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**CAUTION: THE BOSE® MODEL 20 (CD-20) MUSIC CENTER CONTAINS NO USER-SERVICEABLE PARTS. TO PREVENT WARRANTY INFRACTIONS, REFER SERVICE 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 on the parts list. 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 reassembled, 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 AC switch first in the ON position, 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 power cord plug in the outlet and repeat 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 5.2 Megohms. 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 re-checked before it is returned to the customer.

## PROPRIETARY INFORMATION

THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OF BOSE® CORPORATION WHICH IS BEING FURNISHED ONLY FOR THE PURPOSE OF SERVICING THE IDENTIFIED BOSE PRODUCT BY AN AUTHORIZED BOSE SERVICE CENTER OR OWNER OF THE BOSE PRODUCT, AND SHALL NOT BE REPRODUCED OR USED FOR ANY OTHER PURPOSE.

# **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.

## **CD-20 MANUAL REVISION OVERVIEW**

This service manual contains information about changes to the CD-20 PCB assemblies. It also includes the original service manual as well as the supplements (183884-S1, 183884-S2, 183884-S3) concerning the CD-20. The following PCB assemblies (as well as the original CD-20 PCB) are covered by this service manual. PCB part number 199827 (has a slight change to the AM circuit to enable the use of a new AM antenna), PCB part number 250736 (incorporates a new FM section).

# SPECIFICATIONS

Physical		
<b>Dimensions:</b>	2.6"H x 15.5"W x 8"D (6.6 x 39.4 x 20.3 cm)	
<b>Weight:</b>	5.9 lbs. (2.7kg)	
<b>Top Cover:</b>	Brushed aluminum finish	
<b>Bottom Cover:</b>	Plastic, Black	
<b>Display:</b>	Vacuum fluorescent	
<b>Power Input:</b>	5mm coaxial power jack	Detachable power-pack, 12VAC, 1.6A
<b>Line Level Inputs:</b>	Tape, Aux, Video 1, Video 2	RCA Jack pairs Right=Red, Left=White
<b>Line Level Outputs:</b>	Tape	RCA Jack pair Right=Red, Left=White
<b>Zone 1:</b>	Miniature 8-pin DIN connector	L/R fixed line level audio, L/R variable line level audio, DC turn on signal, speaker com- mand data out, audio ground, and data ground
<b>Zone 2:</b>	Miniature 8-pin DIN connector	L/R fixed line level audio, L/R variable line level audio, DC turn on signal, speaker com- mand data out, audio ground, and data ground
<b>Serial Data Port:</b>	3.5mm miniature stereo jack	data out, data in, and ground
<b>Antenna Input:</b>	AM FM, 75Ω	2.5mm mono jack USA/CSA "F" type EURO "PAL" type JAPAN "F" type
<b>Headphone Connector:</b>	3.5mm stereo jack	Variable level output
FM Tuner (per IHF-T-200)		
<b>Channel Spacing:</b>	US: 200 kHz EURO: 50 kHz JAPAN: 100 kHz	
<b>Band Limits:</b>	US: 87.5 MHz-107.9 MHz EURO: 87.50 MHz- 108.00 MHz JAPAN: 76.00 MHz-90.00 MHz	
<b>De-emphasis:</b>	U.S./ Military version: 75μs EURO version: 50μs JAPAN version: 50μs	
<b>Usable Sensitivity:</b>	US: 12 dBf nominal/ 17 dBf limit EURO: 17 dBf nominal/ 22 dBf limit JAPAN: 12 dBf nominal/ 17 dBf limit	

# SPECIFICATIONS

<b>FM Tuner (per IHF-T-200)</b> (continued)		
<b>50 dB Quieting Sensitivity; Mono:</b>	US: 15 dBf nominal/ 20 dBf limit EURO: 20 dBf nominal/ 25 dBf limit JAPAN: 20 dBf nominal/ 25 dBf limit	
<b>Stereo:</b>	US: 37 dBf nominal/ 42 dBf limit EURO: 42 dBf nominal/ 47 dBf limit JAPAN: 37 dBf nominal/ 42 dBf limit	
<b>Signal to Noise Ratio:</b>	Mono: 75 dB nominal/ 70 dB limit Stereo: 65 dB nominal/ 60 dB limit	at 65 dBf US = $\pm 75$ kHz deviation EURO = $\pm 40$ kHz Deviation
<b>Harmonic Distortion:</b>	Mono: 0.2% nominal/ 1.0% limit Stereo: 0.3% nominal/ 1.5% limit	at 65 dBf
<b>Capture Ratio:</b>	1.5 dB nominal/ 2.5 dB limit	
<b>AM Rejection:</b>	60 dB nominal/ 50 dB limit	at 45 dBf
<b>Alternate Channel Selectivity:</b>	US: 70 dB nominal/ 65 dB limit EURO: 75 dB nominal/ 70 dB limit JAPAN: 70 dB nominal/ 65 dB limit	at 45 dBf
<b>Image Rejection:</b>	US: 45 dB nominal/ 40 dB limit EURO: 85 dB nominal/ 70 dB limit JAPAN: 45 dB nominal/ 40 dB limit	
<b>RF Inter-modulation:</b>	60 dB nominal/ 50 dB limit	
<b>Sub-carrier Product Rejection:</b>	55 dB nominal/ 45 dB limit	
<b>Frequency Response:</b>	$\pm 0.5$ dB nominal/ $\pm 1.5$ dB limit	30 Hz - 15 kHz
<b>Stereo Channel Separation:</b>	40 dB nominal/ 25 dB limit	at 1 kHz
<b>Auto Stop Level:</b>	32 dBf $\pm 3$ dB	
<b>Adjacent Channel Selectivity:</b>	12 dB nominal/ 7 dB limit	at 45 dBf
<b>AM Tuner (per IHF-T-100)</b>		
<b>Channel Spacing:</b>	US: 10 kHz EURO: 9 kHz JAPAN: 9 kHz	
<b>Band Limits:</b>	US: 530 kHz - 1710 kHz EURO: 522 kHz - 1611 kHz JAPAN: 522 kHz - 1629 kHz	
<b>Usable Sensitivity:</b>	55 dB $\mu$ V/m nominal/ 60 dB $\mu$ V/m limit	IHF standard test loop
<b>Alternate Channel Selectivity:</b>	60 dB nominal/ 50 dB limit	
<b>Adjacent Channel Selectivity:</b>	45 dB nominal/ 35 dB limit	
<b>Image Rejection Ratio:</b>	40 dB nominal/ 30 dB limit	

# SPECIFICATIONS

## AM Tuner (per IHF-T-100)

(continued)

<b>Signal to Noise Ratio:</b>	50 dB nominal/ 45 dB limit	at 100 dB $\mu$ V/m
<b>Distortion:</b>	1.0% nominal/ 2.0% limit	at 100 dB $\mu$ V/m
<b>Frequency Response:</b>	40 Hz: -3 dB nominal/ -6 dB limit 2 kHz: -3 dB nominal/ -6 dB limit	at 100 dB $\mu$ V/m, 0 dB @ 400 Hz
<b>Auto Stop Level:</b>	60 dBuV/m $\pm$ 3 dB	

## Preamplifier

<b>Input Impedance:</b>	AUX/ VIDEO 1, 2 = 33k $\Omega$ TAPE = 48k $\Omega$	$\pm$ 30%, 1 kHz, max volume $\pm$ 40%, 1 kHz, max volume
<b>Output Impedance:</b>	Zone 1, 2 = 220 $\Omega$ TAPE: = 220 $\Omega$	$\pm$ 10%, 1 kHz, max volume
<b>Output Voltage:</b>	FM: 0.6 Vrms AM: 0.4 Vrms CD: 2.0 Vrms	Mono/ 75 kHz dev. 30% mod., 100 dBuV/m ABEX TCD-782 TNO2
<b>Headphone Output:</b>	31 mW $\pm$ 2 dB	32 $\Omega$ load, 1 Vrms Aux input THD <0.15%
<b>Maximum Output Level:</b>	2.0 Vrms $\pm$ 2 dB	1 kHz, THD < .12%
<b>THD:</b>	.02% nominal/ .08% limit	Output = 1 Vrms
<b>Frequency Response:</b>	$\pm$ 0.5 dB nominal/ $\pm$ 1.0 dB limit	20 Hz- 20 kHz
<b>Signal to Noise Ratio:</b>	115 dB nominal/ 100 dB Limit	A-weighted, max volume
<b>Channel Separation:</b>	70 dB nominal/ 50 dB limit	
<b>Switching "pops" and "clicks":</b>	1 mV nominal/ 10 mV limit	pk, max. vol.
<b>Muting, Zone 1 and 2 outputs:</b>	-100 dB nominal/ -90 dB limit	

## CD Player

<b>Digital to Analog Process:</b>	4X Over-sampling, dual one bit D/A	
<b>Maximum Output Level:</b>	2.0 V $\pm$ 2 dB	
<b>THD + Noise:</b>	0.03% nominal/ 0.12% limit	at 1 kHz, 0 dB
<b>Signal to Noise Ratio:</b>	90 dB nominal/ 85 dB limit	A-weighted
<b>Channel Separation:</b>	70 dB nominal/ 50 dB limit	at 1 kHz
<b>Frequency Response:</b>	$\pm$ 0.5 dB nominal/ $\pm$ 1.0 dB limit	20 Hz - 20 kHz
<b>Low-level Linearity Error:</b>	5.0 dB nominal/ 10.0 dB limit	-90 dB
<b>Dynamic Range:</b>	95 dB nominal/ 90 dB limit	

# SPECIFICATIONS

CD Player (continued)		
<b>Defect Tracking (interruption):</b>	1.0 mm nominal/ 0.8 mm limit	ABEX Test Disk TCD-725R
<b>Defect Tracking (black dot):</b>	1.0 mm nominal/ 0.8 mm limit	ABEX Test Disk TCD 725R
<b>Defect Tracking (scratch):</b>	1.6 mm nominal/ 1.0 mm limit	ABEX Test Disk TCD-721R
<b>Defect Tracking (finger print):</b>	75 µm nominal/ 65 µm limit	ABEX Test Disk TCD-725R
<b>Defect Tracking (warped disc):</b>	1.0 mm nominal/ 0.7 mm limit	ABEX Test Disk TCD-732RA
<b>Defect Tracking (eccentric disc):</b>	210 µm nominal/ 140 µm limit	ABEX Test Disk TCD-714R
<b>Cueing Time:</b>	2 sec nominal/ 3 sec limit	Phillips TS4, TNO 1-15
<b>De-emphasis Error:</b>	5 kHz: -4.53 dB ± 2 dB 16 kHz: -9.04 dB ± 2 dB	
<b>Disc Access Time:</b>	5 seconds nominal/15 seconds limit	Any disc playing to any other disc playing
<b>Disc Unload Time:</b>	5 seconds nominal/15 seconds limit	Any disc playing or stopped to ejected magazine

# THEORY OF OPERATION

## 1.0 Overview

The CD-20 is a self-contained CD player with a 6-disc changer, 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 allows for up to four external audio sources to be connected (Tape, Aux, Video 1 and Video 2). It uses an RF remote control, allowing it to be operated from different rooms within a house without the line-of-sight restrictions of an IR remote. No CE-1 type functionality has been included. All Smart Speaker data commands (i.e.-for AM-25P) have been implemented.

The CD-20 has two independent output zones, similar to CD-10, accessible through circular DIN connectors in the back of the product. This allows Zone 1 to play any of the six possible audio sources, while Zone 2 plays the same source (or any other audio source) simultaneously. The only restriction is that AM and FM cannot be played simultaneously (there is only one tuner source, usable in only AM or FM mode at a given time).

## 2.0 Power Supply Electronics (Schematic Diagram Sheet 1)

The unit is powered by an external 12 VAC power supply capable of delivering 1.6 Amps RMS.

D12, D1 and C3 form a positive half-wave rectifier that supplies voltage to the CD\_VCC regulator transistor Q10 (which powers the CD mechanism). Feedback components R23, D13 and R24 sample the CD output voltage, divide it down, and apply it to Q11's emitter. Q11 keeps Q10 turned on until the CD\_VCC voltage reaches the desired level. Once CD\_VCC reaches about 14.5 volts, Q10 goes linear and keeps the output voltage from going any higher. To disable the CD\_VCC supply, the CD\_RES line is set to +5V by the microprocessor, which turns Q1 and Q2 on. Q1 keeps Q11 turned off, while Q2 quickly shorts CD\_VCC to ground (turning the CD mechanism off immediately).

R2, D4 and C6 form a positive half-wave rectifier that supplies voltage to +5V regulator IC U1. The +5V circuit powers the microprocessor and EEPROM. The microprocessor monitors the DETECT line (via comparator U402) in case of a power failure.

D5 and C10 form a positive half-wave rectifier that supplies voltage to +10V regulator IC U2. The +10V supply powers all the audio circuitry, the tuner, and the enable lines for the external powered speakers.

C24, R28, R29 and C21 form a resistor/capacitor AC voltage divider that provides the 4.2 VAC for the VFD (display) filament. The -30 Vdc and -24 Vdc supplies are also for the VFD, and are generated using a negative voltage tripler. D6, D9, D7, C15, C23, and C18 form the tripler. R11 and zener diode D18 regulate the tripled voltage to -30V. The -24 Vdc supply is divided down from the -30 Vdc by R26, R12 and R14.

The enable lines (also referred to as +10V control lines) for the powered speakers (Z1\_ENBL and Z2\_ENBL) are powered by Q102 and Q104. Q101 and Q103 provide base turn-on current when the microprocessor sets Z1\_ENBL or Z2\_ENBL to +5V. The output of the enable lines is current-limited to less than 100 mA by R134 and R138. This protects against accidental short-circuits in the speakers or their cables.



# THEORY OF OPERATION

## 3.0 Control Electronics (schematic Diagram Sheet 3)

The audio circuits, tuner, CD mechanism, display, EEPROM, remote receiver, push buttons, and AC power status are all overseen by microprocessor (micro) U400. The micro is clocked by an 8 MHz ceramic resonator (X401) and is given a reset pulse by U403 (the reset IC). This occurs whenever the +5V power supply falls below about 4.75V and automatically at power-up.

The micro communicates with all three audio chips (U100, U101, and U102) using a three wire interface (clock, data and ground). In all three cases, the clock line is the ACLOCK line, port P35 on the micro. Depending on which chip is being addressed, the micro may use either the ADATA\_1 or ADATA\_2 lines to send the data. The data is sent in I<sup>2</sup>C format to all three chips. The micro sends commands to the audio chips whenever new input sources are selected, or the volume needs to change, or a zone needs to mute or unmute.

The micro changes AM and FM tuner stations by writing to the PLL (Phase-Locked Loop) chip U302. This information is sent using the same clock and data lines used for the audio chips (ACLOCK and ADATA\_2). However, the PLL chip enable (PLL\_CE) must also be high for the chip to receive the message. The micro can tell when a station is strong enough to stop seeking by monitoring the RF\_SIG/ line from U300 (the LA1851 detector chip). The micro can then check to see if that same station is transmitting a valid carrier (in case an adjacent station was strong enough to fool it into stopping) by asserting the F\_TEST line. The result of the frequency test is signaled to the micro by the RF\_F\_OK line.

The CD-20's 6-disc CD mechanism is a complete (mechanical as well as electrical) assembly that is purchased as an OEM unit from FMS (Ford Mazda Sanyo). It comes with its own microprocessor-based controller PCB that is capable of many functions. The CD-20's micro communicates with this PCB via a dedicated serial data bus (CD\_BUS, micro port P12). The CD-20 micro (U400) sends control commands (play, pause, stop, skip forward, etc.) to the mechanism via the CD\_BUS line, and receives disc, track, etc., information in the same way. The CD mechanism is enabled by U400 by dropping the CD\_RES (CD reset) line and raising the CD\_ENBL (CD enable) line. The appropriate control commands are then sent.

The micro controls the vacuum fluorescent display (VFD400) with its on-chip VFD driver. The driver scans the display's grids and segments automatically using ports P7, P8 and P9. The CD-20 display is divided into 8 groups, each enabled by a separate grid line (G1 through G8). Each of these groups contains up to 15 icons. Each icon is enabled by a separate segment line (S1 through S15). Although icons appear to be lit constantly, in fact each is actually turning on and off at a rate too fast to see. Each of the 8 groups of icons are only enabled 1/8th of the time (first group 1, then group 2, etc., in a repeating sequence). The segment lines are used to select which icons should be lit as each icon group gets enabled. The 511  $\Omega$  series resistors are added to reduce scan currents that might interfere with AM tuner reception. All series resistors and inductors on the +5V, +10V, -24V and -30V power supply lines are similarly added to reduce tuner interference.

U401 is a 1k-bit (128 bytes x 8) EEPROM (Erasable, Programmable Memory) that stores the AM and FM station presets, RF remote House Code and background (self-test) information. Whenever a new preset is stored or erased by the user, information gets written to U401. The micro communicates with the EEPROM using a three wire interface that is identical (but separate) to the interface used for the audio chips. In this case, the clock line is the EE\_CLK signal, port P03, and the data line is the EE\_DATA signal, port P04. Although this data is also sent using the I<sup>2</sup>C format, the EEPROM is busy enough to have its own interface (rather than sharing the audio chip's interface).

# THEORY OF OPERATION

## 3.0 Control Electronics (continued)

The micro monitors messages from the RF remote control with input port P30 (RF\_DATA). RF receiver module RR100 demodulates the signals received on the CD-20's remote antenna (the digital ground conductor in the audio output cables) and converts it into a low-level AC signal. This signal is filtered and converted to TTL levels by one-half of comparator U402 before it is fed to the micro.

Key closures are detected by means of the micro's on-chip A/D converter. When a console key is pressed, the voltage divider formed by R419 and R420 is changed by the switch being pushed. Specifically, a new resistor will be shunted across either R419 or R420. This increases or decreases the voltage at the micro sense lines, KEY\_IN1, KEY\_IN2 or KEY\_IN3 (note that the keys are divided into 3 groups of 4 keys each). The micro examines these sense lines and determines which key is pressed based on the voltage it measures. If the micro measures a voltage of about 2.5 volts, it knows no key is pressed within that particular group of 4.

The AC power status is monitored by the micro using port P10, pin 1 of U400 (PFAIL/). When the AC input voltage to the wall transformer falls, its AC output voltage falls below the nominal 12V. When the voltage falls below a certain point (about 88 VAC in FM mode, about 93 VAC in CD mode), the DETECT line from the power supply (which monitors the raw DC input voltage to the +5V regulator, U1) causes comparator U402's output to go low. This warns the micro that the power is failing, and it responds by shutting the system down (muting the speaker outputs, blanking the display, etc.). When AC power is OK, U402's output (PFAIL/) is high.

## 4.0 Audio Electronics (Schematic Diagram Sheet 2)

The CD-20 has 2 internal audio sources (CD and tuner) and four external sources (Tape, Aux, Video 1 and Video 2). All of the sources get routed through audio matrix chip U101. This IC controls which zone(s) the sources will be connected to. The chip has three left and right outputs. One is used for Zone 1, two for Zone 2, and three for the tape outputs. The micro instructs the chip to connect each of the outputs to the correct input by using the clock and data lines as described above. If a zone is not active (or muted), the audio matrix chip may connect that output to an internal reference rather than one of the inputs for extra muting. The matrix has internal buffer amps, allowing its outputs to be used directly as the Zone 1 and Zone 2 fixed audio outputs.

Output #3 from U101 (pins 16 and 17) is used for the CD-20's left and right Tape output. The micro sees to it that this output nominally is connected to the same input source as the Zone 1 output. This means that any tape deck connected to the Tape outputs would record the same source that is being played on Zone 1. However, if the Tape input is selected for Zone 1, the Tape outputs are muted by the micro to prevent a feedback loop.

The first two matrix chip outputs (pins 12 through 15), as described, are then fed to Zone 1 and Zone 2 volume control ICs (U100 and U102 respectively). Each IC contains the volume-control cell, output-buffer cell and output mute cell for that particular zone. Volume settings, mute settings and output-buffer switching are all controlled by the micro using the ACLOCK, ADATA\_1 (for Zone1) and ADATA\_2 (for Zone2) lines. The final LR audio outputs (called the "adjustable outputs," after volume control and muting) are pins 24 and 25. From here, the audio passes through DC blocking capacitors C114, C214, C124 and C224 (the volume control ICs run on a single +10V supply, so the audio has a 5 Vdc offset component) before running to output circular DIN connectors J101A and J101B.

# THEORY OF OPERATION

## 4.0 Audio Electronics (continued)

Each of the volume control chips has two independently mutable outputs. The #1 outputs are used for the speakers (as described above). The #2 output of the Zone 1 volume chip is used for CD-20's Headphone output (the #2 output on the Zone 2 chip is not used). Anyone plugging in headphones would therefore hear the same source that was previously being played by the Zone 1 speakers. The microprocessor monitors the HP\_SENSE line from the headphone jack to tell if headphones are plugged in. When they are, the micro mutes the #1 outputs from the Zone 1 volume chip (to the speakers), and unmutes the #2 outputs (to the headphones). The opposite occurs when headphones are unplugged. The headphone signals are buffered by U104 in order to drive the required 32  $\Omega$  loads.

Audio from the CD player typically contains a great deal of motor noise. This noise occurs because of ground conductor voltage drops on the ribbon cable connecting to the mechanism. To eliminate this motor noise, op-amp U103 has been configured as a differential amplifier. Any motor noise signals on the left and right audio lines are also on the ground reference line, pin 2 of the CD ribbon cable (pin 2 of connector J110). Therefore, U103 eliminates this common-mode component without affecting the actual audio (which is purely a differential-mode component). At the same time, U103 provides the necessary gain for the CD signal.

## 5.0 Tuner Electronics (Schematic Diagram Sheet 4)

The FM antenna signal comes in through F connector J301 and enters the FM front-end module (U301). U301 contains a tuned RF amplifier, the FM local oscillator, and the first mixer. The 10.7 MHz IF output signal appears on pin 4 and is passed through a 10.7 MHz ceramic filter (CF300). The filter's output is amplified by the first IF gain stage. This stage consists of Q307, Q308 and their associated components. The signal is then passed through a second ceramic filter (CF301), a second gain stage (Q309, Q310, etc.) and a third ceramic filter (CF302). These filter stages reject unwanted FM stations and noise.

The output of the final ceramic filter is fed into the main detector IC (U300). This device contains a second mixer, the FM detector, FM stereo MPX decoder, stop-level detection, as well as most of the AM circuitry. U300 further amplifies the IF signal and then performs FM detection using a double tuned quadrature detector formed by T303 and T304. T304 is adjusted for FM center frequency by adjusting it for 0 VDC between the AFC terminal (pin 4, U300) and the VREG terminal (pin 28, U300). T303 is adjusted for minimum distortion. (These two adjustments are interactive, so a few repetitions may be required.) The recovered audio appears on pin 8 of U300.

The recovered audio is filtered by C326 and the associated components and fed back into U300 on pin 9. U300 performs the FM stereo MPX decoding and outputs the decoded L and R channels (when FM is selected) on pins 14 and 15. The separation is controlled by the resistance from pin 12 to ground. The PLL decoder is clocked by 456 kHz resonator X300. The PLL loop filter components are connected to pin 11. The FM stop level is set by the variable resistance R349 on pin 30 and is nominally set to 33 dBf.

The signals are buffered and amplified by op-amp U303 and its associated components. Components R301, C302, R305, and C303 perform FM de-emphasis. MPX filters T301 and T300 remove any unwanted out-of-band signals.

# THEORY OF OPERATION

## 5.0 Tuner Electronics (continued)

The signal from the AM loop antenna enters the unit through the 2.5 mm AM jack (J300) and is fed to the AM front end module (T302). This device contains an RF tuned section and the AM local oscillator tuner circuit. The tuned output appears on pin 12 and is fed to the AM buffer FET transistor Q303. The buffered output is sent to pin 27 of U300 which contains the AM RF amplifier, mixer, IF amplifier, AM detector, and AM stop level detection. The AM stop level is set by the variable resistor R348 on pin 16 and is nominally set at 70 dBuV/m. The AM IF output signal appears on pin 26. This signal is filtered by the IF filter T306 and fed back into the chip on pin 24 for AM detection. The AM detected output appears on pin 5 where it is filtered by C327, R328 and C328. The filtered output is fed back into U300 on pin 6 where it is sent to the L and R outputs (when AM is selected), pins 14 and 15.

The AM and FM local oscillators are controlled by the PLL IC (U302). This device is instructed by the micro to select either AM or FM and to tune to a particular frequency. The PLL reference oscillator is clocked by a 7.2 MHz crystal (X301). This frequency is divided down to 400 kHz and then appears on pin 7. U302 divides down the Local Oscillator (LO) frequency and compares it to an internal reference frequency. An error signal from the comparison appears on pin 18. This error signal is integrated and filtered by Q304, Q305, and associated components. This produces the tuning voltage which appears at the collector of Q304.

The tuning voltage is filtered by R312, C316, R311, and C309 and fed to pin 14 of the AM front end (T302). Here it is used to vary the capacitance of 2 varactor diodes. The first diode adjusts the frequency of the AM local oscillator. The second tunes the AM RF input section to the desired frequency. Similarly, in FM mode, the tuning voltage is filtered by R316 and C321 and fed to the FM front end. As in the AM case, the FM front end uses this voltage to vary the LO frequency and to tune the RF input sections.

# THEORY OF OPERATION

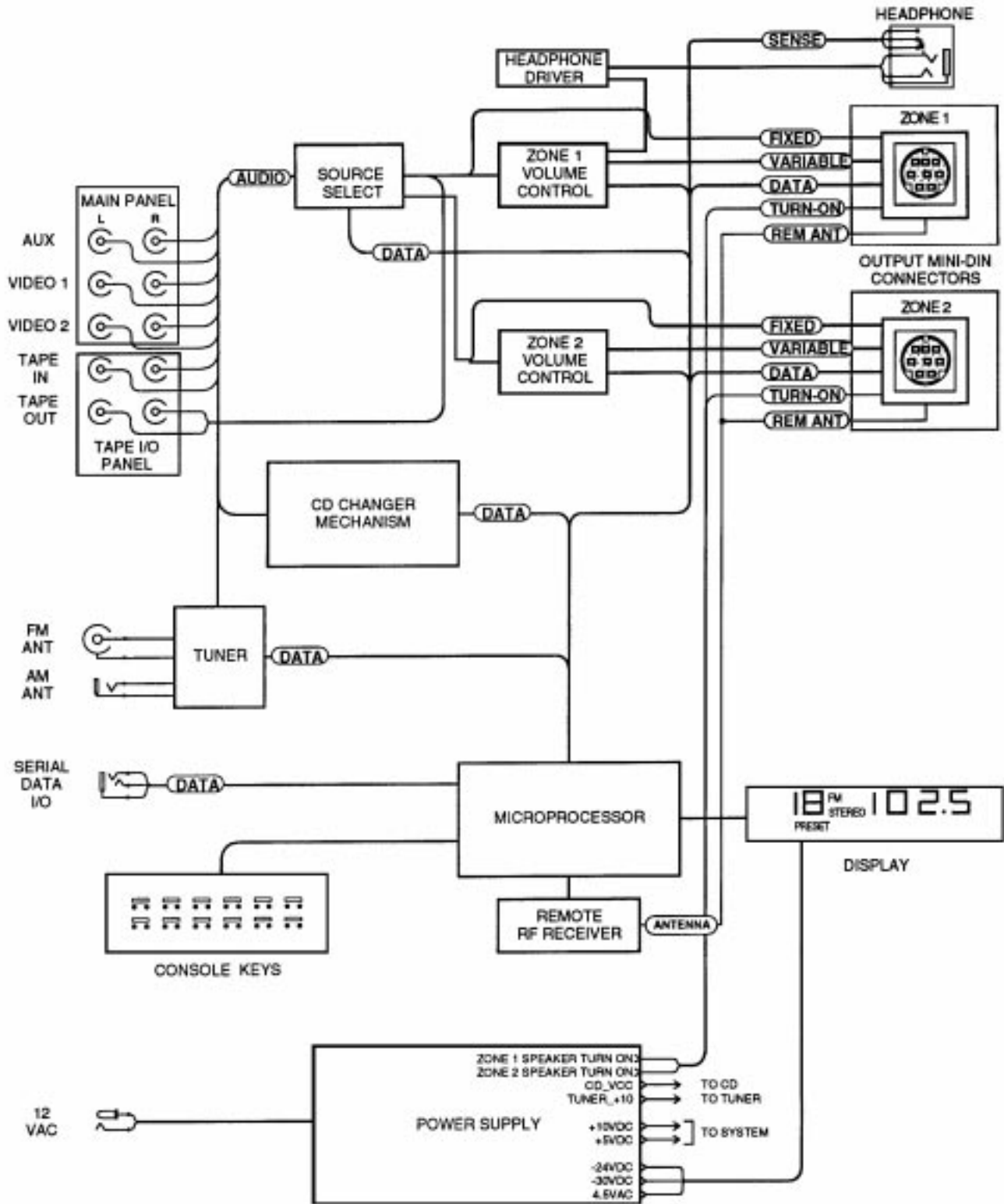


Figure 1. CD-20 Block Diagram

# DISASSEMBLY/ASSEMBLY PROCEDURES

**Note:** Refer to Figures 2 and 3 for the following procedures. Numbers in parentheses correspond to the item callouts in Figures 2 and 3.

## 1. Top Cover Removal

**1.1** Grasp the cover (1) by the edges and work it up to release the christmas tree fasteners from the superstructure (2). This might take some effort. Using a flat-blade screwdriver may be helpful. Take care not to damage the top cover.

## 2. Top Cover Replacement

**2.1** Align the cover's christmas tree fasteners with the holes in the superstructure (2). Push the cover (1) down until it is fully seated.

**Note:** Align the cover so that the BOSE® logo is in the left corner.

## 3. Display Window Removal

**3.1** Grasp the top edge of the display window (3) and pull it forward.

## 4. Display Window Replacement

**4.1** Align the display window (3) so the catches are facing up.

**4.2** Align the display window with the LCD and press it into the superstructure (2).

## 5. Superstructure Removal

**5.1** Perform procedures 1 and 3.

**5.2** Remove the door spring (7) from the superstructure (2) and door assembly (8).

**5.3** Remove the ribbon cable (6) from the super structure and disconnect it from the PCB (18).

**Note:** Make a note of how the ribbon cable was dressed in the rear channel of the superstructure.

**5.4** Remove the three screws (4) from the superstructure.

**5.5** Place a flat-blade screwdriver into each of the four slots (5) on the superstructure and push away from the center of the unit to release the catches.

**5.6** Lift the superstructure away from the base (9).

## 6. Superstructure Replacement

**6.1** Lower the superstructure (2) onto the base (9) and pull the ribbon cable through the large opening.

**6.2** Push down on the superstructure (2) until it snaps into the base (9).

**6.3** Redress the ribbon cable in the channel at the rear of the superstructure (2). Connect the cable to the PCB.

**6.4** Replace the three screws (4) that secure the superstructure to the base.

**6.5** Replace the door spring (7) to the superstructure and door assembly (8).

**6.6** Perform procedures 2 and 4.

## 7. Door Assembly Removal

**Note:** Refer to Figure 3 for the following procedures.

**7.1** Perform procedure 5.

**7.2** Lift the door assembly (8) straight up.

## 8. Door Assembly Replacement

**8.1** Lower the door assembly (8) into the base (9) aligning the post (10) on the door assembly to the holes (11) in the base. Also rotate the hinge (12) on the left side of the door so that the groove fits into the slot on the hinge holder (13).

**8.2** Perform procedure 6.



# DISASSEMBLY/ASSEMBLY PROCEDURES

## 9. CD Mechanism Removal

**9.1** Perform procedure 5.

**9.2** Lift the CD mechanism (14) straight up from the base (9).

## 10. CD Mechanism Replacement

**10.1** With the opening of the CD mechanism facing towards the front of the unit, lower the CD mechanism into the base (9) aligning the four grommets (15) with the four posts on the base (two not shown).

**Note:** Make sure the four springs (16) are located on the four outer posts of the base.

**10.2** Perform procedure 6.

## 11. Control Panel Removal

**11.1** Perform procedure 5.

**11.2** Grasp the top edge of the control panel (17) and pull it forward.

## 12. Control Panel Replacement

**12.1** Tilt the control panel (17) forward and place it into the base (9) so that the lower edge of the control panel is in front of the catches on the base. Tilt the control panel towards the rear of the base until the control panel snaps into place.

## 13. PCB Assembly Removal

**13.1** Perform procedure 5.

**13.2** Grasp the PCB assembly (18) and lift it straight up.

**13.3** The RCA jack PCB (19) and the headphone PCB (20) are wired to the PCB assembly. Lift the RCA Jack PCB and the headphone PCB straight up.

**Note:** When removing the PCB, make a note of the wire dressing for reinstallation.

## 14. PCB Assembly (Disassemble)

**14.1** The power supply PCB (21) and the tuner PCB (22) are plugged into the main PCB (23). Grasp the power supply PCB or the tuner PCB and pull in an outward direction from the main PCB.

## 15. PCB Assembly (Assemble)

**15.1** Connect the power supply (21) and the tuner PCB (22) to the main PCB by plugging them into the main PCB (23) via connectors: J3 and J4 on the power supply PCB, J306 and 307 on the tuner PCB. Tabs on the tuner and power supply PCB lock into slots on the display PCB (24) to create a mechanical support.

## 16. PCB Assembly Replacement

**16.1** While lowering the PCB assembly (18) into the base (9), angle it so that the RCA jacks protrude out the rear of the base.

**16.2** Insert the RCA Jack PCB (19) into the holes in the base marked "TAPE IN, TAPE OUT". The superstructure (2) will give mechanical support to the RCA Jacks.

**16.3** Insert the headphone PCB (20) with connector J612 up, into the slot.

**16.4** Redress all wires.

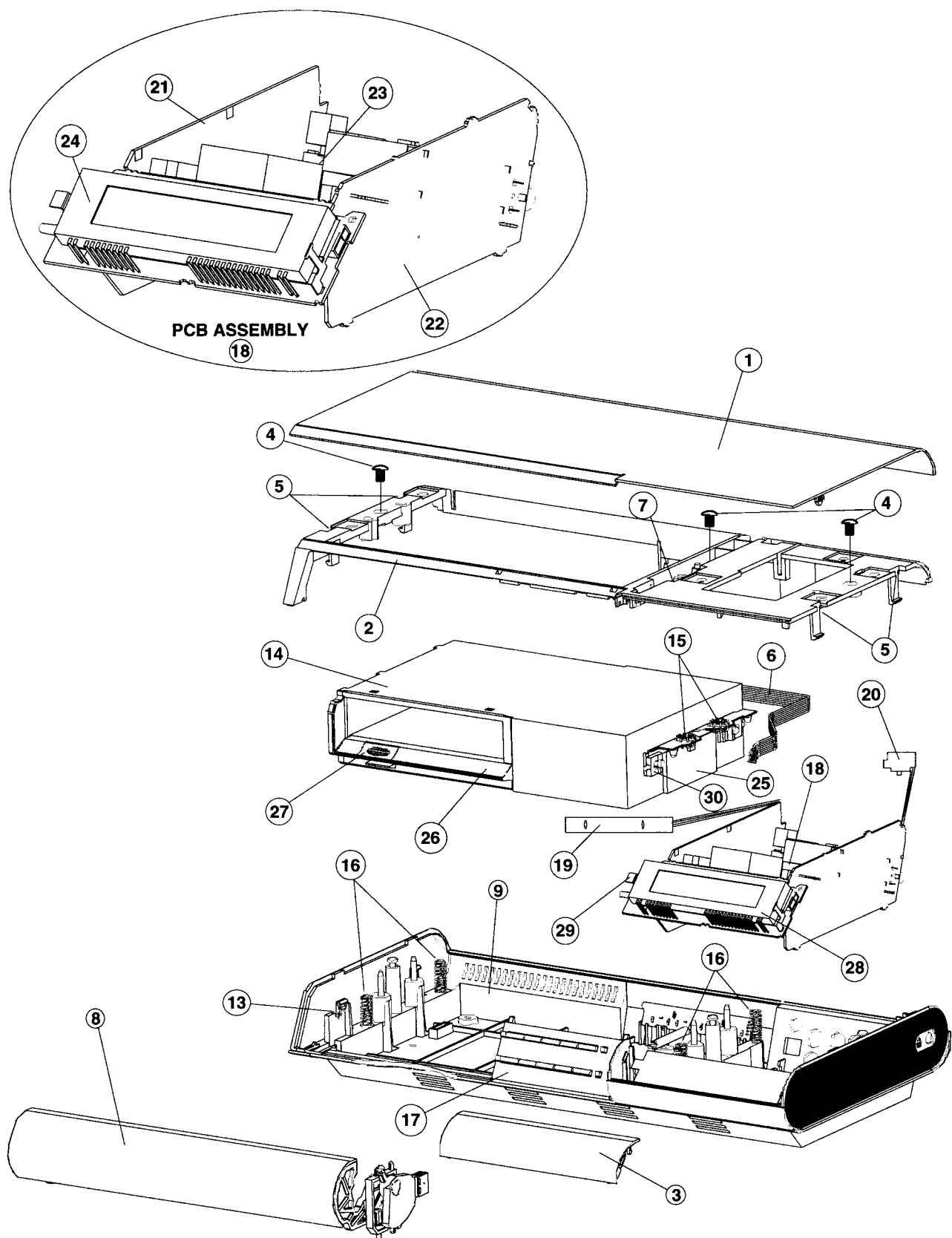
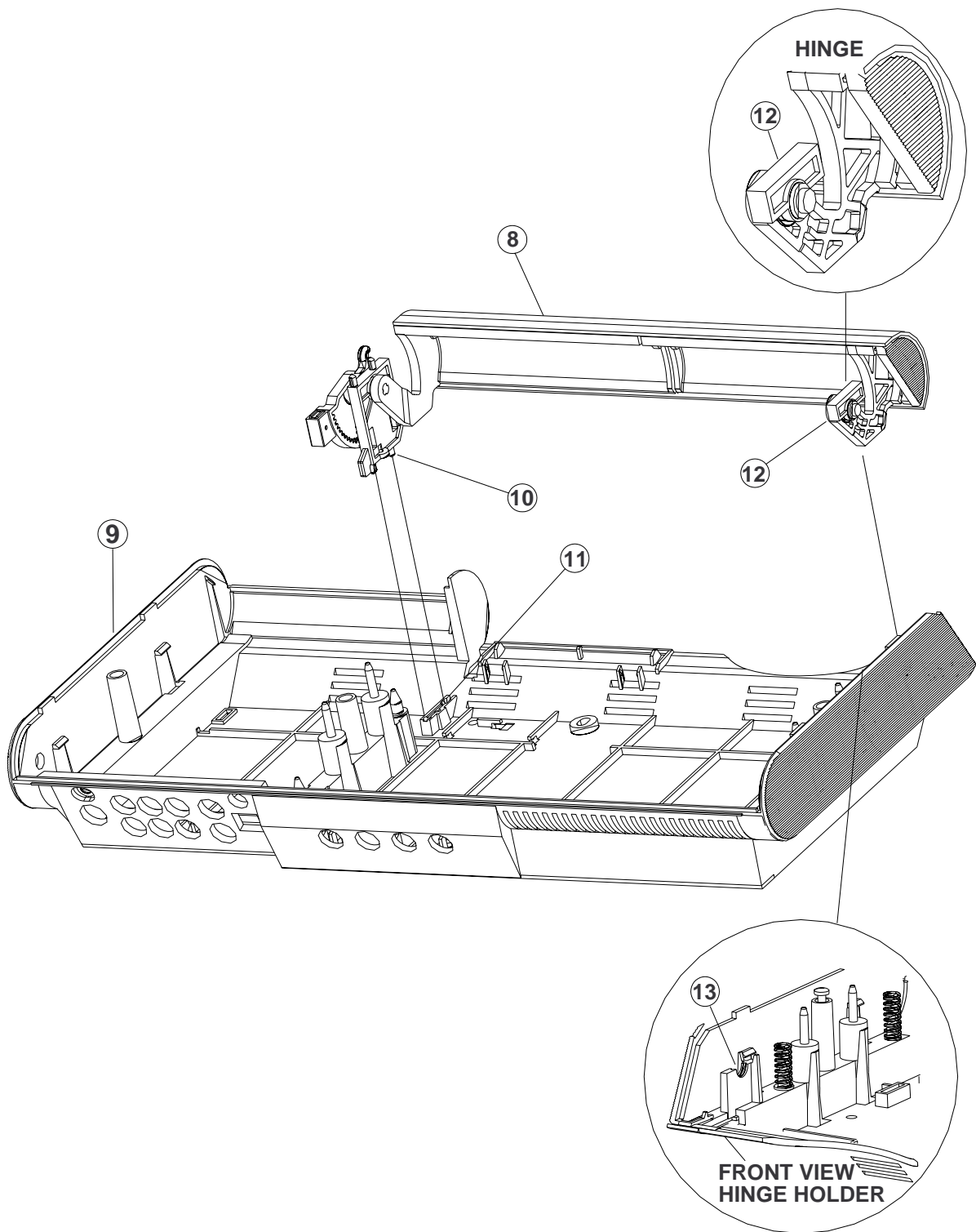


Figure 2. Disassembly/Assembly View





**Figure 3. Exploded View of Door**

# RC-20 REMOTE DISASSEMBLY/ASSEMBLY

**Note:** Numbers in parentheses correspond to the callouts in Figure 4.

## 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 finger tips.

**1.3** With your finger tips in the battery compartment, first pull parallel to the unit 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 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

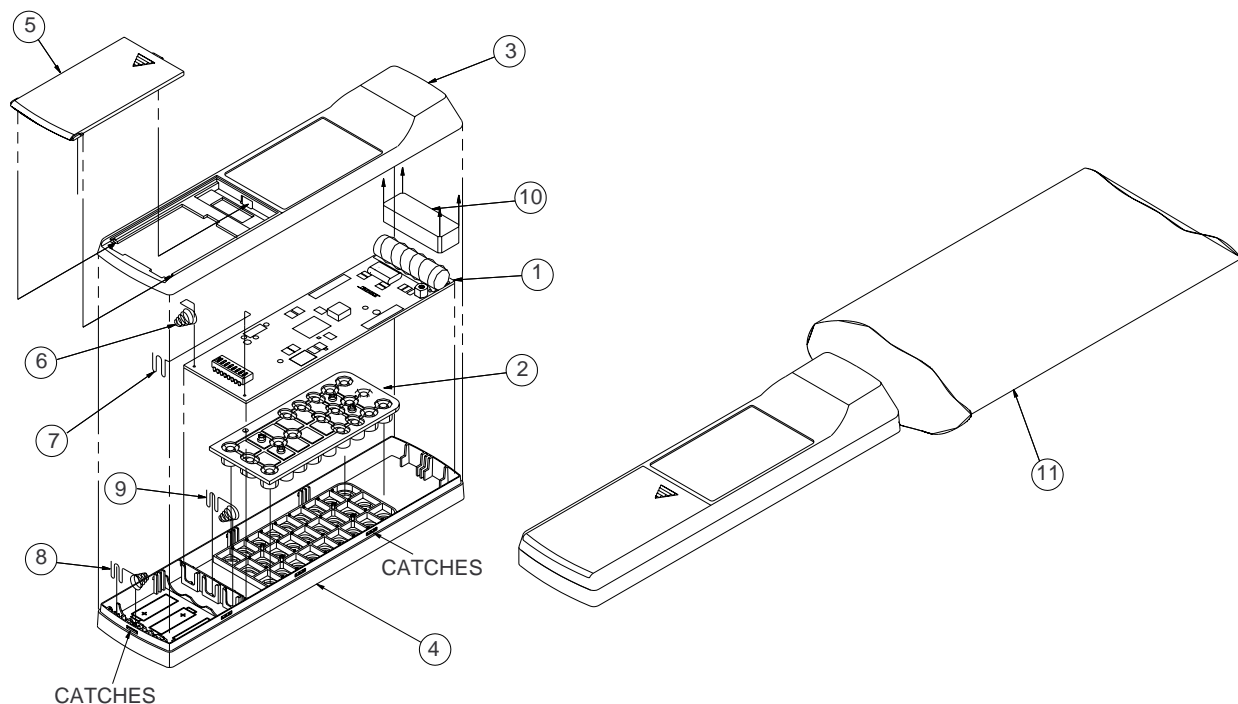
**4.1** Lower the PCB (1) into the bottom cover (3) so that the springs are in the battery compartment.

## 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.

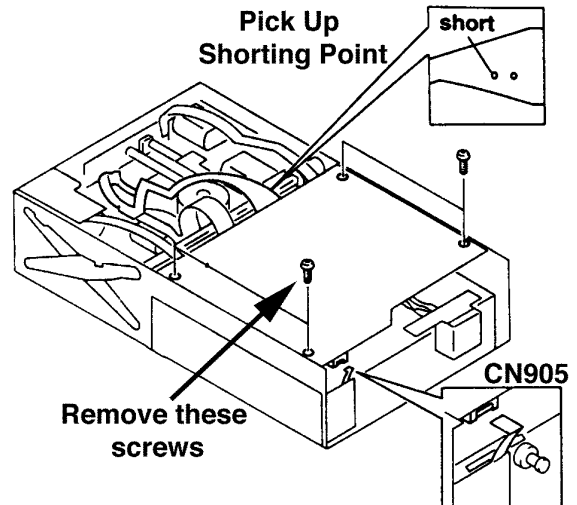


**Figure 4. RC-20 Disassembly/Assembly View**

# CD MECHANISM DISASSEMBLY PROCEDURES

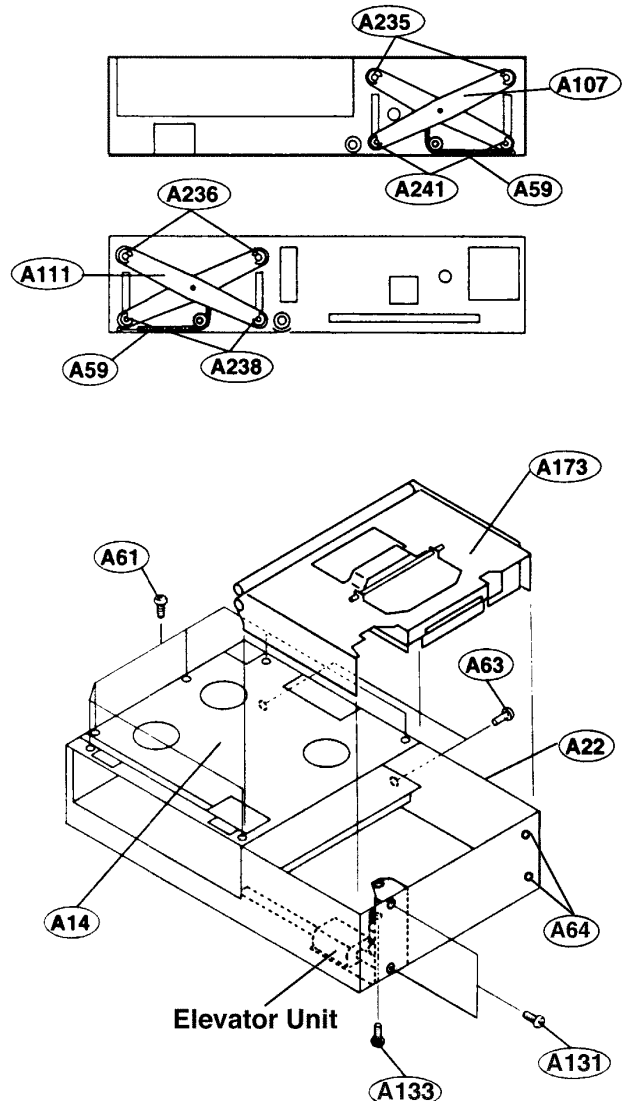
## 1. Main PCB Disassembly

- 1.1 Short the two pads on the ribbon cable coming from the pick up.
- 1.2 Unplug CN905.
- 1.3 Remove the four screws that secure the PCB to the chassis.
- 1.4 Lift the PCB up and remove the remaining connectors.



## 2. Base Chassis Disassembly

- 2.1 Remove all the FPCs that connect the mount chassis (A173) to the main PCB.
  - 2.2 Remove the front and rear elevator tension spring (A59).
  - 2.3 Remove the two E-rings located in the rear (A238) and the two located in the front (A241). Remove the two E-rings located in the front (A235) and the two located in the rear (A236). Remove the link cross bars (A107) and (A111).
  - 2.4 Remove the screw (A133) and the two screws (A131) that mount the elevator unit and remove the elevator unit.
  - Note:** A133 is the screw that secures the plastic piece.
  - 2.5 Remove the six screws (A61) that secure the top base chassis (A14).
  - 2.6 Remove the two screws (A63) and the two screws (A64) that secures the rear base chassis (A22). Remove the spring that connects from the mount chassis to the base chassis.
  - Note:** Use caution when removing the mount chassis so that the washers, rollers, etc. that are mounted on the lift pin of the mount chassis are not lost.
- (Continued on the next page)



# CD MECHANISM DISASSEMBLY PROCEDURES

**Note:** When installing the mount chassis (A173), line up the elevator shaft (A119) so that the lever (A55) is almost touching the eject lever (A45). The mount chassis should be at its lowest position.

## 3. Elevator Motor Disassembly

**3.1** Unplug the FPC (A104) from the PCB.

**3.2** Remove the screw (A133) that secures the elevator unit.

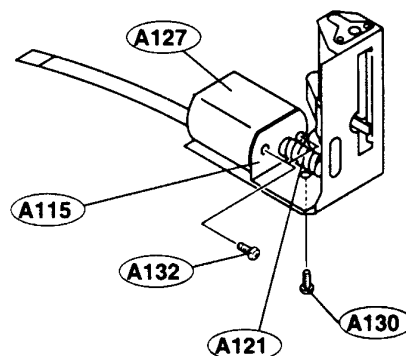
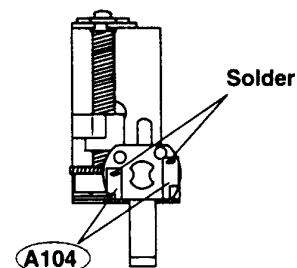
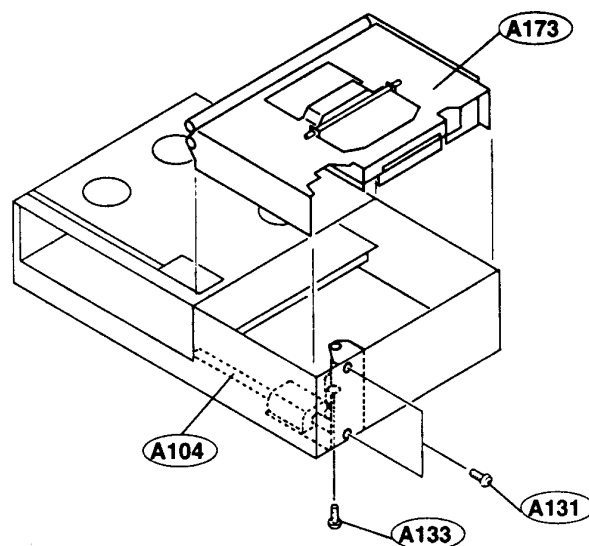
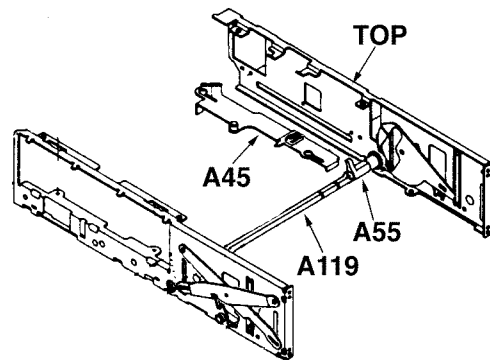
**Note:** A133 is the screw that secures the plastic piece.

**3.3** Remove the two screws (A131) that secure the elevator unit to the base chassis and remove the elevator unit. Lift the elevator unit out through the bottom of the base chassis.

**3.4** Remove the FPC (A104) from the motor (A127) terminal with a soldering iron.

**3.5** Remove the screw (A130) that secures the elevator motor bracket (A115) to the elevator unit bracket.

**3.6** Remove the two screws (A132) that secure the motor to the motor bracket.



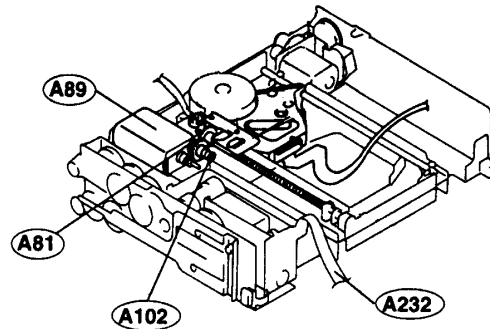
# CD MECHANISM DISASSEMBLY PROCEDURES

## 4. Feed Motor Disassembly

**4.1** Remove the washer (**A102**) and then remove the DV middle gear (**A81**).

**4.2** Remove the FPC from the feed motor with a soldering iron.

**4.3** Remove the two screws (**A94**) that secure the feed motor (**A89**). Lift the motor up.



## 5. Loading Motor Disassembly

**5.1** Unplug the FPCs (**A104**) and (**A232**).

**5.2** Remove the four screws (**A64**) that secure the base chassis side (**A19**) to the base chassis.

**5.3** Remove the screw (**A133**) that secures the elevator unit to the chassis. Remove the base chassis side (**A19**). The elevator unit will be attached to the base chassis side.

**5.4** Remove the two screws (**A246**) that secure the loading motor unit to the base chassis.

**5.5** Remove the FPC (**A232**) that is connected to the motor terminal with a soldering iron.

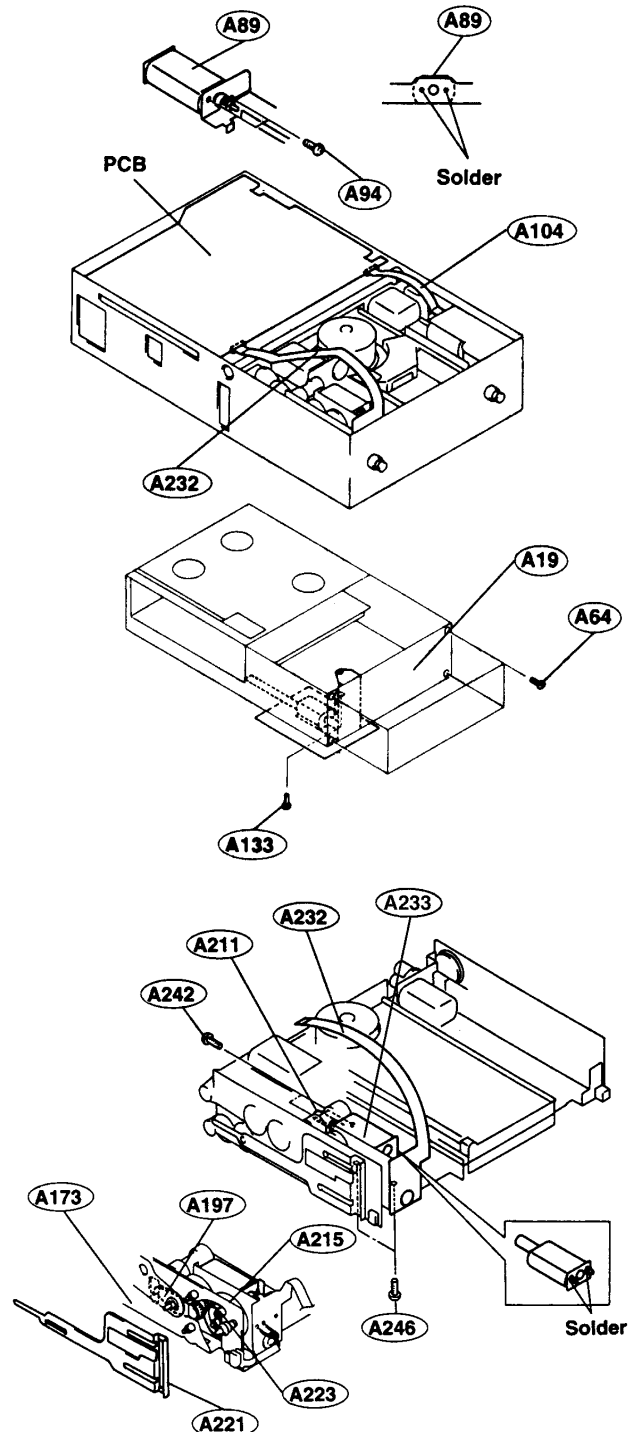
**5.6** Remove the two screws (**A242**) that secure the motor (**A233**) to the motor mount.

**Note:** Assemble in the reverse order of the disassembly and make note of the following.

**1.** Make sure the front bend of the friction gear arm assembly (**A197**) is inserted in the square hole of the chassis mount (**A173**).

**2.** Make sure that the PR cam roller (**A223**) is fitted to the push cam rod (**A215**) and is inserted in the bend groove of the push rod (**A221**).

**3.** The tightening torque of the motor mounting screw (**A242**) is 1.5 to 2.0 kg-cm.



# CD MECHANISM DISASSEMBLY PROCEDURES

## 6. Lift Motor Disassembly

6.1 Perform procedure 3.

6.2 Remove the two DL springs (**A228**) that are located on both sides. The DL springs are black.

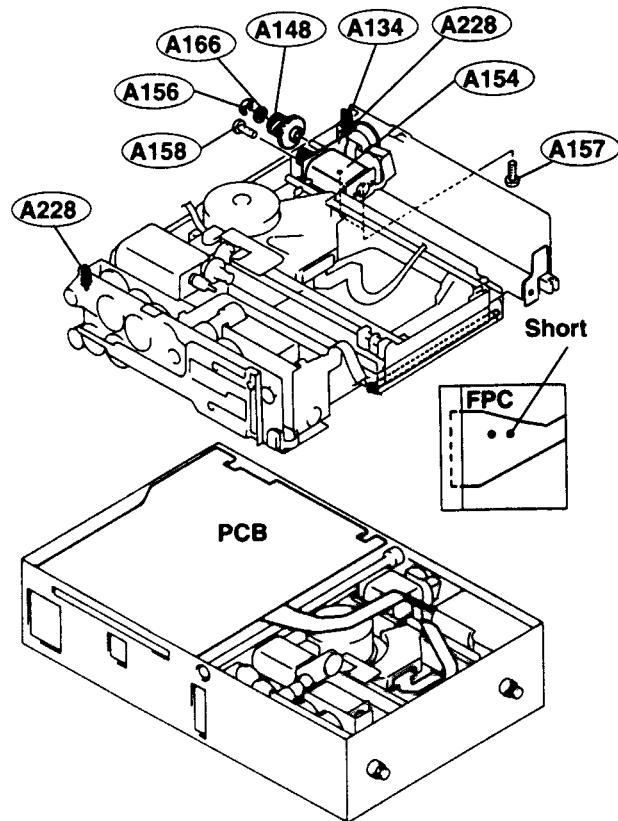
6.3 Remove the FPC from the lift motor (**A154**) with a soldering iron.

6.4 Grasp the unit where the DL springs were located and rotate the motor assembly section up. Remove the two screws (**A157**) that secure the motor bracket to the assembly.

**Note:** Rotate the worm gear A148 until the disc rollers are in contact.

6.5 Remove the E-ring (**A156**) and the washer (**A166**) that secures the worm gear to the motor shaft.

6.6 Remove the screw (**A158**) that secures the motor to the motor bracket.



## 7. Pick Up Disassembly

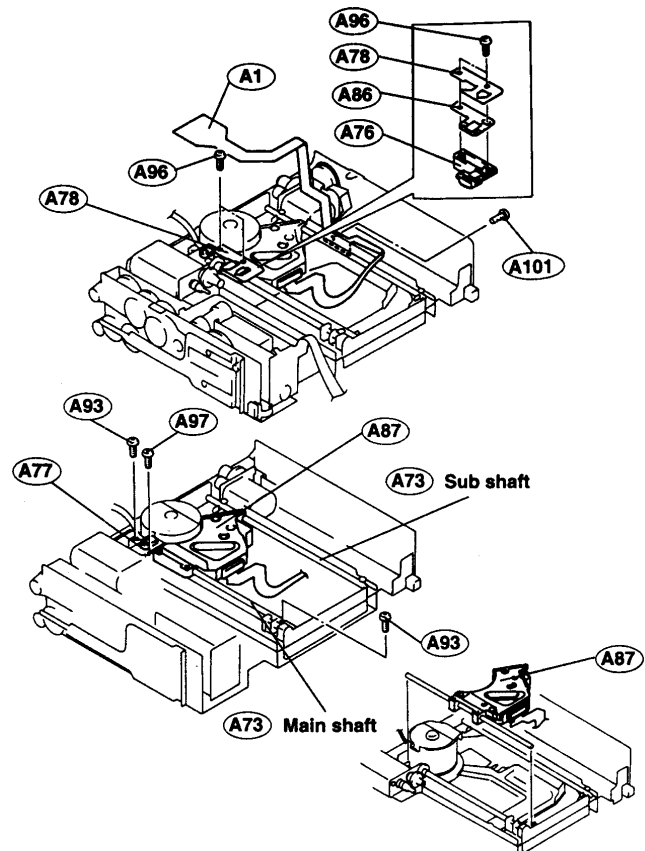
7.1 Short the short pattern located on the FPC (**A1**) with a soldering iron. Unplug the FPC (**A1**).

7.2 Remove the screw (**A101**) that secures the FPC to the chassis. Make note of the location of the FPC that is glued to the chassis.

7.3 Remove the two screws (**A96**) that secure the screw clip (**A78**), DV plate spring (**A86**) and DV spring holder (**A76**) to the pick up (**A87**).

7.4 Remove the screw (**A97**) that secures the switch spacer to the chassis.

7.5 Remove the two screws (**A93**) that secure the sub shaft (**A73**) of the pick up to the chassis. Lift the pick up out of the unit.

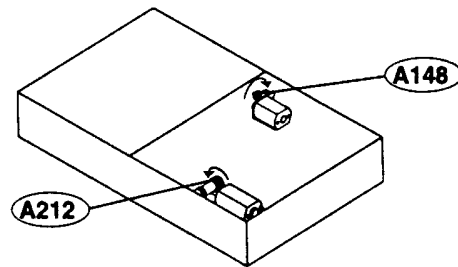


# CD MECHANISM DISASSEMBLY PROCEDURES

**Note:** When replacing the pickup, grease the main shaft and the U groove of the sub shaft. After securing the FPC, apply glue to the end opposite the screw.

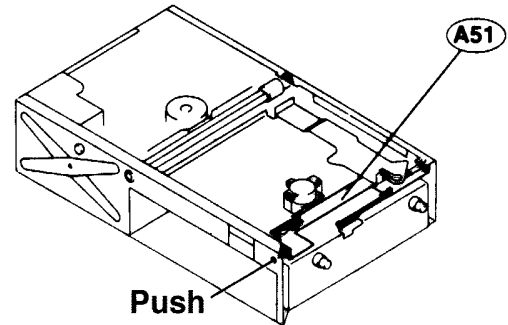
## 8. Manual Magazine Ejection

**8.1** With the disc clamped, rotate the lift motor worm gear (**A148**) 25 to 28 turns in the direction of the arrow to unclamp the disc.



**8.2** With the disc unclamped, rotate the L wheel worm gear (**A212**) in the direction of the arrow to return the disc to the magazine.

**Note:** If the disc comes in contact with the separator and can not be returned, push the edge of the disc up or down so that it returns without coming into contact with the separator of the magazine.



**8.3** After returning the disc to the magazine, push the emergency eject plate (**A51**) with the tip of a screwdriver to remove the magazine.



# TEST PROCEDURES

## General Test Setup

Use cable 184209 for fixed level tests.  
Use cable 183174 for adjustable level tests.  
The miniature switch number 8 on the remote must be up to control ZONE 2.

For ZONE 1 and 2 variable tests, adjust the volume to max.

Terminate the Headphone output into 32Ω.

Terminate all Audio outputs into 10KΩ.

Terminate the serial output jack (tip and ring) into 10kΩ (two resistors).

See Figure 5 for adjustment locations.

## 1. Aux Gain and Separation Test

**1.1** Apply a 2 Vrms, 1 kHz signal to the left AUX input.

**1.2** Ground the TAPE, VIDEO 1, VIDEO 2 and right AUX inputs.

**1.3** Reference a dB meter to the applied signal.

**1.4** Measure the gain according to the chart below.

**Note:** Repeat this test for the right channel.

OUTPUT	MIN dB	MAX dB
Zone 1 L Fixed	-1.5	1.0
Zone 1 L Adjustable	-1.5	1.0
Zone 2 L Fixed	-1.5	1.0
Zone 2 L Adjustable	-1.5	1.0
Tape L	-1.5	1.0
Headphone L	--	-50
Zone 1 R Fixed	--	-50
Zone 1 R Adjustable	--	-50
Zone 2 R Fixed	--	-50
Zone 2 R Adjustable	--	-50
Tape R	--	-50
Headphone R	--	-50

## 2. Video Gain And Separation Test

**2.1** Apply a 2 Vrms, 1 kHz signal to the left VIDEO 1 input.

**2.2** Ground the TAPE, VIDEO 2, AUX and right VIDEO 1 inputs.

**2.3** Reference a dB meter to the applied signal.

**2.4** Measure the gain according to the following chart.

**Note:** Repeat this test for the right channel and VIDEO 2.

OUTPUT	MIN DB	MAX DB
Zone 1 L Fixed	-1.5	1.0
Zone 1 R Fixed	--	-50
Zone 2 L Fixed	-1.5	1.0
Zone 2 R Fixed	--	-50
Tape L	--	-50

## 3. Tape Gain and Separation Test

**3.1** Apply a 2 Vrms, 1 kHz signal to the left TAPE input.

**3.2** Ground the VIDEO 1, VIDEO 2, AUX and right TAPE inputs.

**3.3** Reference a dB meter to the applied signal.

**3.4** Measure the gain according to the chart below.

**Note:** Repeat this test for the right channel.

OUTPUT	MIN dB	MAX dB
Zone 1 L Fixed	-1.5	1.0
Zone 2 L Fixed	-1.5	1.0
Zone 1 R Fixed	--	-50
Zone 2 R Fixed	--	-50



# TEST PROCEDURES

## 4. Volume Control Mute Test

**4.1** Apply a 2 Vrms, 1 kHz signal to the AUX input.

**4.2** Set the volume control to maximum.

**4.3** Reference a dB meter to ZONE 1 adjustable output.

**4.4** Set the volume control to minimum and measure ZONE 1 output (should be  $\leq -80$  dB).

## 5. Distortion Test

**5.1** Apply a 1 Vrms, 1 kHz signal to the AUX input (Volume at full).

**5.2** Measure the distortion at ZONE 1 and ZONE 2 (should be  $\leq .05\%$  A-weighting).

## 6. Frequency Response Test

**6.1** Apply a 1 Vrms, 20Hz signal to the AUX input (Volume at full).

**6.2** Reference a dB meter to the applied signal.

**6.3** Measure ZONE 1 and ZONE 2 output (should be  $\pm 1$  dB).

**6.4** Apply a 1 Vrms, 20 kHz signal to the AUX input.

**6.5** Reference a dB meter to the applied signal.

**6.6** Measure ZONE 1 and ZONE 2 output (should be  $\pm 1$  dB).

## 7. Serial Data Interface Port

**7.1** The voltage at the ring of the serial data jack should be  $\geq 4.5$  VDC.

**7.2** The voltage at the tip of the serial data jack should be  $\leq 0.8$  VDC.

**7.3** While adjusting the volume up or down, the voltage at the tip should be  $\geq .6$  VDC.

## 8. FM Alignment

**8.1** Select FM and tune to 98.1 MHz. Inject an RF signal into the FM antenna terminals at 40 dBf, mono modulation, pilot off.

**8.2** Front End Mixer Coil Adjustment: Connect a DC meter to U300, pin 25. Adjust the FM front end mixer coil for maximum DC voltage (should be within +0, -20 mV of peak value).

**Note:** The front end mixer coil is located in the front end module (it is the only adjustable coil).

**Note:** Do not perform the following test for PCB 250736.

**8.3** FM Detector Zero adjustment: Connect a DC meter to the positive (+) side of C315 and the positive (+) side of C313. Adjust T304 for 0 Vdc  $\pm 110$ mV.

**8.4** FM Distortion adjustment: Adjust T303 for minimum distortion (viewed at tape output).

**8.5** FM distortion should be  $< .6\%$ . If the distortion is out of spec, repeat 8.3 and 8.4. Recheck FM distortion.

## 9. FM Stereo Separation

**9.1** Inject an RF signal into the FM antenna terminal at 65 dBf, L only modulation, pilot on.

**9.2** Connect a dB meter to the left TAPE output. Reference the dB meter to this point.

**9.3** Connect the dB meter to the right TAPE output. The output should be  $\leq -25$  dB.

# TEST PROCEDURES

## 10. FM Stop Level Adjustment

**Note:** Do not perform the following test for PCB 250736.

**10.1** Inject an RF signal into the FM antenna terminals at 25 dBf, L+R modulation, pilot off, set to 98.1 MHz.

**10.2** Connect a DC meter to pin 21 of U300.

**10.3** Rotate R439 counterclockwise until the voltage becomes less than 2.5V, then clockwise until the voltage becomes greater than 2.5V. The correct adjustment is when the voltage just becomes slightly greater than 2.5V.

**10.4** Increase the RF generator to dBf and confirm that the voltage at pin 21 U300 is less than 2.5V.

## 11. FM Sensitivity / SNR

**11.1** Inject an RF signal into the FM antenna terminals at 42 dBf, L=R modulation, pilot on.

**11.2** Connect a dB meter to the TAPE output. Reference the dB meter to this point.

**11.3** Turn the modulation off and measure the output. The output should be  $\leq -50$  dB for US versions and  $\leq -45$  dB for European versions.

## 12. AM RMS

**12.1** Inject an RF signal at a field strength of 70 dBu into the AM antenna terminals.

**12.2** Connect an AC meter to the tape output.

**12.3** Tune the generator and the unit to 630 kHz. Adjust the black slug of T302 for maximum output. The output should be  $\geq 300$  mVrms.

**12.4** Tune the generator and the unit to 1080 kHz. Adjust the brown slug of T302 for maximum output.

**12.5** Repeat steps 12.3 and 12.4 until maximum output is obtained.

## 13. AM Sensitivity

**13.1** Inject an RF signal, 1080 kHz, at a field strength of 70 dBu to the AM antenna terminals.

**13.2** Connect a dB meter to the TAPE output and reference it to this point.

**13.3** Remove the RF signal and measure the TAPE output (should be  $\leq -30$  dB).

## 14. AM Stop Level adjustment

**14.1** Inject an RF signal at a field strength of 59 dBu to the AM antenna terminal.

**14.2** Connect a DC meter to pin 21 of U300.

**14.3** Rotate R348 counterclockwise until the voltage becomes less than 2.5V, then clockwise until the voltage becomes greater than 2.5V. The correct adjustment is when the voltage just becomes slightly greater than 2.5 VDC.

**14.4** Increase the generator output to 64 dBu and confirm the voltage at pin 21 of U300 is less than 2.5V.

# TEST PROCEDURES

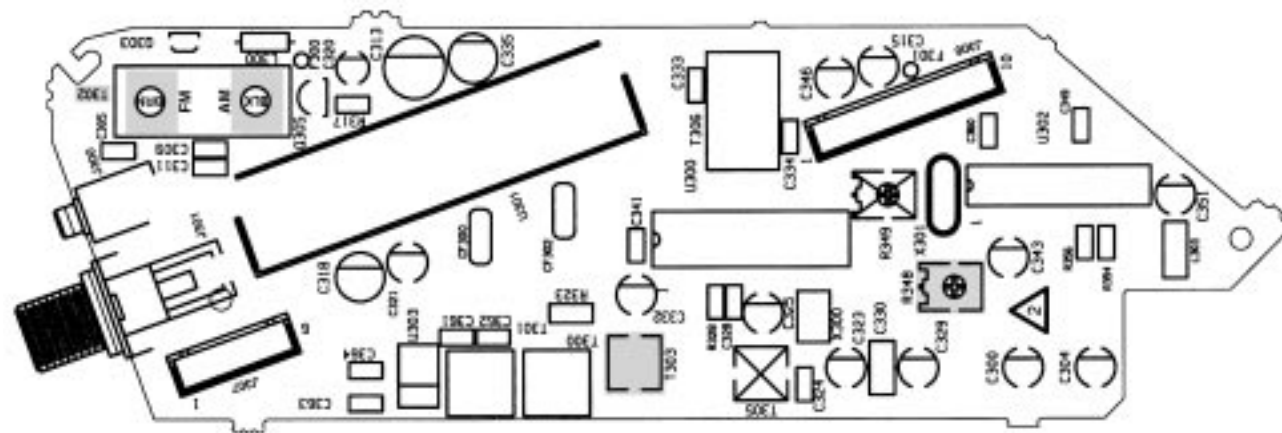
## 15. CD Tracking Ability

**15.1** The test discs listed in the chart below should be played with no audible defects.

**15.2** If the unit fails any of these tests, replace the CD mechanism assembly or proceed to the Alignment procedures.

Disc	Test	Test Conditions
ABEX test disc TCD-725A	Defect tracking (void), 1.0 mm	Track 6, 6 sec.
ABEX test disc TCD-725A	Defect tracking (black dot), .8 mm	Track 9, 8 sec.
ABEX test disc TCD-725A	Defect tracking (finger print), 65 µm	Track 13, 10 sec.
ABEX test disc TCD-732R	Defect tracking (warped disc), -1.0 mm	First and last track, 6 sec.
ABEX test disc TCD-713R	Defect tracking (eccentric disc), 210 µm	First and last track, 6 sec.

### Figure 5. Tuner Alignment Locations



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# REMOTE CONTROL ALIGNMENT

## 1. Remote Control Tuning

1.1 Connect TP48A (BATT +) to TP47.

1.2 Connect TP48A (BAT +) to L1 (AM MOD).

1.3 Connect an oscilloscope probe to TP22. Connect the scope ground near TP22.

**Note:** A x10 probe is recommended.

1.4 Rotating C14 360 degrees, you should see two points where the signal peaks. Adjust C14 until the output at TP22 is peaked ( $\geq 6V_{pp}$ ). It doesn't matter which peak you tune to.

1.5 TP19 should be 3 Vpp. TP20 should be 1 Vpp.

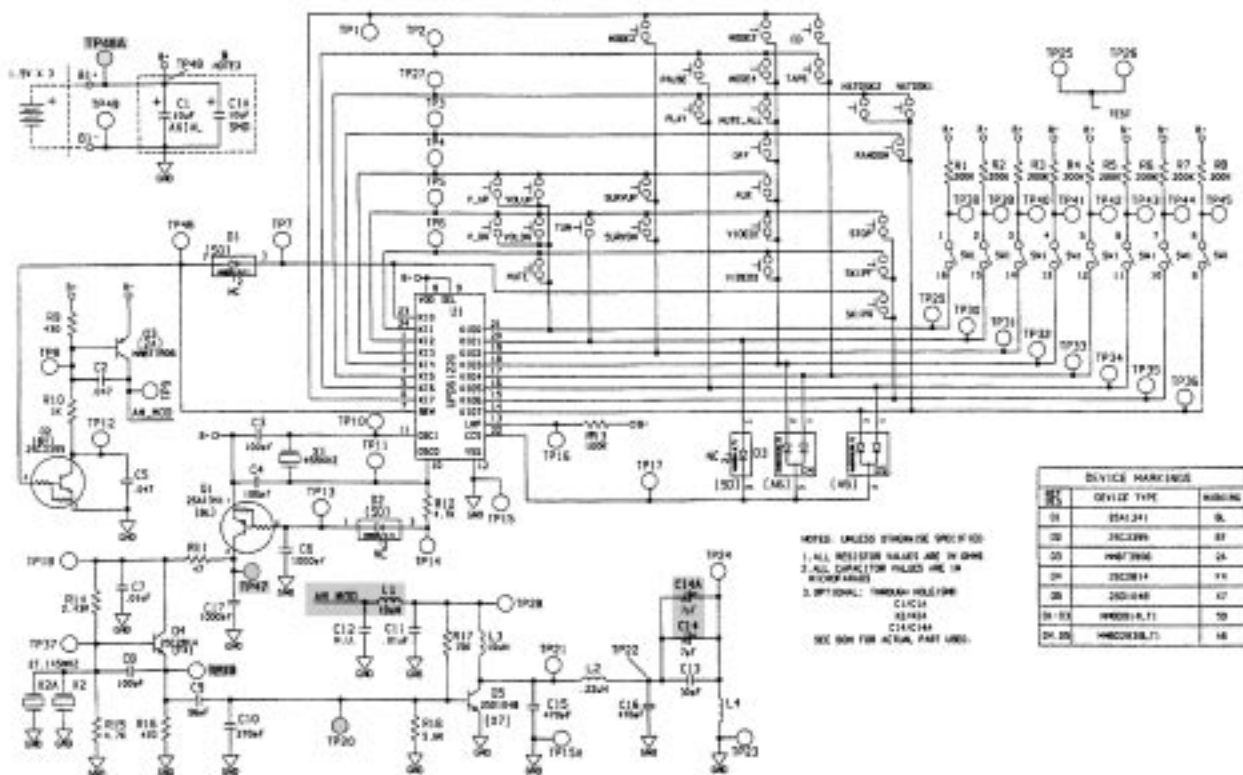


Figure 6. RC-20 Tuning Locations

# ALIGNMENT PROCEDURES

**Note:** The CD changer must be placed into a CD-20 music center for the following procedures. The CD changer cannot be operated by itself.

## Equipment Needed

1. CD-20 Alignment Fixture (P/N: 191749)
2. Oscilloscope
3. DC Voltmeter
4. Test CD (A•Bex TCD-784) or equivalent.

**Note:** Remove the solder from the location ATSC before performing any alignments. Perform these procedures in exact order!

## 1. FE Bias Alignment

**1.1** Connect the power pack to the CD-20 and leave the CD-20 in the OFF mode.

**1.2** Connect a DC voltmeter to **TP824** (FE out) and **TP704** ( $1/2 V_{cc}$ ). See Figure 1.

**1.3** Adjust the potentiometer **PT824** until the meter reads  $< 10\text{mVdc}$ .

## 2. Tracking Balance Alignment

**2.1** Insert the CD A•Bex TCD-784 and play track number seven.

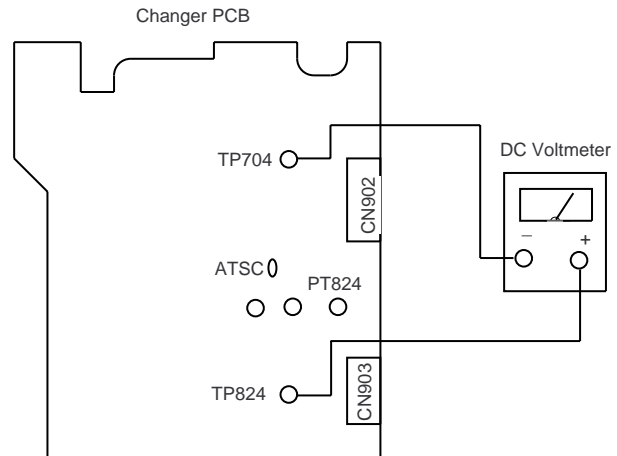
**2.2** Connect **TP601** (TEST) to **TP705** (GND). See Figure 2.

**2.3** Remove the solder from the points labeled SLED and then TRACK.

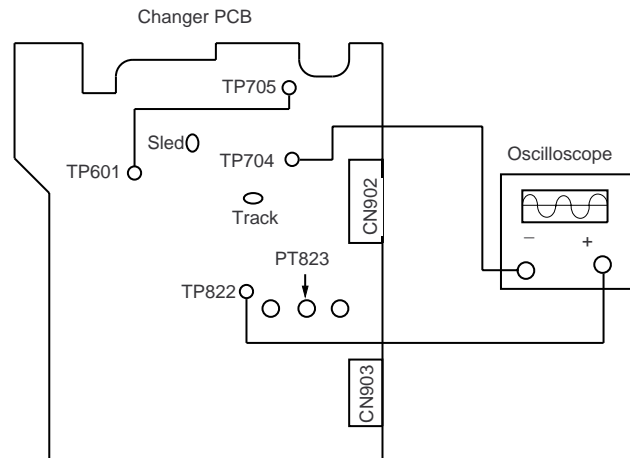
**2.4** Connect an oscilloscope to **TP822** (+) and **TP704** (-).

**2.5** Adjust **PT823** (T.BAL) until the wave form is symmetrical about  $0\text{VDC}$ ,  $V_1=V_2$ . See Figure 5.

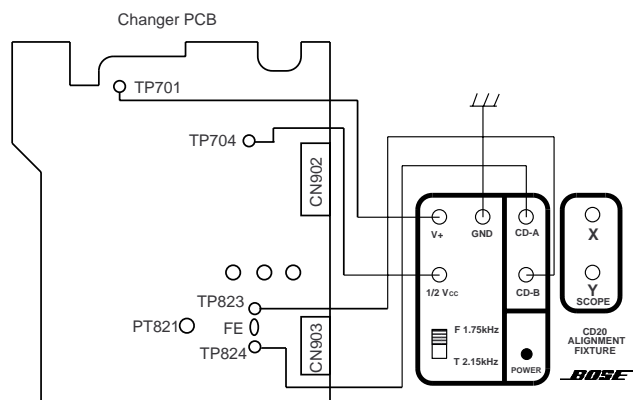
**2.6** After the adjustment is done, solder the points labeled TRACK and SLED. Remove the connection from TP601 (TEST) to TP705 (GRN).



**Figure 1. FE Bias Alignment**



**Figure 2. Tracking Balance Alignment**



**Figure 3. Focus Gain Alignment**



# ALIGNMENT PROCEDURES

## 3. Focus Gain Alignment

**3.1** Unplug the power pack from the CD-20

**3.2** Remove the solder from the point labeled FE and connect the CD-20 alignment fixture as shown in Figure 3.

**3.3** Turn the CD-20 on and play track number one of the A•Bex CD TCD-784.

**3.4** Switch the CD-20 alignment fixture's oscillator to 1.75 kHz.

**3.5** Set the oscilloscope to the X-Y mode and connect CH2 of the oscilloscope to the "X" input and CH1 to the "Y" input of the alignment fixture.

**3.6** Adjust **PT821** (F. GAIN) for the best circle as viewed on the oscilloscope. See Figure 6.

**3.7** After the adjustment is complete, solder the point labeled FE.

## 4. Tracking Gain Alignment

**4.1** Unplug the power pack from the unit.

**4.2** Remove the solder from the point labeled TE and connect the alignment fixture as shown in Figure 4.

**4.3** Plug the CD-20 in and play track number 1 of the A•Bex CD TCD-784.

**4.4** Switch the CD-20 alignment fixture's oscillator to 2.15 kHz.

**4.5** Set the oscilloscope to the X-Y mode. Connect CH2 of the oscilloscope to the "X" input and CH1 to the "Y" input of the alignment fixture.

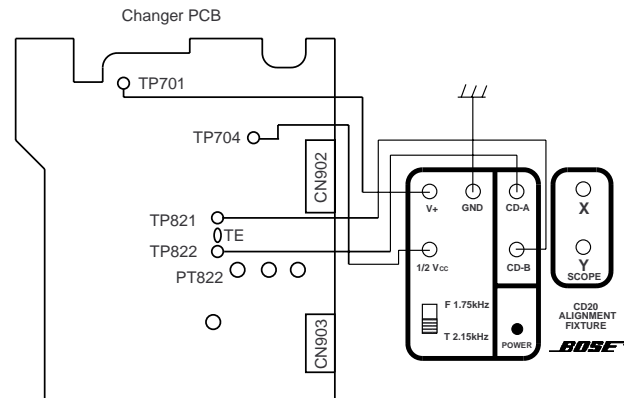
**4.6** Adjust **PT822** (T. GAIN) for the best circle as viewed on the oscilloscope. See Figure 6.

**4.7** After the adjustment is complete, solder the point labeled TE.

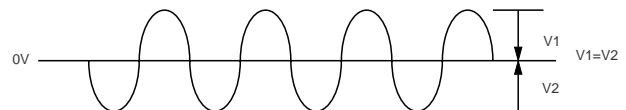
## 5. Alignment Completion.

**5.1** Solder the point labeled ATSC.

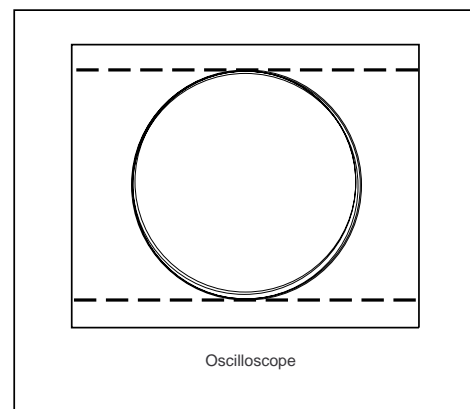
**5.2** Perform test procedure 1.



**Figure 4. Tracking Gain Alignment**



**Figure 5. Symmetrical Waveform**




**Figure 6. X-Y Mode Output  
10mV/ Division**

# PART 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 Lists.

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. The PCB assembly 199831-101C has a change to the AM circuit and uses a new AM antenna part number 199824-002. The PCB assembly 250737-101C has a change to the FM circuit in addition to the AM changes on the 199831-101C PCB. When replacing an older PCB assembly with either one of the PCBs (199831-101C, 250737-101C) the new AM antenna part number 199824-002 must be used with the new PCB assemblies.

5. These parts are not used on the 250737-101C PCB assembly.

6. This part is used on the 178335 PCB only. The 178335 PCB is the original PCB used on the CD-20. Most of the parts listed are common to all of the PCB variants.

7. This part is used on the European variant.

8. This part is used on the Japan variant.

9. This part is used on the Dual voltage variant.

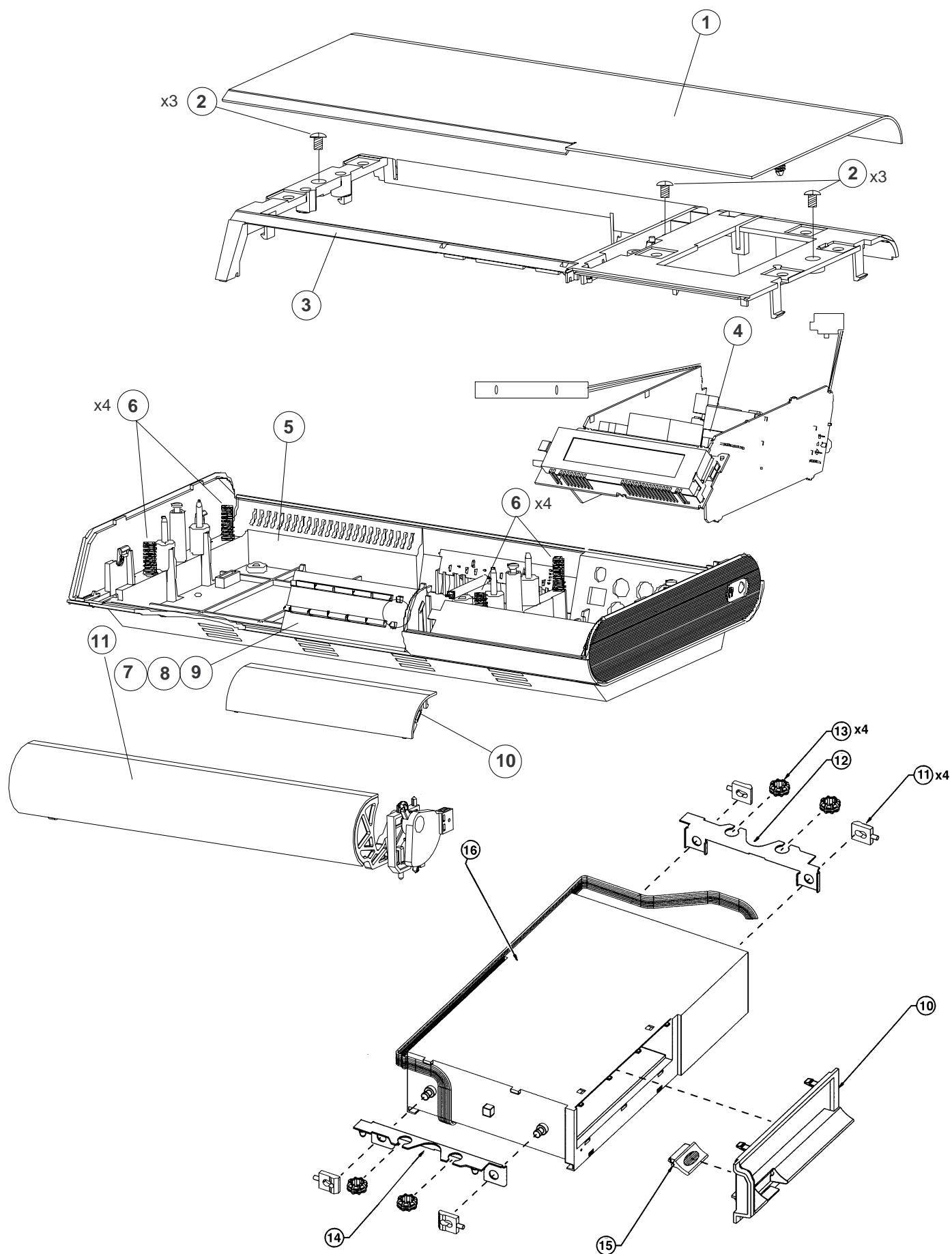
10. The PCB part numbers 178349-101C and 199831-101C are no longer available. They have been replaced by PCB part number 250737-101C. When ordering a new PCB assembly, use part number 250737-101C and order the new AM antenna, part number 199842-002. Due to design changes in the Am section of the PCB 250737-101C it is important to use the new AM antenna, part number 199824-002, for proper impedance matching.



# MAIN PART LIST

(Refer to Figure 7)

Item Number	Description	Part Number	Qty.	Note
1	COVER, TOP	180038	1	
2	SCREW, TAPP, 6-13 X .875, PAN, XREC	187426-14	3	
3	SUPERSTRUCTURE	182311 or 250257	1	
4	PCB, ASSEMBLY	271911-101CK	1	1,4,10
5	BASE ASSY	183889-001	1	
6	SPRING, MOUNTING, CD-MECH	184041	4	
7	CONSOLE, CONTROL	178211	1	
8	BUTTON TREE	178339	1	
9	SHIELD, BUTTON, ESD	180035	1	
10	LENS	178208	1	
11	DOOR ASSY.	180037	1	
12	BEZEL, CHANGER	178210	1	
13	CLIP, SPRING	199801	4	
14	ADAPTER, MOUNTING, RIGHT	187576	1	
15	GROMMET, MOUNTING	178919	4	
16	CD MECHANISM	271835-001K	1	
17	ADAPTER, MOUNTING, LEFT	187577	1	
18	BUTTON, EJECT	197922	1	
---	VIEWSHIELD	181090	1	
---	CLIP, SPRING, U TYPE	178173-01	1	
---	SPRING, DOOR RETURN	178340	1	
---	SCREW, #4-24, HI-LO, PAN, HD.	184042-04	2	
---	TAPE, EMI TRACE	179277	1	
---	SCREW, THUMB, SHIPP'G, CD MECH	198583	3	
---	CLIP, GROUNDING	183893	1	
---	CLIP, CHRISTMAS TREE	179278	4	
---	TAPE, FOAM, ADH BACKED, W/LINER	179265-06	1	
---	TAPE, TRANSFER (3M F9465PC)	183301-25100	1	
---	TAPE, FOAM	179265-01	1	
---	TAPE, FOAM	179265-02	1	
U301	TUNER, SHIELDED, EURO	179270	1	5, 7, 9
U301	TUNER, SHIELDED	181081	1	5
U301	TUNER, FM, 88.5 TO 108 MHz	251054	1	
U301	TUNER, EURO	184589	1	7
U301	TUNER, JAPAN	188466-001	1	8
VFD	BRACKET, VFD DISPLAY	178922	1	
VFD400	DISPLAY, VFD.	179281	1	
RR100	RECEIVER, RF REMOTE, 27.145 MHZ	305091-001	1	5
RR100	RECEIVER, RF REMOTE, 27.145 MHZ	191401-001	1	
RR100	RECEIVER, RF REMOTE, 47.280 MHZ	193053-001	1	7, 9



**Figure 7. CD-20 Exploded View**

# CD MECHANISM PART LIST

(Refer to Figure 8)

Item Number	Description	Part Number	Note
1	Assy, Base Top Comp.	189092	
2	Assy, Base Center Comp.	189108	
3	Assy, Bracket CD-CH Comp.	189159	
4	Assy, Chassis CD Comp.	189199	
5	Assy, Base Rear Comp.	189155	
6	Assy, Shaft EV Comp.	189160	
7	Assy, Base Front Comp.	189193	
8	Assy, Frame EV Comp.	189149	
9	Assy, Base Side Comp.	189112	
10	Assy, Chassis Mount Comp.	189157	
11	Assy, Bracket Loading Comp.	189156	
A1	FPC PIC	189154	
A104	Assy, FPC Elevator	189161	
A153	FPC Lift	189153	
A228	Spring Tension DL	189144	
A232	FPC Loading	189152	
CN906	Wire Assy, 8P, 555mm	189162	2
-	Assy, PCB-W, Main	189163	1

- Note:** 1. This is the complete CD changer mechanism PCB.  
 2. This part is connected to the CD changer mechanism's PCB.

**Note:** The table above lists all the parts that are available for the CD changer mechanism portion of the CD-20. The part numbers that are not preceded by a letter represent an assembly that is outlined in Figure 8. Part numbers that are preceded by a letter represent individual parts called out in Figure 8.



# ELECTRICAL PART LIST

## Resistors

Reference Designator	Description	Part Number	Note
R1	82 OHM, 2512, 1W, 5%	181895-82R0	
R2	7.5 OHM, 2512, 1W, 5%	181895-7R5	
R11	130 OHM, 2512, 1W, 5%	181895-1300	6
R12	910 OHM, 1206, 1/8W, 5%	124895-9115	
R14	2.0K, 2512, 1W, 5%	181895-2001	6
R14	2.7K, 2512, 1W, 5%	181895-2701	
R18	330 OHM, 0805, 1/10W, 5%	133626-3315	
R19	330 OHM, 0805, 1/10W, 5%	133626-3315	
R22	2.2K, 0805, 1/10W, 5%	133626-2225	
R23	220 OHM, 1206, 1/8W, 5%	124895-2215	
R24	220 OHM, 1206, 1/8W, 5%	124895-2215	
R25	4.7K, 0805, 1/10W, 5%	133626-4725	
R26	910 OHM, 1206, 1/8W, 5%	124895-9115	
R27	10.0K, 0805, 1/10W, 5%	133626-1035	
R100	1.00K, 0805, 1/10W, 1%	133625-1001	
R101	100K, 0805, 1/10W, 1%	133625-1003	
R102	1.00K, 0805, 1/10W, 1%	133625-1001	
R103	100K, 0805, 1/10W, 1%	133625-1003	
R104	1.00K, 0805, 1/10W, 1%	133625-1001	
R105	100K, 0805, 1/10W, 1%	133625-1003	
R108	150 OHM, 0805, 1/10W, 1%	133625-1500	
R110	150 OHM, 0805, 1/10W, 1%	133625-1500	
R111	100K, 0805, 1/10W, 1%	133625-1003	
R112	150 OHM, 0805, 1/10W, 1%	133625-1500	
R113	100K, 0805, 1/10W, 1%	133625-1003	
R116	150 OHM, 0805, 1/10W, 1%	133625-1500	
R117	100K, 0805, 1/10W, 1%	133625-1003	
R118	150 OHM, 0805, 1/10W, 1%	133625-1500	
R119	100K, 0805, 1/10W, 1%	133625-1003	
R120	39 OHM, 0805, 1/10W, 5%	133626-3905	
R121	1.00K, 0805, 1/10W, 5%	133626-1025	6
R121	10.0K, 0805, 1/10W, 5%	133626-1035	
R122	1.00K, 0805, 1/10W, 5%	133626-1025	6
R123	15 OHM, 0805, 1/10W, 5%	133626-1505	
R127	1.00K, 0805, 1/10W, 5%	133626-1025	
R128	15 OHM, 0805, 1/10W, 5%	133626-1505	
R129	750 OHM, 0805, 1/10W, 1%	133625-7500	
R130	15 OHM, 0805, 1/10W, 5%	133626-1505	
R131	4.7K, 0805, 1/10W, 5%	133626-4725	
R132	4.7K, 0805, 1/10W, 5%	133626-4725	
R133	3.90K, 0805, 1/10W, 5%	133626-3925	
R134	10 OHM, 0805, 1/10W, 5%	133626-1005	
R135	2.2K, 0805, 1/10W, 5%	133626-2225	
R136	750 OHM, 0805, 1/10W, 1%	133625-7500	
R137	3.90K, 0805, 1/10W, 5%	133626-3925	
R138	10 OHM, 0805, 1/10W, 5%	133626-1005	
R139	2.2K, 0805, 1/10W, 5%	133626-2225	
R140	330 OHM, 0805, 1/10W, 5%	133626-3315	
R141	330 OHM, 0805, 1/10W, 5%	133626-3315	
R142	51.1K, 0805, 1/10W, 0.1%	181896-5112	
R143	220 OHM, 0805, 1/10W, 5%	133626-2215	
R144	16.9K, 0805, 1/10W, 0.1%	181896-1692	
R145	51.1K, 0805, 1/10W, 0.1%	181896-5112	
R146	16.9K, 0805, 1/10W, 0.1%	181896-1692	

# ELECTRICAL PART LIST

Resistors (continued)

Reference Designator	Description	Part Number	Note
R147	220 OHM, 0805, 1/10W, 5%	133626-2215	
R148	10.0K, 0805, 1/10W, 5%	133626-1035	
R152	4.7K, 0805, 1/10W, 5%	133626-4725	
R161	100K, 0805, 1/10W, 1%	133625-1003	
R162	100K, 0805, 1/10W, 1%	133625-1003	
R163	100K, 0805, 1/10W, 1%	133625-1003	
R164	100K, 0805, 1/10W, 1%	133625-1003	
R165	100K, 0805, 1/10W, 1%	133625-1003	
R166	330 OHM, 0805, 1/10W, 5%	133626-3315	
R200	1.00K, 0805, 1/10W, 1%	133625-1001	
R201	100K, 0805, 1/10W, 1%	133625-1003	
R202	1.00K, 0805, 1/10W, 1%	133625-1001	
R203	100K, 0805, 1/10W, 1%	133625-1003	
R204	1.00K, 0805, 1/10W, 1%	133625-1001	
R205	100K, 0805, 1/10W, 1%	133625-1003	
R208	150 OHM, 0805, 1/10W, 1%	133625-1500	
R210	150 OHM, 0805, 1/10W, 1%	133625-1500	
R211	100K, 0805, 1/10W, 1%	133625-1003	
R212	150 OHM, 0805, 1/10W, 1%	133625-1500	
R213	100K, 0805, 1/10W, 1%	133625-1003	
R216	150 OHM, 0805, 1/10W, 1%	133625-1500	
R217	100K, 0805, 1/10W, 1%	133625-1003	
R218	150 OHM, 0805, 1/10W, 1%	133625-1500	
R219	100K, 0805, 1/10W, 1%	133625-1003	
R242	51.1K, 0805, 1/10W, 0.1%	181896-5112	
R243	220 OHM, 0805, 1/10W, 5%	133626-2215	
R244	16.9K, 0805, 1/10W, 0.1%	181896-1692	
R252	4.7K, 0805, 1/10W, 5%	133626-4725	
R262	100K, 0805, 1/10W, 1%	133625-1003	
R263	100K, 0805, 1/10W, 1%	133625-1003	
R264	100K, 0805, 1/10W, 1%	133625-1003	
R300	5.6K, 0805, 1/10W, 5%	133626-5625	
R301	24K, 0805, 1/10W, 5%	133626-2435	
R302	10 OHM, 0805, 1/10W, 5%	133626-1005	
R303	5.6K, 0805, 1/10W, 5%	133626-5625	
R304	2.2K, 0805, 1/10W, 5%	133626-2225	
R305	24K, 0805, 1/10W, 5%	133626-2435	
R309	2.2K, 0805, 1/10W, 5%	133626-2225	
R311	22K, 0805, 1/10W, 5%	133626-2235	
R312	4.7K, 0805, 1/10W, 5%	133626-4725	
R313	10.0K, 0805, 1/10W, 5%	133626-1035	
R314	10 OHM, 0805, 1/10W, 5%	133626-1005	5
R314	100 OHM, 0805, 1/10W, 5%	133626-1015	
R315	4.7K, 0805, 1/10W, 5%	133626-4725	
R316	1.00K, 0805, 1/10W, 5%	133626-1025	
R317	1.60K, 0805, 1/10W, 5%	133626-1625	
R318	620 OHM, 0805, 1/10W, 5%	133626-6215	
R319	22 OHM, 0805, 1/10W, 5%	133626-2205	
R320	9.1K, 0805, 1/10W, 5%	133626-9125	
R321	4.7K, 0805, 1/10W, 5%	133626-4725	6
R321	47.0K, 0805, 1/10W, 5%	133626-4735	
R322	1.2K, 0805, 1/10W, 5%	133626-1225	
R323	33 OHM, 1206, 1/8W, 5%	124895-3305	
R324	3.3K, 0805, 1/10W, 5%	133626-3325	



# ELECTRICAL PART LIST

Resistors (continued)

Reference Designator	Description	Part Number	Note
R325	2.7K, 0805, 1/10W, 5%	133626-2725	5
R326	8.2K, 0805, 1/10W, 5%	133626-8225	5
R326	3.09K, 0805, 1/10W, 1%	133625-3091	
R328	12K, 0805, 1/10W, 5%	133626-1235	
R329	5.11K, 0805, 1/10W, 1%	133625-5111	
R330	10 OHM, 0805, 1/10W, 5%	133626-1005	5
R330	51 OHM, 0805, 1/10W, 5%	133626-5105	
R331	10.0K, 0805, 1/10W, 5%	133626-1035	5
R332	1.00K, 0805, 1/10W, 5%	133626-1025	
R333	120 OHM, 0805, 1/10W, 5%	133626-1215	
R334	330 OHM, 0805, 1/10W, 5%	133626-3325	5
R334	2.32K, 0805, 1/10W, 1%	133625-2321	
R335	18.0K, 0805, 1/10W, 5%	133626-1835	5
R335	499 OHM, 0805, 1/10W, 1%	133625-4990	
R336	390 OHM, 0805, 1/10W, 5%	133626-3915	6
R336	560 OHM, 0805, 1/10W, 5%	133626-5615	5
R336	2.32K, 0805, 1/10W, 1%	133625-2321	
R337	330 OHM, 0805, 1/10W, 5%	133626-3325	5
R337	499 OHM, 0805, 1/10W, 1%	133625-4990	
R338	22K, 0805, 1/10W, 5%	133626-2235	5
R338	330 OHM, 0805, 1/10W, 5%	133626-3315	
R339	330 OHM, 0805, 1/10W, 5%	133626-3325	5
R339	2.32K, 0805, 1/10W, 1%	133625-2321	
R340	18.0K, 0805, 1/10W, 5%	133626-1835	5
R341	390 OHM, 0805, 1/10W, 5%	133626-3915	6
R341	560 OHM, 0805, 1/10W, 5%	133626-5615	5
R342	330 OHM, 0805, 1/10W, 5%	133626-3325	5
R343	22K, 0805, 1/10W, 5%	133626-2235	5
R344	1.05K, 0805, 1/10W, 1%	133625-1051	
R346	4.7K, 0805, 1/10W, 5%	133626-4725	
R347	4.7K, 0805, 1/10W, 5%	133626-4725	
R348	5K OHM, POT, RTRY, 30%, 1/2W	177494-203	6
R348	20K OHM, POT, RTRY, 30%, 1/2W	177494-502	
R349	10K OHM, POT, RTRY, 30%, 1/2W	177494-103	6
R350	1.00K, 0805, 1/10W, 5%	133626-1025	
R351	4.7K, 0805, 1/10W, 5%	133626-4725	
R352	1.00K, 0805, 1/10W, 5%	133626-1025	
R353	4.7K, 0805, 1/10W, 5%	133626-4725	6
R353	47.0K, 0805, 1/10W, 5%	133626-4735	
R354	10.0K, 0805, 1/10W, 5%	133626-1035	
R355	6.80K, 0805, 1/10W, 5%	133626-6825	
R357	10.0K, 0805, 1/10W, 5%	133626-1035	5
R359	4.02K, 0805, 1/10W, 1%	133625-4021	
R360	100 OHM, 0805, 1/10W, 5%	133626-1015	5
R360	2.32K, 0805, 1/10W, 1%	133625-2321	
R361	100 OHM, 0805, 1/10W, 5%	133626-1015	5
R361	330 OHM, 0805, 1/10W, 5%	133626-3315	
R362	100 OHM, 0805, 1/10W, 5%	133626-1015	5
R363	100 OHM, 0805, 1/10W, 5%	133626-1015	5
R401	100 OHM, 0805, 1/10W, 5%	133626-1015	
R402	10.0K, 0805, 1/10W, 5%	133626-1035	
R403	10.0K, 0805, 1/10W, 5%	133626-1035	
R404	1.00K, 0805, 1/10W, 5%	133626-1025	
R405	1.00K, 0805, 1/10W, 5%	133626-1025	

# ELECTRICAL PART LIST

Resistors (continued)

Reference Designator	Description	Part Number	Note
R406	1.00K, 0805, 1/10W, 5%	133626-1025	
R408	100 OHM, 0805, 1/10W, 5%	133626-1015	
R409	1.00K, 0805, 1/10W, 5%	133626-1025	
R410	10.0K, 0805, 1/10W, 5%	133626-1035	
R411	1.00K, 0805, 1/10W, 5%	133626-1025	
R412	1.00K, 0805, 1/10W, 5%	133626-1025	
R413	1.00K, 0805, 1/10W, 5%	133626-1025	
R414	2.7 OHM, 0805, 1/10W, 5%	133626-2R75	
R415	100 OHM, 0805, 1/10W, 5%	133626-1015	
R416	100 OHM, 0805, 1/10W, 5%	133626-1015	
R417	2.7 OHM, 0805, 1/10W, 5%	133626-2R75	
R418	2.7 OHM, 0805, 1/10W, 5%	133626-2R75	
R419	1.00K, 0805, 1/10W, 5%	133626-1025	
R420	1.00K, 0805, 1/10W, 5%	133626-1025	
R421	43.2K, 0805, 1/10W, 1%	133625-4322	
R422	43.2K, 0805, 1/10W, 1%	133625-4322	
R423	10.0K, 0805, 1/10W, 5%	133626-1035	
R424	10.0K, 0805, 1/10W, 5%	133626-1035	
R425	10.0K, 0805, 1/10W, 5%	133626-1035	
R426	10.0K, 0805, 1/10W, 5%	133626-1035	
R428	1.00K, 0805, 1/10W, 5%	133626-1025	
R429	1.00K, 0805, 1/10W, 5%	133626-1025	
R430	10.0K, 0805, 1/10W, 5%	133626-1035	
R431	10.0K, 0805, 1/10W, 5%	133626-1035	
R432	43.2K, 0805, 1/10W, 1%	133625-4322	
R433	511 OHM, 0805, 1/10W, 1%	133625-5110	
R434	511 OHM, 0805, 1/10W, 1%	133625-5110	
R435	100K, 0805, 1/10W, 1%	133625-1003	
R436	33.0K, 0805, 1/10W, 5%	133626-3335	6
R436	4.7K, 0805, 1/10W, 5%	133626-4725	
R437	33K, 0805, 1/10W, 5%	133626-3345	6
R438	30K, 0805, 1/10W, 5%	133626-3035	
R439	10.0K, 0805, 1/10W, 5%	133626-1035	6
R439	1 MEG, 0805, 1/10W, 5%	133626-1055	
R440	10.0K, 0805, 1/10W, 5%	133626-1035	6
R440	4.7K, 0805, 1/10W, 5%	133626-4725	
R441	44.2K, 0805, 1/10W, 1%	133625-4422	
R441	100K, 0805, 1/10W, 1%	133625-1003	6
R442	100K, 0805, 1/10W, 1%	133625-1003	
R443	121K, 0805, 1/10W, 1%	133625-1213	
R444	10.0K, 0805, 1/10W, 5%	133626-1035	
R445	10.0K, 0805, 1/10W, 5%	133626-1035	
R446	10.0K, 0805, 1/10W, 5%	133626-1035	
R447	13K, 0805, 1/10W, 5%	133626-1335	8
R447	62.0K, 0805, 1/10W, 5%	133626-6235	6, 7
R447	7.5K, 0805, 1/10W, 5%	133626-7525	5, 9
R448	1.00K, 0805, 1/10W, 5%	133626-1025	
R449	1.00K, 0805, 1/10W, 5%	133626-1025	
R450	10.0K, 0805, 1/10W, 5%	133626-1035	
R451	10.0K, 0805, 1/10W, 5%	133626-1035	
R452	10.0K, 0805, 1/10W, 5%	133626-1035	
R453	511 OHM, 0805, 1/10W, 1%	133625-5110	
R454	511 OHM, 0805, 1/10W, 1%	133625-5110	
R455	511 OHM, 0805, 1/10W, 1%	133625-5110	



# ELECTRICAL PART LIST

## Resistors (continued)

Reference Designator	Description	Part Number	Note
R456	511 OHM, 0805, 1/10W, 1%	133625-5110	
R457	511 OHM, 0805, 1/10W, 1%	133625-5110	
R458	511 OHM, 0805, 1/10W, 1%	133625-5110	
R459	511 OHM, 0805, 1/10W, 1%	133625-5110	
R460	511 OHM, 0805, 1/10W, 1%	133625-5110	
R461	511 OHM, 0805, 1/10W, 1%	133625-5110	
R462	511 OHM, 0805, 1/10W, 1%	133625-5110	
R463	511 OHM, 0805, 1/10W, 1%	133625-5110	
R464	511 OHM, 0805, 1/10W, 1%	133625-5110	
R465	511 OHM, 0805, 1/10W, 1%	133625-5110	
R466	511 OHM, 0805, 1/10W, 1%	133625-5110	
R467	511 OHM, 0805, 1/10W, 1%	133625-5110	
R468	511 OHM, 0805, 1/10W, 1%	133625-5110	
R469	511 OHM, 0805, 1/10W, 1%	133625-5110	
R470	511 OHM, 0805, 1/10W, 1%	133625-5110	
R471	511 OHM, 0805, 1/10W, 1%	133625-5110	
R472	511 OHM, 0805, 1/10W, 1%	133625-5110	
R473	511 OHM, 0805, 1/10W, 1%	133625-5110	
R474	511 OHM, 0805, 1/10W, 1%	133625-5110	
R475	511 OHM, 0805, 1/10W, 1%	133625-5110	
R476	1.00K, 0805, 1/10W, 5%	133626-1025	
R477	1.00K, 0805, 1/10W, 5%	133626-1025	
R500	1.00K, 0805, 1/10W, 1%	133625-1001	
R501	1 MEG, 0805, 1/10W, 5%	133626-1055	
R502	1.00K, 0805, 1/10W, 1%	133625-1001	
R503	1 MEG, 0805, 1/10W, 5%	133626-1055	
R504	100K, 0805, 1/10W, 1%	133625-1003	
R505	100K, 0805, 1/10W, 1%	133625-1003	
R700	43.2K, 0805, 1/10W, 1%	133625-4322	
R701	43.2K, 0805, 1/10W, 1%	133625-4322	
R702	43.2K, 0805, 1/10W, 1%	133625-4322	
R703	43.2K, 0805, 1/10W, 1%	133625-4322	
R704	43.2K, 0805, 1/10W, 1%	133625-4322	
R705	43.2K, 0805, 1/10W, 1%	133625-4322	
W300	JUMPER, CHIP, 0805	133627	

## Capacitors

Reference Designator	Description	Part Number	Note
C1	.01uF, 100V, 20%	180630-103	
C2	.01uF, 0805, X7R, 50V, 10%	133623-103	
C3	470uF, EL, 85°C, 25V, 20%	149948-471E	
C4	.047uF, 0805, Z5U, 20%	148779-473	
C5	.01uF, 0805, X7R, 50V, 10%	133623-103	
C6	470uF, EL, 85°C, 25V, 20%	149948-471E	
C7	10uF, EL, 85°C, 25V, 20%	149947-100E	
C8	.01uF, 0805, X7R, 50V, 10%	133623-103	
C10	2200uF, EL, 85°C, 25V, 20%	185929-222E	
C11	.01uF, 0805, X7R, 50V, 10%	133623-103	
C12	.047uF, 0805, Z5U, 20%	148779-473	
C13	.01uF, 0805, X7R, 50V, 10%	133623-103	
C14	47uF, EL, 85°C, 25V, 20%	149948-470E	
C15	100uF, EL, 85°C, 50V, 20%	149948-101H	6
C15	470uF, EL, 85°C, 25V, 20%	149948-471E	

# ELECTRICAL PART LIST

## Capacitors (continued)

Reference Designator	Description	Part Number	Note
C16	.01uF, 0805, X7R, 50V, 10%	133623-103	
C17	.01uF, 0805, X7R, 50V, 10%	133623-103	
C18	100uF, EL, 85°C, 50V, 20%	149948-101H	
C19	.01uF, 0805, X7R, 50V, 10%	133623-103	
C20	100uF, EL, 85°C, 50V, 20%	149948-101H	
C21	100uF, EL, 85°C, 50V, 20%	149948-101H	
C22	.01uF, 0805, X7R, 50V, 10%	133623-103	
C23	47uF, EL, 85°C, 25V, 20%	149948-470E	6
C24	100uF, EL, 85°C, 50V, 20%	149948-101H	
C25	1000pF, 0805, COG, 50V, 5%	133622-102	
C26	1000pF, 0805, COG, 50V, 5%	133622-102	
C27	100uF, EL, 85°C, 50V, 20%	149948-101H	
C28	.01uF, 0805, X7R, 50V, 10%	133623-103	
C29	.01uF, 0805, X7R, 50V, 10%	133623-103	
C30	2.2uF, EL, 85°C, 50V, 20%	149947-2R2H	
C32	.01uF, 0805, X7R, 50V, 10%	133623-103	
C33	.01uF, 0805, X7R, 50V, 10%	133623-103	
C100	180pF, 0805, COG, 50V, 5%	133622-181	
C101	2.2uF, EL, 85°C, 50V, 20%	149947-2R2H	
C102	180pF, 0805, COG, 50V, 5%	133622-181	
C103	2.2uF, EL, 85°C, 50V, 20%	149947-2R2H	
C104	180pF, 0805, COG, 50V, 5%	133622-181	
C105	2.2uF, EL, 85°C, 50V, 20%	149947-2R2H	
C107	2.2uF, EL, 85°C, 50V, 20%	149947-2R2H	
C108	10uF, EL, 85°C, 25V, 20%	149947-100E	
C110	10uF, EL, 85°C, 25V, 20%	149947-100E	
C111	1000pF, 0805, COG, 50V, 5%	133622-102	
C112	.047uF, 0805, Z5U, 20%	148779-473	
C114	10uF, EL, 85°C, 25V, 20%	149947-100E	
C115	1000pF, 0805, COG, 50V, 5%	133622-102	
C116	1000uF, EL, 85°C, 16V, 20%	149948-102C	
C118	.047uF, 0805, Z5U, 20%	148779-473	
C119	1000uF, EL, 85°C, 16V, 20%	149948-102C	
C120	.047uF, 0805, Z5U, 20%	148779-473	
C122	10uF, EL, 85°C, 25V, 20%	149947-100E	
C123	1000pF, 0805, COG, 50V, 5%	133622-102	
C124	10uF, EL, 85°C, 25V, 20%	149947-100E	
C125	1000pF, 0805, COG, 50V, 5%	133622-102	
C126	.01uF, 0805, X7R, 50V, 10%	133623-103	
C127	.01uF, 0805, X7R, 50V, 10%	133623-103	
C128	.047uF, 0805, Z5U, 20%	148779-473	6
C129	.047uF, 0805, Z5U, 20%	148779-473	6
C130	470uF, EL, 85°C, 25V, 20%	149948-471E	
C131	2.2uF, 1206, Y5V, 16V, 80%	178212-225	
C132	.01uF, 0805, X7R, 50V, 10%	133623-103	6
C132	100pF, 0805, COG, 50V, 5%	133622-101	
C133	.01uF, 0805, X7R, 50V, 10%	133623-103	
C134	.01uF, 0805, X7R, 50V, 10%	133623-103	
C135	2.2uF, 1206, Y5V, 16V, 80%	178212-225	
C136	2.2uF, 1206, Y5V, 16V, 80%	178212-225	
C137	.047uF, 0805, Z5U, 20%	148779-473	
C138	1000pF, 0805, COG, 50V, 5%	133622-102	
C139	1000pF, 0805, COG, 50V, 5%	133622-102	
C140	1000pF, 0805, COG, 50V, 5%	133622-102	

# ELECTRICAL PART LIST

Capacitors (continued)

Reference Designator	Description	Part Number	Note
C141	180pF, 0805, COG, 50V, 5%	133622-181	
C142	180pF, 0805, COG, 50V, 5%	133622-181	
C143	1000pF, 0805, COG, 50V, 5%	133622-102	
C144	180pF, 0805, COG, 50V, 5%	133622-181	
C145	470uF, EL, 85°C, 25V, 20%	149948-471E	6
C145	1000uF, EL, 85°C, 16V, 20%	149948-102C	
C146	100pF, 0805, COG, 50V, 5%	133622-101	
C200	180pF, 0805, COG, 50V, 5%	133622-181	
C201	2.2uF, EL, 85°C, 50V, 20%	149947-2R2H	
C202	180pF, 0805, COG, 50V, 5%	133622-181	
C203	2.2uF, EL, 85°C, 50V, 20%	149947-2R2H	
C204	180pF, 0805, COG, 50V, 5%	133622-181	
C205	2.2uF, EL, 85°C, 50V, 20%	149947-2R2H	
C207	2.2uF, EL, 85°C, 50V, 20%	149947-2R2H	
C208	10uF, EL, 85°C, 25V, 20%	149947-100E	
C210	10uF, EL, 85°C, 25V, 20%	149947-100E	
C211	1000pF, 0805, COG, 50V, 5%	133622-102	
C214	10uF, EL, 85°C, 25V, 20%	149947-100E	
C215	1000pF, 0805, COG, 50V, 5%	133622-102	
C216	1000uF, EL, 85°C, 16V, 20%	149948-102C	
C222	10uF, EL, 85°C, 25V, 20%	149947-100E	
C223	1000pF, 0805, COG, 50V, 5%	133622-102	
C224	10uF, EL, 85°C, 25V, 20%	149947-100E	
C225	1000pF, 0805, COG, 50V, 5%	133622-102	
C234	2.2uF, 1206, Y5V, 16V, 80%	178212-225	
C235	2.2uF, 1206, Y5V, 16V, 80%	178212-225	
C239	1000pF, 0805, COG, 50V, 5%	133622-102	
C240	1000pF, 0805, COG, 50V, 5%	133622-102	
C241	180pF, 0805, COG, 50V, 5%	133622-181	
C244	180pF, 0805, COG, 50V, 5%	133622-181	
C246	100pF, 0805, COG, 50V, 5%	133622-101	
C300	4.7uF, EL, 85°C, 50V, 20%	149948-4R7H	
C301	.047uF, 0805, Z5U, 20%	148779-473	
C302	22pF, 0805, COG, 50V, 5%	133622-220	6, 7
C302	3300pF, 0805, X7R, 50V, 10%	133623-332	
C303	22pF, 0805, COG, 50V, 5%	133622-220	6, 7
C303	3300pF, 0805, X7R, 50V, 10%	133623-332	
C304	4.7uF, EL, 85°C, 50V, 20%	149948-4R7H	
C305	10pF, 0805, COG, 50V, 5%	133622-100	
C309	.047uF, 0805, Z5U, 20%	148779-473	
C311	9.1pF, 0805, 50V, 5%	133622-9R1	
C312	.047uF, 0805, Z5U, 20%	148779-473	
C313	220uF, EL, 85°C, 25V, 20%	149948-221E	
C314	.047uF, 0805, Z5U, 20%	148779-473	
C315	1.0uF, EL, 85°C, 50V, 20%	149948-1R0H	
C316	.01uF, 0805, X7R, 50V, 10%	133623-103	
C317	.047uF, 0805, Z5U, 20%	148779-473	
C318	100uF, EL, 85°C, 25V, 20%	149948-101E	
C319	.01uF, 0805, X7R, 50V, 10%	133623-103	
C320	2.2uF, EL, 85°C, 50V, 20%	149947-2R2H	
C321	1.0uF, EL, 85°C, 50V, 20%	149948-1R0H	
C322	.047uF, 0805, Z5U, 20%	148779-473	
C323	1.0uF, EL, 85°C, 50V, 20%	149948-1R0H	
C324	470pF, 0805, COG, 50V, 5%	133622-471	6, 7

# ELECTRICAL PART LIST

Capacitors (continued)

Reference Designator	Description	Part Number	Note
C324	39pF, 0805, COG, 50V, 5%	133622-390	
C325	10uF, EL, 85°C, 25V, 20%	149947-100E	
C326	470pF, 0805, COG, 50V, 5%	133622-471	6, 7
C326	100pF, 0805, COG, 50V, 5%	133622-101	
C327	3300pF, 0805, X7R, 50V, 10%	133623-332	
C328	.047uF, 0805, Z5U, 20%	148779-473	
C329	1.0uF, EL, 85°C, 50V, 20%	149948-1R0H	
C330	.33uF, BOX, 85°C, 50V, 5%	137127-334	
C331	.047uF, 0805, Z5U, 20%	148779-473	
C332	47uF, EL, 85°C, 25V, 20%	149948-470E	
C333	.047uF, 0805, Z5U, 20%	148779-473	
C334	180pF, 0805, COG, 50V, 5%	133622-181	
C335	47uF, 85°C, 16V, EL, 20%	178198-470C	
C336	.047uF, 0805, Z5U, 20%	148779-473	
C337	.047uF, 0805, Z5U, 20%	148779-473	5
C338	1000pF, 0805, COG, 50V, 5%	133622-102	
C339	.047uF, 0805, Z5U, 20%	148779-473	
C340	.047uF, 0805, Z5U, 20%	148779-473	
C341	.047uF, 0805, Z5U, 20%	148779-473	5
C341	1000pF, 0805, COG, 50V, 5%	133622-102	
C342	.047uF, 0805, Z5U, 20%	148779-473	5
C343	10uF, EL, 85°C, 25V, 20%	149947-100E	
C344	.047uF, 0805, Z5U, 20%	148779-473	
C345	.047uF, 0805, Z5U, 20%	148779-473	
C346	4.7uF, EL, 85°C, 50V, 20%	149948-4R7H	
C347	.01uF, 0805, X7R, 50V, 10%	133623-103	
C348	100pF, 0805, COG, 50V, 5%	133622-101	
C349	1000pF, 0805, COG, 50V, 5%	133622-102	
C350	.047uF, 0805, Z5U, 20%	148779-473	
C351	47uF, EL, 85°C, 25V, 20%	149948-470E	
C352	.047uF, 0805, Z5U, 20%	148779-473	
C353	27pF, 0805, COG, 50V, 5%	133622-270	
C354	33pF, 0805, COG, 50V, 5%	133622-330	
C355	.047uF, 0805, Z5U, 20%	148779-473	
C356	.01uF, 0805, X7R, 50V, 10%	133623-103	
C357	1000pF, 0805, COG, 50V, 5%	133622-102	
C358	180pF, 0805, COG, 50V, 5%	133622-181	
C359	180pF, 0805, COG, 50V, 5%	133622-181	
C360	.01uF, 0805, X7R, 50V, 10%	133623-103	
C361	180pF, 0805, COG, 50V, 5%	133622-181	
C362	.047uF, 0805, Z5U, 20%	148779-473	
C363	180pF, 0805, COG, 50V, 5%	133622-181	
C364	180pF, 0805, COG, 50V, 5%	133622-181	
C401	1uF, 1206, Y5V, 16V, 80%	173383-105	
C403	.01uF, 0805, X7R, 50V, 10%	133623-103	
C404	.01uF, 0805, X7R, 50V, 10%	133623-103	
C405	.01uF, 0805, X7R, 50V, 10%	133623-103	
C406	.1uF, 1206, Y5V, 50V, 80%	138551-104	
C407	.1uF, 1206, Y5V, 50V, 80%	138551-104	
C408	.1uF, 1206, Y5V, 50V, 80%	138551-104	
C410	180pF, 0805, COG, 50V, 5%	133622-181	
C411	180pF, 0805, COG, 50V, 5%	133622-181	
C412	180pF, 0805, COG, 50V, 5%	133622-181	
C419	39pF, 0805, COG, 50V, 5%	133622-390	

# ELECTRICAL PART LIST

## Capacitors (continued)

Reference Designator	Description	Part Number	Note
C420	39pF, 0805, COG, 50V, 5%	133622-390	
C421	47uF, 85°C, 16V, EL, 20%	178198-470C	
C422	2.2uF, 1206, Y5V, 16V, 80%	178212-225	
C423	.047uF, 0805, Z5U, 20%	148779-473	
C432	.01uF, 0805, X7R, 50V, 10%	133623-103	
C433	1uF, 1206, Y5V, 16V, 80%	173383-105	
C434	.047uF, 0805, Z5U, 20%	148779-473	
C435	1uF, 1206, Y5V, 16V, 80%	173383-105	
C436	4.7uF, EL, 85°C, 50V, 20%	149948-4R7H	6
C436	1000pF, 0805, COG, 50V, 5%	133622-102	
C438	100pF, 0805, COG, 50V, 5%	133622-101	
C439	1000pF, 0805, COG, 50V, 5%	133622-102	
C440	1000pF, 0805, COG, 50V, 5%	133622-102	
C441	100pF, 0805, COG, 50V, 5%	133622-101	
C442	100pF, 0805, COG, 50V, 5%	133622-101	

## Diodes

Reference Designator	Description	Part Number	Note
D1	DO-214AA, SMT, S1G	178380-4	
D4	DO-214AA, SMT, S1G	178380-4	
D6	DO-214AA, SMT, S1G	178380-4	
D7	DO-214AA, SMT, S1G	178380-4	
D8	1N4751, ZENER, 30V, 1W	116995-4751B	5
D8	ZENER, PSM, 1W	187734-30RA	
D9	DO-214AA, SMT, S1G	178380-4	
D10	BAV99, DUAL, SOT-23	147239	
D11	BAV99, DUAL, SOT-23	147239	
D12	DO-214AA, SMT, S1G	178380-4	
D13	1N5232, ZENER, 5.6V, 225mW	135247-5232	
D14	DO-214AA, SMT, S1G	178380-4	
D15	DO-214AA, SMT, S1G	178380-4	
D105	MMBD914LT1, SOT	148582	
D106	MMBD914LT1, SOT	148582	
D107	MMBD914LT1, SOT	148582	
D108	MMBD914LT1, SOT	148582	
D300	MMBD914LT1, SOT	148582	
D301	MMBD914LT1, SOT	148582	
D404	MMBD914LT1, SOT	148582	

# ELECTRICAL PART LIST

## Transistors

Reference Designator	Description	Part Number	Note
Q1	MMBT3904, NPN, SOT	146819	
Q2	MMBT3904, NPN, SOT	146819	
Q10	2SB1136, PNP, TO-126	129002	
Q11	MMBT3904, NPN, SOT	146819	
Q101	BPLR, N, 50V, 100mA, SOT23	258024	**
Q102	BPLR, P, 60V, 200mA, TO-92	119168	
Q103	BPLR, N, 50V, 100mA, SOT23	258024	**
Q104	BPLR, P, 60V, 200mA, TO-92	119168	
Q105	2SA1341, P, 50V	258025	***
Q106	BPLR, N, 50V, 100mA, SOT23	258024	**
Q302	2SA1341, P, 50V	258025	***
Q303	JFET, N, 20V, 20mA, TO-92	148590-E	
Q304	MMBT3904, NPN, SOT	146819	
Q305	JFET, N, 40V, 6mA, TO-92	147561-3	
Q307	BPLR, N, 30V, 30mA, TO-92	147565	5
Q307	BPLR, N, 25V, 30MA, SOT-23	187601-001	
Q308	BPLR, N, 30V, 30mA, TO-92	147565	5
Q308	BPLR, N, 25V, 30MA, SOT-23	187601-001	
Q309	BPLR, N, 30V, 30mA, TO-92	147565	5
Q310	BPLR, N, 30V, 30mA, TO-92	147565	5
Q311	BPLR, P, 40V, 200mA, SOT23	148596	
Q312	BPLR, N, 50V, 100mA, SOT23	258024	**

## Integrated Circuits

Reference Designator	Description	Part Number	Note
U1	VOLT REG, 5V, POS	172942-05	
U2	VOLT REG, 10V, POS	136664	4/1/02
U100	TDA7313, VOL CONT, DIP28/SO28	177983	
U101	AUDIO MATRIX, SO28	177984-2	
U102	TDA7313, VOL CONT, DIP28/SO28	177983	
U103	NJN3404AM, OP AMP	181080	
U104	NJM4556, OP AMP, DUAL, SO-8	148598	
U300	LA1851, DIGITAL TUNER, DIP-30	146815	
U302	PLL FREQ SYNTH, DIP-20	147527	
U303	NJN3404AM, OP AMP	181080	
U400	TMP87XX0, uC, QFP80	199455-001	
U401	24C01A, EEPROM	184044	
U402	LM393, DUAL COMPARITOR, SO-8	148584	
U403	DS1233-10, RESET, VOLTAGE SPV	181016-10	

## Inductors

Reference Designator	Description	Part Number	Note
L1	SMT, LEM4532, 10uH	178370-100	
L2	CHIP, 0805, 400 OHMS	188587-401	
L100	SMT, LM4532, 1uH	178370-1R0	
L101	SMT, LEM4532, 10uH	178370-100	
L101	SMT, LEM4532, 100uH	178370-101	6
L300	1000uH, 40A, .796 Hz	147563-102	6
L300	INDUCTOR, AXIAL, 10%, 1mH	147563-102	
L301	SMT, LEM4532, 100uH	178370-101	5
L302	SMT, LEM4532, 100uH	178370-101	5
L303	SMT, LEM4532, 100uH	178370-101	
L400	SMT, LEM4532, 100uH	178370-101	
L600	SMT, LEM4532, 100uH	178370-101	
L601	SMT, LEM4532, 100uH	178370-101	



# ELECTRICAL PART LIST

## Transformers

Reference Designator	Description	Part Number	Note
CF300	FILTER, CER., 10.7MHz, 280 kHz	253037-001	6
CF300	FILTER, CER., 10.7MHz, 230 kHz	253037-002	
CF301	FILTER, CER., 10.7MHz, 280 kHz	253037-001	6
CF301	FILTER, CER., 10.7MHz, 230 kHz	253037-002	5
CF302	FILTER, CER., 10.7MHz, 280 kHz	253037-001	6
CF302	FILTER, CER., 10.7MHz, 230 kHz	253037-002	5
CF302	FILTER, CER., 10.7MHz, 180 kHz	253037-001	
T300	FILTER, STEREO MPX	147236	
T301	FILTER, STEREO MPX	147236	
T302	MODULE, TUNING, AM, FRONT END	172972	
T303	DETECTOR, FM	147557	5
T303	DETECTOR, FM	147234	
T304	COIL, FM, DETECTOR	147564	5
T305	114 kHz, FTZ, FILTER	147558	7
T306	COIL, AM IF, HIGH SELECTIVITY	148581	

## Connectors

Reference Designator	Description	Part Number	Note
J1	CONN, DC POWER JACK	147540	
J2	CONN, SERIAL	178356	
J3	HEADER, LOW CURRENT 10 POLE	133224-10	
J4	HEADER, LOW CURRENT 6 POLE	133224-06	
J5	CONN, HEADER, 4 POS	184038-04	
J100	CONN, HOUSING, PHONO, 6 POS	148766	
J101	CONN, DUAL, DIN	178355	
J103	CONN, HEADER, JST 10JQST	178368-10	
J104	CONN, HEADER, JST 6JQST	178368-06	
J106	CONN, HEADER, JST 10JQST	178368-10	
J107	CONN, HEADER, JST 6JQST	178368-06	
J108	CABLE, 15 COND, FLEX, 24AWG	178366-15	
J109	CABLE, 15 COND, FLEX, 24AWG	178366-15	
J110	CONNECTOR, HEADER, 8 PIN	180045-08 or 271914-08	
J112	CABLE, RIBBON, 2.5 mm, 165 mm	178365-04165	
J114	CABLE, 28AWG, RIBBON, 179 mm	178363-05179	
J300	CONN, AM ANTENNA	179266	
J301	CONN, F TYPE, THREADED	178354	5
J301	CONN, F TYPE, THREADED	250785	
J301	CONN, FM, EURO, PAL.	250786	
J301	CONN, FM, EURO, PAL.	179271	6
J306	HEADER, LOW CURRENT 10 POLE	133224-10	
J307	HEADER, LOW CURRENT 6 POLE	133224-06	
J410	CABLE, RIBBON, 2.0 mm, 245 mm	178364-05245	
J500	CONN, RCA, SINGLE, WHT	178357-1	
J501	CONN, RCA, SINGLE, RED	178357-2	
J502	CONN, RCA, SINGLE, WHT	178357-1	
J503	CONN, RCA, SINGLE, RED	178357-2	
J514	CABLE, 28AWG, RIBBON, 179 mm	178363-05179	
J601	JACK, HEADPHONE, PCB MNT.	148583	
J612	CABLE, RIBBON, 2.5 mm, 165 mm	178365-04165	
J710	CABLE, RIBBON, 2.0 mm, 245 mm	178364-05245	

11/03



# ELECTRICAL PART LIST

## Switches

Reference Designator	Description	Part Number	Note
S700	SWITCH, TACTILE DOME, 160gf	172999-02	
S701	SWITCH, TACTILE DOME, 160gf	172999-02	
S702	SWITCH, TACTILE DOME, 160gf	172999-02	
S703	SWITCH, TACTILE DOME, 160gf	172999-02	
S704	SWITCH, TACTILE DOME, 160gf	172999-02	
S705	SWITCH, TACTILE DOME, 160gf	172999-02	
S706	SWITCH, TACTILE DOME, 160gf	172999-02	
S707	SWITCH, TACTILE DOME, 160gf	172999-02	
S708	SWITCH, TACTILE DOME, 160gf	172999-02	
S709	SWITCH, TACTILE DOME, 160gf	172999-02	
S710	SWITCH, TACTILE DOME, 160gf	172999-02	
S711	SWITCH, TACTILE DOME, 160gf	172999-02	

## Crystals

Reference Designator	Description	Part Number	Note
X300	RESONATOR, CERAMIC, 456KHz	147233	
X301	CRYSTAL, QUARTZ, 7.2MHz, 50PPM	147223 or 197680	11/02
X401	CRYSTAL, CERAMIC RESONATOR, 8MHz	175627	

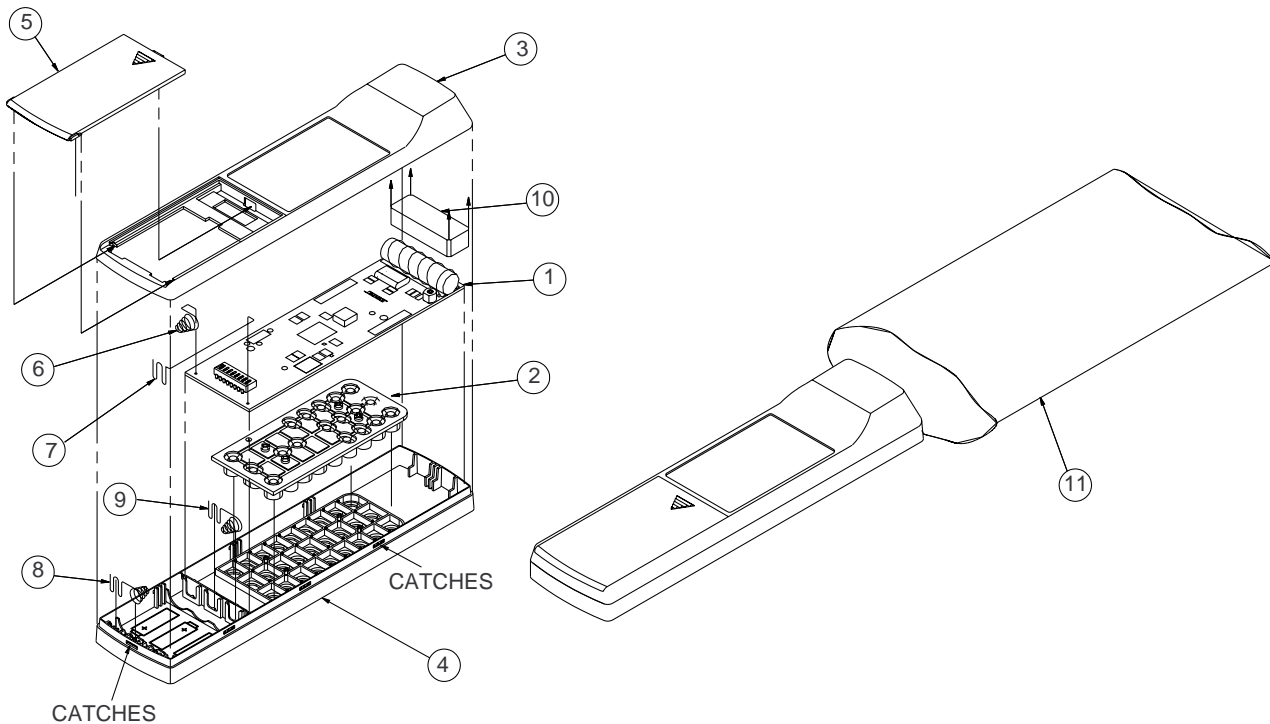


Figure 9. RC-20 Remote Exploded View

## RC-20 REMOTE PART LIST

(Refer to Figure 9)

Item Number	Description	Part Number	Qty Per Assembly	Note
1	PCB Assembly	194386	1	1, 2
2	Pad, Switch, Remote, RC 20, Audio	178379	1	
3	Cover, Bottom, Remote Control	146089	1	
4	Cover, Top, Remote Control, Universal	176190	1	
5	Door, Battery, Remote Control	146226	1	
6	Contact, Battery, Cone	174001	1	
7	Contact, Battery, Flat	174000	1	
8	Contact, Battery, Cone/Flat	174002-01	1	
9	Contact, Battery, Flat/Cone	174002-02	1	
10	Spacer, Pad	173605	1	
11	Polybag	144348	1	

## RC-20 REMOTE ELECTRICAL PART LIST

Resistors

Reference Designator	Description	Part Number	Note
R1	200 k, 1/10W, 5%	133626-2045	
R2	200 k, 1/10W, 5%	133626-2045	
R3	200 k, 1/10W, 5%	133626-2045	
R4	200 k, 1/10W, 5%	133626-2045	
R5	200 k, 1/10W, 5%	133626-2045	
R6	200 k, 1/10W, 5%	133626-2045	
R7	200 k, 1/10W, 5%	133626-2045	
R8	200 k, 1/10W, 5%	133626-2045	
R9	430 OHM, 1/10W, 5%	133626-4315	
R10	1.k, 1/10W, 5%	133626-1025	
R11	47 OHM, 1/10W, 5%	133626-4705	
R12	4.7 k, 1/10W, 5%	133626-4725	
R13	100 k, 1/10W, 5%	133626-1045	
R14	2.43 k, 1/10W, 1%	133625-2431	
R15	4.7 k, 1/10W, 5%	133626-4725	
R16	470 , 1/10W, 5%	133626-4715	
R17	15 k, 1/10W, 5%	133626-1535	
R18	5.6 k, 1/10W, 5%	133626-5625	

# RC-20 REMOTE ELECTRICAL PART LIST

## Capacitors

Reference Designator	Description	Part Number	Note
C1	10 $\mu$ F, 16v, 20%	177902-100C	
C2	.047 $\mu$ F, 50V, 20%	148779-473	
C3	100 pF, 50V, 5%	133622-101	
C4	100 pF, 50V, 5%	133622-101	
C5	.047 $\mu$ F, 50V, 20%	148779-473	
C6	1000 pF, 50v, 5%	133622-102	
C7	.01 $\mu$ F, 50V, 10%	133623-103	
C8	100 pF, 50V, 5%	133622-101	
C9	56 pF, 50V, 5%	133622-560	
C10	270 pF, 50V, 5%	133622-271	
C11	.01 $\mu$ F, 50V, 10%	133623-103	
C13	22 pF, 50V, 5%	133622-220	
C15	470 pF, 50V, 5%	133622-471	
C16	470 pF, 50V, 5%	133622-471	
C17	1000 pF, 50v, 5%	133622-102	

## Diodes

Reference Designator	Description	Part Number	Note
D1	Switching, 75V, 200 mA	148582	
D2	Switching, 75V, 200 mA	148582	
D3	Switching, 75V, 200 mA	148582	
D4	Dual, 75V, 300 mA	148774	
D5	Dual, 75V, 300 mA	148774	

## Transistors

Reference Designator	Description	Part Number	Note
Q1	Bipolar, P, 50V, 100 mA	146818	
Q2	Bipolar, N, 50V, 100 mA	146817	
Q3	Bipolar, P, 40V, 200 mA	148596	
Q4	Bipolar, N, 30V, 30 mA	148781-4	
Q5	Bipolar, N, 20V, 1.5 A	148780-7	

## Coils

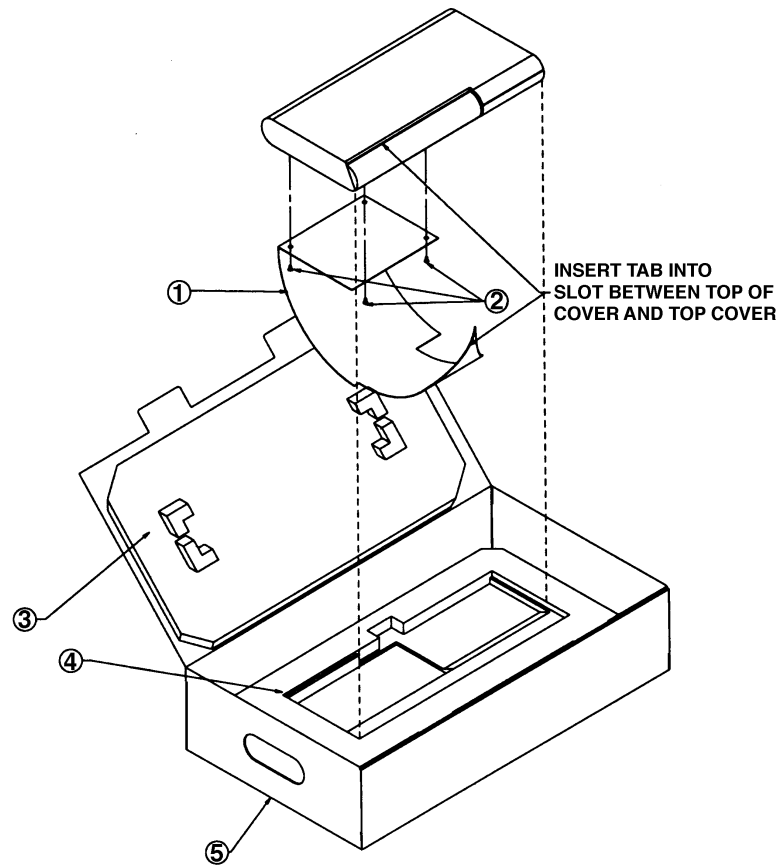
Reference Designator	Description	Part Number	Note
L1	10 $\mu$ H, SMT, LEM4532	178370-100	
L2	.22 $\mu$ H, 10%, SMD	178336-R22K	
L3	10 $\mu$ H, SMT, LEM4532	178370-100	

## Miscellaneous

Reference Designator	Description	Part Number	Note
SW1	Switch, DIP, 8 CT, SMT	179280	
U1	RC Transmitter	148784	
X1	Resonator, Ceramic, 455 kHz	148782	

# PACKAGING PART LIST

Item Number	Description	Part Number	Qty.	Note
1	PACKING, INSERT D/C CARD	188022	1	
2	SCREW, SHIPPING, CD MECH.	198583	3	
3	PACKING, TOP PAD, EPS	186424-001	1	
4	PACKING, TRAY, EPS	186425-001	1	
5	CARTON, D/C, CD-20	188020-001	1	
---	BAG, MICROFOAM, 18 x 10.5	174591	1	
---	MAGAZINE, 6 DISC	256261	1	
---	REMOTE	178915	1	



**Figure 10. Packaging Exploded View**

# ACCESSORY PART LIST

Item Number	Description	Part Number	Qty.	Note
1	POWER PACK, 100V POWER SUPPLY, 120V POWER PACK, 220V, EURO POWER PACK, 230V, UK/SING. POWER PACK, 240, AUST.	178372 178371 178375 251773 178373	1	3 ⚠
2	REMOTE	187700	1	
3	MAGAZINE, 6 DISC	263040	1	10/01
4	PACKING TRAY	190209-004	1	
5	CARTON	190208-003	1	
6	AM ANTENNA	199824-002	1	
7	BATTERIES, AA	147538	3	
8	LINE CORD, 120V LINE CORD, 230V, EURO LINE CORD, 100V, JAPAN LINE CORD, 230V, UK/SING. LINE CORD, 240V, AUST.	198603-001 148203 145316 134725 134726	1	3 ⚠
9	ANTENNA, FM, DIPOLE, 75 OHM, F CONN ANTENNA, FM, DIPOLE, PAL CONN	148589 143185	1	

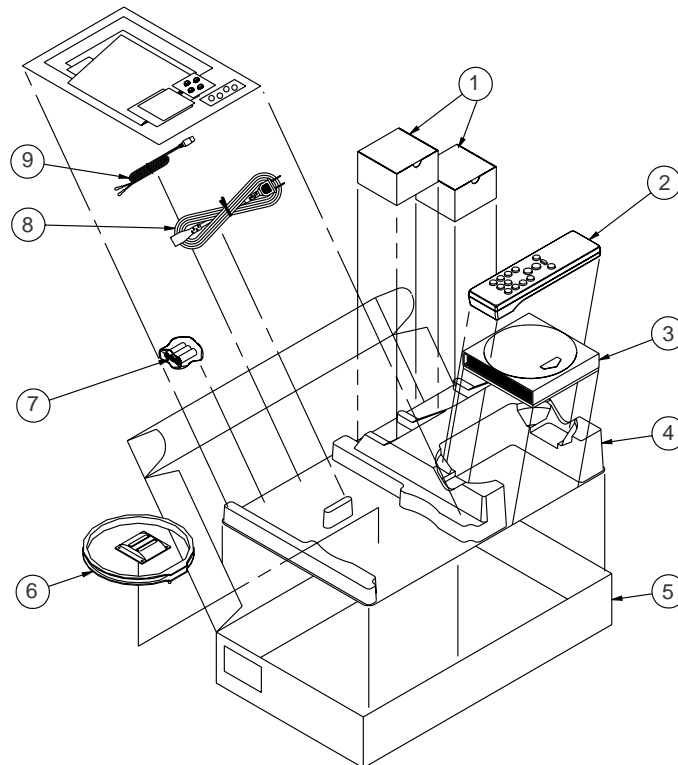
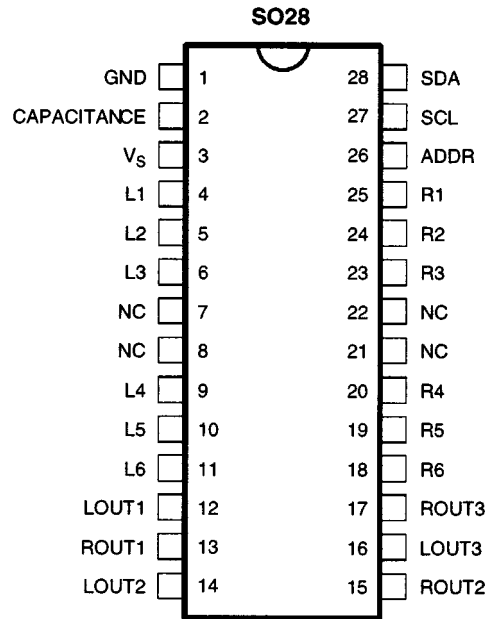
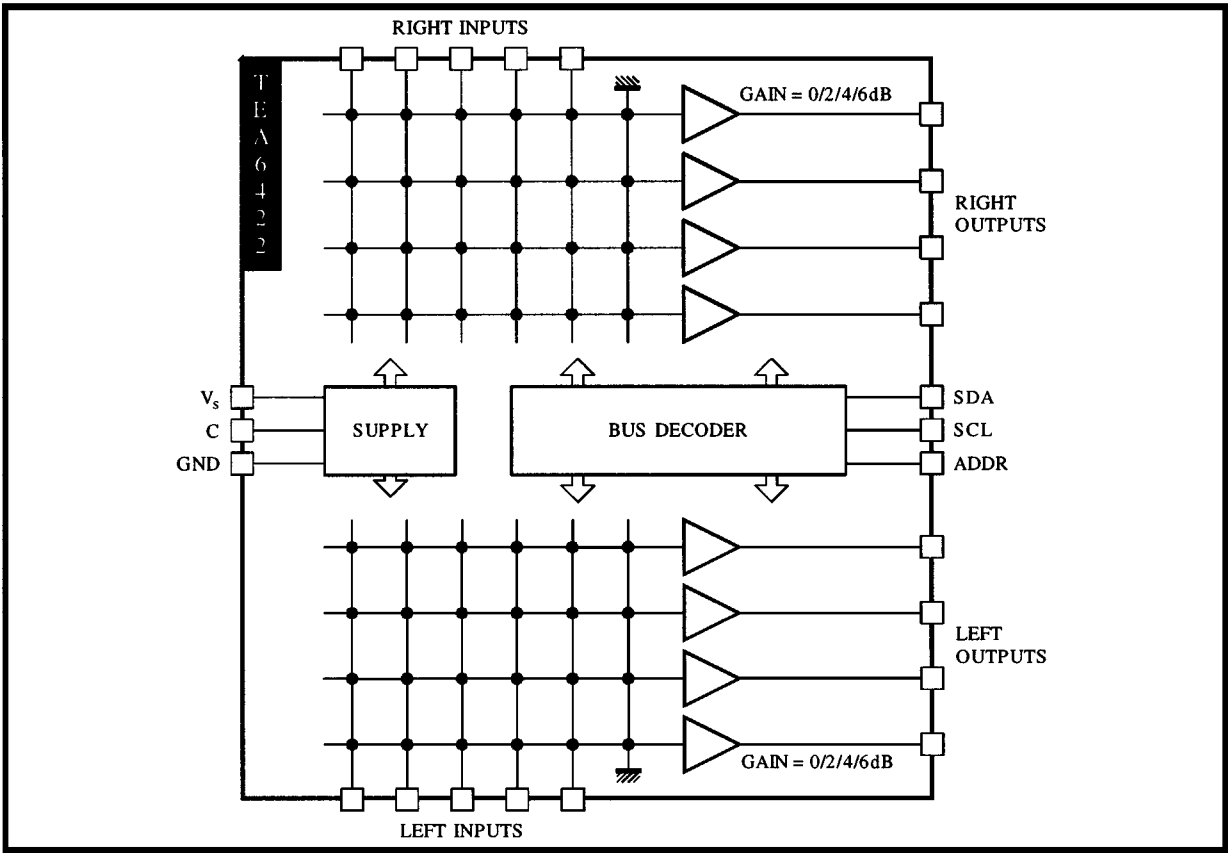


Figure 11. Accessory Packaging

# IC BLOCK DIAGRAMS AND PINOUTS

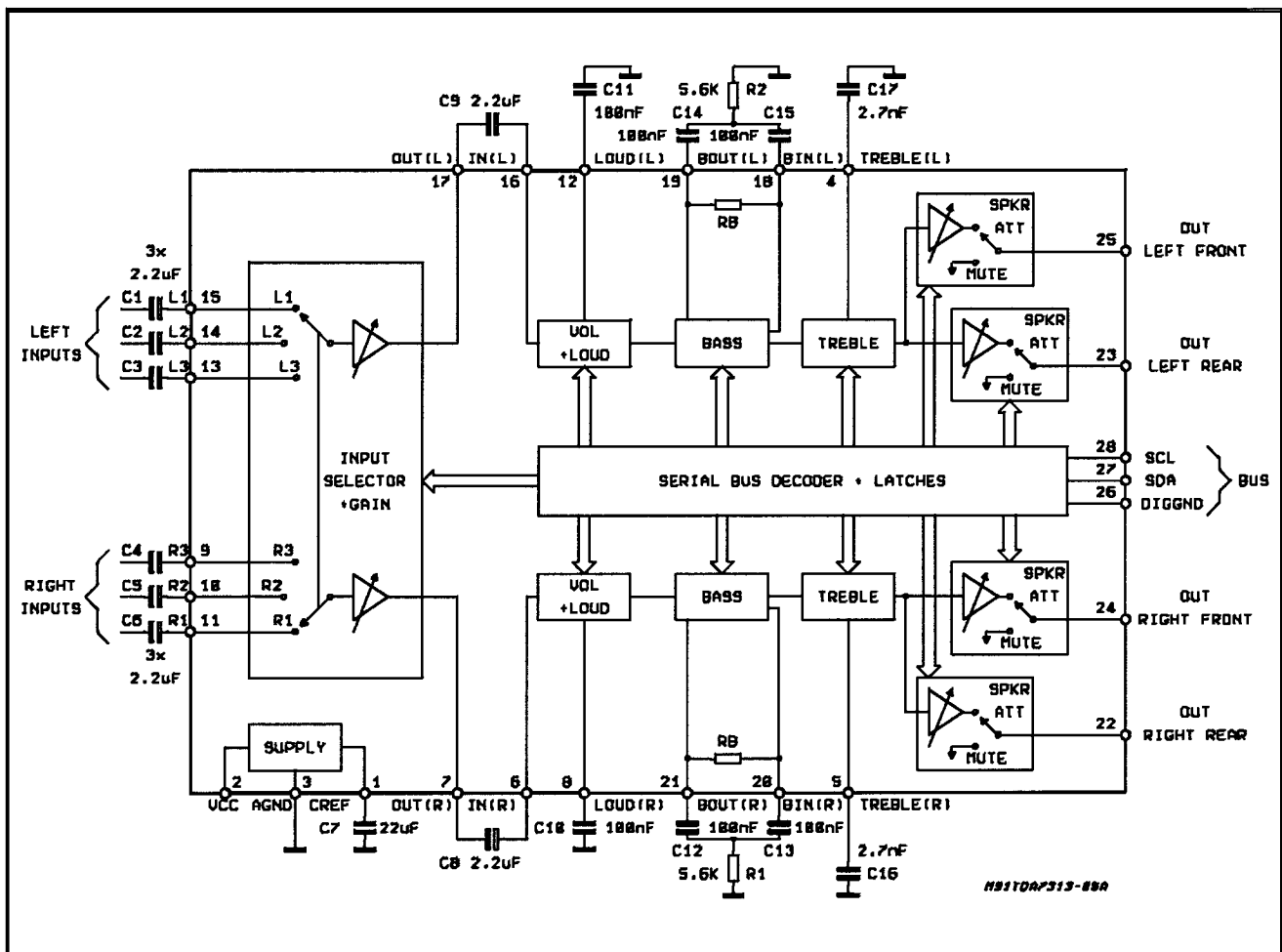
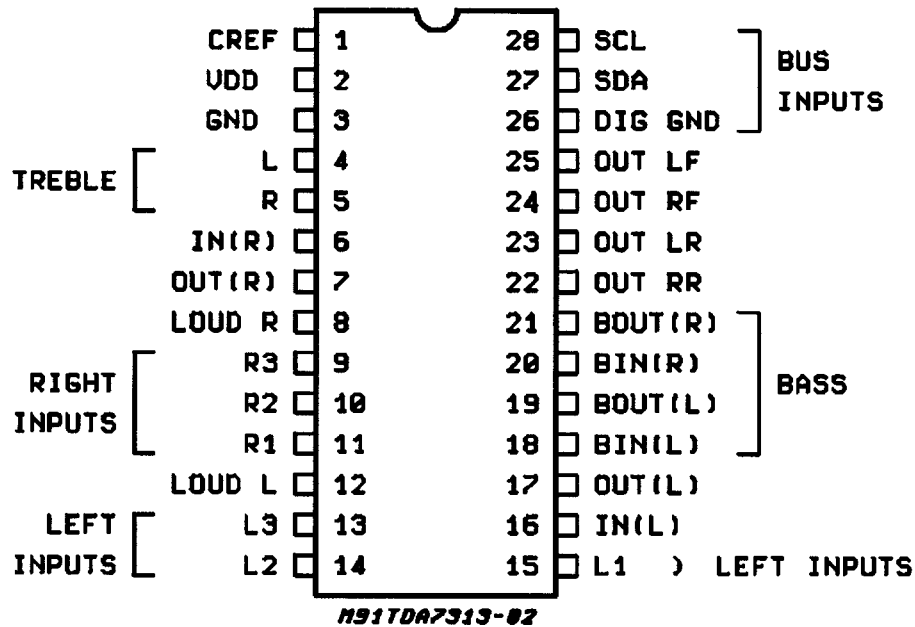


## BLOCK DIAGRAM



U101 Part Number 177984-2

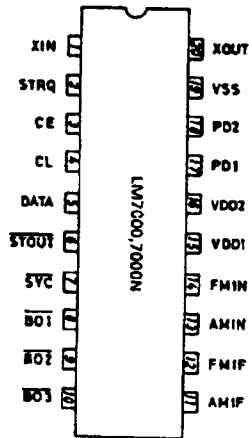
# IC BLOCK DIAGRAMS AND PINOUTS



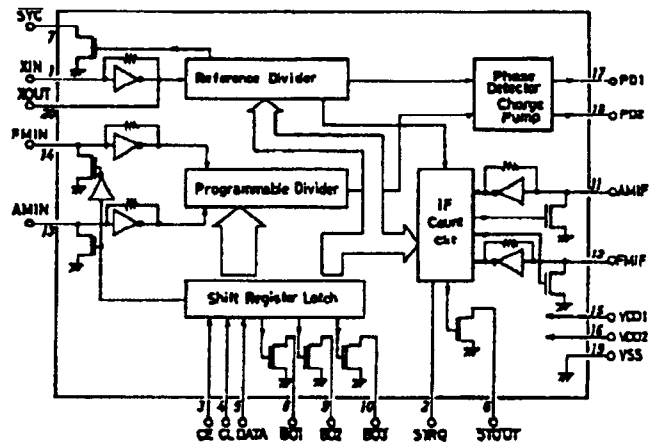
U100, 102 Part Number 177938



# IC BLOCK DIAGRAMS AND PINOUTS



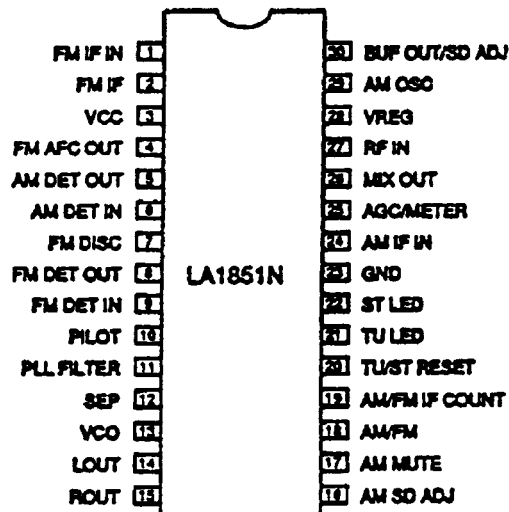
## EQUIVALENT CIRCUIT BLOCK DIAGRAM



### Pin Description

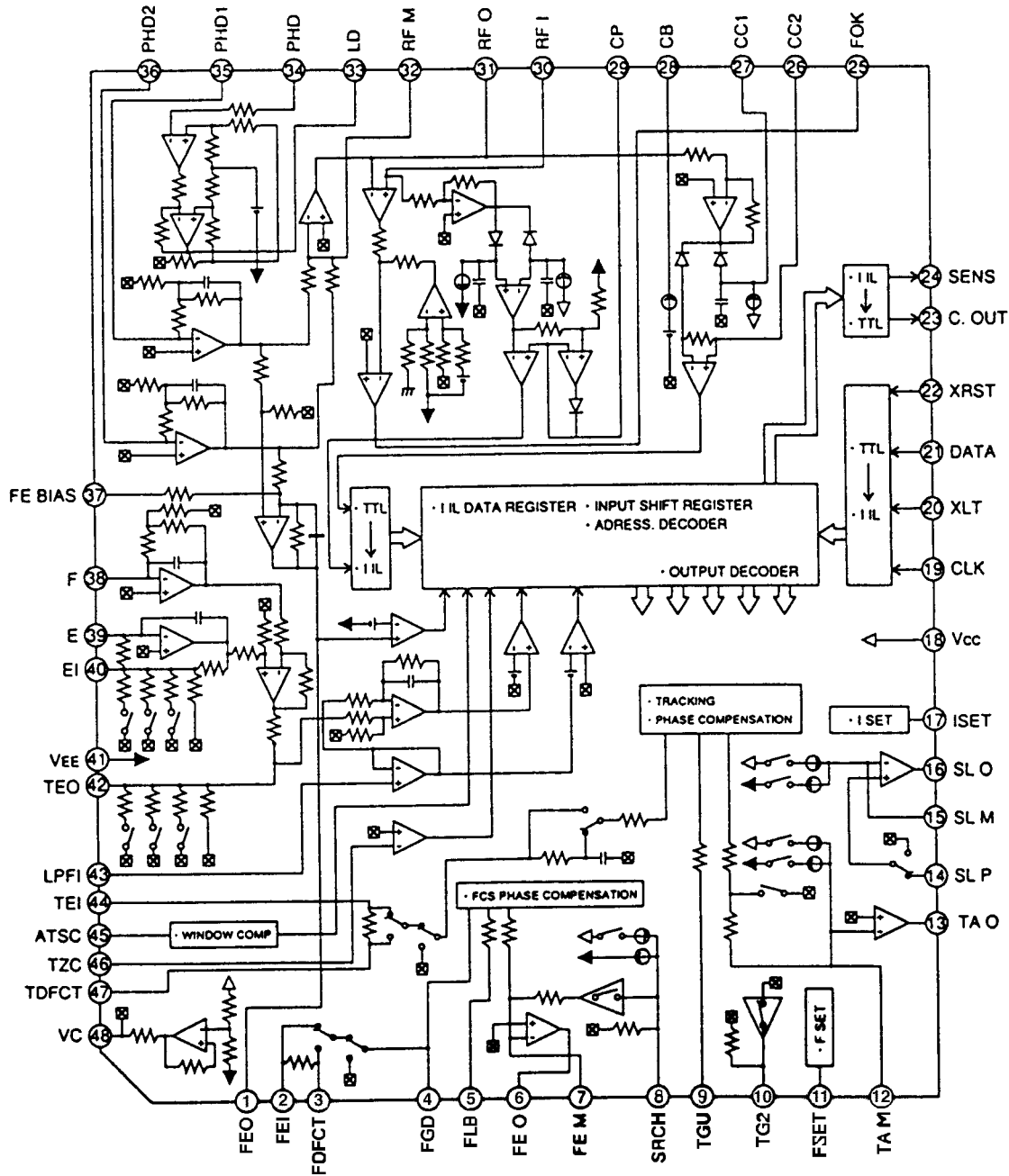
$\overline{\text{SYC}}$	: Controller clock (400kHz)
XIN, XOUT	: Xtal OSC (7.2MHz), on-chip feedback resistor
$\overline{\text{FMIN}}, \overline{\text{AMIN}}$	: Local oscillation signal input
CE, CL, DATA	: Data input
BO1, BO2, BO3	: Band data output, BO1 can be also used for time base output (8Hz)
STRQ	: IF count request input
$\overline{\text{STOUT}}$	: Auto search stop signal output
VDD1, VDD2, VSS	: Power supply (VDD2 is for backup)
AMIF, FMIF	: IF signal input
PD1, PD2	: Charge pump output

### U302 Part Number 147527



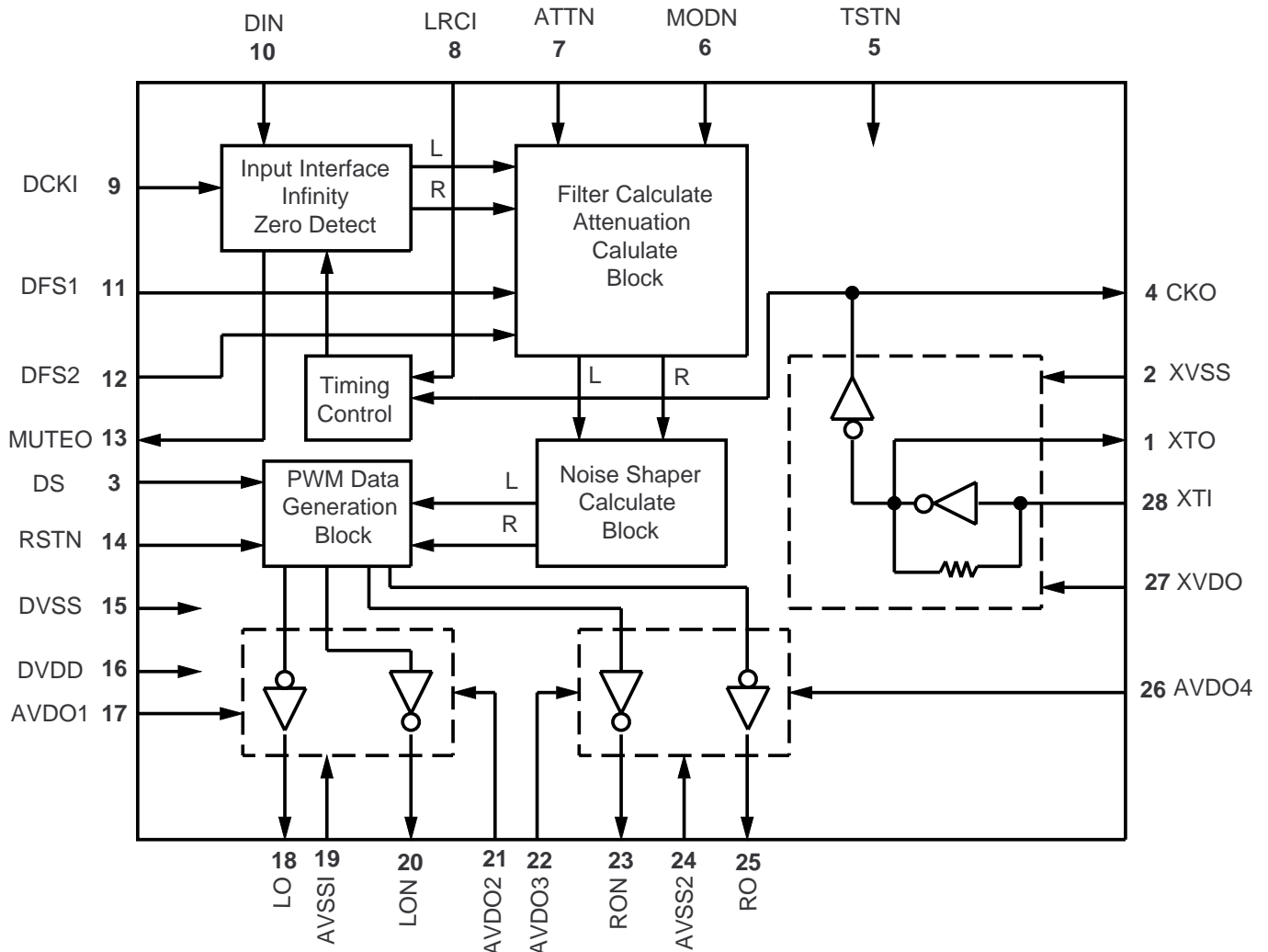
### U300 Part Number 146815

# CD MECHANISM IC BLOCK DIAGRAMS

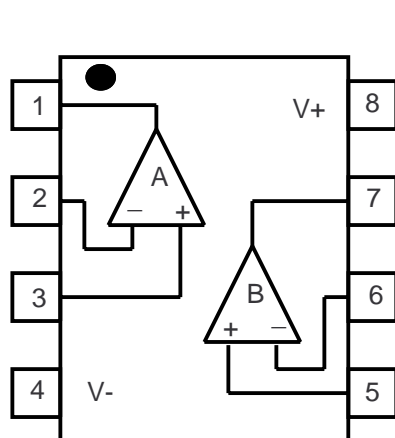


IC 821 (CXA1782BQ) Servo Signal Processor RF Amplifier

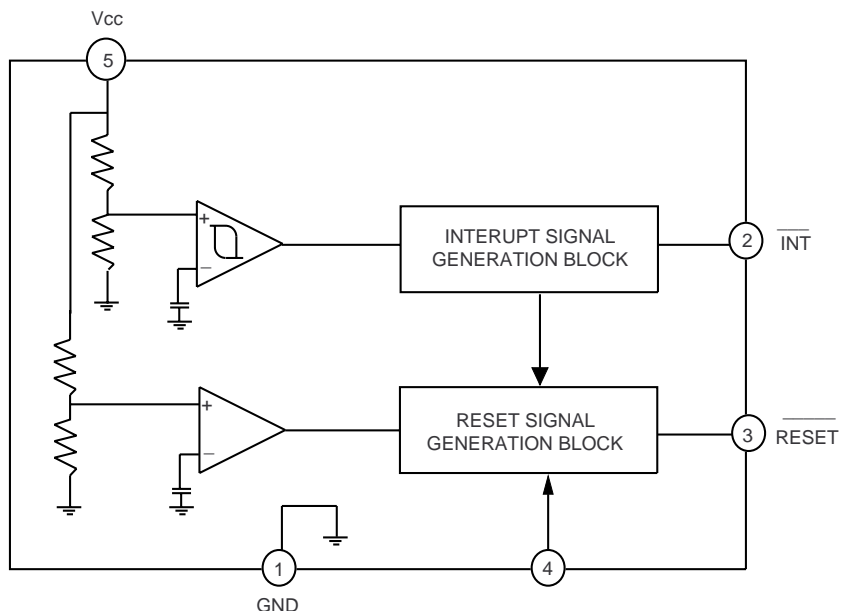
# CD MECHANISM IC BLOCK DIAGRAMS



IC 201 (SM5871AS) D/F and D/A Converter

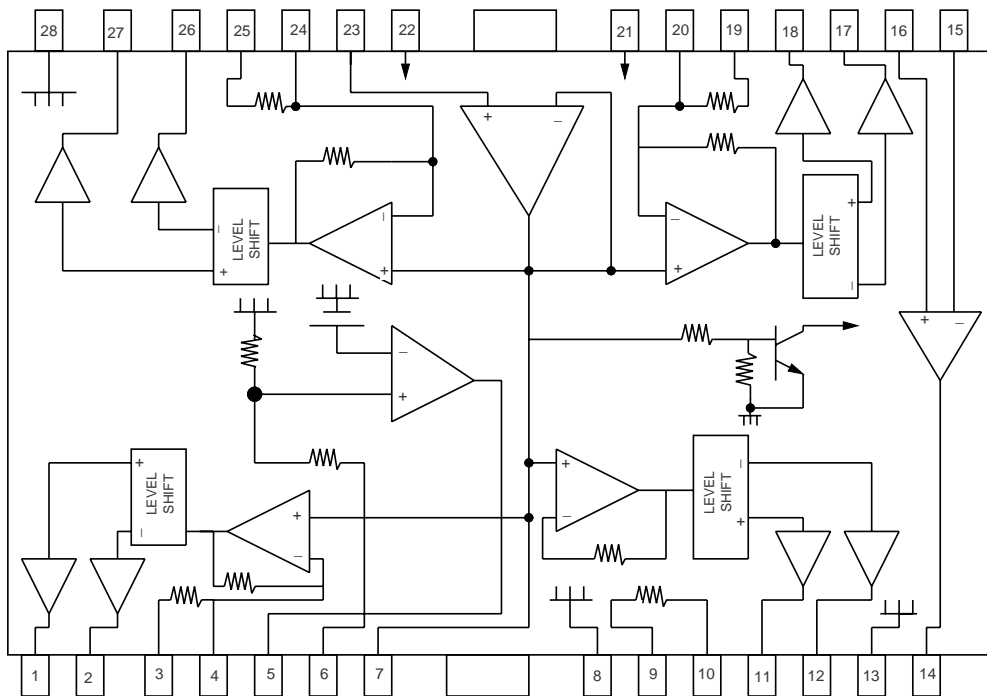
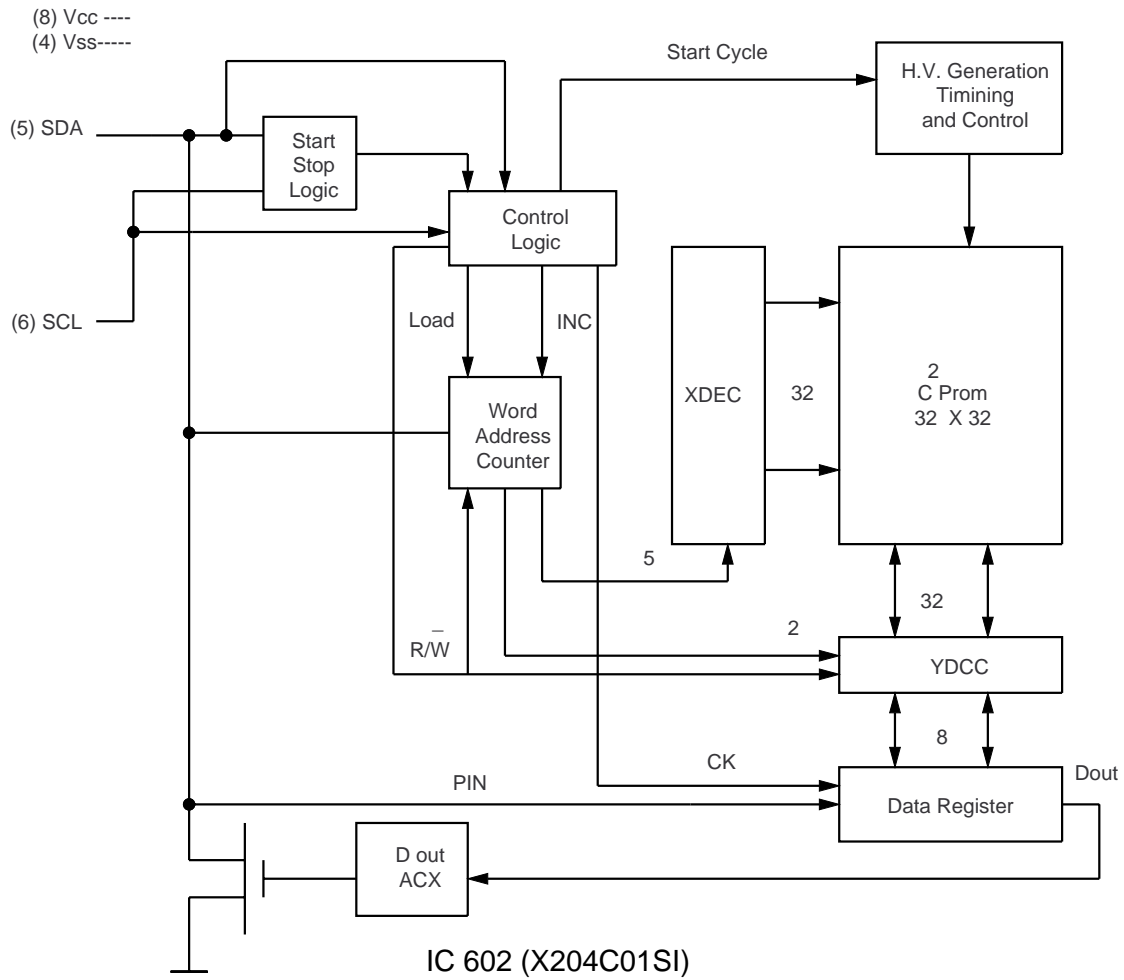


IC 203/204 (NJM4560M)  
Operational Amplifier



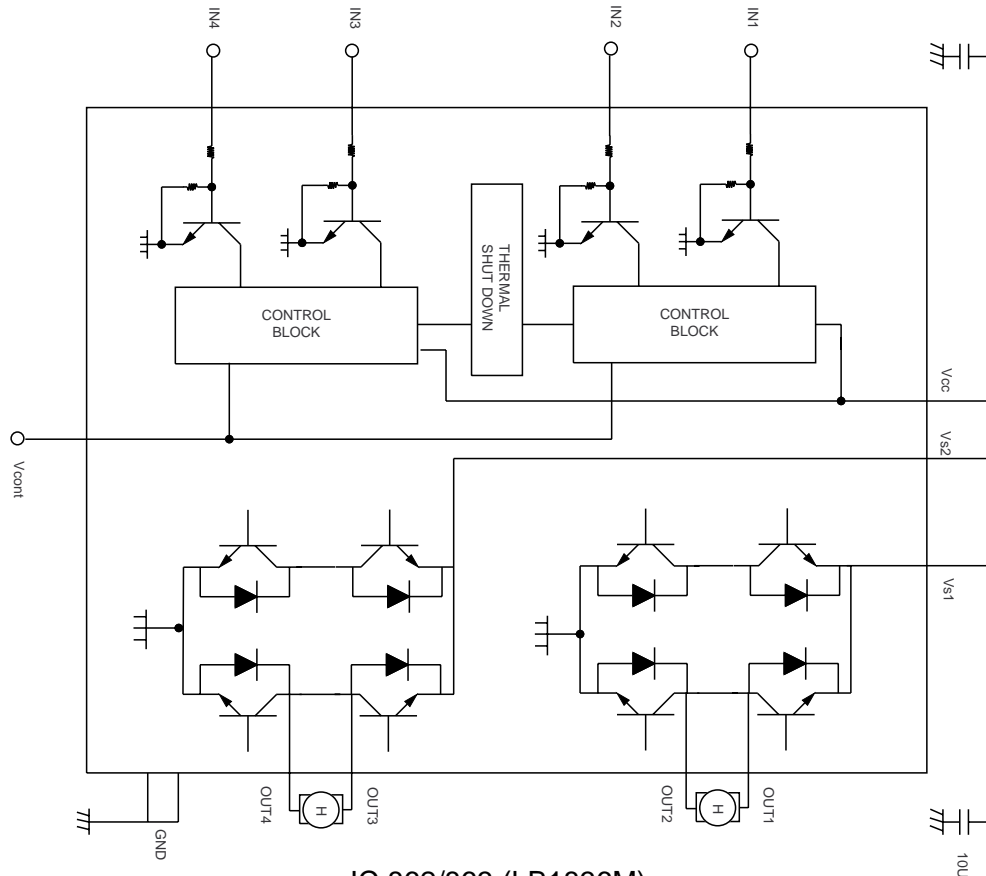
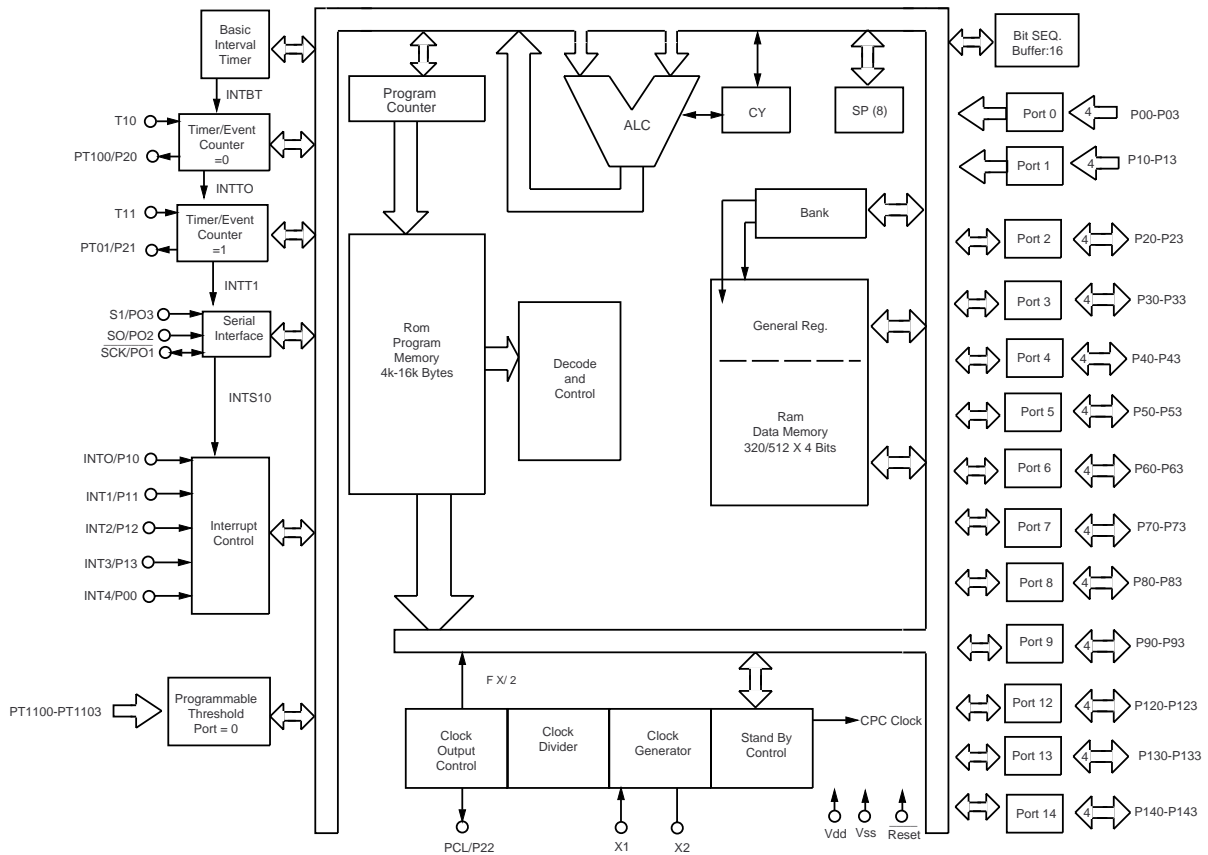
IC 604 (M62007FP)

# CD MECHANISM IC BLOCK DIAGRAMS



IC 861 (BA6398FP) CD Driver and +5V Regulator

# CD MECHANISM IC BLOCK DIAGRAMS



# CD MECHANISM IC PIN CONFIGURATION TABLES

IC 201 (SM5871AS) D/F and D/A Converter Table

Pin No.	I/O	Terminal Name	Description
1	O	XTO	Crystal oscillator output
2	-	XVss	Clock ground
3	I	CKSLN	Clock frequency select input. Internal pull-up resistor
4	O	CKO	Clock output
5	I	TSTN	Test input. This pin should be tied HIGH for normal operation. Internal pull-up resistor
6	I	MODN	Mode select input. Internal pull-up resistor
7	I	ATTN	Soft mute control input. Internal pull-up resistor
8	I	LRCI	Data sample rate clock input. Internal pull-up resistor
9	I	BCKI	Bit clock input. Internal pull-up resistor
10	I	DIN	Serial data input. Internal pull-up resistor
11	I	DFS1	De emphasis select input. Internal pull-up resistor
12	I	DFS2	De emphasis select input. Internal pull-up resistor
13	O	MUTEO	Mute detect output
14	I	RSTN	Reset input. Internal pull-up resistor
15	-	DVSS	Digital ground
16	-	DVDD	5V digital supply
17	-	AVDD1	Analog supply 1
18	O	LO	Left-channel positive PWM output
19	-	AVSS1	Analog ground 1
20	O	LON	Left-channel negative PWM output
21	-	AVDD2	Analog supply 2
22	-	AVDD3	Analog supply 3
23	O	RON	Right-channel negative PWM output
24	-	AVSS2	Analog ground 2
25	O	RO	Right-channel positive PWM output
26	-	AVDD4	Analog supply 4
27	-	XVDD	Clock supply
28	I	XTI	Crystal oscillator or external clock input

IC 601 (uPD75116GF-K12) Microprocessor Table

Pin No.	I/O	Terminal Name	Description
1		NC	
2	I	MODE	Mode switch
3		NC	
4		NC	
5	O	LIFTMC1	Lift motor output
6	O	LIFTMC2	Lift motor output
7	I	RESETB	System reset input
8	-	X2	Ceramic oscillator connection terminal for system clock
9	-	X1	Ceramic oscillator connection terminal for system clock
10	I	LOADS W	Load switch input

# CD MECHANISM IC PIN CONFIGURATION TABLES

IC 601 (uPD75116GF-K12) Microprocessor Table (continued)

Pin No.	I/O	Terminal Name	Description
11	I	TEMP	Thermosensor input
12	I	EJECTS W	Eject switch input
13	I	ACCIN	Acc ON/OFF input
14	O	LOMP	Loading motor output
15	O	LOMN	Loading motor output
16	O	ELEV MN	Elevator motor output
17	O	ELEV MP	Elevator motor output
18	O	RESET O	LSI reset signal
19	O	CD_MUTE	Audio output mute signal
20		NC	
21	O	DR8V	+ 8V Power supply ON/OFF signal
22	O	COM_D ATA	Command output for CXD2517Q
23	O	CLOCK	Serial clock output for CXD2517Q
24	O	XLAT	Data latch output for CXD2517Q
25	O	LDON	Laser diode control signal
26	-	Vss	GND
27	I	STBYST RT	Stand-by mode cancel signal input
28	I	BATTERY	Battery error input signal
29	I	COMDI N	Correspondence data input
30	I	SCOR	CXD2517Q Sub code frame sink input
31		NC	
32		NC	
33	I	DISC	
34	I	H.POS SW A	Home position sensor input
35		NC	
36		NC	
37		NC	
38		NC	
39		NC	
40		NC	
41	I	SQSO	CXD2517Q Sub code data input
42		NC	
43	O	SQCK	Clock output for CXD2517Q sub code reading
44	I	ROTDC TC	Elevator sensor input
45		NC	
46	I	FOK	CXA1782BQ FOK signal input
47	I	SENS	CXA1782BQ SENS signal input
48	I	TEST	Test mode signal input
49	I	MAGZ SW	Magazine switch input
50	I	LIMIT SW	Limit switch input
51	I	LIFT SW B	Lift switch input



# CD MECHANISM IC PIN CONFIGURATION TABLES

IC 601 (uPD75116GF-K12) Microprocessor Table (continued)

Pin No.	I/O	Terminal Name	Description
52	I	LIFTSW B	Lift switch input
53	I	COMDO UT	Correspondence data output
54		NC	
55		NC	
56		NC	
57	-	Vpp	Power supply of PROM writing
58	-	Vdd	Power supply (+5V)
59	I	CDINOK	CD mechanism in switch input
60	O	CD+B	Divider unit control signal
61	O	SCL	Clock output for S-RAM data reading and writhing
62	I/O	SDA	S-RAM data input/output
63		NC	
64		NC	

IC 861 (BA6398FP) CD Driver and +5V Regulator Table

Pin No.	I/O	Terminal Name	Description
1	O	OUT+	Focus amp output (-)
2	O	OUT -	Focus amp output (+)
3	I	IN	Focus amp input
4	-	NC	
5	O	TR-B	Regulator control
6	O	VREG OUT	Regulator control
7	I	MUTE	Mute control terminal (L: Mute)
8	-	Vss	GND
9	-	NC	
10	I	IN	Sled amp input
11	O	OUT -	Sled amp output (-)
12	O	OUT +	Sled amp output (+)
13	-	Vss	GND
14	O	OP OUT	Op amp output
15	I	OP IN -	Op amp input (-)
16	I	OP IN +	Op amp input (+)
17	O	OUT +	Spindle amp output (+)
18	O	OUT -	Spindle amp output (-)
19	I	IN	Spindle amp input
20	-	NC	
21	-	Vcc	+8V
22	-	Vcc	+8V
23	I	VREF	Bias amp input
24	-	NC	
25	I	IN	Tracking amp input
26	O	OUT -	Tracking amp output (-)
27	O	OUT +	Tracking amp output (+)
28	-	Vss	GND

# CD MECHANISM IC PIN CONFIGURATION TABLES

IC 801 (CXD2517Q) Digital Signal Processor Table

Pin No.	I/O	Terminal Name	Description
1	I	FOK	Focus OK input. Used for SENS output and the servo auto sequencer
2		NC	
3	O	MDP	Spindle motor servo control
4		NC	
5		NC	
6	I	Test	Test pin. Normally GND.
7	O	FILO	Master PLL (slave=digital PLL) filter output.
8	I	FILI	Master PLL filter input.
9	O	PCO	Master PLL charge pump output.
10	-	Vss	GND.
11	-	AVss	Analog GND.
12	I	CLTV	Master VCO control voltage input.
13	-	AVdd	Analog power supply (+5).
14	I	RF	EFM signal input.
15	I	BIAS	Constant current input of asymmetry circuit.
16	I	ASYI	Asymmetry comparator voltage input.
17	O	ASYO	EFM full-swing output (low=Vss, high=Vdd)
18	I	ASYE	Low: asymmetry circuit off; High: asymmetry circuit on.
19	O	WDCK	D/A interface. Word clock $f=2f_s$
20	O	LRCK	D/A interface. LR clock $f=f_s$
21	O	PCMD	D/A interface. Serial data (two's complement, MSB first).
22	O	BCK	D/A interface. Bit clock.
23		NC	
24		NC	
25		NC	
26	-	Vdd	Power supply (+5V).
27	O	GFS	GFS output.
28		NC	
29		NC	
30		NC	
31		NC	
32		NC	
33		NC	
34	I	XTAI	16.9344 MHz crystal oscillation circuit input, or 33.8688 MHz input.
35		NC	
36	I	XTSL	Crystal selection input. Set low when the crystal is 16.93444 MHz, high when 33.8688 MHz.
37		NC	
38		NC	
39		NC	
40	O	EMPH	Outputs high signal when the playback disc has emphasis, low signal when no emphasis.
41		NC	
42	-	Vss	GND.

# CD MECHANISM IC PIN CONFIGURATION TABLES

IC 801 (CXD2517Q) Digital Signal Processor Table (continued)

Pin No.	I/O	Terminal Name	Description
43	O	SCOR	Outputs high signal when either subcode sync S0 or S1 is detected.
44		NC	
45		NC	
46	O	SQSO	SubQ 80-bit serial output.
47	I	SQCK	SQSO readout clock input.
48	I	Mute	High: mute; low: release
49	O	SENS	SENS output to CPU.
50	I	XRST	System reset. Reset when low.
51	I	Data	Serial data input from CPU.
52	I	XLAT	Latch input from CPU. Serial data is latched at the falling edge.
53	I	CLOCK	Serial input from SSP.
54	I	SEIN	Sense input from SSP.
55	I	CNIN	Track jump count signal input.
56	O	DATO	Serial data output to SSP.
57	O	XLTO	Serial data latch output to SP. Latched at the falling edge.
58	-	Vdd	Power supply (+5V).
59	O	CLKO	Serial data transfer clock output to SSP.
60	I	SPOA	Microcomputer extended interface (input A).
61	I	SPOB	Microcomputer extended interface (input B).
62	I	SPOC	Microcomputer extended interface (input C).
63	I	SPOD	Microcomputer extended interface (input D).
64		NC	

IC 821 (CXA1782BQ) Servo Signal Processor RF Amplifier Table

Pin No.	I/O	Terminal Name	Description
1	I	FEO	Focus error amplifier output. Connected internally to the FZC comparator input.
2	I	FEI	Focus error input.
3	I	FDFCT	Capacitor connection pin for defect time constant.
4	I	FGD	Ground this pin through capacitor when decreasing the focus servo high-frequency gain.
5	I	FLB	External time constant setting pin for increasing the focus servo low frequency.
6	O	FE_O	Focus drive output.
7	I	FE_M	Focus amplifier negative input pin.
8	I	SRCH	External time constant setting pin for generating focus servo wave form.
9	I	TGU	External time constant setting pin for switching tacking high-frequency gain.
10	I	TG2	External time constant setting pin for
11	I	FSET	High cut off frequency setting pin for focus and tracking phase compensation amplifier.

# CD MECHANISM IC PIN CONFIGURATION TABLES

IC 821 (CXA1782BQ) Servo Signal Processor RF Amplifier Table (continued)

Pin No.	I/O	Terminal Name	Description
12	I	TA_M	Tracking amplifier negative input pin.
13	O	TA_O	Tracking drive output
14	I	SL_P	Sled amplifier non-inversed input.
15	I	SL_M	Sled amplifier negative input pin.
16	O	SL_O	Sled drive output.
17	I	ISET	Setting pin for focus search, Track jump, and sled kick current.
18		NC	
19	I	CLK	Serial data transfer clock input from CPU. (no pull up resistance)
20	I	XLT	Latch input from CPU. (no pull up resistance)
21	I	DATA	Serial data input from CPU. (no pull up resistance)
22	I	XRST	Reset input; resets at low. (no pull up resistance)
23	O	C.OUT	Track number count signal output.
24	O	SENS	Outputs FZC; DFCT.TZC. gain, balance and others according to the command from CPU.
25	O	FOK	Focus OK comparator output. (DC voltage: 10k $\Omega$ load resistance is connected)
26	O	CC2	Input pin for the DEFECT bottom hold output capacitance-coupled.
27	I	CC1	DEFECT bottom hold output.
28	I	CB	Connection pin for DEFECT bottom hold capacitor.
29	I	CP	Connection pin for MIRR hold capacitor. MIRR comparator non-inversed input.
30	I	RF_I	Input pin for the RF summing amplifier output capacitance-coupled
31	O	RF_O	RF summing amplifier output. Eye pattern check point.
32	I	RF_M	RF summing amplifier inversed input. The RF amplifier gain is determined by the resistance connected between this pin and RFO pin.
33	O	LD	APC amplifier output.
34	I	PHD	APC amplifier input.
35	I	PHD1	Rf I-V amplifier inversed input. Connect these pins to the photo diode A+C and B+C pins.
36	I	PHD2	RF I-V amplifier inversed input. Connect these pins to the photo diode A+C and B+D pins.
37	I	FE_BIAS	Bias adjustment of focus error amplifier.
38	I	F	F I-V and E I-V amplifier inversed input. Connect these pins to photo diodes F and E.
39	I	E	F I-V and E I-V amplifier inversed input. Connect these pins to photo diodes F and E.

# CD MECHANISM IC PIN CONFIGURATION TABLES

IC 821 (CXA1782BQ) Servo Signal Processor RF Amplifier Table (continued)

Pin No.	I/O	Terminal Name	Description
40	-	EI	I-V amplifier E gain adjustment. (When not using automatic balance adjustment)
41		NC	
42	O	TEO	Tracking error amplifier output. E-F signal is output.
43	I	LPFI	Comparator input for balance adjustment. (input from TEO through LPF)
44	I	TEI	Tracking error input.
45	I	ATSC	Window comparator input for ATSC detection.
46	I	TZC	Tracking zero-crossing comparator input.
47	I	TDFCT	Capacitor connection pin for defect time constant.
48	O	VC	(Vcc+Vee/2 DC voltage output.

# CD MECHANISM IC AND TRANSISTOR VOLTAGE TABLES

Condition: DC voltage at stop mode.

Voltage readings from common ground are measured with a digital voltmeter.

Pin\Xistor	Q201	Q202	Q203	Q204	Q205	Q601	Q602	Q701	Q702	Q703	Q704
<b>B</b>	14.4	14.4	0	5	0	1.8	-	5.6	9.4	0	5
<b>C</b>	0	0	14.4	0	5	0	5	14.2	14.4	14.4	0
<b>E</b>	0	0	14.4	0	0	0	4.9	5	8.8	14.4	0

Pin\Xistor	Q851	Q852	Q853	Q861
<b>B</b>	0	5	5	8.2
<b>C</b>	5	0.8	0	5
<b>E</b>	0	5	5	8.8

## IC201

Pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	1.9	0	0	2.1	5	5	5	2.5	2.5	0	5	0	NC	4.7	0	4.8	5	2.2	0
Pin	20	21	22	23	24	25	26	27	28										
	2.2	5	5	2.2	0	2.2	5	5	2.2										

Pin	1	2	3	4	5	6	7	8
<b>IC203</b>	3.9	3.9	3.9	0	3.5	3.5	3.9	7.9
<b>IC204</b>	3.9	3.9	3.9	0	3.5	3.5	3.9	7.9

## IC601

Pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	5	0/5 *1	NC	NC	0	0	5	2.7	2.5	0	0	0	4.6	0	0	0	0	5	5
Pin	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
	NC	5	0	5	5	0	0	4.1	5	4.6	0	5	5	4.9	0	5	5	NC	NC
Pin	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
	NC	NC	0	0	5	4.8	5	0	0	5	0	0/5 *2	5	0	4.6	NC	NC	NC	5
Pin	58	59	60	61	62	63	64												
	5	0	0	0	0	5	5												

Note \*1 ID Code 1 .. 0V

ID Code 2 .. 5V

\*2 Pickup located utmost inside .. 0V

Pickup located otherwise .. 5V

Pin	1	2	3	4	5	6	7	8
<b>IC602</b>	NC	NC	NC	0	0	0	NC	5
<b>IC603</b>	4.8	0.2	3.3	0	2.5	4.1	0	5
<b>IC604</b>	5	0	5	NC	NC	NC	0	5

# CD MECHANISM IC AND TRANSISTOR VOLTAGE TABLES

**IC801**

Pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	0	NC	2.5	NC	NC	0	0	5	5	0	0	0	0	2.5	0	2.5	2.5	5	NC
Pin	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
	2.5	0	1.1	NC	NC	NC	5	0	NC	NC	NC	NC	NC	NC	2.1	NC	0	NC	NC
Pin	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
	NC	0	NC	0	0	NC	NC	0	5	5	0	5	0	5	5	0	0	0	5
Pin	58	59	60	61	62	63	64												
	5	5	0	0	0	0	NC												

Pin	1	2	3	4	5
<b>IC802</b>	NC	2.1	0	2.5	5

**IC821**

Pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0	2.5	2.5	2.5	2.5	2.5	1.2	5	5
Pin	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
	5	0	5	0	0	0	2.2	3.7	3.1	1.3	30	31	32	33	34	35	36	37	38
Pin	39	40	41	42	43	44	45	46	47	48									
	2.5	2.5	0	2.5	2.5	2.5	1.9	2.2	0.7	2.5									

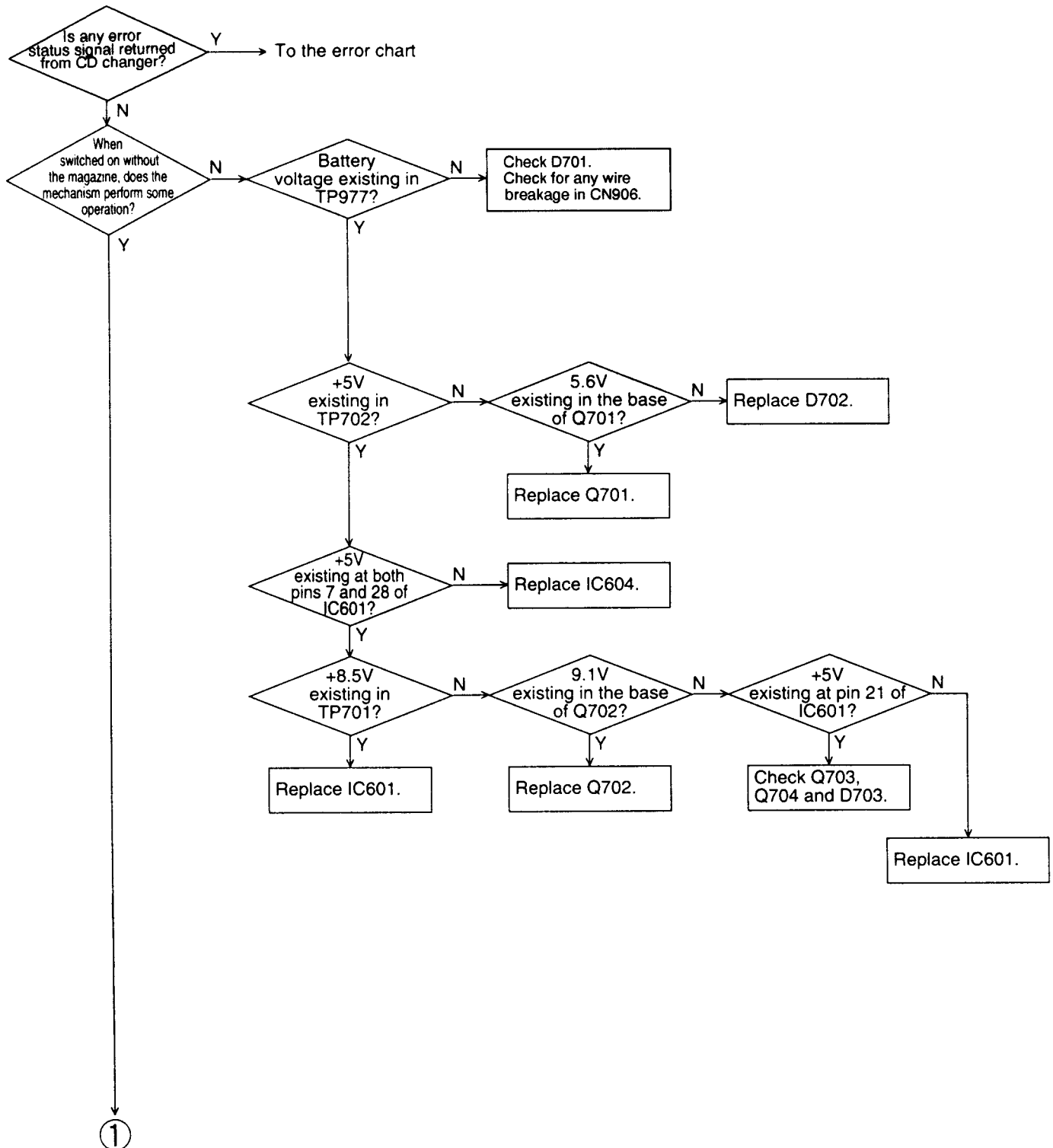
**IC861**

Pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	4.1	4.1	2.5	NC	7.8	5	8.8	0	NC	2.5	4.1	4.1	0	2.5	2.5	2.5	4.1	4.1	2.5
Pin	20	21	22	23	24	25	26	27	28										
	NC	8.8	8.8	2.5	NC	2.5	4.1	4.1	0										

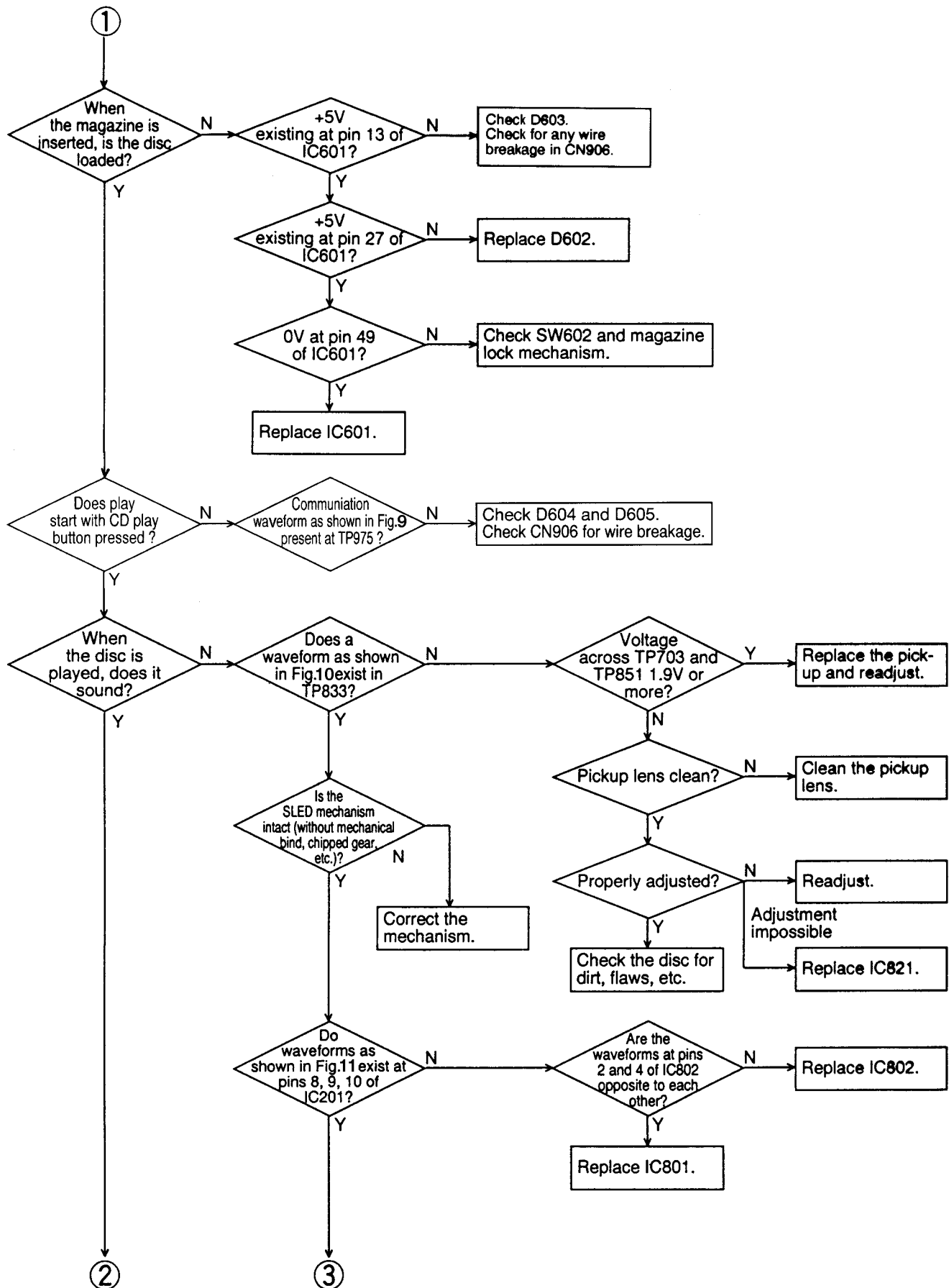
Pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<b>IC862</b>	8.8	0	0	8.8	0	0	0	NC	0	NC	8.8	NC	0	0
<b>IC863</b>	8.8	0	0	8.8	0	0	0	NC	0	0	8.8	0	0	0



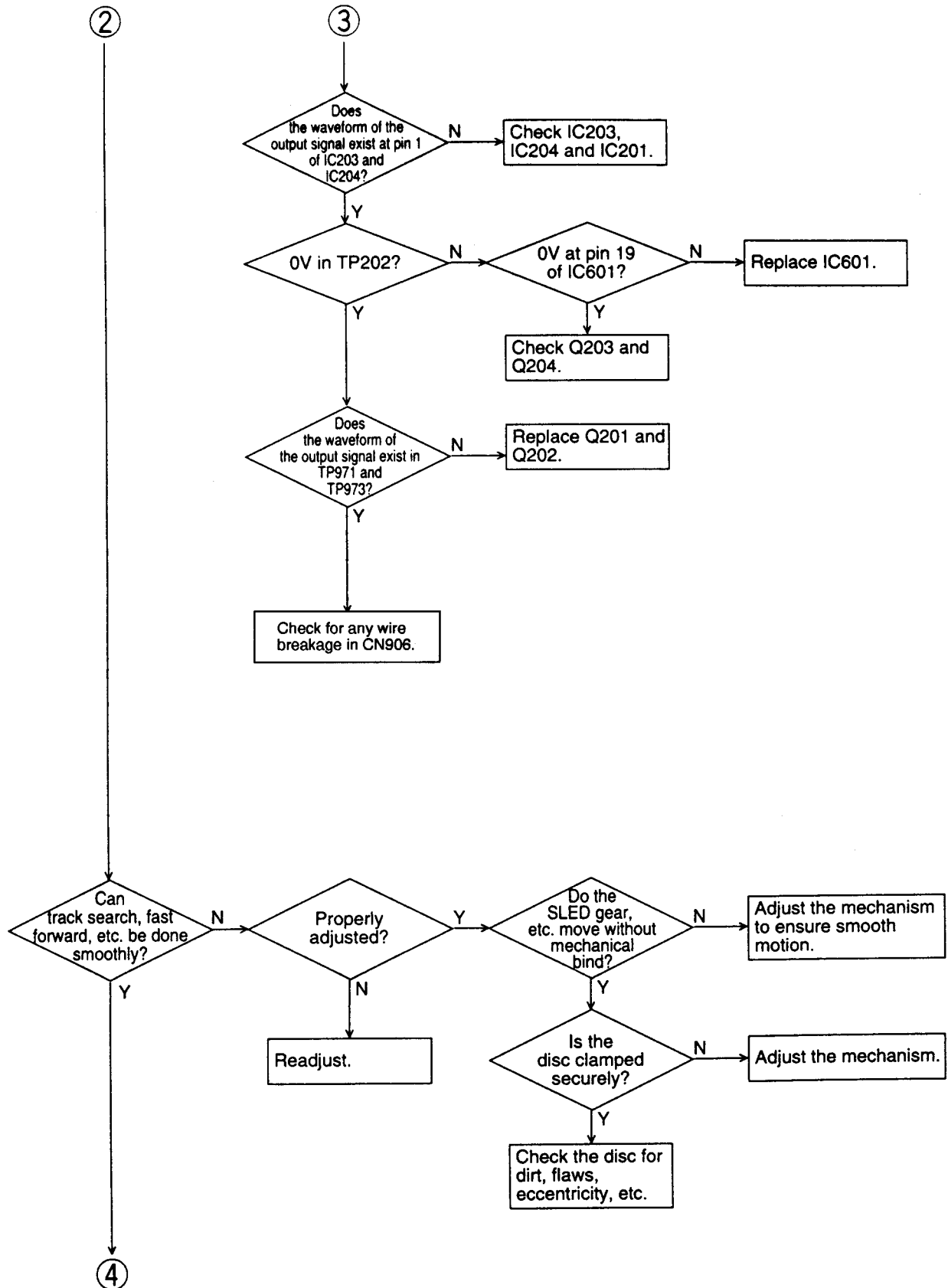
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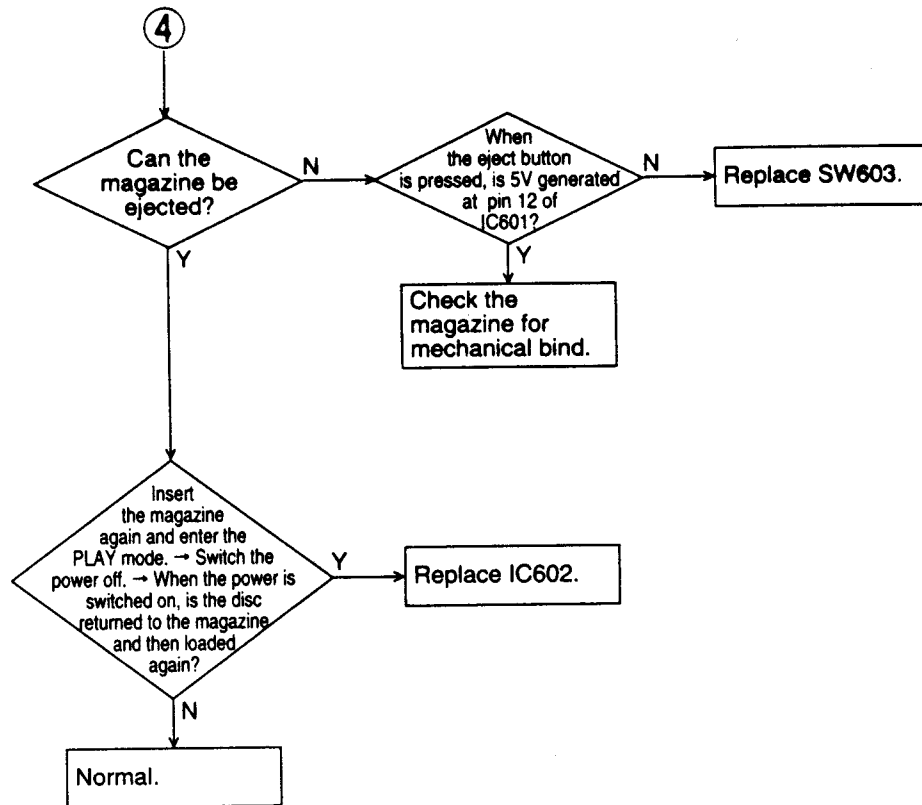
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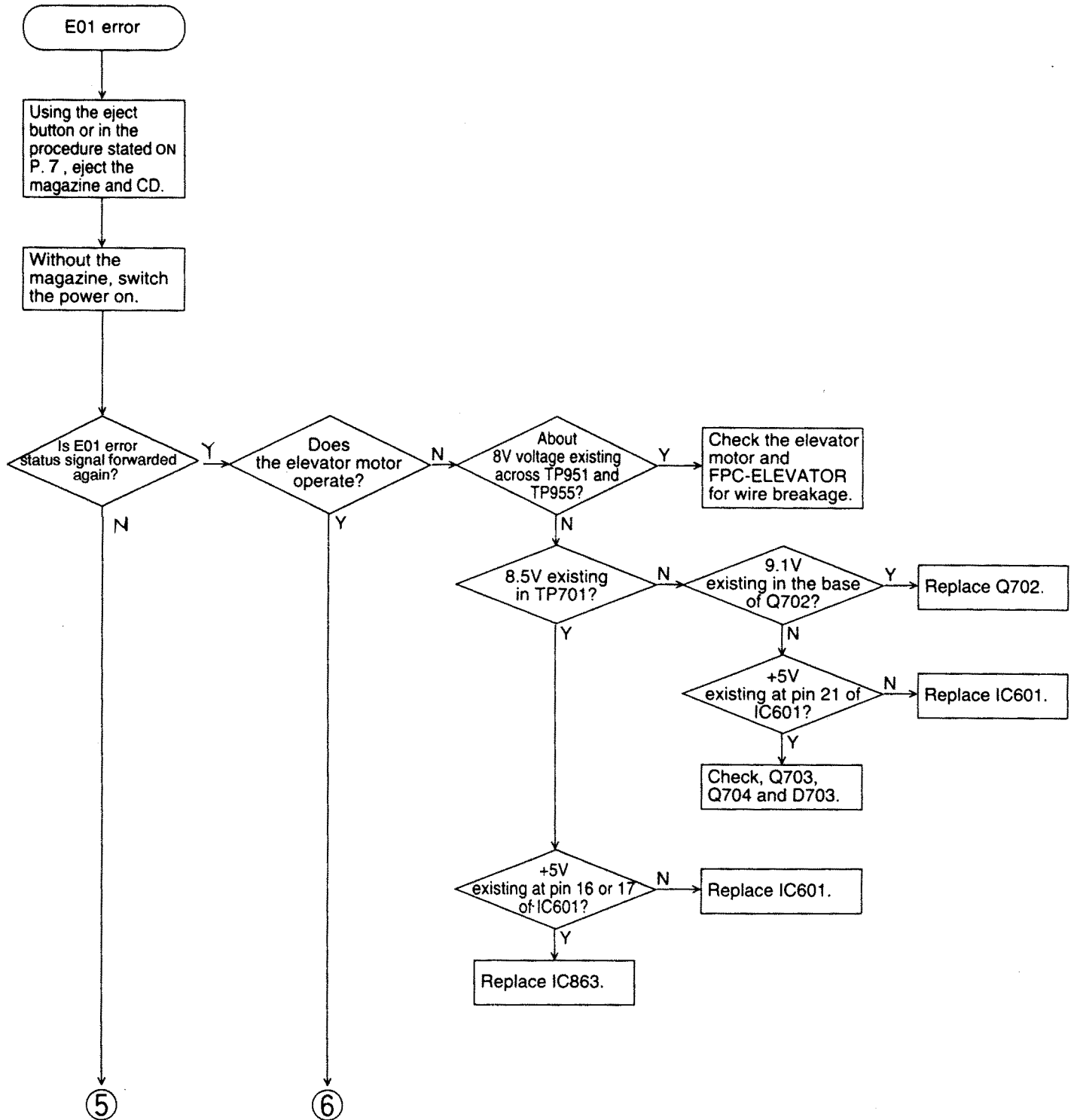
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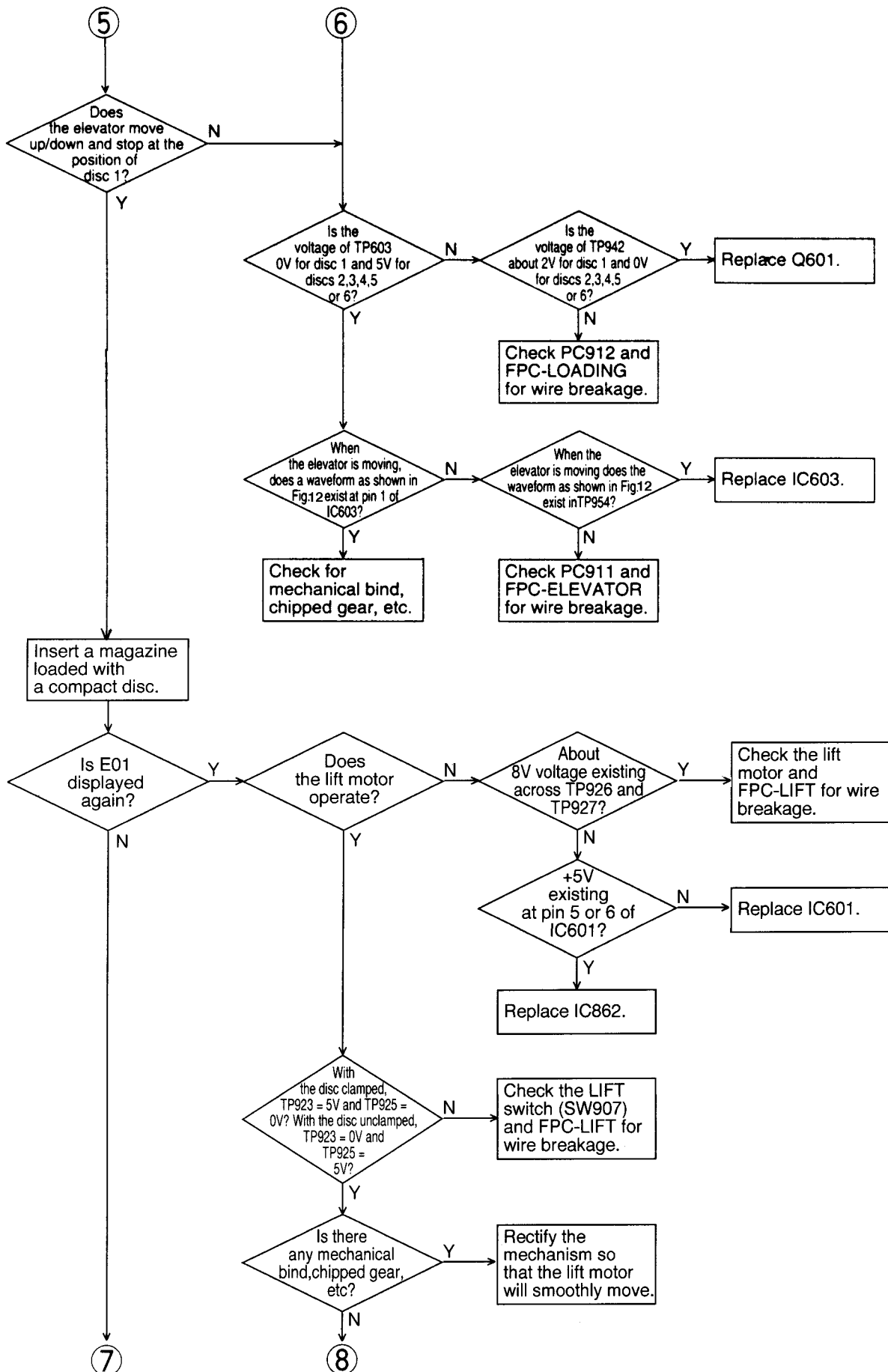
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# CD MECHANISM TROUBLESHOOTING

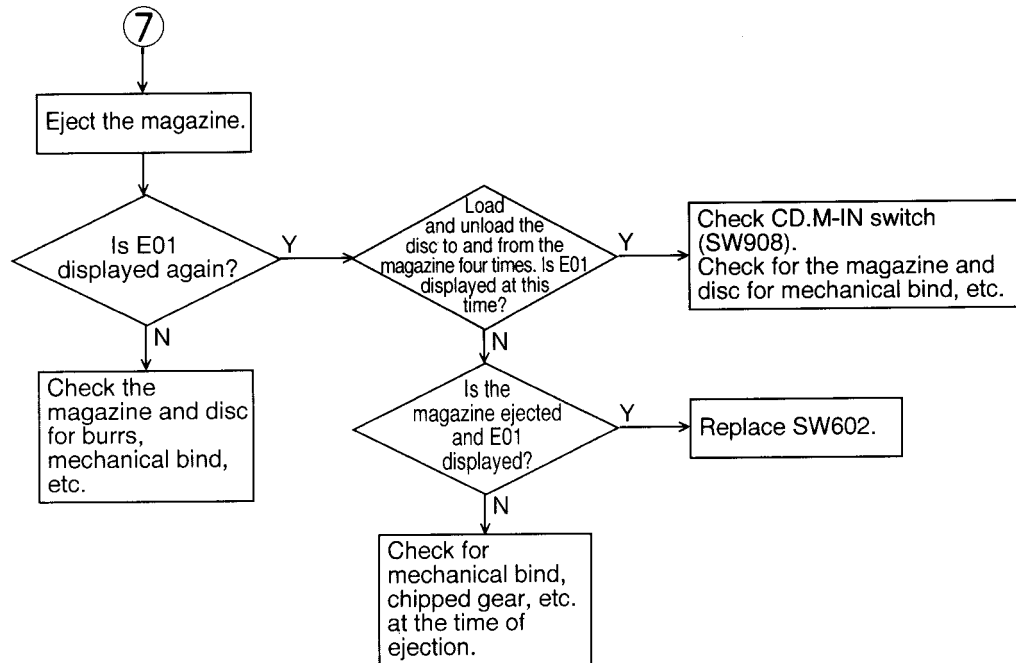


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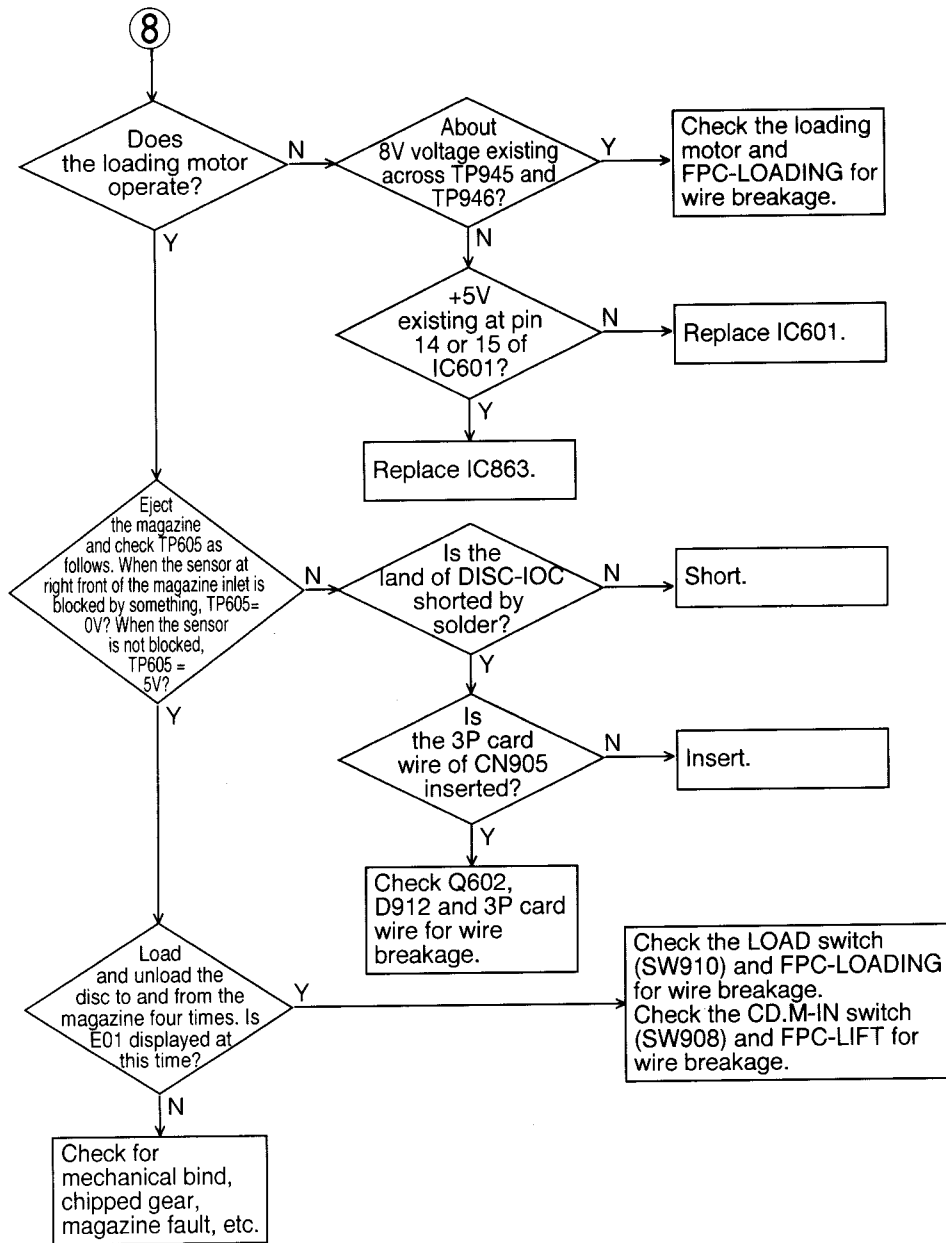




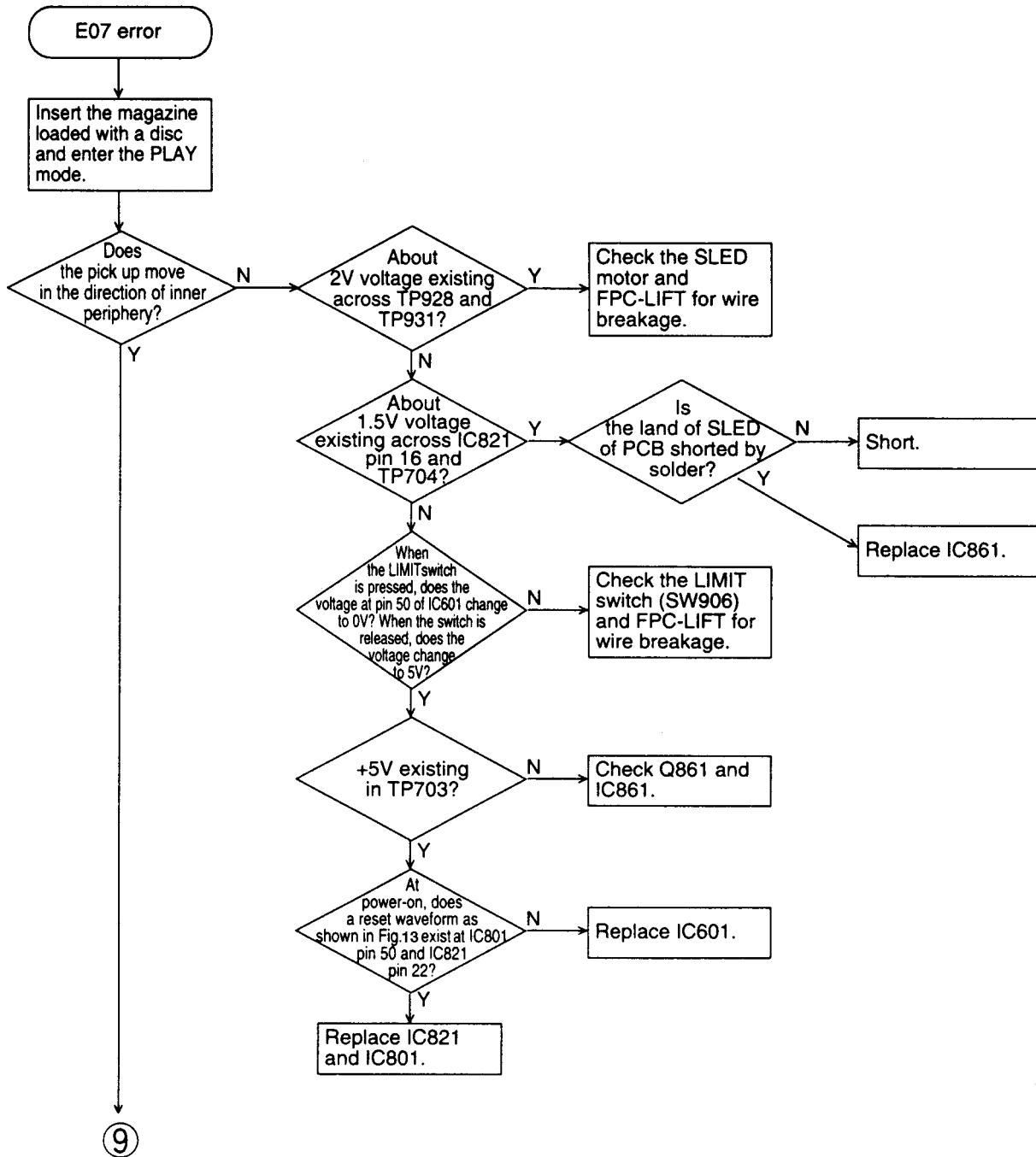
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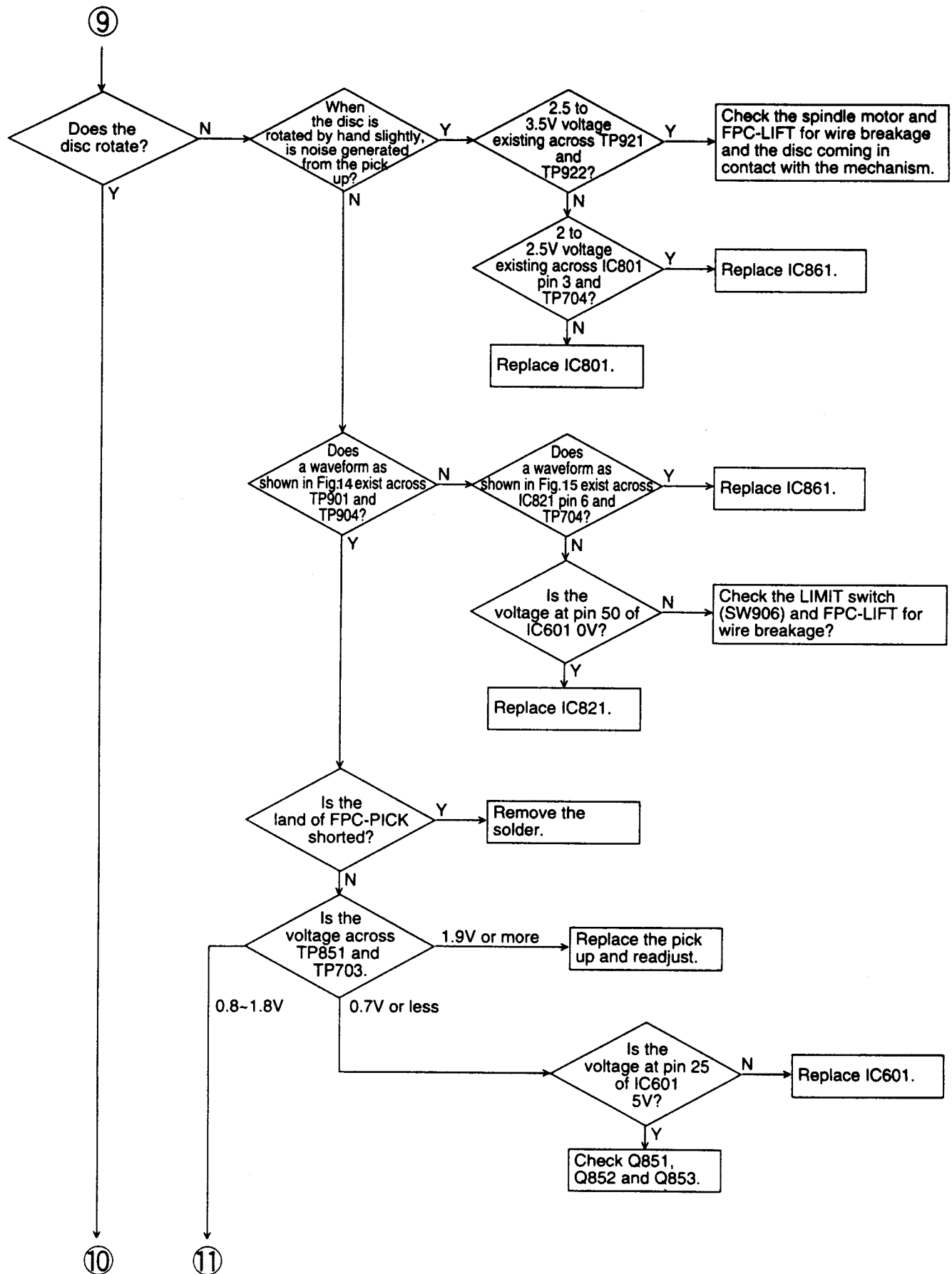
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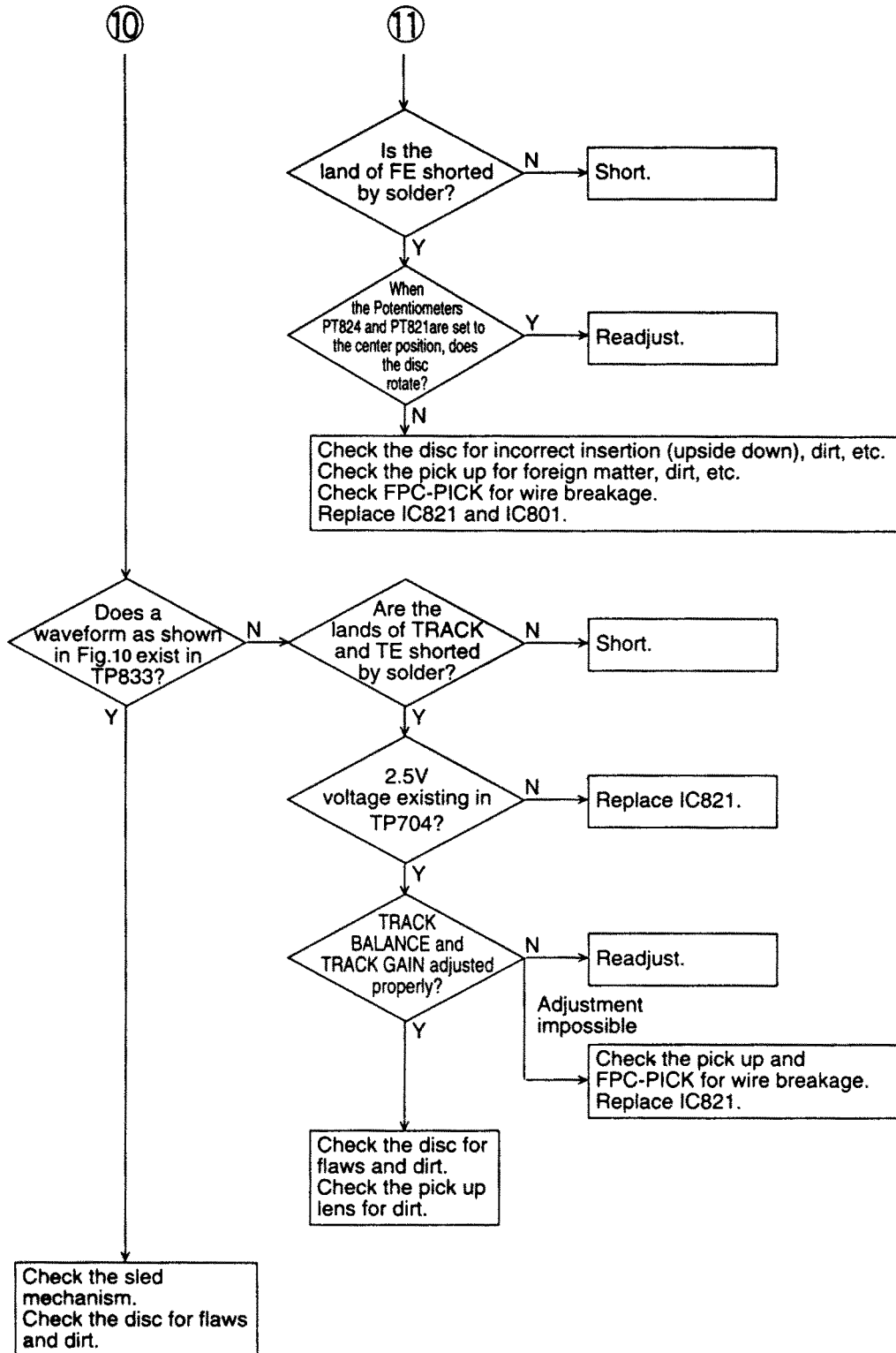
# CD MECHANISM TROUBLESHOOTING



# CD MECHANISM TROUBLESHOOTING



# CD MECHANISM TROUBLESHOOTING



# CD MECHANISM TROUBLESHOOTING

Note: G = GND  
VR = 2.5V (pin 48 of IC821)

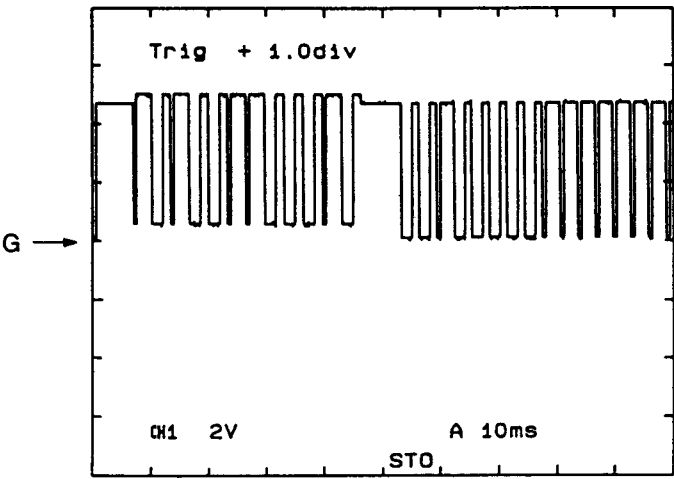


Fig. 9

CH1 BUS (TP975) 2V/div  
Mode: When the CD button of the CD changer controller is pressed.

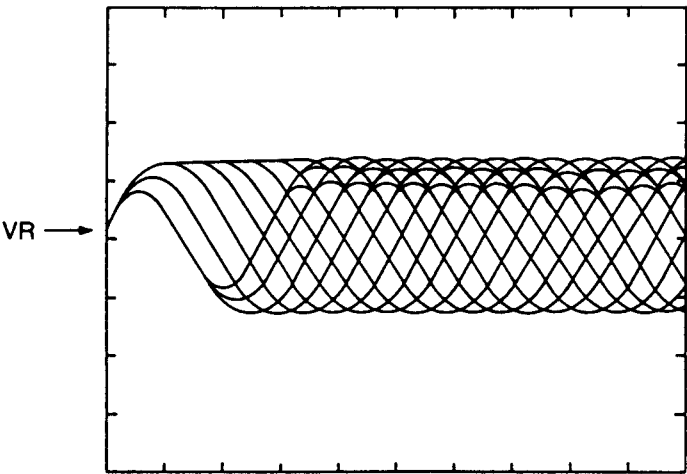


Fig.10

CH1 RF (TP833) AC0.5V/div  
Mode: Play

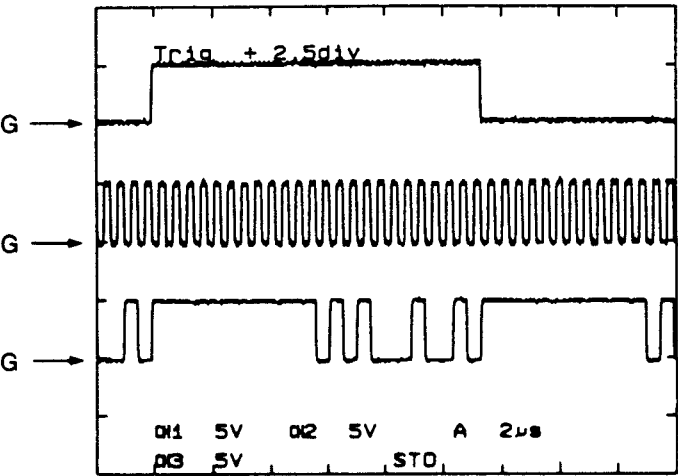


Fig.11

CH1 LRCI (IC201 8 pin) 5V/div  
CH2 BCKI (IC201 9 pin) 5V/div  
CH3 DIN (IC201 10 pin) 5V/div  
Mode: Play

# CD MECHANISM TROUBLESHOOTING

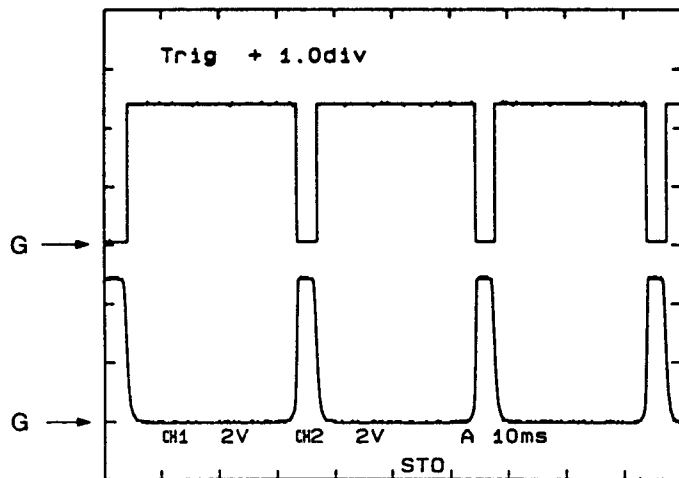


Fig.12

CH1 ROTDTC (IC603 1 pin) 2V/div  
CH2 E.PLS (TP954) 2V/div

Mode: During elevator operation.

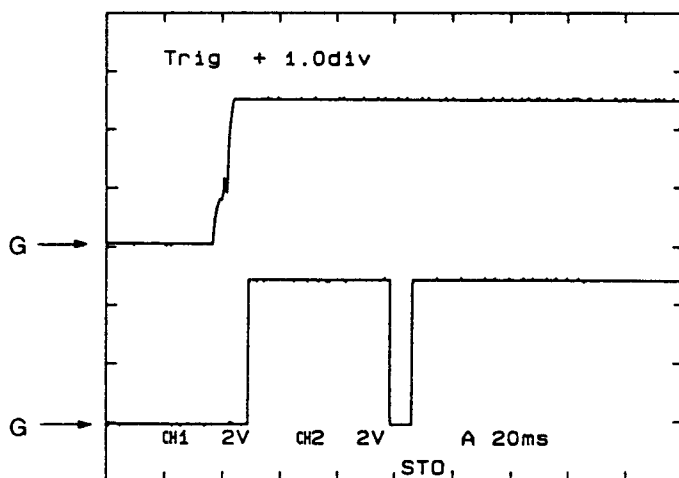


Fig.13

CH1 +5V MAIN (TP703) 2V/div  
CH2 XRST (IC801 50, IC821 22 pin) 2V/div

Mode: At power-on or ACC OFF/ON.

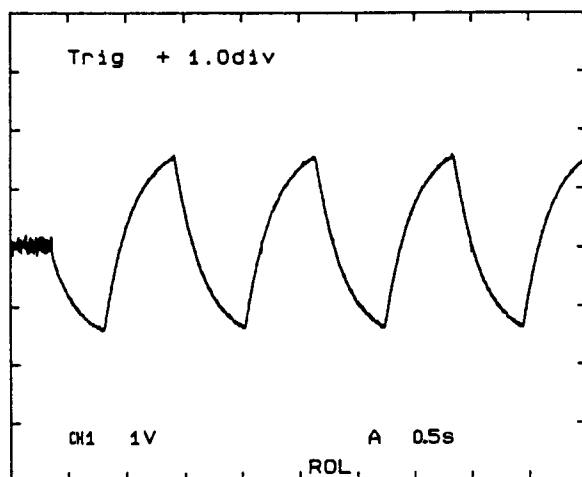


Fig.14

CH1 + side F+ (TP901)  
CH2 - side F- (TP904) 1V/div

Mode: Focus search.  
(When the disc is inserted upside down)



# CD MECHANISM TROUBLESHOOTING

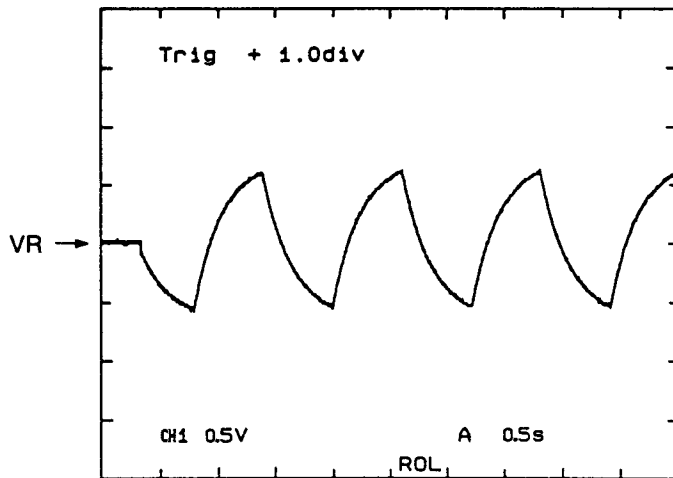


Fig.15

CH1 FEO (IC821 6 pin) 0.5V/div

Mode: Focus search.  
(When the disc is inserted upside down)

## Reference waveforms

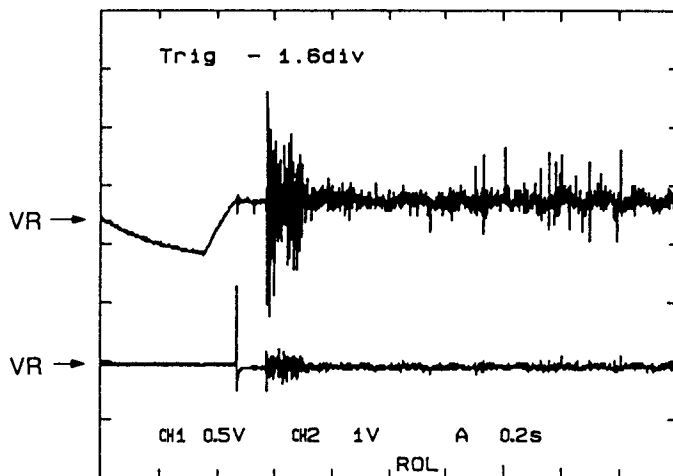


Fig.16

CH1 FEO (IC821 6 pin) 0.5/div

CH2 FE (TP823) 1V/div

Mode: Focus search.  
(When focus is on)

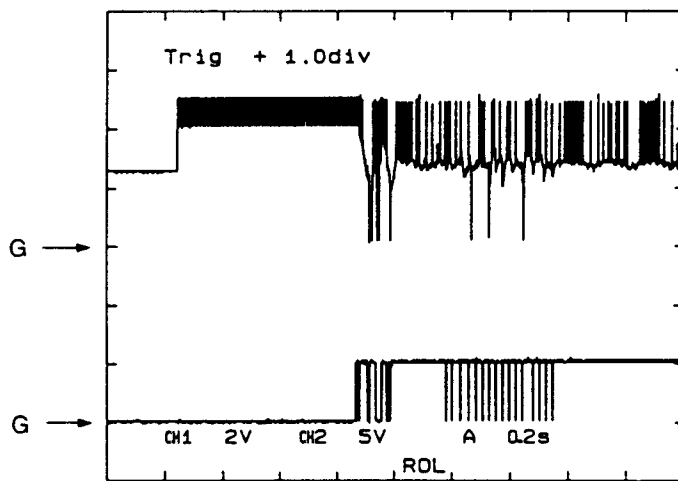


Fig.17

CH1 MDP (IC801 3 pin) 2V/div

CH2 GFS (TP801) 5V/div

Mode: Play→When the spindle is started.

# CD MECHANISM TROUBLESHOOTING

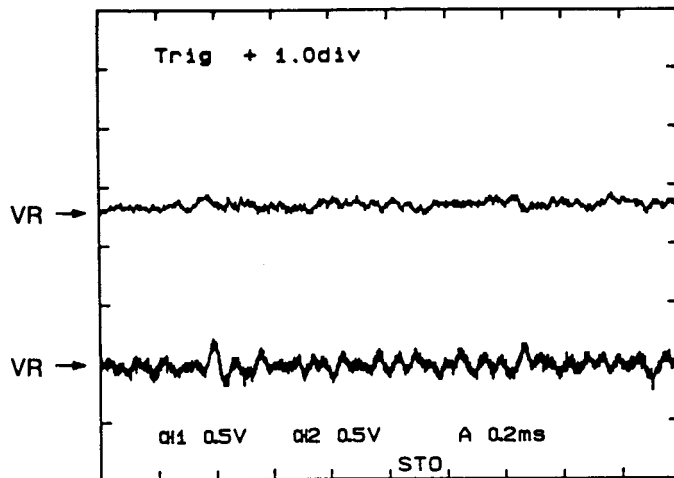


Fig.18

CH1 FEO (IC821 6 pin) 0.5V/div  
 CH2 TAO (TP825) 0.5V/div  
 Mode: Play

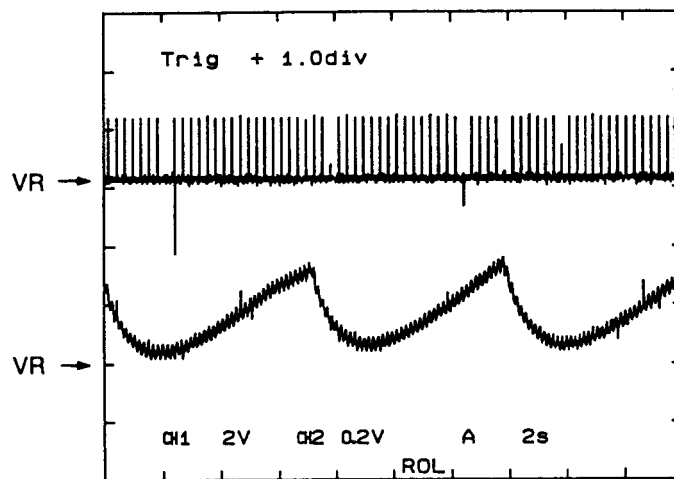


Fig.19

CH1 MDP (IC801 3 pin) 2V/div  
 CH2 SLD (TP827) 2V div  
 Mode: Play

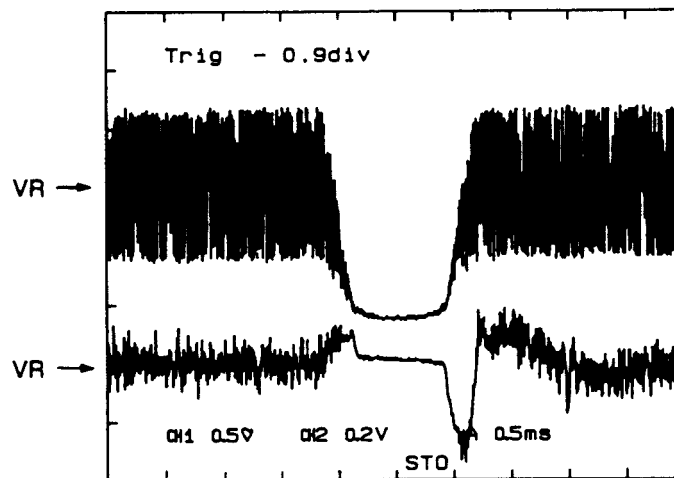


Fig.20

CH1 RF (TP833) AC0.5V/div  
 CH2 TE (TP821) 0.2V/div  
 Mode: Play  
 (When there is a 1mm black dot on the disc)

# CD MECHANISM TROUBLESHOOTING

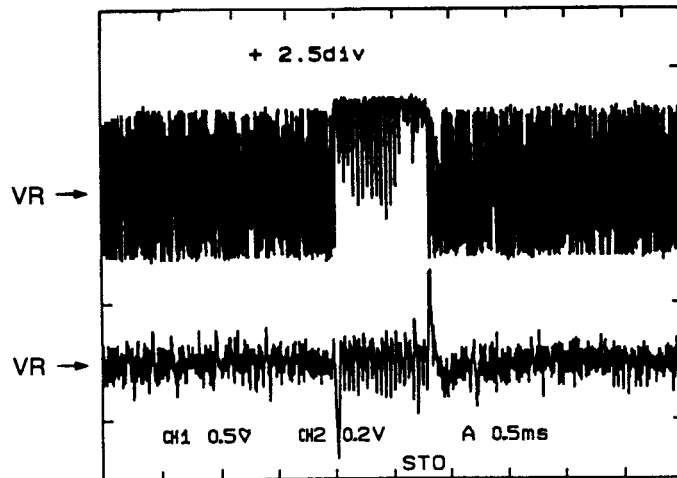


Fig. 21

CH1 RF (TP833) AC0.5V/div  
CH2 TE (TP821) 0.2V/div

Mode: Play  
(When there is a 1mm interruption on the disc)

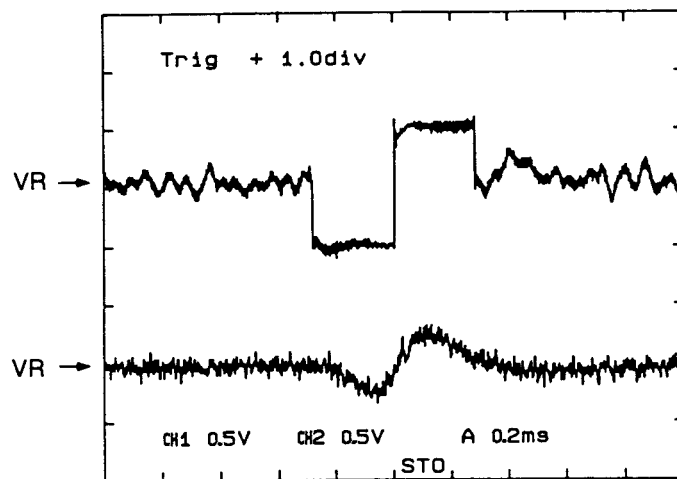


Fig. 22

CH1 TAO (TP825) 0.5V/div  
CH2 TE (TP821) 0.5V/div

Mode: Search (1 track kick)

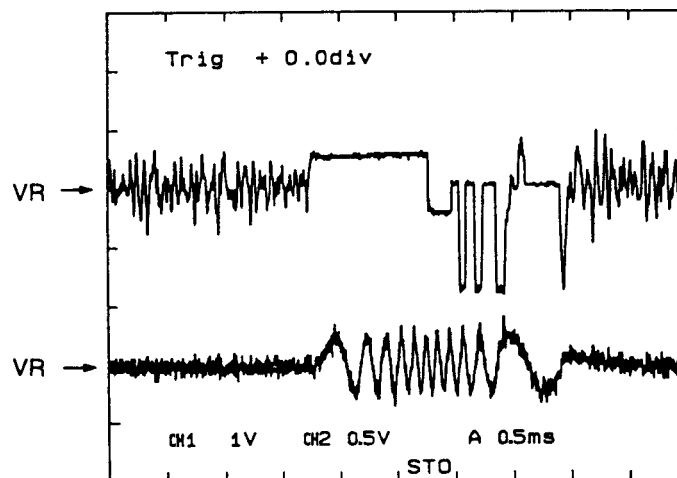


Fig. 23

CH1 TAO (TP825) 1V/div  
CH2 TE (TP821) 0.5V/div

Mode: Search (10 track kick)

# CD MECHANISM TROUBLESHOOTING

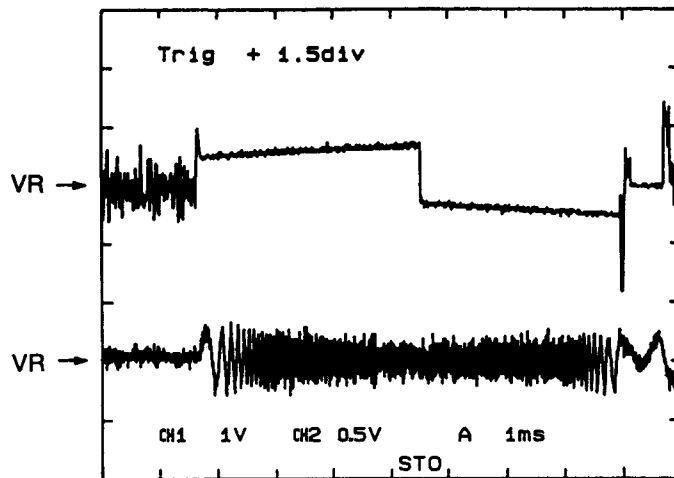


Fig.24

CH1 TAO (TP825) 1V/div  
CH2 TE (TP821) 0.5V/div

Mode: Search (200 track kick in FWD direction)

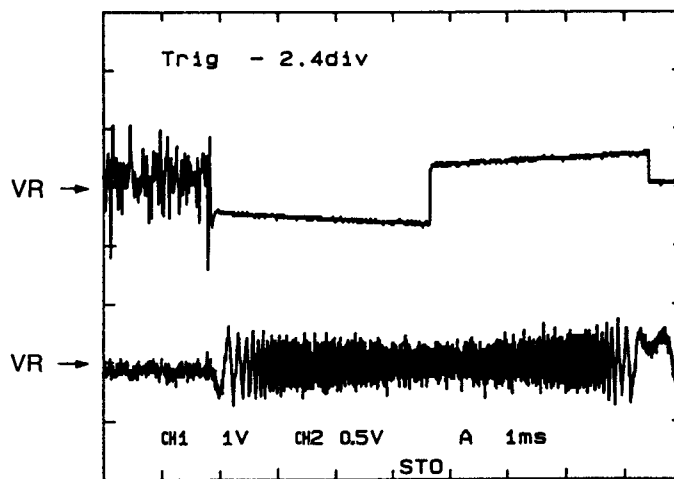


Fig.25

CH1 TAO (TP825) 1V/div  
CH2 TE (TP821) 0.5V/div

Mode: Search (200 track kick in REV direction)

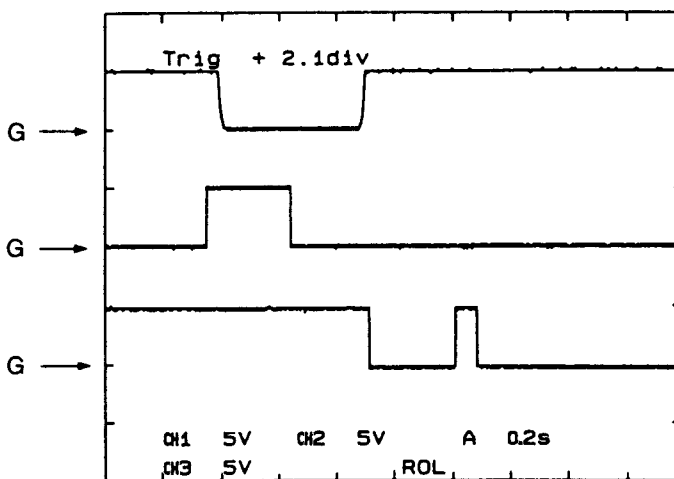


Fig.26

CH1 DISC IOC (TP605) 5V/div  
CH2 LOAD SW (TP941) 5V/div  
CH3 CD.M-IN SW (TP930) 5V/div

Mode: When the disc is loaded from the magazine.

# CD MECHANISM TROUBLESHOOTING

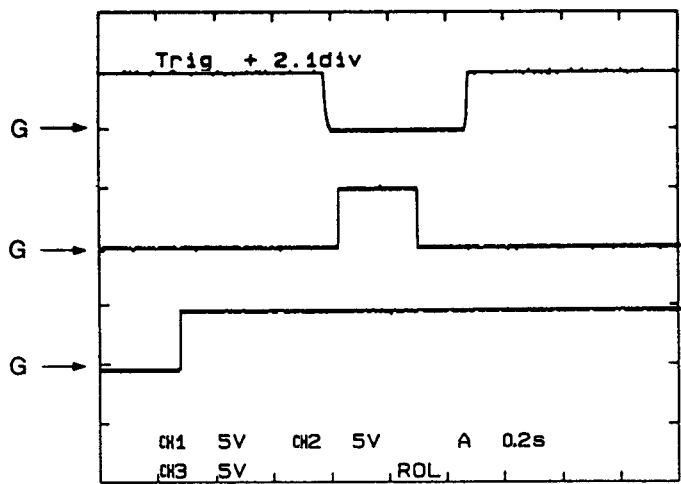
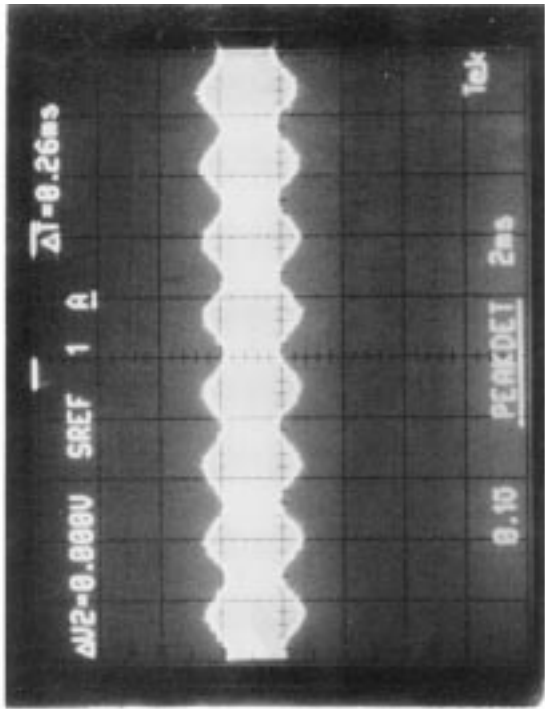


Fig. 27

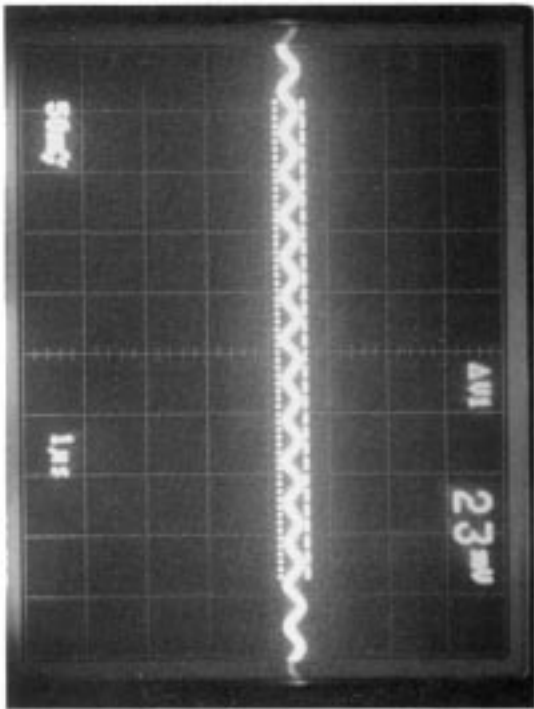
- CH1 DISC IOC (TP605) 5V/div
- CH2 LOAD SW (TP941) 5V/div
- CH3 CD.M-IN SW (TP930) 5V/div

Mode: When the disc is returned to the magazine.

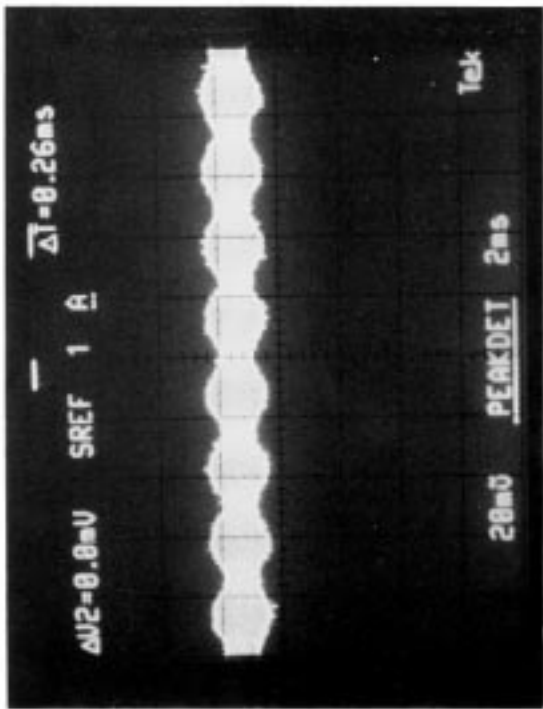
# CD-20 TROUBLESHOOTING WAVEFORMS



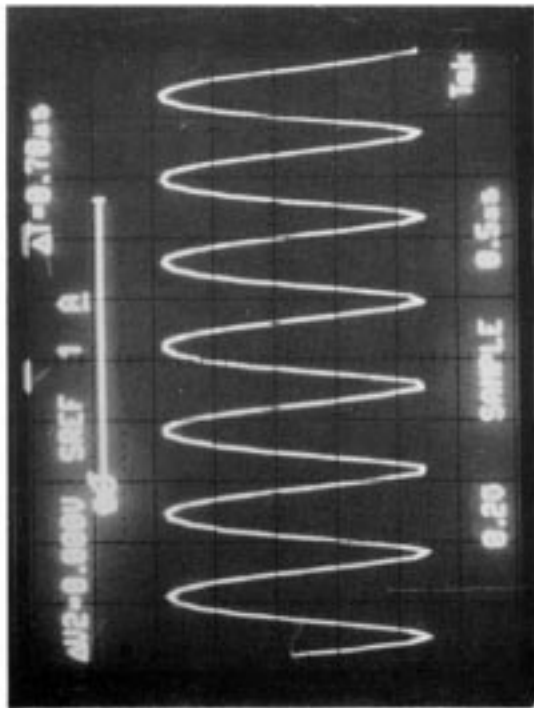
U 300, PIN 26, SET-UP for AM SEN.



Q 303, SOURCE, SET-UP for AM SEN.



U 300, PIN 24 SET-UP for AM SEN.

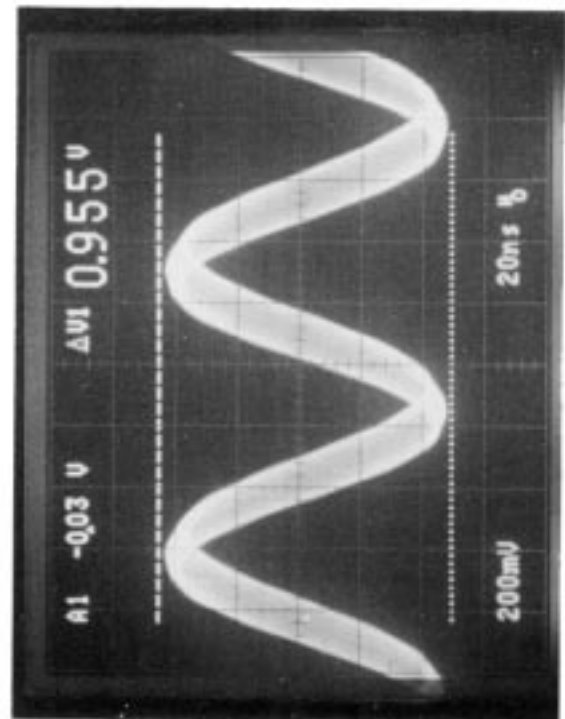


U 300, PIN 29, AM OSC.

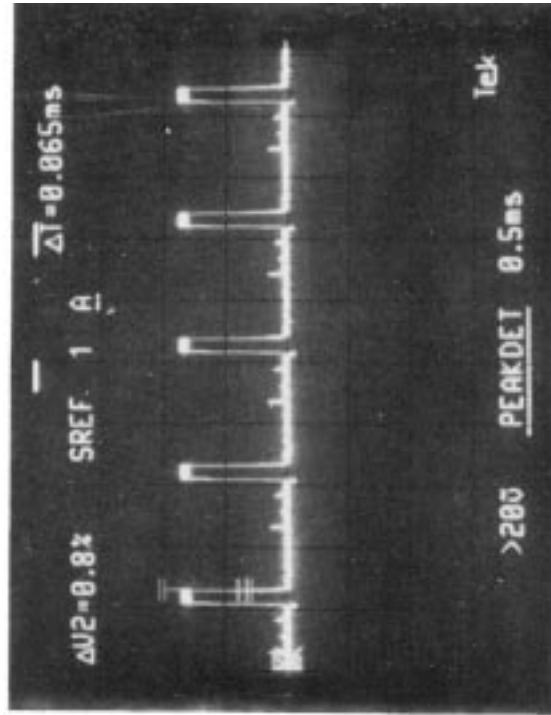
# CD-20 TROUBLESHOOTING WAVEFORMS



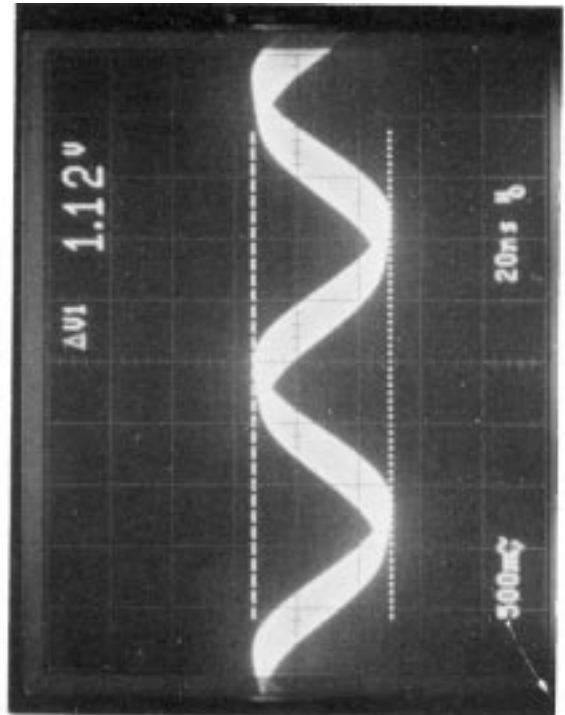
VFD, PN 22, ANODE, FM ON



FRONT END, PIN 4, SET-UP for FM SEN.



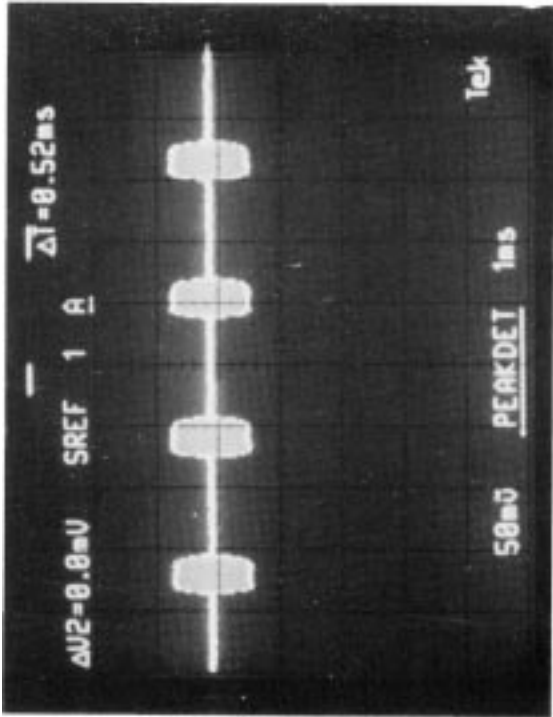
VFD, PIN 12, GRID, FM ON



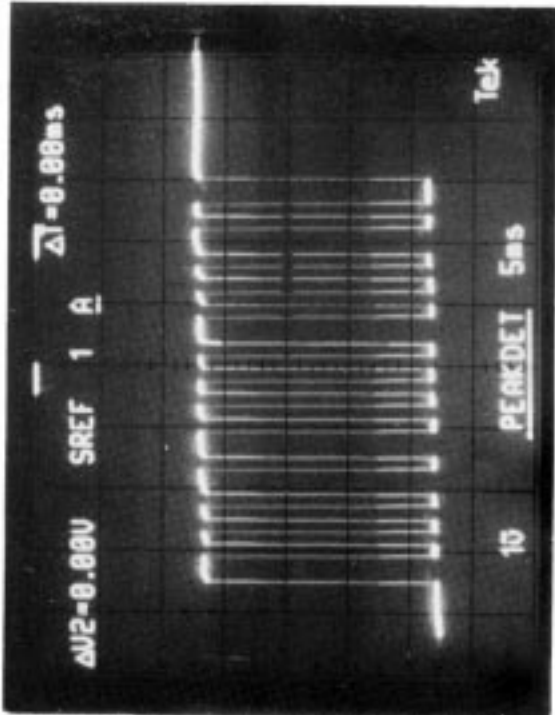
U300, PIN 1, SET-UP for FM SEN.



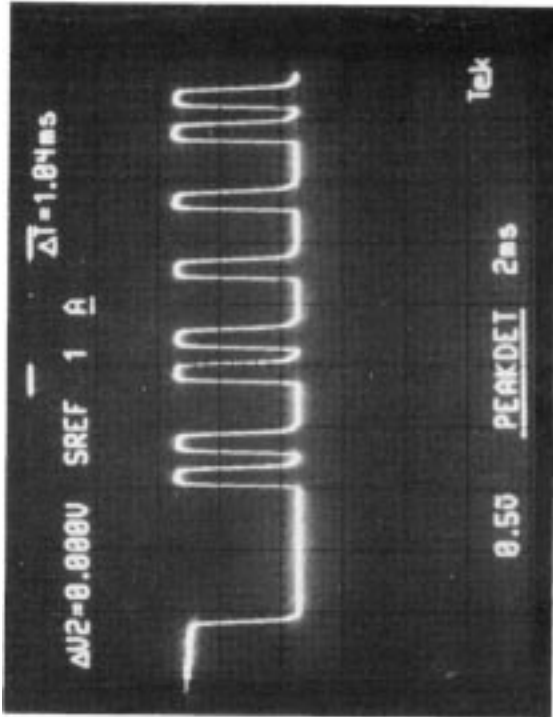
# CD-20 TROUBLESHOOTING WAVEFORMS



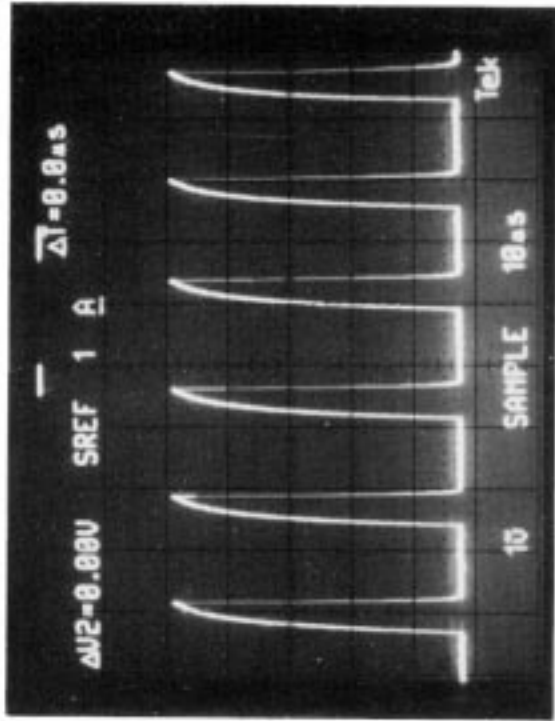
REMOTE CONTROL RECEIVER, PIN 1, VOLUME  
UP/ DOWN



J 109, PIN 10, Z1 DATA, VOLUME  
UP/ DOWN

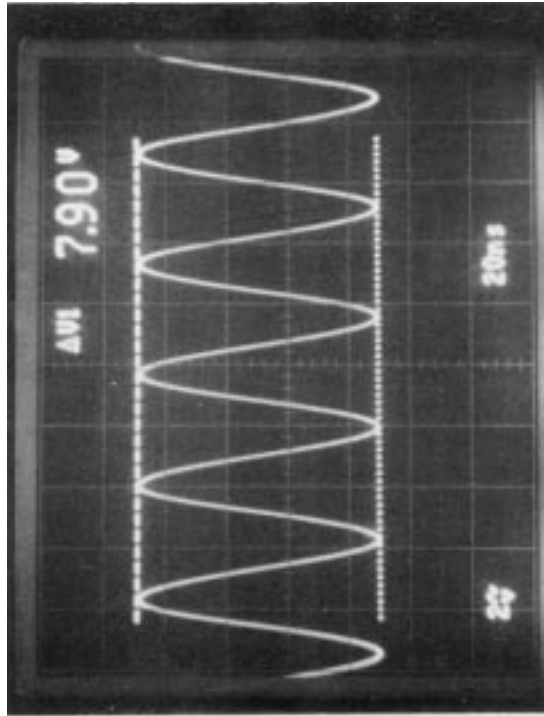


REMOTE CONTROL RECEIVER, PIN 4, VOLUME  
UP/ DOWN

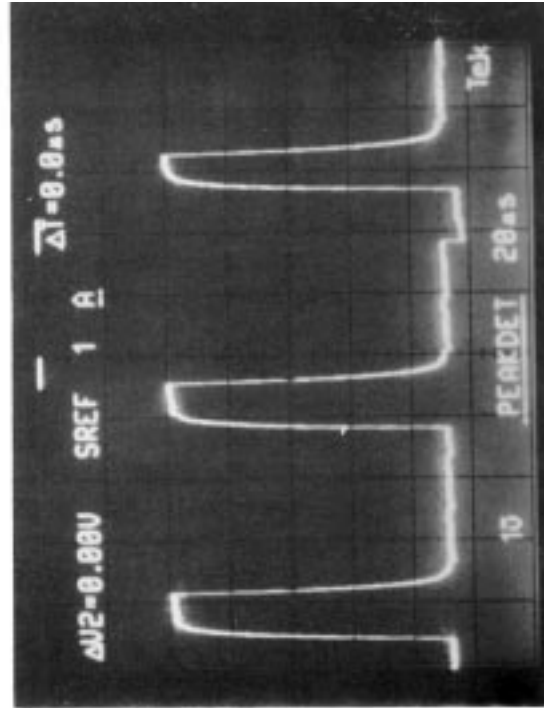


J 108, PIN 14, ACLOCK, VOLUME  
UP/ DOWN

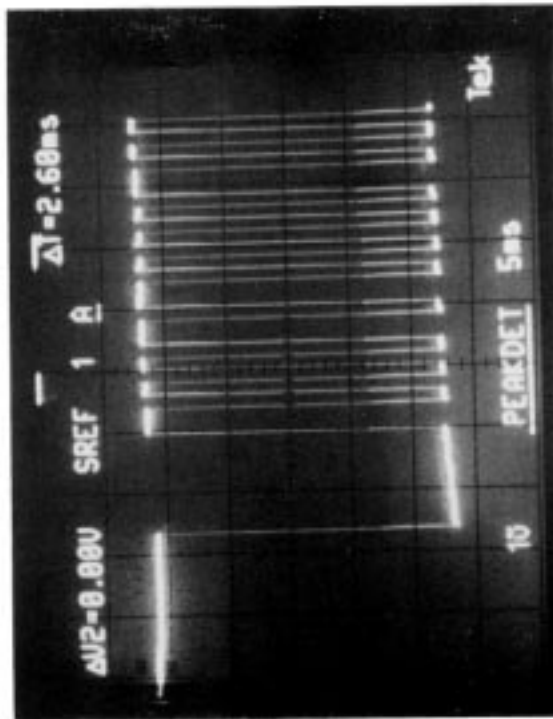
# CD-20 TROUBLESHOOTING WAVEFORMS



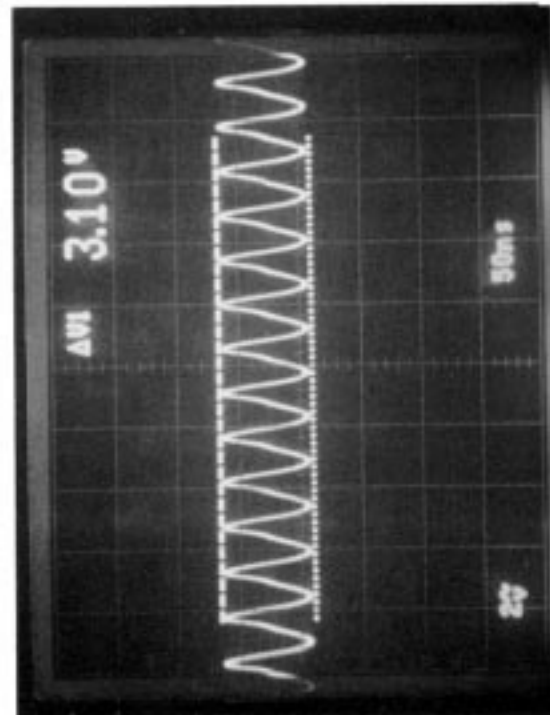
REMOTE CONTROL TRANSMITTER,  
TP 22, MOD. OFF



J 108, PIN 5, ADATA 1

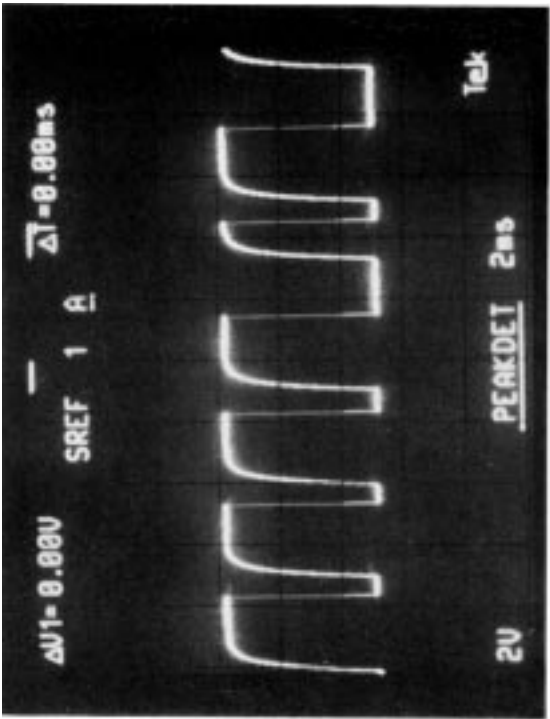


J 109, PIN 11, Z2 DATA, VOLUME UP/ DOWN

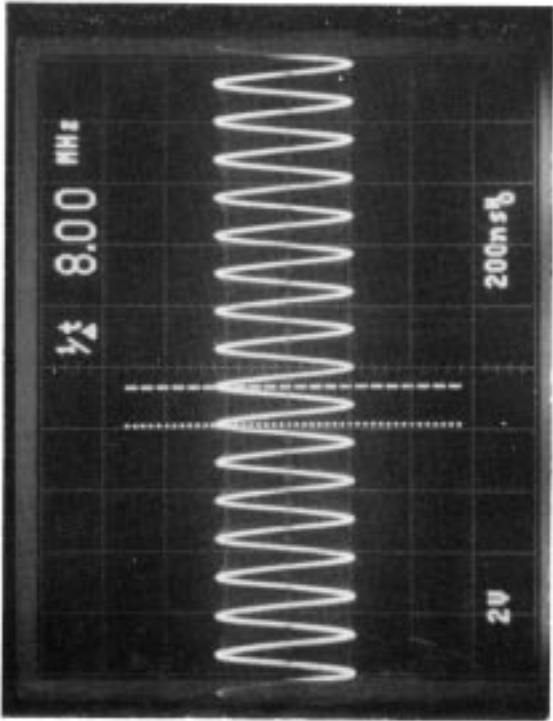


REMOTE CONTROL, TRANSMITTER,  
TP 19, MOD. OFF

# CD-20 TROUBLESHOOTING WAVEFORMS



J110, PIN 5, CD BUS, PLAY MODE



U 400, PIN 13, 8 MHz OSC.



**LIFESTYLE<sup>®</sup> MODEL 20  
MUSIC CENTER  
(CD-20)**

**SPECIFICATIONS AND FEATURES SUBJECT TO CHANGE WITHOUT NOTICE**

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Bose Corporation  
The Mountain

Framingham Massachusetts USA 01701

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