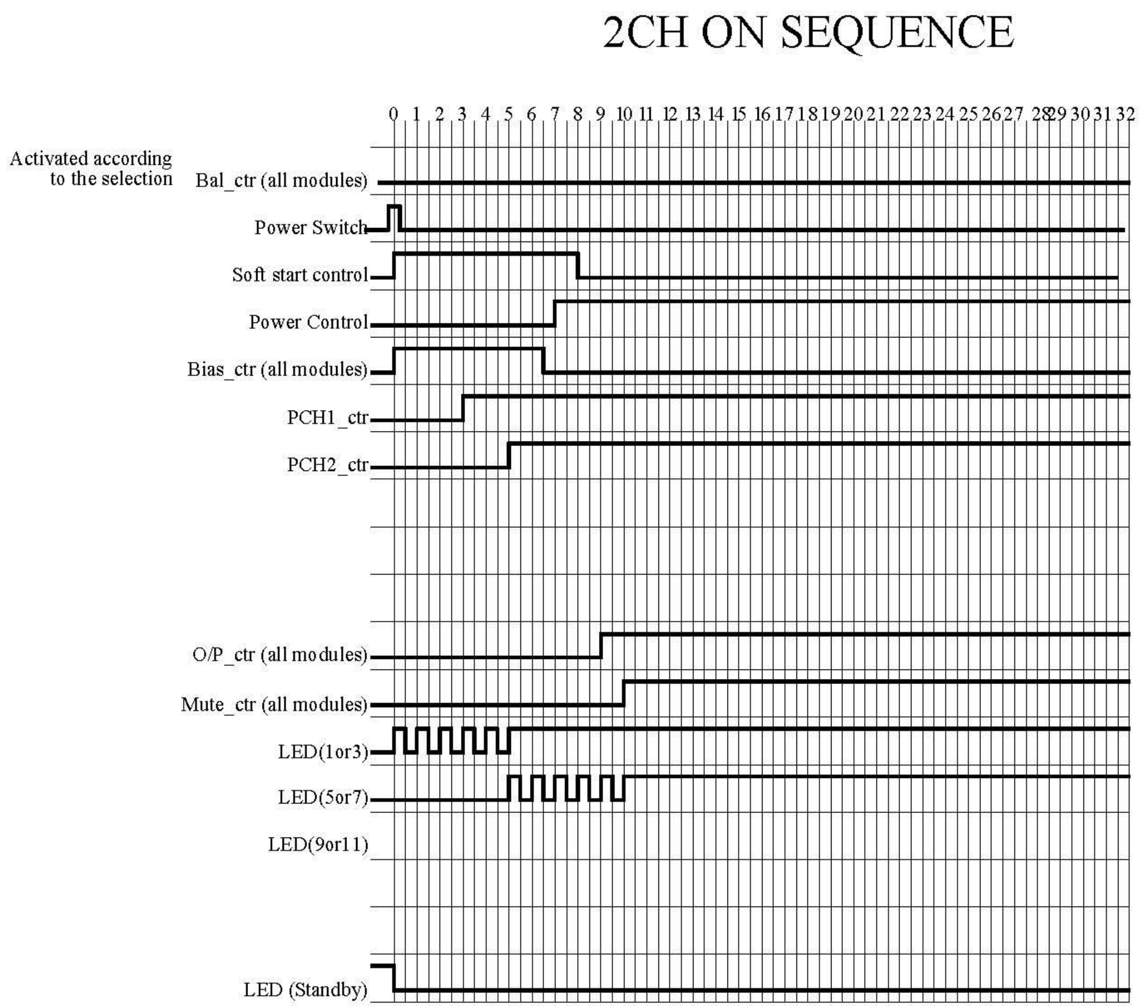
THD+N:

No load: 0.002% (unweighted, 1Vrms/1kHz input, 10Hz-500kHz bandwidth)

With 8ohm load: 0.003% (unweighted, 1Vrms/1kHz input, 10Hz-500kHz bandwidth)

With 4ohm load: 0.005% (unweighted, 1Vrms/1kHz input, 10Hz-500kHz bandwidth)

Appendix E: Power-on Sequence



Appendix F: Modifications checklist

CA2100:

All boards with Voltage Selector circuit (voltage select LEDs):
Changed 100V selection resistor to 0ohm

All amps control/sensor boards (B3B1XR04):
Added 10k ohm resistor from GNDD to U4 pin 4 (pull-down for MUTE_CTR)

All amps AC-control board (B3B3XR02)
Added 0.47uF / 63V WIMA cap from anode of diode D3 (next to test point T1) to ground
Added 10uF/16V capacitor from "current sense" signal (cathode of D2) to ground
Changed R5 to 24.9k
NOTE: No mods on B3B3XR04

All amps AC sensor boards (B3A7XR02 and B3B7XR04/05)
Changed R6, R9, and R10 to flameproof type (matt orange color)
Changed R7 to 221 ohms (RN55D2210)

CA2100 and CAP2100 heatsinks: (B3A2XR02 and B3A3XR00)
R201 and R202 = 3.0kohms, 3 Watts (type ERG-3SJ 302)

CA2100 and CAP2100 main boards (B3B6XR04) compared to CA2200 values:
Changed resistors R104 and R112 to 182 ohms (RN55D1820)
Changed resistors R140 and R141 to 499 ohms (RN60D4990)
Changed resistors R120 and R124 to 40.2kohms (RN60D4022)

CA2100 communications board (B3B9XR02/03)
Changed resistor R1 to RN55D49R9
Installed ground jumper

CA2100 IR/Trigger board (B3BAXR01)
Removed resistor R103

CA2100 front panel (B3A8XR00):
R64 should be RN55D4991, R70 should be RN55D6341, and R71 should be empty.

Retainer clips on ALL 10-pin connectors

CA2100 Software: FRONT PANEL: ca12mbt_LFE_1v0a
Heatsinks: mod_LFE_L1
AC-control: pwr_2E
Downloader: Delta Flasher

CAP2100:

All boards with Voltage Selector circuit (voltage select LEDs):

Changed 100V selection resistor to 0ohm

All amps control/sensor boards (B3B1XR04):

Added 10k ohm resistor from GNDD to U4 pin 4 (pull-down for MUTE_CTR)

All amps AC-control board (B3B3XR02)

Added 0.47uF / 63V WIMA cap from anode of diode D3 (next to test point T1) to ground
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Changed R5 to 24.9k
NOTE: No mods on B3B3XR04

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CA2100 and **CAP**2100 main boards (B3B6XR04) compared to CA2200 values:

Changed resistors R104 and R112 to 182 ohms (RN55D1820)
Changed resistors R140 and R141 to 499 ohms (RN60D4990)
Changed resistors R120 and R124 to 40.2kohms (RN60D4022)

CAP2100 communications board (B3F5XR01):

Ground pins on both connectors need to be tied together for Trigger and IR to work properly. Connect pin 13 (or pin 14) of 14-pin connector (To-Front) to pin 9 (or pin 10) of the 10-pin connector (To-AC).
~~Change resistor R14 to 50 ohms~~ (irrelevant).
Install ground jumper.

CAP2100 AUX PS (B3F2XR04):

Don’t populate (or remove if installed) Q102, R101, and R102.
Install jumper from pin1 of Q101 to pin2 of Q102.
Add a 0.1uF ceramic surface-mount cap across R3 (RS232 protection problem)
Add 1k ohm pull-down resistor from MUTE_VOL to GNDD (between pins 8 and 14 on connector J401)

CAP2100 input board (B3F1XR04 and all subsequent revisions):

Add 10pF mylar capacitors (brown blobs) across R207 and across R426.
Add 10K surface mount resistors from pin5 of U202-B to GNDA_LT and from pin3 of U301-A to GNDA_RT.
Add ceramic surface mount cap on top of (in parallel with) resistor R141.
Cut trace under caps C140 and C143.
Verify that R113 is code 1002 (stuffing problem on first batch).
Verify that a shield plate was installed under the input board.
R801, R804, R807, R134, R811, R814, R817, R331 changed to 0 ohm resistors

CAP2100 IR/Trigger board (B403XR04):

Change R5 to RN55D1001

Change R8 to RN55D1001
Removed resistor R9, cut GND_TRIG trace between trig-in and trig-outs (removed ground from trig-outs, and jumpered normal ground from other side of R9 (end closer to edge of board) to trig-out ground.

R1 changed to RN60D75R0

CAP2100 GUI board (B42AXR06):

1. Encoder color coding as follows:

	B42AXR03	B42AXR06
Pin 1:	Red	Red
Pin 2:	Orange	Orange
Pin3:	Green	Yellow
Pin4:	Yellow	Green

2. Check for 2 red dots and one green dot with an "M" on solder side of the panel board. They indicate the following modifications:

   Red dot 1:
   Remove R119, R121, R123,
   Tie the case of the IR to the outside pin (ground) of the receiver with a jumper.

   Red dot 2:
   Remove Q3 and install change R92 to 71.5K.

   Green dot:
   Remove R38 and put resistor 5063JD56r from left side of C57 to left side of R38, Change R92 to 71.5kohms 0.1%

   Green dot "M":
   Short pins 4 and 5 on the PIC.
   Lift pin4 of U24, run jumper from lifted pin4 to pin9, short pad of pin4 to pin5, cut trace from pin5.
   NOTE: this last mod requires ARM software version 1.05 or higher (otherwise it smokes the TFT backlight).

   Populate L2, L3, L4, L5, L6 with 0.1uF /50V caps (CL10B104KBCN)

   Float ground on LCD display (open case and insulate 4 ground pads)

3. Check standoff between panel board and display, must be the right size and board must be straight not crooked.

4. Check that JP2 is shorted with juno jumper.

Retainer clips on ALL 10-pin connectors

CAP2100 Software: ARM: 1.09
KICKSTART 1.1.3
CPLD 1.1 FOR REV6 BOARDS
FRONT PIC (FP): 0V84_BLT

BACK PIC (BP): 0V83_BLT
Heatsinks: mod_LFE_L1
AC-control: pwr_2H

NOTE: Volume chip series 39Z and H5 are suspected bad (they cause popping noises when volume is changed at fairly low levels).

Appendix G: Troubleshooting

Symptom	Possible cause	Revisions affected
DC offset of about 30mV	Main plug-in (amp) board, transistor Q111, pins 1 and 2 **not** reversed	B3B6XR03, XR02, XR01, XR00
Ch 2 heatsink not on	5-pin cable on AUX PS **not** pin-to-pin (reverse)	Production problem (CA5200)
IR not working	R105 on IR board **not** changed to 200 ohms	B3BAXR00/01
Current calibration impossible	Reversed trimpots on sensor/control board (B3B1XR04)	Production problem
Bias drifts, hard to stablize	Temperature compensation transistor (Q9) not well glued on heatsink	Production problem
Software misbehaving	Missing connection from IR to COMM boards	Production problem
Ground noise when input disconnected or unterminated	Loose or missing screws on RS-232 connector of comm. board	Production problem
Popping on warm-start (25s +)	100uF instead of 10uF on main boards	Mod on XR03, standard on 04
AC current reading 0A on idle	No bias	Production problem
AC current reading 0A w/ load	Solder bridge between pins 3-4 on U1 on AC-control board	Production problem
Sensor board smokes 4.7	Bad via on sensor board, O/P relay control signal interrupted	PCB manufacture problem
Intermittent: smokes 4.7 and huge DC out	Solder bridge on main board (pins 5-6 of K389 FET)	PCB stuffing problem
AC control calibration goes off by 10V when switched to 230V	Wrong value trimpot on AC-control board	PCB stuffing problem
AC control reads 0.255 A (intermittent)	Bad connection on add-on (mod) electrolytic 10uF/35V cap	B3B3XR02 or older
Volume encoder not working	GUI board: PIC (U22) dead, possibly because power was accidentally applied to this IC (cable to P4 swapped with one to P8)	B42AXR03 and future revs

Appendix H: Main board tolerance voltage

	CA/CAP-2100	**CA-22/32/5200**	**CA-M400**
Rails Voltage	66	84	60
Voltage across R140-R141	12	12	7.4
Voltage on R140-R141 (Ref. Gnd)	54.00	72.00	52.60
R140/R141 Values (ohms)	412	665	200
Calculated Current (A)	0.0291	0.0180	0.0370

Tolerance for Board Testing (%)	4%	4%	4%
Tolerance for Unit Testing (%)	5%	5%	5%
Tolerance for resistors (%)	1%	1%	1%
		BOARD TESTING	
MAX current allowed	0.030	0.019	0.038
MIN current allowed	0.028	0.017	0.036
MAX voltage allowed	12.48	12.48	7.70
MIN voltage allowed	11.52	11.52	7.10
MAX voltage allowed	**54.48**	**72.48**	**52.90**
MIN voltage allowed	**53.52**	**71.52**	**52.30**
		START-UP / FINAL TEST	
MAX current allowed	0.031	0.019	0.039
MIN current allowed	0.028	0.017	0.035
MAX voltage allowed	**54.60**	**72.60**	**53.00**
MIN voltage allowed	**53.40**	**71.40**	**52.23**
MAX voltage allowed	12.60	12.60	7.77
MIN voltage allowed	11.40	11.40	7.03