Kurzweil 250

SERVICE MANUAL

(K250, K250X and RMX Models)

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Chapter 1 - Introduction

1.1 - PRODUCT DESCRIPTION

The Kurzweil 250 uses artificial intelligence principles and a Motorola 68000 microprocessor to create complex models of acoustic sounds. The Kurzweil 250's design gives the instrument a velocity-sensitive keyboard so that a note's volume and timbre relates to the force on the key. The 12-note, polyphonic keyboard can accurately reproduce the sounds of several instruments at once and each key on the 88 note keyboard can be individually assigned to play a different sound.

Currently, the Kurzweil 250 comes with 36 different instruments arranged into 98 keyboard setups in the basic Enhanced Resident Sound Block excluding Sound Blocks A thorugh D. The original Kurzweil 250 came with 30 different instruments arranged into 40 keyboard setups.

The Kurzweil 250's sequencer is a built-in, 12,000-note multi-track digital recorder, which can be used to build up to 12 different tracks. Older Kurzweil 250's may have either 4,000 or 8,000 note sequencer. These units can be updated to the current 12,000 with the purchase of available options.

All Kurzweil 250s are currently manufactured with the Kurzweil Sound Modeling Program for user sampling. Older Kurzweil 250s may not have this option, but may be updated with the purchase of the Sound Modeling Program option.

There are many configurations of Kurzweil 250s currently in the field. The Kurzweil 250 Product Line also includes the Kurzweil 250X, an expander unit without keyboard, and the Kurzweil RMX 250 or 225, a rack mount expander unit. Please see the Product History, Chapter 2, for more information.

1.2 - SPECIFICATIONS

1.2.1 - Kurzweil 250

Keyboard: 88 keys with velocity-sensing and piano action.
Pedals: 2, assignable piano-type in the POD, 2, external volume-type
Dimensions (Cabinet): 56"(L) X 27"(W) X 9"(H)
Dimensions (POD): 22"(L) X 11"(W) X 4.5"(H)
Weight (Cabinet): 95 lbs.
Weight (POD): 22 lbs.
Power Consumption: 110/220 VAC, 50/60Hz, 380 watts max.
Operating Conditions: 0 to 50°C Ambient 20 to 80% Relative Humidity
Storage Conditions: -25 to 125°C,10 to 90% Relative Humidity
Audio Outputs: High level, Low level, Balanced, Stereo headphones
External I/O: High-speed parallel computer port, MIDI In, MIDI Out and MIDI Thru ports, Sync In, Sync Out, Trigger In, Click Out, MIC, Line In, 2 External volume-type pedals, cartridge slot

1.2.2 - Kurzweil 250X

Dimensions (Cabinet): 49 1/2" (L) X 20 1/2" (W) X 6 3/4"(H)
Dimensions (POD): 22"(L) X 11"(W) X 4.5"(H)
Weight (Cabinet): 45 lbs.
Weight (POD): 22 lbs.
Power Consumption: 110/220 VAC, 50/60Hz, 380 watts max.
Operating Conditions: 0 to 50°C Ambient 20 to 80% Relative Humidity
Storage Conditions: -25 to 125°C,10 to 90% Relative Humidity
Audio Outputs: High level, Low level, Balanced, Stereo headphones
External I/O: High-speed parallel computer port, MIDI In, MIDI Out and MIDI Thru ports, Sync In, Sync Out, Trigger In, Click Out, MIC, Line In, 2 External volume-type pedals

1.2.3 - Kurzweil 250 RMX AND 225 RMX

Dimensions (Cabinet): 19" (L) X 22" (W) X 10 1/2"(H)
Weight (Cabinet): 53 lbs.
Power Consumption: 110/220 VAC, 50/60Hz, 380 watts max.
Operating Conditions: 0 to 50°C Ambient 20 to 80% Relative Humidity
Storage Conditions: -25 to 125°C,10 to 90% Relative Humidity
Audio Outputs: High level, Low level, Balanced, Stereo headphones
External I/O: High-speed parallel computer port, MIDI In, MIDI Out and MIDI Thru ports, Sync In, Sync Out, Trigger In, Click Out, MIC, Line In, 2 External volume-type pedals

1.3 - HOW THE KURZWEIL 250 WORKS

This section describes briefly how the Kurzweil 250 controls work. Refer to the Kurzweil 250 ¸User's Guide for more detailed information. Since this is a complex instrument, always confirm that a problem truly exists before attempting to service the instrument.

1.3.1 - Masters Section

The group of slider controls in the Masters section controls the overall sounds that the instrument makes.

TUNE - Use this slider control to control the overall pitch of all active voices.

INSTRUMENT GROUPS A & B - These two sliders move two different, assignable instrument groups from left to right in the stereo image.

VOLUME - This controls overall volume.

1.3.2 - Assignments Section

This section of the Front Panel controls are used primarily during live performance.

Each of the three vertical sliders can be assigned to control one of approximately 20 different functions such as tremolo, pitch bend, vibrato, legato, attack, decay and sustain. By using these controls, you can simulate a wide variety of playing techniques, including a full variety of synthetic effects.

Musicians can also assign the foot pedals and Mod Levers using switches in this section.

1.3.3 - Selection Section

The Selection area on the Front Panel contains the switches that allow users to control the main functions of the system. With the LCD display, they tell what operating mode the instrument is in and allow the musician to make changes and answer questions.

SPLIT KEYBOARD - This is another control used at performance time. It allows you to assign a certain section of the keyboard temporarily to a certain instrument.

CHORUS - When you press this button, you can turn one sound into many. The "Chorus" capability can be used for doubling, built-in echo and flanging.

SELECTION SWITCHES - The YES, NO and SELECT switches are used to choose options and answer questions displayed on the LCD.

NUMERIC KEYPAD - Use the numeric keypad to enter choices and to select functions (with the "F" switch).

1.3.4 - Program Section

This group of controls, along with the numeric keypad, allow you to program the Kurzweil 250. These controls are generally used for setup before a performance.

CURSOR KEYS - The cross shaped group of keys below PLAY are the cursor controls. The center key (R) is for resetting when you have made a mistake or want to return to the initial cursor placement.

SEQUENCER - The Kurzweil 250's sequencer is a built-in, 12,000 -note multi-track digital recorder. You can use it to lay down one instrument and then play a second instrument on top of it. By repeating this process, you can build up to 12 different tracks.

Other keys in this section speed up or slow down the tempo of a piece, modulate to another key, change modes or edit keyboards, instruments or sequences.

1.3.5 - Media Section

The Media section lets you program, store and recall your own set of keyboard setups, instruments and sequences.

LIST - This key allows you to run through, in any order, every keyboard setup stored in the Kurzweil 250's memory. You can reprogram this list to meet you own performance needs. You can also list sequences using this switch.

STORAGE - The Storage READ switch is used to prepare the instrument to use a cartridge. In future versions of the instrument, the STORAGE switches will be used with external media options.

1.3.6 - Back Panel

The back panel contains all the input/output connections for the Kurzweil 250.

COMPUTER - This is the parallel computer port for attaching a personal computer to the Kurzweil 250.

TRIGGER IN - The Trigger In is a TTL-compatible input used for starting a sequence from an external device. The sequence triggers on the positive edge of the supplied pulse. Minimum pulse width is 1 microsecond. The input impedance is greater than 10k ohms. The trigger level is 2 volts. This I/O port takes a 1/4 inch phone jack.

CLICK OUT - The Click Out is a TTL-level output pulse. When enabled from the Front Panel, a positive pulse appears at this output. Its repetition rate is the selected sequencer tempo. Driving source is a low power TTL gate through a 51 ohm resistor. This I/O port takes a 1/4 inch phone jack.

SYNC IN - The Sync In is a TTL-compatible input used to drive the Kurzweil 250 from another instrument. The other instrument is to provide a square wave at X12 to X96 the tempo. The input impedance is greater than 10K ohms. The trigger level is 2 volts and this I/O port takes a 1/4 inch phone jack.

SYNC OUT - The Sync Out is a TTL-level square wave output used to drive other instruments in synchrony with the Kurzweil 250. The repetition rate is normally X12 to X96 the tempo. The driving source is a low power, TTL gate through a 51 ohm resistor. This I/O port takes a 1/4 inch phone jack.

MIDI IN - This is a 31.2K baud, 5 milliamp serial input.

MIDI THRU - This is a 31.2K baud, 5 milliamp serial output.

MIDI OUT - This is a 31.2K baud, 5 milliamp serial output, the same as MIDI IN buffered.

LO - These are 2 VPP audio outputs, with a 600 ohm driving source impedance. These require 1/4 inch phone jacks and are suitable for line level inputs.

HI - These are 20 VPP audio outputs, with a 600 ohm driving source impedance. These require 1/4 inch phone jacks and are suitable for directly driving power amplifiers and other high level inputs.

BALANCED - These are 20 VPP audio outputs. They have XLR connectors, floating outputs and a 600 ohm driving source impedance.

EXTERNAL PEDALS 1 & 2 - The 1/4 inch phone jacks accept assignable pedal functions (K250 and K250X only).

MIC - This digitizer input is a 200 mVPP full scale input. It has a 47K ohm input impedance and accepts a 1/4 inch phone jack.

LINE IN - This digitizer input is a 1 VPP full scale input (300 MV rms.) It has a 10K ohm input impedance and accepts a 1/4 inch phone jack.

Chapter 2 - Product History

2.1 - History Introduction

The following outlines possible configurations of K250s in the field. When the K250 was first introduced to the field in August of 1984 the K250 contained Version 1 software and no options. Please be aware that some options are required and some are optional. Please refer to the "Software Versions Versus Options Available" list included in this chapter for configuration information.

Note: Specific part numbers are mentioned in this document pertaining to parts included in option kits. However, not all part numbers required for certain options are mentioned. This document has been prepared to give you a brief history of the options and updates for the K250, K250X and the RMX 250 and 225. This chapter is not meant to replace the installation procedure supplied with each option kit.

The Kurzweil 250, K250X and RMX contain the following printed circuit boards:

CPU/Central Processing Unit
CGP/Channel Group Processor
Channel
Audio
Slider
LCD
Control Panel
Bass and Treble Keyswitch boards (K250 only)
Power Supply (internal, RMX models only)

2.2 - February, 1985

Version 2 software update--a no charge update
Ram Sequencer Expansion--purchased option bringing the Sequencer from 4K to 8K
Sound Modeling Program (25kHz)--purchased option*

*Sound Modeling Program also referred to as sampling

The **Version 2** free software update was offered to all K250 owners and required some modification to the CPU board and the replacement of the 8 software EPROMs located at:

82051001	U54	82051101	U38
82051201	U53	82051301	U37
82051401	U52	82051501	U36
82051601	U51	82051701	U35

The **RAM Sequencer Expansion** required the installation of four memory chips part no. 62000901 in locations U28, U29, U43 and U44. The original Ram Sequencer Expansion kit included a replacement for U95 on the CGP board, however, this part is not included in the current kit.

The **Sound Modeling Program** required a unit with Version 2 software and involved the update of three p.c. boards, the CPU, CGP, Channel; and the possible replacement of the Audio board.

The CPU board with Version 2 installed only required that you install part no. 82000408 in U25, part no. 82000409 in U40, part no. 82000410 in U26 and part no. 82000411 in U41.

The CGP board required 3 cuts to the solder side of the board and 3 jumps to the component side of the board. It also required the installation of 20 DRAM chips in locations U25 through U29, U33 through U37, U51 through U55 and U72 through U76. The CGP board while installed in the K250. These locations are easily found by looking at the inner right hand corner of the CGP board.

The Channel board required the installation of U60, part no. 63001201. Some units did not have a socket at this location; and, therefore, required the addition of that socket. This socket was supplied with the kit. Kurzweil never recommends that this part is soldered into the board. It was also required to check values of certain resistors and capacitors on the Channel board and the addi-tion or replacement of these parts.

The Audio board needed to be replaced for any unit produced prior to February of 1985. Therefore, Kurzweil offers two Sound Modeling Program kits, one with Audio board and one without. (Kurzweil offers these kits at the same cost.) The part number of the Audio board required for Sound Modeling Program is 12011001. Some boards may not actually have this part number printed on it, but will have the correct p.c. board fabrication number, 33011001. The old Audio board that needs to be removed is part no. 12001001 or p. c. board fabrication no. 33001001.

2.3 - May, 1985

Sound Block A--purchased option

The **Sound Block A** board was offered under three part numbers 14000801, 14000802 or14001301. Although there was no difference in the Sound Block A board itself, this was done as a result of the K250s in the field. Older K250s did not have a series of modifications to the CGP board required for Sound Block A. For these units, Kurzweil offered kit part number 14000801. This included an updated CGP board as well as the Sound Block A board. The old CGP was to be returned to Kurzweil or the customer was invoiced for the board. Part number 14000802 was used for customers who sent in their CGP board to be updated at Kurzweil. Once the update was completed Kurzweil returned the CGP board with a Sound Block A board attached. This update to the CGP board was done free of charge. Part number 14001301 was just the Sound Block A board sent to be installed on CGP boards that did not require any modification.

The Sound Block A board is mounted on the CGP board. If you look at a CGP board installed in the K250, you will notice a long white connector (47A) mounted on the board in the lower left hand quarter of the board. The Sound Block A board is plugged into this connector and mounting hardware is installed to secure it.

How to know if the CGP board is ready for the addition of the Sound Block A board? Check in the vicinity of the long white connecter (47A) located in the lower left hand quarter of the CGP board. If this board has been modified to accept a Sound Block A board, you will notice some rework wiring coming from U126, U134 and U149, to name a few. This wiring will begin at these locations and encircle the white connector and end at locations below.

2.4 - June, 1985--new Kurzweil 250 configurations

Part No. 10001601--Basic unit, no sampling or sound block
Part No. 10001701--Full unit, w/Sound Block A
Part No. 10001801--Advanced Sampling, w/Sampling and Sound Block A

Note: These units contained the **Ram Sequencer Expansion** option as standard.

2.5 - August, 1985--Kurzweil 250X introduced

Part No. 10001901--Basic unit, no sampling or sound block
Part No. 10002001--Full unit, w/Sound Block A
Part No. 10002101--Advanced Sampling, w/Sampling and Sound Block A

Note: These units also contained the **Ram Sequencer Expansion** option as standard.

At introduction, the Kurzweil 250X was introduced with Version 2.1 software. This software did not support sampling and sampling could not be used with the K250X until Version 2.2, which will be discussed later. An important difference between the K250 and the K250X is that every K250X produced had its program EPROMs contained in 256K EPROMs. The Kurzweil 250 used 128K EPROMs at that time.

2.6 - October, 1985

Version 2.2 introduced--free update
50kHz Sound Modeling Program--purchased option
50kHz Sound Modeling Upgrade Kit--purchased upgrade

Version 2 software was now obsolete. **Version 2.2** supported 50kHz sampling and corrected some known bugs in Version 2. It was a free update, but was only offered to customers who were experiencing problems or who were purchasing a Sound Modeling Program or a 50kHz Upgrade Kit. One thing to note is that if a customer had a unit with 25kHz sampling and wanted Version 2.2, the unit had to be upgraded to 50kHz. The Version 2.2 EPROMs should be the following:

82051021	U54	82051121	U38
82051221	U53	82051321	U37
82051421	U52	82051521	U36
82051621	U51	82051721	U35

The **50kHz Sound Modeling Program** was offered in the same way the 25kHz options were offered. Kurzweil continued to offer two kits (with or without Audio board) for purchase. The modifications to the K250 were basically the same as those outlined in the installation procedures for the 25kHz upgrade. However, not all modifications were necessary for units recently produced.

The **50kHz Sound Modeling Upgrade Kit** required that the K250 had Version 2.2 installed. The sampling EPROMs on the CPU board needed to be replaced with part no. 82000412 at U25, part no. 82000413 at U40, part no. 82000414 at U26; and part no. 82000415 at U41. The A/D converter at U60 on the Channel board must be replaced with part no. 63001701 and one cut and one jump is required.

Note: When installing the 50kHz Sound Modeling Program or the 50kHz Upgrade kit, the cut and jump to the Channel board is not necessary on the K250X. Every K250X produced had this modification already performed. Also, modifications to the CGP board required for Sound Block A and sampling are not required.

2.7 - March, 1986

Version 3.1 software--purchased option
Enhanced Resident Sound Block--purchased option (new CGP)
Sound Block B (Rock Block)

The installation of **Version 3.1** in K250s required cuts and jumps to the CPU board. These modifications were required to add the additional 4K memory and to reconfigure the board for the installation of 256K EPROM (CPU until this point used 128K EPROMs).

Version 3.1 also required units with 25kHz sampling to be upgraded to 50kHZ sampling. Because Version 3.1 supported a 12K sequencer memory, units with only 4K had to be upgraded to 8K. The installation of Version 3.1 involves installing the Version 3.1 EPROMs at the following locations:

82101401	U54	82101501	U38
82101601	U53	82101701	U37
82101801	U52	82101901	U36
82090401*	U51	82090501*	U35

*50kHz Sound Modeling EPROM locations

Note: The Kurzweil 250X CPU board does not require any cut or jump. It is only necessary to remove the Version 2.1 or 2.2 EPROMs and install the Version 3 EPROMs.

The installation of the **Enhanced Resident Sound Block** requires Version 3.1. For units with Sound Block A boards, the Sound Block A board could be reinstalled on the Enhanced Resident Sound Block. Or, if the Sound Block A chips were socketed; they could be removed and installed on the Enhanced Resident Sound Block in the empty sockets designated for the sound block.

When installing the Enhanced Resident Sound Block, be sure to remove the 20 DRAMs, if present, located on the old CGP and reinstall them on the Enhanced Resident Sound Block. Failure to do so will render sampling useless.

Sound Block B may be installed on a Sound Block A board or the Enhanced Resident Sound Block. If Sound Block B is being installed on a Sound Block A board be sure that there are sockets for the chips. These sockets are supplied with the kit if ordered properly. Kurzweil does not recommend that these chips are soldered into the Sound Block A board. Therefore, when ordering a Sound Block B, please specify if it will be installed in a Sound Block A board. If Sound Block B is being installed in a Enhanced Resident Sound Block it is only necessary to plug the chips in the sockets specified.

Note: When updating units to Version 3.1 without sampling, be sure to remove the old Version 2 or 2.2 EPROMs at locations U35 and U51.

2.8 - August, 1986

Version 3.2 software--purchased option
QLS--purchased option
Sound Block C (Classical Block)--purchased option

To install **Version 3.2** in units that currently have Version 3.1, no modifications will be required to the CPU board. Simply remove the Version 3.1 EPROMs and install Version 3.2. To install Version 3.2 in units with software levels earlier than Version 3.1, the CPU board will require modification as mentioned in the description of Version 3.1. The Version 3.2 EPROMs should be installed in the following locations:

82102001	U54,	82102101	U38
82102201	U53	82102301	U37
82102401	U52	82102501	U36
82090701*	U51	82090801*	U35

*50kHz Sound Modeling EPROM locations

Version 3.2 is required to install **QLS.** QLS contains a p.c. board, Macintosh disk and cable. The installation of the QLS p.c. board requires removing the parallel port chip in location U108 on the CPU board. The QLS p.c. board is plugged into the empty socket at U108 and supported with mounting hardware. It is a fairly simple installation, however, the pins on the solder side of the QLS p.c. board may break off if bent.

Sound Block C may be installed on a Sound Block A board or the Enhanced Resident Sound Block. **Note:** if the unit currently has a Sound Block A board with Sound Block B installed it is not possible to add Sound Block C. If Sound Block C is being installed on a Sound Block A board be sure that there are sockets for the chips. These sockets are supplied with the kit if ordered properly. Kurzweil does not recommend that these chips are soldered into the Sound Block A board. Therefore, when ordering a Sound Block C, please specify if it will be installed in a Sound Block A board. If Sound Block C is being installed in a Enhanced Resident Sound Block, it is only necessary to plug the chips in the sockets specified.

Note: QLS may not be installed in units that do not have sampling.

Note: When updating units to Version 3.2 without sampling, be sure to remove the old Version 2 or 2.2 EPROMs at locations U35 and U51.

2.9 - December, 1986

Version 4 software--purchased option
Superam I or Superam II--purchased option*
*requires Enhanced Resident Sound Block
Sound Block D (Brass Block)--purchased option

To install **Version 4** in units that currently have Version 3.1 or 3.2, no modifications will be required to the CPU board. Simply remove the Version 3.1 or 3.2 EPROMs and install Version 4. To install Version 4 in units with software levels earlier than Version 3.1 or 3.2, the CPU board will require modification as mentioned in the description of Version 3.1. The Version 4 EPROMs should be installed in the following locations:

82102601	U54	82102701	U38
82102801	U53	82102901	U37
82103001	U52	82103101	U36
82091001*	U51	82091101*	U35

*50kHz Sound Modeling EPROM locations

Version 4 is required to install **Superam.** Superam is installed on the CGP board. It requires the Enhanced Resident Sound Block (new CGP). Superam is installed by adding mounting hardware to the CGP and inserting connecting cables from the Superam board into the CGP board.

Sound Block D may be installed on a Sound Block A board or the Enhanced Resident Sound Block. **Note:** if the unit currently has a Sound Block A board with Sound Blocks B or C installed it is not possible to add Sound Block D. If Sound Block D is being installed on a Sound Block A board be sure that there are sockets for the chips. These sockets are no longer supplied with the Sound Block D kit, please order separately from Kurzweil. Kurzweil does not recommend that these chips are soldered into the Sound Block A board. Therefore, when ordering a Sound Block D, please specify if it will be installed in a Sound Block A board. If Sound Block D is being installed in a Enhanced Resident Sound Block, it is only necessary to plug the chips in the sockets specified.

Note: When updating units to Version 4 without sampling, be

sure to remove the old Version 2 or 2.2 EPROMs at locations U35 and U51.

2.10 - March, 1987--RMX introduced

Part No. 10004701--RMX 225, old-style CGP and Sound Blocks A and B
Part No. 10004801--RMX 225, new-style CGP, no Sound Blocks
Part No. 10004801--RMX 250, new style CGP and Sound Blocks A through D
Note: These units also contained the RAM Sequencer Expansion, 50kHZ Sound Modeling Program and QLS as standard.

2.11 - April, 1987

Version 4.1 software--purchased option

To install **Version 4.1** in units that currently have Version 3.1, 3.2 or V4; no modifications will be required to the CPU board. Simply remove the Version 3.1, 3.2 or V4 EPROMs and install Version 4. To install Version 4.1 in units with software levels earlier than Version 3.1, 3.2 or 4, the CPU board will require modification as mentioned in the description of Version 3.1. The Version 4.1 EPROMs should be installed in the following locations:

82103201	U54	82103301	U38
82103401	U53	82103501	U37
82103601	U52	82103701	U36
82091201*	U51	82091301*	U35

*50kHz Sound Modeling EPROM locations

2.12 - October, 1987

Version 5 software--purchased option
Separate Outputs (S/0)--purchased option*

*RMX version of S/O available as of June 1988.

To install **Version 5** in units that currently have Version 4.2, 4.1, 4.0, 3.2 or 3.1; no modifications will be required to the CPU board. Simply remove the current version EPROMs and install Version 5. To install Version 5 in units with software levels earlier than versions mentioned above, the CPU board will require modification as mentioned in the description of Version 3.1. The Version 5 EPROMs should be installed in the following locations:

82104401	U54	82104501	U38
82104601	U53	82104701	U37
82104801	U52	82104901	U36
82091801*	U51	82091901*	U35

*50kHz Sound Modeling EPROM locations

Version 5 is required to install **S/O.** S/O for the K250 contains 2 p.c. boards, Macintosh disk, a new rear panel and cable assembly. The S/O kit for the RMX contains a p.c. board, Macintosh disk, 12-output box and cable assembly.

2.13 - September, 1988

Version 6--purchased option
RAM cartridge--purchased option
RAM cartridge adapter--purchased option

To install **Version 6** in units that currently have Version 5.0 4.2, 4.1, 4.0, 3.2 or 3.1; no modifications will be required to the CPU board. Simply remove the current version EPROMs and install Version 6. To install Version 6 in units with software levels earlier than versions mentioned above, the CPU board will require modification as mentioned in the description of Version 3.1. The Version 6 EPROMs [1] should be installed in the following locations:

82105001	U54	82105101	U38
82105201	U53	82105301	U37
82105401	U52	82105501	U36
82092001*	U51	82093001*	U35

*50kHz Sound Modeling ERPOM locations

The **RAM cartridge** is external to the unit and is only available for the K250. The **RAM cartridge adapter** is installed in the K250 on the CGP board.

2.14 - SOFTWARE VERSIONS VERSUS OPTIONS AVAILABLE

2.14.1 - Version 2

Sound Block A	-optional
Ram Sequencer Expansion (8K)	-optional
25kHz Sound Modeling Program	-optional
MacAttach	-optional

2.14.2 - Version 2.2

Sound Block A	-optional
Ram Sequencer Expansion (8K)	-optional
50kHz Sound Modeling Program	-optional*
MacAttach	-optional

*50kHz sampling required for Version 2.2.

2.14.3 - Version 3.1

Sound Block A	-optional*
Sound Block B (Rock Block)	-optional*
Sound Block C (Classical Block)	-optional*
Sound Block D (Brass Block)	-optional*
Enhanced Resident Sound Block	-optional*
50kHz Sound Modeling Program	-optional
Ram Sequencer Expansion (8K)	-required**
MacAttach	-optional

*Units with Sound Block A boards may have either Sound Block B or C added. Should a customer desire to add Sound Block B and C, the customer would have to have the Enhanced Resident Sound Block installed as there is only room for one additional sound block to the Sound Block A board.

**The Ram Sequencer Expansion bringing the unit from a 4K sequencer memory to 8K sequencer memory is required with the installation of Version 3.1; because version 3.1 brings the sequencer memory to 12K.

Note: The Enhanced Resident Sound Block can only be installed in units with Version 3.1 software or better. Therefore units that currently have Version 2 or 2.2 must be updated when ordering the Enhanced Resident Sound Block.

Note: When installing the Enhanced Resident Sound Block in units with sampling, be sure to remove the 20 DRAMs from the old CGP and reinstall them in the Enhanced Sound Block. If the unit has a Sound Block A board with the 10 Sound Block A chips socketed, the chips may be removed and installed in the Enhanced Resident Sound Block (see Enhanced Resident Sound Block Configuration list).

2.14.4 - Version 3.2

Sound Block A	-optional*
Sound Block B (Rock Block)	-optional*
Sound Block C (Classical Block)	-optional*
Enhanced Resident Sound Block	-optional*
50kHz Sound Modeling Program	
Ram Sequencer Expansion (8K)	-required**
QLS (Quick Load System)	-optional***
MacAttach	

*Units with Sound Block A boards may have either Sound Block B, C or D added. Should a customer desire to add Sound Block B, C or D the customer would have to have the Enhanced Resident Sound Block installed as there is only room for one additional sound block to the Sound Block A board.

**The Ram Sequencer Expansion bringing the unit from a 4K sequencer memory to 8K sequencer memory is required with the installation of Version 3.1; because version 3.1 brings the sequencer memory to 12K.

***QLS may only be installed in units with sampling.

Note: The Enhanced Resident Sound Block can only be installed in units with Version 3.1 or better. Therefore units that currently have Version 2 or 2.2 must be updated when ordering the Enhanced Resident Sound Block.

Note: When installing the Enhanced Resident Sound Block in units with sampling, be sure to remove the 20 DRAMs from the old CGP and reinstall them in the Enhanced Sound Block. If the unit has a Sound Block A board with the 10 Sound Block A chips socketed, the chips may be removed and installed in the Enhanced Resident Sound Block (see Enhanced Resident Sound Block Configuration list).

2.14.5 - Version 4 & 4.1

Sound Block A	-optional*
Sound Block B (Rock Block)	-optional*
Sound Block C (Classical Block)	-optional*
Sound Block D (Brass Block)	-optional*
Enhanced Resident Sound Block	-optional*
50kHz Sound Modeling Program	
Ram Sequencer Expansion (8K)	-required**
QLS (Quick Load System)	-optional***
MacAttach	
Superam I or Superam II	-optional

*Units with Sound Block A boards may have either Sound Block B, C or D added. Should a customer desire to add Sound Block B, C or D the customer would have to have the Enhanced Resident Sound Block installed as there is only room for one additional sound block to the Sound Block A board.

**The Ram Sequencer Expansion bringing the unit from a 4K sequencer memory to 8K sequencer memory is required with the installation of Version 3.1; because version 3.1 brings the sequencer memory to 12K.

***QLS may only be installed in units with sampling.

Note: The Enhanced Resident Sound Block can only be installed in units with Version 3.1 or better. Therefore units that currently have Version 2 or 2.2 must be updated when ordering the Enhanced Resident Sound Block.

Note: When installing the Enhanced Resident Sound Block in units with sampling, be sure to remove the 20 DRAMs from the old CGP and reinstall them in the Enhanced Sound Block. If the unit has a Sound Block A board with the 10 Sound Block A chips socketed, the chips may be removed and installed in the Enhanced Resident Sound Block (see Enhanced Resident Sound Block Configuration list).

2.14.6 - Version 5

Sound Block A	-optional*
Sound Block B (Rock Block)	-optional*
Sound Block C (Classical Block)	-optional*
Sound Block D (Brass Block)	-optional*
Enhanced Resident Sound Block	-optional*
50kHz Sound Modeling Program	
Ram Sequencer Expansion (8K)	-required**
QLS (Quick Load System)	-optional***
MacAttach	
Superam I or Superam II	-optional
Separate Outputs	-optional

*Units with Sound Block A boards may have either Sound Block B, C or D added. Should a customer desire to add Sound Block B, C or D the customer would have to have the Enhanced Resident Sound Block installed as there is only room for one additional sound block to the Sound Block A board.

**The Ram Sequencer Expansion bringing the unit from a 4K sequencer memory to 8K sequencer memory is required with the installation of Version 3.1; because version 3.1 brings the sequencer memory to 12K.

***QLS may only be installed in units with sampling.

Note: The Enhanced Resident Sound Block can only be installed in units with Version 3.1 or better. Therefore units that currently have Version 2 or 2.2 must be updated when ordering the Enhanced Resident Sound Block.

Note: When installing the Enhanced Resident Sound Block in units with sampling, be sure to remove the 20 DRAMs from the old CGP and reinstall them in the Enhanced Sound Block. If the unit has a Sound Block A board with the 10 Sound Block A chips socketed, the chips may be removed and installed in the Enhanced Resident Sound Block (see Enhanced Resident Sound Block Configuration list).

2.14.7 - Version 6

Sound Block A	-optional*
Sound Block B (Rock Block)	-optional*
Sound Block C (Classical Block)	-optional*
Sound Block D (Brass Block)	-optional*
Enhanced Resident Sound Block	-optional*
50kHz Sound Modeling Program	
Ram Sequencer Expansion (8K)	-required**
QLS (Quick Load System)	-optional***
MacAttach	-obsolete*****
Superam I or Superam II	-optional
Separate Outputs	-optional
RAM Cartridge and Adapter	-required****

*Units with Sound Block A boards may have either Sound Block B, C or D added. Should a customer desire to add Sound Block B, C or D the customer would have to have the Enhanced Resident Sound Block installed as there is only room for one additional sound block to the Sound Block A board.

**The Ram Sequencer Expansion bringing the unit from a 4K sequencer memory to 8K sequencer memory is required with the installation of Version 3.1; because version 3.1 brings the sequencer memory to 12K.

***QLS may only be installed in units with sampling.

****Version 6 is required to use the RAM Cartridge in the K250.

*****MacAttach is no longer available when the K250 is upgraded to Version 6.

Note: The Enhanced Resident Sound Block can only be installed in units with Version 3.1 or better. Therefore units that currently have Version 2 or 2.2 must be updated when ordering the Enhanced Resident Sound Block.

Note: When installing the Enhanced Resident Sound Block in units with sampling, be sure to remove the 20 DRAMs from the old CGP and reinstall them in the Enhanced Sound Block. If the unit has a Sound Block A board with the 10 Sound Block A chips socketed, the chips may be removed and installed in the Enhanced Resident Sound Block (see Enhanced Resident Sound Block Configuration list).

2.15 - SOUND BLOCK POSITIONING FOR ENHANCED RESIDENT SOUND BLOCK

Sound Block A	KMSI Part Number	Location
	82018001	U85
	82018101	U84
	82018201	U83
	82018301	U82
	82018401	U80
	82018501	U79
	82018601	U78
	82018701	U77
	82018801	U86
	82018901	U81
Sound Block B	82019001	U65
	82019101	U64
	82019201	U63
	82019301	U62
	82019401	U60
	82019501	U59
	82019601	U58
	82019701	U57
	82019801	U66
	82019901	U61
Sound Block C	82022001	U47
	82022101	U46
	82022201	U45
	82022301	U44
	82022401	U43
	82022501	U42
	82022601	U41
	82022701	U40
	82022801	U39
	82022901	U38

Sound Block D		
	82023001	U20
	82023101	U19
	82023201	U18
	82023301	U17
	82023401	U16
	82023501	U15
	82023601	U14
	82023701	U13
	82023801	U12
	82023901	U11

2.16 - OPTIONS VERSUS K250 CONFIGURATION

OPTION	MUST HAVE OR UPDATE TO:
QLS	Version 3.2 Software 50kHz Sound Modeling Program Ram Sequencer Expansion
Enhanced Resident Sound Block (new CGP)	Version 3.1 or better
Version 3.2 Software (or higher, i.e. Version 6)	Ram Sequencer Expansion 50kHz Sound Modeling Program
Sound Block B	Sound Block A Board Enhanced Resident Sound Block
Sound Block C	Sound Block A Board Enhanced Resident Sound Block
Sound Block D	Sound Block A Board Enhanced Resident Sound Block
Superam I or II	Enhanced Resident Sound Block 50kHz Sound Modeling Program Version 4 or better
Separate Outs (S/O)	Version 5
RAM Cartridge	Version 6 QLS 50kHz Sound Modeling Program

Chapter 3 - System Overview

3.1 - OVERVIEW

The Kurzweil 250 models are electro-mechanical instruments. They generate sound by a combination of mechanical and electrical functions. This section first presents an overview of the instruments and then describes each sub-system as a whole. Each of the three Kurzweil 250 models are described under their specific headings.

3.1.1 - Kurzweil 250

The Kurzweil 250's hardware is divided into two modules, the enclosure and the POD. The enclosure contains the piano keyboard and most of the system's electronics. The POD contains the power supply and the foot pedals.

The enclosure usually rests on its stand. The POD sits on the floor and is connected to the enclosure by a large harness cable.

The user has two main ways to control the instrument, through the piano keyboard (primarily during performance) and through the front control panel (mostly during "setup" before a performance).

3.1.2 - Kurzweil 250X

The Kurzweil 250X's hardware is also divided into two modules, the enclosure and POD. The enclosure contains most of the system's electronics. The POD contains the power supply. The POD sits on the floor and is connected to the enclosure by a large harness cable.

3.1.3 - Kurzweil RMX 250 AND 225

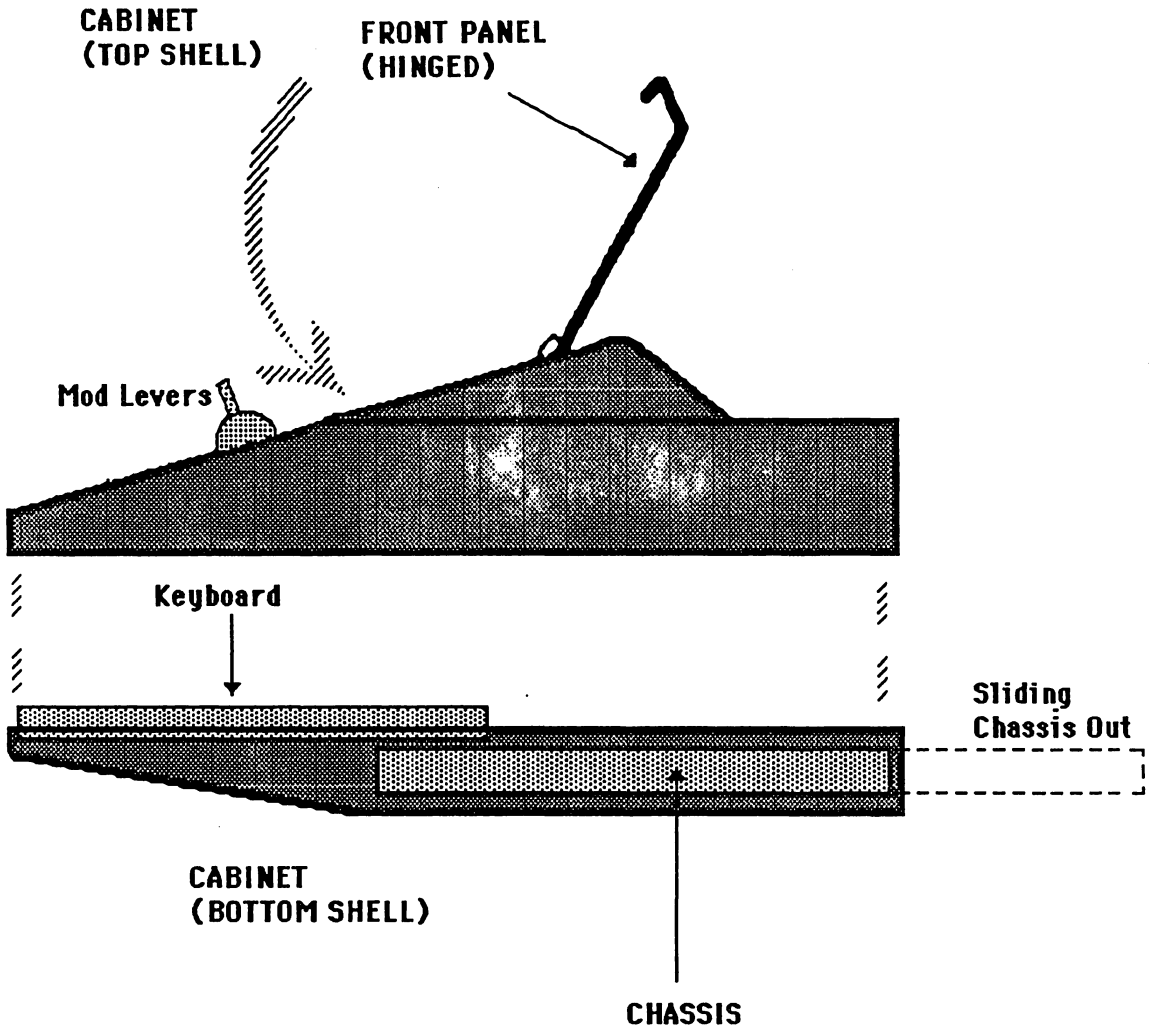
The hardware for the Kurzweil RMX is in its self-contained, rack mount enclosure. Unlike the K250 and K250X, the power supply is internally mounted in the RMX module.

3.2 - MECHANICAL OVERVIEW

3.2.1 - Kurzweil 250 Enclosure Overview

The enclosure is molded in two parts, a top and bottom.

Figure 3.1



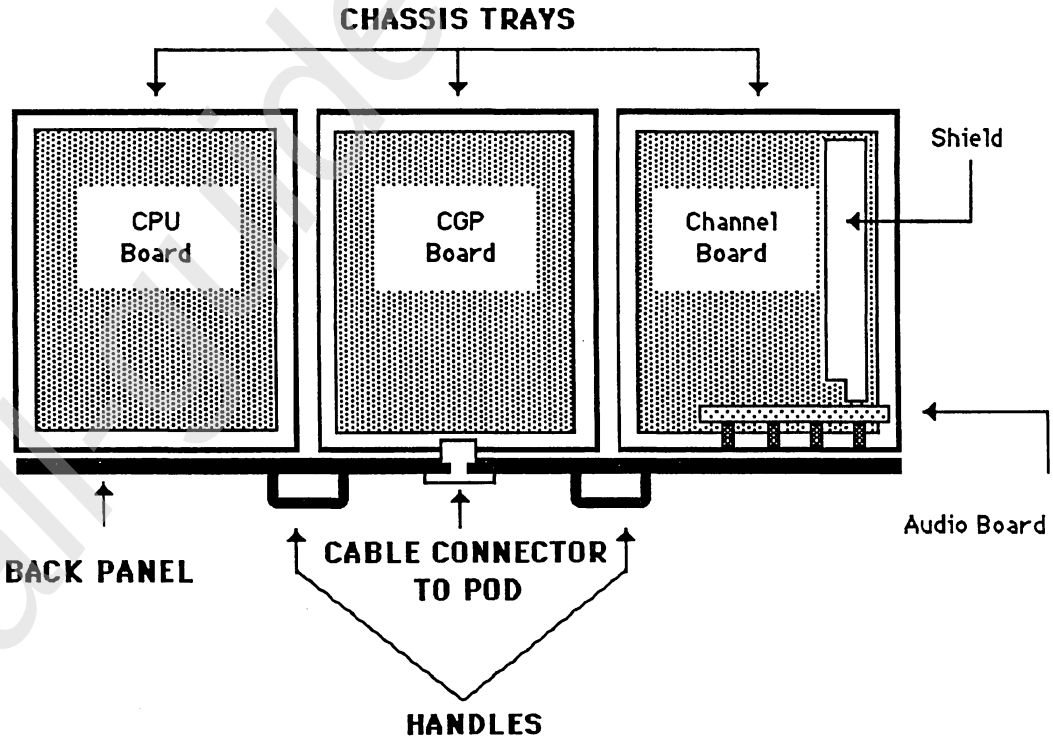
Inside the enclosure there are three major sub-assemblies:

*The Chassis Sub-assembly
*The Keyboard Sub-assembly
*The Front Panel Sub-assembly

Chassis Sub-Assembly

The chassis sub-assembly is a metal tray which slides out from the back of the instrument for servicing. The chassis is divided into three compartments, each cradling a large circuit board. Most of the circuitry in the system is on the three large boards. The boards are the Central Processing Unit (CPU), the Channel Group Processor (CGP) and the Channel board. The chassis also contains a small board, the Audio board, mounted inside the back panel. These boards are described in detail later.

Figure 3.2



Front Panel Sub-Assembly

The Front Panel sub-assembly of the Kurzweil 250 and the Kurzweil 250X has three board mounted on the faceplate. They are the following:

Slider board
Control Panel board
LCD board

The Slider board contains circuitry for the continuous (smooth-panning) controls. The Control Panel board controls the on/off operation of the 55 buttons and the 38 LEDs. The Control Panel also contains an analog/digital converter (ADC) that translates the analog signals into digital values. The LCD board controls the liquid crystal display which shows numbers and text.

The Front Panel sub-assembly of the Kurzweil RMX has one board mounted on the faceplate. The assembly is referred to as the RMX Control Panel board.

POD Assembly (K250 and K250X only)

The POD contains the power supply and the piano-style foot pedals. Most of the bulk of the POD is the power supply.

The POD contains a 5 volt supply for the system's logic circuitry, and a ±15 volt supply for the audio circuitry. The newer POD contains only one printed circuit board.

The POD assembly also contains a circuit that watches the AC power line and produces an "advance warning" of imminent power failure. When this pulse is detected, the machine saves information about its current state so that it can resume after the power interruption.

The POD is discussed further in the Electrical Overview section.

Keyboard Sub-Assembly (K250 only)

The Keyboard sub-assembly includes the following:

a wooden, piano-style key assembly
the action assembly
two keyswitch boards

The Keyboard sub-assembly is mounted in the bottom shell of the enclosure. The top shell must be removed to service the keyboard assembly. Each scanner module (which consists of a Keyswitch board and 44 leaf switches mounted on a bracket) scans half of the 88 keys on the keyboard, with one sensor (leaf switch) per key.

3.3 - ELECTRICAL OVERVIEW

Input from the user (from the keyboard and the control panel) is received via the Front Panel boards and keyboard sensors. These signals go to the CPU for processing (it has the 68000, I/O circuitry and keyboard interfaces). The CPU passes data to the Channel Group Processor board, which has the waveform memory. After its processing, it passes the data to the Channel board which has the 12 DACs (analog and support filters, etc.). After passing through the audio mixer on the Channel board, the signals then go to the Audio board.

The "Central Processing Unit" (CPU) board controls the operation of the entire system. It reads data from the keyboard and the Front Panel, directs the dialogue on the LEDs and display, tells the other two boards when to generate sounds and coordinates the signals on the various connectors on the back panel.

The "Channel Group Processor" (CGP) board acts as an intermediary between the CPU and channels. It has, in a large memory, definition for all the sounds the intrument produces. On command from the CPU, it will send any sound in the memory to a designated channel (or multiple sounds to multiple channels).

The actual generation of sound is performed by the "Channel board". Each of the 12 channels on it can create different arbitrary sounds, all of which get mixed together into two audio outputs. These outputs are sent to an external amplifier and speakers via the Audio board.

Figure 3.3 - ELECTRICAL/CONTROL FLOW

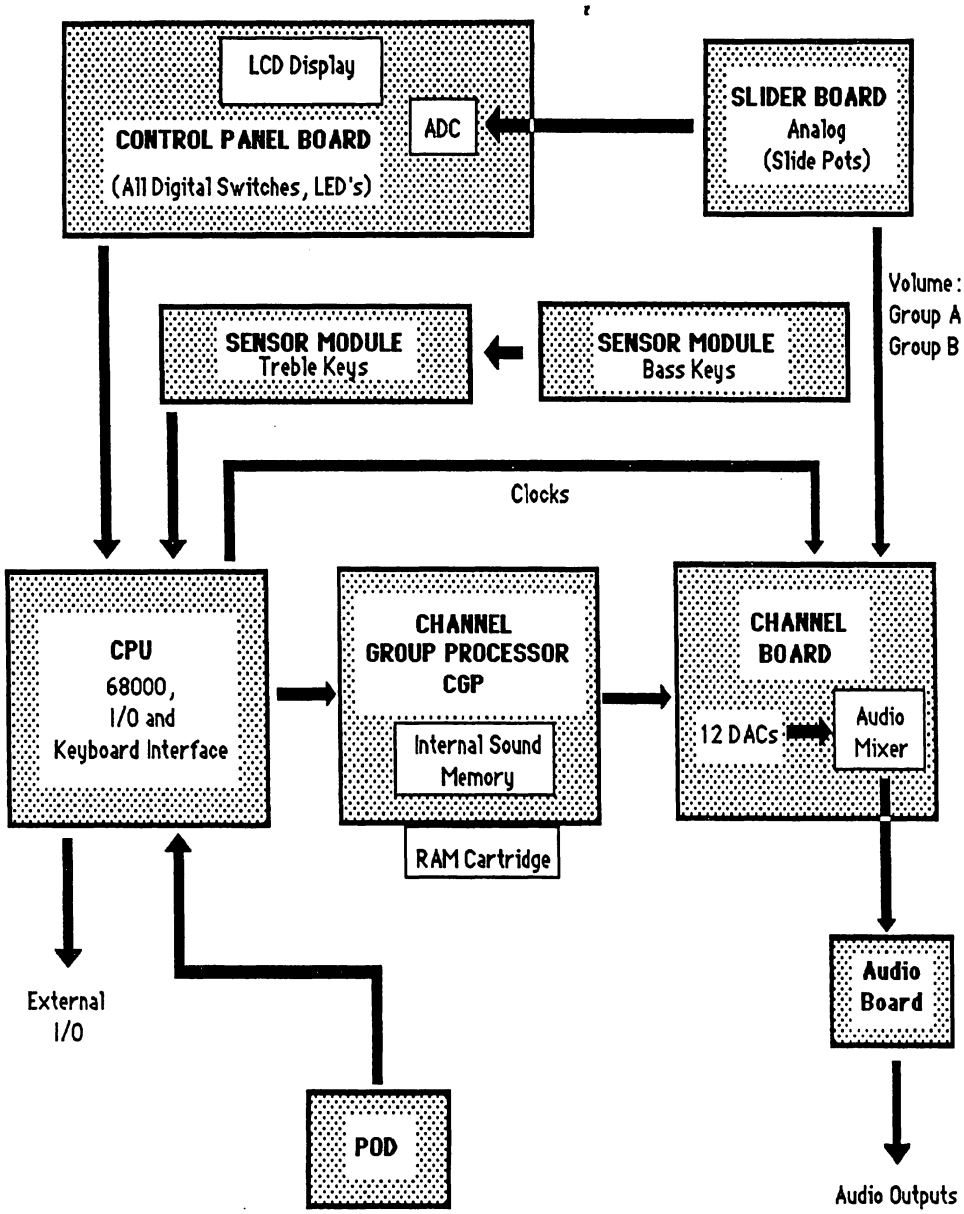
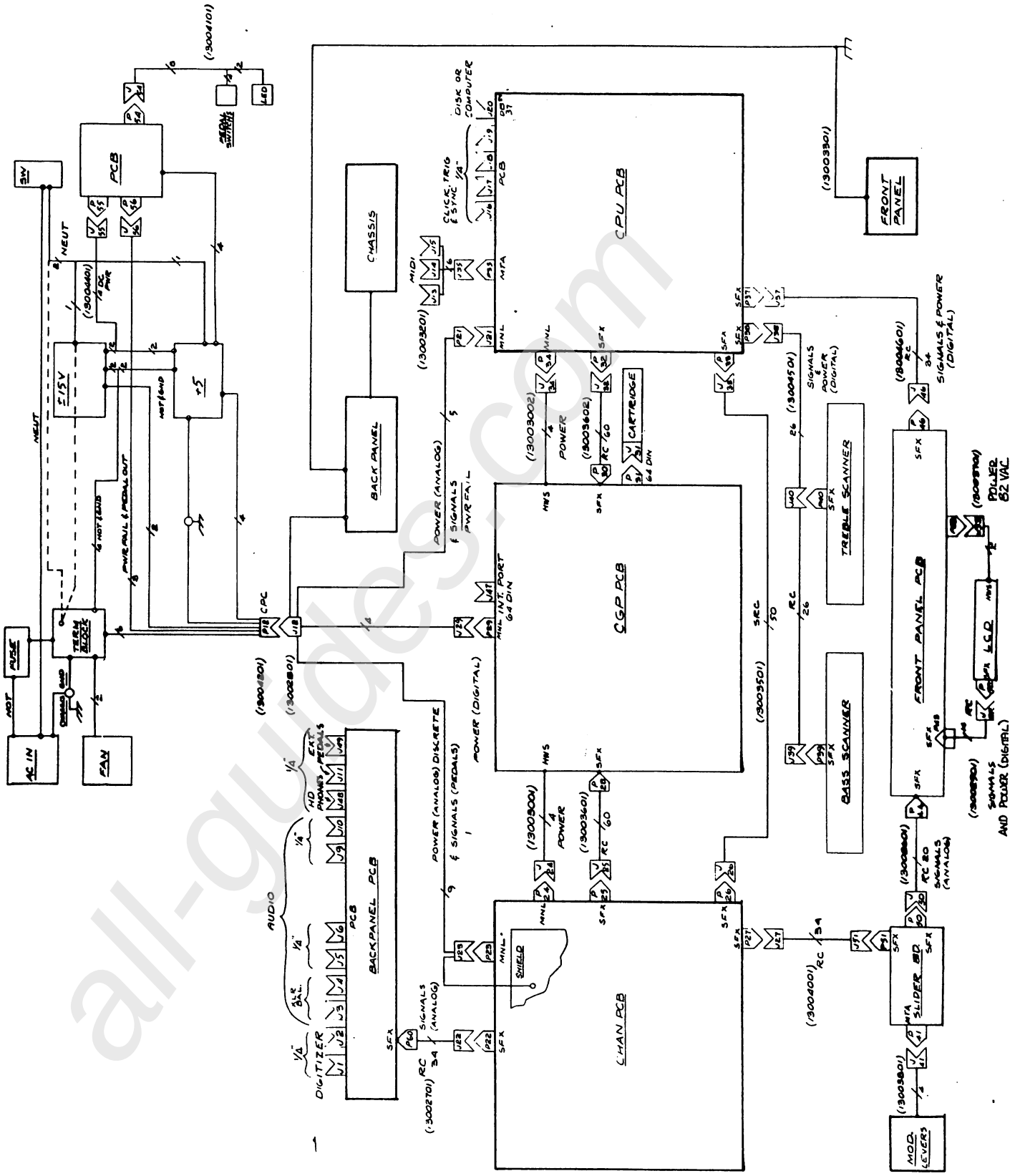


Figure 3.4 - INTERCONNECT DIAGRAM



3.4 - FUNCTIONAL DESCRIPTIONS

3.4.1 - CPU (Central Processing Unit)

The "Central Processing Unit" (CPU) board controls the operation of the entire system. It controls all I/O:reads data from the keyboard and the Front Panel, directs the dialogue on the LEDs and LCD display, controls the bi-directional personal computer port, and handles MIDI In, Out and Thru. The CPU board also tells the other two boards when to generate sounds, and it coordinates the signals on the various connectors on the back panel.

The CPU board contains the following hardware:

*68000 microprocessor
*PROM bank
*RAM bank
*PROM-or-RAM bank
*Interface to Front Panel
*Music Keyboard scanner with interface to keyboard
*Interface to Personal Computer
*MIDI interface
*24 16-bit programmable timers

Of the 16 megabytes of memory addressable by the 68000, the first 2 Mbytes are reserved for system memory and I/O. The remaining 14 Mbytes are reserved for sound file memory located external to the CPU board, on the Channel Group Processor board (CGP).

The CPU board's internal bus is not accessible to the Channel Group Processor (CGP). Instead the CGP talks directly to sound file memory over its own bus. The CPU communicates with the CGP over a special interface bus. It has access to the sound file memory, but under control of the CGP.

The CPU board also contains the hardware for handling the 88-note keyboard, including switch debounce circuitry.

68000 and Memory

RAM - The K250 has 128 Kbytes of memory. The memory is allocated for the system's use and for sounds.

PROM - The software that controls the K250 is built into PROM. There are 8 system PROMs on the CPU board. Two of these are replaced when the Diagnostic PROMs are used. Each PROM is labeled with a sticker that indicates its location in the bank of PROM, and a checksum value. Every version of the software will have unique checksums associated with it.

Battery-Backed Memory - The CPU board contains a battery which provides power to retain memory after power down. This Battery-Backed memory saves keyboard setups and other user information.

I/O Ports

MIDI - The MIDI port is a 68A50 serial port.

MIDI IN - This is a 31.2K baud, 5 milliamp serial input.

MIDI THRU - This is a 31.2K baud, 5 milliamp serial output.

MIDI OUT - This is a 31.2K baud, 5 milliamp serial output, the same as MIDI In buffered, conforms to MIDI specifications.

Computer Port - This port is for attaching a personal computer to the K250. The K250 Personal Computer I/O Port currently uses the Apple Macintosh's serial signalling convention.

Trigger In - The Trigger In is a TTL-compatible input used for starting a sequence from an external device. The sequence triggers on the positive edge of the supplied pulse. Minimum pulse width is 1 microsecond. The input impedance is greater than 10k ohms. The trigger level is 2 volts. This I/O port takes a 1/4 inch phone jack.

Click Out - The Click Out is a TTL-level output pulse. When enabled from the Front Panel, a positive pulse appears at this output. Its repetition rate is the selected sequencer tempo. Driving source is a low power TTL gate through a 51 ohm resistor. This I/O port takes a ,1/4 inch phone jack.

Sync In - The Sync In is a TTL-compatible input used to drive the K250 from another instrument. The other instrument is to provide a square wave at X12 to X96 the tempo. The input impedance is greater than 10k ohms. The trigger level is 2 volts and this I/O port takes a 1/4 inch phone jack.

Sync Out - The Sync Out is a TTL-level square wave output used to drive another instrument in synchrony with the K250. The repetition rate is normally X12 to X96 the tempo. The driving source is a low power TTL gate through a 51 ohm resistor. This I/O port takes a 1/4 in phone jack.

LO - These are 2.6, absolute maximum, VPP audio outputs, with a 600 ohm driving source impedance. Typical output levels are an order of magnitude lower than maximums. These require 1/4 inch phone jacks and are suitable for line level inputs.

HI - These are 26, absolute maximim, VPP audio outputs, with a 600 ohm driving source impedance. Typical output levels are an order of magnitude lower than maximums. These require 1/4 inch phone jacks and are suitable for directly driving power amplifiers and other high level inputs.

Balanced - These are 26, absolute maximum, VPP audio outputs. They have XLF connectors, floating outputs and a 600 ohm driving source impedance. Typical output levels are an order of magnitude lower than maximums.

External Pedals 1 and 2 - The 1/4 inch phone jacks accept external pedals.

MIC - This digitizer input is a 200 mVPP full scale input. It has a 47K ohm input impedance and accepts a 1/4 inch phone jack.

Line In - This digitizer input is a 1 VPP full scale input (300 mV rms). It has a 10K ohm input impedance and accepts a 1/4 inch phone jack.

Front Panel Control Interface

The Front Panel Control Interface circuitry is located on the CPU board. It consists of an 8 bit bi-directional data port, and eight control lines. The CPU communicates with the control panel through the data port. The front Panel Control Interface consists of:

*LCD Interface
*Switch/LED Interace
*A/D Interface

Keyboard Interface

The Keyboard Interface is on the CPU board. It detects "events" happening at the keyboard, and reports information about them to the CPU. Since the CPU may not be able to respond to events immediately, data is saved until ready for use. An event may be either an "attack" (key depression) or a "release" (key released).

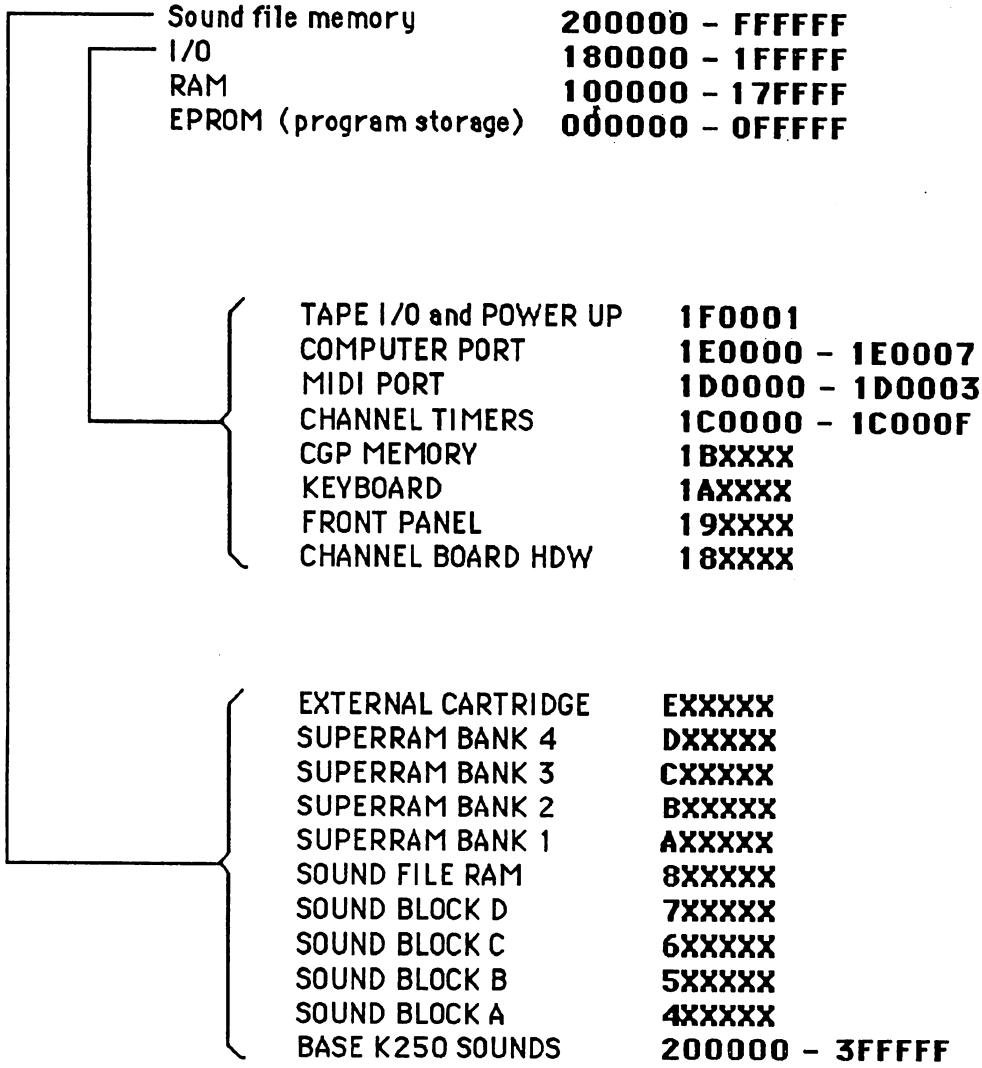
When the machine is first plugged in, the keyboard controller assumes that all the keys are "at rest". It then requests the keyboard sensor modules to examine each key 4000 times per second. As long as a key remains "at rest", the sensors activate the "Kr" signals when the key is examined. The key is said to be "at rest". When a key is pressed down, though, "Kr" is no longer activated. If it is pressed down for long enough, the "Kd" will be activated but this does not happen right away, so for a while neither the "Kr" nor "Kd" is active.

As long as neither "Kr" or "Kd" is active, following "rest" the key is said to be in the "falling" state.

When "Kd" finally becomes active, the key is said to have entered the "down state". At the same time, an "attack event" is reported to the CPU. This report includes a flag identifying it as an attack, the key number and its time of flight. Time of flight is used to determine how hard a key was pressed.

A counter exists for each key. Whenever a key is in the "rest state", its counter is reset to zero. While a key is in the "falling state", its counter is incremented every quarter-millisecond. As soon as the key enters the "down" state, the accumulated count is reported (in inverted form) as velocity. It shows how many quarter-milliseconds the key took to fly between "rest" and "down" state. A "release" is essentially a mirror image of an attack. When "Kd" ceases to be active, the key enters the "rising state" and its counter starts incrementing every quarter-millisecond. As soon as "Kr" becomes active again, the count is reported as time of flight, tagged as a "release event" and the key re-enters the rest state.

Figure 3.5 - K250 MEMORY MAP



3.4.2 - Channel Group Processor (CGP)

The Channel Group Processor (CGP) board acts an intermediary between the CPU and channels. It has, in a large memory, definition for all the sounds the instrument can produce. On command from the CPU, it will send any sound in the memory to designated channel (or multiple sounds to multiple channels).

The soundfile memory is a dual-ported, dual-mode array of memories which have a maximum of 14 Megabytes of total address range. The two ports are the CPU and the CGP. The two modes are sound and data.

The CGP performs four functions:

1. Fetching (DMA) sound samples from main memory
2. Buffering of up to 16 sound samples in (FIFO)
3. Servicing of requests for sound samples from up to 12 channels (one per sampling clock tick)
4. Interrupting the main process at the end of each waveform, under microprogram control

Each port has its own address strobe (CGAS/ for the CGP, SFAS/ for the CPU). This indicates to the memory controller PAL that a request is pending, and will initiate arbitration of the soundfile memory. In both devices, the request will remain stable until an acknowledge (SFACK/ is given to the appropriate device. If no request is active, the controller PAL will initiate a RAM refresh cycle.

The two address busses are tri-state multiplexed onto a common Soundfile Address bus (SFADDR). The buffer enables are tied to CPSFIP/ and CGSFIP/. When arbitration has occurred, these signals indicate access to soundfile memory, and 50 ns. is allowed for the signals to settle on the SFADDR bus. On the next cycle RAS/ will always go low, which signifies that the addresses are valid, and the access time of the memory begins (usually 250 to 350 ns.). During the RAS/ state, we require that the memory control signals such as read/write and SOUND, the mode control, become valid. This allows the data paths to be set up in the appropriate way, as well as the special circuitry required to generate the SOUND samples. Depending on the memory type (shown in figure 3.5) and the setting of the DTACK jumper, this may also generate DTACK/ to the requesting device. The next cycle, CAS/ is generated only if the RAM was accessed. There are actually 4 CAS/ signals, corresponding to UDS/, LDS/, SOUND*UDS/, and SOUND*LDS/ (CASH/, CASL/, SCASH/ and SCASL/).

The main soundfile data path (SFDATA), is used for both sound and data. The CPU selects the mode it wishes to access soundfile memory by writing to two locations in the CGP address while RDSOUND changes back into data mode. Both of these accesses have no wait stages. When the CPU accesses sound, each sample appears to occupy a single byte (this so that the soundfile can have uniform addressing, and word transfers can occur in one cycle). This means that the 68000 must pre-store the 2 LSBs of the sound in a special latch (called, not surprisingly, the Sound Latch) before doing a write to sound memory, and this is accomplished whenever WRSOUND occurs. The reading of soundfiles is done by writing WRSOUND, performing a soundfile access, and then extracting the 2 LSB's by reading RDSOUND.

The 12 channels operate independently in all of the above tasks, and are time-multiplexed using high-speed (10MHz.) dedicated logic. Before a channel may be enabled, the appropriate parameters must be loaded by the main CPU into the CGP Local Memory. In addition, the individual channel must be set up to generate the appropriate amplitude, Sampling clock and Anti-Alias clock rate.

We begin our description with the programming sequence required to initiate a sound in the CGP. In the Kurzweil 250, only 12 channels of the possible 16 channels are provided. Each channel has an on/off hardware control located in the Channel Enable Word (CEW). This bit must be off (0) before channel initialization begins. Then, we write the CSW with all 0s which performs the following functions:

1. Initializes the FIFO write and read pointers to FIFO location 0.
2. Sets the "FIFOFUL" bit to 0, indicating that the FIFO is not full, and should be filled the first time the channel is polled.
3. Clears the "End-of-Waveform Pending" and "Audio Enable" bits (described later).
4. Sets the "Toggle" bit to point to the lower span.

Once the CSW is initialized, it should not be re-written until the channel has been de-allocated, because the parameters are modified as the sound progresses.

Next, two spans should be loaded into the appropriate locations of the CGP, the lower one being first, followed by the higher one. Note that the span has a maximum length of 64K samples, and may never cross a 64K boundary. When the appropriate sampling and alias clocks and amplitude DAC have been initialized, the channel can be enabled by writing to the CEW.

First, we will describe a typical life of a waveform. We begin with setting up all of parameters described above. When all is ready, the channel in question is enabled by writing to the appropriate bit in the Channel Enable Word. On the subsequent 16 polls of the enabled channel, the CGP will perform a DMA cycle to fetch a sound sample pointed to by the DMA HIGH and DMA LOW parameters in the CGP parameter memory. This DMA address is then incremented and written back into the CGP local memory, compared with the DMA LAST. The sound sample is also written into the CGP local memory in a special location dedicated to this channel's FIFO. The pointer address to the channel's CGP FIFO pointed to by a field in the CHANNEL STATUS WORD (CSW). This word is updated every time the FIFO is written to or read from. The CSW is written into only once, when the channel is being initialized.

Sixteen such DMA operations will occur in succession, until the FIFO is filled. At this point, the sampling clock will be enabled (free running mode). Nothing will happen until the first sampling clock tick occurs, which signifies that a sound sample is requested at the Signal Channel Data in the channel. The CGP simply pops the first FIFO'd sample onto the DAC BUS, updates the CSW (now indicating that the FIFO is not full), and proceeds to the next channel. On the next poll, the CGP will perform another DMA operation to keep the FIFO full.

Another function concerns when the DMA address matches the micro-programmed DMA LAST ADDRESS. This will generate a vectored interrupt of the main CPU, and invert the TOGGLE BIT, which points to one of 2 sets of parameters which the CGP processes. In this way, the DMA operation is not stopped at the end of each waveform, the main CPU has one full waveform to update the other parameter set in the CGP local memory.

If an interrupt has been generated by one channel, and another channel also reaches the End-of-Waveform before the first interrupt has been serviced; a bit is set in the CSW and the interrupt is issued on the next DMA cycle in which an interrupt is not pending.

Finally, when the amplitude of the signal has been ramped down to inaudible, the channel may be de-allocated by writing a zero to a bit in the Channel Enable Word.

Now, we can look at the CGP State Diagram (figure 3.7) to trace the cycle by cycle operation of the CGP. On RESET/, the CGP is initialized to state 0, then it unconditionally jumps into state F, which increments the Channel Count (CHCNT), which will be stable before the end of state F. In addition, the CPU may want to access the Group Processor, so that if CPGPRQ/ is active, State F is when the CPU-Group Processor communication occurs (CPGPIP). When the access is complete, or if no access occurs, the CGP reads the CSW in State D. The status should be latched and stable by the end of this clock cycle. The appropriate bit of the CEW which determines the Channel Enable (CHEN) should also be present at the PAL input, and determines whether the CSW should be ignored (State F) or looked at (State 3).

In the Decision state, we discover (via the CSW) whether the FIFO is full (FIFOFUL), whether the channel (via the Channel board) is requesting a sample (CHRDRQ), and whether the 68000 is currently accessing soundfile ROM. Anytime the FIFO is not full, the CGP performs a DMA from soundfile memory to the FIFO, however it may have to wait for the CPU-soundfile transfer (CPSFIP) to complete. If the channel is requesting a sample, it can service this request during a DMA cycle, or to State 5 if the FIFO is already full.

Figure 3.6 - CGP BLOCK DIAGRAM

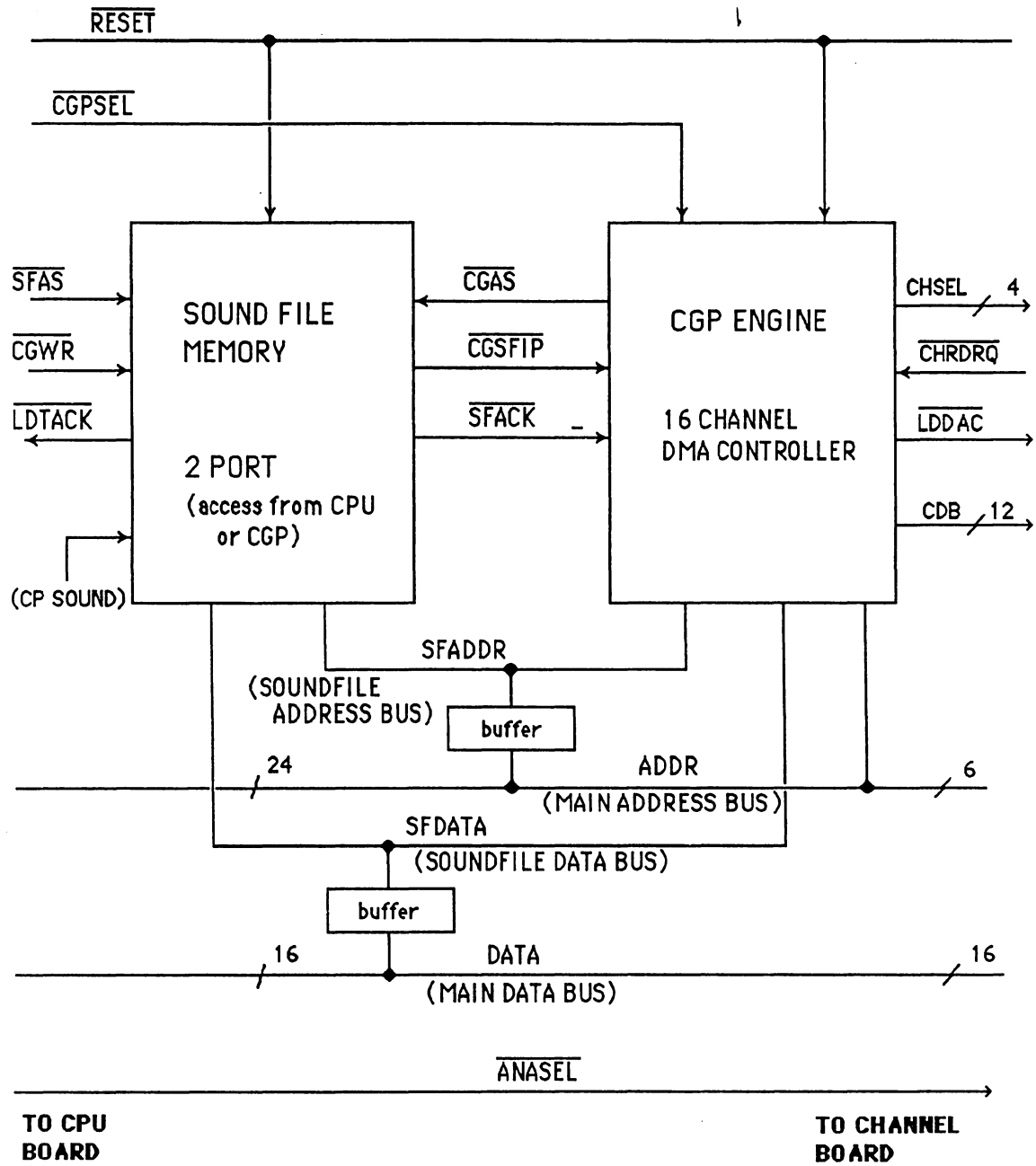


Figure 3.7 - CGP STATE DIAGRAM

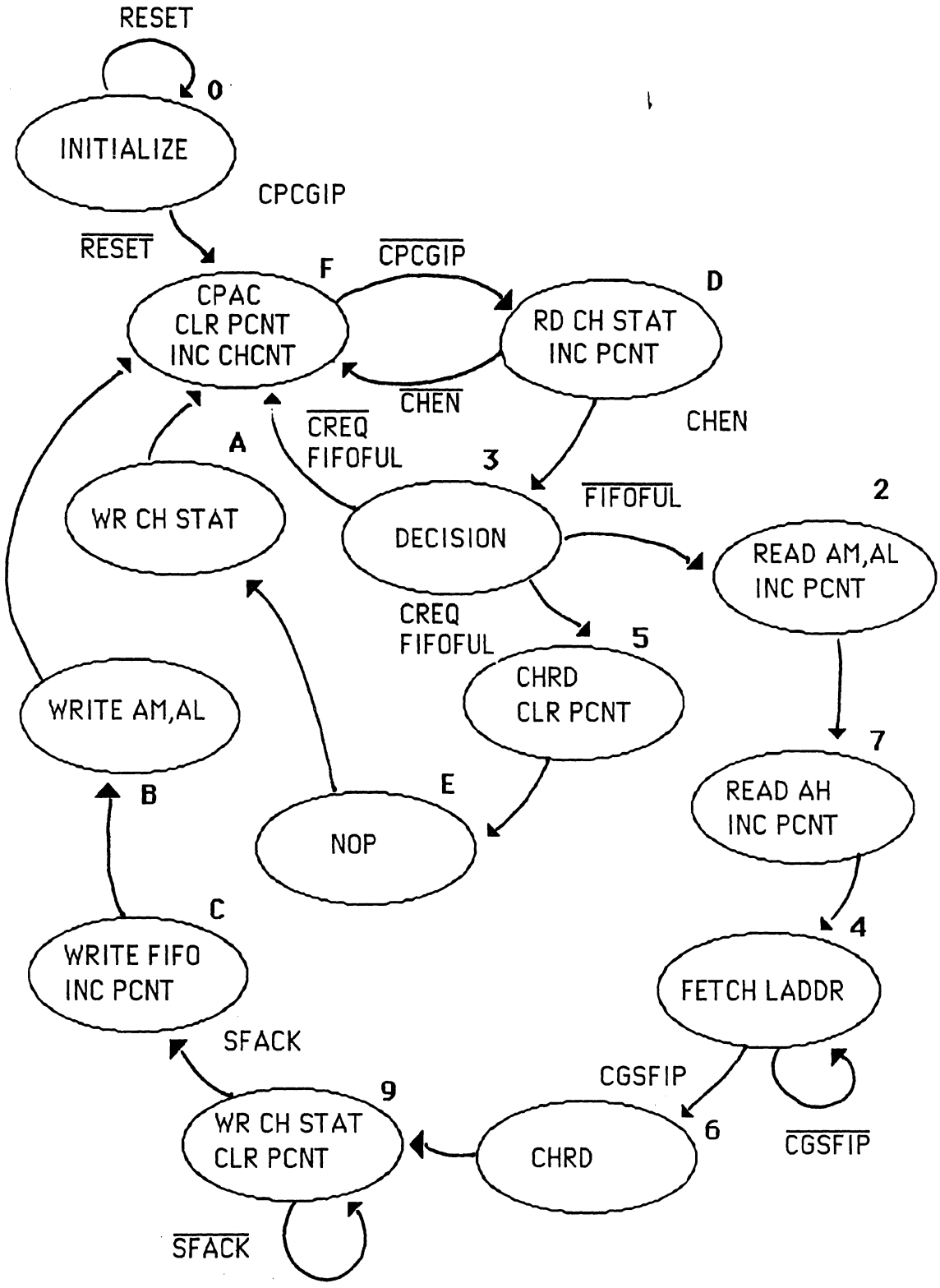
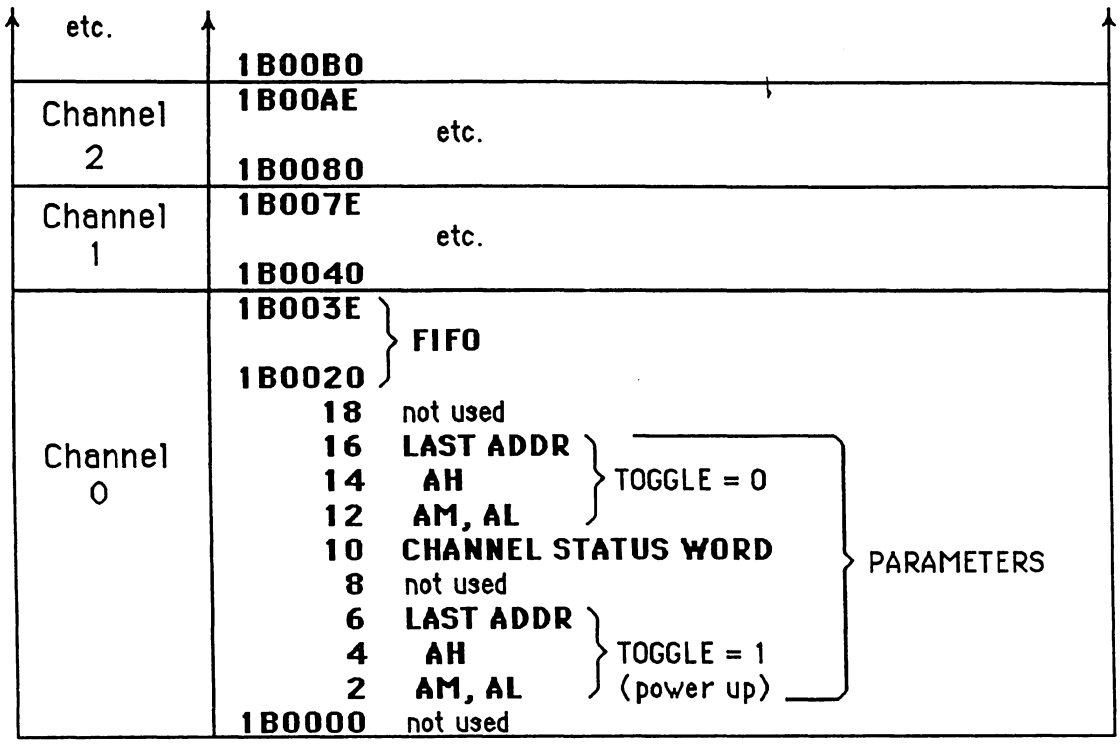


Figure 3.8 - CGP MEMORY MAP



CHANNEL STATUS WORD : FETA ZZZZ YYYY XX
(16 bits)

where: **F** = $\overline{\text{FIFOFUL}}$
E = $\overline{\text{EOWPEND}}$
T = $\overline{\text{TOGGLE}}$
A = $\overline{\text{AUDIOEN}}$

XXXX = don't care
YYYY = FIFO READ ADDR
ZZZZ = FIFO WRITE ADDR

In State 5, the CGP memory is addressed by appending the channel number (CHCNT), and the FIFO read pointer to fetch the appropriate sound sample, and latch it into a buffer for transfer to the Channel board. Next, we increment the FIFO read pointer, and compare it to the FIFO write pointer. If they are equal then the new FIFO full is asserted, and the new CSW is written over the old one.

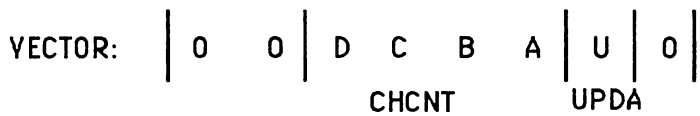
If a DMA cycle is required, the sequence is as follows:

1. Read and latch the low 16 bits of the DMA address.
2. Read and latch the high 8 bits of the DMA address. Also assert CGP address strobe (CGAS).
3. Perform a Channel Read, if required (identical to State 5).
4. Read, latch and compare the programmed last address (LADDR) with the current DMA address
5. Rewrite the CSW, incrementing the FIFO write pointer, the FIFO read pointer (if necessary), and updating FIFOFUL.
6. Write the new sound sample into the CGP at the address pointed to by the FIFO write pointer.
7. Write the new DMA address for the channel (old one +1) over the old one.

In this way, the CGP attempts to keep all of the active FIFO's full, while guaranteeing one-poll service of channel requests.

The other interface requirement is that of the Last Access (LAST), which performs the following functions;

1. Inverts the Toggle bit of the CSW, which points to the current active span parameters.
2. If there is no interrupt pending, the current channel number (CHCNT) and a single bit (UPDATE) are latched into a buffer for examination by a CPU. The format of the Vector byte is:



The CPU is then interrupted (level 6) and must read the contents of the vector to determine which channel and which span to update. This also clears the interrupt. During the time between the interrupt and the reading of the vector, End-of-Waveform in Progress (EOWIP) is set.

If there is an interrupt pending, the current CSW is modified to have its End-of-Waveform Pending (EOWPEND) bit set. This is examined every time the CSW is read, and if active, the EOWIP signal is sampled to determine whether the current EOWPEND can be made active ("peeled") or remain pending. The vector and EOWPEND bit are adjusted accordingly.

How to operate a channel

1. Set up sampling and alias clock rates

   write to 8254 control location
   write 2 bytes to each clock location

2. Set up parameter block in CGP local memory

   write channel status word 0 x FFFF
   write DMA starting location (AM, AL)
   write DMA high order address, interrupt vector
   write DMA last address

3. Write to appropriate amplitude DAC

4. Enable channel via channel control location

To disable a Channel

1. Make sure AMP DAC is at minimum amplitude

2. Disable channel via channel control location

3.4.3 - Channel Board

The actual generation of sound is performed by the Channel board. Each of the 12 channels on it can create different arbitrary sounds, all of which get mixed together into two audio outputs. These outputs are sent to an external amplifier and speakers via the Audio board.

As shown in the drawing, K250 Channel board (figure 3.9), the Channel board has several subsections of circuitry. The block on the right hand side of the board is labeled CGP/Channel interface. The section of the circuitry controls the flow of sound samples in an orderly manner from the CGP to each of the 12 channels on the Channel board. Each channel must receive its sound samples in exact synchronizim with the channel timers located on the CPU board. Since the K250 is a variable sampling rate instrument, each channel may be playing out a sound at a different sample rate. There are two sets of signals which go from the CPU to the Channel board one labeled FSAMP and the other labeled FALIAS. There are 12 FSAMP signals, one for each channel and 12 FALIAS signals, one for each channel. These 24 signals come over the long flat ribbon cable from the CPU board to the Channel board directly.

These two sets of signals are generated by the 24 programmable timers located on the CPU board. The clock rate for each FSAMP signal is precisely the sampling rate of that particular channel. The CGP is designed to deliver samples just as fast as the Channel board can call for them for each of its channels. Therefore, this section of circuitry could be thought of as a section which trottles the flow of samples to each channel. The middle section of the board is actually where the 12 identical channels reside. All channels are identical expect channel 12. Channel 12 varies slightly from the other 11 in one respect. Some of Channel 12's circuitry is used for the sampling function.

The output of each of the 12 channels is then fed into a stereo mixer section on the left hand side of the Channel board where the 12 channels are mixed into 2 channels. Driver amplifiers in this section of circuitry amplify the left and right signals and feed them to the output connector which goes to the Audio board.

This section circuitry also controls the 12 groups select swiches for switching each channel's sound onto either an A BUS or B BUS. The audio board which attaches to this connector holds primarily the audio outputs jacks. On the Audio board is also a preamplifier circuit used the Channel board. The external pedal inputs come in over this connector and are routed through the Channel board to the connector at the bottom of the Channel board which goes to the Slider board. Coming from the Slider board to the Channel board are the signals which control the left/right balance, the audio outputs.

A typical channel is diagrammed in the drawing, Analog/Channels Block Diagram (figure 3.10). On the left-hand side of the diagram is a BUS called DATA, this is a set of 16 data lines which come directly from the CPU board.

The three sets of signals labeled DATA, FALAIS and FSAMP come directly from the CPU board, whereas a set of signals labeled CDB BUS come directly from the CGP board. These 12 lines labeled CDB carry the actual sample data from the CGP to the Channel board. Samples are stored in 10-bit format so the bottom 2 bits of this 12-bit bus always contain zeros. The design of the K250 attempts to maximize the signal to noise ratio by keeping the actual sample data as close to full scale as possible at all times, and having the decay information in the sound contained in an envelope control section. By way of example, consider the Kurzweil Grand Piano sound. When a note is struck, as the sound dies away, the sound samples themselves are kept as close to full scale as possible and the ramp down of the sound is caused by the envelope ramping down. Each channel has a 8-bit DAC which serves as the envelope control.

As sample data is being fed from the CGP, amplitude envelope information is being fed simultaneously from the CPU. The update rate of the amplitude envelope control information is much slower than the actual delivery of the samples from the CGP. Therefore, the CPU is fast enough to deliver this information in a timely manner. The amplitude envelope information for each channel comes in over the 16 data lines from the CPU. Actually, only 8 of these are used since the amplitude envelope control DAC is an 8-bit DAC. The output of this DAC, as seen on the block diagram, goes to the control input of the final VCA on each channel where the actual ramp down of the sound occurs on those sounds which decay.

The CDB BUS from the group processor feeds the sample information into each channel's 12-bit DAC. The output of the DAC goes into a sample and hold whose timing is controlled by the FSAMP signal which comes from the CPU board. The output of each sample and hold is fed into a very sharp cutoff low-pass filter called an alias filter. The function of the alias filter is to remove those components of the spectrum which are generated by the sampling process. As a channel finishes playing a note or sound a one sampling frequency, the next note that it receives may be at a different sampling frequency.

The frequency FSAMP changes to reflect the different sampling rates. Also the corner frequency of the alias filter changes to accommodate the new sampling rate. The output of the alias filter is fed to the output channel VCA, mentioned earlier, whose control input is driven from the 8-bit envelope control DAC. The output of this VCA goes to a solid state, SPDT switch. This switch switches the output of the channel onto either an A BUS or B BUS. The A output of each of the channels are all ganged into 4 additional VCAs. These VCAs control the relative balance of the A and B signals onto the left and right output busses. The control inputs to these 4 VCAs come from the Slider board on the front panel. At the top of the drawing labeled, Analog/Channels Block Diagram (figure 3.10), is a block called buffer. There are 12 outputs from this device; 1 for each channel. When a note is struck on the keyboard, the CPU after determining which note it is and various other parameters; determines whether the sound should be switched onto the A BUS or the B BUS. It does this switching before the sound actually starts.

Refer now to the diagram labeled Handshake Diagram for a Single Channel (figure 3.11). As mentioned earlier, the CGP can deliver samples generally much more quickly than the Channel board can take them. So the function of the interface circuitry on the Channel board is to throttle the delivery of the samples to each of the channels. It effectively does this throttling through the 12 signals labeled FSAMP. Imagine for a moment that the K250 is a 1 channel instrument while looking at this diagram. The signal labeled LDDAC stands for Load DAC Not and is the signal which eventually causes the signal DAC for this channel on the Channel board to be loaded with a sound sample. Once the CGP has been told by the CPU to start playing out a particular sound were it not for the throttling effect from the Channel board, the CGP would just spit out samples in rapid fire succession to the Channel so the LDDAC signals would be happening in rapid succession.

Imagine for a moment that the output of the box called 1-bit register is always high. So that the cross coupled gate flip-flop simply flip flops back and forth in response to the LDDAC and the FSAMP signal. The output of this cross coupled gate flip-flop is called CHRDRQ which stands for channel read request. It is this signal CHRDRQ which signals the CGP that the channel is ready for a new sample. Whenever this line goes low the CGP will then begin the process of loading a new sample into the channel.

But this signal CHRDRQ will only go low in response to the FSAMP input going low, but this is precisely the time when you want the sample to be delivered. That is, in synchronization with the FSAMP signal. Once that sample has been loaded into the DAC by the LDDAC pulse, then this same signal LDDAC sets the cross coupled gate flip-flop to the other state and causes CHRDRQ to go high. When the CGP sees the signal CHRDRQ go high, it will deliver no further samples until CHRDRQ goes low again, which will happen only when the next FSAMP pulse goes low. It is in this way that the sampling clock or FSAMP throttles the loading of the sampling information into channel. This all assumes that the output of the 1-bit register is always high. This would be the case if the channel is turned on. If that channel is not turned on, that is, not intended to play any sound, then the output of this register will be low by forcing the signal CHRDRQ to always reside high, which then causes the CGP to not load samples into that channel.

The channel is turned on or off by the loading of a 1 or 0 into this 1-bit register. If a 1 is loaded the channel will be turned on, if a 0 is loaded the channel will be turned off. This register is loaded at the beginning of the sound, right after the note is struck at the performance keyboard. When the note has finished playing out, then this register will be written from the CPU with a zero, which then turns off that channel. The 1-bit register for each channel goes to one line of the set of signals called DATA which come directly from the CPU board. DATA line 0 controls the turning on and off of channel 1, the 1 controls channel 2, 2 controls 3, etc.

The diagram labeled, CGP-Channel Interface (figure 3.12), shows how this simple single channel interface is used to service all 12 channels. The CGP only gives the illusion that all 12 channels are being loaded simultaneously. Each channel is actually being loaded one after the other in a round robin fashion. This sequentinal loading happens at a rate high enough to be indistinguishable from simultaneous loading of the channels. The set of four signals called CHSEL A, B, C and D determines which channel is to be loaded with a sample of information at any point in the cycling of the channels. The signal labeled CEW controls the turning on or turning off of each channel at the appropriate time. Through loading each channel with a either a 1 or 0 from the respective line from the DATA BUS. CHEN is a signal which is fed back to the group processor for its own use in determining whether a particular channel is on or off, as that channel reaches its turn in the continual cycling of the 12 channels.

Figure 3.9 - K250 CHANNEL BOARD

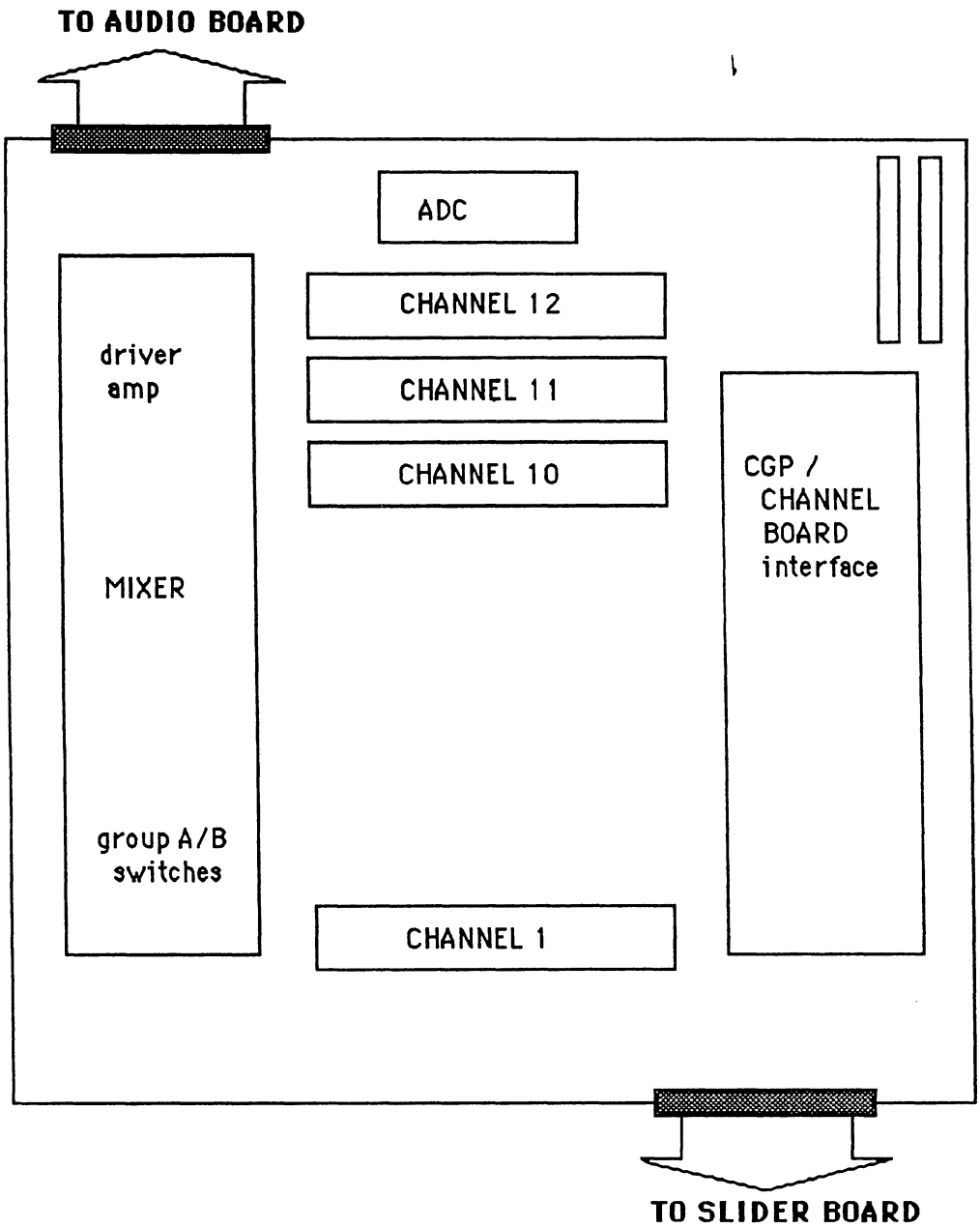
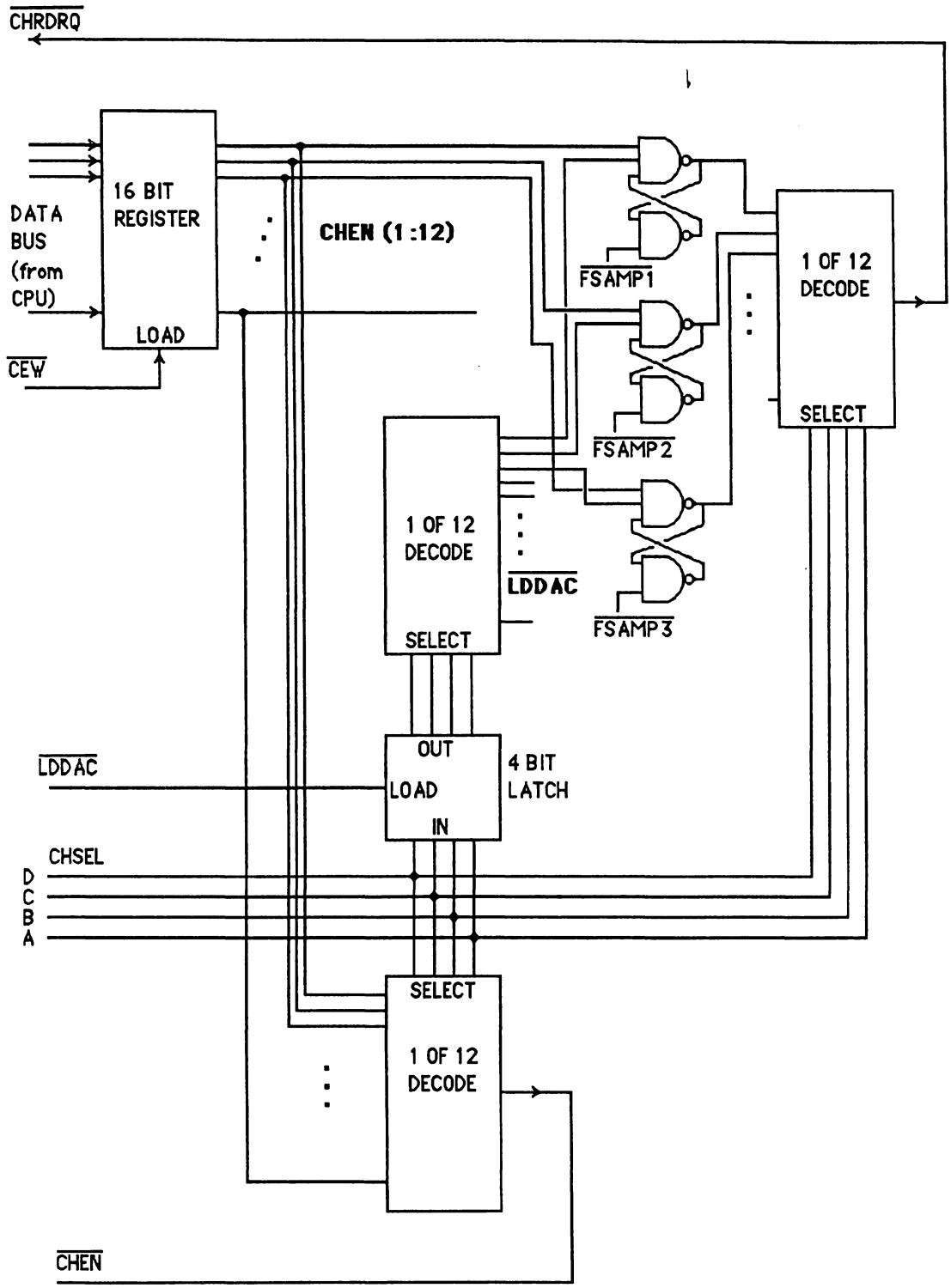


Figure 3.12 - CGP-CHANNEL BOARD INTERFACE (12 CHANNEL HANDSHAKE)



3.4.4 - Front Panel Assembly

The Front Panel assembly is hinged to open upwards for servicing. The faceplate silk-screening identifies each control. The three circuit boards, Control Panel, Display and Slider boards are attached underneath. The Control Panel board contains mostly digital circuitry and the Slider board contains mostly analog circuitry.

The Display board consists of the liquid crystal display unit (LCD) and its circuitry. The display shows numbers and text, letting the user carry on a "dialogue" with the instrument. The LCD shows two lines of 24 characters each. Any letter, number or punctuation can be shown. The display is used when a more elaborate message is needed than a flashing lamp can convey.

Control Panel Board

The Control Panel board is controlled and monitored by the CPU board. The signals from the CPU are decoded to see which sub-system (switches, lamps, LCD, etc.) is to be activated.

The Control Panel board also contains an "analog-to-digital converter" (ADC). This translates analog voltage levels into 8-bit binary digital values.

The main functions of the Control Panel are:

1. Control the LCD display
2. Control the LED's
3. Control the switches
4. Convert A/D

The "switch matrix" contains 55 pushbutton switches, used to enter numbers and predefined commands into the machine. Of these switches, 38 contain "light emitting diodes" (LED's) which form the "lamp array". These lamps are lit for various purposes such as a confirmation of actions or an indication of next possible actions.

The Control Panel board receives power and signals from the CPU through its connector. Power comes in on multiple wires to allow more current to flow. This also provides redundant contacts, increasing reliability. Most signals have either power or ground lines between them to reduce crosstalk.

Slider Board

The Slider board contains seven slide potentiometers which affect the instrument's tuning and other characteristics. It conditions and passes on signals from two "special-effects" levers, the two piano-type foot pedals in the POD, and two (optional) special effects pedals that plug into the back panel.

The Slider board provides analog signals:

1. to the Control Panel board for control of playing parameters (pitch, vibrato, etc.)
2. for the audio mixer on the Channel board, for controlling the audio output (loudness and balance)
3. for the two pots used to trim the Mod Lever

The Slider board is mounted on the left (bass) side of the front panel. It connects to three places:

1. through P51, carrying power from the signals to the Channel board
2. through P50 delivering power and signals to the Front Panel
3. through P41 from the Mod Levers

Display Board

The LCD display receives signals and power through connector P43. A bias voltage is applied to set the display's contrast and viewing angle. This voltage is adjustable with a pot which is accessible through a small hole (remove hole plug) in the Front Panel to the left of the keypad.

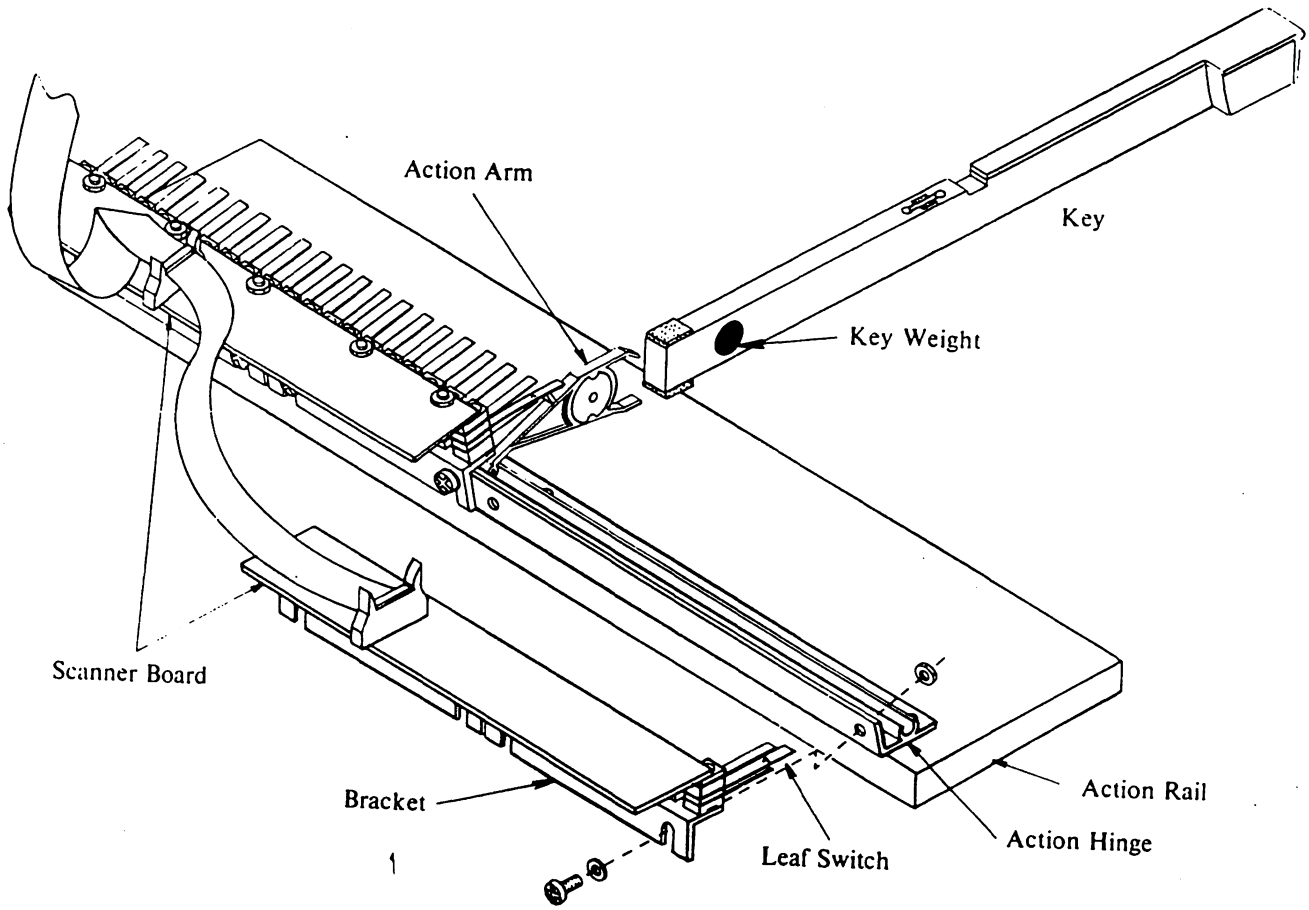
3.4.5 - Keyboard Sub-Assembly

The keyboard sub-assembly consists of the mechanical key actions (with wooden piano keys) and the two Scanner boards. The keyboard interface circuitry is on the CPU board and is described under that section.

Each of the 88 keys pivot on a rail running across the center of the keybed. When the "head" of the key (the black or white part) is pressed down, the "tail" (opposite end) rises. All the keys are weighted so that they normally rest with the tail end down.

When the tail rises, the action pivots upwards. A pin on the action activates a sensor. Each key has a corresponding sensor which is stationary with respect to the keybed.

Figure 3.13



These sensors are leaf switches. They have a flexible inner "leaf", separated by spacers between two rigid outer leaves. The leaves are conductive. Normally, the center leaf touches one of the outer leaves making electrical contact. The action pin pressing against the center leaf moves it to the other contact. This changing electrical contact is used to determine when a key has been pressed.

Since the outer leaves are separated by some distance, it takes the center leaf a while to move from one contact to the other. This "time of flight" may be measured to see how hard the key was pressed. A key pressed softly takes a relatively long time to move the center leaf and make contact with the upper leaf, and conversely, a key pressed hard takes a short amount of time. This is called "velocity sensing". The K250 uses velocity sensing to express loudness, timbre and other aspects of the sound.

The standard spacing of the sensors is determined by piano-making convention. The standard "octave span" (width of 12 keys) on a piano keyboard is 6.5 inches. This is about 0.54 inches per keys. All 88 keys together span 47.5 inches. Since this is too large to economically put on one circuit board, the sensors are on two modules each 24 inches long. One handles the bass keys (left half of the keyboard) and the other monitors the treble (right half).

3.4.6 - Keyswitch Boards

The CPU sends out a binary number pointing to the key to be examined. The sensor modules decode this and return a code representing the poisition of that key (up, down or in transit).

The 88 keys on the keyboard are normally stamped with a number on the top of the wooden lever. These numbers range from 1 (at the extreme left, or bass end) to 88 (at the right or treble end). They ascend in sequence from left to right.

3.4.7 - Audio Board

The Audio board functions simply as a distribution panel. The Audio board takes the two outputs from the Channel board's mixer and sends them to external audio connectors.

3.4.8 - POD Assembly

The POD assembly has been changed since the Kurzweil 250 was originally introduced. The original POD did not have a power supply that was switchable for different voltages. Therefore, the internal design for the PODs is quite different. The only design difference between the Kurzweil 250 and the Kurzweil 250X POD is that the Kurzweil 250X POD does not have pedals. The power supply board for the Kurzweil RMX is internal to the unit.

The following is a list of the part numbers for the different Kurzweil 250 and Kurzweil 250X PODs:

10000301	110V/120V, Kurzweil 250 POD
10000302	220V/240V, Kurzweil 250 POD
10002201	110V/120V, Kurzweil 250X POD
10002202	220V/240V, Kurzweil 250X POD
10002501	Switchable Kurzweil 250 POD
10003001	Switchable Kurzweil 250X POD

The bulk of the POD is the power supply. It contains a 5 volt supply for the system's logic circuitry, and a ± 15 volt supply for the audio circuitry. The newer, switchable POD contains only one board.

Another sub-system in the POD is a pair of piano-style pedals for controlling characteristics of the sound (such as whether notes are sustained after key release). The pedals are monitored by a circuit on the "POD board" which sends signals up through a cable to the main enclosure. These signals denote whether a pedal is up, down or in transit.

The POD assembly also contains circuitry which monitors the AC power line and produces an "advance warning" of imminent power failure. This circuitry is contained on the POD board in the older, non-switchable POD assembly. When this pulse is detected, the instrument saves information about its current state so that it can resume after power interruption.

Chapter 4 - Diagnostic Test Procedures

4.1 - INTRODUCTION TO DIAGNOSTICS

Revision B Diagnostic EPROMs are for use with Kurzweil 250 and Kurzweil 250X units with Version 2.2 or earlier software installed. If the instrument you are testing has software later than Version 2.2 installed, you should test it with Revision D Diagnostics.

Revision B Diagnostic EPROMs are in 128K EPROMs. If you are testing a Kurzweil 250X, you will need Revision B Diagnostic EPROMs in 256K EPROM.

4.2 - INSTALLING DIAGNOSTIC EPROMS

1. Turn off system power
2. Open the slide chassis.
3. Remove U38 and U54 from the CPU board. Be careful when removing these EPROMs as you will be reinstalling them when the testing is complete.
4. Install U38 (Loc. 01) and U54 (Loc. 02) Diagnostic EPROMs in the empty sockets on the CPU board.
   NOTE: When installing the diagnostic EPROMs, be sure pin 1 is facing the rear panel.
5. Turn on system power
   NOTE: When the system is first turned on, the front panel LEDs may come on in an unpredictable pattern. They should all turn off after about one second.
6. The red power indicator light on the POD should be on. The front panel LCD should indicate:

   K250 DIAGNOSTICS (C)
   REV. B 24-JAN-85

   The **SELECT** switch LED should be blinking on and off.

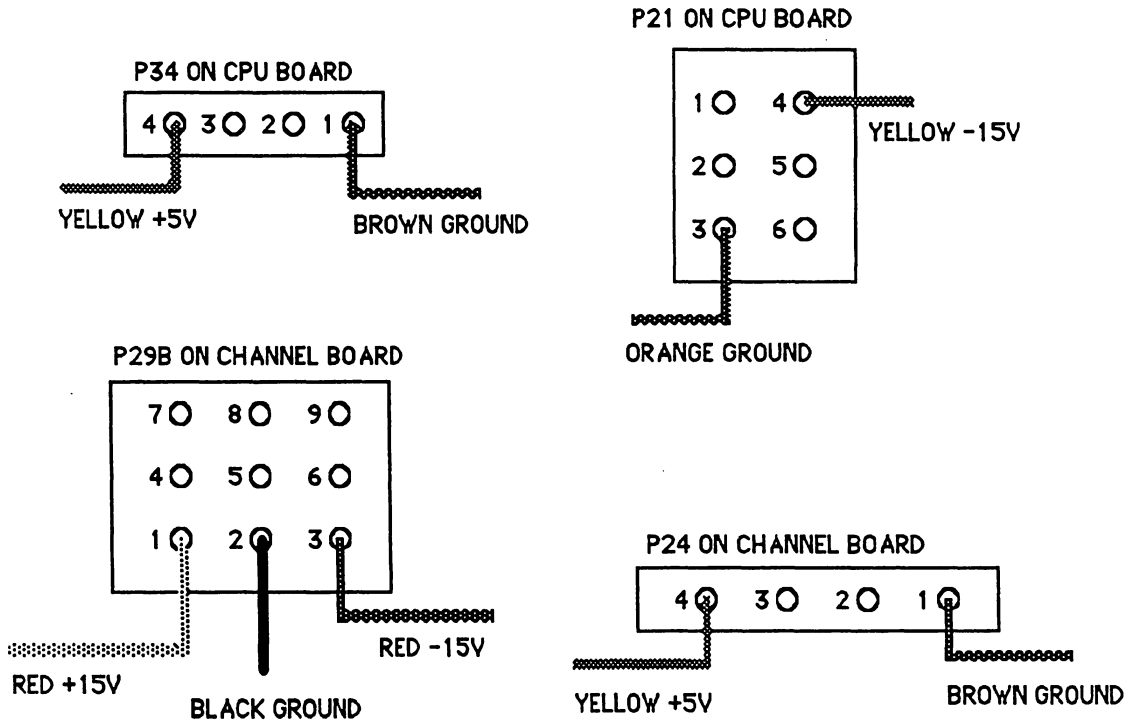
4.3 - POWER SUPPLY (POD) VOLTAGES

Before beginning the diagnostic test procedure, please be sure that the power supply voltages are correct. Verify the following:

1. The Power Supply (POD) provides:

   +5 volts DC
   +15 volts DC
   -15 volts DC

2. Using a VOM or DVM check the power supply voltages at the following power connectors:



4.4 - RUNNING THE DIAGNOSTIC TESTS

The Diagnostic tests check the following subsystems:

A. Front Panel assembly
B. CPU board
C. CGP board
D. Channel board

The **SELECT** switch and the **YES** and **NO** switches are used to select a test and answer the prompts displayed on the LCD. When a **YES** or **NO** response is required by the diagnostic test, the **YES** and **NO** switch LEDs will blink on and off alternately. When a **SELECT** response is required, the **SELECT** switch LED will be blinking in some instances, and no LEDs will be blinking in other instances. When no LEDs are blinking, only the **SELECT** switch has an effect when pressed.

4.5 - FRONT PANEL TESTS

The Front Panel tests check the following subassemblies:

1. LCD
2. Control Panel LEDs
3. Control Panel switches
4. Control Panel analog to digital converter:

   External Pedal 1
   Feedback from Channel board mixer, group B
   Feedback from Channel board mixer, group A
   Master Tune slider
   Slider board voltage maximum
   Slider board voltage minimum
   External Pedal 2
   Assignable Slider 3
   Assignable Slider 2
   Assignable Slider 1
   Left Mod Lever
   Right Mod Lever
   Right POD Pedal
   Left POD Pedal

4.6 - LCD TEST

To run the LCD test from the initial power up display message:

1. Press **SELECT**
2. Answer the displayed questions by pressing the **YES** of **NO** switch on the front panel as follows:

   CLR PWR FAIL CTN? Press **YES**
   AUTOTEST? Press **NO**
   RUN ALL TESTS? Press **NO**
   FRONT PANEL? Press **YES**
   ALL FP TESTS? Press **YES**

The LCD should now display the following:

!"#$%&'()*+,-./01234567
89:;<=>?@ABCDEFGHIJKLMNO

Press **SELECT**

The LCD should now display the following:

PQRSTUVWXZ[]^_abcdefg
hijklmnopqrstuvwxyz{|}><

4.7 - LED TEST

The LED test follows immediately after the LCD test by pressing **SELECT**. These four tests will step through in sequence automatically. To abort the LED tests, press and hold the **SELECT** switch.

The Front Panel LED test consists of four parts:

1. All LEDs on/off 10 times
2. One LED on at a time
3. One LED off at a time
4. Enable/disable LEDs on/off 10 times

4.8 - SWITCH TEST

After the LED test the LCD will indicate:

SWITCH TEST
PRESS ANY SWITCH

When any of the Front Panel switches is pressed, the switch number and function name will be displayed on the LCD. If the switch has an LED, the LED will blink on and off.

Press the **SELECT** switch to exit this test.

4.9 - ANALOG TO DIGITAL CONVERTER TEST

The ADC test will verify operation of some of the Front Panel sliders as well as the Foot Pedals and Mod Levers. The LCD display will prompt for a **YES** or **NO** switch response as follows:

A/D CONVERTER TEST
EXTERNAL PED 1? Press **YES**

The LCD will show the A/D reading in HEX. for External Pedal 1 the approximate readings should be:

0 0	**PEDAL NOT PLUGGED INTO REAR PANEL JACK**
7E	**PEDAL UP**
0B	**PEDAL DOWN**

Press **SELECT** to proceed to the next ADC test.

FEEDBACK B? Press **YES**

The ADC reading should be approximately **7D.**

Press **SELECT** to proceed to the next ADC test.

FEEDBACK A? Press **YES**

The ADC reading should be approximately **7F.**

Press **SELECT** to proceed to the next ADC test.

MASTER TUNE? Press **YES**

The ADC reading should be approximately:

14	**SLIDER IN LEFTMOST POSITION**
8 1	**SLIDER IN CENTER POSITION**
ED	**SLIDER IN RIGHTMOST POSITION**

Press **SELECT** to proceed to the next ADC test.

VOLTAGE MAX? Press **YES**

The ADC reading should be **ED**, the same as the Master Tune rightmost position.

Press **SELECT** to proceed to next ADC test.

VOLTAGE MIN? Press **YES**

The ADC reading should be **14** the same as the Master Tune leftmost position.

Press **SELECT** to proceed to the next ADC test.

EXTERNAL PED 2? Press **YES**

The ADC readings should be approximately the same as for the External Pedal 1:

00	**PEDAL NOT PLUGGED INTO REAR PANEL JACK**
7E	**PEDAL UP**
0B	**PEDAL DOWN**

Press **SELECT** to proceed to the next ADC test.

ASSIGNABLE 3? Press **YES**

The ADC readings should be approximately the same as for the Master Tune slider:

14	**SLIDER IN DOWN POSITION**
80	**SLIDER IN CENTER POSITION**
ED	**SLIDER IN UP POSITION**

Press **SELECT** to proceed to the next ADC test.

ASSIGNABLE 2? Press **YES**

The ADC readings should be approximately the same as for the Master Tune slider:

14 **SLIDER IN DOWN POSITION**
80 **SLIDER IN CENTER POSITION**
ED **SLIDER IN UP POSITION**

Press **SELECT** to proceed to the next ADC test.

ASSIGNABLE 1? Press **YES**

The ADC readings should be approximately the same as for the Master Tune slider:

14 **SLIDER IN DOWN POSITION**
80 **SLIDER IN CENTER POSITION**
ED **SLIDER IN UP POSITION**

Press **SELECT** to proceed to the next ADC test.

LEFT MOD LEVER? Press **YES**

The Mod Lever ADC reading may vary since final calibration is performed during an audio test. The approximate readings should be:

80 **MOD LEVER CENTERED**
0A **MOD LEVER DOWN**
EB **MOD LEVER UP**

Press **SELECT** to proceed to the next ADC test.

RIGHT MOD LEVER? Press **YES**

The Mod Lever ADC reading may vary since final calibration is performed during an audio test. The approximate readings should be:

80 **MOD LEVER CENTERED**
0A **MOD LEVER DOWN**
EB **MOD LEVER UP**

Press **SELECT** to proceed to the next ADC test.

The POD foot pedals have three positions:

52 **PEDAL UP**
7B **PEDAL HALF WAY DOWN**
A9 **PEDAL DOWN**

Press **SELECT** to proceed to the next ADC test.

LEFT PEDAL? Press **YES**

The left POD pedal readings should be approximately the same as the right pedal:

52 **PEDAL UP**
7B **PEDAL HALF WAY DOWN**
A9 **PEDAL DOWN**

Press **SELECT** to exit the Front Panel Test and return to the main menu.

4.10 - CPU TESTS

Some of the CPU tests require the use of the loopback connectors provided in the Diagnostic Kit. These connectors are:

1. MIDI loopback connector
2. SYNC IN/OUT loopback connector (also used for CLICK OUT /TRIG IN)
3. Parallel Computer (PC) loopback connector

Starting with the first main menu question displayed on the Front Panel LCD, press the **YES**, **NO** or **SELECT** switch in response to the display prompts as follows:

CLR PWR FAIL CNT? Press **YES**
AUTOTEST? Press **NO**
RUN ALL TESTS? Press **NO**
FRONT PANEL? Press **NO**
TEST CPU? Press **YES**
ALL CPU TESTS? Press **NO**
TEST CPU RAM? Press **YES**
ALL CPU RAM? Press **YES**

The diagnostic will now proceed to test the main CPU random access memory (RAM). If there is an error during the test, a diagnostic error message will be displayed on the front panel LCD indicating the address of the error, the expected (good) data, and the actual (bad) data read.

EXAMPLE:

RAM TEST ERR A: 1003FF <<<< THIS IS THE ADDRESS
GOOD: 55 BAD: FF

If the RAM data error occurs, the individual RAM tests may be run to determine the memory chip component number.

If there are no main RAM errors, the next LCD prompt will be:

TEST OPTIONAL RAM?

(**NOTE:** This RAM is standard on newer units.)

The response to this question is **NO** if the sequencer RAM is not installed on the CPU board. The response is **YES**, if the RAM is present. If the test passes the next prompt will be:

TEST INDIVIDUAL RAM?

The response to this question is **NO** if the previous RAM test(s) have run successfully with no error messages displayed. The response to the this question is **YES**, if there were errors during the previous RAM test(s). If you respond with **YES**, the following prompts will be displayed:

MAIN CPU RAM

TEST U33?
TEST U49?
TEST U32?
TEST U48?
TEST U31?
TEST U47?
TEST U30?
TEST U46?

OPTIONAL CPU RAM

TEST U29?
TEST U44?
TEST U28?
TEST U43?

NOTE: U26, U41, U25 AND U40 ARE SAMPLING EPROMS ON REV. B CPU BOARDS IF SAMPLING IS INSTALLED. THESE LOCATIONS WILL FAIL THE DIAGNOSTICS.

TEST U26?
TEST U41?
TEST U25?
TEST U40?

The next prompt after the RAM tests is:

TEST CPU ROM? Press **YES**
ALL CPU ROM? Press **YES**

The CHECKSUM for each EPROM will be displayed on the LCD. The CHECKSUMs are for the following EPROMs:

U38	(DIAGNOSTIC EPROM)
U54	(DIAGNOSTIC EPROM)
U37	
U53	
U36	
U52	
U35	
U51	

NOTE: The CHECKSUMS for the EPROMs are displayed and should be compared with the CHECKSUMS located on each EPROM label.

NOTE: The CHECKSUMS for the EPROMs on Rev. B CPU boards with sampling are not checked by the diagnostics (Locations U26, U41, U25 and U40).

The 8254 timers are the next CPU components checked. The outputs of the timers are Pins 10, 13 and 17. The prompt is:

INIT TIMERS? Press **YES**

Using an oscilloscope with probe, check for the following square waves at the IC and pin number indicated:

IC NUMBER	PIN NUMBER	SQUARE WAVE PERIOD
U68	10	200 nsec.
U68	13	400 nsec.
U68	17	600 nsec.
U69	10	800 nsec.
U69	13	1 µsec.
U69	17	2 µsec.
U87	10	3 µsec.
U87	13	4 µsec.
U87	17	5 µsec.
U88	10	6 µsec.
U88	13	7 µsec.
U88	17	8 µsec.
U106	10	9 µsec.
U106	13	25 µsec.
U106	17	50 µsec.
U107	10	75 µsec.
U107	13	100 µsec.
U107	17	125 µsec.
U118	10	150 µsec.
U118	13	175 µsec.
U118	17	200 µsec.
U119	10	225 µsec.
U119	13	250 µsec.
U119	17	500 µsec.

The next CPU test is the keyboard interface test.

TEST KEYBOARD? Press **YES**

KEYBOARD TEST
PRESS ANY KEY

The first key on the left is numbered zero. The last key on the right is numbered 87. The keyboard is divided into two keyswitch boards. The left half of the keyboard contains keys 0 through 43. The right half of the keyboard contains keys 44 through 87. The keyboard split occurs between E4 and F4 in the center of the keyboard.

Pressing and holding down the E4 key on the keyboard will NOT sound an audible note, but will cause the front panel LCD to show:

EXAMPLE:

ATTACK KEY 43
TOF: FO COUNT: 1

Releasing the E4 key will cause the front panel display to show:

RELEASE KEY: 43
TOF: 93 COUNT: 2

NOTE: The Time-Of-Flight (TOF) indicated will vary depending upon how fast the key is pressed or released. A fast key stroke will show a larger number (hexadecimal). A very slow key stroke will show 00 for the Time-Of-Flight. The key number and count are in decimal. The count should always be even when no keys are pressed down.

Press **SELECT** to exit the keyboard test.

The next four tests require the loopback connectors provided with the Diagnostic Kit.

TEST MIDI? Press **YES**

Disconnect the MIDI connector from the CPU board and plug in the MIDI loopback connector.

Press **SELECT** to begin the test.

If a test error occurs a diagnostic error message will be displayed on the front panel LCD. If no error occurs, proceed with the following.

TEST PC? Press **YES**

Connect the Parallel loopback connector to the computer port located on the back panel.

Press **SELECT** to being the test.

If a test error occurs a diagnostic error message will be displayed on the front panel LCD. If no error occurs, proceed with the following.

TEST SYNC LO? YES

Connect the 1/4" to 1/4" cable supplied with the Diagnostic Kit. Connect this cable from SYNC OUT to SYNC IN.

If a test error occurs a diagnostic error message will be displayed on the front panel LCD display. If no error occurs, proceed with the following.

TEST CLICK OUT? YES

Connect 1/4" to 1/4" cable from CLICK OUT to TRIG IN.

Press **SELECT** to begin the test.

If a test errror occurs a diagnostic error message will be displayed on the front panel LCD display. If no error occurs, proceed with the following.

Disconnect all loopback connectors.

TEST U67 TIMER 1? Press **YES**

If a test errror occurs a diagnostic error message will be displayed on the front panel LCD display. If no error occurs, proceed with the following.

Press **SELECT** to exit the CPU tests.

4.11 - POWER FAIL TEST

To check the power fail interrupt logic on the CPU board:

CLR PWR FAIL CNT? Press **YES**

Turn off system power, then turn on system power.

Press **SELECT**

CLR PWR FAIL CNT? Press **NO**
COUNT: 1

The **COUNT** indicates the number of times a power fail interrupt was detected by the CPU. Cycling the power off then on several more times and answering **NO** to the **CLR PWR FAIL CNT** prompt should increment the count by one each time. If the count does not increment by one, there may be a problem with the CPU interrupt logic or the battery-backed RAM.

4.12 - CGP TESTS

CGP RAM

Starting with the first main menu question displayed on the front panel display, press the **YES**, **NO** or **SELECT** switch in response to the display prompts as follows:

CLR PWR FAIL CNT? Press **YES**
AUTOTEST? Press **NO**
RUN ALL TESTS? Press **NO**
FRONT PANEL? Press **NO**
TEST CPU? Press **NO**
TEST CGP? Press **YES**
ALL CGP TESTS? Press **NO**
TEST CGP RAM? Press **YES**

The diagnostic will now proceed to test the CGP random access memory (RAM). If there is an error during the test, a diagnostic error message will be displayed on the front panel LCD display indicating the address of the error, the expected (good) data, and the actual (bad) data read.

EXAMPLE:

RAM TEST ERR A: 1B03FE <<<< This is the address
GOOD: 5555 BAD: FFFF

Press **SELECT** to proceed.

SOUND FILE RAM

TEST SF RAM WORD? Press **YES or NO**

The response to this questions is **NO** if the digitizer optional RAM is not present on the CGP board. The response is **YES** if the digitizer RAM is present on the CGP. If an error occurs, the error message will appear as in the example for the CGP RAM.

TEST SF RAM SOUND? Press **YES or NO**

The response to this questions is **NO** if the digitzer optional RAM is not present on the CGP board. The response is **YES** if the digitizer RAM is present on the CGP. If an error occurs, the error message will appear as in the example for the CGP RAM.

SOUND FILE ROM

The sound file ROM is divided into six rows of 10 ROMs each. If a CHECKSUM error occurs during the test, the ROM component number on the CGP will be displayed along with the expected CHECKSUM (GOOD) and the actual CHECKSUM (BAD):

EXAMPLE:

CGP ROM CHKSUM ERR U125
GOOD: 354B BAD: 7894

NOTE: A checksum of 8000 indicates that the ROM could not be read, or the location is empty.

TEST SF ROM? Press **YES**

As the sound file ROM test proceeds, the LCD display will show:

TESTING SF ROM ROW 1
TESTING SF ROM ROW 2
TESTING SF ROM ROW 3
TESTING SF ROM ROW 4
TESTING SF ROM ROW 5
TESTING SF ROM ROW 6

CGP STATUS TEST

TEST CGP DMA? Press **YES**

During the CGP status test, the test status will be displayed on the front panel LCD as follows:

EXAMPLE:

CSW:D00F
AL1: E7F1 AL2:0000

In the preceeding example, the CSW is the channel status word. The four status digits are in hexadecimal. If the test is progressing correctly:

1. The first CSW digit will usually vary from D to F.
2. The second and third digits will increment in pairs from 00 to FF.
3. The fourth CSW digit should always be F.
4. AL1 will count up from 0000 to FFFF and then stop. When AL1 reaches FFFF, AL2 will start counting up from 0000 to FFFF and then stop. AL1 will then begin counting up again from 0000 to FFFF. AL1 and AL2 will continue counting up alternately until **SELECT** is pressed.

NOTE: If the following LCD display appears and does not change, it usually indicates that no sample clock is present at the channel sample DAC:

CSW: 900F
AL1: 0010 AL2: 0000

If this error occurs, check the ribbon cable connections going from the CPU board to the channel board. Also run the CPU timer test.

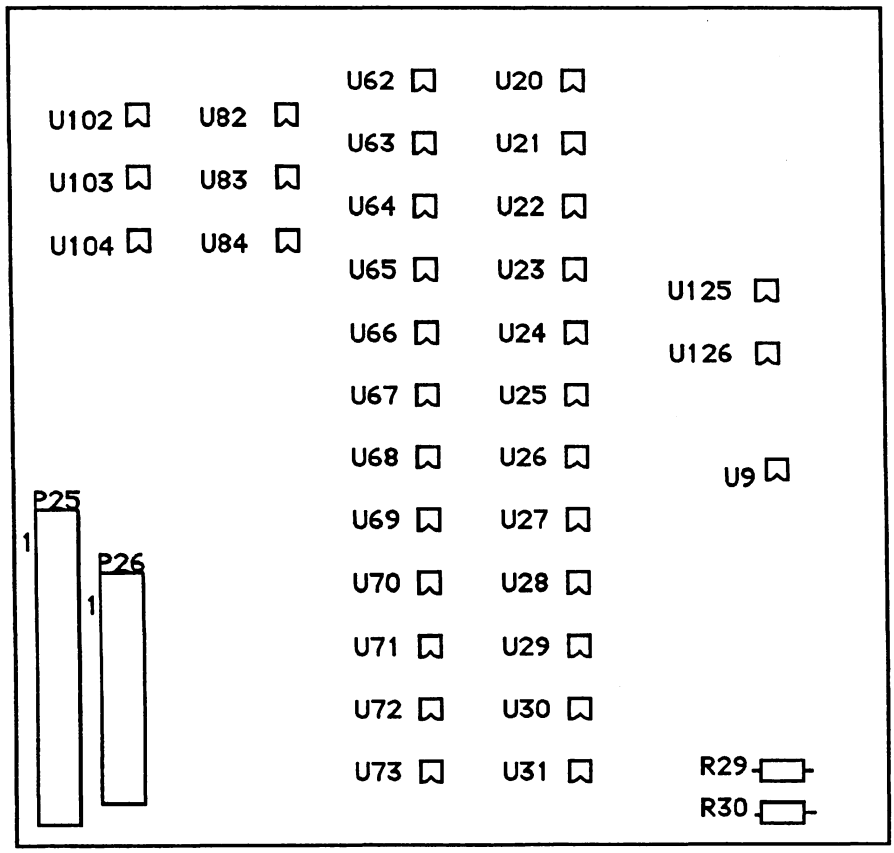
Press **SELECT** to exit the CGP test.

4.13 - CHANNEL BOARD TESTS

The following diagram of the Channel board shows the component placement of the integrated circuits which will be probed using an oscilloscope during the following Channel board test procedure. The point of view of this diagram is from the back of the instrument, looking down onto the Channel board.

NOTE: The oscilloscope must be grounded to the K250 chassis ground.

CHANNEL BOARD COMPONENT PLACEMENT



Audio Mute Select

The audio output from the Channel board to the Audio board can be enabled or disabled by a relay which resides on the Channel board. After selecting the Channel test, the diagnostic will ask?

MUTE AUDIO OUTPUT?

If you press the **YES** switch the relay will be closed, disabling the audio output. If you press the **NO** switch the relay will be open, enabling the audio output.

NOTE: the audio mute relay will not be opened or closed until the channels have been selected (test begins).

Sinewave Select

One of three sinewaves stored in Sound File ROM may be selected. The sinewaves will be output to the selected channels continuously to provide oscilloscope signals. These sinewaves correspond to the keys on the keyboard and are therefore named accordingly. The sinewave names are:

C2 SINEWAVE sampled at 5 KHZ rate, frequency 65 HZ
C5 SINEWAVE sampled at 10 KHZ rate, frequency 523 HZ
C8 SINEWAVE sampled at 15 KHZ rate, frequency 4186 HZ

By selecting one of the three sinewaves, and selecting the same sampling rate as that used for originally storing the sinewaves, the frequency will be the same as that shown above. The diagnostic will ask:

C2 SINEWAVE? if you press the **NO** switch then it asks
C5 SINEWAVE? if you press the **NO** switch then it asks
C8 SINEWAVE? if you press the **NO** switch,

the questions are asked again. This will continue until you press the **YES** switch for one of the choices.

Sampling Rate Select

One of the four sampling rates may be selected. The sampling rate selected will apply to all channels activated during the channel select portion of the test. Therefore, each channel will have the same frequency sinewave output. The sampling rate choices are: 5kHz, 10kHz, 15kHz and 25kHz.

The frequency of the sinewave will vary depending upon the sampling rate selected. Table 1 shows the 12 possible frequencies available. The time (T) shown in Table 1 indicates the period of each sinewave. The diagnostic will ask:

5kHz SAMPLE RATE? If you press **NO** switch, then it asks
10kHz SAMPLE RATE? If you press **NO** switch, then it asks
15kHz SAMPLE RATE? If you press **NO** switch, then it asks
25kHz SAMPLE RATE? If you press **NO** switch, then it asks

these questions again until the **YES** switch is pressed.

Channel Select

Any combination of the twelve channels, numbered 1 through 12, may be selected for test. Each channel may have one of three attenuation settings and can be assigned to mixer Group A or Group B. As described in the Sampling Rate Select section, each channel will have the same frequency sinewave output. The diagnostic will ask:

TEST CHANNEL 1?

To test the channel, press the **YES** switch on the front panel. To disable the channel press the **NO** switch on the front panel. The diagnostic will ask this question for each of the channels 1 through 12. If you press the **YES** switch to select a channel for test, the diagnostic will ask the attenuation and group select questions described next.

Attenuation Select

One of the three channel amplitude control digital/analog converter settings may be selected for each channel. These settings are:

1. **RAMP** the amplitude DAC output
2. **Maximum** Attenuation
3. **Minimum** Attenuation

If **RAMP** the amplitude DAC output is chosen, the output signal of the amplitude DAC may be observed with an oscilloscope at the Channel board locations shown in Table 3. The output will appear as shown in figure 2. If **maximum** attenuation is selected the output of the amplitude DAC should be +10 VDC. If **minimum** attenuation is selected, the output of the amplitude DAC for that channel should be 0 VDC.

Note: If neither **RAMP** nor **MAXIMUM** attenuation is selected, the default is **MINIMUM** attenuation.

The diagnostic will ask:

RAMP AMP DAC? If you press the **NO** switch then it asks **MAXIMUM ATTENUATION?** If you press the **NO** switch then **MINIMUM** attenuation is used.

Group Select

Each of the 12 channels may be assigned to one of the two mixer outputs. These mixer outputs are designated Group A and Group B. The final audio outputs are designated LEFT and RIGHT. The channels assigned to Group A can be panned from left to right by moving the Group A slider on the front panel of the K250. Similarly, the channels assigned to Group B can be panned from left to right by moving the Group B slider on the front panel of the K250.

The diagnostic will ask:

ASSIGN TO GROUP A?

If you press the **YES** switch on the front panel, the channel will be assigned to mixer Group A. If you press the **NO** switch on the front panel, the channel is assigned to mixer Group B.

4.14 - CHANNEL AND AMPLITUDE DAC TEST

1. Select the **CHANNEL TEST**
2. Select **AUDIO OUTPUT MUTED**
3. Select **C2 SINEWAVE at 5kHz SAMPLING RATE**
4. Enable channels 1 through 12, ramp amplitude DACs, Group A
5. Use an oscilloscope and probe the test points indicated in Table 2 or 3 to verify channel operation. Probe the test points indicated in Table 4 to verify Amplitude DAC operation.

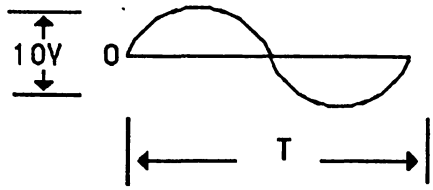
NOTE: Use caution when probing pin 7 of the amp DAC opamps, because pin 8 is a power pin. If the scope probe shorts pin 7 to pin 8 the opamp will be damaged.

The frequency of the sinewave will vary depending upon the sampling rate selected. Table 1 shows the 12 possible frequencies available. The time (T) shown in Table 1 indicates the period of each sinewave. Figure 1 shows how the sinewave should appear at the outputs of the alias filters (See Table 2).

TABLE 1: SINEWAVE PERIOD TIMES (T)

SAMPLING RATE	C2	C5	C8
5kHz	15 ms	3.8 ms	0.7 ms
10kHz	7.5 ms	1.9 ms	.35 ms
15kHz	5.0 ms	1.25 ms	0.25 ms
25kHz	3.0 ms	0.75 ms	0.15 ms

FIGURE 1



The following table shows the integrated circuit pin numbers to probe with the ocilloscope to observe these sinewaves:

TABLE 2: ALIAS FILTER OUTPUTS

U20	PIN 2	CHANNEL 1
U21	PIN 2	CHANNEL 2
U22	PIN 2	CHANNEL 3
U23	PIN 2	CHANNEL 4
U24	PIN 2	CHANNEL 5
U25	PIN 2	CHANNEL 6
U26	PIN 2	CHANNEL 7
U27	PIN 2	CHANNEL 8
U28	PIN 2	CHANNEL 9
U29	PIN 2	CHANNEL 10
U30	PIN 2	CHANNEL 11
U31	PIN 2	CHANNEL 12

The following, Table 3, shows the Sample D/A Converter test points to probe if any of the Channel Alias Filter outputs are incorrect. The sinewaves at these points are not as clean in appearance.

Note: Be sure to use the C2 sinewave at 5kHz sampling rate. If a sample DAC output is bad, refer to the CGP procedure.

TABLE 3: SAMPLE DAC OUTPUTS

U62	PIN 20	CHANNEL 1
U63	PIN 20	CHANNEL 2
U64	PIN 20	CHANNEL 3
U65	PIN 20	CHANNEL 4
U66	PIN 20	CHANNEL 5
U67	PIN 20	CHANNEL 6
U68	PIN 20	CHANNEL 7
U69	PIN 20	CHANNEL 8
U70	PIN 20	CHANNEL 9
U71	PIN 20	CHANNEL 10
U72	PIN 20	CHANNEL 11
U73	PIN 20	CHANNEL 12

4.15 - AMPLITUDE DAC TEST

The Amplitude DAC output waveforms should appear as shown in figure 2 at each of the test points on the Channel board shown in Table 4.

FIGURE 2: AMPLITUDE DAC OPAMP OUTPUT WAVEFORM

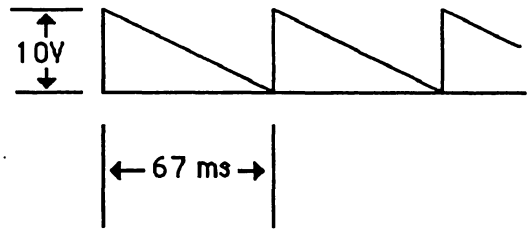


TABLE 4: AMPLITUDE DAC OUTPUTS

U82	PIN 7	CHANNEL 1
U82	PIN 1	CHANNEL 2
U83	PIN 7	CHANNEL 3
U83	PIN 1	CHANNEL 4
U84	PIN 7	CHANNEL 5
U84	PIN 1	CHANNEL 6
U102	PIN 7	CHANNEL 7
U102	PIN 1	CHANNEL 8
U103	PIN 7	CHANNEL 9
U103	PIN 1	CHANNEL 10
U104	PIN 7	CHANNEL 11
U104	PIN 1	CHANNEL 12

4.16 - GROUP A/B MIXER AND LEFT/RIGHT AUDIO OUTPUT TEST

1. Select **CHANNEL TEST**
2. Select **AUDIO OUTPUT NOT MUTED**
3. Select **C2 SINEWAVE, 5kHz SAMPLING RATE**
4. **Assign CHANNEL 1** with **MINIMUM** attenuation to **GROUP A.**
   Assign CHANNEL 2 with **MINIMUM** attenuation to **GROUP B.**

The **GROUP A** and **GROUP B** mixer outputs are available at the following test points:

U125, pin 1	**GROUP A** mixer output
U125, pin 7	**FEEDBACK A** output
U126, pin 1	**GROUP B** mixer output
U126, pin 7	**FEEDBACK B** output

5. Move the volume control slider on the K250 front panel to check the mixer gain control. The sinewave output should decrease in amplitude as the slider is moved left, and increase in amplitude as the slider is moved right.

NOTE: The final output drivers will show clipping when the volume slider is moved to the rightmost position.

The **LEFT** and **RIGHT** audio outputs are available at the following test points:

U9, pin 1	**LEFT** audio output
U9, pin 1	**RIGHT** audio output
R29 right end	**LEFT** audio output
R30 right end	**RIGHT** audio output

6. While observing the sinewave at **R29 right end**, move the **GROUP A** and **GROUP B** sliders to the **LEFT**. The sinewave should decrease in amplitude. While observing the sinewave at **R30 right end**, move the **GROUP A** and **GROUP B** sliders to the **RIGHT**. The sinewave should decrease in amplitude.

7. Exit the Channel Test by pessing the **SELECT** switch.

4.17 - DIAGNOSTIC TEST PROCEDURE, REVISION D

Revision D Diagnostic EPROMs are for use with Kurzweil 250, Kurzweil 250X and Kurzweil RMX units with Version 3 or later software installed. If the instrument you are testing has less than Version 3 installed, you should test it with Revision B Diagnostics.

4.18 - INSTALLING DIAGNOSTIC EPROMS

1. Turn off system power
2. Open the slide chassis.
3. Remove U38 and U54 from the CPU board. Be careful when removing these EPROMs as you will be reinstalling them when the testing is complete.
4. Install U38 (Loc. 01) and U54 (Loc. 02) Diagnostic EPROMs in the empty sockets on the CPU board.
   NOTE: When installing the diagnostic EPROMs, be sure pin 1 is facing the rear panel.
5. Turn on system power
   NOTE: When the system is first turned on, the front panel LEDs may come on in an unpredictable pattern. They should all turn off after about one second.
6. The red power indicator light* on the POD should be on. The front panel LCD should indicate:

   *If you are testing an RMX the power supply is internal to the unit, no power indicator is used.

   K250 DIAGNOSTICS (C)
   REV. D 11 JUL 86

   The **SELECT** switch LED should be blinking on and off.

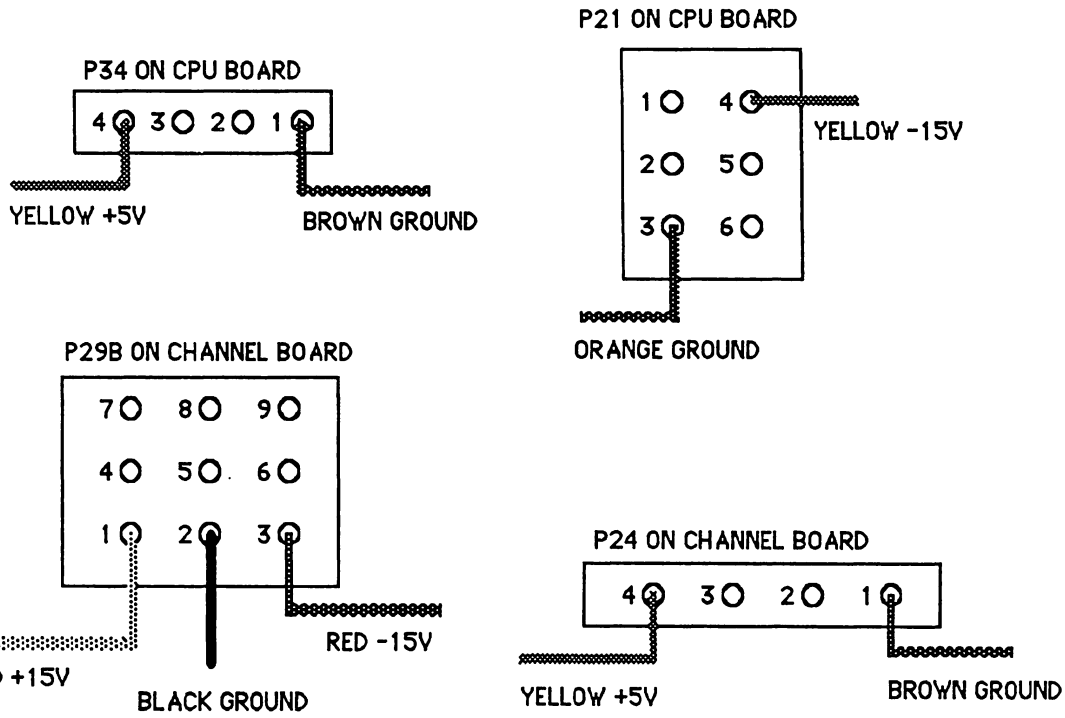
4.19 - POWER SUPPLY (POD) VOLTAGES

Before beginning the diagnostic test procedure, please be sure that the power supply voltages are correct. Verify the following:

1. The Power Supply (POD) provides:

   +5 volts DC
   +15 volts DC
   -15 volts DC

2. Using a VOM or DVM check the power supply voltages at the following power connectors:



4.20 - RUNNING THE DIAGNOSTIC TESTS

The Diagnostic tests check the following subsystems:

A. Front Panel assembly
B. CPU board
C. CGP board
D. Channel board

The **SELECT** switch and the **YES** and **NO** switches are used to select a test and answer the prompts displayed on the LCD. When a **YES** or **NO** response is required by the diagnostic test, the **YES** and **NO** switch LEDs will blink on and off alternately. When a **SELECT** response is required, the **SELECT** switch LED will be blinking in some instances, and no LEDs will be blinking in other instances. When no LEDs are blinking, only the **SELECT** switch has an effect when pressed.

4.21 - FRONT PANEL TESTS

The Front Panel tests check the following subassemblies:

1. LCD
2. Control Panel LEDs
3. Control Panel switches
4. Control Panel analog to digital converter:

   External Pedal 1
   Feedback from Channel board mixer, group B
   Feedback from Channel board mixer, group A
   Master Tune slider
   Slider board voltage maximum
   Slider board voltage minimum
   External Pedal 2
   Assignable Slider 3
   Assignable Slider 2
   Assignable Slider 1
   Left Mod Lever
   Right Mod Lever
   Right POD Pedal
   Left POD Pedal

4.22 - LCD TEST

To run the LCD test from the initial power up display message:

1. Press **SELECT**
2. Answer the displayed questions by pressing the **YES** of **NO** switch on the front panel as follows:

   CLR PWR FAIL CTN? Press **YES**
   AUTOTEST? Press **NO**
   RUN ALL TESTS? Press **NO**
   FRONT PANEL? Press **YES**
   ALL FP TESTS? Press **YES**

The LCD should now display the following:

!"#$%&'()*+,-./01234567
89:;<=>?@ABCDEFGHIJKLMNO

Press **SELECT**

The LCD should now display the following:

PQRSTUVWXZ[]^_abcdefg
hijklmnopqrstuvwxyz{|}><

4.23 - LED TEST

The LED test follows immediately after the LCD test by pressing **SELECT**. These four tests will step through in sequence automatically. To abort the LED tests, press and hold the **SELECT** switch.

The Front Panel LED test consists of four parts:

1. All LEDs on/off 10 times
2. One LED on at a time
3. One LED off at a time
4. Enable/disable LEDs on/off 10 times

4.24 - SWITCH TEST

After the LED test the LCD will indicate:

SWITCH TEST
PRESS ANY SWITCH

When any of the Front Panel switches is pressed, the switch number and function name will be displayed on the LCD. If the switch has an LED, the LED will blink on and off.

Press the **SELECT** switch to exit this test.

4.25 - ANALOG TO DIGITAL CONVERTER TEST

The ADC test will verify operation of some of the Front Panel Sliders as well as the Foot Pedals and Mod Levers. The LCD display will prompt for a **YES** or **NO** switch response as follows:

A/D CONVERTER TEST
EXT PED 1? Press **YES**

The LCD will show the A/D reading in HEX. for External Pedal 1 the approximate readings should be:

0 0	**PEDAL NOT PLUGGED INTO REAR PANEL JACK**
7E	**PEDAL UP**
0B	**PEDAL DOWN**

Press **SELECT** to proceed to the next ADC test.

FEEDBACK B? Press **YES**

The ADC reading should be approximately **7D.**

Press **SELECT** to proceed to the next ADC test.

FEEDBACK A? Press **YES**

The ADC reading should be approximately **7F.**

Press **SELECT** to proceed to the next ADC test.

MASTER TUNE? Press **YES**

The ADC reading should be approximately:

14	**SLIDER IN LEFTMOST POSITION**
8 1	**SLIDER IN CENTER POSITION**
ED	**SLIDER IN RIGHTMOST POSITION**

Press **SELECT** to proceed to the next ADC test.

VOLTAGE MAX? Press **YES**

The ADC reading should be **ED** the same as the Master Tune rightmost position.

Press **SELECT** to proceed to next ADC test.

VOLTAGE MIN? Press **YES**

The ADC reading should be **14** the same as the Master Tune leftmost position.

Press **SELECT** to proceed to the next ADC test.

EXT PED 2? Press **YES**

The ADC readings should be approximately the same as for the External Pedal 1:

00	**PEDAL NOT PLUGGED INTO REAR PANEL JACK**
7E	**PEDAL UP**
0B	**PEDAL DOWN**

Press **SELECT** to proceed to the next ADC test.

ASSN 3? Press **YES**

The ADC readings should be approximately the same as for the Master Tune slider:

14	**SLIDER IN DOWN POSITION**
80	**SLIDER IN CENTER POSITION**
ED	**SLIDER IN UP POSITION**

Press **SELECT** to proceed to the next ADC test.

ASSN 2? Press **YES**

The ADC readings should be approximately the same as for the Master Tune slider:

14	**SLIDER IN DOWN POSITION**
80	**SLIDER IN CENTER POSITION**
ED	**SLIDER IN UP POSITION**

Press **SELECT** to proceed to the next ADC test.

LEFT MOD LEVER? Press **YES**

The Mod Lever ADC reading may vary since final calibration is performed during an audio test. The approximate readings should be:

80	**MOD LEVER CENTERED**
0A	**MOD LEVER DOWN**
EB	**MOD LEVER UP**

Press **SELECT** to proceed to the next ADC test.

RGT MOD LEVER? Press **YES**

The Mod Lever ADC reading may vary since final calibration is performed during an audio test. The approximate readings should be:

80	**MOD LEVER CENTERED**
0A	**MOD LEVER DOWN**
EB	**MOD LEVER UP**

Press **SELECT** to proceed to the next ADC test.

The POD foot pedals have three positions:

52	**PEDAL UP**
7B	**PEDAL HALF WAY DOWN**
A9	**PEDAL DOWN**

Press **SELECT** to proceed to the next ADC test.

LEFT PEDAL? Press **YES**

The left POD pedal readings should be approximately the same as the right pedal:

52	**PEDAL UP**
7B	**PEDAL HALF WAY DOWN**
A9	**PEDAL DOWN**

Press **SELECT** to exit the Front Panel Test and return to the main menu.

4.26 - CPU TESTS

Some of the CPU tests require the use of the loopback connectors provided in the Diagnostic Kit. These connectors are:

1. MIDI loopback connector
2. SYNC IN/OUT loopback connector (also used for CLICK OUT /TRIG IN)
3. Parallel Computer (PC) loopback connector

IF YOU UNIT HAS QLS DO NOT USE THE PARALLEL COMPUTER LOOPBACK CONNECTOR!

Starting with the first main menu question displayed on the Front Panel LCD, press the **YES**, **NO** or **SELECT** switch in response to the display prompts as follows:

CLR PWR FAIL CNT? Press **YES**
AUTOTEST? Press **NO**
RUN ALL TESTS? Press **NO**
FRONT PANEL? Press **NO**
TEST CPU? Press **YES**
ALL CPU TESTS? Press **NO**
TEST CPU RAM? Press **YES**
ALL CPU RAM? Press **YES**

The diagnostic will now proceed to test the main CPU random access memory (RAM). If there is an error during the test, a diagnostic error message will be displayed on the front panel LCD indicating the address of the error, the expected (good) data, and the actual (bad) data read.

EXAMPLE:

RAM TEST ERR A: 1003FF <<<< THIS IS THE ADDRESS
GOOD: 55 BAD: FF

If the RAM data error occurs, the individual RAM tests may be run to determine the memory chip component number. After each memory test questions, a **LOOP ON TEST?** question is asked. If **YES** is the response, the test will repeat until **SELECT** is pressed or an error is detected.

If there are no main RAM errors, the next LCD prompt will be:

TEST OPTIONAL RAM?

(**NOTE:** This RAM is standard on newer units and should be installed in units with Version 3 or better.)

The response to this question is **NO** if the sequencer RAM is not installed on the CPU board. The response is **YES**, if the RAM is present. If the test passes the next prompt will be:

TEST INDIVIDUAL RAM?

The response to this question is **NO** if the previous RAM test(s) have run successfully with no error messages displayed. The response to the this question is **YES**, if there were errors during the previous RAM test(s). If you respond with **YES**, the following prompts will be displayed:

MAIN CPU RAM

TEST U33?
TEST U49?
TEST U32?
TEST U48?
TEST U31?
TEST U47?
TEST U30?
TEST U46?
TEST U29?
TEST U44?
TEST U28?
TEST U43?

OPTIONAL CPU RAM

TEST U26?
TEST U41?
TEST U25?
TEST U40?

The next prompt after the RAM tests is:

TEST CPU ROM? Press **YES**
ALL CPU ROM? Press **YES**

The CHECKSUM for each EPROM will be displayed on the LCD. The CHECKSUMs are for the following EPROMs:

U38	(DIAGNOSTIC EPROM)
U54	(DIAGNOSTIC EPROM)
U37	
U53	
U36	
U52	
U35	
U51	
U26	
U41	
U25	
U40	

NOTE: THE CHECKSUMS FOR THE EPROMS ARE DISPLAYED AND SHOULD BE COMPARED WITH THE CHECKSUMS LOCATED ON EACH EPROM LABEL.

The 8254 timers are the next CPU components checked. The outputs of the timers are Pins 10, 13 and 17. The prompt is:

INIT TIMERS? Press **YES**

Using an oscilloscope with probe, check for the following square waves at the IC and pin number indicated:

IC NUMBER	PIN NUMBER	SQUARE WAVE PERIOD
U68	10	200 nsec.
U68	13	400 nsec.
U68	17	600 nsec.
U69	10	800 nsec.
U69	13	1 µsec.
U69	17	2 µsec.

IC NUMBER	PIN NUMBER	SQUARE WAVE PERIOD
U87	10	3 µsec.
U87	13	4 µsec.
U87	17	5 µsec.
U88	10	6 µsec.
U88	13	7 µsec.
U88	17	8 µsec.
U106	10	9 µsec.
U106	13	25 µsec.
U106	17	50 µsec.
U107	10	75 µsec.
U107	13	100 µsec.
U107	17	125 µsec.
U118	10	150 µsec.
U118	13	175 µsec.
U118	17	200 µsec.
U119	10	225 µsec.
U119	13	250 µsec.
U119	17	500 µsec.

The next CPU test is the keyboard interface test.

TEST KEYBOARD? Press **YES**

KEYBOARD TEST
PRESS ANY KEY

The first key on the left is numbered zero. The last key on the right is numbered 87. The keyboard is divided into two keyswitch boards. The left half of the keyboard contains keys 0 through 43. The right half of the keyboard contains keys 44 through 87. The keyboard split occurs between E4 and F4 in the center of the keyboard.

Pressing and holding down the E4 key on the keyboard will NOT sound an audible note, but will cause the front panel LCD to show:

EXAMPLE:

ATTACK KEY 43
TOF: FO COUNT: 1

Releasing the E4 key will cause the front panel display to show:

RELEASE KEY: 43
TOF: 93 COUNT: 2

NOTE: The Time-Of-Flight (TOF) indicated will vary depending upon how fast the key is pressed or released. A fast key stroke wills how a larger number (hexadecimal). A very slow key stroke will show 00 for the Time-Of-Flight. The key number and count are in decimal. The count should always be even when no keys are pressed down.

Press **SELECT** to exit the keyboard test.

The next four tests require the loopback connectors provided with the Diagnostic Kit.

TEST MIDI? Press **YES**

Disconnect the MIDI connector from the CPU board and plug in the MIDI loopback connector.

Press **SELECT** to begin the test.

If a test error occurs a diagnostic error message will be displayed on the front panel LCD. If no error occurs, proceed with the following.

IF YOUR UNIT HAS QLS DO NOT USE

TEST PC? Press **YES**

Connect the Parallel loopback connector to the computer port located on the back panel.

Press **SELECT** to being the test.

If a test error occurs a diagnostic error message will be displayed on the front panel LCD. If no error occurs, proceed with the following.

TEST SYNC LO? YES

Connect the 1/4" to 1/4" cable supplied with the Diagnostic Kit. Connect this cable from SYNC OUT to SYNC IN.

If a test error occurs a diagnostic error message will be displayed on the front panel LCD display. If no error occurs, proceed with the following.

TEST CLICK OUT? YES

Connect 1/4" to 1/4" cable from CLICK OUT to TRIG IN.

Press **SELECT** to begin the test.

If a test errror occurs a diagnostic error message will be displayed on the front panel LCD display. If no error occurs, proceed with the following.

Disconnect all loopback connectors.

TEST U67 TIMER 1? Press **YES**

If a test errror occurs a diagnostic error message will be displayed on the front panel LCD display. If no error occurs, proceed with the following.

Press **SELECT** to exit the CPU tests.

4.27 - POWER FAIL TEST

To check the power fail interrupt logic on the CPU board:

CLR PWR FAIL CNT? Press **YES**

Turn off system power, then turn on system power.

Press **SELECT**
CLR PWR FAIL CNT? Press **NO**
COUNT: 1

The **COUNT** indicates the number of times a power fail interrupt was detected by the CPU. Cycling the power off then on several more times and answering **NO** to the **CLR PWR FAIL CNT** prompt should increment the count by one each time. If the count does not increment by one, there may be a problem with the CPU interrupt logic or the battery-backed RAM.

4.28 - CGP TESTS

CGP RAM

Starting with the first main menu question displayed on the front panel display, press the **YES**, **NO** or **SELECT** switch in response to the display prompts as follows:

CLR PWR FAIL CNT? Press **YES**
AUTOTEST? Press **NO**
RUN ALL TESTS? Press **NO**
FRONT PANEL? Press **NO**
TEST CPU? Press **NO**
TEST CGP? Press **YES**
ALL CGP TESTS? Press **NO**
TEST CGP RAM? Press **YES**
LOOP ON TEST? **YES** or **NO**

The diagnostic will now proceed to test the CGP random access memory (RAM). If there is an error during the test, a diagnostic error message will be displayed on the front panel LCD display indicating the address of the error, the expected (good) data, and the actual (bad) data read.

EXAMPLE:

RAM TEST ERR A: 1B03FE <<<< This is the address
GOOD: 5555 **BAD: FFFF**

Press **SELECT** to proceed. If **LOOP ON TEST** is selected, the test will repeat until an error is detected or **SELECT** is pressed and held until the test is complete.

SOUND FILE RAM

TEST SF RAM WORD? Press **YES or NO**
LOOP ON TEST? Press **YES or NO**

The response to this questions is **NO** if the digitizer optional RAM is not present on the CGP board, or if SUPERAM is installed.

> **NOTE: Do not use this test to test the SUPERAM option.**

The response is **YES** if the digitizer RAM is present on the CGP. If an error occurs, the error message will appear as in the example for the CGP RAM.

If **LOOP ON TEST** is selected, the test will repeat until an error is detected or **SELECT** is pressed and held until the end of the test.

> **TEST SF RAM SOUND?** Press **YES or NO**
> **LOOP ON TEST?** Press **YES or NO**

The response to this questions is **NO** if the digitzer optional RAM is not present on the CGP board, or if SUPERAM is installed.

> **NOTE: Do not use this test to test the SUPERAM option.**

The response is **YES** if the digitizer RAM is present on the CGP. If an error occurs, the error message will appear as in the example for the CGP RAM. If **LOOP ON TEST** is selected, the test will repeat until an error is detected or **SELECT** is pressed and held until the test is complete. This could take as long as 30 seconds for this test.

SOUND FILE ROM

There are two configurations of Sound File ROM. The early configuration consists of six rows of ten 256K ROMs per row. In that configuration, optional sound blocks are installed on a daughter board. The diagnostic program expects to find only Sound Block A and B on the daughter board. The current configuration consists of two rows of ten 1M ROMs each. In this configuration, optional sound blocks are installed in the extra rows on the CGP board. The rows are numbered from 1 to 6 starting from the row nearest to the rear of the instrument. Rows 1 and 2 contain the basic sounds that all units produced with this 1M, board configuration are produced with. Row 3 is reserved for the optional Sound Block A. Row 4 is reserved for the optional Sound Block B. Row 5 is reserved for the optional Sound Block C. Row 6 is reserved for the optional Sound Block D. There are four checksums per row in the current configuration.

If a checksum error occurs during the test, the ROM component number on the CGP will be displayed along with the expected checksum (GOOD) and the actual checksum (BAD):

EXAMPLE:

CGP ROM CHKSUM ERR U125
GOOD: 354B BAD: 7894

NOTE: A checksum of 8000 indicates that the ROM could not be read, or the location is empty.

TEST SF ROM? Press **YES**
LOOP ON TEST? Press **YES** or **NO**

As the sound file ROM test proceeds, the LCD display will show:

TESTING SF ROM ROW 1
TESTING SF ROM ROW 2

If the early configuration is being tested, the following will also be displayed:

TESTING SF ROM ROW 3
TESTING SF ROM ROW 4
TESTING SF ROM ROW 5
TESTING SF ROM ROW 6

If **LOOP ON TEST** is selected, the message:

LOOPING ON TEST

will be displayed on the second line of the display, and the test will repeat until an error is detected or **SELECT** is pressed and held until Row 6 (early configuration) or row 2 (current configuration) has been tested.

OPTIONAL SOUND FILE ROM

Optional sounds are Sound Blocks A, B, C and D. In the early configuration Sound Blocks A and B are installed on a daughter board. The daughter board sound file ROM is divided logically into eight rows of ten ROMs each. Physically, there are actually only two rows of ten 1M ROMs each. In the later configuration optional sound blocks are installed in rows 3 through 6 on the CGP board.

If a checksum error occurs during the test, the ROM component number on the CGP or daughter board will be displayed along with the expected checksum (GOOD) and the actual checksum (BAD):

EXAMPLE:

CGP ROM CHKSUM ERR U26
GOOD: 9FEA BAD: 7894

NOTE: A checksum of 8000 indicates that the ROM could not be read or the location is empty.

TEST SOUND BLOCK A?
YES (to test Block A)
NO (to go to next test)

LOOP ON TEST? Press **YES** or **NO**

As the sound file ROM test proceeds, the LCD will show:

TESTING SOUND BLOCK A
LOOPING ON TEST (if selected)

If **LOOP ON TEST** is selected, the test will repeat until an error is detected or **SELECT** is pressed and held until the last chip has been tested. After exiting from the Sound Block A test, or after responding **NO** to the Sound Block A test, the display will show:

TEST SOUND BLOCK B?
YES (to test Block B)
NO (to go to next test)

LOOP ON TEST? Press **YES** or **NO**

As the sound file ROM test proceeds, the LCD will show:

TESTING SOUND BLOCK B
LOOPING ON TEST (if selected)

If **LOOP ON TEST** is selected, the test will repeat until an error is detected or **SELECT** is pressed and held until the last chip has been tested. After exiting from the Sound Block B test, or after responding **NO** to the Sound Block B test, the display will show:

TEST SOUND BLOCK C?
YES (to test Block C)
NO (to go to next test)

LOOP ON TEST? Press **YES** or **NO**

As the sound file ROM test proceeds, the LCD will show:

TESTING SOUND BLOCK C
LOOPING ON TEST (if selected)

If **LOOP ON TEST** is selected, the test will repeat until an error is detected or **SELECT** is pressed and held until the last chip has been tested. After exiting from the Sound Block C test, or after responding **NO** to the Sound Block C test, the display will show:

TEST SOUND BLOCK D?
YES (to test Block D)
NO (to go to next test)

LOOP ON TEST? Press **YES** or **NO**

As the sound file ROM test proceeds, the LCD will show:

TESTING SOUND BLOCK D
LOOPING ON TEST (if selected)

If **LOOP ON TEST** is selected, the test will repeat until an error is detected or **SELECT** is pressed and held until the last chip has been tested.

The daughter board Sound Block A ROM component numbers are:

U26, U2, U5, U8, U11, U28, U14, U17, U20 and U23

The daughter board Sound Block B ROM component numbers are:

U1, U4, U7, U10, U13, U16, U19, U22, U25 and U27.

EXTERNAL CARTRIDGE SOUND FILE ROM (K250 only)

This test should not be used. The external cartridge has diagnostics in the K250 software.

CGP STATUS TEST

TEST CGP DMA? Press **YES**
CHANNEL 1? Press **YES** or **NO**

Each successive channel number will be asked until a **YES** response is given. Only one channel may be tested at a time.

During the CGP status test, the test status will be displayed on the front panel LCD as follows:

EXAMPLE:

CSW:D00F
AL1: E7F1 AL2:0000

In the above example, the CSW is the channel status word. The four status digits are in hexadecimal. If the test is progressing correctly:

1. The first CSW digit will usually vary from D to F. Occasionally, it will flash briefly from D to 5 or from F to 7. If 5 or 7 are displayed for any appreciable length of time, there may be a problem on the CGP board. Any number or letter other than D, F, 5 or 7 in the first character of the CSW also indicates a problem on the CGP board.
2. The second and third digits will increment in pairs from 00 to FF.
3. The fourth CSW digit should always be F.
4. AL1 will count up from 0000 to FFFF and then stop. When AL1 reaches FFFF, AL2 will start counting up from 0000 to FFFF and then stop. AL1 will then begin counting up again from 0000 to FFFF. AL1 and AL2 will continue counting up alternately until **SELECT** is pressed.

   NOTE: If the following LCD display appears and does not change, it usually indicates that no sample clock is present at the channel sample DAC:

   CSW: 900F
   AL1: 0010 AL2: 0000

If this error occurs, check the ribbon cable connections going from the CPU board to the channel board. Also run the CPU timer test.

Press **SELECT** to exit the CGP test.

4.29 - DIGITIZER TEST

The digitizer test requires a 1/4" monural audio cable, similar to the one used for the SYNC IN/OUT loopback. An oscilloscope with probe grounded to the instrument chassis ground, and a pair of stereo headphones are the only other equipment required in addition to the K250.

SETUP PROCEDURE

1. Connect one end of the 1/4" monaural audio cable to the LEFT HI audio output jack on the rear panel of the K250. Connect the other end of the audio cable to the LINE IN jack on the rear panel of the K250.
2. Set the GROUP A slider to the leftmost position.
3. Set the GROUP B slider to the rightmost position.
4. Set the VOLUME slider to the rightmost position (maximum).

TEST DESCRIPTION

The digitizer test will use the K250 channel 1 as the signal source to be digitized. Channel 12 will be set up in digitizer mode and will be used to sample the input signal coming in from the LINE IN jack. When the sampling is complete, the original channel 1 sinewave signal will be output on channel 1, Group A. The digitized sinewave signal will be output on channel 2, Group B for comparison. The channel 2 signal will be lower in amplitude than the channel 1 signal, but should not have distortion or noise present. The audio output has been enabled during the test to permit aural verification. The channel 1 signal should be audible on the left headphone speaker, and the channel 2 digitized signal should be audible on the right headphone speaker, at a slightly lower volume.

SELECTING THE DIGITIZER TEST

Starting with the first main menu question displayed on the front panel display, press the **YES**, **NO** or **SELECT** switch in response to the display prompts as follows:

CLR PWR FAIL CNT? Press **YES**
AUTOTEST? Press **NO**
RUN ALL TESTS? Press **NO**
FRONT PANEL? Press **NO**
TEST CPU? Press **NO**
TEST CGP? Press **NO**
TEST CHANNELS? Press **YES**
TEST DIGITIZER? Press **YES**

There is a choice of one of three sinewaves to sample:

C8 SINEWAVE? Press **YES** or **NO**
C5 SINEWAVE? Press **YES** or **NO**
C2 SINEWAVE? Press **YES** or **NO**

After selecting one of the sinewaves, the display will show:

TEST DIGITIZER

After a one second sampling period, the display will show:

TEST DIGITIZER
SCOPE CHANNEL 1 AND 2

At this point, the digitized output signal should be available:

CHANNEL	SIGNAL	FREQUENCY	PERIOD	AMPLITUDE
1	C2 SINEWAVE	65HZ	15.29 MS	10V P-P
1	C5 SINEWAVE	523HZ	1.91 MS	10V P-P
1	C8 SINEWAVE	4186HZ	239US	8.8V P-P

Location U20, Pin 2 on the Channel board

CHANNEL	SIGNAL	FREQUENCY	PERIOD	AMPLITUDE
1	C2 SINEWAVE	65HZ	15.29 msec.	6.2VP-P
1	C5 SINEWAVE	523HZ	1.91 msec.	6.4VP-P
1	C8 SINEWAVE	4186HZ	239 µsec.	6VP-P

Location U21, Pin 2 on the Channel board.

During the approximately 1 second of input sampling, the input signal can be checked with the scope at U60, Pin 13. This is the A/D converter input pin.

SPECIAL NOTE: Testing the digitizer at sampling rates greater than 15KHz.

The diagnostic chips are not capable of testing the digitzer at rates higher than 15KHz. If the unit passes all diagnostic tests, the digitizer may be tested at rates above 15KHz. using the following procedure:

4.30 - 50KHz. SAMPLING OPTION DIAGNOSTIC TEST

NOTE: The instrument must pass all other diagnostic tests before proceeding with this test. An incorrect fault diagnosis may result if this is not done.

EQUIPMENT REQUIRED:

1. Sine Wave Generator, capable of generating 8KHz. with an amplitude of 0.5 VPP.
2. Dual trace oscilloscope
3. Cable to connect sine wave generator to LINE IN jack on the K250
4. Piezoelectric microphone or equivalent (only used for checking MIC input circuit)
5. 1/4" plug to bare wires (to observe the output of the K250 on the scope)
6. Version 3 or later software with same version sampling software.

Set-Up:

The diagnostic EPROMs should be removed and the system operating software should be reinstalled. Check to be sure that the software has been installed correctly. Connect the sine wave generator to the K250 LINE IN jack. Connect one trace of the scope to the output of the sine wave generator and the other trace to the left or right HI output on the K250. Set Group A and B sliders to center. Adjust the frequency of the sine wave generator to aproximately 8KHz. and the amplitude to approximately 0.5 VPP.

Procedure

LCD READS	PRESS	COMMENTS
KURZWEIL GRAND PIANO PLAY MODE	**INSTRUMENT**	Display on power up
RECORD SOUND? DIG 1	**SELECT**	Active sampling
Sound type (1-6): QUICKTAKE 1	**SELECT**	Using QUICKTAKE achieves the fastest turnaround time

Sampling rate (1-14): **25000 10**	**14, SELECT**	Select the highest sampling rate. If the unit has not been upgraded to 50K, 25K will be the highest rate.
Sampling rate (1-14): **5000 14**	**SELECT**	(or 25000 10)
Time to record:	**SELECT**	Use maximum 10 sampling time (20 at 25000)
Trigger level (0-6): **24dB 3**	**SELECT**	
Pre-trigger recording? **NONE0**	**SELECT**	
Check level?	**YES**	
CONTINUOUS**** **PEAK HOLD* ***		VU meter display

Set volume slider to full. Use slider 3 to set gain. The right end of both **CONTINUOUS** and **PEAK HOLD** will change to "+" signs and 'SPLIT KBD" button will light if you are clipping. If you can't reach clipping with slider 3 all the way up, slowly increase the output on the sine wave generator until clipping is indicated. Now back off slider 3 to a level as close as possible to clipping without actually clipping. You are now ready to sample:

CONTINUOUS********* **PEAK HOLD* ***	**SELECT**	Done setting level
HIT RECORD TO START	**RECORD**	Record sound
RECORDING...		
DONE. EVALUATING...		
CLIPS 0 MAX XXX		

Preview root at C4

Hit **SELECT** to continue

While playing C4 (middle C), observe the output of the K250 on the scope. Look for distortion, glitches and discontinuities in the waveform. Compare the output of the K250 with the output of the sine wave generator. The two should be idiential in frequency. The amplitude of the output from the K250 will depend on how hard you hit the key.

SELECT

Save this sound? (Y/N) **NO**

Retake? (Y/N) **NO**

RECORD SOUND? **PLAY**
DIG 1

KURZWEIL GRAND PIANO
PLAY MODE

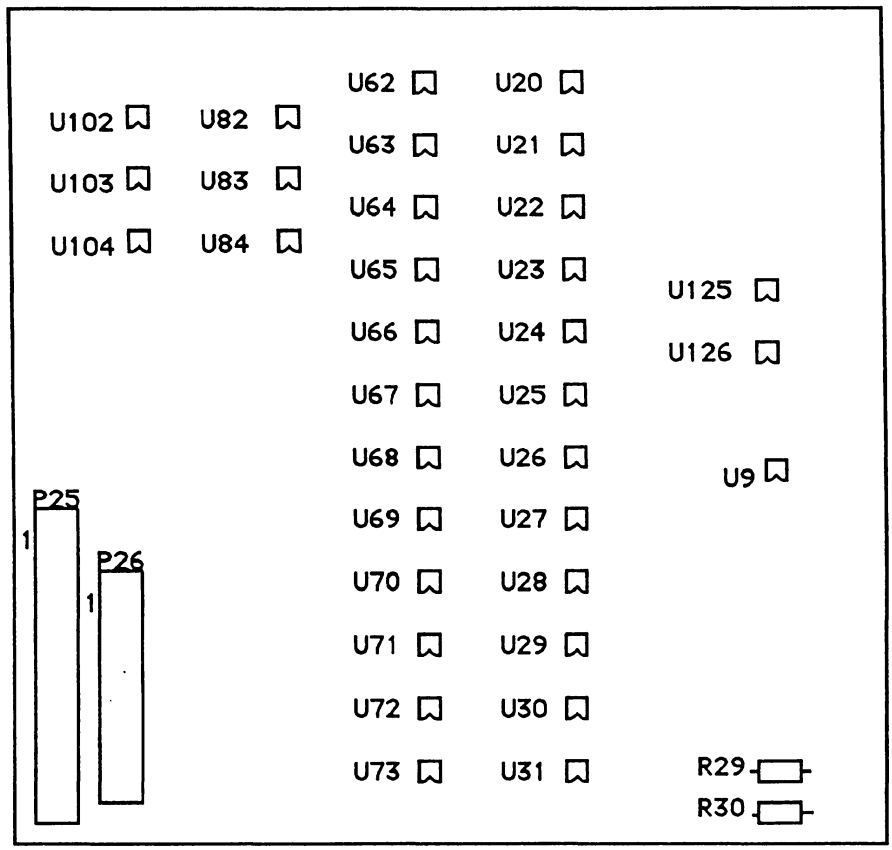
Disconnect the scope and the sine wave generator. Connect the microphone to the MIC jack on the K250. Repeat the procedure outlined above. Make some sound when the display says **RECORDING...** Using pure tonal sounds will make it easier to detect and diagnose any possible problems. It is not necessary to observe the output on the scope this time unless problems are encountered.

4.31 - CHANNEL BOARD TESTS

The following diagram of the Channel board shows the component placement of the integrated circuits which will be probed using an oscilloscope during the following Channel board test procedure. The point of view of this diagram is from the back of the instrument, looking down onto the Channel board.

NOTE: The oscilloscope must be grounded to the K250 chassis ground.

CHANNEL BOARD COMPONENT PLACEMENT



Audio Mute Select

The audio output from the Channel board to the Audio board can be enabled or disabled by a relay which resides on the Channel board. After selecting the Channel test, the diagnostic will ask?

MUTE AUDIO OUTPUT?

If you press the **YES** switch the relay will be closed, disabling the audio output. If you press the **NO** switch the relay will be open, enabling the audio output.

NOTE: the audio mute relay will not be opened or closed until the channels have been selected (test begins).

Sinewave Select

One of three sinewaves stored in Sound File ROM may be selected. The sinewaves will be output to the selected channels continuously to provide oscilloscope signals. These sinewaves correspond to the keys on the keyboard and are therefore named accordingly. The sinewave names are:

C2 SINEWAVE sampled at 5 KHZ rate, frequency 65 HZ
C5 SINEWAVE sampled at 10 KHZ rate, frequency 523 HZ
C8 SINEWAVE sampled at 15 KHZ rate, frequency 4186 HZ

By selecting one of the three sinewaves, and selecting the same sampling rate as that used for originally storing the sinewaves, the frequency will be the same as that shown above. The diagnostic will ask:

C2 SINEWAVE? if you press the **NO** switch then it asks
C5 SINEWAVE? if you press the **NO** switch then it asks
C8 SINEWAVE? if you press the **NO** switch the questions

are asked again. This will continue until you press the **YES** switch for one of the choices.

Sampling Rate Select

One of the four sampling rates may be selected. The sampling rate selected will apply to all channels activated during the channel select portion of the test. Therefore, each channel will have the same frequency sinewave output. The sampling rate choices are: 5kHz, 10kHz, 15kHz and 25kHz.

The frequency of the sinewave will vary depending upon the sampling rate selected. Table 1 shows the 12 possible frequencies available. The time (T) shown in Table 1 indicates the period of each sinewave. The diagnostic will ask:

5kHz SAMPLE RATE? If you press **NO** switch, then it asks
10kHz SAMPLE RATE? If you press **NO** switch, then it asks
15kHz SAMPLE RATE? If you press **NO** switch, then it asks
25kHz SAMPLE RATE? If you press **NO** switch, then it asks

these questions again until the **YES** switch is pressed.

Channel Select

Any combination of the twelve channels, numbered 1 through 12, may be selected for test. Each channel may have one of three attenuation settings and can be assigned to mixer Group A or Group B. As described in the Sampling Rate Select section, each channel will have the same frequency sinewave output. The diagnostic will ask:

TEST CHANNEL 1?

To test the channel, press the **YES** switch on the front panel. To disable the channel press the **NO** switch on the front panel. The diagnostic will ask this question for each of the channels 1 through 12. If you press the **YES** switch to select a channel for test, the diagnostic will ask the attenuation and group select questions described next.

Attenuation Select

One of the three channel amplitude control digital/analog converter settings may be selected for each channel. These settings are:

1. **RAMP** the amplitude DAC output
2. **Maximum** Attenuation
3. **Assign to Group A**

If **RAMP** the amplitude DAC output is chosen, the ouput signal of the amplitude DAC may be observed with an oscilloscope at the Channel board locations shown in Table 3. If **maximum** attenuation is selected the output of the amplitude DAC should be +10 VDC. If **minimum** attenuation is selected, the output of the amplitude DAC for that channel should be 0 VDC.

Note: If neither **RAMP** nor **MAXIMUM** attenuation is selected, the default is **MINIMUM** attenuation.

The diagnostic will ask:

RAMP AMP DAC? If you press the **NO** switch then it asks **MAXIMUM ATTENUATION?** If you press the **NO** switch then **MINIMUM** attenuation is used.

Group Select

Each of the 12 channels may be assigned to one of the two mixer outputs. These mixer outputs are designated LEFT and RIGHT. The channels assigned to Group A can be panned from left to right by moving the Group A slider on the front panel of the K250. Similarly, the channels assigned to Group B can be panned from left to right by moving the Group B slider on the front panel of the K250.

The diagnostic will ask:

ASSIGN TO GROUP A?

If you press the **YES** switch on the front panel, the channel will be assigned to mixer Group A. If you press the **NO** switch on the front panel, the channel is assigned to mixer Group B.

ALL CHANNELS TEST

To select the ALL CHANNELS test, answer:

TEST CHANNELS? Press **YES**
MUTE AUDIO OUTPUT? Press **YES** or **NO**

If you press the **YES** switch, the relay will be closed disabling the audio output. If you press the **NO** switch, the relay will be open, enabling the audio output.

All 12 channels will be enabled, with a different frequency sinewave on each channel. Channel 1 will have the lowest frequency sinewave, and channel 12 will have the highest frequency sinewave. The signals can be checked on pin 2 of each of the alias filter outputs shown in table 2. The following table shows the frequencies expected for each channel:

CHANNEL	SIGNAL	SAMPLE RATE	FREQ.	PERIOD
1	C2 SINEWAVE	5KHZ	65HZ	15.3 msec.
2	C2 SINEWAVE	10KHZ	130HZ	7.6 msec.
3	C2 SINEWAVE	15KHZ	195HZ	5.1 msec.
4	C2 SINEWAVE	25KHZ	325HZ	3.1 msec.
5	C5 SINEWAVE	5KHZ	261HZ	3.8 msec.
6	C5 SINEWAVE	10KHZ	523HZ	1.9 msec.
7	C5 SINEWAVE	15KHZ	783HZ	1.3 msec.
8	C5 SINEWAVE	25KHZ	1305HZ	766 µsec.
9	C8 SINEWAVE	5KHZ	1395HZ	716 µsec.
10	C8 SINEWAVE	10KHZ	2790HZ	358 µsec.
11	C8 SINEWAVE	15KHZ	4186HZ	239 µsec.
12	C8 SINEWAVE	25KHZ	6976HZ	143 µsec.

4.32 - CHANNEL AND AMPLITUDE DAC TEST

1. Select the CHANNEL TEST by pressing the **YES** switch when the **TEST ANY CHANNEL?** is displayed.
2. Select audio output muted
3. Select C2 sinewave at 5kHz sampling rate
4. Enable channels 1 through 12, ramp amplitude DACs, Group A
5. Use an oscilloscope and probe the test points indicated in Table 2 or 3 to verify channel operation. Probe the test points indicated in Table 4 ot verify Amplitude DAC operation.

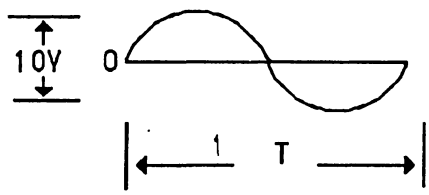
NOTE: Use caution when probing pin 7 of the amp DAC opamps, because pin 8 is a power pin. If the scope probe shorts pin 7 to pin 8 the opamp will be damaged.

The frequency of the sinewave will vary depending upon the sampling rate selected. Table 1 shows the 12 possible frequencies available. The time (T) shown in Table 1 indicates the period of each sinewave. Figure 1 shows how the sinewave should appear at the outputs of the alias filters (See Table 2).

TABLE 1: SINEWAVE PERIOD TIMES (T)

SAMPLING RATE	C2	C5	C8
5kHz	15 ms	3.8 ms	0.7 ms
10kHz	7.5 ms	1.9 ms	.35 ms
15kHz	5.0 ms	1.25 ms	0.25 ms
25kHz	3.0 ms	0.75 ms	0.15 ms

FIGURE 1



The following table shows the integrated circuit pin numbers to probe with the ocilloscope to observe these sinewaves:

TABLE 2: ALIAS FILTER OUTPUTS

U20	PIN 2	CHANNEL 1
U21	PIN 2	CHANNEL 2
U22	PIN 2	CHANNEL 3
U23	PIN 2	CHANNEL 4
U24	PIN 2	CHANNEL 5
U25	PIN 2	CHANNEL 6
U26	PIN 2	CHANNEL 7
U27	PIN 2	CHANNEL 8
U28	PIN 2	CHANNEL 9
U29	PIN 2	CHANNEL 10
U30	PIN 2	CHANNEL 11
U31	PIN 2	CHANNEL 12

The following, Table 3, shows the Sample D/A Converter test points to probe if any of the Channel Alias Filter outputs are incorrect. The sinewaves at these points are not as clean in appearance.

Note: Be sure to use the C2 sinewave at 5kHz sampling rate. If a sample DAC output is bad, refer to the CGP procedure.

TABLE 3: SAMPLE DAC OUTPUTS

U62	PIN 20	CHANNEL 1
U63	PIN 20	CHANNEL 2
U64	PIN 20	CHANNEL 3
U65	PIN 20	CHANNEL 4
U66	PIN 20	CHANNEL 5
U67	PIN 20	CHANNEL 6
U68	PIN 20	CHANNEL 7
U69	PIN 20	CHANNEL 8
U70	PIN 20	CHANNEL 9
U71	PIN 20	CHANNEL 10
U72	PIN 20	CHANNEL 11
U73	PIN 20	CHANNEL 12

4.33 - AMPLITUDE DAC TEST

The Amplitude DAC output waveforms should appear as shown in figure 2 at each of the test points on the Channel board shown in Table 4.

FIGURE 2: AMPLITUDE DAC OPAMP OUTPUT WAVEFORM

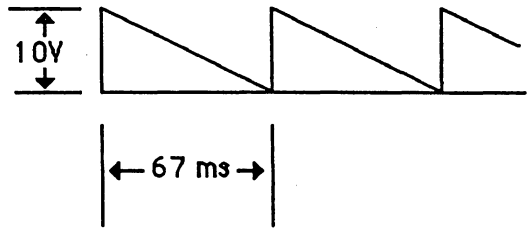


TABLE 4: AMPLITUDE DAC OUTPUTS

U82	PIN 7	CHANNEL 1
U82	PIN 1	CHANNEL 2
U83	PIN 7	CHANNEL 3
U83	PIN 1	CHANNEL 4
U84	PIN 7	CHANNEL 5
U84	PIN 1	CHANNEL 6
U102	PIN 7	CHANNEL 7
U102	PIN 1	CHANNEL 8
U103	PIN 7	CHANNEL 9
U103	PIN 1	CHANNEL 10
U104	PIN 7	CHANNEL 11
U104	PIN 1	CHANNEL 12

4.34 - GROUP A/B MIXER AND LEFT/RIGHT AUDIO OUTPUT TEST

1. Select **CHANNEL TEST**
2. Select **AUDIO OUTPUT NOT MUTED**
3. Select **C2 SINEWAVE, 5kHz SAMPLING RATE**
4. **Assign CHANNEL 1** with **MINIMUM** attenuation to **GROUP A.**
   Assign CHANNEL 2 with **MINIMUM** attenuation to **GROUP B.**

The **GROUP A** and **GROUP B** mixer outputs are available at the following test points:

U125, pin 1	**GROUP A** mixer output
U125, pin 7	**FEEDBACK A** output
U126, pin 1	**GROUP B** mixer output
U126, pin 7	**FEEDBACK B** output

5. Move the volume control slider on the K250 front panel to check the mixer gain control. The sinewave output should decrease in amplitude as the slider is moved left, and increase in amplitude as the slider is moved right.

NOTE: The final output drivers will show clipping when the volume slider is moved to the rightmost position.

The **LEFT** and **RIGHT** audio outputs are available at the following test points:

U9, pin 1	**LEFT** audio output
U9, pin 1	**RIGHT** audio output
R29 right end	**LEFT** audio output
R30 right end	**RIGHT** audio output

6. While observing the sinewave at **R29 right end**, move the **GROUP A** and **GROUP B** sliders to the **LEFT**. The sinewave should decrease in amplitude. While observing the sinewave at **R30 right end**, move the **GROUP A** and **GROUP B** sliders to the **RIGHT**. The sinewave should decrease in amplitude.

7. Exit the Channel Test by pessing the **SELECT** switch.

Chapter 5 - Disassembly/Assembly Procedures

5.1 - KURZWEIL 250

5.1.1 - Kurzweil 250 Enclosure

The Kurzweil 250 cabinet enclosure is two halves, a top and a bottom half. Should a repair require the top enclosure to be removed, you will need to loosen 7 captive screws that secure the top enclosure. The 7 captive screws are located under the unit. They come up through the bottom enclosure securing the top half. Loosen the screws until they move freely.

Once the 7 captive screws are loose, carefully lift the top enclosure up. You should be standing at the keyboard when you begin to lift the top enclosure. Next disconnect the following: a flat ribbon cable coming from the Channel board to the Slider board, a flat ribbon cable coming from the CPU board to the Control Panel board and a ground strap that is connected to the right hand side of the faceplate. You can now completely lift off the top enclosure.

CAUTION: When securing the 7 captive screws to the top enclosure from the bottom enclosure, be sure that no cables coming from the Control Panel or Keyswitch boards to the CPU or from the Slider board to the Channel board get caught between the screw mounting posts.

5.1.2 - Kurzweil 250 Slide Chassis

The Kurzweil 250 Slide Chassis is secured by 3 phillips head screws. They come up through the bottom enclosure securing the slide chassis. The 3 screws are spaced proportionally along the rear panel. To open the slide chassis, simply remove the screws. You will notice 2 handles mounted on the rear panel. Once the 3 screws have been removed, pull on these handles to release the slide chassis. The slide chassis will pull out about 14 inches. Please note that the slide chassis when completely open does not clear the large printed circuit boards mounted to the slide chassis.

Once you have opened the slide chassis, the following boards will be visible to you: CPU, CGP, Channel and Audio.

5.1.3 - CPU Board

To remove the CPU board, it is necessary to disconnect all cables connected to the CPU. There are 4 flat ribbon cables to be removed: 1 from the CGP board (center board), one from the Channel board (right-hand side) and two ribbon cables that connect to the inside edge of the CPU (these two cables come from the Control Panel and Keyswitch boards). Next, remove the two brown power connectors and the MIDI cable located next to the rear panel on the CPU. Now it is necessary to remove the 4 fastening nuts securing the four 1/4 inch phone jacks to the rear panel. Then remove the 13 phillips head screws which mount the CPU to the slide chassis. It is necessary to have a very short screwdriver to remove the 2 screws located at the inner edge of the board.

5.1.4 - CGP Board

To remove the CGP board, it will be necessary to remove 6 cables. Two from the CGP board to the Channel board, two from the CGP board to the CPU board, one from the power connector to the CGP board and one long flat ribbon cable that goes across the CGP board from the CPU to the Channel board. Once the cables have been disconnected, remove the 13 phillips head screws holding the CGP to the chassis. It is necessary to have a very short screwdriver to remove the 2 screws located at the inner edge of the board.

5.1.5 - Channel Board

To remove the Channel board, it will be necessary to remove the following cables: 1 from the Audio board to the Channel board, 1 from the power connector to the Channel board, 1 coming from the Slider board to the Channel board, 1 coming from the CPU to the Channel board and 1 coming from the CGP to the Channel board. It is not always necessary to remove the shield. However, if you are replacing the Channel board, be sure that the shield is put on the replacement. Once the cables have been disconnected, remove the 13 phillips head screws holding the Channel board to the chassis. It is necessary to have a very short screwdriver to remove the 2 screws located at the inner edge of the board.

5.1.6 - Audio Board

To remove the Audio board, simply disconnect the ribbon cable from the Audio board to the Channel board. Next, remove all hardware securing it to the rear panel.

5.2 - FRONT PANEL ASSEMBLY

5.2.1 - Accessing the Front Panel Assembly

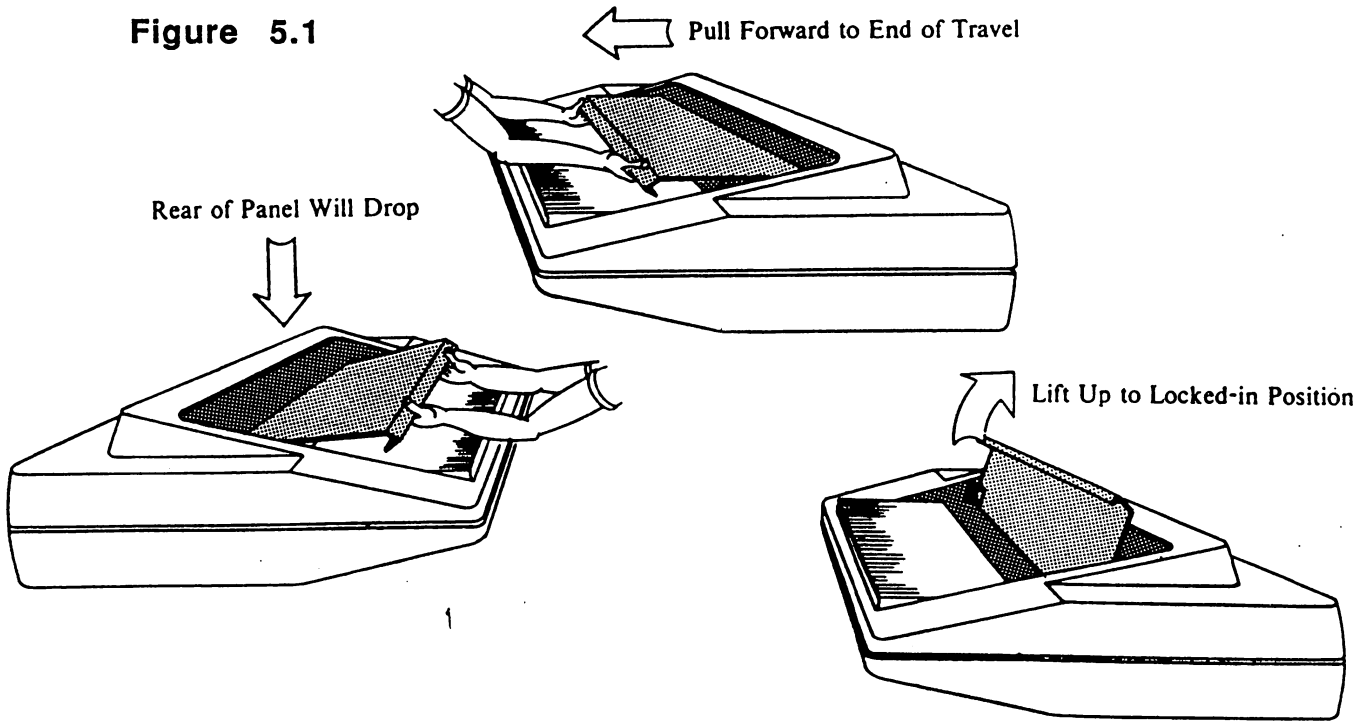
With this procedure you can reach and remove the three boards mounted on the Front Panel assembly. You can also remove all but two of the wooden keys with the Front Panel up. For most repairs, you will not have to remove the entire Front Panel assembly from the instrument.

There are three steps for opening up the Front Panel assembly:

1. Loosen the two captive screws on the Front Panel assembly. (One screw at each end of the Front Panel assembly.)
2. Lift the Front Panel assembly from its bottom edge (edge that meets keyboard). Carefully lift the assembly up and towards you about an inch. At this point the assembly could rest on the sharp and flat keys.
3. The assembly is now free and can be pivoted up and back so that the faceplate rests up against the top enclosure (see illustration below).

With the Front Panel assembly in this position, you can reach the three boards.

Figure 5.1



5.2.2 - Removing the Front Panel Assembly

Should you have to remove the entire Front Panel assembly, lift the assembly into its service position and disconnect the Mod Lever cable, the Slider board cable, the Control Panel cable and the ground strap wire. The ground strap wire will require a 5/16 nut driver.

Pivot the front edge of the assembly down towards the bottom enclosure and carefully bend the flange of either the left or right pivot bracket towards the center of the keyboard. Then lift that end of the assembly free of the pin. The entire assembly can now be removed.

5.2.3 - Closing the Front Panel Assembly

To return the Front Panel assembly to its operating position, grasp either end of the panel and pivot it down until it is flat (parallel to the ground). Now lift the panel up, keeping it level, until the pivot points are at the bottom of the grooves. Then push the panel towards the back of the instrument about one inch, lifting the back of the assembly so that the top edge of the assembly is above the supporting flange on the top enclosure, and the three clips attached underneath the the assembly go under the flange.

As you push the panel back into place, make sure all the cables are inside the cabinet. The cables must lie above the damper bar so they do not rest on the keys.

Now gently push the front edge of the assembly down behind the keys and tighten the 2 captive screws. Do not over-torque the mounting screws.

5.3 - KEYBOARD ASSEMBLY

5.3.1 - Accessing the Keyboard

You can remove all the K250 wooden keys, except the two end keys, by simply opening the Front Panel assembly as previoulsy described. The two keys that cannot be removed are the ones at each end of the keyboard. These keys can only be removed if the top enclosure is off.

5.3.2 - Accessing the Keyswitch Board Assemblies

Should you need to remove, replace or adjust the Keyswitch board assemblies, disconnecting the top and bottom enclosures is required. When disconnecting the top from the bottom enclosure for this purpose, removing the Front Panel assembly is not required. Simply disconnect the ribbon cables coming from the CPU and Channel boards to the Keyswitch and Front Panel assemblies. These cables can easily be accessed once the slide chassis is opened.

Once you have disconnected the top from the bottom enclosure and disconnected the cables, the Keyswitch board assemblies can be accessed.

There are two Keyswitch board assemblies, each consisting of a set of 44 leaf switches and a printed circuit board. A Keyswitch board assembly is always treated as a unit; you do not have to disassemble. The Keyswitch board assemblies are mounted on a bracket which screws into the action assembly. To remove a Keyswitch board assembly, loosen the four mounting screws and lift the assembly up (vertically) off the action assembly. Be careful to slide it up off the mounting screws since pulling the assembly out horizontally may strip the screws.

5.3.3 - Keyswitch Maintenance

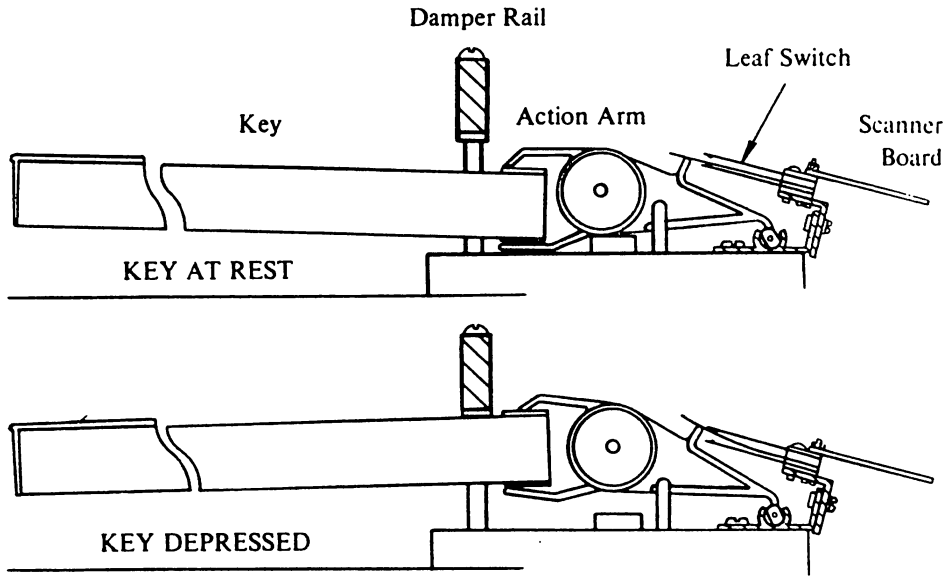
The keyswitches are "self-wiping" which means that they are automatically cleaned with each movement. At the end of their travel, the switches move a bit farther and this dragging motion cleans the contact.

The keyswitches should not be cleaned with any abrasive material or solvent. They may be gently sprayed with compressed air.

5.3.4 - Replacing a Keyswitch Board Assembly

To install a Keyswitch board assembly, insert the screws in the holes in the mounting bracket on the action assembly. Then slide the Keyswitch board assembly down over the screws. Slightly tighten the screws at the far ends first, then the two screws in the center. Do not tighten the screws completely at first. Simply tighten so that the assembly will slide up or down with slight pressure. Align one side .01 inch from the tab. Tighten and align the otherside. Then align the middle of the assembly and tighten. This should give a rough alignment. The longest leaf of the switch should be no more than .01 inch from the black tab on the action arm. The longest leaf must be touching the bottom leaf, and you can visually verify that this is correct by pressing a key and watching when it is released to be sure whether the bottom leaf moves when the longest leaf returns.

Figure 5.2



5.4 - MOD LEVERS

5.4.1 - Accessing the Mod Levers

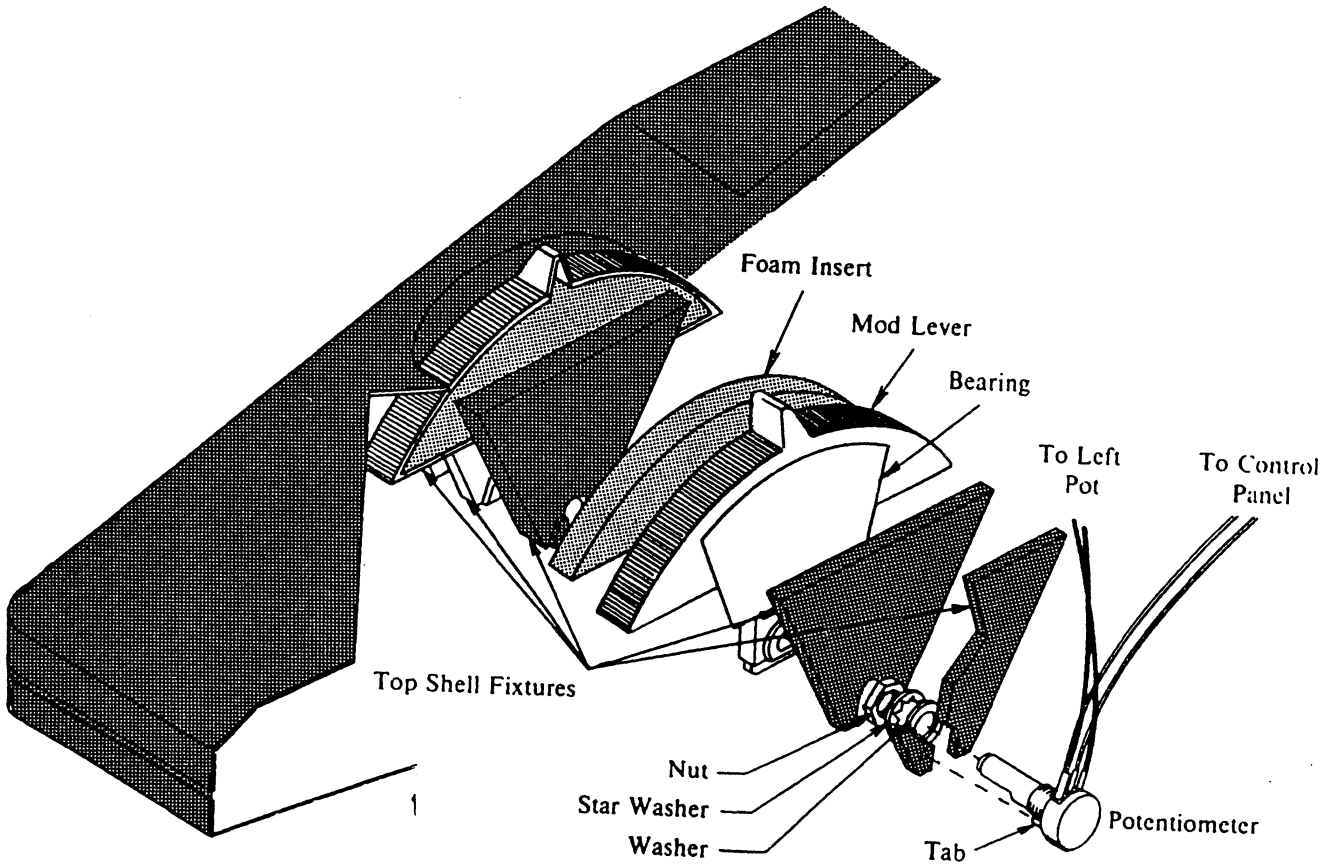
The Mod Levers are mounted under the top enclosure and are connected to the Slider board on the Front Panel assembly by a cable.

Follow the previously described procedure for disconnecting the top and bottom enclosure. The Mod Levers are held by the shafts of their rotary potentiometers. The potentiometers are held in place by a single nut with a lock and play washer.

5.4.2 - Removing the Mod Lever Pots

To remove the Mod Lever pots, it will require a thin 1/2 inch open end wrench. A positioning tab keeps the potentiometers from rotating. This tab is aligned with a hole in the side of the enclosure rib where the pot is mounted.

Figure 5.3



5.4.3 - Calibrating the Mod Levers

On new instruments, Mod Levers are calibrated at the factory and do not need any adjustment in the field. If you replace the Mod Levers or the Slider board, then the Mod Levers must be re-calibrated.

The steps are:

1. Put the instrument in its default settings, preferably with battery-backed memory cleared.
2. Turn the power off and open up the Front Panel.
3. Turn the power back on, leaving the Front Panel in its service position.
4. Turn the LOWER trimpot on the Slider board while hitting a piano note and listening to the pitch.
5. Listen for the "dead band" where the pitch of the piano note is constant and center the trimpot in that range.
6. Now enable Assignable control 1 (vibrato rate) and move the Assignable slider 1 to mid-scale (34Hz vibrato).
7. Adjust the UPPER trimpot to minimize the amount of vibrato with the right Mod Lever at rest position.

5.5 - KURZWEIL 250X

5.5.1 - Kurzweil 250X Enclosure

The Kurzweil 250X cabinet enclosure unlike the K250 is a single piece. No portion of the Kurzweil 250X cabinet enclosure is removable. Please follow the procedures described for the K250 model for board removal.

5.6 - KURZWEIL RMX 250 AND 225

The RMX enclosure consists of an outer and inner enclosure. Before you begin to service the unit, please remove the unit from any rack assembly or enclosure it may be mounted in.

5.6.1 - Front Panel Assembly

Accessing the Front Panel Assembly

With this procedure you can reach and remove the two boards mounted on the Front Panel assembly and gain access to the inner chassis enclosure. Remove the 4 hex nuts from the rack ears. Slide the inner chassis enclosure towards you. You may do this by either separating the unit at the rack ears or by pushing on the rear panel. **CAUTION:** be sure that the unit is secure on a work bench. Do not allow the inner chassis to hang over the work bench. Most of the unit's weight is in the inner chassis.

Remove the Front Panel Assembly by doing the following:

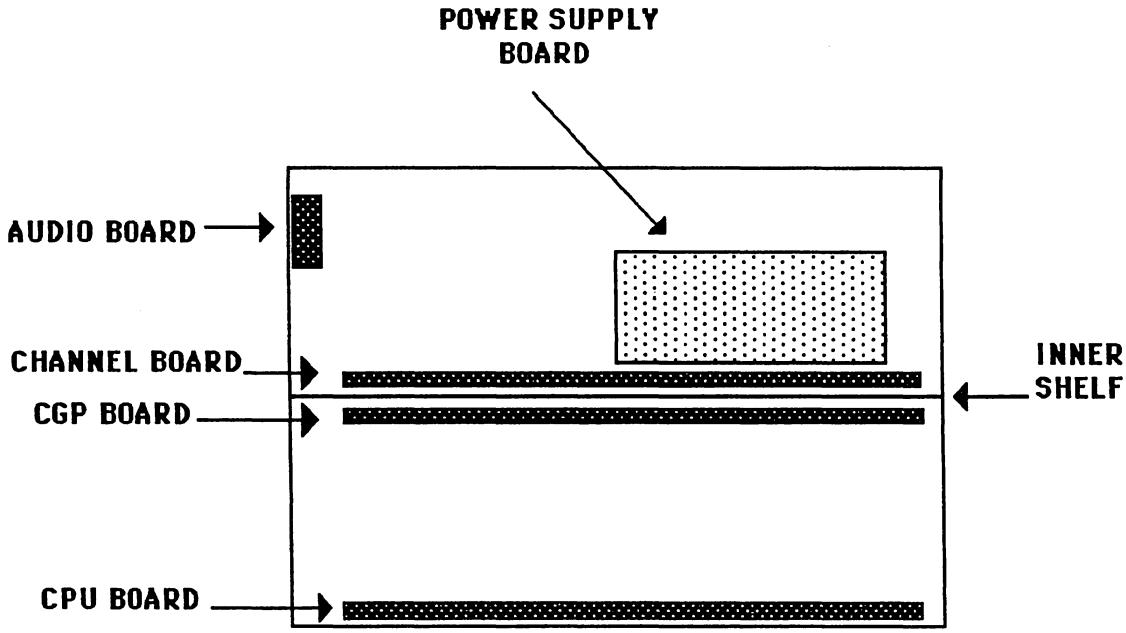
1. remove the 2 phillips head screws from each side of the assembly,
2. remove the 3 phillips head screws from the bottom (underside) of the assembly,
3. disconnect the flat ribbon cable from the Channel to the Control Panel board (J02) and the flat ribbon cable from the CPU to the Control Panel board (J37).
4. place the Front Panel assembly on foam or safely aside so that no harm is done to the slidepots as they are fragile.

5.6.2 - Inner Chassis Assembly

To gain access to the inner chassis assembly follow the instuctions described above to remove the Front Panel assembly. Once the Front Panel assembly has been removed turn the unit on its side. Remove 3 phillips head screws from each slide on the bottom of the inner chassis. Turn the unit back to its normal position and remove the inner chassis. Remove the outer chassis safely out of your work area.

The illustration below shows a side view of the p.c. board placement in the RMX inner chassis.

Figure 5.4



5.6.3 - CPU Board

To remove the CPU board, it is necessary to disconnect all cables connected to the CPU. There are 3 flat ribbon cables to be removed: 1 from the CGP board, one from the Channel board and one ribbon cable that connects the CPU to the Front Panel board Next, remove the two brown power connectors and the MIDI cable located next to the rear panel on the CPU. Now it is necessary to remove the 4 fastening nuts securing the four 1/4 inch phone jacks to the rear panel. Then remove the 13 phillips head screws which mount the CPU to the inner chassis.

5.6.4 - Replacing RMX Engine EPROMs

Remove the 4 phillips head screws from each side of the shelf containing the Channel board. Lift the shelf **slightly**. You will not be able to use an EPROM puller as there is not enough clearance. You can use a long thin flat head screwdriver. Please be careful not to damage p.c. board or sockets while doing this.

5.6.5 - CGP Board

To remove the CGP board, it will be necessary to remove 6 cables. Two from the CGP board to the Channel board, two from the CGP board to the CPU board, one from the power connector to the CGP board and one long flat ribbon cable that from the CPU to the Channel board. Once the cables have been disconnected, remove the 13 phillips head screws holding the CGP to the chassis.

5.6.6 - Power Supply Assembly

The Power Supply board is attached to the Channel Board on the inner shelf and is enclosed in a metal shield. Depending on the repair you are performing it may or may not be necessary to remove the top portion of the Power Supply enclosure. If you are replacing the Power Supply board, it will be necessary to remove the 6 phillips head screws securing the top enclosure, disconnect the wire terminals going to the Power Supply board from the interal harness cable and then remove the 7 phillips head screws securing the Power Supply board to the bottom portion of the enclosure (see Chapter 7 for RMX Wiring Diagram).

5.6.7 - Channel Board

To remove the Channel board, it will be necessary to remove the Power Supply enclosure and the following cables: 1 from the Audio board to the Channel board, 1 from the power supply to the Channel board, 1 coming from the Control Panel board to the Channel board, 1 coming from the CPU to the Channel Board and 1 coming from the CGP to the Channel board. It is not always necessary to remove the shield. However, if you are replacing the Channel board, be sure that the shield is put on the replacement. Once the cables have been disconnected, remove the 8 remaining phillips head screws holding the Channel to the inner chassis shelf.

5.6.8 - Audio Board

To remove the Audio board, simply disconnect the ribbon cable from the Audio board to the Channel board. Next, remove all hardware securing it to the rear panel.

Chapter 6 - Parts Lists

6.1 - K250 SLIDER BOARD, Part Number 12001401 and 1200140A

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
21000402	WASHER LOCK SPLIT NO. 2	4	FOR P44,51
21000601	WASHER NYLON FLAT NO. 2	4	FOR P44,51
21000801	SCREW MACH PH CR 2-56X1/2 S NI	4	FOR P44,51
21002605	NUT HEX 2-56 S NI	4	FOR P44,51
41003201	TERMINAL TURRET DUAL PC MT	2	
41004720	HEADER RT ANGLE LG LATCH 20 PIN	1	P50
41004734	HEADER RT ANG LATCH 34 PIN	1	P51
41005005	HEADER RIGHT ANGLE 5 PIN	1	P41
41006301	CONN KEY POLARIZING	1	P51
510001033	RES CARB FILM 22 OHM 1/4W 5%	1	R26
510001057	RES CARB FILM 220 OHM 1/4W 5%	2	R14,15
510001066	RES CARB FILM 510 OHM 1/4W 5%	3	R19,20,34
510001073	RES CARB FILM 1K 1/4W 5%	2	R24,28
510001080	RES CARB FILM 2K 1/4W 5%	1	R29
510001084	RES CARB FILM 3K 1/4W 5%	1	R25
510001089	RES CARB FILM 4.7K 1/4W 5%	1	R8
510001097	RES CARB FILM 10K 1/4W 5%	5	R3-6,27
510001114	RES CARB FILM 51K 1/4W 5%	2	R9,11
510001121	RES CARB FILM 100K 1/4W 5%	4	R10,13,30,33
51000811	RES NET ISOL 470 OHM X 4 8 PIN	2	RS5,9
51000812	RES NET ISOL 47K X 4 8 PIN SIP	2	RS7,8
51000813	RES NET ISOL 4.7K X 4 8 PIN SIP	1	RS3
51000814	RES NET ISOL 6.8K X 4 8 PIN SIP	1	RS1
51000915	RES NET 1M X 5 6 PIN SIP	1	RS6
51000917	RES NET 2.2K X 5 6 PIN SIP	1	RS4
51000918	RES NET 27K X 5 6 PIN SIP	1	RS2
51000919	RES NET 10K X 5 6 PIN SIP	1	RS10
51001501	POT SLIDE 10K LINEAR	4	R12,16,17,18
51001601	POT SLIDE 10 LINEAR W/DETENT	3	R1,2,7
51001701	POT TRIM SQUARE 10K	2	R31,32 (SOLDER SIDE)
52000102	CAP TANT 10UF 35V	2	C1,4
52000103	CAP TANT 3.3UF 16V	1	C2
52000201	CAP MONO CER .1UF 50V	23	C3,5-26
52000205	CAP MONO CER .47UF 50V	1	ACROSS U3 (SOLDER SIDE)
53000201	DIODE 1N914	4	D5-8
53000401	DIODE 1N270	4	U1-4
64000101	IC LINEAR LM1458N	1	U2
64000401	IC LINEAR LM348N	4	U1,4-6
64001201	IC LINEAR LM79L05ACZ	1	U3

6.2 - K250 CONTROL PANEL BOARD, Part Number 12001501 and 1200150A

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
13002501	C/A CONTROL PANEL TO LCD	1	P43
13002601	C/A CONTROL PANEL TO SLIDER	1	P44
23001201	SWITCH CAP 1	1	
23001202	SWITCH CAP 2	1	
23001203	SWITCH CAP 3	1	
23001204	SWITCH CAP 4	1	
23001205	SWITCH CAP 5	1	
23001206	SWITCH CAP 6	1	
23001207	SWTICH CAP 7	1	
23001208	SWITCH CAP 8	1	
23001209	SWITCH CAP 9	1	
23001210	SWITCH CAP 0	1	
23001211	SWITCH CAP +/-	1	
23001212	SWITCH CAP R	1	
23001213	SWITCH CAP F	1	
23001214	SWITCH CAP ARROW LEFT	1	
23001215	SWITCH CAP ARROW RIGHT	1	
23001216	SWITCH CAP ARROW DOWN	1	
23001217	SWITCH CAP ARROW UP	1	
23001301	SWITCH CAP WITH LED HOLE	38	
41003201	TERMINAL TURRET DUAL PC MT	3	
41004734	HEADER RT ANG LATCH 34 PIN	1	REF: P46
41005834	HEADER LATCH 34 POS	1	P46
41006301	CONN KEY POLARIZING	1	P46
41006703	HEADER RT ANG 94V-0 3 PIN	1	P53
43000601	SWITCH SPST WITH LED	38	S1-16,21,30,32, 33,37,39-55
43000701	SWITCH SPST W/O LED	17	S17-20,22-29,31, 34-36,38
510001073	RES CARB FILM 1K 1/4W 5%	1	R1
510001097	RES CARB FILM 10K 1/4W 5%	1	R3
51000901	RES NET 270 OHM X 5 6 PIN SIP	4	RS1,4,8,11
51000902	RES NET 270 OHM 9 10 PIN SIP	3	RS2,9,10
51000903	RES NET 1K X 9 10 PIN SIP	1	RS7
51000904	RES NET 4.7 X 7 8 PIN SIP	1	RS3
51000913	RES NET 1K X 7 8 PIN SIP	1	RS12
51001103	RES NET ISOL 330 OHM X 7 14 PIN	2	RS5,6
51001701	POT TRIM SQUARE 10K	1	R2
52000101	CAP TANT 33UF 16V	6	C8,9,19,25,27,28
52000201	CAP MONO CER .1UF 50V	22	C1-7,10-18, 20-24,26
53000201	DIODE 1N914A	2	D56,57
59000301	PWR SUPPLY 8K LIGHTING LCD	1	T1
61000201	IC DIGITAL 74LS138	1	U24
61000301	IC DIGITAL 74LS145	1	U21
61001301	IC DIGITAL 74LS04	1	U13
61001401	IC DIGITAL 74LS00	3	U10,12,14
61001601	IC DIGITAL 74LS32	1	U18
61001801	IC DIGITAL 74LS08	1	U11
61002501	IC DIGITAL 74LS393	1	U26

K250 CONTROL PANEL BOARD, Part Number 12001501 and 1200150A (CONTINUED)

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
61003301	IC DIGITAL 74LS14	2	U15,17
61003501	IC DIGITAL 74LS242	2	U2,7
61003601	IC DIGITAL 74LS244	1	U20
61003701	IC DIGITAL 74LS374	5	U8,9,19,22,25
61003801	IC DIGITAL 74C175	1	U1
61005501	IC DIGITAL 74LS126A	1	U23
61008101	IC DIGITAL 74HC14	1	U16
63000501	IC INTERFACE ADC0803LCN	1	U6
63000601	IC INTERFACE CD4051BC	2	U4,5
64001301	IC LINEAR LM78L05ACZ	1	U3

6.3 - CPU BOARD, Part Number 12001701-5

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
21000907	SCREW MACH PH CR 4-40 X .500 S NI	2	
21002601	NUT HEX 4-40 S NI	2	FOR J20
41004726	HEADER RT ANGLE LG LATCH 26 PIN	1	P38
41004734	HEADER RT ANGLE LG LATCH 34 PIN	1	P37
41005850	HEADER LATCH 50 PIN	1	P33
41005860	HEADER LATCH 60 PIN	1	P32
41006501	JACK PHONE 1/4 RT ANGLE PCMT SL/TIP	4	J16-19
41006601	CONN RECPT RT ANGLE PCMT DB-37S	1	J20
41006807	HEADER .10CC 94V-0 7 PIN	1	P35
41007004	HEADER PIN 94V-0 .250CC 4 POS	1	P34
41007006	HEADER PIN 94V-0 6 POS	1	P21
41011016	SOCKET IC 16 PIN DUAL LEAF	4	XU12-15
41011018	SOCKET IC 18 PIN DUAL LEAF	3	XU7-9
41011020	SOCKET IC 20 PIN DUAL LEAF	4	XU4,18,42,50
41011028	SOCKET IC 28 PIN DUAL LEAF	9	XU35-38,51-54,67
41011040	SOCKET IC 40 PIN DUAL LEAF	1	XU108
41011064	SOCKET IC 64 PIN DUAL LEAF	1	XU98
43000701	SWITCH SPST W/O LED	1	JP1
510001042	REC CARB FILM 51 OHM 1/4W 5%	3	R16,23,29
510001057	RES CARB FILM 220 OHM 1/4W 5%	1	R15
510001061	RES CARB FILM 330 OHM 1/4W 5%	1	R36
510001064	RES CARB FILM 430 OHM 1/4W 5%	1	R33
510001065	RES CARB FILM 470 OHM 1/4W 5%	2	R34,35
510001073	RES CARB FILM 1K 1/4W 5%	9	R3,12-14,17, 18,30-32
510001097	RES CARB FILM 10K 1/4W 5%	5	R7,10,27,28, BETWEEN R10 & R14
510001125	RES CARB FILM 150K 1/4W 5%	1	R11
510001128	RES CARB FILM 200K 1/4W 5%	2	R4,24
510001145	RES CARB FILM 1M 1/4W 5%	2	R25,26
51000302	RES NET 330/390 10 PIN	3	RS2,RS4,RS5
51000905	RES NET BUSSED 2KX9 10 PIN SIP	2	RS1,3
51000909	RES NET 4.7K X 9 10 PIN	1	RS6
51001102	RES NET ISOL 220 OHM X 7 14 PIN	1	U116
51001105	RES NET ISOL 100 OHM X 8 16 PIN	3	U62,80,100
51001107	RES NET ISOL 3.3K X 7 14 PIN	1	U58
52000101	CAP TANT 33UF 16V	8	C1,2,28,55, 168A-170A, BETWEEN R10 & J17-TIP
52000102	CAP TANT 10UF 35V	2	C10,171A
52000204	CAP MONO CER .01MF 50V	2	C141,144
52000205	CAP MONO CER .47UF 50V	1	C142
52000302	CAP CER DISC .001UF 1000WVDC	1	BETWEEN R10 AND GND
52000503	CAP DIPPED POLYEST .0022UF 100VDC	1	C173
52001001	CAP DIPPED MICA 470PF 500WVDC	1	C172
52001209	CAP CER .1UF 50V	124	C3-9,11-20, 22-26,29-54, 56-59,61-75, 77-129,131,146,163

CPU BOARD, Part Number 12001701-5 (CONTINUED)

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
52002503	CAP NPO 47PF 500V	1	UX-PINS 10 & 11
53000201	DIODE 1N914A	4	CR2-5
53000401	DIODE 1N270	2	U85,PIN 5
53000601	DIODE SCHOTTKY 1N6263	1	CR1
54000301	TSTR 2N2905A	2	Q2,4
54000401	TSTR 2N222A	2	Q1,3
59000501	BATTERY 3.6V	1	BT1
59000601	OSCILLATOR CLOCK 20MHZ	1	REF: SP8
61000201	IC DIGITAL 74LS138	2	U64,86
61000601	IC DIGITAL 74S32	1	U75
61000801	IC DIGITAL 74S00	1	U90
61001301	IC DIGITAL 74LS04	6	U56,59,65,70,79,84
61001401	IC DIGITAL 74LS00	3	U66,77,91
61001501	IC DIGITAL 74LS74A	3	U83,103,104
61001601	IC DIGITAL 74LS32	4	U57,60,63,76
61001801	IC DIGITAL 74LS08	2	U78,82
61002201	IC DIGITAL 74LS139	2	U20,72
61002301	IC DIGITAL 74LS161A	1	U1
61002901	IC DIGITAL 74LS373	2	U10,11
61003001	IC DIGITAL 74LS245	11	U81,96,97,99,101, 102,110-114
61003301	IC DIGITAL 74LS14	2	U120,UX
61003401	IC DIGITAL 74LS02	1	U61
61004501	IC DIGITAL 7406	1	U94
61004701	IC DIGITAL 74S74	1	U74
61004801	IC DIGITAL 74S11	1	U92
61005001	IC DIGITAL 74LS20	1	U17
61005101	IC DIGITAL 74LS51	1	U21
61005201	IC DIGITAL 74LS164	1	U73
61005301	IC DIGITAL 74LS27	1	U22
61005401	IC DIGITAL 74LS165	1	U3
61005501	IC DIGITAL 74LS126A	2	U2,16
61005601	IC DIGITAL 74LS367A	1	U115
61005701	IC DIGITAL 74LS259	1	U71
61005801	IC DIGITAL 68A50	1	U105
61005901	IC DIGITAL 74LS148	1	U55
61006001	IC DIGITAL 74LS113A	1	U19
61006101	IC DIGITAL 74LS640	1	U5
61006501	IC DIGITAL MC68A40	1	U67
61006601	IC DIGITAL 8254-2	8	U68,69,87,88,106, 107,118,119
61006801	IC DIGITAL 74C02	1	U45
61007201	IC DIGITAL 74393	1	U6
61008901	IC DIGITAL F74F04	1	U95
62000601	IC LSI MEMORY 2114	3	U7-9
62000701	IC LSI DIGITAL 2841	4	U12-15
62000901	IC LSI MEMORY 8KX8 STATIC RAM CMOS	16	U25,26,28,29,30-33, 40,41,43,44,46-49
62001001	IC LSI DIGITAL 68000	1	U98

CPU BOARD, Part Number 12001701-5 (CONTINUED)

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
63000101	IC INTERFACE 6N138	1	U109
63001001	IC INTERFACE LM339N	1	U85
64001101	IC LINEAR LM556N	1	U93
64002001	IC LINEAR LM320MP-12	1	U117
81006202	IC PAL10L8 PROG	1	U42
81006204	IC PAL10L8 PROG	1	U50
81007101	IC PAL16R4 PROG KYBD CONTROLLER	1	U18
82000503	IC DIGITAL PAL16R8 KYBD INCREMENT	1	U4

6.4 - CGP, Part Number 12001801

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
13003001	C/A LOGIC POWER JUMPER	1	J24, ADJ TO U171
13003002	C/A LOGIC POWER JUMPER	1	J34, ADJ TO U170
13003601	C/A CGP TO CHANNEL	1	28A
13003602	C/A CGP TO CPU	1	30A
21000801	SCREW MACH PH CR 2-56X1/2 S NI	2	FOR 31A
21002605	NUT HEX 2-56 S NI	2	FOR 31A
41005301	CONN DIN 64 PIN RA PLUG 4 PINS EXTD	1	31A
41005401	CONN DIN 64 PIN PLUG	1	47A
41007004	HEADER PIN 94V-0 .250CC 4 POS	1	29B
41008201	CONN DIN 64 PIN RA PLUG PCMT	1	31A
41011016	SOCKET IC 16 PIN DUAL LEAF	20	XU25-29,33-37, 51-55,72-76
41011020	SOCKET IC 20 PIN DUAL LEAF	2	XU95,160
51000301	RES NET DUAL TERM 220/330X8 10 PIN	6	RS001,002,004, 005,006,007
51000905	RES NET BUSSED 2KX9 10 PIN SIP	11	U001-010,140
51000908	RES NET BUSSED 3.3KX9 10 PIN SIP	1	U69
51000909	RES NET 4.7K X 9 10 PIN SIP	3	U022,093,158
51001106	RES NET ISOL 33 OHMX7 14 PIN DIP	1	U031
52000101	CAP TANT 33UF 16V	4	C003,004,167,179
52000201	CAP MONO CER .1UF 50 V	189	C001,002,005-035, 037-166,168-178, 180-194
61000101	IC DIGITAL 74LS283	6	U127,137,157, 164,173,183
61000401	IC DIGITAL 74LS157	1	U172
61000501	IC DIGITAL 74S08	2	U171,193
61000601	IC DIGITAL 74S32	2	U068,195
61000801	IC DIGITAL 74S00	2	U088,180
61000901	IC DIGITAL 74S04	2	U070,161
61001001	IC DIGITAL 74S10	1	U134
61001101	IC DIGITAL 74S138	5	U130,133,141,149,159
61001201	IC DIGITAL 74S157	1	U096
61001301	IC DIGITAL 74LS04	1	U166
61001401	IC DIGITAL 74LS00	1	U189
61001501	IC DIGITAL 74LS74A	4	U092,097,115,192
61001601	IC DIGITAL 74LS32	3	U050,156,191
61001701	IC DIGITAL 74LS151	1	U094
61001801	IC DIGITAL 74LS08	3	U090,136,167
61001901	IC DIGITAL 74LS86	1	U198
61002001	IC DIGITAL 74LS153	4	U048,049,132,143
61002101	IC DIGITAL 74S02	2	U190,194
61002201	IC DIGITAL 74LS139	1	U147
61002301	IC DIGITAL 74LS161A	2	U177,178
61002401	IC DIGITAL 74LS125A	1	U091
61002601	IC DIGITAL 74LS266	5	U071,089,113,114,184
61002701	IC DIGITAL 74S240	3	U169,170,179
61002801	C DIGITAL 74LS279	1	U162
61002901	IC DIGITAL 74LS373	12	U110,112,128,129,138, 153,154,174,175,176, 185,199

CGP, Part Number 12001801 (CONTINUED)

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
61003001	IC DIGITAL 74LS245	29	U021,024,030,032,056, 067,087,108,131,135, 139,142,144,145,146, 148,150,151,152,155, 163,165,168,186,187, 188,200,201,202
61006301	IC DIGITAL 74S273	2	U109,111
61007201	IC DIGITAL 74393	1	U023
61007301	IC DIGITAL 74S174	1	U126
62000101	IC LSI MEMORY 2149H	4	U181,182,196,197
82000501	IC DIG PAL16R8 PROG CGP CONTROL	1	U160
82000505	IC PAL 16R8 PROG SF MEM CONTROL	1	U095
82011001	IC MEMORY 256K SOUND ROM RB0105-0A	1	U125
82011101	IC MEMORY 256K SOUND ROM RB0101-1A	1	U124
82011201	IC MEMORY 256K SOUND ROM RB0103-2A	1	U123
82011301	IC MEMORY 256K SOUND ROM RB0111-3A	1	U122
82011401	IC MEMORY 256K SOUND ROM RB0113-4A	1	U121
82011501	IC MEMORY 256K SOUND ROM RB0115-5A	1	U120
82011601	IC MEMORY 256K SOUND ROM RB0102-6A	1	U119
82011701	IC MEMORY 256K SOUND ROM RB0104-7A	1	U118
82011801	IC MEMORY 256K SOUND ROM RB0112-8A	1	U117
82011901	IC MEMORY 256K SOUND ROM RB0114-9A	1	U116
82012001	IC MEMORY 256K SOUND ROM RB0205-0A	1	U107
82012101	IC MEMORY 256K SOUND ROM RB0201-1A	1	U106
82012201	IC MEMORY 256K SOUND ROM RB0203-2A	1	U105
82012301	IC MEMORY 256K SOUND ROM RB0211-3A	1	U104
82012401	IC MEMORY 256K SOUND ROM RB0213-4A	1	U103
82012501	IC MEMORY 256K SOUND ROM RB0215-5A	1	U102
82012601	IC MEMORY 256K SOUND ROM RB0202-6A	1	U101
82012701	IC MEMORY 256K SOUND ROM RB0204-7A	1	U100
82012801	IC MEMORY 256K SOUND ROM RB0212-8A	1	U99
82012901	IC MEMORY 256K SOUND ROM RB0214-9A	1	U98
82013001	IC MEMORY 256K SOUND ROM RB0305-0A	1	U86
82013101	IC MEMORY 256K SOUND ROM RB0301-1A	1	U85
82013201	IC MEMORY 256K SOUND ROM RB0303-2A	1	U84
82013301	IC MEMORY 256K SOUND ROM RB0311-3A	1	U83
82013401	IC MEMORY 256K SOUND ROM RB0313-4A	1	U82
82013501	IC MEMORY 256K SOUND ROM RB0315-5A	1	U81
82013601	IC MEMORY 256K SOUND ROM RB0302-6A	1	U80
82013701	IC MEMORY 256K SOUND ROM RB0304-7A	1	U79
82013801	IC MEMORY 256K SOUND ROM RB0312-8A	1	U78
82013901	IC MEMORY 256K SOUND ROM RB0314-9A	1	U77
82014001	IC MEMORY 256K SOUND ROM RB0405-0A	1	U66
82014101	IC MEMORY 256K SOUND ROM RB0401-1A	1	U65
82014201	IC MEMORY 256K SOUND ROM RB0403-2A	1	U64
82014301	IC MEMORY 256K SOUND ROM RB0411-3A	1	U63
82014401	IC MEMORY 256K SOUND ROM RB0413-4A	1	U62
82014501	IC MEMORY 256K SOUND ROM RB0415-5A	1	U61
82014601	IC MEMORY 256K SOUND ROM RB0402-6A	1	U60
82014701	IC MEMORY 256K SOUND ROM RB0404-7A	1	U59
82014801	IC MEMORY 256K SOUND ROM RB0412-8A	1	U58
82014901	IC MEMORY 256K SOUND ROM RB0414-9A	1	U57

CGP, Part Number 12001801 (CONTINUED)

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
82015001	IC MEMORY 256K SOUND ROM RB0505-0A	1	U47
82015101	IC MEMORY 256K SOUND ROM RB0501-1A	1	U46
82015201	IC MEMORY 256K SOUND ROM RB0503-2A	1	U45
82015301	IC MEMORY 256K SOUND ROM RB0511-3A	1	U44
82015401	IC MEMORY 256K SOUND ROM RB0513-4A	1	U43
82015501	IC MEMORY 256K SOUND ROM RB0515-5A	1	U42
82015601	IC MEMORY 256K SOUND ROM RB0502-6A	1	U41
82015701	IC MEMORY 256K SOUND ROM RB0504-7A	1	U40
82015801	IC MEMORY 256K SOUND ROM RB0512-8A	1	U39
82015901	IC MEMORY 256K SOUND ROM RB0514-9A	1	U38
82016001	IC MEMORY 256K SOUND ROM RB0605-0A	1	U20
82016101	IC MEMORY 256K SOUND ROM RB0601-1A	1	U19
82016201	IC MEMORY 256K SOUND ROM RB0603-2A	1	U18
82016301	IC MEMORY 256K SOUND ROM RB0611-3A	1	U17
82016401	IC MEMORY 256K SOUND ROM RB0613-4A	1	U16
82016501	IC MEMORY 256K SOUND ROM RB0615-5A	1	U15
82016601	IC MEMORY 256K SOUND ROM RB0602-6A	1	U14
82016701	IC MEMORY 256K SOUND ROM RB0604-7A	1	U13
82016801	IC MEMORY 256K SOUND ROM RB0612-8A	1	U12
82016901	IC MEMORY 256K SOUND ROM RB0614-9A	1	U11

6.5 - CGP BOARD (1M SOUND ROMS), Part Number 12001804

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
13007001	C/A CGP TO CHANNEL	1	P28
13007002	C/A CGP TO CPU	1	P30
21000801	SCREW MACH PH CR 2-56X1/2 S NI	2	FOR 31A
21002605	NUT HEX 2-56 S NI	2	FOR 31A
41005401	CONN DIN 64 PIN PLUG	1	47A
41005860	HEADER .10CC 2 ROW LG LTCH 60 PIN	2	P28,30
41007004	HEADER PIN 94V-0 .250CC 4 POS	1	29B
41008201	CONN DIN 64 PIN RA PLUG PCMT	1	31A
41011016	SOCKET IC 16 PIN DUAL LEAF	20	XU25-29,33-37, 51-55,72-76
41011020	SOCKET IC 20 PIN DUAL LEAF	2	XU95,160
41011028	SOCKET IC .60 DIP 28 PIN DUAL LEAF	40	XU11-20,38-47, 57-66,77-86
51000301	RES NET DUAL TERM 220/330X8 10 PIN	6	RS001,002,004,005, 006,007
51000905	RES NET BUSSED 2KX9 10 PIN SIP	11	U001-010,140
51000908	RES NET BUSSED 3.3KX9 10 PIN SIP	1	U69
51000909	RES NET 4.7K X 9 10 PIN SIP	3	U022,093,158
51001106	RES NET ISOL 33 OHMX7 14 PIN DIP	1	U031
52000101	CAP TANT 33UF 16V	4	C003,004,167,179
52000201	CAP MONO CER .1UF 50V	189	C001,002,005-035, 037-166,168-178, 180-194
61000101	IC DIGITAL 74LS283	6	U127,137,157,164, 173,183
61000401	IC DIGITAL 74LS157	1	U172
61000501	IC DIGITAL 74S08	2	U171,193
61000601	IC DIGITAL 74S32	2	U068,195
61000801	IC DIGITAL 74S00	2	U088,180
61000901	IC DIGITAL 74S04	2	U070,161
61001001	IC DIGITAL 74S10	1	U134
61001101	IC DIGITAL 74S138	5	U130,133,141,149,159
61001201	IC DIGITAL 74S157	1	U096
61001301	IC DIGITAL 74LS04	1	U166
61001401	IC DIGITAL 74LS00	1	U189
61001501	IC DIGITAL 74LS74A	4	U092,097,115,192
61001601	IC DIGITAL 74LS32	3	U050,156,191
61001701	IC DIGITAL 74LS151	1	U094
61001801	IC DIGITAL 74LS08	3	U090,136,167
61001901	IC DIGITAL 74LS86	1	U198
61002001	IC DIGITAL 74LS153	4	U048,049,132,143
61002101	IC DIGITAL 74S02	2	U190,194
61002201	IC DIGITAL 74LS139	1	U147
61002301	IC DIGITAL 74LS161A	2	U177,178
61002401	IC DIGITAL 74LS125A	1	U091
61002601	IC DIGITAL 74LS266	5	U071,089,113,114,184
61002701	IC DIGITAL 74S240	3	U169,170,179
61002801	IC DIGITAL 74LS279	1	U162
61002901	IC DIGITAL 74LS373	12	U110,112,128,129,138, 153,154,174,175,176, 185,199

CGP BOARD (1M SOUND ROMS), Part Number 12001804

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
61003001	IC DIGITAL 74LS245	29	U021,024,030,032,056, 067,087,108,131,135, 139,142,144,145,146, 148,150,151,152,155, 163,165,168,186,187, 188,200,201,202
61006301	IC DIGITAL 74S273	2	U109,111
61007201	IC DIGITAL 74393	1	U023
61007301	IC DIGITAL 74S174	1	U126
62000101	IC LSI MEMORY 2149H	4	U181,182,196,197
82000501	IC DIG PAL16R8 PROG CGP CONTROL	1	U160
82000506	IC PAL 16R8 PROG SF MEM CONTROL	1	U095
82020001	IC MEMORY 1M SOUND ROM SB0101-1A	1	U124
82020101	IC MEMORY 1M SOUND ROM SB0103-2A	1	U123
82020201	IC MEMORY 1M SOUND ROM SB0111-3A	1	U122
82020301	IC MEMORY 1M SOUND ROM SB0113-4A	1	U121
82020401	IC MEMORY 1M SOUND ROM SB0102-6A	1	U119
82020501	IC MEMORY 1M SOUND ROM SB0104-7A	1	U118
82020601	IC MEMORY 1M SOUND ROM SB0112-8A	1	U117
82020701	IC MEMORY 1M SOUND ROM SB0114-9A	1	U116
82020801	IC MEMORY 1M SOUND ROM SB0105-0A	1	U125
82020901	IC MEMORY 1M SOUND ROM SB0115-5A	1	U120
82021001	IC MEMORY 1M SOUND ROM SB0201-1A	1	U106
82021101	IC MEMORY 1M SOUND ROM SB0203-2A	1	U105
82021201	IC MEMORY 1M SOUND ROM SB0211-3A	1	U104
82021301	IC MEMORY 1M SOUND ROM SB0213-4A	1	U103
82021401	IC MEMORY 1M SOUND ROM SB0202-6A	1	U101
82021501	IC MEMORY 1M SOUND ROM SB0204-7A	1	U100
82021601	IC MEMORY 1M SOUND ROM SB0212-8A	1	U99
82021701	IC MEMORY 1M SOUND ROM SB0214-9A	1	U98
82021801	IC MEMORY 1M SOUND ROM SB0205-0A	1	U107
82021901	IC MEMORY 1M SOUND ROM SB0215-5A	1	U102

6.6 - CHANNEL BOARD, Part Number 12002002

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
21000402	WASHER LOCK SPLIT NO. 2	2	
21000601	WASHER NYLON FLAT NO. 2	2	
21000801	SCREW MACH PH CR 2-56X1/2 S NI	2	
21002605	NUT HEX 2-56 S NI	2	
22002801	TRANSI PAD 8 LEADS .200 (TO-5)	12	XU48-59
22004901	TRANSI PAD 8 LEADS .230 (TO-5)	2	XU3,7
41004734	HEADER RT ANG LATCH 34 PIN	1	P27
41005834	HEADER LATCH 34 POS	1	P22
41005850	HEADER LATCH 50 PIN	1	P26
41005860	HEADER LATCH 60 PIN	1	P25
41006301	CONNECTOR KEY POLARIZING	4	FOR P22,P25-27
41007004	HEADER PIN 94V-0 .250CC 4 POS	1	P24
41007009	HEADER PIN 94V-0 9 POS	1	P23
41011016	SOCKET IC 16 PIN DUAL LEAF	4	XU1,2,4,5
41011028	SOCKET IC 28 PIN DUAL LEAF	1	XU60
43000801	RELAY DPDT 8 PIN 12V	1	K1
510001033	RES CARBON FILM 22 OHM 1/4W 5%	45	R27,28,31,32,70,75, 81,86,92,97,103,108, 114,119,121,126,133, 139,145,151,157,162, 165,168,171,174,177, 180,183,186,189,192, 195,198,201,204,207, 210,213,216,219,223, 226,231,234
510001045	RES CARB FILM 68 OHM 1/4W 5%	1	R26
510001049	RES CARB FILM 100 OHM 1/4W 5%	40	R43,45,52,54,63,68,79, 90,101,112,131, 137,143,149,155, 235,316,317,320, 321,324,325,328, 329,332,333,337, 339-349,359,360
510001051	RES CARB FILM 120 OHM 1/4W 5%	2	R8,37
510001056	RES CARB FILM 200 OHM 1/4W 5%	8	R14,15,21,22,40,41, 49,50
510001059	RES CARB FILM 270 OHM 1/4W 5%	12	R73,76,84,87,95,98, 106,109,117,120,124, 128
510001067	RES CARB FILM 560 OHM 1/4W 5%	8	R11,18,72,83,94, 105,116,123
510001073	RES CARB FILM 1K 1/4W 5%	30	R9,16,25,39,46,57,69, 80,91,102,113,132, 138,144,150,156,159, 240,243,246,249,252, 255,258,261,264,267, 269,271,273
510001075	RES CARB FILM 1.2K 1/4W 5%	12	R352-357,361-366
510001077	RES CARB FILM 1.5K 1/4W 5%	13	R164,170,176,182,188, 194,200,206,212,218, 225,233,338
510001080	RES CARB FILM 2K 1/4W 5%	1	R358

CHANNEL BOARD, Part Number 12002002 (CONTINUED)

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
510001082	RES CARB FILM 2.4K 1/4W 5%	11	R12,19,33-36,71,82, 93,104,115
510001089	RES CARB FILM 4.7K 1/4W 5%	1	R122
510001094	RES CARB FILM 7.5K 1/4W 5%	1	R221
510001096	RES CARB FILM 9.1K OHM 1/4W 5%	12	R74,85,96,107,118,125, 127,134,140,146,152, 158
510001097	RES CARB FILM 10K 1/4W 5%	44	R1,4,58,241,244,247, 250,253,256,259,262, 265,268,272,274-288, 290,292,294,296,298, 300,302,304,306,308, 311,312,314,336,367
510001099	RES CARB FILM 12K 1/4W 5%	1	R230
510001101	RES CARB FILM 15K 1/4W 5%	2	R2,5
510001104	RES CARB FILM 1/4W 20K 5%	49	R161,166,167,172,173, 178,179,184,185,190, 191,196,197,202,203, 208,209,214,215,220, 222,227229,239,242, 245,248,251,254,257, 260,263,266,270,289, 291,293,295,297,299, 301,303,305,307,309, 310,313,315
510001105	RES CARB FILM 22K 1/4W 5%	1	R237
510001106	RES CARB FILM 24K 1/4W 5%	1	
510001109	RES CARB FILM 33K 1/4W 5%	8	R3,6,7,10,13,17,20,38
510001121	RES CARB FILM 100K 1/4W 5%	2	R23,24
510001125	RES CARB FILM 150K 1/4W 5%	16	R42,44,53,55,64,67,78, 89,100,111,130,136, 142,148,154,236
510001129	RES CARB FILM 220K 1/4W 5%	1	R238
510001145	RES CARB FILM 1M 1/4W 5%	12	R163,169,175,181,187, 193,199,205,211,217, 224,232
510005056	RES CARB FILM 200 OHM 1W 5%	2	R29,30
510007049	RES METAL FILM 100 OHM 1/4W 1%	2	R60,61
510007069	RES METAL FILM 681 OHM 1/4W 1%	2	R59,62
510007095	RES METAL FILM 8.25K 1/4W 1%	12	R318,319,322,323,326, 327,330,331,334,335, 350,351
51000905	RES NET BUSSED 2KX9 10 PIN SIP	2	RS3,4
51000906	RES NET BUSSED 10KX9 10 PIN SIP	2	RS5,6
51001101	RES NET ISOL 10KX8 16 PIN DIP	2	RS1,2
51001401	POT TRIM SQUARE 100K SQUARE	16	R47,48,51,56,65,66,77, 88,99,110,129,135, 141,147,153,160
52000101	CAP TANT 33UF 16V	2	C384,416
52000102	CAP TANT 10UF 35V	9	C15,17,17-A,23,35,41, 58,279,280

CHANNEL BOARD, Part Number 12002002 (CONTINUED)

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
52000103	CAP TANT 3.3UF 16V	24	C49-51,55-57,59, 64-66,70-72, 76-78,81,83,84, 122,129,136,140,420
52000307	CAP CER DISC 33PF 1KV	25	C107,239,244,246,247, 249,250,252,253,255, 256,258-260,262,264, 265,267,268,270,271, 273,274,276,277
52000501	CAP DIPPED POLYEST .001UF 100VDC	2	C341,369
52000502	CAP DIPPED POLYEST .0015UF 100VDC	12	C313,316,319,322,325, 328,331,334,337,340, 371,373
52000505	CAP DIPPED POLYEST .0047UF 100VDC	24	C112,115,118,121,125, 128,132,135,139,143, 147,150,151,155,159, 163,167,171,175,179, 183,187,191,195
52000506	CAP DIPPED POLYEST .01UF 100VDC	42	C16,22,25,30,36,46, 52,60,67,73,96, 100-104,144,314,315, 320,321,326,327,332, 333,338,339,343,344, 347,348,351,352,370, 372,390,391,394,395, 398,399,419
52000601	CAP ELECT AL 1000UF 25V	2	C43,44
52000701	CAP FILM POLYEST 5600PF 25WVDC	11	C206,209,212,215,218, 221,224,227,230,233, 236
52001001	CAP DIPPED MICA 470PF 500WVDC	28	C32,34,38,40,47,54,62, 69,75,80,87,89,91,93, 95,98,154,158,162,166, 170,174,178,182,186, 190,194,198
52001209	CAP CER .1UF 50V	183	C1-6,8,10-13,18-21, 24,26,27,29,31,33 37,39,42,45,48,53,61, 63,68,74,79,85,86,88, 90,92,94,97,99,105, 108,109,111,114,117, 120,124,127,131,134, 138,142,146,149,152, 153,156,157,160,161, 164,165,168,169,172, 173,176,177,180,181, 184,185,188,189,192, 193,196,197,200-205, 207,208,210,211,213, 214,216,217,219,220, 222,223,225,226,228,

CHANNEL BOARD, Part Number 12002002 (CONTINUED)

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
52001209 (CONT'D)			229,231,232,234,235, 237,238,241-243,245, 248,251,254,257,261, 263,266,269,272,275, 278,281-284,286,288, 290,292,294,296,298, 300,302,304,306, 308-310,342,345,346, 349,350,378-383, 385-389,392,393,396, 397,400-415,417,418
52001301	CAP METAL POLYEST 1UF 50V 10%	15	C82,106,110,113,116, 119,123,126,130,133, 137,141,145,148,199
52001401	CAP DIPPED MICA 220PF 500WVDC	24	C311,312,317,318, 323,324,329,330,335, 336,354-363,365,368, 374,375
52001501	CAP DIPPED MICA 330PF 500V	4	C7,9,14,28
52002802	CAP POLYSTYRENE AX 2700PF 25V 5%	1	C240
53000201	DIODE 1N914A	18	D3,4,7,8,11-24
53000401	DIODE 1N270	18	D1,2,5,6,9,10,25-36
54000501	TSTR MPS A13 (TO-92)	1	Q1
61000201	IC DIGITAL 74LS138	3	U93,119,120
61000401	IC DIGITAL 74LS157	3	U107-109
61001301	IC DIGITAL 74LS04	1	U87
61001501	IC DIGITAL 74LS74A	2	U98,99
61001701	IC DIGITAL 74LS151	4	U117,118,121,122
61001801	IC DIGITAL 74LS08	2	U95,97
61002801	IC DIGITAL 74LS279	3	U110-112
61002901	IC DIGITAL 74LS373	1	U94
61003001	IC DIGITAL 74LS245	2	U105,106
61003401	IC DIGITAL 74LS02	1	U96
61003701	IC DIGITAL 74LS374	2	U89,U100
61004001	IC DIGITAL 74LS273	4	U91,92,115,116
61005601	IC DIGITAL 74LS367A	1	U88
63000201	IC INTERFACE 9602	1	U85
63000301	IC INTERFACE AD7528	6	U81,86,90,101,113,114
63000401	IC INTERFACE AD7545KN	12	U62-73
63000701	IC INTERFACE R5609	12	U20-31
63001701	IC INTERFACE HI1674AKD-5 A/D CONV	1	U60
64000601	IC LINEAR LF13333N	2	U18,46
64000701	IC LINEAR LF353N	8	U32,74,82-84,U102-104
64000801	IC LINEAR LH0002CH	2	U3,7
64000901	IC LINEAR LM317MP	1	U6
64001001	IC LINEAR LM337MP	1	U8
64001101	IC LINEAR LM556N	6	U75-80
64001201	IC LINEAR LM79L05ACZ	1	U123
64001301	IC LINEAR LM78L05ACZ	1	U124
64001401	IC LINEAR LM324N	3	U19,33,47
64001501	IC LINEAR CEM3335	8	U10-17
64001601	IC LINEAR TL072CP	3	U9,125,126

CHANNEL BOARD, Part Number 12002002 (CONTINUED)

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
64001701	IC LINEAR SMP11GY	12	U34-45
64001801	IC LINEAR REF-01CP	1	U61
64002301	IC LINEAR LF412CN	12	U48-59
64002401	IC LINEAR CD4053BCN	4	U1,2,4,5

6.7 - AUDIO BOARD, PART NO. 12011001

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
13002701	C/A AUDIO TO CHANNEL	1	
41002401	CONN XLR PC MT	2	J3,4
41003501	JACK PHONE 1/4 PC MT SL/TIP	2	J9,0
41003601	JACK PONE 1/4 PC MT SL/RG/TIP	4	J1,11,48,49
41003701	JACK PHONE 1/4 PC MT SL/TIP/TS	3	J2,5,6
510001065	RES CARB FILM 470 OHM 1/4W 5%	1	ACROSS R15 SOLDER SIDE
510001067	RES CARB FILM 560 OHM 1/4W 5%	2	R19,21
510001079	RES CARB FILM 1.8K 1/4W 5%	1	R15
510001086	RES CARB FILM 3.6K 1/4W 5%	1	R13
510001090	RES CARB FILM 5.1K 1/4W 5%	2	R18,20
510001095	RES CARB FILM 8.2K 1/4W 5%	2	R10,12
510001097	RES CARB FILM 10K 1/4W 5%	1	R16
510001104	RES CARB FILM 20K 1/4W 5%	1	R8
510001121	RES CARB FILM 100K 1/4W 5%	2	R7,9
510001166	RES CARB FILM 0 OHM 1/4W 5%	2	R11,14
510007171	RES METAL FILM 49.9K 1/4W 1%	5	R1-5
52000201	CAP MONO CER .1UF 50V	4	C5,6,10,11
52000308	CAP CER DISC 200PF 1KV	2	C1,2
52000506	CAP DIPPED POLYEST .01UF 100VDC	2	C12,13
52000513	CAP DIPPED POLYEST .022UF 100VDC	1	ACROSS R15 SOLDER SIDE
52001301	CAP METAL POLYEST 1UF 50V 10%	5	C3,4,7,8,14
55000201	TRANSFORMER AUDIO PC MT	4	T1,2,3,4
64002801	IC LINEAR NE5532AN	2	U1,2

6.8 - RMX CONTROL PANEL BOARD, Part Number, 12014101

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
21000902	SCREW MACH PH CR 4-40 X .187 S NI	4	LCD MOUNTING
22011501	STANDOFF PC MT 4-40 X 1/8 LG AL	4	LCD MOUTNING
22011601	WASHER FLAT NO. 4 X .250 NYLON	4	LCD MOUNTING
23002902	SWITCH CAP 1	1	
23002903	SWITCH CAP 2	1	
23002904	SWITCH CAP 3	1	
23002905	SWITCH CAP 4	1	
23002906	SWITCH CAP 5	1	
23002907	SWITCH CAP 6	1	
23002908	SWTICH CAP 7	1	
23002909	SWITCH CAP 8	1	
23002910	SWITCH CAP 9	1	
23002911	SWITCH CAP 0	1	
23002912	SWITCH CAP +/-	1	
23002913	SWITCH CAP R	1	
23002914	SWITCH CAP F	1	
23002915	SWITCH CAP ARROW LEFT	1	
23002916	SWITCH CAP ARROW RIGHT	1	
23002917	SWITCH CAP ARROW DOWN	1	
23002918	SWITCH CAP ARROW UP	1	
23003001	CAP SWITCH BLACK W/LED HOLE	33	S1-6,12-16,21,30, 32,33,37,39-55
41001114	HEADER 14 PIN 2 ROW	1	P54
41003201	TERMINAL TURRET DUAL PC MT	2	TP1,2
41005834	HEADER LATCH 34 POS	2	P46,51
41006301	CONNECTOR KEY POLARIZING	2	P46,51
43000601	SWITCH SPST WITH LED	33	S1-6,12-16,21,30, 32,33,37,39-55
43000701	SWITCH SPST W/O LED	17	S17,-20,22-29,31, 34-36,38
45000201	DISPLAY LCD 48 CHAR RMX	1	
45001201	DISPLAY LCD 48 CHAR SUPER TWIST RMX	1	
510001033	RES CARB FILM 22 OHM 1/4W 5%	1	R126
510001057	RES CARB FILM 220 OHM 1/4W 5%	2	R114,115
510001061	RES CARB FILM 330 OHM 1/4W 5%	3	R135-137
510001066	RES CARB FILM 510 OHM 1/4W 5%	3	R119,120,134
510001073	RES CARB FILM 1K 1/4W 5%	3	R1,124,128
510001080	RES CARB FILM 2K 1/4W 5%	1	R129
510001084	RES CARB FILM 3K 1/4W 5%	1	R125
510001089	RES CARB FILM 4.7K 1/4W 5%	1	R108
510001097	RES CARB FILM 10K 1/4W 5%	6	R3,103-106,127
51000812	RES NET ISOL 47K X 4 8 PIN	1	RS108
51000813	RES NET ISOL 4.7K X 4 8 PIN	1	RS103
51000814	RES NET ISOL 6.8K X 4 8 PIN	1	RS101
51000901	RES NET 270 OHM X 5 6 PIN	4	RS1,4,8,11
51000902	RES NET 270 OHM X 9 10 PIN	3	RS2,9,10
51000903	RES NET 1K X 9 10 PIN	1	RS7
51000904	RES NET 4.7 X 7 8 PIN	1	RS3

RMX CONTROL PANEL BOARD, Part Number, 12014101 (Continued)

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
51000913	RES NET 1K X 7 8 PIN	1	RS12
51000917	RES NET 2.2K X 5 6 PIN	1	RS104
51000918	RES NET 27K X 5 6 PIN	1	RS102
51000919	RES NET 10K X 5 6 PIN	1	RS110
51001103	RES NET ISOL 330 OHM X 7 14 PIN	1	RS6
51001701	POT TRIM SQUARE 10K	1	R2 51003201
	POT SLIDE 10K LINEAR W/DETENT RMX	3	R101,102,107
51003301	POT SLIDE 10K LINEAR 45MM RMX	4	R112,116-118
52000101	CAP TANT 33UF 16V	7	C8,9,19,25,27,28,33
52000102	CAP TANT 10UF 35V	2	C101,104
52000103	CAP TANT 3.3UF 16V	1	C102
52000201	CAP MONO CER .1UF 50V	42	C1-7,10-18,20-24, 26,29-32,105,106, 117-126
53000201	DIODE 1N914A	6	D56,57,105-108
53000401	DIODE 1N270	4	U101-104
59000301	PWR SUPPLY 8K LIGHTING LCD	1	T1
61000201	IC DIGITAL 74LS138	1	U24
61000301	IC DIGITAL 74LS145	1	U21
61001301	IC DIGITAL 74LS04	1	U13
61001401	IC DIGITAL 74LS00	3	U10,12,14
61001601	IC DIGITAL 74LS32	1	U18
61001801	IC DIGITAL 74LS08	1	U11
61002501	IC DIGITAL 74LS393	1	U26
61003301	IC DIGITAL 74LS14	2	U15,17
61003501	IC DIGITAL 74LS242	2	U2,7
61003601	IC DIGITAL 74LS244	1	U20
61003701	IC DIGITAL 74LS374	5	U8,9,19,22,25
61003801	IC DIGITAL 74C175	1	U1
61005501	IC DIGITAL 74LS126A	1	U23
61008101	IC DIGITAL 74HC14	1	U16
63000501	IC INTERFACE ADC0803LCN	1	U6
63000601	IC INTERFACE CD4051BC	2	U4,5
64000401	IC LINEAR LM348N	3	U101,105,106
64001301	IC LINEAR LM78L05ACZ	1	U3

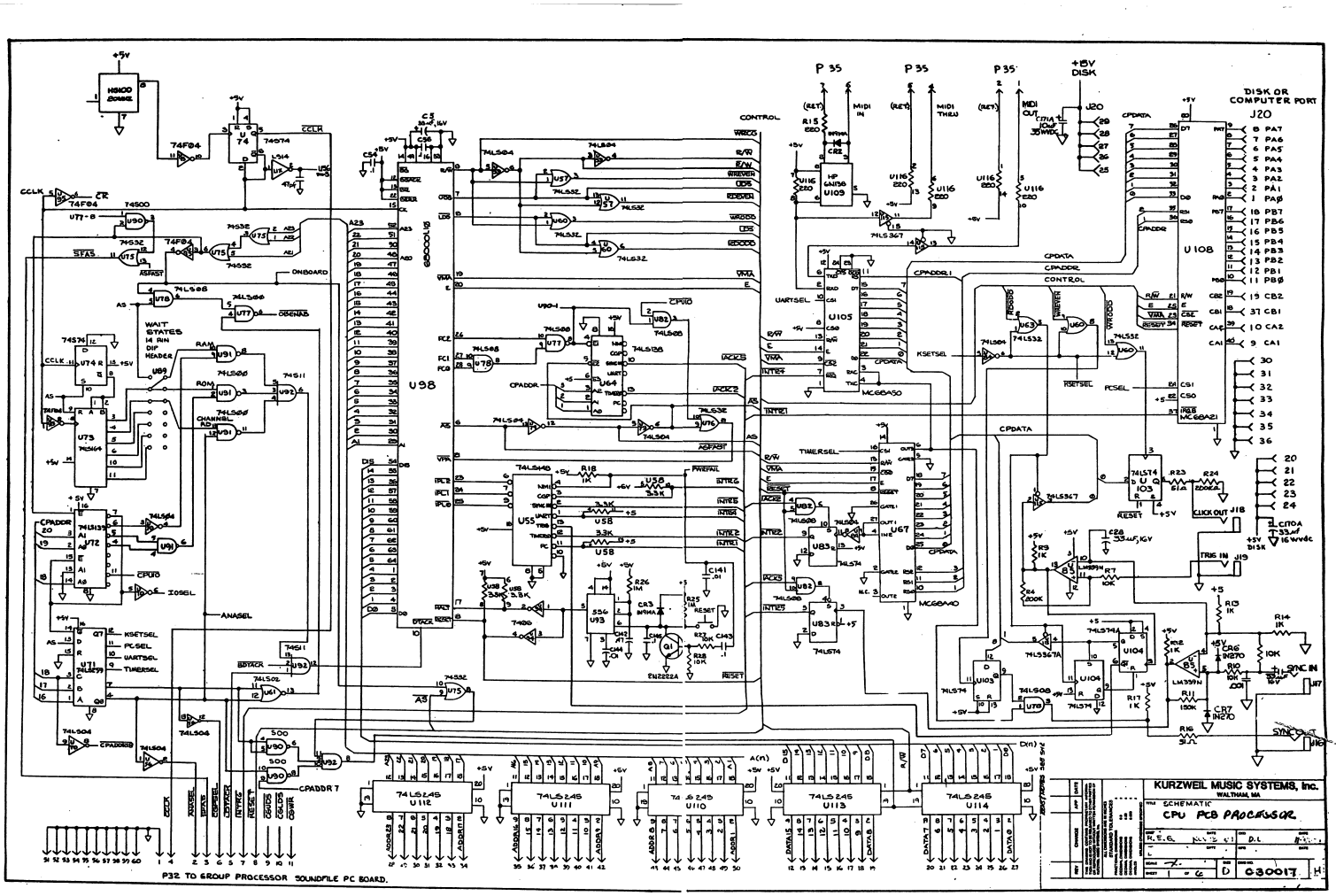
6.9 - K250 KEYSWITCH BOARD, Part Number 12046001

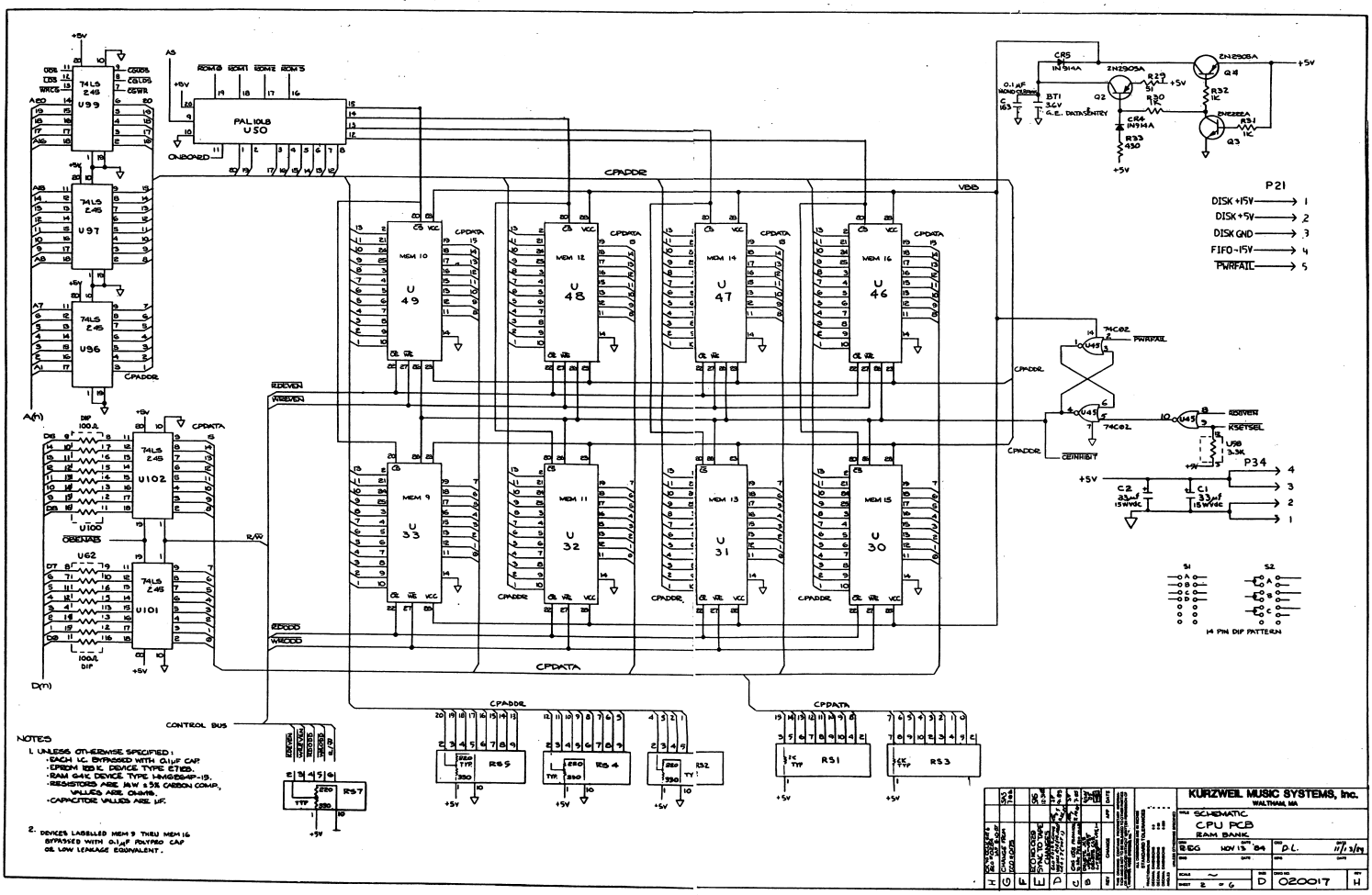
KMSI P/N	DESCRIPTION	QTY.	REF. DES.
21000911	SCREW MACH PH CR 4-40X.750	10	
41009808	HEADER .10CC ST PC MT 8 POS DIP	1	BBTT
41010301	CONN .10CC 2-POS JUMPER	2	
41015926	CONN W/FULL SHROUD 26 POS	1	P39
510001080	RES CARB FILM 2K 1/4W 5%	1	R1
52000101	CAP TANT 33UF 16V .100 CTRS	1	C8
52000201	CAP MONO CER .1UF 50V .20CRTS	7	C1-7
61000201	IC DIGITAL 74LS138	1	U7
61000301	IC DIGITAL 74LS145	6	U1-6

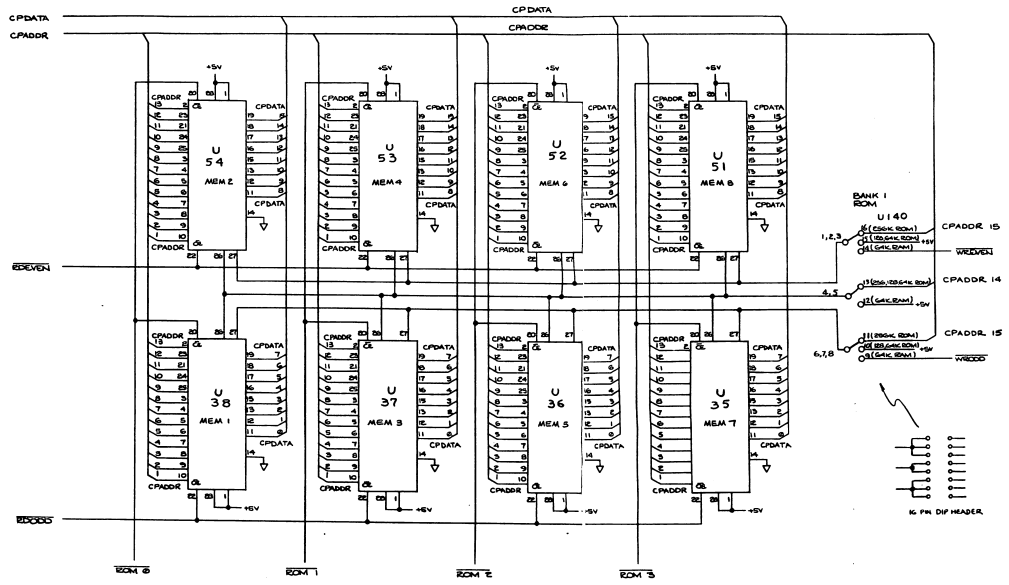
6.10 - MISCELLANEOUS PARTS AND CABLES

KMSI P/N	DESCRIPTION	QTY.	REF. DES.
13003501	CABLE ASSY CPU TO CHANNEL	1	
13004001	CABLE ASSY CHANNEL TO SLIDER	1	
13005101	CABLE ASSY CPU TO KEYSWITCH	1	
13005201	CABLE ASSY CPU TO CONTROL PANEL	1	
13007201	CABLE ASSY POD TO K250	1	
21000602	WASHER FLAT NYLON NO. 6	1	
21001003	SCREW MACH PH CR 6-32X1/4	2	
21001501	SCREW SEMS PH CR 6-32X1/4 S NI	37	
21001805	SCRES SEMS PH CR 10-32X7/16	3	
21002502	NUT KEPS 6-32 S NI	1	
21002607	NUT HEX 3/16 AF 4-40X1/16	1	
21003302	SCREW MACH PH CR 8-32X1/4 BLK	4	
21003601	SCREW 4-40X1/4	4	
21004201	NUT .50 HEX 3/8-32 3/32 THK	13	
22000502	STANDOFF HEX 1/4 AF M/F 6-32X3/8 BR	2	
22003001	U CLIP 8-32 SST	2	
22003801	CLIP CABLE ADHESIVE SIDE ENTRY	2	
22004302	SUPPORT PCB NYLON .50 SNAP IN	4	
22005302	SUPPORT PCB NYLON .375 LG ADHESIVE	2	
22005401	CABLE TIE HOLDER SNAP IN	2	
22006001	WASHER FLAT .625 ODX.39 IDX.022	13	
39000201	ARM ACTION KEYBOARD ASSEMBLY	88	
39002301	SHIELD CHANNEL BOARD	1	

Chapter 7 - Schematics, Layouts, Wiring Diagrams





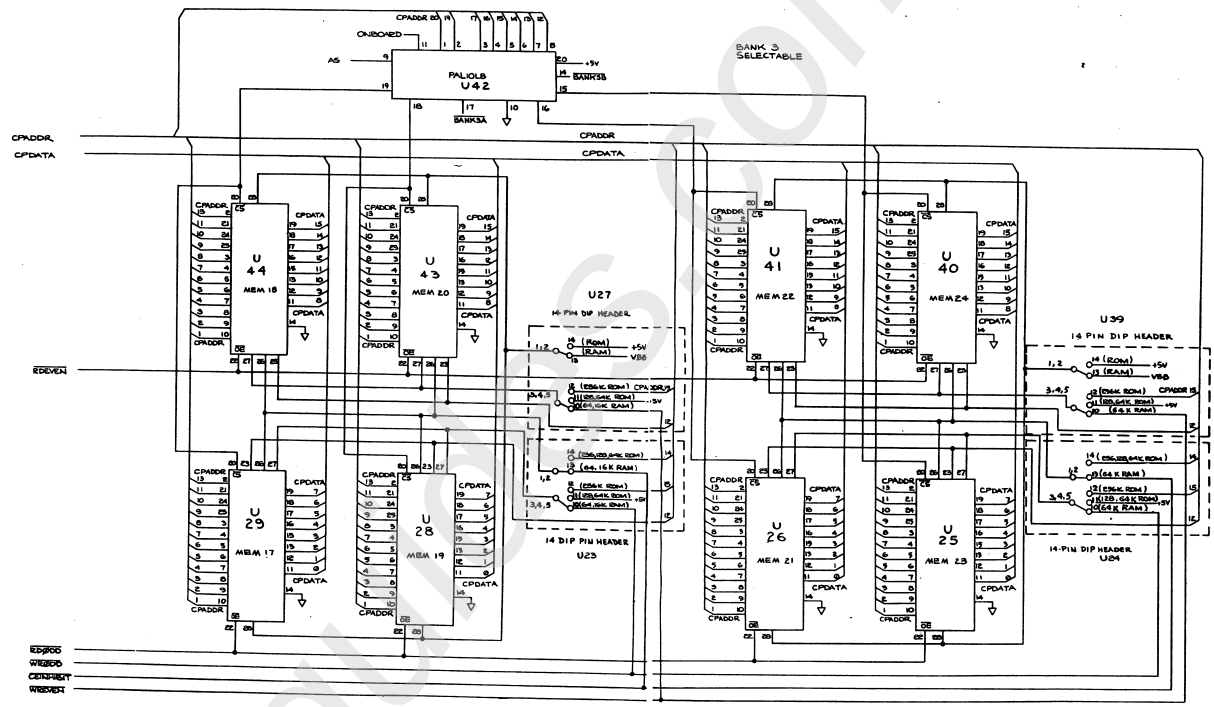


KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

TITLE SCHEMATIC
CPU PCB
ROM BANK

DRN REG NOV 15 84 DATE
CHK D.L 11-13-84
ENG DATE
MFG DATE

SCALE
SHEET 3 OF 6
SIZE D
DWG NO 020017
REV H

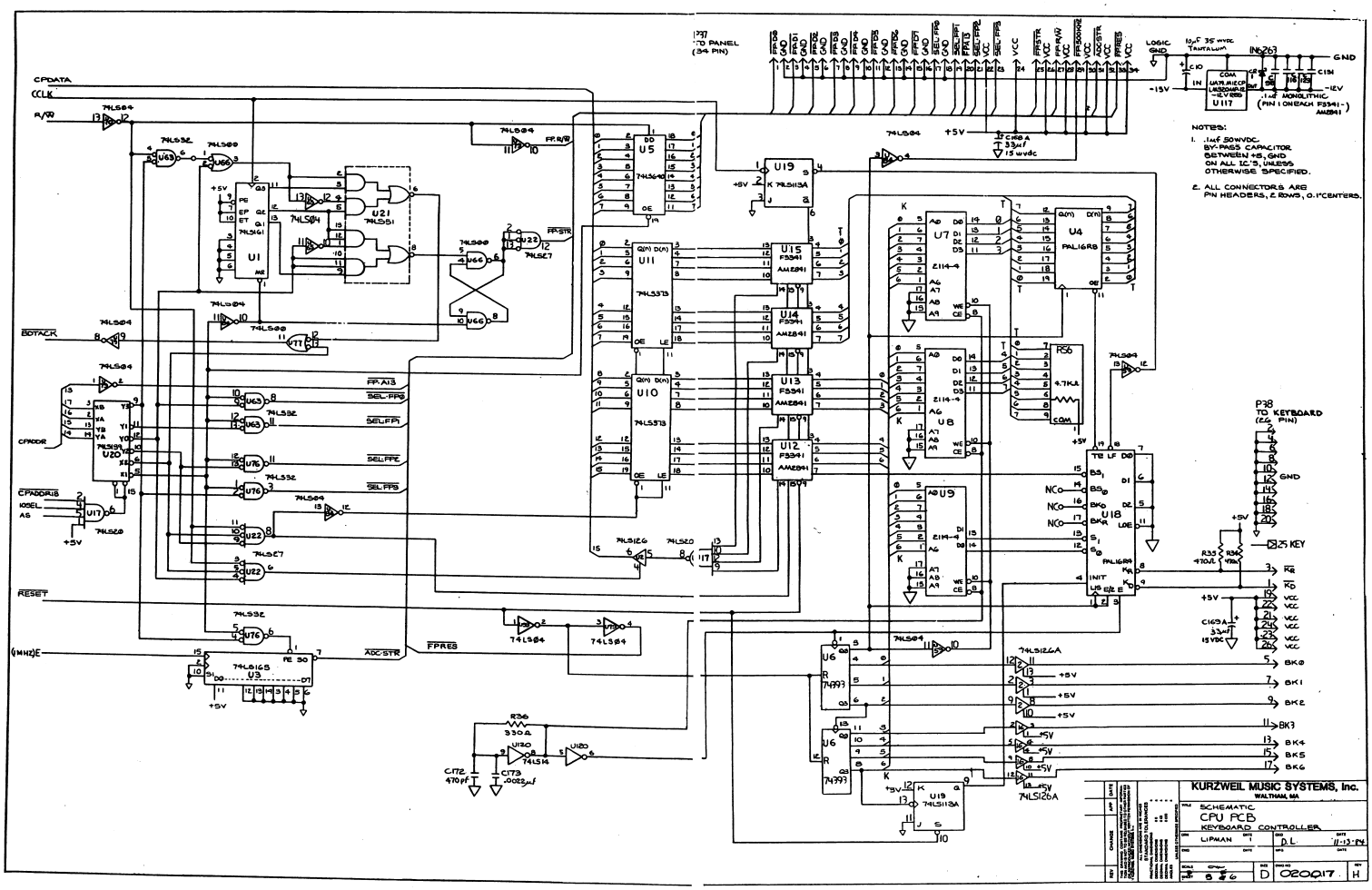


NOTE: DEVICES LABELLED MEM 17 THRU MEM 24 BYPASSED WITH 0.1 uF POLYPAC CAP OR LOW LEAKAGE EQUIVALENT.

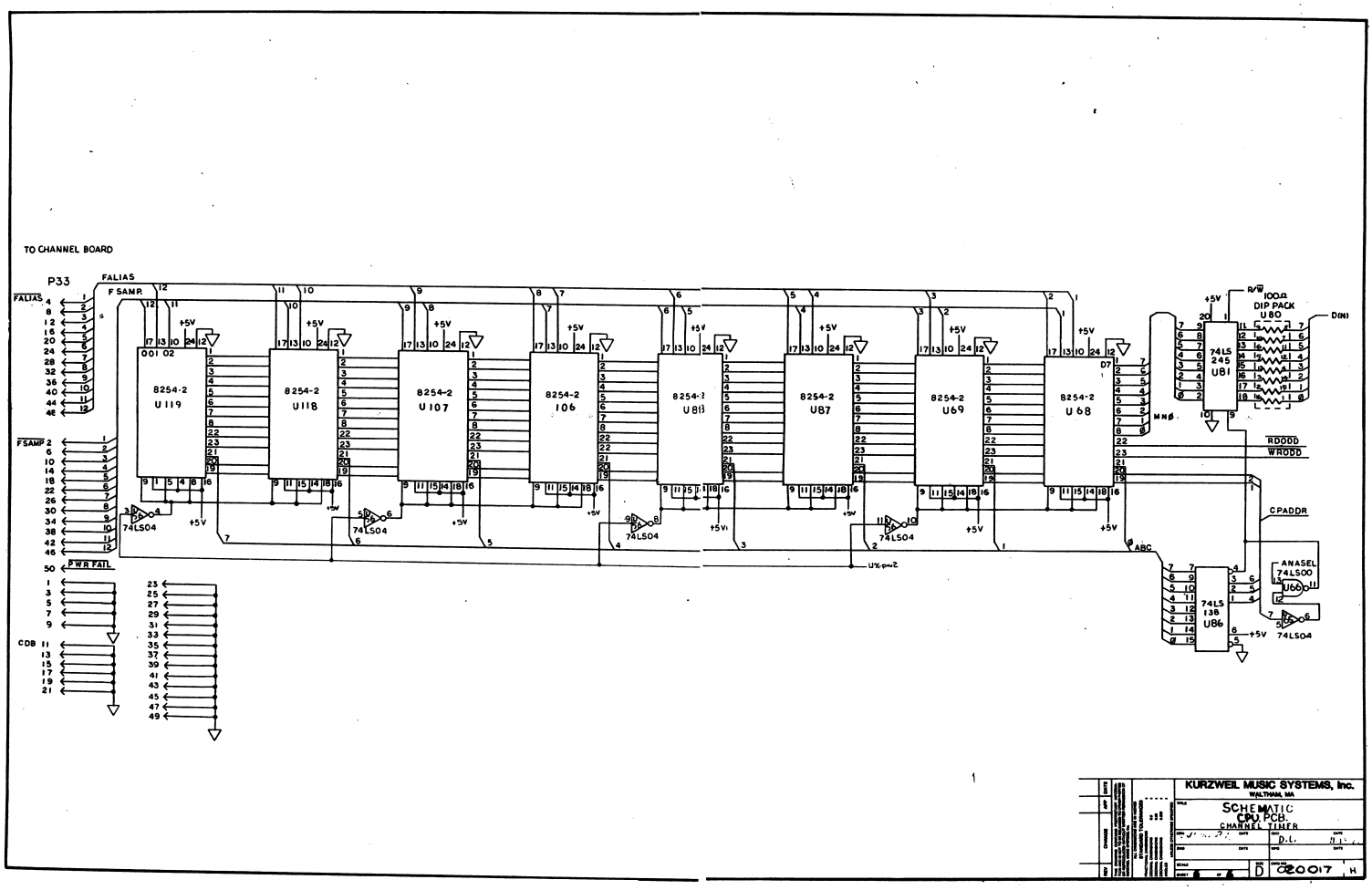
KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

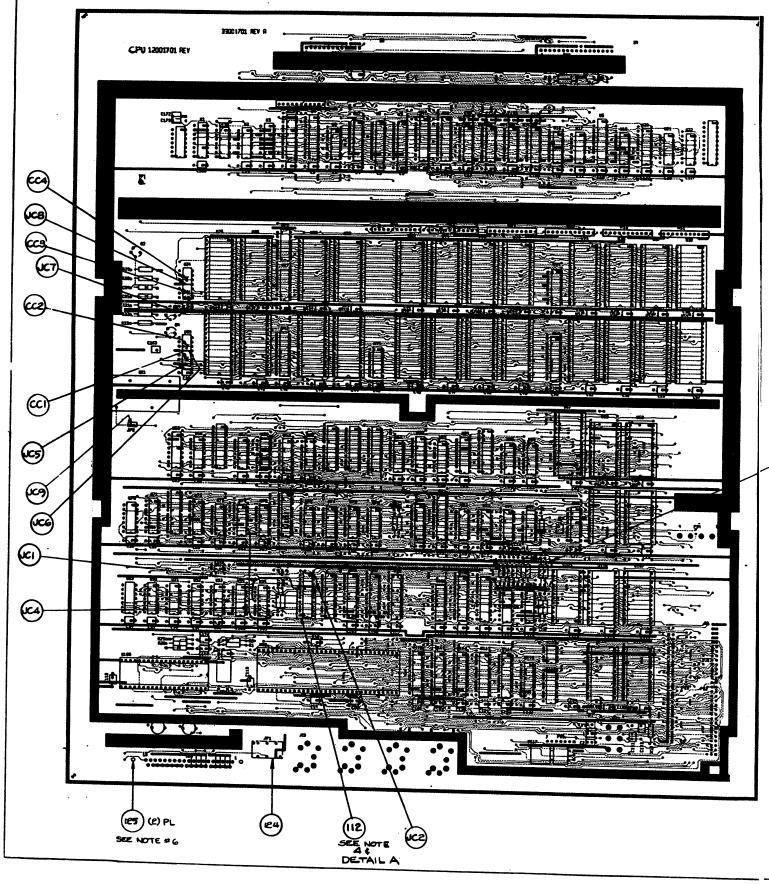
SCHEMATIC
CPU PCB
SELECTABLE BANK

DRN RSB NOV 15 84	APP D.L 11-13-84	
DESIGN	SHEET 4 OF 6	SIZE D 020017 REV H



NOTES:
1. .1mF 50WVDC BYPASS CAPACITOR BETWEEN +5,GND ON ALL IC'S, UNLESS OTHERWISE SPECIFIED.
2. ALL CONNECTORS ARE PIN HEADERS, 2 ROWS, 0.1" CENTERS.



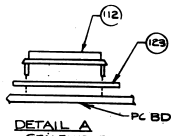


ETCH CUTS

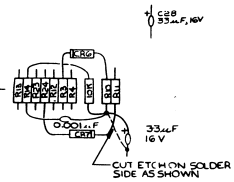
REF DES.	CUT BETWEEN	
CC1	U89-2 & U89-13	
CC2	U89-3 & U89-10	SEE NOTE #2
CC3	U24-2 & U24-13	SEE NOTE #3
CC4	U24-5 & U24-10	

JUMPERS

REF DES.	FROM	TO
JC1	SP -14	U95-11
JC2	SP -10	SP -7
JC3		
JC4	U95-1	U74-2
JC5	U89-1	U89-14
JC6	U89-4	U89-11
JC7	U24-1	U24-14
JC8	U24-4	U24-11
JC9	JP2	



DETAIL A
SCALE: NONE
SEE NOTE #4



DETAIL B
SCALE = NONE

NOTES:

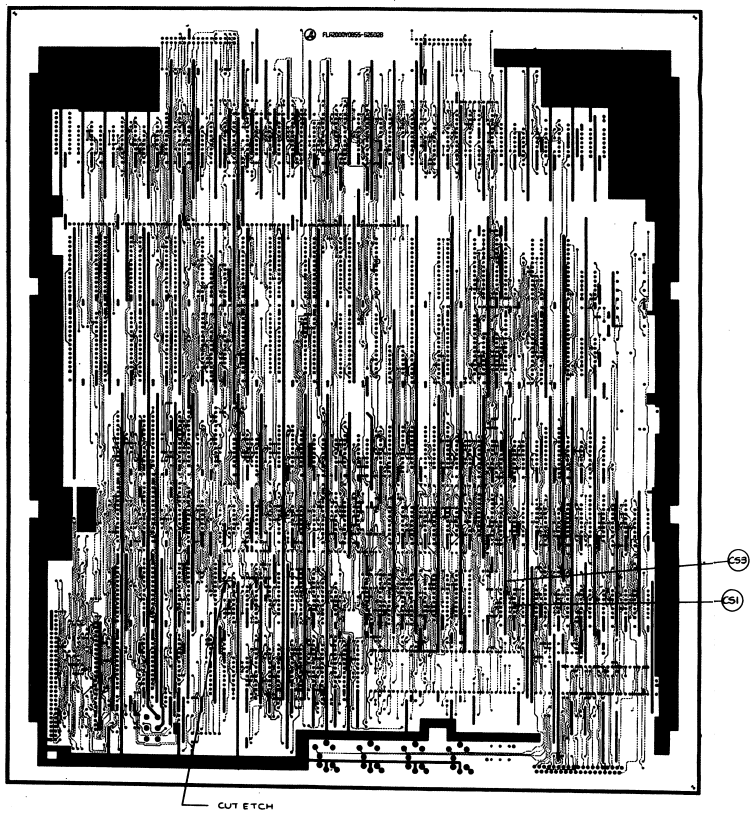
1. ALL JUMPERS TO BE 30 AWG KYNAR WIRE.
2. ETCH CUT TO BE MADE BETWEEN FEEDTHROUGH HOLE & PIN 5
3. ETCH CUT TO BE MADE BETWEEN FEEDTHROUGH HOLE & PIN 2.
4. ITEM 112 (NEL HS100) IS TO BE INSTALLED IN EMPTY IC PATTERN NEAREST TO R86. EMPTY IC PATTERN HAS REF DES. "SP -". A SPACER (ITEM 123) MUST BE INSTALLED BETWEEN ITEM 112 & PC BD. PIN 1 OF ITEM 112 IS TO INSERTED INTO PIN 1 OF EMPTY IC PATTERN "SP -". PIN 8 OF ITEM 112 IS TO BE INSERTED INTO PIN 14 OF "SP -".
5. COMPONENTS ARE NOT TO BE INSTALLED AT THE FOLLOWING LOCATIONS: R1, R2, Y1, C21, RS7
6. SCREW IN FROM SOLDER SIDE

KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

ASSEMBLY
CPU PCB
(COMPONENT SIDE)

KD 10-11-84 1 of 5 BM/K

SHEET 1 of 2 | D | 1200703



ETCH CUTS

REF DES	CUT BETWEEN
C51	U95-11 & U95-12
C52	
C53	CUT AT FEEDTHRU BETWEEN U95-5 & U95-10

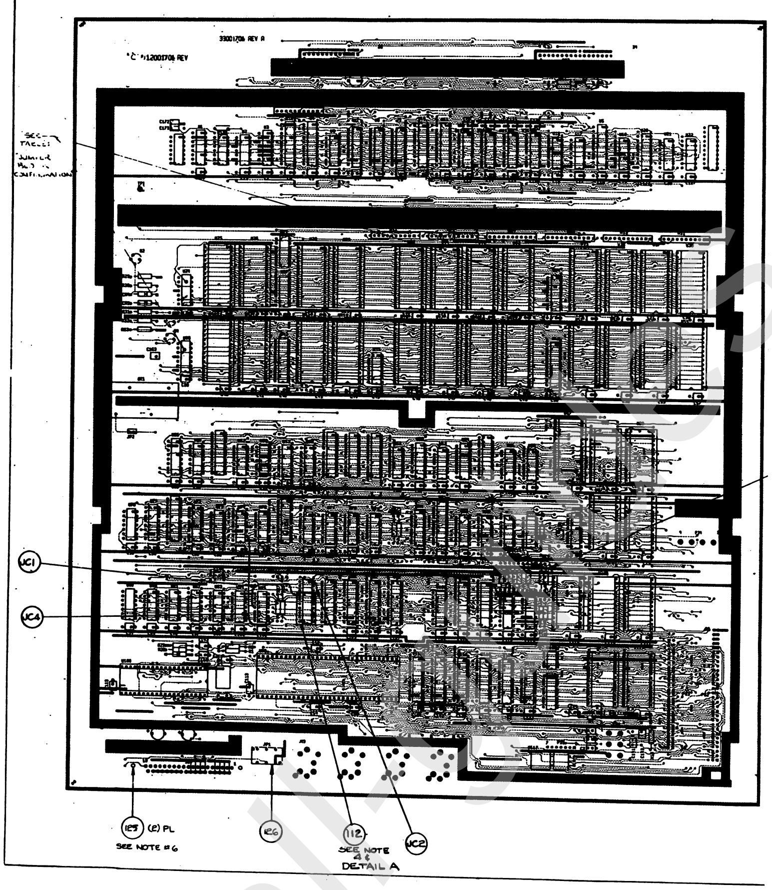
KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

ASSEMBLY
CPU PCB
(SOLDER SIDE)

KHD 10-1-84

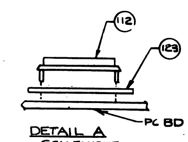
SIZE D | 1800/103 | REV M

SHEET 2 OF 2



JUMPERS

REF DES.	FROM	TO
JC1	SP -14	U95-11
JC2	SP -10	SP -7
JC3		
JC4	U95-1	UT4-2

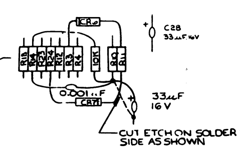


DETAIL A
SCALE: NONE
SEE NOTE # 4

JUMPER BLOCK CONFIGURATION:
U24 U34 U39

NOTE: VARIOUS PREVIO[illegible] OF [illegible] HAVE DIFFER[illegible] OF THE JUMPER BLOCKS [illegible] EITHER ETCH OR WIRE [illegible] IN THE CO[illegible] SHOWN BELOW [illegible] JUMPERS REQUIRED ON THE JUMPER BLOCKS U24, U34 U39.

FROM	TO
U24-2	U24-13
U34-5	U24-10
U34-2	U34-16
U34-4	U34-13
U34-7	U34-11
U39-2	U39-1?
U39-5	U39-13



DETAIL 'B'
SCALE: NONE

1. ALL JUMPERS TO BE 30 AWG. KYNAR WIRE.
2. ITEM 112 (NEL HS100) IS TO BE INSTALLED IN EMPTY IC PATTERN NEAREST TO R28. EMPTY IC PATTERN HAS REF. DES. "SP ". A SPACER (ITEM 123) MUST BE INSTALLED BETWEEN ITEM 112 & PC BD. PIN 1 OF ITEM 112 IS TO INSERTED INTO PIN 1 OF EMPTY IC PATTERN "SP "; PIN 8 OF ITEM 112 IS TO BE INSERTED INTO PIN 14 OF "SP ".
3. COMPONENTS ARE NOT TO BE INSTALLED AT THE FOLLOWING LOCATIONS: R1, R2, Y1, C21, R57.
4. SCREW IN FROM SOLDER SIDE.

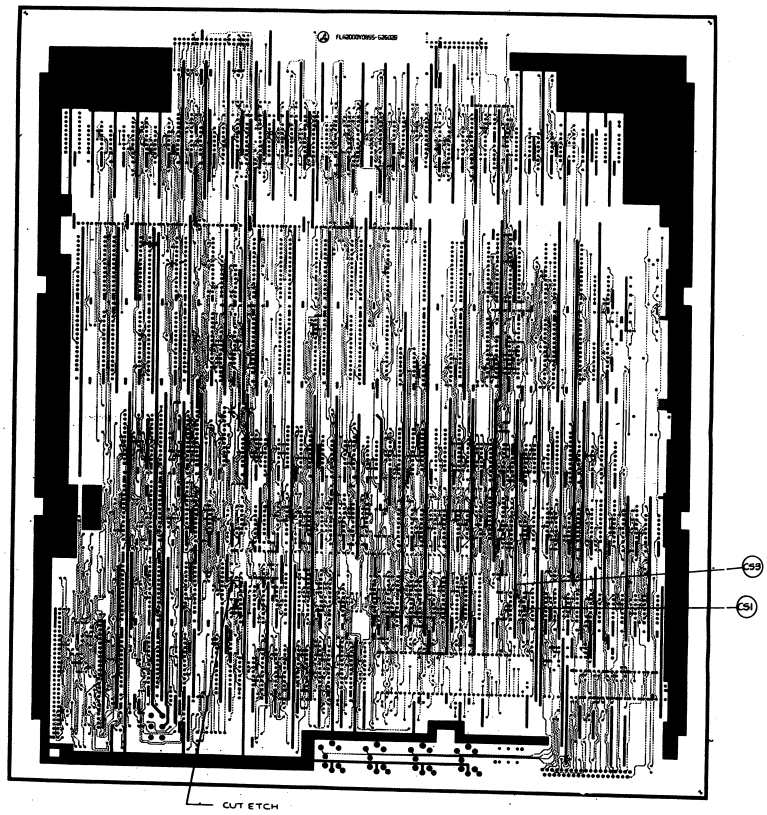
KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

TITLE: ASSEMBLY CPU PCB/250X (COMPONENT SIDE)

DRN: KHD DATE: 8-7-85

DWG NO: 12001704

SHEET 1 of 2 SIZE D



ETCH CUTS

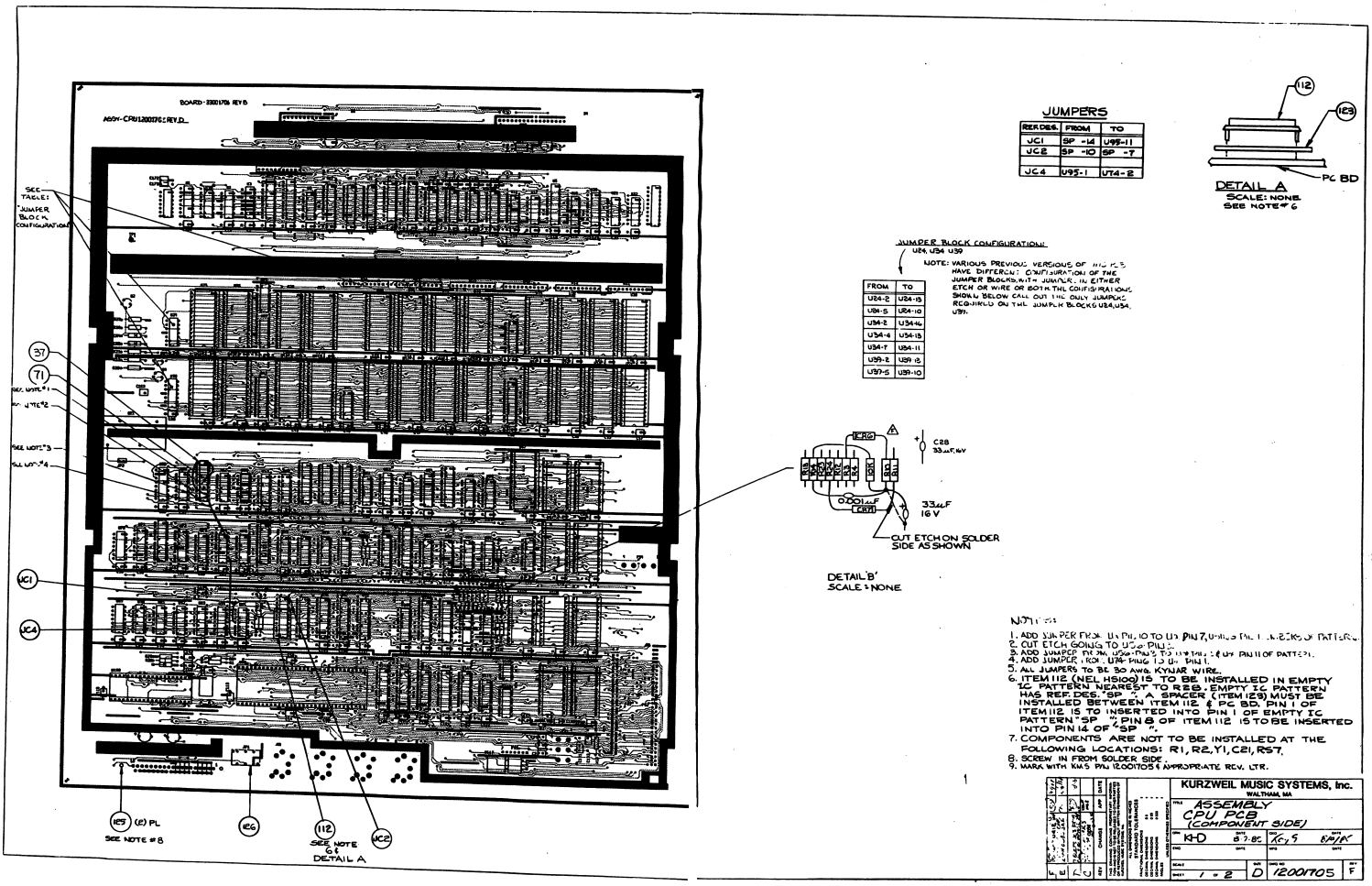
REF DES	CUT BETWEEN
C51	U95-11 & U95-12
C52	
C53	CUT AT FEEDTHRU BETWEEN U95-5 & U95-10

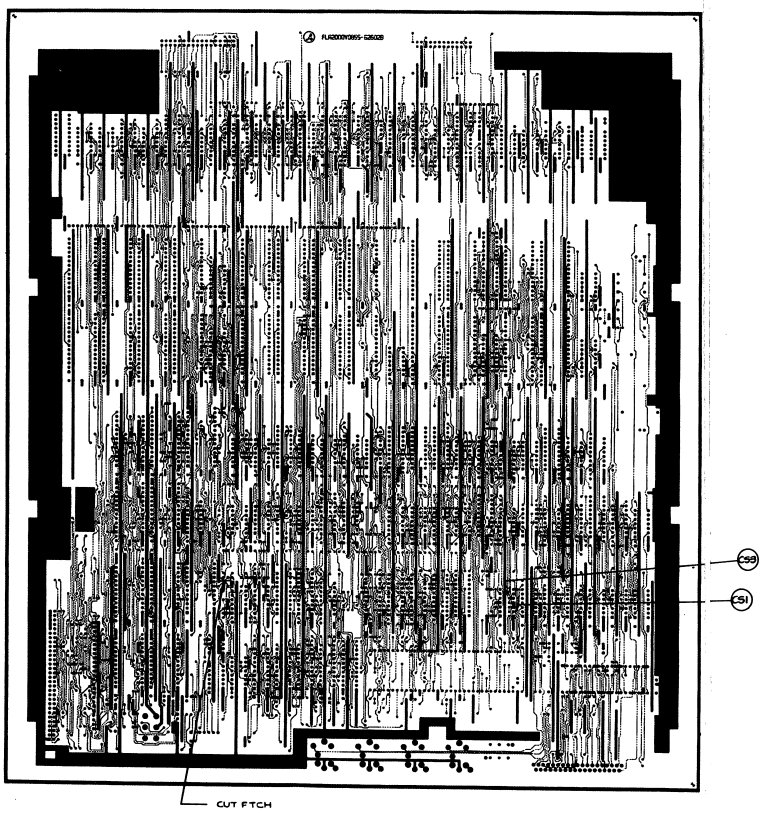
KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

TITLE: ASSEMBLY
CPU PCB/250X
(SOLDER SIDE)

DRN: KHD 10-14-84
CHK:
ENG:
MFG:

SIZE: D
DRAWING: 120X104
REV: 01
SHEET: 2 - 2





ETCH CUTS

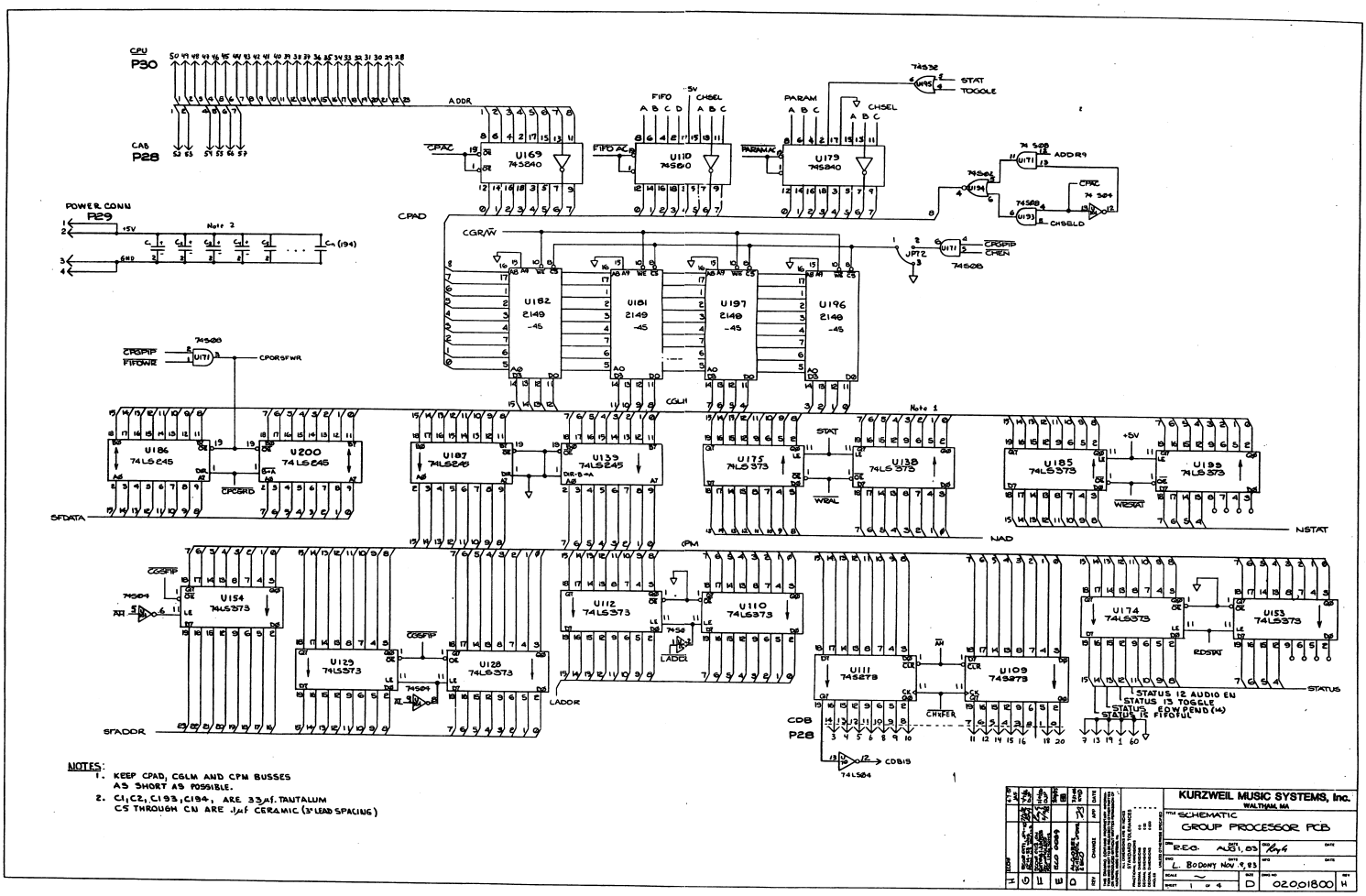
REF DES	CUT BETWEEN
C51	U95-11 & U95-12
C52	
C53	CUT AT FEEDTHRU BETWEEN U92-5 & U95-10

KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

TITLE: ASSEMBLY CPU PCB/250X (SOLDER SIDE)

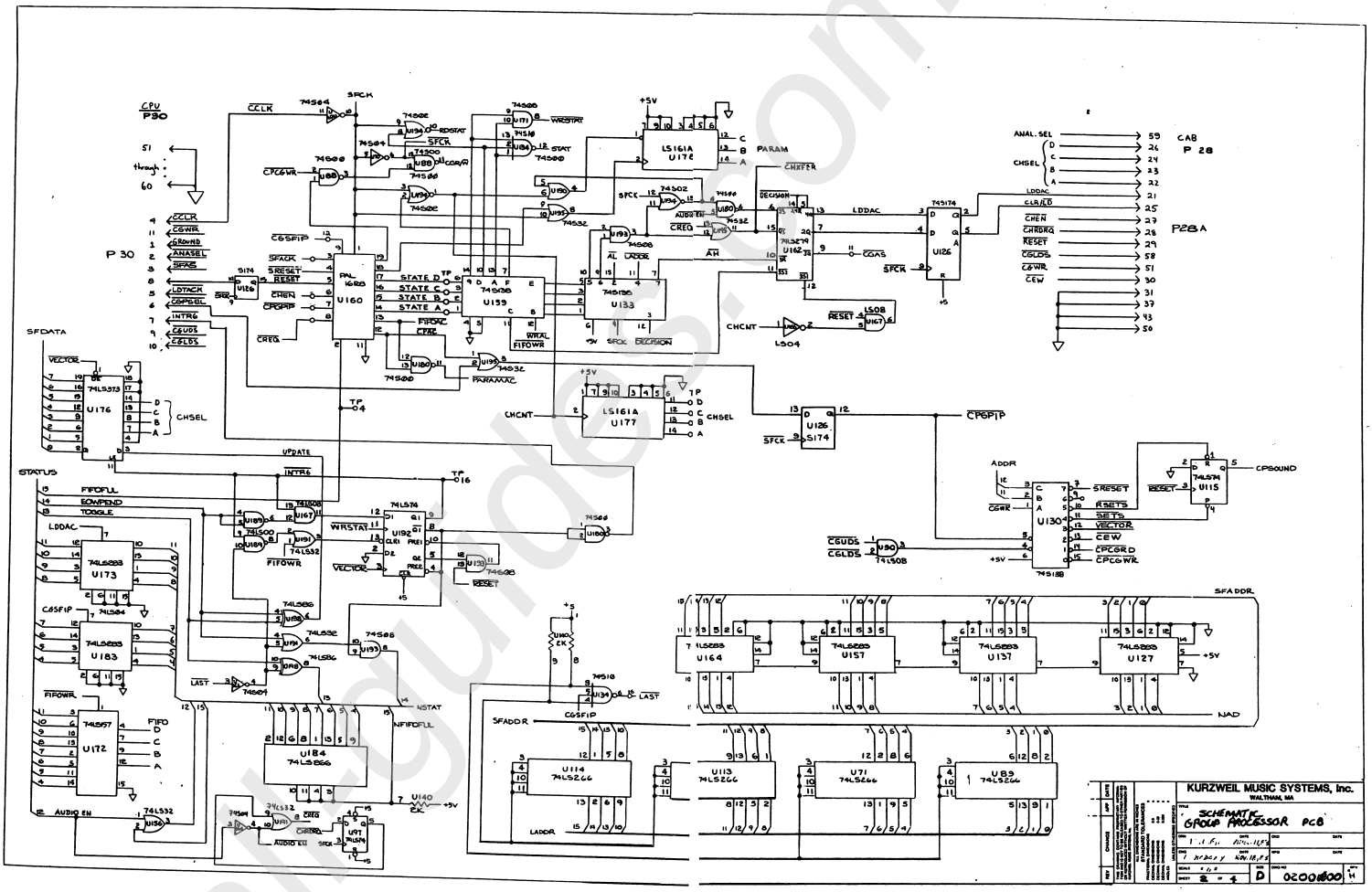
DRN KJD 10/1/84 | CHK | ENG | MFG

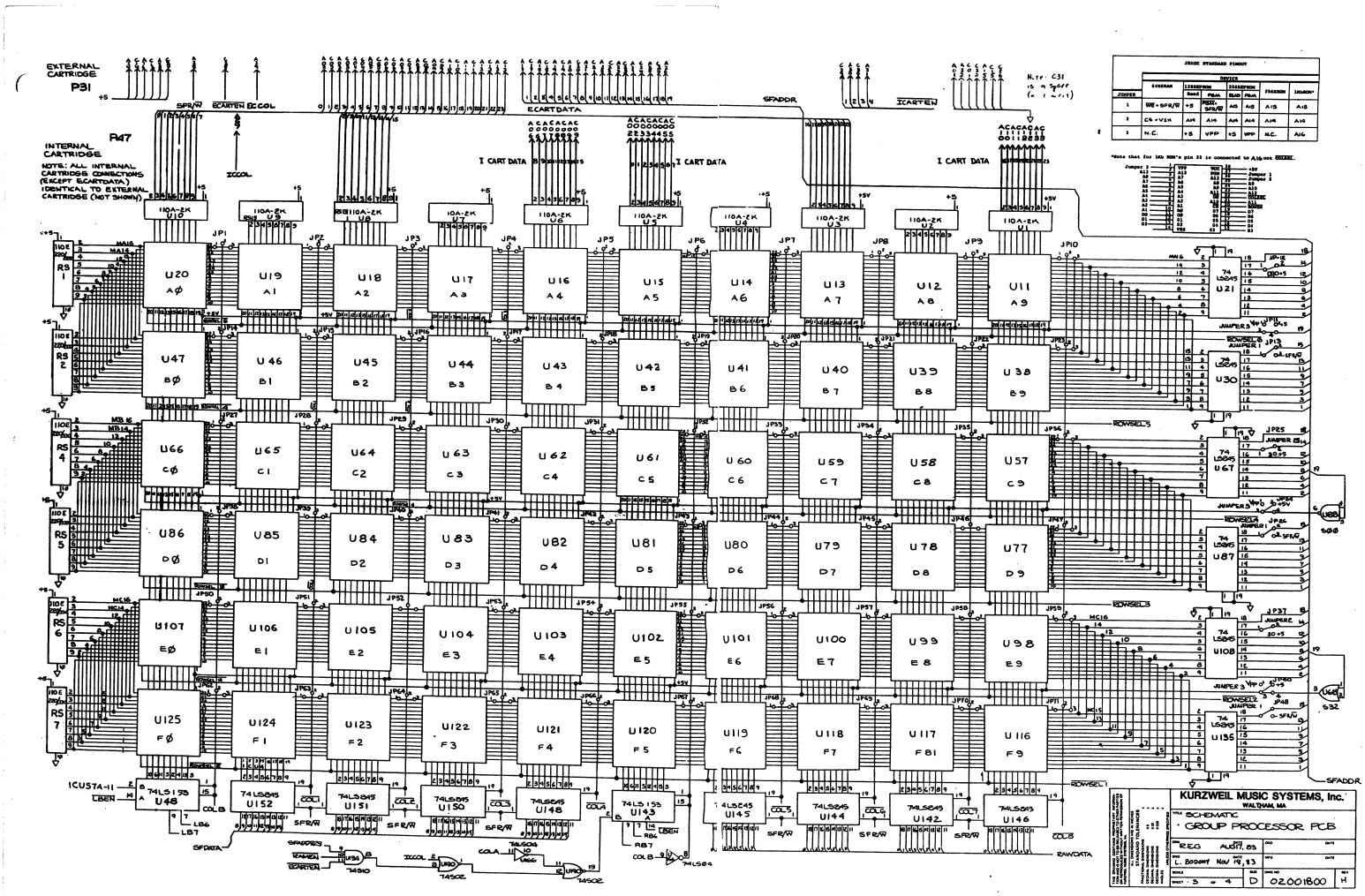
SCALE | SHEET 2 OF 3 | SIZE D | DRWG NO 1800/105 | REV F

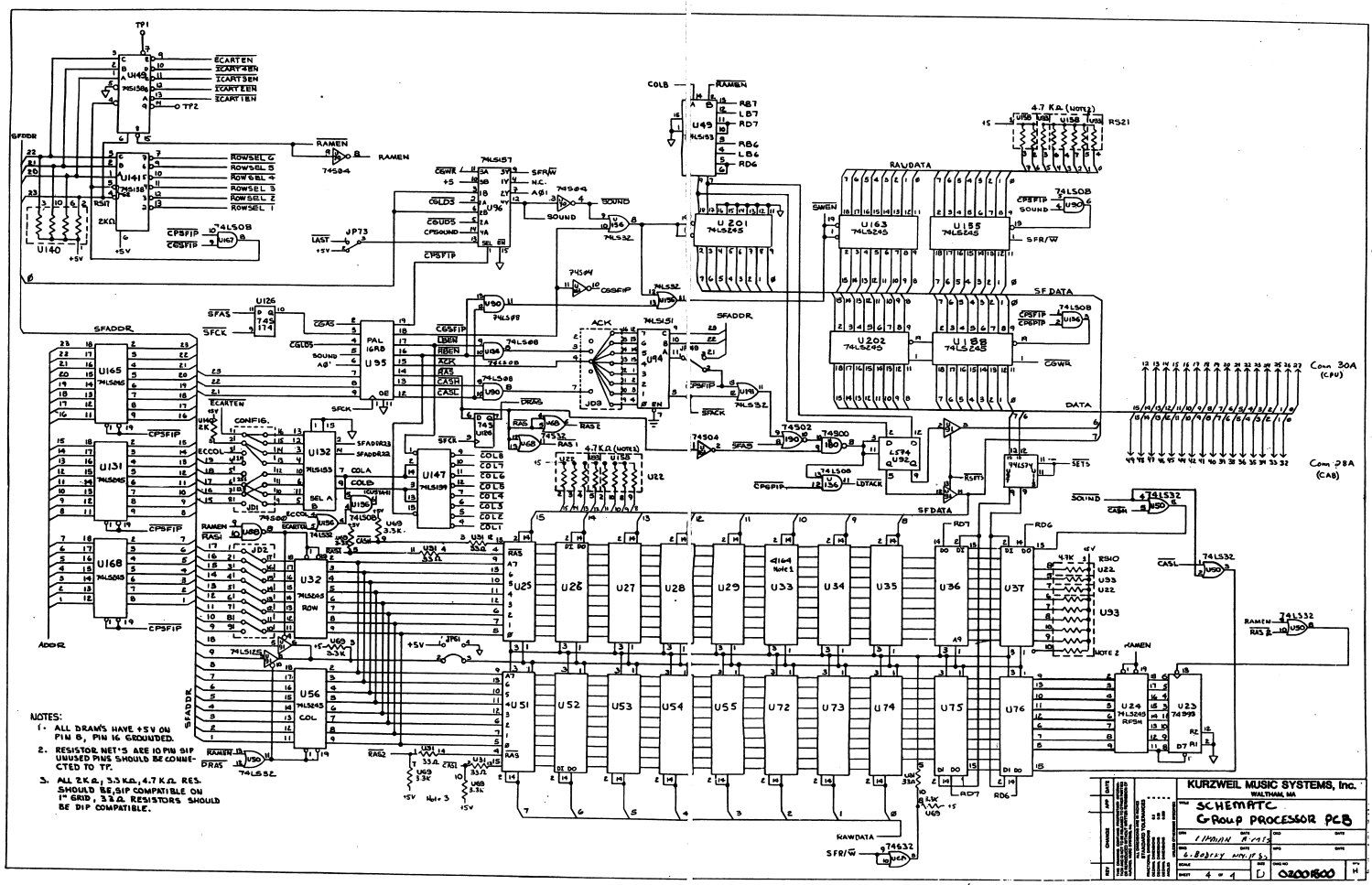


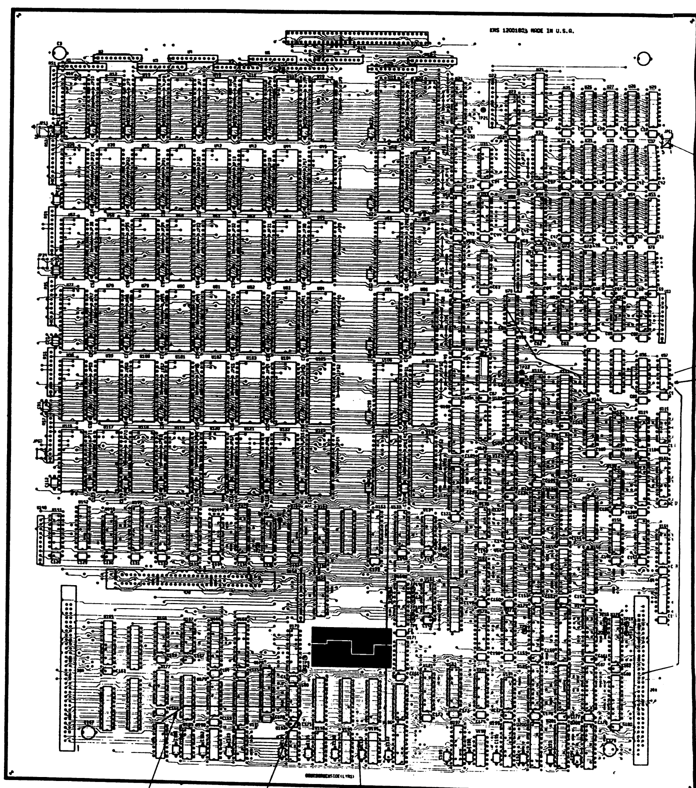
NOTES:
1. KEEP CPAD, CGLM AND CPM BUSSES AS SHORT AS POSSIBLE.
2. C1, C2, C193, C194, ARE 33uf. TANTALUM C5 THROUGH CN ARE .1uf CERAMIC (.3" LEAD SPACING)

KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA
SCHEMATIC
GROUP PROCESSOR PCB
R.E.C. AUG 1, 83
L. BODNEY NOV 5, 83
SIZE D
020018000
REV H
SHEET 1 OF 4









VARIATION	DESCRIPTION	REV
12001803	CGP M-BIT W/OUT ROMS	REV C
12001804	CGP WITH MBIT ROMS	REV A
12001805	CGP WITH MBIT ROM(KBCD	REV A

NOTES:

1. MARK WITH KMS P/N 12001805 & APPROPRIATE REV. LEVEL.
2. ASSEMBLE PER KMS PROCESS SHEET 06002901
3. USE 30 AWG KYNAR WIRE FOR ALL JUMPERS
4. CUT ETCH FROM P30A-PIN 7 TO U192-PIN 9 (UNDERNEATH SPARE LOCATION NEXT TO U189), SOLDER SIDE.
5. CUT ETCH FROM U191-PIN 9 TO FEED THRU BETWEEN U169-PIN 1 & 20, SOLDER SIDE.
6. ADD JUMPER FROM U97 PIN 5 TO U191-PIN 9, COMP. SIDE.
7. ADD JUMPER FROM U192 PIN 8 TO U180 PIN 1 & 2, COMP SIDE.
8. ADD JUMPER FROM U180 PIN 3 TO FEED THRU BETWEEN C168 & SPARE, CLOSEST TO SPARE, COMP SIDE.
9. ADD JUMPER FROM U70 PIN 10 TO U97 PIN 3, COMP SIDE.
10. ADD JUMPER FROM U97 PIN 12 TO P28A-PIN 28, COMP SIDE.

REV	CHANGE	CKD	ENG
C	DELETE JP11 NOTE ADD TO JP61 NOTE PER ECO 0308		
B	ADD CUT & JUMP PER ECO #0294 JAF 4.7.87		

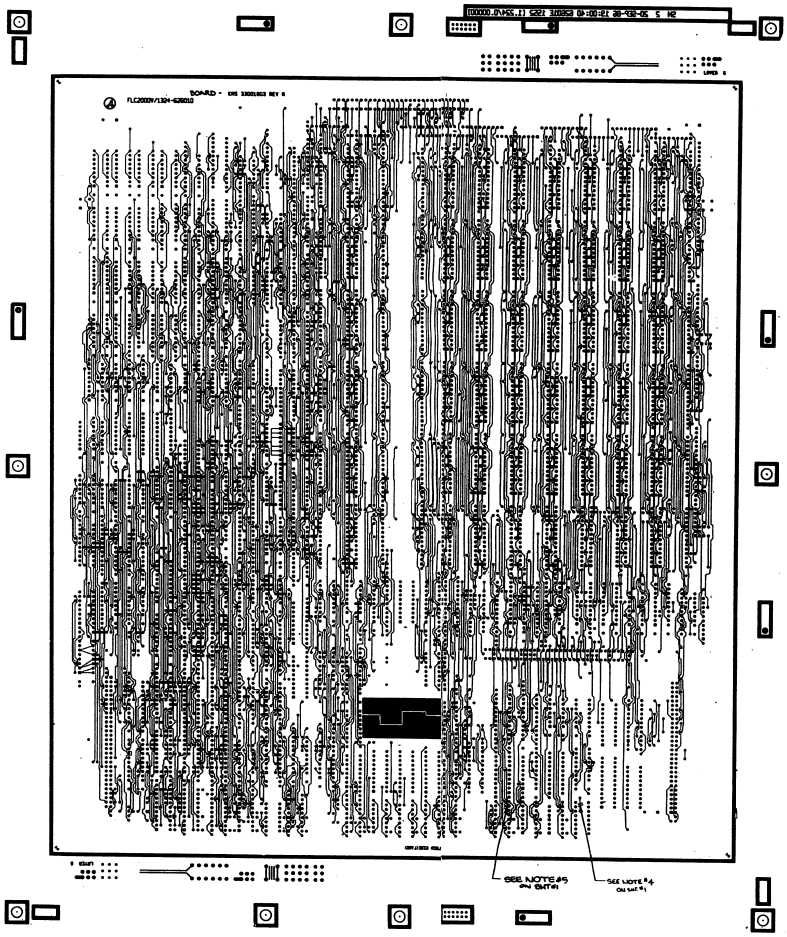
KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

TITLE: ASSY - PCB CGP K250

DRN J. A. F.

APPROVED FOR PRODUCTION — ENG 4/14/87; PROD 4/1_/87

SCALE 1:1 — SHEET 1 OF 2 — SIZE D — DWG NO 12001800

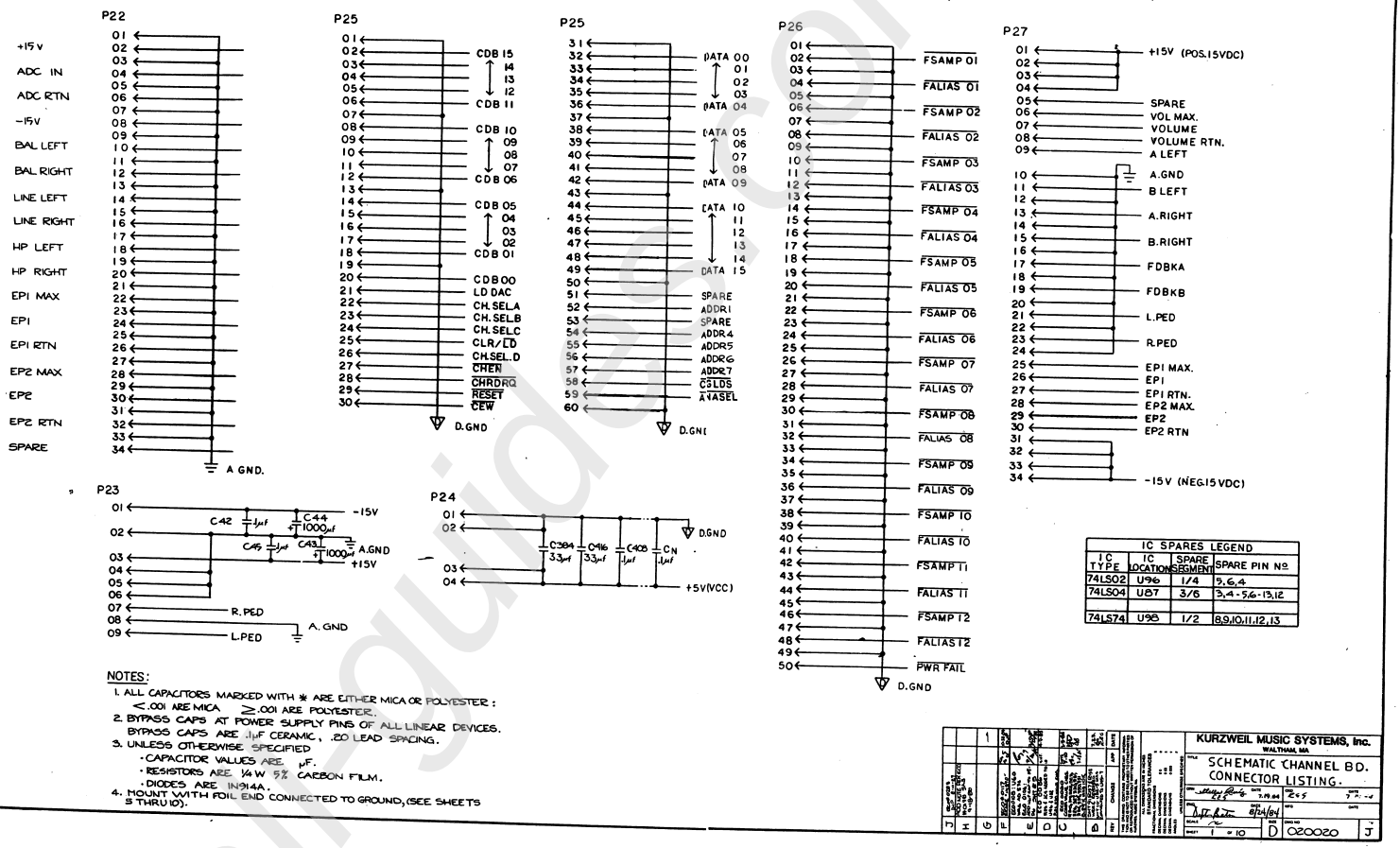


KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

ASSY PCB COP K250

4-6-87

12001800

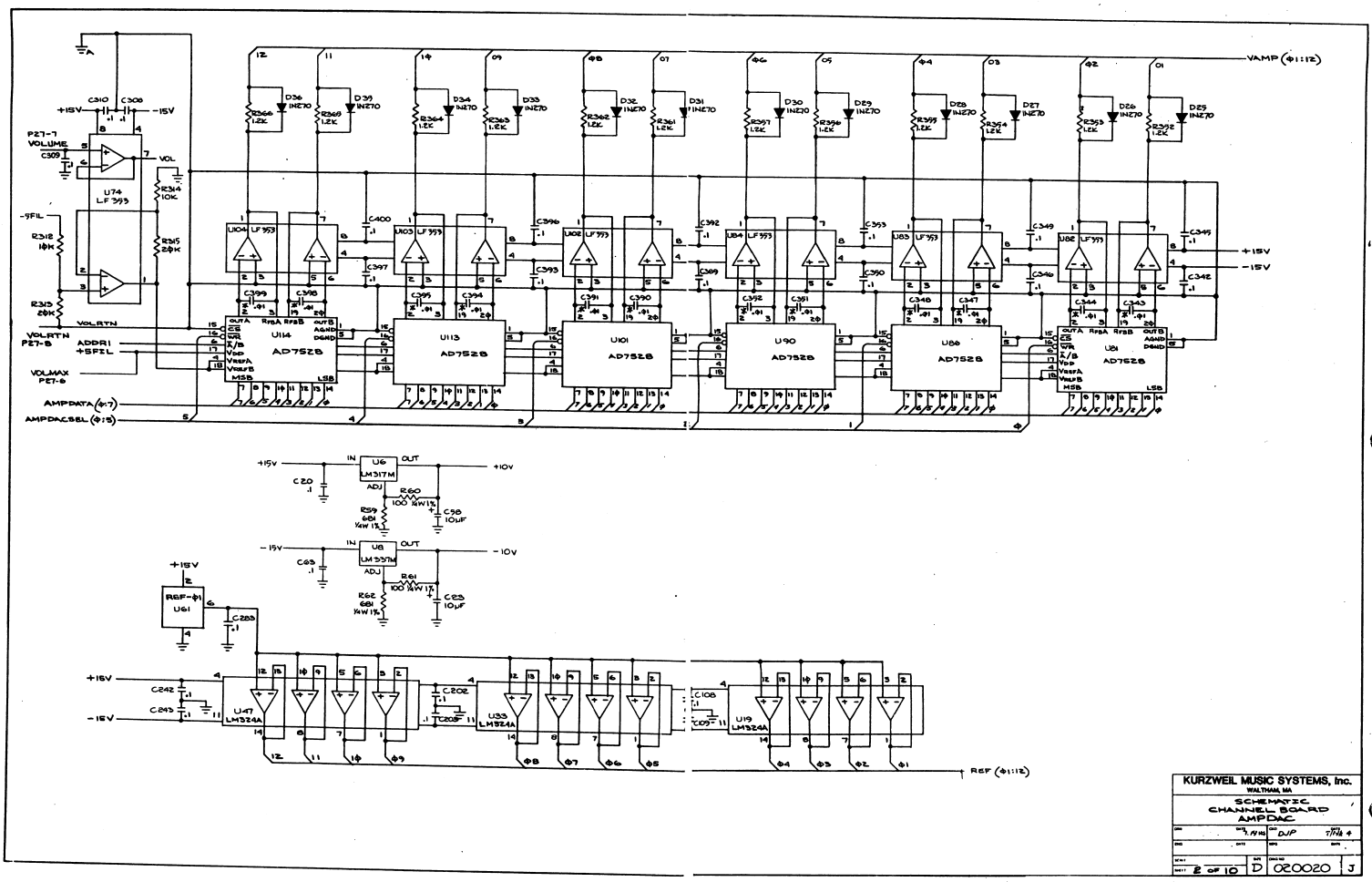


IC SPARES LEGEND			
IC TYPE	IC LOCATION	SPARE SEGMENT	SPARE PIN NO.
74LS02	U96	1/4	5,6,4
74LS04	U87	3/6	3,4-5,6-13,12
74LS74	U98	1/2	8,9,10,11,12,13

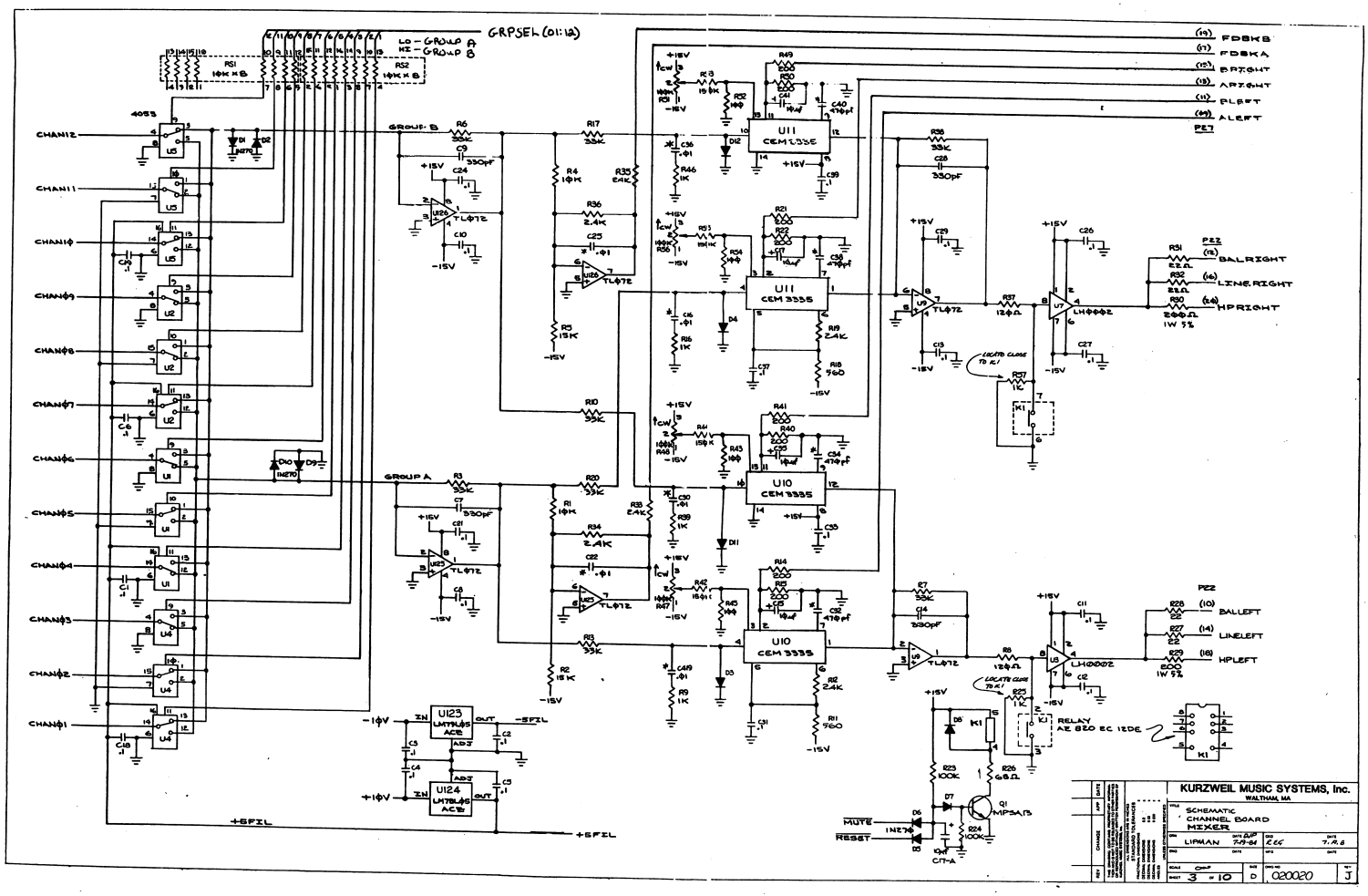
NOTES:

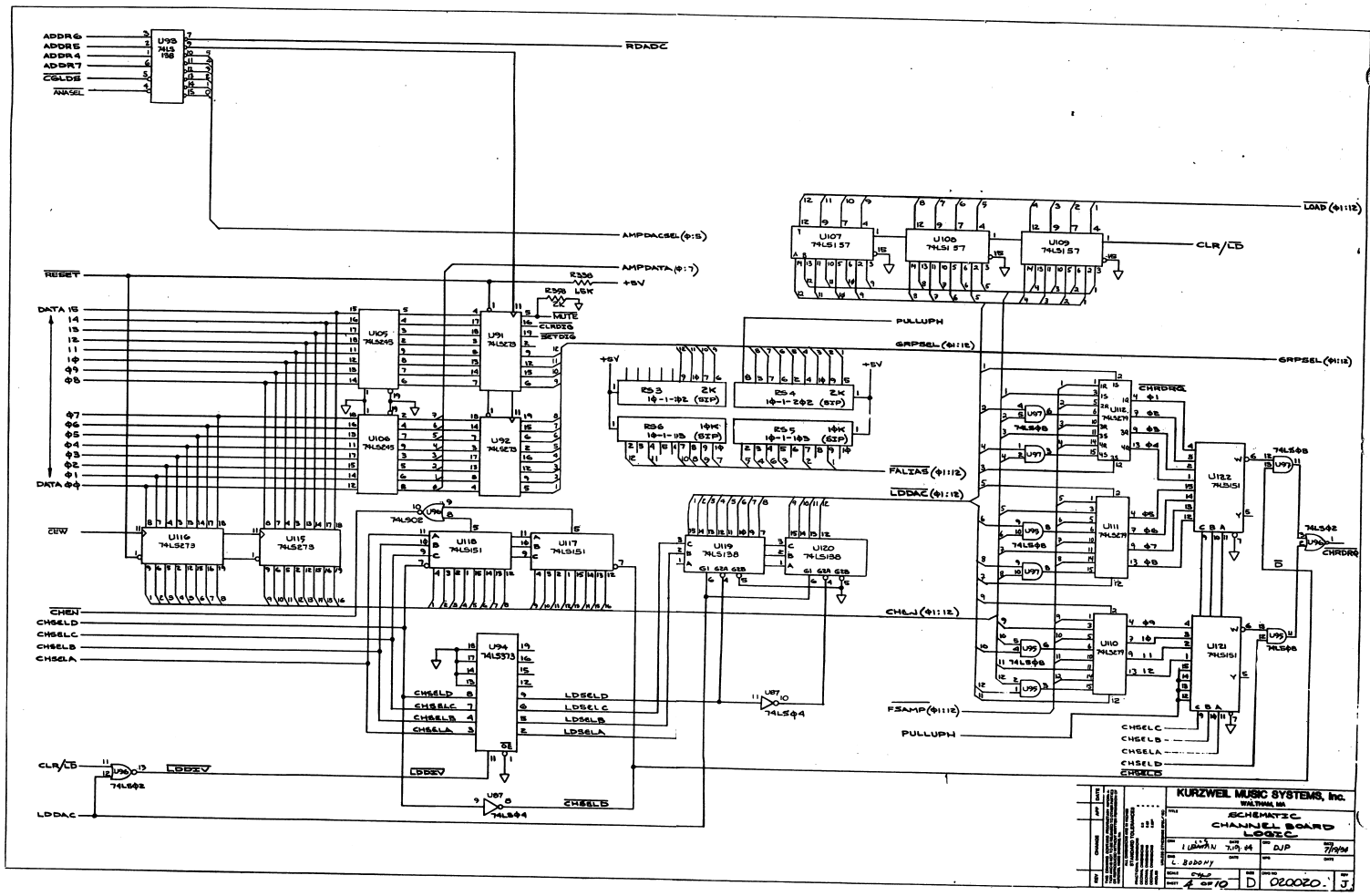
1. ALL CAPACITORS MARKED WITH * ARE EITHER MICA OR POLYESTER: <.001 ARE MICA ≥.001 ARE POLYESTER.
2. BYPASS CAPS AT POWER SUPPLY PINS OF ALL LINEAR DEVICES. BYPASS CAPS ARE .1µF CERAMIC, .200 LEAD SPACING.
3. UNLESS OTHERWISE SPECIFIED
   - CAPACITOR VALUES ARE µF.
   - RESISTORS ARE ¼W 5% CARBON FILM.
   - DIODES ARE IN914A.
4. MOUNT WITH FOIL END CONNECTED TO GROUND, (SEE SHEETS 5 THRU 10).

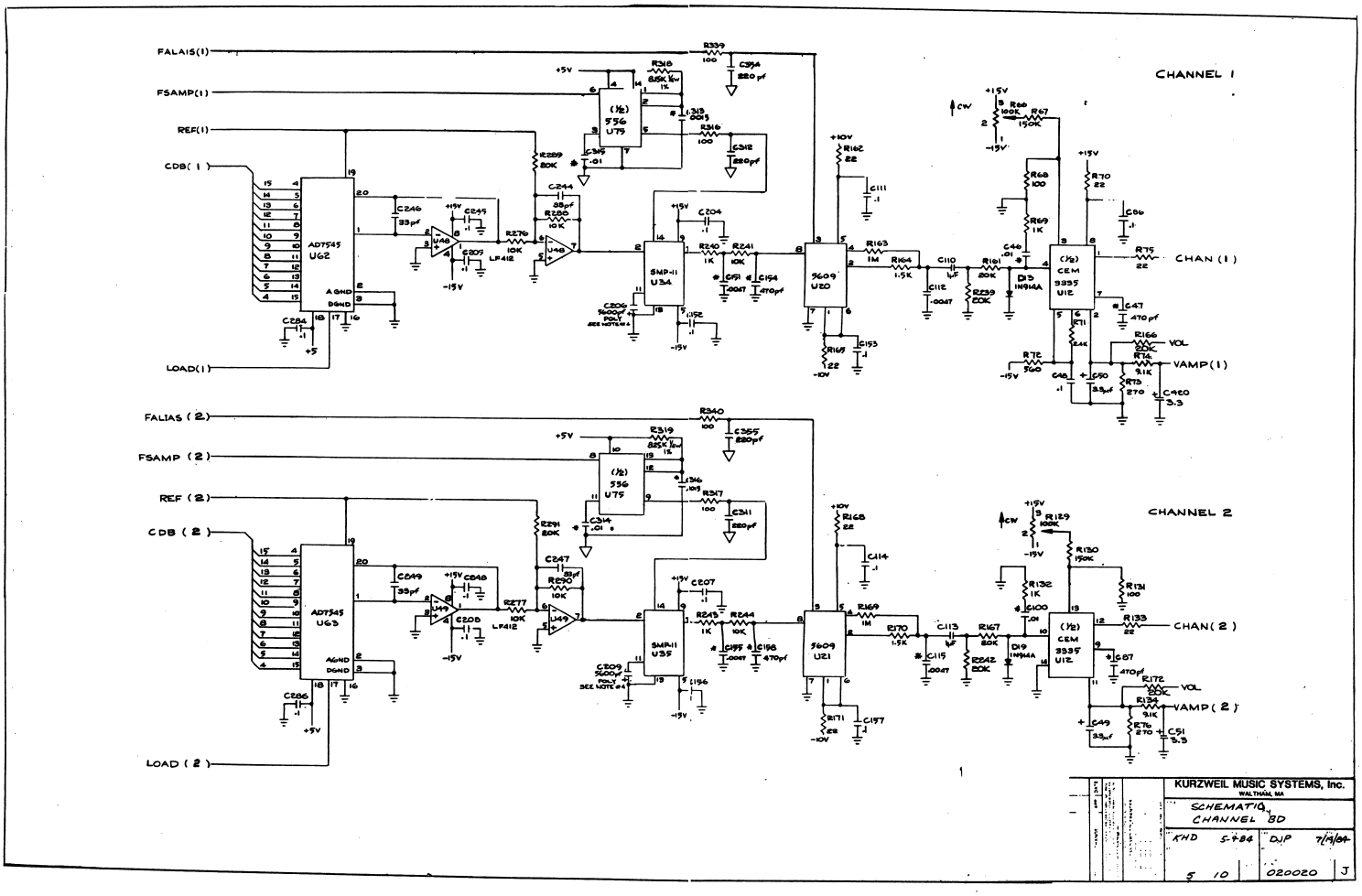
KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA
SCHEMATIC CHANNEL BD. CONNECTOR LISTING.
SIZE D
020020
REV J
SHEET 1 of 10

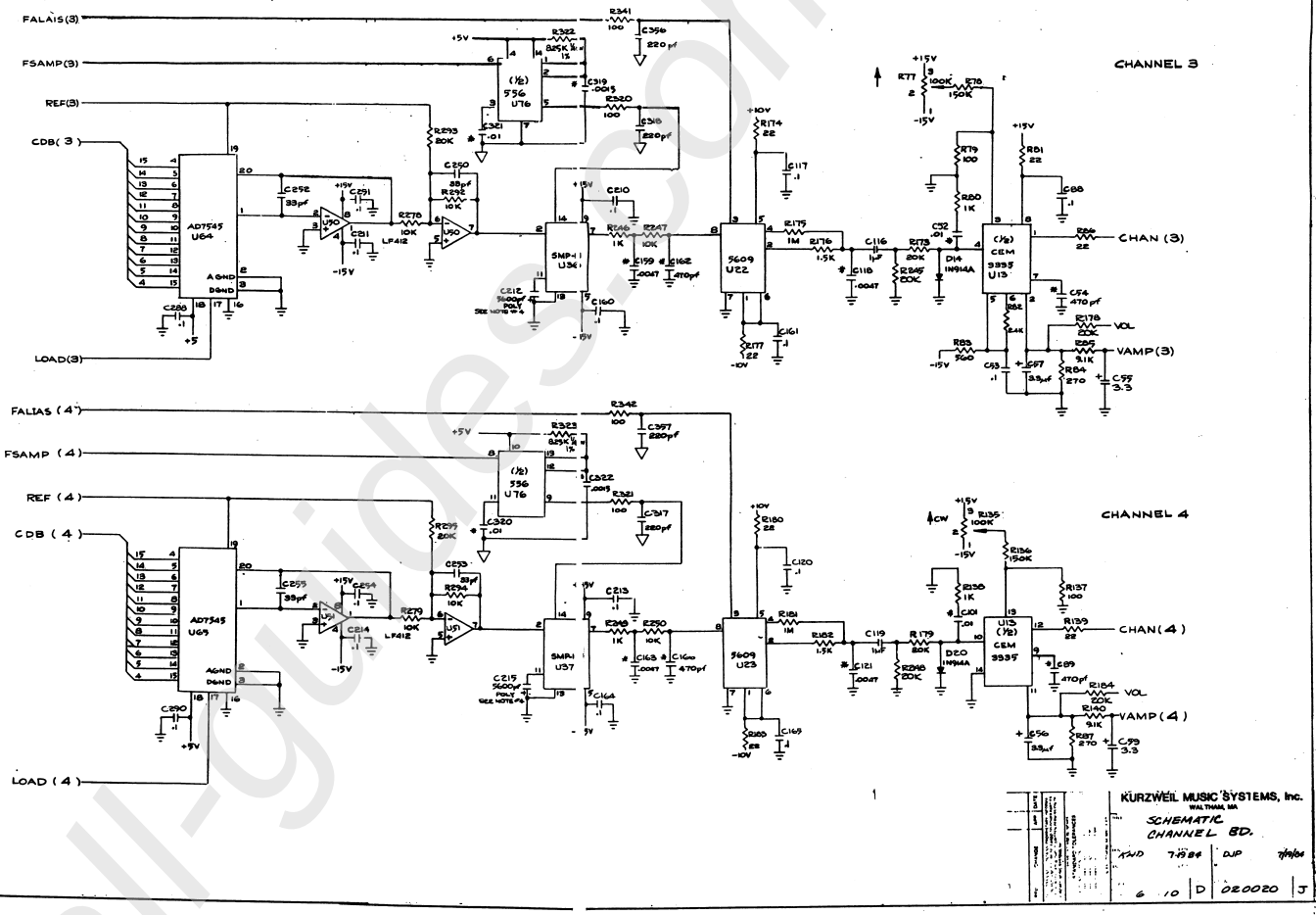


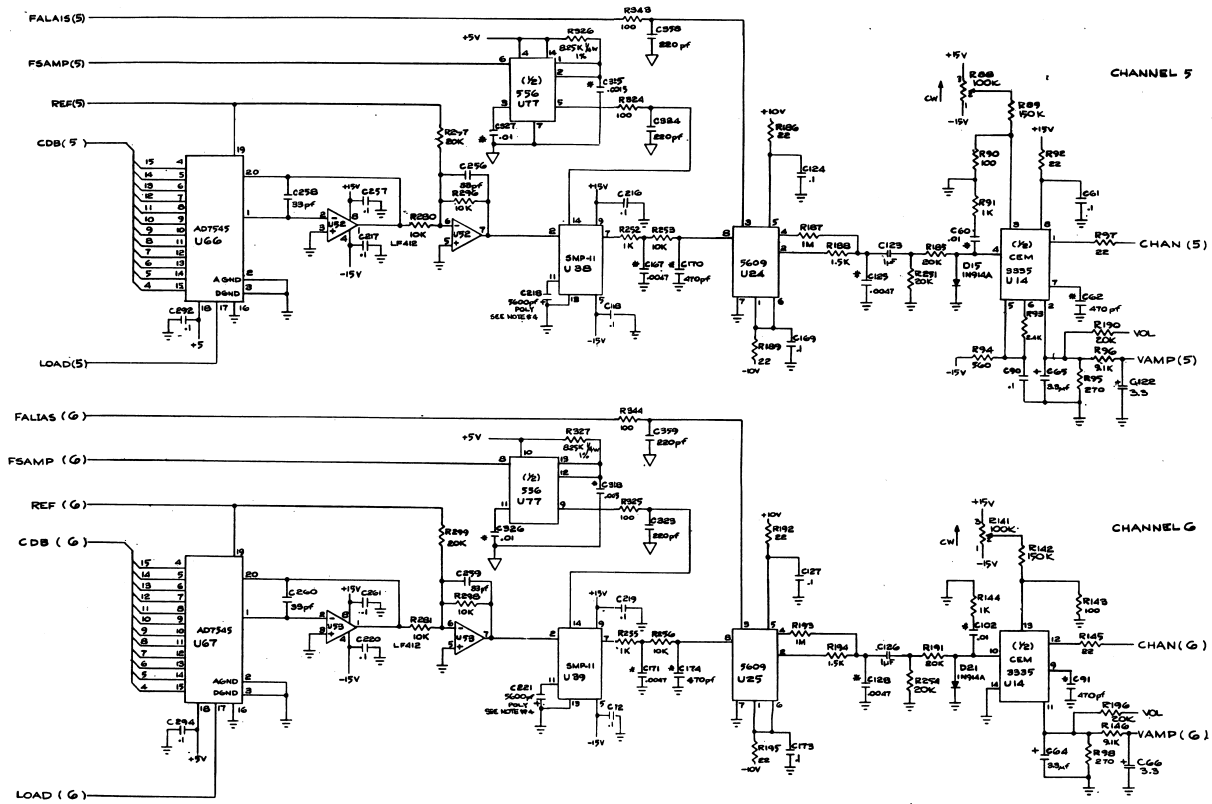
KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA
SCHEMATIC
CHANNEL BOARD
AMPDAC
SHT 2 OF 10 | D | 020020 | J



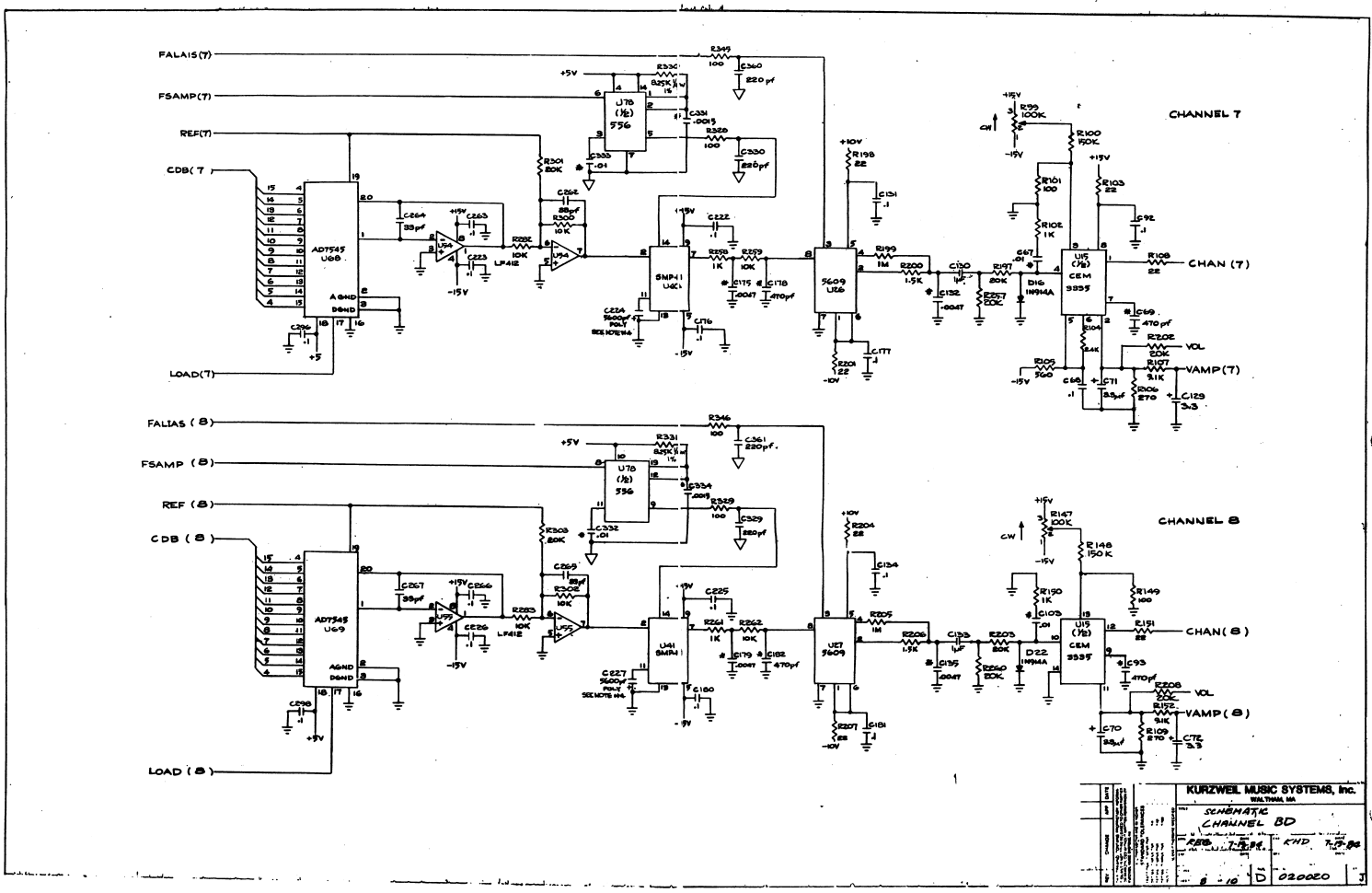


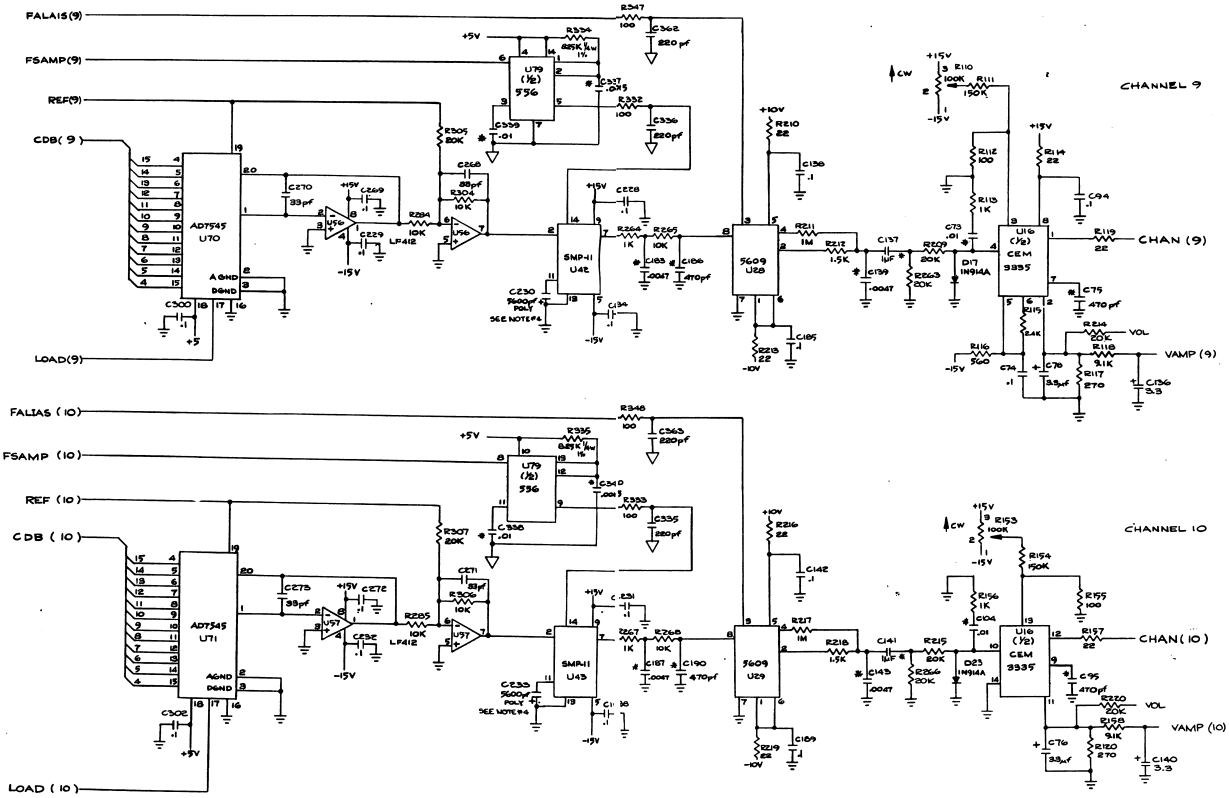






KURZWEIL MUSIC SYSTEMS, Inc. WALTHAM, MA	
SCHEMATIC CHANNELS BD	
KND 5-3-84	020020





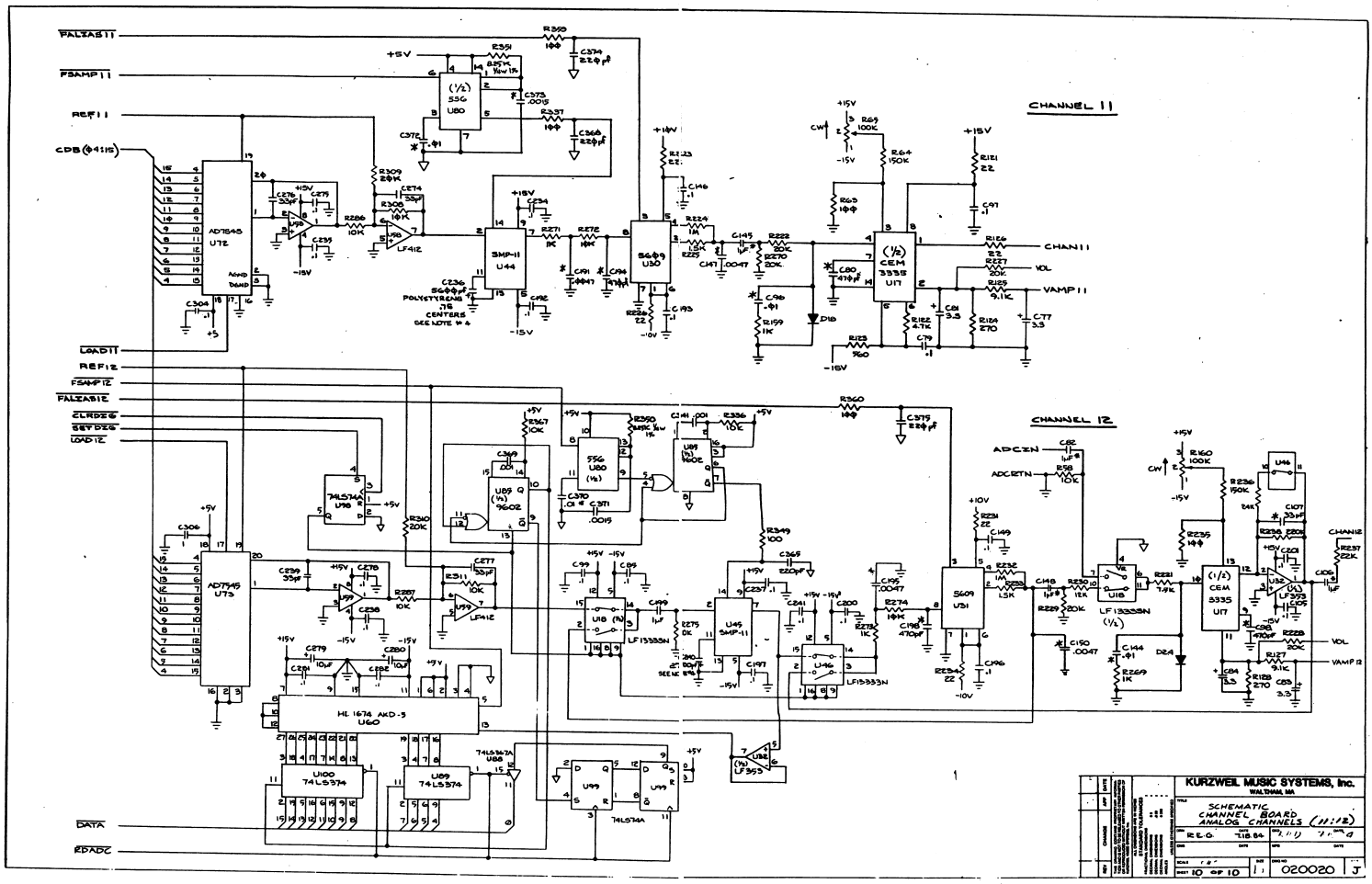
KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

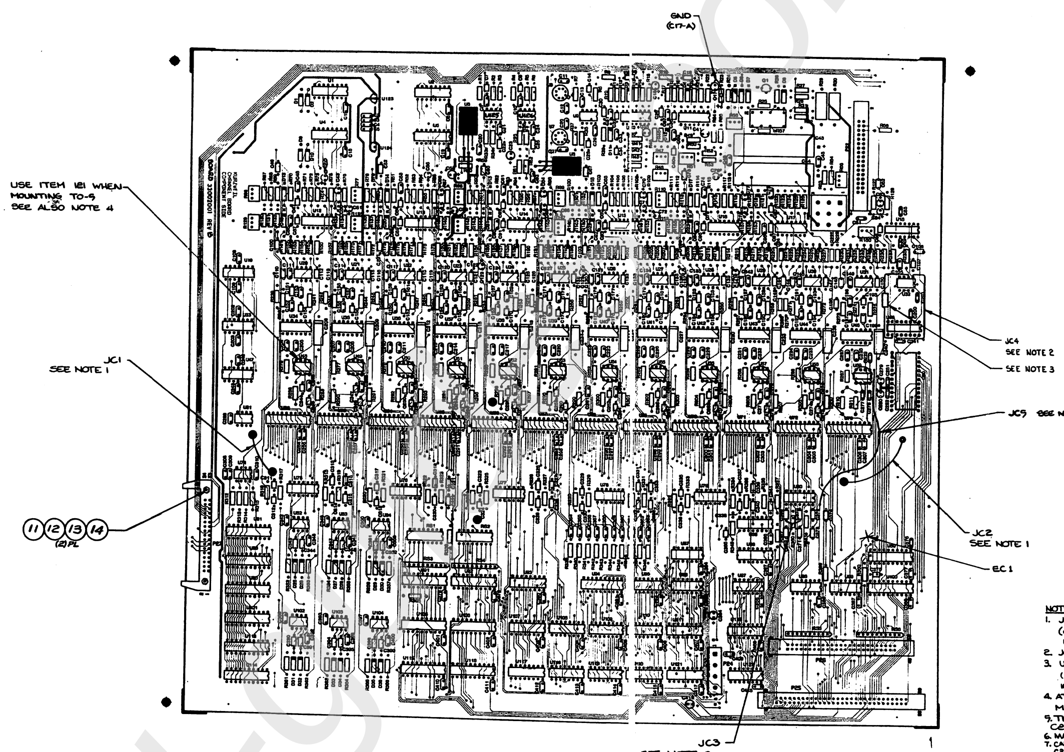
SCHEMATIC
CHANNEL BD

AND 7-19-84

020020

9 = 10





NOTES

1. JC1 & JC2 ARE INSTALLED AFTER TEST. (AWG 22 STRANDED COPPER, UL STYLE 1007, BLK)
2. JC3, 4, 5 ARE 30 GAGE KYNAR WIRE.
3. USE HEAT SHRINK ON LEADS OF 24KΩ RES. (ITEM 46) INSTALL IN IC HOLES FROM U46, 10 TO U32, 2 ON COMPONENT SIDE OF BOARD.
4. AT U48-99, LF412CN (DIP PATTERN) MAY BE USED AS ALTERNATIVE.
5. THE FOLLOWING ARE NOT INSTALLED: C285, 287, 289, 291, 293, 295, 297, 299, 301, 303, 305, 307, + 376.
6. MARK WITH KMS P/N 12002002 & APPROPRIATE REV. LTR.
7. CAPACITORS C206, C209, C212, C215, C218, C221, C224, C227, C230, C233, C236, C240 ARE HEAT SENSITIVE PARTS TO BE INSERTED POST-WAVE & ARE NOT TO BE WASHED IN A SOLVENT BATH; FREON, DEOL (OR DON TE)

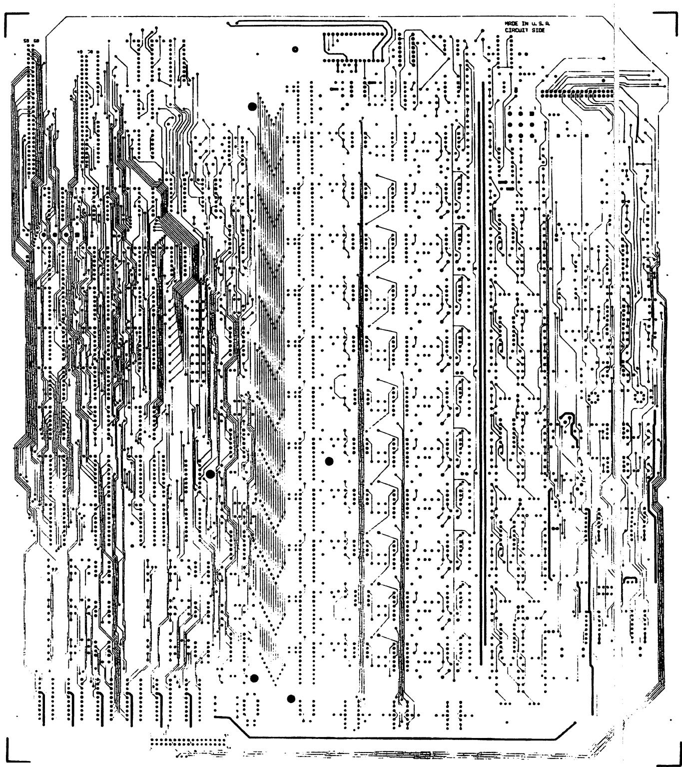
KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

TITLE	ASSEMBLY CHANNEL BOARD
DRN	KHD
DATE	7-5-84
CKD	
ENG	DB
DATE	4/9/85
MFG	
SCALE	1/1
SHEET	1 of 2
SIZE	D
DWG NO	12002002
REV	F

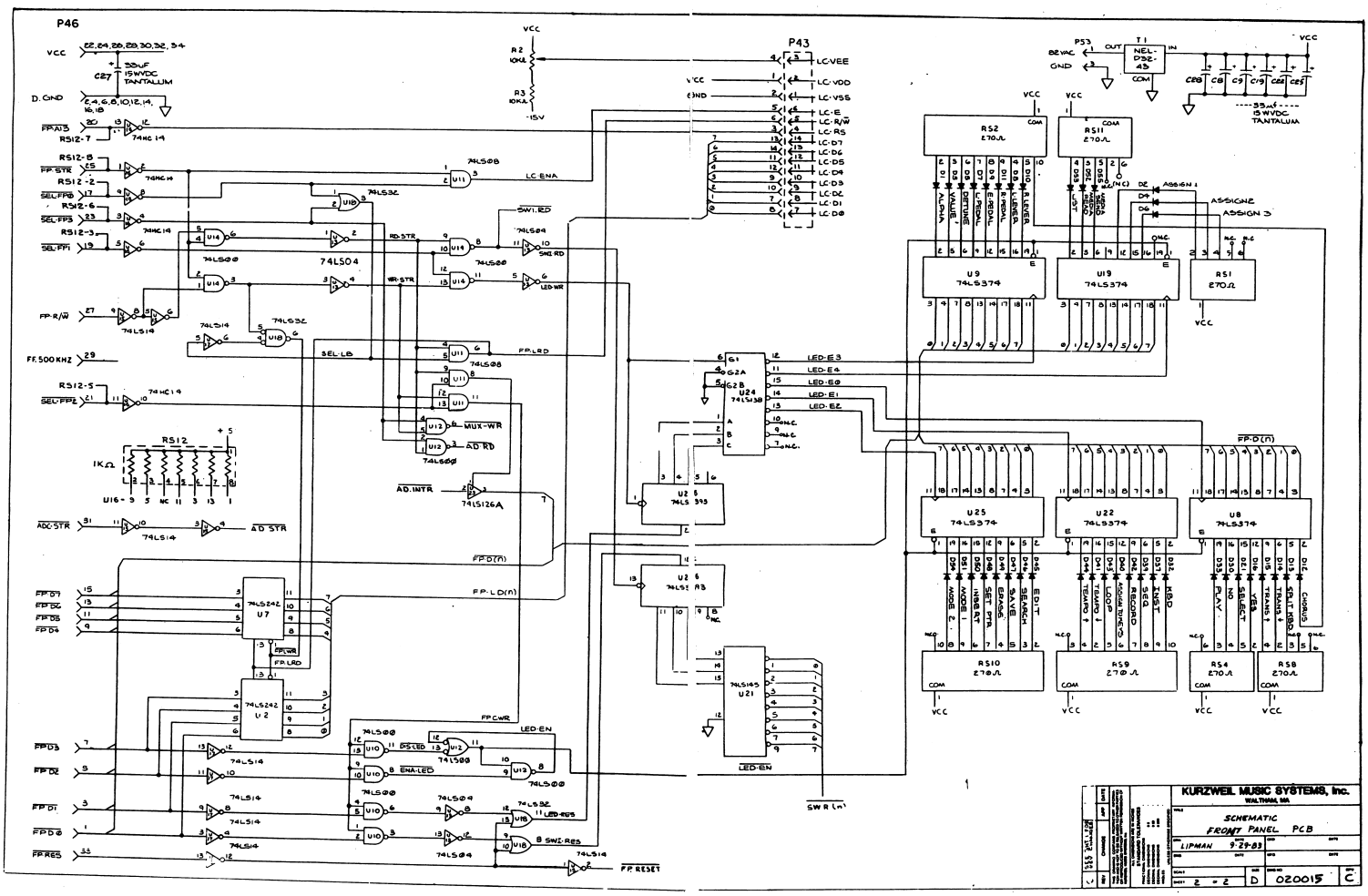
REV	CHANGE	APP	DATE
B	SHOW ORIENTATION OF POLY CAPS PER ECO ...	SAS	
C	ECO#0288 ADD NOTES 5 ...		
D	ADD U48 ...	SMB	
E	POLY KEY ADDED ...	SD	
F	AUTO INSERT CAPS 0300 ...		

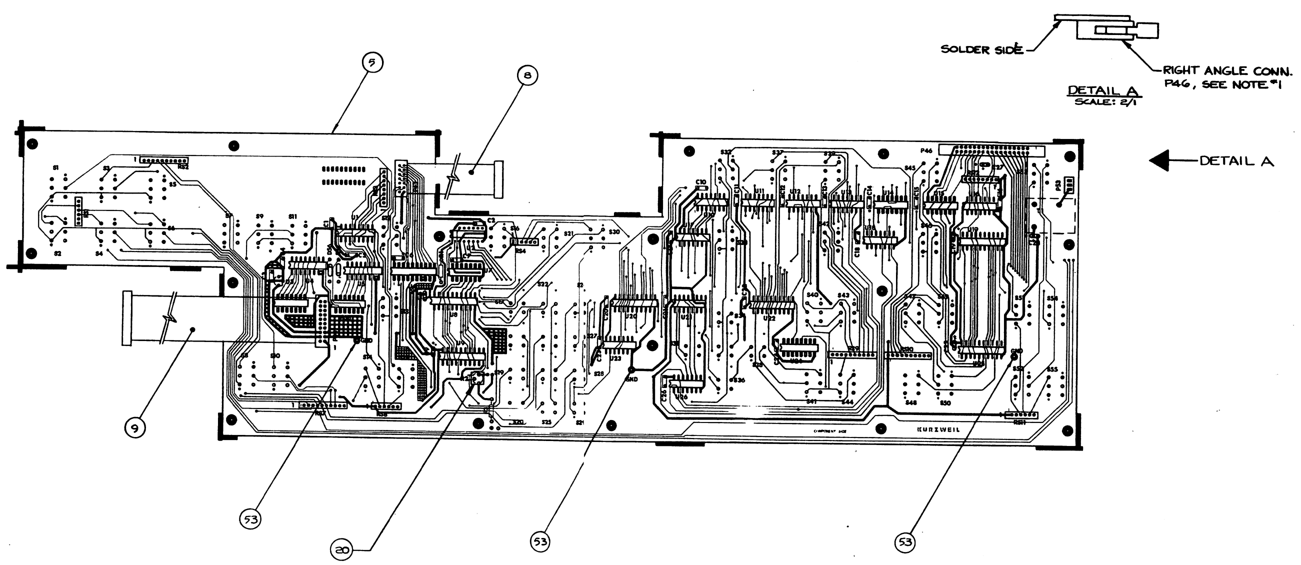
THIS DRAWING CONTAINS PROPRIETARY INFORMATION AND IS NOT TO BE RELEASED TO OTHER PARTIES OR REPRODUCED WITHOUT WRITTEN PERMISSION OF KURZWEIL MUSIC SYSTEMS, Inc.

ALL DIMENSIONS ARE IN INCHES
STANDARD TOLERANCES
FRACTIONAL DIMENSIONS
DECIMAL DIMENSIONS .XX
DECIMAL DIMENSIONS .XXX
DECIMAL DIMENSIONS .XXXX
ANGLES
UNLESS OTHERWISE SPECIFIED



KURZWEIL MUSIC SYSTEMS, Inc. WALTHAM, MA				
TITLE ASSEMBLY CHANNEL PCB (SOLDER SIDE)				
DRN K-D	DATE 10-11-84	CKD	DATE	
ENG	DATE	MFG	DATE	
SCALE	SIZE D	DWG NO 12002002	REV F	
SHEET 2 OF 2				





NOTES

1. P46 & T1 MOUNTED ON SOLDER SIDE.
2. MARK WITH KMS P/N 12001501 & APPROPRIATE REV LTR.

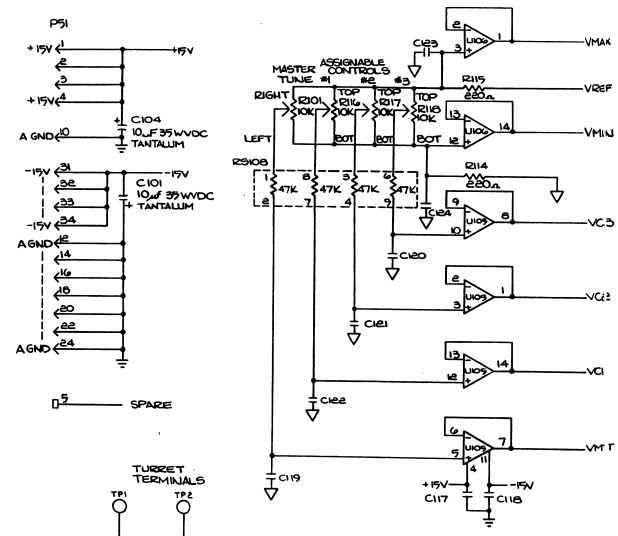
REV	CHANGE	APP	DATE
E	ECO NO. 0130 ITEM # 20		2-3-86 SAS
D	ECO # 0061		1-3-85 CJF
C	SEE ECO 0027		10/1/84 RO

STANDARD TOLERANCES

KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

TITLE: ASSEMBLY CONTROL PANEL PC BD

DRN: REG	DATE: JUN 11 '84	CKD	DATE
ENG	DATE	MFG	DATE
SCALE: FULL	SIZE: D	DWG NO: 120015	REV: E
SHEET 1 OF 1			



NOTES:

UNLESS OTHERWISE SPECIFIED

1. DISCRETE RESISTORS ARE 1/4 W, 5%
2. OPAMPS ARE LM348 QUADS.
3. CAPACITORS ARE 0.1µF MONO CER.
4. NETWORKS ARE SINGLE IN-LINE.

REV	CHANGE	CHK'D
A	RELEASED	

KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

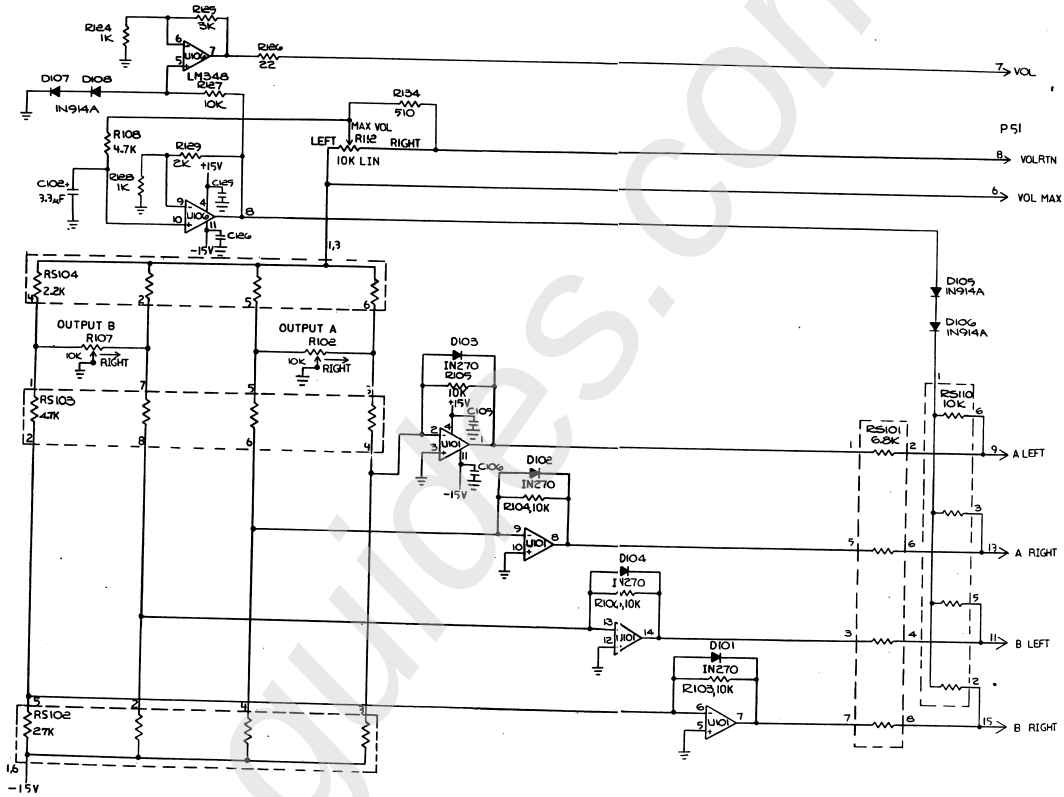
TITLE: SCHEMATIC PCB CONTROL PANEL 250RMX

DWN: DJP

APPROVED ONLY FOR	QUOTE	CHK'D	
	SAMPLE	CHK'D	
	PILOT	CHK'D	
APPROVED FOR PRODUCTION		CHK'D	
		PROD'N	7/7/87
		MATL	

SCALE: 1/1 SHEET 4 OF 4

SIZE: D DRWG NO: 08041000 REV: D

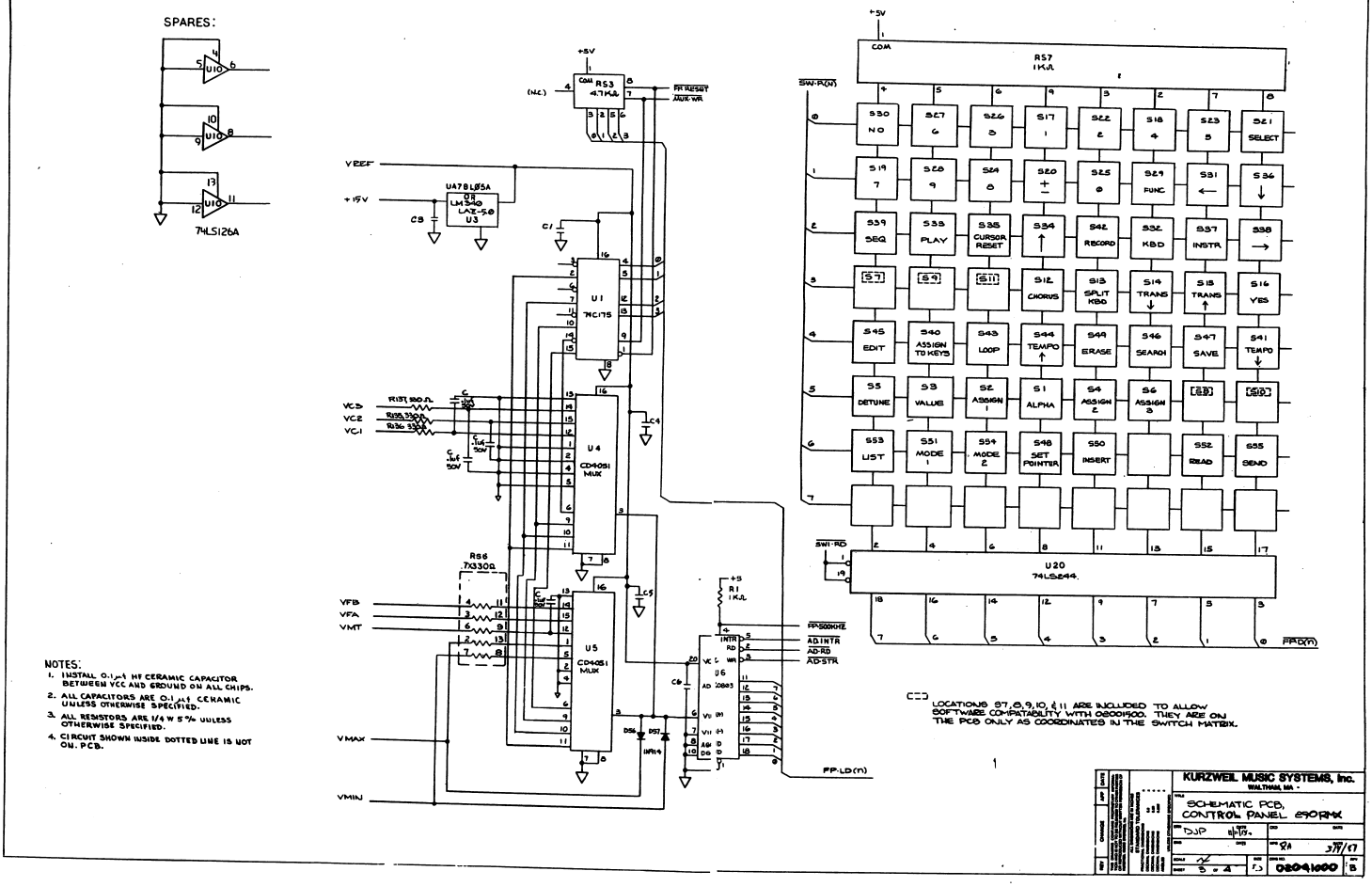


KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

SCHEMATIC, PCB
CONTROL PANEL 250RMX

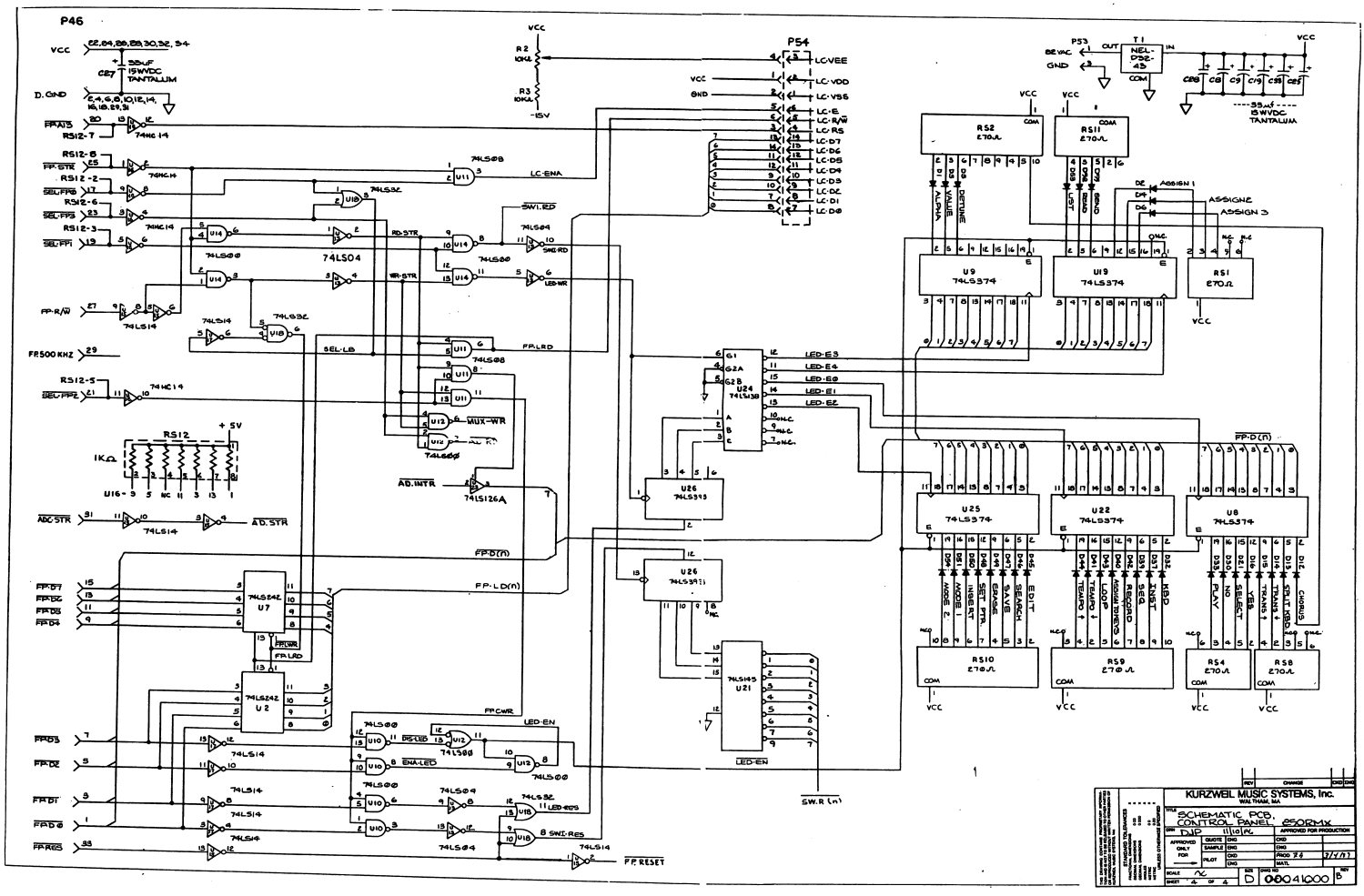
DJP 4/19/86

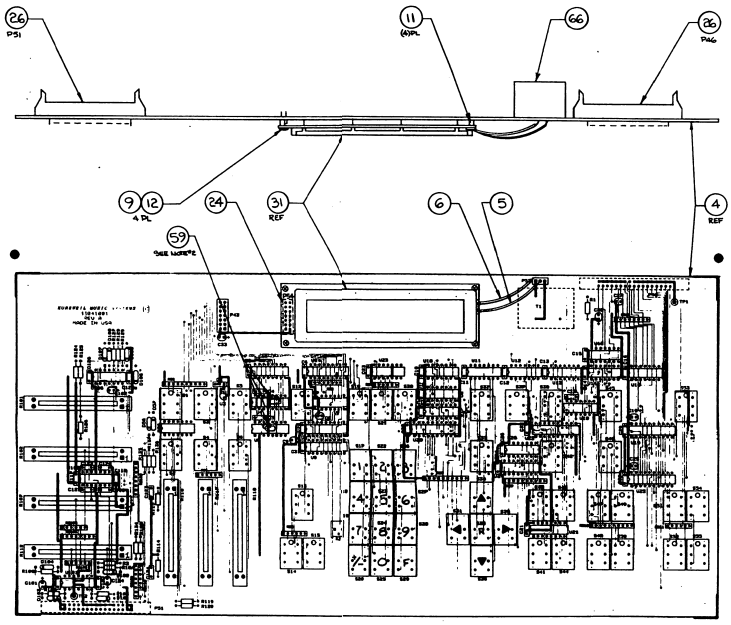
SCALE NONE
SHEET 2 OF 4
SIZE D
DWG NO 020410008
REV B



NOTES:
1. INSTALL 0.1μf HF CERAMIC CAPACITOR BETWEEN VCC AND GROUND ON ALL CHIPS.
2. ALL CAPACITORS ARE 0.1μf CERAMIC UNLESS OTHERWISE SPECIFIED.
3. ALL RESISTORS ARE 1/4 W 5% UNLESS OTHERWISE SPECIFIED.
4. CIRCUIT SHOWN INSIDE DOTTED LINE IS NOT ON PCB.

KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA
SCHEMATIC PCB, CONTROL PANEL 250RMX
DJP 8/1/87
RA 3/11/87
SCALE NONE SHEET 3 of 4
08001000 REV B





KURZWEIL MUSIC SYSTEMS, INC.
CONTROL PANEL 250RMX
AA * 4322 1/87
SILKSCREEN

ARTWORK BY: ANTAL ASSOCIATES, INC.

NOTES:
1. MARK WITH KMS PN: 12041001 & APPROPRIATE REV LTR.
2. ADD CAP (ITEM#39) FROM U4-PIN 13 TO U4-PIN 2 &
ADD CAP (ITEM#39) FROM U4-PIN 14 TO U4-PIN 4 &
ADD CAP (ITEM#39) FROM U4-PIN 12 TO U4-PIN 15 &
ADD CAP (ITEM#39) FROM U5-PIN 2 TO U5-PIN 13 ALL ON COMP SIDE.

REV	CHANGE	CHD	DWG
B	ADDED CAPS PER ECO 5615		
A	RELEASED		

KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

TITLE: ASSY. CONTROL PNL. 250RMX

DRN: JAF 9.24.87 APPROVED FOR PRODUCTION

APPROVED ONLY FOR	QUOTE	DWG	CHD
	SAMPLE	DWG	DWG
	PILOT	CHD	PROD
		DWG	QUAL

SCALE 1:1 SIZE D DWG NO 12041001 REV B

KURZWEIL MUSIC SYSTEMS, INC.
CONTROL PANEL 250RMX
AA # 4352 1/87
CIRCUIT SIDE

ARTWORK BY: ANTAL ASSOCIATES, INC.

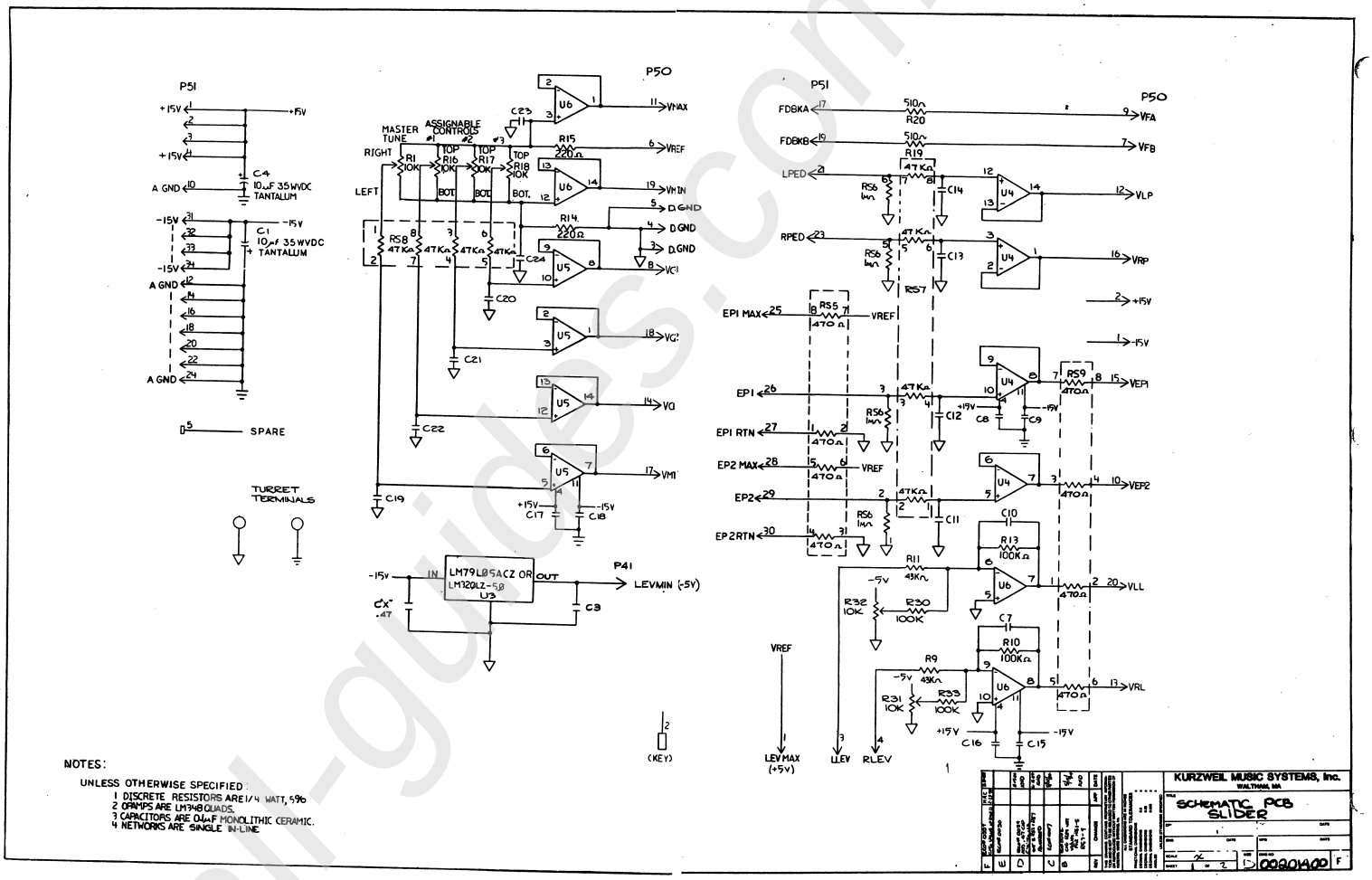
REV	CHANGE	CHK	ENG
	SEE SHT. 1		

KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

TITLE: ASSY. CONTROL PNL 250 RMX

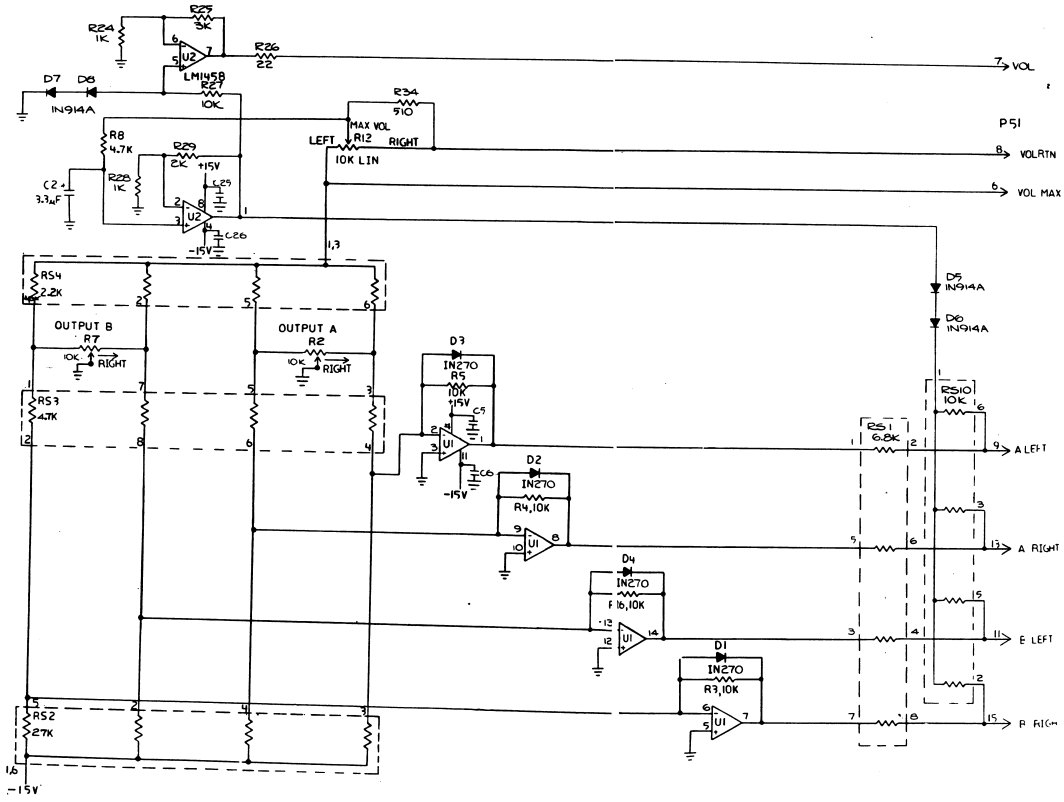
DRN			APPROVED FOR PRODUCTION
APPROVED ONLY FOR →	QUOTE	ENG	CHK
	SAMPLE	ENG	ENG
	PILOT	CHK	PROD
		ENG	MATL

SCALE 1:1 SHEET 2 OF 2 | SIZE D | DWG NO 2041001 | REV B



NOTES:

UNLESS OTHERWISE SPECIFIED:
1 DISCRETE RESISTORS ARE 1/4 WATT, 5%
2 OPAMPS ARE LM348 QUADS.
3 CAPACITORS ARE 0.1μF MONOLITHIC CERAMIC.
4 NETWORKS ARE SINGLE IN-LINE

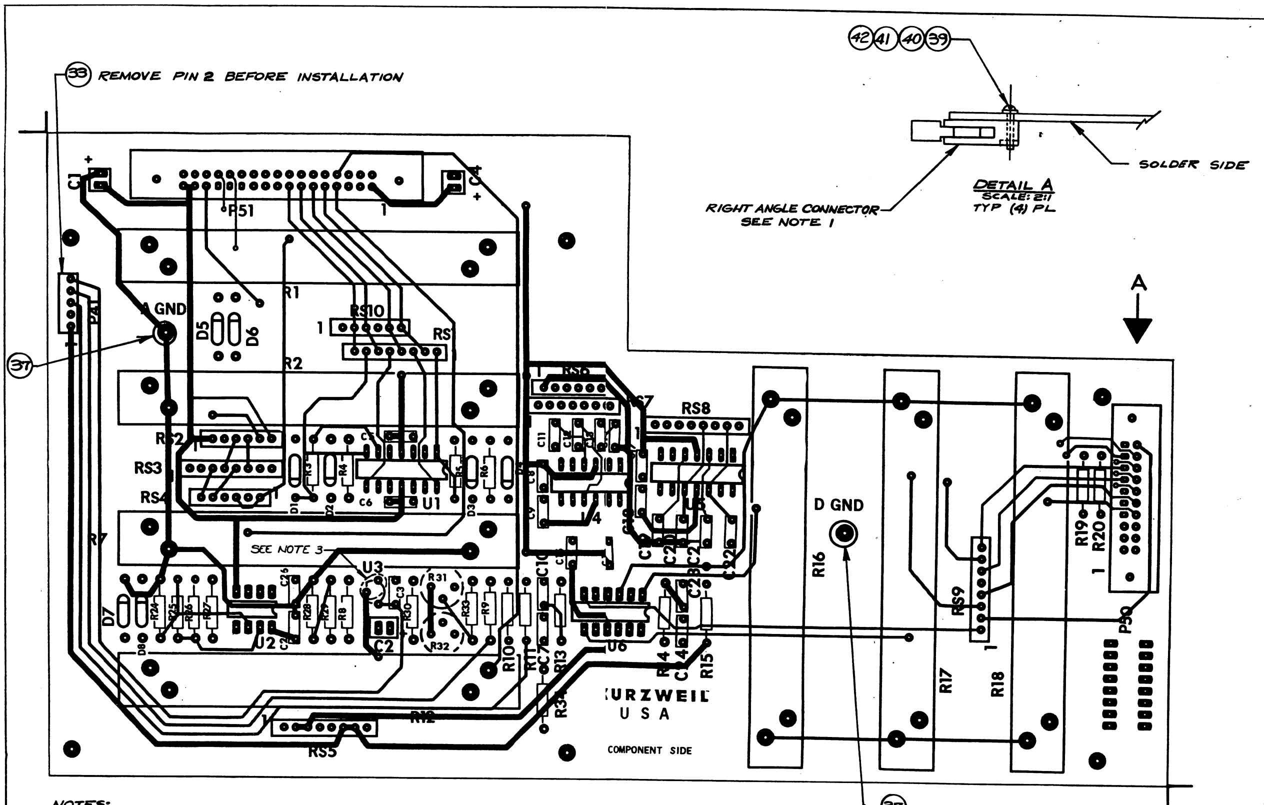


KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

SLIDER PCB

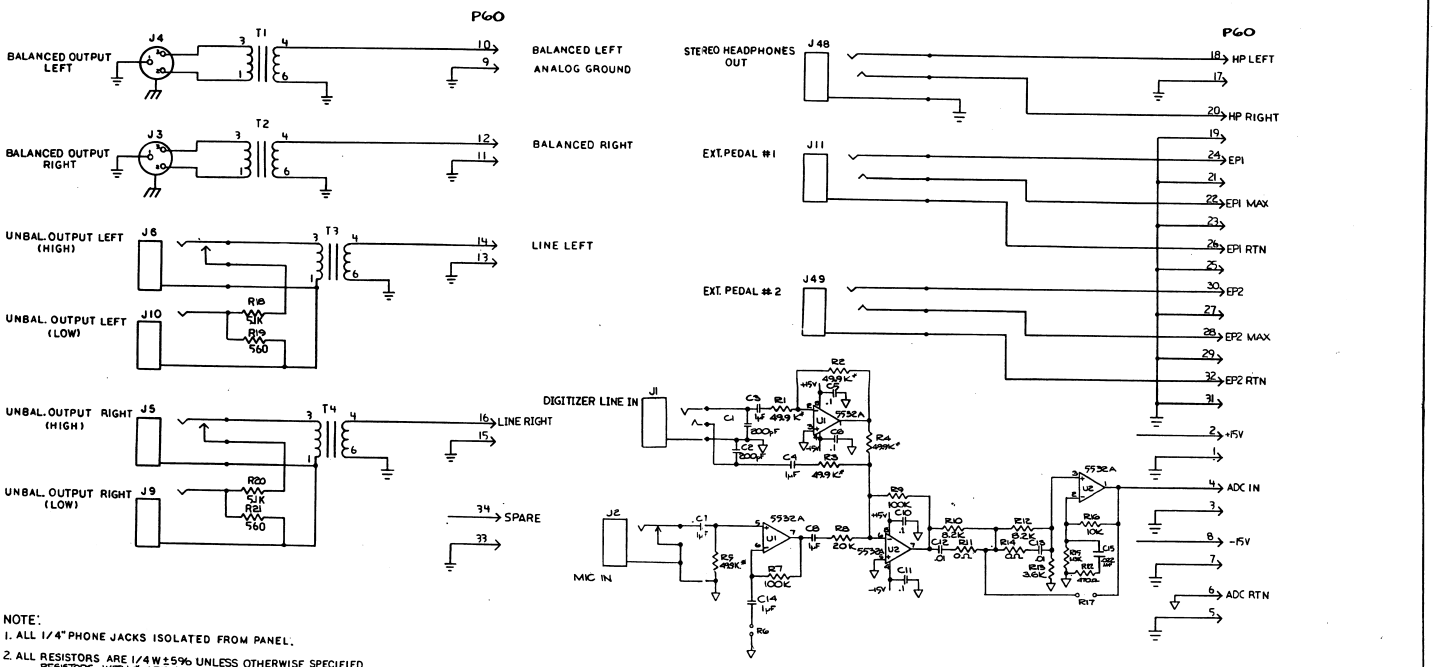
SIZE D | DWG NO 020014 | REV T

SHEET 2 OF 2



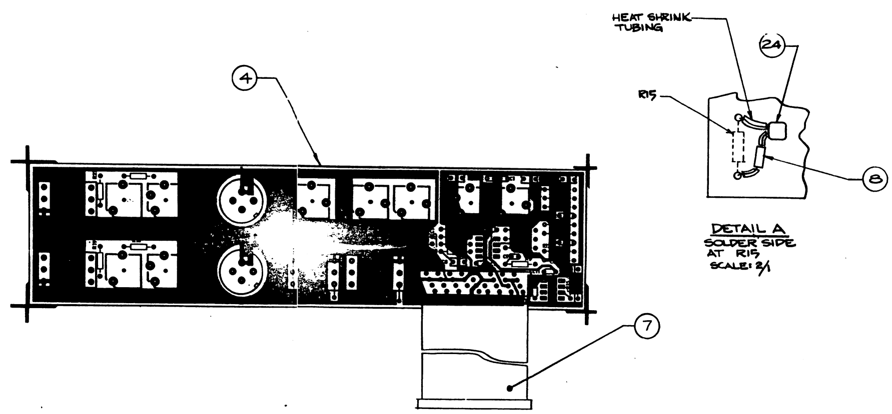
NOTES:
1. P50 & P51 ARE ON SOLDER SIDE ON PC BD.
R31 & R32 ARE ON SOLDER SIDE OF PC BD.
2. MARK WITH KMS P/N 12001401 & APPROPRIATE REV. LTR.
3. ADD .47µf CAP, (ITEM 32 KMS P/N 58000805), TO SOLDER SIDE OF U3.

	KURZWEIL MUSIC SYSTEMS, Inc. WALTHAM, MA
TITLE	ASSY., SLIDER PCB
DRN	KHD 5/29/84
ENG	7/25/84
SCALE	2/1
SHEET	1 of 1
DWG NO	120014
REV	G



NOTE:
1. ALL 1/4" PHONE JACKS ISOLATED FROM PANEL.
2. ALL RESISTORS ARE 1/4 W ±5% UNLESS OTHERWISE SPECIFIED RESISTORS WITH * ARE 1/4W ±1%
3. R11,R14 ARE 1/4 W ±5% 0 OHMS, R17 IS OMITTED.

KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA
SCHEMATIC PC BD
AUDIO
DRN REG DEC 10 '86
CHK
APP
MFG
020110
D



NOTES
1. MARK WITH KMS PART NO. 12011001 & APPROPRIATE REV LTR
2. USE .03 HEAT SHRINK TUBING (BLACK) AS SHOWN

REV	CHANGE	APP	DATE
E	CHANGES PER ECO #0205		SAS 10-27-86
D	ECO #0138		SAS 2-10-86
C	ADD HEAT SHRINK		
B	ECO 0089 MOD. TO SOLDER SIDE ADD (24) + (8)	DB 4/4/85	4/3/85
A	ECO #0065 RELEASED		1-30-85 DJP

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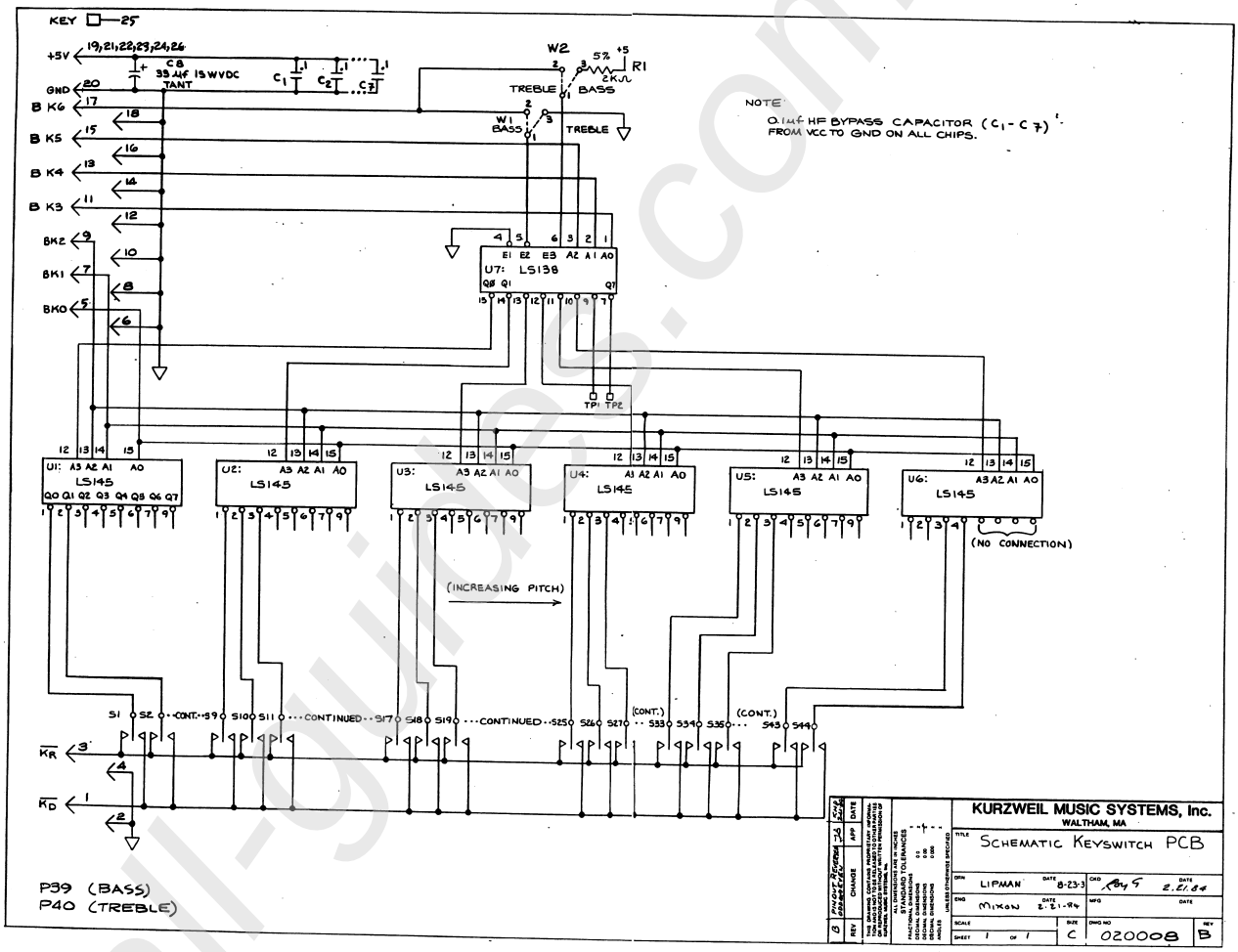
UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
STANDARD TOLERANCES
FRACTIONAL DIMENSIONS ±
DECIMAL DIMENSIONS 0.0 ±
DECIMAL DIMENSIONS 0.00 ±
DECIMAL DIMENSIONS 0.000 ±
ANGLES ±

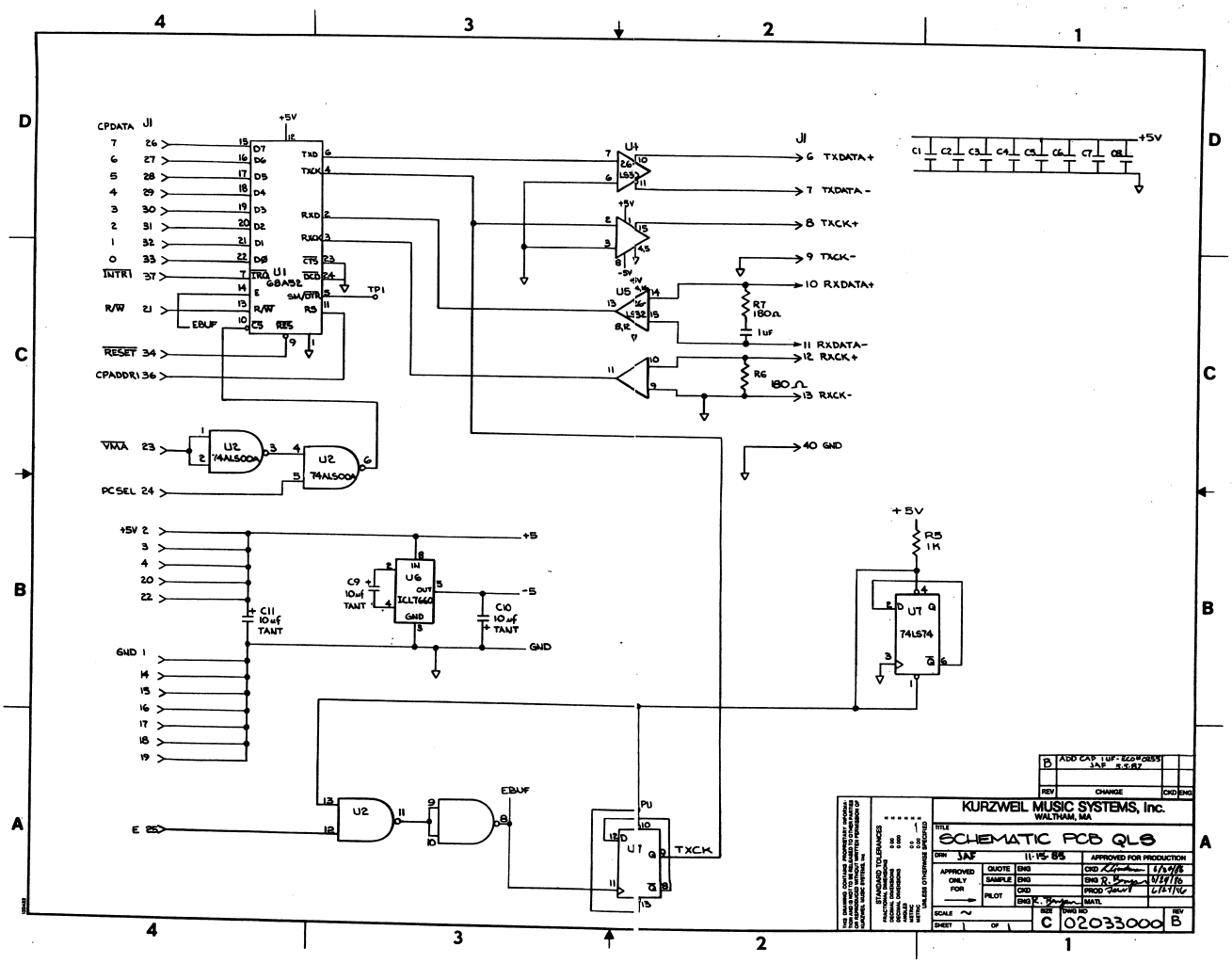
KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

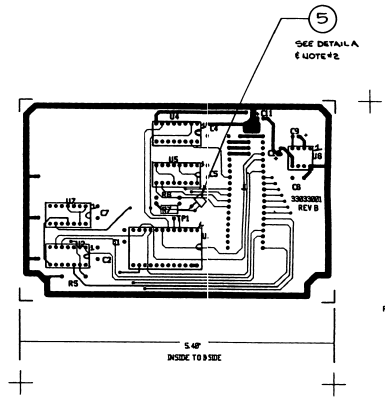
TITLE: ASS'Y PC BD AUDIO

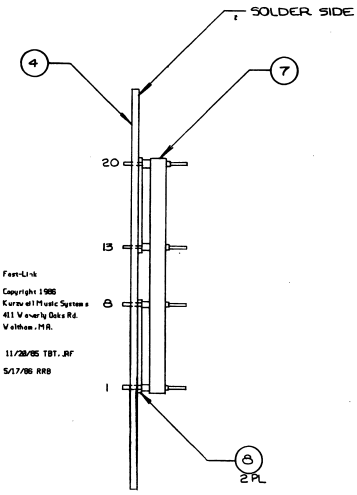
DRN	DATE	CKD	DATE
R.E.G	DEC 10, 84	XFS	2.5.85
ENG	DATE	MFG	DATE
DB			

SCALE	SHEET	SIZE	DWG NO	REV
1:1	1 OF 1	C	120110	E









Fast-Link

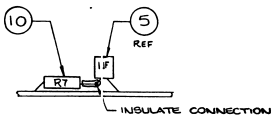
11/28/85 TBT. JAF

REV B 5/17/86 RRB

SIDE VIEW SHOWING INSTALLATION
OF ITEMS 7 AND 8
SCALE 2:1

NOTES:

1. MAKE PER KMS WORKMANSHIP MANUAL 06000100, REV A.
2. TO INSTALL 52001301 (ITEM #5), LIFT RIGHT SIDE OF R7 (ITEM #10) & INSERT CAP TO LIFTED LEAD OF R7 & PAD PREVIOUSLY OCCUPIED BY R7, AS SHOWN IN DETAIL 'A'.



DETAIL A
SCALE: NONE

REV	CHANGE	CKD	ENG
D	ADD [illegible] PER ECO 0455 JAF 5/22/86		
A			

KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

TITLE: ASSY PCB QLS

DRN JAF 5-22-86 — APPROVED FOR PRODUCTION

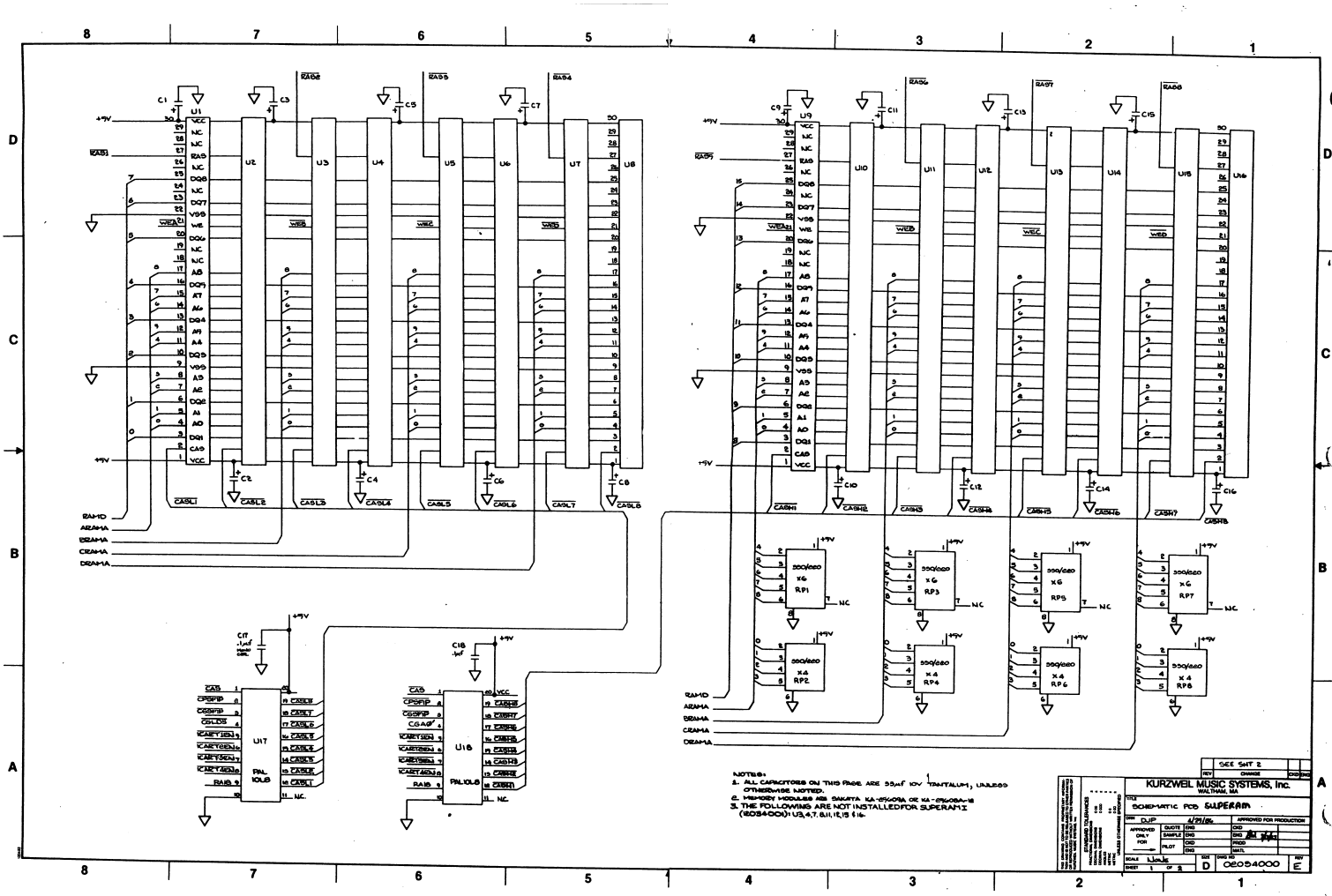
APPROVED ONLY FOR →			
	QUOTE	ENG	
	SAMPLE	ENG	
	PILOT	CKD	
		ENG	

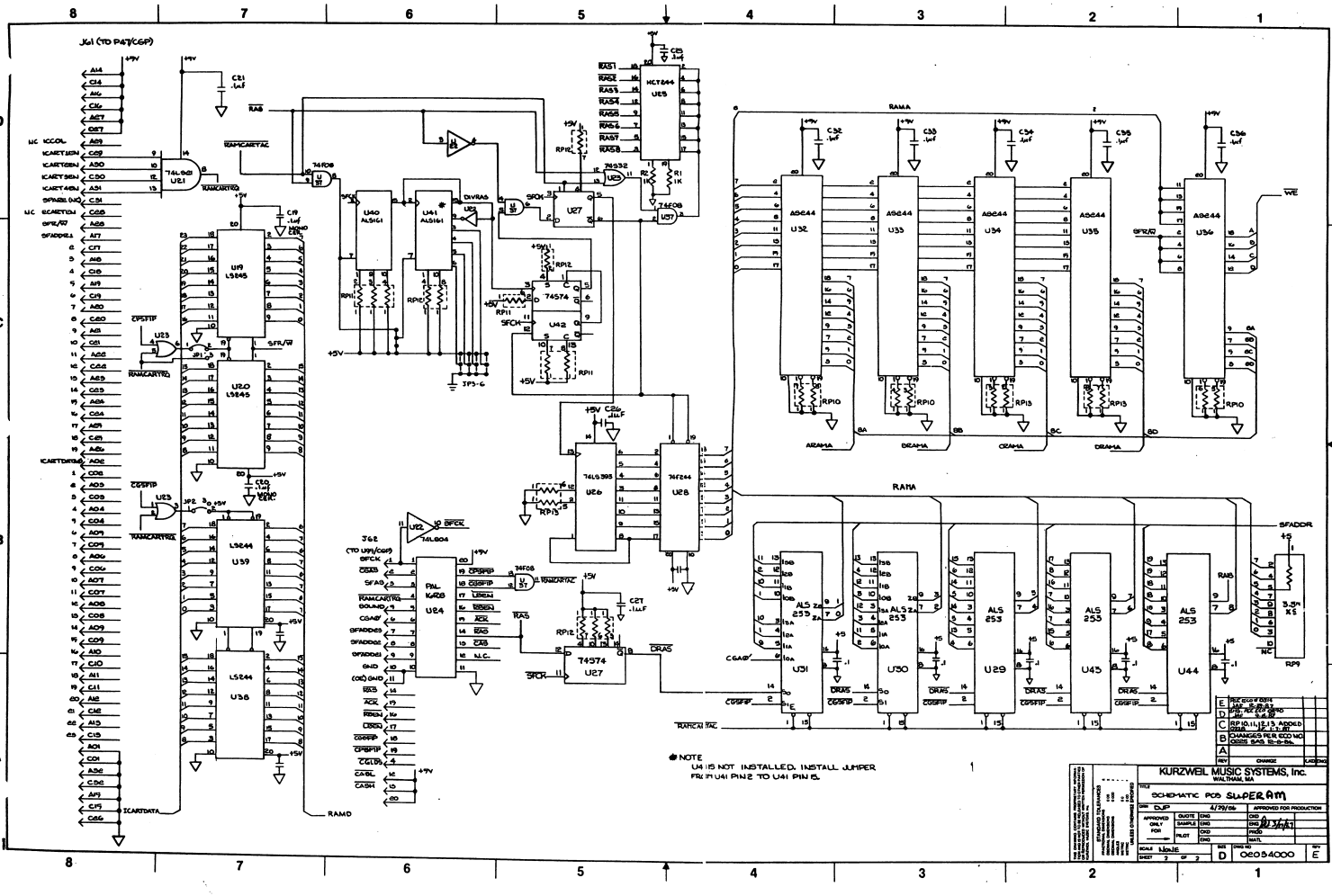
CKD [illegible] 6/11/86
ENG R. Bonisa 6/11/86
PROD [illegible] 6/11/86
MATL

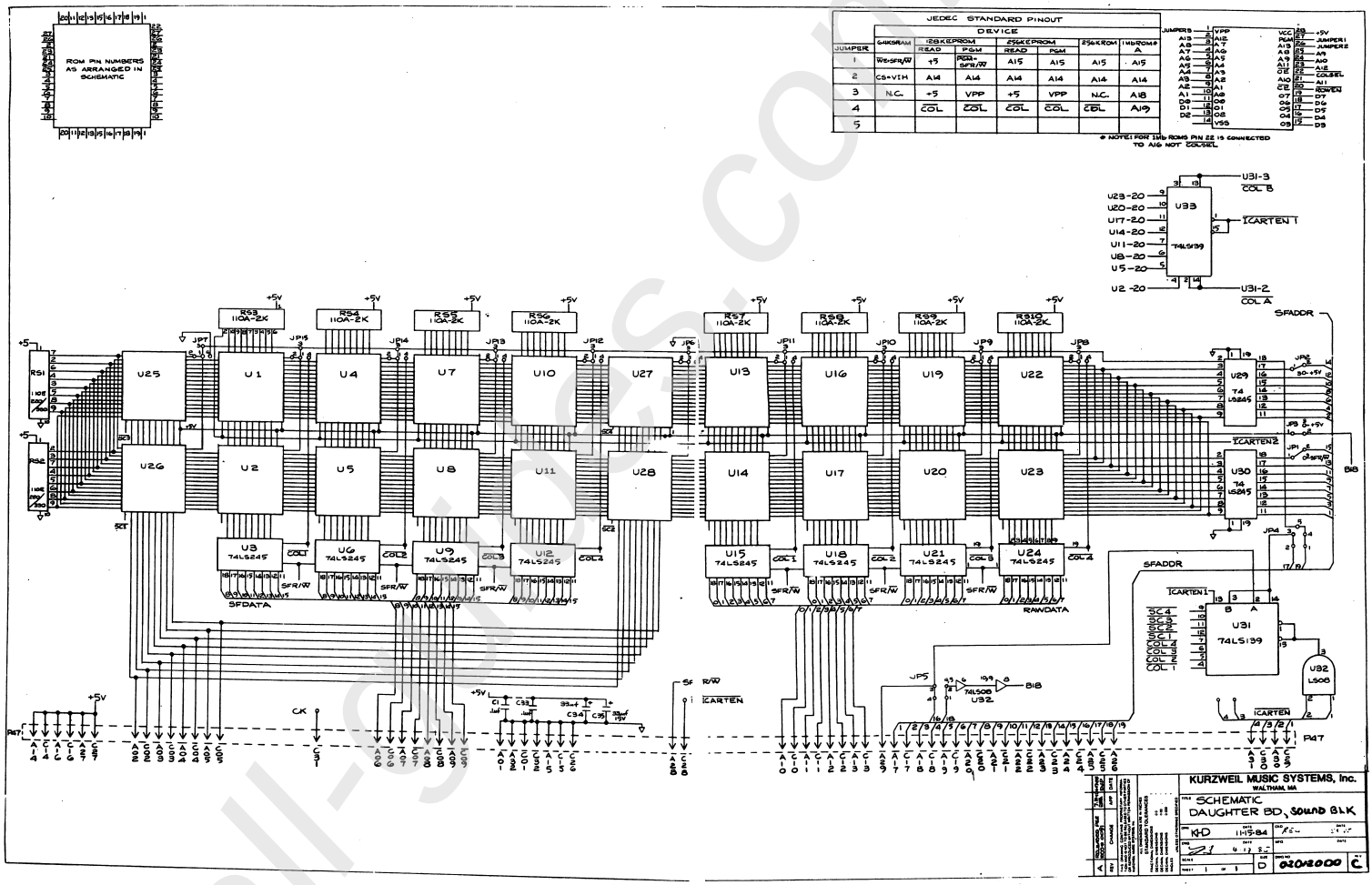
SCALE 1:1 — SIZE C — DWG NO 12033001 — REV D

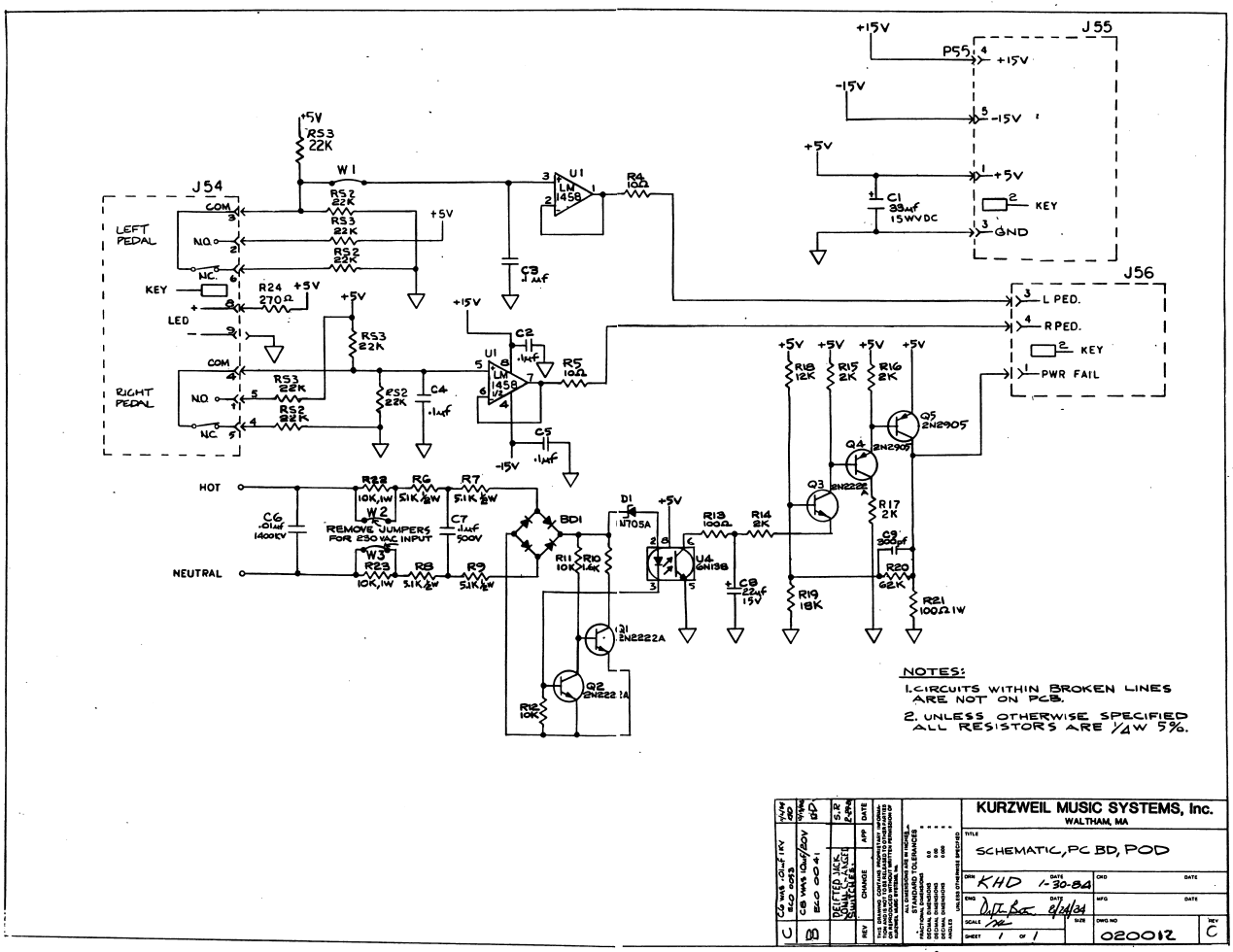
SHEET 1 OF 1

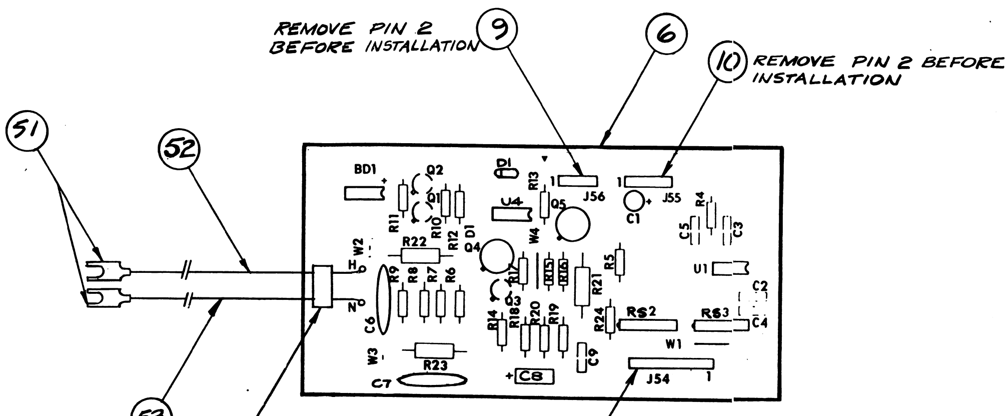
STANDARD TOLERANCES
DECIMAL DIMENSIONS
ANGULAR
METRIC
UNLESS OTHERWISE SPECIFIED



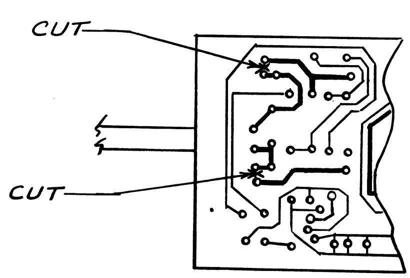








TOP VIEW (COMP. SIDE)



BOTTOM VIEW (SOLDER SIDE)

SEE NOTE 2

VAR.	V
01	110
02	220

SEE NOTE 2

NOTES:

1. MARK WITH KMS P/N 12001201/02 & APPROPRIATE REV LTR
2. VAR 02: 1) REMOVE (DO NOT INSTALL) W2 & W3 2) CUT ETCH ON SOLDER SIDE AT LOCATIONS SHOWN IN "BOTTOM" VIEW OF BD.

REV	CHANGE	APP	DATE
D	ECO 0053 IT. 52 WAS IT. 49 IT. 53 WAS IT. 50 C6 WAS .01uf@1KV		11/1/84 KHD
C	C8 WAS 10uf/20V ECO 0041		10/19/84 KHD
B	RS2 WAS U2 RS3 WAS U3 CHG. PER ARTWORK		KHD 7-10-84

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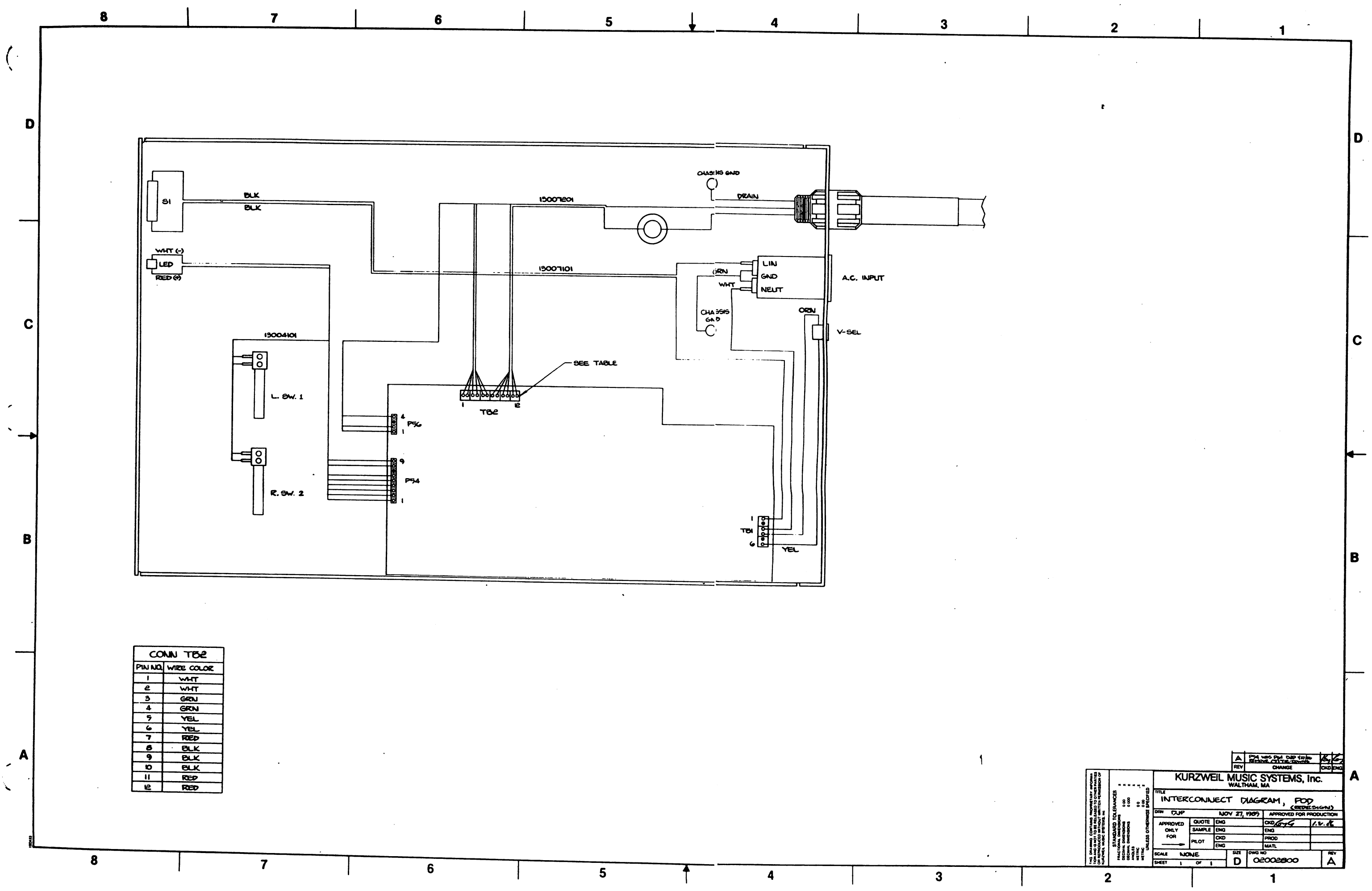
ALL DIMENSIONS ARE IN INCHES
STANDARD TOLERANCES
FRACTIONAL DIMENSIONS ±
DECIMAL DIMENSIONS 0.0 ±
DECIMAL DIMENSIONS 0.00 ±
DECIMAL DIMENSIONS 0.000 ±
ANGLES ±
UNLESS OTHERWISE SPECIFIED

KURZWEIL MUSIC SYSTEMS, Inc.
WALTHAM, MA

TITLE: PCB ASSY POD

DRN KHD DATE 3-24-84 | CKD DATE
ENG DATE | MFG DATE
SCALE 1/1 | SHEET 1 OF 1 | SIZE B | DWG NO. 120012 | REV. D



CONN TB2	
PIN NO.	WIRE COLOR
1	WHT
2	WHT
3	GRN
4	GRN
5	YEL
6	YEL
7	RED
8	BLK
9	BLK
10	BLK
11	RED
12	RED