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**Service Manual**

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**Model**

**X-24**

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**multitracker**

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**Fostex®**



### CAUTION

RISK OF ELECTRIC SHOCK  
DO NOT OPEN



CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK,

DO NOT REMOVE COVER (OR BACK).

NO USER-SERVICEABLE PARTS INSIDE.

REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

### CAUTION:

TO PREVENT ELECTRIC SHOCK, MATCH WIDE BLADE OF PLUG TO WIDE SOLT, FULLY INSERT.

### ATTENTION:

POUR ÉVITER LES CHOCS ÉLECTRIQUES, INTRODUIRE LA LAME LA PLUS LARGE DE LA FICHE DANS LA BORNE CORRESPONDANTE DE LA PRISE ET POUSSER JUSQU' AU FOND.



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

### "WARNING"

"TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE."

## SAFETY INSTRUCTIONS

1. Read instructions - All the safety and operating instructions should be read before the appliance is operated.
2. Retain instructions - The safety and operating instructions should be retained for future reference.
3. Heed warnings - All warnings on the appliance and in the operating instructions should be adhered to.
4. Follow instructions - All operating and use instructions should be followed.
5. Water and Moisture - The appliance should not be used near water - for example, near a bathtub, washbowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool, and the like.
6. Carts and Stands - The appliance should be used only with a cart or stand that is recommended by the manufacturer.
7. Wall or Ceiling Mounting - The appliance should be mounted to a wall or ceiling only as recommended by the manufacturer.
8. Ventilation - The appliance should be situated so that its location or position does not interfere with its proper ventilation. For example, the appliance should not be situated on a bed, sofa, rug, or similar surface that may block the ventilation openings; or, placed in a built-in installation, such as a bookcase or cabinet that may impede the flow of air through the ventilation openings.
9. Heat - The appliance should be situated away from heat sources such as radiators, heat registers, stoves, or other appliances (including amplifiers) that produce heat.
10. Power Sources - The appliance should be connected to a power supply only of the type described in the operating instructions or as marked on the appliance.
11. Grounding or Polarization - The precautions that should be taken so that the grounding or polarization means of an appliance is not defeated.
12. Power Cord Protection - Power supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plugs, convenience receptacles, and the point where they exit from the appliance.
13. Cleaning - The appliance should be cleaned only as recommended by the manufacturer.
14. Nonuse Periods - The power cord of the appliance should be unplugged from the outlet when left unused for a long period of time.
15. Object and Liquid Entry - Care should be taken so that objects do not fall and liquids are not spilled into the enclosure through openings.
16. Damage requiring Service - The appliance should be serviced by qualified service personnel when:
  - A. The power supply cord or the plug has been damaged; or
  - B. Objects have fallen, or liquid has been spilled into the appliance; or
  - C. The appliance has been exposed to rain; or
  - D. The appliance does not appear to operate normally or exhibits a marked change in performance; or
  - E. The appliance has been dropped, or the enclosure damaged.
17. Servicing - The user should not attempt to service the appliance beyond that described in the operating instructions. All other servicing should be referred to qualified service personnel.



An appliance and cart combination should be moved with care. Quick stops, excessive force, and uneven surfaces may cause the appliance and cart combination to overturn.

## TABLE OF CONTENTS

1. SPECIFICATIONS .....	4
2. CONTROLS, INDICATORS AND CONNECTORS .....	7
3. ADJUSTING PROCEDURES .....	8
4. EXPLODED VIEW, PCB ASSEMBLY AND PARTS LIST .....	14
5. CIRCUIT & BLOCK DIAGRAMS .....	23

### NOTES

\* Adjusting Procedures, Parts List and circuit diagrams are given in this manual to assist the service technician in maintaining the Model X-24.

\* The following accessories are supplied with X-24 as the standard accessories.

Owner's manual	: 8288418000 (for export & domestic model)
△ AC adaptor AD-12A	: 8270727003 (for USA/CND)
	: 8270727006 (for EUR)
	: 8270727007 (for UK)
	: 8270727010 (for JPN)

\* Following is the packing material for the Model X-24.

Carton, inner, X-24	: 8228715000
Packing, L, X-24	: 8228439001
Packing, R, X-24	: 8228439002

### CAUTION

△ Parts marked with this sign are safety critical components. They must always be replaced with identical components. Refer to the Fostex Parts List and ensure exact replacement.

# 1. SPECIFICATIONS

## DEFINITION

<b>Specification Unit</b>	0 dBV = 1 Vrms
<b>Normal Fader Position</b>	
<b>Input fader</b>	At $8 \pm 1$ position
<b>Condition</b>	LINE IN / INSERT: -10 dBV / 1 kHz Recorder: Input Monitor mode (REC - PAUSE) Adjust input fader for -10 dBV at TAPE OUT. PAN: L (R)
<b>Master fader</b>	At $8 \pm 1$ position
<b>Condition</b>	LINE IN / INSERT: -10 dBV / 1 kHz Recorder: Input Monitor mode (STOP) Adjust master fader for -10 dBV at LINE OUT. PAN: L (R)

## MIXER SECTION

### Standard Input

#### MIC IN

<b>Connector</b>	Phone (unbalanced) / XLR (balanced)
<b>Input level</b>	-50 ~ -10 dBV
<b>Impedance</b>	10 k $\Omega$ or more

#### LINE IN / INSERT (RCV)

<b>Connector</b>	Stereo phone (tip)
<b>Input level</b>	-10 dBV
<b>Impedance</b>	10 k $\Omega$ or more

### Standard Output

#### TAPE OUT 1 ~ 4

<b>Connector</b>	RCA pin
<b>Output level</b>	-10 dBV
<b>Load impedance</b>	10 k $\Omega$ or more

#### LINE OUT L, R

<b>Connector</b>	RCA pin
<b>Output level</b>	-10 dBV
<b>Load impedance</b>	10 k $\Omega$ or more

#### INSERT (SEND)

<b>Connector</b>	Stereo phone (ring)
<b>Output level</b>	-10 dBV
<b>Load impedance</b>	10 k $\Omega$ or more

### Phones Max. Output Level

20 mW or more (1 kHz, 16  $\Omega$  load)

### Level Indication

0 dB is indicated by 5-dot LED bargraph meter when input / output level is -10 dBV with the above standard input / master fader position settings.

### Frequency Response

<b>MIC IN (Input Level: -50 dBV)</b>	40 ~ 20 kHz $\pm$ 3 dB at LINE OUT
<b>MIC IN (Input Level: -10 dBV)</b>	20 ~ 20 kHz $\pm$ 3 dB at LINE OUT
<b>LINE IN (Input Level: -10 dBV)</b>	50 ~ 10 kHz $\pm$ 2 dB at PHONES (10 mW / 16 $\Omega$ )

### S / N (shorted by 150 $\Omega$ resistor)

<b>MIC IN (MIC GAIN: MIC)</b>	66 dB or more at LINE OUT (DIN AUDIO) 68 dB or more at LINE OUT (IHF A)
<b>MIC IN (MIC GAIN: LINE)</b>	73 dB or more at LINE OUT (DIN AUDIO) 75 dB or more at LINE OUT (IHF A)

**MIXER SECTION (continued)**

**Distortion**

(With 400 Hz HPF & 30 kHz LPF)

0.05 % or less (Input: 1 kHz / 0 dBV signal, MIC GAIN: LINE, LINE OUT: 0 dBV.)

0.2 % or less (Input: 1 kHz / 0 dBV signal, MIC GAIN: LINE, PHONES: 3 mW / 16Ω.)

**Fader Attenuation**

70 dB or more at 1 kHz (from standard fader position)

**Crosstalk**

60 dB or more at 1 kHz (Input: MIC IN, MIC GAIN: LINE, OUT: SEND OUT. Measure level at non-input channel.)

**PAN Crosstalk**

42 dB or more at 1 kHz (Input: MIC IN, MIC GAIN: LINE, OUT: LINE OUT. Measure level at non-input channel.)

**Click Noise**

**Power on / off**

-20 dBV<sub>p-p</sub> or less

**Other switching**

-30 dBV<sub>p-p</sub> or less

**Shock Noise**

-30 dBV<sub>p-p</sub> or less (Measure noise level when one side of appliance is dropped 3 times from 5 cm height.)

**RECORDER SECTION**

**Tape Speed**

9.5 cm/s ± 1.5 % (3000 Hz ± 45 Hz when reproducing TCW-211 test tape.)

**Wow & Flutter**

**PLAY**

0.25 % or less (TCW-211 test tape, ANSI WTD.)

**REC & PLAY**

0.30 % or less (AC-514 test tape, ANSI WTD.)

**Pitch Control**

**MIN (PITCH VR: Fully CCW)**

-45 % or less (TCW-211 test tape)

**MAX (PITCH VR: Fully CW)**

+12 % or more (TCW-211 test tape)

**Fast Winding Time (FF / RWD)**

150 ± 20 sec. (TAPE: C-60)

**Tape Counter Deviation**

0 ± 7 (FF from BOT to EOT and then RWD to BOT again.)

**Standard Level**

**PLAY**

-10 ± 1 dB (TCW-231 test tape)

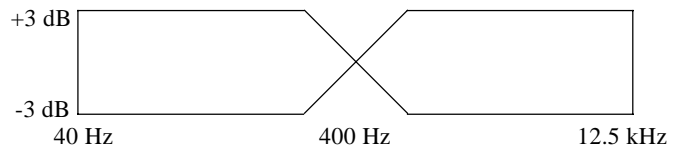
**REC & PLAY**

-10 ± 1 dBV (AC-514 test tape, 1 dB or less of level difference between channels is also required.)

**Frequency response**

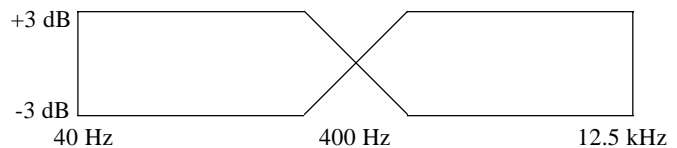
**PLAY**

Test tape: SCW-977 / TCW-284F (NR: OUT)

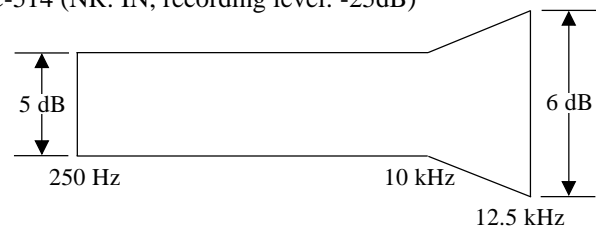


**REC & PLAY**

Test tape: AC-514 (NR: OUT, recording level: 0 dB)



Test tape: AC-514 (NR: IN, recording level: -25dB)



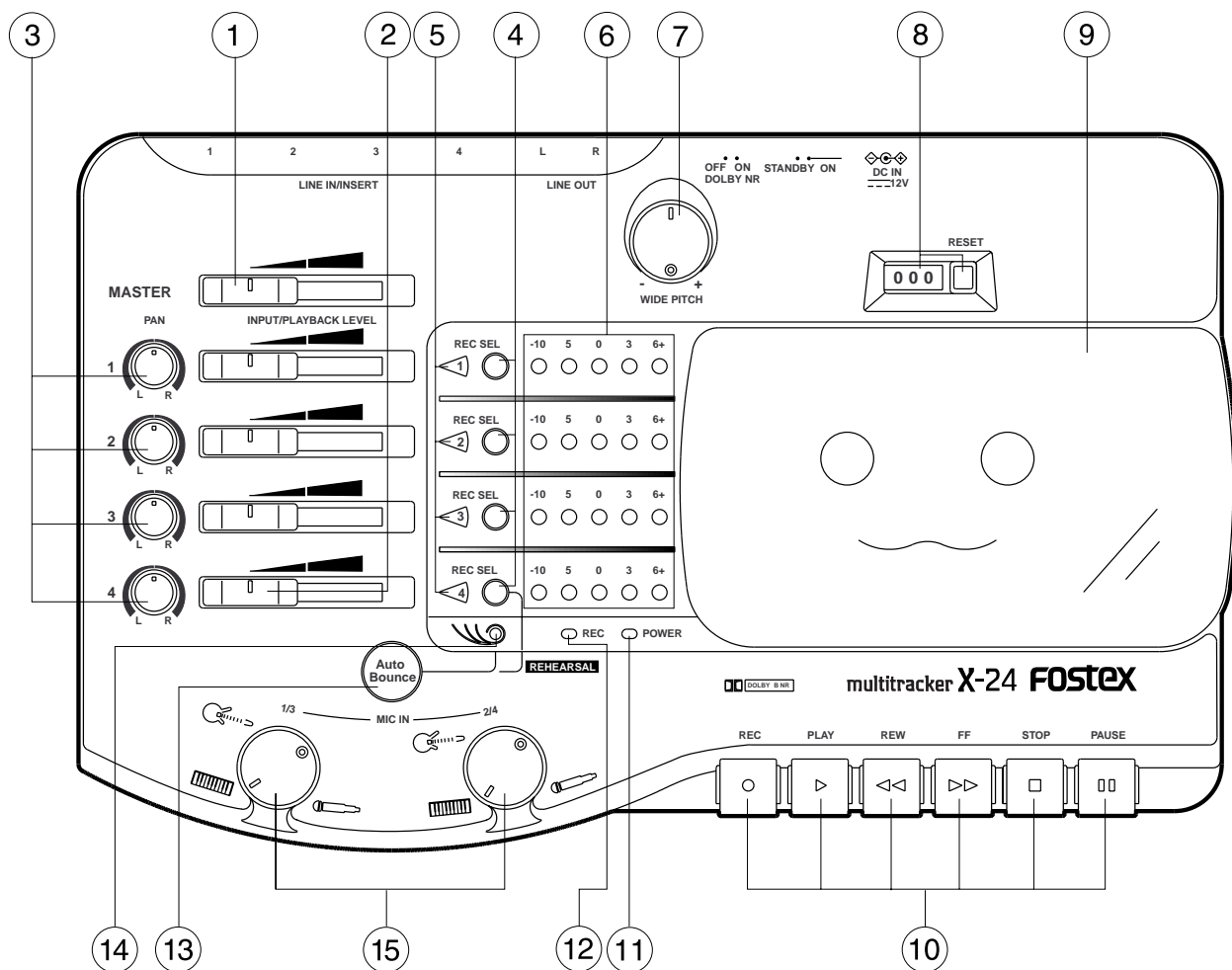
**RECORDER SECTION (continued)****Level Deviation at Reference Output Level**

<b>PLAY</b>	1 dB or less at 400 Hz (NR: OUT, TCW-231 test tape) 3 dB or less at 40 Hz ~ 12.5 kHz (NR: OUT, SCW-977 / TCW-284F test tape)
<b>REC &amp; PLAY</b>	1 dB or less at 400 Hz (NR: OUT, AC-514 test tape) 2 dB or less at 100 Hz ~ 10 kHz (NR: OUT, AC-514 test tape)
<b>S/N</b>	
<b>PLAY</b>	47 dB or more (NR: OUT, DIN AUDIO) 55 dB or more (NR: OUT, IHF-A)
<b>REC &amp; PLAY</b>	45 dB or more (NR: OUT, DIN AUDIO) 48 dB or more (NR: OUT, IHF-A) 48 dB or more (NR: IN, DIN AUDIO) 55 dB or more (NR: IN, IHF-A)
<b>Distortion (REC &amp; PLAY)</b>	2 % or less (Input signal: 1 kHz / standard level, standard fader position, with 400 Hz HPF & 30 kHz LPF)
<b>Erase Ratio</b>	67 dB or more at 1 kHz (Input signal: 1 kHz / 0 dBV, standard fader position, with 1 kHz BPF)
<b>Cross Erasure</b>	1 dB or less (Input signal: 10 kHz / -10 dBV, standard fader position. Measure level difference when adjacent track is put into REC mode.)
<b>Channel Separation</b>	50 dB or more (Input signal: 1 kHz / -10 dBV, standard fader position, with 1 kHz BPF. Measure leakage level when adjacent track is put into REC mode.)
<b>Sync Crosstalk</b>	-25 dBV or less (Input signal: 1 kHz / -10 dBV) -10 dBV or less (Input signal: peak frequency / -10 dBV) (Measure leakage level when adjacent track is put into REC mode.)
<b>Bias Leakage</b>	-35 dBV or less (No LED meter is lit. Standard fader position. Measure leakage level at TAPE OUT when unit is put into REC mode.)
<b>Click Noise</b>	
<b>PLAY → STOP</b>	-30 dBV <sub>p-p</sub> or less
<b>REC → STOP</b>	
<b>Monitor</b>	-20 dBV <sub>p-p</sub> or less
<b>PLAY</b>	-20 dBV <sub>p-p</sub> or less
<b>Punch In / Out</b>	-30 dBV <sub>p-p</sub> or less at PLAY
<b>Shock Noise</b>	-30 dBV <sub>p-p</sub> or less (Measure playback noise level when one side of appliance is dropped 3 times from 5 cm height.)

Specifications and appearance are subject to change without notice for product improvement.

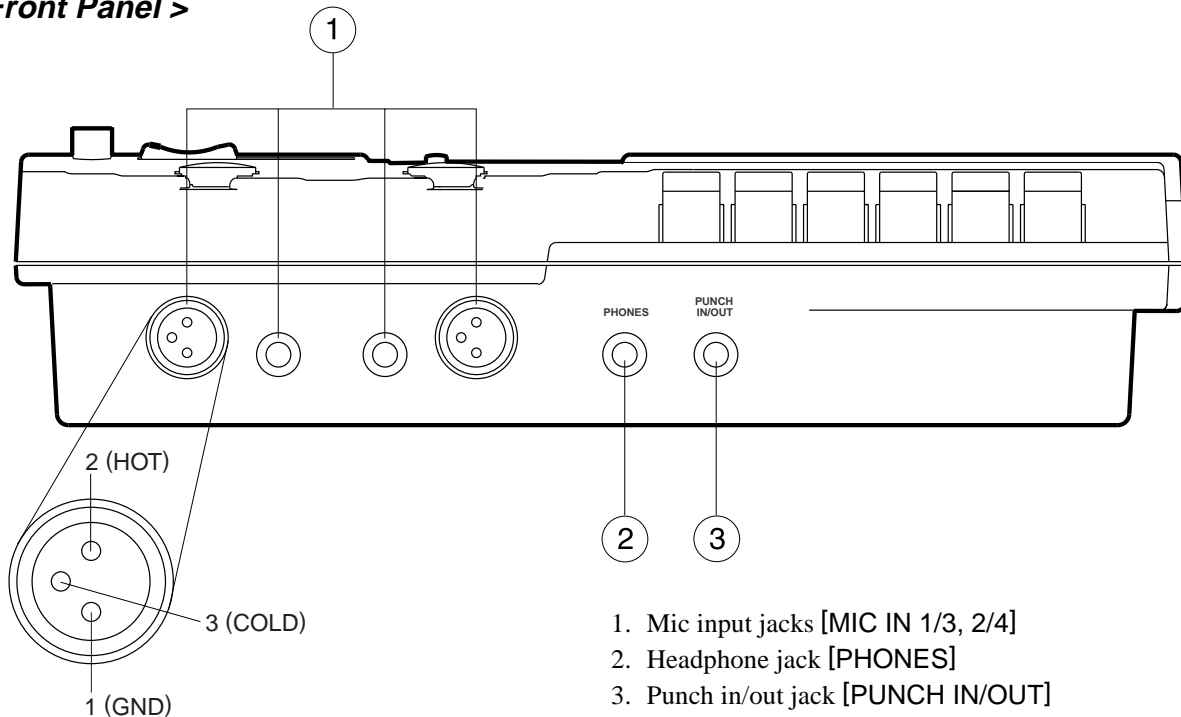
## 2. CONTROLS, INDICATORS & CONNECTORS

< Top Panel >

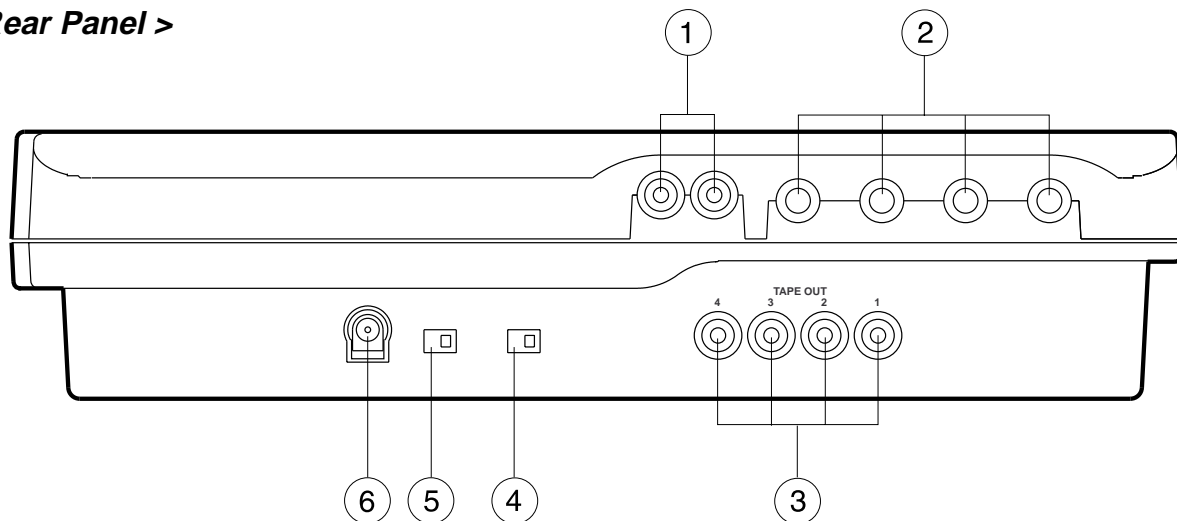


- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. Master fader [MASTER]</li> <li>2. Input/playback level control faders [INPUT/PLAYBACK LEVEL]</li> <li>3. Pan pot knob [PAN]</li> <li>4. Record track select switches [REC SEL]</li> <li>5. Record track LED</li> <li>6. Level meter</li> <li>7. Pitch control knob [WIDE PITCH]</li> <li>8. Tape counter/reset button [RESET]</li> <li>9. Cassette lid/Cassette tray</li> </ol> | <ol style="list-style-type: none"> <li>10. Transport control buttons<br/>                     Play button [PLAY]<br/>                     Stop button [STOP]<br/>                     Fast forward button [FF]<br/>                     Rewind button [REW]<br/>                     Recording button [REC]<br/>                     Pause button [PAUSE]</li> <li>11. Power LED [POWER]</li> <li>12. Record LED [REC]</li> <li>13. Auto bounce on/off button [Auto Bounce]</li> <li>14. Auto bounce LED</li> <li>15. Trim knob</li> </ol> |
|---|--|

## &lt; Front Panel &gt;



## &lt; Rear Panel &gt;

**3. ADJUSTING PROCEDURES****3-1. Routine Maintenance****3-1-1. Cleaning****1) Head**

With constant use, the head surface becomes soiled with magnetic particles from the tape, dirt and dust. Under such conditions, the tape will not always be in smooth contact with the head and thus result in poor performance. Less



output in the high region and dropout (some parts of sound not reproduced) are typical symptoms. It is therefore recommended to clean the heads periodically before recording and playback to avoid such troubles.

## 2) Capstan and pinch roller

Buildup of magnetic particles and dust on these parts will cause increase in wow, flutter and wrapping of tape on the capstan. Thus, these parts must always be kept clean. Cleaning is done with cotton buds moistened with fluids prescribed or recommended for tape recorders and especially the heads. Never use lacquer thinner, acetone or other organic solvents.

## 3-1-2. Demagnetizing

The REC/PLAY head becomes magnetized by extended use or when the head is touched with a magnetized object. As a result, frequency response especially in the high region will deteriorate, noise level increases, and in some cases may transfer noise to valuable prerecorded tapes. For this reason, do not touch the head with magnetized screwdriver and scissors or allow DC current to flow through the head winding such as when testing continuity with a circuit tester. Should the head becomes magnetized, demagnetize it with a head demagnetizer designed for this purpose.

### Demagnetizing Procedures

- 1) After turning off the power of Model X-24, open the cassette lid and if a cassette tape is loaded, remove and place it far away from the deck.
- 2) Switch on the head demagnetizer while holding it about one meter away from the Model X-24. Then, slowly move the head demagnetizer tip to the head and wave the tip up and down several times close to the head surface.
- 3) On completing the above procedures, slowly draw the demagnetizer away from the head and switch it off when it is more than one meter away from the head. As demagnetism in the head cannot be seen, unlike the soiled head, routine demagnetizing is necessary. It is recommended to do so at the same time the head is cleaned.

## 3-2. Test Equipment and Adjusting Tools

The following tools and equipment are required for adjusting the Model X-24.

- |   |  |
|---|--|
| 1) Head height and tape contact adjusting jig | Model 9001 (P/N: 8286001000)   |
| 2) Torque meter                               |  |
| Cassette torque meter                         | TW-2231 (P/N: 8286008000): 0 ~ 200 g-cm (0 ~ 2.8 Oz-In)              |
| Cassette torque meter                         | TW-2111A (P/N: 8286009000): 0 ~ 100 g-cm (0 ~ 1.4 Oz-In)             |
| 3) Mirror tape cassette                       | TCC-902 (P/N: 8286002000)  |
| 4) Test tape                                  |  |
| Speed / Flutter (3 kHz)                       | Model 9152 (P/N: 82660022000)  |
|   | Also 3150 Hz test tape for Wow & Flutter measurement is recommended. |
| Reference playback level                      | TCW-231 (P/N: 8266002000)  |
| Playback frequency response                   | TCW-284F (P/N: 8266003000)   |
| 5) Blank tape                                 | C-90 or shorter tape, TYPE II / HIGH position                        |
| 6) Audio oscillator                           | General type   |
| 7) Frequency counter                          | General type   |
| 8) Bandpass filter                            | General type   |
| 9) AC voltmeter                               | Stereo type is recommended.  |
| 10) Oscilloscope                              | General type   |
| 11) Wow & Flutter meter                       | General type   |
| 12) Distortion meter                          | General type   |
| 13) Frequency counter                         | General type   |

### 3-3. Tape Transport Mechanical Data

#### 3-3-1. Reel torque

- |                          |                        |
|--------------------------|------------------------|
| 1) PLAY mode (TW-2111A)  | Supply: 1.5 ~ 6 g-cm   |
|                          | Takeup: 20 ~ 70 g-cm   |
| 2) FF/REW mode (TW-2231) | FF /REW: 60 ~ 120 g-cm |

#### 3-3-2. Pinch roller pressure

- |            |             |
|------------|-------------|
| Pull force | 300 ~ 500 g |
|------------|-------------|

### 3-4. Tape Travel Check and Adjustment

Using the mirror type cassette, check to see that the tape is running stable between the ERASE and REC/PLAY heads tape guides without weaving. If the tape is not running stable between the guides, erasure and frequency response will be affected or the tape will be damaged by curling. It then becomes necessary to check the guide height, perpendicularity of the head surface, and alignment of the pinch roller in relation to the capstan. In addition to the mirror type cassette, the Head Height and Tape Contact Jig is required. To check the head guide height, the cassette tape is removed and the above jig is placed on the head mount base plate. While firmly seating the jig on the base plate surface, slide the jig past each head guide to see that it goes through without hitting them. Also check perpendicularity of each head surface, using the rear check bar of the jig. If the guide is low, insert the required amount of 0.1 mm or 0.2 mm thick washers under the head mounting legs, or vice versa, if it is high.

**NOTE:** Always adjust the head azimuth and phase when the head height is adjusted.

### 3-5. Volume & SW setting

- |              |                                  |
|--------------|----------------------------------|
| Input fader  | At $8 \pm 1$ position            |
| Master fader | At $8 \pm 1$ position            |
| Pan          | Fully CCW (L) or CW (R) position |

### 3-6. Check and Adjusting of Head Azimuth

- 1) Switch off the DOLBY SW.
- 2) Connect an AC volt meter to the TAPE OUT and playback the 12.5 kHz section on the TC-284W test tape.
- 3) Rotate the REC/PLAY head azimuth adjusting screw to obtain a maximum output level.

### 3-7. Tape Speed Check and Adjustment

- 1) Confirm that the Pitch control knob is at center position.
- 2) Connect a frequency counter or wow & flutter meter with frequency counter to the TAPE OUT and playback the Model 9152 test tape.
- 3) Check the tape speed and wow & flutter if they satisfy the following specifications.
 

Tape Speed:	3000 Hz $\pm$ 30 Hz at both BOT (beginning of tape) and EOT (end of tape) positions
Wow & Flutter:	0.25 % (CCIR WTD) at both BOT and EOT positions
- 4) If the tape speed is not within the above specification, adjust R43 (3.3 k $\Omega$ ) on the R/P AMP PCB assy.
- 5) Next, check if the tape speed variable range satisfies the specifications below.
 

Maximum tape speed:	+12 % or more (3360 Hz or more)
Minimum tape speed:	-45 % or less (1650 Hz or less)

### 3-8. Playback Level Calibration

- 1) Set the controls as follows.
 

Record track select switch:	OFF
Dolby B noise reduction on/off switch:	OFF
- 2) Connect an AC volt meter to the TAPE OUT 1 through 4 pin jacks.

- 3) Playback the TCW-231 test tape and check the output level if it is  $-10 \text{ dBV}$  ( $0.3 \text{ V}$ )  $\pm 1 \text{ dB}$  reading.
- 4) If the reading is not within the above range, adjust R106 ~ R406 on the R/P AMP PCB assy.

### 3-9. Playback Frequency Response Calibration

- 1) Set the controls as follows.
  - Record track select switch: OFF
  - Dolby B noise reduction on/off switch: OFF
- 2) Connect an AC volt meter to the TAPE OUT 1 through 4 pin jacks respectively.
- 3) Playback the TCW-284F test tape and adjust R103 ~ R403 so that the output level at 6.3 kHz is 0.5 dB lower than the 400 Hz output level.
- 4) Confirm that the output level at 12.5 kHz is within  $\pm 1 \text{ dB}$  of the 400 Hz output level.

### 3-10. Erase Current Adjustment

At adjusting the erase current, put a blank cassette tape to the transport and the track to be adjusted is put in REC mode. Assuming the track 1 to be adjusted, the oscilloscope probe is connected to the test point TP106 on the R/P PCB assy and rotate and fix the core T101 for minimum voltage point. Then, confirm that the voltage at TP105 is more than 55 mV.

**NOTE:** If the voltage at TP106 is adjusted at minimum, the erase current flowing the erase head is set to the maximum.

Adjust the remaining tracks in the same way.

Track 2: Adjust T201 for minimum voltage at TP206. Then, confirm that the voltage at TP205 is more than 55 mV.

Track 3: Adjust T301 for minimum voltage at TP306. Then, confirm that the voltage at TP305 is more than 55 mV.

Track 4: Adjust T401 for minimum voltage at TP406. Then, confirm that the voltage at TP405 is more than 55 mV.

### 3-11. Coarse Bias Adjustment

At coarsely adjusting the bias current, put a blank cassette tape to the transport and the track to be adjusted is put in REC mode. Assuming the track 1 to be adjusted, the oscilloscope probe is connected to the test point TP104 on the R/P PCB assy and rotate and fix the pot R133 (220 k $\Omega$ ) at 60 mV.

Adjust the remaining tracks in the same way.

Track 2: Adjust R233 so that the voltage at TP204 is 60 mV.

Track 3: Adjust R333 so that the voltage at TP304 is 60 mV.

Track 4: Adjust R433 so that the voltage at TP404 is 60 mV.

### 3-12. Record Level Calibration

\* The procedures up to 3-10 must be completed before proceeding to this adjustment.

- 1) Put a blank cassette tape to the transport and apply a 400 Hz,  $-10 \text{ dBV}$  ( $0.3 \text{ V}$ ) sine wave signal to the INPUT 1 and 2 phone jacks. (In the case the signal is input from XLR jack, the terminal No.3 (COLD) and No. 1 (GND) must be shortened.)
- 2) Set the controls as follows.
  - Record track select switch: All tracks ON (Confirm that the REC TRK LEDs (1 ~ 4) are blinking.)
  - Trim knob: At minimum
  - Dolby B noise reduction on/off switch: OFF
- 3) Connect an AC volt meter to the TAPE OUT 1 ~ 4 pin jacks.
- 4) Put the transport into REC PAUSE mode and adjust the Input Fader so that the level at TAPE OUT 1 ~ 4 is  $-10 \text{ dBV}$  ( $0.3 \text{ V}$ ).
- 5) Release the PAUSE button and start recording the signal.
- 6) After recording a certain length, rewind the tape to the start point of recording section. Then, playback the tape and check the level at TAPE OUT 1 ~ 4. If the AC volt meter reading is not within  $-10 \text{ dBV}$  ( $0.3 \text{ V}$ )  $\pm 0.5 \text{ dB}$ , adjust the pot R121 ~ 421 (22 k $\Omega$ ) on the R/P PCB assy.

### 3-13. Overall Frequency Response Adjustment

- 1) Set the controls under the same condition as 3.12 except the DOLBY switch. (The switch should be turned on.)
- 2) Apply a 400 Hz, -35 dBV (18 mV) signal to the INPUT 1 and 2 phone jacks.
- 3) Record the signal, rewind and playback the recorded section of the tape and memorize the output level at TAPE OUT 1 ~ 4.
- 4) Next, apply 6 kHz & 12 kHz, -35 dBV (18 mV) signals to the INPUT 1 and 2 phone jacks.
- 5) Record the signal, rewind and playback the recorded section of the tape.
- 6) Check if the 6 kHz / 12 kHz output level at TAPE OUT 1 ~ 4 is within  $\pm 2$  dB comparing to the 400 Hz output level. If the AC volt meter reading is not within the above specification, adjust the pot R133 ~ 433 (220 k $\Omega$ ) on the R/P AMP PCB assy so that the recording level at 6 kHz will be within the specification.

### 3-14. T.H.D. Measurement

- 1) Connect a distortion meter, 400 Hz HPF and 30 kHz LPF to TAPE OUT 1 ~ 4 and set the controls under the same condition as 3-12.
- 2) Record a 1 kHz, -10 dBV (0.3 V) sine wave signal.
- 3) Playback the recorded part and check if the distortion level is less than 2 %.

### 3-15. Erasure Measurement

- 1) Connect a 1 kHz bandpass filter and AC volt meter to TAPE OUT 1 ~ 4 and set the controls under the same condition as 3-12.
- 2) Record a 1 kHz, 0 dBV (1 V) sine wave signal which is 10 dB higher than the reference recording level on a blank tape.
- 3) Rewind the tape to the start point of recording and advance it by a short length. Then, record again without applying the signal on the remaining part.
- 4) Rewind the tape to the start point again and play it back. Check if the level ratio between the playback level and no-signal section (erased part) is 67 dB or more.

### 3-16. Cross Erasure Measurement

- 1) Set the controls as follow.  
 Trim knob: At minimum  
 Input fader: Standard position (At  $8 \pm 1$ )  
 Dolby B noise reduction on/off switch: OFF
- 2) Input a 100 kHz, -10 dBV signal to the INPUT 1 and 2 phone jacks and record the signal on all tracks.
- 3) Rewind the tape to the start point of recording. Then, erase the 10 kHz signal on the track and check if the level difference at the corresponding track indicated below is within 1 dB.

Tracks to be measured	Track (s) to be erased
1	2
2	1 and 3
3	2 and 4
4	3

- 4) If the level goes down by more than 1 dB, check the tape running path again.

### 3-17. Sync crosstalk measurement

Sync crosstalk is a relative figure against the reference level, on how much of the recording signal from a track in recording mode is leaking into the track being reproduced. When sync crosstalk is excessively high, playback output during overdubbing will sound muddy by effect of the recording signal leakage or cause oscillation at pingpong recording (where the playback output is transferred to another track).

- 1) Set the controls as follow and put a blank tape to the transport.
  - Trim knob: At minimum
  - Input fader: Standard position (At  $8 \pm 1$ )
  - Dolby B noise reduction on/off switch: OFF
- 2) Apply a signal whose level is -10 dBV (0.3 V).
- 3) Put one track into REC mode and check if the level at TAPE OUT on an adjacent track is within the specifications listed below when sweeping the oscillator frequency.
  - At 1 kHz: -25 dBV or less
  - 1 ~ 20 kHz: -10 dBV or less

### 3-18. S/N Measurement

#### 3-18-1. Reproduce

- 1) Set the control as follow.
  - Dolby B noise reduction on/off switch: OFF
- 2) Connect an AC volt meter and put the transport into PLAY mode without loading a tape.
- 3) Check if the AC volt meter reading is within the following specifications.
  - DIN AUDIO: 47 dB
  - IHF-A: 55 dB

#### 3-18-2. Record and reproduce (Overall)

- 1) Set the control as follow.
  - Dolby B noise reduction on/off switch: OFF
- 2) Put a blank cassette tape and start recording without applying a signal.
- 3) Rewind the tape to the start point and play it back.
- 4) Check if the AC volt meter reading is within the following specifications.
  - DIN AUDIO: 45 dB
  - IHF-A: 48 dB
- 5) Next, turn the Dolby switch on and repeat the above procedures 2) ~ 4).
- 6) Check if the AC volt meter reading is within the following specifications.
  - DIN AUDIO: 48 dB
  - IHF-A: 55 dB

### 3-19. Click Noise Measurement

#### 3-19-1. Dolby switch on/off

- 1) Check if the click noise level at TAPE OUT when turning on/off the Dolby switch is less than -30 dBV<sub>p-p</sub>.

#### 3-19-2. REC/STOP (monitor)

- 1) Check if the click noise level at TAPE OUT when punching out by pressing the STOP button is less than -20 dBV<sub>p-p</sub>.

#### 3-19-3. REC/STOP (on tape)

- 1) Turn off the Dolby switch, turn on all the 1 ~ 4 record track switches and put a blank cassette tape in the transport.
- 2) Plug the foot switch (e.g. Model 8051) in the Punch in/out jack and press the PLAY button.
- 3) Press the foot switch repeatedly and check if the click level at TAPE OUT 1 ~ 4 is less than -20 dBV<sub>p-p</sub>.

### 3-20. Table of Adjusting Items

Adjusting Item	Measuring Point	Adjusting Point	Ref. Clause (page)
Tape speed	TAPE OUT	R43 (R/P)	3-7 (P10)
Playback level calibration	TAPE OUT 1 ~ 4	R106 ~ R406 (R/P)	3-8 (P10 ~ 11)
Playback frequency response calibration	TAPE OUT 1 ~ 4	R103 ~ R403 (R/P)	3-9 (P11)
Erase current adjustment	TP106 ~ TP406	T101 ~ 401 (R/P)	3-10 (P11)
	TP105 ~ TP405		
Coarse bias adjustment	TP104 ~ 404	R133 ~ 433	3-11 (P11)
Record level calibration	TAPE OUT 1 ~ 4	R121 ~ 421	3-12 (P11)
Overall frequency response adjustment	TAPE OUT 1 ~ 4	R133 ~ 433	3-13 (P12)

## 4. EXPLODED VIEW, PCB ASSEMBLY AND PARTS LIST

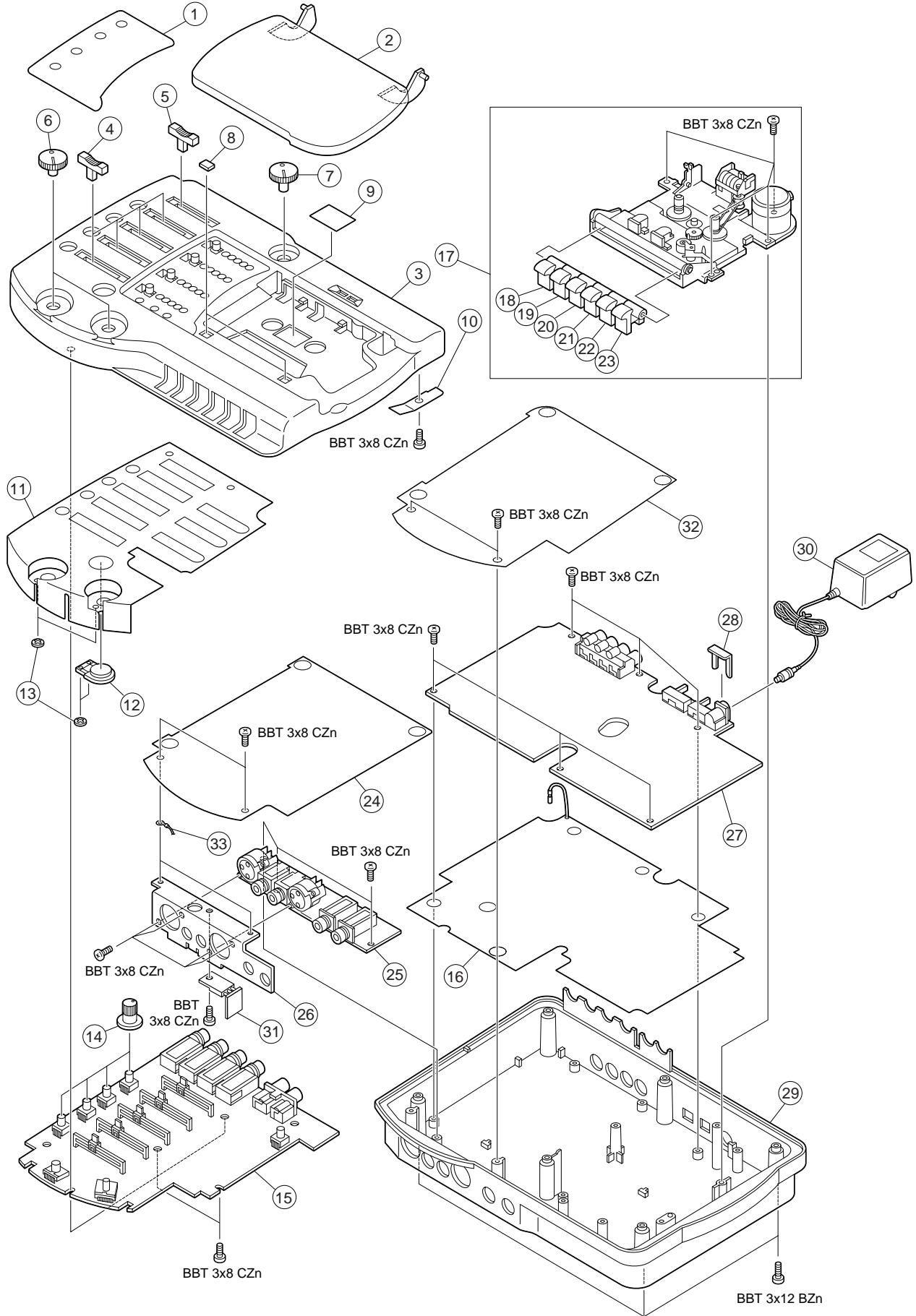
### ● X-24 OVERALL EXPLODED VIEW & PARTS LIST

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
1	8216 6580 00	Sheet, meter, X-24	20	8226 2091 01	Knob, cassette, REW, X-14/24
2	8212 5931 00	Cover, cassette, X-14/24	21	8226 2081 01	Knob, cassette, FF, X-14/24
3	8212 6050 00	Case, top, X-24	22	8226 2111 01	Knob, cassette, STOP, X-14/24
4	8226 1590 04	Knob, fader, N7, GR	23	8226 2121 01	Knob, cassette, PAUSE, X-14/24
5	8226 1590 05	Knob, fader, N7, R	24	8216 6600 00	Shield, center, X-24
6	8226 2070 02	Knob, pitch, gain, N7	25	8274 1340 00	PCB assy, Jack, X-24
7	8226 2070 01	Knob, pitch, N7	26	8221 2260 00	Bracket, jack, X-24
8	8216 6490 00	Cushion, cover, X-14/24	△ 27	8274 1350 00	PCB assy, R/P, X-24
9	8216 4230 00	Reflector, cassette	28	8204 0820 00	Plate, mounting, B
10	8214 2110 00	Spring, cassette, X-18/14/24	29	8212 6060 00	Case, bottom, X-24
11	8216 6590 00	Shield, top, X-24	△ 30	8270 7270 03	AC adaptor, AD-12A, USA/CND
12	8226 2360 01	Knob, sel, bounce, X-24		8270 7270 06	AC adaptor, AD-12A, EUR
13	8204 0370 01	Ring, CSTW-2		8270 7270 07	AC adaptor, AD-12A, UK
14	8226 1620 05	Knob, volume, N7, Y		8270 7270 10	AC adaptor, AD-12A, JPN
15	8274 1330 00	PCB assy, Mixer, X-24	△ 31	8274 1400 00	PCB assy, Regulator, X-24
16	8216 6610 00	Shield, bottom, X-24	32	8216 6800 00	Sheet, isolation X-24
17	8270 8240 00	Transport assy, X-24	33	8277 4470 15	Cable assy, 1P, earth lug, D3-8MF/F, L150
18	8226 2131 01	Knob, cassette, REC, X-14/24			
19	8226 2101 01	Knob, cassette, PLAY, X-14/24			

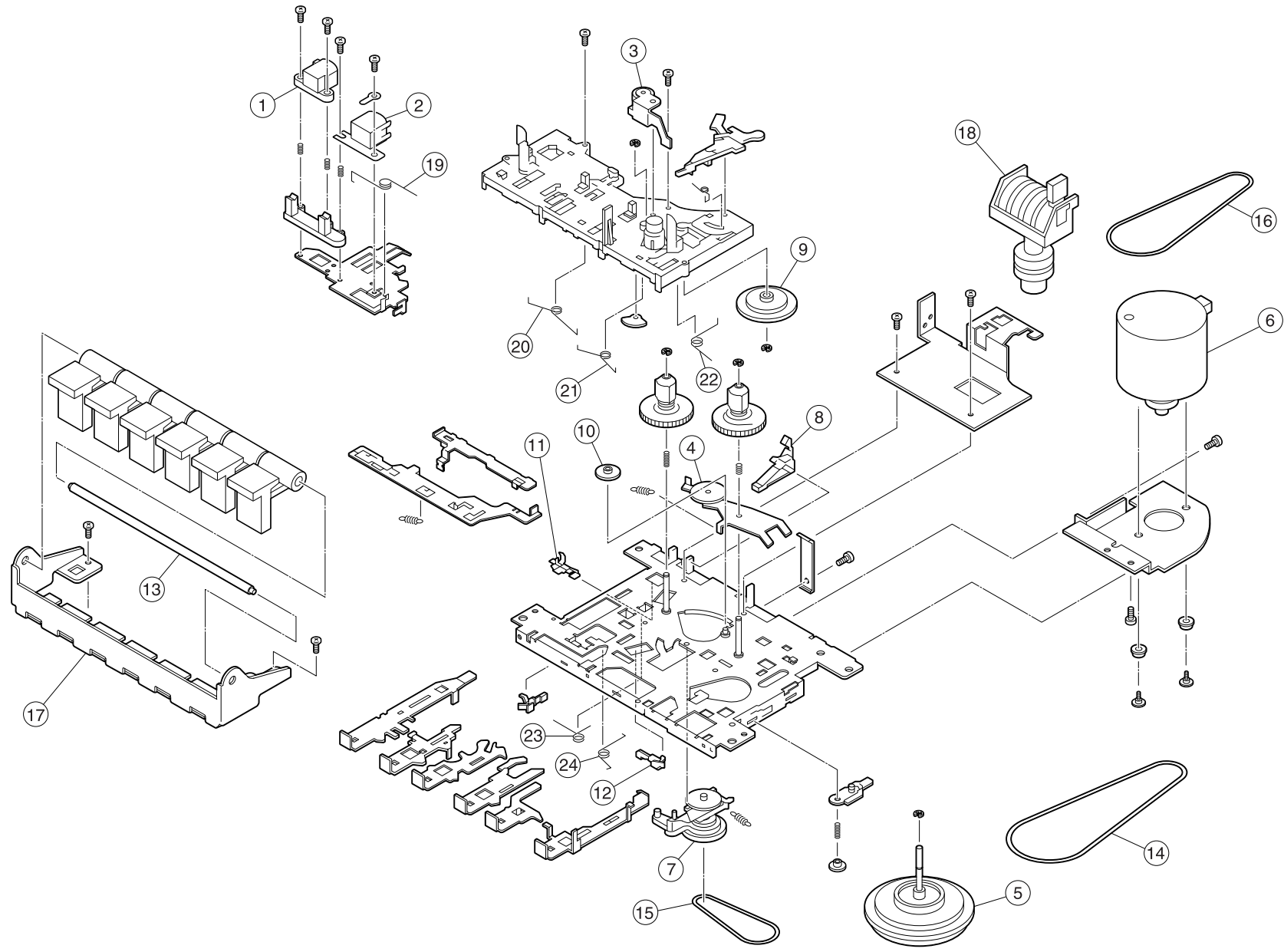
### ● X-24 TRANSPORT EXPLODED VIEW & PARTS LIST

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
1	8259 0500 00	Head, erase, X-14/24	13	8223 2770 00	Shaft, button
2	8259 0520 00	Head, R/P, 4T, N-LR44RS07, X-24	14	8216 5310 00	Belt, main
3	8260 4620 00	Pinch roller assy	15	8216 5320 00	Belt, sub
4	8260 4630 00	Idler arm assy	16	8216 5330 00	Belt, counter
5	8260 4640 00	Fly wheel assy	17	8221 1970 00	Bracket, button
6	8260 4650 00	Motor assy	18	8256 1690 00	Counter
7	8260 4660 00	F.R. arm assy	19	8214 3550 00	Spring, pinch arm
8	8212 4930 00	Lever, REC safety	20	8214 3560 00	Spring, FR torsion
9	8212 4910 00	Gear, arm	21	8214 3570 00	Spring, stop/pause
10	8212 4920 00	Gear, FF	22	8214 3580 00	Spring, safety sensor
11	8253 4280 00	SW, leaf, MSW-1541XACV	23	8214 3590 00	Spring, rec lever
12	8253 4290 00	SW, leaf, MSW-1716CV	24	8214 3600 00	Spring, play lever

● X-24 OVERALL EXPLODED VIEW

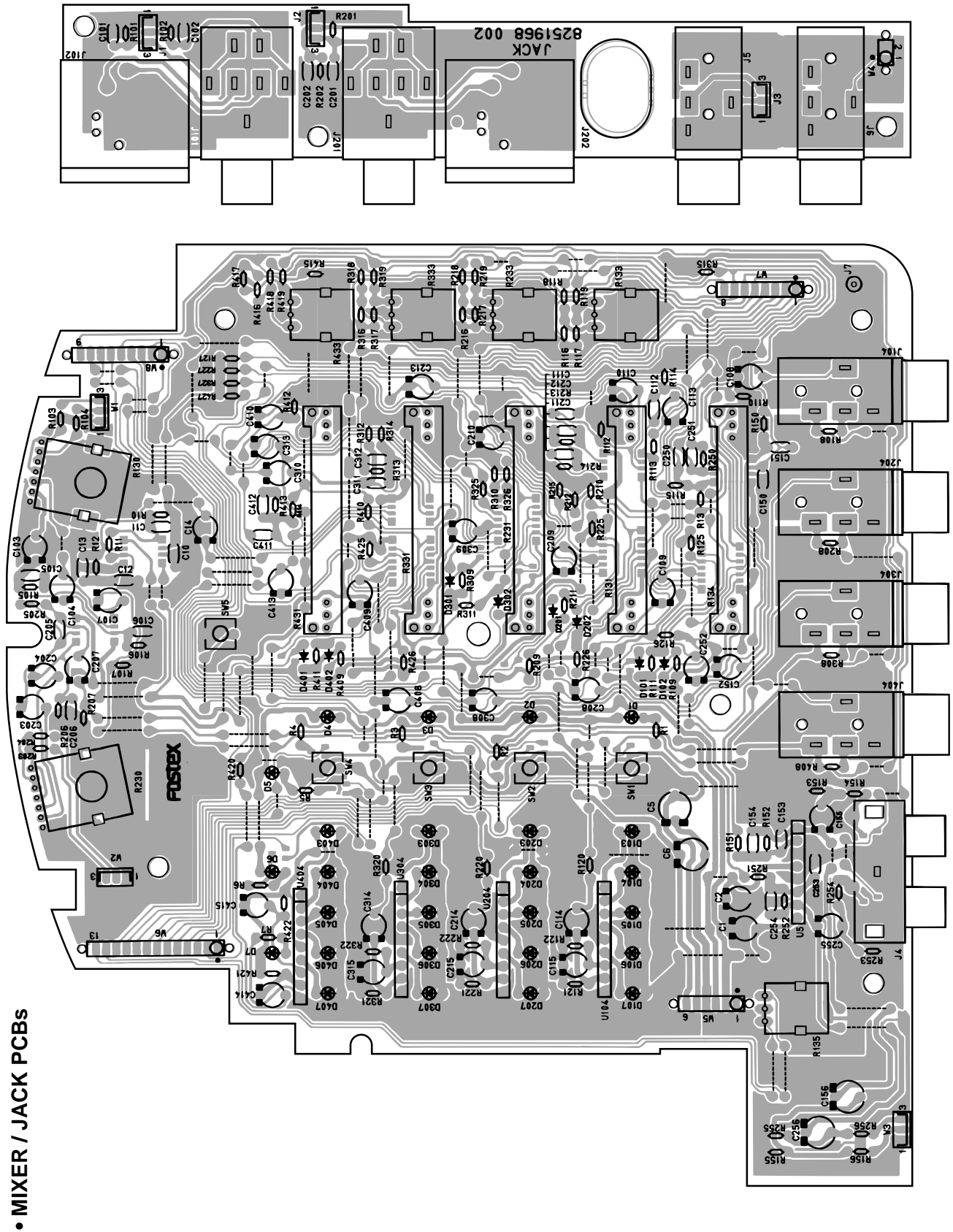


### ● X-24 TRANSPORT EXPLODED VIEW



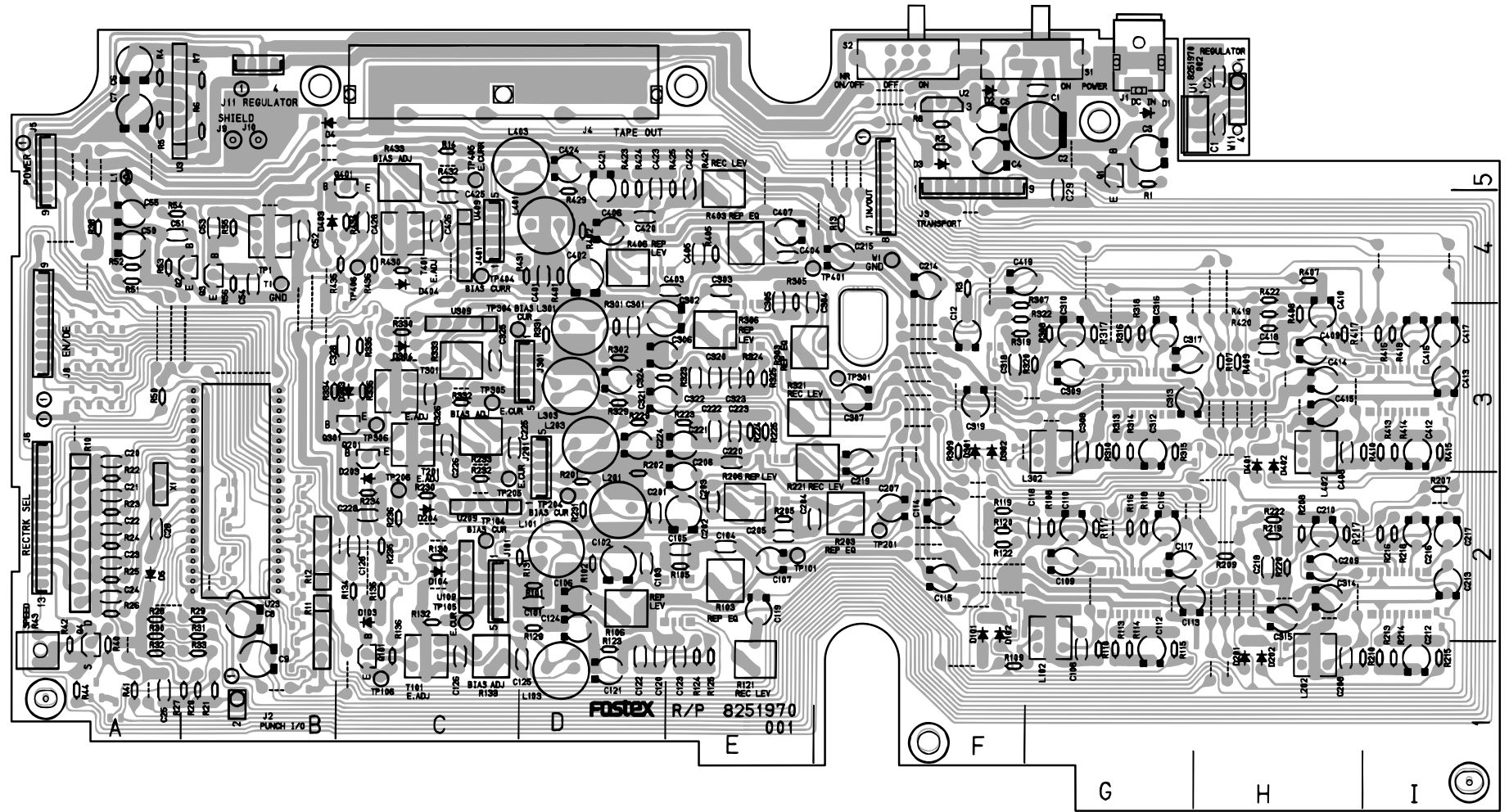


● X-24 PCB PATTERN DRAWING



● MIXER / JACK PCBs

• R/P / REGULATOR PCBs



## ● X-24 Parts List

### • MIXER PCB

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
	8274 1330 00	PCB assy, Mixer, X-24	R108~408	8230 1384 32	HT, carbon, 1/4W, 4.3kΩ, 5%
B001	8251 9680 01	Plain PCB, Mixer, X-24	R109~409	8230 1383 03	HT, carbon, 1/4W, 30kΩ, 5%
<b>ICs</b>					
Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
U001	8236 5405 00	ST, analog, NJM2068M	R110~410	8230 1384 73	HT, carbon, 1/4W, 47kΩ, 5%
U002~004	8236 7207 00	ST, analog, NJM4560M	R111~411	8230 1381 23	HT, carbon, 1/4W, 12kΩ, 5%
U005	8236 0352 03	SIP, analog, NJM4556AL	R112~412	8230 1381 04	HT, carbon, 1/4W, 100kΩ, 5%
U006	8236 7207 00	ST, analog, NJM4560M	R113~413	8230 1381 23	HT, carbon, 1/4W, 12kΩ, 5%
U007~012	8236 5707 01	ST, digital, DTA144EK	R114~414	8230 1381 23	HT, carbon, 1/4W, 12kΩ, 5%
U101~401	8236 5000 00	ST, digital, CMOS, 4066BF	R115~415	8230 1384 73	HT, carbon, 1/4W, 47kΩ, 5%
U102~402	8236 5706 01	ST, digital, DTC144EK	R116~416	8230 1382 43	HT, carbon, 1/4W, 24kΩ, 5%
U103~403	8236 5706 01	ST, digital, DTC144EK	R117~417	8230 1382 43	HT, carbon, 1/4W, 24kΩ, 5%
U104~404	8236 0832 00	SIP, analog, LED driver, BA6124	R118~418	8230 1383 03	HT, carbon, 1/4W, 30kΩ, 5%
U105~205	8236 5702 01	ST, digital, driver, DTC314TK	R119~419	8230 1383 03	HT, carbon, 1/4W, 30kΩ, 5%
<b>DIODES</b>					
Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
D001~005	8234 1046 02	Opt., VT, LED, GRN, SLR-332MC-TE7	R120~420	8230 1381 23	HT, carbon, 1/4W, 12kΩ, 5%
D006	8234 1046 01	Opt., VT, LED, RED, SLR-332VC-TE7	R121~421	8230 1385 12	HT, carbon, 1/4W, 5.1kΩ, 5%
D007	8234 1046 02	Opt., VT, LED, GRN, SLR-332MC-TE7	R122~422	8230 1381 03	HT, carbon, 1/4W, 10kΩ, 5%
D101~401	8234 5007 00	HT, 1SS136	R125~425	8230 1384 73	HT, carbon, 1/4W, 47kΩ, 5%
D102~402	8234 5007 00	HT, 1SS136	R126~426	8230 1381 23	HT, carbon, 1/4W, 12kΩ, 5%
D103~403	8234 1046 03	Opt., VT, LED, YEL, SLR-332YC-TE7	R127~427	8230 1381 23	HT, carbon, 1/4W, 12kΩ, 5%
D104~404	8234 1046 03	Opt., VT, LED, YEL, SLR-332YC-TE7	R130, 230	8240 1710 28	Pot, PI, RT14, 100kΩCC, RK14K123, L15
D105~405	8234 1046 03	Opt., VT, LED, YEL, SLR-332YC-TE7	R131	8240 2740 03	Pot, PI, SL30, 20kΩA, RS30H111
D106~406	8234 1046 01	Opt., VT, LED, RED, SLR-332VC-TE7	R133~433	8240 1670 06	Pot, PI, RT09, 50kΩB, RK09K113
D107~407	8234 1046 01	Opt., VT, LED, RED, SLR-332VC-TE7	R134~434	8240 2740 04	Pot, PI, SL30, 20kΩAA, RS30H121
<b>RESISTORS</b>					
Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
R001~007	8230 1387 51	HT, carbon, 1/4W, 750Ω, 5%	R135	8240 1670 08	Pot, PI, RT09, 10kΩB, RK09K113
R010~012	8230 1381 23	HT, carbon, 1/4W, 12kΩ, 5%	R150, 250	8230 1386 83	HT, carbon, 1/4W, 68kΩ, 5%
R013	8230 1384 73	HT, carbon, 1/4W, 47kΩ, 5%	R151, 250	8230 1381 23	HT, carbon, 1/4W, 12kΩ, 5%
R103, 203	8230 1381 02	HT, carbon, 1/4W, 1kΩ, 5%	R152, 252	8230 1382 43	HT, carbon, 1/4W, 24kΩ, 5%
R104, 204	8230 1381 02	HT, carbon, 1/4W, 1kΩ, 5%	R153, 253	8230 1384 73	HT, carbon, 1/4W, 47kΩ, 5%
R105, 205	8230 1381 04	HT, carbon, 1/4W, 100kΩ, 5%	R154, 254	8230 1381 02	HT, carbon, 1/4W, 1kΩ, 5%
R106, 206	8230 1381 04	HT, carbon, 1/4W, 100kΩ, 5%	R155, 255	8230 1384 73	HT, carbon, 1/4W, 47kΩ, 5%
R107, 207	8230 1384 73	HT, carbon, 1/4W, 47kΩ, 5%	R156, 256	8230 1381 60	HT, carbon, 1/4W, 16Ω, 5%
<b>CAPACITORS</b>					
ALU = Electrolytic type					
CER = Ceramic type					
Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
C001, 002	8232 1424 76	VT, ALU, 10V, 47μF, 20%, SME	C010	8232 8012 21	VT, CER, 50V, 220pF, 5%, SL
C005, 006	8232 1424 76	VT, ALU, 10V, 47μF, 20%, SME	C011	8232 8012 20	VT, CER, 50V, 22pF, 5%, SL
C010	8232 8012 21	VT, CER, 50V, 220pF, 5%, SL	C012	8232 8012 21	VT, CER, 50V, 220pF, 5%, SL
C011	8232 8012 20	VT, CER, 50V, 22pF, 5%, SL	C013	8232 8012 20	VT, CER, 50V, 22pF, 5%, SL
C012	8232 8012 21	VT, CER, 50V, 220pF, 5%, SL	C014	8232 1431 06	VT, ALU, 16V, 10μF, 20%, SME
C013	8232 8012 20	VT, CER, 50V, 22pF, 5%, SL	C103, 203	8232 1421 07	VT, ALU, 10V, 100μF, 20%, SME
C014	8232 1431 06	VT, ALU, 16V, 10μF, 20%, SME	C104, 204	8232 1421 07	VT, ALU, 10V, 100μF, 20%, SME
C103, 203	8232 1421 07	VT, ALU, 10V, 100μF, 20%, SME	C105, 205	8232 8011 00	VT, CER, 50V, 10pF, 5%, SL
C104, 204	8232 1421 07	VT, ALU, 10V, 100μF, 20%, SME	C106, 206	8232 8011 00	VT, CER, 50V, 10pF, 5%, SL
C105, 205	8232 8011 00	VT, CER, 50V, 10pF, 5%, SL			
C106, 206	8232 8011 00	VT, CER, 50V, 10pF, 5%, SL			

Ref. No.	Part No.	Description
C107, 207	8232 1431 06	VT, ALU, 16V, 10μF, 20%, SME
C108~408	8232 1431 06	VT, ALU, 16V, 10μF, 20%, SME
C109~409	8232 1431 06	VT, ALU, 16V, 10μF, 20%, SME
C110~410		Wire, jumper, IPS-1041-2, F5
C111~411		N/A
C112~412		N/A
C113~413	8232 1431 06	VT, ALU, 16V, 10μF, 20%, SME
C114~414	8232 1431 06	VT, ALU, 16V, 10μF, 20%, SME
C115~415	8232 1431 06	VT, ALU, 16V, 10μF, 20%, SME
C150, 250	8232 8012 21	VT, CER, 50V, 220pF, 5%, SL
C151, 251	8232 8012 20	VT, CER, 50V, 22pF, 5%, SL
C152, 252	8232 1431 06	VT, ALU, 16V, 10μF, 20%, SME
C153, 253	8232 8012 21	VT, CER, 50V, 220pF, 5%, SL
C154, 254	8232 8012 20	VT, CER, 50V, 22pF, 5%, SL
C155, 255	8232 1431 06	VT, ALU, 16V, 10μF, 20%, SME
C156, 256	8232 1424 77	VT, ALU, 10V, 470μF, 20%, SME

#### MISCELLANEOUS

Ref. No.	Part No.	Description
E001		Wire, jumper, IPS-1041-2, F5
E002		Wire, jumper, IPS-1041-4, F10
J004	8245 2120 01	Connector, PL, jack, RCA, 2P, BLK
J007	8245 5280 01	Connector, PI, jack, 1P, RT-01T-1.0B
J104~404	8245 2980 00	Connector, PL, jack, phone, LGR4609-7000
S001~005	8253 1350 02	Switch, PT, tact, SOR-112HS
Y005	8207 0122 09	Holder, cable, 9P, 51048
Y006	8207 0122 13	Holder, cable, 13P, 51048
Y007	8207 0122 08	Holder, cable, 8P, 51048
Y008	8207 0122 06	Holder, cable, 6P, 51048
W001	8277 0160 15	Cable assy, shield 2C, 3P, WHT-9073, L150
W002	8277 0161 30	Cable assy, shield 2C, 3P, RED-9073, L300
W003	8277 0162 50	Cable assy, shield 2C, 3P, BLK-9073, L500
W005	8276 9086 25	Cable, flat, 6P, L250
W006	8276 9093 25	Cable, flat, 13P, L250
W007	8276 9088 25	Cable, flat, 8P, L250
W008	8276 9089 25	Cable, flat, 9P, L250

#### • JACK PCB

Ref. No.	Part No.	Description
	8274 1340 00	PCB assy, Mixer, X-24
B001	8251 9681 02	Plain PCB, Jack, X-24

Ref. No.	Part No.	Description
R101, 201	8230 1381 23	Resistor, HT, carbon, 1/4W, 12kΩ, 5%

Ref. No.	Part No.	Description
R102, 202	8230 1381 23	Resistor, HT, carbon, 1/4W, 12kΩ, 5%
C101, 201		N/A
C102, 202		N/A
E001		Wire, jumper, IPS-1041-2, F5
E002		Wire, jumper, IPS-1041-4, F10
J001	8245 1711 03	Connector, PI, jack, 8283, 3P, WHT
J002	8245 1712 03	Connector, PI, jack, 8283, 3P, RED
J003	8245 1713 03	Connector, PI, jack, 8283, 3P, BLK
J005	8245 2980 00	Connector, PL, jack, phone, LGR4609-7000
J006	8245 2980 00	Connector, PL, jack, phone, LGR4609-7000
J101, 201	8245 3390 04	Connector, PL, jack, phone, YKB21-5074
J102, 202	8245 2680 04	Connector, PL, jack, XLR31, NC3FAHR10
W004	8276 9082 20	Cable, flat, 2P, L200
Y901	8207 0122 02	Holder, cable, 2P, 51048

#### • R/P PCB

Ref. No.	Part No.	Description
	8274 1350 00	PCB assy, R/P, X-24
B001	8251 9700 01	Plain PCB, R/P, X-24

#### ICs

Ref. No.	Part No.	Description
U001		N/A
U002	8236 0782 06	PT, digital, driver, DTA143TS
U003	8236 0361 00	SIP, analog, BA4560N
U004~022	8236 5707 01	ST, digital, driver, DTA144EK
U023	8236 0837 00	SDI, digital, CPU, X-24, TMP47C200BN
U030, 031	8236 5706 01	ST, digital, driver, DTC144EK
U040	8236 5706 01	ST, digital, driver, DTC144EK
U041	8236 5707 01	ST, digital, driver, DTA144EK
U101~401	8236 5405 00	ST, analog, NJM2068M
U102~402	8236 0457 00	SOP, analog, HA12135AF
U104~404	8236 5701 03	ST, digital, driver, DTC114TK
U105~405	8236 5707 01	ST, digital, driver, DTA144EK
U106~406	8236 5701 03	ST, digital, driver, DTC114TK
U107~407	8236 5701 03	ST, digital, driver, DTC114TK
U108~408	8236 5701 03	ST, digital, driver, DTC114TK
U109~409	8236 4190 00	SIP, analog, head SW, BA7755A

#### TRANSISTORS

Ref. No.	Part No.	Description
Q001	8234 1430 00	V, NPN, 2SC3071

Ref. No.	Part No.	Description
Q002, 003	8234 5043 03	VT, NPN, 2SC1740S, S
Q004	8234 5050 00	VT, FET, 2SK117, Y/GR/BL
Q101~401	8234 5043 03	VT, NPN, 2SC1740S, S

**DIODEs**

Ref. No.	Part No.	Description
D001	8234 0196 02	VT, DSK10C-BT
D002		Wire, jumper, IPS-1041-2, F5
D003	8234 0196 02	VT, DSK10C-BT
D004, 005	8234 5007 00	HT, 1SS136
D101~401	8234 5007 00	HT, 1SS136
D102~402	8234 5007 00	HT, 1SS136
D103~403	8234 5007 00	HT, 1SS136
D104~404	8234 5007 00	HT, 1SS136

**RESISTORs**

Ref. No.	Part No.	Description
R001	8230 1388 21	HT, carbon, 1/4W, 820Ω, 5%
R002	8230 1383 94	HT, carbon, 1/4W, 390kΩ, 5%
R003	8230 1382 03	HT, carbon, 1/4W, 20kΩ, 5%
R004, 005	8230 1381 03	HT, carbon, 1/4W, 10kΩ, 5%
R006, 007	8230 1382 20	HT, carbon, 1/4W, 22Ω, 5%
R008	8230 1387 51	HT, carbon, 1/4W, 750Ω, 5%
R010	8230 0510 06	V, array, 1/8W, 47kΩ-47kΩ x 5, 5%, RKC-E
R011	8230 0361 03	V, array, 1/8W, 10kΩ x 4, 5%, RKC
R012	8230 0361 03	V, array, 1/8W, 10kΩ x 4, 5%, RKC
R013, 014	8230 1384 79	HT, carbon, 1/4W, 4.7Ω, 5%
R020	8230 1384 73	HT, carbon, 1/4W, 47kΩ, 5%
R021	8230 1381 03	HT, carbon, 1/4W, 10kΩ, 5%
R022~026	8230 1384 73	HT, carbon, 1/4W, 47kΩ, 5%
R027	8230 1381 03	HT, carbon, 1/4W, 10kΩ, 5%
R028, 029	8230 1384 73	HT, carbon, 1/4W, 47kΩ, 5%
R030	8230 1381 03	HT, carbon, 1/4W, 10kΩ, 5%
R031	8230 1384 73	HT, carbon, 1/4W, 47kΩ, 5%
R032	8230 1381 03	HT, carbon, 1/4W, 10kΩ, 5%
R033	8230 1384 73	HT, carbon, 1/4W, 47kΩ, 5%
R038	8230 1381 03	HT, carbon, 1/4W, 10kΩ, 5%
R040	8230 1381 05	HT, carbon, 1/4W, 1MΩ, 5%
R041	8230 1381 03	HT, carbon, 1/4W, 10kΩ, 5%
R042	8230 1383 32	HT, carbon, 1/4W, 3.3kΩ, 5%
R043	8231 5033 32	R-TRIM, PIT, carbon, 3.3kΩ, 637T
R044	8230 1385 11	HT, carbon, 1/4W, 510Ω, 5%
R050	8230 1382 03	HT, carbon, 1/4W, 20kΩ, 5%
R051	8230 1384 72	HT, carbon, 1/4W, 4.7kΩ, 5%
R052	8230 1383 32	HT, carbon, 1/4W, 3.3kΩ, 5%
R053	8230 1384 73	HT, carbon, 1/4W, 47kΩ, 5%
R054	8230 1384 70	HT, carbon, 1/4W, 47Ω, 5%
R055	8230 1383 33	HT, carbon, 1/4W, 33kΩ, 5%
R056	8230 1384 72	HT, carbon, 1/4W, 4.7kΩ, 5%
R101~401	8230 1382 43	HT, carbon, 1/4W, 24kΩ, 5%

Ref. No.	Part No.	Description
R102~402	8230 1381 04	HT, carbon, 1/4W, 100kΩ, 5%
R103~403	8231 5032 23	R-TRIM, PIT, carbon, 22kΩ, 637T
R105~405	8230 1383 94	HT, carbon, 1/4W, 390kΩ, 5%
R106~406	8231 5034 71	R-TRIM, PIT, carbon, 470Ω, 637T
R107~407	8230 1383 32	HT, carbon, 1/4W, 3.3kΩ, 5%
R108~408	8230 1381 81	HT, carbon, 1/4W, 180Ω, 5%
R109~409	8230 1382 22	HT, carbon, 1/4W, 2.2kΩ, 5%
R110~410	8230 1383 32	HT, carbon, 1/4W, 3.3kΩ, 5%
R113~413	8230 1381 83	HT, carbon, 1/4W, 18kΩ, 5%
R114~414	8230 1382 03	HT, carbon, 1/4W, 20kΩ, 5%
R115~415	8230 1382 03	HT, carbon, 1/4W, 20kΩ, 5%
R116~416	8230 1382 41	HT, carbon, 1/4W, 240Ω, 5%
R117~417	8230 1382 02	HT, carbon, 1/4W, 2kΩ, 5%
R118~418	8230 1382 02	HT, carbon, 1/4W, 2kΩ, 5%
R119~419	8230 1382 02	HT, carbon, 1/4W, 2kΩ, 5%
R120~420	8230 1384 72	HT, carbon, 1/4W, 4.7kΩ, 5%
R121~421	8231 5032 23	R-TRIM, PIT, carbon, 22kΩ, 637T
R122~422	8230 1386 22	HT, carbon, 1/4W, 6.2kΩ, 5%
R123~423	8230 1383 63	HT, carbon, 1/4W, 36kΩ, 5%
R124~424	8230 1381 53	HT, carbon, 1/4W, 15kΩ, 5%
R125~425	8230 1381 53	HT, carbon, 1/4W, 15kΩ, 5%
R129~429	8230 1386 22	HT, carbon, 1/4W, 6.2kΩ, 5%
R130~430	8230 1381 03	HT, carbon, 1/4W, 10kΩ, 5%
R131~431	8230 1381 01	HT, carbon, 1/4W, 100Ω, 5%
R132~432	8230 1381 09	HT, carbon, 1/4W, 1Ω, 5%
R133~433	8231 5032 24	R-TRIM, PIT, carbon, 220kΩ, 637T
R134~434	8230 1382 22	HT, carbon, 1/4W, 2.2kΩ, 5%
R135~435	8230 1382 22	HT, carbon, 1/4W, 2.2kΩ, 5%
R136~436	8230 1382 20	HT, carbon, 1/4W, 22Ω, 5%

**CAPACITORs**

ALU = Electrolytic type

CER = Ceramic type

PES = Mylar type

PPR = Polypropylene type

Ref. No.	Part No.	Description
C001	8232 8031 03	VT, CER, 50V, 0.01μF, YF
C002	8232 1444 77	VT, ALU, 25V, 470μF, 20%, SME
C003	8232 1441 07	VT, ALU, 25V, 100μF, 20%, SME
C004	8232 1421 07	VT, ALU, 10V, 100μF, 20%, SME
C005	8232 1432 26	VT, ALU, 16V, 22μF, 20%, SME
C006, 007	8232 1422 27	VT, ALU, 10V, 220μF, 20%, SME
C008, 009	8232 1421 07	VT, ALU, 10V, 100μF, 20%, SME
C012	8232 1432 26	VT, ALU, 16V, 22μF, 20%, SME
C020~025	8232 8031 03	VT, CER, 50V, 0.01μF, YF
C028	8232 8181 04	VT, CER, 25V, 0.1μF, YF
C029	8232 8031 03	VT, CER, 50V, 0.01μF, YF
C050	8232 1421 07	VT, ALU, 10V, 100μF, 20%, SME
C051	8232 9011 04	VT, PES, 50V, 0.1μF, 5%, AMZ
C052	8232 9012 23	VT, PES, 50V, 0.022μF, 5%, AMZ

Ref. No.	Part No.	Description
C053, 054	8232 9014 72	VT, PES, 50V, 0.0047μF, 5%, AMZ
C055	8232 1431 06	VT, ALU, 16V, 10μF, 20%, SME
C101~401	8232 8015 61	VT, CER, 50V, 560pF, 5%, SL
C102~402	8232 1461 05	VT, ALU, 50V, 1μF, 20%, SME
C103~403		N/A
C104~404	8232 8012 21	VT, CER, 50V, 220pF, 5%, SL
C105~405	8232 9018 22	VT, PES, 50V, 0.0082μF, 5%, AMZ
C106~406	8232 1424 76	VT, ALU, 10V, 47μF, 20%, SME
C107~407	8232 1462 25	VT, ALU, 50V, 2.2μF, 20%, SME
C108~408	8232 9013 92	VT, PES, 50V, 0.0039μF, 5%, AMZ
C109~409	8232 1461 05	VT, ALU, 50V, 1μF, 20%, SME
C110~410	8232 1461 05	VT, ALU, 50V, 1μF, 20%, SME
C112~412	8232 1464 75	VT, ALU, 50V, 4.7μF, 20%, SME
C113~413	8232 1462 24	VT, ALU, 50V, 0.22μF, 20%, SME
C114~414	8232 1424 76	VT, ALU, 10V, 47μF, 20%, SME
C115~415	8232 1424 76	VT, ALU, 10V, 47μF, 20%, SME
C116~416	8232 1424 76	VT, ALU, 10V, 47μF, 20%, SME
C117~417	8232 1424 76	VT, ALU, 10V, 47μF, 20%, SME
C118~418	8232 9012 73	VT, PES, 50V, 0.027μF, 5%, AMZ
C119~419	8232 1431 06	VT, ALU, 16V, 10μF, 20%, SME
C120~420		N/A
C121~421	8232 1461 04	VT, ALU, 50V, 0.1μF, 20%, SME
C122~422	8232 8011 81	VT, CER, 50V, 180pF, 5%, SL
C123~423	8232 9011 82	VT, PES, 50V, 0.0018μF, 5%, AMZ
C124~424	8232 1462 25	VT, ALU, 50V, 2.2μF, 20%, SME
C125~425	8232 8012 21	VT, CER, 50V, 220pF, 5%, SL
C126~426	8233 0481 52	VT, PPR, 100V, 0.0015μF, 5%, APS
C128~428	8232 9011 03	VT, PES, 50V, 0.01μF, 5%, AMZ

#### MISCELLANEOUS

Ref. No.	Part No.	Description
E001		Wire, jumper, IPS-1041-2, F5
E002		Wire, jumper, IPS-1041-3, F7.5
E003		Wire, jumper, IPS-1041-4, F10
E004		Wire, jumper, IPS-1041-5, F12.5
J001	8245 5410 00	Connector, PL, jack, DC-inlet, YKB31-0012
J002	8245 3080 02	Connector, PI, jack, SBRK, 2S-4
J003	8245 5470 09	Connector, PI, jack, PH, 9P, WHT
J004	8245 2260 01	Connector, PL, jack, RCA 4P, YKC21-3115
J005	8245 3080 06	Connector, PI, jack, SBRK, 6S-4
J006	8245 3080 13	Connector, PI, jack, SBRK, 13S-4
J007	8245 3080 08	Connector, PI, jack, SBRK, 8S-4
J008	8245 3080 09	Connector, PI, jack, SBRK, 9S-4
J009, 010	8245 5280 01	Connector, PI, jack, 1P, RT-01T-1.0B
J011	8245 3080 04	Connector, PI, jack, SBRK, 4S-4
J101	8245 5470 05	Connector, PI, jack, PH, 5P, WHT
J201	8245 5471 05	Connector, PI, jack, PH, 5P, RED

Ref. No.	Part No.	Description
J301	8245 5472 05	Connector, PI, jack, PH, 5P, BLU
J401	8245 5473 05	Connector, PI, jack, PH, 5P, GRN
L001	8242 1420 00	Coil, bias, 150μH
L101~401	8256 0660 00	Module, trap, 80kHz
L102~402	8256 0990 00	Module, MPX, XR-5/X-24
L103~403	8256 0660 00	Module, trap, 80kHz
S001, 002	8253 6520 05	SW, PL, slide, 2-2, non-shortening, SSSU1, L09
TP001	8276 0010 00	Pin, header
TP101~401	8276 0010 00	Pin, header
TP104~404	8276 0010 00	Pin, header
TP105~405	8276 0010 00	Pin, header
TP106~406	8276 0010 00	Pin, header
T001	8242 1250 00	Transformer, osc, main, 80kHz
T101~401	8242 2470 00	Transformer, osc, sub, 80kHz
W001	8276 3640 07	Cable assy, earth lug, D3-kink, L70
X001	8256 0980 00	Resonator, P, CER, 4MHZ, EFO

#### • REGULATOR PCB

Ref. No.	Part No.	Description
	8274 1400 00	PCB assy, Regulator, X-24
B001	8251 9700 02	Plain PCB, Regulator, X-24

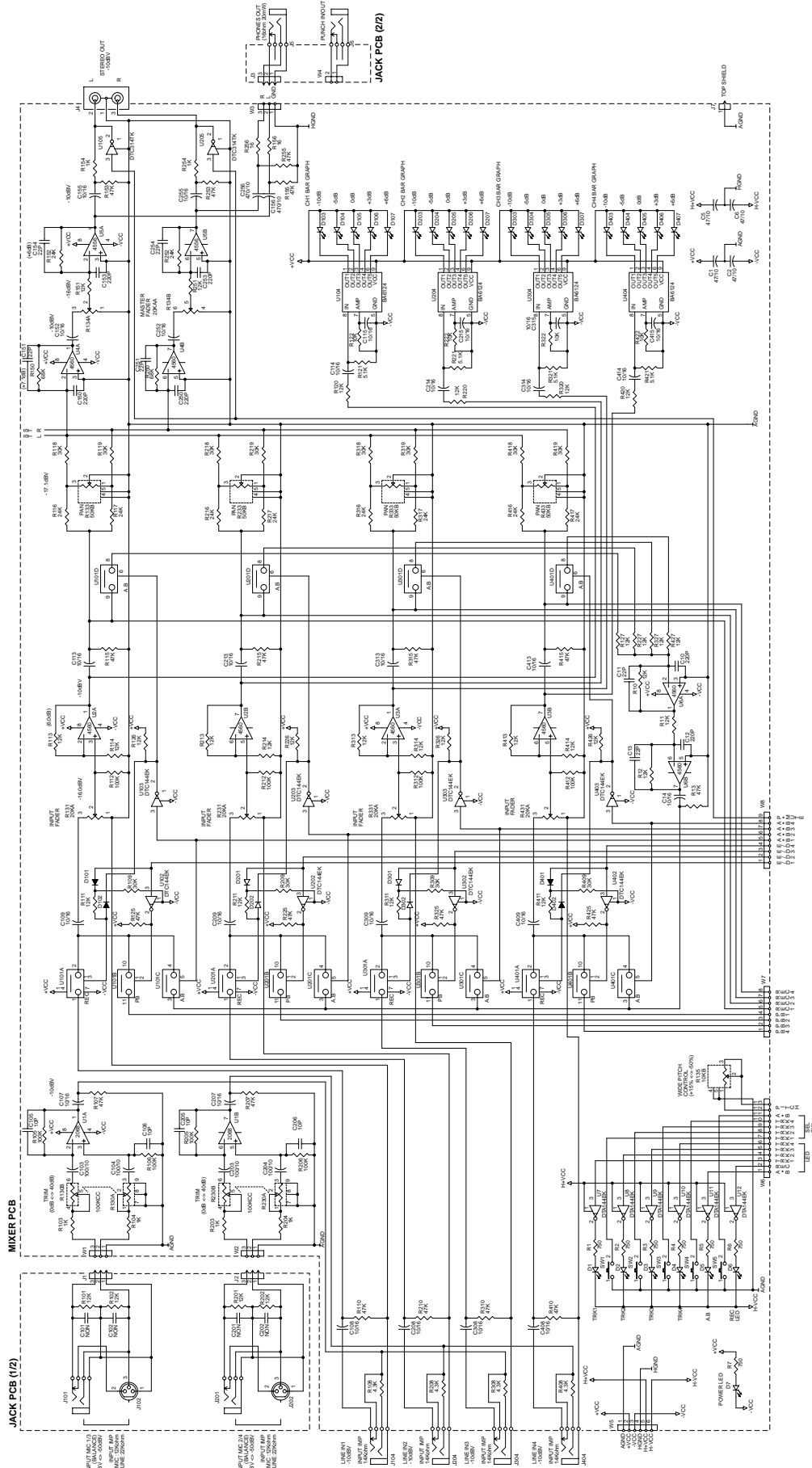
Ref. No.	Part No.	Description
U001	8236 0449 10	IC, 220, regulator, μPC2410HF
C001, 002	8232 9011 03	Capacitor, VT, PES, 50V, 0.01μF, AMZV
W011	8276 9084 20	Cable, flat, 4P, L200
Y101	8207 0122 04	Holder, cable, 4P, 51048

#### ● Abbreviation

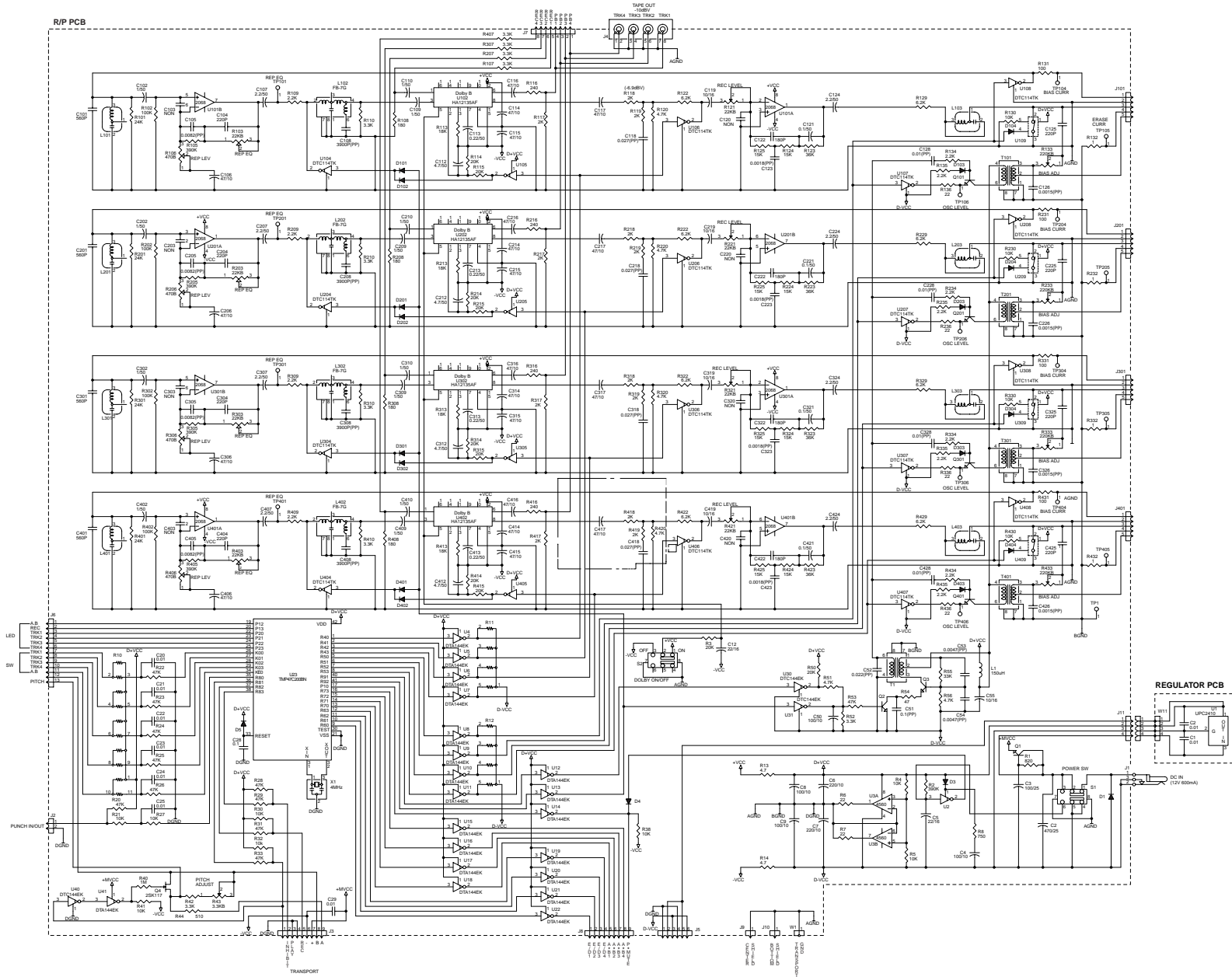
ST:	Small Outline Package
SIP:	Single In-line Package
220:	TO-220 type
SDI:	Shrink DIP (dual in-line)
SOP:	Small Outline Package
HT:	Horizontal mount taping device
V:	Vertical mount
VT:	Vertical mount Taping device
PI:	Penetrate mount I form (straight)
PL:	Penetrate mount L form (right angle)
PT:	Penetrate mount Taping device
PIT:	Penetrate mount I form Taping device

# 5. CIRCUIT & BLOCK DIAGRAMS

## MIXER / JACK PCBs

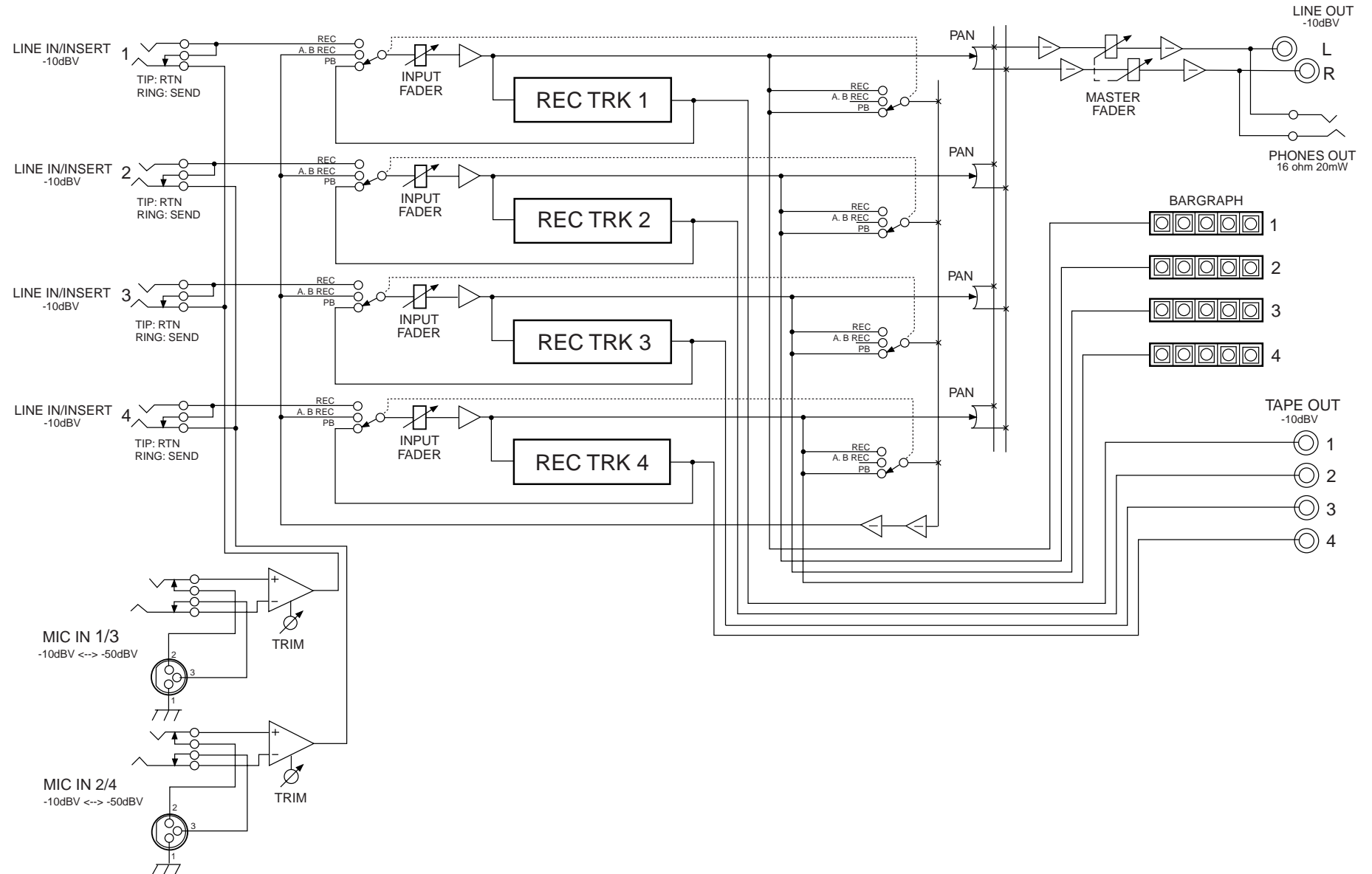


# R/P / REGULATOR PCBs





# ● BLOCK DIAGRAM





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