
Service Manual

Model

X-24

multitracker

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.

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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

| | |
|------------------------------|--|
| Specification Unit | 0 dBV = 1 Vrms |
| Normal Fader Position | |
| Input fader | At 8 ± 1 position |
| Condition | 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) |
| Master fader | At 8 ± 1 position |
| Condition | 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 | |
| Connector | Phone (unbalanced) / XLR (balanced) |
| Input level | -50 ~ -10 dBV |
| Impedance | 10 k Ω or more |
| LINE IN / INSERT (RCV) | |
| Connector | Stereo phone (tip) |
| Input level | -10 dBV |
| Impedance | 10 k Ω or more |
| Standard Output | |
| TAPE OUT 1 ~ 4 | |
| Connector | RCA pin |
| Output level | -10 dBV |
| Load impedance | 10 k Ω or more |
| LINE OUT L, R | |
| Connector | RCA pin |
| Output level | -10 dBV |
| Load impedance | 10 k Ω or more |
| INSERT (SEND) | |
| Connector | Stereo phone (ring) |
| Output level | -10 dBV |
| Load impedance | 10 k Ω or more |
| Phones Max. Output Level | 20 mW or more (1 kHz, 16 Ω 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 | |
| MIC IN (Input Level: -50 dBV) | 40 ~ 20 kHz \pm 3 dB at LINE OUT |
| MIC IN (Input Level: -10 dBV) | 20 ~ 20 kHz \pm 3 dB at LINE OUT |
| LINE IN (Input Level: -10 dBV) | 50 ~ 10 kHz \pm 2 dB at PHONES (10 mW / 16 Ω) |
| S / N (shorted by 150 Ω resistor) | |
| MIC IN (MIC GAIN: MIC) | 66 dB or more at LINE OUT (DIN AUDIO) 68 dB or more at LINE OUT (IHF A) |
| MIC IN (MIC GAIN: LINE) | 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_{p-p} or less

Other switching

-30 dBV_{p-p} or less

Shock Noise

-30 dBV_{p-p} 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)

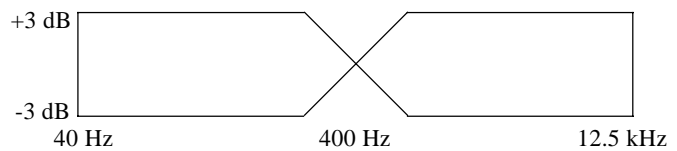
REC & PLAY

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

Frequency response

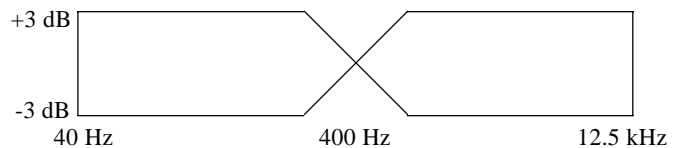
PLAY

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

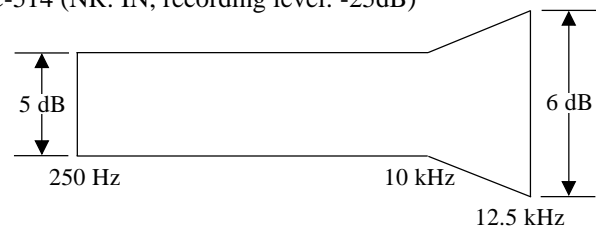


REC & PLAY

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



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



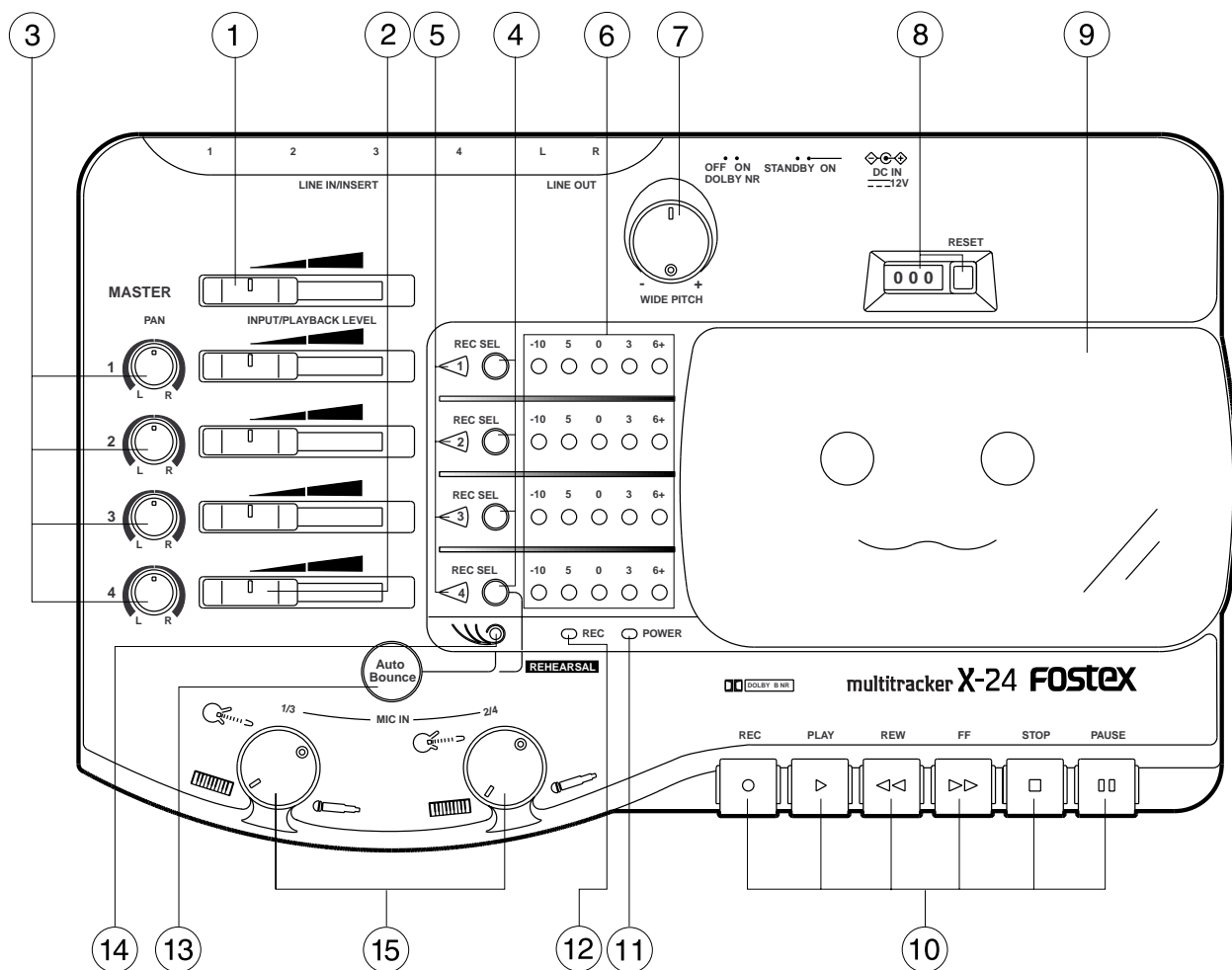
RECORDER SECTION (continued)**Level Deviation at Reference Output Level**

| | |
|------------------------------------|--|
| PLAY | 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) |
| REC & PLAY | 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) |
| S/N | |
| PLAY | 47 dB or more (NR: OUT, DIN AUDIO) 55 dB or more (NR: OUT, IHF-A) |
| REC & PLAY | 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) |
| Distortion (REC & PLAY) | 2 % or less (Input signal: 1 kHz / standard level, standard fader position, with 400 Hz HPF & 30 kHz LPF) |
| Erase Ratio | 67 dB or more at 1 kHz (Input signal: 1 kHz / 0 dBV, standard fader position, with 1 kHz BPF) |
| Cross Erasure | 1 dB or less (Input signal: 10 kHz / -10 dBV, standard fader position. Measure level difference when adjacent track is put into REC mode.) |
| Channel Separation | 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.) |
| Sync Crosstalk | -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.) |
| Bias Leakage | -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.) |
| Click Noise | |
| PLAY → STOP | -30 dBV _{p-p} or less |
| REC → STOP | |
| Monitor | -20 dBV _{p-p} or less |
| PLAY | -20 dBV _{p-p} or less |
| Punch In / Out | -30 dBV _{p-p} or less at PLAY |
| Shock Noise | -30 dBV _{p-p} 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.

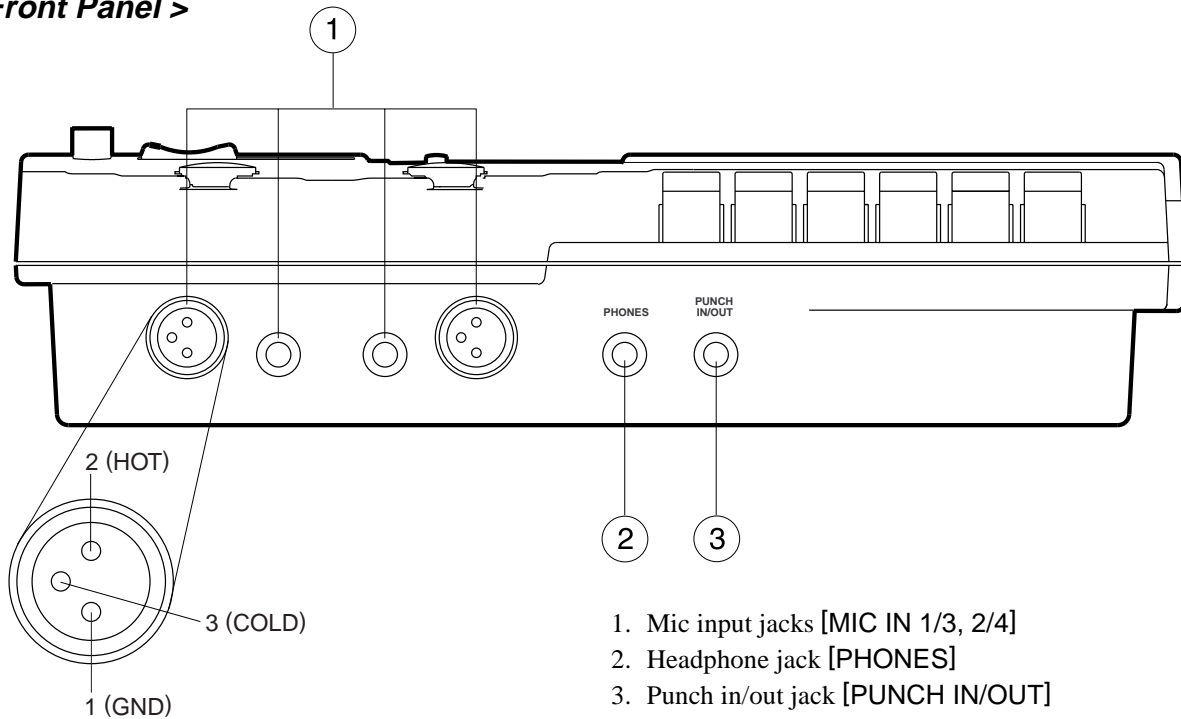
2. CONTROLS, INDICATORS & CONNECTORS

< Top Panel >



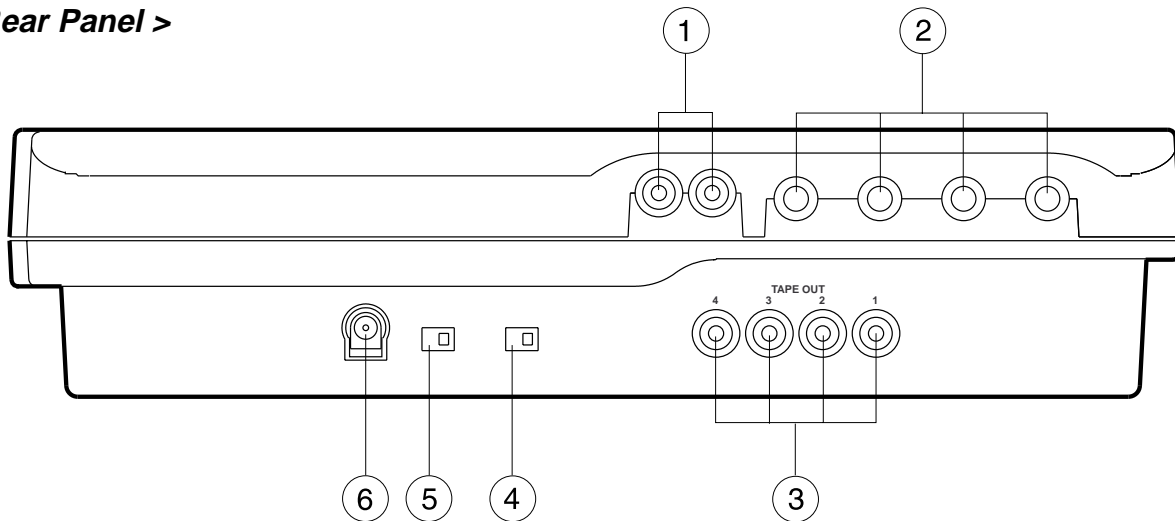
- | | |
|---|--|
| <ul style="list-style-type: none"> 1. Master fader [MASTER] 2. Input/playback level control faders [INPUT/PLAYBACK LEVEL] 3. Pan pot knob [PAN] 4. Record track select switches [REC SEL] 5. Record track LED 6. Level meter 7. Pitch control knob [WIDE PITCH] 8. Tape counter/reset button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

< Front Panel >



- 1. Mic input jacks [MIC IN 1/3, 2/4]
- 2. Headphone jack [PHONES]
- 3. Punch in/out jack [PUNCH IN/OUT]

< Rear Panel >



- 1. Line out jacks [LINE OUT L, R]
- 2. Line in/insert jacks [LINE/INSERT 1, 2, 3, 4]
- 3. Tape out jacks [TAPE OUT 1, 2, 3, 4]
- 4. Dolby B noise reduction on/off switch [DOLBY NR ON/OFF]
- 5. Power switch [ON-STANDBY]
- 6. DC IN connector [DC IN 12V]

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 become 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 ± 1 position |
| Master fader | At 8 ± 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 Ω) 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 dBV (0.3 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 Ω) 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 dBV (0.3 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 dBV (0.3 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 dBV (0.3 V) $\pm 0.5 \text{ dB}$, adjust the pot R121 ~ 421 (22 k Ω) 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 ± 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 Ω) 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 ± 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 ± 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_{p-p}.

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_{p-p}.

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_{p-p}.

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

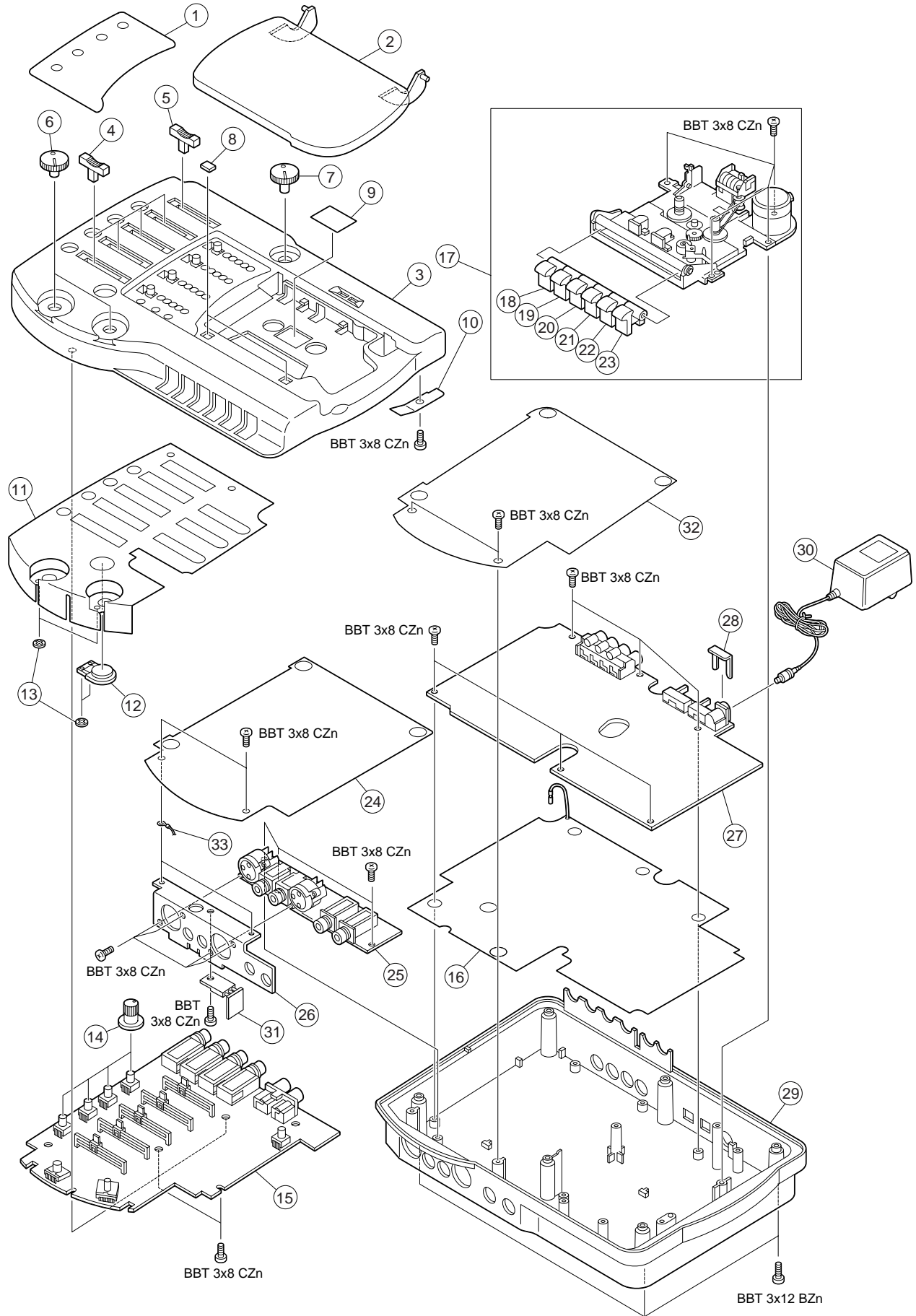
● X-24 OVERALL EXPLODED VIEW & PARTS LIST

| 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 | | | |

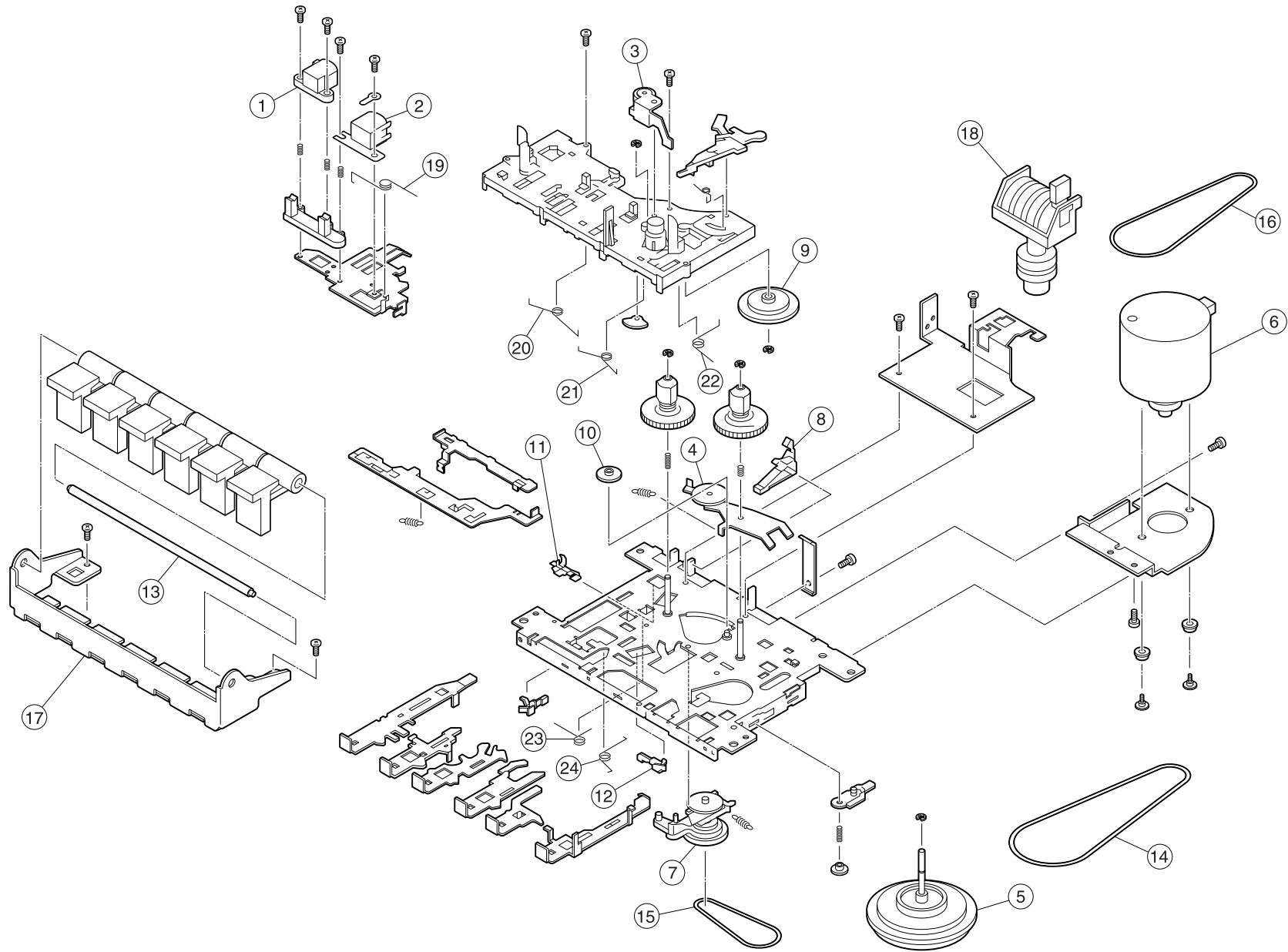
● X-24 TRANSPORT EXPLODED VIEW & PARTS LIST

| 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 |

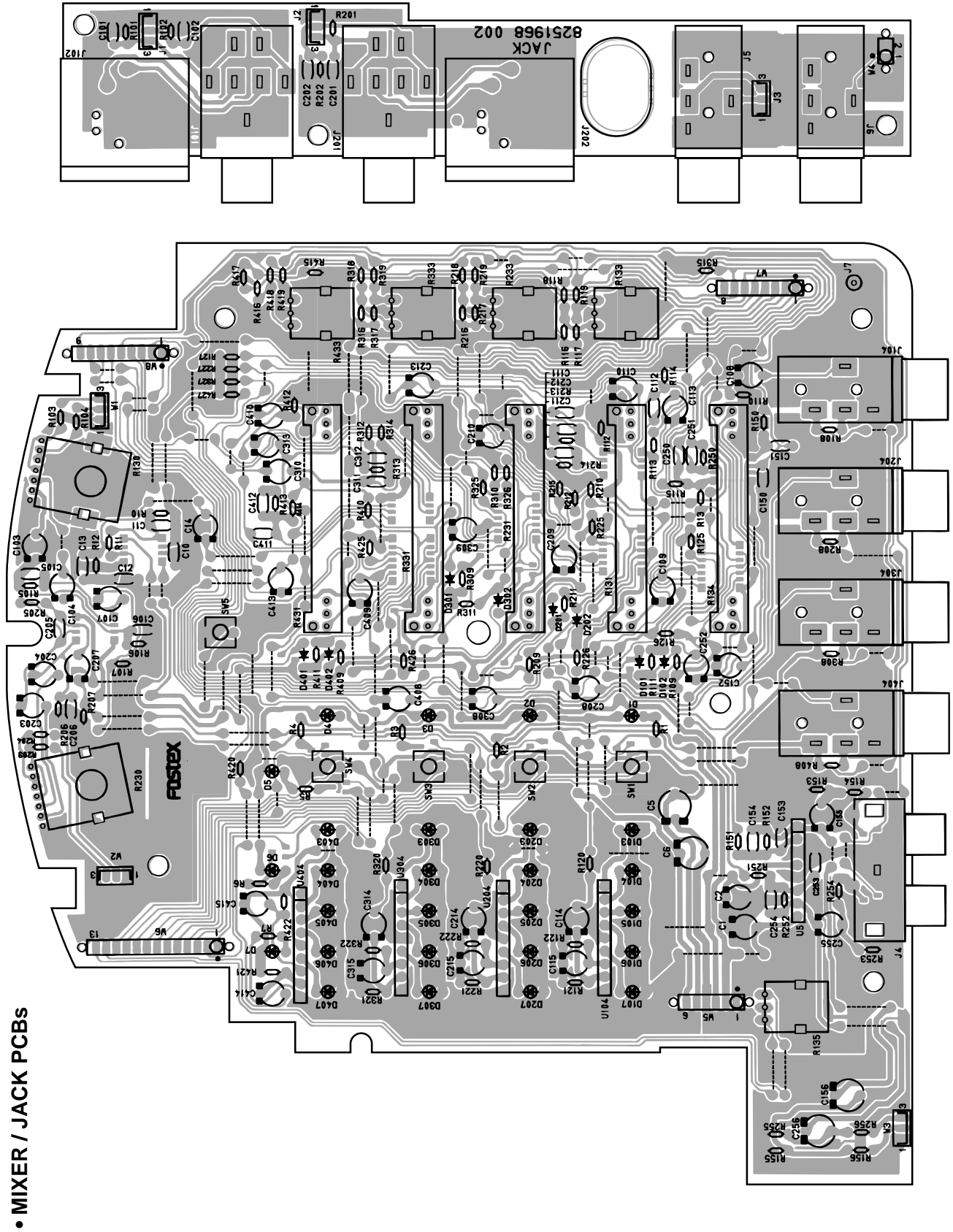
● X-24 OVERALL EXPLODED VIEW



● X-24 TRANSPORT EXPLODED VIEW

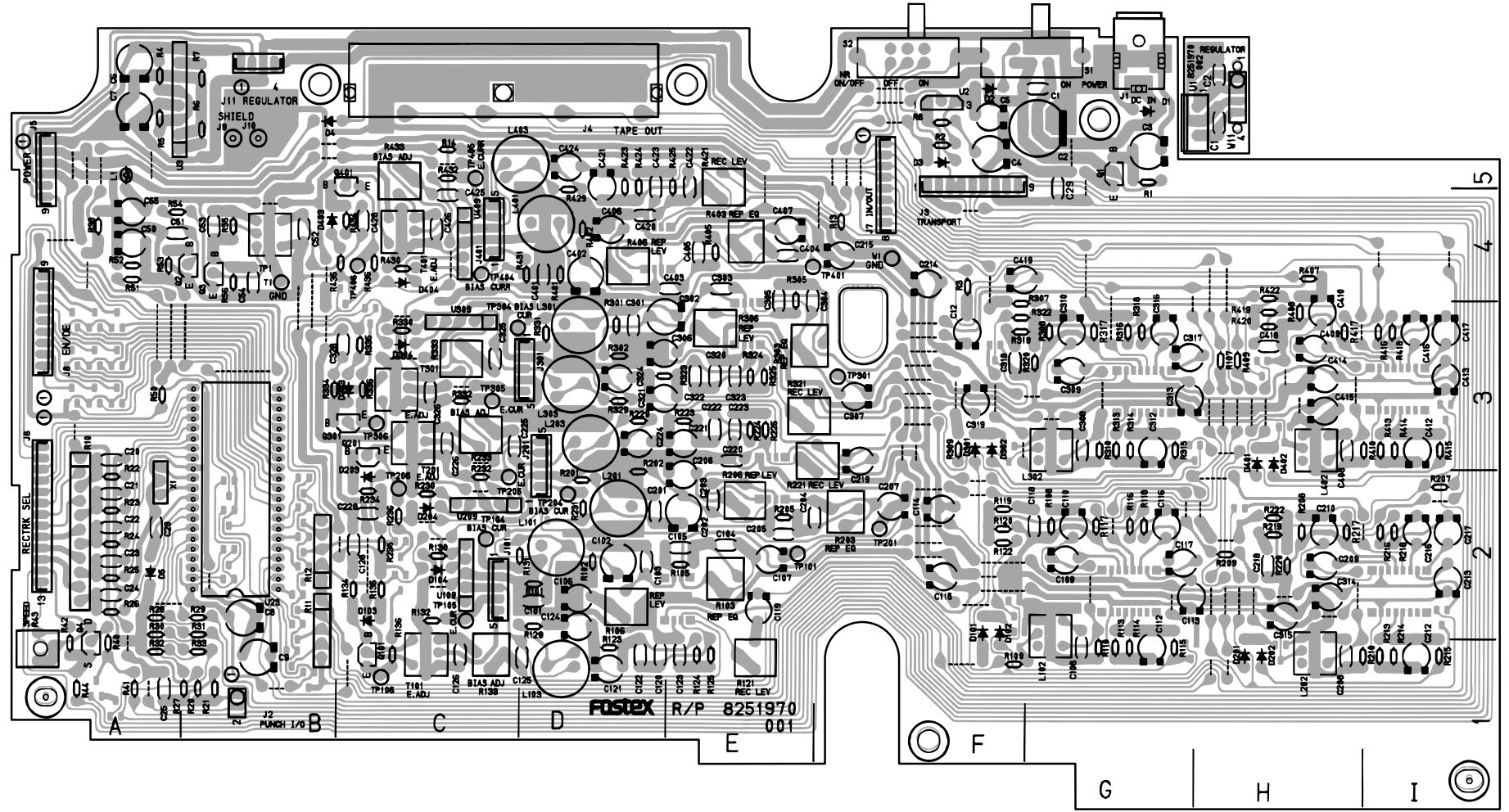


● X-24 PCB PATTERN DRAWING



● 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% |
| ICs | | | | | |
| 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% |
| DIODES | | | | | |
| 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 |
| RESISTORS | | | | | |
| 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% |
| CAPACITORS | | | | | |
| 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, 820 Ω , 5% |
| R002 | 8230 1383 94 | HT, carbon, 1/4W, 390k Ω , 5% |
| R003 | 8230 1382 03 | HT, carbon, 1/4W, 20k Ω , 5% |
| R004, 005 | 8230 1381 03 | HT, carbon, 1/4W, 10k Ω , 5% |
| R006, 007 | 8230 1382 20 | HT, carbon, 1/4W, 22 Ω , 5% |
| R008 | 8230 1387 51 | HT, carbon, 1/4W, 750 Ω , 5% |
| R010 | 8230 0510 06 | V, array, 1/8W, 47k Ω -47k Ω x 5, 5%, RKC-E |
| R011 | 8230 0361 03 | V, array, 1/8W, 10k Ω x 4, 5%, RKC |
| R012 | 8230 0361 03 | V, array, 1/8W, 10k Ω x 4, 5%, RKC |
| R013, 014 | 8230 1384 79 | HT, carbon, 1/4W, 4.7 Ω , 5% |
| R020 | 8230 1384 73 | HT, carbon, 1/4W, 47k Ω , 5% |
| R021 | 8230 1381 03 | HT, carbon, 1/4W, 10k Ω , 5% |
| R022~026 | 8230 1384 73 | HT, carbon, 1/4W, 47k Ω , 5% |
| R027 | 8230 1381 03 | HT, carbon, 1/4W, 10k Ω , 5% |
| R028, 029 | 8230 1384 73 | HT, carbon, 1/4W, 47k Ω , 5% |
| R030 | 8230 1381 03 | HT, carbon, 1/4W, 10k Ω , 5% |
| R031 | 8230 1384 73 | HT, carbon, 1/4W, 47k Ω , 5% |
| R032 | 8230 1381 03 | HT, carbon, 1/4W, 10k Ω , 5% |
| R033 | 8230 1384 73 | HT, carbon, 1/4W, 47k Ω , 5% |
| R038 | 8230 1381 03 | HT, carbon, 1/4W, 10k Ω , 5% |
| R040 | 8230 1381 05 | HT, carbon, 1/4W, 1M Ω , 5% |
| R041 | 8230 1381 03 | HT, carbon, 1/4W, 10k Ω , 5% |
| R042 | 8230 1383 32 | HT, carbon, 1/4W, 3.3k Ω , 5% |
| R043 | 8231 5033 32 | R-TRIM, PIT, carbon, 3.3k Ω , 637T |
| R044 | 8230 1385 11 | HT, carbon, 1/4W, 510 Ω , 5% |
| R050 | 8230 1382 03 | HT, carbon, 1/4W, 20k Ω , 5% |
| R051 | 8230 1384 72 | HT, carbon, 1/4W, 4.7k Ω , 5% |
| R052 | 8230 1383 32 | HT, carbon, 1/4W, 3.3k Ω , 5% |
| R053 | 8230 1384 73 | HT, carbon, 1/4W, 47k Ω , 5% |
| R054 | 8230 1384 70 | HT, carbon, 1/4W, 47 Ω , 5% |
| R055 | 8230 1383 33 | HT, carbon, 1/4W, 33k Ω , 5% |
| R056 | 8230 1384 72 | HT, carbon, 1/4W, 4.7k Ω , 5% |
| R101~401 | 8230 1382 43 | HT, carbon, 1/4W, 24k Ω , 5% |

| Ref. No. | Part No. | Description |
|----------|--------------|---|
| R102~402 | 8230 1381 04 | HT, carbon, 1/4W, 100k Ω , 5% |
| R103~403 | 8231 5032 23 | R-TRIM, PIT, carbon, 22k Ω , 637T |
| R105~405 | 8230 1383 94 | HT, carbon, 1/4W, 390k Ω , 5% |
| R106~406 | 8231 5034 71 | R-TRIM, PIT, carbon, 470 Ω , 637T |
| R107~407 | 8230 1383 32 | HT, carbon, 1/4W, 3.3k Ω , 5% |
| R108~408 | 8230 1381 81 | HT, carbon, 1/4W, 180 Ω , 5% |
| R109~409 | 8230 1382 22 | HT, carbon, 1/4W, 2.2k Ω , 5% |
| R110~410 | 8230 1383 32 | HT, carbon, 1/4W, 3.3k Ω , 5% |
| R113~413 | 8230 1381 83 | HT, carbon, 1/4W, 18k Ω , 5% |
| R114~414 | 8230 1382 03 | HT, carbon, 1/4W, 20k Ω , 5% |
| R115~415 | 8230 1382 03 | HT, carbon, 1/4W, 20k Ω , 5% |
| R116~416 | 8230 1382 41 | HT, carbon, 1/4W, 240 Ω , 5% |
| R117~417 | 8230 1382 02 | HT, carbon, 1/4W, 2k Ω , 5% |
| R118~418 | 8230 1382 02 | HT, carbon, 1/4W, 2k Ω , 5% |
| R119~419 | 8230 1382 02 | HT, carbon, 1/4W, 2k Ω , 5% |
| R120~420 | 8230 1384 72 | HT, carbon, 1/4W, 4.7k Ω , 5% |
| R121~421 | 8231 5032 23 | R-TRIM, PIT, carbon, 22k Ω , 637T |
| R122~422 | 8230 1386 22 | HT, carbon, 1/4W, 6.2k Ω , 5% |
| R123~423 | 8230 1383 63 | HT, carbon, 1/4W, 36k Ω , 5% |
| R124~424 | 8230 1381 53 | HT, carbon, 1/4W, 15k Ω , 5% |
| R125~425 | 8230 1381 53 | HT, carbon, 1/4W, 15k Ω , 5% |
| R129~429 | 8230 1386 22 | HT, carbon, 1/4W, 6.2k Ω , 5% |
| R130~430 | 8230 1381 03 | HT, carbon, 1/4W, 10k Ω , 5% |
| R131~431 | 8230 1381 01 | HT, carbon, 1/4W, 100 Ω , 5% |
| R132~432 | 8230 1381 09 | HT, carbon, 1/4W, 1 Ω , 5% |
| R133~433 | 8231 5032 24 | R-TRIM, PIT, carbon, 220k Ω , 637T |
| R134~434 | 8230 1382 22 | HT, carbon, 1/4W, 2.2k Ω , 5% |
| R135~435 | 8230 1382 22 | HT, carbon, 1/4W, 2.2k Ω , 5% |
| R136~436 | 8230 1382 20 | HT, carbon, 1/4W, 22 Ω , 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, 0.01 μ F, YF |
| C002 | 8232 1444 77 | VT, ALU, 25V, 470 μ F, 20%, SME |
| C003 | 8232 1441 07 | VT, ALU, 25V, 100 μ F, 20%, SME |
| C004 | 8232 1421 07 | VT, ALU, 10V, 100 μ F, 20%, SME |
| C005 | 8232 1432 26 | VT, ALU, 16V, 22 μ F, 20%, SME |
| C006, 007 | 8232 1422 27 | VT, ALU, 10V, 220 μ F, 20%, SME |
| C008, 009 | 8232 1421 07 | VT, ALU, 10V, 100 μ F, 20%, SME |
| C012 | 8232 1432 26 | VT, ALU, 16V, 22 μ F, 20%, SME |
| C020~025 | 8232 8031 03 | VT, CER, 50V, 0.01 μ F, YF |
| C028 | 8232 8181 04 | VT, CER, 25V, 0.1 μ F, YF |
| C029 | 8232 8031 03 | VT, CER, 50V, 0.01 μ F, YF |
| C050 | 8232 1421 07 | VT, ALU, 10V, 100 μ F, 20%, SME |
| C051 | 8232 9011 04 | VT, PES, 50V, 0.1 μ F, 5%, AMZ |
| C052 | 8232 9012 23 | VT, PES, 50V, 0.022 μ F, 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 |

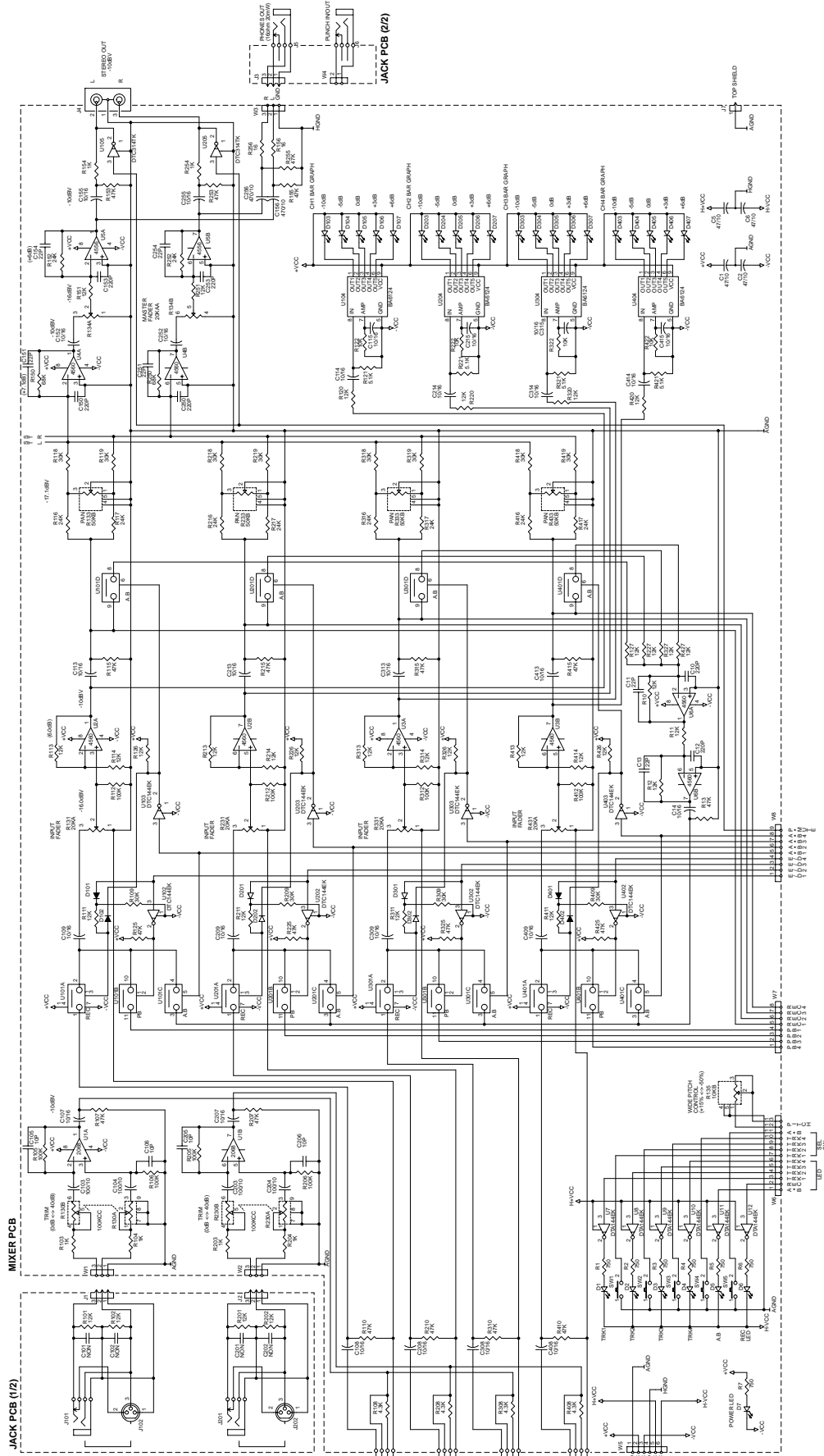
| Ref. No. | Part No. | Description |
|-----------|--------------|---------------------------------------|
| U001 | 8236 0449 10 | IC, 220, regulator, μPC2410HF |
| C001, 002 | 8232 9011 03 | Capacitor, VT, PES, 50V, 0.01μF, AMZV |
| W011 | 8276 9084 20 | Cable, flat, 4P, L200 |
| Y101 | 8207 0122 04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

● Abbreviation

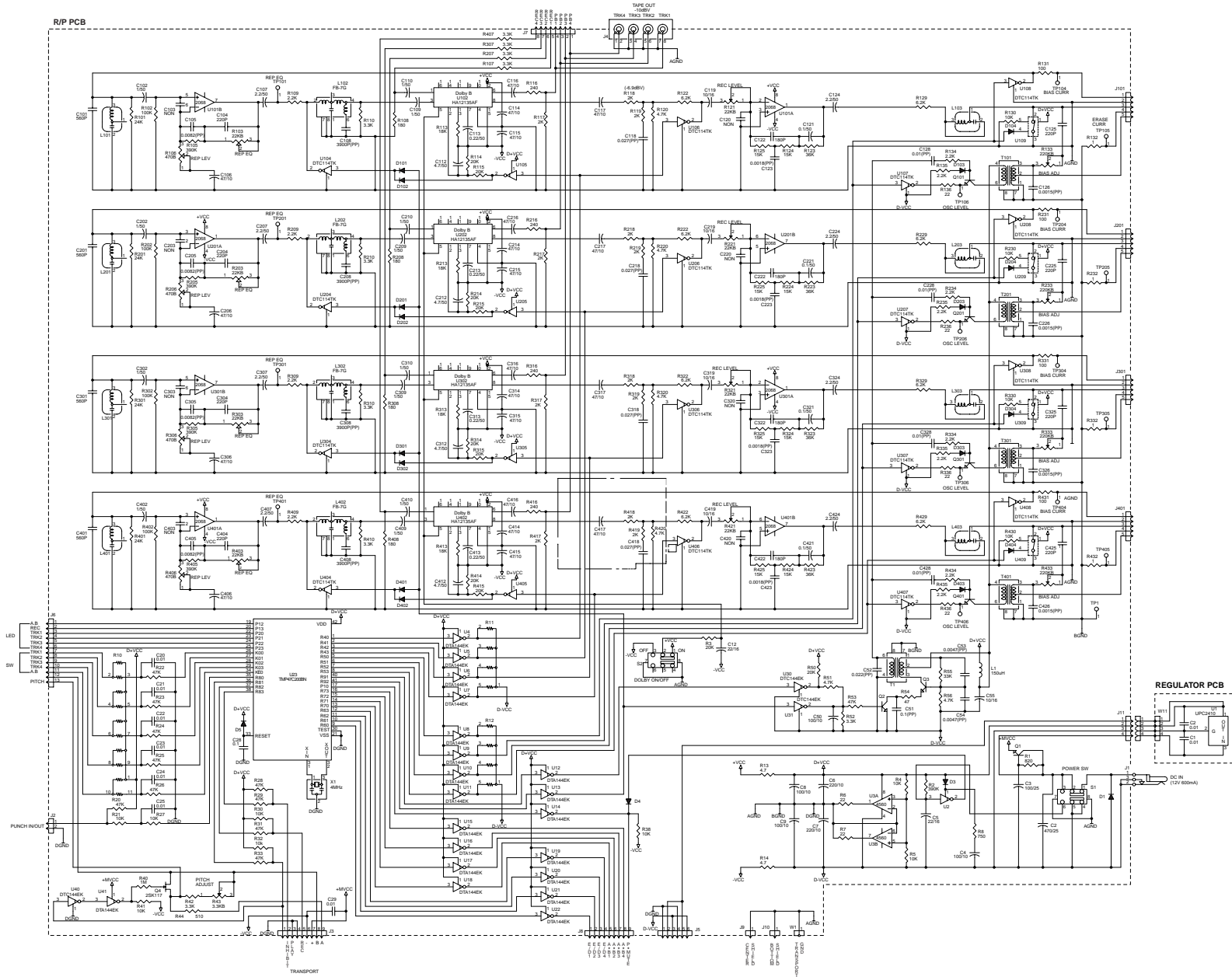
| | |
|------|--------------------------------------|
| ST: | Small Outline Package |
| SIP: | Single In-line Package |
| 220: | TO-220 type |
| SDI: | Shrink DIP (dual in-line) |
| SOP: | Small Outline Package |
| HT: | Horizontal mount taping device |
| V: | Vertical mount |
| VT: | Vertical mount 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

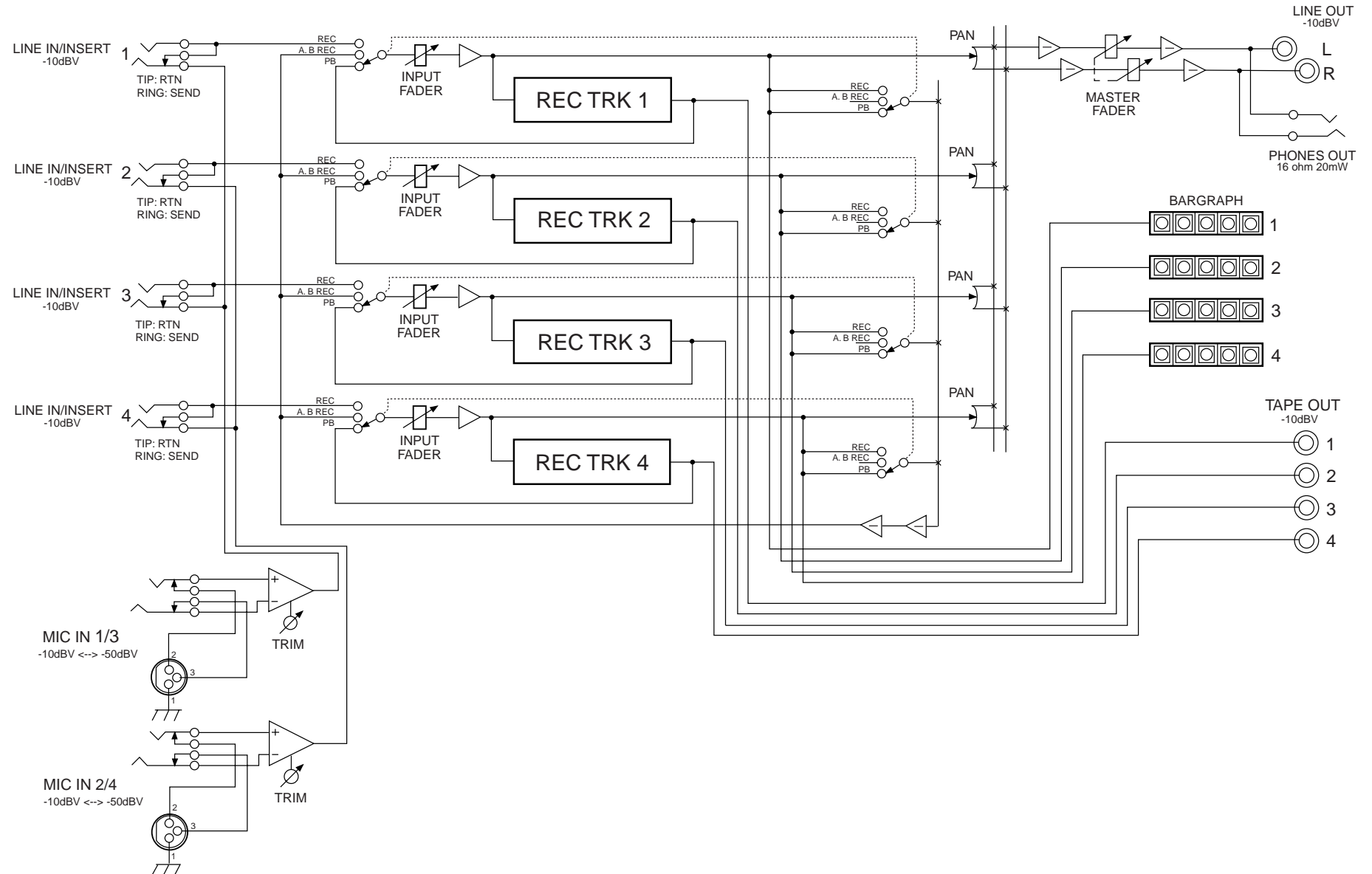
MIXER / JACK PCBs



R/P / REGULATOR PCBs



● BLOCK DIAGRAM



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