

HIFI QUARTZ CONTROLLED FM STEREO TUNER

MODEL NO. AT-9700H, E, K

AIWA®

[SERVICE MANUAL]

Code No., 09-970-000-20



DATE OF ISSUE 11/1978

SPECIFICATIONS

| | | | |
|---------------------------------------|---|--|---|
| Semiconductors: | 23 ICs, 6 FETs, 61 transistors, 67 diodes, 43 LEDs | Selectivity: | 20 ± 5 dB (narrow) 20 ± 5 dB (normal) |
| Power source: | AC 110-120 V/220-240 V (switchable) 50/60 Hz | | more than 70 dB (narrow) more than 50 dB (normal) more than 85 dB (narrow) |
| Power consumption: | 28W | Frequency scale accuracy: | ±150 kHz (at 88, 108 MHz) ±30 kHz (at 98 MHz) |
| Dimensions: | 448 (W) x 149 (H) x 376 (D) mm | Muting threshold: | 19 ± 5 dB (narrow) |
| Weight: | 87.5 ~ 108.0 MHz (E model) 8.7 kg | Stereo separation: | more than 45 dB (normal) more than 25 dB (narrow) |
| Frequency range: | 87.4 ~ 109.0 MHz (K, H model) | | more than 50 dB (normal) more than 25 dB (narrow) more than 40 dB (normal) more than 25 dB (narrow) more than 30 dB (normal) more than 20 dB (narrow) |
| Frequency response: | Mono 40 ~ 50 Hz less than 1.0 dB 50 ~ 6,300 Hz less than 0.2 dB 6,300 ~ 12,500 Hz less than 0.5 dB Stereo | Distortion: | Mono less than 0.035% (normal) less than 0.3% (narrow) Stereo less than 0.05% (normal) less than 0.5% (narrow) less than 0.1% (normal) less than 0.7% (narrow) |
| 50 dB Quieting sensitivity: | 30 ~ 15,000 Hz +0.2 dB -0.5 dB | (1 kHz, Mono 75 kHz deviation Stereo 67.5 kHz deviation, pilot 7.5 kHz at 10 kHz | |
| Usable sensitivity: | 50 ~ 10,000 Mono 12 ± 3 dB (normal) 12 ± 3 dB (narrow) Stereo 35 ± 3 dB (normal) 35 ± 3 dB (narrow) | | |
| (Mono S/N 26 dB, 40 kHz deviation) | | | |
| Image rejection ratio: | 3 ± 2 dB (normal) 3 ± 2 dB (narrow) (at 88, 98, 108 MHz) | | |
| IF interference ratio: | more than 110 dB (at 98 MHz) more than 80 dB (at 98 MHz) | | |
| AM suppression ratio: | 65 ± 5 dB (at 98 MHz) | | |
| Capture ratio: | less than 2 dB (normal) less than 3 dB (narrow) | | |
| Spurious rejection ratio: | more than 110 dB (normal) more than 110 dB (narrow) Mono 81 ± 4 dB (normal) 81 ± 4 dB (narrow) | | |
| SN ratio: | Stereo more than 70 dB (normal) | | |

• Specifications and external appearance are subject to change without notice due to product improvement.

SPECIAL CIRCUITRY DESCRIPTION

1. Quartz crystal-controlled PLL MPX

MPX sections configured with PLL (phase-locked loop) circuits are now widely being used in order to enhance the stability of the separation. This makes it possible to resist aging and facilitate adjustments without using an LC-resonance circuit.

In the PLL MPX section, a 38 kHz switching signal which is phase synchronized with the 19 kHz pilot signal provided from the detector is obtained and the stereo demodulation operation is performed.

The 76 kHz oscillator, (voltage-controlled oscillator) receives the DC voltage and its oscillation frequency undergoes a change. The frequency divider serves to scale down the frequency to half the 76 kHz frequency (38 kHz), this operation switches the composite signals and these are then separated into the left and right channel signals. In order to configure the phase-locked loop, the difference in phase between that of the pilot signal and that of the 19 kHz signal, which is scaled down from the 38 kHz signal is detected and a servo loop is configured so that the value of this difference is accurately set to 90° . If the free-running frequency of the VCO shifts greatly from the 76 kHz frequency, the above-mentioned 90° phase difference can no longer be maintained and the separation is no longer obtained. The loop gain is increased to prevent these phenomena from occurring. This means that even if the free-running frequency of the VCO is not exactly 76 kHz (adjustments, aging, temperature variations), the separation does not suffer much deterioration.

However, should this operation be conducted for a signal other than the pilot signal, the VCO is activated and beat distortion is generated. This beat distortion does not only exist in the high-frequency components of the signals but also in the difference components with the 19 kHz signals (10 kHz with 9 kHz signals). In order to suppress this beat distortion, the loop gain is decreased and only the pilot signal is supplied to the PLL in some tuners with a resonance circuit. However, such tuners are not able to take advantage of the reduction of aging in the separation.

The AT-9700 gets round this problem by using a quartz crystal for the VCO and a phase-locked loop is configured with 19 kHz signals across a ± 4 Hz range. This helps to yield an MPX section in which both beat distortion and aging are reduced to the bare minimum.

The AT-9700 also employs a pilot canceler circuit and for general signals, those with a frequency over 15 kHz are suppressed by the filter. The cut-off frequency of the filter is set at 19 kHz and a wide-band reproduction sound is provided.

2. Quartz crystal-controlled servo lock system

Accurate tuning is essential for the high-quality reception of broadcasts. Even with a high level of selectivity, the interference is worsened at times if the broadcasting station is not tuned in properly. Furthermore, the distortion deteriorates with detuning. All this means that the actual tuning operation is extremely important from the viewpoint of making the tuner display its performance to the full.

The quartz crystal-controlled servo lock system is designed to provide both accurate and easy tuning.

2-1. Description of operation

1) Servo lock system

First, an outline of the servo lock system is given. Fig. 1 shows its basic configuration.

The local oscillator employs a variable capacitor, and the oscillation frequency undergoes the changes shown in Fig. 2 in accordance with the control voltage. In addition, the output of the detector also undergoes change as indicated in Fig. 3 in accordance with the input frequency.

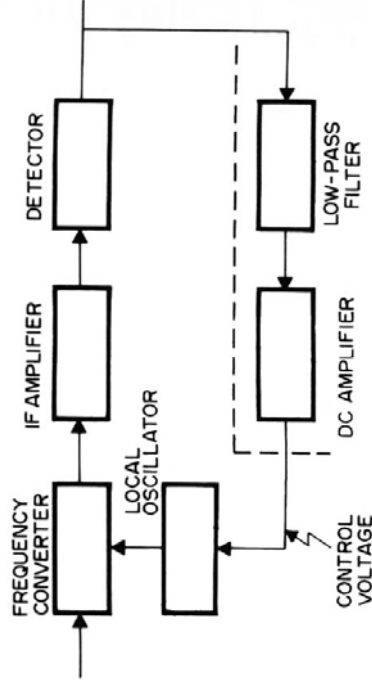


Fig. 1

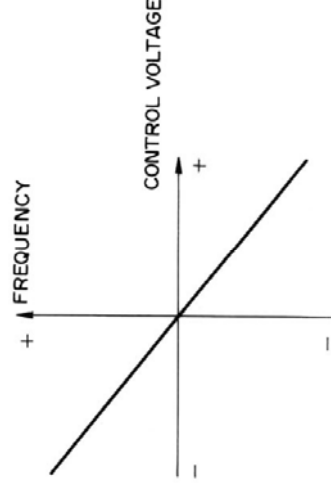


Fig. 2

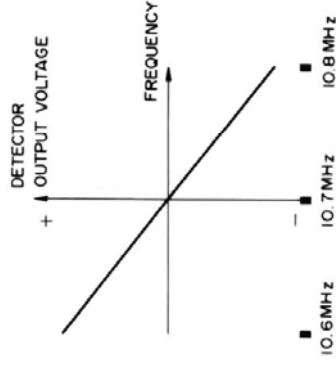


Fig. 3

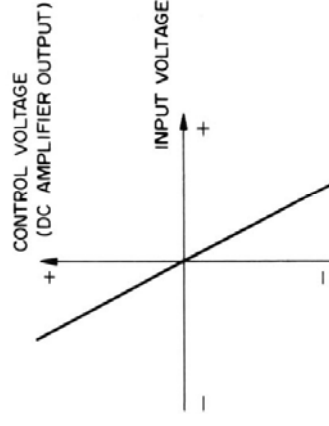


Fig. 4

Accurate tuning means that the local oscillator frequency is higher than the intermediate frequency (10.7 MHz) with relation to the frequency of the broadcasting station which is being tuned in. In this case, the detector output is 0 V, and the output of the DC amplifier, or in other words the control voltage of the local oscillator becomes 0 V. This means that the local oscillator frequency does not change.

When the frequency of the broadcasting station is not tuned in accurately, for instance, if the local oscillator frequency is high and the intermediate frequency is higher than 10.7 MHz, the detector output goes negative. As shown in Fig. 4 by the input and output characteristics, the DC amplifier acts as an inverting amplifier. Therefore, the output goes positive and the local oscillator frequency is reduced. In this way, compensation is provided even if the tuning shifts.

The operation is the same as that provided by an AFC. However, since the DC amplifier is performing the operation, the compensation capability is increased.

In order to compensate for the local oscillation frequency, a control voltage which agrees with the error frequency is required. This is applied by the DC components in the detector output. Therefore, in order to compensate for the frequency, the detector output takes on DC components. In other words, it is not possible to compensate for the tuning point perfectly. Nevertheless, if the detector output is amplified by the DC amplifier, the DC components in the detector output aimed at providing the same control voltage need only be small and it is then possible to compensate up to a more accurate tuning point.

In this kind of servo lock system (generally known as an AFC with a DC amplifier), a greater compensation capability is featured than an AFC with a normal configuration within the limited detuning range.

2) Quartz crystal-controlled servo system

There is, conversely, a disadvantage in providing the servo lock system with a high compensation capability. As with a wide-range AFC, once high input strength signals are caught, it no longer becomes possible to receive the weaker signals on either side of the tuning point, and in extreme cases there is a certain amount of danger in receiving at the point where there is a shift from the RF amplifier stage tuning point.

This demerit can be resolved if the servo lock function can be made to work only with a range centering on an accurate tuning point. To do this, the accurate tuning point must be predicted beforehand, and the operation of the servo lock system must be controlled. However, it is not possible to memorize all the frequencies of the broadcasting stations. Most stations broadcast on a frequency which is an integer of 100 kHz and so the servo control function is made to operate at 100 kHz intervals across a range of ± 40 kHz. Fig. 5 is a block diagram of the quartz crystal-controlled servo lock system.

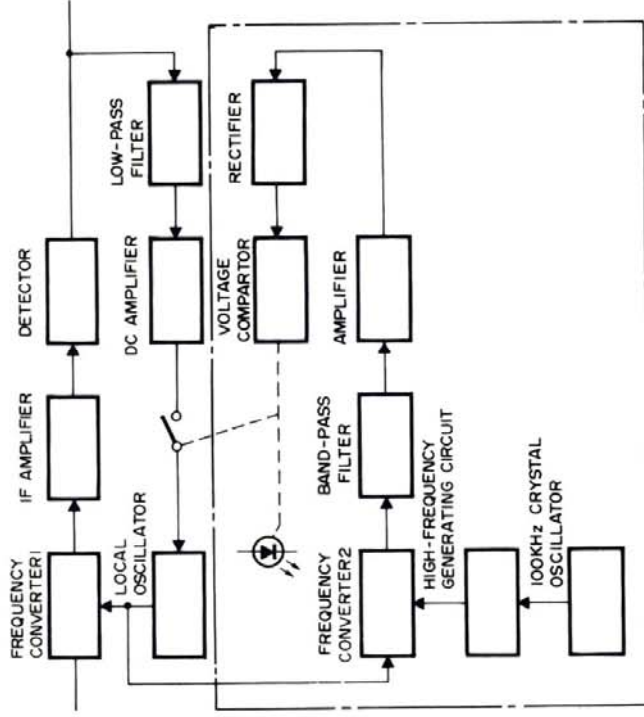


Fig. 5

The output signals of the 100 kHz crystal oscillator are expanded up to the frequency range of the local oscillator (about 98 MHz to 120 MHz) corresponding to the reception frequency by the high-frequency generating circuit. The beat with the local oscillator output is taken out by frequency converter 2. As long as the beat components with a frequency of 50 kHz and below are taken out by the filter, it is possible to obtain beat components equivalent to the detuned frequency. (See Fig. 6). If these components are further passed through a filter so that those with a frequency of 20 kHz and above are taken out, beat components are provided only when the local oscillator frequency shifts more than 20 kHz with respect to the 100 kHz integer.

After the beat components are amplified and then rectified, the servo lock is activated only when the resulting value is less than the constant voltage.

When the servo lock function starts to operate, the control voltage undergoes small changes, and when the servo lock function stops operating, this voltage returns sharply to 0 V.

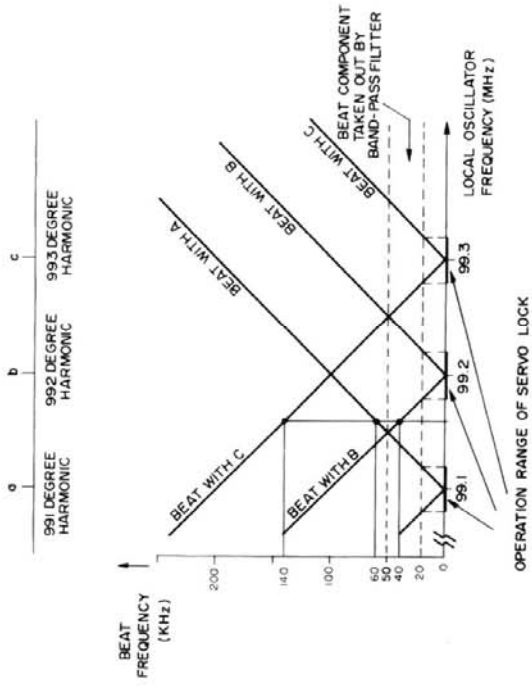


Fig. 6

When the local oscillator frequency is 99.16 MHz, the beat components are as follows

- 40 kHz — Beat with 100 kHz 992 degree harmonic
- 60 kHz — Beat with 100 kHz 991 degree harmonic
- 140 kHz — Beat with 100 kHz 993 degree harmonic
- 160 kHz — Beat with 100 kHz 990 degree harmonic
- 240 kHz — Beat with 100 kHz 994 degree harmonic

Among these components, the 40 kHz component passes through the 20-50 kHz band-pass filter.

When the local oscillator frequency is 99.21 MHz, the beat components are as follows

- 10 kHz — Beat with 100 kHz 992 degree harmonic
- 90 kHz — Beat with 100 kHz 993 degree harmonic
- 110 kHz — Beat with 100 kHz 991 degree harmonic

None of these components passes through the 20-50 kHz band-pass filter.

With this kind of configuration, once the tuning pointer is set near the accurate tuning point, the servo lock function is activated. If the local oscillator frequency shifts more than 20 kHz with respect to the tuning point with a manual operation performed by the user, the servo lock function stops. (The changes in the frequency per unit time caused by manual operation are much higher compared with drift and these can be identified by the low-pass filter.) The servo lock function will continue to operate even when there is a shift in the frequency of over 20 kHz with respect to small frequency variations caused by temperature drift.

Remarks:

Servo lock effect

Detector output with servo lock at OFF

$$E_e = K_D \cdot \Delta$$

Detector output with servo lock at ON

$$E_e = \frac{K_D}{1 - K_D \cdot K_O \cdot K_A} \cdot \Delta$$

Degree of detuning improvement

$$K = \frac{1}{1 - K_D \cdot K_O \cdot K_A}$$

Where:

- K_D: Demodulation sensitivity (V/Hz)
- K_O: Local oscillator voltage sensitivity (Hz/V)
- K_A: Amplification of DC amplifier
- Δ : Detuning frequency

3. Dual system IF amplifier

The filter which is employed in the IF amplifier determines both the distortion of the audio source which is demodulated and the selectivity which indicates the interference suppression capability. These two aspects of the filter's performance are made reciprocal technologically. If the selectivity is increased, the distortion is also increased. In the AT-9700, however, an independent dual system IF amplifier is used. For the narrow (sharp) channel is used a narrow band ceramic filter in order to yield a high selectivity, and for the normal channel is used an LC filter featuring a superior group delay response for determining the distortion once a satisfactory selectivity is provided under conditions of normal use. Either of these can be selected manually although normally the channel which is most suited to the reception state is chosen with the automatic selectivity selector circuit.

In actual fact, the normal channel uses two 6-pole LC filters (BPF 1, 2). The group delay response is adjusted with a direct-view device in order to obtain a flat response. Moreover a MOS FET-based cascade amplifier (Q6 3SK40L, Q7 2SC1923), a 2-stage differential amplifier (IC3 TA7302P) and a Darlington differential amplifier (IC 4, 5, 6, 7, 8 μPC 1163H) are employed for amplification at a low level of noise and phase distortion.

The narrow (sharp) channel employs two 4-pole narrow band ceramic filters (CF 1, 2). The same amplification devices are used as those for the normal channel, and the undesirable feedback is reduced to the bare minimum and the most is derived from the characteristics of the two filters.

4. Auto selectivity selector

When the components outside the signal band (100 kHz to 400 kHz) which are contained in the detector output exceed the set level, the auto selectivity selector is switched over to narrow (sharp). (If there are interference signals at a 300 kHz detuned point, the components outside the signal band centering on 300 kHz appear in the detector output.)

The degree of interference depends entirely on the modulation rate of the interference signals. Therefore, after the auto selectivity selector has automatically switched over to narrow (sharp), the modulation rate of the interference signals falls, and the degree of interference is alleviated. When the auto selectivity selector is switched back to normal, the modulation rate is not constant and so this switching process continues all the time.

The restoration of the selector to the normal mode is performed at that point when another station is tuned in.

At the time of the band selection operation, the IF signals are momentarily cut off and there is a muting effect serving to suppress the noise temporarily just before the switching operation. When the muting switch is set to the OFF position, the restoration of the band to the normal mode is not performed automatically. With stations whose signals are received only weakly when the muting switch is at the OFF position, the narrow (sharp) band is mostly selected, and since the switch is being kept at the OFF position all the time, the muting effect is temporarily irritating to listen to.

5. Ten-point LED display

A ten-point LED (light-emitting diode) display serves to indicate the signal strength and the reception quality of the signals. Fig. 7 is a block diagram of the circuitry.

In order to display the signal strength, a DC voltage is required which rectifies the subcarrier of the intermediate frequency and is proportional to the signal strength. In the AT-9700, a DC voltage which is rectified at five separate locations is added and it permits the indication of a signal strength over a wide range.

The detector output contains components outside the signal band. If 1) the signal strength of the input signals is low, 2) there is neighboring interference, or if 3) there are multipath reflections in the signals, these components increase.

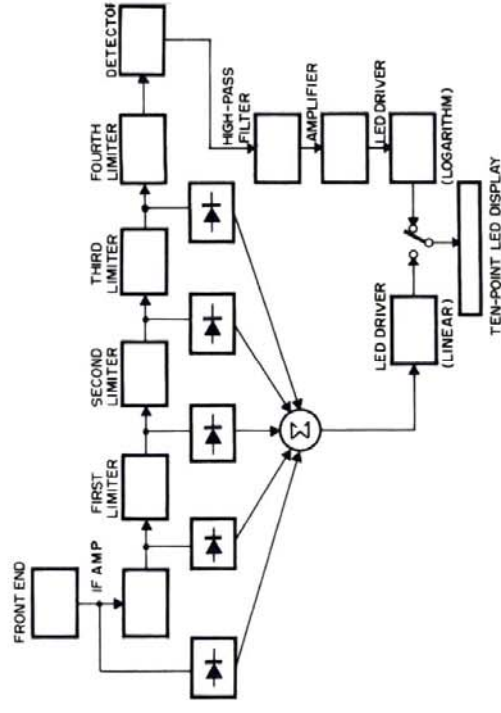


Fig. 7

IC 18 (SN16889) is used in the LED drivers for the indication of the signal strength. In proportion to the value of the DC voltage which is applied, this IC causes the LEDs to come on further and further to the right of the display. Since this is a 5-point IC, two units are used, one for the bottom (left) half and the other for the top (right) half of the display. The output of the second LED from the left is used as the muting control signals, and the output of the third LED from the left is used as the forced release control signal.

IC 19 (SN16880) is employed as the LED driver which is used to display the quality of the reception. It causes the LEDs to light up from left to right logarithmically with respect to the AC voltage which is applied.

Since two different indications are provided by the same display, it is conceivable that the user may read out the indication incorrectly. Therefore, the signal strength is indicated by the LEDs coming on step-by-step, and the reception indication is step-less in order to avoid any confusion.

6. FM demodulator with gating demodulator (GD)

Fig. 8 shows the basic circuit of the demodulator. The values of the coil and capacitor are such that the resonance point is set to the intermediate frequency. Therefore, the phase of E2 is delayed 90° at the intermediate frequency (10.7 MHz) with respect to E1. Fig. 12 shows the phase of E2 with respect to E1. In the vicinity of this 10.7 MHz frequency, the phase of E2 is delayed in proportion to the frequency.

When a positive potential is applied to the gate of the n-channel MOS FET, the channel resistance decreases. Conversely, when a negative potential is applied, the channel resistance increases. Fig. 11 shows how E3 varies according to the frequency and it is produced by dividing E1 with the MOS FET channel resistance and R1. When the E3 carrier frequency band is eliminated, a potential which is proportionate to the frequency is produced.

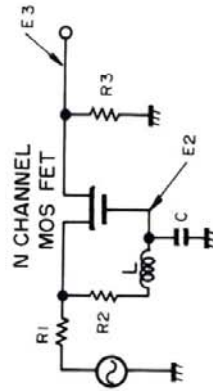


Fig. 8

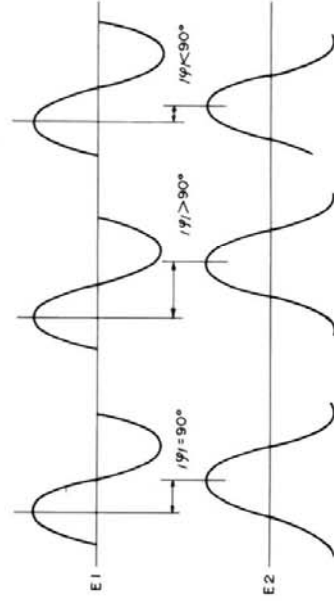


Fig. 9

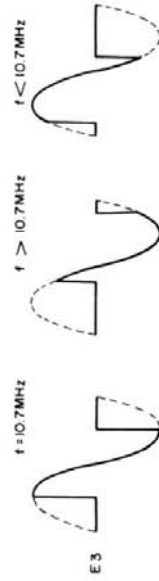


Fig. 10

Fig. 11

Fig. 13 shows a detail of Fig. 12. It indicates that the phase variation based on the coil and capacitor (LC) is not strictly linear, that the variation in the phase per unit frequency is highest at the resonance point (10.7 MHz) and that the further it is removed from this resonance point on either side, the smaller it becomes. For this reason, the frequency versus E3 DC potential is as shown in Fig. 13.

The absolute value of E3 increases, the further the frequency is shifted from the 10.7 MHz resonance point. This is the same, however, even when E1 increases.

E1 is divided by the R1 and R2 LC series resonance circuit and obtained. This means that, as shown in Fig. 14, it is at its minimum at the LC resonance point. Therefore, if the E2 phase lag is linear with respect to the frequency, the E3 DC potential will be as shown in Fig. 15, the non-linearity of the phase lag in Fig. 13 is compensated for, and overall linearity is produced.

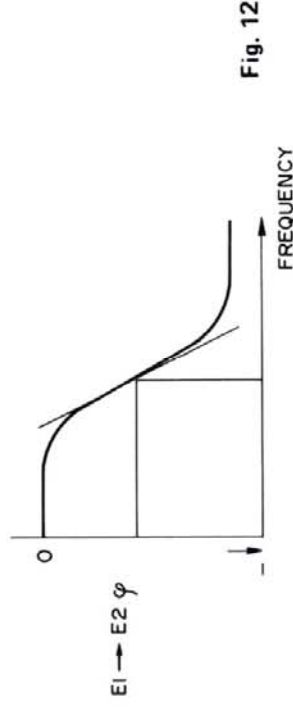


Fig. 12

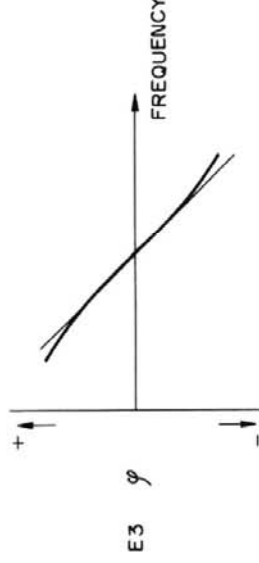


Fig. 13

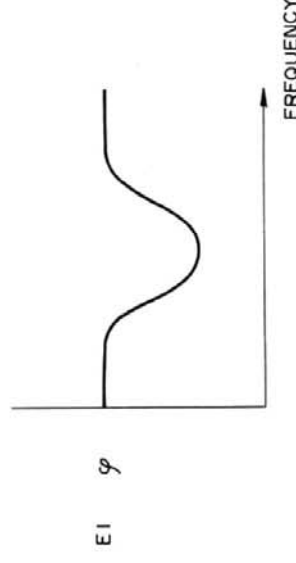


Fig. 14

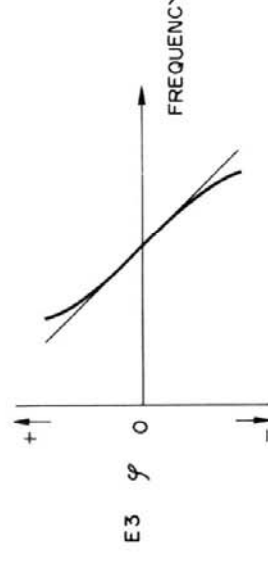
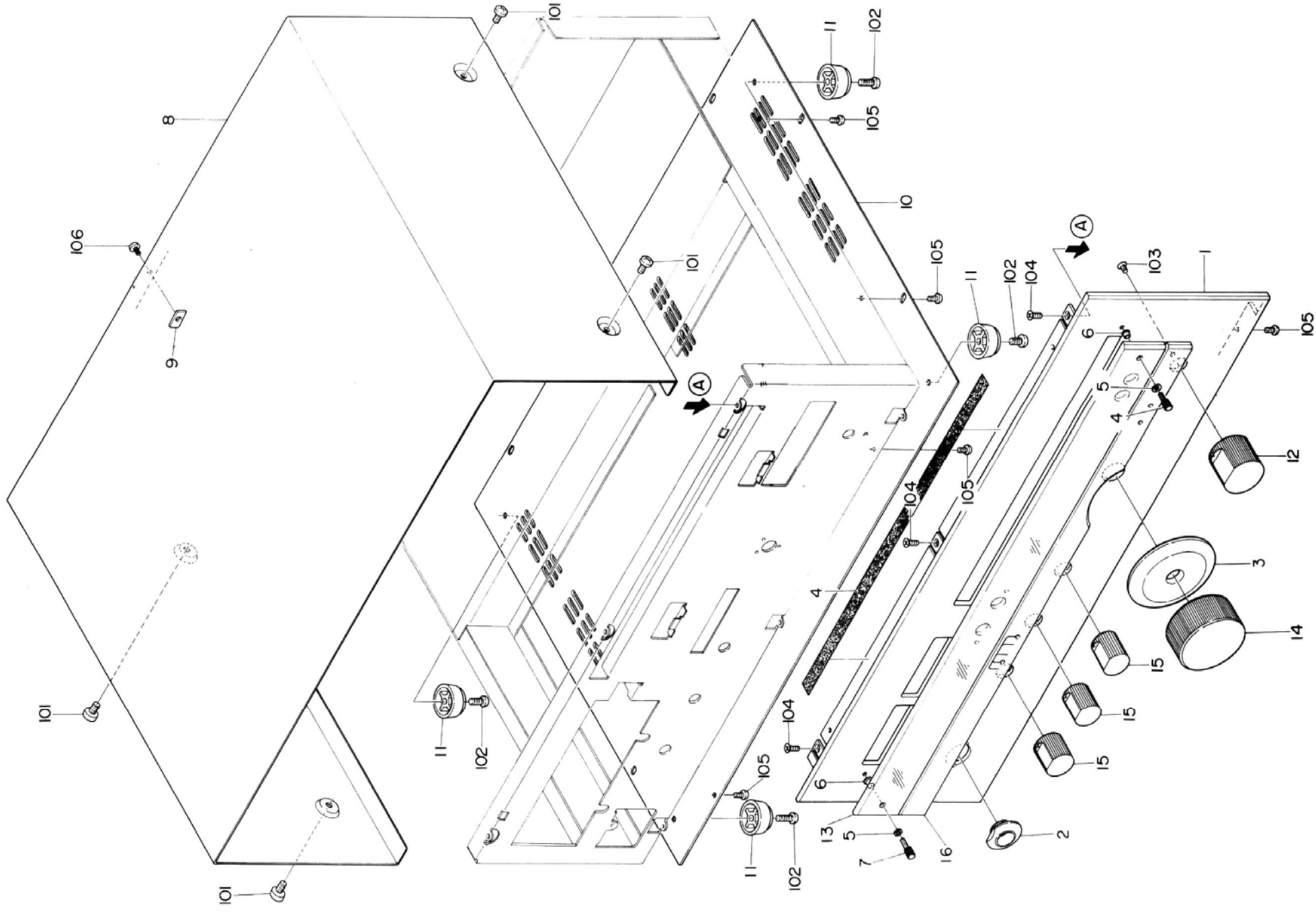


Fig. 15

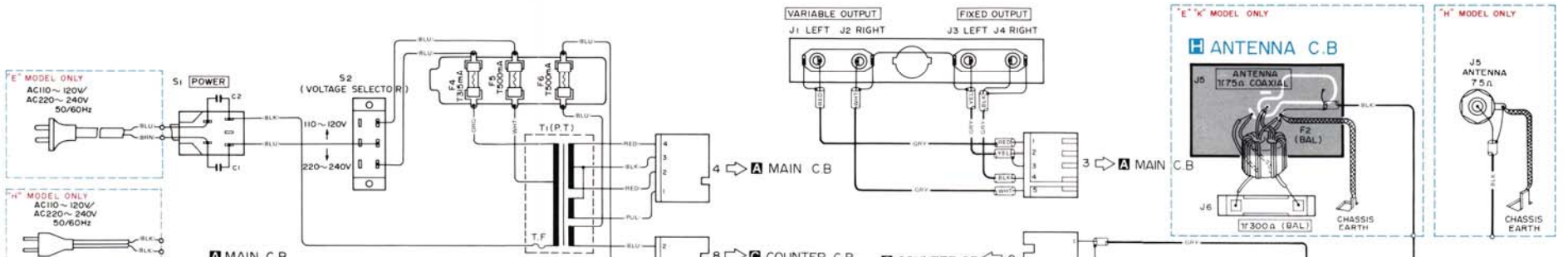
7. Digital frequency display

The reception frequency is indicated with a 4-digit numerical LED display. The local oscillator output is passed through the buffer and then applied to the counter LSI [IC 800, (T-1400B)].

EXPLODED VIEW-1



A
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O

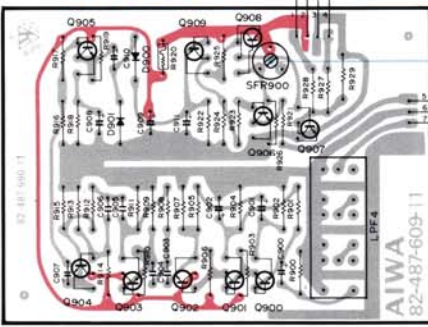


11 Locked LED Adjustment
Settings:

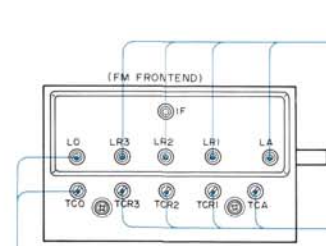
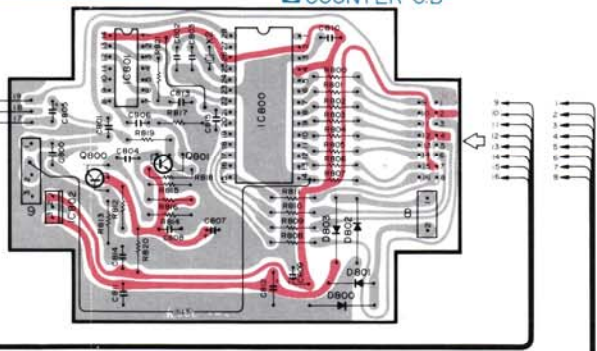
- Input signal: 98 MHz, 66 dB, 1 kHz (Mod. freq.), MOD. ON
- MODE SELECTOR: AUTO
- INDICATOR SELECTOR: MUTING OFF
- SELECTIVITY SELECTOR: NORMAL
- Test point: TP2, 3
- Adjustment location: SFR 900

Method: Adjust SFR900 so that the LED light up when detuning level is 100 mV. Confirm that the LED vanish out when detuning level is 100 ~ 130 mV.
Rating: 100 × 30 mV

B QUARTZ CONTROLLED SERVO LOCK C.B.



C COUNTER C.B.



3 Sensitivity (at Distortion 3%) Adjustment
Settings:

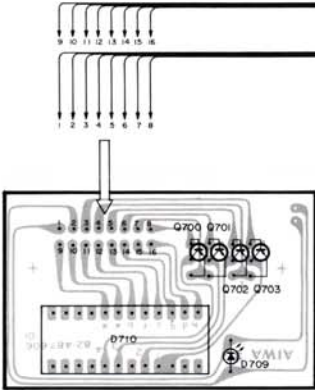
- Input signal: 88, 98, 108 MHz, 10 dB, 1 kHz (Mod. freq.) MOD. ON
- Adjustment location: LA, LR1, 2, 3, TCA, TCR1, 2, 3, IF2, 3, 4

Method: Adjust so that the distortion 3% sensitivity is 5 dB.
Rating: 5 × 2 dB

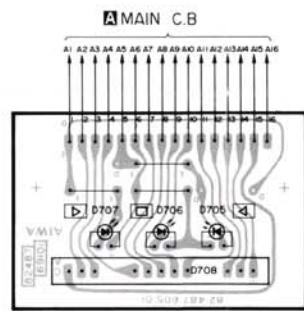
2 Frequency Range Adjustment
Settings:

- Input signal: 10 dB, 1 kHz (Mod. freq.) 75Ω (Antenna terminal)
- MODE SELECTOR: AUTO
- INDICATOR SELECTOR: MUTING OFF
- SELECTIVITY SELECTOR: NORMAL
- Adjustment location: LO (87.4 MHz), TCO (109.0 MHz) West Germany Model: LO (87.5 MHz), TCO (108.0 MHz)

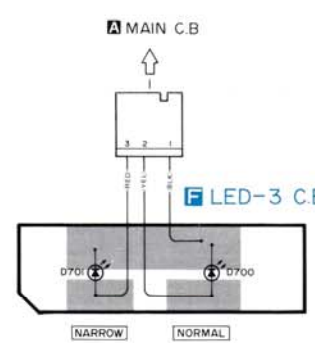
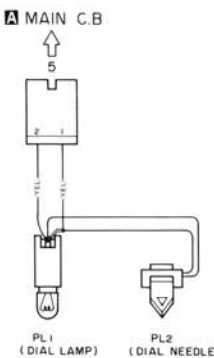
Method: Adjust LO, TCO so that the distortion is brought to its minimum value.



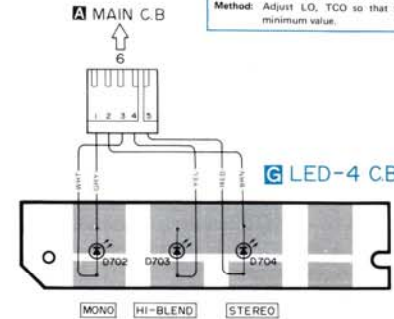
D LED-1 C.B.



E LED-2 C.B.



F LED-3 C.B.



G LED-4 C.B.

How to change the upper limit of FM frequency range from 108 MHz to 104 MHz

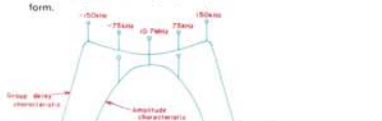
| Description | 108 MHz | 104 MHz |
|--------------|---------------|---------------|
| FM front end | 82-487-645-01 | 82-487-695-01 |

NOTES (1) B (+) Pattern (2) The voltage is the reference value measured with a tester (20 K ohms/V DC) when there are no signals.

A
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16 Free Running Adjustment
 Settings: • Test point: TP8
 • Adjustment location: SFR5
 For others, proceed as for 11, 12 Phase adjustment.
 Method: Adjust SFR5 so that the frequency is 152,000 Hz
 Rating: 152,000 Hz ± 0.001%

1 Group delay characteristic Adjustment
 Settings: • Adjustment location: IFT 1, SFR 1, 2, TC 1, 2
 Method: Adjustment used to the direct viewing system. Adjust IFT 1 so that the amplitude characteristic level is maximum. Adjust SFR 1, 2 and TC 1, 2 so that the group delay characteristic is below wave form.



7 Limiter Level Adjustment
 Settings: • Input signal: 10.7 MHz, 30 dB, 1 kHz (Mod. freq.), MOD. ON
 • Test point: TP6
 • Adjustment location: IFT2, 3, 4
 For others, proceed as for 4. 10.7 MHz Trap Coil adjustment.
 Method: Adjust IFT2, 3, 4 so that the voltage is brought to its maximum value.
 Rating: 1,000 mV

6 Distortion (MONO) Adjustment
 Settings: • Input signal: 10.7 MHz, 96 dB, 1 kHz (Mod. freq.), MOD. ON
 • Test point: VARIABLE OUTPUT
 • Adjustment location: IFT5
 For others, proceed as for 4. 10.7 MHz Trap Coil adjustment.
 Method: Adjust IFT5 so that the distortion becomes the same for both left and right channels.
 Rating: 0.02 ± 0.01%

12 Phase Adjustment
 Settings: • Input signal: 98 MHz, 66 dB, 1 kHz (Mod. freq.), MOD. OFF, 90(L+R)
 • MODE SELECTOR: AUTO
 • INDICATOR SELECTOR: MUTING OFF
 • SELECTIVITY SELECTOR: NORMAL
 • Test point: TP7
 • Adjustment location: SFR4
 Method: Adjust SFR4 so that the level is 0 V.
 Rating: 0 ± 0.5 V

14 Separation Adjustment
 Settings: • Input signal: 98 MHz, 66 dB, 1 kHz (Mod. freq.), MOD. ON
 • Test point: TP8
 • Adjustment location: SFR9, SFR6
 For others, proceed as for 12 Phase adjustment.
 Method: Adjust SFR9 so that the separation is more than 53 dB. And adjust SFR6 so that leakage is minimum value.
 Rating: More than 53 dB

9 Frequency Response Adjustment
 Settings: • Input signal: 10.7 MHz, 96 dB, 100 Hz, 1 kHz, 3 kHz (Mod. freq.), MOD. ON
 • MODE SELECTOR: AUTO
 • INDICATOR SELECTOR: MUTING OFF
 • SELECTIVITY SELECTOR: NORMAL
 • Test point: VARIABLE OUTPUT
 • Adjustment location: SFR 7 (L ch), SFR 8 (R ch)
 Method: Adjust so that the 100 Hz and 3 kHz outputs are identical.

15 Carrier Leak Adjustment
 Settings: • Input signal: 98 MHz, 66 dB, 1 kHz (Mod. freq.), MOD. ON
 • Test point: L+R (MOD. 0, 90°)
 • Adjustment location: SFR6, L16
 For others, proceed as for 12 Phase adjustment.
 Method: Adjust SFR6, L16 so that the carrier leak is more than 70 dB.
 Rating: More than 70 dB

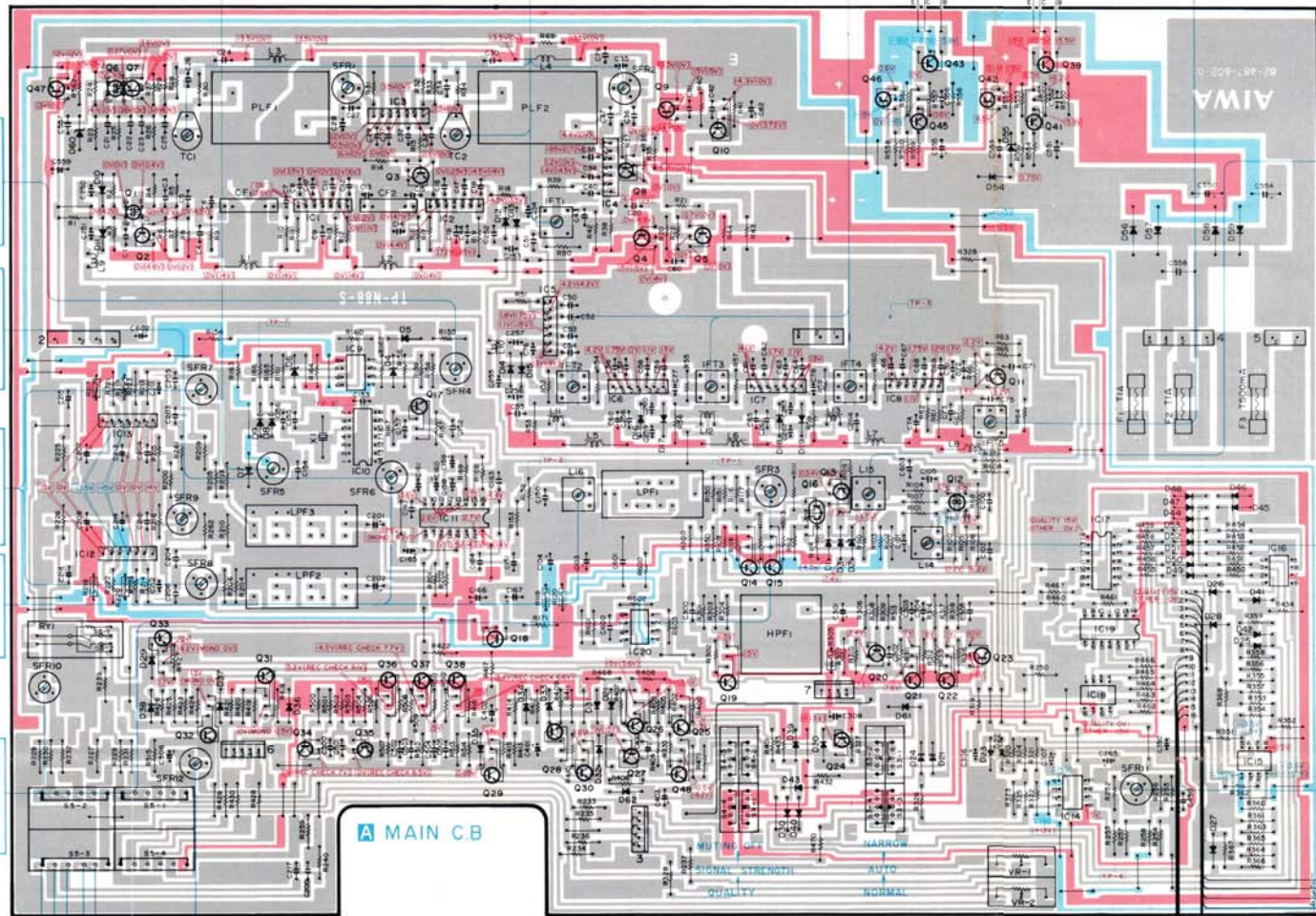
8 Fixed Output Level Adjustment
 Settings: • Input signal: 10.7 MHz, 96 dB, 400 Hz (Mod. freq.), MOD. ON
 • Test point: FIXED OUTPUT
 • Adjustment location: SFR13, SFR10 (R ch)
 For others, proceed as for 4. 10.7 MHz Trap Coil adjustment.
 Method: Adjust SFR3 and SFR10 (R ch) so that the output becomes the same for both left and right channels.
 Rating: 500 mV

10 REC. Level Check Adjustment
 Settings: • MODE SELECTOR: REC LEVEL CHECK
 • INDICATOR SELECTOR: MUTING OFF
 • SELECTIVITY SELECTOR: NORMAL
 • Test point: FIXED OUTPUT
 • Adjustment location: SFR 12
 Method: Adjust so that the output becomes 250 mV.
 Rating: 250 ± 5 mV

4 10.7 MHz Trap Coil Adjustment
 Settings: • Input signal: 10.7 MHz, 96 dB, 1 kHz (Mod. freq.), MOD. OFF
 • MODE SELECTOR: AUTO
 • INDICATOR SELECTOR: MUTING OFF
 • SELECTIVITY SELECTOR: NORMAL
 • OUTPUT LEVEL: MAX
 • Test point: TP1, TP3
 • Adjustment location: L15
 Method: Adjust L15 so that the output level is reduced to minimum value.

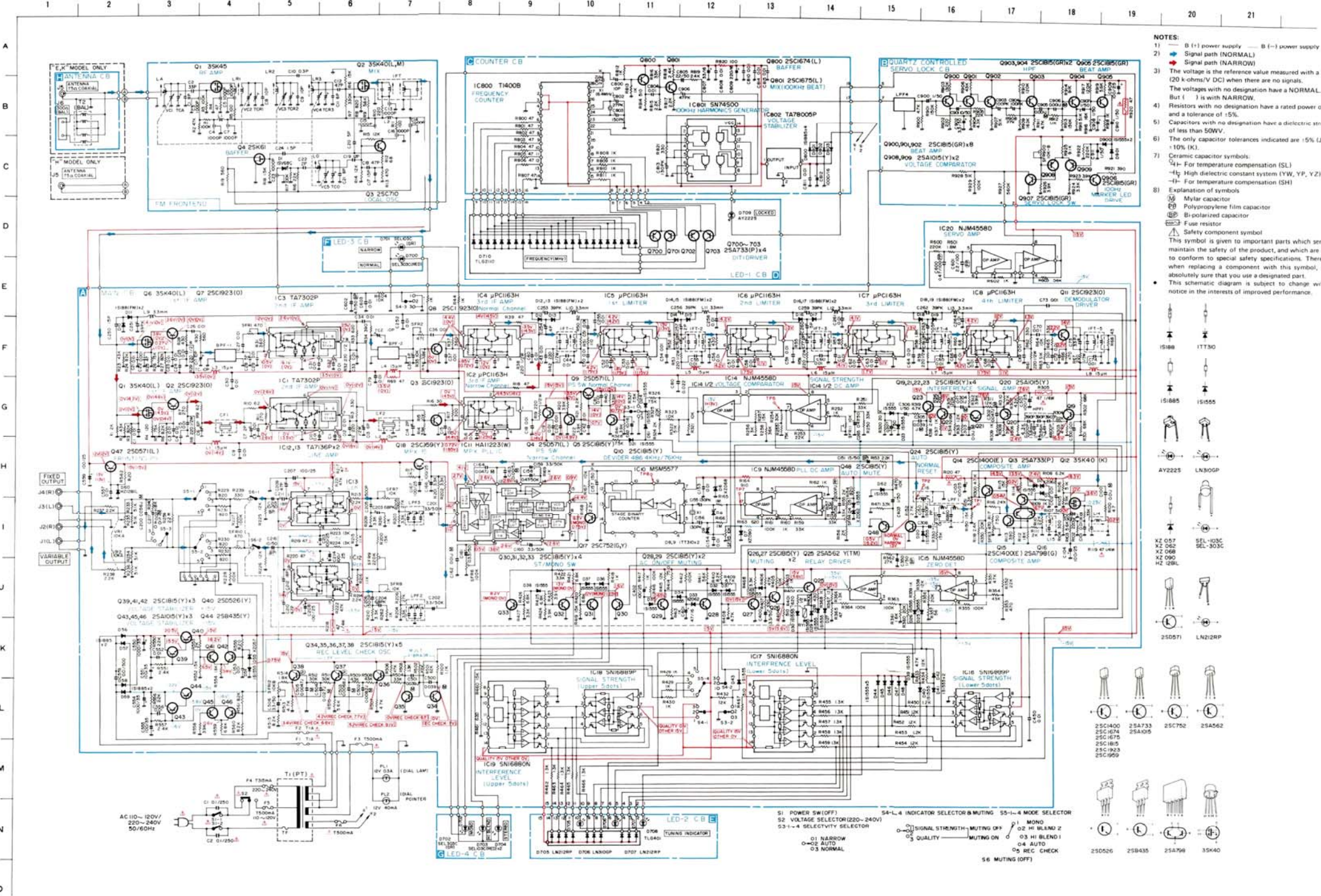
5 DC Zero Center Adjustment
 Settings: • Test point: TP2, TP3
 • Adjustment location: L14
 For others, proceed as for 4. 10.7 MHz Trap Coil adjustment.
 Method: Pointer is oscillated right and left of indicator points "0" center.

13 Muting Level Adjustment
 Settings: • Input signal: 98 MHz, 66 dB, 1 kHz (Mod. freq.), MOD. OFF
 • Test point: VARIABLE OUTPUT
 • Adjustment location: SFR11
 For others, proceed as for 12 Phase adjustment.
 Method: Adjust so that the signal to noise ratio is 45 dB. Adjust SFR11 so that the MONO indicator LED light up. Confirm that the STEREO indicator light up when the input level is increased by 1 dB.



NOTES (1) B (+) Pattern B (-) Pattern Others pattern (2) The voltage is the reference value measured with a tester (20 K ohms/V DC) when there are no signals

SCHEMATIC DIAGRAM



- NOTES:**
- 11 B (+) power supply — B (-) power supply
 - 12 Signal path (NORMAL)
 - 13 Signal path (NARROW)
 - 14 The voltage is the reference value measured with a tester (20 k-ohms/V DC) when there are no signals. The voltages with no designation have a NORMAL. But () is with NARROW.
 - 15 Resistors with no designation have a rated power of 1/8W and a tolerance of 5%.
 - 16 Capacitors with no designation have a dielectric strength of less than 50WV.
 - 17 The only capacitor tolerances indicated are ±5% (J) and ±10% (K).
 - 18 Ceramic capacitor symbols:
 SL — For temperature compensation (SL)
 YW, YP, YZ — High dielectric constant system (YW, YP, YZ)
 T — For temperature compensation (SH)
 - 19 Explanation of symbols:
 M — Mylar capacitor
 P — Polypropylene film capacitor
 Bi — Bifilar capacitor
 F — Fuse resistor
 Δ — Safety component symbol
 This symbol is given to important parts which serve to maintain the safety of the product, and which are made to conform to special safety specifications. Therefore, when replacing a component with this symbol, make absolutely sure that you use a designated part.
 * This schematic diagram is subject to change without notice in the interests of improved performance.

Legend:

- IS188, ITT30, IS185, IS155, AY225, LN300P, XZ 057, XZ 062, XZ 068, XZ 090, XZ 28L, 25057, LN212RP, 25C400, 25C674, 25C1675, 25C185, 25C182, 25C1950, 25A733, 25A015, 25C702, 25A562, 250526, 25B435, 25A798, 35K40

Legend:

- S1 POWER SW (OFF)
- S2 VOLTAGE SELECTOR (220-240V)
- S3-4 SELECTIVITY SELECTOR
- S5-6 MUTE (OFF)
- S7-8 MODE SELECTOR
- S9 VOLTAGE SELECTOR (220-240V)
- S10-4 SELECTIVITY SELECTOR
- S11-4 MODE SELECTOR
- S12 VOLTAGE SELECTOR (220-240V)
- S13-4 SELECTIVITY SELECTOR
- S14-4 MODE SELECTOR
- S15-4 SELECTIVITY SELECTOR
- S16 MUTE (OFF)
- S17-4 MODE SELECTOR
- S18 VOLTAGE SELECTOR (220-240V)
- S19-4 SELECTIVITY SELECTOR
- S20-4 MODE SELECTOR
- S21-4 SELECTIVITY SELECTOR
- S22-4 MODE SELECTOR
- S23-4 SELECTIVITY SELECTOR
- S24-4 MODE SELECTOR
- S25-4 SELECTIVITY SELECTOR
- S26-4 MODE SELECTOR
- S27-4 SELECTIVITY SELECTOR
- S28-4 MODE SELECTOR
- S29-4 SELECTIVITY SELECTOR
- S30-4 MODE SELECTOR
- S31-4 SELECTIVITY SELECTOR
- S32-4 MODE SELECTOR
- S33-4 SELECTIVITY SELECTOR
- S34-4 MODE SELECTOR
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- S94-4 MODE SELECTOR
- S95-4 SELECTIVITY SELECTOR
- S96-4 MODE SELECTOR
- S97-4 SELECTIVITY SELECTOR
- S98-4 MODE SELECTOR
- S99-4 SELECTIVITY SELECTOR
- S100-4 MODE SELECTOR

PARTS LIST

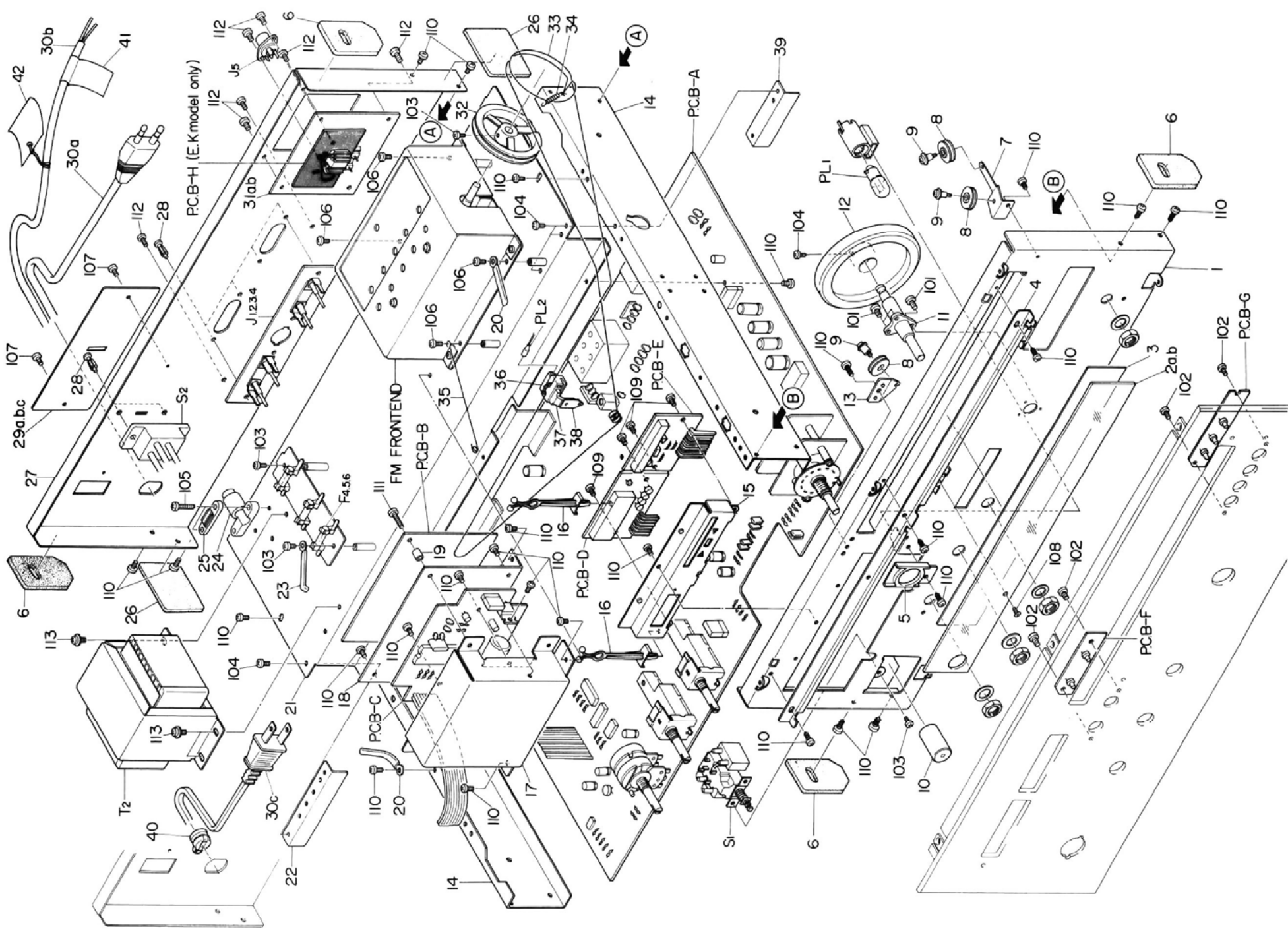
MECHANICAL PARTS

- * mark in this part list shows exclusive part (which is used) for only Model AT-9700.

| Ref. No. | Part No. | Part No. Changed to | Description | Common Model | Q'ty |
|----------|---------------|---------------------|-------------------------|--------------|------|
| 1~4 | 09-047-121-01 | | Panel Assembly | | |
| 1-1 | 82-487-001-01 | | Front sash | * | 1 |
| 1-2 | 82-478-012-01 | | Ring, Power button | AA-8700 | 1 |
| 1-3 | 82-487-012-01 | | Ring, Knob | * | 1 |
| 1-4 | 82-397-245-01 | | Himeron cloth, Cabinet | | 1 |
| 1-5 | 82-488-024-01 | | G washer | | 2 |
| 1-6 | 82-488-023-01 | | G sleeve | | 2 |
| 1-7 | 82-488-016-01 | | Screw, Window | | 2 |
| 1-8 | 82-478-048-01 | | Steel cabinet ass'y | AA-8700 | 1 |
| 1-9 | 82-380-439-01 | | Spacer, Back panel | AD-6500 | 1 |
| 1-10 | 82-487-010-01 | | Bottom plate | * | 1 |
| 1-11 | 87-085-162-01 | | Foot | | 4 |
| 1-12 | 82-478-008-01 | | Selector knob ass'y | AA-8700 | 1 |
| 1-13 | 82-487-004-01 | | Decorative plate, Front | * | 1 |
| 1-14 | 82-487-017-01 | | Tuning knob ass'y | * | 1 |
| 1-15 | 82-478-031-01 | | Tone knob ass'y | AA-8700 | 3 |
| 1-16 | 82-487-001-01 | | Decorative plate, Front | * | 1 |

| Ref. No. | Part No. | Description | Q'ty | Ref. No. | Part No. | Description | Q'ty |
|----------|---------------|----------------|------|----------|---------------|------------------------------|------|
| 1-101 | 87-257-169-11 | U + 4-6(Black) | 3 | 1-104 | 87-231-094-21 | Q + 3-6 | 3 |
| 1-102 | 87-253-170-11 | U + 4-8 | 4 | 1-105 | 87-081-511-01 | VTT + 3-6 | 12 |
| 1-103 | 87-231-074-21 | Q + 2.6-8 | 3 | 1-106 | 87-340-095-01 | UT ₁ + 3-8(Black) | 3 |


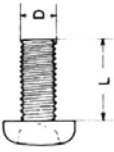



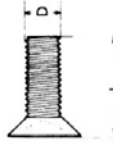



EXPLODED VIEW-2



| Ref. No. | Part No. | Part No. Changed to | Description | Common Model | Q'ty |
|----------|---------------|---------------------|---|--------------|------|
| 2-1 | 82-487-201-01 | | Front chassis | * | 1 |
| 2-2a | 82-487-013-01 | | Dial plate (E, K model only) | * | 1 |
| 2-2b | 82-487-020-01 | | Dial plate (H model only) | * | 1 |
| 2-3 | 82-487-007-01 | | Dial back plate | * | 1 |
| 2-4 | 82-487-203-01 | | Frame, Dial | * | 1 |
| 2-5 | 82-487-215-01 | | Light cover | * | 1 |
| 2-6 | 82-473-245-01 | | Spacer A, Side panel | AX-7500 | 2 |
| 2-7 | 82-487-204-01 | | Holder A, Roller | * | 1 |
| 2-8 | 82-470-276-01 | | Roller, 14φ | AF-3030 | 3 |
| 2-9 | 87-081-483-01 | | Motor screw, M2.6 | | 3 |
| 2-10 | 82-339-025-01 | | AC switch button ass'y | | 1 |
| 2-11 | 82-487-208-11 | | Flywheel shaft ass'y | * | 1 |
| 2-12 | 82-487-207-01 | | Flywheel | * | 1 |
| 2-13 | 82-487-205-01 | | Holder B, Roller | * | 1 |
| 2-14 | 82-478-202-01 | | Chassis, Side | AA-8700 | 2 |
| 2-15 | 82-487-216-01 | | Dis-play plate | * | 1 |
| 2-16 | 82-487-614-01 | | Wire clamp | * | 2 |
| 2-17 | 82-487-611-01 | | Shield case A | * | 1 |
| 2-18 | 82-487-612-01 | | Shield case B | * | 1 |
| 2-19 | 82-375-244-01 | | Collar, AC button | | 2 |
| 2-20 | 87-064-080-01 | | Wire binder | | 2 |
| 2-21 | 82-487-213-Q1 | | Sub-chassis ass'y | * | 1 |
| 2-22 | 82-487-222-01 | | Auxiliary plate L | * | 1 |
| 2-23 | 87-038-039-01 | | Wire binder | | 1 |
| 2-24 | 87-085-094-01 | | Holder A, AC power cord (E, K model only) | | 1 |
| 2-25 | 87-085-095-01 | | Holder B, AC power cord (E, K model only) | | 1 |
| 2-26 | 82-473-247-01 | | Spacer B, Side panel | AX-7500 | 2 |
| 2-27 | 82-487-002-01 | | Back panel | * | 1 |
| 2-28 | 87-085-102-01 | | Nylon rivet, 3.5-5.5 | | 1 |
| 2-29a | 82-487-016-01 | | Name plate, Spec. (E model only) | * | 1 |
| 2-29b | 82-487-019-01 | | Name plate, Spec. (K model only) | * | 1 |
| 2-29c | 82-487-021-01 | | Name plate, Spec. (H model only) | * | 1 |
| 2-30a | 87-034-877-01 | | AC power cord (E model only) | | 1 |
| 2-30b | 87-034-872-01 | | AC power cord (K model only) | | 1 |
| 2-30c | 87-034-826-01 | | AC power cord (H model only) | | 1 |
| 2-31a | 82-487-217-01 | | Antenna terminal plate (E, K model only) | * | 1 |
| 2-31b | 82-487-219-01 | | Antenna terminal plate (H model only) | * | 1 |
| 2-32 | 82-487-206-01 | | Dial drum | * | 1 |
| 2-33 | 87-096-045-01 | | Dial string | | 1 |
| 2-34 | 82-487-220-01 | | Drum spring | * | 1 |
| 2-35 | 82-487-221-01 | | Guide, Wire | * | 1 |
| 2-36 | 82-470-013-01 | | Holder, Dial pointer | AF-3030 | 1 |
| 2-37 | 82-487-011-01 | | Dial pointer | * | 1 |
| 2-38 | 82-487-008-01 | | Decorative plate, Dial pointer | * | 1 |
| 2-39 | 82-487-223-01 | | Auxiliary plate R | * | 1 |
| 2-40 | 87-085-101-01 | | Cord bushing (H model only) | | 1 |
| 2-41 | 87-056-008-01 | | Label, AC power cord (K model only) | | 1 |
| 2-42 | 87-056-007-01 | | Tag, Main voltage (K model only) | | 1 |

| Ref. No. | Part No. | Description | Q'ty | Ref. No. | Part No. | Description | Q'ty |
|----------|---------------|----------------|------|----------|---------------|--------------------------------|------|
| 2-101 | 87-261-073-21 | V + 2.6-6 | 3 | 2-108 | 87-231-035-21 | Q + 2-6 | 1 |
| 2-102 | 87-261-093-21 | V + 3-5 | 4 | 2-109 | 87-081-501-01 | VTT + 2.6-4 | 4 |
| 2-103 | 87-261-094-21 | V + 3-6 | 5 | 2-110 | 87-081-511-01 | VTT + 3-6 | 31 |
| 2-104 | 87-261-095-21 | V + 3-8 | 5 | 2-111 | 87-081-514-01 | VTT + 3-12 | 2 |
| 2-105 | 87-261-099-21 | V + 3-15 | 2 | 2-112 | 87-081-854-01 | VTT ₂ + 3-6 (Black) | 8 |
| 2-106 | 87-264-169-11 | V + 4-6 | 4 | 2-113 | 87-500-169-11 | VF + 4-6 | 4 |
| 2-107 | 87-257-033-01 | U + 2-4(Black) | 2 | | | | |

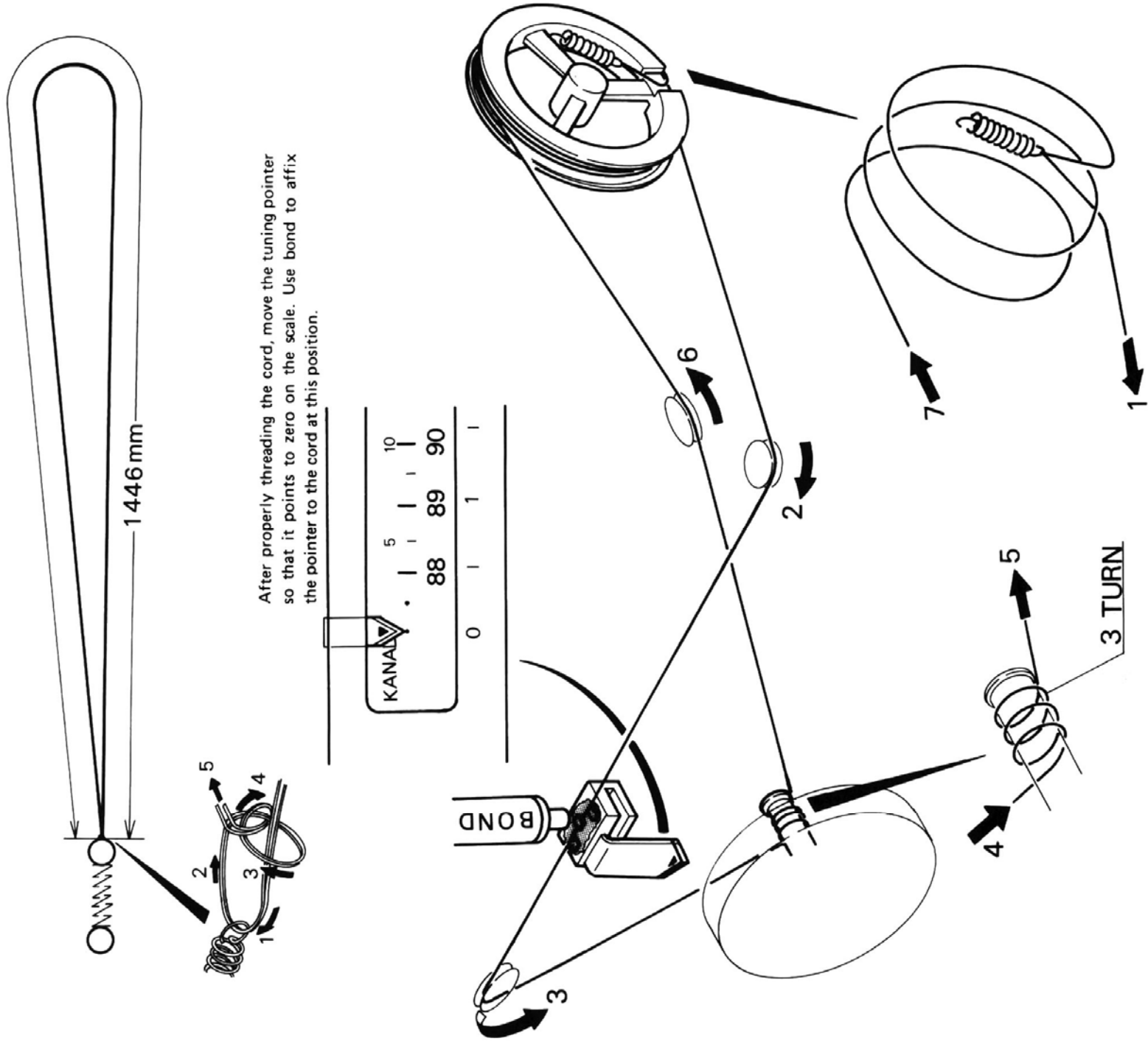
HARDWARE NOMENCLATURE

| | | | | | |
|--------------|-----------------------------|---|-----------------|---|--|
| V: | Pan head screw |  | Example: |  | V + 3 - 6 Length in mm Diameter in mm Type of Slot Type of Head |
| U: | Binding head screw |  | | | |
| Q: | Flat countersunk head screw |  | | | |
| UT1: | Binding head tapping screw |  | Example: |  | Q + 3 - 6 Length in mm Diameter in mm Type of Slot Type of Head |
| VF: | Flange and Pan head screw |  | | | |
| VTT: | Pan head tap-tight screw |  | | | |
| VTT2: | Pan head tap-tight screw |  | | | |

ACCESSORIES/PACKAGE

| Ref. No. | Part No. | Part No. Changed to | Description | Common Model | Q'ty |
|----------|---------------|---------------------|-------------------------------------|--------------|------|
| 1 | 82-487-851-01 | | Printed indiv., Packing | * | 1 |
| 2 | 82-487-852-01 | | Cushion L, Printed indiv. | * | 1 |
| 3 | 82-487-853-01 | | Cushion R, Printed indiv. | * | 1 |
| 4 | 87-051-131-01 | | Poly-vinyl sack | | 1 |
| 5 | 87-056-564-01 | | Curli stopper | | 2 |
| 6 | 87-056-607-01 | | Poly-vinyl sack | | 1 |
| 7a | 82-487-901-01 | | Instructions booklet (E model only) | * | 1 |
| 7b | 82-487-902-01 | | Instructions booklet (K model only) | * | 1 |
| 7c | 82-487-903-01 | | Instructions booklet (H model only) | * | 1 |
| 8 | 87-051-171-01 | | Poly-vinyl sack | | 1 |
| 9 | 87-056-007-01 | | Tag, Main voltage (K model only) | | 1 |
| 10 | 87-056-008-01 | | Label, AC power cord (K model only) | | 1 |
| 11 | 87-056-009-01 | | Distributors list | | 1 |
| 12 | 86-944-619-01 | | Connection cord, CW-129KS | | 1 |
| 13 | 87-032-845-01 | | Siemens plug (H model only) | | 1 |
| 14a | 87-032-933-01 | | M/F adaptor (K model only) | | 1 |
| 14b | 87-032-931-01 | | 75/300Ω adaptor (H model only) | | 1 |
| 15a | 87-043-046-01 | | FM antenna (E, K model only) | | 1 |
| 15b | 87-043-025-01 | | FM antenna (H model only) | | 1 |
| 16 | 87-058-023-01 | | Cord biner | | 1 |

DIAL CORD STRINGING



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