

CIRCUIT DESCRIPTION

DSB by IC4 goes through the SSB transmit switching diodes D17 and D18, filter switching diodes D14 and D12, and SSB ceramic filter CF1, to obtain the SSB signal. The SSB signal then goes through the transmit switching diode D36 and is fed into the transmit first mixer, IC6, where the SSB signal is mixed with the output from the 8.375 MHz oscillator in the IF unit, and converted to 8.83 MHz. In CW or FM mode, the carrier signal from the PLL unit does not go through IC5 BM or the 455 kHz filter. These carrier signals are applied to IC6 via switching diodes D53 and D54. The output signal from IC6 goes through the MCF to remove spurious components, and is amplified by the IF amplifier Q46 (3SK73) and sent to the RF unit. Q46 provides ALC control and CW keying.

In the transmitter second mixer, consisting of Q11 and Q12, (3SK122), the 8.83 MHz transmit IF signal input to the RF unit is mixed with HET oscillator signal (36.22 MHz) from the PLL unit and converted to 45.05 MHz signals. The 45.05 MHz signal goes through D23 and the MCF to remove any spurious components. The 45.05 MHz signal then goes through D27 and is supplied to the transmit third mixer consisting of Q13 and Q14 (3SK122). In the third mixer the signal is mixed with VCO signal (Q21 to Q24) amplified by Q12 (2SC2668) and converted to the required transmit frequency (1.8 to 29.7 MHz). The signal from the third mixer goes through the low pass filters C156, C158, C159, and L89, and is amplified by the wide band amplifier Q15 (2SC2570). The signal then goes through the wide band transformer T19 and low pass filters C164, C165, and L90, and is further amplified by wide band amplifier Q16 (2SC2538). The signal from the Q16 goes through the output transformer T20 and is used as the drive output.

In FM mode, the PLL VCO is directly modulated. The audio signal from IF unit IC4 (UPC1158HZ) is fed into the RF unit via the FMI pin. In the RF unit, the audio signal is amplified by Q36 (2SC2459) and Q37 (2SC2603), and goes through the limiter circuit consisting of Q38 (UPC4558C) and low pass filter circuit, and is sent to the PLL unit via the FMD pin. In the PLL unit, the 36.22 MHz VCO is modulated. Q39 (2SC2603) is a switching circuit to prevent the modulated signals from being emitted from the PLL unit in a mode other than FM.

For "S" model radios the output from the RF unit is amplified to a 100 W power level by Q1 (2SC2075), Q2 and Q3 (2SC2509), and Q4 and Q5 (2SC2879) in the final unit. The 100 W output goes through the LPFs which differ by bands, and is sent as output to the antenna via the AT unit and transmit/receive switching relay. SWR and ALC detection is performed at the output of the LPFs.

1) Antenna tuner

The antenna tuner operates when the AUTO/THRU switch is in the AUTO position and the AT TUNE switch is ON. The antenna tuner is driven in the CW mode and power is reduced to 50 W by the microcomputer regardless of the mode selected before the AT TUNE switch was turned ON. The range of operating frequencies is determined by a microcomputer program, and is from 3.5 MHz to 30 MHz.

• AT unit operation

Power transmitted by the final unit passes through the current and voltage detecting transformers L1 and L2 using toroidal cores. Current and voltage components detected by the transformers are supplied to pins 9 and 13 of IC2 for wave shaping and their phases are compared by IC3 HD10131. The output from pin 3 of IC3 depends upon the phase of the voltage and current waveforms applied to IC3. The signal from IC3 pin 3 is sent to pins 10 and 15 of buffer IC IC3 HD10125. Output from pins 12 and 13 of IC3 goes through level shift Zener diodes D5 and D6 to control the input circuit of motor drive IC IC5 BA6109U2. The output signal is used to drive motor M1 to adjust the variable capacitor VC1 so that the phase difference between voltage and current components is reduced.

The current and voltage components output from the current and voltage detecting transformers is also supplied to the voltage comparator IC1 NJM2903D. The comparator output is used by motor drive IC IC6 BA6109U2 to drive motor M2 to adjust variable capacitor VC2 so that the amplitude difference is reduced. That is, the phase control variable capacitor VC1 is controlled so that the current is in phase with the voltage and the voltage control variable capacitor VC2 is controlled so that the amount of amplitude difference between the current and voltage is reduced (SWR1, an SWR of 1 to 1, is obtained when the current and voltage are in phase and the amount of amplitude difference is 0). VC1 and VC2 are designed to operate independently of each other, but since phase difference affects the amount of amplitude difference and vice versa, VC1 and VC2 will normally rotate together.

Forward and reflected waves detected by the filter unit are converted to SWR control signals in the SWR arithmetic circuit in the control unit and are sent to the ISW pin of the AT unit. Since the SWR control signals are current waveforms, the signals are converted from I to V waveforms by IC8 (b/4) in the AT unit and to obtain the corresponding voltage mode SWR signals are generated. The SWR signals are then fed into the SWR comparator IC8 (C/4). The reference voltage pin 9 of the IC8 (C/4) is supplied with a voltage corresponding to an SWR of 1.25 to 1 via a potentiometer. Therefore, when the actual SWR value exceeds 1.25, pin 8 of SWR comparator IC8 (C/4) is H, so the motor drive voltage control transistor Q5 turns on and the collector of Q4 is supplied with voltage from pin 14S. The voltage is also used to turn the tuning LED on. The inverted input pin of IC8 (d/4) is supplied with triangular waves generated by IC7, and its non-inverted input pin is supplied with the above SWR voltage signals. As a result, as SWR lowers, IC8 (d/4) outputs

CIRCUIT DESCRIPTION

waves changing from continuous waves to relatively low duty pulses. Q1 is driven by this voltage waveform to control Q2, which is connected to the collector of Q4 in series and motor drive voltage is generated.

If the motor turns too fast, the SWR value will be smaller than the motor stop value because of the inertia of the motor. As a result, the motor will continue to operate even if

the motor stop signal is sent and the SWR value will continue to be greater than the motor stop value, causing the motor stop signal to turn off. That is, the motor will not stop and it will be difficult to obtain a match. If the motor speed is too slow, it will take a long time to satisfy a matching condition. The TS-440 therefore controls the motor speed according to changes in SWR.

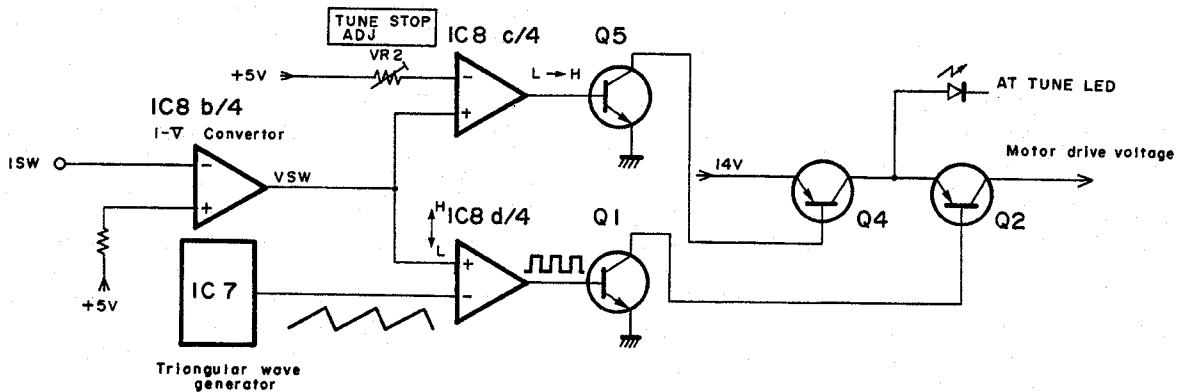


Fig. 7 Antenna tuner circuit

The antenna coupler is a T type. Six relays RL100 to RL105 are used to change taps within the range 3.5 MHz to 30 MHz.

2) Cooling fan circuit

The final unit contains the temperature-sensitive thermistor TH1 thermally coupled with final transistor Q4. When temperature on the surface of Q4 reaches approx. 50°C, the fan start comparator Q9B operates (H level), causing Q8 to turn on to operate the fan. During operation of the fan, temperature protection comparator Q9A is at a L level, so the temperature protection circuit does not operate. When temperature on the surface of Q4 goes down to 45°C, the cooling fan turns off.

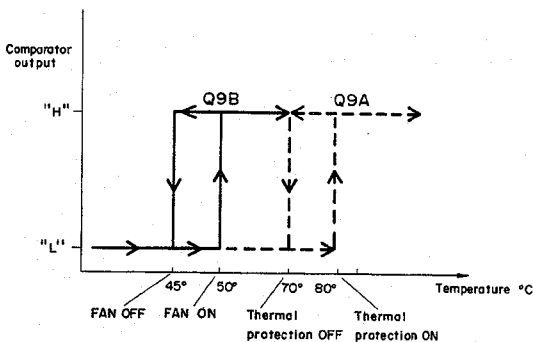


Fig. 8 temperature protection operation

• Final temperature protection circuit

When the temperature of the final transistor Q4 rises up to approx. 80°C, the temperature protection comparator Q9A turns on (H level), Q1 in the filter unit also turns on, and a minus DC voltage is supplied to the ALC line, reducing the transmitter output to zero. (The TS-440 does not return to a receive state.) When the temperature of the final transistor Q4 falls to approx. 70°C, the protection circuits turns off allowing the transmitter to operate again.

• SWR protection circuit

When antenna VSWR is bad, or the reflected wave is too large, because the auto antenna is tuning for example, L42 and L43 detect the state and its output is rectified. The rectified signal is then amplified by Q2 to control the ALC voltage so that drive power is reduced. As a result, load on the final unit is reduced.

• SWR automatic arithmetic circuit

The TS-440 uses the automatic arithmetic circuit in the AT-250. The forward wave voltage V_{SF} and reflected wave voltage V_{SR} from the filter unit are fed into the analog arithmetic circuit of the switch unit, and used to set the voltage level of IC8 pin 2 ($5V + V_{SR}/V_{SF}$). Output voltage from the pin 2 is shifted by IC5 to move the needle in the SWR meter.

IC5 contains a level shift/meter amplifier and an auto tuner V-I converter. IC7 contains a square wave generator and a voltage comparator. IC8 contains an integration circuit. Q3 and Q4 are used to switch forward and reflected wave input signals alternately.

PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Telle ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
S53			S31-2405-05	SLIDE SWITCH		
S54 -56			S40-2440-15	PUSH SWITCH		
S57			S40-2441-15	PUSH SWITCH		
S58 -60			S40-2440-15	PUSH SWITCH		
D1 -4			1S1555	DIODE		
D5 ,6			MTZ6.2JA	ZENER DIODE		
D50 ,51			1SS133	DIODE		
D52			1SS101	DIODE		
IC1		*	UPD6300C	IC(FL LATCH DRIVER)		
IC2			MB4052	IC(4CH 8BIT A/D CONVERTER(ADC)		
IC3			TC4013BP	IC(D FLIP-FLOP X2)		
PL1		*	FIP13BM7	FLUORESCENT INDICATOR TUBE		
Q1 ,2			DTA114ES	DIGITAL TRANSISTOR		
Q3			DTC144WS	DIGITAL TRANSISTOR		
Q4 ,5			2SC1959(Y)	TRANSISTOR		
Q50			DTC143TS	DIGITAL TRANSISTOR		
AT UNIT (X57-1150-00)						
C1 ,2			C91-0117-05	CERAMIC 0.01UF K		
C3 ,4			CK45B1H102K	CERAMIC 1000PF K		
C5			C91-0119-05	CERAMIC 0.047UF K		
C6			CK45B1H102K	CERAMIC 1000PF K		
C7			C91-0119-05	CERAMIC 0.047UF K		
C8			CK45B1H102K	CERAMIC 1000PF K		
C9			C91-0119-05	CERAMIC 0.047UF K		
C10			CE04W1H100M	ELECTRO 10UF 50WV		
C11			CE04W1C470M	ELECTRO 47UF 16WV		
C12			C91-0119-05	CERAMIC 0.047UF K		
C13 -15			C91-0117-05	CERAMIC 0.01UF K		
C16			CK45F1H473Z	CERAMIC 0.047UF Z		
C17 ,18			C91-0117-05	CERAMIC 0.01UF K		
C19			CE04W1E101M	ELECTRO 100UF 25WV		
C20			C91-0117-05	CERAMIC 0.01UF K		
C21			CK45F1H473Z	CERAMIC 0.047UF Z		
C22			C91-0117-05	CERAMIC 0.01UF K		
C23			C91-0119-05	CERAMIC 0.047UF K		
C24			CC92M1H333K	MYLAR 0.033UF K		
C25			CK45B1H102K	CERAMIC 1000PF K		
C26			CE04W1H010M	ELECTRO 1.0UF 50WV		
C27			CE04W1H100M	ELECTRO 10UF 50WV		
C28 ,29			CK45F1H103Z	CERAMIC 0.010UF Z		
C30			C91-0117-05	CERAMIC 0.01UF K		
C31			CC45SL2H560J	CERAMIC 56PF J		
C100-105			CK45F1H473Z	CERAMIC 0.047UF Z		
C106-111			CK45F1H103Z	CERAMIC 0.010UF Z		
C112			CK45F1H473Z	CERAMIC 0.047UF Z		
TC1			C05-0324-05	TRIMMING CAP 60PF		
VC1 ,2		*	C02-0023-05	VARIABLE CAPACITOR		
163	2P	*	D40-0629-05	GEAR MECHANISM ASSY		
-			ED4-0157-05	RF COAXIAL CABLE RECEPTACLE		
-			E40-0273-05	PIN CONNECTOR (MINI,2P)		
-			E40-0473-05	PIN CONNECTOR (MINI,4P)		
-			E40-0673-05	PIN CONNECTOR (MINI,6P)		
-			E40-0873-05	PIN CONNECTOR (MINI,8P)		

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

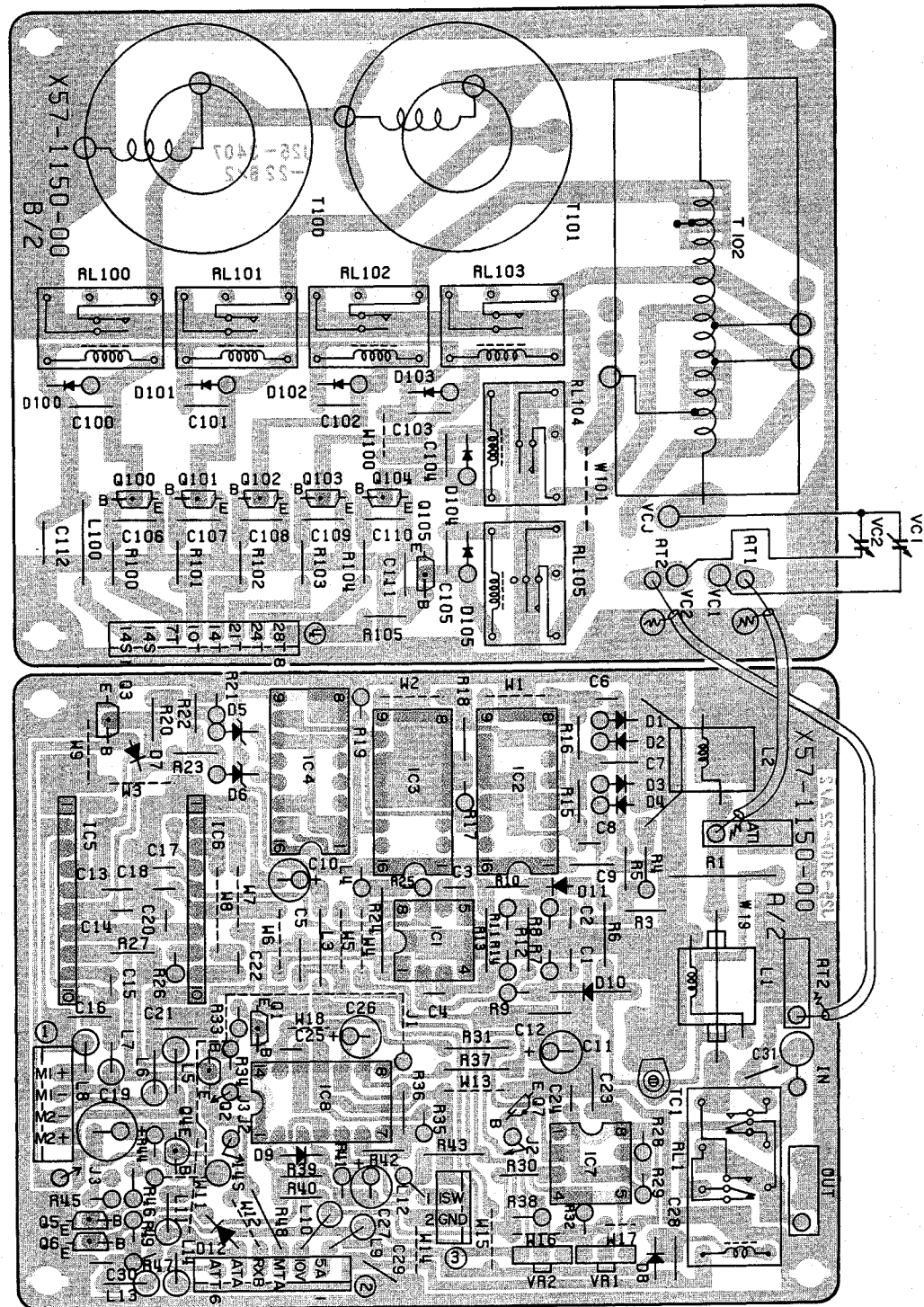
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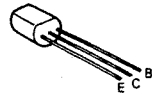
Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
-			L92-0103-05	TRIADAL CORE (FOR L1,2)		
-		*	L92-0119-05	TRIADAL CORE (FOR T100,101)		
L1			L39-0416-05	COIL		
L2			L39-0415-05	COIL		
L3			L40-1011-13	SMALL FIXED INDUCTOR		
L4			L40-1011-14	SMALL FIXED INDUCTOR		
L5 -11			L40-1011-13	SMALL FIXED INDUCTOR		
L12			L40-1011-14	SMALL FIXED INDUCTOR		
L13 ,14			L40-1011-13	SMALL FIXED INDUCTOR		
L100			L40-1011-13	SMALL FIXED INDUCTOR		
T100		*	L34-3144-15	COIL		
T101		*	L34-3145-15	COIL		
T102		*	L34-3146-15	COIL		
R	1P,1Q		N88-3006-46	FLAT HEAD TAPTITE SCREW		
M	1Q,2R		N87-2606-46	BRAZIER HEAD TAPTITE SCREW		
N	2P,1R		N87-3006-46	BRAZIER HEAD TAPTITE SCREW		
R1		*	RC05GF2H510J	RC 51 J 1/2W		
VR1 ,2			R12-3425-05	TRIMMING POT. (10K)AUTO ANT TUN		
W11			R92-0150-05	JUMPER REST 0 OHM		
W16 ,17			R92-1061-05	JUMPER REST 0OHM		
W19			R92-0150-05	JUMPER REST 0 OHM		
RL1		*	S51-2417-05	RELAY (DC-2,12V)		
RL100-105			S51-1420-05	RELAY (DC-1,12V)		
M1 ,2			T42-0303-05	DC MOTOR ASSY		
D1 -4			1S599	DIODE		
D5 ,6		*	UZ6.2BL	ZENER DIODE		
D7			1S5133	DIODE		
D8			1N4448	DIODE		
D8			1S1555	DIODE		
D9			1S5133	DIODE		
D10 ,11			1N60	DIODE		
D12			1S5133	DIODE		
D100-105			1N4448	DIODE		
D100-105			1S1555	DIODE		
IC1			NJM2903D	IC(DUAL COMPARATOR)		
IC2			HD10116	IC(TRIPLE LINE RECEIVERS)		
IC2			MC10116L	IC		
IC3			HD10131	IC(D FLIP-FL0P)		
IC3			MC10131L	IC		
IC4			HD10125	IC(QUAD ECL-TTL TRANSLATORS)		
IC4			MC10125L	IC		
IC5 ,6			BA6109U2	IC(MOTOR DRIVER)		
IC7			NE555P	IC		
IC8			MB3614	IC(QUAD OPERATIONAL AMPLIFIER)		
Q1		*	DTC114ES	DIGITAL TRANSISTOR		
Q2			2SA950(Y)	TRANSISTOR		
Q3		*	DTC114ES	DIGITAL TRANSISTOR		
Q4			2SA950(Y)	TRANSISTOR		
Q5			2SC2458(Y)	TRANSISTOR		
Q6		*	DTC114ES	DIGITAL TRANSISTOR		
Q7			DTC124ES	DIGITAL TRANSISTOR		
Q100-105			2SC2668(Y)	TRANSISTOR		

TS-440S PC BOARD VIEW

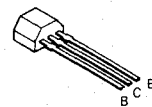
AT UNIT (X57-1150-00) Component side view



2SA950 (Y)



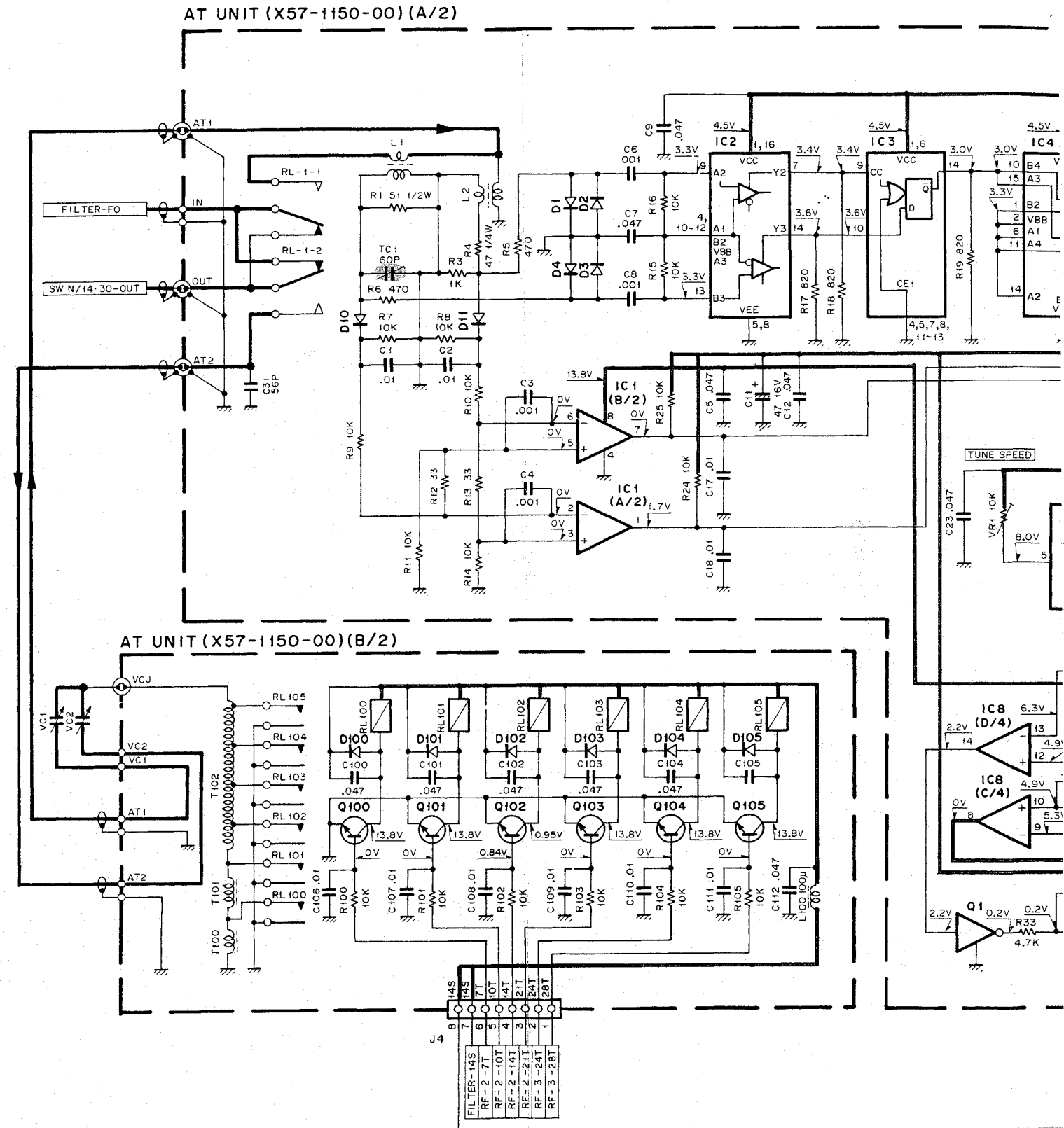
2SC2458 (Y)



IC1: NJM2903D, IC2: HD10116 or MC10116L, IC3: HD10131 or MC10131L, IC4: HD10125 or MC10125L, IC5, 6: BA6109U2, IC7: NE555P, IC8: MB3614, Q1, 3, 6: DTC114ES, Q2, 4: 2SA950 (Y), Q5: 2SC2458 (Y), Q7: DTC124ES, Q100-105: 2SC2668 (Y), D1-4: 1SS99, D5, 6: UZ-6.2BL, D7, 9, 12: 1SS133, D8, 100-105: 1N4448 or 1S1555, D10, 11: 1N60

TS-440S CIRCUIT DIAGRAM

AT UNIT (X57-1150-00)



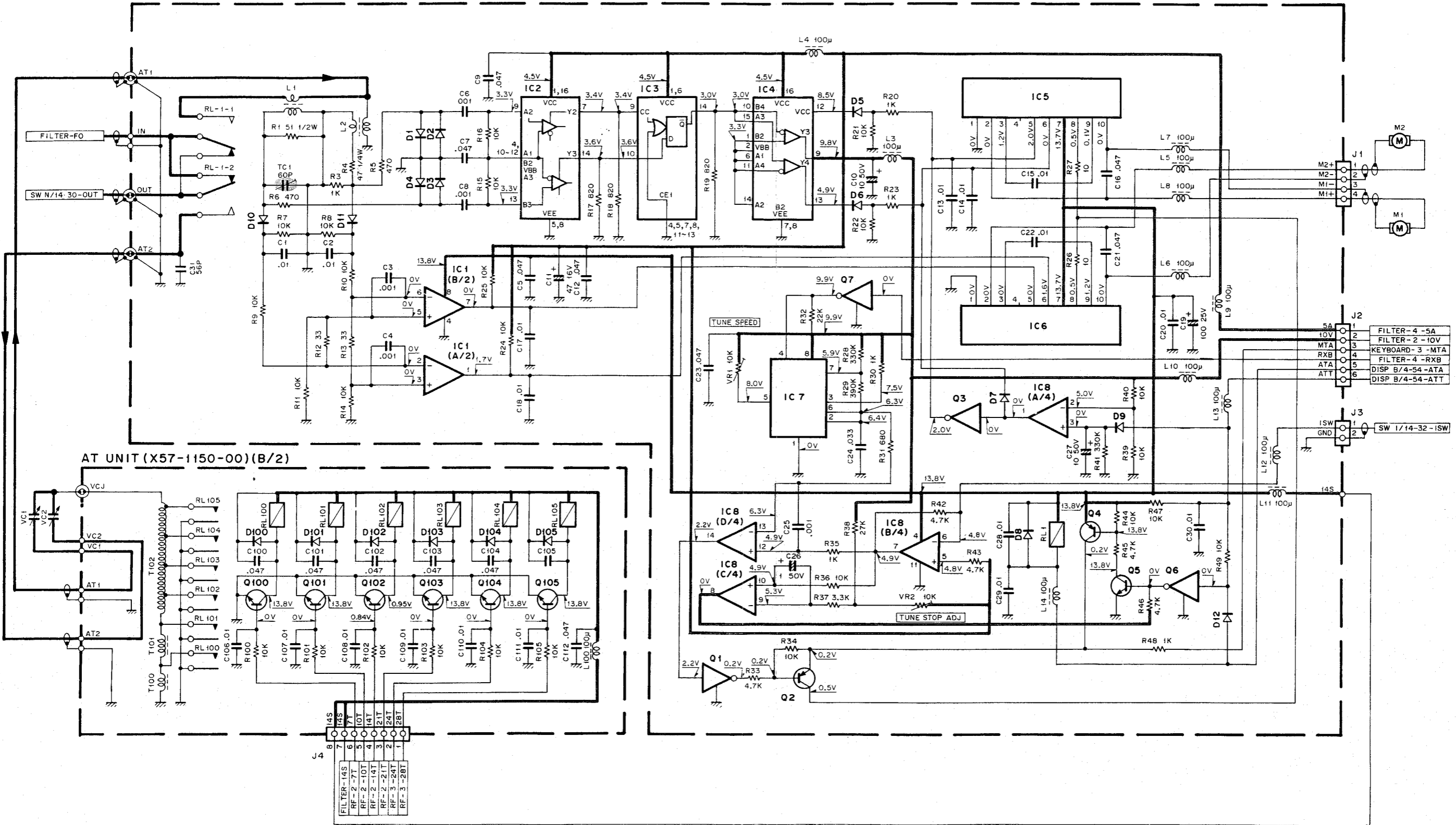
IC 1 : NJM2903D	Q 1,3,6 : DTC114ES	D 1-4 : 1SS99
IC 2 : HD10116	Q 2,9 : 2SA950(Y)	D 5,6 : UZ-6.2BL
IC 3 : HD10131	Q 5 : 2SC2458(Y)	D 7,9,12 : 1SS133
IC 4 : HD10125	Q 7 : DTC124ES	D 8,100-105: 1S1555
IC 5,6 : BA6109U2	Q100-105 : 2SC2668(Y)	D10,11 : 1N60
IC 7 : NE555P		
IC 8 : MB3614		

TS-440S CIRCUIT DIAGRAM

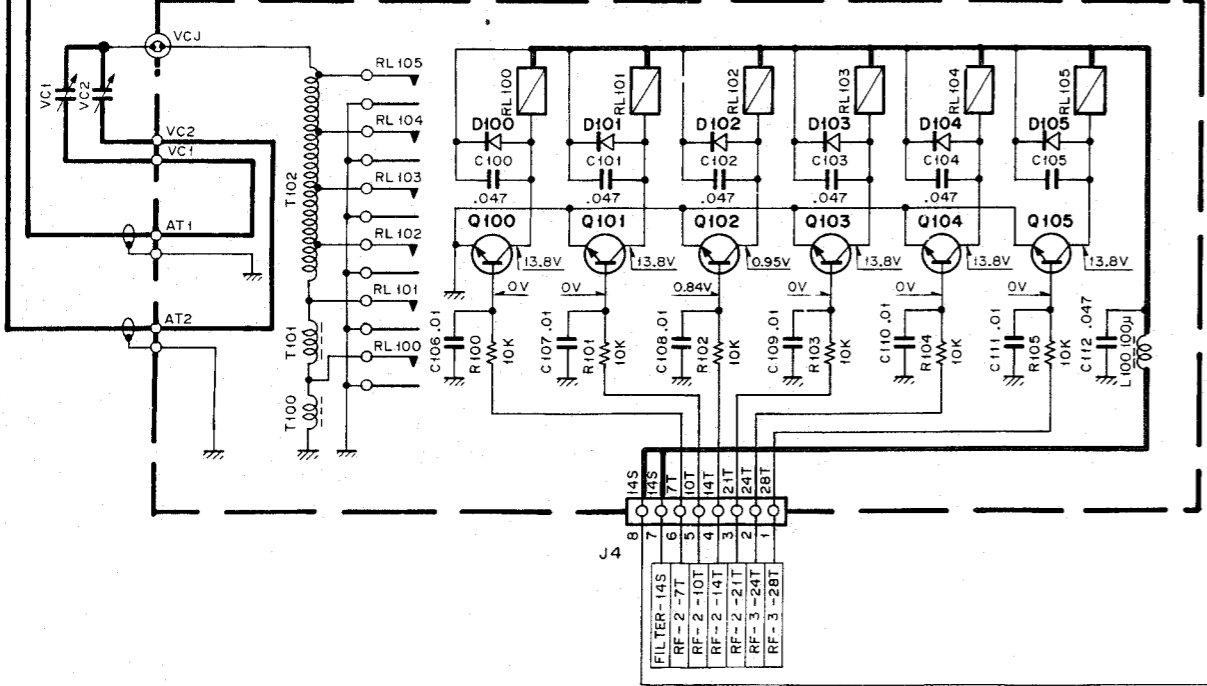
AT UNIT (X57-1150-00)

Refer to Schematic diagram on page 113.

AT UNIT (X57-1150-00) (A/2)

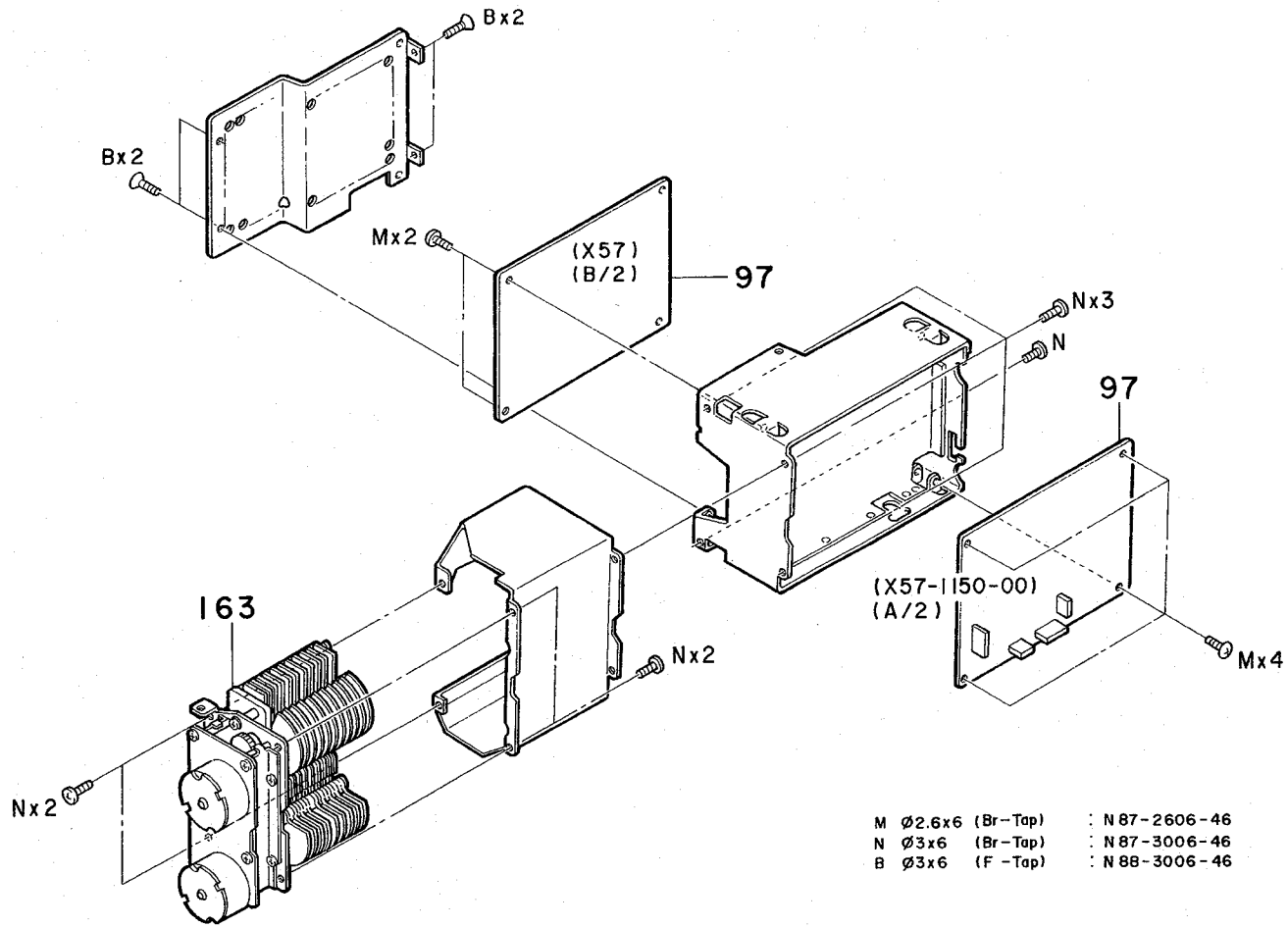


AT UNIT (X57-1150-00) (B/2)



- | | | |
|-------------------|-----------------------|---------------------|
| IC 1 : NJM2903D | Q 1,3,6 : DTC114ES | D 1~4 : 1SS99 |
| IC 2 : HD10116 | Q 2,9 : 2SA950(Y) | D 5,6 : UZ-6.2EL |
| IC 3 : HD10131 | Q 5 : 2SC2458(Y) | D 7,9,12 : 1SS133 |
| IC 4 : HD10125 | Q 7 : DTC124ES | D 8,100~105: 1S1555 |
| IC 5,6 : BA6109U2 | Q100~105 : 2SC2668(Y) | D10,11 : 1N60 |
| IC 7 : NE555P | | |
| IC 8 : MB3614 | | |

A B C D E F G H I J K



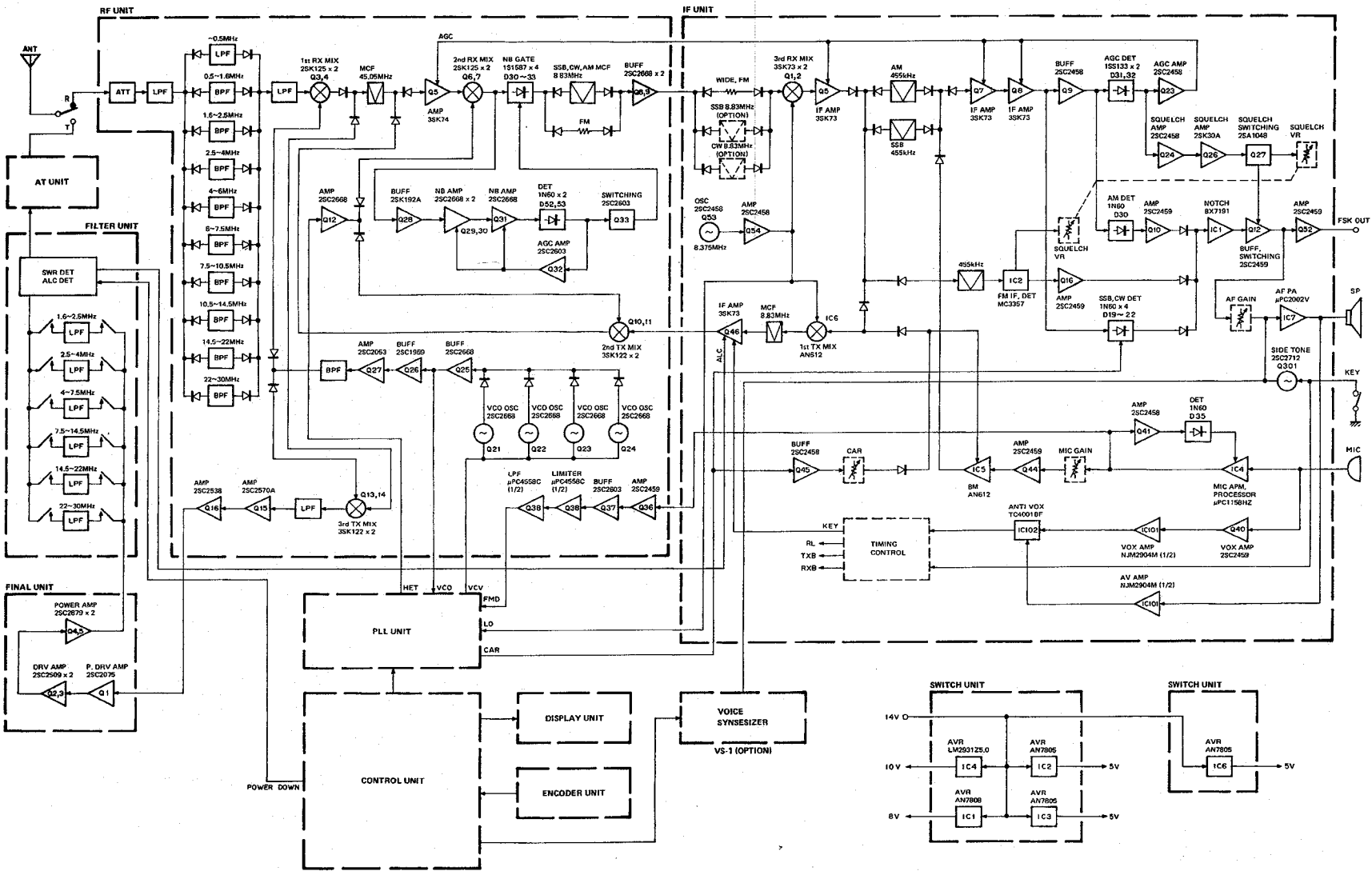
M	∅2.6x6 (Br-Tap)	:	N87-2606-46
N	∅3x6 (Br-Tap)	:	N87-3006-46
B	∅3x6 (F-Tap)	:	N88-3006-46

TS-440(G/8)

DISASSEMBLY

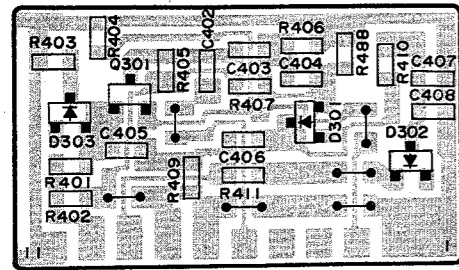
TS-440S

Parts with the exploded numbers larger than 700 are not supplied.

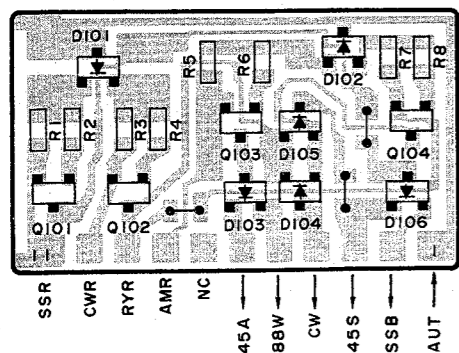


BLOCK DIAGRAM

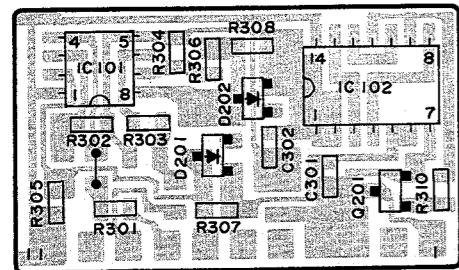
**SIDE TONE UNIT
(X59-1060-00)**



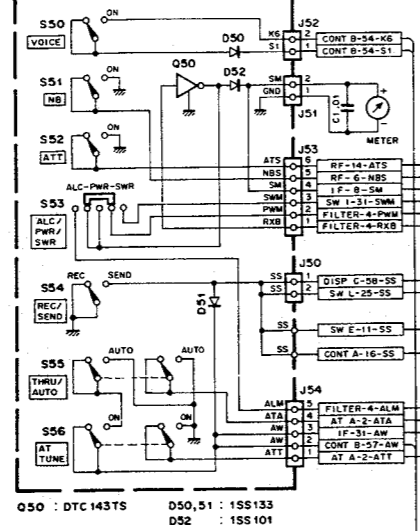
**SELECTIVITY UNIT
(X59-1070-00)**



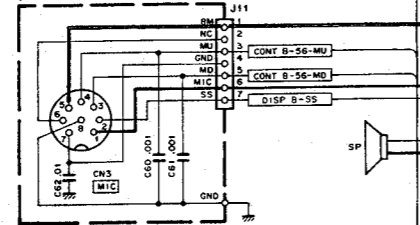
**VOX UNIT
(X59-1080-00)**



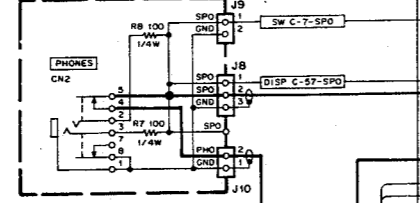
DISPLAY UNIT (X54-1870-00) (B/4)



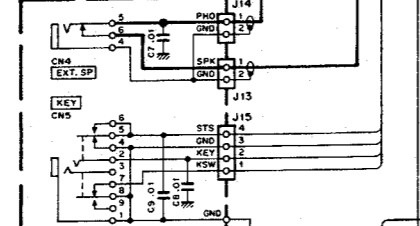
**SWITCH UNIT
(X41-1610-00) (E/14)**



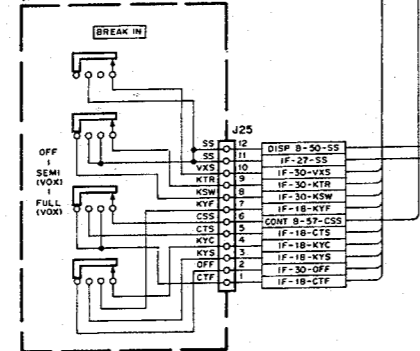
**SWITCH UNIT
(X41-1610-00) (D/14)**



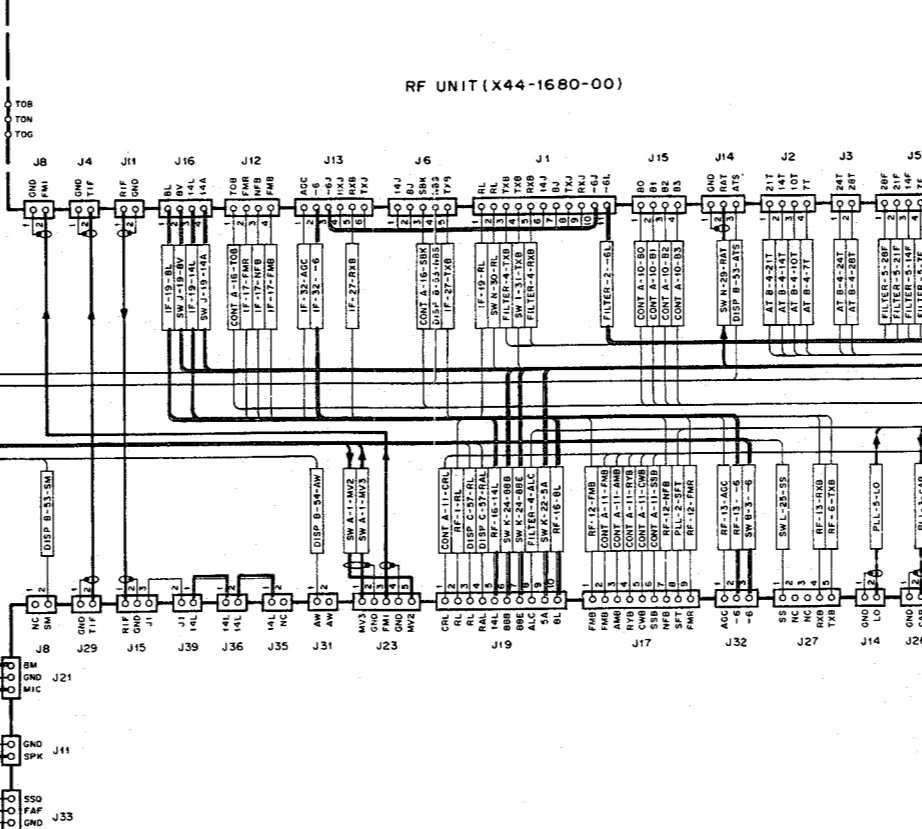
**SWITCH UNIT
(X41-1610-00) (G/14)**



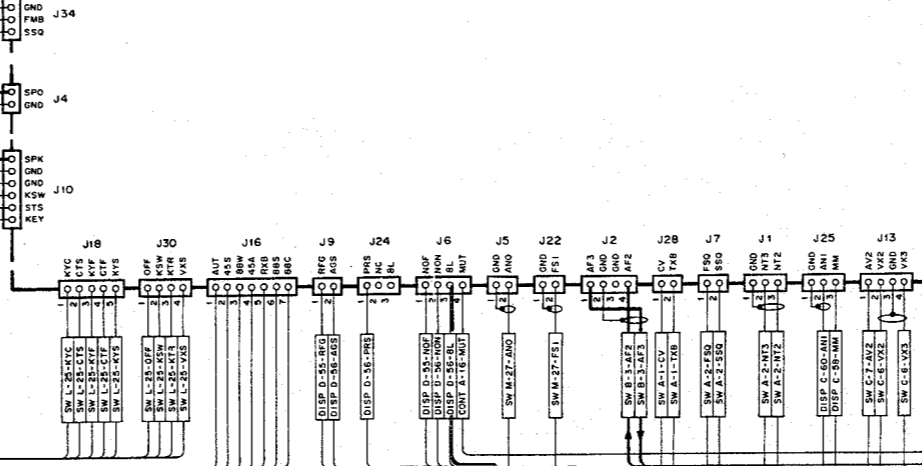
**SWITCH UNIT
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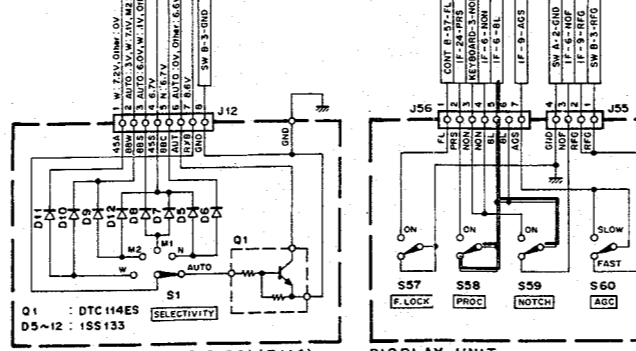
RF UNIT (X44-1680-00)



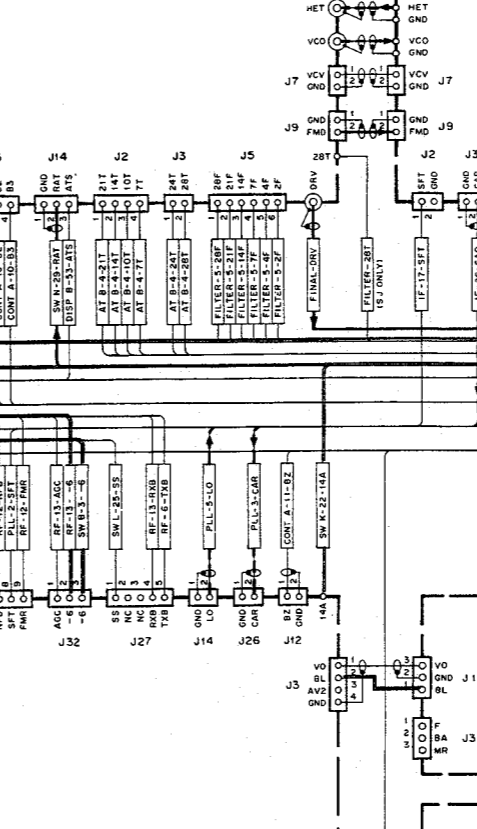
IF UNIT (X60-1300-00)



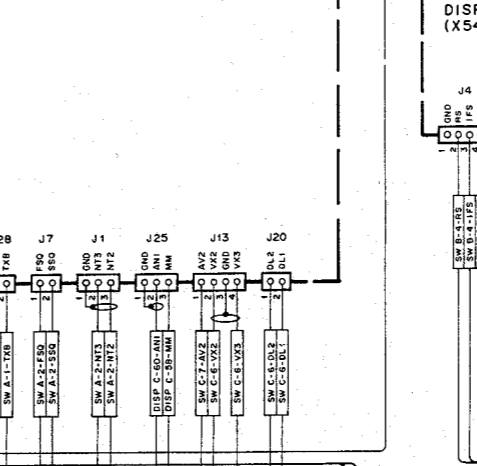
SWITCH UNIT (X41-1610-00) (F/14)



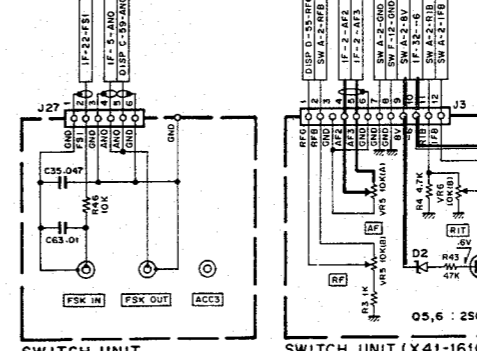
PLL UNIT (X50-2050-00)



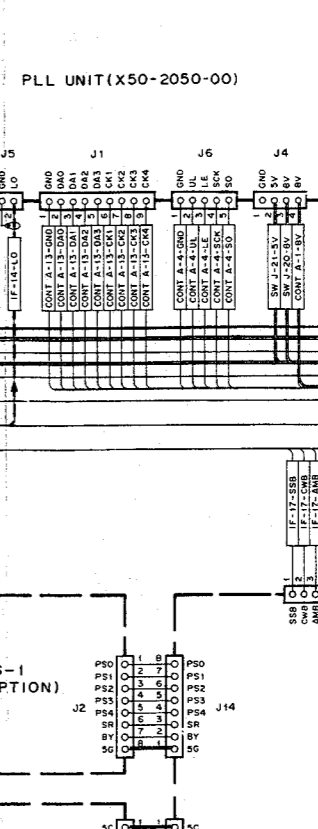
VS-1 (OPTION)



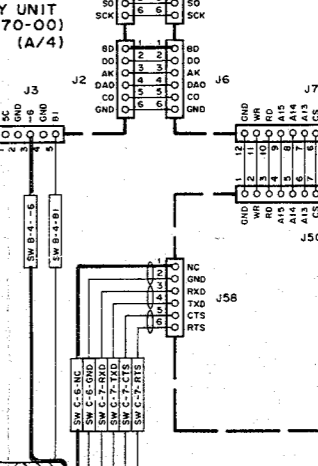
DISPLAY UNIT (X54-1870-00) (D/4)



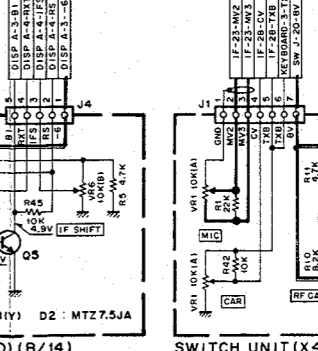
FINAL UNIT (X45-1470-00)



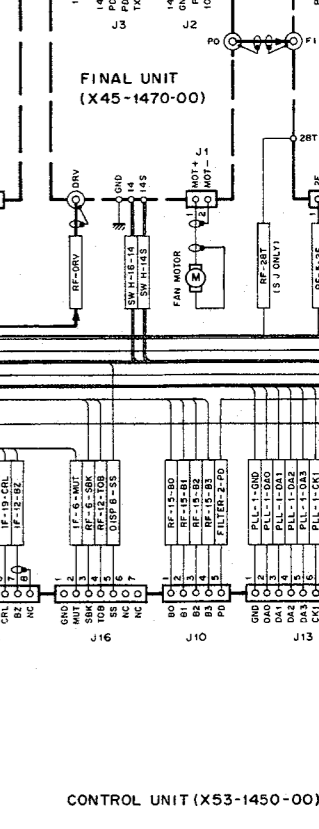
CONTROL UNIT (X53-1450-00) (A/2)



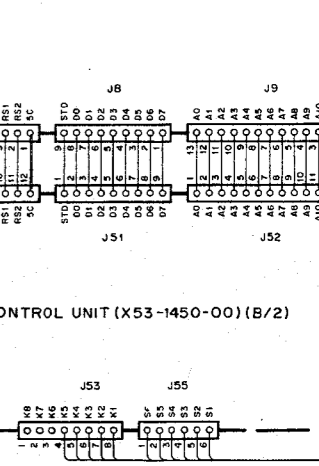
CONTROL UNIT (X53-1450-00) (B/2)



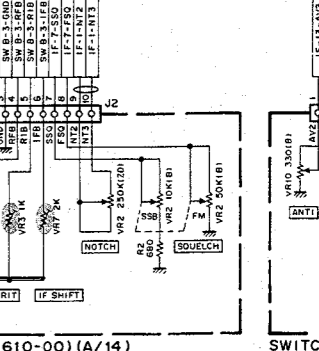
SWITCH UNIT (X41-1610-00) (A/14)



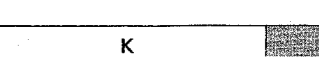
SWITCH UNIT (X41-1610-00) (M/14)

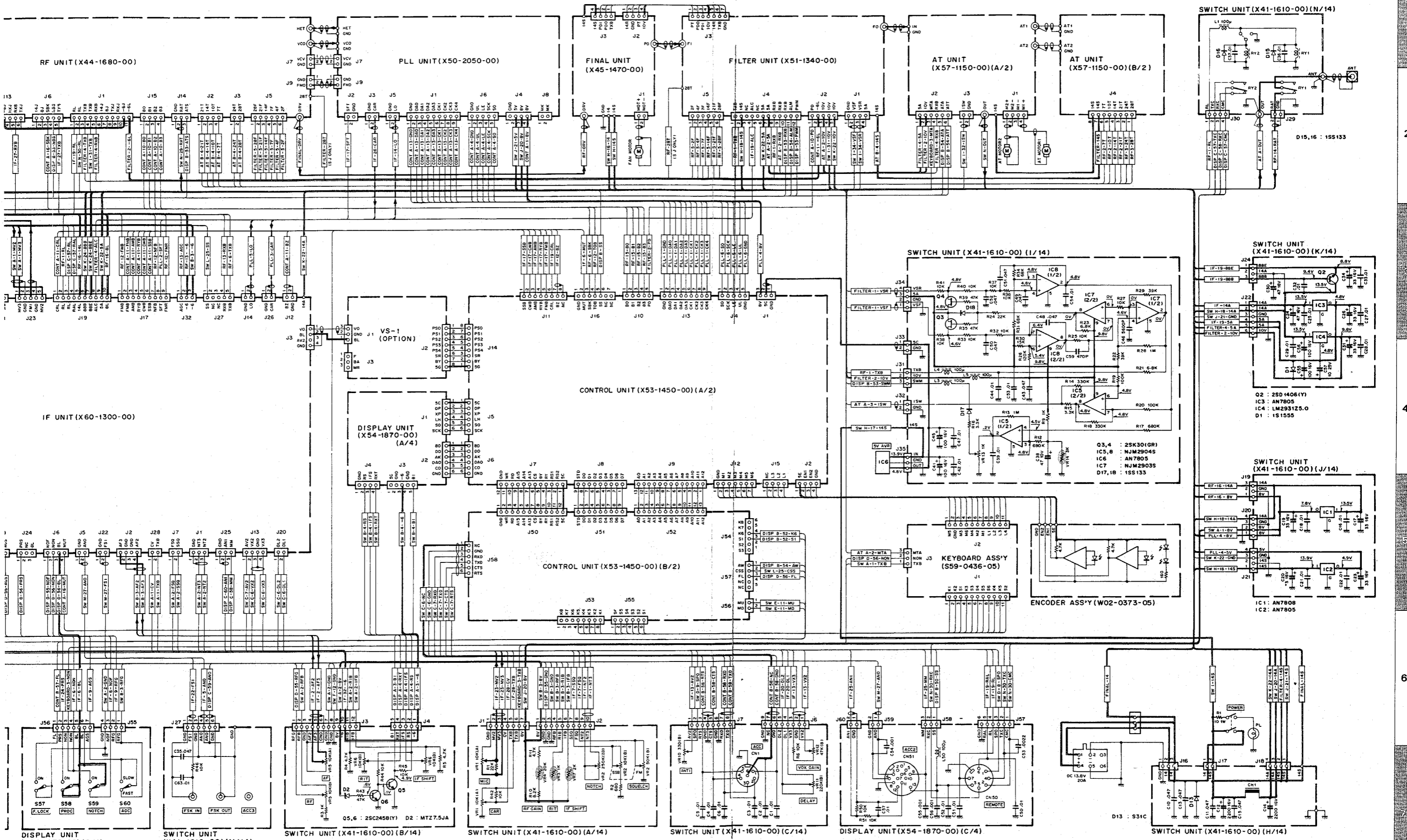


SWITCH UNIT (X41-1610-00) (B/14)



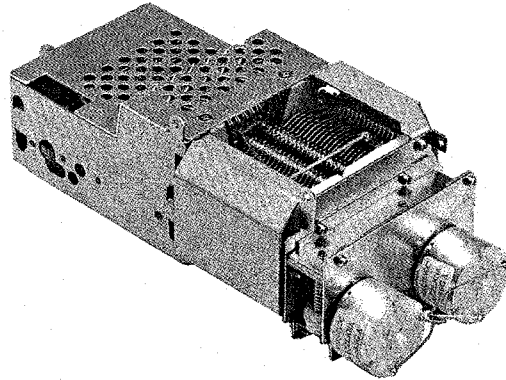
SWITCH UNIT (X41-1610-00) (A/14)





AT-440

PARTS LIST



× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
AT-440						
-			B46-0411-00	WARRANTY CARD		
-		*	B50-8054-00	INSTRUCTION MANUAL	K	
-		*	H01-4695-04	ITEM CARTON BOX		
-		*	H03-2283-04	CARTON BOX (OUTSIDE)		
-		*	H12-1390-03	PACKING FIXTURE		
-		*	H12-1391-04	PACKING FIXTURE		
-			H25-0029-04	PROTECTION BAG		
-			H25-0705-04	PROTECTION BAG		
-			N87-3006-46	BRAZIER HEAD TAPTITE SCREW		
-			X57-1150-00	AT UNIT ASSY		