Better sound through research®

Bose® Lifestyle®
Model CD5 Series I Music Center

Note: The first series CD5 can be distinguished from the later CD5V and CD5VII by the serial number label located on the bottom of the unit. The CD5 will not have a V on the serial number label, the CD5V will have a V, and the CD5V2 will have a V with the number 2 above the V.

Service Manual

Part Number 174798 REV 01

Contents

CAUTION: THE LIFESTYLE® MODEL 5 MUSIC CENTER CONTAINS NO USER SERVICEABLE PARTS. TO PREVENT WARRANTY INFRACTIONS, REFER SERVICING TO WARRANTY SERVICE STATIONS OR FACTORY SERVICE.

SAFETY INFORMATION

1. Parts that have special safety characteristics are identified by the ⚠ symbol on schematics or by special notes in the part lists. Use only replacement parts that have critical characteristics recommended by the manufacturer.

2. Make leakage current or resistance measurements to determine that exposed parts are acceptably insulated from the supply circuit before returning the unit to the customer. Use the following checks to perform these measurements:

A. Leakage Current Hot Check: With the unit completely assembled, plug the AC line cord directly into a 120V AC outlet. (Do not use an isolation transformer during this test.) Use a leakage current tester or a metering system that complies with American National Standards Institute (ANSI) C101.1 "Leakage Current for Appliances" and Underwriters Laboratories (UL) 1492 (71). With the unit's AC switch first in the ON position and then in the OFF position, measure from a known earth ground (metal water pipe, conduit, etc.) to all exposed metal parts of the unit (antennas, handle bracket, metal cabinet, screw-heads, metallic overlays, control shafts, etc.), especially any exposed metal parts that offer an electrical return path to the chassis. Any current measured must not exceed 0.5 milliamp. Reverse the unit's power cord plug in the outlet and repeat the test. **ANY MEASUREMENTS NOT WITHIN THE LIMITS SPECIFIED HEREIN INDICATE A POTENTIAL SHOCK HAZARD THAT MUST BE ELIMINATED BEFORE RETURNING THE UNIT TO THE CUSTOMER.**

B. Insulation Resistance Test Cold Check: (1) Unplug the power supply and connect a jumper wire between the two prongs of the plug. (2) Turn on the power switch of the unit. (3) Measure the resistance with an ohmmeter between the jumpered AC plug and each exposed metallic cabinet part on the unit. When the exposed metallic part has a return path to the chassis, the reading should be between 1 and 5.2M Ω. When there is no return path to the chassis, the reading must be "infinite". If it is not within the limits specified, there is the possibility of a shock hazard, and the unit must be repaired and rechecked before it is returned to the customer.

ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICE HANDLING

This unit contains ESDS devices. We recommend the following precautions when repairing, replacing or transporting ESDS devices:

- Perform work at an electrically grounded work station.
- Wear wrist straps that connect to the station or heel straps that connect to conductive floor mats.
- Avoid touching the leads or contacts of ESDS devices or PC boards even if properly grounded. Handle boards by the edges only.
- Transport or store ESDS devices in ESD protective bags, bins, or totes. Do not insert unprotected devices into materials such as plastic, polystyrene foam, clear plastic bags, bubble wrap or plastic trays.

SPECIFICATIONS

General

Dimensions:	2.5"H x 15"W x 9"D (6 x 38 x 23cm)
Weight:	3.7lb. (1.7kg)
Finish:	Plastic, in-mold brushed aluminum finish
Power Input:	Detachable power pack, 12VAC compatible with each country's power requirements
Serial Data Output:	2-3.5mm stereo jacks, Tip: Serial data output, Ring: +12Vdc turn on output.
Power:	14 Watts max.
Input Impedance (@ 1kHz, max. volume):	5kΩ @ aux./video input, 100kΩ @ tape input
Output Impedance:	600Ω @ Speaker A, B output, 1kΩ @ tape output
Distortion:	≤ 0.02% THD @ 1kHz, 2Vrms
S/N Ratio:	≥ 105dB (A-weighted, max. volume)
Headphone Output (32Ω):	45mW (max. output)
Channel Separation:	70dB
Muting (A, B outputs):	-80dB
Max. Output Level:	5Vrms (@ 1kHz, THD < .12%)

FM Electrical

Antenna Input:	US: 75Ω F connector, Europe: 75Ω PAL
Usable Sensitivity:	US: 12dBf, Europe: 17dBf
50dB quieting sensitivity:	Mono: US: 15dBf, Europe: 20dBf Stereo: US: 37dBf, Europe: 42dBf
S/N ratio (65dBf input):	Mono: 75dB, Stereo: 70dB
THD (65dBf, 1kHz input):	Mono: ≤ 0.2%, Stereo: ≤ 0.3%
Capture Ratio:	1.5dB
AM Rejection (45 dBf input):	60dB
Alternate Channel Selectivity (45 dBf input):	US: 70dB, Europe: 75dB
Image Rejection:	70dB
Frequency Response:	± 0.5dB (30Hz-15kHz)
Stereo Channel Separation:	40dB @ 1kHz

SPECIFICATIONS
(Continued)

AM Electrical

Antenna Input:	Binding posts
Usable Sensitivity:	55dBuV/m (IHF standard test loop antenna)
Alternate Channel Selectivity:	60dB
Adjacent Channel Selectivity:	45dB
Image Rejection Ratio:	40dB
S/N Ratio:	50dB (@ 100dBuV/m)
THD:	≤ 1.0% (@ 100dBuV/m)
Frequency Response (@ 100dBuV/m):	100Hz: -8dB 3kHz: -8dB

CD Electrical

D/A Process:	8x over sampling dual 16-bit D/A conversion
Maximum Output Level:	4V
THD+N:	0.05% (@ 1kHz, 0dB)
S/N Ratio:	100dB (A-weighted)
Channel Separation:	≥ 50dB (@ 1kHz)
Frequency Response:	± 0.5dB (20Hz-20kHz)
Dynamic Range:	≥ 90dB
Defect Tracking (Void):	1.5mm (Pierre Verany Test Disc #2)
Defect Tracking (Black Dot):	1mm (ABEX Test Disc TCD-725R)
Defect Tracking (Scratch):	1.6mm (ABEX Test Disc TCD-721R)
Defect Tracking (Fingerprint):	75um (ABEX Test Disc TCD-725R)
Defect Tracking (Warped disc):	1mm (ABEX Test Disc TCD-732RA)
Defect Tracking (Eccentric Disc):	280um (ABEX Test Disc TCD-741R)

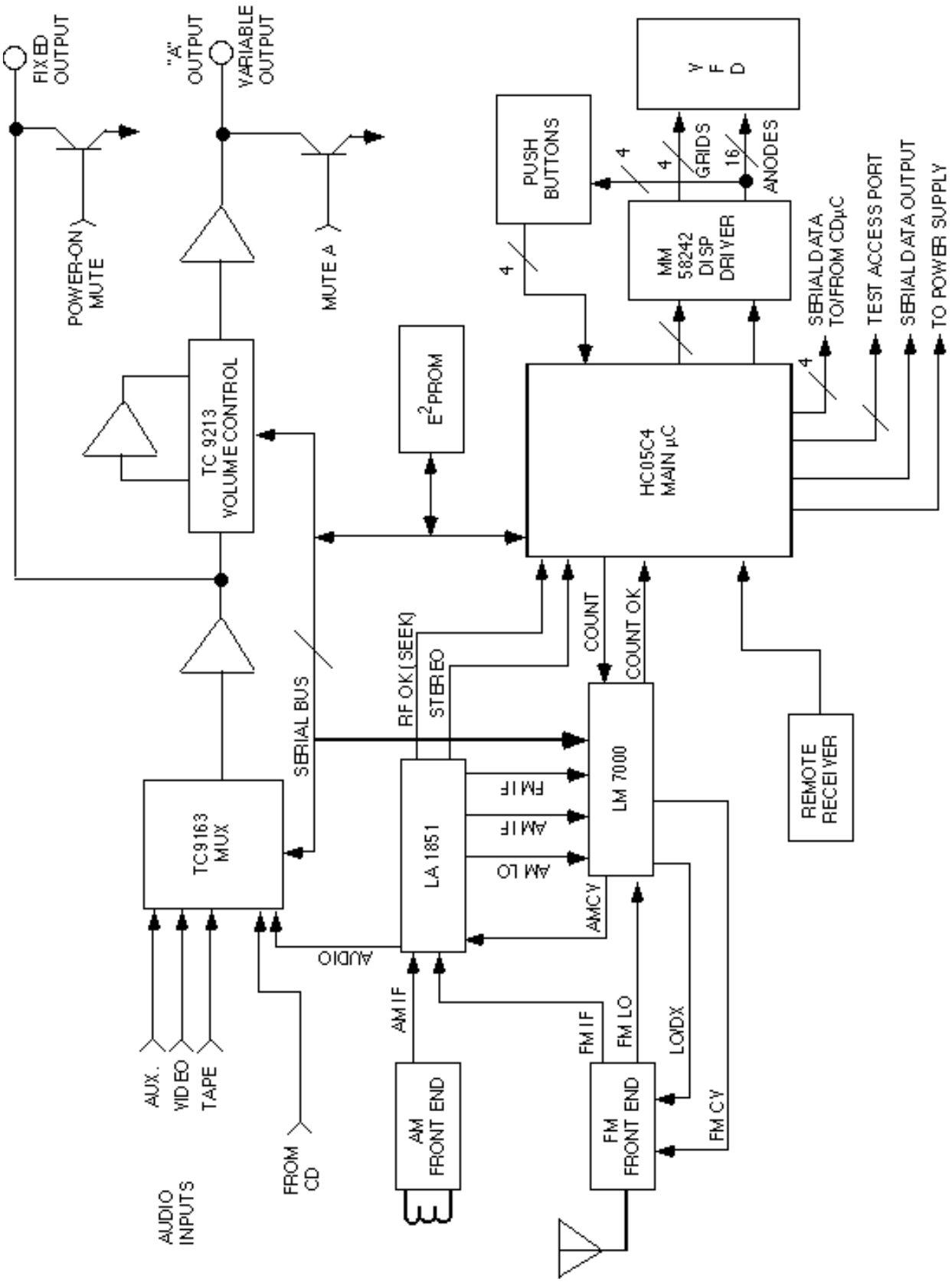


Figure 1. CD5 Block Diagram Sheet 1 of 2

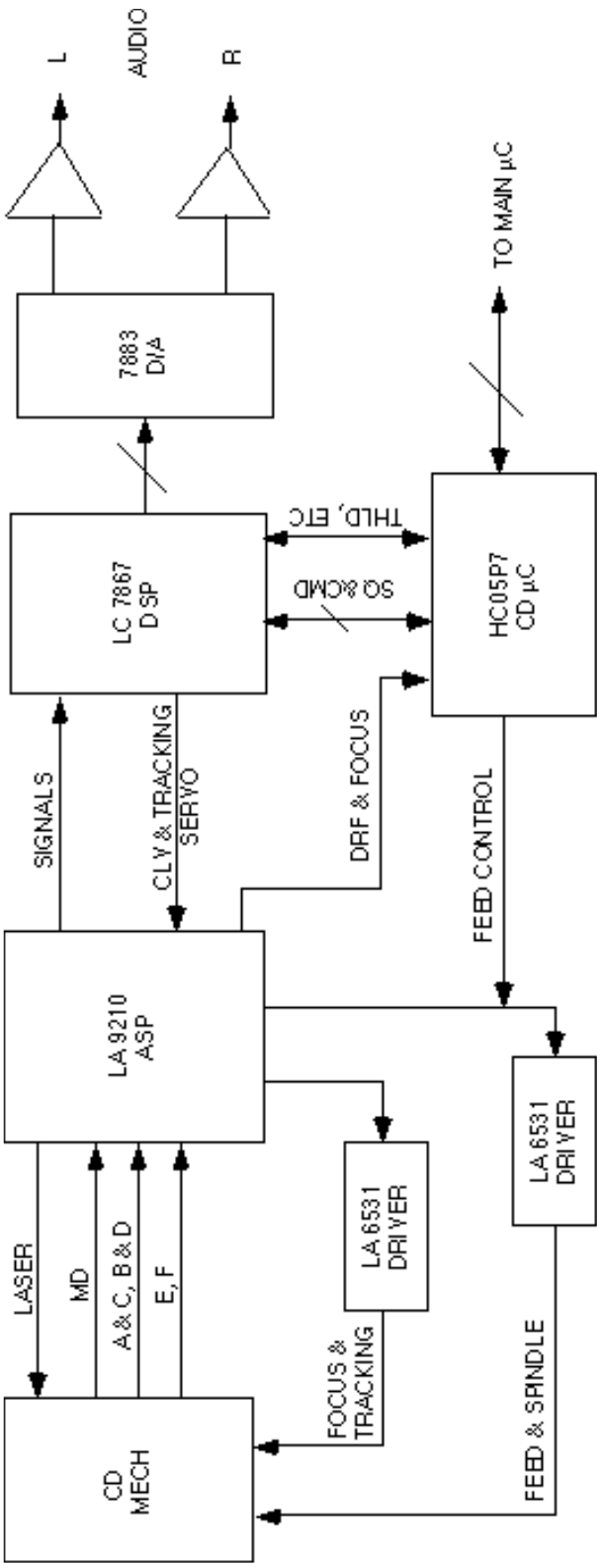


Figure 2. CD5 Block Diagram Sheet 2 of 2

CD TERMS

Basic Terms

Access: See track access.

Access Time: The length of time required to change tracks.

CD Mechanism: The mechanical assembly of components used to read information off of the CD. It contains the optical pickup, sled assembly, disc motor, sled motor, and spindle.

Disc Motor: The motor which spins the disc.

Focus Actuator: The magnet and coil assembly that moves the optical pickup's lens up and down.

Laser: A semiconductor light source similar to an LED that is used to read the data off of a CD. When the laser is turned on it can be seen as a red glow inside the lens.

Laser Pickup: The portion of the CD mechanism that contains the laser diode, lens, focus and tracking actuators, and photodetector diodes.

Mechanism: see CD Mechanism.

Optical Pickup: See Laser Pickup.

Playability: The extent to which a player can successfully play less than perfect discs. Playability is measured with special test discs (playability discs) that contain certain types of defects and problems.

Playability Disc: A disc which contains a calibrated defect or problem. These include eccentricity, warp, scratch, void, black dot, and fingerprints.

Parking: When the sled is moved to the innermost position on the disc. This is done before (if necessary) and after playing a disc.

Sled: The portion of the CD mechanism that moves inside to outside to position the optical pickup near the desired track.

Sled Motor: The motor which moves the sled back and forth.

Spindle: The hub that the disc sits on.

Track Access: The process of moving from one track on a disc to a different track.

Tracking Actuator: The magnet and coil assembly that moves the optical pickup's lens inside and out.

Playability Terms

Dropout: A momentary loss of the audio signal, usually caused by a large scratch or other optical defect.

CD TERMS

Eccentricity: The extent to which the hole in the middle of the disc is not located in the geometric center. In other words, the amount that the disc moves in and out as it rotates. Eccentricity is measured as the distance between the center of the hole and the center of the disc (as determined by the spiral tracks).

Mistracking: When a CD player fails to play the disc in a continuous manner. This may be caused by a large enough optical defect (scratch, etc.) or by vibration.

Optical Defect: A defect on the surface of the disc which adversely affects the reading of information by the laser pickup. There are four basic types of optical defects: voids, black dots, fingerprints, and scratches.

Skipping: When a CD mistracks backwards and gets caught in an “endless loop”. This is usually caused by a large scratch or other optical defect.

Warp: The extent to which the surface of the disc is not parallel to the seating plane of the disc (at the center). In other words, the amount that the disc wobbles up and down. Warp is measured as the vertical deviation between the seating plane and the particular point on the disc.

Alignment Terms

CD Alignment: The process of adjusting a CD player for optimum performance, particularly with respect to its playability.

Free Run Frequency: The VCO frequency in the absence of any signal from the disc. Accurate frequency adjustment is required for the player to be able to read data off the disc. VCO misalignment results in poor track access and longer access times.

Tracking Offset: The DC offset voltage present at the output of the tracking servo in the absence of any input signal. For best results, the offset should be adjusted near 0 to keep the laser positioned in the center of the track. Negative offset causes the laser to be positioned towards the inside of the track. Misalignment of this parameter can cause the player to skip or mistrack when playing a dirty or “black dot” disc, especially if the disc is also eccentric. Scratches and voids may also cause the problem.

Focus Offset: The DC offset voltage present at the output of the focus servo in the absence of any input signal. For best results, the offset should be adjusted near 0 to keep the laser exactly in focus. Misalignment of this parameter usually causes dropouts when playing a dirty or “black dot” disc, especially if the disc is also warped. Scratches may also cause problems. Note that on the CD5, the focus offset is preset and the adjustment pot is not loaded, however, there is a spot on the PCB for it.

E-F Balance: The DC offset that results from driving both the E and the F elements of the photodetector with equal signals. For best results, the offset should be adjusted near 0 to keep the laser positioned in the center of the track. As with track offset, negative offset causes the laser to be positioned towards the inside of the track. Misalignment of this parameter can cause any number of problems including: 1. Poor or slow track access even when playing a good disc, and 2. Skipping or mistracking when playing a scratched or void disc, especially if the disc is also eccentric.

CD TERMS

Tracking Gain: The overall loop gain of the tracking servo. This controls how tightly the laser is held in the center of the track. If the gain is too low, the player will have trouble with vibration and eccentric discs, especially during track access. If the gain is too high the player will have skips or mistracking with voids and scratches. Proper alignment is a compromise between these two performance parameters.

Focus Gain: The overall loop gain of the focus servo. This controls how tightly the laser is held in focus. If the gain is too low, the player will have trouble with vibration and warped discs, especially during track access. If the gain is too high the player will have skips or mistracking with black dots and scratches. Proper alignment is a compromise between these two performance parameters.

Technical Terms

RFSM: RF SUM. The amplified A+B+C+D signal from the laser pickup.

Eye Pattern: The pattern displayed on an oscilloscope when monitoring the RFSM test point.

Jitter: The extent to which the zero crossings of the eye pattern occur at other than their ideal times.

Focusing: Before a disc can be played, the player must focus the CD mechanism by changing the distance between the lens and the surface of the disc. This must occur before the disc can start rotating. If the player fails to achieve focus, it will retry. This occurs four times in the CD5 before it “gives up” and indicates “no disc” by lighting up the disc icon in the display.

TOC: Table Of Contents. The innermost area on the disc where track and time information is stored. When a new disc is inserted into a player (i.e. when the door switch is opened), it must read the TOC before the first track can be played.

CIRC: Cross Interleave Reed-Solomon Coding: The error detection and correction scheme used on CDs to provide immunity to small scratches, etc.

CLV: Constant Linear Velocity. CD players rotate the disc at a constant linear velocity of 1.25 M/S. The angular velocity changes from about 500 RPM down to 200 RPM as the disc plays from beginning (inside) to end (outside).

EFM: Eight-to-Fourteen-Modulation. The format in which the digital data is recorded on the CD.

Photo Diode: The receiving element that translates the modulated light beam into electrical signals.

Subcode Q data: The track and time information read off the CD.

Three Beam System: The most common system for providing focus and tracking error signals for the respective servos. A three beam system uses a six element photo diode array, with the elements designated A through F. The A, B, C, and D elements are located in the center and read the information as well as supply the focus error signal. The E and F elements are located on either side and provide the tracking error signal.

CD TERMS

Major Components of the System

ASP: Analog Signal Processor. The component in the CD circuitry that contains the RF amplifier, VCO, and the tracking, focus, and sled servos.

DSP: Digital Signal Processor. The component in the CD circuitry that performs slicing, EFM demodulation, CIRC decoding, error correction and concealment, track access, CLV regulation, and drives the D/A.

Digital to Analog Converter (D/A, DAC): A device that converts digital information (usually a serial data stream) into an analog signal.

µC: Micro Controller. The component of the CD circuitry that performs track access, sequences all events (such as focus, disc start, stop, etc.), monitors for servo errors, and processes user information (commands, door open, etc.).

CLV Servo: The circuit that keeps the disc rotating at a constant linear velocity.

Focus Servo: The circuit that keeps the optical pickup's lens the proper distance away from the surface of the disc.

Sled Servo: The circuit that keeps the sled positioned within the linear range of the tracking actuator.

Tracking Servo: The circuit that keeps the optical pickup's lens positioned within a single track as the disc rotates.

VCO: Voltage Controlled Oscillator. Part of the phased locked loop circuit that generates an output frequency dependent on its input voltage.

Signal Names

ATSC: Anti-Shock Circuit.

SLEQ: Sled Equalizer

FDO: Focus Drive Output

FEAO: Focus Error Amplifier Output.

HFL: High Frequency Level

PDO: Phase Detector Output

PH: Peak Hold

SLDO: Sled Drive Output.

SPDO: Spindle Drive Output.

CD TERMS

Signal Names
(continued)

TAP: Test Access Port. A 3 pin test interface used by automated test to control and observe the board under test.

TDO: Tracking Drive Output.

TEAO: Tracking Error Amplifier Output.

TGL: Tracking Gain Low.

THLD: Tracking Hold.

TOFF: Tracking Off

TPA+: Tracking Pre-Amplifier (+ input).

TPA-: Tracking Pre-Amplifier (- input).

TPAO: Tracking Pre-Amplifier Output.

VCOO: VCO Output

Vref1: The reference voltage used by the RF amplifier in the ASP.

Vref2: The unbuffered reference voltage used by the servos in the ASP.

Vref3: The buffered reference voltage used by servos in the ASP.

List of Abbreviations

ASP	Analog Signal Processor
CE	Control Expander™
CIRC	Cross Interleave Reed-Solomon Code
CLV	Constant Linear Velocity
D/A	Digital to Analog
DSP	Digital Signal Processor
EEPROM	Electrically Erasable Program Read Only Memory
EFM	Eight-to-Fourteen Modulation
IC	Integrated Circuit
IR	Infrared
kHz	Kilohertz
MHz	Megahertz
PLL	Phase Locked Loop
RF	Radio Frequency
µC	Microcontroller
VCO	Voltage Controlled Oscillator
VFD	Vacuum Fluorescent Display

THEORY OF OPERATION

Overview

The Lifestyle® Model 5 music center is a self-contained CD player, AM/FM tuner, preamplifier, and control center for use with Bose® powered speaker systems. In addition to the two internal sources (CD and tuner), it also allows for up to three external devices to be connected (i.e. AUX, VIDEO, and TAPE). It uses a Radio Frequency (RF) remote control that allows the unit to be operated from different rooms within a house without the need for a line-of-sight path back to the console. The remote control commands for the external sources are translated and passed to the serial data output jack. With the CE-I accessory device this data can be converted to Infrared (IR) for use with many conventional audio devices.

Power Supply

The unit is powered by an external **12VAC** power supply capable of delivering **1.2 amps** rms. **Dl, C2, D2,** and **C6** form positive and negative half-wave rectifiers respectively. **Q1, Q2, Q3,** and their respective components make up a discrete low dropout regulator with a nominal output voltage of **10. 2V**. **VR1** is the corresponding negative voltage regulator with an output of **-12V**. These two regulators create the bipolar supply used by all of the audio circuits. The supply is turned on and off with the unit by the control signal on **J7-10**.

R5, D3, C9, and **VR2** create an **+8V** regulated supply that is used by the CD servo circuits and the remote RF receiver. **R6, D4, C11,** and **VR3** create a **+5V** regulated supply that is used by the main and CD microcontrollers **(U402 and U505)**, and the CD control circuits **(U501, U502,** etc.). Both supplies are live at all times. **R5** and **R6** limit the power dissipation of their respective regulators. **VR2** and **VR3** normally run quite hot to the touch.

R8, D6, and **C13** form an unregulated supply (**M+**) that is used by the CD drive electronics. **C14, D7, D8,** and **C15** form a charge pump that creates a negative high voltage. This voltage is regulated down to **-24V** by **R9, D9,** and **C16**. The vacuum fluorescent display (VFD) driver **U403** uses this **-24V** to shut off segments in the display. **C19** and **C18** reduce the **12VAC** to approximately **3Vrms.** This voltage powers the display's **(VFD401)** heater. **C16, D10, C17,** and **R10** provide a DC bias of **-15V** for the VFD heater (cathode).

Control Electronics

Main microcontroller (μC) **U402** controls the audio circuits, tuner, display, and push buttons. The μC runs at a nominal frequency of **4.0MHz** that is supplied by ceramic resonator **X401**. The μC is reset by a rising edge on pin 1 caused by **R409** and **C404**. This occurs automatically on power-up but may be forced manually by depressing **S416** (if installed).

U402 communicates with **U403** over a four wire serial data bus **(U403, pins 15, 16, 18 and 19).** The bus is updated once per millisecond. **U403** latches the serial data into its outputs, driving the VFD. The VFD is a four grid multiplexed display with 16 anodes at each grid. The grids are turned on sequentially, one each millisecond. As each grid is turned on, the corresponding anodes for that grid are also turned on. This lights the desired segments. When the next grid is turned on, the anodes are changed to correspond to the desired segments under this next grid. In this way, the entire display is scanned, 1/4 at a time. The display is blanked for a brief interval in-between when one grid is turned off and the next is turned on. In this blanking interval, the push buttons are scanned to determine what keys are being pressed. This data is read in on **U402, pins 12 through 15**.

THEORY OF OPERATION

There is one main serial data bus that controls source selection IC **U101**, volume control IC **U103**, PLL frequency synthesizer **U302**, and EEPROM **U401**. The clock and data information for all of these devices is sent out on **U402, pins 5 and 7**. However, **U401, U302**, **U101 and U103** each have their own chip select line. Data is sent to **U302** whenever the tuner frequency is changed. During the serial data transmission, **U302, pin 3** is driven high. Data is sent to **U101 or U103** whenever a new source is selected or the volume is changed. At the completion of this transmission, the **STRB** line (**J9-5**) is driven high briefly.

U401 is a nonvolatile EEPROM which is used for storing certain data such as tuner presets and house codes. This data is protected from loss during a power outage. **U401** communicates with **U402** over the main serial data bus. During communication to this chip, the chip select line (**U401, pin 1**) is driven high.

There is another serial data bus between **U402** and **U505**. These lines are labeled **CD_READY, CD_CLK, CD_ CMD, and CD_DATA** on the schematic. The bus sends commands (play, stop, etc.) to **U505** and also sends track and time information to **U402** so that it may be displayed. This bus is constantly in use any time **"CD"** is selected as the source.

RR101 receives and demodulates commands from the RF remote control. **R138, C130, C129, R139, and D109** remove noise and shape the pulse. **U106** squares up the pulse edges and converts them to **5V** logic levels. This signal is then fed to **U402, pin 37**. **C401** prevents any glitches at this pin.

In addition to the major functions mentioned above, **U402** also performs several miscellaneous tasks. The bipolar power supply for the audio circuits (**+1OV/-12V**) is turned on and off by **U402, pin 19** (**power**). Both supplies are turned on when this line is high (**+5V**), and off when it is low. The unregulated supply is monitored by **C414, R407, and R408**. In the event of a power failure, **U402** will shut down the system gracefully. There are three independent muting circuits: **Mute A, Mute B, and Power-on Mute**. **Mute A and Mute B** are controllable from the remote, and allows the A and B outputs to be controlled independently. The **Power-on Mute** is used only during power-up (when the bipolar supply is turned on) to prevent pops and clicks. When an external source is selected (AUX, VIDEO, or TAPE), the transport commands (FF, FR, etc.) are passed through the serial data jack via **Q401** and its associated circuitry.

Audio Circuits

There are two internal audio sources (CD and Tuner) and three external sources (AUX, VIDEO, and TAPE). All of the sources are routed to **U101**. **R101-106** and **R201-206** provide level matching for the different input sources. **D101-106, D201-206, C101-103, and C201-203** provide static protection on the inputs. **U101** selects 1 of the 5 input sources, and routes it to its output on **pins 5 and 9 (left)**, and **pins 20 and 24 (right)**.

One half of **U102 (pins 1-3 and 12-14)** provides gain and buffering for the input signal. The buffered output is routed to **U103** and to the FIXED output on **J103**. **U103** consists of two sections. The first section attenuates the signal from **0** to **70dB** in **10dB** steps. The output of the first section is buffered by the other half of **U102 (pins 5-7 and 8-10)** and is fed to the second section. The second section attenuates the signal in **1dB** steps. The two sections together provide smooth attenuation from **0** to **80dB** in **1dB** steps.

U103's output signal is buffered by **U105,** and is fed to the A and B outputs. These outputs are independently mutable through transistors **Q103-106** and **Q203-206**. Each pair of transistors provides approximately **80dB** of attenuation when muted. These mute transistors are controlled by the signals on **J9-7** and **J9-8**. **U103's** output signal is also routed to headphone amplifier **U104**. This provides gain and buffers the signal in order to drive a low impedance load. When the headphones are inserted into **J104**, the control signal on **J105-3** causes the A speaker output to be muted.

The TAPE output jack functions like the FIXED output does. There is one exception. The TAPE output is shut off whenever **"TAPE"** is selected as the source. This prevents feedback through the TAPE deck if it was placed in "Record" while **"TAPE"** was selected as the source. This is accomplished by feeding the FIXED level output signal from **U102, pins 1 and 14** back into **U101**. A control signal from **U402** allows **U101** to pass this signal to its outputs on **pins 5 and 17**, except when **"TAPE"** is selected as a source.

The FIXED, TAPE, and headphone outputs all have a single mute transistor which is used to prevent pops and clicks during power-up and power-down. These transistors are all controlled by the signal on **J9-6**. Each transistor provides about **40dB** of attenuation when the muting is switched on.

CD Player

The CD circuitry consists of six major sections: Analog signal processor (ASP) **U501**, digital signal processor (DSP) **U502**, digital to analog converter (D/A) **U506**, CD microcontroller (µC) **U505**, power drivers **U503 and U504**, and the CD mechanism. **U501** contains the RF amplifier and servo control circuits. **U502** performs EFM demodulation, CIRC decoding, and outputs the digital audio to **U506**. It also extracts the subcode Q information (track #, time, etc.) and controls **U501** during track access. **U505** receives and interprets the subcode Q data from **U502** and sends it along to **U402**. It also issues commands to **U502** for track access, and controls all operations of the CD circuitry.

U501 receives its input signal (through **P501**) from the mechanism's photo diode pickup. The A, B, C, and D inputs are added together and amplified. The RF amplifier output appears on **RFSM** (**U501, pin 72**). This signal is the familiar "eye pattern." This signal is sent to **EFMIN** on **U502, Pin 8** where it is sliced for EFM demodulation. The inverted and non-inverted sliced outputs appear on the **EFMO** and **EFMO~** lines (**U502, pins 6 and 7**) . These signals are low-passed and subtracted and the output appears on **SLCO** (**U501, pin 53**). This signal supplies the DC bias for the **RFSM** signal. This signal is then sent to the slicer for slice level control.

The **RFSM** signal is peak-detected and compared to a reference to determine if there is a signal being received back from the disc. The output appears on **DRF** (**U501, pin 40**). This signal is used by **U505** to determine if the lens is in focus. The envelope of the **RFSM** signal is also used in determining when the laser crosses a track boundary during track access. The **HFL** signal (**U501, pin 48**) conveys this information to **U502**.

The **A+C** signal is subtracted from the **B+D** signal. This produces the focus error signal **FEAO** (**U501, pin 26**). The focus gain is adjusted by **R527**. This signal is amplified and filtered by the focus servo amplifier (inside **U501**). It then appears as an output at **FDO** (**U501, pin 22**). The **FDO** signal is fed to **U503. U503** generates the complementary outputs (**pins 11 and 14**) that are used to actuate the focus coil (**P502, pins 5 and 8**).

THEORY OF OPERATION

The **E and F** signals are amplified and subtracted. This produces the tracking error signal **TEAO** (**U501, pin 7**). The F channel's gain is adjusted by E-F balance potentiometer **R506**. The **TEAO** signal is used by the anti-shock circuit, the track jump detection circuit, and the tracking servo. The track jump detection output is sent to **U502** on the **TES** line (**U501, pin 47**). **R510,** which is connected to **TPA+** (**U501, pin 13**), adjusts the tracking gain. This signal is amplified and filtered. It then appears as an output on **TPAO** (**U501, pin 15**). **R511** adjusts the tracking offset . The **TPAO** signal is further amplified and filtered. It then appears as an output on **TDO (U501, pin 21)**. This signal is fed to **U503. U503** generates the complementary outputs **(U503)** that are used to actuate the tracking coil (**P502, pins 6 and 7**).

The **TDO** signal is also used as the input for the sled servo. This signal is filtered and fed to the sled servo amplifier on **SLEQ (U501, pin 20)**. This signal is amplified and is then added to the **FEED** signals from **U505**. The result appears on **SLDO (U501, pin 33)**. This signal is fed to **U504. U504** generates the complementary outputs **(pins 11 and 14)** that are used to drive the sled motor **(P503, pins 5 and 6)**.

The Constant Linear Velocity (CLV) servo is regulated by comparing the playback speed to a FIXED reference frequency in **U502.** The error signal appears at **U502, pins 10 and 11 (CLV+ and CLV-)**. These signals are subtracted and the difference appears on **SPD (U501, pin 29)**. The **SPD** signal is filtered and amplified. It then appears at the output on **SPDO (U501, pin 31)**. This signal is fed to **U504. U504** generates the complementary outputs **(pins 3 and 6)** that are used to drive the disc motor **(P503, pins 1 and 2)**.

U501 regulates the laser power by monitoring the **MD** input **(P502-3)**. This signal is compared to a reference to generate the proper drive signal on **LDD (U501, pin 74)**. This signal biases **Q501**. **Q501** drives the laser diode output **LD (P502-1)**. **U501's** main DC reference voltage is **Vref3** which appears on **pin 9**. This voltage is nominally **4V**.

The VCO is the final function contained in **U501**. The VCO is used by **U502** for EFM demodulation. The **PDO** output signal **(U502, pin 4)** is filtered and amplified by **U501.** In turn, this output appears on **VCOC (U501, pin 59)** This is the VCO control voltage input. The nominal VCO free-run frequency is **8.64MHz** and is set by **R558**. The VCO also requires a **16.9344MHz** clock input from **U502.** This input appears on **CLK (U501, pin 62)**. The VCO output appears at **VCOO (U501, pin 60)**. This signal is buffered by **U502.** The buffered output appears on **AO (U502, pin 2)**. The VCO output is divided by 2 in **U502.** In turn, its output appears on **PCK (U502, pin 18),** which is **4.32MHz**.

The DSP clock is derived from a **16.9344MHz** crystal oscillator **(X501)**. However, this oscillator is normally turned off by **U505**. It is only switched on during focusing and when a disc is playing. **U502** receives its EFM input from **U501** on **EFMIN (pin 8)**. This signal is sliced, EFM demodulated, and CIRC decoded. The digital audio output signal is sent serially to **U506** on the **LRCLK, DFOUT and DACLK** lines **(U502, pins 33, 35, and 36)**.

U502 receives servo control commands from **U505** on the serial bus **(U502, pins 51, 53 and 54)**. These commands are translated to appropriate control signals for **U501** for focusing, disc start, disc stop, disc braking, and track jumps. The focus servo is controlled by the **FOCS and FST** outputs. The CLV servo is controlled through the **CLV+ and CLV-** lines. The tracking servo is controlled by the **TOFF, TGL, and THLD** outputs. Track jumps are created by signals on the **JP+ and JP-** lines. Track jump detection is based on signals from **U501** on the **HFL and TES** inputs.

THEORY OF OPERATION

U505's oscillator is obtained from a **4MHz** ceramic resonator (**X502**). **U505** is reset by a rising edge on **pin 1** that is caused by **R573** and **C574**. This occurs automatically on power-up, but may be forced manually by depressing **S502** (if installed). **U505** communicates with **U502** on a serial bus (**U502, pins 50 through 54**). **U505** sends servo commands for focusing and track access to **U502**. **U502** sends subcode Q data to **U505** which extracts track, time and table of contents information from it. The time and track data is formatted, and is sent to **U402** on a serial bus **(U505, pins 11-13)**.

During track access, **U505** controls the sled motor directly using the **FEED+** and **FEED-** lines (**U505, pins 21 and 22**). It also directly controls the laser **U503** and **VCO** using the **LASER~** line (**U505, pin 9**). When the laser is turned on, the VCO and **U503** are enabled, otherwise they are turned off. **U505** can also enable and disable **U504** with the **MOTOR_EN** line (**U505, pin 20**).

U506 (D/A converter) performs 8x oversampling and digital filtering. It then converts the digital audio into left and right stereo outputs. D/A reference voltages are obtained from zener diode **D504**. **U506's** analog outputs are buffered by one-half of **U507 (pins 5-7 and 8-10)**. The buffered signal is lowpass filtered by the other half of **U507.** This removes any residual out-of-band digital noise. The recovered audio is then routed to **U101**.

Tuner

The FM antenna signal is routed through F connector **J301** and enters the FM front end module. This contains a tuned RF amplifier, FM local oscillator, and a mixer. The IF output signal appears on **pin 4 (front end)** and passes through **10.7MHz** ceramic filter **CF302**. The filter's output is amplified by the IF gain stage. This stage consists of **Q307, Q308** and their associated components. The signal is then passed through a second ceramic filter, **CF303**, a second gain stage (**Q309, Q310, etc.**) and a third ceramic filter, **CF304**.

CF304's output signal is sent to the main tuner IC, **U301**. This device contains the FM detector, FM stereo MPX decoder, stop level detection, as well as most of the AM circuitry (see below). **U301** further amplifies the IF signal, and then performs FM detection. This detection uses a double tuned quadrature detector formed by **T304** and **T305**. **T305** is adjusted for FM center frequency by adjusting it for **0VDC** between the AFC terminal **(U301, pin 4)** and the Vreg terminal **(U301, pin 28)**. **T304** is adjusted for minimum distortion (A few iterations may be required because these two adjustments are dependent on one another). The recovered audio appears on **U301, pin 8**.

C313 and its associated components filter the recovered audio and feed it back into **U301**, **pin 9**. **U301** performs the FM stereo MPX decoding. When you select FM, the decoded L/R channel signals are sent out on **pins 14 and 15**. The resistance between **pin 12** and **ground** controls the separation. **456kHz** ceramic resonator **CF301** controls the PLL decoder. The PLL loop filter components are connected to **pin 11**. Potentiometer **R334**, which is connected to **pin 30**, sets the FM stop level to **33dBf** (nominal).

C304, R304, C307, and R309 perform FM de-emphasis. **Q301, Q302** and their associated components buffer the signals. MPX filters **T301** and **T302** remove any unwanted out-of-band signals before sending them to **U101**.

The AM loop antenna signal enters the unit through **J301**'s screw terminals. The signal is then fed to AM front end module, **T303**. This device contains an RF tuned section and the AM local

oscillator tuned circuit. The tuned output appears on **pin 12** and is fed to AM buffer FET **Q300**. The buffered output is sent to **U301, pin 27**. **U301** contains the AM RF amplifier, mixer, IF amplifier, AM detector and AM stop level detection. Potentiometer **R339**, which is connected to pin 16, sets the AM stop level to **70dB uV/M** (nominal). The IF output signal appears on **pin 26** and is filtered by IF filter **T307**. The signal is then fed back into **U301, pin 24** for AM detection. The AM detected output **(pin 5)** is filtered by **C315, R316, and C314**. The filtered output is fed back into **U301, pin 6**. Finally, it is sent to the L/R outputs **(pins 14 and 15)** when **"AM"** is selected.

U302 controls the AM and FM local oscillators. **U402** sets **U302** so that it can select the AM or FM band and can tune to a particular frequency. The PLL reference oscillator originates from **7.2MHz** crystal **X301**. This frequency is divided down to **400KHz (U302, pin 7)**. **U302** divides down the local oscillator frequencies and compares them to an internal reference frequency. The error signal resulting from this comparison appears at **pin 18**. This error signal is integrated and filtered by **Q304, Q305,** and their associated components. This produces the tuning voltage which appears at **Q304**'s collector.

The tuning voltage is further filtered by **R323, C326, R322, and C319.** This signal is then sent to AM front end module **T303, pin 14**. It is used to vary the capacitance of two varactor diodes. This first diode varies the frequency of the AM local oscillator. The second tunes the AM RF input section to the desired frequency. Similarly, the tuning voltage is filtered by **R330 and C333.** Then it is fed to the FM front end module. The front end uses this voltage to vary the local oscillator frequency and to tune the RF input sections.

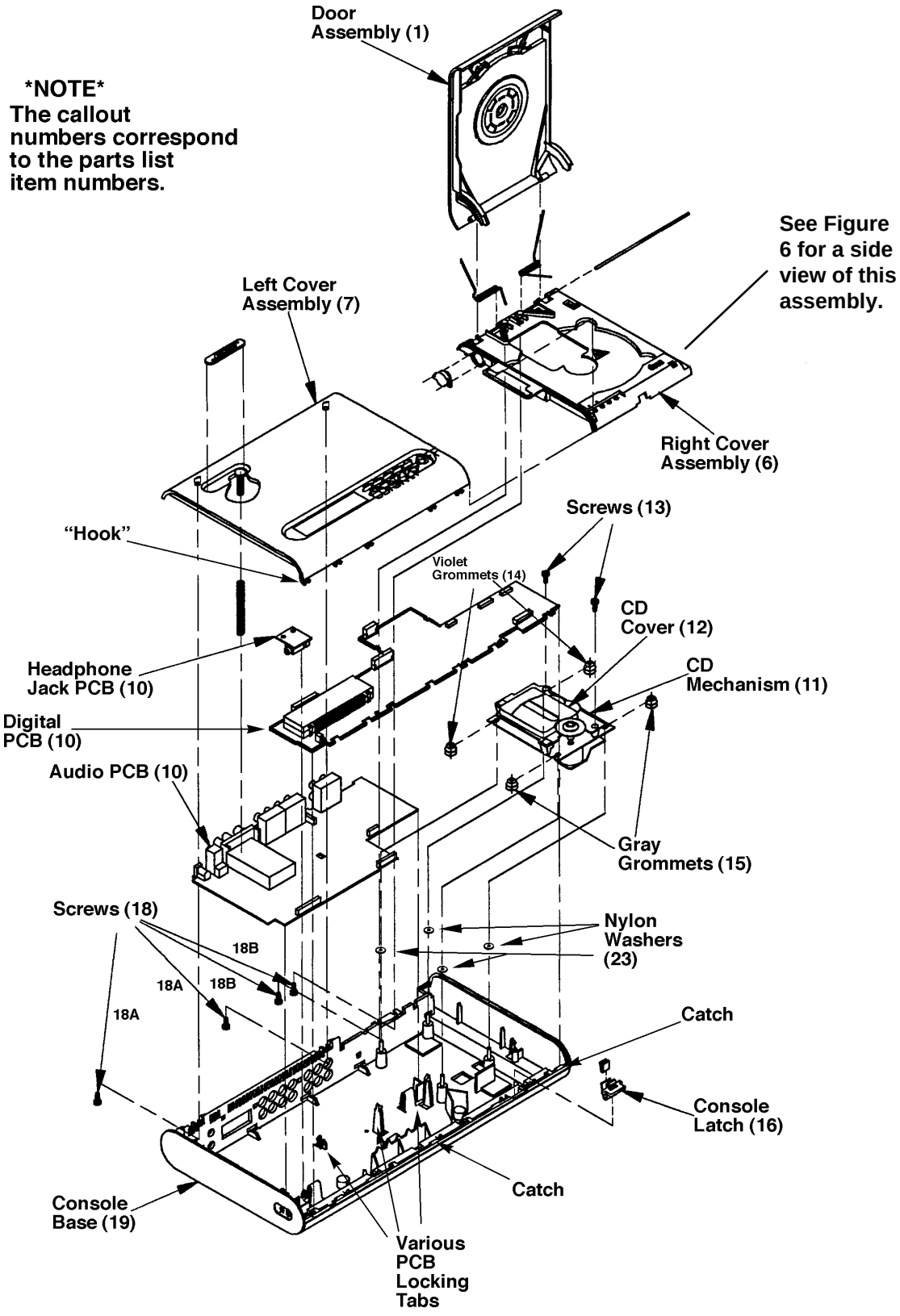


Figure 3. Labelled Exploded View

DISASSEMBLY/ ASSEMBLY PROCEDURES

1. Left Cover Assembly Removal

Note: Refer to Figures 3 and 5 for Procedures 1 and 2.

1.1 Remove the two screws (18A) that secure the left cover (7) to the base (19).

1.2 Press in the three recessed gray tabs located on the connector panel and lift up on the rear of the cover.

2. Left Cover Assembly Replacement

2.1 Align the five hooks on the left cover (7) with the five catches on the front of the base (19).

2.2 Lower the left cover and snap it into place. The cover should be flush with the closed door assembly (1).

2.3 Replace the two screws (18A) that secure the left cover to the base (19).

3. Door Assembly and Right Cover Removal

Note: Refer to Figures 3, 5 and 6 for Procedures 3 and 4.

3.1 Remove the left cover assembly (Procedure 1).

3.2 Remove the two screws (18B) that secure the right cover (6) to the base (19).

3.3 Press in the two recessed black tabs located on the connector panel. Lift up on the rear of the door assembly (1) and right cover assembly (6).

3.4 Remove the console latch (16).

4. Door Assembly and Right Cover Replacement

4.1 Position the console latch (16) in the base (19).

4.2 Align the two hooks on the right cover assembly (6) with the two catches on the front of the base assembly (19). Lower the cover into position.

4.3 There are two black tabs on the bottom of the right cover. Push them in slightly and snap the cover into place.

4.4 Replace the two screws (18B) that secure the right cover to the base.

4.5 Replace the left cover assembly (Procedure 2).

5. CD Mechanism Removal

Note: Refer to Figures 3, 4 and 7 for Procedures 5 and 6.

5.1 Remove the left cover assembly (Procedure 1) and the door/right cover assembly (Procedure 3).

5.2 Lift the CD mechanism (11) straight up from the four metal posts in the base (19). Later models have 4 nylon washers (23) mounted on the posts. Do not remove them.

5.3 To prevent electrostatic damage to the mechanism, solder together the two points indicated in Figure 4.

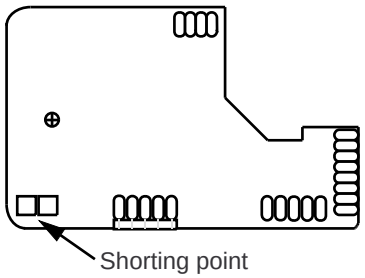


Figure 4. APC PCB

5.4 Disconnect the 6 pin connector from the PCB that is attached to the motors and the 5 pin and 8 pin connectors from the APC PCB.

Note: The support grommets (14, 15) and CD cover (12) are not supplied as part of the mechanism. Remove and reuse them if complete replacement of the mechanism is required.

DISASSEMBLY/ ASSEMBLY PROCEDURES

5.5 Slide the violet (14) and gray (15) grommets away from the slots in each corner of the mechanism.

5.6 Remove the two screws (13) that secure the cover (12) to the mechanism. Unsnap the cover from the mechanism.

6. CD Mechanism Replacement

6.1 Snap the cover (12) into position. Align the screw holes and replace the two screws (13) that secure the cover to the mechanism (11).

6.2 Slide the violet (14) and gray (15) grommets into their respective slots on each corner of the mechanism. See Figure 3 for their proper locations.

6.3 Connect the 6 pin connector to the PCB that is connected to the motors and the 5 pin (with black cable) and 8 pin connectors to the APC PCB.

6.4 Remove the solder from the shorted points shown in Figure 4.
Note: Make sure that four nylon washers (23) are mounted on the posts before installing the mechanism (later models only).

Note: The CD mechanism wires must be routed correctly (see Figure 7) for proper CD operation. A sign of improper routing is a clicking noise when playing tracks at the outermost edge of the CD. Perform the CD Final Verification tests on page 31 to ensure proper operation.

6.5 Place the mechanism on the four metal posts located in the base (19). Position as shown in Figure 3.

6.6 Replace the door/right cover assembly (Procedure 4) and left cover assembly (Procedure 2).

7. Digital PCB Removal
Note: Refer to Figures 3 and 7 for Procedures 7 and 8.

7.1 Remove the left cover assembly (Procedure 1) and the right cover/door assembly (Procedure 3).

7.2 Lift up the CD mechanism (11) and move it aside. Keep the mechanism connected to the PCB unless removal is required. See Procedure 5 for removal procedure.

7.3 There are four black plastic tabs that hold the PCB (10) in position. See Figure 3. Flex them carefully outward and pull the PCB up and out.

7.4 Remove any connections required to troubleshoot the PCB.

8. Digital PCB Replacement

8.1 Replace any connections that were disconnected during troubleshooting.

8.2 Slide the PCB (10) into position. There are notches in the PCB which mate with notches in the base (19). See Figure 7.

8.3 Snap the PCB carefully down under the four locking tabs.

8.4 Push the CD mechanism (11) down onto the four metal posts.

8.5 Replace the right cover/door assembly (Procedure 4) and the left cover assembly (Procedure 2).

9. Audio PCB Removal
Note: Refer to Figures 3 and 7 for Procedures 9 and 10.

9.1 Remove the left cover assembly (Procedure 1), the door/right cover assembly (Procedure 3), and the Digital PCB (Procedure 7).

9.2 There are four locking tabs (three on the PCB edges and one in the middle of the PCB) that secure the PCB (10) to the base (19). Flex the tabs carefully away from the PCB and disengage the PCB.

DISASSEMBLY/ASSEMBLY PROCEDURES

9.3 Slide the PCB clear of the connector panel, and pull it away from the base.

9.4 Remove any connections required to troubleshoot the PCB.

10. Audio PCB Replacement

Note: Make sure that the connections to the Headphone Jack PCB (10) are routed through the guiding notch on the side of the console (see Figure 7).

10.1 Restore any connections that were disconnected during troubleshooting.

10.2 Slide the PCB's connectors through the holes in the rear of the base (19).

10.3 Snap the PCB (10) carefully down under the four locking tabs. Make sure that the CD mechanism connections are routed properly. See Figure 7 and procedure 6 note.

10.4 Replace the Digital PCB (Procedure 8), the door/right cover assembly (Procedure 4), and the left cover assembly (Procedure 2).

11. Headphone Jack PCB Removal

Note: Refer to Figures 3 and 7 for Procedures 11 and 12.

11.1 Remove the left cover assembly (Procedure 1) and door/right cover assembly (Procedure 3).

11.2 There are two black plastic snaps that secure the PCB (10). Flex the snaps outward and carefully pull the PCB away from the unit.

12. Headphone Jack PCB Replacement

12.1 Snap the PCB (10) into place by engaging the two locking tabs.
Note: Make sure that the connector wires are routed through the guiding notch on the side of the base (19).

12.2 Replace the door/right cover assembly (Procedure 4) and the left cover assembly (Procedure 2).

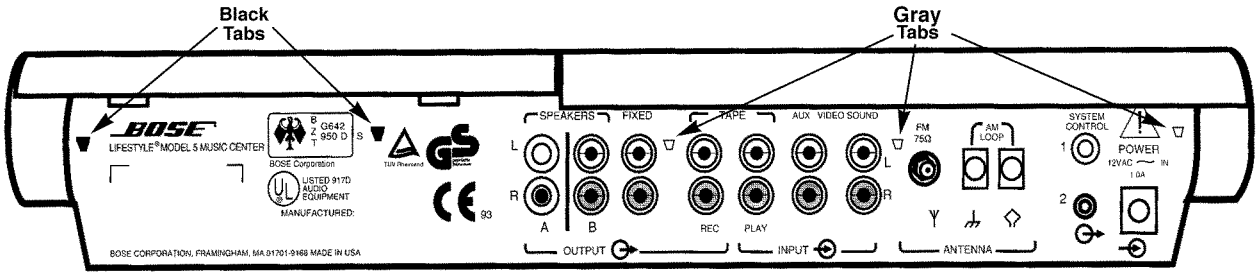


Figure 5. Back Panel with Tab Locations

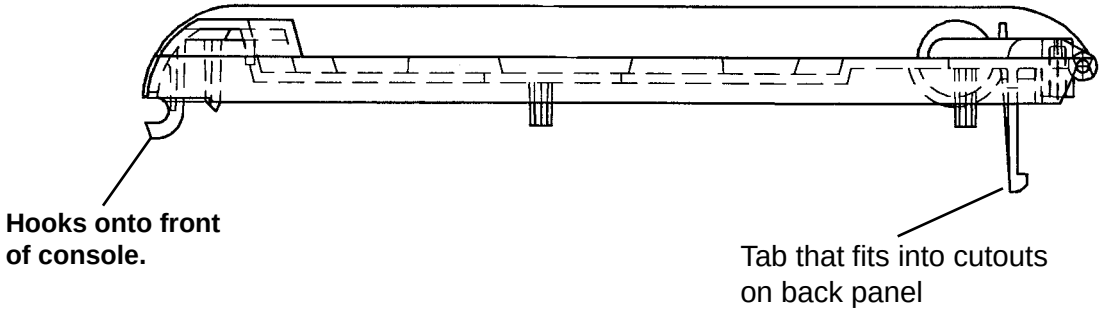


Figure 6. Right Cover Assembly (side view)

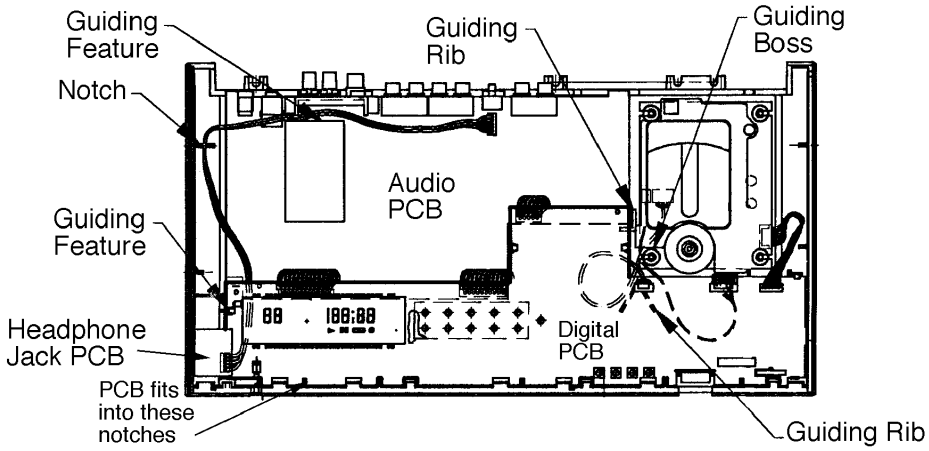


Figure 7. Base Assembly (top view with covers removed)

RC5 DISASSEMBLY/ASSEMBLY PROCEDURES

1. Enclosure Disassembly

1.1 Slide off the battery compartment door (5) and remove the batteries.

1.2 While holding the top cover (4) with one hand, place your fingers from your other hand in the battery compartment and grasp the lower part of the bottom cover (3) with your fingers.

1.3 With your finger tips in the battery compartment, first pull parallel to the unit and then pull perpendicular.

1.4 With the catches released at the bottom, work your fingers up the sides to release the rest of the catches.

2. Enclosure Assembly

2.1 Lower the bottom cover (3) onto the top cover (4) so that the bottom cover's lip fits over the top cover.

2.2 Press the top cover and the bottom cover together until they snap into place.

3. PCB Removal

3.1 Lift the PCB (1) straight up. The springs will come up with the PCB.

4. PCB Replacement

4.1 Lower the PCB (1) into the top cover (4) so that the springs are in the battery compartment.

5. Pad Removal

5.1 The pad (2) is not secured. Grasp a corner of the pad and lift it out.

6. Pad Replacement

6.1 Lower the pad (2) into the top cover (4) so that the buttons line up with the holes in the top cover.

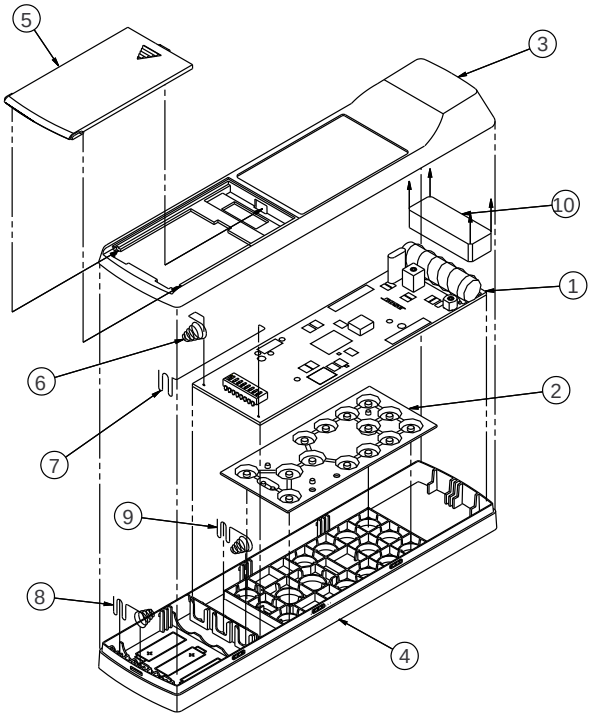


Figure 8. Remote Control Assembly Exploded View

TEST PROCEDURES

GENERAL TEST SETUP

Load the outputs as follows:
Headphone output-33Ω, 1% load.
Audio (A, B, Fixed) outputs-10kΩ load.

Note: The remote control or console buttons can be used to select sources in these procedures.

1. AUX Gain Test

1.1 Select AUX.

1.2 Apply a 500mVrms, 1kHz signal to the left (right) AUX input. Adjust the volume to maximum. Reference a dB meter to the applied signal.

1.3 Ground the TAPE, VIDEO and the right AUX inputs.

1.4 Measure the outputs according to the following table.

Output	Min (dB)	Max (dB)
Speaker A (L,R)	4.2	5.4
Speaker B (L,R)	4.2	5.4
Tape (L,R)	3.3	4.5
Fixed (L,R)	4.2	5.4
Headphone (L,R)	5.4	7.4

1.5 Repeat this test for the right channel.
Note: This test is the same for the VIDEO input**.** Apply a 500mVrms, 1kHz signal to the left (right) VIDEO input and repeat this test.

2. AUX Separation Test

2.1 Select AUX.

2.2 Apply a 500mVrms, 1kHz signal to the left (right) AUX input. Adjust the volume to maximum. Reference a dB meter to the applied signal.

2.3 Ground the TAPE, VIDEO, and right AUX inputs.

2.4 Measure the outputs according to the following table.

Output	Separation (dB)
Speaker A (L,R)	≥50
Speaker B (L,R)	≥50
Tape (L,R)	≥50
Fixed (L,R)	≥50
Headphone (L,R)	≥50

2.5 Repeat this test for the right channel.
Note: This test is the same for the VIDEO input**.** Apply a 500mVrms, 1kHz signal to the left (right) VIDEO input and repeat this test.

3. TAPE Gain Test

3.1 Select TAPE.

3.2 Apply a 500mVrms, 1kHz signal to the left (right) TAPE input. Adjust the volume to maximum. Reference a dB meter to the applied signal.

3.3 Ground the AUX, VIDEO and the right TAPE inputs.

3.4 Measure the FIXED level output. It should be 8.9 to 9.9dB.

3.5 Repeat this test for the right channel.

4. Volume Control Mute

4.1 Select the AUX input.

4.2 Apply a 500mVrms, 1kHz signal to the left (right) AUX input.

4.3 Set the volume to minimum at the speaker A output.

4.4 Measure the gain at the A output (relative to maximum volume). It should be ≥ -75dB.

TEST PROCEDURES

5. Headphone Mute

5.1 Select the AUX input.

5.2 Apply a 500mVrms, 1kHz signal to the L/R AUX input.

5.3 Insert a mini-jack into the headphone output. The A output should mute.

FM ALIGNMENT TESTS AND ADJUSTMENTS

Unless otherwise noted, set an RF generator to 98.1MHz, 40dBf, 1kHz, mono modulation, pilot off, 100% (75kHz deviation).

1. Front End Mixer Coil Adjustment

1.1 Adjust the FM front end **(TUNER)** mixer coil until a maximum DC voltage is measured at U301 pin 25. Adjust the coil until the voltage comes within +0, -20mV of the peak voltage.

2. FM Detector Zero Adjust and Distortion Adjustment

2.1 Set the RF generator to 65dBf.

2.2 Adjust T305 until the voltage reads 0Vdc ± 110mVdc across C317+ (AFC test point) and C322+ (VREG test point).

2.3 Adjust T304 for minimum distortion. The distortion should be < 0.4%.

2.4 Repeat this procedure until optimal results are obtained.

3. FM Stop Level Adjustment

3.1 Set the RF generator to 31dBf.

3.2 Rotate R334 counterclockwise until the voltage at U301 pin 21 drops below 2.5Vdc. Then rotate R334 clockwise until the voltage goes above 2.5Vdc.
Note: The correct adjustment is at the point just after the voltage switches high.

3.3 Adjust the generator's output to 35dBf. Verify that U301 pin 21 is **<** 2.5Vdc.

4. Stereo Separation

4.1 Set the RF generator to 65 dBf, pilot on, left modulation, 1kHz, 100% (75kHz deviation).

4.2 Reference a dB meter to left FIXED output.

4.3 Measure the right FIXED output. It should be ≤ **-**25dB.
Note: If the unit fails this test, perform the following procedure.
1. Change R354 to a 560Ω, 5%, 1/10.
2. Remove W302.
3. Add R355 (a 1kΩ, 10%, 1/2 W potentiometer). Adjust R355 for maximum separation. This option is listed on note 9 of the schematic.

5. FM Sensitivity

5.1 Set the RF generator to 42dBf, L= -R modulation, pilot on.

5.2 Reference a dB meter to the left FIXED output.

5.3 Measure the noise (with modulation off and pilot on) at the right FIXED output. The SNR should be **>** 50dB for the 120V version and **>** 45dB for the 220V version.
Note: If the unit fails this test, the FM front end should be replaced.

TEST PROCEDURES

AM ALIGNMENT PROCEDURES

Test setup: Connect the generator to a standard radiating loop. Unless otherwise noted, set an RF generator to 70dBu field strength, 400Hz, 30% modulation.
See Figure 9.

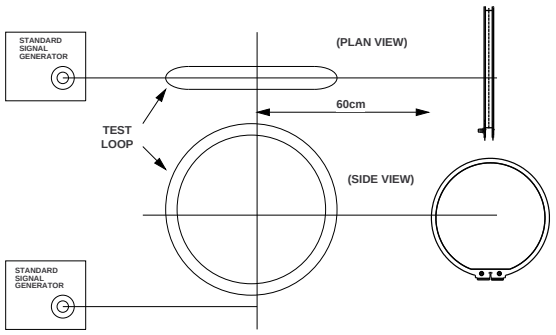


Figure 9. AM Test Setup

The equivalent field intensity is 26dB less than the generator output level or 1/20th of the output voltage.

1. AM Sensitivity Alignment

1.1 Set the RF generator so that the field strength at the unit's antenna is 70dBµ (70dBµ V/M).

1.2 Reference a dB meter to the Fixed level output.

1.3 Shut off the modulation and measure the noise. The SNR should be **>** 30dB.

2. AM Stop Level Adjustment

2.1 Set the RF generator so that the field strength at the unit's antenna is 59dBµ (59dBµ V/M).

2.2 Rotate R339 counterclockwise until the voltage measured at U301 pin 21 goes below 2.5Vdc. Then, rotate R339 clockwise until the voltage goes above 2.5Vdc.
Note: The correct adjustment is at the point just after the voltage switches high.

2.3 Adjust the field strength to 64 dBµ (64 dBµ V/M). Verify that the voltage at U301 pin 21 is **<** 2.5Vdc.

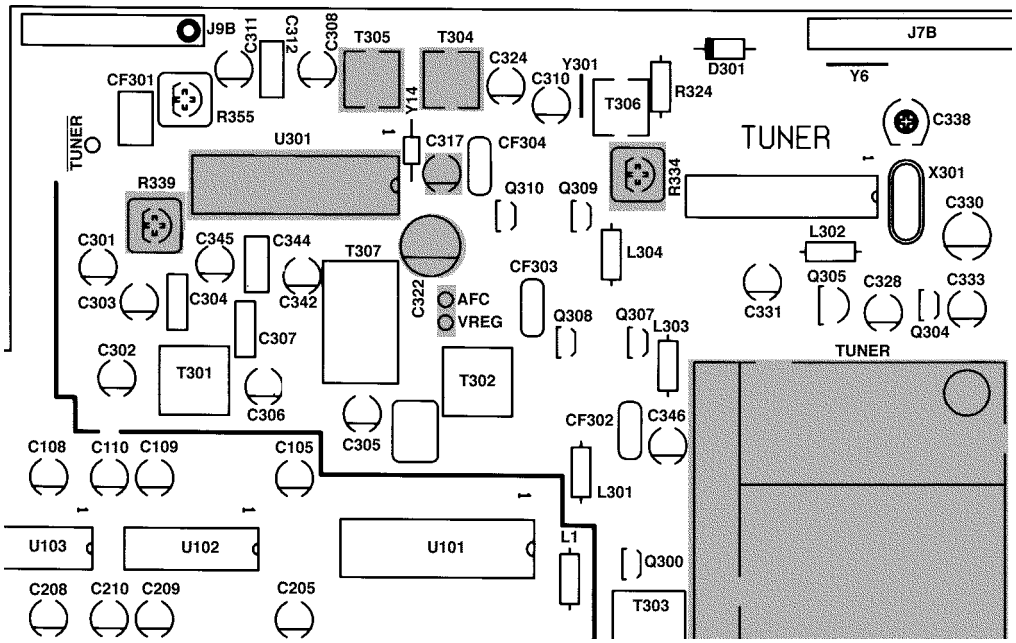


Figure 10. Audio PCB Test Section

CD TEST PROCEDURES

CD ALIGNMENT PROCEDURES (WITH FIXTURE)

Note: Some of these procedures require the use of a CD alignment fixture (P/N 176318). Alternate procedures that do not require a fixture begin on page 30. Refer to Figure 11, CD Alignment Fixture Test Setup. The fixture is required unless otherwise specified. Refer to Figure 13 for adjustment locations.

Test Equipment Needed

Digital Voltmeter
Frequency Counter
Sony Disc YEDS-18
Bose® CD Alignment Fixture (176318)

1. PLL Free Run Frequency (VCO)

Note: This test does not require a test disk or the alignment fixture.

1.1 Connect the frequency counter to PCK and ground.

1.2 Simulate a closed CD door by placing an object between S501's two black posts (the CD door latch can be used). Select CD (S413).

1.3 Adjust R558 until the frequency counter reads 4.320MHz ± 20kHz. (If the adjustment is not done within 4 seconds, then CD must be selected again).

2. Tracking Offset (TO)

Note: Remove any previously loaded test disc. This test will not work with a disc loaded.

2.1 Connect the cable from the test fixture to connector P504 on the unit.

2.2 Connect a DC voltmeter to the positive (+) and negative (-) terminals on the test fixture.

2.3 Select TO on the fixture (press the ADV button until TO lights up). The meter should read approximately 90mVdc.

2.4 Simulate a closed CD door by placing an object between S501's two black posts (the CD door latch can be used). Select CD (S413).

2.5 After the focusing operation is completed, press ERASE (S403). The meter should change from its previous reading in step 2.3 (it will drop). If not, remove power and repeat the test.

2.6 Adjust R511 until the meter reads between -7 to 17mVdc.

3. E/F Balance (E/F)

3.1 Advance the alignment fixture (ADV button) to the E/F setting and set the voltmeter to read DC voltage.

3.2 Simulate a closed CD door by placing an object between S501's two black posts (the CD door latch can be used). Load the YEDS-18 test disc, select CD (S413), and play track 2.

3.3 Press STORE (S411). This puts the unit in the E/F balance mode. The time display will stop.

3.4 Adjust R506 until the meter reads between - 10 to + 50mVdc.

4. Tracking Gain (TG)

4.1 Shut the unit off.

4.2 Advance the fixture to the TG setting and set the voltmeter to read AC voltage.

4.3 Simulate a closed CD door by placing an object between S501's two black posts (the CD door latch can be used). Load the YEDS-18 test disc, select CD (S413), and play track 2.

4.4 Adjust R510 until the meter reads between 440 to 500mVrms.

CD TEST PROCEDURES

5. Focus Gain (FG)

5.1 Advance the fixture to FG and set the voltmeter to read AC voltage.

5.2 Simulate a closed CD door by placing an object between S501's two black posts (the CD door latch can be used). Load the test disc, select CD (S413), and play track 2.

5.3 Adjust R527 until the meter reads between 380 to 420mVrms.

6. Tracking Offset Readjustment

6.1 Refer to procedure 2 and readjust if necessary.

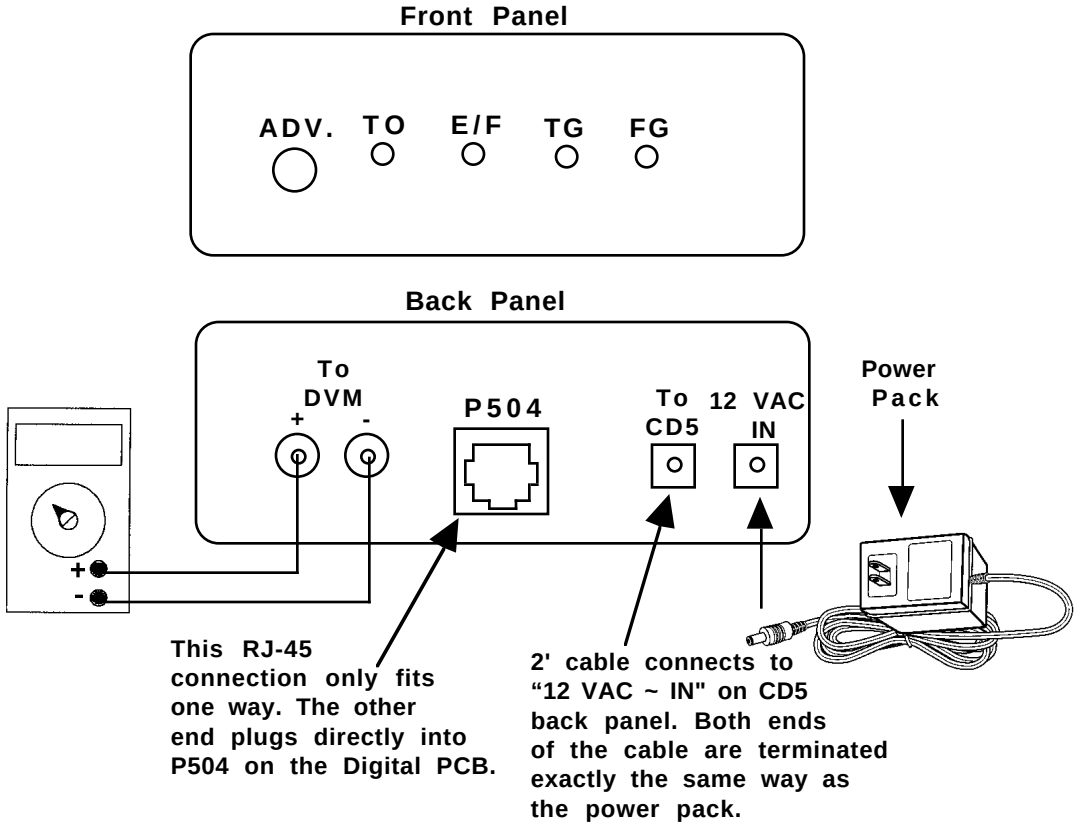


Figure 11. CD Alignment Fixture and Test Setup

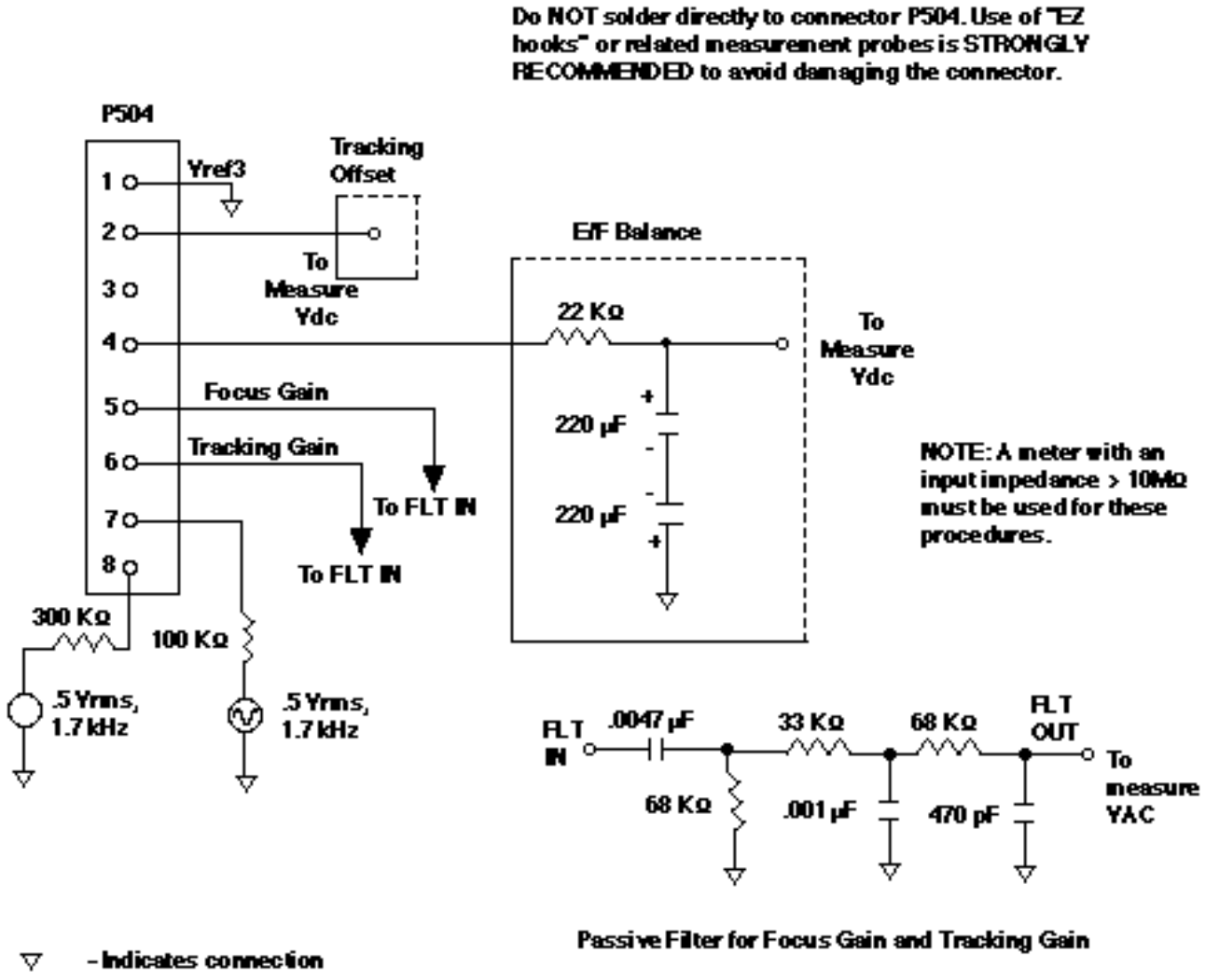


Figure 12. Passive Filter Network and Test Setup

CD TEST PROCEDURES

CD ALIGNMENT PROCEDURES
(Without Fixture)

Note: Refer to Figure 12 throughout this procedure.

Test Equipment Needed

Voltmeter (input impedance > 10MΩ)
Frequency Counter
Sony Disc YEDS-18
Audio Oscillator

1. PLL Free Run Frequency (VCO)

1.1 Connect the frequency counter to PCK and ground.

1.2 Simulate a closed CD door by placing an object between S501's two black posts (the CD door latch can be used). Select CD (S413).

1.3 Adjust R558 until the frequency counter reads 4.320MHz ± 20kHz. (If the adjustment is not done within four seconds, then CD must be selected again).

2. Tracking Offset

Note: Remove any previously loaded test discs. This test will not work with a disc loaded.

2.1 Connect a DC voltmeter between P504 pins 2 (TDO) and 1 (Vref3). The meter should read approximately 90mVdc.

2.2 Simulate a closed CD door by placing an object between S501's two black posts (the CD door latch can be used). Select CD (S413).

2.3 After the focusing operation is completed, press ERASE (S403). The meter should change from its previous reading in step 2.1 (it will drop). If not, remove power and repeat the test.

2.4 Adjust R511 until the meter reads between -7 to +17mVdc.

3. E/F Balance

Note: The test disc is required for this test. Construct the filter indicated in Figure 12 and connect it to P504 pin 4 (TEAO).

3.1 Connect a DC voltmeter between the filter output and P504 pin 1 (Vref3).

3.2 Load the test disc, select CD (S413), and play track 2. Skip forward using S408.

3.3 Press STORE (S411). This puts the unit in the E/F balance mode. The time display will stop.

3.4 Adjust R506 until the meter reads between - 10 to + 50mVdc.

4. Tracking Gain

Note: Shut the unit off. Construct the filter indicated in Figure 12 and connect it (FLT IN) to P504 pin 6 (TPA+).

4.1 Connect an AC voltmeter between the filter output (FLT OUT) and P504 pin 1 (Vref3).

4.2 Connect a 100kΩ resistor to P504 pin 7 (TPA-). Connect an oscillator to the resistor's other end and apply a .5Vrms, 1.7kHz signal to it.

4.3 Insert the test disc and select CD (S413) and play track 2.

4.4 Adjust R510 until the meter reads between 26.3 ± 1.5mVrms.

5. Focus Gain

Note: Construct the filter indicated in Figure 12 and connect it (FLT IN) to P504 pin 5 (FEAO).

5.1 Connect an AC voltmeter between the filter output (FLT OUT) and P504 pin 1 (Vref3).

5.2 Connect a 300kΩ resistor to P504 pin 8 (FSW). Connect an oscillator to the resistor's other end and apply a .5Vrms, 1.7kHz signal to it.

CD TEST PROCEDURES

5.3 Skip back to the beginning of track 2.

5.4 Adjust R527 until the meter reads between 23.2 ± 1.5mVrms.

6. Tracking Offset Readjustment

6.1 Refer to procedure 2 and readjust if necessary.

Final CD Verification Tests

Note: Audible defects are defined as CD dropouts or skipping during play. All units must be able to pass these tests without any audible defects.

1. Warp

1.1 Insert Abex test disc TCD-732RA (or equivalent). Play track 16 (.7 mm).

1.2 Pause the CD and confirm that there are no mechanical scraping sounds.

1.3 Access track 16 again and confirm that it plays properly.

2. Eccentricity

2.1 Insert Abex test disc TCD-714R (equivalent test disc must be eccentric by 210µm).

2.2 Play track 1 (210µm). Listen for at least 4 seconds.

2.3 Access track 15 (or furthest track on equivalent disc) and confirm that the unit plays properly.

3. Optical Defects

3.1 Insert Abex test disc TCD-725 (or equivalent).

3.2 Void: Play track 6 (1mm). Listen for at least 6 seconds.

3.3 Black dot: Play track 9 (.8mm). Listen for at least 8 seconds.

3.4 Fingerprint: Play track 15 (75µm). Listen for at least 10 seconds.

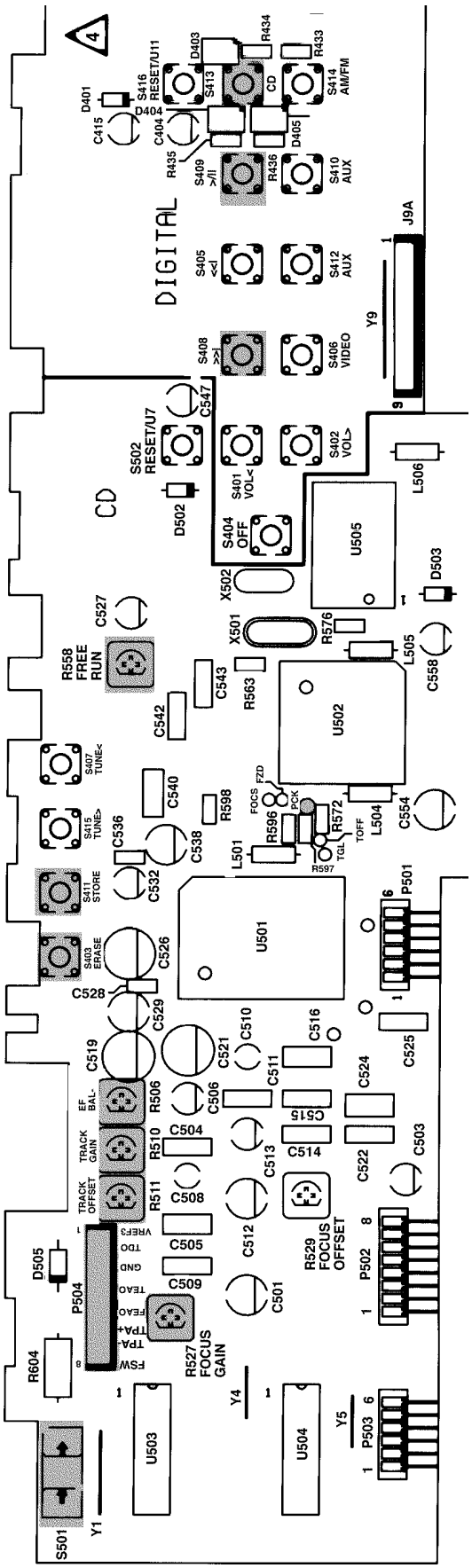


Figure 13. Digital PCB Adjustment Locations

PARTS LIST NOTES

1. This part is not normally available from Customer Service. Approval from the Field Service Manager is required before ordering.

2. The individual parts located on the PCBs are listed in the Electrical Parts List.

3. ⚠ This part is critical for safety purposes. Failure to use a substitute replacement with the same safety characteristics as the recommended replacement part might create shock, fire and/or other hazards.

4. This PCB is part of a pallet. The pallet contains the Display PCB, Audio PCB, and Headphone PCB. This PCB assembly is manufactured and sold as a pallet.

CONSOLE ASSEMBLY PARTS LIST

(Figure 14)

Item Number	Description	Part Number	Note
1	Door Assembly	187743-001	
2	Spring-Torsion, LH	176083	
3	Spring-Torsion, RH	176082	
4	Pin-Hinge, 5.3"	173210	
5	Gear-Damper, Blue	146816-05	
6	Cover Assembly, Right	149956	
7	Cover Assembly, Left	190819	
8	Nameplate, Flat Black	180213	
9	Spring, Ground	173449	
10	PCB Assembly, 120V PCB Assembly, 220V PCB Assembly, 120V/220V	146075-101A 146075-201A 146075-601A	1, 2, 4
11	CD Mechanism, CD90V1, W/APC	146074	
12	Cover, CD Mechanism	148787	
13	Screw-Tapp, 2 x 6 mm, PAN, XREC	149954-04	
14	Grommet, CD Support, Violet	146822-02	
15	Grommet, CD Support, Gray	146822-01	
16	Latch, Console	146081	
17	Spacer, Foam, Rectangular, .25	172332-04	
18	Screw-Tapp, 6-20 x .375, PAN, XRC/S	172779-06	
19	Base Assembly	149955-01	
20	Cable, 5 conductor, 8"	172599	
21	Cable, 8 conductor, 8"	172673	
22	Pad, Foam, Adhesive Backed	174231	

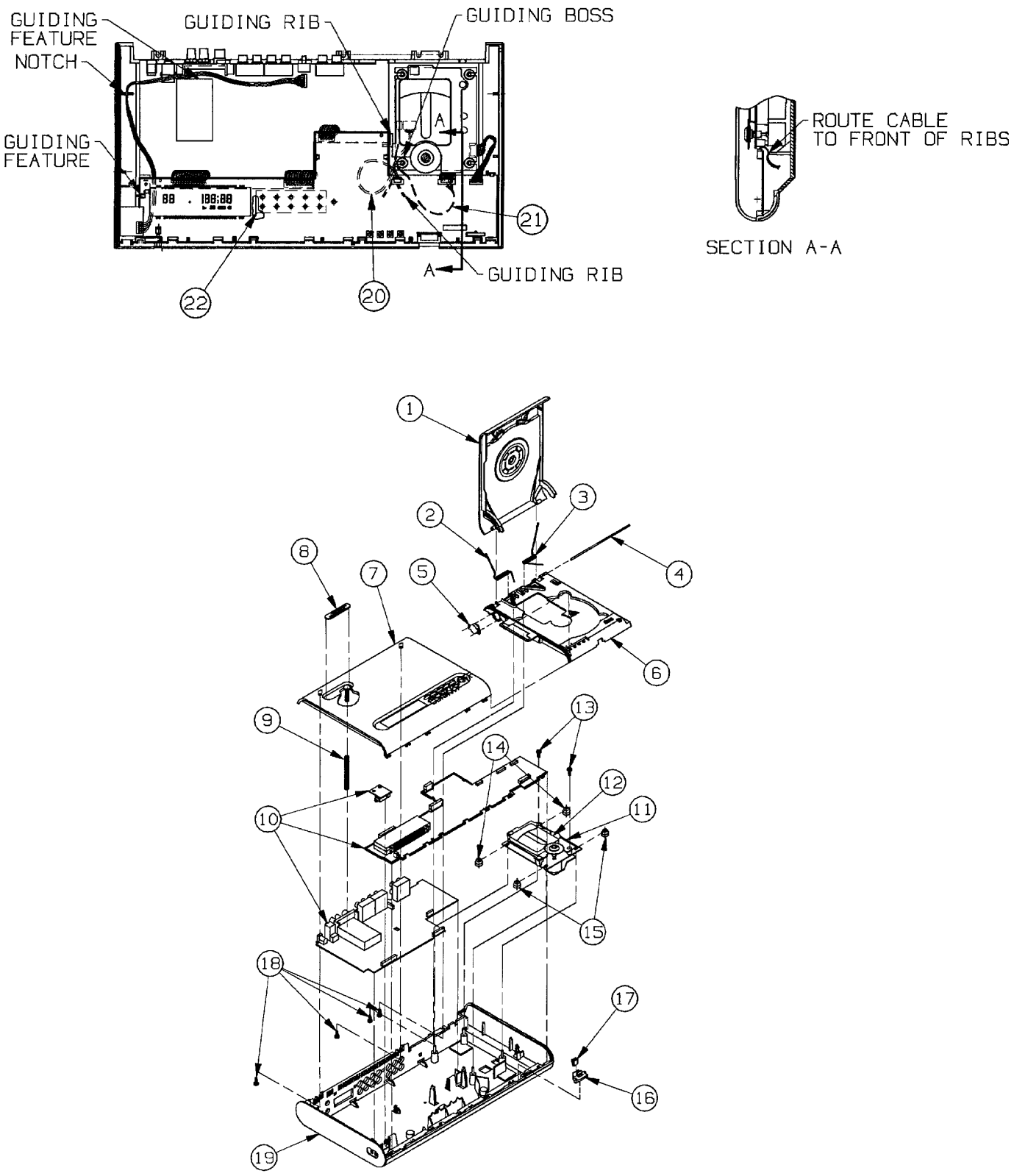


Figure 14. Exploded View

REMOTE CONTROL ASSEMBLY PARTS LIST

(Figure 15)

Item Number	Description	Part Number	Note
1	PCB ASSY RMT CNTRL, RC-5A	194387	1, 2
2	MAT, SWITCH, CD-5	146088	
3	COVER, BOTTOM, CD-5	146089	
4	COVER, TOP, CD-5	146090	
5	DOOR, BATTERY, CD-5	146226	
6	CONTACT, BATTERY, CONE	174001	
7	CONTACT, BATTERY, FLAT	174000	
8	CONTACT, BATTERY, CONE/FLAT	174002-01	
9	CONTACT, BATTERY, FLAT/CONE	174002-02	
10	SPACER, PAD, FOAM	173605	

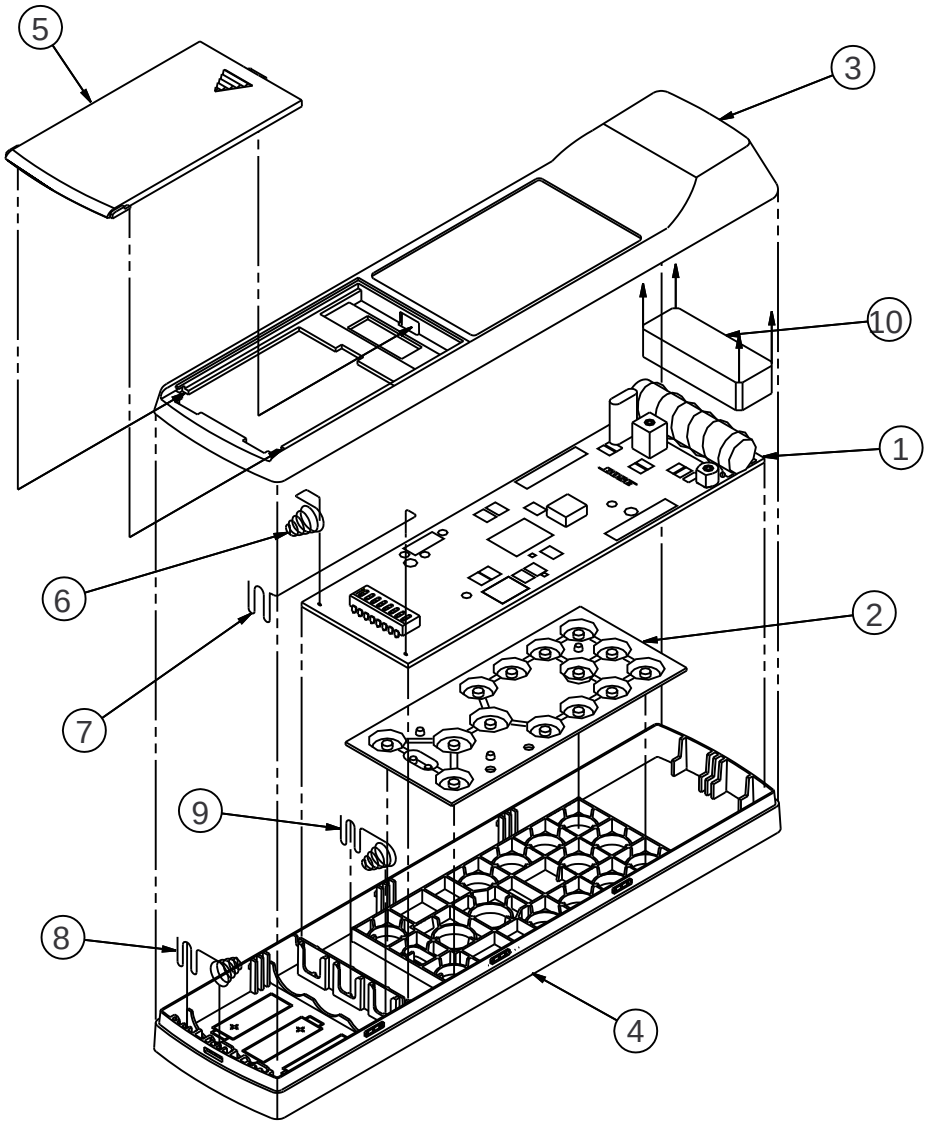


Figure 15. RC5 Exploded View

ELECTRICAL PART LIST

Resistors

Reference Designator	Description	Part Number	Reference
R1, 4, 113, 213, 330, 333, 336, 342, 348, 353, **145,** 406, 420-423, 426, 427, 431, 433-442, 502, 503, 553, 572, 598, 600	1kΩ, 5%, 1/10W, 0805	133626-1025	US/Can.
R2, 315	5.11kΩ, 1%, 1/10W, 0805	133625-5111	
R3, 109, 111, 209, 211	4.75kΩ, 1%, 1/10W, 0805	133625-4751	
R5	2.7Ω, 5%, 1/2W, 52mm, CF	121243-1512R75	
R6	10Ω, 5%, 1W, Metallic Oxide	173314-1005	
R7	1.5kΩ, 5%, 1/4W, 52mm, CF	121243-1211525	
R8	1.5Ω, 5%, 1W, Metallic oxide	171259-1R55	
R9	220Ω, 5%, 1/4W, 52mm, CF	121243-1212215	
R10	75Ω, 5%, 1/4W, 52mm, CF	121243-1217505	
R12	27Ω, 5%, 1/10W, 0805	133626-2705	
R101, 102, 201, 202	9.76kΩ, 1%, 1/10W, 0805	133625-9761	
R103, 203, 588, 592	1kΩ, 1%, 1/10W, 0805	133625-1001	
R104, 105, 204, 205	15.4kΩ, 1%, 1/10W, 0805	133625-1542	
R106, 107, 110, 114, 139, 206, 207, 210, 214, 407, 415, 424, 425, 545, 566, 568, 575, 577, 589, 593, 595	100kΩ, 5%, 1/10W, 0805	133626-1045	
R108, 208	12.4kΩ, 1%, 1/10W, 0805	133625-1242	
R112, 212	22.1kΩ, 1%, 1/10W, 0805	133625-2212	
R115, 215	825Ω, 1%, 1/10W, 0805	133625-8250	
R116, 117, 119, 120, 123-125, 127, 130-133, 216, 217, 219, 220, 223-225, 227, 230-233, 318, 331, 337, 323, 327, 335, 356, 357, 410, 414, 509, 524, 560, 580, 603	4.7kΩ, 5%, 1/10W, 0805	133626-4725	
R118, 218	619Ω, 1%, 1/10W, 0805	133625-6190	

ELECTRICAL PART LIST

Resistors (Continued)

Reference Designator	Description	Part Number	Note
R121, 128, 221, 228	432Ω, 1%, 1/10W, 0805	133625-4320	
R122, 129, 222, 229	182Ω, 1%, 1/10W, 0805	133625-1820	
R126, 226	150Ω, 1%, 1/10W, 0805	133625-1500	
R134-136, 142, 599, 601	1MΩ, 5%, 1/10W, 0805	133626-1055	
R138, 304, 309, 325, 338, 341, 358	10kΩ, 5%, 1/10W, 0805	133626-1035	
R140, 303, 308, 552	330kΩ, 5%, 1/10W, 0805	133626-3345	
R141, 522, 557, 578	33kΩ, 5%, 1/10W, 0805	133626-3335	
R143	30kΩ, 5%, 1/10W, 0805	133626-3035	
R144, 569	1.8kΩ, 5%, 1/10W, 0805	133626-1825	
R145	3.3kΩ, 5%, 1/10W, 0805	133626-3325	Military (120/230V)
R145, 302, 307, 504, 565	2.2kΩ, 5%, 1/10W, 0805	133626-2225	Eur./UK/Sing./Aus.
R300, 525, 540	1.2kΩ, 5%, 1/10W, 0805	133626-1225	
R301	220Ω, 5%, 1/10W, 0805	133626-2215	
R305, 310, 313, 507	2.7kΩ, 5%, 1/10W, 0805	133626-2725	
R306, 311, 516	5.6kΩ, 5%, 1/10W, 0805	133626-5625	
R314, W302, W401	Jumper, Chip, 0805	133627	
R316	12kΩ, 5%, 1/10W, 0805	133626-1235	
R317	8.2kΩ, 5%, 1/10W, 0805	133626-8225	
R319	22Ω, 5%, 1/10W, 0805	133626-2205	
R320	9.10kΩ, 5%, 1/10W, 0805	133626-9125	
R322, 345, 350, 530-533, 548-551, 555	22kΩ, 5%, 1/10W, 0805	133626-2235	
R324	43Ω, 5%, 1/4W, 52mm, CF	121243-1214305	
R326	100Ω, 5%, 1/10W, 0805	133626-1015	
R328	1.6kΩ, 5%, 1/10W, 0805	133626-1625	
R329	620Ω, 5%, 1/10W, 0805	133626-6215	
R332, 535	6.8kΩ, 5%, 1/10W, 0805	133626-6825	
R334	Potentiometer, 10kΩ, 10%, 1/2W	170042-103	

ELECTRICAL PART LIST

Resistors (Continued)

Reference Designator	Description	Part Number	Note
R339, 558	Potentiometer, 20kΩ, 10%, 1/2W	170042-203	
R340	120Ω, 5%, 1/10W, 0805	133626-1215	
R343, 501	10Ω, 5%, 1/10W, 0805	133626-1005	
R344, 346, 349, 351, 429, 430, 561, 582	330Ω, 5%, 1/10W, 0805	133626-3315	
R347, 352	18kΩ, 5%, 1/10W, 0805	133626-1835	
R354	1.05kΩ, 5%, 1/10W, 0805	133625-1051	US/Can./Mil.
R354	1.5kΩ, 5%, 1/10W, 0805	133626-1525	Eur./UK/Sing./Aus.
R401-405, 411, 413, 416-419, 432, 505, 521, 526, 554, 562, 576, 594	10kΩ, 5%, 1/10W, 0805	133626-1035	
R408, 538	120kΩ, 5%, 1/10W, 0805	133626-1245	
R409, 514, 517	390kΩ, 5%, 1/10W, 0805	133626-3945	
R412, 543, 544, 546, 547	27kΩ, 5%, 1/10W, 0805	133626-2735	
R428, 556, 563, 581, 583-585, 596, 597	470Ω, 5%, 1/10W, 0805	133626-4715	
R506, 527	Potentiometer, Trim, 5kΩ, 10%, 1/2W	170042-502	
R508, 542	220kΩ, 5%, 1/10W, 0805	133626-2245	
R510	Potentiometer, Trim, 2kΩ, 10%, 1/2W	170042-202	
R511	Potentiometer, Trim, 100kΩ, 10%, 1/2W	170042-104	
R512, 528, 574	4.7MΩ, 5%, 1/10W, 0805	133626-4755	
R513	15kΩ, 5%, 1/10W, 0805	133626-1535	
R515, 559	3.9kΩ, 5%, 1/10W, 0805	133626-3925	
R518	150kΩ, 5%, 1/10W, 0805	133626-1545	
R519	62kΩ, 5%, 1/10W, 0805	133626-6235	
R520	1.5MΩ, 5%, 1/10W, 0805	133626-1555	
R523, 539, 571	56kΩ, 5%, 1/10W, 0805	133626-5635	
R534	3.3kΩ, 5%, 1/10W, 0805	133626-3325	
R536	82kΩ, 5%, 1/10W, 0805	133626-8235	

ELECTRICAL PART LIST

Resistors (Continued)

Reference Designator	Description	Part Number	Note
R537	160kΩ, 5%, 1/10W, 0805	133626-1645	
R541	91kΩ, 5%, 1/10W, 0805	133626-9135	
R567	200kΩ, 5%, 1/10W, 0805	133626-2045	
R570	68kΩ, 5%, 1/10W, 0805	133626-6835	
R573, 579	270kΩ, 5%, 1/10W, 0805	133626-2745	
R586, 587, 590, 591	2.21kΩ, 1%, 1/10W, 0805	133625-2211	
R602	3.9MΩ, 5%, 1/10W, 0805	133626-3955	
R604	56Ω, 5%, 1/2W, CF	121243-1515605	

Capacitors

Reference Designator	Description	Part Number	Note
C1	.01µF, 20%, 100V, Z5U, Disc	146821-103	
C2, C13	2200µF, 20%, 25V, 85, EL	149948-222E	
C3, 4, 7, 8, 10, 12, 20, 114, 214, 310, 345	10µF, 20%, 50V, 85, EL	149948-100H	
C5, 100, 107, 112, 207, 212, **313,** 336 412, 413, 523	100pF, 5%, 50V, COG, 0805	133622-101	US/Can./Mil.
C6	470µF, 20%, 25V, 85, EL	149948-471E	
C9, 11	1000µF, 20%, 16V, 85, EL	149948-102C	
C14, 17, 18, 116, 216, 330	100µF, 20%, 25V, 85, EL	149948-101E	
C15, 16	100µF, 20%, 50V, 85, EL	149948-101H	
C19	33µF, 20%, 25V, 85, EL	149948-330E	
C101, 102, 201, 202, 354, 533	180pF, 5%, 50V, COG, 0805	133622-181	
C103, 104, 117-120, 203, 204, 217-220, 337, 349, 401, 411, 502, 539	1000pF, 5%, 50V, COG, 0805	133622-102	
C105, 109, 111, 129, 205, 209, 211, 308, 311, 333, 414	1µF, 20%, 50V, 85, EL	149948-1R0H	
C106, 206	47pF, 5%, 50V, COG, 0805	133622-470	
C108, 208, 328	2.2µF, 20%, 50V, 85, EL	149948-2R2H	

ELECTRICAL PART LIST

Capacitors (continued)

Reference Designator	Description	Part Number	Note
C110, 210, 302, 305, 342	4.7µF, 20%, 50V, 85, EL	149948-4R7H	
C113, 213, 301, 324, 331, 346	47µF, 20%, 25V, 85, EL	149948-470E	
C115, 215	22µF, 20%, 25V, 85, EL	149948-220E	
C121, 130, 133, 134, 221, 314, 326, 327, 335, 403, 534, 535, 574	.01µF, 10%, 50V, X7R, 0805	133623-103	
C122-127, 132, 135, 332, 402, 407, 408, 518, 520, 528, 537, 545, 546, 553, 555, 568, 570-573, 575	.10µF, 80%, 25V, Y5V, 0805	133624	
C300, 316, 319, 321, 323, 325, 329, 334, 341, 343, 347, 348, 350-353	.047µF, 20%, 50V, Z5U, 0805	148779-473	
C303, 306, 317	3.3µF, 20%, 50V, 85, EL	149948-3R3H	
C304, 307	.0056µF, 5%, 100V, 85, Box	137127-562	Eur./UK/Sing./Aus.
C304, 307	.0082µF, 5%, 100V, 85, Box	137127-822	US/Can./Mil.
C309, 313	470pF, 5%, 50V, COG, 0805	133622-471	Eur./UK/Sing./Aus.
C**309,** 405, 406, 548, 549	39pF, 5%, 50V, COG, 0805	133622-390	US/Can./Mil
C312, 524	.33µF, 5%, 50V, 85, Box	137127-334	
C315	6800pF, 10%, 50V, X7R, 0805	133623-682	
C318, 556, 557	16pF, 5%, 50V, COG, 0805	133622-160	
C322	220µF, 20%, 25V, 85, EL	149948-221E	
C339	33pF, 5%, 50V, COG, 0805	133622-330	
C340	27pF, 5%, 50V, COG, 0805	133622-270	
C344, 505, 516, 540	.1µF, 5%, 50V, 85, Box	137127-104	
C404	.22µF, 20%, 50V, 85, EL	149948-R22H	
C415	.47µF, 20%, 50V, 85, EL	149948-R47H	
C501, 512, 529, 538, 554, 559, 561	47µF, 20%, 16V, 85, EL	149947-470C	
C503, 506, 513, 527	10µF, 20%, 25V, 85, EL	149947-100E	
C504	.01µF, 5%, 100V, 85, BOX	137127-103	

ELECTRICAL PART LIST

Capacitors (continued)

Reference Designator	Description	Part Number	Note
C507	560pF, 5%, 50V, COG, 0805	133622-561	
C508	1µF, 20%, 50V, EL, 85, BP	147522-1R0	
C509	.018µF, 5%, 100V, 85, Box	137127-183	
C510	.47µF, 20%, 50V, EL, 85, BP	147522-R47	
C511, 514, 525, 542, 543	.033µF, 5%, 63V, 85, Box	137127-333	
C515	.068µF, 5%, 63V, 85, Box	137127-683	
C519, 521, 526	100µF, 20%, 16V, EL, 85	149947-101C	
C522, 562, 565	.0033µF, 5%, 100V, 85, Box	137127-332	
C530	12pF, 5%, 50V, COG, 0805	133622-120	
C531	2.7pF, 5%, 50V, COG, 0805	133622-2R7	
C532	.47µF, 20%, 50V, 85, EL	149947-R47H	
C536	.033µF, 10%, 50V, X7R, 0805	133623-333	
C541	220pF, 5%, 50V, COG, 0805	133622-221	
C544	390pF, 5%, 50V, COG, 0805	133622-391	
C547, 558, 564, 567	1µF, 20%, 50V, 85, EL	149947-1R0H	
C563, 566	.0015µF, 5%, 100V, 85, Box	137127-152	

Diodes

Reference Designator	Description	Part Number	Note
D1-4, 6-8, 301	Rectifier, 1N4004, 400V, 1A	116996-4	
D5	LED, Green, Rt. Angle Mount	147551	
D9	Zener, 1N5252, 24V, .5W, 5%	136758-5252	
D10	Zener, 1N5239, 9.1V, .5W, 5%	136758-5239	
D101-109, 201-206, 302, 303, 401, 502, 503	1N4148, 75V, 300mA, Switching	121501	
D402-405	Switch, 75V, 200mA, SOT-23	148582	
D406	Zener, 1N5246, 16V, .5W, 5%	136758-5246	

ELECTRICAL PART LIST

Diodes (continued)

Reference Designator	Description	Part Number	Note
D407	Zener, 1N5232, 5.6V, .5W, 5%	136758-5232	
D504	Zener, 1N5231, 5.1V, .5W, 5%	136758-5231	
D505	Zener, 1N4742A, 12V, 1W, 5%	116995-4742A	

Transistors

Reference Designator	Description	Part Number	Note
Q1	Bipolar, P, 60V, 5A, TO-126	147529-S	
Q101-107, 201-207	Bipolar, N, 50V, 800mA, SOT23	148770	
Q2, 3, 5, 301, 302, 401, 502	Bipolar, N, 40V, 200mA, SOT23	146819	
Q300	JFET, N, 20V, 20mA, TO-92	148590-F	
Q304	Bipolar, N, 60V, 200mA, TO-92	146812-T	
Q305	JFET, N, 40V, 10mA, TO-92	147561-3	
Q307-310	Bipolar, N, 30V, 30mA, TO-92	147565	
Q312, 405, 500	Bipolar, N, 50V, 100mA, SOT23	146817	
Q4, 311, 501	Bipolar, P, 40V, 200mA, SOT23	148596	
Q402-404	Bipolar, P, 50V, 100mA, SOT23	146818	

Integrated Circuits

Reference Designator	Description	Part Number	Note
U101	Analog Switch, TC9163N, DIP28	146814	
U102, 507	Op-Amp, Quad, NJM074, DIP14	146078	
U103	Volume Control, TC9213P, DIP16	147622	
U104	Op-Amp, Dual, NJM4556, SO-8	148598	
U105	Op-Amp, Dual, NJM2082M, SO-8	146820	
U106	Comparator, Dual, LM393, SO-8	148584	
U301	Digital Tuner, LA1851, DIP30	146815	
U302	Frequency Synthesizer, PLL, LM7000, DIP20	147527	

ELECTRICAL PART LIST

Integrated Circuits (continued)

Reference Designator	Description	Part Number	Note
U401	EEPROM, 59C11, 1 KB, SO-8	147536	
U402	Microcontroller, 68HC05C12, Programmed	178324	
U403	VFD Driver, MM58342, DIP28	146813	
U501	ASP, LA9210M, DIP80	146809	
U502	DSP, LC7867, DIP64	146810	
U503, 504	Motor Driver, LA6531, DIP16	146808	
U505	Microcontroller, 68HC05P7, SO-28, Programmed	146806	
U506	DAC, LC7883M, 16 bit, SO-28	146811	
VR1	Regulator, 12V, Neg., LM320LZ, TO-92	147530-12	
VR2	Regulator-Voltage, Pos., 8V, TO-92	171406-08	
VR3	Regulator-Voltage, Pos., 5V, TO-92	171406-05	

Inductors

Reference Designator	Description	Part Number	Note
L1, 400, 501, 504, 506	10µH, 160A, 7.96Hz	147563-100	
L101, 505	1µH, 270A, 25.2Hz	147563-1R0	
L301	1000µH, 40A, .796Hz	147563-102	
L302-304	100µH, 90A, 2.52Hz	147563-101	
L502, 503	Inductor, 4.7µH, 10%	147563-4R7	
L507	Inductor, 2.2µH, SMD	173273-2R2	

Ceramic Filter

Reference Designator	Description	Part Number	Note
CF301	Resonator, Ceramic, 456kHz	147233	
CF302-304	Filter, Ceramic, 10.7MHz, 230kHz	147559	Eur./UK/Sing./Aus.
CF302-304	Filter, Ceramic, 10.7MHz, 280kHz	173107	US/Can./Mil.

ELECTRICAL PART LIST

Crystals

Reference Designator	Description	Part Number	Note
X301	Crystal, Quartz, 7.2MHz, 50 PPM	147223	
X401, 502	Resonator, Ceramic, 4MHz	147534	
X501	Crystal, 16.93444MHz, 100 PPM	147533	

Tuning Coils

Reference Designator	Description	Part Number	Note
T301, 302	Filter, Stereo MPX, Single-tuned	147236	
T303	Module, Tuning, AM, Front End	172972	
T304	Inductor, FM Detector, Distortion Adj., 10.7MHz	147557	
T305	Inductor, FM Detector, Center Adj., 10.7MHz	147564	
T306	Filter, FTZ, 114kHz	147558	Eur./UK/Sing./Aus.
T307	Inductor, AM IF, High Selectivity, 450kHz	148581	
TUNER	Tuner, Front, FM, 4-gang	140088	US/Can./Mil.
TUNER	Tuner, Front, FM, 4-gang	140089	Eur./UK/Sing./Aus.

Miscellaneous

Reference Designator	Description	Part Number	Note
RR101	Receiver, RF Remote, 27.145MHz	148588	
J6A	Connector, Header, 5 pos.	148591-05	
	Cable, 24 AWG, 5 conductor, 2.5 mm, 3"	148772-0503	
J7A	Connector, Header, 12 pos.	148591-12	
J7B	Cable, 24 AWG, 12 conductor, 2.5 mm, 3"	148772-1203	
J9A	Connector, Header, 9 pos.	148591-09	
J9B	Cable, 24 AWG, 9 conductor, 2.5 mm, 3"	148772-0903	

ELECTRICAL PART LIST

Miscellaneous (continued)

Reference Designator	Description	Part Number	Note
J101, 102	Connector, Jack, Quad Phono	149959	
J103	Connector, Jack, Phono, 6 pos.	148766	
J104	Connector, Jack, Headphone, 3.5mm	148583	
J105A-B, 105B-A	Cable, 26 AWG, 5 conductor, 2 mm, 13"	148771-0513	
J301	Connector, Antenna, F/SCR Terminal	148586	US/Can./Mil.
J301	Connector, Antenna, PAL	171623	Eur./UK/Sing./Aus.
J401	Connector, Dual Stereo, Mini	145310	
P1	Connector, Jack, DC Power	147540	
P401	Connector, Header, 3 pin	148595-03	
P501	Connector, Header, 6 pin, Male	134740-06	
P502	Connector, Header, 8 pin, Male	134740-08	
P503	Cable, 6 conductor, 3", 28AWG	172162-0603	
P504	Connector, Header, 8 pos.	148591-08	
S501	Switch, Optical	171258	
S401-415	Switch, Tactile Dome, 160 gf	172999-02	
VFD401	Display, Vacuum Fluorescent	146077	

RC5 ELECTRICAL PART LIST

Resistors

Reference Designator	Description	Part Number	Note
R2-5,13, 21-23	200kΩ, 5%, 1/10W, 0805	133626-2045	
R6, 9	100kΩ, 5%, 1/10W, 0805	133626-1045	
R7	470kΩ, 5%, 1/10W, 0805	133626-4745	
R8	4.7kΩ, 5%, 1/10W, 0805	133626-4725	
R10	2.7kΩ, 5%, 1/10W, 0805	133626-2725	
R11	1kΩ, 5%, 1/10W, 0805	133626-1025	
R12	680Ω, 5%, 1/10W, 0805	133626-6815	
R14	130kΩ, 5%, 1/10W, 0805	133626-1345	
R15	180kΩ, 5%, 1/10W, 0805	133626-1845	
R16	560Ω, 5%, 1/10W, 0805	133626-5615	
R17	220kΩ, 5%, 1/10W, 0805	133626-2245	
R18	150kΩ, 5%, 1/10W, 0805	133626-1545	
R19	10kΩ, 5%, 1/10W, 0805	133626-1035	
R20	4.3kΩ, 5%, 1/10W, 0805	133626-4325	

Capacitors

Reference Designator	Description	Part Number	Note
C1	330pF, 5%, 50V, COG, 0805	133622-331	
C2	0.033µF, 10%, 50V, X7R, 0805	133623-333	
C3, 4, 6	100pF, 5%, 50V, COG, 0805	133622-101	
C5	.10µF, 80%, 25V, Y5V, 0805	133624	
C7	10µF, 20%, 25V, 85, EL	148769-100E	
C8	.047µF, 20%, 50V, 0805, Z5V	148779-473	
C10	120pF, 5%, 50V, COG, 0805	133622-121	
C12	270pF, 5%, 50V, COG, 0805	133622-271	
C13, 18, 25	.022µF, 10%, 50V, X7R, 0805	133623-223	
C14	10pF, 5%, 50V, COG, 0805	133622-100	

RC5 ELECTRICAL PARTS LIST

Capacitors (continued)

Reference Designator	Description	Part Number	Note
C16	33pF, 5%, 50V, COG, 0805	133622-330	
C17	27pF, 5%, 50V, COG, 0805	133622-270	
C19	56pF, 5%, 50V, COG, 0805	133622-560	
C20	22pF, 5%, 50V, COG, 0805	133622-220	
C21	39pF, 5%, 50V, COG, 0805	133622-390	
C22	68pF, 5%, 50V, COG, 0805	133622-680	
C23	560pF, 5%, 50V, COG, 0805	133622-561	
C24	27pF, 5%, 100V, T2H, 0805	147531-270	
C26	1000pF, 5%, 50V, COG, 0805	133622-102	
TC1	2-7pF, 100V, NPO, Trim Capacitor	148768-Z070	

Diodes

Reference Designator	Description	Part Number	Note
D2, 4, 5	Switch, 75V, 200mA, SOT23	148582	
D3, 6, 7	Dual, 75V, 300mA, SOT23	148774	

Transistors

Reference Designator	Description	Part Number	Note
Q1, 3	Bipolar, 40V, 200mA, P, SOT23	148596	
Q2	Bipolar, 40V, 200mA, N, SOT23	146819	
Q4, 5	Bipolar, 30V, 30mA, N, SOT23	148781-4	
Q6	Bipolar, 20V, 1.5A, N, SOT23	148780-7	

Integrated Circuit

Reference Designator	Description	Part Number	Note
U1	RC Transmitter, SO-24	148784	
U2	Monostable Multivibrator, CD4538, SO-16	148785	

RC5 ELECTRICAL PARTS LIST

Miscellaneous

Reference Designator	Description	Part Number	Note
-	Connector receptacle, Battery contact (2 in qty.)	171982	
L2, 5, 6, 9	10µH, 160A, 7.96Hz, Axial	147563-100	
L3	6.8µH, 175A, 7.96Hz, Axial	147563-6R8	
L4	1.2µH, 260A, 7.96Hz, Axial	147563-1R2	
L7	.47µH, 330A, 25.2Hz, Axial	147563-R47	
L8	Bar antenna, 1.15µH, 5%	148786	
SW1	Switch, DIP, SPST, 16 DIP, 8 position	148777	
T1	Inductor, 27.145MHz	148778	
X1	Resonator, Ceramic, 455kHz	148782	
X2	9.04833MHZ, 35PPM	148783	

PACKAGING PART LIST

Item Number	Description	Part Number	Note
1	Remote Control Assembly (RC5A) Remote Control Assy Packaged for Resale	179980 172724	2
2	Polybag (Remote)	144348	
3	Wire Cover	173201	
4	Power Supply, 120V (US/Can.) Power Supply, 220V (Eur.) Power Supply, 230V (UK/Sing.) Power Supply, 240V (Aus.)	146225 146798 146799 146800	3
5	Batteries-AA size	147538	
6	Packing-Insert, Top	147539	
7	Antenna-FM Dipole, 75Ω, F connector (US/Can., Mil.) Antenna-FM Dipole (Eur./UK/Sing./Aus.)	148589 143185	
8	Microfoam Bag	174591	
9	Antenna, AM Loop	147544	
10	Packing, Insert, Bottom	147543	
11	Carton, Shipping	148767	
-	Shipping Carton Kit	179730	

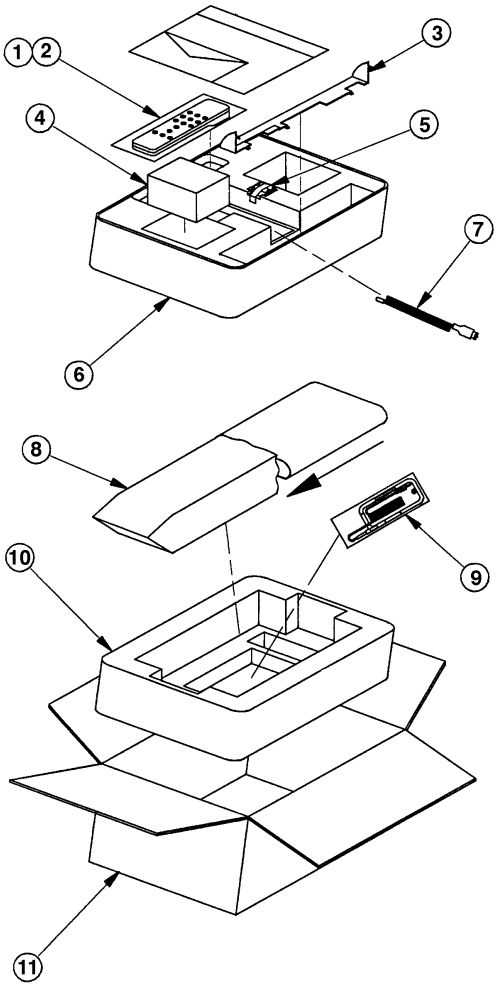


Figure 16. Packaging Exploded View

SERVICE BULLETIN

181473

Product: CD5

Subject: Micro Reset Modification

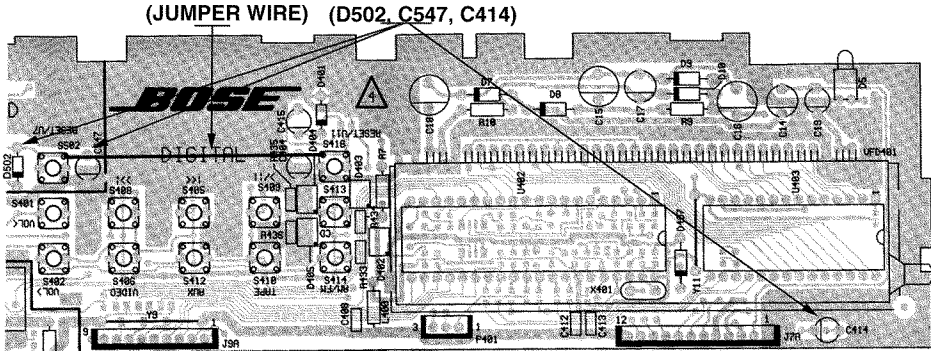
Symptom: Customer complains of CD not working.

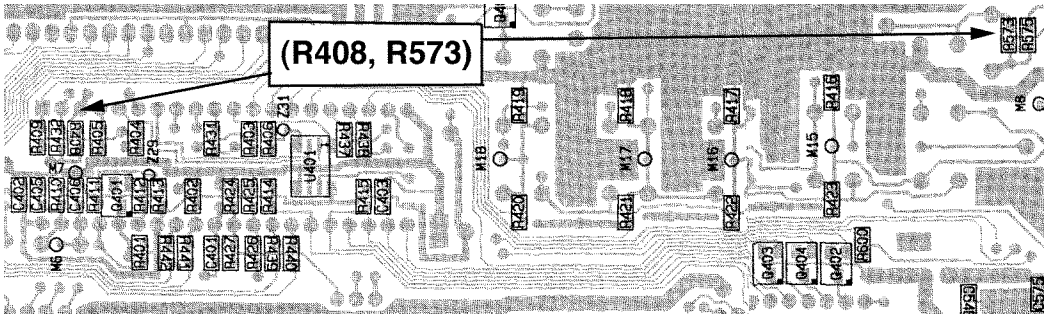
Reason: CD micro is not resetting under certain conditions.

Solution: Perform reset modification listed below to display PCB.

1) Remove: R408 (120k), C414 (1uf), R573 (270k), C547 (1uf), D502.

2) Add a jumper wire from the hot side of S416 to hot side of S502. This wire should not be excessively long, and should lay flat on the board. (See diagrams below)
Note: Latter production units used an improved reset circuit (U404). U404 is located on the display PCB under the BOSE® logo. This modification is not needed on these units.





SERVICE BULLETIN

177871-B1

Product: CD-5

Subject: Display Failure

Symptom: Flashing VFD displays are being observed on CD-5 units.

Reason: The existing ground trace breaks at the pad leaving no ground. This change affects PCB P/N 177400 and has been added to all production units starting the week of 12/17/95.

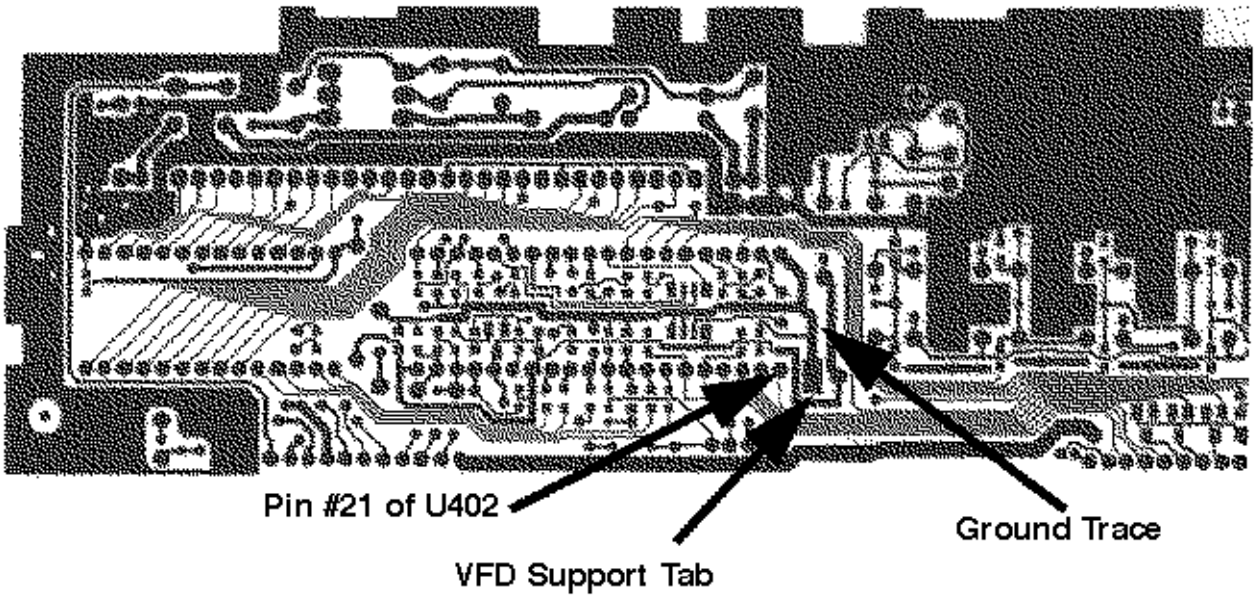
Solution: Repair ground trace.

1. Refer to the disassembly/ assembly procedures to access the Digital PCB.

2. Compare the PCB to the figure below. If a piece of jumper buss wire is present from the VFD Support tab (closest to pin 21 of U402) to the ground trace, the modification has been done. If it is not present, proceed to step 3.

3. Scrape the ground trace a 1/4" from the VFD Support tab until the copper is visible.

4. Install a jumper buss wire from the VFD Support tab to the broken ground trace. Be sure to wrap the wire around the tab once or twice before soldering it to the ground trace.



SERVICE BULLETIN

174798-B1

Product: Lifestyle® CD5

Subject: Dim VFD Display

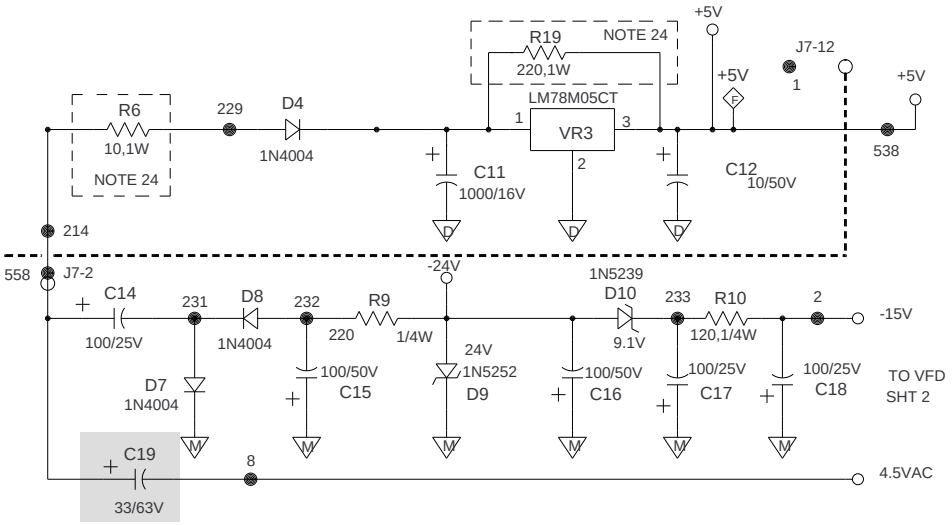
Effective Date: 8/27/96

Symptom: Dim VFD Display.

Reason: Improper voltage rating on C19.

Solution: Replace C19 with a 33uF, 63V capacitor, part number **149948-3301J**.

The display dims on some units, after the unit has been in use for a period of time. When a unit is returned from the field for service, C19 should be checked to ensure that the voltage rating on C19 is 63V. If it is not, it should be replaced with a 33uF, 63V capacitor, part number 149948-3301J. This should be done to all units returned for service to ensure this failure does not occur in the future. Refer to the schematic below, the CD5 service manual, part number 174798, and the CD5 supplement, part number 177871, for schematics, PCB layouts and disassembly procedures.



CD5 Power Supply

Date issued: 6/17/97

CD5 TROUBLESHOOTING GUIDE

Symptom	Probable Cause	Solution	Service Bulletin
Hum	C2, physical damage	Replace C2	
Intermittent or no operation	P1, fractured solder joint or lifted pad	Repair fractured solder joint or lifted pad.	
No operation	Q2, 3, 4, 5 failed	Replace Q2, 3, 4, 5.	
Display Dim	C19 voltage under rated	Replace C19 with a 33uF, 63V cap part number 149948-3301J.	174798-B1
Display Flashes	Ground break at VFD support tab	Repair ground break at VFD support tab located near U402, pin 21.	177871-B1
Will not track or focus. CD mechanism not the problem	U503 or U501	Ensure U501 and 503 is properly soldered. Check U501 and 503 for proper operation.	
No laser output	Solder short across C502	Remove solder short from C502 and check Q501.	
One or more of the unit's functions do not operate using controls on center but work with remote	Defective switch	Replace switch.	
No remote control operation	Remote control receiver not properly soldered	Remove solder from legs of remote receiver and scrape legs and then solder	
No FM	X301 defective	Replace X301	
No audio output	U101 (multiplex IC) defective	Replace U101	
Distorted output, CD only	Defective U506 (D/A converter) or poor solder connection	Ensure U506 is properly soldered or replace U506	
Customer complains that CD does not operate. CD operates after unit is unplugged and plugged in again.	CD micro is not resetting under certain conditions	See service bulletin 181473 for reset modification procedures.	181473
CD will not operate.	C13, located in the power supply, has a bad connection causing low voltage on pin 1 (≈ 14V) and pin 16 (≈ 4V) of U503 or U504.	Repair fractured solder joint or damaged track.	

CD5 VOLTAGES AND WAVEFORMS

Remote Control Voltages

Node	Voltages			Units	Test Condition
	Min.	Typical	Max.		
Q1 C		4.50		VDC	Button pressed
Q1 C		0.00		VDC	Remote off
Q3 C		0.00		VDC	Remote off
Q4 B		1.25		VDC	Button pressed
Q4 E		.62		VDC	Button pressed

Power Supply Section Voltages (Reference Designators 0-99)

Node	Voltages			Units	Test Condition
	Min.	Typical	Max.		
P1 pin 1 (AC power in)		13.0		VRMS	FM on
D1 Cathode		14.5		VDC	FM on
C3+ (+10V supply)	9.4	10.3	11	VDC	FM on
C3+ (+10V supply)		0.0		VDC	Unit off
D2 Anode		-17.9		VDC	FM on
C8- (-12V supply)	-12.8	-12.0	-11.2	VDC	FM on
C8- (-12V supply)		0.0		VDC	FM on
C4+		0.0		VDC	Unit off
D6 Cathode (M+ supply)		14.25		VDC	FM on
D3 Cathode	11.5	13.6	14.8	VDC	FM on
C10+ (+8V supply)	7.5	8.0	8.5	VDC	FM on
D4 Cathode	9.2	10.4	12.4	VDC	FM on
C12+ (+5V supply)	4.7	5.0	5.3	VDC	FM on
D9 Anode (-24V supply)	-26.5	-24.5	-22.3	VDC	FM on
C18- (VFD heater)		-15.3		VDC	FM on
C19- (VFD heater)		-15.3		VDC	FM on
Across VFD heater	2.6		4.3	VRMS	FM on

Audio Section Voltages (Reference Designators 100-299)

Node	Voltages			Units	Test Condition
	Min.	Typical	Max.		
J8 pin 8		-10.7		VDC	FM on
J8 pin 8		+4.9		VDC	Unit off
J8 pin 6		-10.7		VDC	A unmuted
J8 pin 6		+4.9		VDC	A muted
J8 pin 7		-10.7		VDC	B unmuted
J8 pin 7		+4.9		VDC	B muted

CD5 VOLTAGES AND WAVEFORMS

Microcontroller Section Voltages (Reference Designators 400-499)

Node	Voltages			Units	Test Condition
	Min.	Typical	Max.		
U402 Pin 40 (Vdd)		5.0		VDC	
U402 Pin 35 (reset)		4.8		VDC	
U402 Pin 36		4.9		VDC	

Tuner Section Voltages (Reference Designators 300-399)

Node	Voltages			Units	Test Condition
	Min.	Typical	Max.		
Q301 E		4.3		VDC	FM on
Q301 C		6.9		VDC	FM on
Q302 E		4.3		VDC	FM on
Q302 C		6.9		VDC	FM on
C346+		9.5		VDC	FM on
Q311 C (FM B+)		10.2		VDC	FM on
Q308 E		3.3		VDC	FM on
Q308 C		8.6		VDC	FM on
Q310 E		3.3		VDC	FM on
Q310 C		8.6		VDC	FM on
Q300 S		.55		VDC	FM on
U301 Pin 28 (Vreg)	2.1	2.3	2.6	VDC	FM on
U301 Pin 5 (AM det out)		0.83		VDC	FM on
U301 Pin 7 (FM Disc)	8.30			VDC	FM on
U301 Pin 8 (FM det out)		3.15		VDC	FM on
U301 Pin 14 (Lout)		4.8		VDC	FM on
U301 Pin 15 (Rout)		4.8		VDC	FM on
Q305 S		2.1		VDC	FM on

CD5 VOLTAGES AND WAVEFORMS

CD Section Voltages (Reference Designators 500-699)

Node	Voltages			Units	Test Condition
	Min.	Typical	Max.		
U501 pin 80 (Vref1)		1.6		VDC	CD on
U501 pin 8 (Vref2)	3.6	4.0	4.4	VDC	CD on
U501 pin 9 (Vref3)	3.6	4.0	4.4	VDC	CD on
U501 pin 7 (TEAO)		4.0		VDC	CD on
U501 pin 15 (TPAO)		4.0		VDC	CD on
U501 pin 21 (TDO)		4.0		VDC	CD on
U501 pin 22 (FDO)		4.0		VDC	CD on
U501 pin 26 (FEAO)		4.0		VDC	CD on
U501 pin 31 (SPDO)		4.0		VDC	CD on
U501 pin 33 (SLDO)		4.0		VDC	CD on
P501 pin 4 (A+C)		1.6		VDC	CD on
P501 pin 5 (B+D)		1.6		VDC	CD on
P501 pin 2 (E)		4.0		VDC	CD on
P501 pin 1 (F)		4.0		VDC	CD on
P502 Pin 1 (LD)		1.9		VDC	CD on
U505 pin 1 (reset)		4.8		VDC	CD on
U505 pin 23 (door sw)		4.8		VDC	CD door closed
U505 pin 23 (door sw)		0.2		VDC	CD door open
U502 pin 56 (reset)		4.9		VDC	
D504 Cathode	4.75	5.0	5.4	VDC	
U506 VrefH	4.0	4.4	4.75	VDC	
U507 pin 1		2.2		VDC	
U507 pin 14		2.2		VDC	

Remote Control Waveforms

Node	Waveform	Bias Level (VDC)	Amplitude	Frequency (MHz)	Test Condition
U1 pin 10	(sine)	2.2	4.5VPP	.455	Button pressed
Q3 C	Data	--	4.2VPP	--	Button pressed
Q4 B	Sine	1.1	3.2VPP	9.048	Button pressed
Q4 E	Sine	0.7	2.8VPP	9.048	Button pressed
Q4 C	Sine	4.3	2.1VPP	27.145	Button pressed
Q5 B	Sine+Data	0.3	1.3VPP	27.145	Button pressed
Q5 C	Modulated Sine		4.3VPP	27.145	Button pressed
Q6 C	Modulated Sine		3.0VPP	27.145	Button pressed
L7/C23 (TP27)	Modulated Sine		3.0VPP	27.145	Button pressed

CD5 VOLTAGES AND WAVEFORMS

Power Supply Section Waveforms (Reference Designators 0-99)

Node	Waveform	Bias Level (VDC)	Amplitude	Frequency	Test Condition
C18-	Sine	-15.3	4.3 VPP	50/60HZ	Display off
C19-	Sine	-15.3	1.3 VPP	50/60HZ	Display off

Microcontroller Section Waveforms (Reference Designators 400-499)

Node	Waveform	Bias Level (VDC)	Amplitude	Frequency	Test Condition
U402 pin 38	Sine	2.2	6.0 VPP	4.0MHz	
U402 pin 33	Clock pulse	--	0/5V	--	
D402 Cathode	Pulse	--	-.5/4.5 V	1.0KHz	
D403 Cathode	Pulse	--	-.5/4.5 V	1.0KHz	
D404 Cathode	Pulse	--	-.5/4.5 V	1.0KHz	
D405 Cathode	Pulse	--	-.5/4.5 V	1.0KHz	

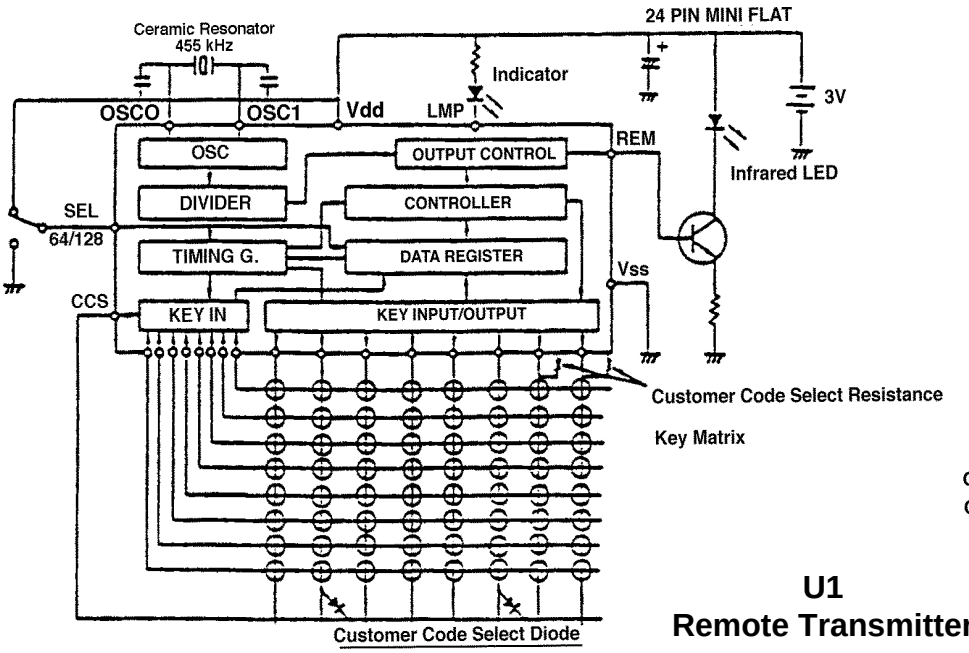
Tuner Section Waveforms (Reference Designators 300-399)

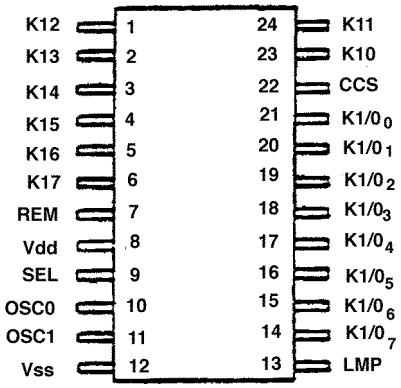
Node	Waveform	Bias Level (VDC)	Amplitude	Frequency	Test Condition
U301 pin 13	Sine	6.5	2.4 VPP	456KHz	FM on
U301 pin 29	Sine	2.3	0.9 VPP	1450KHz	AM, 1 MHz
U301 pin 26		8.3	--	450KHz	AM, Sig. in
U301 pin 30	Sine	0.7	0.8 VPP	1450KHz	AM, 1 MHz
U302 pin 7		--	3.8 VPP	400KHz	
FM F.E pin 1	Sine	0.0	0.4 VPP	108.8MHz	FM, 98.1
FM F.E pin 4		0.0	--	10.7MHz	FM on

CD Section Waveforms (Reference Designators 500-699)

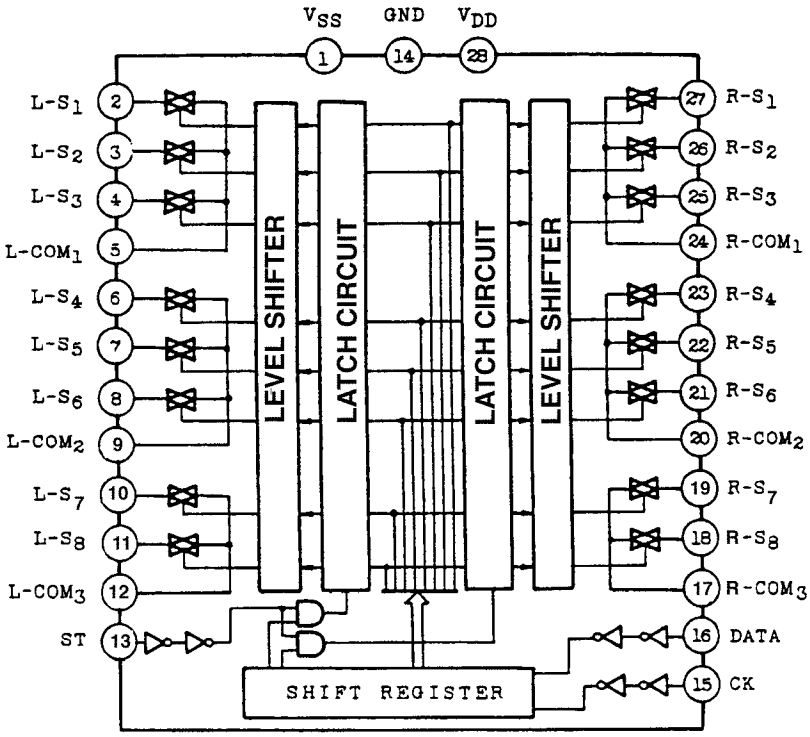
Node	Waveform	Bias Level (VDC)	Amplitude	Frequency	Test Condition
U501 pin 72 (RFSM)	(Eye Pattern)	1.45	2.4 VPP	--	CD playing
U501 pin 60 VCO		3.8	1.9 VPP	8.64MHz	CD playing
U502 pin 2 AO	Sine	2.2	4.1 VPP	8.64MHz	CD playing
U505 pin 26	Sine	2.2	6.0 VPP	4.0MHz	
U502 pin 59 4M	Square	--	0/5 V	4.234MHz	CD playing
U502 pin 64 Xo	Sine	2.2	4.8 VPP	16.93MHz	CD playing
U502 pin 58 16M		2.1	5.3 VPP	16.93MHz	CD playing
U506 pin 5 BCLK	Square	--	0/5 V	2.117MHz	CD playing
U506 pin 7 LRCK	Square	--	0/5 V	44.1MHz	CD playing

INTEGRATED CIRCUIT DIAGRAMS

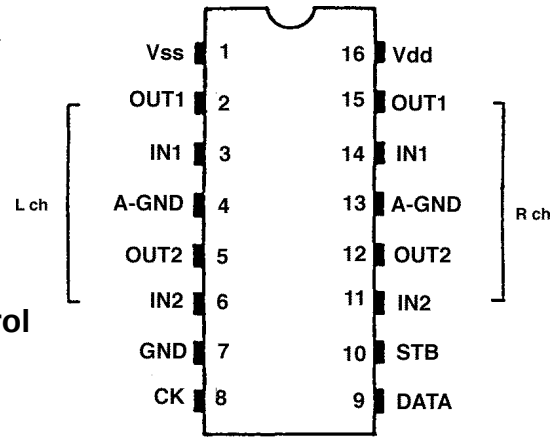




U1
Remote Transmitter

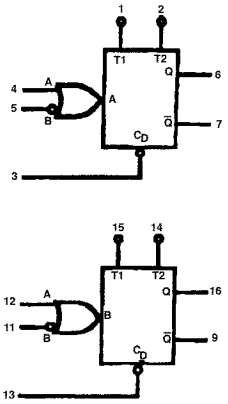


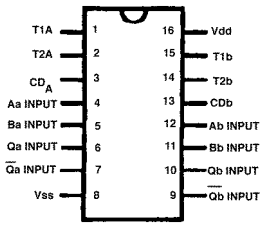
U101
Analog Switch
TC9163N



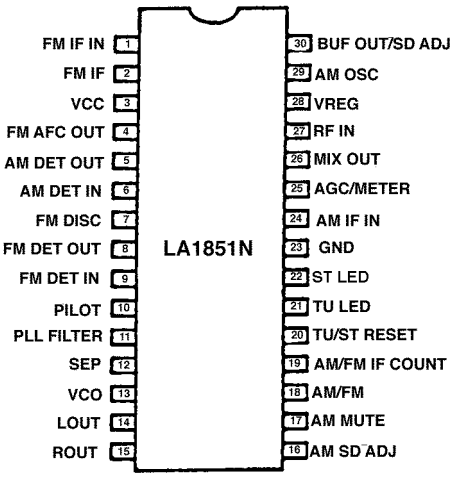
U103
Volume Control
TC9213P

INTEGRATED CIRCUIT DIAGRAMS

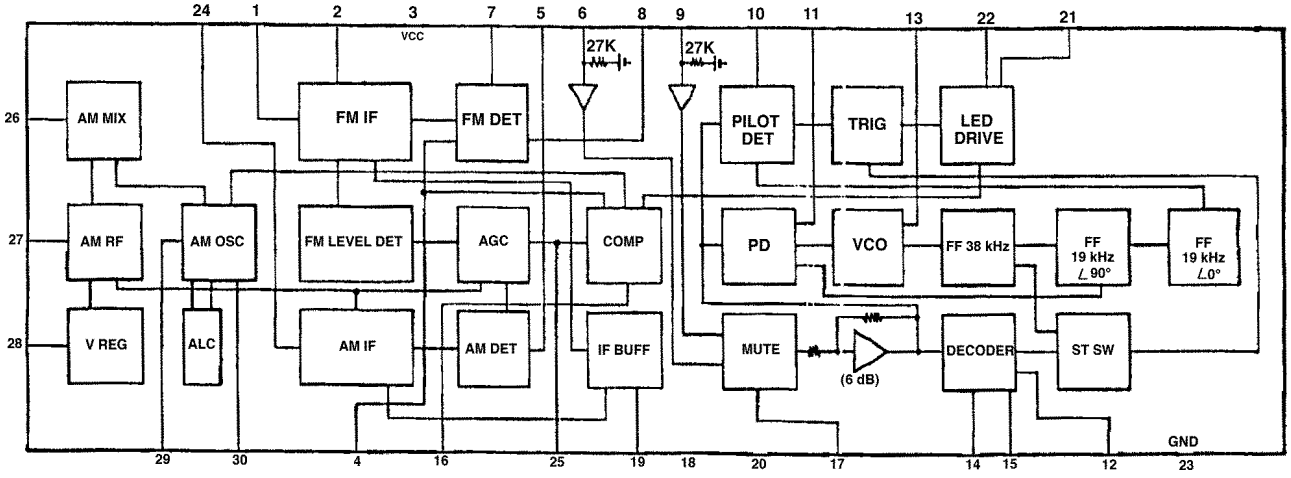


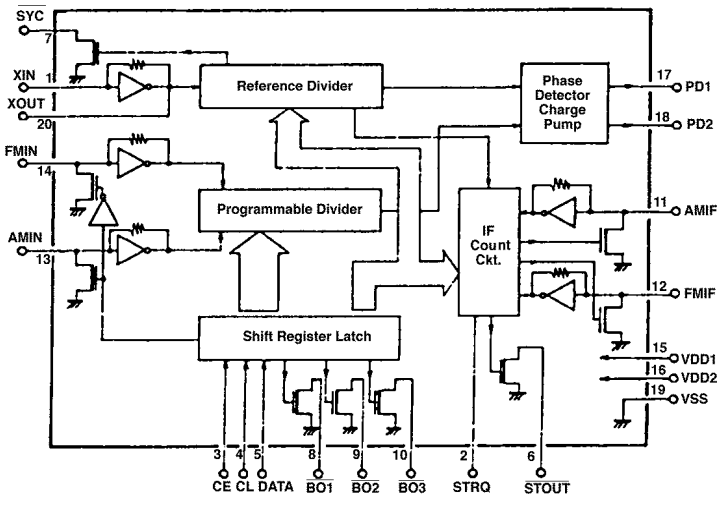


U2
Monostable Multivibrator
CD4538

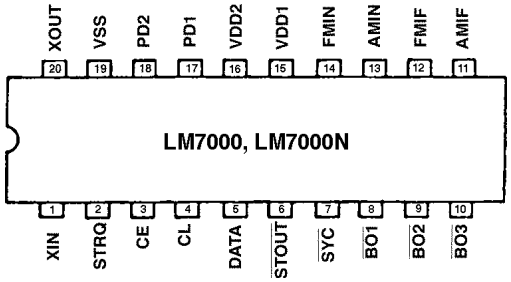


U301
AM/FM Tuner
LA1851N

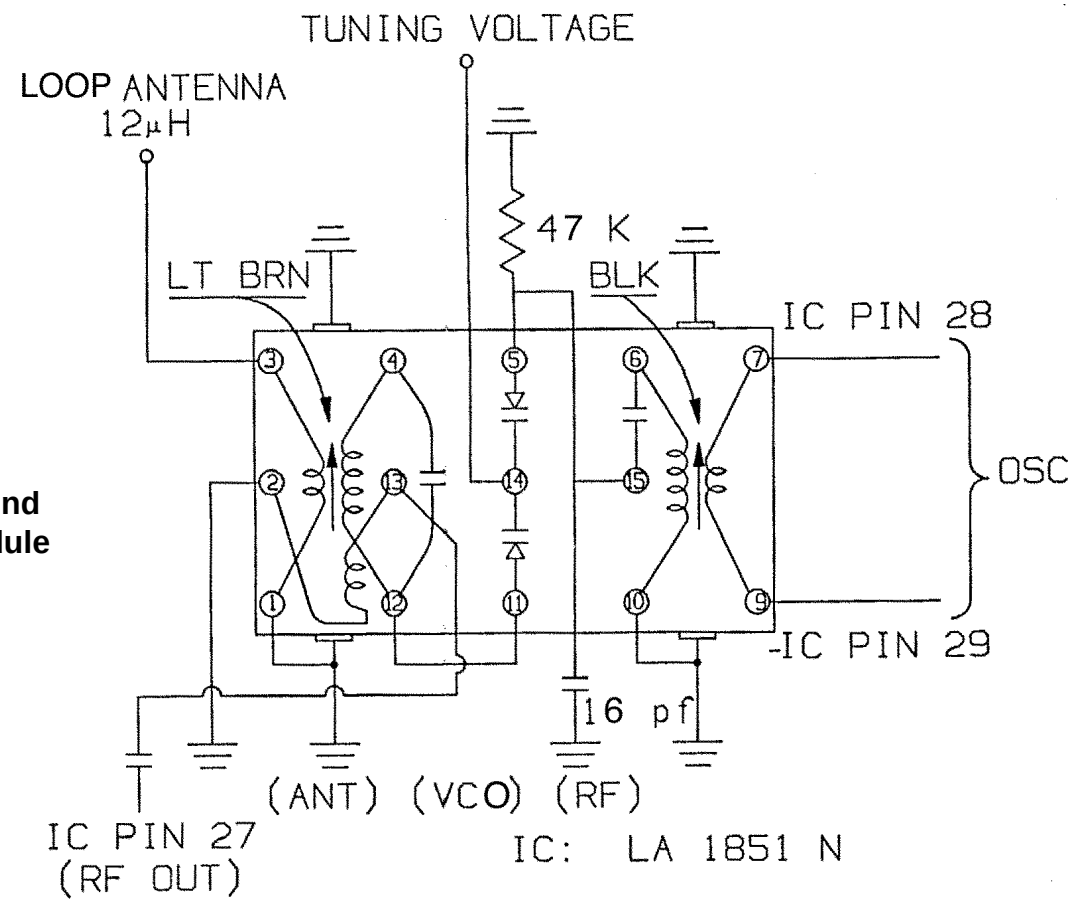




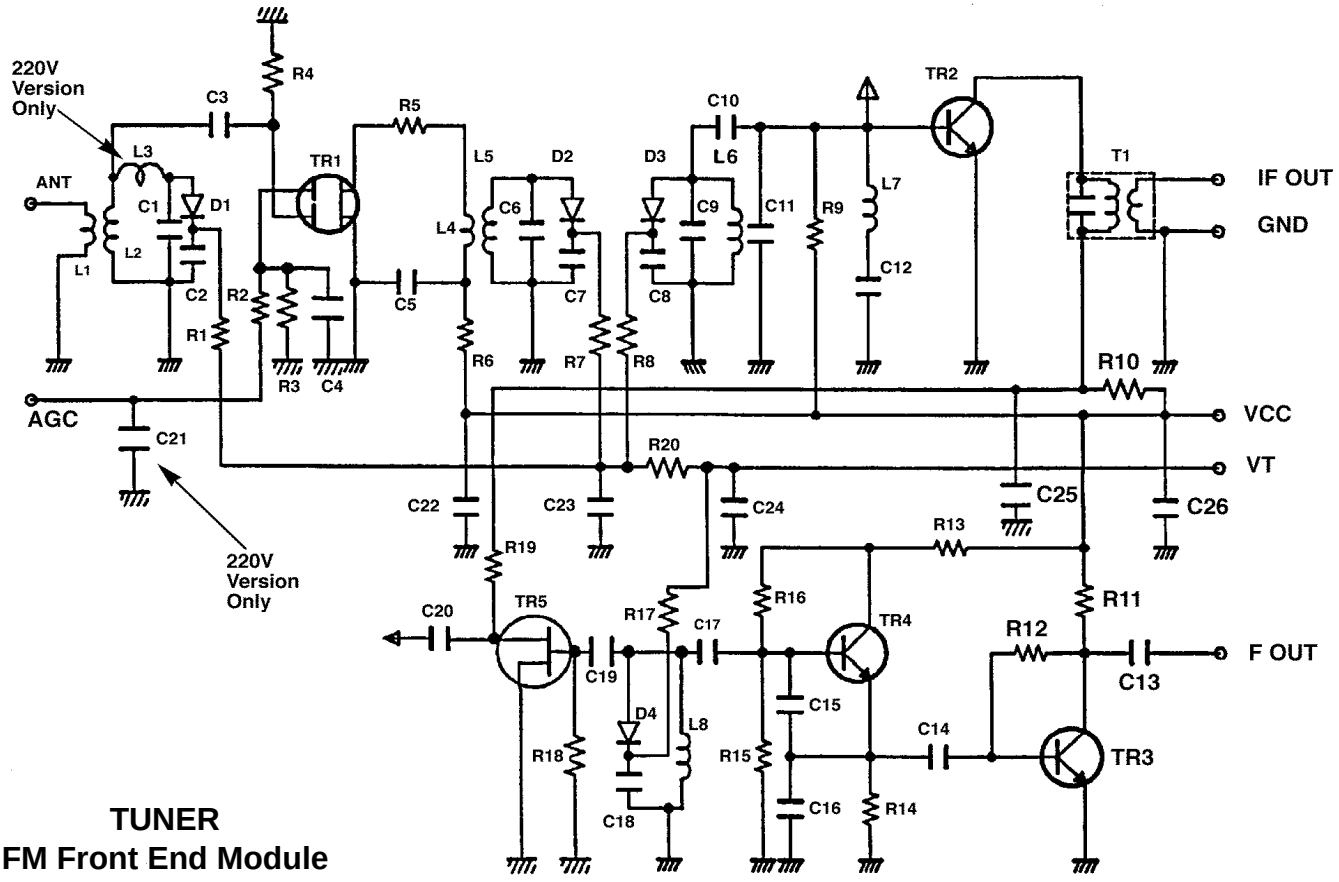
U302
PLL Frequency Synthesizer
LM7000



INTEGRATED CIRCUIT DIAGRAMS

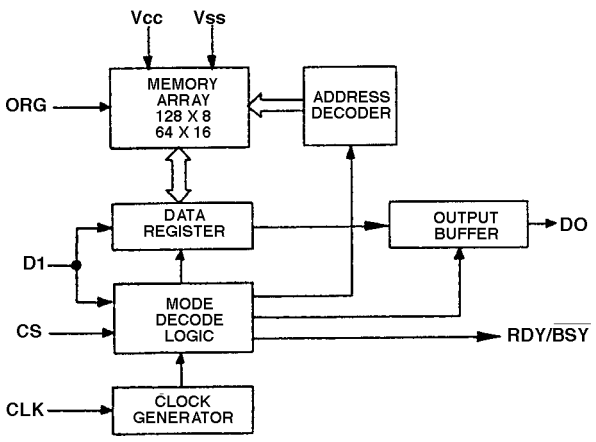


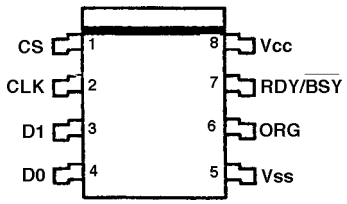
T303
AM Front End
Tuning Module



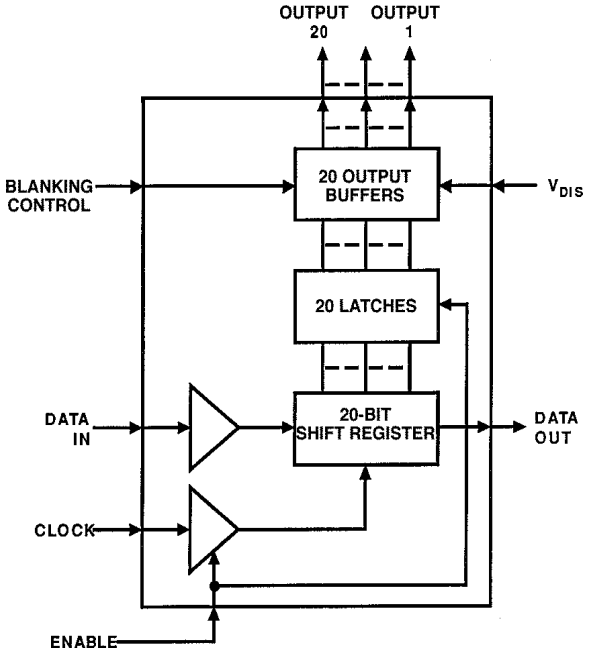
TUNER
FM Front End Module

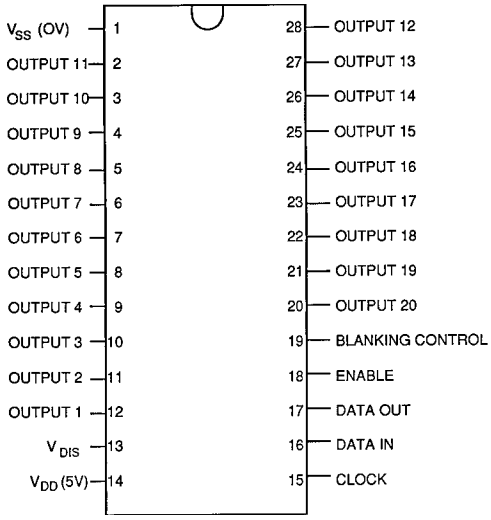
INTEGRATED CIRCUIT DIAGRAMS



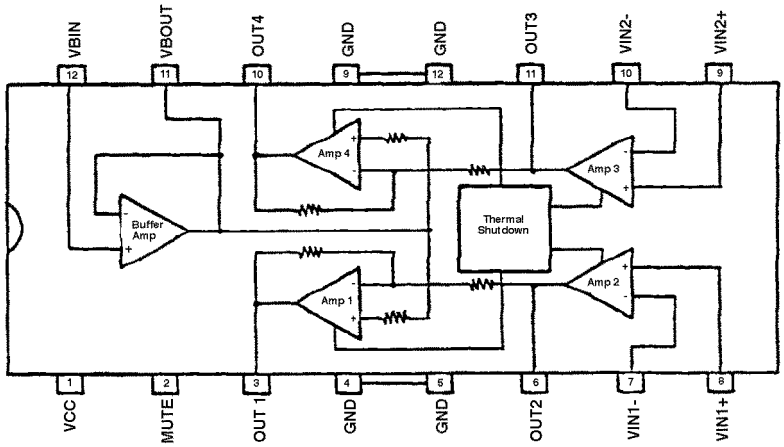


U401
EEPROM
59C11



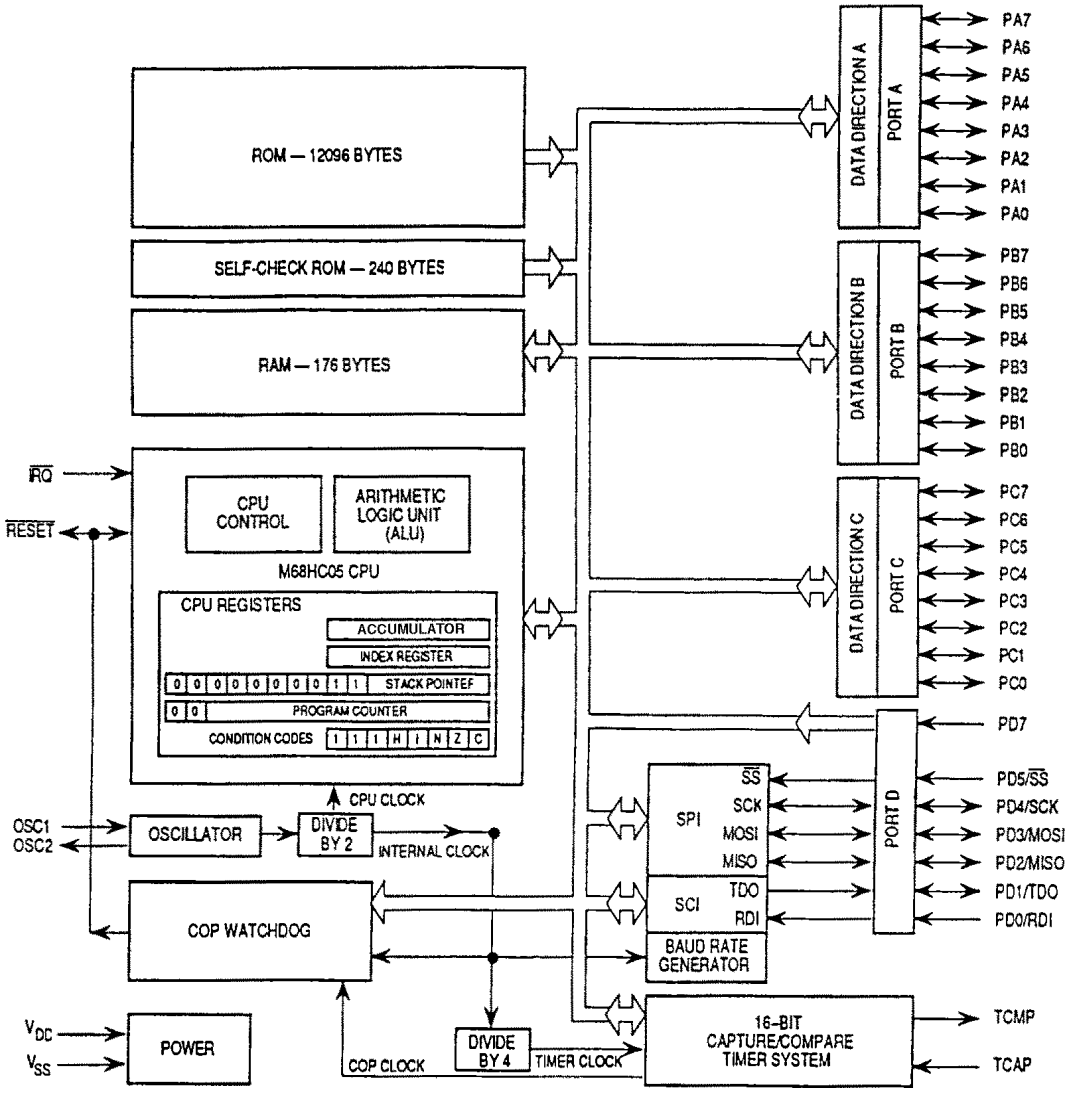


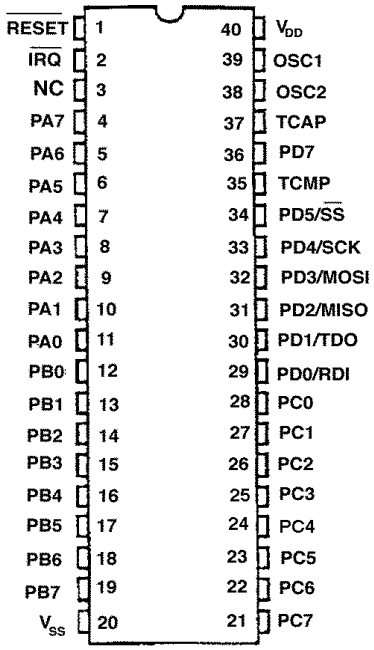
U403
VFD Driver
MM58342



U503, U504
Motor Driver
LA6531

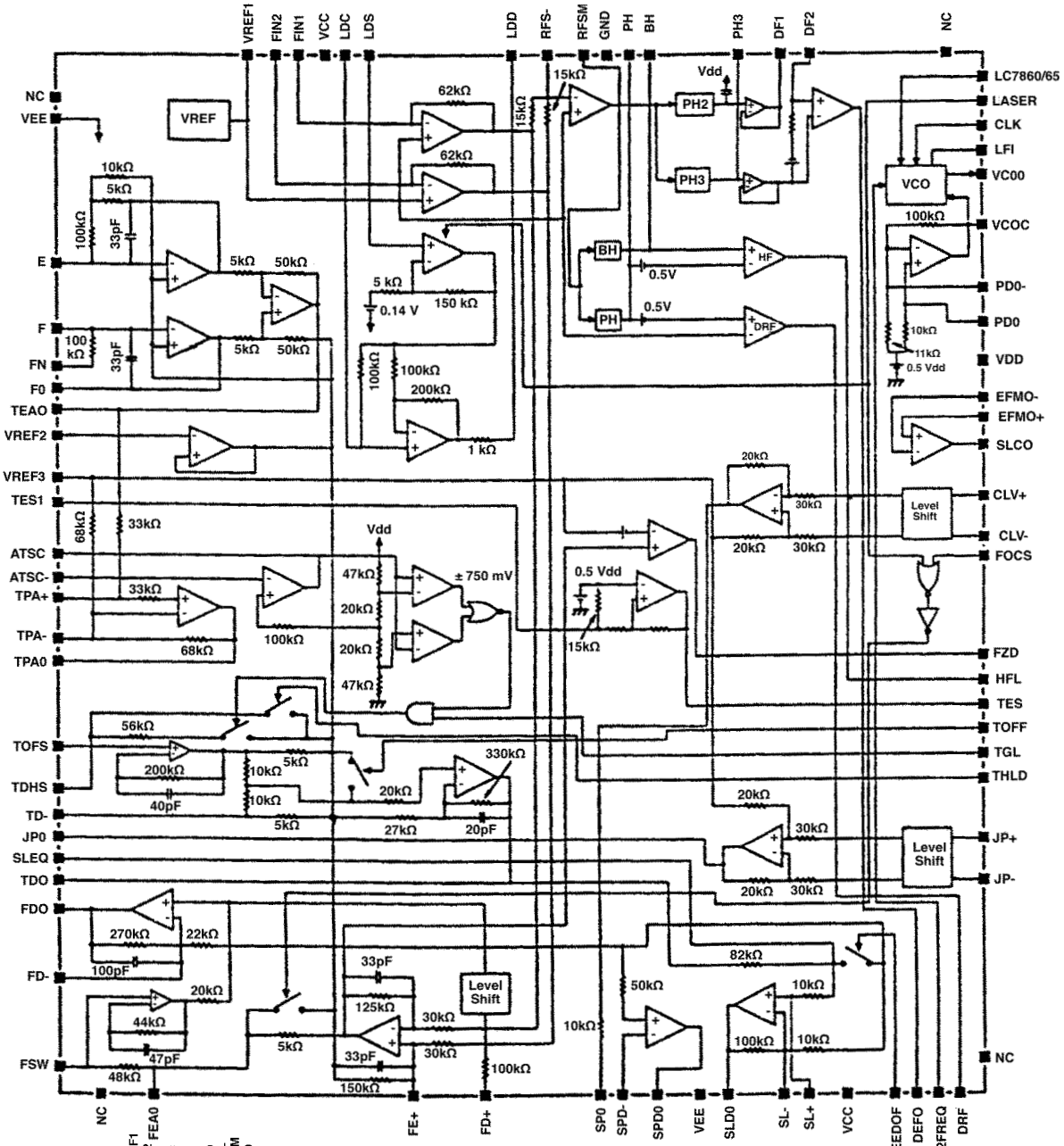
INTEGRATED CIRCUIT DIAGRAMS

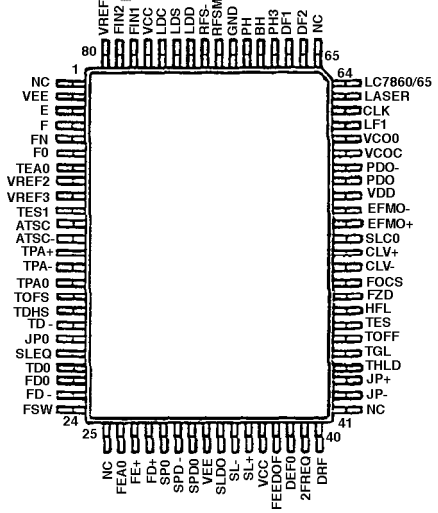




U402
Microcontroller
68HC05C12

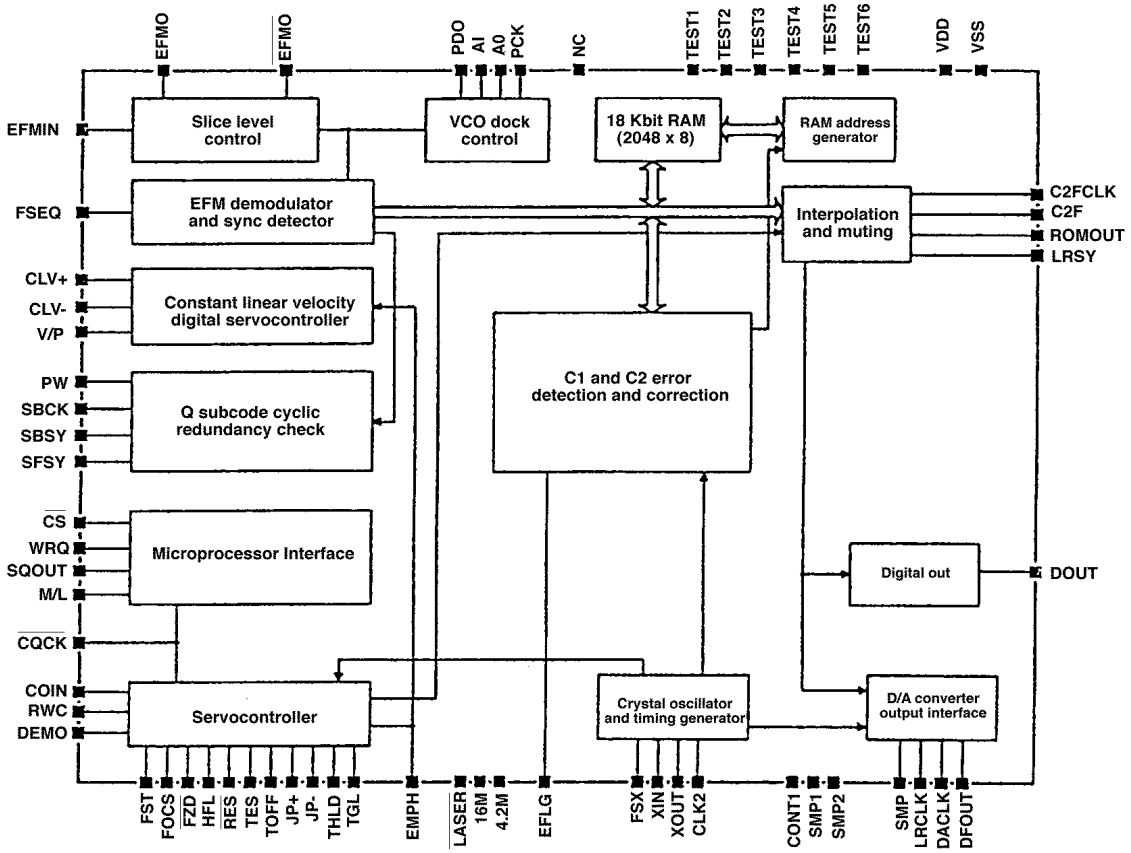
INTEGRATED CIRCUIT DIAGRAMS

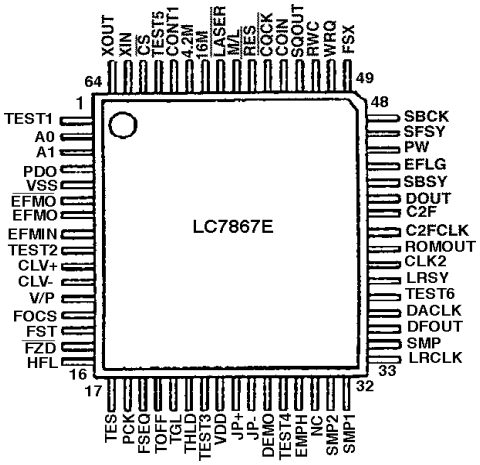




U501
ASP
LA9210M

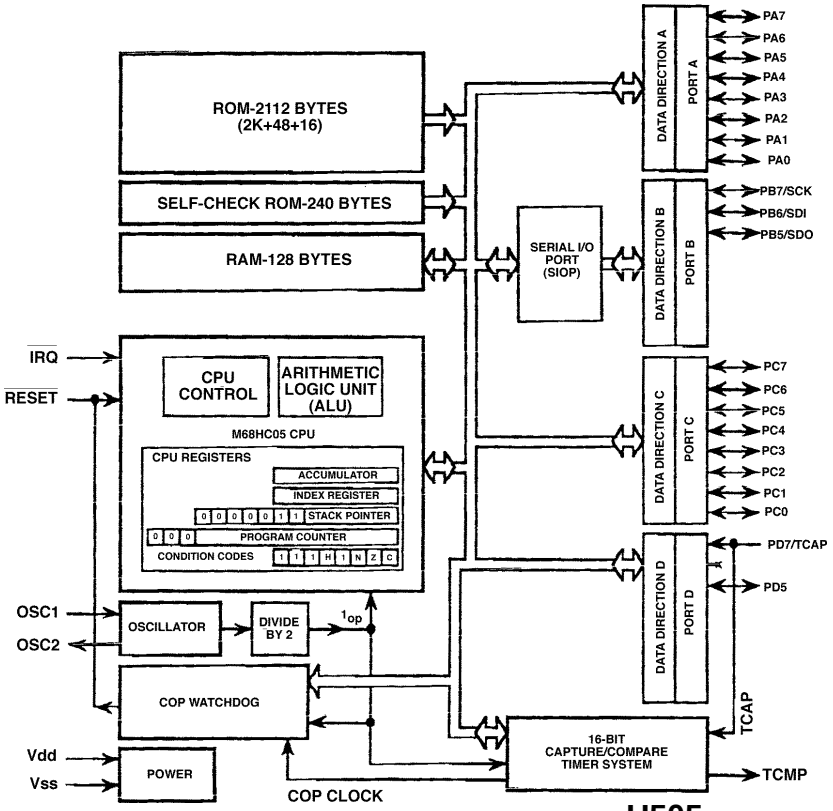
INTEGRATED CIRCUIT DIAGRAMS

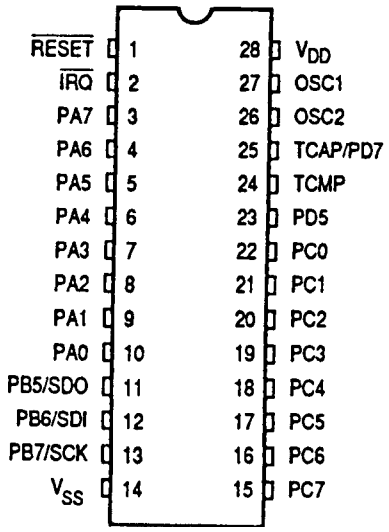




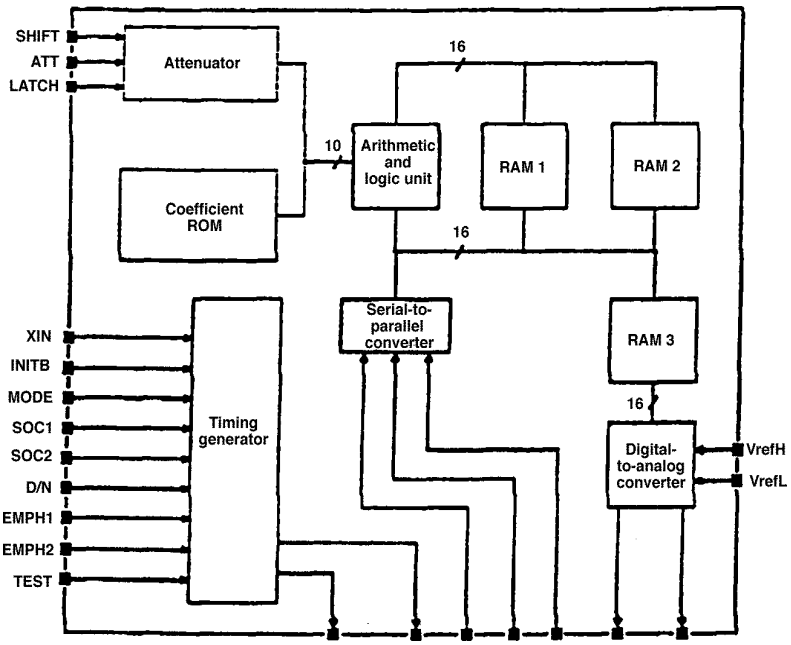
U502
DSP
LC7867

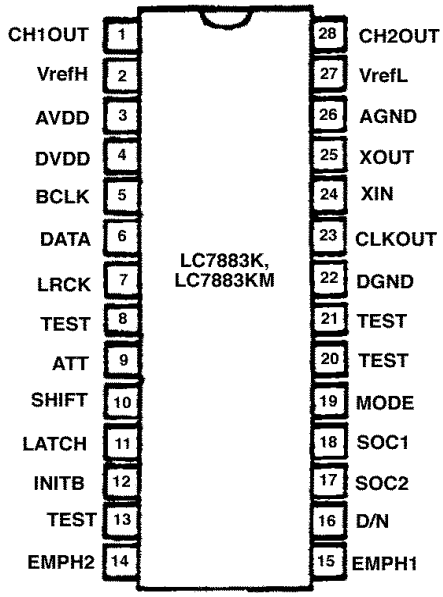
INTEGRATED CIRCUIT DIAGRAMS





U505
Microcontroller
68HC05P7





U506
D/A Converter
LC7883M

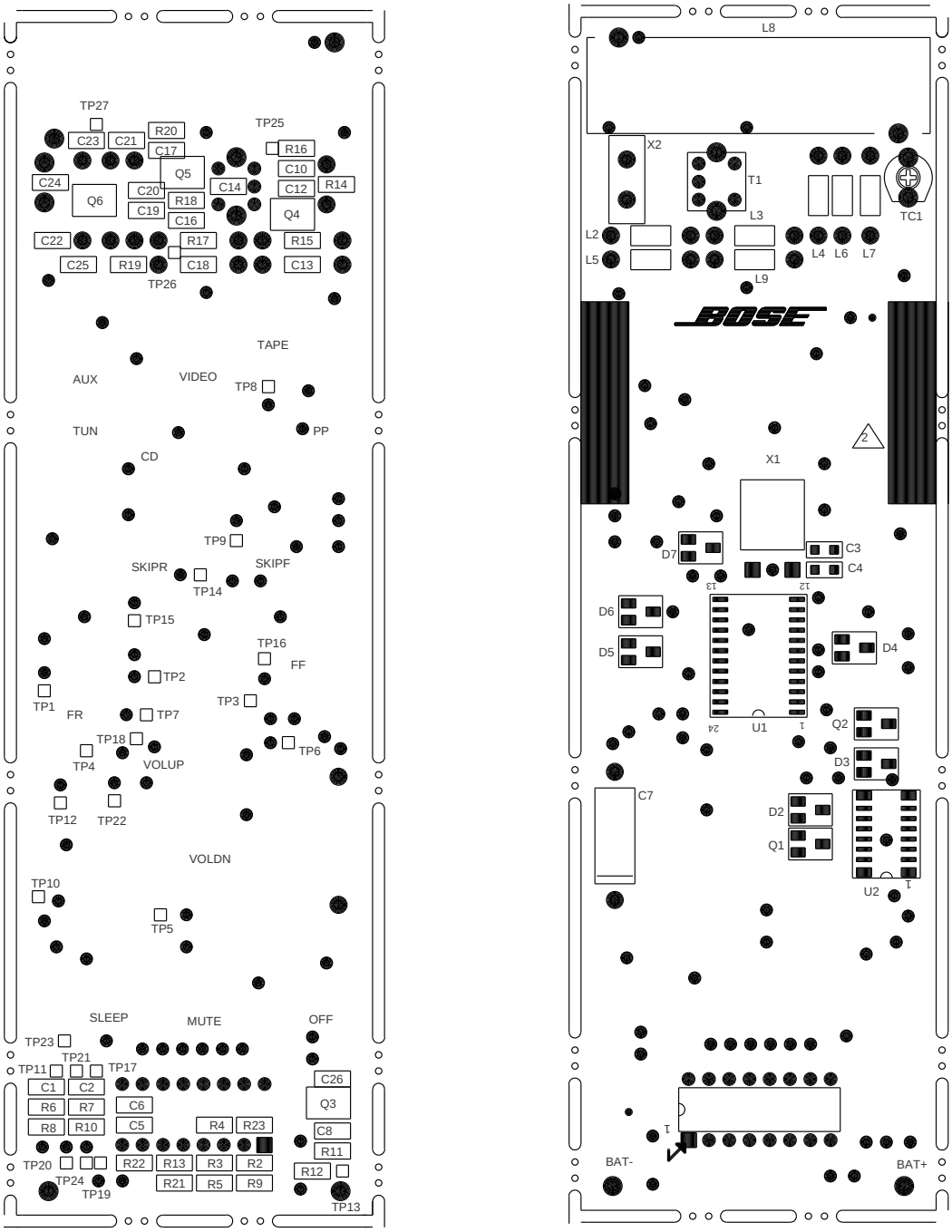


Figure 17. RC5 PCB Layout

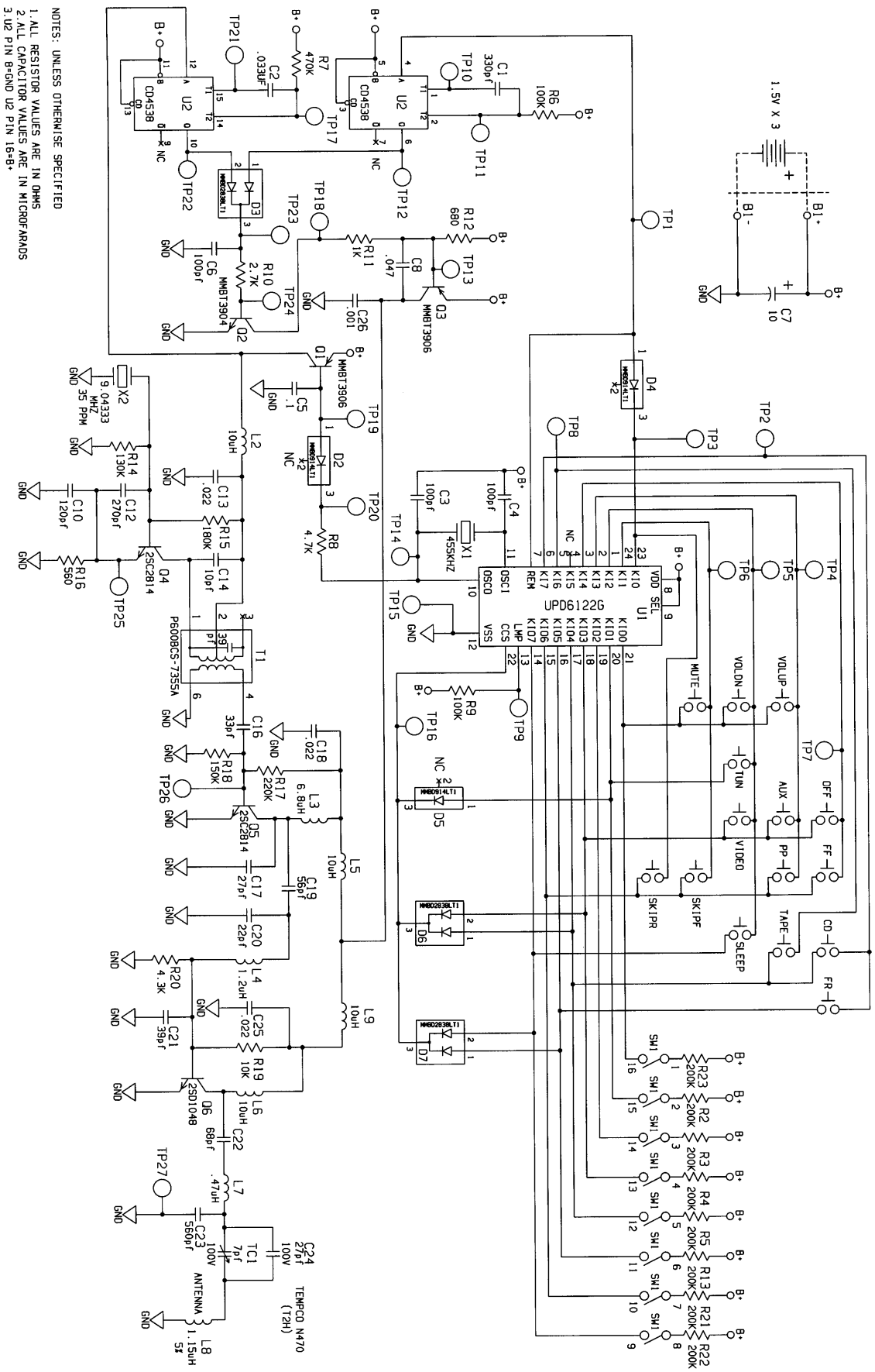


Figure 18. RC5 Schematic

SPECIFICATIONS AND FEATURES SUBJECT TO CHANGE WITHOUT NOTICE

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