Service Manual

ORDER NO.
CRT2291

MD MECHANISM MODULE

CX-893

- **This service manual outlines operations of the MD mechanism module used in the models listed below.**
- **For repair, use this Service Manual and the Service Manual of the model used in the system.**

Model	Service manual	MD mechanism module
MEH-P5000R/EW	CRT2287	CXB2784

CONTENTS

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1. CIRCUIT DESCRIPTION

1.1 APC Part

Figure 1 below shows the block diagram. This block controls the output from the block LD to be consistent with the monitor diode.
The block consists of IC 102 and turned to LD ON when LDON (6 pin) is H and to LD OFF when LDON is L. LD output level is set with the voltage value of LDVAR and is usually around 2.4 V.

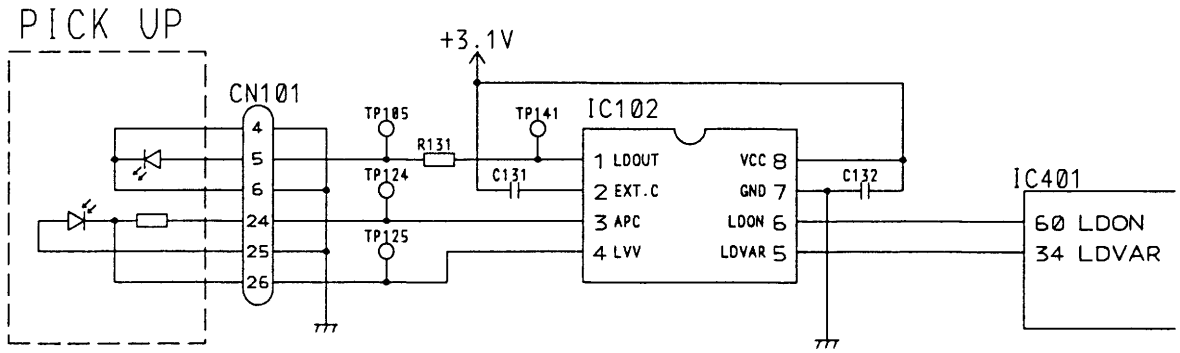


Fig.1

1.2 RF amplifying part

The block amplifies the pickup output signal and generates RF and ADIP signals.
This block mainly consists of IC101.

REFO part

REFO (+1.5 V) is the reference voltage for the servo. The signal is resistive divided at the IC (REFI: 5 pin) and output to 6 pin through buffer. This signal will be the reference for RFIC.

RF signal amplifying part

Figure 2 below shows the block diagram. The signal which is I-V converted at the pickup is input to the RF1-4 (1-4 pin). Gain at the I-V amplifier contained in the PU is switched depending on the disc types. The switching is controlled by OPICGA (IC401, 61 pin) and H is output at Premaster DISC and L is output at Recordable DISC. The signal input from the I-V amplifier is operated with the contained resistance and amplifiers (A1, A2) and the signal (RF1 + RF2 + RF3 + RF4) (POUT) and the signal (RF1 + RF2 + RF3 - RF4) (GOUT) are generated. Each of POUT and GOUT is equipped with an analog switch. The switches are controlled with the DISC signal (bits on microprocessor serial communications). The POUT signal is output through 48 pin when the DISC signal is H (PIT mode) and GOUT signal is output through 47 pin when the DISC signal is L (GRV mode).

These signals are input to EFMAGC (45 pin) through the coupling capacitors (C133, C112) and transmitted to the AGC circuit and filter part to be output from EFMO (40 pin). The EFMO is maintained at almost same level (approx. 1.5 Vpp) with the AGC circuit. These signals are input to the signal processing part (IC201: 3 pin) and used for data processing and spindle control when playing a Premaster Disc.

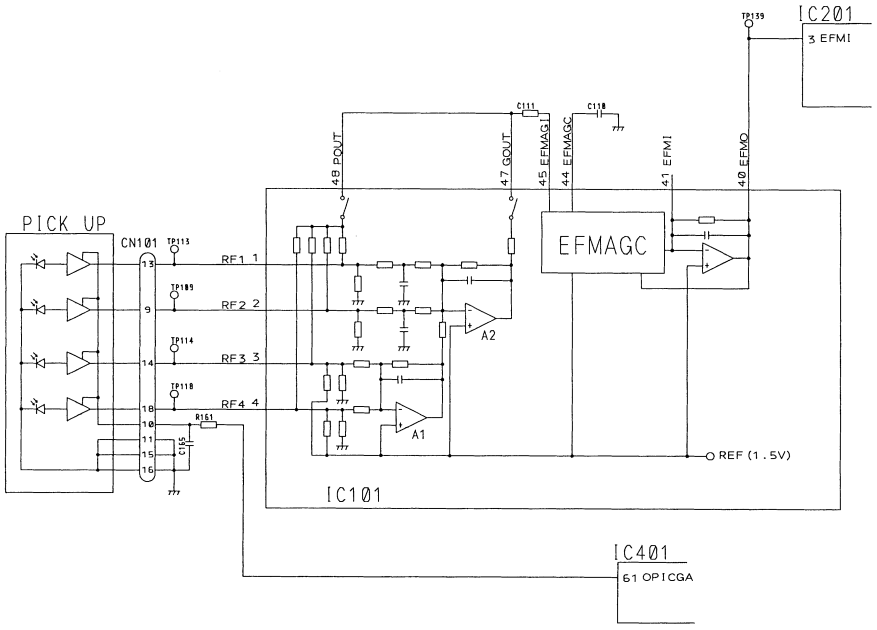


Fig.2

ADIP signal amplifying part

Figure 3 shows the block diagram of this part. The block generates the ADIP signal which exists only on a Recordable DISC of a MD.

Signals input to RF1 and RF2 (1,2 pin) are transmitted through the AGC part and the filter part to be output to 22KO (32 pin). The 22KO is designed to be maintained at almost same level (approx. 1.2 Vpp) with the AGC circuit. However, fluctuation of about +0.5V may be observed due to core components, responsibility of tracking servo, etc. The signal is then converted to 1 and 0 signal with the comparator C1, input to the signal processing part (IC201:11 pin), and used for address control when playing disc for recording and spindle control.

*Will not be used when Premaster Disc is played.

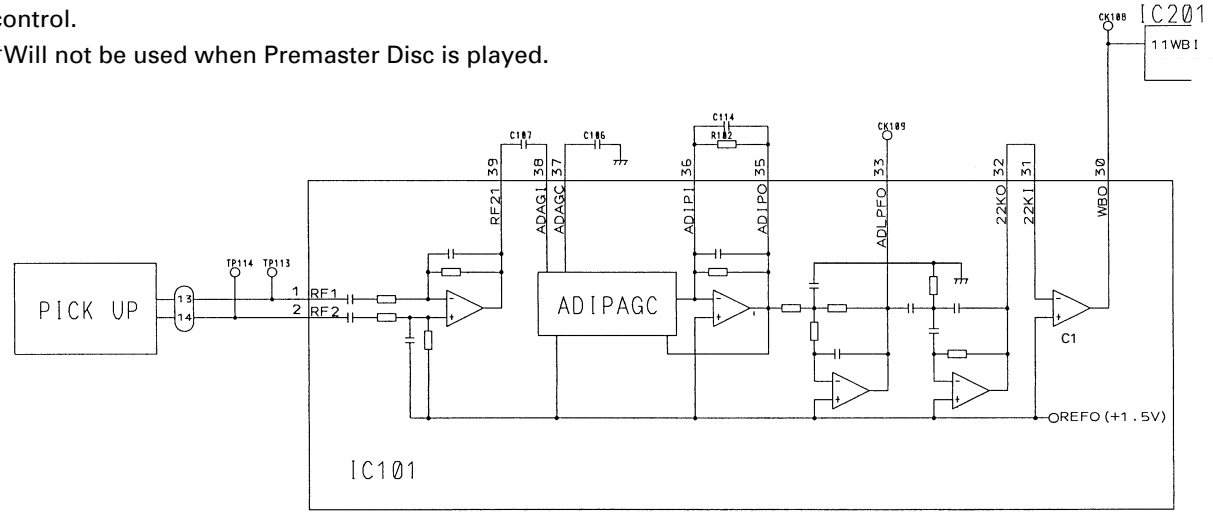


Fig.3

Track cross part, signal amplifying part for servo

Figure 4 shows the block diagram of these parts.

The signal input to RF1-4 (1-4 pin) is resistive divided and amplified to be output to TCGO (29 pin). TCGO is input to the signal processing part (IC201:7 pin) and TCRS signal is generated and will be used when the system skips tracks to play.

Outputs from the focus servo based photo diode are input to AIN (9 pin) and BIN (10 pin) and are output to AOUT (28 pin) and BOUT (27 pin), respectively, after being amplified.

Outputs from focus servo based photo diode are input to EIN (11 pin) and FIN (12 pin) and are output to EOUT (26 pin) and FOUT (25 pin), respectively, after being amplified .

These signals are input to the signal processing part (IC201: 5,6,7,8,9 pin) and used at each servo. Amplifying ratios of each signal are controlled by the microprocessor and adjusted so that they reach optimized values when mechanical modules are shipped. Those optimized values are stored in IC402. Therefore, when you replace IC or PU switch, etc., you should have the IC402 memorize new optimized values by turning EEPROM (IC402) to write mode (See the relevant sections for details.) and running test modes AUTO1 and AUTO2 with a Recordable DISC (MMD-211 or MMD-212).

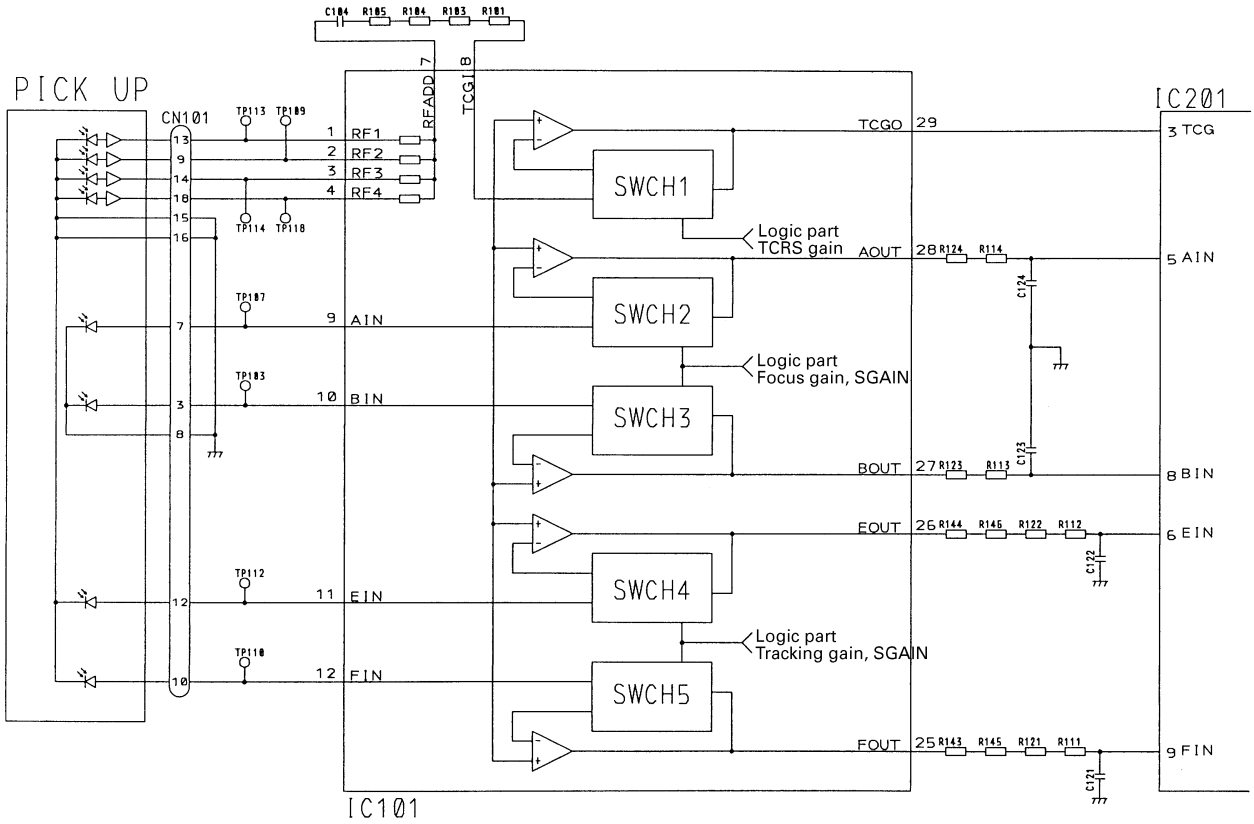
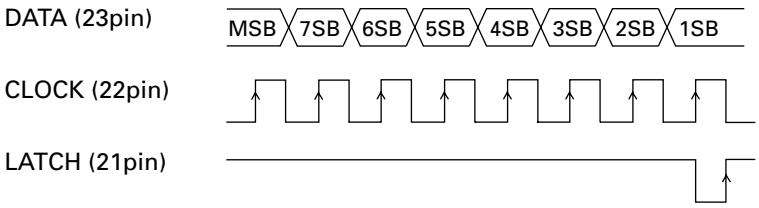


Fig.4

Logic part

Serial commands of the microprocessor determines the setting of this IC.

Timing chart



Structure of serial data

	MSB	7SB	6SB	5SB	4SB	3SB	2SB	1SB
Pattern A	H	L	Focus gain			Tracking gain		
Pattern B	L	H	STBY	DISC	SGAIN	Track loss gain		

Gain setting (+12dB when SGAIN=H at normal operation)

Setting value	Focus gain	Tracking gain	Track loss gain
000	–40	–40	–18
001	–34	–34	–12
010	–28	–28	–6
011	–22	–22	0
100	–16	–16	6
101	–10	–10	12
110	–4	–4	18
111	–4	–4	18

STBY: Switches to stand-by mode
H: Normal L: Stand-by
DISC: Switches to disc mode
H: PIT (Premaster Disc)
L: GRV (Recordable Disc)
SGAIN: Switch of amplifier gain for servo
H: +12dB
L: Normal

1.3 Signal processing part (IC201)

This block consists of the following four parts:
1) Servo part
2) Signal processing part
3) Shock proof controlling part
4) ATRAC part
The details for each part are described below.

1) Servo part

1.1) Focus servo

Figure 5 shows the block diagram of the focus servo. The signals input to AIN (5 pin) and BIN (8 pin) are processed with subtraction treatment after analog-digital conversion. These signals can be monitored with FEMON (75 pin). These signals, however, should be monitored using LPF with cutoff of around 50 kHz (e.g. R=100 kΩ, C=33 pF) because they are PWM signals. These signals are equalized at subsequent D and F parts and output to FODRF (18 pin) and FODRR (19 pin) with PWM.

The output signals are amplified with the driver (IC601) and drive the actuator.
You must move the lens up and down for close focus. Close the focus when the following requirements are met:
1) When the lens is going down.
2) FOK (82 pin) = L
3) FZC (signal inside IC) = ↑

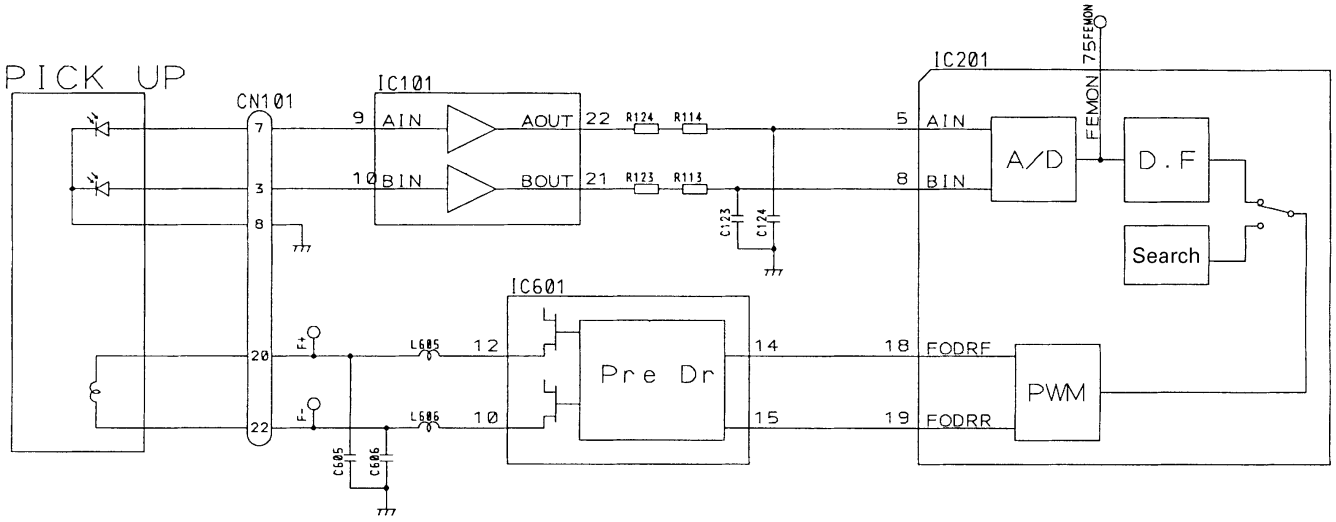


Fig.5

1.2) Tracking servo and thread (carriage) servo

Figure 6 shows the block diagram of the tracking servo and thread (carriage) servo.

1.2.1) Tracking servo

Signals input to EIN (6 pin) and FIN (9 pin) are processed with subtraction treatment after analog-digital conversion. These signals can be monitored with TEMON (75 pin). These signals, however, should be monitored using LPF with cutoff of around 50 kHz (e.g. R=100 kΩ, C=33pF) because they are PWM signals.

These signals are equalized at subsequent D and F parts and output to TRDRF (20 pin) and TRDRR (21 pin) with PWM. The output signals are amplified with the driver (IC601) and drive the actuator.

1.2.2) Thread servo

Thread servo extracts and amplifies only low frequency signals by transmitting the outputs from tracking D and F parts through D and F parts. When these signals exceed a certain threshold voltage, they are output to SLDRF (22 pin) and SLDRR (23 pin) with PWM.

These signals are amplified with the driver (IC601) and then drives the motor.

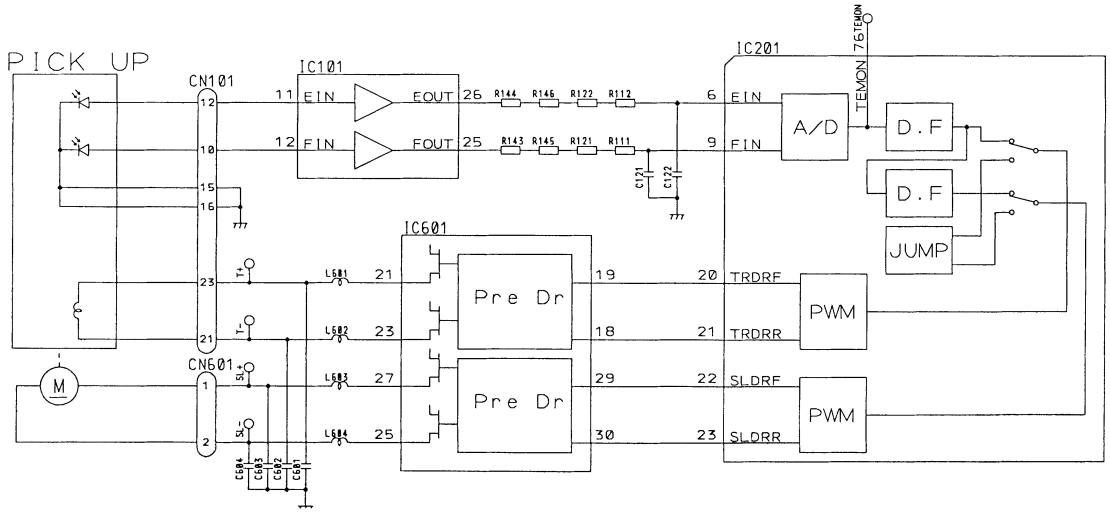


Fig.6

1.3) Track jumping

Tracks to play are automatically skipped using AUTO mode which is an LSI function.
Figure 7, 8, and 9 show examples of 1TJUMP, 10JUMP and Auto MOVE, respectively.

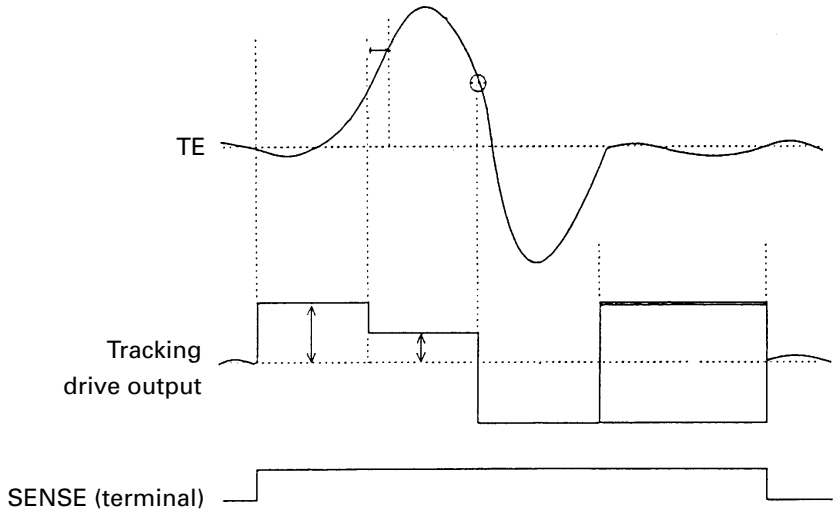


Fig.7

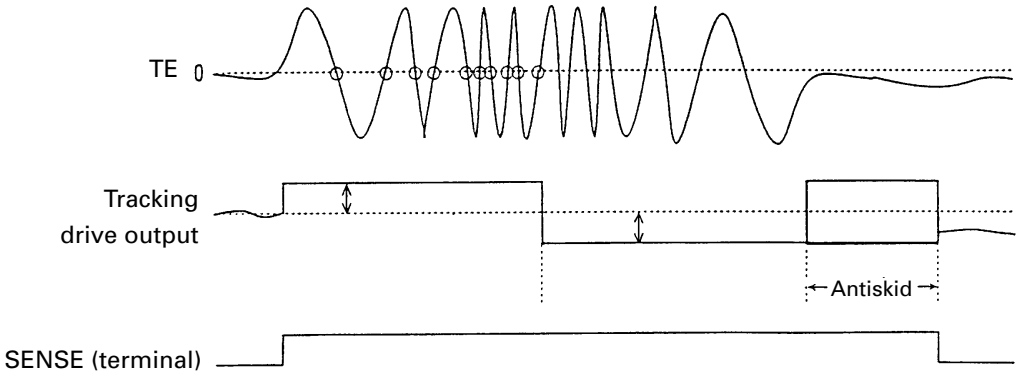


Fig.8

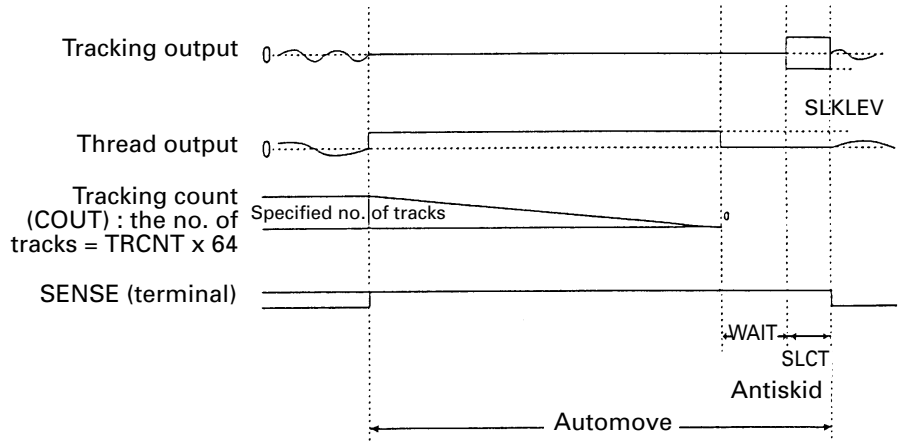


Fig.9

1.4) Spindle servo

Figure 10 shows the block diagram of the spindle servo. Perform CLV control with EFMI (3 pin) when you play the read-in area of a Premaster DISC or Recordable DISC and with WBI (11 pin) when you play the program area of a Recordable DISC.

1.5) Auto tuning

This mechanical module is automatically tuned so that it absorbs dispersion among discs caused by ambient changes or course of time thereby stabilizing the play of discs. This auto tuning will be made whenever you insert a disc or select MD mode with the source cue.

1.5.1) When you play Premaster DISC

Tracking ATT tuning

Measures the levels of LPFEINO, LPFFINO and EFMIO that EIN (6 pin) and FIN (9 pin) generate and specifies the amount of ATT that is calculated with formula.

↓

Maintains the tracking loop gain at a certain level and stabilizes the tracking servo operation.

Focus ATT tuning

Measures the levels of LPFABO that AIN (5 pin) and EIN (8 pin) generate and specifies the amount of ATT that is calculated with formula.

↓

Maintains the focus loop gain at a certain level and stabilizes the tracking servo operation.

1.5.2) When you play a Recordable DISC

Tracking ATT tuning (PIT. GRV)

Measures the levels of LPFEINO, LPFFINO and EFMIO that EIN (6 pin) and FIN (9 pin) generate and specifies the amount of ATT that is calculated with formula.

↓

Maintains the tracking loop gain at a certain level and stabilizes the stabilizes the tracking servo operation.

Focus ATT tuning (PIT. GRV)

Measures the levels of LPFABO that AIN (5 pin) and EIN (8 pin) generate and specifies the amount of ATT that is calculated with formula.

↓

Maintains the focus loop gain at a certain level and stabilizes the tracking servo operation.

TCRS ATT tuning

Measures the level of TCGSMIO that TOG (7 pin) generates and specifies the amount of ATT that is calculated with formula.

↓

Stabilizes searches when you play a Recordable DISC.

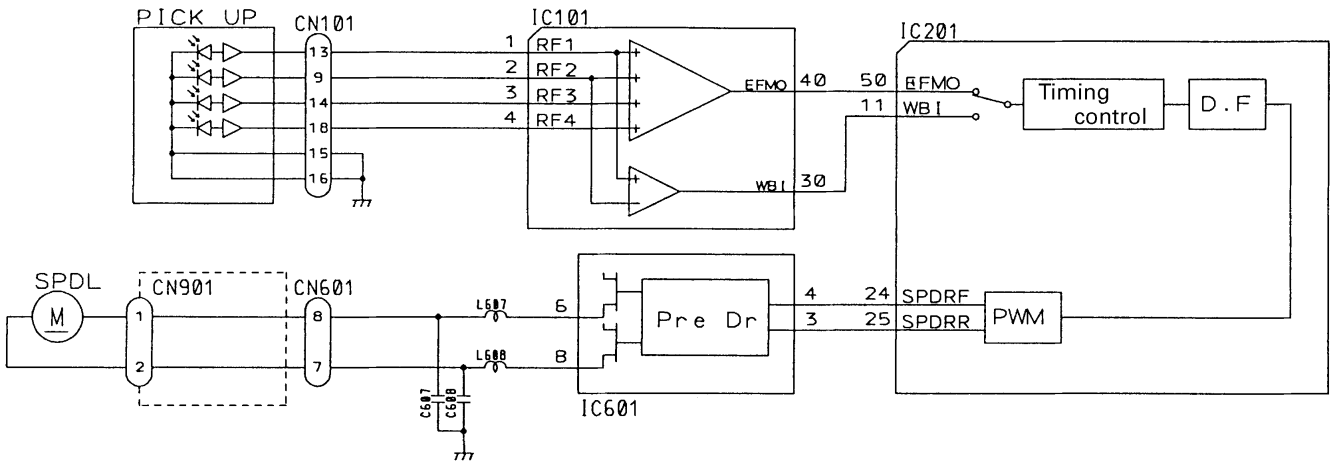


Fig.10

2) Signal processing part

Figure 11 shows the block diagram of signal processing, shock proof controlling and ATRAC parts. The signal processing part consists of the two blocks, one of which demodulates the music data on the disc and corrects errors, and the other of which controls addresses used for searches and time calculation.

2.1) Music data

The signal input from EFMI (3 pin) is equalized with the digital filter after analog-digital conversion. This signal can be monitored with EFMO (1 pin). The signal will be sliced at an appropriate level and modulated to 0 and 1 signal and then transmitted to the subsequent shock proof part after EFM demodulation and error correction are completed.

2.2) Address control

Reads the address data on the disc and specifies targets for time control during play and searches. The methods of reading the address data depends on the disc types.

When you use a Premaster DISC
Extracts the address data from the music data after error correction is completed.

When you use a Recordable DISC
Modulates frequency of the signal input from WBI (11 pin) and reads the addresses from the data.

3) Shock proof controlling part

The data from the signal processing part is temporarily stored in DRAM (IC202). Later, the data will be sent out sequentially by the data requests from the subsequent ATRAC part or instructions from the microprocessor.

This mechanical module contains the 4MB DRAM and can store the data of approximately 10 seconds.

4) ATRAC part

The data from DRAM (IC202) will be extended for ATRAC at this block and then converted into the audio data.
The data formats to be used at the subsequent DAC (IC501) are as follows:
BCLK (71 pin): 64 Fs
DADATA (74 pin): 20 bits from the last
DFCK (72 pin): 256 Fs
LRCK (70 pin): Fs, L/R
*Fs=44.1 kHz

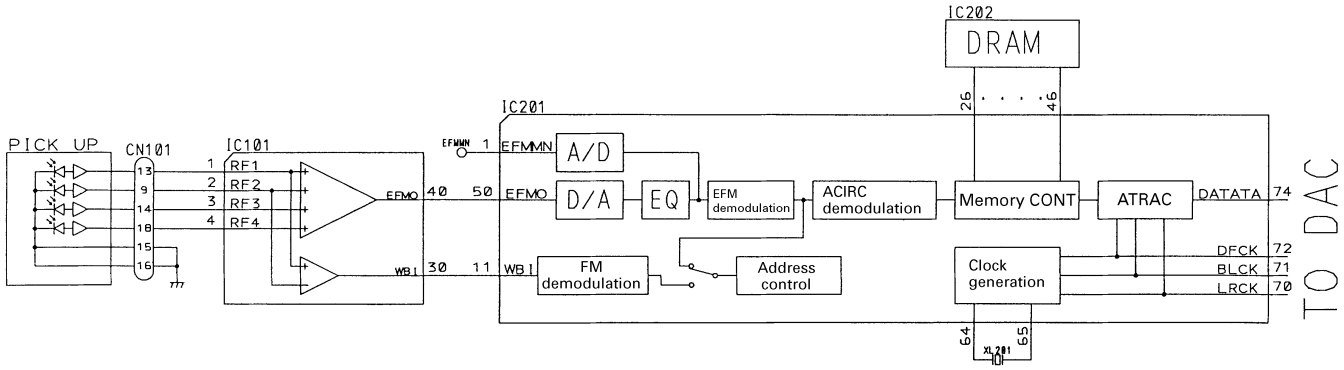


Fig.11

1.4 Mechanical control

1) Loading

The microprocessor instructs the motor driver IC651 to rotate backward (IC651: 3 pin: L, 4 pin:H→¨L+: L, L-:H) if LOAD STRAT SW (SW652) detects OFF (LOAD STRAT=H). If LOAD STRAT SW (SW652) detects ON (LOAD END=L) later, the microprocessor instructs the motor driver IC651 to stop (IC651: 3pin: H, 4pin:H→¨L+: L, L-:H) and completes the loading and then transits to PLAY operation. If DISC IN SW (SW903) is OFF (DISC IN=H) or LOAD END SW has been OFF for a long time, the microprocessor determines that there is no inserted disc or a disc insertion error and performs EJECT or Error STOP.

2) EJECT

The microprocessor instructs the motor driver IC651 to positively rotate (IC651: 3 pin: H, 4 pin:L→¨L+: H, L-:L) when it receives the EJECT instruction. If EJECT END SW (SW653) detects ON (EJECT END=L) later, the microprocessor instructs the motor driver IC651 to stop (IC651: 3pin: H, 4pin:H→¨L+: H, L-:H) and completes the EJECT operation.

1.5 Others

1) Temperature detection

This module detects high temperatures, to protect PU. When the temperature of the output from the temperature sensor (IC402) exceeds a certain voltage level, it is determined as high temperature and an appropriate process such as Error STOP will be performed. The ambient temperature which causes that high temperature on the module is approximately 80 degree Celsius.

2) Voltage monitoring

This module monitors voltage to protect the system. The signals which are resistive divided (R803, 804) from the input VD from the product (CN301: 1,2) are monitored (IC401, 25 pin). If the voltage of the signal is higher than 2.86 V (VD7V or higher) or lower than 2.04 V (VD5V or lower), an appropriate process such as Error STOP will be performed.

1.6 How to rewrite EEPROM

This mechanical module stores adequate values for the servo, etc., in the EEPROM (IC402). Therefore you need to rewrite the data in the EEPROM when you replaced mechanism, PU, LSI, or microprocessor.

● When you replaced EEPROM (IC402), microprocessor (IC401)

① Make TP435 (IC402: 6 pin) and TP421 (IC402: 8 pin) short-circuited.

② Start the product in Test mode. (See manuals for each product for how to start.)

③ Display the EEPROM setting menu and view any setting value, e.g., Focus "FGP__XX". (You should not change the value.)

④ Switch to Test STOP mode.

⑤ Turn ACC off. * After turning ACC off, wait for about 10 seconds because EEPROM is written into during that time.

⑥ Turn Backup off.

⑦ Disconnect the short-circuits you have done in the step ①).

● When you replace pickup, mechanism, LSI (IC101, 201) or their peripherals.

① Make TP435 (IC402: 6 pin) and TP421 (IC402: 8 pin) short-circuited.

② Start the product in Test mode. (See manuals for each product for how to start.)

③ Load Recordable DISC (MMD-211 or MMD-212) and run AUTO1. When "Complete" sign appears, press the FUNC key and run AUTO2. When "Complete" sign appears again, press the FUNC key and confirm the indicated addresses are normally counted up.

*If "Can't ADJ" sign appears in this step, check the soldering if it has any problem.

④ Switch to Test STOP mode.

⑤ Turn ACC off. * After turning ACC off, wait for about 10 seconds because EEPROM is written into during that time.

⑥ Turn Backup off.

⑦ Disconnect the short-circuits you have done in the step ①).

2. DISASSEMBLY

● How to remove mechanism

1. Remove No.3 screws and remove the loading motor.
2. Rotate No.4 gear in the direction indicated by the arrow.
3. Remove the No.1 screw and then No.2 screw and take out the mechanism.

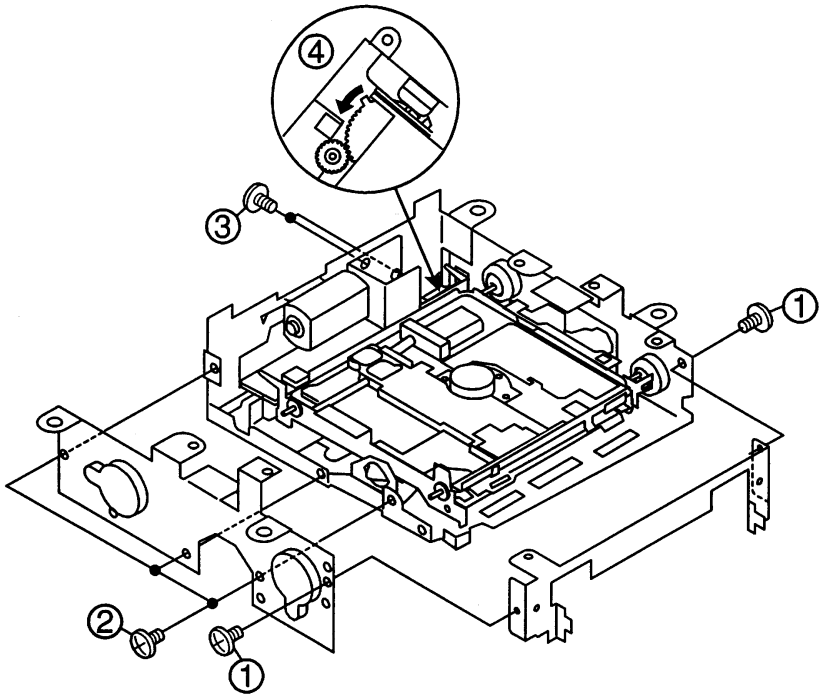


Fig.12

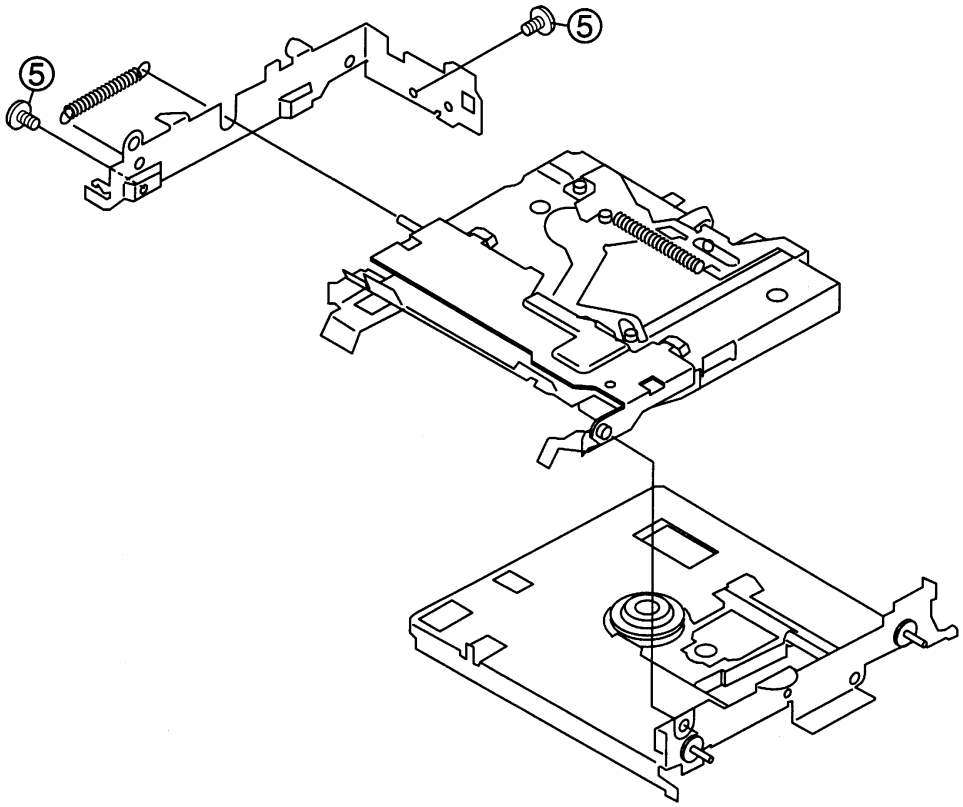


Fig.13

● **How to remove the disc motor**

1. Remove the connector from the mechanism PCB.
2. Release the three screws and remove the disc motor.

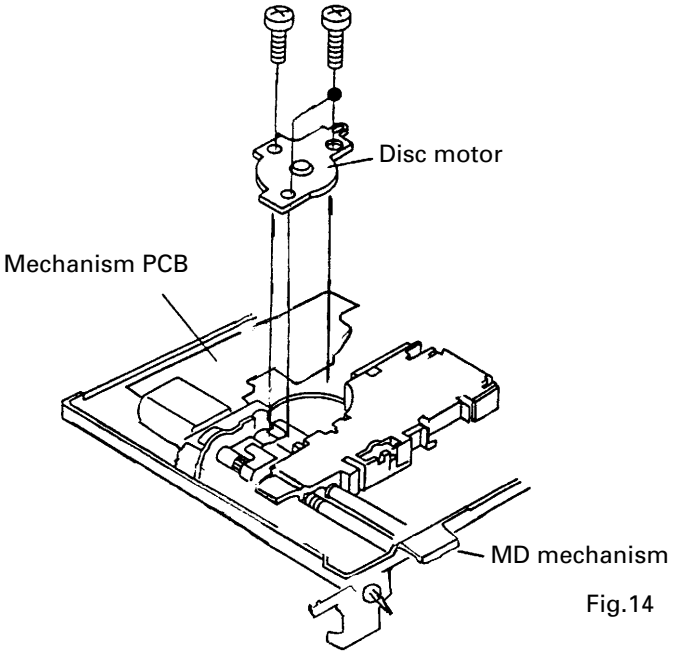


Fig.14

● **How to remove the sled motor.**

1. Remove the two points of solder on the sled motor terminal.
2. Release the two screws and remove the sled motor.

Note) Be sure not to damage the motor gear.

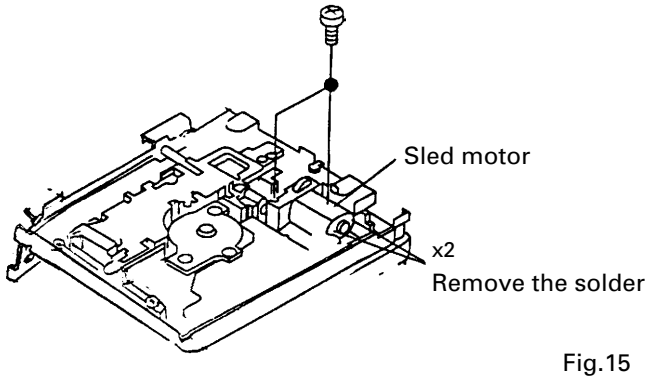


Fig.15

● **How to remove optical pickup**

1. Release the three screws.
2. Pull one shaft out a little to the slide motor side and lift the optical pickup upward slowly.

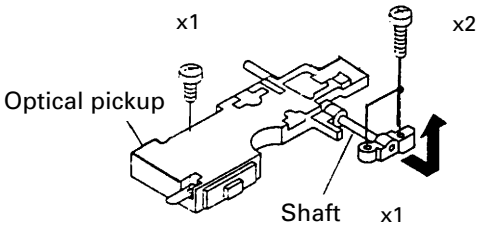


Fig.16