A DIVISION OF FAST FORWARD DESIGNS

AxSys 212 Service Manual

Version 1.1
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Overview

The AxSys 212 is a stereo guitar amplifier that processes the guitar signal digitally. This makes many aspects of it quite different than other tube or solid state guitar amplifiers. All of the controls that affect the guitar sound are implemented in the software that is loaded into the digital signal processors. In order to become more familiar with how the AxSys 212 operates and the specifics of its features, we recommend reading the owner's manual prior to performing any service functions.

The two main components of the AxSys 212 are the wood box (with two 12" speakers) and the head (enclosed in an aluminum box). All of the electronics of the AxSys 212 are contained in the head.

Checking the software version

To check the software version of the AxSys 212 without opening the head, press and hold the button next to the edit row labeled AUX/MIDI and the button next to the edit row labeled MAIN at the same time. The display will show the software version number.

Re-initializing the edit buffer and global parameters

Press and hold TUNER and COMPARE at the same time while turning the power on. Wait until the display reads "Edt" (edit) and then "CLr" (clear) to indicate that the edit buffer has been cleared. In addition to the edit buffer being cleared, all of the global parameters (global Aux settings, global noise gate settings, MIDI channel, and global Main controls) will be set to their default values. For more information on global parameters, please refer to the owner's manual.

Re-initializing all user programs

Press and hold USER/PRESET and STORE SOUND at the same time while turning the power on. Wait until the display reads "PrE" (presets) and then "Str" (stored) to indicate that the all 128 Presets have been stored into the 128 User sound locations.

WARNING: This procedure will erase ALL user program memory. Be sure that any user sounds that are desired to be retained are saved to another AxSys 212 or to a MIDI sysex storage device first. See the owner's manual for more information on storing sounds via MIDI.

Disassembling the Head

Before proceeding, be sure the power is off and the AC cable is disconnected. You will also need to disconnect the two 1/4” speaker plugs from the rear panel.

First locate two Phillips screws on each side panel of the amp cabinet (four screws total). These screws keep the amp head from moving side to side. Take out all four, making sure not to lose the finishing washers.

Next, take out the two screws that hold the top handle. They provide the main support for the head (on newer units you will see two additional screws on the top that also need to be removed). As you remove them, try to support the descending weight by lifting up on the head from behind.

Carefully slide the chassis straight out from the back of the cabinet, being very careful not to tear the vinyl covering. You’ll need to use two hands in order to ease both sides out evenly.

Now that you have the amp head out, remove the eight screws that hold the bottom plate on the chassis. Some amps also have an additional support bracket (mentioned in ECO #3) that will also be removed when taking out these screws. Newer amps will have nine screws instead of eight, and will not have the support bracket.

Changing the software

Caution: When changing software, there is always the possibility that the user program memory could be erased due to electrostatic discharge. It is always a good idea to save the user programs to a MIDI storage device before changing the software or performing any work on the Processor board.

After disassembling the head, locate the EPROM at U14 on the Processor PCB (it is the only socketed chip, and will have a sticker on it indicating the version number). Notice which end of the EPROM has a notch; the EPROM socket has the same indented notch. You’ll want the new chip to be oriented the same direction. Always double check to make sure the chip you’re installing faces the same way as the socket. Carefully pry out the old chip with an EPROM puller or a flat screwdriver.

Insert the new chip in the socket; again remember to match the notched ends. Check to make sure all the chip legs are aligned with their female counterparts in the socket. Press the chip firmly in place from directly overhead.

Now you can reassemble the amp by following the disassembly instructions in reverse. Plug the power cord in and then turn the amp head on while holding the Compare and Tuner buttons. This will reinitialize all of the global settings and the current edit buffer, but will not affect the user programs. If you want to erase and reinitialize all of the User programs as well, hold Preset/User and Store together while powering on (please read “Re-initializing all user programs” above first).

Changing the Power Amps

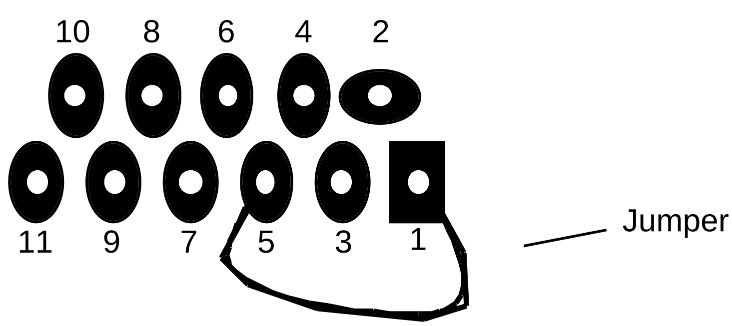
Note: On units prior to serial number A1-007719, the possibility of one or both power amps failing due to an over voltage on the AC input is slightly higher than normal. This is due to the slightly higher secondary voltage of the original transformer design, #4-49-8604 (Line 6 part number 11-30-0010). If a power amplifier needs to be replaced on a unit prior to A1-007719, it is recommended that the transformer also be replaced (see next section).

Follow the procedure in the section “Disassembling the Head” above. Remove the rear PC board by removing the screws holding the power amp devices, and the nuts holding the 1/4” jacks.

Before unsoldering the power amplifiers (located at U1 and U2), note the horizontal spacing between the pins and the circuit board. When the new power amplifiers are installed, provide the same spacing. Remove power amplifiers from the circuit board. Using wire cutters, cut the pins on the power amplifier so the body can be removed. Remove the remaining pieces of the power amplifier pins from the circuit board.

Install new National LM3886TF power amplifiers, allowing some space between the pins and the circuit board. This reduces the possibility of shorts between power amplifier pins and the pads on the circuit board.

If the serial number is prior to A1-008646, add a jumper on each power amplifier between pins 1 and 5 (as further described in ECO #8). The jumper should be soldered on the bottom side of the circuit board. Use 26 gauge or larger wire. See bottom of board diagram below:

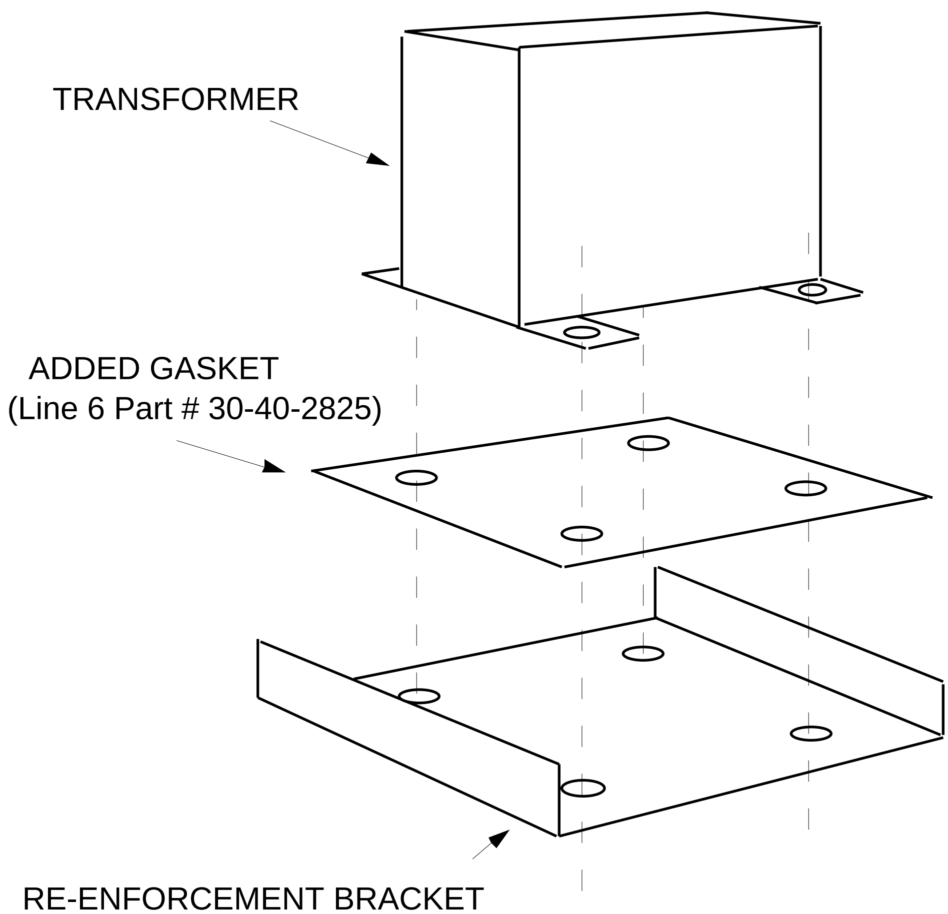


Place circuit board back into chassis, being sure to apply thermal grease between the power amplifiers and the rear metal panel. Replace black hex nuts and power amplifier mounting screws.

Changing the Transformer

On units prior to serial number A1-007719, a dual primary transformer with a slightly higher secondary voltage was used. If power amplifier failure occurs, the transformer should be replaced with transformer number 4-49-8607 (part # 11-30-8607) for 100/120VAC, or transformer number 4-49-8609 (part # 11-30-8609) for 220/240VAC.

First, disconnect all colored wires from the transformer. Remove the four screws holding the transformer in place and remove the transformer. Place re-enforced bracket (part #30-21-0012) on top of chassis where transformer sits. Place the gasket (part #30-40-2825) on top of re-enforced bracket. Place the new transformer on top of gasket. See diagram below.



Insert screws with lock washers and tighten. Reconnect colored wires to transformer as described in section (Description of Circuitry, Power supply). The black and gray wires should be removed.

Description of Circuitry

Inside the head are two main printed circuit boards (PCBs) connected together with a 20 pin ribbon connector: the Processor board (including the small breakaway board for the input jacks) and the Power board (including the small breakaway board for the AC input).

The Processor board contains all of the digital electronics, including the microcontroller, memory, software EPROM, DSPs,(Digital Signal Processors) etc., and the ADC (Analog to Digital Converter) and DAC (Digital to Analog Converter). It also contains all of the front panel controls (buttons, LEDs, and potentiometers).

The Power board contains the power supply, and the two audio power amplifiers that power the speakers. It also contains all of the input and output connectors on the rear panel.

Power Supply

The power supply section is located on the Power board. 100V-120VAC or 220V-240VAC is applied at IEC connector J9. SW1 is the power switch located on the rear panel. L1, L2, and C20 are used to filter RFI from the AC line. The power passes through fuse F1. The AC is then connected to the power transformer through four wires. For older units (serial numbers A1-005001 through A1-007718, which used transformer part number 4-49-8604, our part number 11-30-0010), the position of these wires on the PCB at pad locations H1 through H6 determine whether the AxSys 212 is wired to receive 120VAC or 240VAC. The color of the wires connected to the transformer should correspond to the colors labeled on the PCB for the appropriate line voltage, as follows:

PCB Pad	120VAC	240VAC
H1	Gray	no connect
H2	White	White
H3	no connect	Gray
H4	no connect	Black
H5	Brown	Brown
H6	Black	no connect

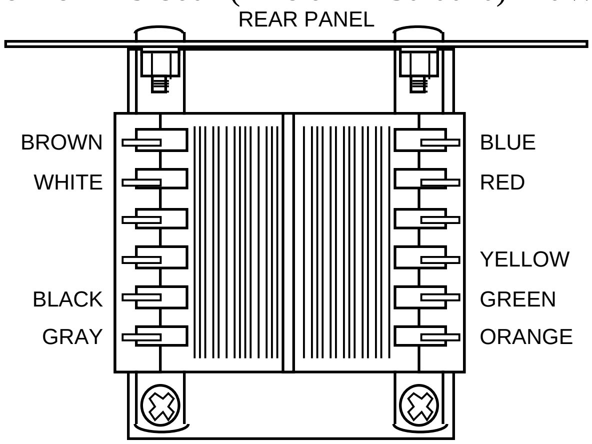
Units with serial number A1-00719 and above use one of two different transformers depending on the input voltage. For 100-120V AC, transformer number 4-49-8607 (our part number 11-30-8607) is used. For 220-240V AC, transformer number 4-49-8609 (our part number 11-30-8609) is used. In both cases, the black and gray wires described above are no longer necessary. The wiring at the PCB pads H1-H6 should be as follows:

PCB Pad	Any AC
H1	no connect
H2	White
H3	no connect
H4	no connect
H5	Brown
H6	no connect

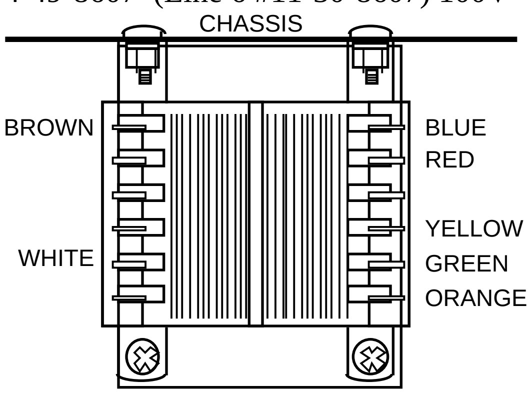
When replacing an older transformer with a newer one, the black and gray wires should be removed.

If the wires become disconnected from the transformer, they should be connected as follows:

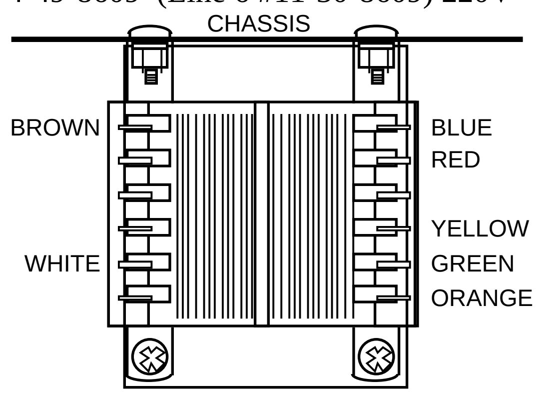
Transformer 4-49-8604 (Line 6 #11-30-0010) 120V/240V



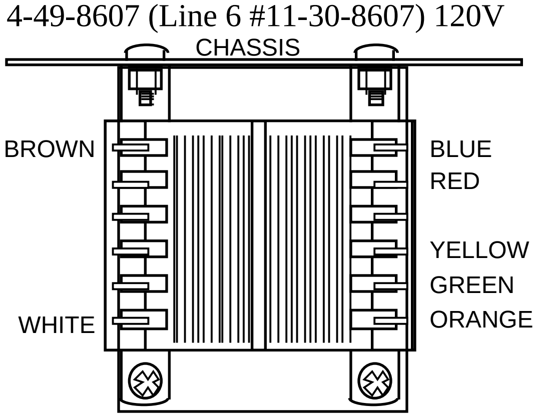
4-49-8607 (Line 6 #11-30-8607) 100V



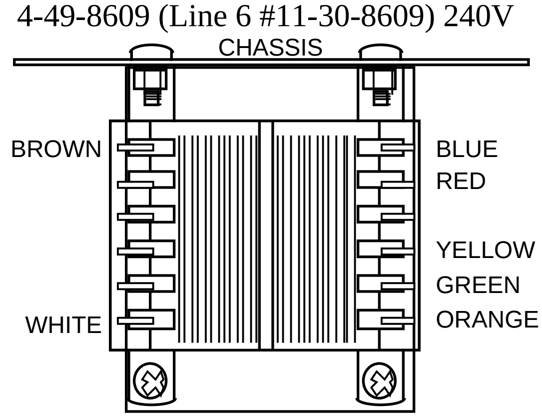
4-49-8609 (Line 6 #11-30-8609) 220V



4-49-8607 (Line 6 #11-30-8607) 120V



4-49-8609 (Line 6 #11-30-8609) 240V



In all cases, there are two secondary windings on the transformer, one with a center tap. The center tapped winding (connected through H7, H8, and H9) is connected to a full wave bridge rectifier D1, which generates the +35VDC and -35VDC used to power the power amplifiers, and are filtered via C15 and C16. These voltages will actually measure to be about ±44 volts when no audio is being played at the speakers. The other secondary winding (connected at H10 and H11) is half rectified through D2 and filtered by C17 to generate approximately +8VDC, and half rectified through D3 and filtered by C18 to generate approximately -8VDC. The +8VDC voltage is connected to regulator U3 to generate the +5VDC (and filtered by C19), which is used by most of the circuitry on the main board.

Audio Input

The aux input signal and guitar input signal enter through J1 and J2, respectively, on the small break away PCB adjacent to the Processor Board. The signals are filtered for radio frequencies via C1 and C3, AC coupled by C2 and C4, have a 1 megohm load via R1 and R3, pass through R2 and R4, and are then voltage limited by zener diodes D12/D13 and D14/D15. The signals are then buffered through U1A and U1B, which are two opamps of a TL084 quad opamp. The input level of the aux and guitar inputs are controlled by R6 and R8, respectively, which control the gain of U1C and U1D. The signals then pass through R9 and R10/C59 into the two inputs of U2, which is a 20-bit ADC modulator. The modulator outputs are connected to U3 which digitally filters the modulator output and generates the digital audio signals for the DSP though pin 18 in a serial 20-bit, 31.2KHz sample rate format. This serial data is clocked by the BIT_CLK (1.9968MHz) and LR_CLK (31.2KHz) signals, both of which are generated by the ADC digital filter U3 by dividing the signal labeled 12MHz (which is actually 11.9808MHz) by 6 and 384, respectively.

DSP

Located on the Processor board, the DSP section consists of two 24-bit, 24 MIPS (Million Instructions Per Second) DSP chips (U12 and U19), one 64K by 16 bit DRAM (U13), and a counter and shift register (U20 and U21, respectively) for loading the DSP instructions. The serial digital audio input is connected to the serial inputs of both DSPs at pin 78 (ADC_DATA), and clocked in via the BIT_CLK and LR_CLK signals generated by U3. The DSP software to be executed and the coefficients required by the DSP are serially downloaded to U12 and U19 from the microprocessor (U9). This is accomplished by the micro loading the specific data into shift register U21, which triggers U20 to shift the 8 bits of data into the selected DSP in about 1.3 microseconds. When the user changes sounds, the micro will download a large amount of data (depending on how different the sound is from the previous sound) to the DSPs. Much of the DSP process (compression, EQ, tube modeling, tremolo, etc.) is handled entirely inside the DSP chips using internal RAM. Some of the processing, notably the chorus/flange, delay, and reverb, require much larger amounts of RAM than is available inside the DSPs. This processing is handled by the DSP at U19, and it utilizes the DRAM at U13 for these functions. U13 also outputs the final digital outputs (DAC_DATA) serially at U49 for the DACs.

Audio Output

The DSP's digital output is connected to the DAC U4. This signal contains both the left and right data. The DAC is clocked by the BIT_CLK and LR_CLK signals generated by ADC U3. The DAC converts the signal into 2.8 volt peak-to-peak (maximum) analog voltages centered at 2.5 volts, and outputs them at pins 17 and 18 for the right and left output, respectively. These signals are AC coupled through C32 and C33 and then passed through the stereo volume potentiometer, R71. Additional gain is then provided by U5 (5532 dual opamp) before passing the signals through the ribbon cable to the Power board. The signals are then passed through U1 and U2, which are the 50W power amplifiers. The outputs of U1 and U2 are connected to the speaker output jacks J1 and J2, as well as resistors R13 and R14 for driving the headphone output jack.

Microcontroller

Located on the Processor board, the Microcontroller section consists of the 80C31 microcontroller (U9), and address latch (U11), a 64K by 8 bit EPROM for the software (U14), and a 32K by 8 bit SRAM (U15) for scratch pad memory and user sounds. The microcontroller is clocked by a 11.9808MHz crystal, which (through U10) is also used to clock the DSPs, the ADC, and the DAC. The micro fetches operating instructions, DSP code, and preset sounds from the EPROM. It downloads the DSP code as described in the DSP section. The micro's serial ports are connected through the ribbon connector to the Power board, where they are used for the MIDI input and output (J3 and J4, respectively). The MIDI input first passes through optoisolator U4. The micro also interfaces to the LEDs, switches, and pots as described in the next section. The decoding of the latches used for the switches and LEDs is controlled by address decoder U18.

User Interface

On the Processor board, the front panel circuitry consists of all of the components relating to the switches, LEDs, and edit potentiometers. For the switches, the microcontroller selects one column of the switch matrix at a time by loading the latch U8 appropriately, and then reads the data at its input port 1 bits 5 through 7 (which have internal pull-up resistors). The micro then selects the next column, until all switches have been checked. The LEDs are also arranged as a matrix, and are multiplexed by the microprocessor. U18 is used to connect one column of LEDs to ground at a time, and U17 is used to latch that column's LEDs on or off. The micro varies the amount of time an LED is turned on in order to control the brightness of the LEDs next to the six edit pots. The signal labeled LED connected to R67 and C49 is used by the micro to change the amount of current driving the LEDs to further control the level of the variable brightness LEDs. The six edit potentiometers are connected to an 11 input, 8-bit ADC (U7). The micro can read the 8-bit digital values of the pots serially by selecting this chip and clocking out its data. The remaining inputs of U17 are used for the two variable pedal inputs, the remote footswitches, sensing A/D clipping, and for sensing whether or not anything is plugged into either of the pedal inputs or the headphone output. The two pedal inputs are designed to work with 9K ohm linear potentiometers.

Reset Circuit

On the Processor board, zener diode D57 is used to monitor the +8VDC supply voltage (which is used by U3 on the Power board to generate +5VDC). If this voltage drops below 7 volts, transistor Q3 will turn off, causing transistor Q4 to turn on, which will cause inverter U10D to reset the microcontroller. This signal is inverted again at U10E and is used to reset the ADC digital filter U3 and LED latch U16. The DAC and the DSPs are reset by the microcontroller software via the signal PRESN, which will be low upon power up since the micro's port outputs are set high when the micro is reset.

Accessing the test routines

Press and hold the STORE SOUND button while turning power on until the display reads “SrA” to access the internal test routines. Different tests can be selected by using the BANK UP or BANK DOWN buttons. The selected test is started by pressing the TUNER button. The display will then usually show “Err” (error) or “PAS” (pass) to indicate the test status. The nine tests are:

#	Display	Name	Description	Result Display
1.	SrA	SRAM test	Tests SRAM (U15)	Err or PAS
2.	EPr	EPROM test	Tests EPROM (U14)	Err or PAS
3.	LEd	LED test	Lights all LEDs	no result; visual inspection
4.	bAt	Battery test	Tests SRAM retention	Err or PAS
5.	bUt	Button test	Tests buttons & pots	Displays button or pot name
6.	PEd	Pedal test	[only at factory]	Err
7.	AC	AC timer test	Tests AC freq counter	Err or PAS
8.	idi	MIDI test	Tests MIDI in & out	Err or PAS
9.	Aud	Audio test	Passes audio with delay	Err or blank
10.	AdA	A/D/A path test	Tests audio THD, etc.	Err or PAS (version 1.05)

Power off then on to exit the test routines.

Descriptions of Test Routines

SrA The SRAM test performs read and write cycles to all memory locations of the SRAM. If the data read back is different than what was written, the display will show Err. If this occurs, check all signals connected to U15.

EPr The EPROM test calculates the checksum of the EPROM and compares it with the checksum stored in the EPROM. If it does not match, the display will show Err. If this occurs, it usually indicates that there is some erroneous data in the EPROM (or a missing checksum), and the EPROM should be replaced (U14). It could also be caused by a problem on an upper address line connected to the EPROM. However, in general, major problems with the EPROM or the address and data lines are likely to prevent any of the test routines to be entered in the first place.

LEd The LED test can be used to check that all LEDs are functioning properly. First, all LEDs will turn on at the same time. Then, the software will cycle each LED on and off one at a time. When the six LEDs next to the edit potentiometers are cycled, they will be lit at half brightness. NOTE: When entering this test, holding TUNER will cause all of the LEDs to stay on until the button is released.

bAt The battery test actually is testing the SRAM’s contents, which can be an indicator as to the battery status. It checks to see if a specific set of SRAM locations contain specific data. This data is loaded in once at the factory, and it is assumed that if the data remains unchanged in the field, the battery is working properly. If an error occurs, it will be necessary to check the battery, the SRAM, and the reset circuitry. Once an error has occurred, it will continue to reoccur until the specific data is written back to the SRAM. This can be performed from within this test routine by pressing and holding the SOUND D button and the USER/PRESET button. The display will show "---" to indicate that the SRAM has been initialized.

bUt The button test can be used to check that each button and edit potentiometer is working properly. Pressing each button will cause the name of that button to be displayed. The display will show as follows:

Button	Display
no button	"---"
User/Preset	"U-P"
Sound Bank Up	"UP "
Sound Bank Down	"Dn "
Sound A	" A "
Sound B	" b "
Sound C	" C "
Sound D	" d "
Tuner	"tnr"
Compare	"CPr"
Store Sound	"Str"
Function 1	"Fn1"
Function 2	"Fn2"
Function 3	"Fn3"
Function 4	"Fn4"
Function 5	"Fn5"
Function 6	"Fn6"

The function buttons are the small black buttons to the left of the edit matrix. The top button is 1 and bottom button is 6. When any of the six edit potentiometers are turned, the display should read "P1" through "P6", depending on which pot was turned. This test can be exited by pressing the function 5 and function 6 buttons at the same time. This is indicated by the LEDs next to each of these switches being lit.

PEd The sixth test is performed on a test fixture at the factory to verify that the pedal inputs are working. Without the test fixture, this test will always result in an "Err". For this reason, this test should always be skipped. The pedal inputs can be easily tested by performing a functional test to see that the wah and volume functions are being controlled by the pedals. If the pedal inputs do not work, try checking that the voltages reach the ADC (U7), and that the switch in each jack is working properly. This switch lets the micro know that something is plugged in, and is sensed by checking the ADC voltage at U7 pin 11 and comparing it to the table shown in the Power PCB schematic.

AC The AC verifies that the micro can properly determine the current AC line frequency. It expects to find 50Hz or 60Hz, and will display an "Err" if the results are different. If this occurs, check the Power PCB signal labeled AC, as well as R38 and Q1 on the Processor board.

idi The MIDI requires that a MIDI cable be connected from the MIDI output back to the MIDI input. Without this cable, this test will always fail. If the test fails with the cable, check the connection first, then check U4 on the Power board, and then check for the serial interface signals at the microcontroller U9 pins 11 and 13 and follow the signal path through to the MIDI connectors.

AUd The Audio takes the Guitar input and passes it unmodified to the left speaker, and takes the Aux input and passes it unmodified to the right speaker. It also adds a 1 second delayed signal to each of these signals in order to verify that the audio DRAM (U13) is functioning properly. The audio passes through both DSPs, so this test checks their functionality as well. The display should be blank during this test. If the display reads “rd1 or “rd2” followed by “Err”, this means that an error occurred when the micro tried to read data from either DSP. If the error was “rd1”, then the problem was between the micro (U9) and the DSP U19. If the error was “rd2”, then the problem was between the micro and DSP U12.

AdA The speaker outputs must be connected to the aux and guitar inputs. The left speaker output should be connected to the guitar input, and the right speaker output should be connected to the aux input. Since the speaker outputs are too high a level for the inputs, a pad must be used. Each speaker output should pass through a 30K resistor, followed by a 1K resistor to ground prior to connecting to the input. The Guitar and Aux input level knobs should be set to 5 (pointing straight up), and the Master volume knob should be at 0 (off). When this test is first entered, the display will read “OFF”, to inform you that the Master volume should be off. Press the Tuner button. The software will output a 1KHz sine wave on both outputs, and verify that no signal is coming in (since the Master is off). During this test, a dot will appear to indicate the test is running (display reads “OFF.”). If signal is received, the display will show “Err”, followed by one of the following:

n L	Noise present on left input
n r	Noise present on right input
nLr	Noise present on left and right inputs
A L	1K Hz Audio tone present at left input
A r	1K Hz Audio tone present at right input
ALr	1K Hz Audio tone present at left and right inputs

If there are no errors, the display will momentarily show “PAS”, followed by “HLF”. This stands for “half”, and indicates that the Master volume should now be turned up half way, or 5 (pointing straight up). Pressing Tuner again will initiate the next tests, and cause a dot to be displayed again. The software will then check the level, frequency response, and distortion of both inputs and outputs. It performs this test by outputting a sine wave at 40Hz, 1KHz, and then 10KHz, and measuring the absolute input level, the relative input level, and the level of signal at frequencies other than the tone being generated. If there is an error, the display will show “Err”, followed by one of the following alternating messages:

Ldt	XX	Left distortion too high by XX dB.
rdt	XX	Right distortion too high by XX dB.
L40	±XX	Left amplitude error at 40Hz of ±XX dB.
L 1	±XX	Left amplitude error at 1KHz of ±XX dB.
L10	±XX	Left amplitude error at 10KHz of ±XX dB.
L A	±XX	Left amplitude error of ±XX dB.
r40	±XX	Right amplitude error at 40Hz of ±XX dB.
r 1	±XX	Right amplitude error at 1KHz of ±XX dB.
r10	±XX	Right amplitude error at 10KHz of ±XX dB.
r A	±XX	Right amplitude error of ±XX dB.
L-r		Left signal crosstalk into the right input.
r-L		Right signal crosstalk into the left input.

The relative amplitude of the three tones are used to determine the frequency response. If any one tone is more than 1dB from the relative volume of the other tones, it will be displayed as an error. If all three tones are more than 1dB apart from each other, the one that is the furthest away from the other two will be displayed. If the amplitude of all

three tones are within 1dB of each other, the average is taken and compared with an absolute level that is expected when all knobs are at 5. If this absolute amplitude has an error of ±2dB or more, the display will show the error amount. When measuring the level of each tone, the software will also measure the level after passing the signal through a steep notch filter set to the same frequency as the tone. If the level after the filter is greater than a predetermined level, the display will show the number of dB above this level that the distortion exists. If when performing the tests on the left input, signal is received in the right, or vice versa, the display will show this as a crosstalk error.
If there are no errors, the display will momentarily show "PAS", followed by "FUL". This indicates that the Master volume should now be turned up all the way to 10. Pressing Tuner again will initiate the next tests, and display a dot. The software will again check the level, frequency response, and distortion of both inputs and outputs, and will display "PAS" or any of the above mentioned error displays. The tests are identical, except that the software's output level is dropped 6dB to accommodate for the increase in Master volume level. If an error occurs only during the half way up test and not the full test, or vice versa, the Master stereo pot or its connections should be considered the likely source of the problem.

Troubleshooting

For technicians familiar with component level troubleshooting and surface mount components, the test routines, the circuit descriptions and the schematic diagrams should be useful tools in focusing in on the problem. If the problem cannot be specifically located, an attempt should be made to identify which board is the source of the problem. At that point, a board swap would be the most likely solution.

Software history

All AxSys 212s starting from serial number A1-009160 were shipped with version 1.05 software. AxSys 212s that are serviced that do not have version 1.05 should be updated to 1.05 (or above, if new releases occur). AxSys 212s starting from serial number A1-005701 through A1-009159 were shipped with version 1.04 software. Of the first 700 AxSys 212s built (serial numbers A1-005001 through A1-005700), approximately the first 25 units contained version 1.00, the next 50 units contained 1.01, the next 100 units contained version 1.02, and the remainder contained 1.03. These updates took care of a few rare bugs that could result in the amp freezing until it is turned off and on, and some other minor changes. The change to 1.04 or higher also includes some new user features (such as the main global controls), so if an update is performed, be sure to provide the user with the manual addendum sheet included with the EPROM update. The specific changes implemented in version 1.05 are listed in ECO #19.

Revision history and ECOs

The first 500 amps were shipped with revision A Processor boards. The current revision of the Processor board is rev C (rev B never existed). ECOs 1 and 2 have been performed on all production units. The capacitor in ECO 2 was attached on top of the rev A boards, and has been added to the PCB layout in rev C.

ECO 3 provides additional mechanical support for the transformer, and has been included in all units after A1-005833. This change should only be required of units prior to A1-006736 that may be subject to strong shipping handling. It helps prevent the transformer from bending the rear metal of the head.

The value changes of ECO 4 and ECO 5 have been implemented starting with A1-005701. These changes should be performed on earlier units on an as needed basis. ECO 4 will increase the amplitude of the amp by 12dB. ECO 5 will reduce the thump that occurs when turning the power off.

ECO 6 changes the model number of the power amp devices. This change started at amp A1-006318. This change should only be required for customers having problems when connecting the AxSys 212 to external speakers. If this change is implemented, two jumpers will be required as described in the ECO.

ECO 7 has been implemented starting with A1-005998. It should only be necessary on amplifiers prior to this if they are exhibiting noise on the aux input. This can be determined by turning the Aux Input Mix parameter all the way down and listening if the noise is turned down as well.

ECO 8 has been implemented starting with A1-008646. It changes the Power board rev from B to C. This change simply incorporates the two jumpers required by ECO 6 onto the printed circuit board.

ECO 9 has been implemented starting with A1-007252. It adds a steel plate behind the transformer, reducing the chance of the rear panel bending in extreme shipping handling.

ECO 10 has been implemented starting with A1-006736. It is a revision of the metal work, which eliminates the need for the bracket in ECO 3.

ECOs 11 through 14 reflect minor wood cabinet changes that began with A1-006495.

ECO 15 has been implemented starting with A1-007448. It adds an extra grounding wire for better U.L. compliance. It does not affect the audio or any circuitry.

ECOs 16 and 17 have been implemented starting with A1-007719. ECO 16 describes the change from a dual primary transformer for 110V/220V, to two separate transformers depending on input voltage at the destination. ECO 17 adds a gasket to the transformer mount to reduce vibration.

ECO 18 has been implemented starting with A1-009142. It replaces two capacitors on the rear board so as to increase the power amplifier’s high frequency response.

ECO 19 has been implemented starting with A1-009160. It lists the changes with software version 1.05.

LINE 6

Engineering Change Order

ECO #: 1

Units in stock ☒

Units in field ☒

Product Affected: AxSys 212

Effective date: Aug 22 1996

Ordered by: Michel Doidic

Authorized by: Michel Doidic

Reason for change:

The Headphone / Direct output resistor value are too small and they can be overpowered by the power amplifier when one of the channel is grounded (i.e. when a mono jack is used on the Headphone / Direct output).

Change Implementation:

Replace R13 and R14 on the rear board with 820Ω 1/2 Watt 5% carbon resistors (original value was 51Ω 1/4W 5% Carbon)

Notes:

Delete two 51Ω 1/4W 5% Carbon resistors from part list, and add two 820Ω 1/2 Watt 5% carbon resistors.

Enough 820Ω 1/2 Watt 5% carbon resistors have already been ordered for updating the assembled boards currently in stock.

LINE 6

Engineering Change Order

ECO #: 2

Product Affected: AxSys 212

Effective date: Aug 28 1996

Units in stock ☒

Units in field ☒

Ordered by: Michel Doidic

Authorized by: Michel Doidic

Reason for change:

Under some temperature conditions, and for sounds using large drive gain, "pop corn" clicks are sometime generated in the ADC input circuitry. Typically these clicks are more frequent when the input level potentiometer is set at a low level.

Change Implementation:

Add a 0.1µF capacitor between pin 14 of U1 and AGND on the main board.
For practical implementation the cap can be added between pin 1 of the Guitar input potentiometer (= pin 14 of U1) and the ground side of 28 (= AGND)

Notes:

Add a **through hole** 0.1µF, 25V Min ,20% Max, capacitor to the main PCB part list (FFD part # 03-36-0104 is fine).

LINE 6

Engineering Change Order

ECO #: 3 | Date: Oct / 21 /96

Units in stock ☒

Units in field ☐

Product Affected: AxSys 212

Effective date: As soon as brackets are available

Ordered by: Michel Doidic

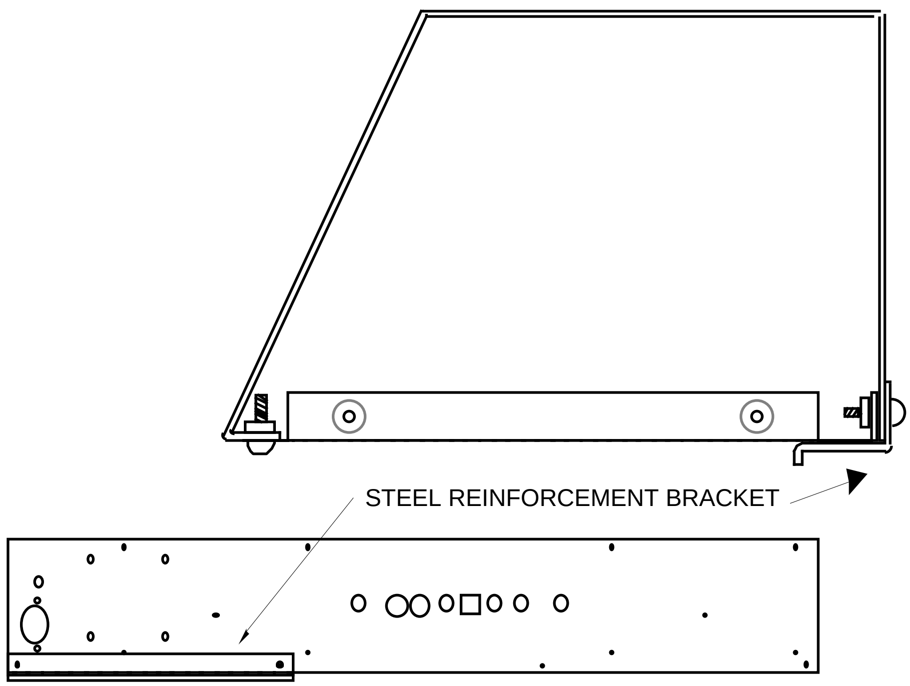
Authorized by: Michel Doidic

Reason for change:

Under rough handling, the metal work may bend in the power transformer area.

Change Implementation:

A reinforcement bracket is installed on the left side of the back panel. The braket is mounted using the two left most screws.



BACK PANEL VIEW

Notes:

The bracket is specified in the drawing " Axsys 212 REINFORCEMENT BRACKET" dated Oct / 21 /96.

LINE 6

Engineering Change Order

ECO #: 4

Date: Oct / 29 /96

Future Units ☒
Units in stock ☐
Units in field ☐

Product Affected: AxSys 212

Effective date: Starts with next kit

Ordered by: Michel Doidic

Authorized by: Michel Doidic

Reason for change:

Increase maxinum audio power

Change Implementation:

On the main board, R20 and R22 and changed from 1K to 150Ω.

Notes:

- Delete two 01-04-0102 from original part list
- Add two Surface mount, type 1206 Thick film chip, 150Ω

LINE 6

Engineering Change Order

ECO #: 5

Date: Oct / 29 /96

Future Units ☒
Units in stock ☐
Units in field ☐

Product Affected: AxSys 212

Effective date: Starts with next kit

Ordered by: Michel Doidic

Authorized by: Michel Doidic

Reason for change:

Remove power off audio thump.

Change Implementation:

On the rear board, C18 is changed from 470µF to 1000µF.

Notes:

- Delete 03-12-0477 from original part list
- Add one Capacitor, 1000µF,16V min 20% max, Through hole, Lead spacing = 200 mI , Radial, Electrolitic type

LINE 6 Engineering Change Order

ECO #: 6 | Date: Dec 9, 1996

Future Units ☒
Units in stock ☐
Units in field ☐

Product Affected: AxSys 212

Effective date: Starts with next kit

Ordered by: Marcus Ryle

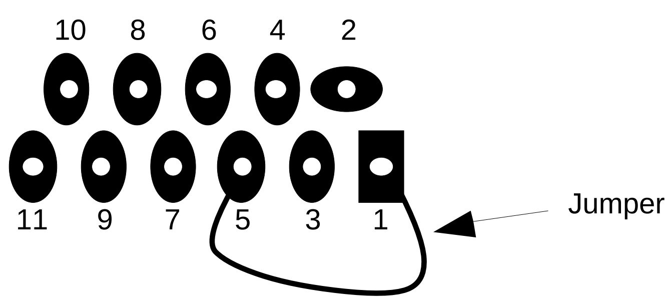
Authorized by: Marcus Ryle

Reason for change:

To reduce the chance of the power amp device distorting the output at loud volumes when connected to different speakers (due to the current limiting protection of the amp).

Change Implementation:

On the rear board, replace power amp I.C.s U1 and U2 (currently National LM3876, our part number 12-30-3876) with National LM3886 (part number 12-30-3886). If the printed circuit board is revision A or B, two jumpers need to be added when performing this change: Pin 1 of each LM3886 should be jumpered to pin 5 on the bottom of the board. A minimum of 26 guage solid core wire should be used. Revision C rear boards include this connection, so the jumpers aren't necessary.



Pin out of U1 and U2 from underside of printed circuit board

Notes:

- Delete two pieces of 12-30-3876 from original part list, add two 12-30-3886

LINE 6

Engineering Change Order

ECO #: 7

Date: Nov 27, 1996

Product Affected: AxSys 212

Future Units ☒
Units in stock ☒
Units in field ☐

Effective date: Nov 27, 96

Ordered by: Curtis Senffner

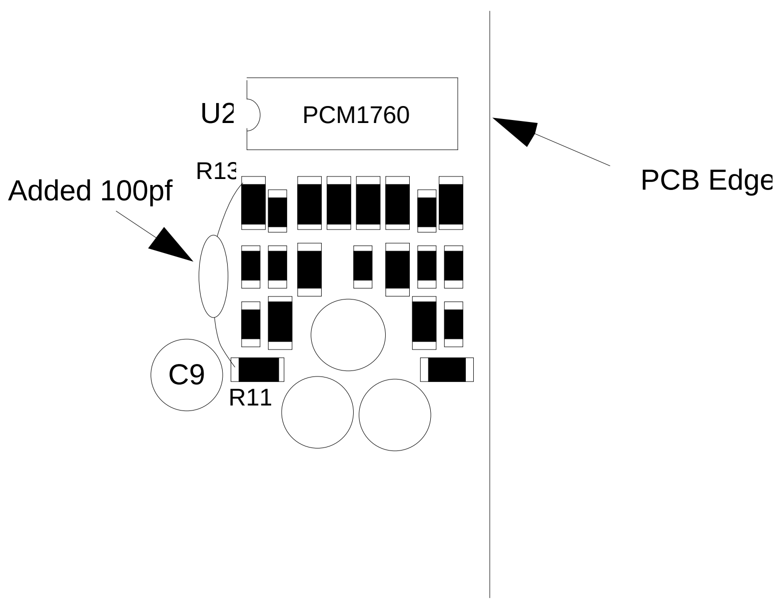
Authorized by: Michel Doidic

Reason for change:

To avoid AUX channel ADC to become noisy upon some power on sequence.

Change Implementation:

Add a 100pF between pin 1 and 2 of ADC (U2). For practical implementation the cap should be added between R13 and R11 as shown below:



Notes:

- Add a 100pf through hole capacitor to part list (new part)
like DigiKey part #: P4024A-ND or Panasonic ECC-F1H101J
- Part parameters: 100 pf, +/-10% max, 50V min

LINE 6

Engineering Change Order

ECO #:	8	Date:	Dec 2, 1996
Product Affected:	AxSys 212		
Effective date:	Starts with next kit	Ordered by:	Marcus Ryle
		Authorized by:	Marcus Ryle

- [x] Future Units
- [ ] Units in stock
- [ ] Units in field

Reason for change:

To eliminate two jumpers on rear board required by ECO #6, which changed the power amp I.C.s U1 and U2 from National LM3876 to National LM3886. Jumpers were placed from pin 1 to pin 5 of U1 and U2, respectively.

Change Implementation:

Rear board part number 35-00-0011 changed from revision B to revision C.

Notes:

LINE 6

Engineering Change Order

ECO #: 9

Date: Dec / 20 /96

Future Units ☒
Units in stock ☐
Units in field ☐

Product Affected: AxSys 212

Effective date: As soon as plates are available

Ordered by: Michel Doidic

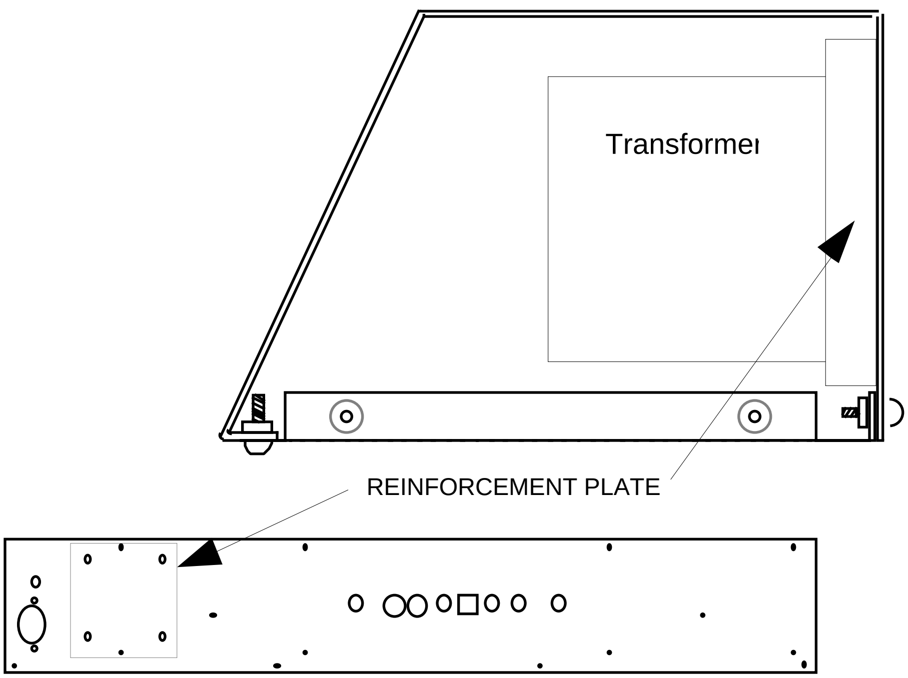
Authorized by: Michel Doidic

Reason for change:

Under rough handling, the metal work may bend in the power transformer area.

Change Implementation:

A reinforcement plate is installed between the transformer and the metal work. No additional screws are required.



BACK PANEL VIEW

Notes:

The bracket is specified in the drawing " Axsys 212 Transformer Plate" dated Dec / 19 /96.

LINE 6

Engineering Change Order

ECO #: 10

Date: Dec 20, 1996

Future Units ☒
Units in stock ☐
Units in field ☐

Product Affected: AxSys 212

Effective date:

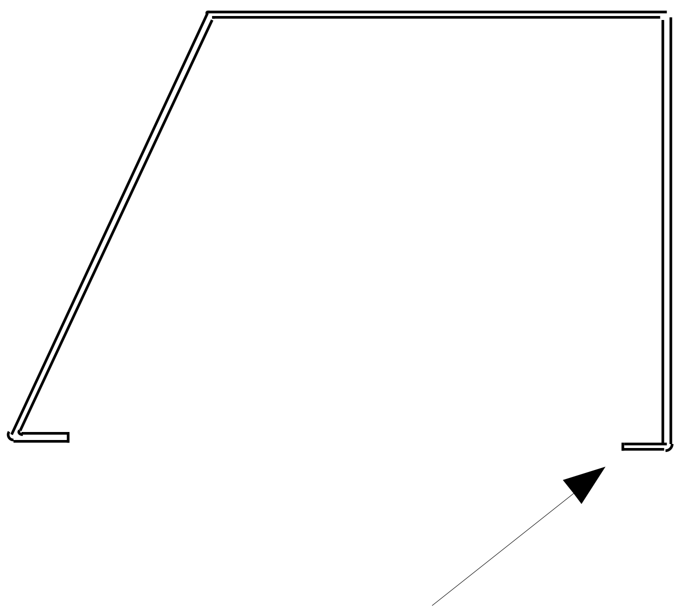
Ordered by: Michel Doidic

Authorized by: Michel Doidic

Reason for change:

The bracket added in ECO # 3 is no longer needed with metal work revision which includes the extra bend at the bottom of the top metal work piece (see drawing below)

Change Implementation:



If this bend is present the bracket of ECO #3 is not required.

Notes:

LINE 6

Engineering Change Order

ECO #:	11	Date:	Dec / 23 /96
Product Affected:	AxSys 212		
Effective date:	As soon as wood is available		
Ordered by:	Michel Doidic	Authorized by:	Michel Doidic

Future Units ☒
Units in stock ☐
Units in field ☐

Reason for change:

Increase strength of speaker board wood panel.

Change Implementation:

The diameter of the speaker cut out on the speaker panel board has been reduced from 10.75 " to 10.375".

Notes:

LINE 6

Engineering Change Order

ECO #: 12

Date: Dec / 23 /96

Future Units ☒
Units in stock ☐
Units in field ☐

Product Affected: AxSys 212

Effective date: As soon as T nuts are available

Ordered by: Michel Doidic

Authorized by: Michel Doidic

Reason for change:

Increase strength of speaker board wood panel.

Change Implementation:

The speaker T nuts mounted on the speaker panel are now 1-1/4 " diameter instead of 0.7". The T nut's new part number is 30-06-2454. The 1-1/4 T nut can only be used with the new speaker panel described in ECO # 11.
If necessary, the original 0.7 " T nut can be used with the new speaker panel (described in ECO #11)

Notes:

Delete 8 part # 30-06-1024 and add 8 part # 30-06-2454 to part list.

LINE 6

Engineering Change Order

ECO #: 13

Date: Jan / 9 /96

Future Units ☒
Units in stock ☐
Units in field ☐

Product Affected: AxSys 212

Effective date: As soon as new wood is available

Ordered by: Michel Doidic

Authorized by: Michel Doidic

Reason for change:

Avoid high reject of back panel wood because of excessive warping.

Change Implementation:

The back panel board is now made of 1/4" Baltic Plywood instead of Luan.

Notes:

LINE 6

Engineering Change Order

ECO #: 14

Date: Jan / 27 /96

Future Units ☒
Units in stock ☐
Units in field ☐

Product Affected: AxSys 212

Effective date: As soon as new wood is available

Ordered by: Michel Doidic

Authorized by: Michel Doidic

Reason for change:

Ease box width tolerance requirement

Change Implementation:

The width of the wooden box has been increased by 1 millimeter. Also the width of all Dado have been increased by 0.5 millimeter.

Notes:

LINE 6

Engineering Change Order

ECO #: 15 Date: Jan 29, 1997

Future Units ☒
Units in stock ☐
Units in field ☐

Product Affected: AxSys 212

Effective date: When components are available

Ordered by: Michel Doidic

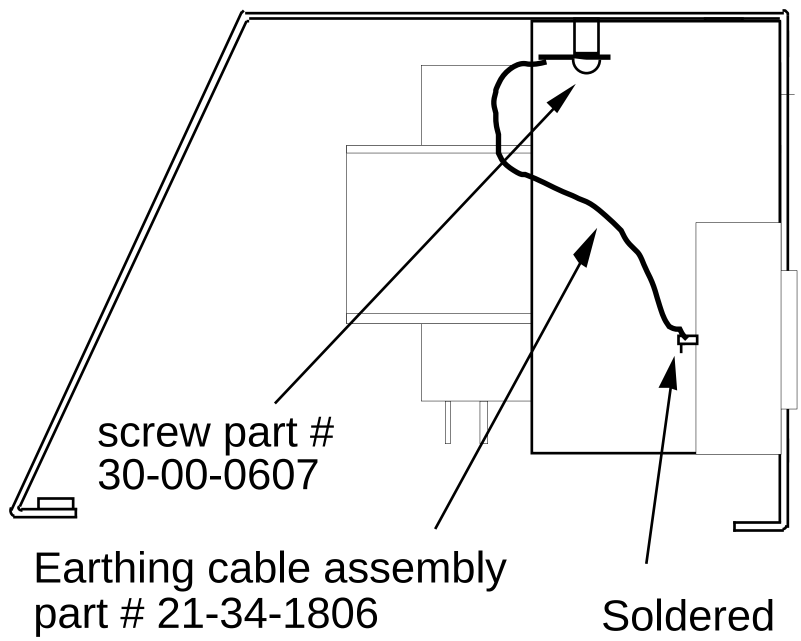
Authorized by: Michel Doidic

Reason for change:

Better UL compliance.

Change Implementation:

A ground wire is added between the AC receptacle ground lug and a stand off on the metal work top piece. This can be implemented only with the new metal work top described in ECO #10.



Notes:

- Add a screw part number 30-00-0607 and a Earthing Cable Assembly part number 21-34-1806 to part list.
- Notify board assembly house to add Earthing Cable to back PCB.

LINE 6

Engineering Change Order

ECO #: 16

Date: March 3, 1997

Future Units ☒
Units in stock ☐
Units in field ☐

Product Affected: AxSys 212

Effective date: When components are available

Ordered by: Michel Doidic

Authorized by: Michel Doidic

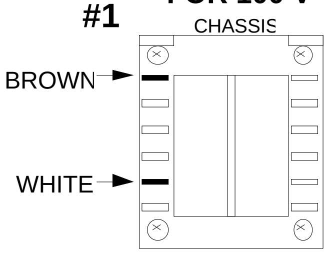
Reason for change:

Relieve stress on power amplifier when speaker are unplugged and AC line voltage is high.

Change Implementation:

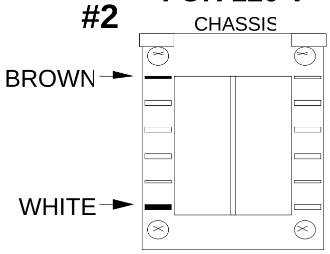
Three versions of the AC transformer are now available:
100/120 V: MCI part number = 4-49-8607
220/240 V: MCI part number = 4-49-8609
220 V: MCI part number = 4-49-8604 (this is the original 110/220 part)
The wiring for each case is as follows:

#1 **FOR 100 V**



4-49-860**7**

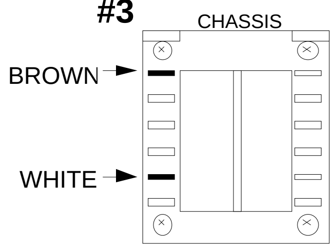
#2 **FOR 120 V**



4-49-860**7**

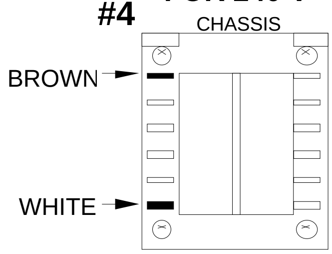
The BLACK and GRAY wires are removed from the AC input PCB

#3 **FOR 220 V**



4-49-860**9**

#4 **FOR 240 V**

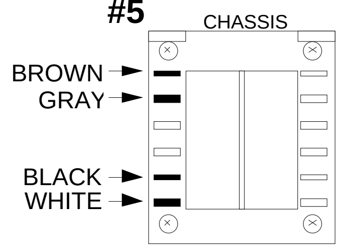


4-49-860**9**

The BLACK and GRAY wires are removed from the AC input PCB

This configurations will be used for 100 V and 220 V until all 4-49-8604 transformers in stock have been used up. We will then use configuration # 1 for 100V and #3 for 220V

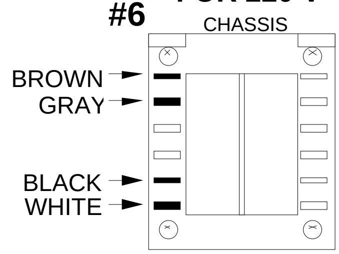
#5 **FOR 100V**



4-49-860**4**

The AC input board is wired for 120 V

#6 **FOR 220 V**



4-49-860**4**

The AC input board is wired for 220 V

Notes:

1)-Consult country AC guide to determine the required voltage for shipping destination.
2)-The AC sticker will have to specify 100 V, 120 V, 220V, or 240 V.

LINE 6

Engineering Change Order

ECO #: 17 | Date: March 3, 1997

Product Affected: AxSys 212

Future Units ☒
Units in stock ☐
Units in field ☐

Effective date: When gasket is available

Ordered by: Michel Doidic

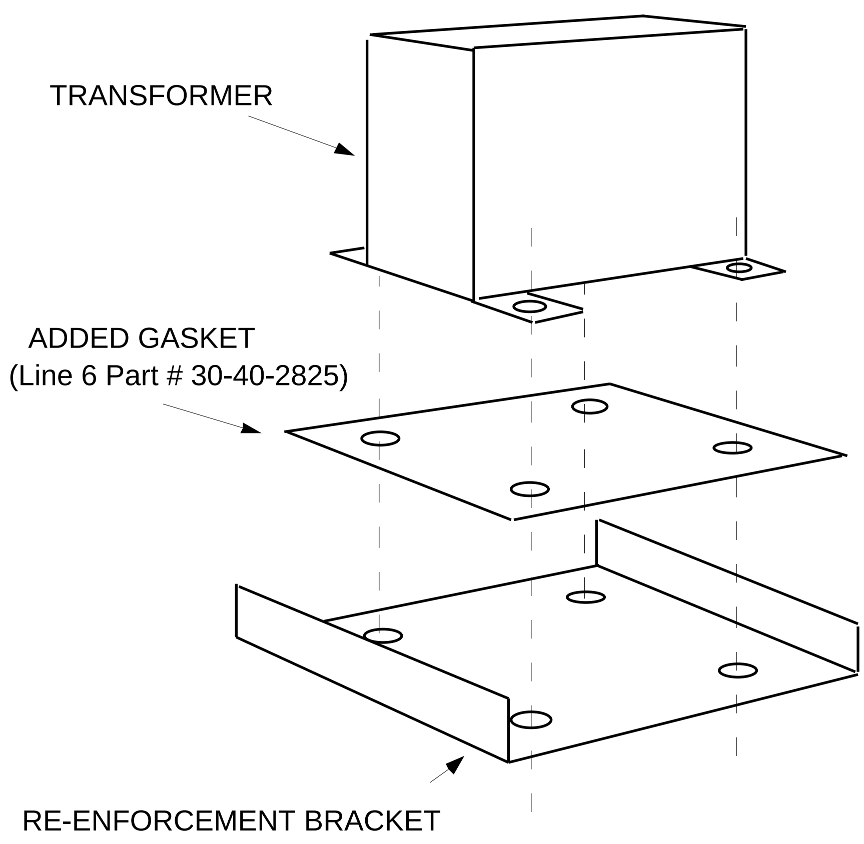
Authorized by: Michel Doidic

Reason for change:

Avoid AC induced vibrations between the AC transformer body and the Steel re-enforcement bracket

Change Implementation:

ADD GASKET BETWEEN STEEL RE-ENFORCEMENT BRACKET AND TRANSFORMER



Notes:

LINE 6

Engineering Change Order

ECO #: 18

Date: April, 29, 1997

Future Units ☒
Units in stock ☒
Units in field ☐

Product Affected: AxSys 212

Effective date: ASAP

Ordered by: Eric Brooking

Authorized by: Michel Doidic

Reason for change:

To increase high frequency response.

Change Implementation:

-Change C7 and C14 on back PCB from 680 pF to 68 pF ceramic disk, 50 V minimum, +/-20% minimum, 0.25 inch lead spacing, such as Philips part # D680J25 COGHAAAC

Notes:

LINE 6

Engineering Change Order

ECO #:	19
Date:	May 9th, 1997
Product Affected:	AxSys 212
Effective date:	May 12th, 1997
Ordered by:	Curtis Senffner
Authorized by:	Michel Doidic

- [x] Future Units
- [ ] Units in stock
- [ ] Units in field

Reason for change:

Add features and improve Floor Board operation

Change Implementation:

Replace EPROM at location U14 with version 1.05, checksum 2D9BH.

Notes:

Changes from version 1.04 to 1.05:

1.The TubeTone models have been refined to add clarity and more high frequency response.

2.When holding the bank button on the Floor Board, the Sound Bank number will scroll faster.

3.The Floor Board display will now be initialized immediately when the AxSys 212 is turned on, and will power up in program change mode instead of effects mode.

4.When the wah pedal modulation is routed to a graphic EQ band, or the bass, mid, or treble controls, the pedal will now control the EQ from its current setting when in the heel down position (instead of the center) and increase the value as the pedal is moved to the toe position.

5.Repeating delays now continue to sound if the delay effect is turned off on the Floor Board.

6.Program changes between 4 programs can now be achieved with a momentary normally open footswitch. The footswitch must be plugged into the Pedal 2 input (Wah) prior to turning on the AxSys 212. Each press of the switch will cause the AxSys 212 to cycle to the next sound of the 4 sounds in the current Sound Bank. After selecting sound D, the next press of the footswitch will select sound A of the same Sound Bank.

7.The Floor Board Wah pedal will now always change to the setting stored with each program when a new program is selected. Previously, the Wah would stay on until a program was selected that had the wah off after selecting a program in which the wah was on.

8.The Wah pedal on/off switch on the Floor Board has been further debounced in software to reduce the possibility of switch bouncing.

9.The acoustic guitar simulator algorithms have been made louder.

10.The presets have been enhanced, and are tailored to work with all Floor Board functions.

LINE 6

Engineering Change Order

ECO #:	21	Date:	8/4/97
Product Affected:	AxSys 212		
Effective date:	8/4/97		

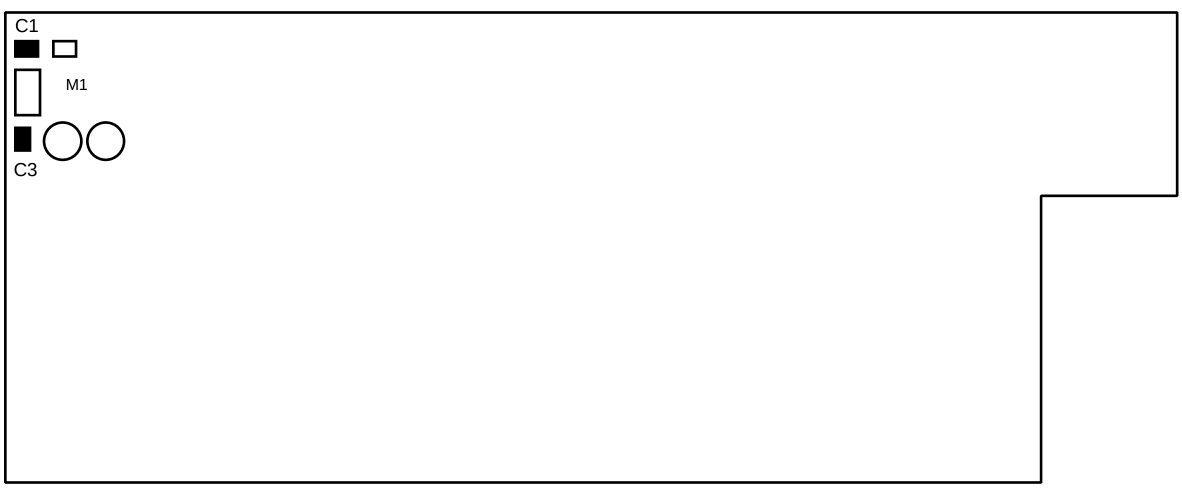
Future Units	X
Units in stock	
Units in field	
Ordered by:	Eric Brooking
Authorized by:	Michel Doidic

Reason for change:

To improve high frequency response when amp is used with high impedance pickups

Change Implementation:

Change C1 and C3 from 1nF to 220 pF, 50V min, 20% Max,0805 package
(Line 6 Part number : 03-52-0221)



Notes:

LINE 6

Engineering Change Order

ECO #: 22 | Date: Jan/2/98

Future Units [x]
Units in stock [ ]
Units in field [ ]

Product Affected: AxSys 212

Effective date: Jan/2/98

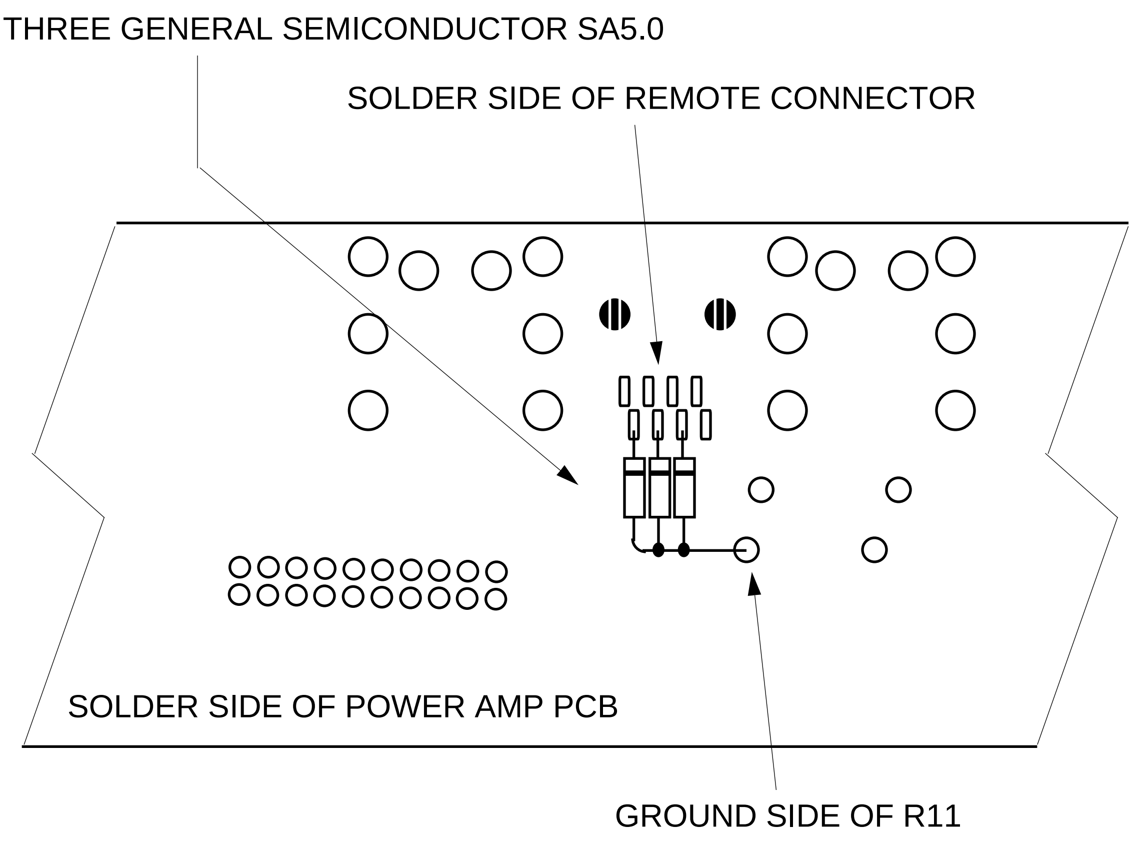
Ordered by: Michel Doidic

Authorized by: Michel Doidic

Reason for change:

To protect remote control connector input from electrostatic discharge

Change Implementation:



Notes:

This ECO will stop being required with REV:D PCB and above

LINE 6

Engineering Change Order

ECO #: 22 / B

Date: Jan/14/98

Future Units [x]

Units in stock [ ]

Units in field [ ]

Product Affected: AxSys 212

Effective date: Jan/14/98

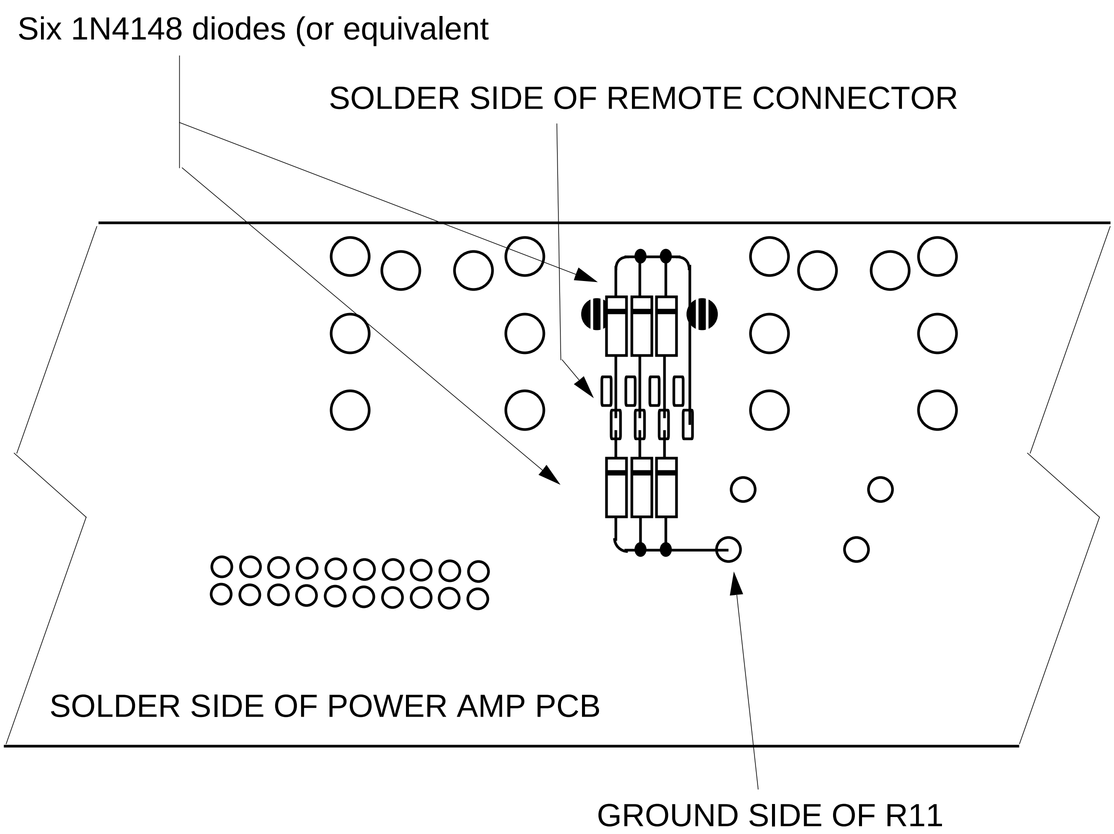
Ordered by: Michel Doidic

Authorized by: Michel Doidic

Reason for change:

To protect remote control connector input from electrostatic discharge
This is an alternate way to implement ECO #22 with 6 standard diodes instead of 3 General Semiconductor SA5.0 surge suppressors. The surge suppressor method is the preferred way for production run.

Change Implementation:



Notes:

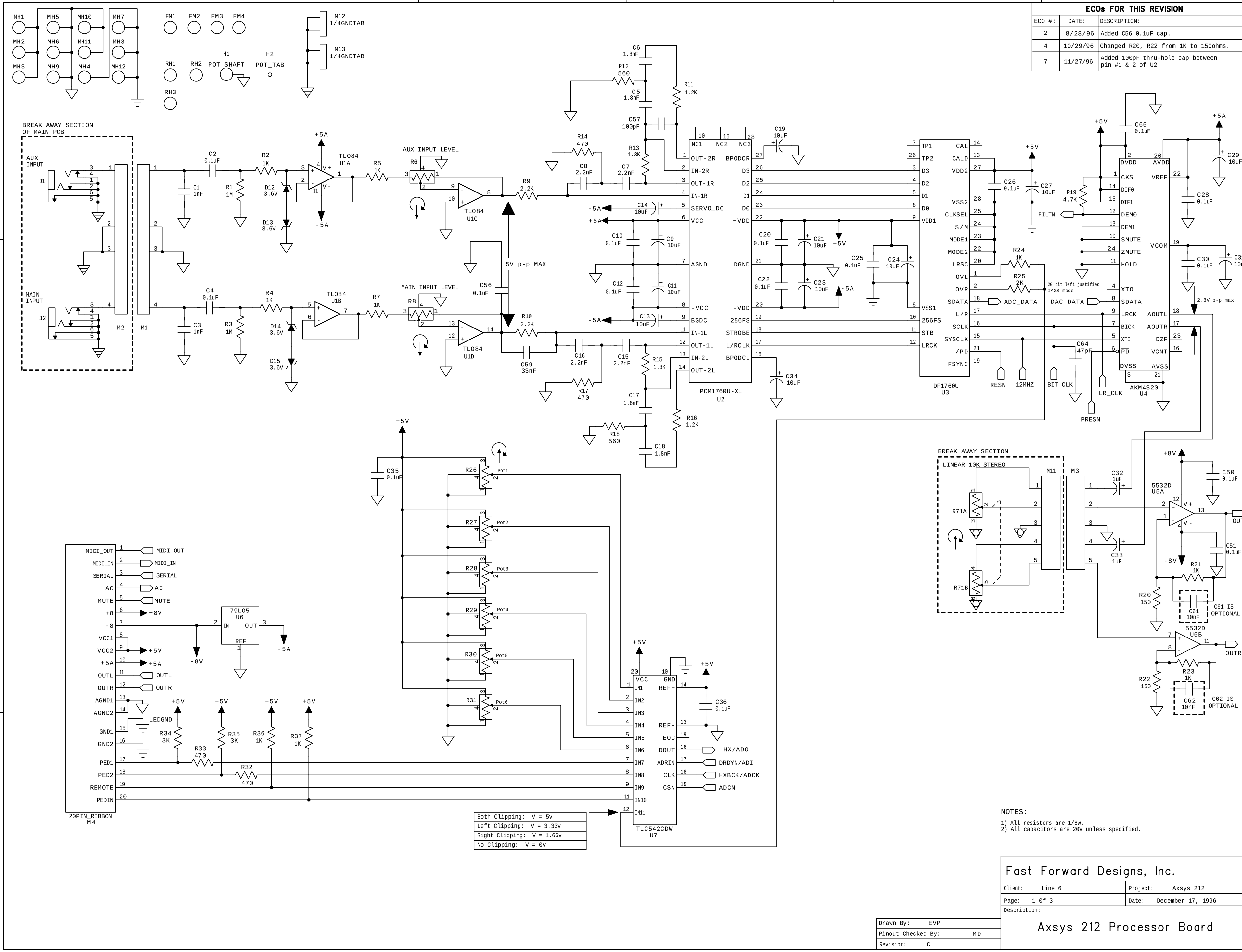
This ECO will stop being required with REV:D PCB and above

Schematics

The schematics consist of three pages for the Processor board revision C, and one page for the Power board revision C. The Processor board schematic includes the break away boards for the input jacks and the master volume control. The Power board schematic includes the break away board for the AC input.

ECOs FOR THIS REVISION

ECO #:	DATE:	DESCRIPTION:
2	8/28/96	Added C56 0.1uF cap.
4	10/29/96	Changed R20, R22 from 1K to 150ohms.
7	11/27/96	Added 100pF thru-hole cap between pin #1 & 2 of U2.



NOTES:

1) All resistors are 1/8w.
2) All capacitors are 20V unless specified.

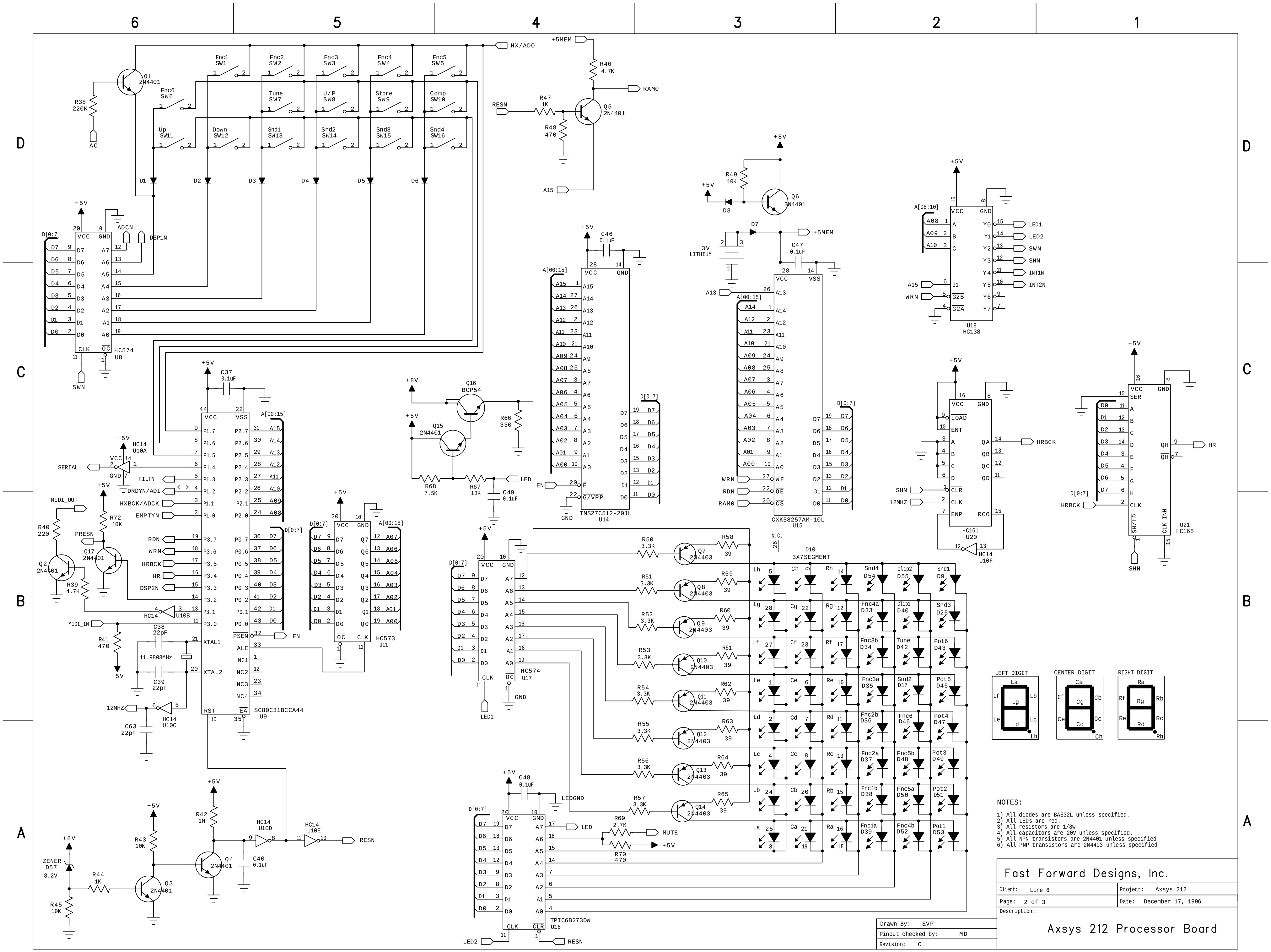
Fast Forward Designs, Inc.

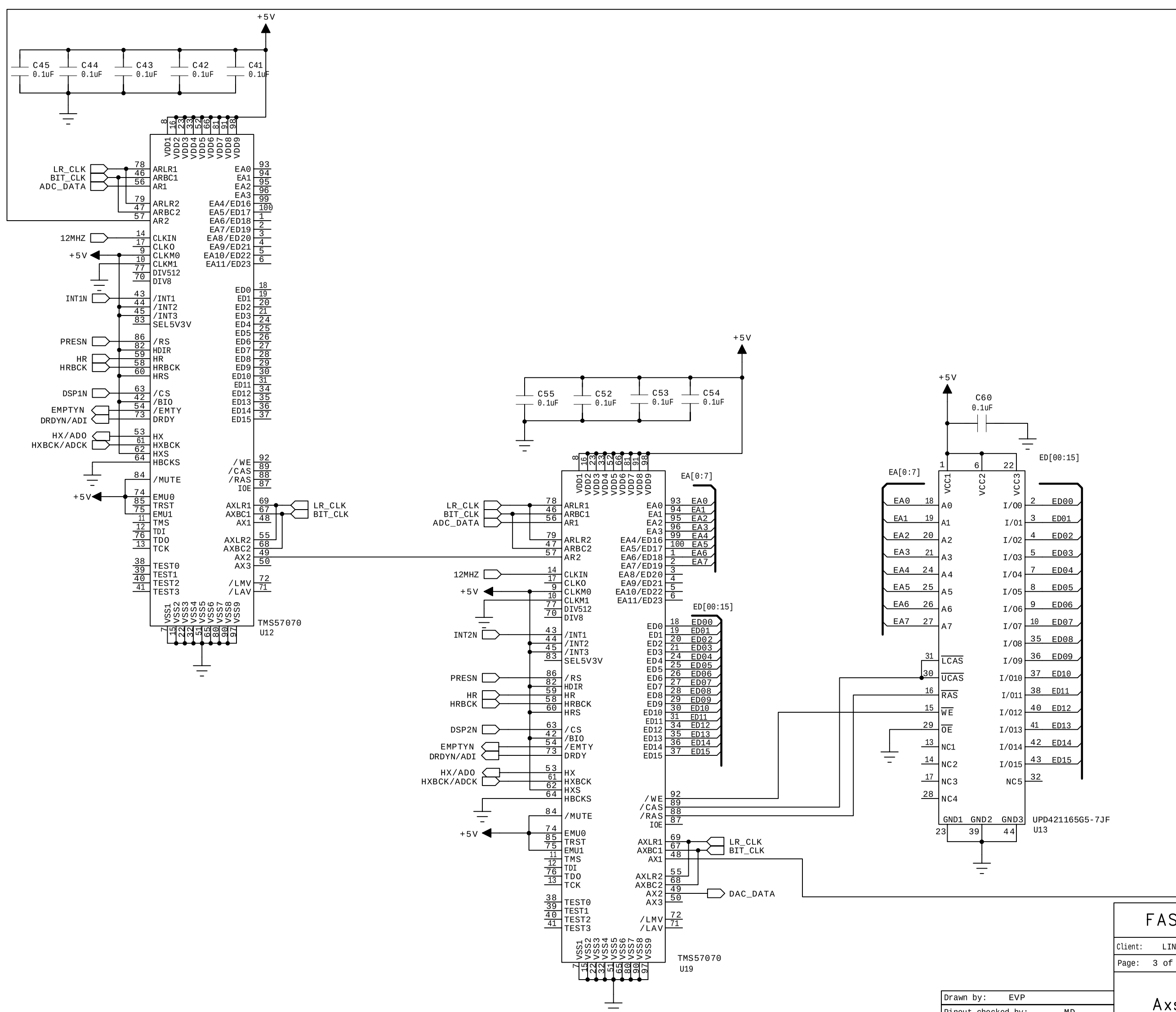
Client:	Line 6	Project:	Axsys 212
Page:	1 of 3	Date:	December 17, 1996

Description:

Axsys 212 Processor Board

Drawn By:	EVP
Pinout Checked By:	MD
Revision:	C


NOTES:
1) All diodes are BAS32L unless specified.
2) All LEDs are red.
3) All resistors are 1/8W.
4) All capacitors are 20V unless specified.
5) All NPN transistors are 2N4401 unless specified.
6) All PNP transistors are 2N4403 unless specified.
LEFT DIGIT
CENTER DIGIT
RIGHT DIGIT
Fast Forward Designs, Inc.
Client: Line 6
Project: Axsys 212
Page: 2 of 3
Date: December 17, 1996
Description:
Axsys 212 Processor Board
Drawn By: EVP
Pinout checked by: MD
Revision: C



FAST FORWARD DESIGNS, INC.

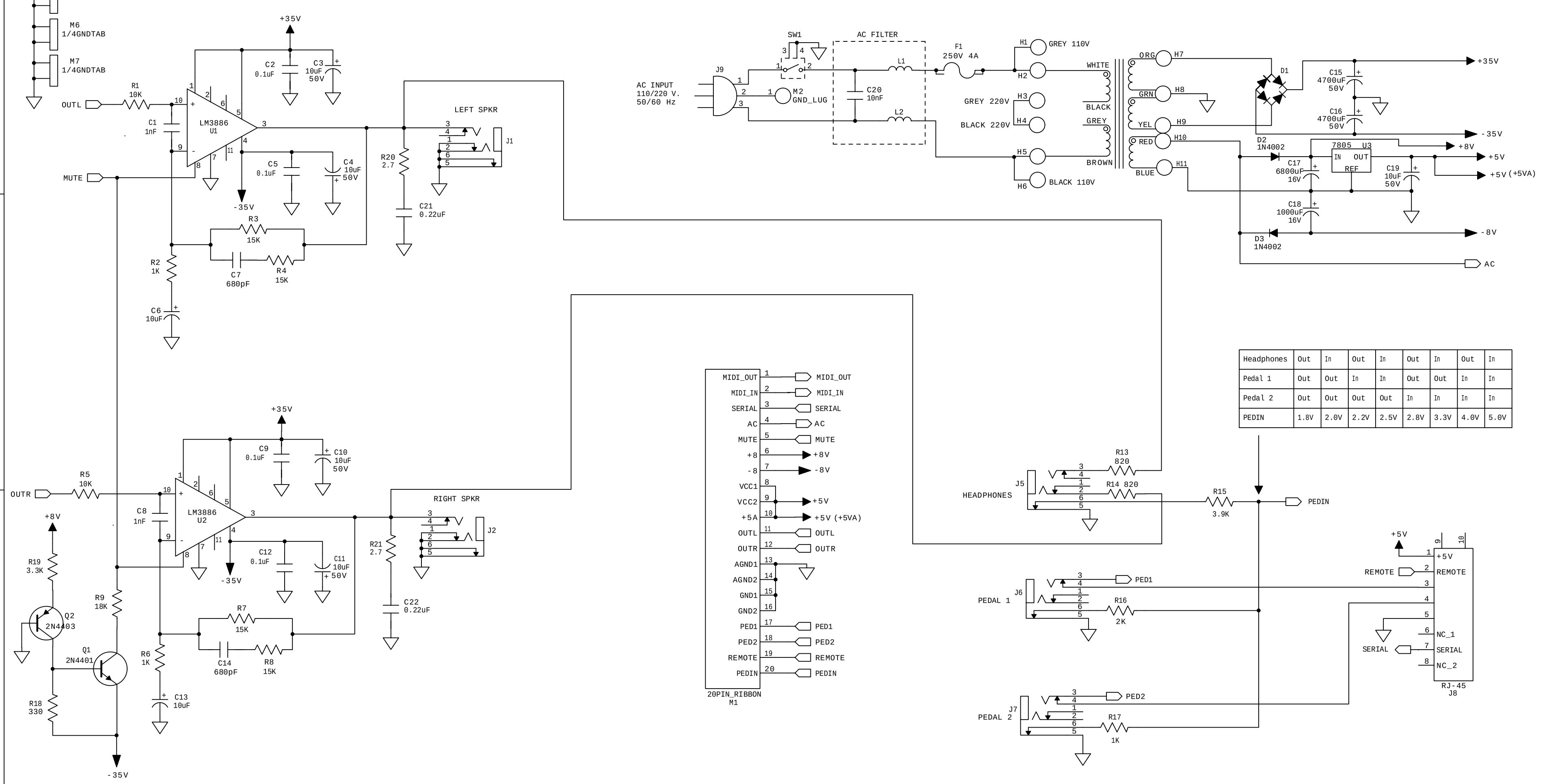
Client: LINE 6	Project: AXSYS 212
Page: 3 of 3	Date: December 17, 1996

Drawn by: EVP
Pinout checked by: MD
Revision: C

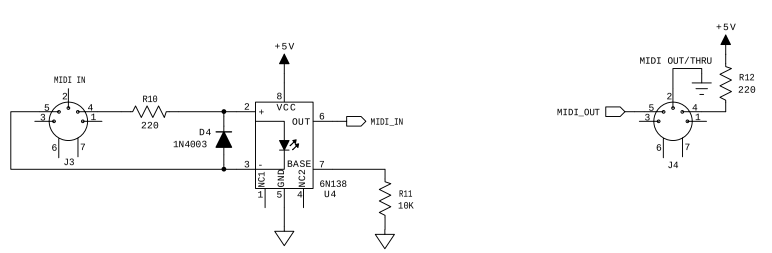
Axsys 212 Processor Board

ECOs FOR THIS REVISION

ECO #:	DATE:	DESCRIPTION:
6	12/9/96	Connected pins #1, #5 together on U1 and U2. Decreased pad sizes on top side for U1, U2. Changed U1, U2 from LM3876 to LM3886.
5	10/29/96	C18 changed from 470uF to 1000uF.



Headphones	Out	In	Out	In	Out	In	Out	In
Pedal 1	Out	Out	In	In	Out	Out	In	In
Pedal 2	Out	Out	Out	Out	In	In	In	In
PEDIN	1.8V	2.0V	2.2V	2.5V	2.8V	3.3V	4.0V	5.0V



NOTES:
1) All resistors are 1/4W.
2) All capacitors are 50V. unless specified.

Fast Forward Designs, Inc.

Client: Line 6	Project: Axsys 212
Page: 1 of 1	Date: December 17, 1996

Description:

Power amplifier & power supply

Drawn By: EVP
Pinout checked by: MD
Revision: C

Parts list

The following list contains the Line 6 part numbers for all of the components in the AxSys 212. Please refer to these numbers when ordering replacement parts.

Part #	Description	Qty	Location
99-AXSYS-212	**Final Assembly**		
21-37-1067	6' 7" Three Wire 10 Amp Power cable - UL	1	Lit pack
40-00-0010	AxSys 212 Users Manual	1	Lit pack
40-00-0011	AxSys 212 Patch chart	1	Lit pack
40-03-0010	AxSys 212 Registration card	1	Lit pack
40-10-0010	AxSys 212 Shipping Box	1	Shipping Box
40-12-0010	Corner Insert for Shipping Box	9	Shipping Box
40-13-0010	Front Insert for Shipping Box	1	Shipping Box
40-14-0010	Bubble Pack for Shipping Box	1	Shipping Box
40-20-0010	Plastic bag for amp	1	Shipping Box
40-20-0011	Plastic bag for manual	1	Lit pack
98-AXSYS-212	Amp Assembly	1	
98-AXSYS-212	**Amp Assembly**		
30-00-0620	Phillips Screw, Black finish 6-32, 1 1/4"	4	For side panel into Head
30-00-1128	Phillips Screw, Zinc Plated 10-32, 1 3/4", Black	2	Screw for Handle into Head
30-03-0006	Countersunk Finishing Washer, Blck, size 6	4	Finish washer for side screw
30-57-0580	Handle	1	Top of box
50-00-0012	Head Assembly	1	In box
50-00-0016	Box Assembly	1	
50-00-0012	**Head Assembly**		
11-30-0010	Power transformer 110V/220V #4-49-8604	1	(Obsolete)
11-30-8607	Power transformer 120V #4-49-8607	1	100/120V units only
11-30-8609	Power transformer 240V #4-49-8609	1	220/240V units only
24-21-0001	Plastic power switch cap	1	
24-30-0001	AxSys 212 rubber keypad	1	
30-00-0404	Pan Phillips Type 1, Zinc Plated, 4-40, 1/4"	1	Ground lug
30-00-0607	Pan Phillips Screw + SEMS washer, 6-32, 7/16"	24	PCB, AC plug, Power amps
30-00-1008	Pan Phillips Screw, Zinc plated, 10-24, 1/2"	4	Transformer
30-03-0004	Lock washer, External Tooth, Size 4	1	Ground lug
30-03-0010	Machine screw flat washer, zinc plated finish	4	Transformer
30-06-0006	Hex machine screw nut 6/32, zinc plated finish	4	Nut for AC plug & power amp
30-06-0024	Nylon Insert Lock Nut, Zinc Plated, 10-24	4	Transformer
30-21-0011	Bracket, Reinforcement	1	Back panel (obsolete)
30-21-0012	Transformer metal plate	1	Between transformer and rear panel
30-40-2825	Transformer gasket	1	Between transformer and metal plate
30-42-0010	AxSys 212 overlay for front panel	1	Front panel
30-45-1528	Front panel knobs	9	Front panel
30-51-0010	AxSys 212 Metal work -Bottom piece	1	
30-51-0011	AxSys 212 Metal work - Top piece	1	
50-00-0010	Processor Board Assembly	1	
50-00-0011	Power Board Assembly	1	
50-00-0010	**Processor Board Assembly**		
01-04-0102	Resistor chip , 1K, 5%, 1/8 W	10	R2,4-5,7,23-24,36-37,44,47
01-04-0103	Resistor chip , 10K, 5%, 1/8 W	4	R43,R45,R49,R72

01-04-0105	Resistor chip , 1M, 5%, 1/8 W	3	R1,R3,R42
01-04-0122	Resistor chip , 1.2K, 5%, 1/8 W	2	R11,R16
01-04-0132	Resistor chip , 1.3K, 5%, 1/8 W	2	R13,R15
Part #	**Description**	**Qty**	**Location**
01-04-0133	Resistor chip , 13K, 5%, 1/8 W	1	R67
01-04-0151	Resistor chip 150Ω, 5% , 1/8w	2	R20,R22
01-04-0202	Resistor chip , 2.0K, 5%, 1/8 W	1	R25
01-04-0221	Resistor chip , 220Ω, 5%, 1/8 W	1	R40
01-04-0222	Resistor chip , 2.2K, 5%, 1/8 W	2	R9,R10
01-04-0224	Resistor chip , 220K, 5%, 1/8 W	1	R38
01-04-0272	Resistor chip , 2.7K, 5%, 1/8 W	1	R69
01-04-0302	Resistor chip , 3K, 5%, 1/8 W	2	R34,R35
01-04-0331	Resistor chip , 330Ω, 5%, 1/8 W	1	R66
01-04-0332	Resistor chip , 3.3KΩ, 5%, 1/8 W	8	R50-R57
01-04-0390	Resistor chip , 39Ω, 5%, 1/8 W	8	R58-R65
01-04-0471	Resistor chip , 470Ω, 5%, 1/8 W	7	R32-33,14,17,41,48,70
01-04-0472	Resistor chip , 4.7K, 5%, 1/8 W	3	R19,R39,R46
01-04-0561	Resistor chip , 560Ω, 5%, 1/8 W	2	R12,R18
01-04-0752	Resistor chip , 7.5K, 5%, 1/8 W	1	R68
01-48-0103	Pot 10K Lin Mono 25 mm D Shaft, +nut washer	8	R6,R8,R26-R31
01-48-3103	Pot 10K Lin Stereo 25mm D Shaft, +nut washer	1	R71
03-00-0101	Capacitor, 100pF, 50V min, 20% max, TH	1	SEE ECO #7
03-18-0105	Capacitor 1µF Elec, 50V mn 20% mx radial TH	2	C32,C33
03-18-0106	Capacitor 10µF Elec 50V mn 20% mx radial TH	12	C9,11,13-14,19,21,23-24,27,29,31,34
03-46-0104	Capacitor 0.1µF 50V min 20% max, 1206, X7R	31	C2,4,10,12,20,22,25,26,28,30,35-37,40-55,60,65
03-52-0102	Capacitor, 1nF, 50V min. 20% max, 0805, X7R	2	C1,C3
03-52-0182	Capacitor 1.8nF 50V min. 20% max, 0805, X7R	4	C5- C6,C17-C18
03-52-0220	Capacitor 22pF 50V min. 20% max, 0805, NPO	3	C38-C39,C63
03-52-0222	Capacitor 2.2nF 50V min. 20% max, 0805, X7R	4	C7-C8,C15-C16
03-52-0333	Capacitor 33nF, 50V min. 20% max, 0805, X7R	1	C59
03-52-0470	Capacitor 47pF 50V min. 20% max, 0805, NPO	1	C64
06-20-4148	Diode Small Signal, 1206, SMT	8	D1-D8
06-28-0360	Diode Zener, 3.6 Volt, DL-35, SMT	4	D12-D15
06-28-0620	Diode Zener, 6.2 Volt, DL-35, SMT	1	D57
09-10-4401	Transistor, NPN Small Signal SOT-23	8	Q1-Q6,Q15,Q17
09-10-4403	Transistor, PNP Small Signal SOT-23	8	Q7-Q14
09-13-0054	Transistor, NPN Mid Power SOT-223	1	Q16
11-00-1198	Crystal - 11.9808MHz TH	1	M9
11-40-0030	3V Lithium Battery TH	1	M10
12-00-7905	Regulator, -5V, 100mA T092	1	U6
12-54-0084	Op Amp, Quad, SMT TL084CD	1	U1
12-54-5532	Op Amp, Dual low noise, SMT NE5532D	1	U5
12-64-0542	8 Bit 11 channel ADC SMT TLC542CDW	1	U7
12-64-1760	Stereo 20 bit ADC Modulator SMT PCM1760U	1	U2
12-64-1761	Stereo 20 bit ADC Filter SMT DF1760U	1	U3
12-68-4320	Stereo 20 bit DAC SMT AK4320-VM	1	U4
15-62-0014	Hex Schmitt Inverter SMT SN74HC14D	1	U10
15-62-0138	3-to-8 address decoder SMT SN74HC138D	1	U18
15-62-0161	4-bit binary counter SMT SN74HC161D	1	U20
15-62-0165	8-bit shift register SMT SN74HC165D	1	U21
15-62-0573	Octal Latch D-Type Transparent SMT	1	U11
15-62-0574	Octal D Flip Flop 3-State Non-Invert SMT	2	U8,U17
15-66-0273	Octal Latch D-Type Transparent SMT TPIC6B273DW	1	U16
15-70-1664	DRAM 64K x 16 SMT	1	U13
15-72-0256	SRAM - 32K x 8 SMT	1	U15
15-84-8031	Microprocessor - 80C31 SMT	1	U9

15-86-7070	57070 DASP SMT	2	U12,U19
18-00-0314	Red LED TH	24	D9,17,25,33-40,42-43,45-55
18-10-0003	3 digit 7-Segment Red LED TH	1	D10
21-00-4420	1/4 inch jack earthing washer	2	M12-M13
21-00-6616	Jack 1/4 inch phone with nut	2	J1-J2
Part #	**Description**	**Qty**	**Location**
21-20-0204	header, 4 pin, 2mm	2	M1-M2
21-20-0205	header, 5 pin, 2mm	2	M3,M11
21-23-1002	20-pin 0.1" ribbon header	1	M4
21-34-0012	4 conductor 2mm cable assembly	1	M1,M2
21-34-0013	5 conductor 2mm cable assembly	1	M3,M11
21-42-0028	Socket, 28 pin, 600mI wide, TH	1	U14
30-03-1218	Lock Washer, Internal Tooth	1	R71
30-15-0420	LED spacer 2mm	24	D9,17,25,33-40,42-43,45-55
45-00-0010	AxSys 212 EPROM 64K x 8 - Programmed	1	U14
50-00-0011	**Power Board**		
01-12-0027	Resistor, 2.7Ω, 5%, 1/4 W	2	R20,R21
01-12-0102	Resistor, 1K, 5%, 1/4 W	3	R2,R6,R17
01-12-0103	Resistor, 10K, 5%, 1/4 W	3	R1,R5,R11
01-12-0103	Resistor, 10K, 5%, 1/4 W	3	R1,R5,R11
01-12-0153	Resistor, 15K, 5%, 1/4 W	4	R3,R4,R7,R8
01-12-0183	Resistor, 18K, 5%, 1/4 W	1	R9
01-12-0202	Resistor, 2.0K, 5%, 1/4 W	1	R16
01-12-0221	Resistor, 220Ω, 5%, 1/4 W	2	R10,R12
01-12-0331	Resistor, 330Ω, 5%, 1/4 W	1	R18
01-12-0332	Resistor, 3.3K, 5%, 1/4 W	1	R19
01-12-0392	Resistor, 3.9K, 5%, 1/4 W	1	R15
01-16-0821	Resistor, 820Ω, 5%, 1/2 W	2	R13,R14
03-00-0102	Capacitor, 1nF, 50V min. 20% max TH	2	C1,C8
03-00-0681	Capacitor, 680pF, 50V min. 20% max TH	2	C7,C14
03-01-0103	Capacitor, 10nF, 125V min. 20% max TH	1	C20
03-12-0102	Capacitor 1000µF Elec 16V mn 20% mx Radial	1	C18
03-12-0688	Capacitor 6800µF Elec 16V mn 20% mx Radial	1	C17
03-18-0106	Capacitor 10µF Elec 50V min 20% max Radial	7	C3-4,6,10-11,13,19
03-18-0478	Capacitor 4700µF Elec 50V mn 20% mx Radial	2	C15,C16
03-36-0104	Capacitor, 0.1µF, 50V min. 20% max TH	4	C2,C5,C9,C12
03-36-0224	Capacitor, 0.22µF, 50V min. 20% max TH	2	C21,C22
06-00-4148	Diode Small SIgnal TH 1N4148	1	D4
06-04-4002	Diode Mid Power TH 1N4002ID	2	D2,D3
06-16-6200	Diode bridge TH	1	D1
09-00-4401	Transistor, NPN Small Signal TH 2N4401	1	Q1
09-00-4403	Transistor, PNP Small Signal TH 2N4403	1	Q2
11-10-2020	2 turn Choke TH	2	L1,L2
12-02-7805	Regulator, +5V, 1.5 Amp TO-220 uA7805C	1	U3
12-30-3886	Power Amp, 50W, National LM3886	2	U1,U2
15-40-6138	Opto-isolator 6N138 TH	1	U4
21-00-4420	1/4 inch jack earthing washer	5	M3-M7
21-00-6616	Jack 1/4 inch phone	5	J1-J2,J5-J7
21-04-5075	5 pin female DIN jack	2	J3,J4
21-14-0001	Power AC receptacle	1	J9
21-16-0045	Connector RJ-45 LAN Female, side PCB mount	1	J8
21-23-6610	20-pin ribbon cable with connectors	1	M1
21-34-0011	Transformer wiring cable set (9 colors)	1	H1-H11
21-34-1806	AxSys212 Earthing cable assy	1	
21-48-2071	Fuse holder Clip	2	F1
24-18-4250	4 Amp, 250 V Normal Blow Fuse	1	F1
24-24-0010	AC Power Switch	1	SW1

30-00-0607	Pan Phillips Screw + SEMS washer, 6-32, 7/16"	3	J9,U3
30-06-0006	Hex machine screw nut 6/32, zinc plated finish	2	J9
30-12-2210	1/2" female hex 6/32 threaded stand off	1	U3

Part #	Description	Qty	Location
50-00-0016	**Box Assembly**		
11-20-1200	Eminence Speaker - 12"	2	In wood box
21-34-0010	1/4" Phone cables with tabs	2	Speaker cables
30-00-0621	Truss Phillips A, Black wax Finish, 6, 1 1/4"	3	Screw for speaker grill
30-00-0812	Truss Phillips A Self Tapping Black wax 8, 3/4"	20	Metal corners & back panel
30-00-1014	Flat Phillips A, Self tapping, 10, 7/8"	4	Screw for rubber feet
30-00-1016	Pan Phillips Screw, Black wax Finish, 10-24, 1"	8	Screw for speaker
30-27-0010	AxSys 212 Plastic extrusion	1	Front
30-30-1520	Metal Corners, Powder coated, textured, Black	8	Corners
30-48-1686	Rubber Feet	4	Bottom of box
50-00-0013	Speaker Grill	1	Front of box
50-00-0014	Wood Box	1	
50-00-0015	Rear Wood	1	Rear of box
50--00-0013	**Speaker Grill**		
30-33-0018	AxSys 212 Wood Box -Grill frame vertical	2	
30-33-0019	AxSys 212 Wood Box -Grill frame horizontal	2	
30-39-0001	Speaker Grill Cover Fabric	1	
30-60-0001	Nameplate GA Line 6 Logo	1	
50-00-0014	**Wood Box**		
30-06-1024	Tee Nut, 3 prong, 10-24, 5/16	8	Tee Nut for speaker
30-33-0011	AxSys 212 Wood Box -Bottom	1	
30-33-0012	AxSys 212 Wood Box - Left Side	1	
30-33-0013	AxSys 212 Wood Box - Right Side	1	
30-33-0014	AxSys 212 Wood speaker board	1	
30-33-0015	AxSys 212 Wood Box -speaker panel top	1	
30-33-0016	AxSys 212 Wood Box -Top	1	
30-33-0017	AxSys 212 Wood Box -Back support	2	
30-36-0001	Vinyl, black		
50-00-0015	**Rear Wood**		
30-33-0010	AxSys 212 Wood Box - Back Panel	1	
30-36-0001	Vinyl, black		