Technical Manual

Radiotelephone
DEBEG 3120

STN SYSTEMTECHNIK NORD

Technical Manual

Radiotelephone
DEBEG 3120

07/91

AMENDMENT RECORD SHEET

AMENDMENT No.	AMENDED BY	DATE	REMARKS
1	ITTAMEIER / A413 B21	07/91	- FREQUENCY TABLE (PROM Vers: 2)
			- LAYOUT P.A. 5P030082 (Vers: 2)
			- AF Section (Vers. [illegible]
			- Circuit Diagr 5P03008A (Vers.2)
			- PART LIST P.A. (Vers. 2)

Technical Manual

Radiotelephone DEBEG 3120

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Part 1

DESCRIPTION

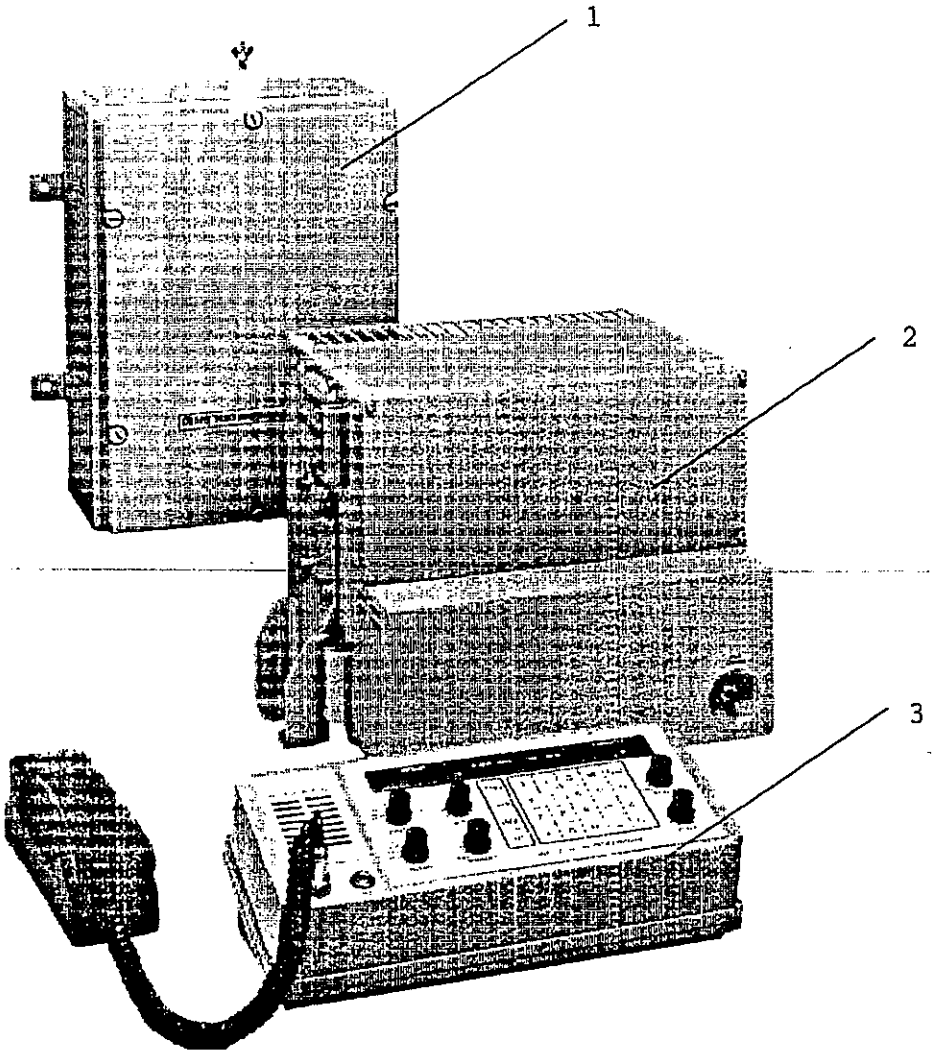


Figure 1-1 General View

1 Antenna Tuning Unit
2 Transceiver Unit
3 Control Unit

1.1 General Description

The radiotelephone DEBEG 3120 is designed for marine as well as for point-to-point applications and meets the technical requirements of CEPT, FCC, FTZ, MPT and PTT NL.

The standard version offers simplex/semiduplex communication in the frequency range 1.6 to 28 MHz in the classes of emission H3E, J3E (USB and LSB) and J2B.

Optional facilities as preselector, radio telex, and Morse telegraphy permit an adjustment to various needs.

The easy to operate radiotelephone consists of two units:
- the transceiver with receiver, exciter, transmitter and power supply, the remote control unit and
- the automatic antenna tuning unit.

The control unit contains all receiver and transmitter operating controls. Separate LED-displays indicate the RX and TX frequencies, which are selected separately with the exception of simplex channels. A bargraph display shows alternatively the receiver signal strength or the antenna current, controlled by the push-to-talk button.

Frequency and channel selection are done by the membrane keyboard which facilitates the entering at darkness by back illumination.

Up to 50 frequency pairs are user programmable or can be factory-programmed.

The marine version additionally offers 176 ITU duplex and 68 ITU simplex maritime mobile voice channels being selected by entering a 3 or 4 digit number (in case of optional J2B this is valid for 338 ITU telex channels, too) and a direct access key to the distress frequency 2182 kHz with automatic selection of H3E (optionally J3E/USB) as well as a built-in two-tone alarm signal generator.

The receiver can be tuned in selectable steps of 10 Hz to 5 kHz at the choice of the operator.

The RF output power of the solid state radiotelephone is 200 W PEP into the antenna and can be reduced in two steps (-4 dB and -12 dB).

The fast tuning, microprocessor controlled automatic antenna tuning unit is used to match all antennas between 12 m and 18 m including 3 m feeder line.

The equipment DEBEG 3120 can be supplied directly from 12 V or 24V DC and with an additional rectifier unit from 110/220V AC mains.

1.2 Technical Data

General:	
Frequency Generation:	Synthesizer
Frequency Selection:	via keyboard, direct access key 2182 kHz incl. H3E (J3E optionally). 50 user programmable frequency pairs. 176 ITU duplex and 68 ITU simplex voice channels, 338 ITU telex channels
Frequency indication:	separate LED-displays for transmit and receive frequencies
Frequency stability:	+/-20 Hz, typical +/-10 Hz
Classes of emission:	A3E (RX only), H3E (2182 kHz) J3E (USB/LSB), J2B A1A (option)
Environmental condition:	
Temperature range:	0 C to 40 C, performance specification met -15 C to +55 C, operational
Humidity:	95% rel. at 40 C
Power supply:	12 V or 24V DC (-10%, +30%)
Power consumption:	
Transmitt mode:	H3E: 24V DC 15 A 12V DC 35 A J3E: 24V DC 12 A 12V DC 28 A A1A: 24V DC 25 A 12V DC 55 A
TX off, RX only:	1.1 A
Dimensions:	
Transceiver Unit:	H 300, W 350, D 300
Antenna Tuning Unit:	H 400, W 300, D 185
Transmitter:	
Frequency range:	1.6 to 28 MHz, selectable in 100 Hz steps
RF output power:	250 W PEP -1.4dB
Power reduction:	in two steps (-4dB, -12dB)
Medium:	80 W PEP approx.
Low:	13 W PEP approx.

1.2 Technical Data (Cont.)

Receiver:

Frequency range:	0.1 to 30 MHz, tunable in selectable steps of 10 Hz to 5 kHz	
IF-Rejection:	> 80 dB, 90 dB typical	
Image rejection:	> 70 dB, 80 dB typical	
Intermodulation:	> 80 dB	
Crossmodulation:	> 90 dB	
Blocking:	> 90 dB, 100 dB typical	
Input sensitivity:	EMF at 20 dB SINAD	
A3E, H3E	< 15 uV	
J3E, J2B	< 2 uV	
Bandwith:	-6 dB	-60 dB
A3E, H3E:	+/-2.7 kHz	+/-10 kHz
J3E (USB):	+350 Hz	-500 Hz
	+2700 Hz	+3800 Hz
J3E (LSB):	-350 Hz	+500 Hz
	-2700 Hz	-3800 Hz
J2B, A1A: (up to S.No. 9000 0390)	+/-250 Hz	+/-1300 Hz
J2B, A1A: (from S.No. 9000 0391)	+/-170 Hz	+/-500 Hz
Input protection:	30 V EMF up to 15 min	
AF output power:	> 3 W into 8 Ohms	

Antenna-Tuning Unit:

Frequency range:	1.6 to 28 MHz
Antenna tuning:	fully automatic. manual setting possible
Matching range:	all antennas (wire or whip) from 12 to 18 m incl. feeder line
Input impedance after tuning:	50 Ohms, SWR < 1.5 typical

Options:

- Preselector
- External loudspeaker
- Morse telegraphy
- Reference frequency oscillator of 0.5 ppm stability
- J3E (USB) for direct access key 2182 kHz

1.3 Control Unit

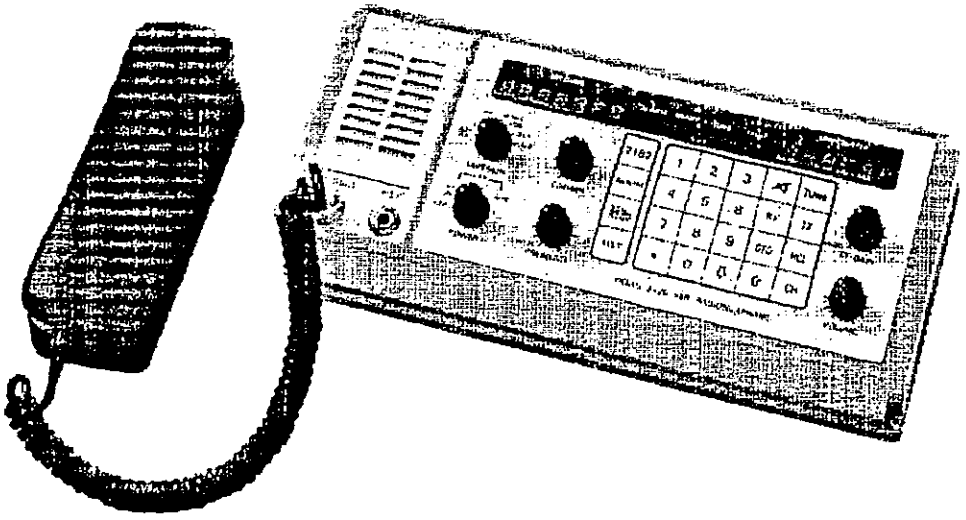


Figure 1-2 Control Unit

This unit includes keyboard, control section (5PO1765A), AF section (5PO1545B) and the display card (5PO1544A). The unit controls the whole transceiver by the signals coming from the keyboard and the function selectors. The control unit is generally used as a remote control unitwith addition of the junction board (5PO1555B).

The control section consists of the back illuminated keyboard, the 8 bit microprocessor to control the switch positions and the data communication between the transceiver unit and the display circuit to drive all indicators except the LED bargraph for receiver signal strength and TX output power (ant. current for 2182 kHz).

The AF section consists of the ALC circuit, the speaker amplifier circuit, the bar LED driver, the dimmer control circuit and the alarm signal generator.

1.4 Transceiver Unit

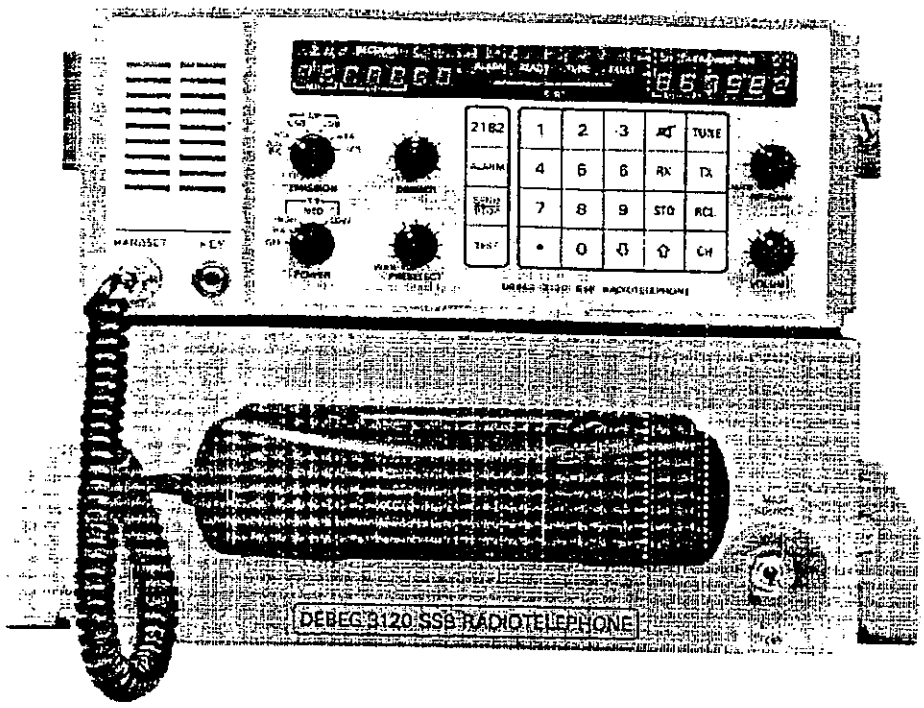


Figure 1-3 Transceiver Unit

The transceiver unit consists of RX/Exciter, frequency pll synthesizer, T/R control, preselector, RF power amplifier, low pass filter, power supply unit and junction board. The transceiver unit is controlled by signals of the control unit.

1.4.1 T/R Control Section

This section consists mainly of an 8 bit MPU which controls the circuits of the transceiver unit and ATU according to the data signals of the control unit.

1.4.2 RX/Exciter Section

This board consists of the receiver and the exciter. They are switched over by the transistor switch and the diode switch, which are controlled by the signal of the PTT key. In the receiver, the RF signals are converted to AF signals. In the exciter the AF signals are reversely converted to RF signals. This frequency conversion is made by two passive DBM (double balanced mixer) and one active DBM.

1.4.3 Frequency Synthesizer Section (PLL)

The frequency synthesizer consists mainly of 6 PLL circuits as Hybrid IC's. These circuits generate all RF signals needed for transmission and reception. The signals are send to the RX/Exciter which produces the RF signals of 455 kHz (for modulation/demodulation), 70 MHz (2nd local) and 70.555 MHz - 100.455 MHz (3rd. local) for selection of transmitting/receiving frequency) based on 10 MHz of the standard oscillator.

1.4.4 RF (Power Amplifier) Section

This section consists of the RF amplifier, the bias circuit and the self diagnosis circuit. The specified performance of the RF amplifier is as follows:

Frequency range:	1.6 to 28MHz
Impedance (output and input):	50 Ohms
Power gain:	44 dB (approximately)
Output power:	250W
Heat dissipation:	Heat sink cooling

1.4.5 L.P.F. (Low Pass Filter) Section

The filter circuit is designed to eliminate the high order harmonics included in the RF signal output to power amplifier.

1.4.6 Power Supply Section

This unit converts input voltage 12/24V DC (-10%, +30%) by the DC-DC converter to voltages 48V DC, 24V DC, 19V DC and 6V DC needed in various sections.

1.4.7 Preselector Section (Option)

This section consists of the RF tuners provided at input stage of the receiver. The receiving frequency range of 100 kHz to 29999.99 kHz is devided into 7 bands by PB3 to PB5 and further devided in smaller bands by PB1 and PB2. These bands are switched over according to the control signals to T/R Control (5P01738A).

1.4.8 Junction Board

The junction board is provided for connection between the transceiver unit. control unit and ATU. Connection is made by means of the terminal board and plug-in connectors.

1.5 Antenna Tuning Unit

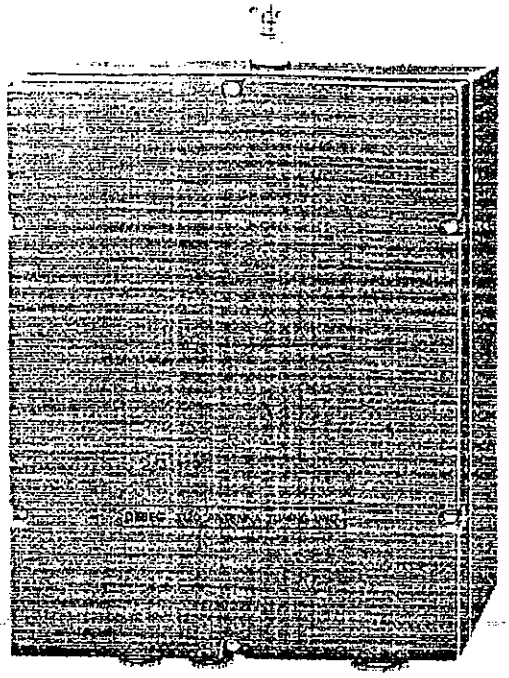


Figure 1-4 Antenna Tuning Unit

The ATU (Antenna Tuning Unit) is composed of LC network and the shielded ATU control circuit. The transceiver unit and the ATU are connected by the 12-wires system cable, the transmitting coaxial cable and the receiving coaxial cable. Antenna matching is automatically performed with the TUNE signal of the transceiver unit.

Part 2

OPERATION

2.1 DISTRESS OPERATION ON 2182 kHz

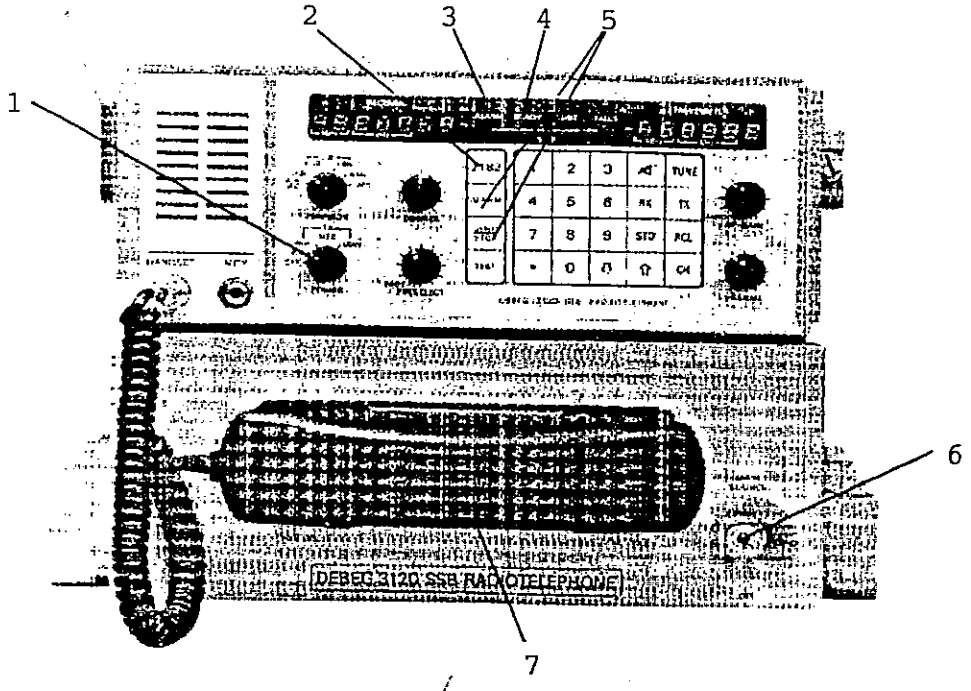


Figure 2-1 Controls for Distress Operation

TRANSMISSION OF TWO-TONE ALARM SIGNAL

1. Switch **MAIN SOURCE** (6) switch to ON Position
2. Switch **POWER** switch (1) to TX HIGH Position
3. Press 2182 push button (2) at keyboard
4. Press **ALARM** and **SEND/STOP** push button (5) simultaneously

Transmission starts immediately after the automatically initiated tuning sequence and the two-tone alarm signal is now transmitted for 45 seconds. The antenna current is displayed at the bargraph (4), the ALARM LED (3) blinks, and the alarm tone is audible in the built-in loudspeaker.

To repeat the alarm signal transmission, just press **ALARM** and **SEND/STOP** (5) again simultaneously.

The alarm signal transmission may be interrupted any time by pressing **SEND/STOP**.

TRANSMISSION OF DISTRESS MESSAGE

When the alarm signal ceases, press PTT (7) at handset and transmit the distress message by speaking into the handset microphone with a clear and calm voice.

Release PTT key and wait for reply.

Repeat the distress message at intervals until a reply is received.

2.2 Information Before Operation

Connect each section and assure that plugs and connectors are inserted before operation. Usually connectors of the transceiver unit have been connected. Mainly check before external connection.

Before Operation
Check the following switch positions before connection of each section.

The mains switch (at lower right in front of unit) shall be switched off.

The power switch (rotary switch at control panel) shall be switched off.

TX (transmitting) control cord shall not be connected to the telegraph key connector.

Connection of each Section
Connect coaxial cable to the TX-OUT connector at the rear side of the main unit and to TX connector (J1) of ATU.

Connect coaxial cable to the RX connector at the rear side of main unit and to RX connector (J2) of ATU.

Fix the ground wiring to the earth terminal at the rear side of the main unit. (Use copper band only).

Use multi-core screened cable to connect TB3 terminal of the junction board inside the main unit to terminal TB2 of the ATU.

Connect the ground wiring from the ATU earth terminal strip.

Connect antenna (feeder) to the ATU output terminal (TB1). Upon completion of above checks, connect the power supply.

Connect 12V DC or 24V DC power supply to + (plus) and - (minus) terminals at the rear side of the unit. At this time pay attention to connect plus (+) and minus (-) correctly. In addition the remote control and external speakers may be connected to TB1 and TB2 on the junction board of the main unit.

2.3 Operation of the Unit

Refer figure 2-3 at page 2-19.

Figure 2-2 Main Source Switch

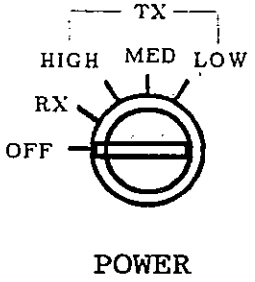
Switch MAIN SOURCE to ON

When Main Source Switch is switched to ON, the relay power control is activated and the power switch at control panel is enabled.

2.3.1 Operation at Control Panel

All switches except for the Main Source Switch are positioned at the control panel.

Turn POWER on



POWER

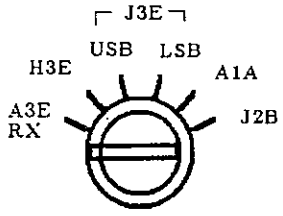
Set the power switch from OFF position to receiving position (for transmission, set it to TX one of HIGH. MED and LOW).

Selfcheck function operates and RX/TX display flashes. Upon completion of selfcheck, error codes are indicated in RX display and then the last frequency used previously is displayed. The unit is now ready for reception.

Set RX/TX Frequency by the keyboard.
(Keyboard selection is described later)

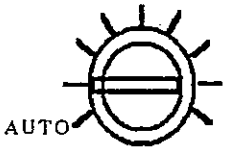
RX/TX frequency is displayed on the RX/TX display.

2.3.1 Operation at Control Panel (Cont.)



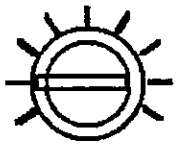
EMISSION

The standard version of DEBEG 3120 offers four different classes of emission: A3E, H3E and J3E (USB/LSB). A3E is used for broadcast reception-only. ITU channels are selected with previous setting of corresponding class of emission, J3E (USB) for voice communication and J2B for telex. If a private channel has been selected and is indicated on the RX/TX frequency display, the previously stored class of emission has to be switched to enable the transmission.
The setting to other types of emission will disable the transmission. If a frequency is displayed only on the RX display, the transmission is disabled at all classes of emission, at all. A1A is an optional function and thus may not be operated usually.



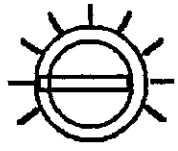
RF-GAIN

Control for the receiver RF amplifier gain. At "AUTO" position, the inside circuit adjusts the RF gain automatically. Except at "AUTO" position, the gain can be changed continuously from minimum to maximum.



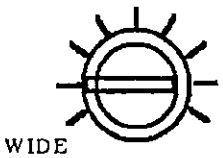
VOLUME

Control for the AF level during reception. Set it to appropriate position for listening.



DIMMER

Control for brightness of all LED's (excluding FAULT LED) of control panel.



PRESELECT

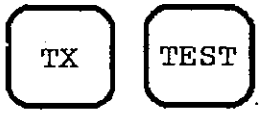
Switching ON and tuning the preselector of the receiver.
WIDE position: Preselector OFF

2.3.1 Operation at Control Panel (Cont.)

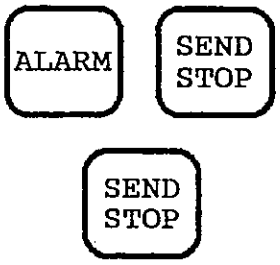
Pressing this key will start the automatic tuning process in the ATU and the TUNE LED lights up. Tuning is performed after extinction of TUNE LED and illumination of the green READY LED. The unit is now ready for transmission. If tuning cannot be made, "TUNE" extinguishes and FAULT LED lights up. (Handset PTT button may be substituted for TUNE switch.)

When operating this switch, RX/TX frequency is set automatically to 2182 kHz and the type of emission is set to H3E. When 2182 is displayed on the RX/TX display. the unit enters automatically into the tuning state.

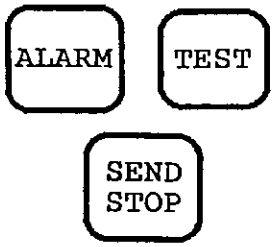
When TEST is pressed alone, a selftest of the RX circuitry is started. Nothing will be indicated on the RX frequency display during test procedure.



When TX and TEST are pressed simultaneously the transceiver is set for a self test. The self test includes all transmitter, receiver and power sections of the unit. After completition of the test, either the previous selected RX frequency appears, or an error message consisting an "E" and a two digit number, if a failure occurs.



When pressing ALARM and SEND/STOP simultaneously, the two tone alarm signal is transmitted for about 45 seconds. The alarm signal will be transmitted after completion of tuning procedure. While the alarm tone sounds, keys ecxept SEND/STOP shall not be used. To stop transmission press SEND/STOP.



When pressing ALARM and TEST simultaneously, the two tone alarm signal is sent to the built-in speaker, handset and external speaker line regardless of the selected frequency. The test time is about 45 seconds. To stop the alarm signal test press SEND/STOP.

2.3.1 Operation at Control Panel (Cont.)

This control switches the built-in speaker ON and OFF.

These switches are used for counting up/down the channel number and RX frequency changes in defined steps.

To store RX/TX frequency into the memory.

To recall RX/TX frequency from memory.

To enter RX frequency.

To enter TX frequency.

To enter a channel number.

2.3.2 Keyboard Entry

Frequency setting, changing and channel calling are described in the table below.

1. Selection of receiving frequency (regardless of channel)
2. Up/Down of receiving frequency
3. Up/Down of receiving frequency in specified step
4. Selection of channel
5. Selection of another channel
6. Up/Down of channels
7. Fine adjustment of receiving frequency A1A - BFO
8. Emergency 2182 kHz and alarm test
9. Private channel to be entered Example No. 1
10. Private channel to be entered Example No. 2
11. Selection of private channels
12. Change of transmit frequency

2.3.2 Keyboard Entry (Cont.)

1. Selection of Receiving Frequency (regardless of channel)

Example: to receive 14225.32 MHz

Step	Function Key	RX Display	TX Display	Remarks
1	1	1		
2	4	14		The last receiving frequency remains
3	2	142		
4	2	1422		
5	5	14222		
6	.	14225.00		The position of dot "." on the display represents kHz. The newly entered frequency is ready for receiving. The emission mode switch should be positioned at the desired mode.
7	3	14225.30		
8	2	14225.32		
9	RX	14225.32		

2. UP/DOWN of Receiving Frequency

Step	Function Key	RX Display	TX Display	Remarks
		14225.32		
1	⇧	14225.33		Single push (0.5s max.) increases 50 Hz.
2	⇧	14225.43		Press down continuesly to increase to 100 Hz in 10 steps/s.
3	⇩	14225.42		Single push (0.5s max.) decreases 10 Hz.
4	⇩	14225.32		Hold down continuesly to decrease to 100Hz in 10 steps/s. (New frequency is recieved all the time the indication has changed.)

2.3.2 Keyboard entry (Cont.)

3. Up/Down of receiving frequency in specified step

Step	Function Key	RX Display	TX Display	Remarks
		14225.32		Single push (0.5s max.) increases 1.5 kHz.
1	1	1		
2	.	1.00		
3	5	1.50		
4	⇧	14226.82		
5	⇧	14241.82		Press down cont. to increase to 10 steps/s.
6	⇩	14240.32		Single push (0.5s max.) decreases 1.5 kHz.
7	⇩	14225.32		Hold down cont. to decrease to 10 steps/s. (Step can be set within 10 Hz to 5 kHz,

4. Selection of Channel ex Ch 2201

Step	Function Key	RX Display	TX Display	Remarks
		14225.32		
1	CH	C		No channel number is displayed if the channel is not specified prev. TX frequency is displ. only when TX power supply is switched on.
2	2	C 2		
3	2	C 22		
4	0	C 220		
5	1	C2201		
6	RCL	22596.00	22000.0	New freq. is ready for receiving. If the setting of the emission switch at the panel does not meet the required Class of Emission, the TX display blinks.
7	TUNE or MIC PRESS	22596.00	22000.00	When TUNE or MIC PRESS is pressed, ATU operates and READY lamp lights up to indicate the unit is ready for transmission.

2.3.2 Keyboard entry (Cont.)

5. Selection of another channel
   Example: CH 2201 - CH 1201

Step	Function Key	RX Display	TX Display	Remarks
		22596.00	22000.0	
1	CH	C2201		The last channel is displayed.
2	1	C 1		Ready for receiving
3	2	C 12		CH 1201.
4	0	C 120		
5	1	C 1201		
6	RCL	13100.80	12330.0	

6. Up/Down of channels

Step	Function Key	RX Display	TX Display	Remarks
		13100.80	12330.0	Single push (0.5s max.)
1	CH	C1201		increases 1 CH.
2	⇧	C1202		
3	⇧	C 810		Press down continuesly to increase to 10 ch/s (in the circle order of 12MHz band to 16MHz band to 22 MHz band to private channel band to 4MHz band to 6MHz band to 8MHz band)
4	⇧	C 809		Single push (0.5s max.) decrease 1 CH.
5	⇧	C2201		Press down continuesly to decrease at 10 ch/s (in the reverse order of UP operation).
6	RCL	22596.00	22000.0	Ready for receiving CH 2201.

2.3.2 Keyboard entry (Cont.)

7. Fine adjustment of receiving frequency
AlA - BFO

Step	Function Key	RX Display	TX Display	Remarks
		22596.00	22000.0	RX/TX freq. of CH 2201.
1	⇧	22596.01	22000.0	single push (0.5 s max) increases 10 Hz.
2	⇧	22596.50	22000.0	Press down continuesly to increase to 50 Hz at 5 steps/s up to +500 Hz.
3	⇩	22596.49	22000.0	Single push (0.5 s max.) decreases 10 Hz.
4	⇩	22595.50	22000.0	Hold down continuesly to decrease to 50 Hz at 5 steps/s down to -500Hz.
				Step width can be specified (see para. 3). However the maximum up/down is +500 Hz.

8. Emergency 2182 kHz and alarm test

Step	Function Key	RX Display	TX Display	Remarks
		22595.50	22000.0	
1	2182	2182.0	2182.0	Automatic selection of emission mode H3E. Ready for transm/reception.
2	ALARM SEND STOP	2182.00	2182.0	Automatic transmission of the 2-tone alarm sign. for about 45 seconds. "ALARM" LED lights up.
3	SEND STOP			Automatic transmission stops.
				2-tone alarm signal is transmitted by phone channel set previously.
4	ALARM TEST	FREE	FREE	Alarm sound is heard of speakers, however, no transmission made.
5	SEND STOP	FREE	FREE	The alarm sound goes off.

2.3.2 Keyboard entry (Cont.)

9. Private channel to be entered
Example No. 1

Step	Function Key	RX Display	TX Display	Remarks
				Storage of RX 6124.3 kHz, TX 6012.1 kHz. and emis. mode J3E(USB) into channel 07 is shown.
1	J3E(USB)			Set emission mode select. at J3E(USB).
2	6	6		Entry of RX frequency.
3	1	61		(6124.3 kHz)
4	2	612		
5	4	6124		
6	.	6124.00		
7	3	6124.30		Completion of entry (RX frequency)
8	RX			
9	6	6		Entry of TX frequency.
10	0	60		(6012.1 kHz)
11	1	601		
12	2	6012		
13	.	6012.00		
14	1	6012.10		Completion of entry (TX frequency).
15	TX	6124.30	6012.1	
16	CH	C		Entry of channel number 07
17	0	C 0		
18	7	C 07		
19	STO	C 07		Completion of storage to chan. 07. After chan. No. is displayed for one second, frequencies are displayed and memorized
20		6124.30	6012.1	with class of emission J3E(USB)

10. Private channel to be entered
Example No. 2

Step	Function Key	RX Display	TX Display	Remarks
				Storage of RX/TX 8452.4kHz and emission mode J3E(LSB) into channel 36 is shown.
1	J3E(LSB)			Set emission mode selector at J3B (LSB).
2	8	8		Entry of RX/TX frequency. (8452.4 kHz)
3	4	84		
4	5	845		
5	2	8452		
6	.	8452.00		
7	4	8452,40		
8	RX	8452.40		Completion of entry (RX frequency).
9	TX	8452.40	18452.4	Completion of entry (TX frequency).
10	CH	C		Entry of channel No. 36
11	3	C 3		
12	6	C 36		
13	STO	C 36		Completion of storage to channel 36
				After channel No. is displayed for one to two seconds. frequencies are displayed and memorized with class of emission
14		8452.40	18452.4	J3E (LSB)

11. Selection of private channels

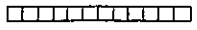
Step	Function Key	RX Display	TX Display	Remarks
		8452.40	8452.4	
1	CH	CH 36		The last channel is displayed.
2	0	C 0		
3	7	C 07		
4	RCL	6124.30	6012.1	New frequency is ready for receiving. If the setting of EMISSION does not conform to the stored class of emission, the TX display blinks until mode is set.

12. Change of transmit frequency

Step	Function Key	RX Display	TX Display	Remarks
		8452.40	8452.4	Previous selected TX/RX frequencies TX frequency to be changed to 16615.0 kHz class of emission: J2E LSB) unchanged
1	1	1	8452.4	Entry of new TX freq.
2	6	16	8452.4	
3	6	166	8452.4	
4	1	1661	8452.4	
5	5	16615	8452.4	
6	.	16615.	8452.4	
7	0	16615.0	8452.4	
8	TX	8452.4	16615.0	Completion of TX freq. entry

Note: In case of DEBEG 3120 version with free frequency selection, TX and RX frequencies as well as classes of emission can be changed according to the customer's requirements.

2.3.3 Panel Display Function (LED Display)



S/RF

Electric field strength indicator

Indicates relative electric field strength at receiving input in RX mode and transmitter feeder current in TX mode.
In case 2182kHz is selected, SRF indicates antenna current (When ATU of DEBEG 3120 is used).

RECEIVER

MHz kHz

Receiver display has 7 digits to indicate RX frequency and channel.

TRANSMITTER

MHz kHz

Transmitter display has 6 digits to indicate TX frequency.

ALARM LED

This LED illuminates during transmission of 2-tone alarm.

READY LED

This LED illuminates upon completion of ATU automatical adjustment.

TUNE LED

This LED illuminates while ATU is tuning. TUNE LED lights up, when SWR becomes worse.

FAULT LED

This LED illuminates in case ATU tuning fails and transmission is impossible.

2.3.4 ATU Operation

All control switches and indicators for this unit are incorporated internally.

POWER switch:
Power switch for power supplied from the transceiver unit to the unit. Normally this switch is kept on.

AUTO-MAN switch:
Normally, this switch is set to AUTO.
At MANUAL position, ATU can be manually operated by MANUAL SET SWITCHES.

TUNE switch:
When this switch is pressed TUNE function operates.

MANUAL SET switch:
Switch corresponding to LC network control relay.
Used when setting 2182 kHz manually.

ANTENNA CURRENT and PF-PR switch:
At ANTENNA CURRENT (about 4A max.) position,
Bar LED indicates antenna current.
At Pf-Pr position, Bar LED indicates the forward or reflected wave of ATU input.

PF-PR switch:
"ANT POWER LED" selector switch.
Indicates forward wave power when set to "Pf" and indicates reflected wave power when set to "Pr".

BAR LED:
Indicates forward and reflected wave power detected by ANT output circuit during transmission.

OVERLOAD LED:
Illuminates when power supply output is overloaded.
OVERLOAD LED lights up until it is reset by TUNE.
During this position, the communication is impossible.

SET LED:
Indicates when the LC network control relay operates.

2.3.5 Presetting for Manual Tuning to 2182 kHz during Installation

Adjustment of ATU at 2182kHz:

At control unit: Type 2182 kHz via keyboard
Press TX
Press TUNE
ATU tunes to 2182 kHz

Open the cabinet of ATU.

Set dip-switches S5 - S8 in accordance with the LED's D18 - D36.
LED lights: DIP-switch ON

Close the cabinet of ATU.

Manual Antenna Tuning to 2182 kHz in case of an inoperable antenna tuning unit:

Remove the cover of ATU.

Set switch AUTO/MAN to MAN-position.

The tuning has been carried out when all LED'S are lighting in correspondence with the pre-setted DIP-switches.

blank

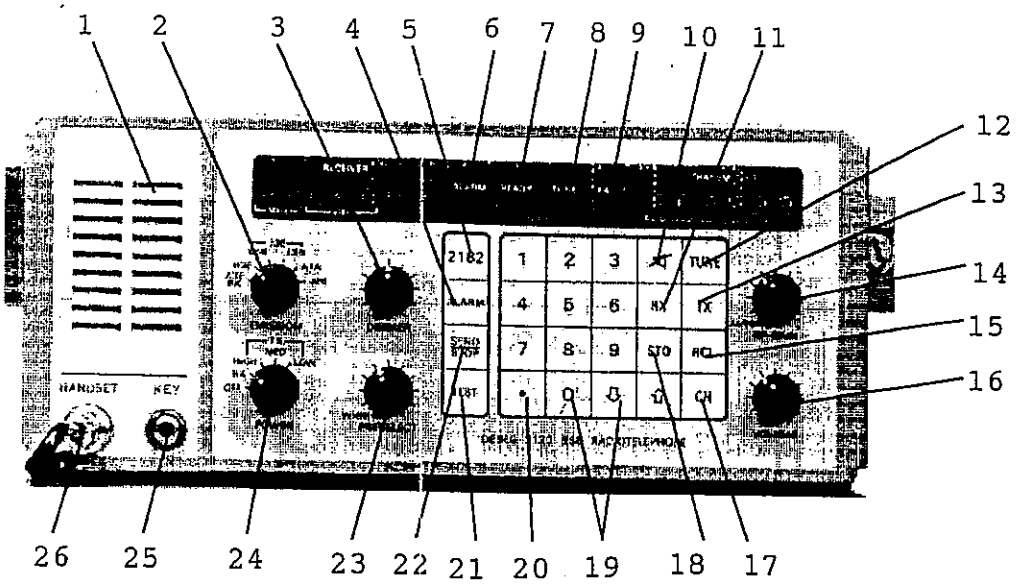


Figure 2-3 Control Panel

1 Speaker
2 Emission
3 Dimmer
4 Alarm
5 2182
6 LED Alarm
7 LED Ready
8 LED Tune
9 LED Fault
10 Speaker On/Off
11 RX
12 Tune
13 TX
14 RF Gain
15 Recall
16 Volume
17 Channel
18 Store
19 Frequency Up/Down
20 Keyboard
21 Two Tone Alarm Test
22 Two Tone Alarm Send/Stop
23 Preselect
24 Power Mode
25 Key
26 Handset

Part 3

MAINTENANCE AND REPAIR

3.1 Technical Description

3.1.1 Fuses

The fuses of the equipment are fitted inside transceiver unit.
Junction Board: F1 (2A semi delayed, DC for ATU).
Power Supply: F1 (100A semi delayed, DC power supply)
Power Supply A1: F1 (15A semi delayed)
F2 (0.5A semi delayed)

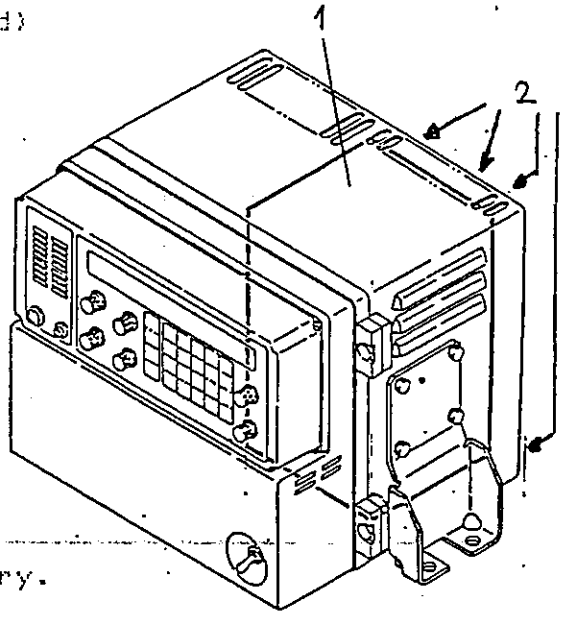


Figure 3-1 Transceiver Unit

Procedure:
Disconnect the DC power supply.
Open the housing of transceiver unit.
Remove power supply unit (1):
Unscrew 4 screws (2) at heat sink
Disconnect plugs P3, P4 and P5 at Junction Board.
Remove power supply unit carefully, pay attention to connection cables.
Remove AF-unit (left side) if necessary.
Remove Junction Board, pay attention to connection cables.

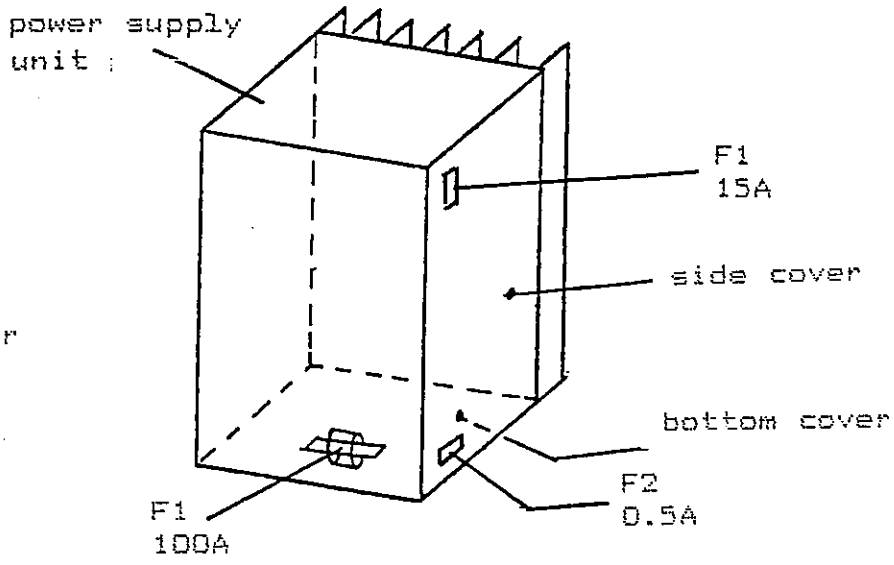


Figure 3-2 Location of Fuses

Check fuses F1 and F2 of Power Supply A1:
Unscrew side cover

Check fuse F1 of Power Supply:
unsrew bottom cover

Reassambly:
Mount AF-unit if necesarry.
Move power supply unit into housing, pay attention to connection cables.
Connect plugs P3, P4 and P5 at Junction Board.
Slide Junction Board into guide, pay attention to connection cables.
Fitt power supply.
connect the DC power supply.

3.2 Control Unit

The control unit includes the control section (5P01765A), AF section (5P01545B), Display card (5P01544A), Hand-set Filter (5P02038) and Key board.
The control unit is removable from the cabinet case and can be used as the remote control unit with addition of the Junction Board (5P01555B).

3.2.1 Control Section 5P01765A

The control section is composed of the 8-bit MPU (IC-5), the program ROM (IC-7), the ITU telephone channel ROM (IC-8), ITU J2B channel ROM (IC-9), the RAM (IC-10) with back-up battery, and the scan deco der/driver circuit (IC11 to IC-15).
The display of transmitting frequency, receiving frequency and 4 lamp LEDs is selected by IC-11 and IC -12.
The scanning of the key board matrix and the 7 segment LEDs of the Display card are made by IC-13 to IC-15.
Lighting of these 7 segment LEDs and of the 4 lamp LEDs located above the Bar LED are made by IC-16 and IC-17.
Scanning Data (by IC-13 to IC -15) of the key board, the control switches of the control panel and the Link A to Link D are applied to PA and PC ports of MPU (IC-5).
The control signal of AF section (5P0545B) is applied from the MPU PC port through the driver IC-1.
Data communication between Control unit and Main unit is made on serial signals through the circuits of MPU PC port (PC 0 Output, PC 1 Input) and Line receiver driver (IC-2).

3.2.2 AF Section 5P01545B

AF section is composed of the audio signal transmitting circuit, the interface for the transmitting signal from RTTY, the circuit which transmits the audio signal of the receiver to the loud speaker, Hand-set receiver, and RTTY, the 2-tone alarm signal generator, the control logic circuit, the Bar LED driver and the dimmer circuit.

Transmitting of Audio Signals

Audio frequency signals from the microphone are applied to IC-4 through the hand-set filter (5P02038) eliminating radio frequency signals and T-1.
IC-4 having function of ALC (automatic level control)regulates the output level within the specified allowance.
The output of IC-4 is applied to IC-5 2/2 for amplification through the analogue switch IC-9 that is "on" in transmission of audio signals on emission mode H3E and J3E.
After amplification, the output is mixed with other transmitting signals at IC-5 1/2 to make the transmitting audio signals which are transmitted to the main unit.
Transmitting signals from RTTY are applied to the limitter circuit consisting of D-13 and D-15 through the filter consisting of L-4 and L-5 which eliminates radio frequencies.
The output is applied to the mixing amplifier IC-5 1/2 through the analogue switch IC-9 (different with the above IC-9) that is "on" in transmission of RTTY signals (tone) on emission mode J2B.
The amplified output is applied to the the main unit.

Receiving of Audio Signals

Audio signals from the receiver (main unit) is applied to IC-6 1/2 for amplification through the analogue switch IC-9 (different with the above IC-9s) that is "on" only when receiving.
The amplified output is divided and applied to (1) the terminal of RTTY (2) the volume control of the front panel and (3) hand-set receiver.
Audio frequency output of the volume control is applied through IC-7 amplifier to both of the internal speaker and the external speaker (terminal).
The relay K-1 is provided between the internal speaker and IC-7 in order to "off " the internal speaker when to be disconnected.
The audio frequency output to the hand-set receiver is applied through IC-6 1/2 to IC -6 2/2 for amplification.
Phone RV-9 of the IC-6 2/2 circuit is provided for adjustment of the hand-set receiver output level.

2-Tone Alarm Signal Generator

The tone signals of 1300 Hz and 2200 Hz are generated by the 180° phase shift oscillator consisting of TR-2 and TR-3.
1300 Hz and 2200 Hz are switched by the control signal from the control section.
The two tone signals are applied to the excitor (main unit) through IC-5 1/2 and to the hand-set receiver , the internal speaker, and the external loud speaker through IC -6 1/2 and IC-7.

Control Logic Circuit

The logic circuit is composed of IC-11 and IC-12. The circuit is designed to select according to the control signals from the control section, the transmitting audio signals, the receiving audio signals, the handset keying signals and the RTTY keying signals.
Voice signals of emission mode J3E and H3E are transmitted and received by the microphoene, receiver and the press switch of the hand set.
Press signals & tone signals are transmitted and received by RTTY on emission mode of J2B .

Bar LED Driver

The lighting of Bar LED of Display card (5P01544A) is controlled by IC-1 according to the strength of receivng signals and the transmitting signals of the main unit.
DC voltages of these inputs are A/D convered by IC-1 to light up LED bars. The number of bars to be lighted is proportional to the strength of the signals.

Dimmer Circuit

The dimmer volume consists of two control sections. On section controls the brightness of thirteen 7-segment LEDs used for transmitting frequency display and for receiving frequency display as well as three lamp LEDs (READY, TUNE and ALARM). These controls are performed by changing the base voltage of TR-1 in the control section (5P01765A).

The other section controls the brightness of Bar LEDs and back-light LEDs for the key board.

Their controls are performed as follows.

The control section supplys the control voltage to the comparator (IC-2) at which the control voltage is compared with the output of the triangle wave form oscillator (IC -3) to produce pulse signals whose duty rate is changed according to the control voltage.

The pulse signals of changeable duty rate control the output current of IC-1 and then the power supply voltage of bar LEDs by controlling the base voltage of TR-1 in AF section (5P01545B).

Others

TR-7 in AF section is the power supply to give +5 V DC to the control section (5P01765A).

3.2.3 Display Card 5P01544A

The card consists of five groups of LEDs as mentioned below.

(1) Lamp LEDs ALARM, TUNE, READY, FAULT ..... D- 1 to D- 4
(2) Receiving frequency Display (7 digits, 7 segment) ..... D- 5 to D-11
(3) Transmitting frequency display (6 digits, 7 segment) ..... D-12 to D-17
(4) Key Board back lighting ..... D-19 to D-43
(5) Bar LED D-18

3.2.4 Handset Filter 5P02038

The filter is provided to eliminate radio frequency signals induced in transmission in the hand-set and the curl cord.
The filter circuit is composed of three filters (coils L1 to L3 and condensers C1 to C6) and connected to the Hand-set connector J-6 directly.
They are inserted in the microphone Line , the receiver Line and the presstalk Line respectively.

3.2.5 Keyboard

The key board circuit is made up of 4 × 8 matrix. which is directly connected through connectors to Control Section (5P01765).

3.2.6 Junction Board 5P01555B (Option)

For remote control operation , the control unit is removed from the main cabinet.
Junction Board is used for connection between the removed control unit and the main unit of the main cabinet.
J1 is the connector to the control unit and TB-1 is the connector to Junction Board (not same) installed in the main unit. TB-2 is the terminal for connection with RTTY and the external loud speaker.

3.3 Transceiver Unit (Main Unit)

The main unit consists of RX/ Exciter (5P02077), Frequency Synthesizer (5P02078), T/R Control (5P01738A) , Pre-Selector (5P02039), RF Power Amplifier (5P02033), Low Pass Filter (5P02034), Power Supply unit (NJD-1966B) and Junction Board(5P01764A). The former four components are installed in the front portion of the cabinet case and the latter four components are installed in the rear portion of the cabinet.

The main unit is controlled by the signals from the control unit.
The control signals from the control unit are applied by the flatcable in the compact type system and by the system cable in the remote control type system.
The control signals are applied to T/R control via Junction Board and to each component.
+8 V DC, +19V DC and +24V DC produced at P.S Unit (NJD - 1966B) are applied to each component with exception of RF Power Amplifier.
+19V DC and +48V DC are directly applied to RF Power Amplifier from P.S. unit.

3.3.1 T/R Control 5P01738A

The board consisting mainly of a 8 bits MPU controls the circuits of the main unit and ATU according to the data signals from the control unit.

Entry of Data into the 6 PLLs of the Frequency Synthesizer Board

According to the data of transmitting and receiving frequencies from the control unit, MPU IC-16 transmits the data from PB port to the frequency synthesizer board through the latch circuit (IC-2) that is controlled by PC-4 port signal.
Frequency data (from J4 - 38) and Clock data (from J4 - 37) are applied to each of 6 PLLs.
But entry of frequency data to them is controlled by Latch signal LAT - 1 to LAT - 6.

Switching of Emission Mode

The output data from the MPU (IC-16) PB port is passed to the Latch circuit (IC- 5) which is controlled by the signal from the PC-5 port .
The data of emission mode is applied to the frequency synthesizer board, the key timing circuit and RX/Exciter board through one of the drivers (IC-3 and IC-9 open collectors).

Crystals are switched over by the data to Frequency Synthesizer board.
Different key signals are generated by the key timing circuit according to the emission mode selected.
The receiver filters and AGC circuit are switched over by the data to RX/Exciter.

Key Timing Circuit

KEY signal from P1-26 is passed to the line receiver (IC21-2), added by the signal from PC-1 port (IC19-38), level inverted by TR-10 and applied through the key timing circuit to the RX/Exciter, ATU and PLL etc with appropriate timing delay according to the emission mode selected.

The delay is varied by the delay circuit and signals on some mode not needing delay are by passed the delay circuit.

The switch IC-30 is provided to select these signals needing the time delay and other signals not needing time delay.

Those signals applied to Frequency Synthesizer are

(1) T (J4-23) to switch the transmitting frequency PLL (2 ea.)

(2) R (J4-24) to switch the receiving frequency PLL (2 ea.)

(3) A1R (J4-25) to actuate BFO when receiving A1A signals

(4) ST (J4-26) to actuate 455 KHz Local signal

Different key signals are applied

(1) KEY (P2-30) to RX/Exciter

(2) PK (P1-54) to RF Power Amplifier

(3) ATU KEY (P1-32) to ATU

Besides the above signals, two AF CUT signals are generated .

The one is generated in the key timing circuit in order to eliminate the spike noises which are produced in the receiver on the instant of conversion from transmitting to receiving.

The other one is generated in Frequency Synthesizer circuit in order to eliminate unwanted signals which are produced on lock-out of PLL.

These AF CUT signals are superposed and transmitted to P4-10 and then to RX/Exciter.

Data Output Circuit

The receiving bands switching signal (RXB-1 to RXB-6) of MPU (IC-16) PB port is applied to RX/Exciter board through IC-3 which is latched by the signal from the PC-port and through the buffer amplifiers IC-14 and IC-15 (open collector).

Transmitting Low Pass Filters switching signal (TB-1 to TB -8) of IC-19 PB port is applied to the Low Pass Filter through the buffer amplifiers IC-22 and IC-27 (open collectors) and through the junction board via P1 connector.

Pre-Selector receiving band switching signal (PB-1 to PB-5) of MPU (IC-16) is latched at IC-8 and applied to the Pre-Selector via P-3 connector through the buffer amplifier IC-7 (open collector).
Pre-Selector operation switching signal (to pass Pre-Selector tuning circuit or not) is transmitted from MPU (IC-16) PF-7 port to Pre-Selector through IC-14.

IC-19 PC port output signals are

PC-0 : "TUNE" signal is applied to ATU via P1-36 through IC -22 and Buffer Amplifiers TR-8 and TR-9.

PC-1 : "KEY" signal is transmitted when ATU is in tuning operation and when the alarm signal is transmitted.

PC-2 : "RESET" signal (on overload) is applied to Power Supply unit from P1-7 (RST).

PC-3/PC-4 : "Power Reduction " signal is applied to RX/Exciter from P2-6 and P2-4.

PC-5 : "AGC manual operation signal" is applied to RX/Exciter from P4-5.

Data Input

Diagnosis Signal

The diagnosis signals are consist of digital signals and of analogue signals.
Some of digital signals are through IC-1 and IC-4 applied to MPU (IC-16) PA port and others to the IC-19 (Input-Output port extension) PA port.
Digital Input signals are as follows.

(1) Signals from the frequency synthesizer board
- UNL 1 to 6 ····· indicate the PLL conditions
- OSC 1 to 3 ····· indicate the Crystal Oscillator conditions

(2) Signals from RX/Exciter board
- 70 MC ····· indicate the 70 MHz local signal conditions
- 455 C ····· indicate the 455 KHz local signal conditions
- CH C ····· indicate the channel signal conditions
- EX OUT C ····· indicate the Exciter RF output conditions

(3) Signals from P-1 connector
- OL ····· indicate the P.S. (+48 V) current conditions
- ATU FAULT ····· indicate ATU conditions
- 100 ℃ ····· indicate the RF power amplifier temperature conditions
- P48C ····· indicate the RF power amplifier power supply (+48 V) voltage conditions
- OH ····· indicate the P.S. temperature conditions and the signal (generated by IC21-1) indicating the SWR conditions of transmitting output power

Analogue Input Signal are as follows.

(1) Signals from Frequency Synthesizer board (J4)
- PLL 5C ····· indicate the power supply (+5 V) voltage conditions
- PLL 15C ····· indicate the power supply (+15 V) voltage conditions

(2) Signals from RX/Exciter (P2)
- RX/EX15C ····· indicate the power supply (+15V) voltage conditions

(3) Signals from Connector P 1

A24C ····· indicate ATU power supply voltage conditions

P19C ····· indicate RF Power Amplifier voltage conditions

PA - PF ····· indicate RF Power Amplifier transmitting output power voltage conditions

L - PR ····· indicate reflection power (Low Pass Filter output) voltage conditions

L - PF ····· indicate the forward wave power (Low Pass Filter output) voltage conditions

Besides the above, the signals indicating the power supply (+24 V, +19 V and 5 V) voltage conditions.

These analogue signals are applied to MPU AN-port.

Other Input Data

B-1 READY (P1-35) signal is applied from ATU to RX/Exciter (P2-24) through the line receiver IC21-4.
The overall gain of the transmitter is automatically controlled by this signal for the specified transmitting power.
Upon adjustment to the specified output power, READY (RST) signal is transmitted from P2-28 to IC-19 PA7 port.

B-2 TX-TUNE (P1-33) signal is applied from ATU to IC-19 PA -4 port through IC21-3.
Tuning operation of the main unit is remotely controlled by the signal from ATU.

B-3 Emission mode switching (2182 KHz) signal H3E mode is available by connecting JP-1 and JP-2 is common and J3E-USB by opening connection of JP-1 and JP-2.
The switching signal is applied to MPU through IC-1.

Bar LED Display Indicating RF signal strength

The Bar-LED Display is designed to indicate the strength of the receiving electric field and the transmitting output power. The selection between the receiving electric field strength and the transmitting output power is made by means of the analogue switch IC-26 that is controlled by the key signal from IC22-16.

The receiver AGC voltage is used for indication of the receving electric field strength. The signal from P4-16 (AGC voltage) is converted in polarity by IC20-2 and adjusted by RV - 1 and RV-2 up to the appropriate level for LED display.
The forward wave voltage (L-PF) detected by the Low Pass Filter is used for indication of the transmitting power strength.
The signal is converted in polarity by IC20-1 and the signal wave is smoothed by D-22 and C-126 for LED display.
The signal then is through the buffer amplifier TR-3 to the control unit via P1-24.

3.3.2 Frequency Synthesizer 5P02078

The board generates 455 KHz , 70 MHz and 70.555 MHz to 100.455 MHz local signals of RX/ Exciter from the 10 MHz (reference frequency) oscillator.
The frequency synthesizer consists mainly of 6 PLLs which are Hybrid ICs.

80MHz to 80.4MHz Synthesizer

IC-1 and IC-3 are Hybrid ICs (4155P00451) which are oscillated at 80 MHz to 80.4 MHz . IC-1 generates the last 2 digits of receiving channel frequency and IC-3 generates the last digit of transmitting channel frequency.
The Hybrid consists of prescaler, Up/Down counter, programmable divider, Reference divider, shift register, Phase comparator and Oscillator.

The data of dividing numbers of the programmable divider and the Reference divider, the frequency data of Up/Down counter (FDTA) which are applied from T/R Control Board are latched at the Hybrid IC in synchronization with clock (CLK).
Reference frequency of the Hybrid IC is 4 KHz and the dividing number of the programmable divider is 20000 to 20099.
The number is determined according to the oscillation frequency.
The output frequency of IC-1 is divided to 1/40 and then 1/10 by the fixed dividers IC-6 and IC-11 to make the square wave of 200 KHz to 201 KHz.
The output frequency of IC-3 is divided in the same way by IC-8 and IC-12 to make the same square wave.
The output of IC-11 (or IC-12) selected by R signal is converted to sine wave through the filters.

91.16MHz Synthesizer (Option)

IC-5 is the Hybrid IC (4155P00453) that makes the RF local signal of 455.8 KHz for receiving A1A signals.
The Hybrid IC is oscillated at 90.86 MHz to 91.46 MHz.
The Hybrid is almost same to IC-2 and IC-4.
The reference frequency is 10 KHz and the dividing number of the programmable divider is 9086 to 9146.
The output of the Hybrid IC (90.86 MHz to 91.46 MHz) is divided to 1/20 then 1/10 by IC -10 and IC-13 to make the RF local signal (455.8 KHz) which is variable ± 1.5 KHz by 50 Hz step.
The output of IC-13 is applied to TR-8 of 455 Local Amplifier consisting of TR-8 and TR-9.

98MHz to 108MHz Synthesizer

IC-2 and IC-4 are Hybrid ICs (4155P00452) for receiving channel RF signals and transmitting channel RF signals respectively.
They are oscillated at 98 MHz to 108 MHz and make the KHz digits frequencies (1 KHz, 10 KHz and 100 KHz) of receiving channels and transmitting channels.
IC-2 and IC-4 are almost same to IC-1 and IC-3.
The reference frequency of these Hybrid ICs is 10 KHz.

The dividing number of the programmable divider is 9800 to 10800 and determined the oscillation frequency of the oscillator.
The output frequencies of IC-2 and IC-4 are divided to 1/10 by IC-7 and IC-9 to make the square waves of 9.8 MHz to 10.8 MHz.

The output of IC-7 (or IC-9) selected by R signal is converted to sine wave through the filters.

455MHz Local Amplifier

The amplifier consists of the mixer, 10.455 MHz oscillator, RF Amplifier and A1A transmitting Key Filter circuits.
RF signal from the 10.455 MHz oscillator and 10 MHz signal from the reference frequency oscillator are mixed at the mixer TR-6 to make 455 KHz.
10.455 MHz oscillator consists of one of the crystals (X1 to X 4) and TR-10.
The selection of the crystal is made by the emission mode signal from T/R Control.
The RF signal of 10.455 MHz is applied to 455 KHz Local Mixer and IC-16 to make 60.455 MHz. RF Amplifier consists of TR-8 and TR-9.
455 KHz Local signal applied to TR-8 Buffer Amplifier is transmitted to TR-9 Buffer Amplifier through the filter of Impedance 600 Ω to eliminate high frequency elements of the signal. TR-9 is provided to reduce the output impedance of the signal.
The Key Filter circuit consists of IC-22 and TR-1 to TR-5.
ST signal of square wave is applied to IC-22 #5pin through TR-3 which is switched on and off to make the 15V DC - 0 V DC square signal.
The signal applied to IC-22 is passed to the two stages of operational amplifiers to eliminate high order harmonics modulation frequencies of Key signals from 455 KHz Local Signal.

IC-22 is the circuit to smooth the 455 KHz Local Signal wave form and TR-1 to TR-5 are provided to control 455 KHz output level when transmitted A1A mode.

Reference Frequency Oscillator and 70MHz Local Amplifier

The 10 MHz RF output of the reference frequency oscillator OSC-1 is amplified by TR-14 and applied through Buffer Amplifiers of TR-15 and TR-16 to 455 Local mixer , 70 MHz multiplier and 40 MHz multiplier.
The oscillated reference frequency output is multiplied by TR-18 and TR-19 to make 70 MHz local signal and then applied to RX/Exciter through TR-20 for Impedance conversion.

10MHz to 11MHz Amplifier

The Amplifier consists of the 16.7 MHz oscillator and three mixers.
The 16.7 MHz Oscillator consists of TR-21 and the crystal X-6.
The output of the oscillator is applied to the mixer of IC-18 and IC-20 through the Buffer Amplifier TR-22.
The 200 KHz frequency for (transmitting & receiving) channel RF signal and the output of 16.7 MHz are mixed to make 16.9 MHz and 16.5 MHz.
The unwanted 16.5 MHz is eliminated at the filter FL-1.
The signal of 16.9 MHz is mixed at Mixer IC-19 with the 9.8 to 10.8 MHz for (transmitting & receiving) channel RF signals to make RF signal of 26.7 MHz to 27.7 MHz.
The produced signal is again mixed with 16.7 MHz at IC-20 to make 10 MHz to 11 MHz RF signal that is applied to the 60.455 MHz circuit.

60.455MHz Amplifier

The reference frequency oscillator output of 10 MHz is multiplied at TR-18 to TR-20 to make 40 MHz which is mixed at IC -16 with 10.455 MHz to make 50.455 MHz RF signal.
The RF signal of 50.455 MHz is mixed with 10 to 11 MHz RF signal at IC-17 to make 60.455 to 61.455 MHz RF signal .
The RF signal of 60.455 to 61.455 MHz is tuned and amplified through T-16 to T-19 and TR -28 to be applied to the 70.455 to 100.455 MHz synthesizer.

70.455MHz to 100.455MHz Synthesizer

The synthesizer is the final stage PLL consisting of the mixer, the oscillator and Hybrid IC9 (4155P000454).
The RF signal from the 60.455 MHz amplifier, the channel RF signal from IC-15 and the RF signal of 70.455 MHz to 100.455 MHz are mixed at IC-14 to make 10 MHz to 40 MHz signals.
The reference frequency of 1 MHz is produced at IC-15 by dividing the reference oscillation frequency of 10 MHz to 1/10.
The RF signal of 10 MHz to 40 MHz also divided to 1/10 to 1/40 to make 1 MHz.
These two 1 MHz are compared to control the output frequencies of the oscillators in order to synthesize the channel RF signals.
There are provided three oscillators (one inside of IC-15 and two outside of IC-15).
These three oscillators are switched by the control signal VB-1 to VB-3 from T/R control.
The synthesized RF signals are applied to RX/Exciter through RF amplifier, Buffer Amplifier of IC-15 for amplification and impedance conversion.

Self-Diagnosis

The board has the circuit to monitor the following oscillations ..

(1) 10..455 MHz oscillators 4 frequencies (very slightly different)
(2) Reference Frequency Oscillator 10 MHz
(3) 16.7 MHz oscillator

(1) The output is detected by D-8, amplified by TR-13 and applied to T/R control as the OSC 1C signal .
(2) The output is detected by D-9, amplified by TR-17 and applied to T/R control as the OSC 2C signal .
(1) The output is detected by D-10,amplified by TR-23 and applied to T/R control as the OSC 3C signal .

3.3.3 RX/Exiter 5P02077

The RX/Exciter board consists of the receiver and the exciter.
They are switched over by the transistor switch and the diode switch which are controlled by the key signals.
In the receiver, RF signals are converted to AF signals through the RF, 1st IF (70.455 MHz) the 2nd IF (455 KHz) and AF circuits.
In the Exciter, AF signals are reversely converted to RF signals.
Frequency conversion is made by the two passive DBM (double ballanced mixer) and the one active DBM.

Receiver

RF signals received at the RX antenna are applied to RF stage.
The RF stage has the two protection circuits. One against the excessively large Input (D- 17 to D-20) and the other against static electricity charged at the RX antenna. (T -18)
There are provided the following six Band - Pass Filters which are switched over by diodes (D-21 to D-32) according to the RX-Band data signals and which are designed to eliminate inter-modulations and cross-modulations.

RXB1	.....	100 KHz	to	405 KHz	(except 405 KHz)
RXB2	.....	405 KHz	to	527 KHz	(except 527 KHz)
RXB3	.....	527 KHz	to	1.6 MHz	(except 1.6 MHz)
RXB4	.....	1.6 MHz	to	4.0 MHz	(except 4.0 MHz)
RXB5	.....	4.0 MHz	to	1 4 MHz	(except 1 4 MHz)
RXB6	.....	1 4 MHz	to	3 0 MHz	

RXB1 to BXB4 have the impedance conversion circuits respectively which are designed for high capacitive impedance antenna.
Each impedance conversion circuit has three tap terminals, L, Center and H.
L and Center are connected for regular (50 Ω) impedance and Center and H are connected for high impedance antenna. (TP-1 to TP-12)
The output of BPF is applied to the attenuator circuit which is controlled by RF AGC signal.

The attenuator is composed of three pin diodes (D33 to D35) and its maximum attenuation is about 30 dB at its impedance (input and output) 50 Ω.
RF signal is amplified by the wide band RF Amplifier TR-13 and applied to the 1st mixer H 2 through the diplexer consisting of L and C elements.
The Mixer M2 is a DBH of impedance (input and output) 50Ω and RF local signals of 70.555 MHz to 100.455 MHz are applied to the #8 pin of the mixer.
At the mixer, RF signals are converted to 70.455 MHz and amplified by the IF Amplifier consisting of two FETs, TR-14 and TR-15 (N-Channel Junction FET).
The amplified IF signal (70.455 MHz) is applied to the crystal filter FL-1 through the attenuator of D33 to D35.
The performance characteristics of the crystal filter FL-1 is as follows .

the input & output impedance	·····	50 Ω
the Center Frequency	·····	70.455 MHz
6 dB Band-width	·····	15 KHz (approximately)

The crystal filter is provided to eliminate undesirable RF signals and to prevent inter -modulation and cross-modulation which are possibly produced at the subsequent IF stages.
The IF signal is amplified by TR-18 and TR-19 (FET) and applied to the 2nd mixer M1 which has the input & output impedance of 50Ω.
The IF signal is mixed with 70 MHz RF local signal at the mixer M1 (DBH) (pin #8) to be converted to the 2nd IF signal of 455 KHz and to be applied to the next FET Amplifier of TR-20 and TR-21.
The input impedance 50Ω of the FET Amplifier is converted to the output impedance 1.8 k Ω through the output transformer T-9.

The 2nd IF signal is applied to the mechanical filter in order to eliminate unwanted signals. FL2, FL3 or FL4 of the mechanical filter is switched over according to the emission mode data.
The input and output impedance of the mechanical filter is 1.8 kΩ and the sharp attenuation characteristics is as follows .

FL 2	·····	2.4 KHz	for	6 dB attenuation band width
FL 3	·····	5.4 KHz	for	6 dB attenuation band width
FL 4	·····	0.5 KHz	for	6 dB attenuation band width

The IF stage consists of TR-22 to TR-24 and TR-28 ; two MOS FETs and two transistors. AGC voltage is applied to the gate 2 of the FETs in order to give the large dynamic range.

The 2nd IF signal is beat-detected by IC-2 on emission mode of J3E, A1A and J2B and envelope-detected by D-76 on emission mode of H3E and A3A to be converted to AF (Audio Frequency).

The detected output is applied to the AF Hybrid IC (IC-9) through the analogue switch IC -8 or TR-38.

Selection of the analogue switches is performed according to the emission mode selected.

The AF Hybrid IC is an active low-pass filter of 4 order , and provided to eliminate unwanted high frequency elements from the detected output.

The performance characteristics of the active filter is as follows.

Input impedance	.....	10 KΩ
Output impedance	.....	200 Ω
Cut off frequency	.....	3 KHz

AF signal, the output of the active filter is amplified by the operation amplifier to the specified level, balanced at the AF output transformer and applied to T/R Control Board (5P01738A).

TR-29 to TR-37 and IC-7 in the AGC circuit is provided to control the receiver gain.

Exciter

In transmission, the AF signal is amplified by the AF Section board (5P01765A) to the specified level and applied to the modulator IC-2 through the analogue switch IC-1 to be converted to the transmitting 1st IF 455 KHz.
The transmitting 1st IF is applied to the filter FL-2 through RV-1 (or RV-2) and TR-1 for establishment of modulation level.

RV-1 is selected for emission mode of J3E and RV-2 for H3E.
The filter is provided to block the unwanted side band signals and carrier frequency, limiting the transmitting frequency bandwidth.
The 1st IF signal of the filter output is applied to the 2nd mixer of input impedance 50 Ω through the TR-2 Buffer Amplifier for impedance conversion.
On emission mode of A1A and H3E , the carrier frequency is applied through IC-4 to the base of TR-2.
The 2nd IF signal converted to 70.455 MHz at the mixer M1 is applied to the gate 1 of TR-3 through the filter FL-1 which is provided to increase the transmitting S/N.
The voltage of the gate 2 of TR-3 is controlled by IC-11.
Then the transmitting RF output of TR-3 is controlled (automatic power control) to prevent the the overinput of Power Amplifier unit (5P02033).
TR-3 (FET) output is converted to RF signal through the 3rd mixer DBM M2.

RF amplifier consists of three transistors of TR-4 to TR-6 and there is provided between TR-4 and TR-5 the power reduction attenuation circuit of power medium and power low steps.
The RF signal is amplified to the specified level by TR-5 and TR-6 and applied to the Power Amplifier unit.

3.3.4 RF (Power Amplifier) 5P02033

The unit consists of the RF Amplifier, the bias circuit and the self - diagnosis circuit.
The specified performance of the RF Amplifier is as follows.

Frequency range	1.6 to 28 MHz
Impedance (output & input)	50 Ω
Power gain	44 dB (approximately)
Output power	250 W
Heat dissipation	Heat - sink cooling

The RF signal from J-1 is amplified by TR-2 to the rated level .
TR-2 is a A-class single amplifier and its bias is supplied from TR-1 which is controlled by the key signal.
The amplified RF-signal is applied divided to the AB class push-pull amplifier of TR-3 and TR -4 through T-1 which converts impedance.
The bias of the push-pull amplifier is controlled by TR-7 to TR-10 which are conrolled by the key signal.
TR-9 is the transistor for temperature compensation of the TR-3 and TR-4 bias circuit.
TR-5 and TR-6 compose the final stage of the push-pull AB class amplifier where the RF signal is amplified up to the specified output power.
The grounding of TR-5 and TR-6 is floating and insulated by T-4 and T-6.
The bias circuit of TR-5 and TR-6 is composed of TR-11 to TR-13 and IC-1 (key signal convertor).
TR-12 is the transistor for temperature compensation of the bias circuit.
With the S-1 actuated, no key control signals are applied and no bias is applied to the final stage amplifier.
With S-2 actuated, T/R control reduces the output of RX/Exciter to "medium".
The diode D-1 detects only the forward wave of RF signal that is passed through T-7 and T -8. The detected forward wave is converted to DC (voltage) of the specified level at the T/R control to be used as the DC signal which controls the RX/Exciter transmitting output power.
IC-3 is provided to monitor the power supply of 48 V for the final stage. If the 48 V is out of the voltage range allowed, IC-3 actuates TR-14 that applies the 48 V check signal to T/R control through IC-1.
IC-1 is the grounding isolation IC.

3.3.5 RF (Power Amplifier) 5PO3008

The unit consists of the RF Amplifier, the bias circuit and the self - diagnosis circuit. The specified performance of the RF Amplifier is as follows.

Frequency range	1.6 to 28 MHz
Impedance (output & input)	50 Ω
Power gain	44 dB (approximately)
Output power	250 W
Heat dissipation	Heat - sink cooling

The RF signal from J-1 is amplified by TR-2 to the rated level .
TR-2 is a A-class single amplifier and its bias is supplied from TR-1 which is controlled by the key signal.
The amplified RF-signal is applied divided to the AB class push-pull amplifier of TR-3 and TR -4 through T-1 which converts impedance.
The bias of the push-pull amplifier is controlled by TR-7 to TR-10 which are conrolled by the key signal.
TR-9 is the transistor for temperature compensation of the TR-3 and TR-4 bias circuit.
TR-5 and TR-6 compose the final stage of the push-pull AB class amplifier where the RF signal is amplified up to the specified output power.
The grounding of TR-5 and TR-6 is floating and insulated by T-4 and T-6.
The bias circuit of TR-5 and TR-6 is composed of TR-11 TR-12, and IC-1 (key signal convertor).
TR-12 is the transistor for temperature compensation of the bias circuit.
With the S-1 actuated, no key control signals are applied and no bias is applied to the final stage amplifier.
With S-2 actuated, T/R control reduces the output of RX/Exciter to "medium".
The diode D-1 detects only the forward wave of RF signal that is passed through T-7 and T -8. The detected forward wave is converted to DC (voltage) of the specified level at the T/R control to be used as the DC signal which controls the RX/Exciter transmitting output power.
IC-3 is provided to monitor the power supply of 48 V for the final stage. If the 48 V is out of the voltage range allowed, IC-3 actuates TR-14 that applies the 48 V check signal to T/R control through IC-1.
IC-1 is the grounding isolation IC.

3.3.6 LPF (Low Pass Filter) 5PO2034

The filter circuit is designed to eliminate the high order harmonics included in the RF signal output of Power Amplifier.
The frequency range of 1.6 to 28 MHz is divided into 8 bands of TB -1 to TB-8 as described below.
These bands are switched according to the TB signals from the main unit.

TB-1	.....	1.6 MHz	to	2.3 MHz	(2.3 MHz not included)
TB-2	.....	2.3 MHz	to	3.3 MHz	(3.3 MHz not included)
TB-3	.....	3.3 MHz	to	4.7 MHz	(4.7 MHz not included)
TB-4	.....	4.7 MHz	to	6.7 MHz	(6.7 MHz not included)
TB-5	.....	6.7 MHz	to	9.7 MHz	(9.7 MHz not included)
TB-6	.....	9.7 MHz	to	13.8 MHz	(13.8 MHz not included)
TB-7	.....	13.8 MHz	to	19.7 MHz	(19.7 MHz not included)
TB-8	.....	19.7 MHz	to	28 MHz	

Each band is composed of the 7 order or 8 order type filter and its input and output impedande is 50 Ω.
T1 and T2 at the output of the Low Pass Filter are the directional couplers to detect the forward wave and the reflected wave of the RF signal.
The detected RF signal is rectified by D-9 and D-10 to be converted to the DC signal (forward wave signal and reflected wave signal).
The DC signals are computor-processed by the T/R control PCB to be used for measurement of SWR and for self-diagnosis.

3.3.7 PS (Power Supply) NJD - 1966B

General

The power supply unit is designed to convert the input of 10.8 ~31.2V DC to the output of 48V, 24V, 19V and 6V.

Performance Specification

(1) Input voltage DC 12V/24 V (10.8 V ~31.2 V)

(2) Output voltage and output current

(a)	4.8 V ± 3 %	13 A~ 0.1 A
(b)	24 V ±10 %	1 A~ 0.3 A
(c)	19 V ±10 %	4 A~ 1.6 A
(d)	8 V ± 2 V	1.2 A~ 0.3 A

(3) Output ripple

(a) (b) ..... 500 mV P-P

(c) (d) ..... 300 mV P-P

(4) Overvoltage protection

The protection circuit works and the power supply unit does not operate when the 48 V output is increased more than up to 110 % .

(5) Overcurrent protection

The protection circuit works and the power supply unit does not operate when the current of 48 V output is increased more than up to 110 % (14.3 A).

(6) Operation temperature

- 20 ℃~ 60 ℃

Operation

(a) Make sure that the input and the output connectors are secured in the right way.

(b) Make sure that the switches "MSW", "RX" and "R/T" are put off.

Apply the DC power supply .

(c) Apply the input and turn on "MSW".

The power unit works with "RX" or "T/R" switch turned on.

"MSW" switch ------ Main switch

"RX" switch ------ Switch for the outputs excepting 48 V

"R/T" switch ------ Switch for all outputs

During the warming-period of several seconds after turn on of "MSW", the power supply unit does not work. But this is not trouble.

The power supply unit operation is interrupted during the period when the power supply unit input voltage is instantaneous by dropped to below the specified minimum voltage.

Theory

The Fig.-1 shows the Block Diagram of power supply unit which consists of the 48 V - chopper and the DC/DC converter to convert the 48 V to the other specified voltages.

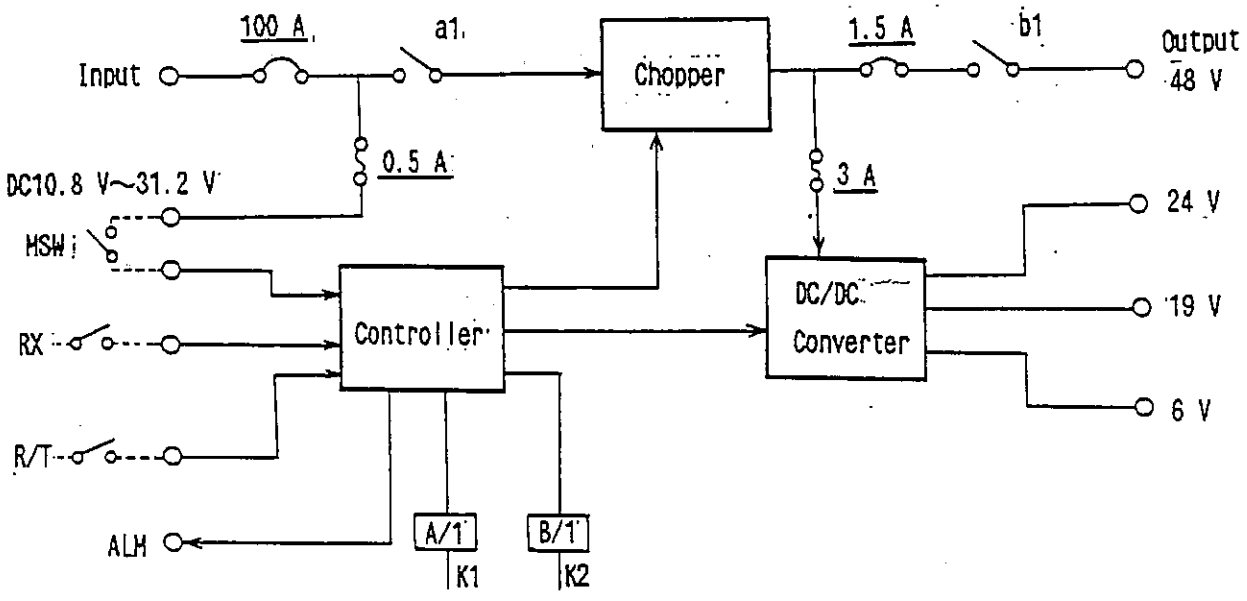


Fig. 1

With "MSW" turned on, the power supply unit is ready for operation.

With "RX" turned on, the chopper works and DC/DC converter works.

The DC/DC converter receives the 48 V output of the chopper and converts to the 24 V, 19 V and 6 V.

With "R/T" turned on, the output relay K2 works and the output current is applied to all the outputs of 48 V, 24 V , 19 V and 6 V.

Chopper

The Fig.-2 shows the chopper circuit.

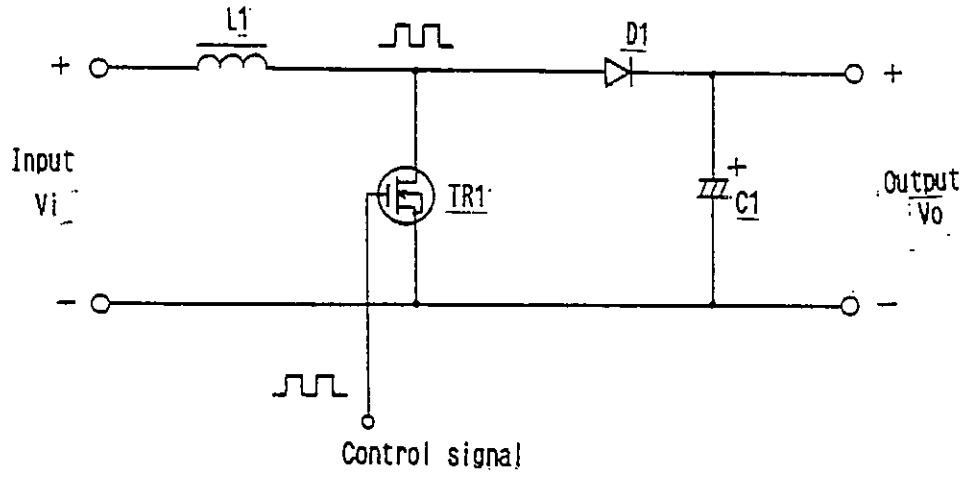


Fig.-2

The chopper circuit is a step-up type switching regulator to get the output voltage higher than the input voltage.

L1 and C1 are the reactor and the capacitor to store energy.

TR-1 is the switching transistor and D1 is the rectifier diode.

With the TR-1 switch on, the input voltage V1 is applied to the reactor L1 and energy is stored at L1.

With TR-1 switch off, energy stored at L1 is passed through D1 to the capacitor C1 keeping the output voltage Vo at constant.

$$Vo \fallingdotseq Vi + Vi\frac{t\ on}{t\ off}$$

t on : TR-1 switch is on.

t off : TR-1 switch is off.

Therefore, the output voltage is kept at constant by controlling the time of "on" and time of "off". Time of "on" and time of "off" are the time (period) while TR-1 switch is on and off.

The control signal of TR-1 is applied from the control IC (HB3759).

The control IC has the oscilator, the high-gain amplifier and the reference voltage circuit and is able to supply the precise control .

DC/DC Converter

Fig-3 shows the converter circuit.

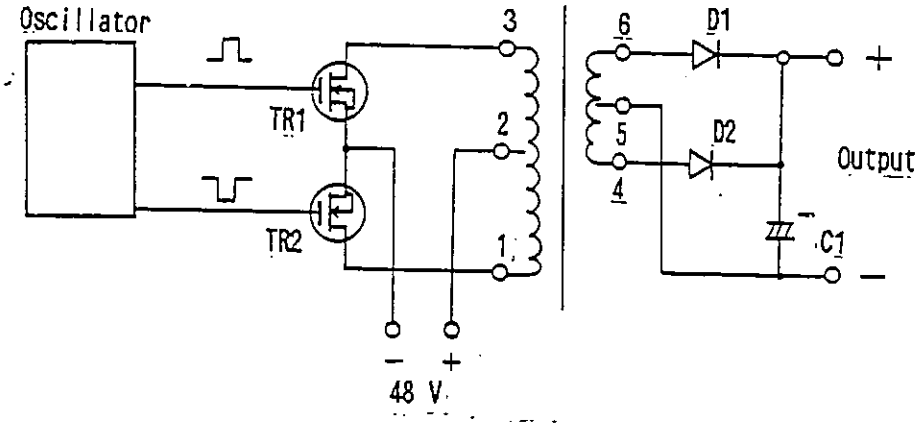


Fig.-3

The converter circuit is designed to convert the DC 48 V to 24 V, 19 V and 6 V.
The control IC (μPC1042C) is employed in the oscillator of the unit to generate the signal that is shifted 180° in phase alternately.(AC)
The signal is power-amplified to the specified level by the switching transistors TR-1 and TR-2.
The voltage of power-amplified signal is transformed by the transformer T-1 and converted to DC by D-1, D-2 and C-1 to produce the specified DC output voltages.
The Fig.-4 shows the driving signals of TR-1 and TR-2 and the wave-form applied on T-1.
The driving signal TR-2 is delayed by (time) td from that of TR-1 to prevent Dead-Time zero (overcurrent).
The output voltage are established by adjusting the time delay td.
The output voltages are not regulated and instable.

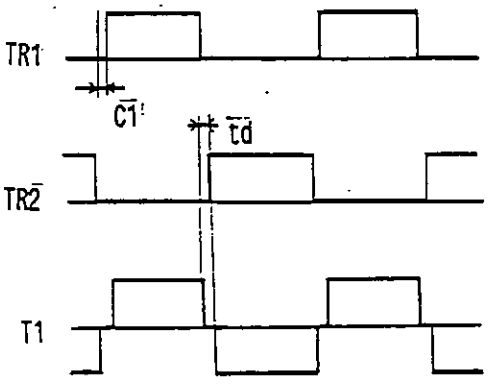


Fig. 4

Control

The control circuit and its control signals are as follows.

(a) MSW : to ON/OFF of power supply to the control circuit
(b) RX : to drive the chopper circuit and actuate the DC/DC converter circuit
(c) R/T : to actuate the output relay K-2 to supply all the outputs.
(d) O.H : to cut-off the 48 V output on sensing over-heat of the power supply unit and to transmit the "L" level signal.
(The power supply unit operates again when the temperature is decreased to the allowable level.)
(e) O.C : to cut off the 48 V output on detection of the overload of the 48 V output circuit and transmit the "L" level signal.
(Transmission is interrupted by the drop of 48 V output voltage.)
For re-setting, "RST" shall be positioned to "L" level or "RX" and"R/T" signals shall be off.
(f) RST : to re-set the power supply unit operation interruption due to the overcurrent (overload) protection.
(g) Sensing of the input voltage : The power supply unit is not operated when the input voltage is below the allowable level.

The timer is built in to delay operation of the power supply unit several seconds after the connection to the main power source and switch on of "MSW".

Adjustment

Usually no adjustment is needed because the power supply unit is perfectly adjusted in factory before delivery.

But if necessary, the adjustment shall be made as follows.

(a) 48 V output voltage adjustment

The output voltage shall be adjusted by VR-1(A-1 board) to the +48 V at the output connector terminal (P8).

(b) 48 V output current adjustment

The output current shall be adjusted by VR-2 in the A-1 board.

The output current should be increased gradually (The load resistance is decreased.) up to about 14.3 A where the output voltage shall begin decreasing.

If the output voltage is excessively decreased down to below 45 V, no output is applied to the board and "O.C" (overcurrent) signal is set to "L" level.

After restoration of load resistance to normal condition , the 48 V output is again applied with "KST" set to "L" level.

During the overcurrent adjustment, the 24 V,19 V and 6 V outputs shall be the rated loads.

(c) 24 V/ 19 V/ 6 V output voltage adjustment

The output voltages shall be adjusted by VR-1 in the A-2 board.

The 24 V output shall be adjusted at 24 V with the output load adjusted at about 70 % of the rating.

The 19 V output and the 6 V output shall be varied with the adjustment of the 24 V output. As it is impossible to adjust each of the outputs independently, their adjustments shall be achieved .

It should be noted that the output voltage is increased 10~ 15 % higher than the rating, if their output loads are none or very small. (less than 30 % of the rating voltage)

When adjusted , the adjusting volumes (VR-1 and VR-2) should be marked with white paint in order not to be tampered with.

It should be cautioned that the wrong adjustment of the output voltages and currents reduces performance and damages the power supply unit.

3.3.8 Junction Board PO1764A

Junction Board is provided for connection among the main unit, Control unit and ATU. Connection is made by means of the terminal boards and the plug-in connectors.
The terminal boards are used for connection to the external units such as RTTY , external speaker, ATU and Remote Control unit while plug-in connecotrs are used for internal connections with for example power supply, T/R control, Power Amplifier etc.
2A fuse in the ATU +24 V DC line is provided for protection of ATU power supply and the main unit power supply.
R1 and R2 in the +24 V DC line are provided to devide the line voltage to make A24C signal (low voltage) to monitor the line voltage.
A24C signal (ATU +24 V DC check) is applied to T/R control unit to be used for self -diagnosis test.
The display card of the Control unit shows the error code (E-32) when the +24 V DC is out of the specified voltage range.

3.3.9 Preselector 5P02039 (Option)

The board consists of the RF tuners provided at the input stage of the receiver.
The receiving frequency range of 100 KHz to 29999.99 KHz is divided into 7 bands by PB-3 to PB-5 and further divided in smaller bands by PB-1 and PB-2.
These bands are switched over according to the control signals from T/R control (5P01738 A).
The division of frequency band by the control signal is shown on the next page.
The selection and switching to these bands are performed by the diode switches connected to the respective tuner circuits.
In case of "preselector wide (off)" , the diode switch for "preselector wide " is selected and RF signal is directly applied to RX/Exciter.
Each multi-tuner circuit consists of transformers, varicap diodes, condenses and choke coils.
The varicap diodes are functioned as the tuning condensers and coupling condensers to the transformers.
The varicap diodes are controlled by the collector voltage of TR-1 that is controlled by the volume installed on the Control unit panel and connected to the PRSEL Input port.
The choke coils inserted in parallel in the multi-tuner circuit is provided to reduce inductance of the tuning transformers and these coils are selected depending upon the band frequency to be tuned.
In case of an antenna that is capacitive and high impedance (our design is based on 10 Ω +250 PF maximum), connection of jumping wires to the center and " H" position is recommended to apply RF signal to the tuning circuit.
Usually, the antenna impedance is 50Ω at Factory adjustment for the connection of the "center" to "L" position.
The receiving frequency (band) signals from PB-1 to PB-5 are converted to the 11 bits signals by Decorder IC, (IC-1 and IC-2) and amplified by Driver IC(IC-3 and IC-4), selecting the diode switch and the receiving frequency band.

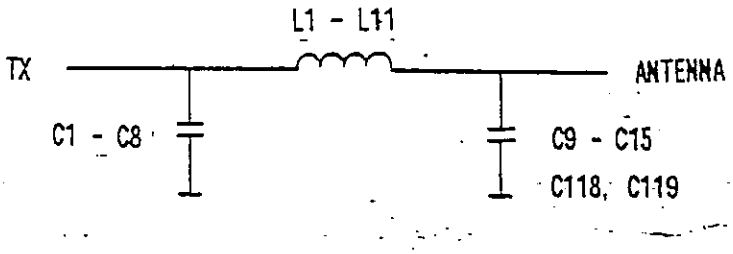
PRE - SELECTOR BAND CODE

PRE - SELECTOR	PSEL	P31	P32	P33	P34	P35
WIDE	H	L	L	L	L	L
100.00 ~ 141.99 KHz	L	L	L	H	H	L
142.00 ~ 199.99 KHz	L	L	H	H	H	L
200.00 ~ 284.99 KHz	L	H	L	H	H	L
285.00 ~ 404.99 KHz	L	H	H	H	H	L
405.00 ~ 526.99 KHz	L	L	L	H	L	H
527.00 ~ 933.99 KHz	L	L	L	H	L	L
934.00 ~ 1599.99 KHz	L	L	H	H	L	L
1600.00 ~ 2559.99 KHz	L	L	L	L	H	H
2560.00 ~ 3999.99 KHz	L	L	H	L	H	H
4000.00 ~ 5699.99 KHz	L	L	L	L	H	L
5700.00 ~ 7999.99 KHz	L	L	H	L	H	L
8000.00 ~ 11399.99 KHz	L	L	L	L	L	H
11400.00 ~ 15999.99 KHz	L	L	H	L	L	H
16000.00 ~ 21999.99 KHz	L	L	L	L	L	L
22000.00 ~ 29999.99 KHz	L	L	H	L	L	L

3.4 Antenna Tuning Unit

ATU (Antenna Tuning Unit) is composed of the LC Network (5P01553A) and the ATU Control (5P01749B) that is shielded.
The main Unit and ATU are connected by the 12-wires system cable, the transmitting coaxial cable and the receiving coaxial cable.
Antenna matching is automatically performed with the "tune" signal from the main Unit.

3.4.1 LC-Network 5P01553A



LC Network is composed of (1) the attenuator that is inserted in tuning operation to the transmitting signal Line (2) the directional coupler that measures the situation of antenna matching (3) the 90° phase-shift circuit (4) LC circuit as shown above and (5) the relay circuit switches the elements of the LC circuit.
The Attenuator (1) is designed to prevent the transmitter load impedance deviate largely from 50 Ω

3.4.2 ATU Control 5P01749B

ATU Control is composed of 8 bits MPU, the detector and the Bar LED Display.
The detector consists of the Double Balanced Mixers M1 and M2 and the Comparator IC-13.
The Bar LED Display indicates the strength of (1) the forward wave, (2) the reflected wave and (3) the antenna current.

Theory of Tuning Operation

The forward wave voltages and the reflected wave voltages of the directional coupler are applied to DBM(M1) for product of these two voltages.

After elimination of the high frequency elements, the output is applied to the comparator IC-13 for estimation of the antenna Impedance absolute value.

| Z ant | > 50 Ω if IC-13-1 output "H" (nearly + 5 V DC)
| Z ant | < 50 Ω if IC-13-1 output "L" (nearly 0 V DC)

Also, the forward wave voltage of the directional coupler and the 90° phase shift circuit voltage are applied to DBM (M2) for product of these two voltages.
After elimination of the high frequency elements, the output is applied to the comparator IC-13 for estimation of the antenna Impedance Inductivity

Z ····· +J (Inductive) if IC-13-7 output "H" (nearly + 5 V DC)
Z ····· -J (Capacitive) if IC-13-7 output "L" (nearly 0 V DC)

The forward wave voltage and the reflected wave voltage are detected by D-8 and D-7 to be applied to the analogue input port of MPU (IC-1).
"Tuning" is performed by calculating the detected signal voltage in the MPU (IC-1).
When the reflected wave voltage is lower than the specified level, "Ready" signal is transmitted to indicate that tuning is completed.
Tuning is performed automatically with selection of the most appropriate combination of L and C elements of LC Network as described below.
Refer to the Figure of 3-1.

Here we call the group of C-1 to C-8 as CA (transmitter side capacitors), the group of C-9 to C-15, C-118 and C-119 as CB (Antenna side capacitors) , the group of L1 to L11 as L.
Their particular capacitance & inductance values are described in the table of 3-4.
If the antenna impedance is - J (capacitive), L should be increased from the smallest (L -1) value to an appropriate value (signal L element or combination of some L elements) where -J (capacitive) is converted to +J (inductive).
The impedance absolute value Z shall be measured at this turning point.
If Z is lower than 50 Ω, tuning is performed by selecting appropriate combination of elements CA and L.
If Z is higher than 50 Ω, tuning is performed by selecting appropriate combination of elements CB and L.

If the antenna impedance is +J (inductive), capacitance should be increased from the smallest (C-9 + C-118) value to an appropriate value (signal CB element or combination of some CB elements) where +J is converted to -J.
The impedance absolute value Z shall be measured at this turning point.
If Z is higher than 50 Ω, tuning is performed by selecting appropriate combination of elements of CB and L.
If Z is lower than 50 Ω , appropriate combination of CA elements (instead of CB elements) and L elements shall be selected.

Bar LED Display

The display is provided to indicate the strength of the forward wave, the reflected wave and the antenna current.
The output DC voltage of the forward wave detected by D-8, the output DC voltage of the reflected wave detected by D-7 and the DC voltagte proportional to the antenna current detected D-47 are applied to the Buffer Amplifier consisting IC-11 and IC-12.
These DC voltages are selected for Bar LED Display by means of S-4 and S-5 on the LC Network PCB.
The selected DC voltage is applied to IC-10 through the smoothing circuit consisting of IC -11 and D-16 which smoothes the instantaneously changing signal voltage for display purpouse.
IC-10 is the Bar LED Driver having A/D convertor built in it.
The number of LED Bars which are lighted is varied depending upon the input voltage of IC - 10.

3.4.3 Input and Output Signals

Input or Output Signals		Terminal	Level
Power Supply	+24 V DC	TB 2-2	
TUNE	(Input)	TB 2-5	"L" 0 V to 6 V
			"H" 6 V to 12 V
KEY	(Input)	TB 2-10	"L" 0 V to 6 V
			"H" 6 V to 12 V
OL (over load)	(Input)	TB 2-7	"L" less than 10V
			"H" higher than 12 V or high impedance
READY	(Output)	TB 2-6	"L" 0 V
(tune completed)			"H" 12 V
FAULT	(Output)	TB 2-3	"L" 0 V
			"H" high impedance
TX TUNE	(Output)	TB 2-5	"L" 0 V
			"H" high impedance
MANUAL	(Output)	TB 2-8	"L" 0 V
			"H" high impedance

Power Supply

+24 V DC is supplied from the main unit through the system cable.
The 24 V DC is directly supplied to the LC Network, Attenuator, and the antenna switch relay.
+12 V DC and +5 V DC are produced by IC-1 and IC-2 on the LC Network PCB.
+12 V DC is applied to the analogue circuit of the ATU control unit and +5 V DC is applied to the MPU and its associated circuits.

Tune and Key Signals to the ATU Control Unit

Through the line receiver IC-14 , the tune signal is applied to MPU and the Key signal to the antenna switching relay driver circuit.

Tune Completion Signal READY

Tune Signal is applied from the main unit. When tuning is completed, "READY" signal is transmitted from the MPU to the main unit through the line driver circuit consisting of TR-6 to TR-8.

FAULT Signal

FAULT signal is transmitted to the main unit when (1) + 12 V DC power supply line and / or (2) + 5 V DC power supply line is not normal or (3) the power switch (S -1) on the LC Network PCB is not in "on" position.

TX TUNE Signal

TX TUNE signal is transmitted through S-3 on the LC Network PCB (ATU) to the main unit in order ot tune the exciter (main unit) at the transmitting frequency selected at the main unit side.

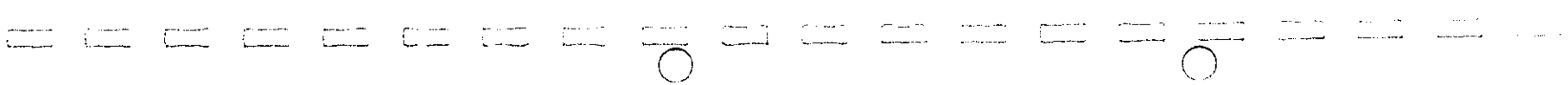
MANUAL Signal

MANUAL signal is transmitted by setting S-2 (on the LC Network PCB) at "manual " position when LC elements of the LC Network should be manually selected.

3.4.4 Manual Selection of LC Elements of LC Network

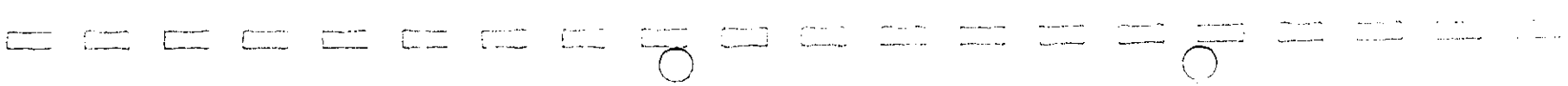
The parts and switches

Switch No.	Circuit Reference No.	Ratings	Responding LED
S 6 - 1	C - 1	30 PF	D14 - 1
2	C - 2	60 PF	2
3	C - 3	120 PF	3
4	C - 4	240 PF	4
5	C - 5	480 PF	5
6	C - 6	960 PF	6
7	C - 7	1900 PF	7
8	C - 8	3800 PF	8
S 7 - 1	L - 1	60 nF	D15 - 1
2	L - 2	120 nF	2
3	L - 3	240 nF	3
4	L - 4	480 nF	4
5	L - 5	960 nF	5
6	L - 6	1.9 μF	6
7	L - 7	3.8 μF	7
8	L - 8	7.5 μF	8
S 8 - 1	L - 9	15 μF	D16 - 1
2	L -10	30 μF	2
3	L -11	55 μF	3
4	none	—	4
5	none	—	5
S 9 - 1	C 9 + C-118	15 PF	D17 - 1
2	C 10 + C-119	30 PF	2
3	C - 11	60 PF	3
4	C - 12	120 PF	4
5	C - 13	240 PF	5
6	C - 14	480 PF	6
7	C - 15	960 PF	7
8	none	—	8



Part 4

TROUBLE SHOOTING CHECK LIST



4. Trouble Shooting Check List

When a trouble occurs in DEBEG 3120 the cause of trouble is found by the check list which referring to the error message shown on RX DISPLAY.

4.1 Function of Self-Diagnosis

DEBEG 3120 has a function of Self - Diagnosis.
If there is some failure inside, the details are shown on RX DISPLAY.
There are 25 types of displaying the failure (Refer to table 2).
The error message is displayed when turn the power supply switch "ON", press the [TEST] button, and press the [TEST], [TX] button simultaneously.
The conditions of displaying the error messages are different in each case as follows.

A. When turn the power supply switch "ON".
   Function of Self - Diagnosis becomes operative with setting the TX and RX frequency to distress frequency 2182 KHz (USB).
   There are 21 types of error messages.

B. When press the [TEST] button.
   Function of Self - Diagnosis becomes operative with TX and RX frequency on RX and TX DISPLAY. There are 21 types of error messages.

C. When press the [TEST] and [TX] button simultaneously.
   (Note ; Be sure to press the [TEST] button first.)
   Function of Self - Diagnosis becomes operative with TX and RX frequency on RX DISPLAY.
   There are 25 types of error messages (21 types in Item B plus 4 types as to transmission.)

4.2 List of Error Messages

ERROR MESSAGE NO.	PRINTED CIRCUIT BOARD WITH SENSER	DETAILS OF FAILURE
E01	Frequency Synthesizer UNL 6	IC15 RX/TX 1 MHz Step loop lock out
E02	Frequency Synthesizer UNL 2	IC 2 TX 100 Hz Step loop lock out
E03	Frequency Synthesizer UNL 4	IC 4 TX 1 KHz Step loop lock out
E04	Frequency Synthesizer UNL 3	IC 1 RX 10 Hz Step loop lock out
E05	Frequency Synthesizer UNL 5	IC 3 RX 1 KHz Step loop lock out
E06	Frequency Synthesizer UNL 1	IC 5 A1A BFO 50 Hz Step loop lock out
E13	Frequency Synthesizer OSC 3	16.7 MHz Crystal Oscilator (X 6) is inoperative.
E14	Frequency Synthesizer OSC 2	10 MHz Reference Oscilator (OSC 1) is inoperative.
E15	Frequency Synthesizer OSC 1	Crystal Oscilator (X1 - X4) is inoperative.
E17	RX / Exciter RX / EX 15C	Output of IC12 (+15 V DC, AVR) is not fed in RX / Exciter.
E18	T / R Control 19C	+19 V DC is not fed from P.S. unit or the actual current is quite different from +19 V DC.
E19	T / R Control 24C	+24 V DC is not fed from P.S. unit or the actual current is quite different from +24 V DC.

ERROR MESSAGE NO.	PRINTED CIRCUIT BOARD WITH SENSER	DETAILS OF FAILURE
E20	T / R Control 5 C	+ 5 V DC voltage from P.S. unit is different from the standard voltage + 5 V DC.
* E21	Low Pass Filter L - PFX	Transmitting signal is missing.
* E22	Low Pass Filter L - PR	Load of Low Pass Filter is quite different from 50Ω (Check the TX cable , ATU and Antenna.).
E23	Frequency Synthesizer PLL 15C	Output of IC25 (+15 V DC, AVR) is not fed in Frequency Synthesizer.
E24	Frequency Synthesizer PLL 5C	Output of TR36 (+ 5 V DC) is not fed in Frequency Synthesizer
E25	P.S. unit OH	Overheat in P.S. unit.
* E26	Power Amplifier P48C	+48 V DC is not fed from P.S. unit. (Check P3)
E27	Power Amplifier 100 ℃	The temperature of Power Amplifier becomes more than 100 ℃ (S2).
E28	A T U ATU FAULT	Power switch is not tuned "on " or output of IC1 or IC2 (AVR) is not fed in ATU .
* E29	Power Amplifier P - PF	Transmitting signal is not fed to LPF unit from Power Amplifier.
E30	Power Amplifier P-19C	+19 V DC is not fed from P.S. unit. (Check P4).
E31	Power Amplifier 110 ℃	The tempareture of Power Amplifier becomes more than 110 ℃ (S1).
E32	Junction Card A24C	+24 V DC voltage is not fed to ATU. (Check F1)

* [TEST] and [TX] only

4.3 Check List

4.3.1 CPU

The following phenomenon occurs, when there is something wrong with CONTROL SECTION.

(• The mark " 8" is displayed on one segment of RX / TX DISPLAY and at the same time tones come out continuously.)

The following phenomenon occurs, when there is something wrong with T / R CONTROL.

- "CPU" is shown on Display several seconds after Main switch and RX switch are turned "on" .

The following phenomenon occurs, when there is something wrong with ATU CONTROL.

- "E28" is shown on RX Display when TEST or TUNE button is pressed.

4.3.2 Frequency Synthesizer

Check items as to Power Supply

- E23; ① IC25 (+ 15 V, AVR)
  ② Isn't there anything wrong with the load of + 15 V ?
  ③ Is the voltage + 19 V fed to P1-49 and 50?
- E24; ① TR36 and D17 are bad.
  ② The load of +5 V (IC1 - 13 ,23, 24)
  ③ Is approx. 6.5 V fed to P1-1 and 2 ?
  ④ Is the voltage + 19 V fed to P1-49 and 50 ?

Check items as to Crystal Oscilator

- E13; ① X6
  ② TR21 - 23
- E14; ① OSC1
  ② IC21
  ③ TR14,16,17
- E15; ① X1 - 4
  ② TR10 - 13

Check items as to P.L.L

- E01; IC15,TR31,TR32 (RX / TX 1 MHz Loop)
  and IC6 - 14, 16 - 20 ,TR10 - 12, 14 - 16, 18 - 22, 24 - 30, 33 - 35
- E02; IC3(TX 100 Hz Loop) 80 - 80.4 MHz, IC 8 ; 1/40, IC12 ; 1/10
- E03; IC4(TX 1 KHz Loop) 98 -108 MHz, IC 9 ; 1/10
- E04; IC1(RX 10 Hz Loop) 80 - 80.4 MHz, IC 6 ; 1/40, IC11 ; 1/10
- E05; IC2(RX 1 KHz Loop) 98 -108 MHz, IC 7 ; 1/10
- E06; IC5(A1A BFO Loop) 91.16 MHz ; BFO center frequency
- IC1-6; Pin NO. 20 RF Output / Pin NO. 10 (IC1 - 5), NO. 9 (IC15)
  VCO control voltage (+2 - +14V)

Check as to RF-Output

- P4 RF Output 70.455- 100.455 MHz
- P2 RF Output 455 KHz, TR1 - 9
- P3 RF Output 70 MHz, TR18 - 20

4.3.3 RX/Exciter

Check items as to Power Supply

- E17; ① IC12 (+ 15 V, AVR)
  ② Isn't the load of IC12 shorted out ?
  ③ Is the voltage +19V fed to J6-33 and 34 ?

Check items as to RX Power Supply

- TR49-51; Power Supply Switch of RX
- TR52-57; Power Supply Switch changing over at the each emission

Check items as to Power Supply of EXICITER

- TR46-48; Power Supply Switch of TX

RX Section Main Circuit

Check items as to AF Amplifier of RX section

- SSB DETECTOR / MODULATOR IC2
- H3E / A3E DETECTOR D76
- AF Switches and Amplifier IC7, 8, TR38,39

Check Process when there is something wrong with the RF / IF Signal Line of RX SECTION

- J1 (RF input)→D17-20 (High voltage protector) → D21-32 (RX bands selector) →D33-35(Voltage controlled attenuator) →TR13(RF Amplifier) →D36 (T /R Switch) → M2 (Mixer) →D37 (T / R Switch) →TR 14,15(1st IF Amplifier 70.455 MHz)→ D39-41(Voltage controlled attenuator)→D38 (T / R Switch)→ →FL1 (70.455 MHz Crystal Filter)→D42 (T/R switch) →TR18,19 (1st IF Amplifier) →D43(T / R switch)→M1(Mixer) →D44 (T / R switch) →TR 20,21(2nd IF Amplifier) → IC4,6 (2nd IF Filters Selector) →FL2 (J3E) →FL3 (H3E / A3E), FL4(J2B/A1A) →IC3,5 (2nd IF Filters Selector)→TR 22-24(2nd IF Amplifier 455 KHz) →
  - IC2 (SSB Detector)
  - D76 (A3E / H3E Detector)
  - TR 28 (IF Amplifier) , TR31 (AGC - OFF Switch)

Check Process when there is something wrong with RF / IF AGC Line

- D45,46(AGC Detector) →TR29,30,32,34,35(AGC Amplifier) →IC8 (AGC / MGC Switch) → IC7 (2/2) (DC Amplifier) →
  - TR22,23 (IF Amplifier)
  - TR36,37 (AGC Amplifier) →

  →TR12,17 (Voltage controlled attenuator)

Exciter Section

. Check Process when there is something wrong with SSB

• TX AF signal (J7-1, 2) →IC2 (Modulator)→D1 , 2(switches of level adjuster)→ TR1(DSB Amplifier) →IC3(T / R Switch) →FL2(SSB Filter 455 KHz) →IC4 (T/R switch) →TR2 (455 KHz Amplifier)→D3 (T/R Switch) →H1, D4, 5, FL1 (Mixer, T/R switch and 70. 455 Crystal Filter)→D6 (T/R Switch)→TR3 (Gain controlled attenuator) → D7(T/R Switch)→H2 (Mixer) →D8(T/R switch) →TR4 (RF Amplifier)→D9-13 (Power reduction circuit) →TR5,6 (RF Amplifier)→J5 (RF output)

. Check Process when there is something wrong with A1A

• J2 (455 KHz Local signal input)→D58-60 (A1A and H3E carrier level selector) →TR2 (455 KHz Amplifier)→After this same as the case of SSB

Check Process when there is something wrong with Local Signal Amplifier (70.455-100.455 MHz, 70 MHz)

• 70.455 - 100.455 MHz ; TR43, Frequency Synthesizer and J4
• 455 KHz ; Frequency Synthesizer and J2
• 70 MHz ; TR41, Frequency Synthesizer and J3

4.3.4 RF Power Amplifier

Check items as to Power Supply

• When ※E26 and "FAULT" lamp light up except the over load and not in tuning, check P3, IC1-3, and TR14.
• E30; P4

Temperature

• E27; When the heat sink temperature rises up to 100 ℃, even if Power Reduction Circuit is set to "H", it is made to set to "H".

• E31; When the heat sink temperature rises up to 110 ℃, Key Circuit is to be "OFF" and RF output power is not fed.
When the temperature falls down less than 110℃ the situation becomes back automatically.

Check items as to Power Amplifier Circuit

• ※E29; ① Check T7, 8 and D1 .
② Check TR1-6
Check the bias circuit of TR3,4 ···· TR7-9
Check the bias circuit of TR5,6 ···· IC1 (1/2), TR11-13

4.3.5 Low Pass Filter

Check items as to Low Pass Filter

- E21; Transmitting signal is missing.

  Check D9, 10, T1,2, J1, P1

  ① When the code of E29 comes out simultaneously with that of E21, Power Amplifier is bad.

  ② Check items when the code of E29 does not come out

  - Low Pass Filter elements
  - K1-16

- E22; Check J2, ATU and TX Cable

4.3.6 P.S. Unit

Check items as to P.S. UNIT

- E18; The voltage +19 V is not within ±25 % limit.
- E19; The voltage +24 V is not within ±25 % limit.
- E20; The voltage + 5 V is not within ±10 % limit.
  - Fuse F1 (3A) in Card A2
  - DC-DC Converter transforming 48 V into 19 V, 24 V and +5 V

- E26; P8 (Connector), Fuse F1(15A) in Card A2
- E30; P9 (Connector)

Check items when it is impossible to turn the Power Supply "ON"

- Fuse F1(100 A)
- F2 (0.5 A) in Card A1

4.3.7 AF Card (in Control Unit)

Check items when the receiving tone is not fed to the loud speaker

- Check whether the error message of E01-06 is transmitted or not.
- IC6,7,9, K1, P3 , P4

Check items when the receiving tone is not fed to the Handset.

- IC6 , P3, Handset Filter ,Connector of Handset

Check items when the receiving tone is not fed to the external terminal.

- T4

Check items when there is no modulation (USB / LSB / H3E)

- Handset Filter
- Connector of Handset
- IC4, 5, 9, T3

Check items when the output is not fed from 2-tone alarm signal generator.

- TR2, 3, IC5, 8, T3

Check items when the brightness of the bar LED does not change with the knob of DIMMER

Control or the bar LED dose not light up.

- IC1, 2, 3, 10

4.3.8 ATU

- E32; +24 VDC fed to ATU is not within ±25 % limit.
  Check F1 (2A) in JUNCTION BOARD.

- When it is impossible to tune.
  ① When there is something wrong with Antenna.
  Impedance of Antenna is out of the standard.
  (In this case, it is less than 5Ω+180 PF and the frequency is near the resonance point of $\lambda/2$.)
  It is necessary to change the length of Antenna.

  ② Because of the capacitive load
  Check K2-16, 18-20, 23-25, 33, 34 , C1-8, L1-11

  ③ Because of the inductive load
  Check K10, K26-34, C9-15, 118, 119

Appendix

Power Supply Trouble Shooting

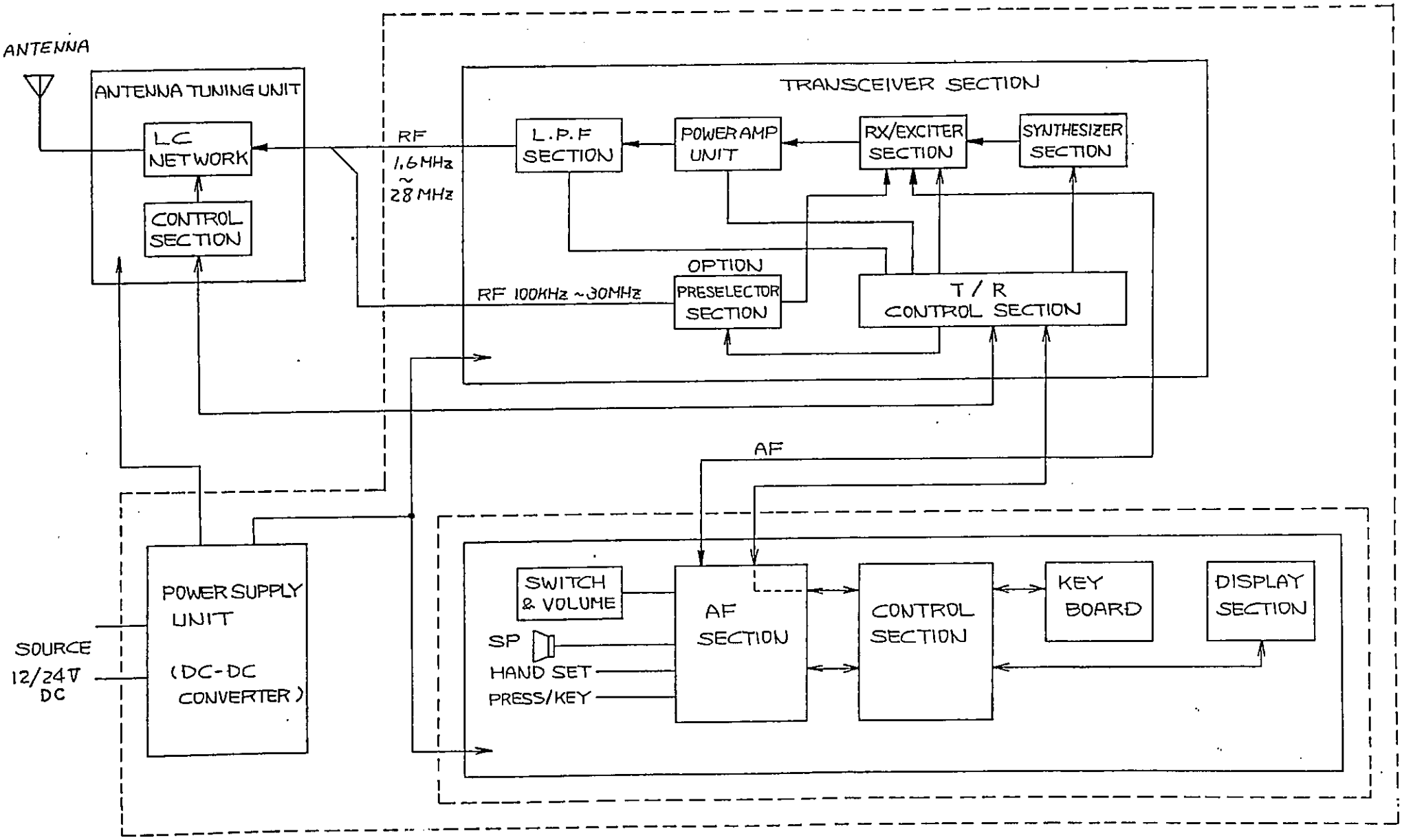
Symptoms	Possible cases	Check points
No operation	• The polarity of input (Voltage) is not correct.	• the input polarity
	• The input voltage is not within the specified rating. (more than 11 V necessary for starting operation)	• the input voltage
	• Fuse (F1) is broken. • Some transistors through TA1A to TA1T in the A1 board are broken.	• The transistors and the fuse (to be replaced if broken)
	• Fuse (F2) is broken. • The wirings of "MSW" switch circuit is open. • Defective parts in the A1 board.	• The wiring of "MSW" switch circuit • The fuse (F2) and the parts in the A1 board.
	• No operation some(less than 10)seconds after the tuning on of "MSW" switch or after the connection of the input	• No trouble • Operation begins after the warming period.
	• The over-voltage • Protection circuit of the 48V output is mal-functioned. (The output voltage is mis-adjusted.)	• The variable resistor(A1-board) for voltage adjustment (to be re-adjusted)

Symptoms	Possible cases	Check points
No operation	• Defective parts of the control stage (A1 board)	• The parts in the control stage (Probably IC-1 and its associated circuits to be replaced)
No 48V-output	• "R/T" switch is not turned on.	• The switch
	• Mal-function of the over-heat protection circuit ("OH" signal is transmitted.)	• If the temperature is higher than the specified degree, trace where the overheating is caused. • After repair, wait until cooled down.
	• Mal-function of the over-current protection circuit ("OC" signal is transmitted.)	• Trace where the over-current is caused. • After repair, "RST" signal shall be set "L" level.
	• Fuse (F1) is broken.	• Trace where the over-current is caused. (Fuse (F1) to be replaced)
No 24V/19V/6V output	• Fuse (F2) in A2 board is broken. • Transistor TR1 or TR2 is broken. • The one of 24V/19V/or 6V circuit is overloaded or shorted.	• Fuse(F1), transistors (to be replaced) • Trace where the overload is causesd.

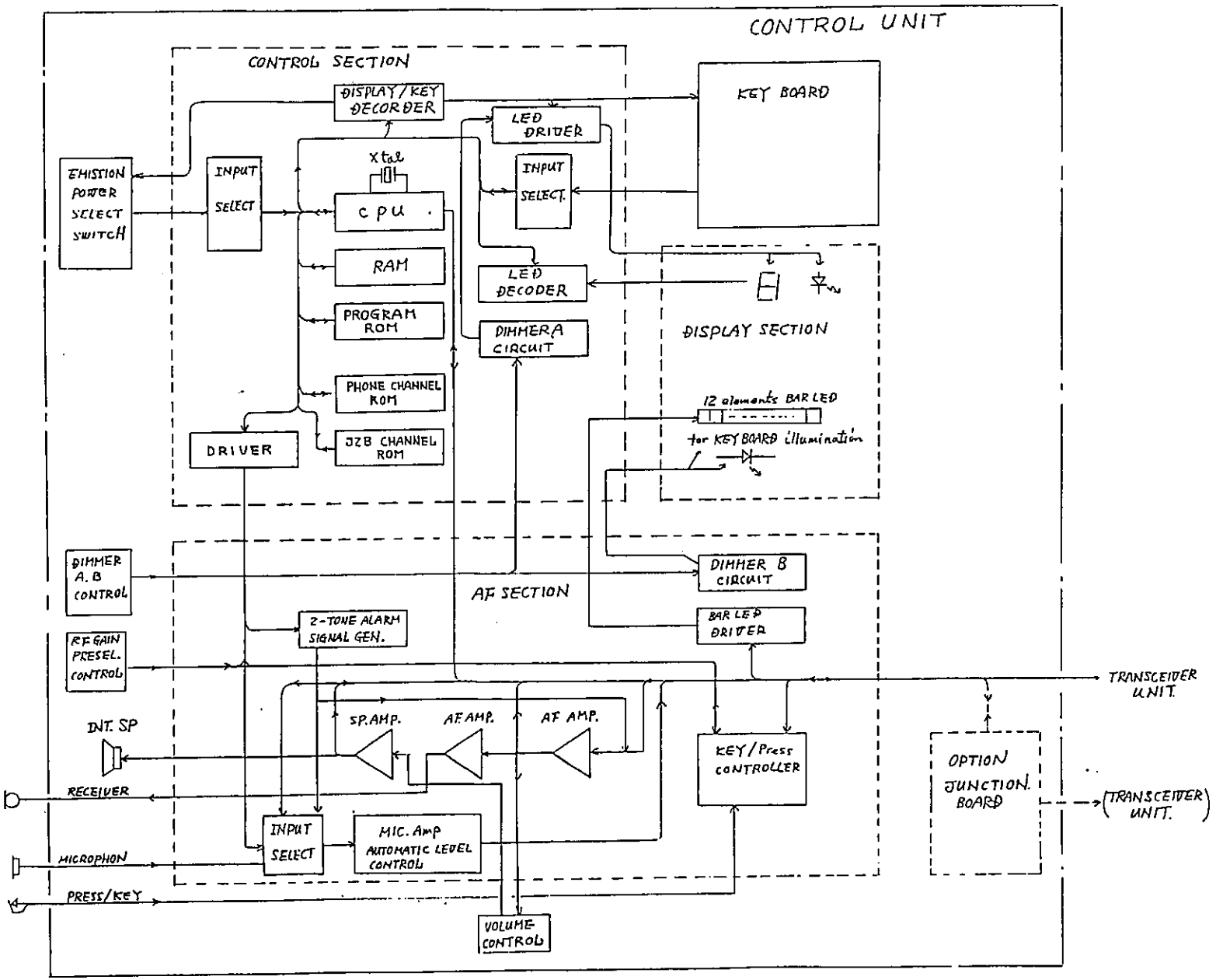
A P P E N D I X

List of Drawings

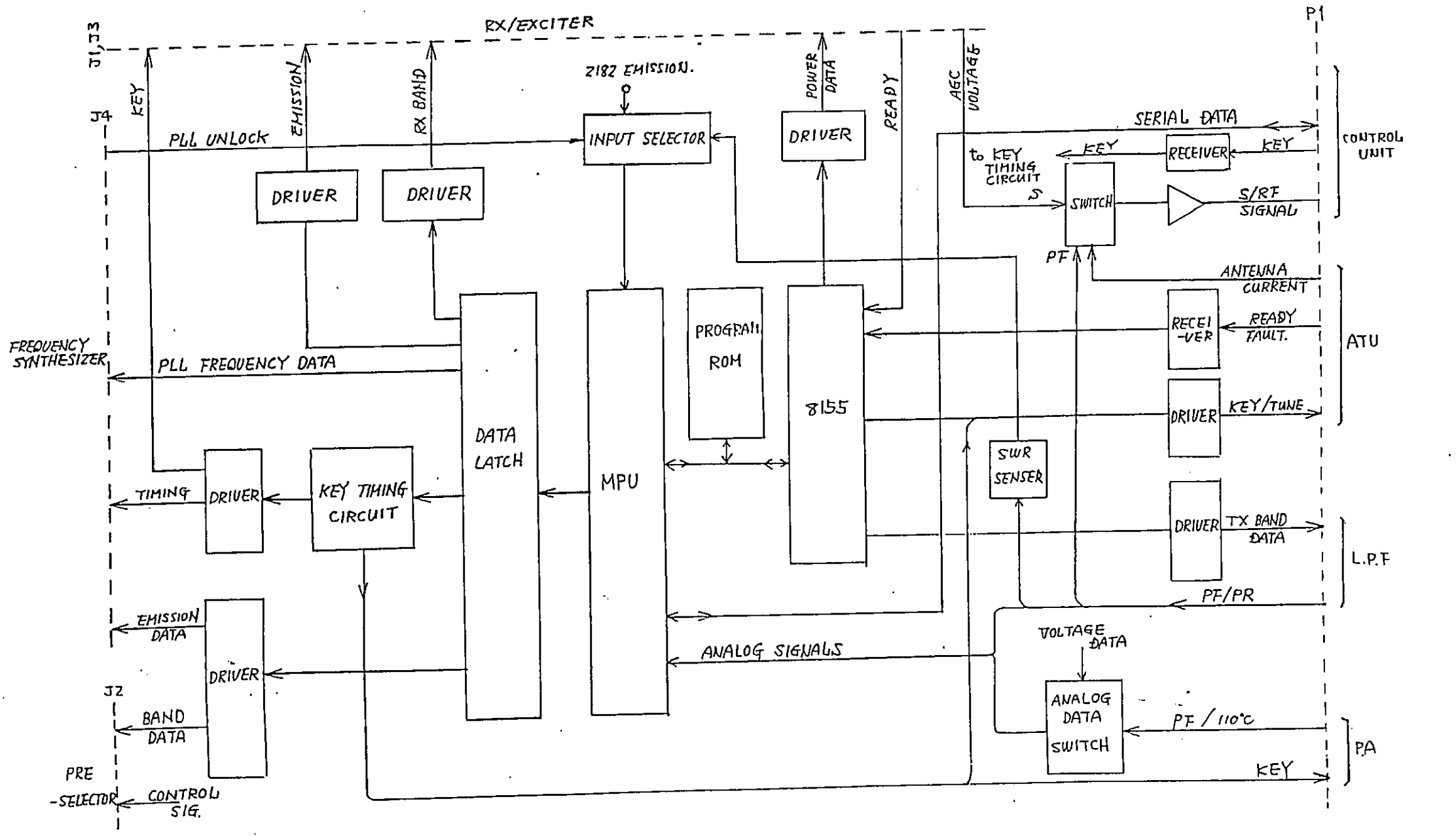
Block Diagrams:
System
Control Unit
T/R Control
RX/Exciter and Frequency Synthesizer
Power Amplifier and Low-Pass Filter
Power Supply Unit
Antenna Tuning Unit (ATU)
Circuit Diagram and PCB Layout
System Diagram
General Diagram
Control Unit
Control Section 5P01765A Layout
Control Section Circuit Diagram
AF Section 5P01545B Layout
AF Section Circuit Diagram
Display Card 5P01544A Layout
Display Circuit Diagram
Handset Filter 5P02038 Layout
Handset Filter
Remote Control Diagram
Junction Board (for Remote Control) Circuit Diagram
Junction Board (for Remote Control) 5P01555B Layout
T/R Control 5P01738A Layout
T/R Control Circuit Diagram
Frequency Synthesizer 5P02078 Layout
Frequency Sysnthesizer Circuit Diagram
RX/Exciter 5P02077 Layout
RX/Exciter Circuit Diagram
Preselector 5P0 2039 Layout
Preselector Circuit Diagram
Low Pass Filter 5P02034 Layout
Low Pass Filter Circuit Diagram
Power Supply Main Control
Power Amplifier 5P02033 Layout
Power Amplifier 5P02033 Circuit Diagram
Power Amplifier 5P03008 Layout
Power Supply 5P03008 Circuit Diagram
Power Supply A1 Layout
Power Supply A1 Control Board Circuit Diagram
Power Supply A2 Layout
Power Supply A2 DC/DC Converter Circuit Diagram
Power Supply A3 Layout
Power Supply A3 Line Interface Circuit Diagram
Junction Board P01764A Layout
Junction Circuit Diagram
ATU DiagramATU Control 5P01553A Layout
Atu Control Circuit Diagram
ATU LC Network 5P01535A Layout
ATU LC Network Circuit Diagram
Outline Dimensions
Cable Diagrams
Connection Cable, Sheet 1 to 9
3120NL Relay PCB Circuit Diagram
3120NL Relay PCB Component Side
Part List Electrical
Mechanical Drawings
Remote Control Unit
Control Panel
Front Case Rear Case 1
Front Case Rear Case 2
Front Case Rear Case 3
Antenna Tuning Unit
Power Supply 1
Power Supply 2
Part List Mechanical
Channel Table



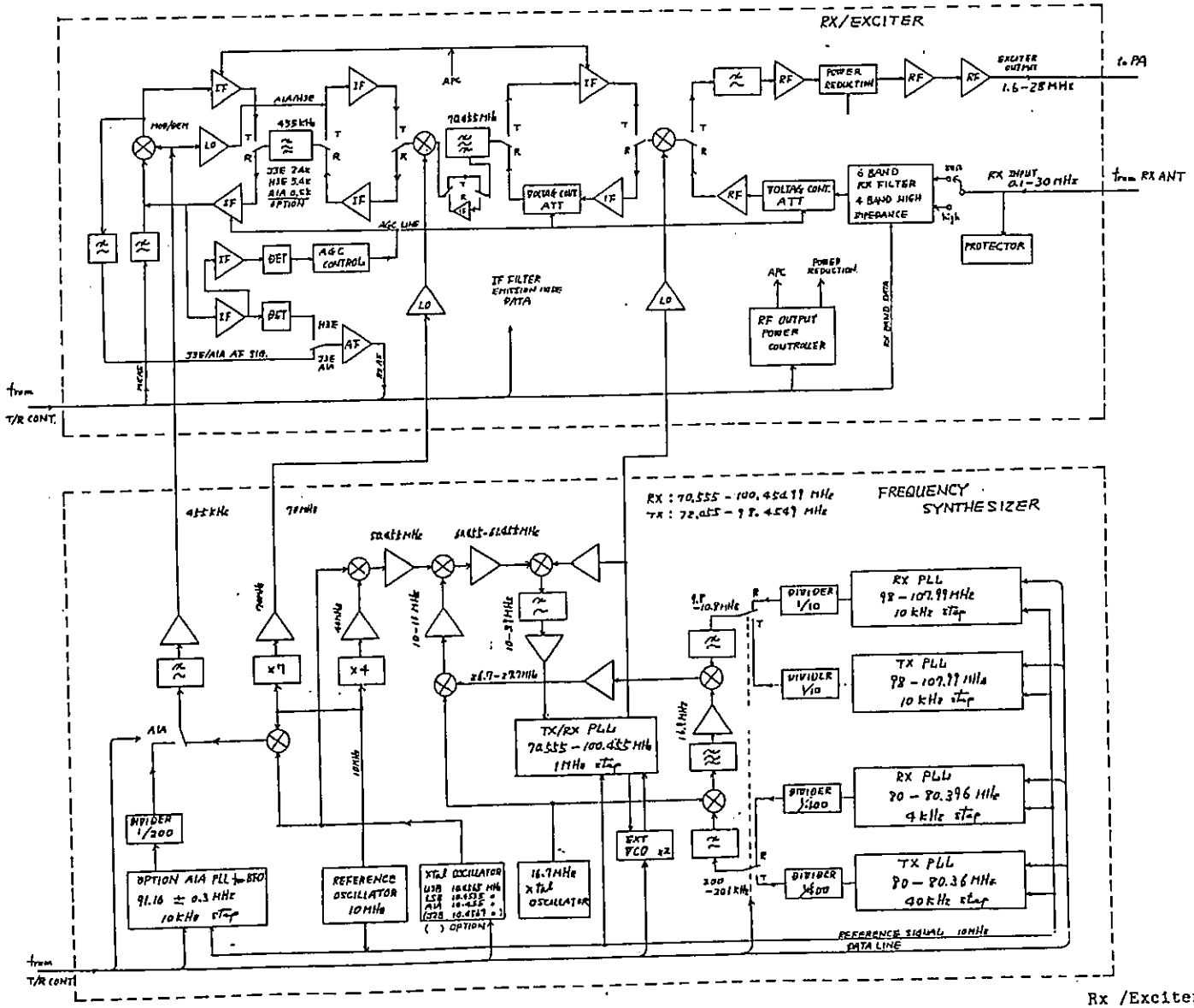
System Block Diagram



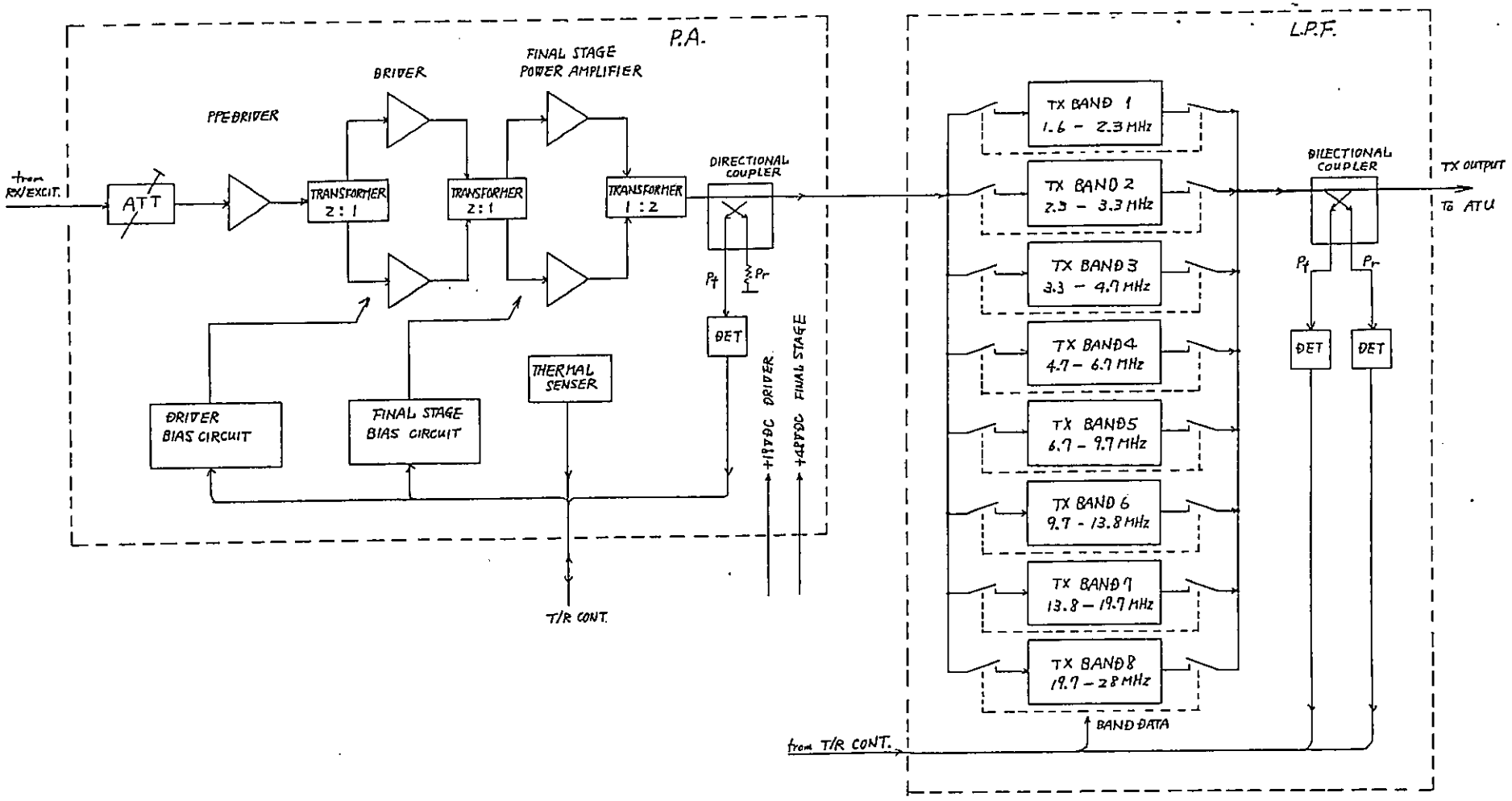
Control Unit



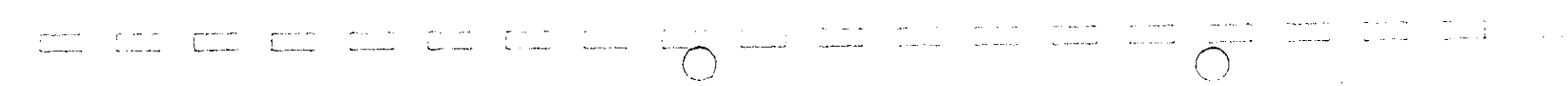
T/R CONTROL BLOCK DIAGRAM

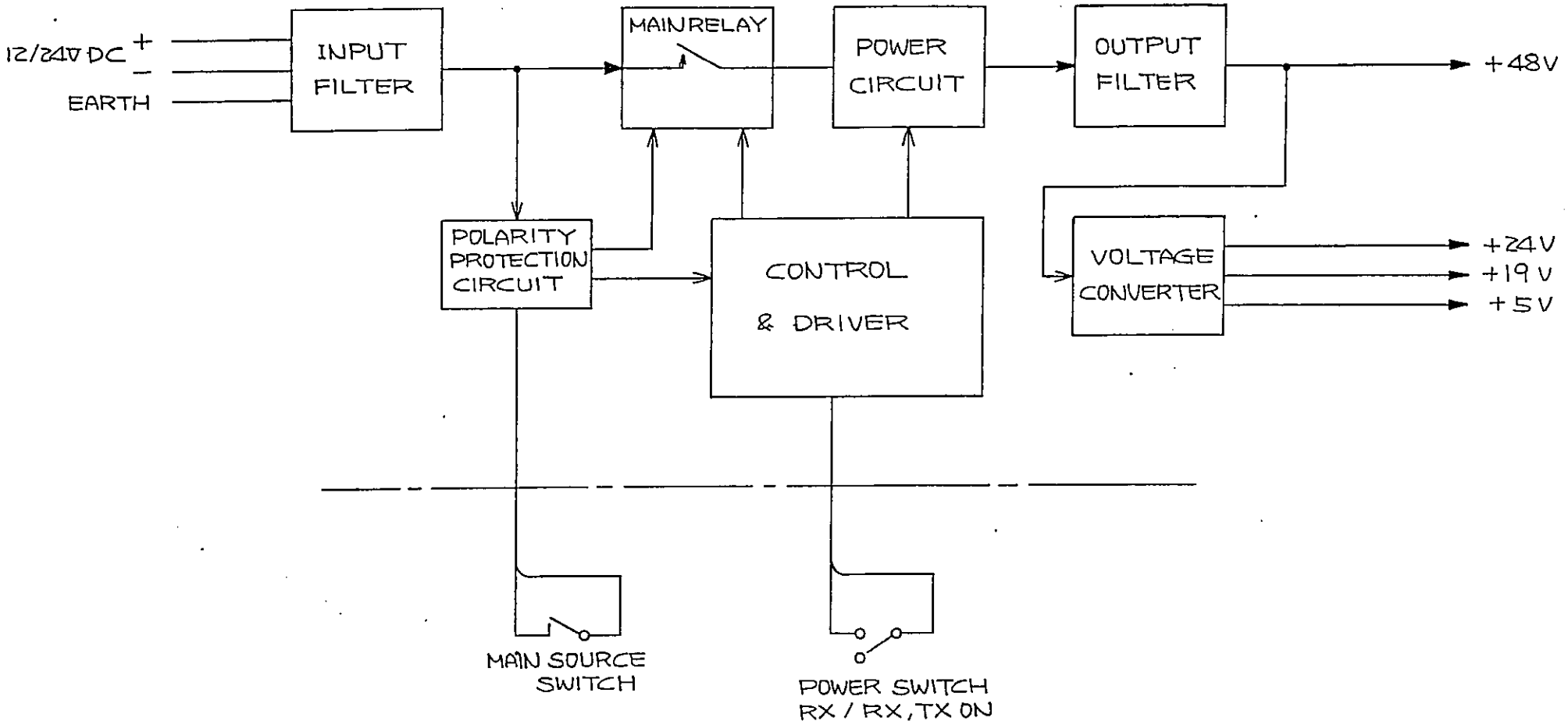


Rx /Exciter &
Frequency Synthesizer (PLL)

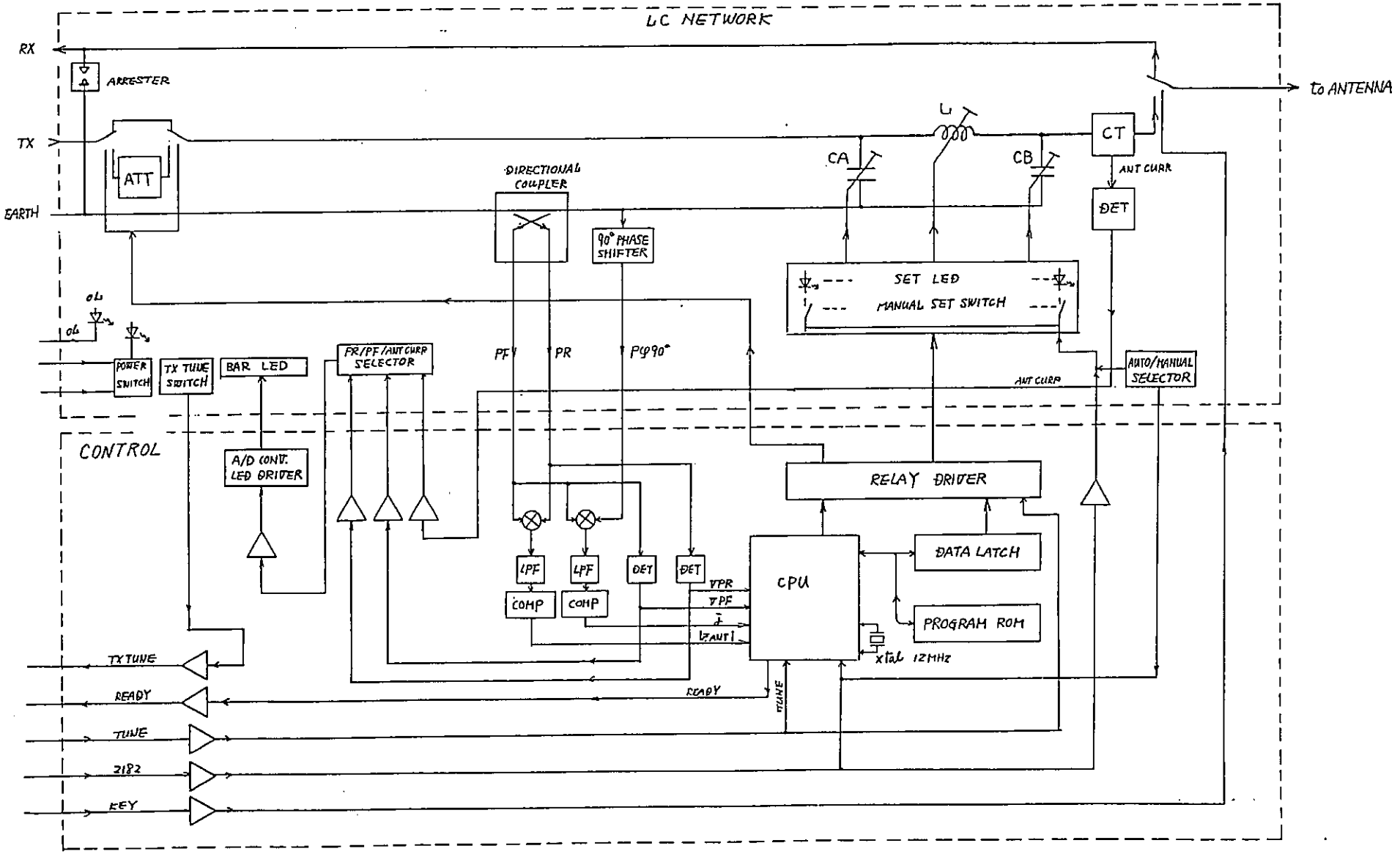

P.A.
L.P.F.
PREDRIVER
DRIVER
FINAL STAGE
POWER AMPLIFIER
from RX/EXCIT.
ATT
TRANSFORMER 2:1
TRANSFORMER 2:1
TRANSFORMER 1:2
DIRECTIONAL COUPLER
Pf
Pr
DET
THERMAL SENSER
DRIVER BIAS CIRCUIT
FINAL STAGE BIAS CIRCUIT
+18VDC DRIVER
+42VDC FINAL STAGE
T/R CONT.
TX BAND 1
1.6 - 2.3 MHz
TX BAND 2
2.3 - 3.3 MHz
TX BAND 3
3.3 - 4.7 MHz
TX BAND 4
4.7 - 6.7 MHz
TX BAND 5
6.7 - 9.7 MHz
TX BAND 6
9.7 - 13.8 MHz
TX BAND 7
13.8 - 19.7 MHz
TX BAND 8
19.7 - 28 MHz
BAND DATA
from T/R CONT.
BILECTIONAL COUPLER
TX OUTPUT
To ATU
DET
DET

PA & LPF

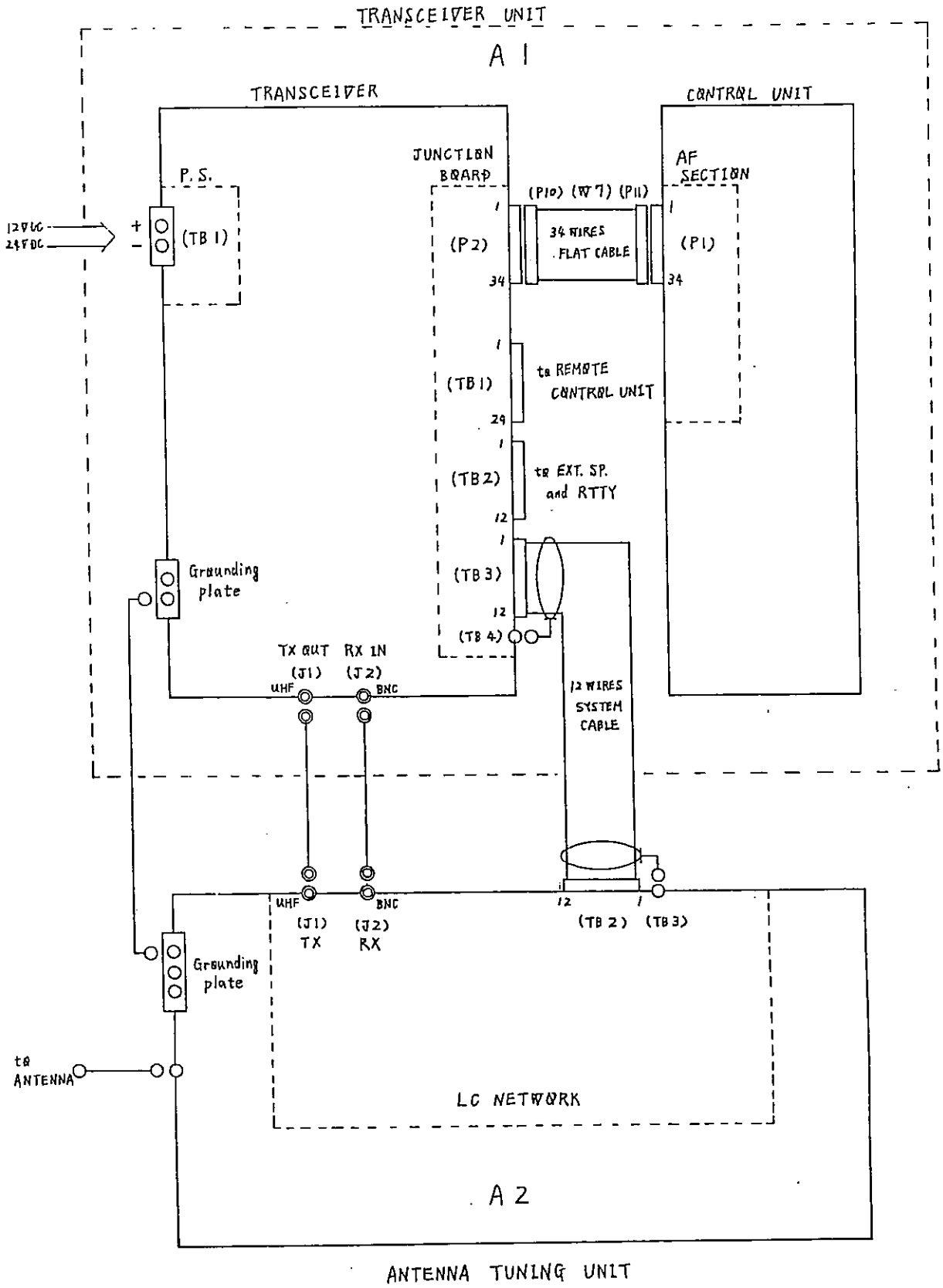




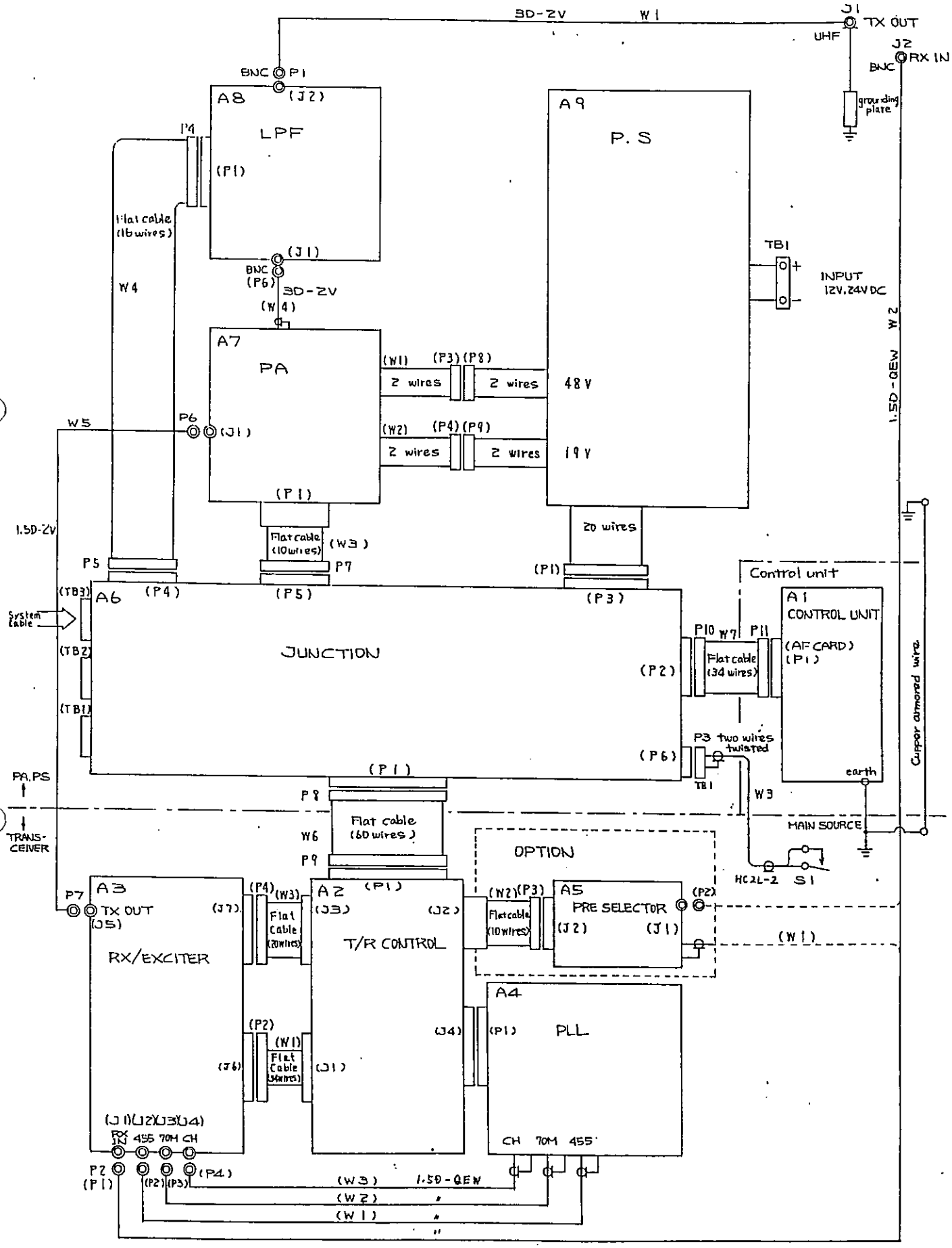
Power supply



Antenna Tuning Unit

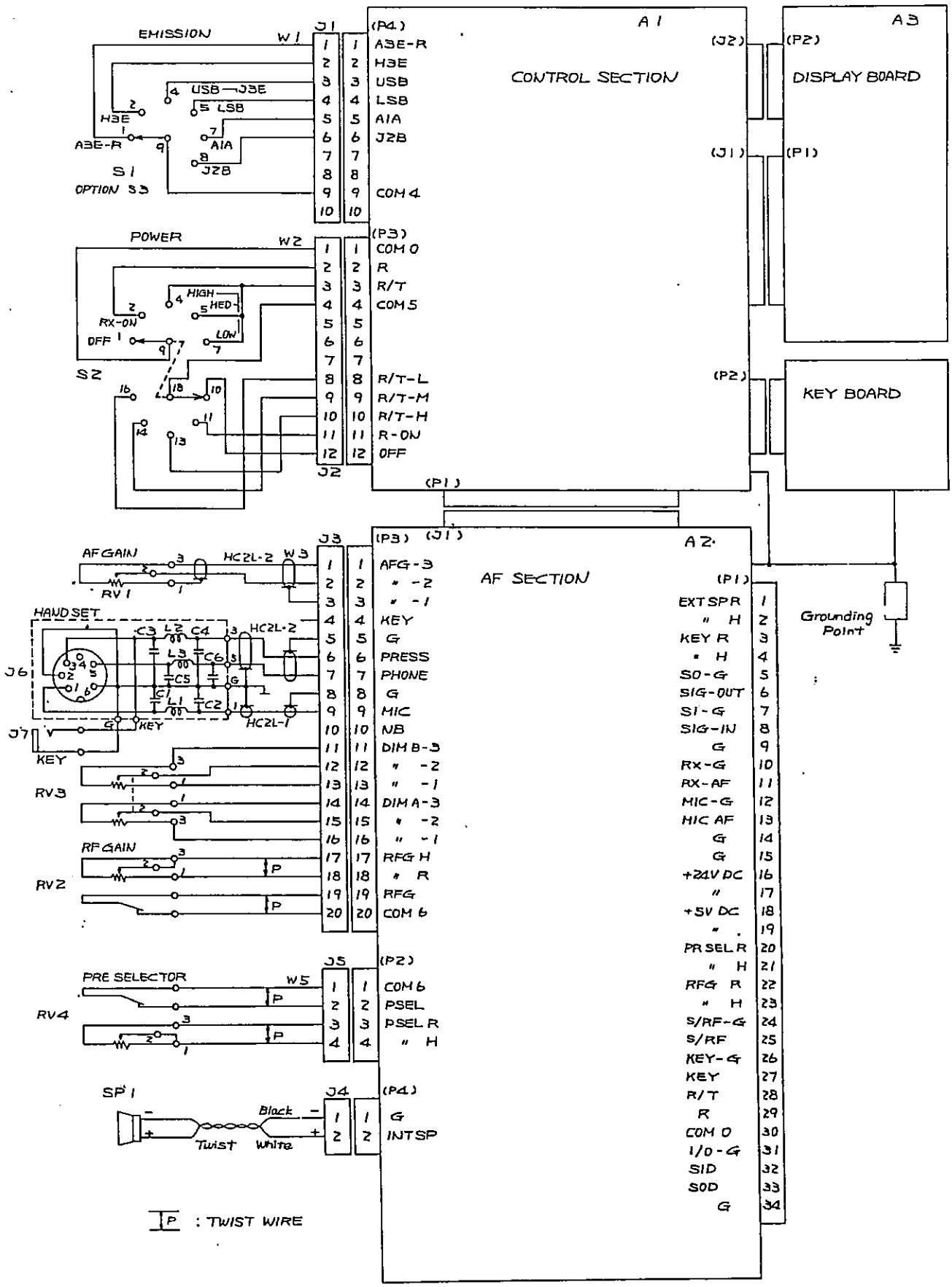


System Diagram
Version 2

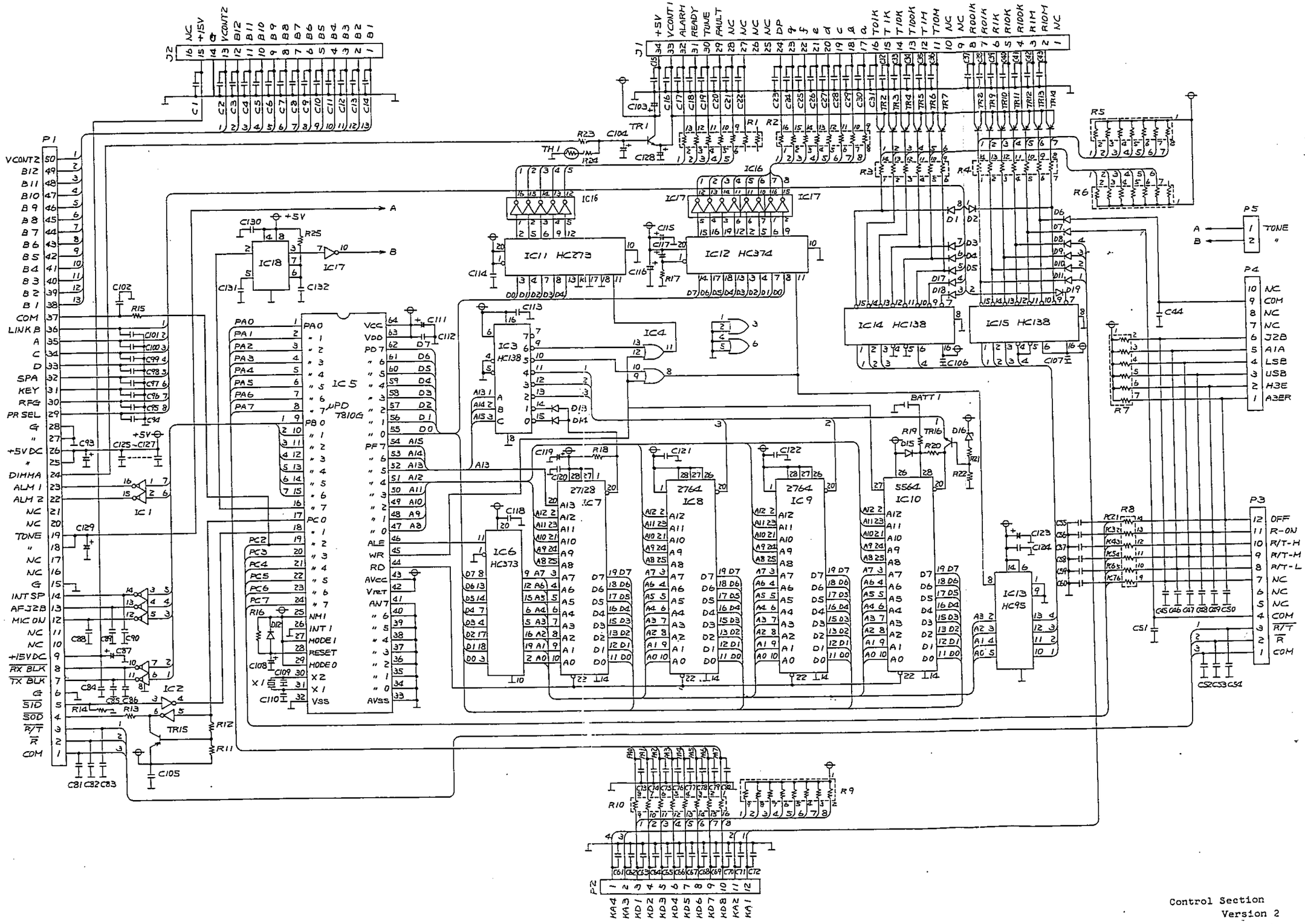


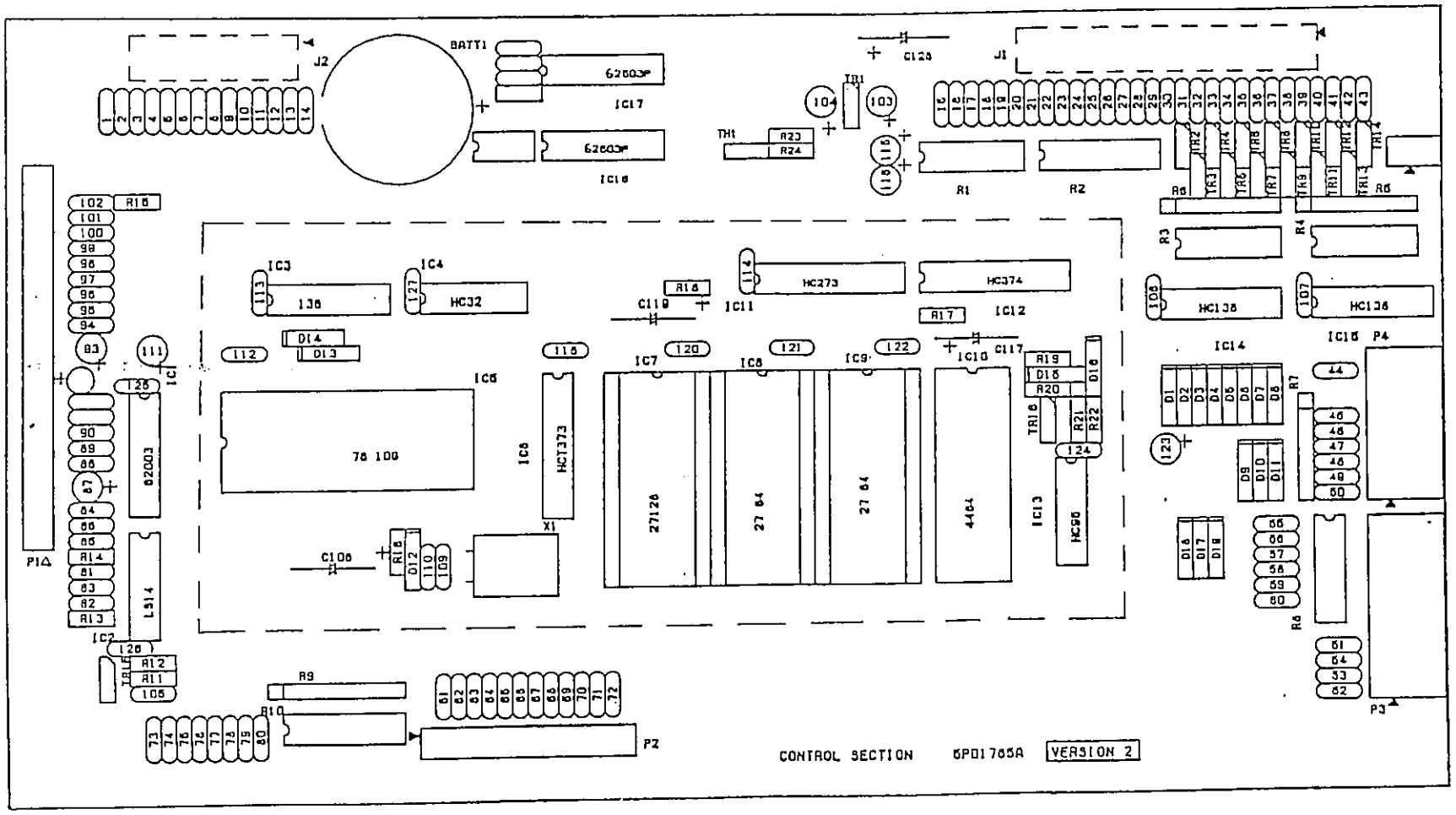
Simbol numbers in the parentheses are included in each block.

General Diagram
Version 2

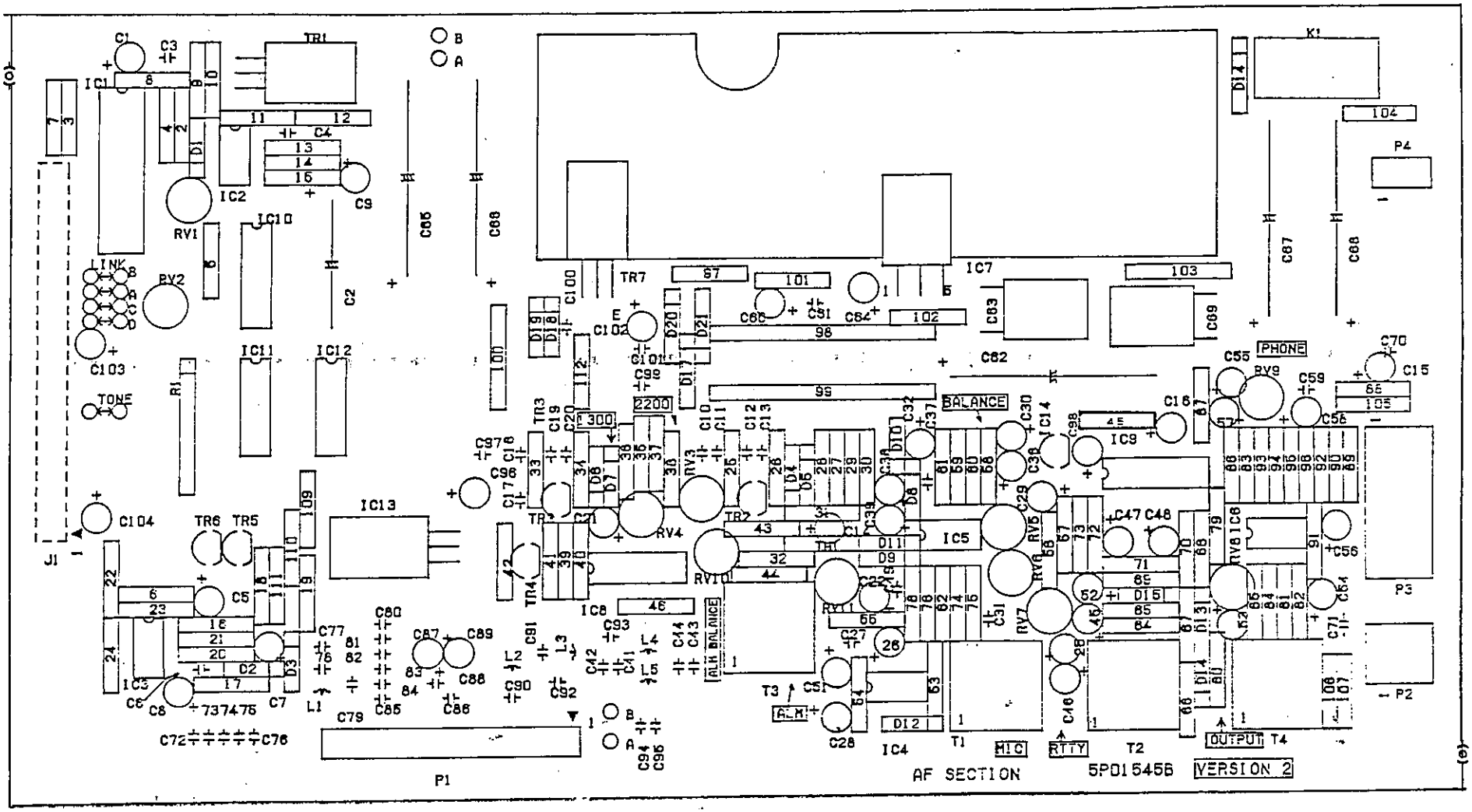


Control Unit
Version 2

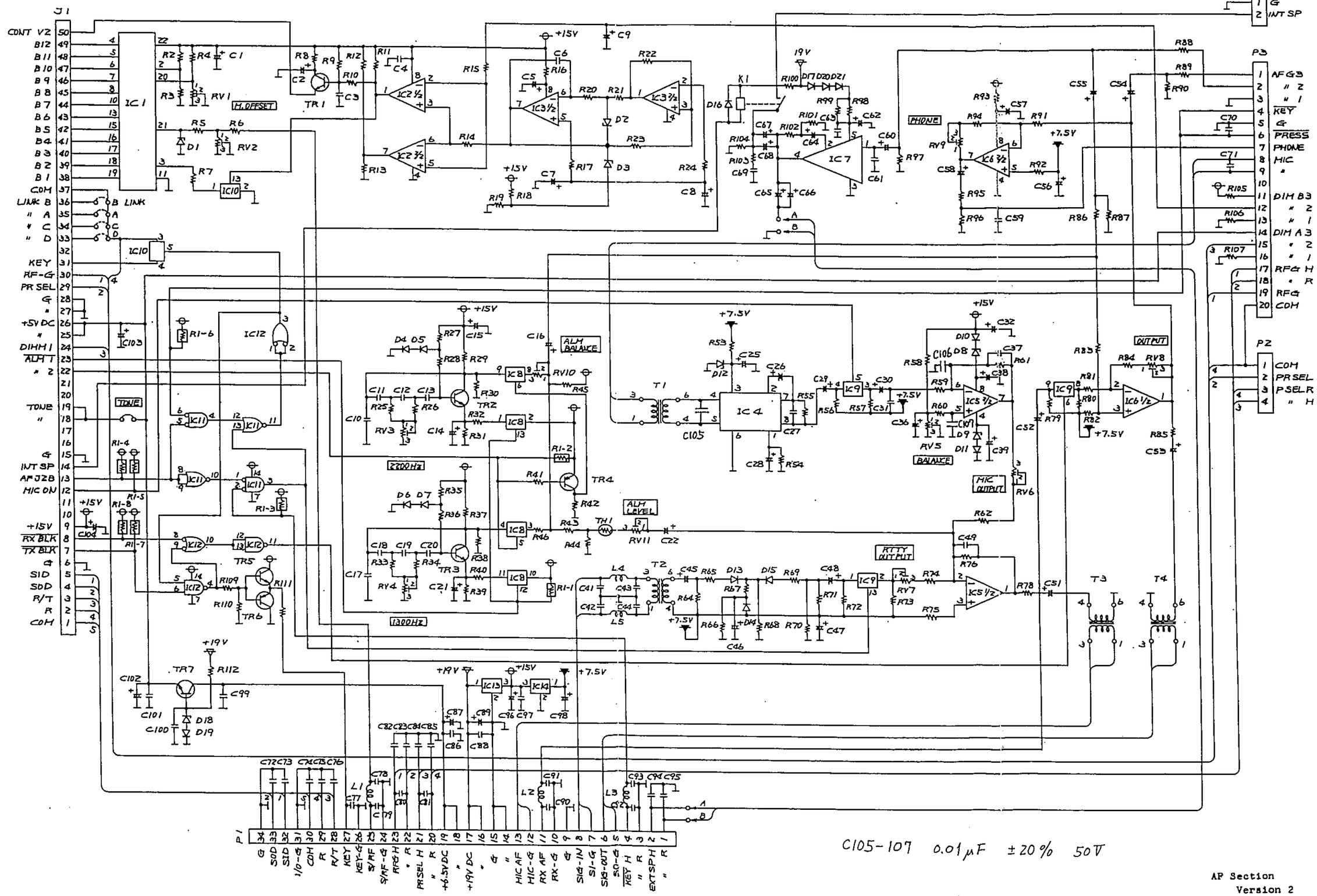

P1
J2
J1
IC1
IC2
IC3 HC138
IC4
IC5 μPD 7810G
IC6 HC373
IC7 27128
IC8 2764
IC9 2764
IC10 5564
IC11 HC273
IC12 HC374
IC13 HC95
IC14 HC138
IC15 HC138
IC16
IC17
IC18
TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TR10
TR11
TR12
TR13
TR14
TR15
TR16
TH1
P2
P3
P4
P5
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
BATT 1
VCONT2
B12
B11
B10
B9
B8
B7
B6
B5
B4
B3
B2
B1
COM
LINK B
A
C
D
SPA
KEY
RPG
PR SEL
INT SP
AFJ2B
MIC ON
RX BLK
TX BLK
SID
SOD
R/T
R
+5V DC
DIMMA
ALM 1
ALM 2
TONE
+15V DC
VCONT1
ALARM
READY
TUNE
FAULT
OFF
R-ON
R/T-H
R/T-M
R/T-L
TONE
COM
NC
J2B
A1A
LSB
USB
H3E
A3ER
Control Section
Version 2



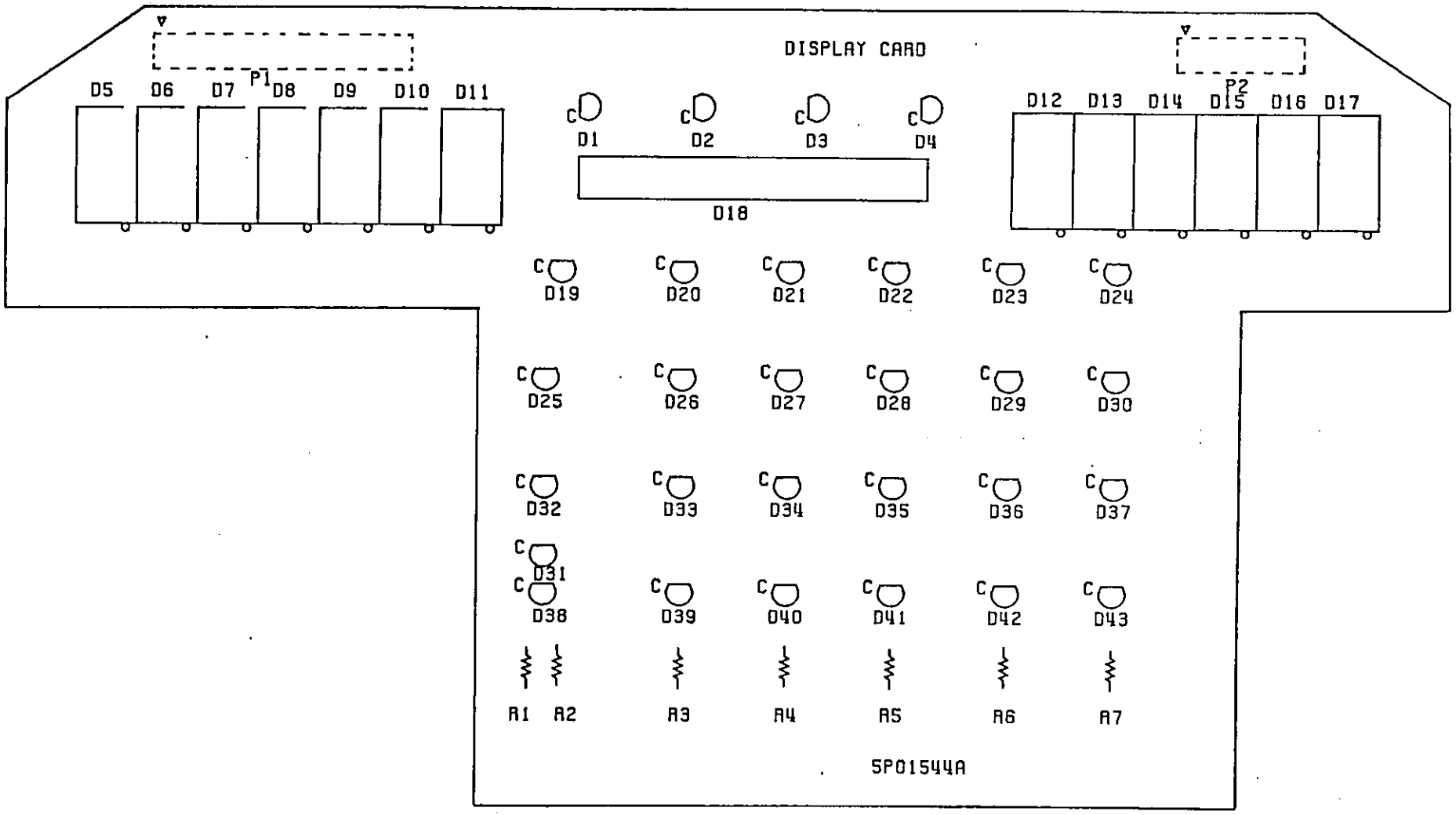
Control section
PCB lay-out



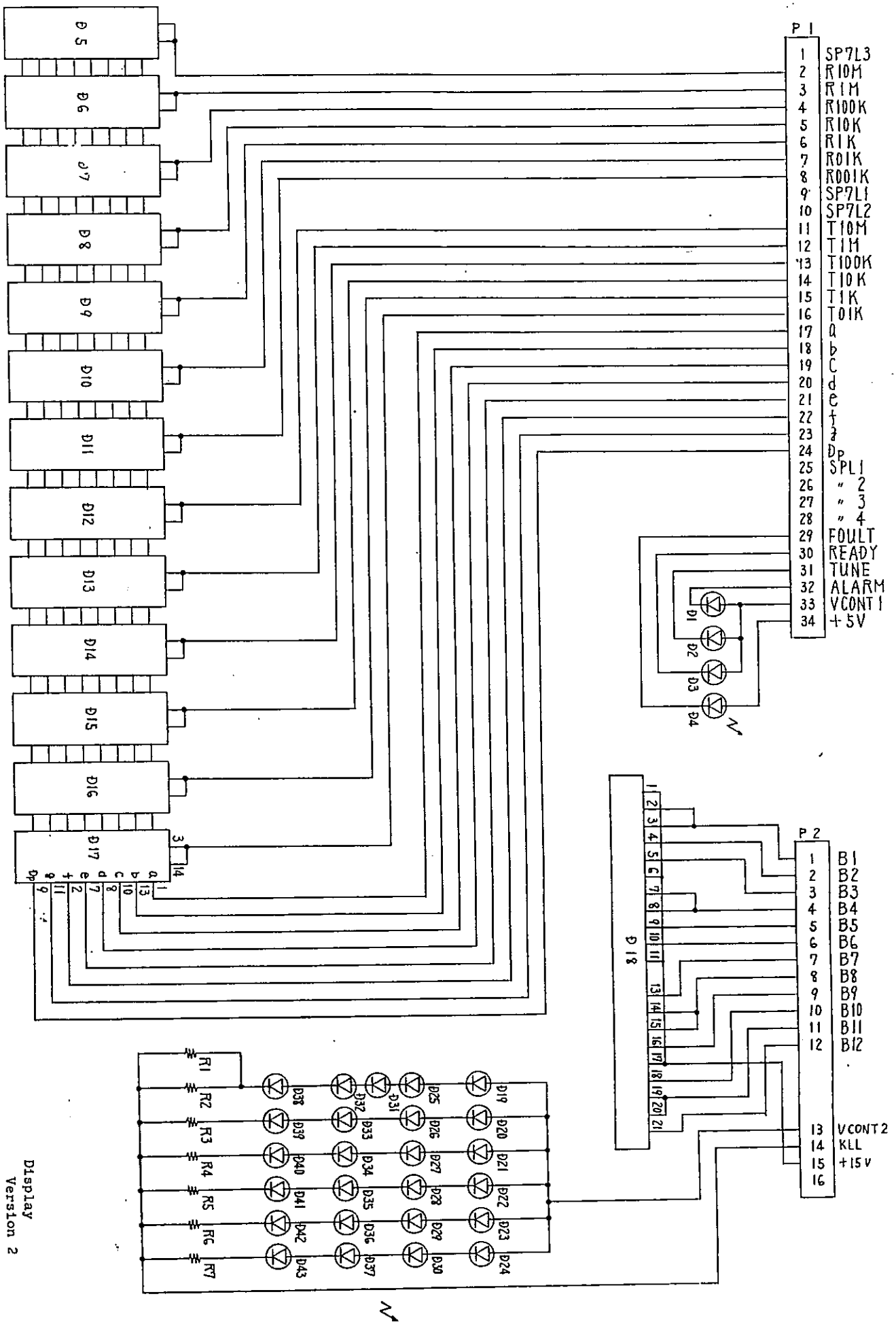
AF section
PCB lay-out

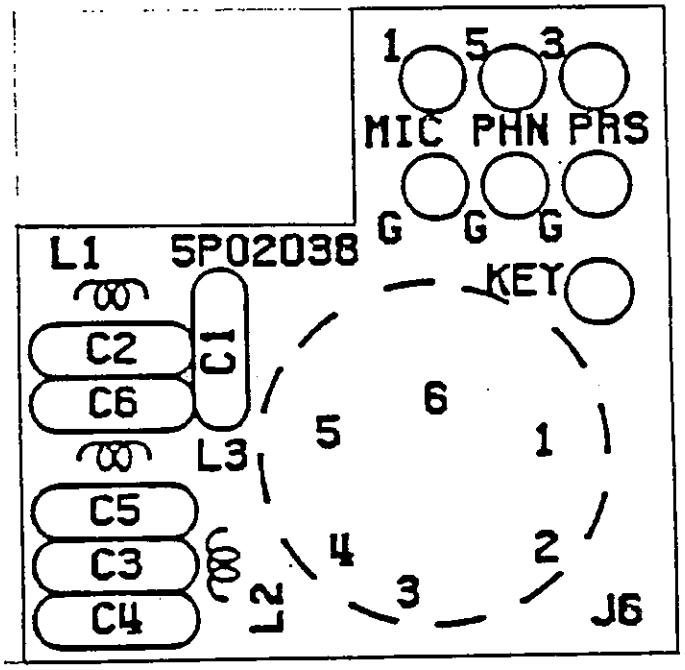


AP Section
Version 2

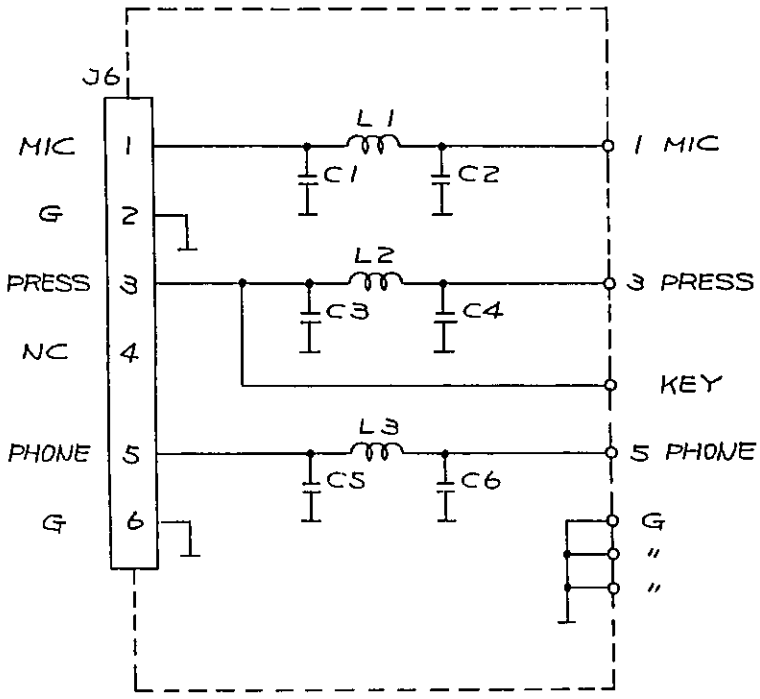


Display card
PCB lay-out

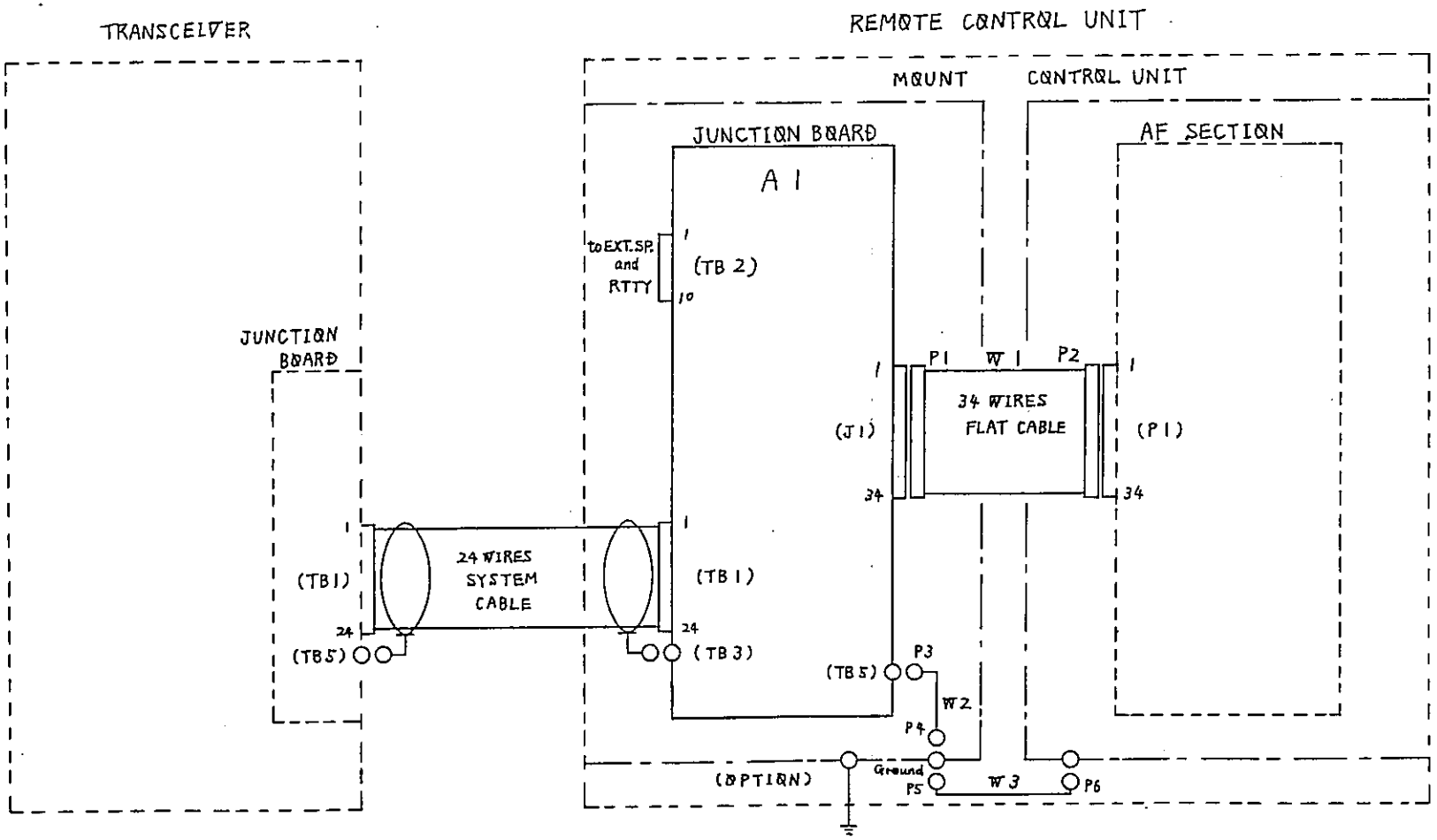

P1
1 SP7L3
2 R10M
3 R1M
4 R100K
5 R10K
6 R1K
7 R01K
8 R001K
9 SP7L1
10 SP7L2
11 T10M
12 T1M
13 T100K
14 T10K
15 T1K
16 T01K
17 a
18 b
19 C
20 d
21 e
22 f
23 g
24 Dp
25 SPL1
26 " 2
27 " 3
28 " 4
29 FOULT
30 READY
31 TUNE
32 ALARM
33 VCONT1
34 +5V
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
D16
D17
D18
P2
1 B1
2 B2
3 B3
4 B4
5 B5
6 B6
7 B7
8 B8
9 B9
10 B10
11 B11
12 B12
13 VCONT2
14 KLL
15 +15V
16
R1
R2
R3
R4
R5
R6
R7
Display
Version 2



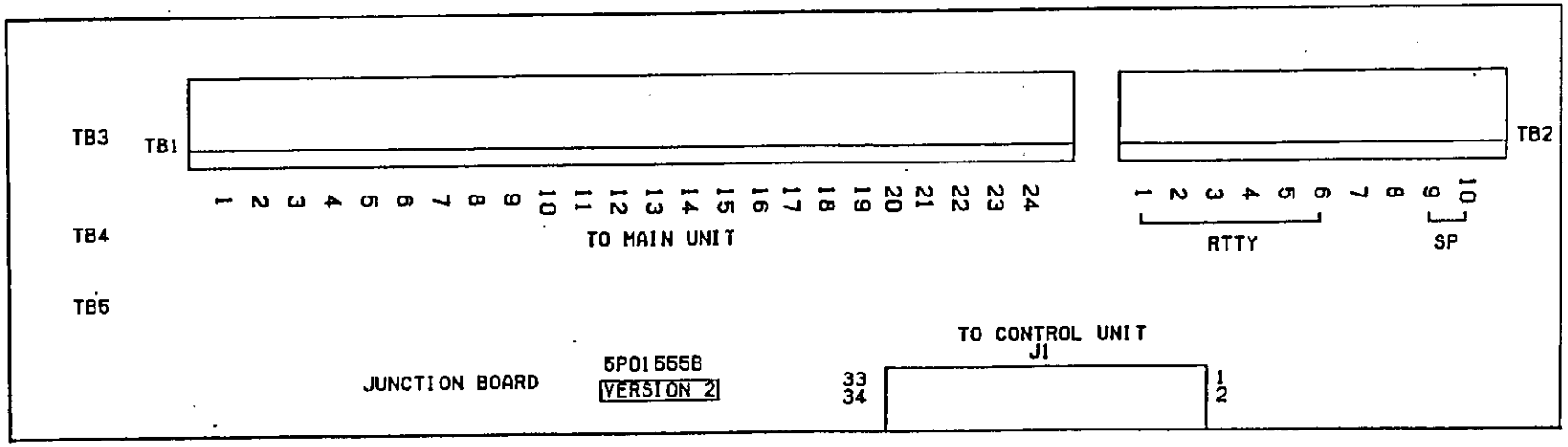
Handset filter
PCB lay-out



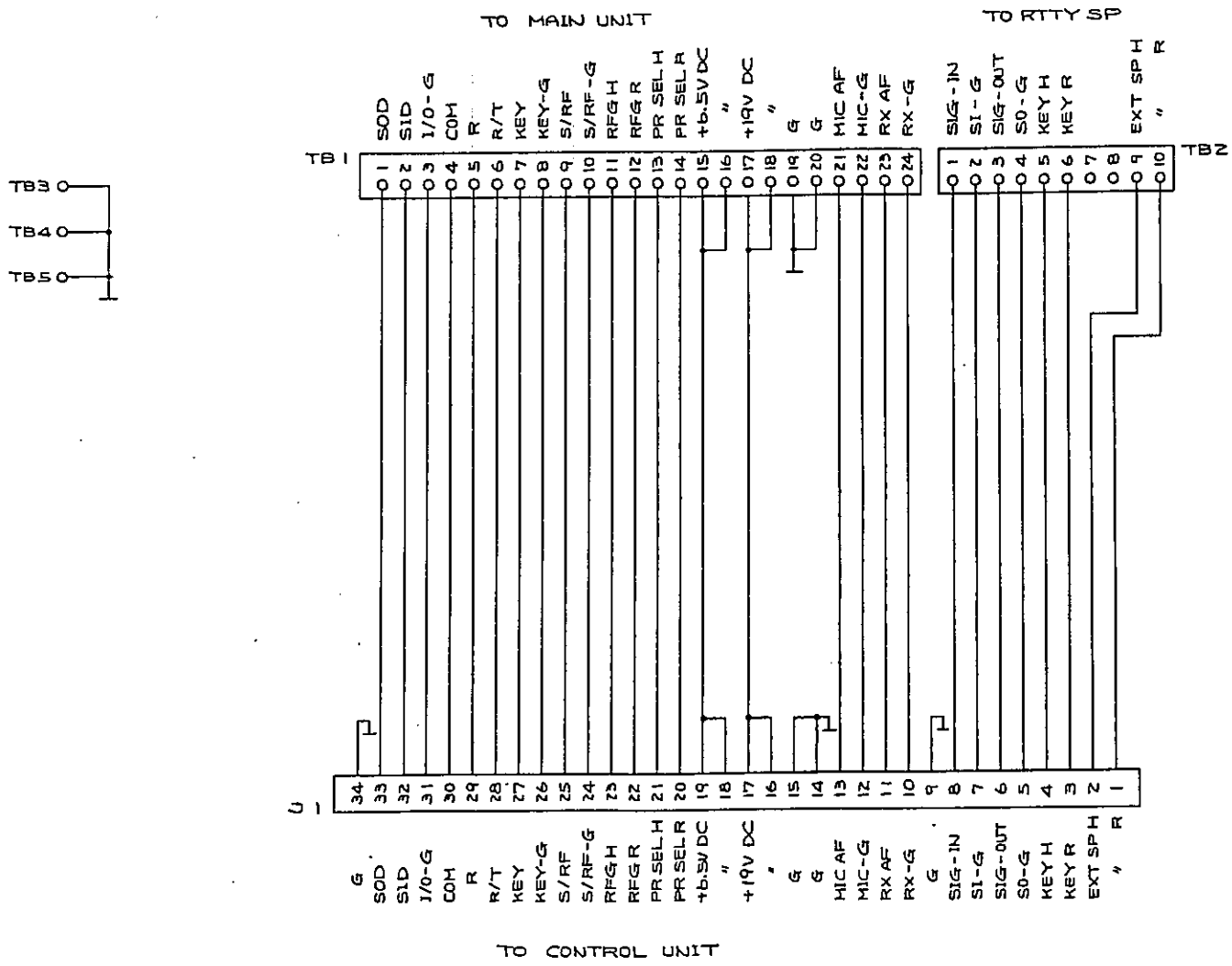
HANDSET Filter
Version 2



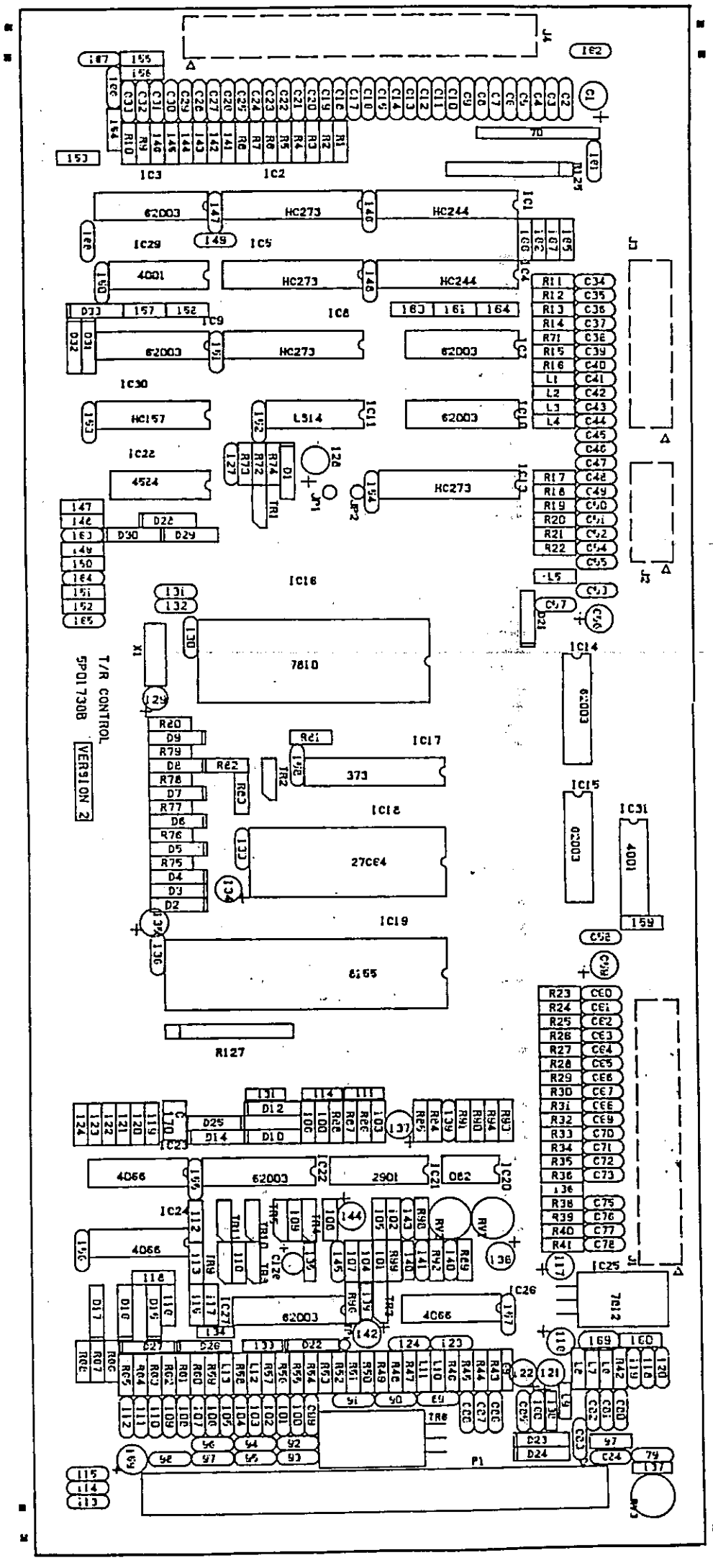
Remote Control Diagram
Version 2



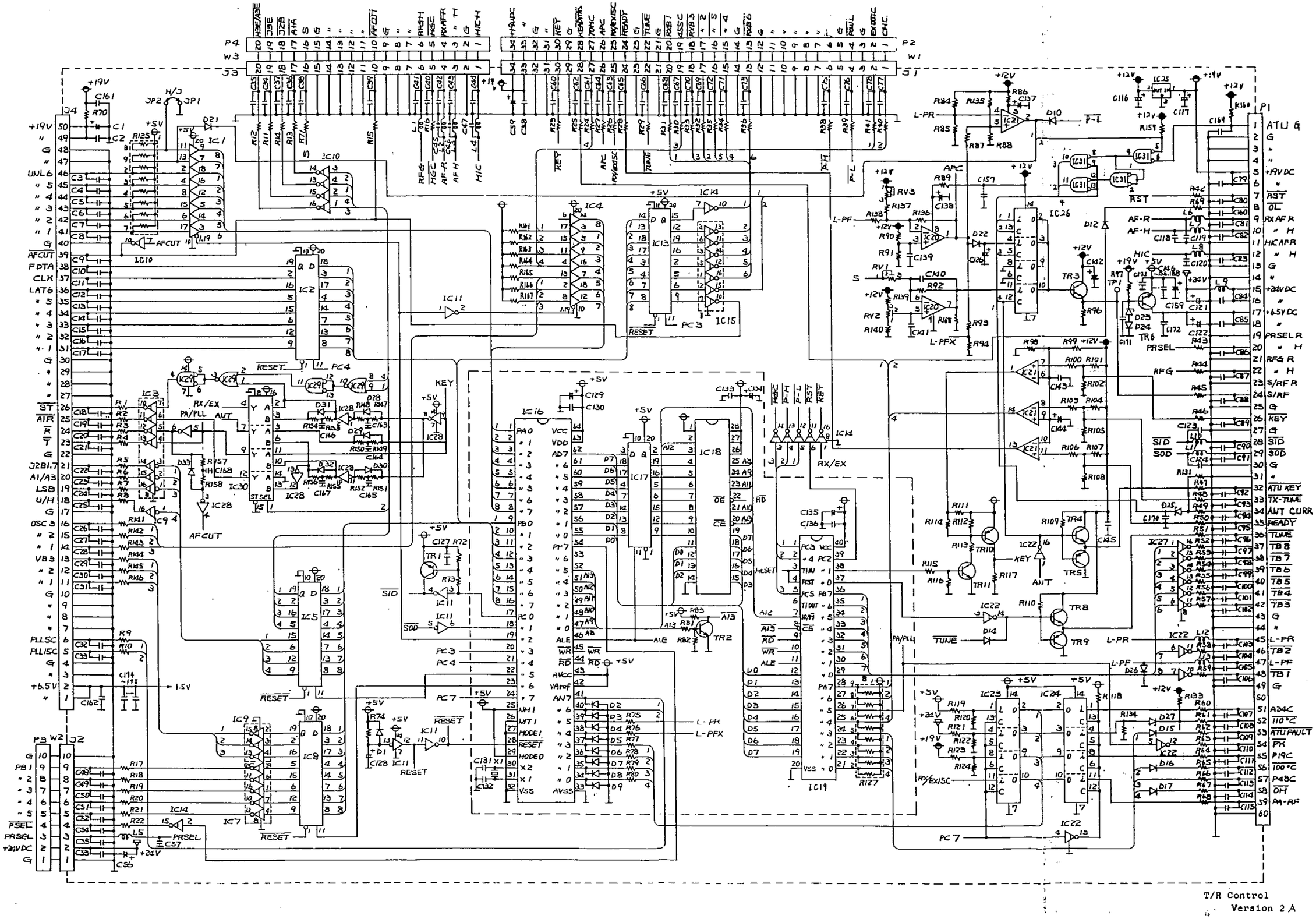
Junction board (for Remote control)
PCB lay-out

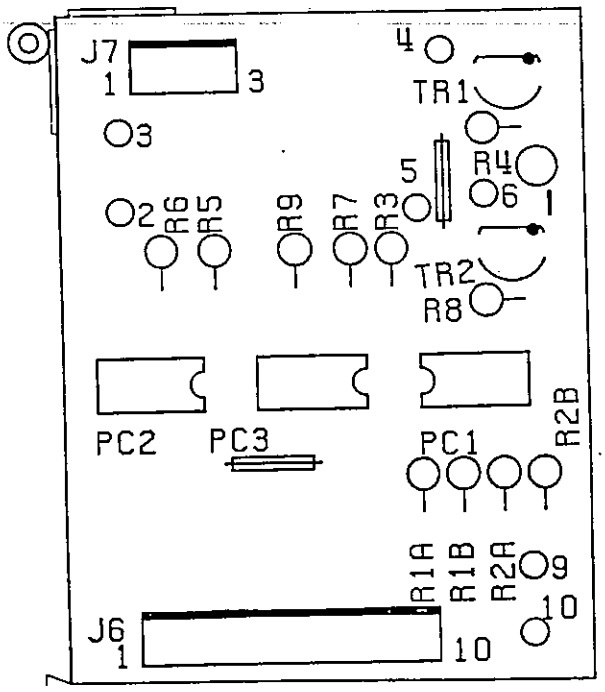


Junction (Remote Control)
Version 2

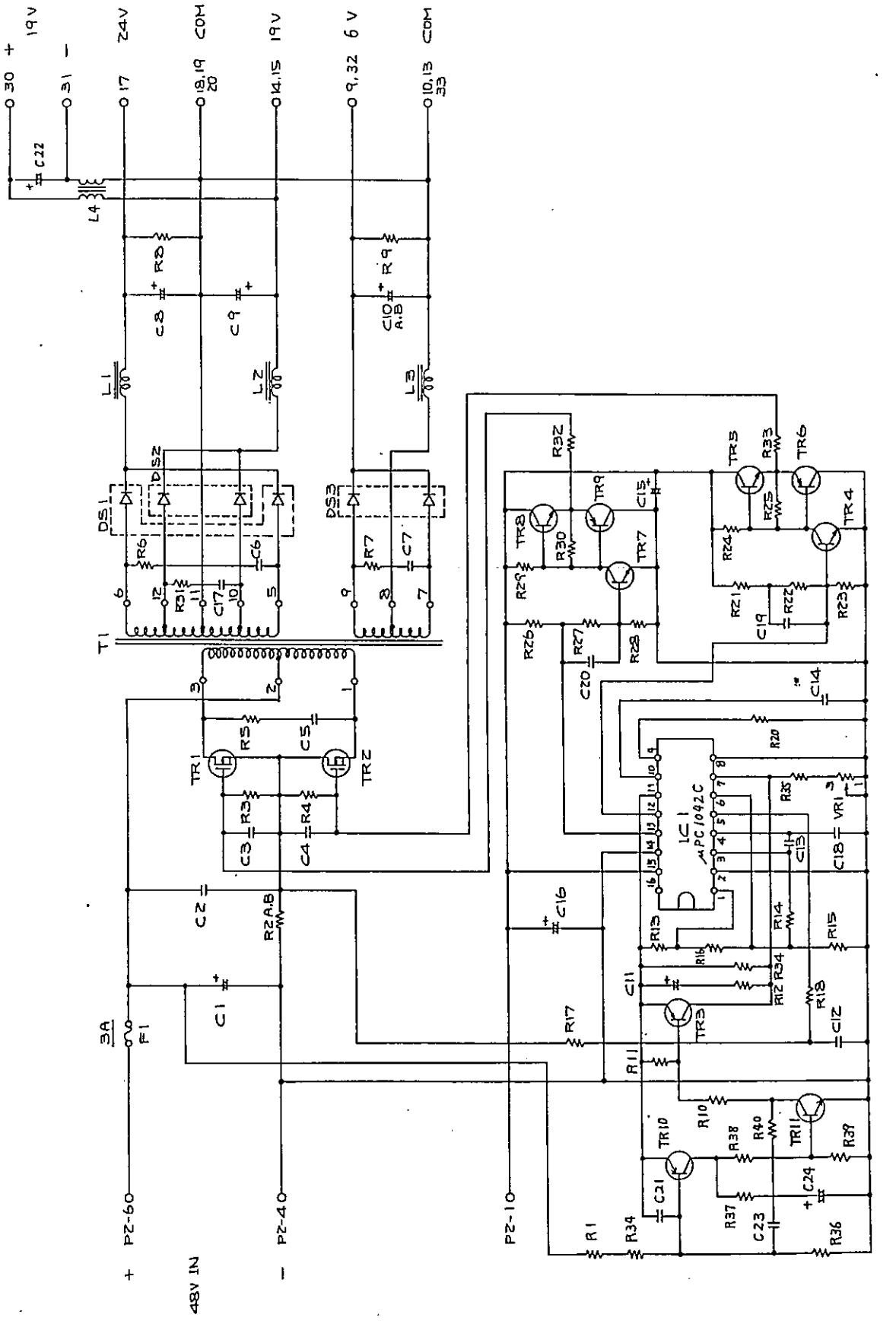


T/R control
PCB lay-out

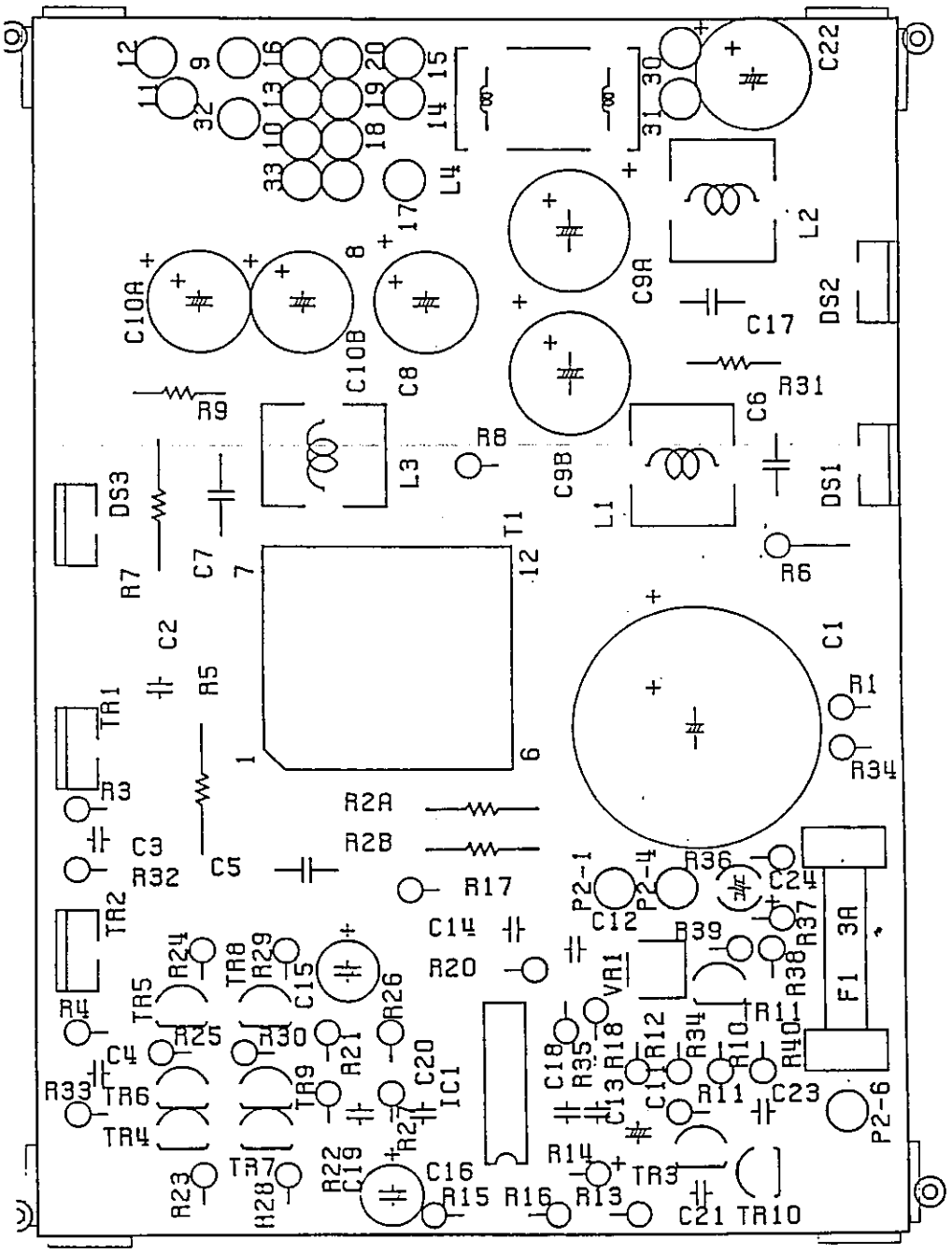

T/R Control
Version 2 A



Power supply A3
PCB lay-out

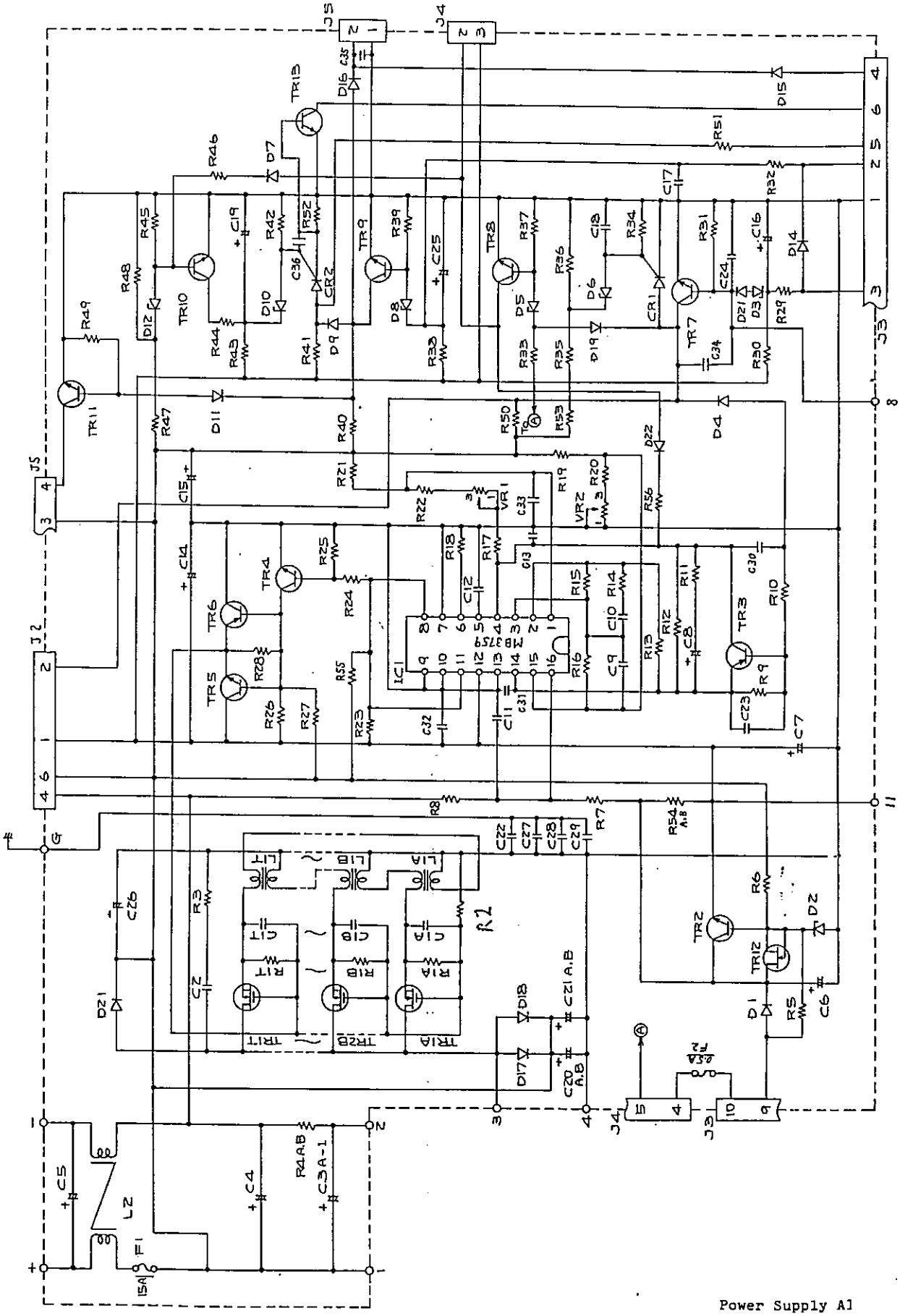


Power Supply A2
DC/DC Convertor
Version 2

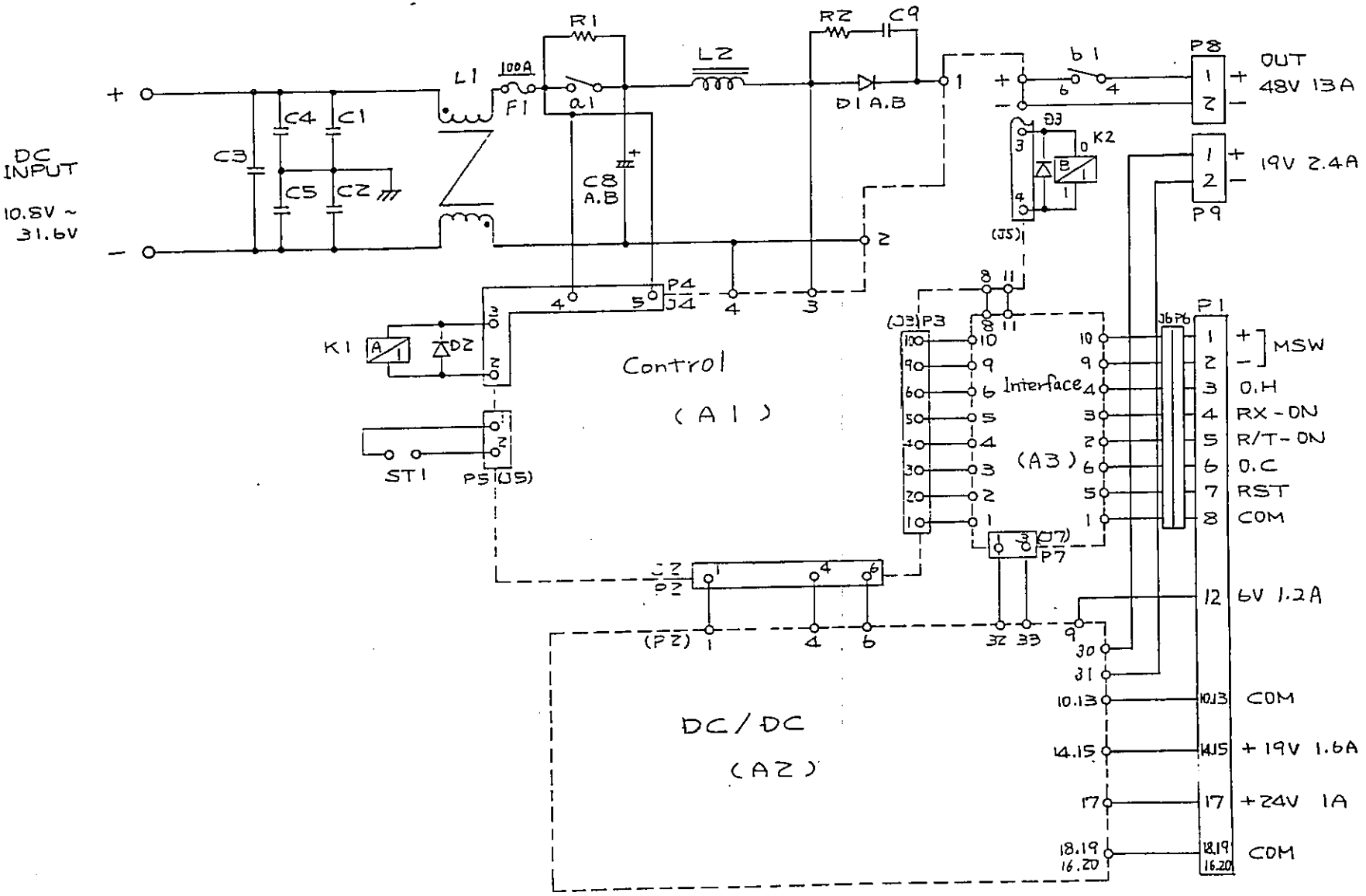


Power supply A2

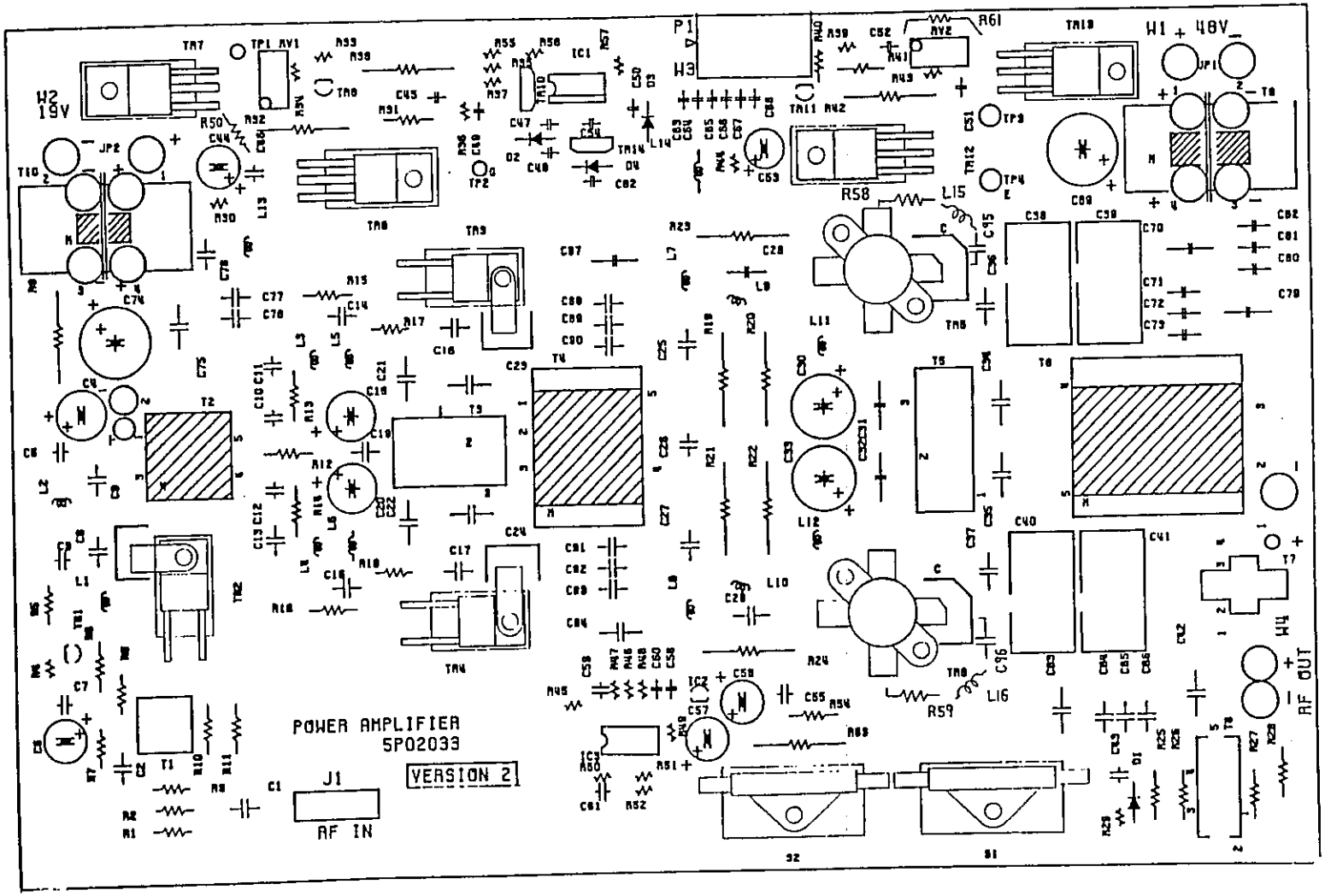
PCB lay-out



Power Supply A1
Control Board
Version 2

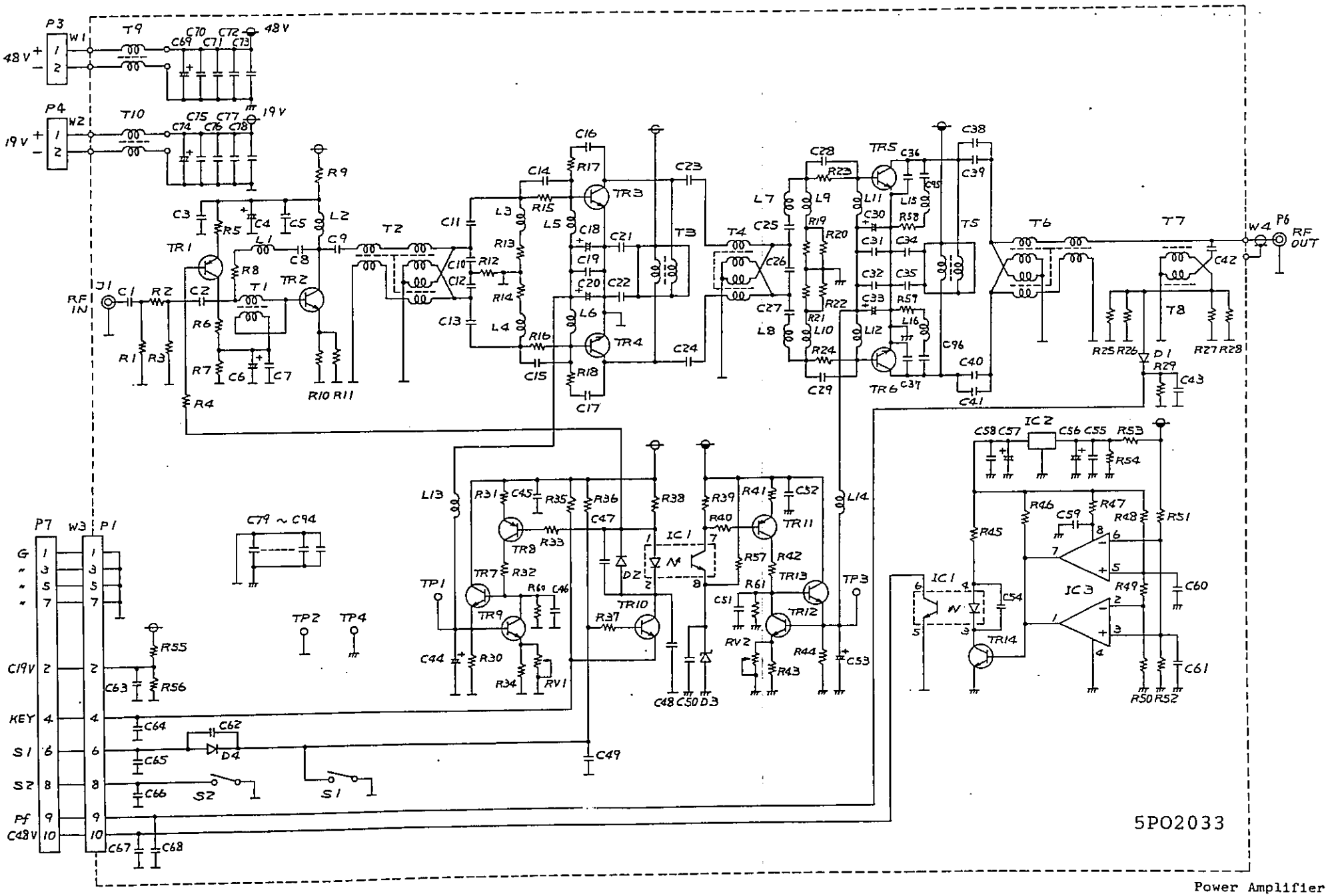


Power Supply
Main Circuit
Version 2

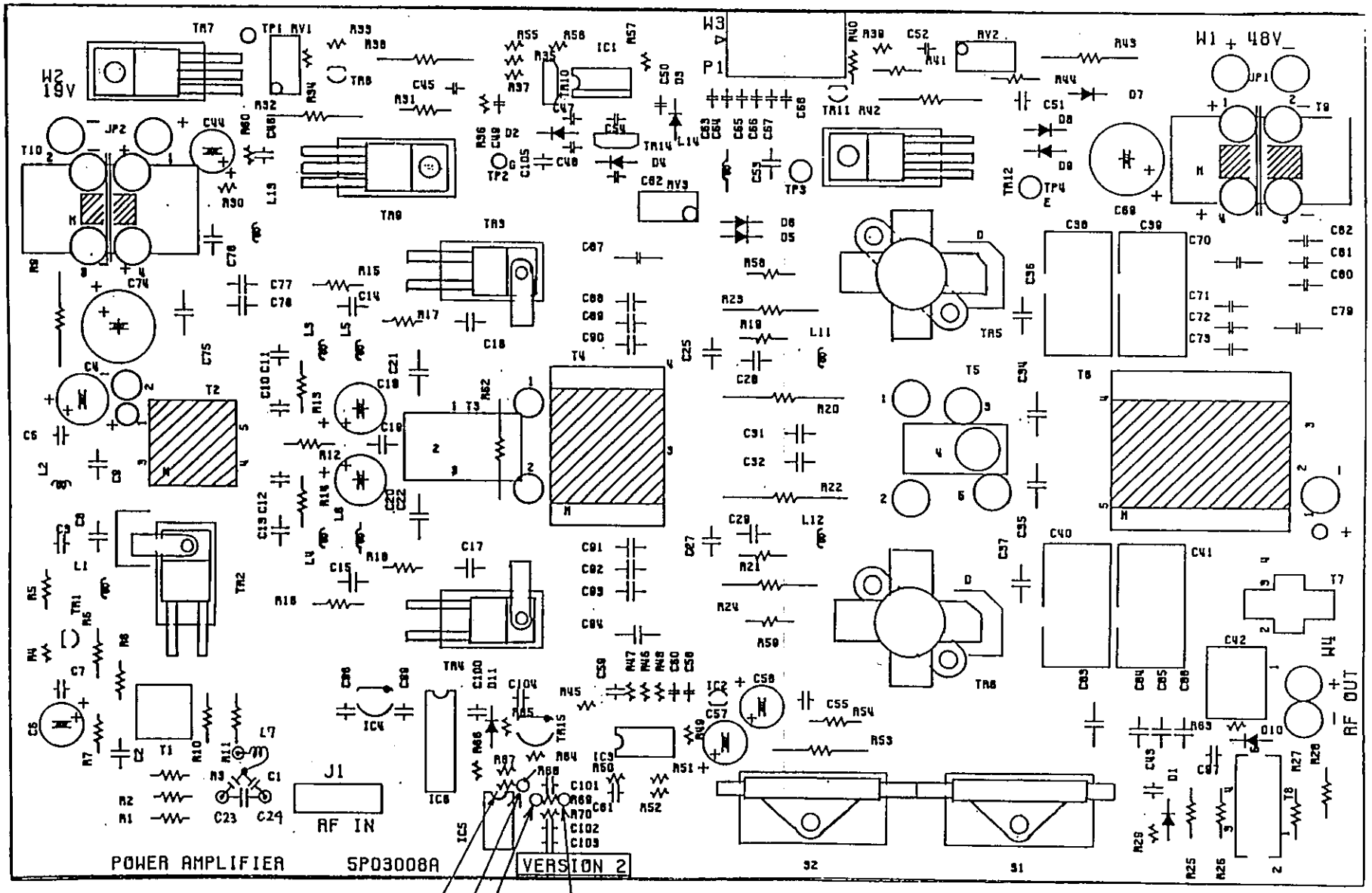


Power amplifier 5PO2033

PCB lay-out

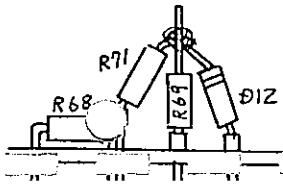


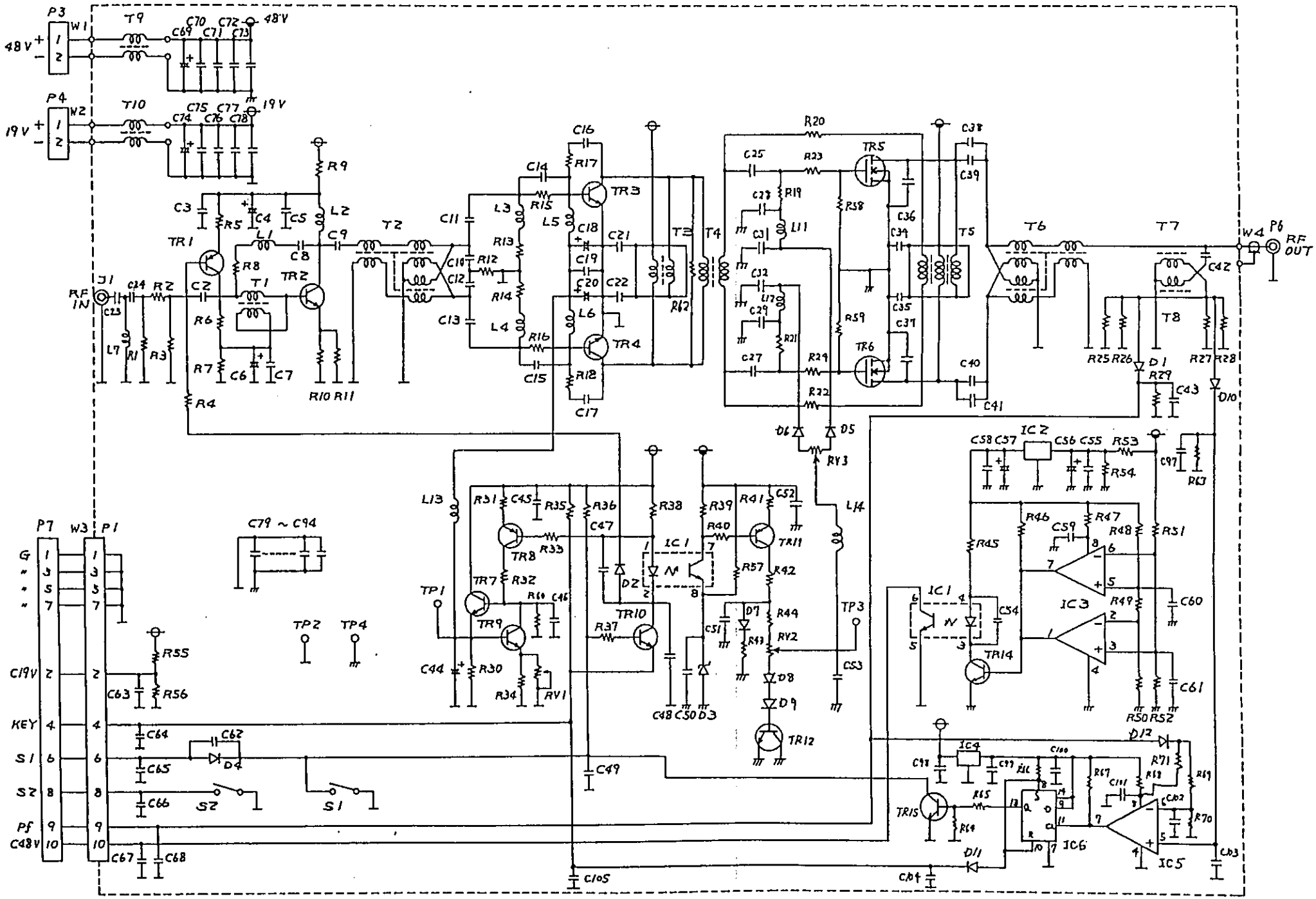
Power Amplifier
Version 2

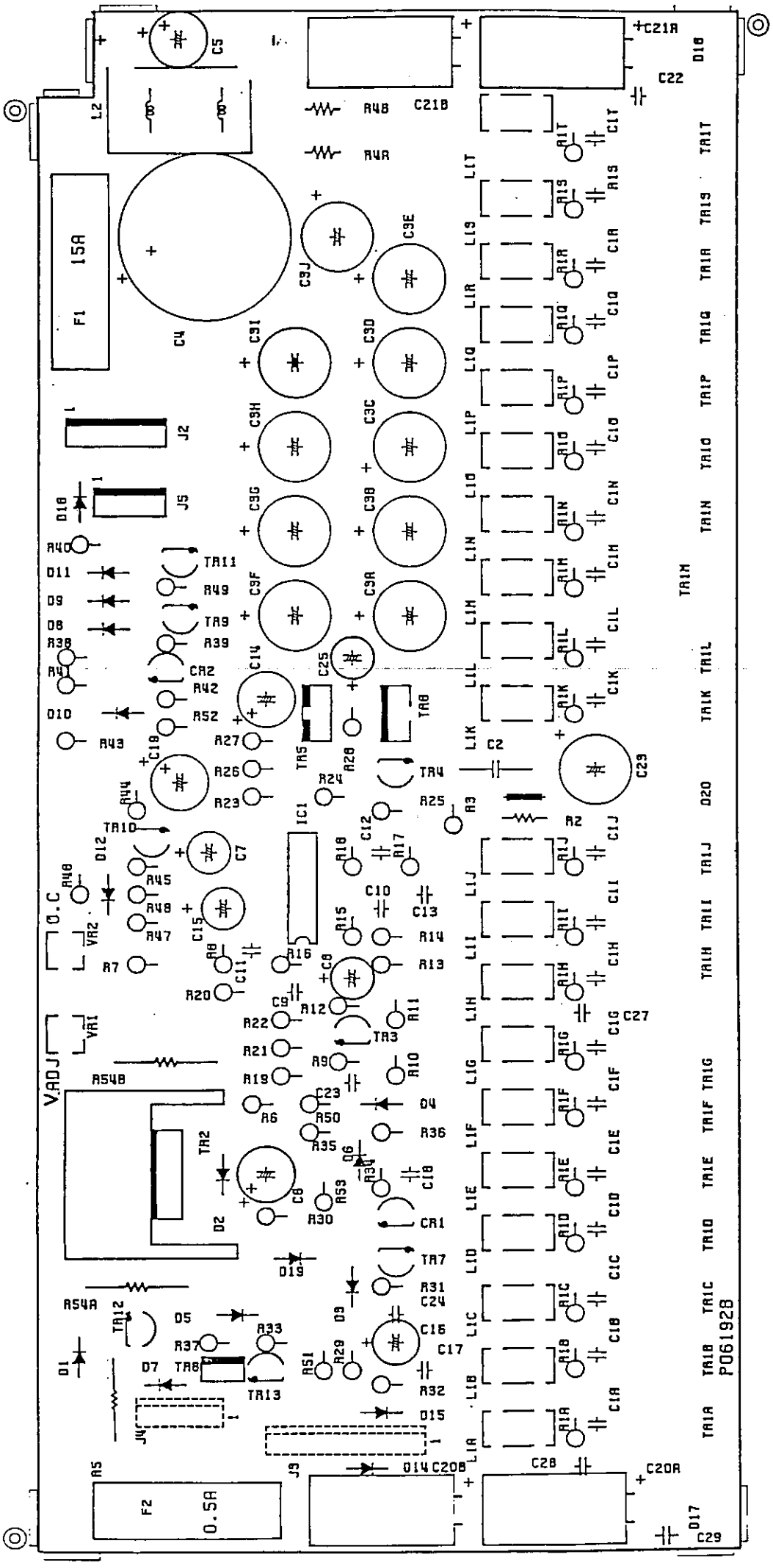


POWER AMPLIFIER SP03008A

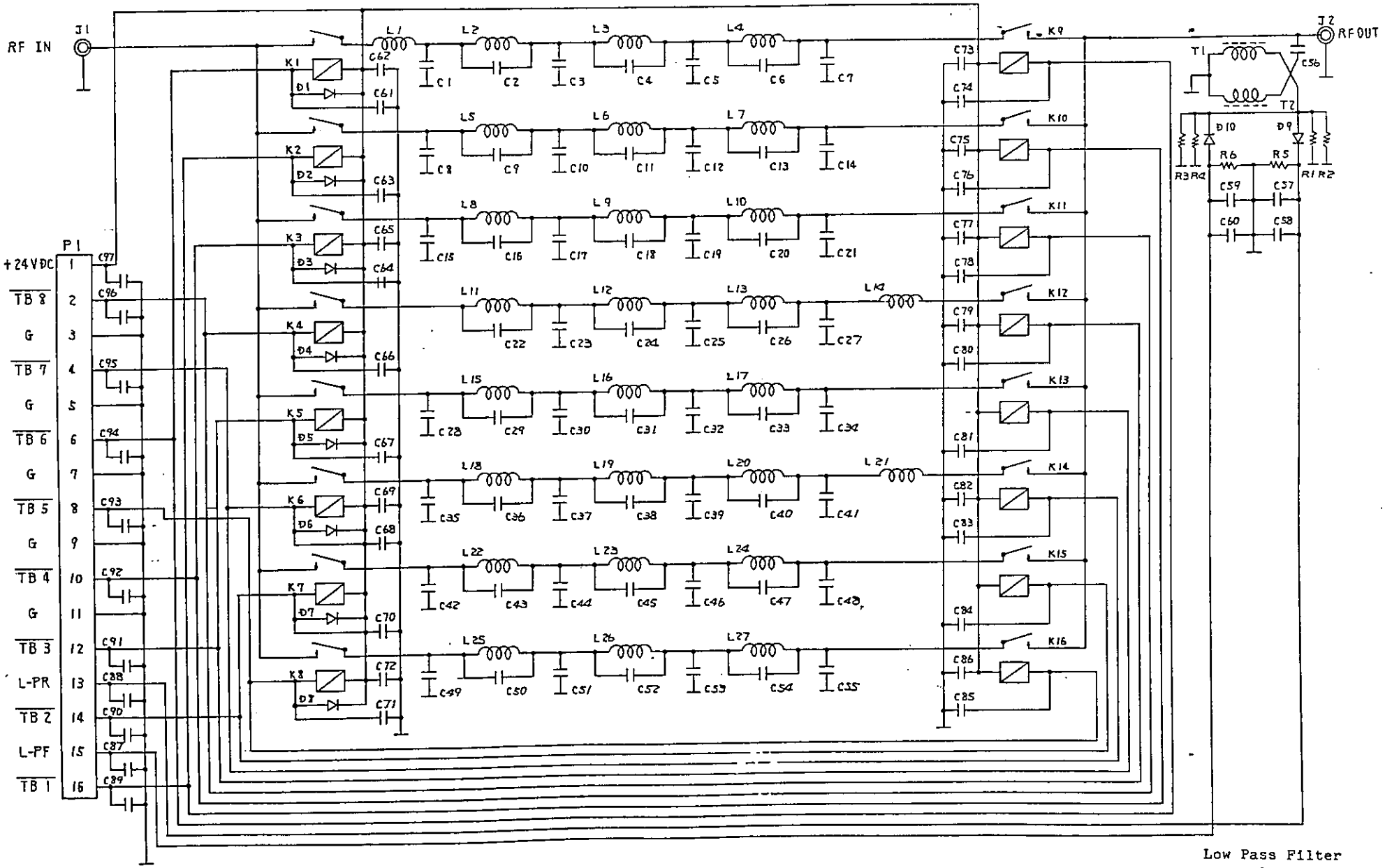
VERSION 2



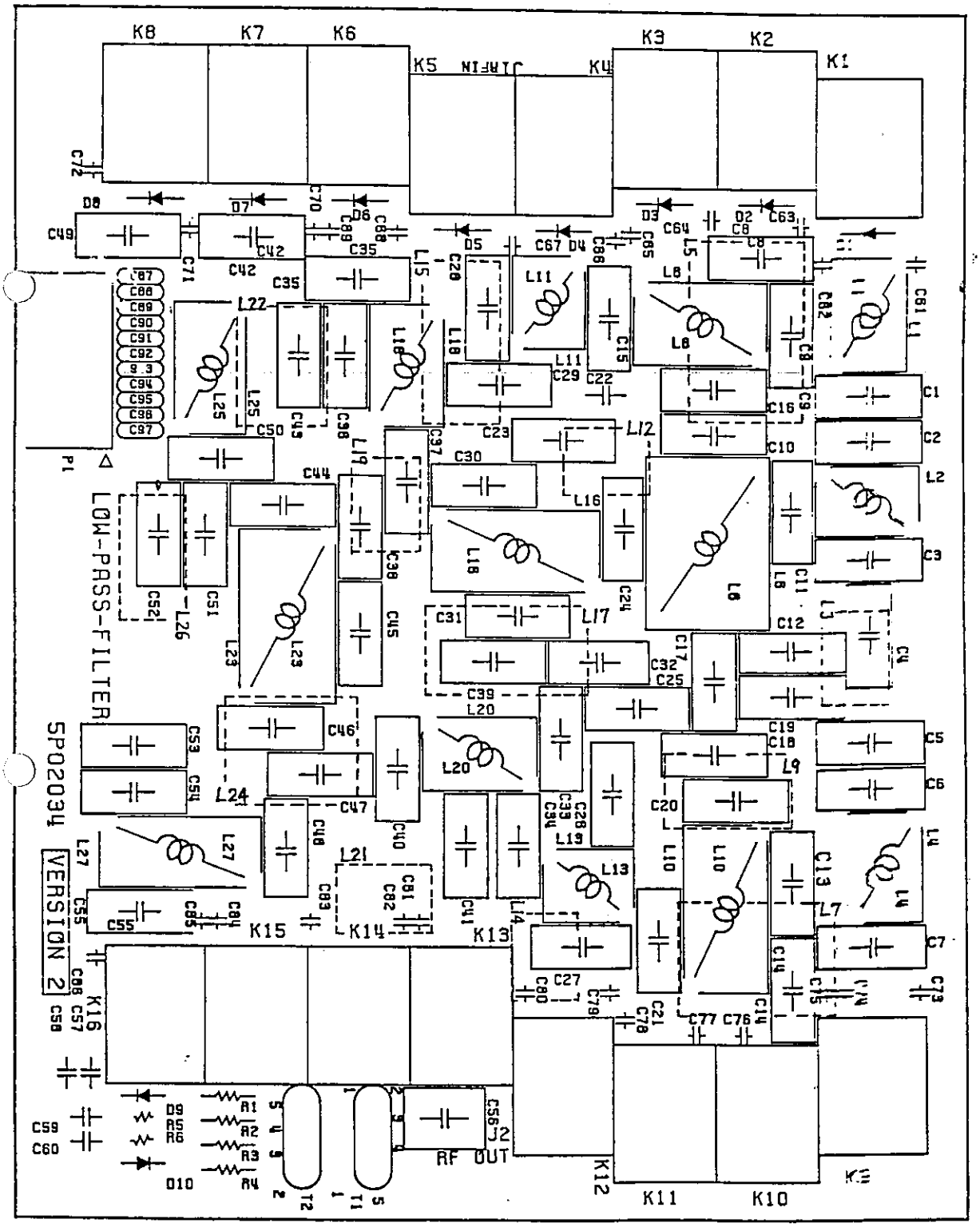

P3
48V
T9
48V
P4
19V
T10
19V
RF IN
RF OUT
TR1
TR2
TR3
TR4
TR5
TR6
T1
T2
T3
T4
T5
T6
T7
T8
IC1
IC2
IC3
IC4
IC5
IC6
P7
P1
W3
TP1
TP2
TP3
TP4
S1
S2
KEY
C79 ~ C94
POWER AMPLIFIER
5P03008A



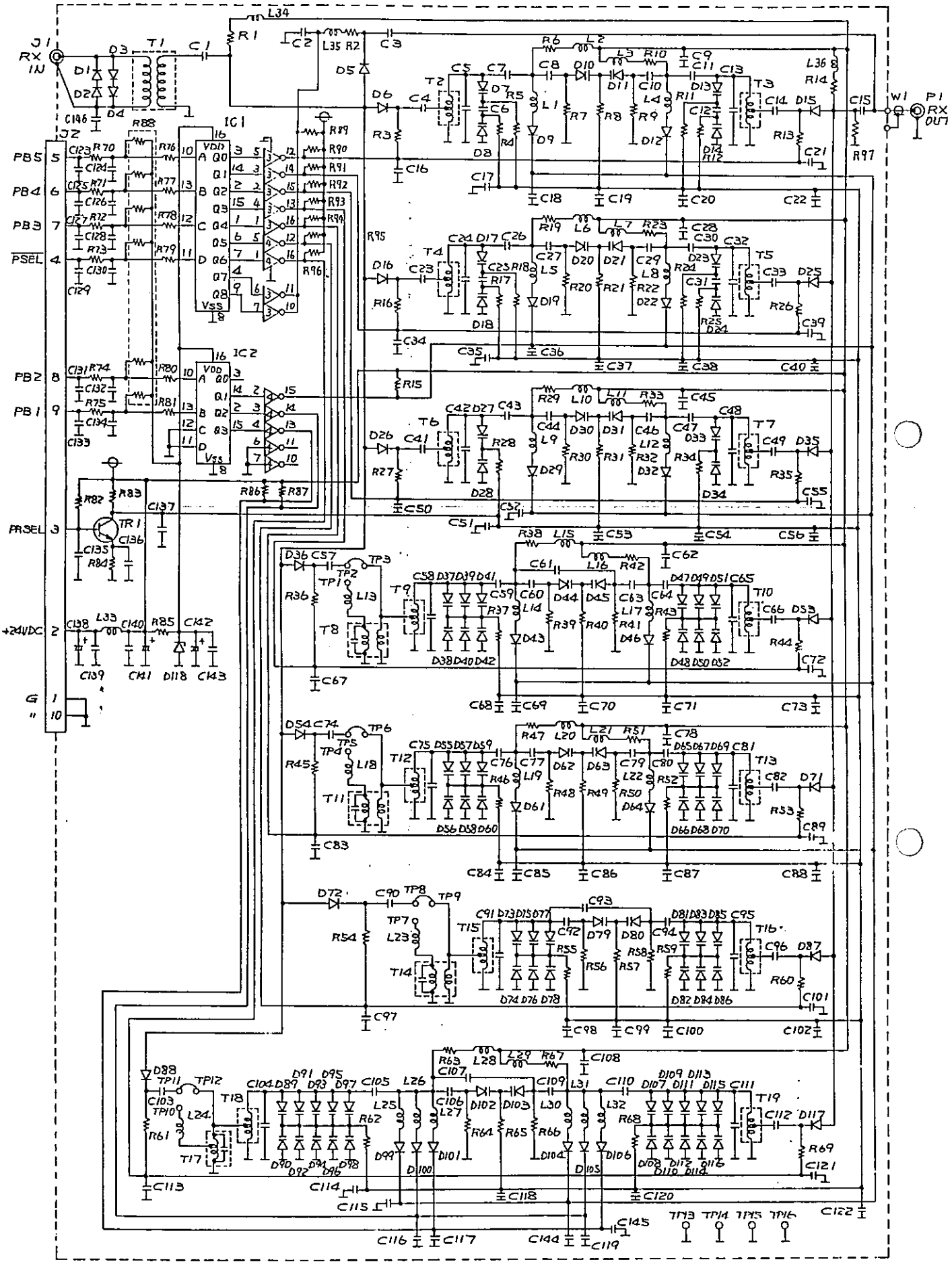
Power supply A1
PCB lay-out



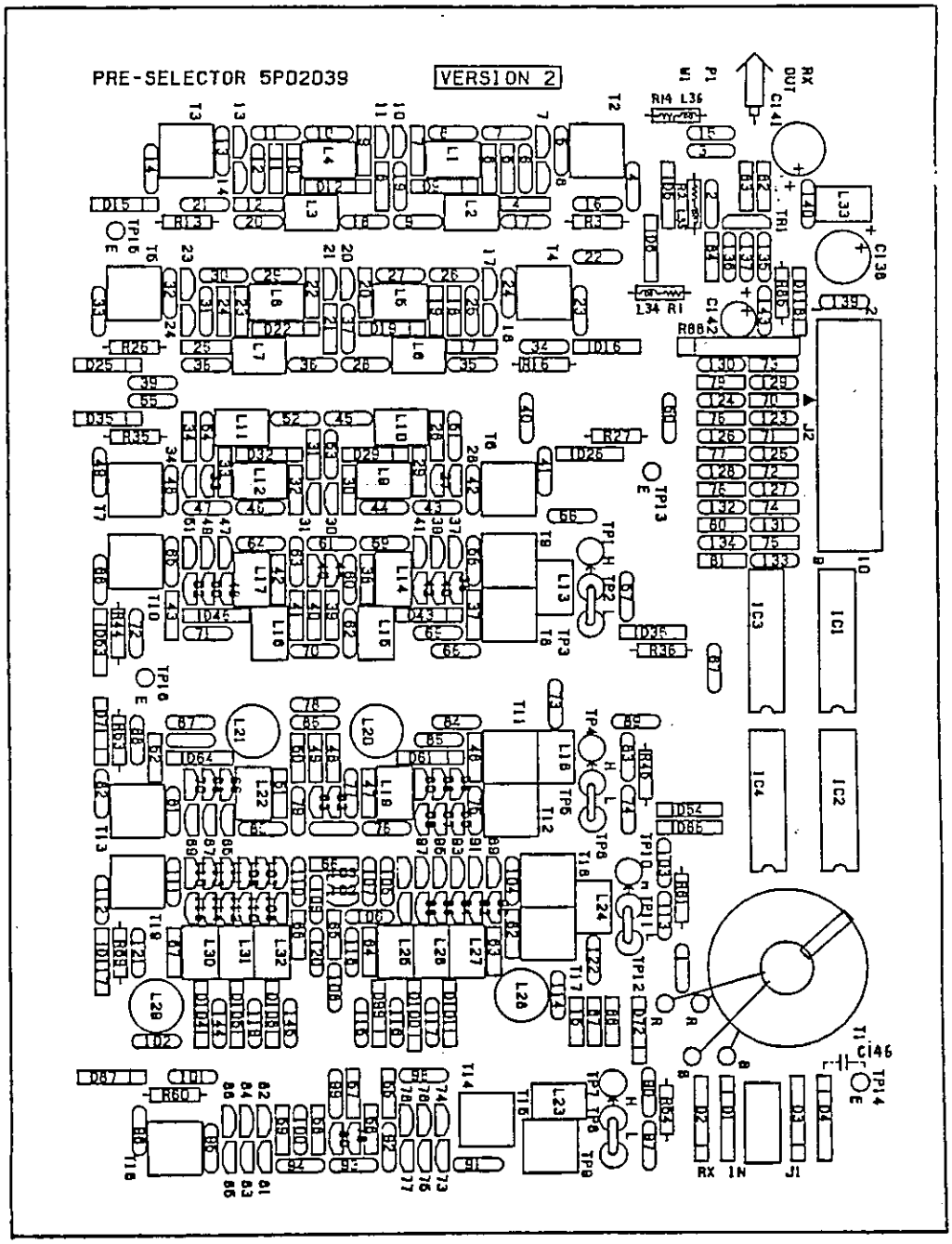
Low Pass Filter
Version 2



Low-pass filter
PCB lay-out



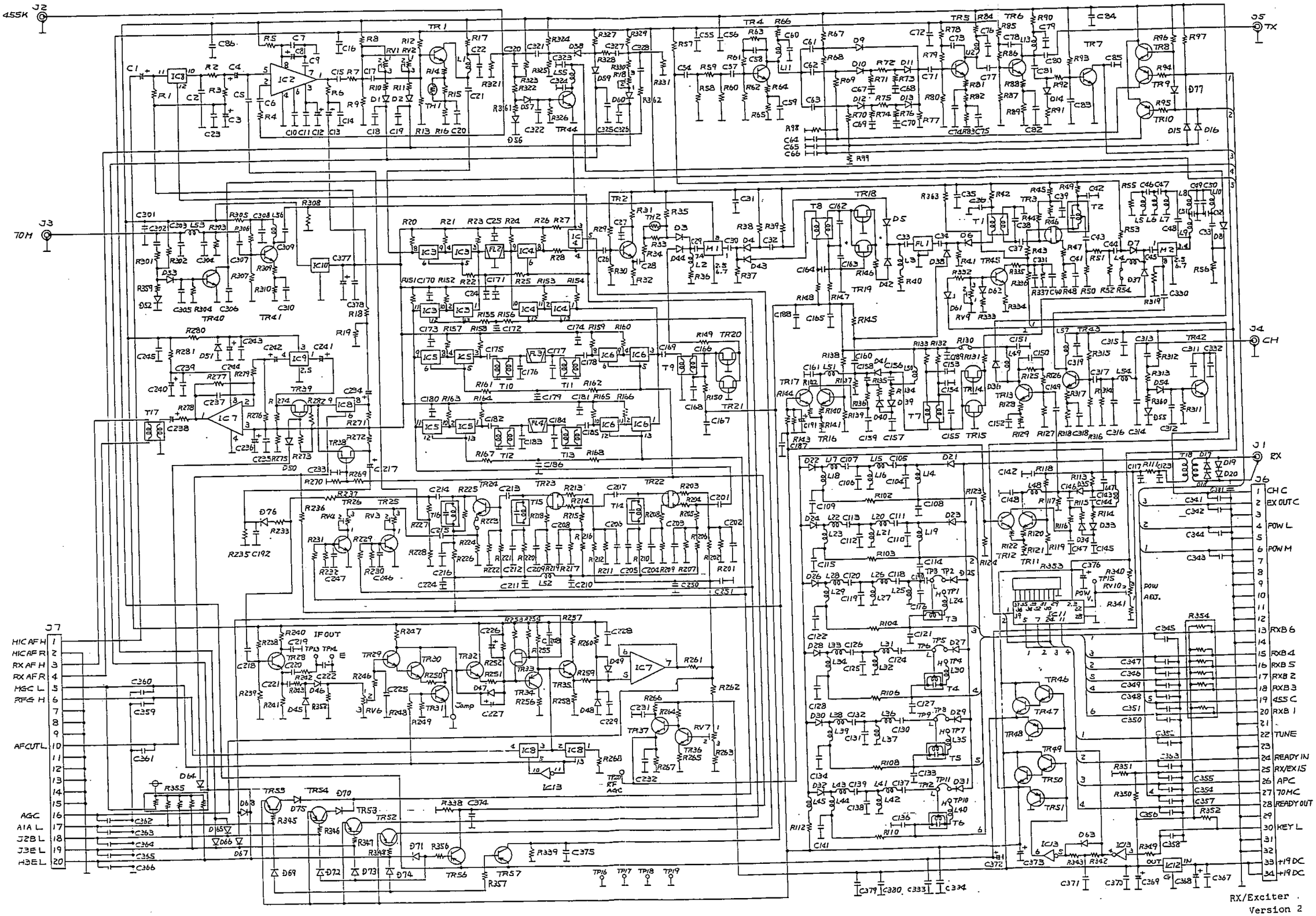
Pre-Selector
Version 2



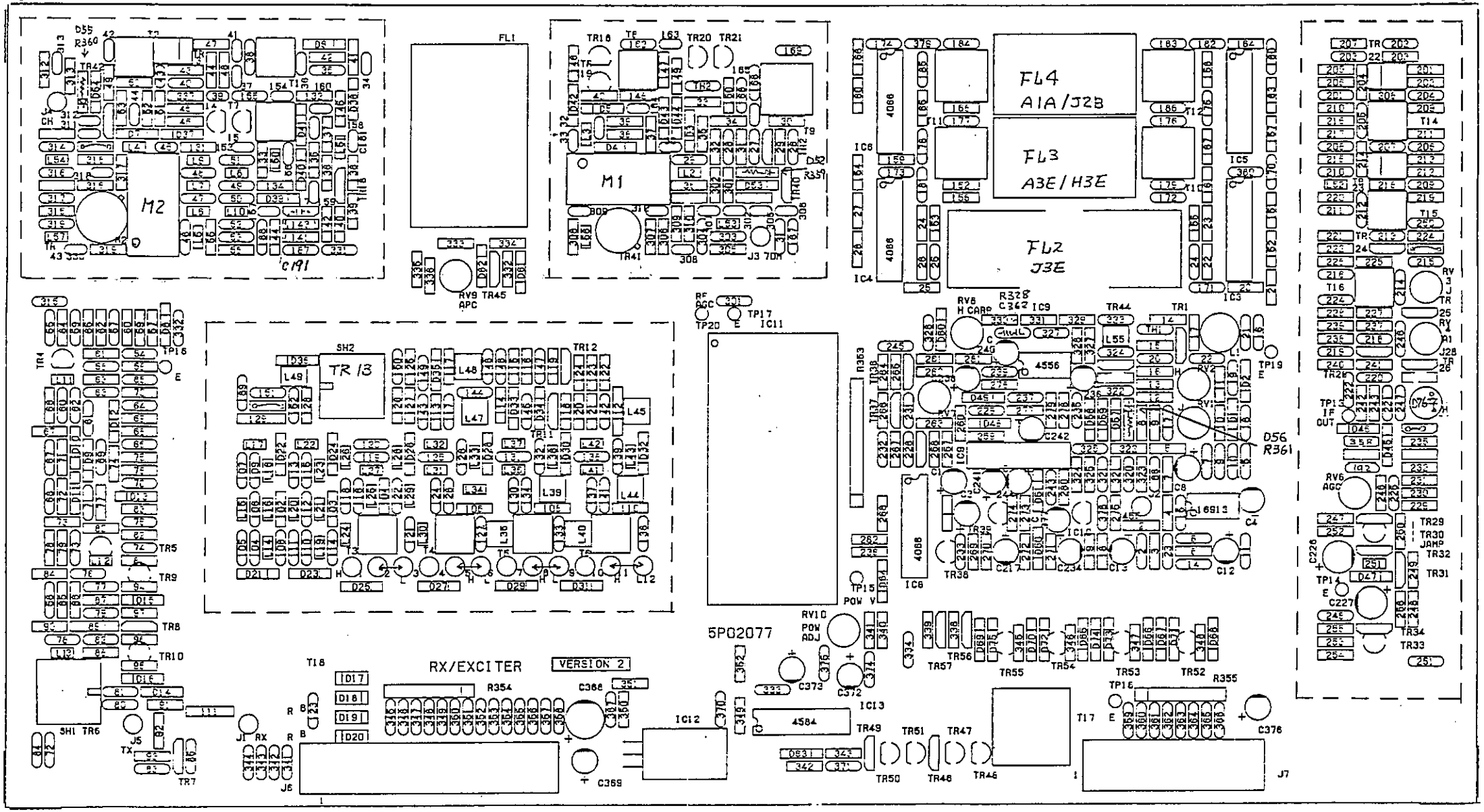
Pre-selector
PCB lay-out

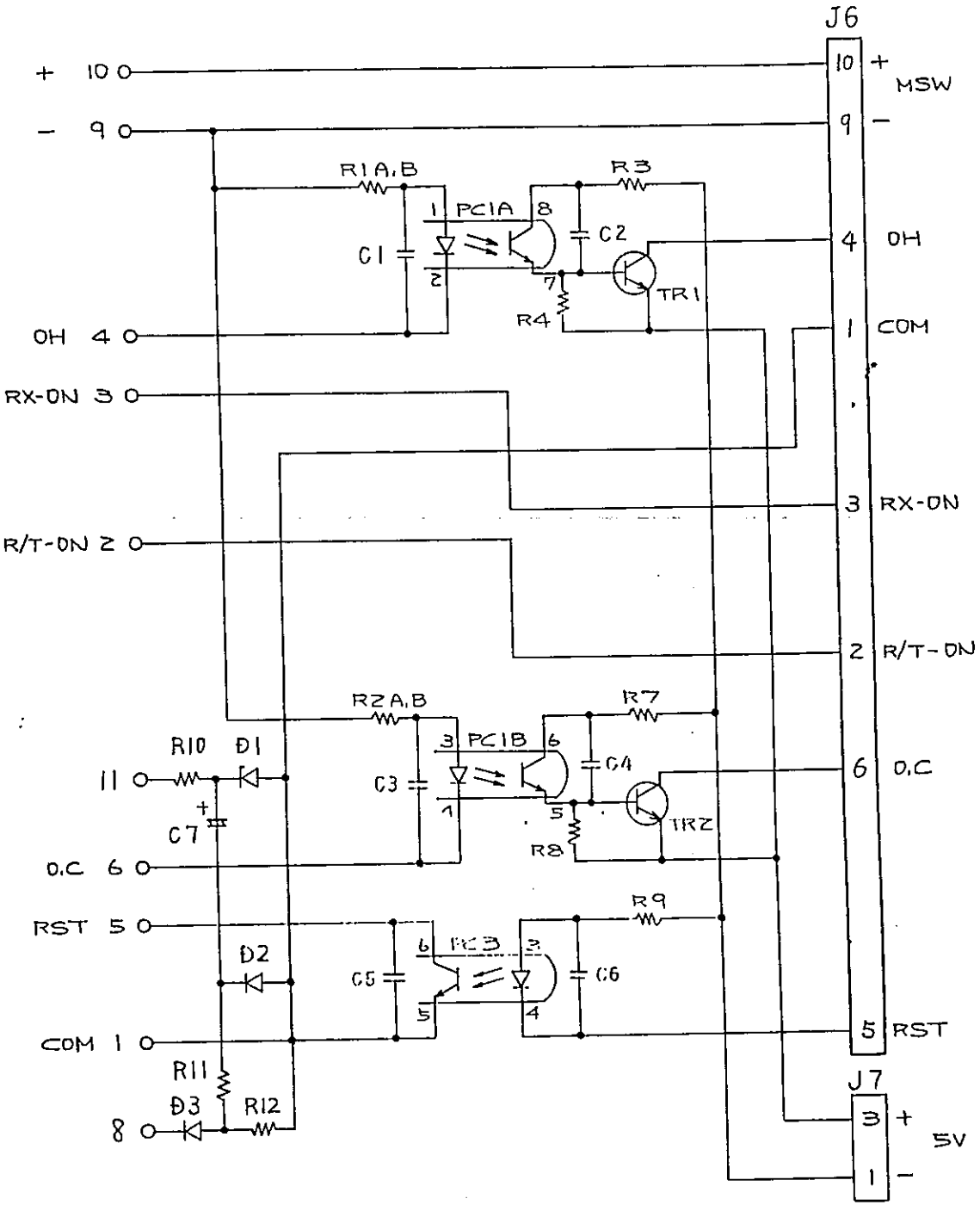
Frequency Synthesizer (PLL)
Version 2

Frequency Synthesizer
Layout

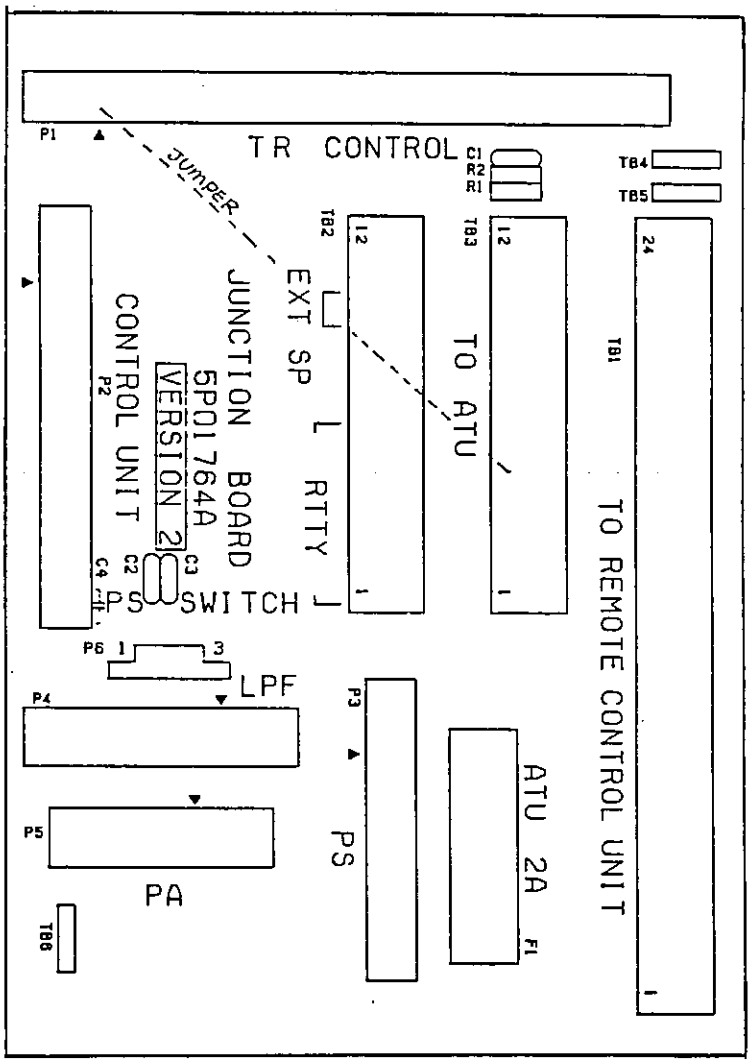

J2
455K
J3
70M
J5
TX
J4
CH
J1
RX
J6
CH C
EX OUT C
POW L
POW M
RXB 6
RXB 4
RXB 5
RXB 2
RXB 3
455 C
RXB 1
TUNE
READY IN
RX/EX IS
APC
70MC
READY OUT
KEY L
+19 DC
+19 DC
J7
HIC AF H
HIC AF R
RX AF H
RX AF R
HGC L
RFG H
AFCUT L
AGC
AIA L
J2B L
J3E L
H3E L
IF OUT
RF AGC
POW ADJ.
RX/Exciter
Version 2

RX/Exciter
PCB lay-out:

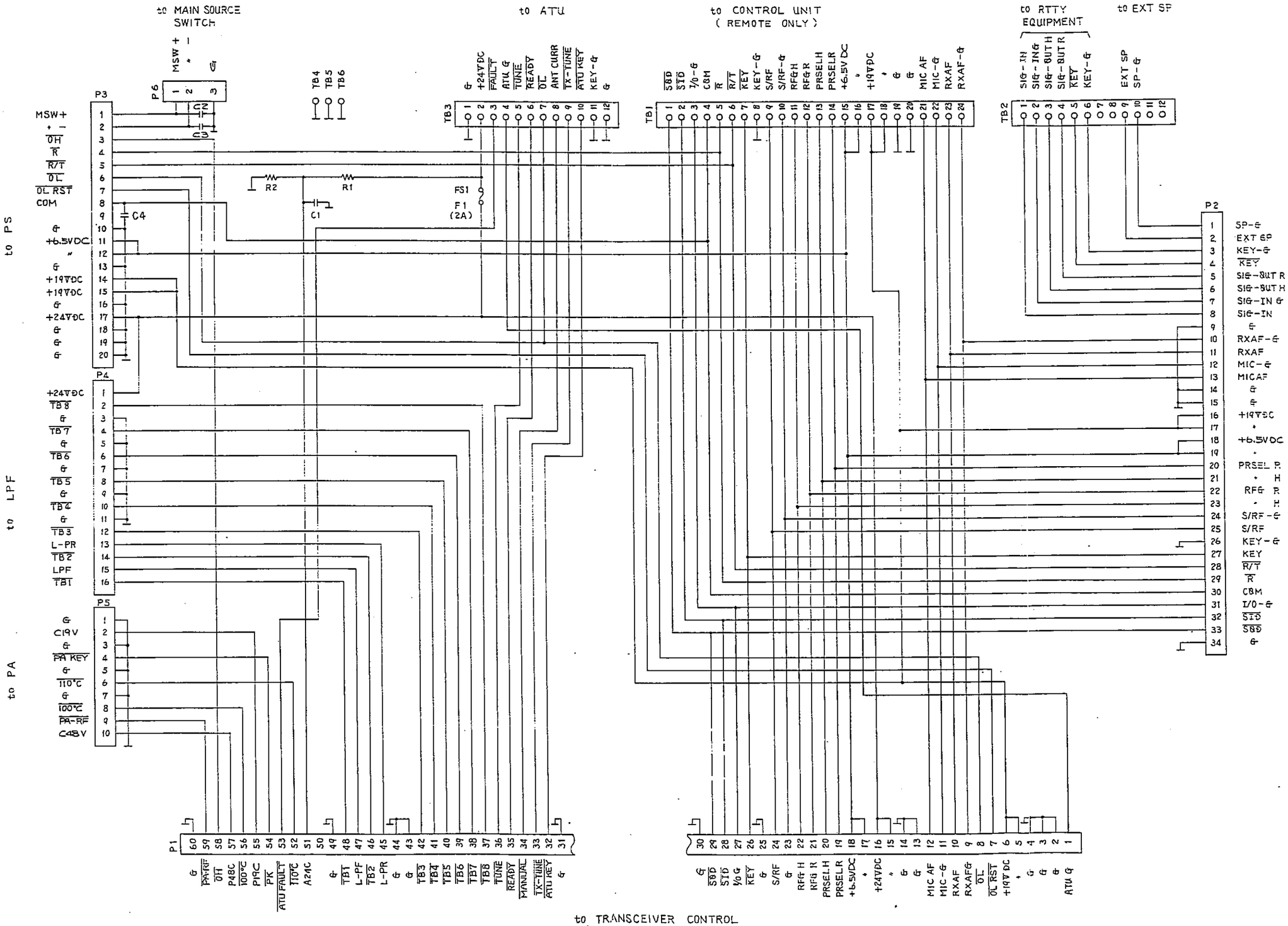




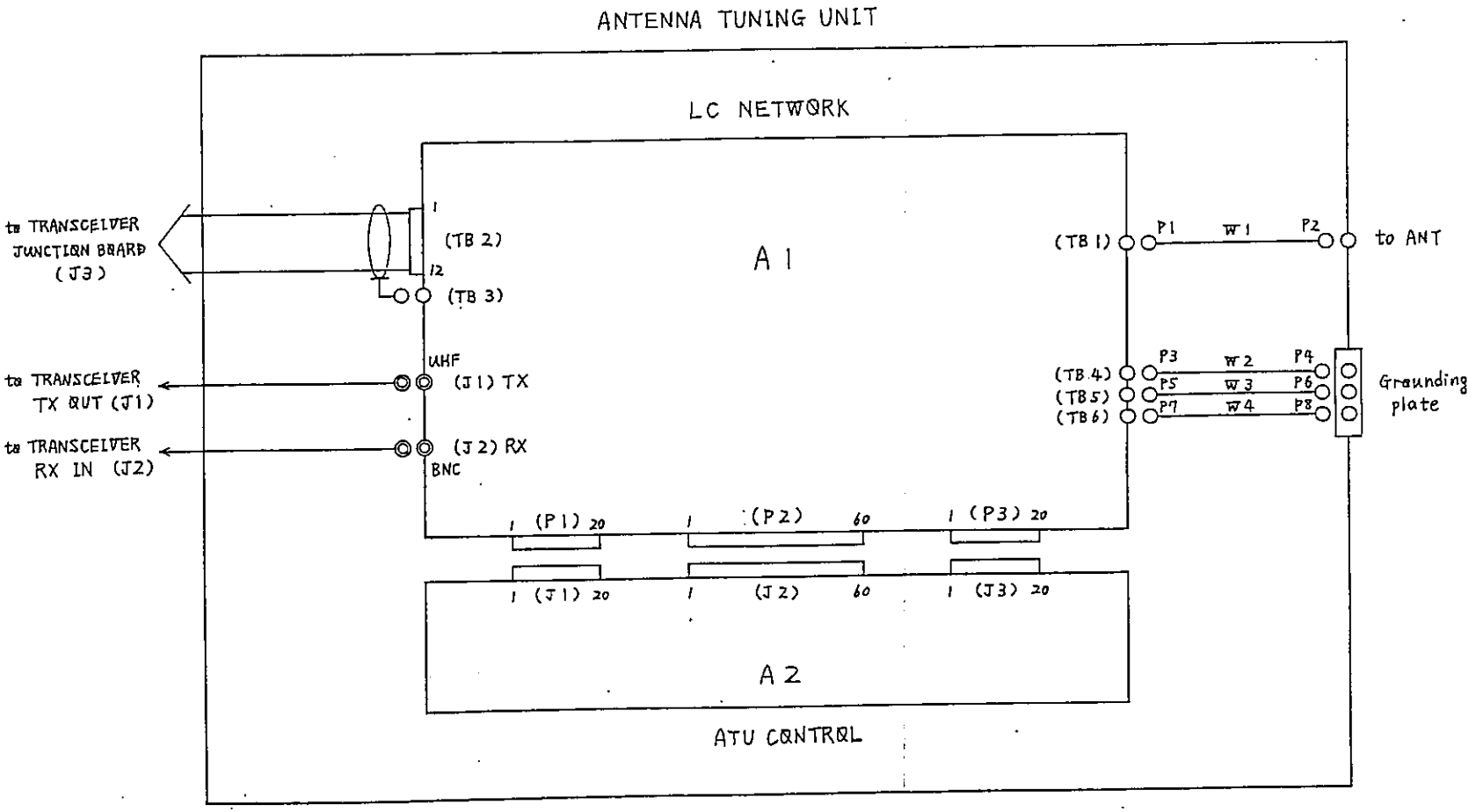
Power Supply A3
Line Interface
Version 2



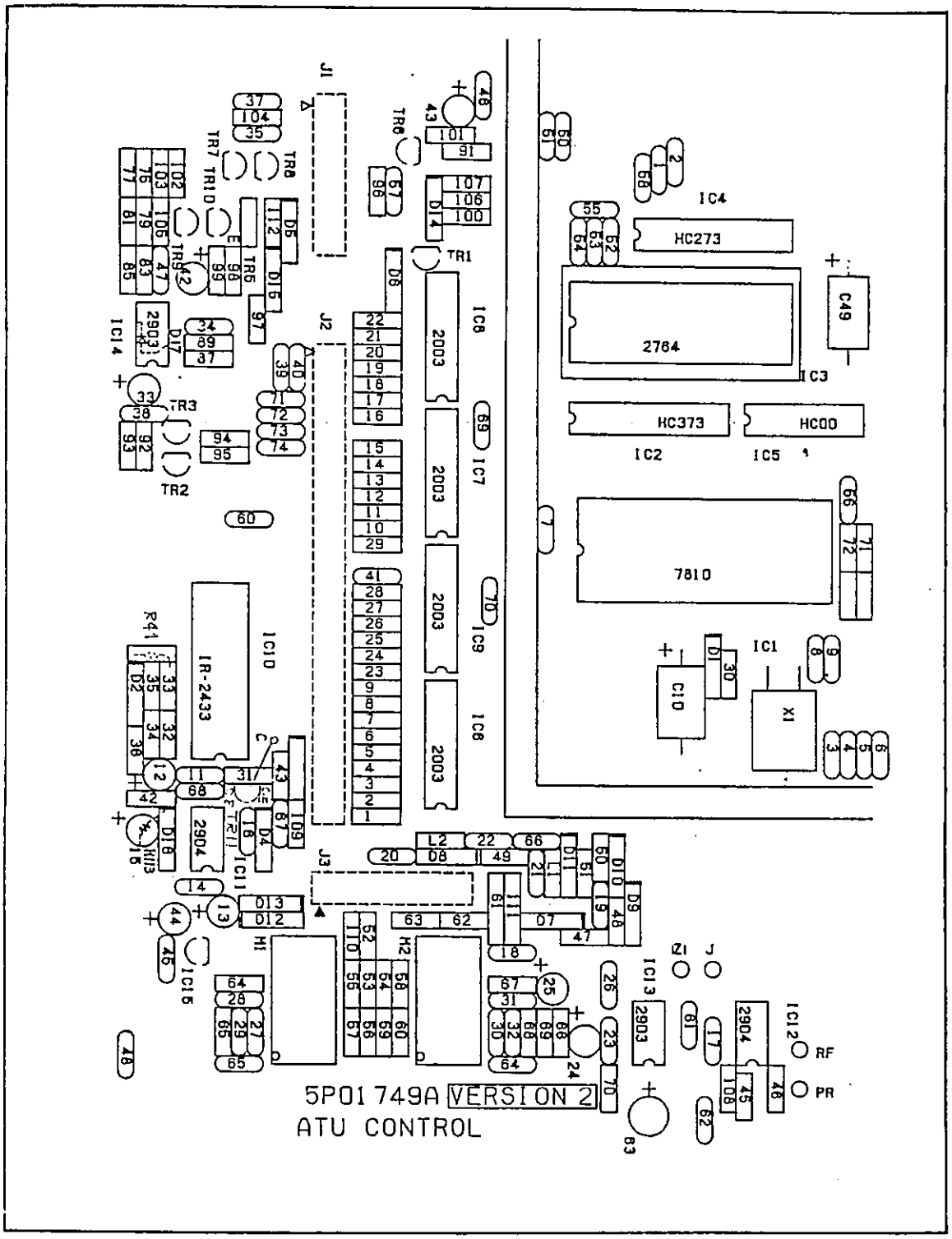
Junction board
PCB lay-out



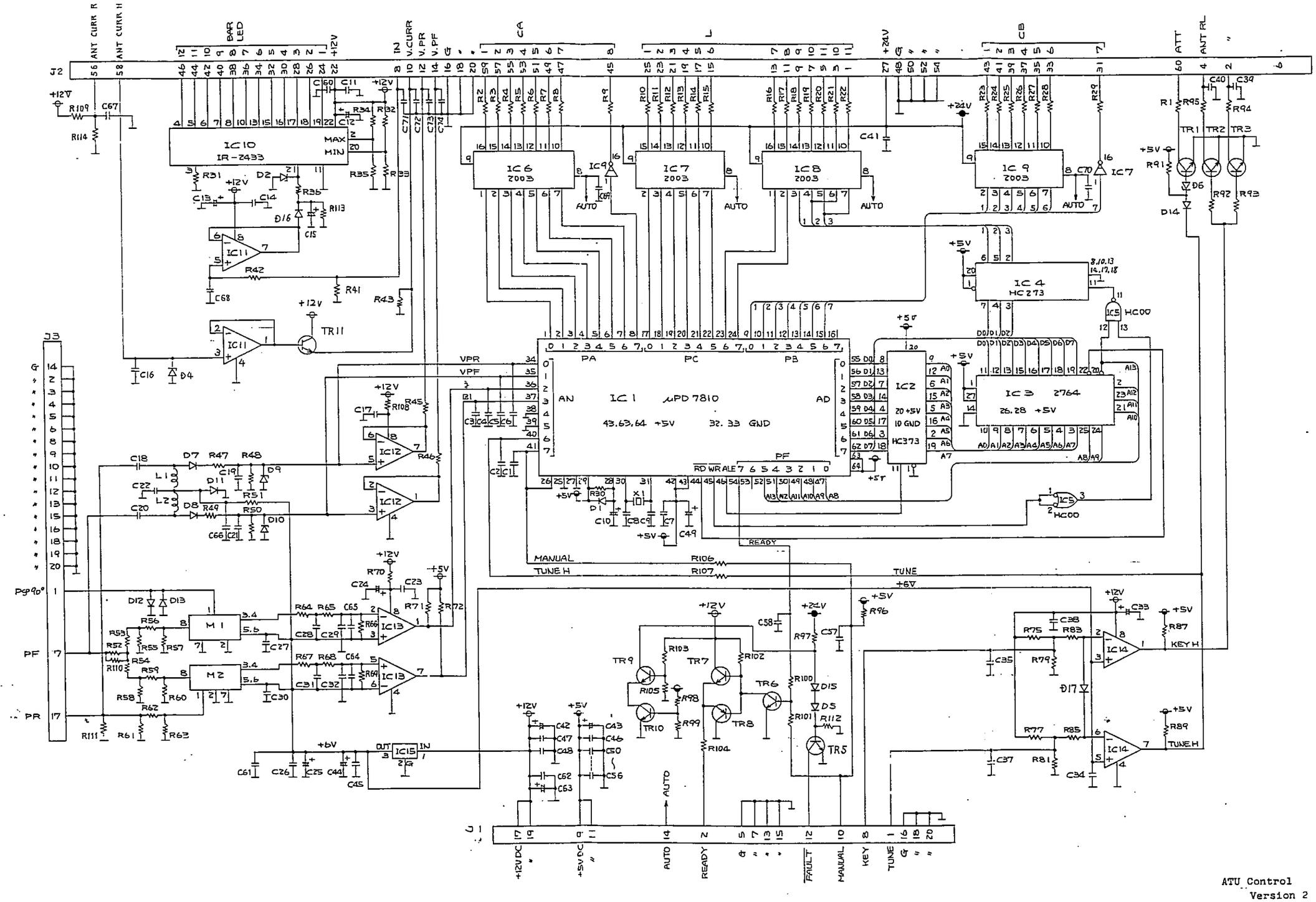
Junction
Version .2



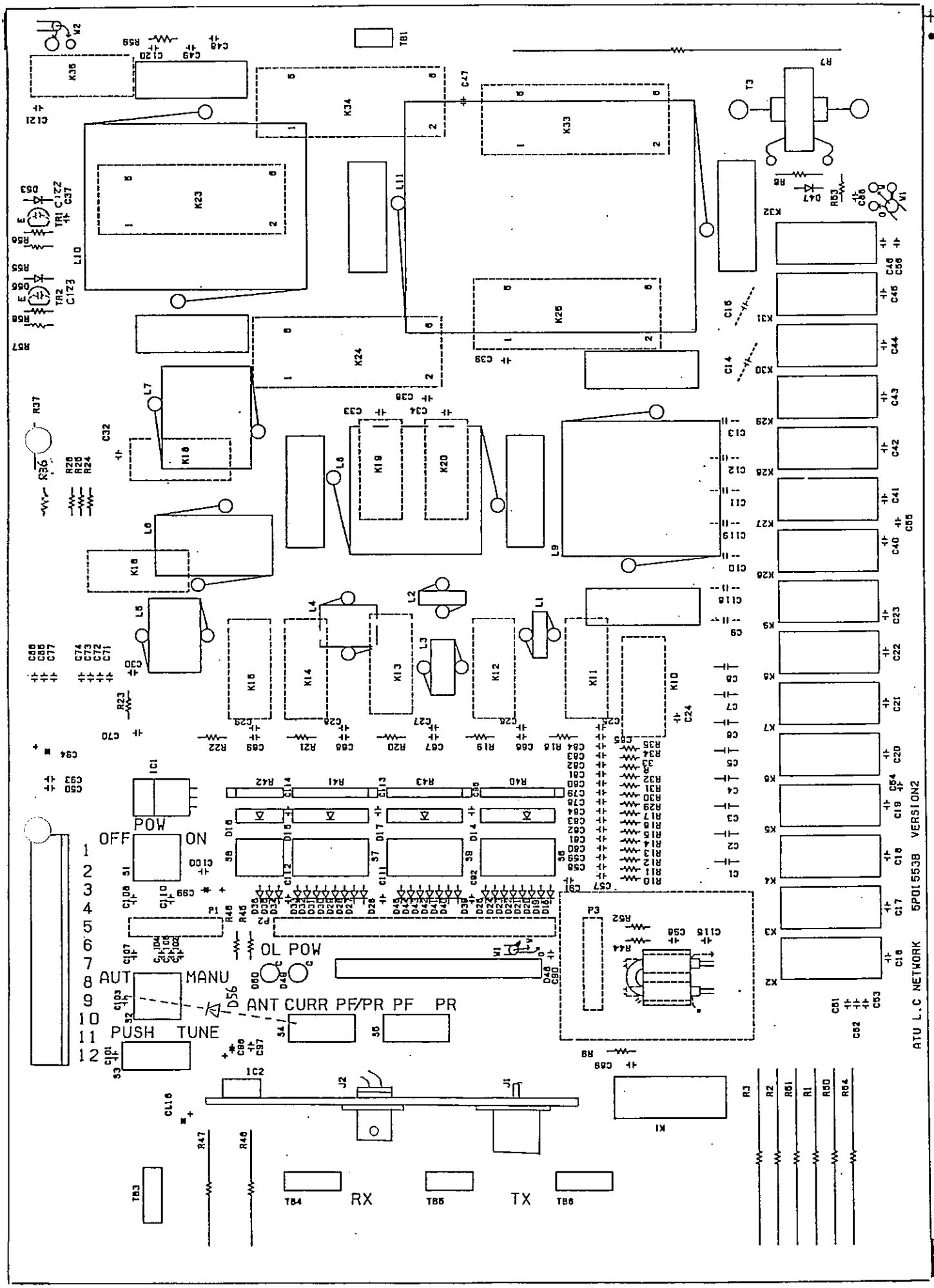
ATU Diagram
Version 2



ATU control
PCB lay-out

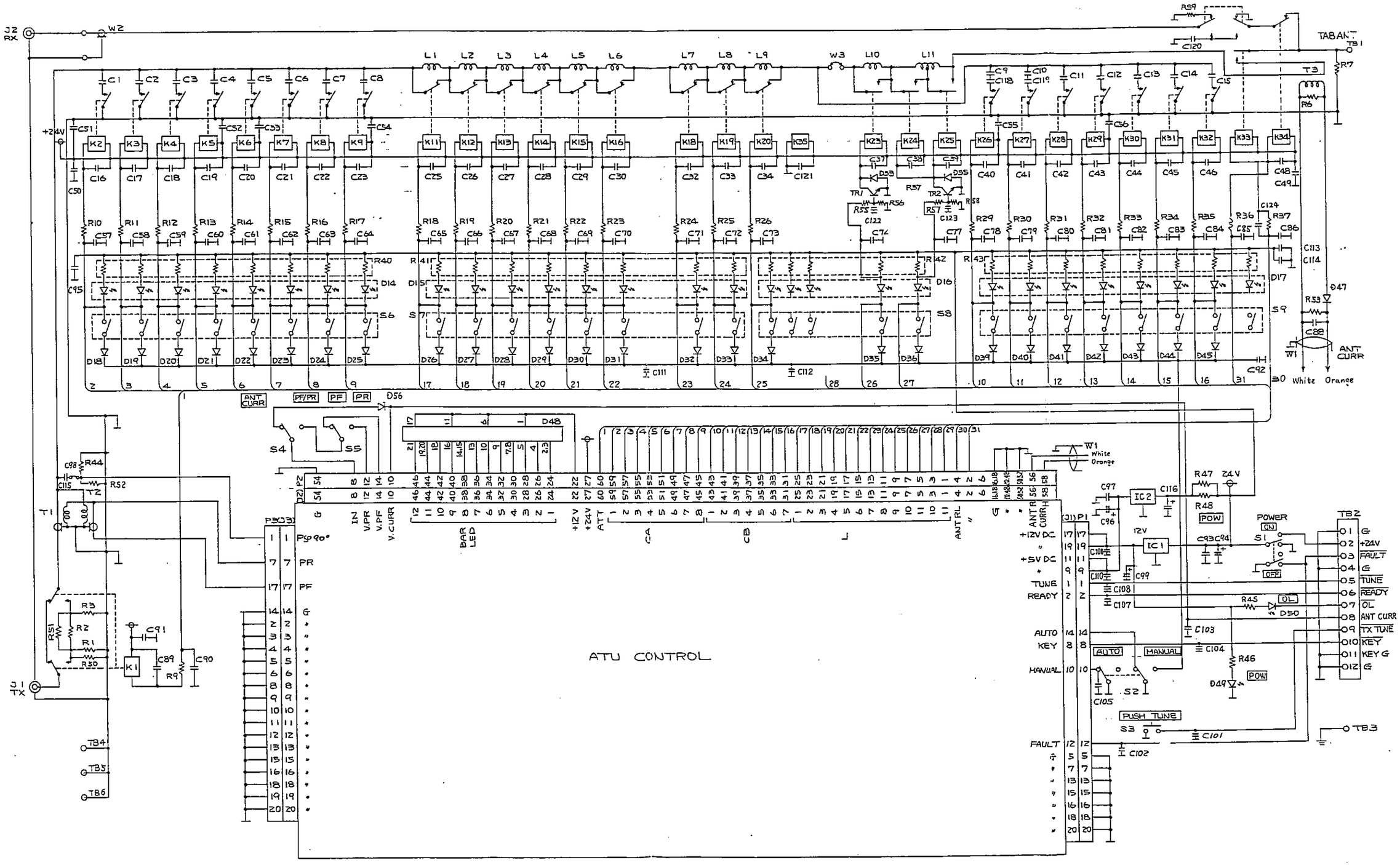


ATU Control
Version 2



ATU L.C network

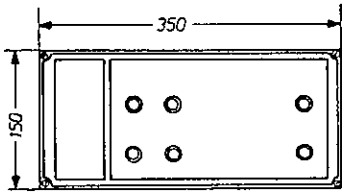
PCB lay-out

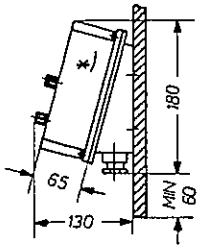


LC Network
Version 2

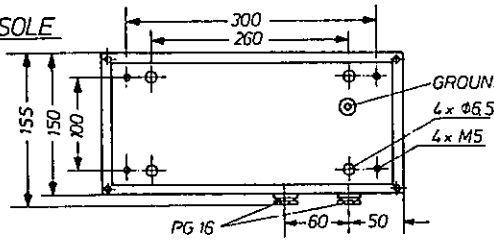
CONTROL UNIT WITH CONSOLE

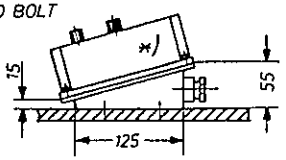
C.U.



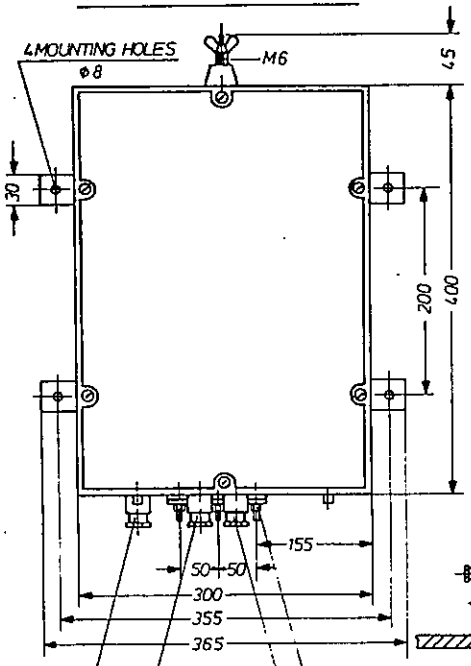


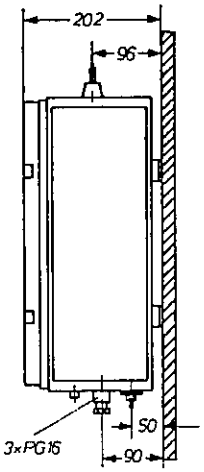
CONSOLE

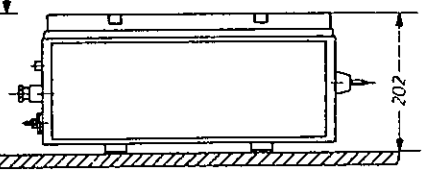




ANTENNA TUNING UNIT

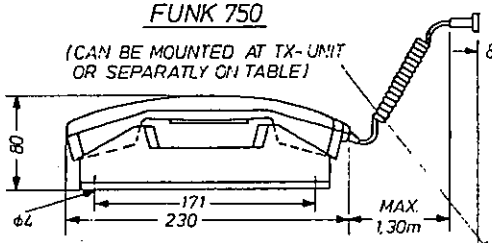


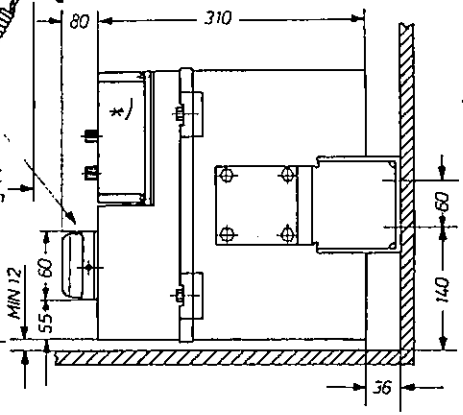




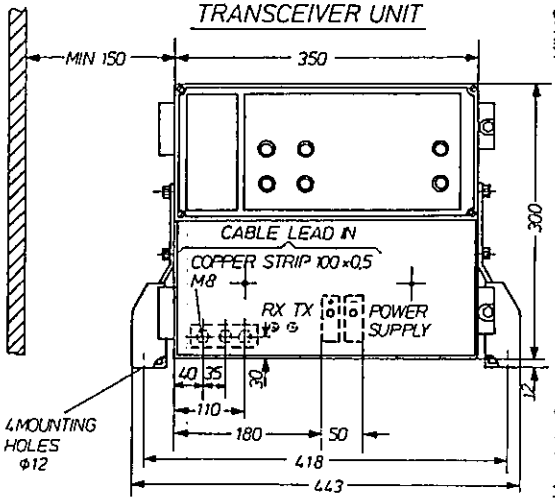
HANDSET WITH CRADLE FUNK 750

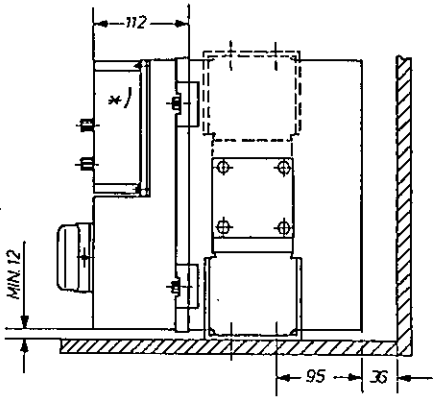
(CAN BE MOUNTED AT TX-UNIT OR SEPARATLY ON TABLE)





TRANSCEIVER UNIT





*) CONTROL UNIT CAN BE MOUNTED IN TRANSCEIVER UNIT OR SEPARATLY WITH CONSOLE

Magnet. Schutzabstände MAGN. SAFETY DISTANCE	deutsch GERMANY		ausländisch FOREIGN
	normal NORMAL	vermindert REDUCED	
Regelkomp. STANDARD			
Steuerkomp. STEERING			
Regelkomp. STANDARD			
Steuerkomp STEERING			

UNIT	APPR. WEIGHT
CONTROL UNIT	3 kg
ANTENNA TUNING UNIT	7 kg
TRANSCEIVER UNIT WITHOUT CU	23 kg

ALL DIMENSIONS IN mm

	Datum	Name
Bearbeitet	2.4.86	Drobne
Geprüft		
Bearbeitet		
Norm		

DEBEG

MHF/HF RADIOTELEPHONE 3120

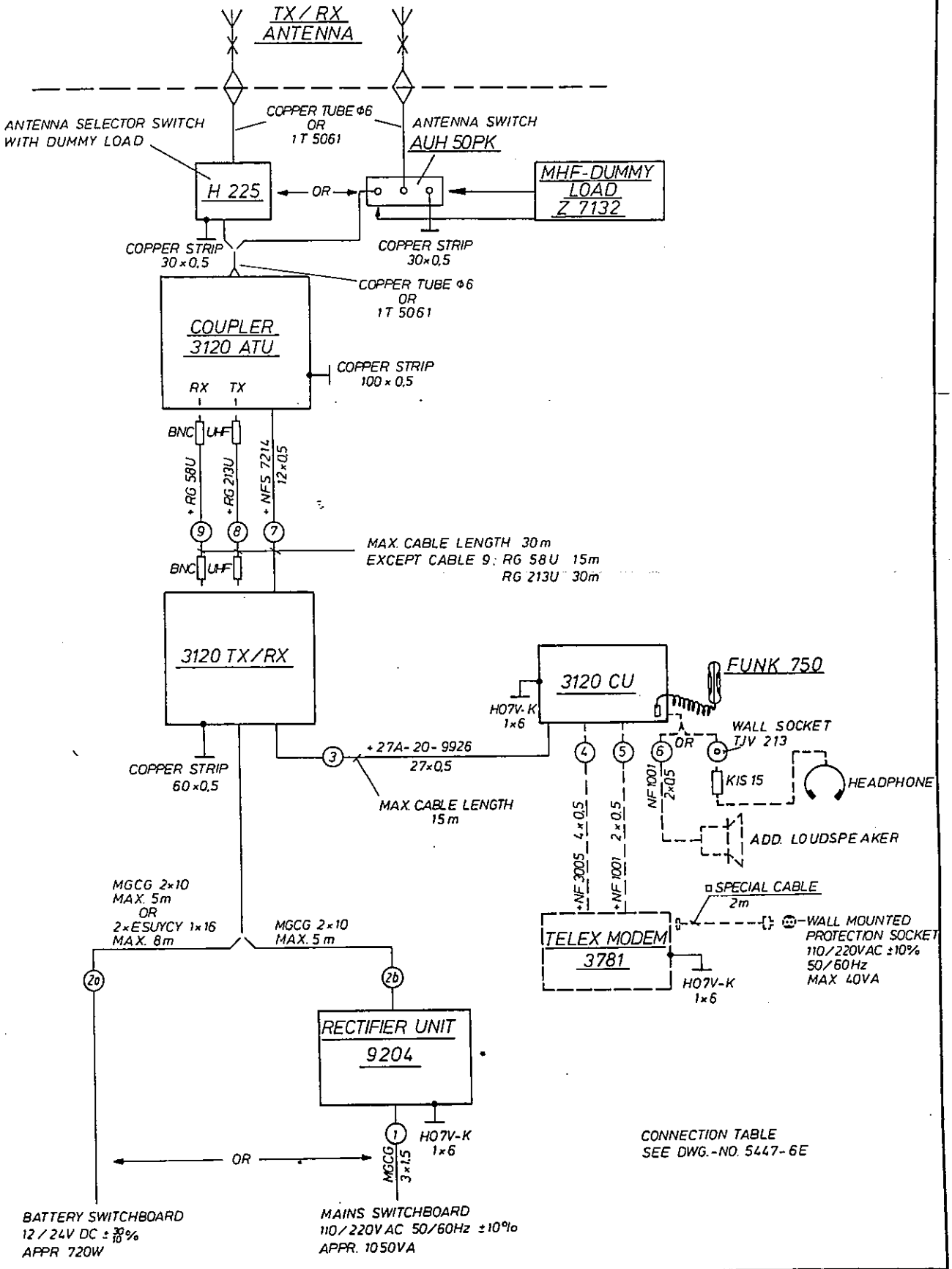
OUTLINE DIMENSIONS CONTROL UNIT, TRANSCEIVER UNIT AND ANTENNA TUNING UNIT

Maßstab —

Zeichnungs-Nr 5447-3E

Blatt —

Ausgabe | Änder.-Nr. | Datum | Name | Ursprung | Ersatz für | Ersetzt durch | — Blätter



TYPE, SIZE AND INSTALLATION OF CABLES IN ACCORDANCE WITH THE REGULATIONS OF THE COMPETENT CLASSIFICATION SOCIETIES ONLY.
ALL CABLES - EXCEPT □ - TO BE SUPPLIED BY THE SHIPYARD.
□ CABLE SUPPLIED WITH DEBEG EQUIPMENT.
ALL CABLES TO BE INSTALLED BY THE SHIPYARD.
× IN METALLIC CABLE CONDUIT.
+ IN METALLIC CABLE CONDUIT OR ON SEPARATE TRAY.

Ausgabe	Änder.-Nr.	Datum	Name
5	11598	4.11.87	Dr/La
4	11595	3.7.87	Dr/La
3	11588	12.3.87	Dr/La
2	13458	5.9.86	Ui

	Datum	Name
Gezeichnet	25.6.86	Dröhne
Geprüft		Hta
Bearbeitet		
Norm		
Ursprung		

DEBEG

MHF/HF RADIOTELEPHONE 3120

CABLE DIAGRAM
12/24V DC OR 110/220VAC

Maßstab: –

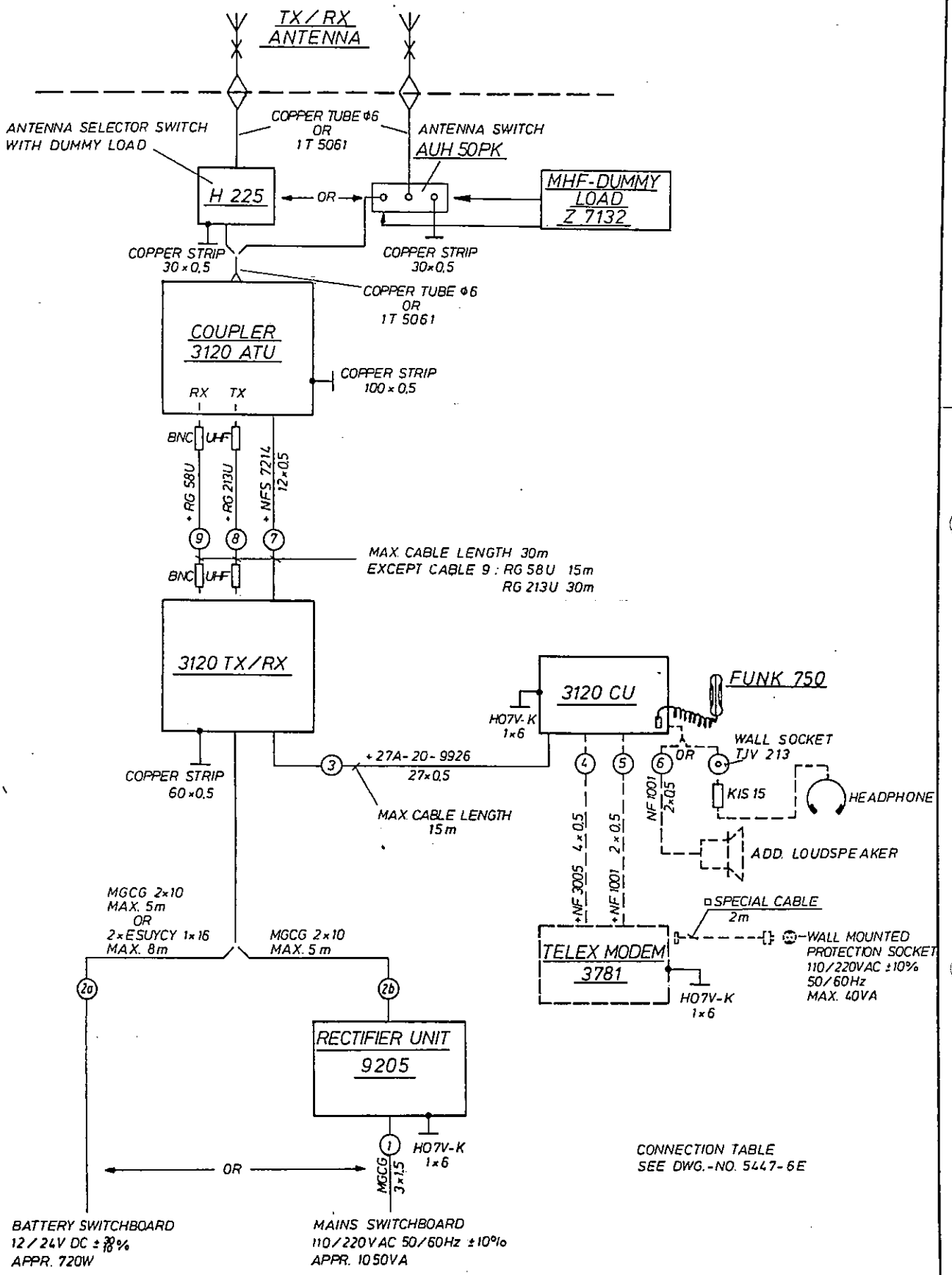
Zchngs.-Nr.: 5447-5E

Blatt: –

Ersatz für: 5447-1E

Ersatzt durch:

– Blätter



TYPE, SIZE AND INSTALLATION OF CABLES IN ACCORDANCE WITH THE REGULATIONS OF THE COMPETENT CLASSIFICATION SOCIETIES ONLY.
ALL CABLES - EXCEPT ¤ - TO BE SUPPLIED BY THE SHIPYARD.
¤ CABLE SUPPLIED WITH DEBEG EQUIPMENT.
ALL CABLES TO BE INSTALLED BY THE SHIPYARD.
* IN METALLIC CABLE CONDUIT.
+ IN METALLIC CABLE CONDUIT OR ON SEPARATE TRAY.

Ausgabe	Änder.-Nr.	Datum	Name
3	11598	4.11.87	Dr/La
2	11595	3.7.87	Dr/La

	Datum	Name
Gezeichnet	17.3.87	Dröhne
Geprüft		Lange
Bearbeitet		
Norm		

DEBEG

Ursprung

MHF/HF RADIOTELEPHONE 3120

CABLE DIAGRAM
12/24V DC OR 110/220V AC

Maßstab –

Zchngs-Nr. 5447-9E

Blatt –

Ersatz für

Ersetzt durch

– Blätter

CABLE TYPE: MGCG 3x1,5	CABLE NO.: 1	REMARKS: Cable Diagram see DWG. No. 5447-5E

FROM	TO
UNIT: MAINS Switch Board	UNIT: 9204 / 9205
PLUG CONSTRUCTION TYPE:	PLUG CONSTRUCTION TYPE:
PLUG TYPE:	PLUG TYPE:
PLUG POS. NO.:	PLUG POS. NO.:
TERMINAL POS. NO.:	TERMINAL POS. NO.:

CONTACT/TERMINAL NO.	CORE COLOUR	FUNCTION 9204	CONTACT/TERMINAL NO.
			+5V AC
	GR	0V AC	0V AC
			-5V AC
			210V AC
	BK	110/220V AC	220V AC
	RD	GROUND	GROUND
	SCREEN	GROUND	GROUND

CONTACT/TERMINAL NO.	CORE COLOUR	FUNCTION 9205	CONTACT/TERMINAL NO.
	GR	0V AC	2
	BK	110/220V AC	1
	RD	GROUND	GROUND
	SCREEN	GROUND	GROUND

Ausgabe	Ander-Nr	Datum	Name
4	11598	4.11.87	Dr/La
3	11588	17.3.87	Dr/La
2	13458	2.9.86	Hta

	Datum	Name
Gezeichnet	13 6 86	Ue
Geprüft		Hta
Bearbeitet		
Norm		

DEBEG

Ursprung

MHF/HF RADIOTELEPHONE 3120

CONNECTION TABLE
CABLE NO. 1

Maßstab: X

Zchngs-Nr. 5447-6E

Blatt 1

Ersatz 5447-4E für: 5447-10E

Ersetzt durch

10 Blätter

CABLE TYPE: MGCG 2x10 OR 2xESUYCY 1x16	CABLE NO.: 2a	REMARKS: Cable length MGCG max. 5m, Esuycy max. 8m. Cable Diagram see DWG No. 5447-5E

FROM

UNIT: BATT. Switchboard
PLUG CONSTRUCTION TYPE:
PLUG TYPE:
PLUG POS. NO.:
TERMINAL POS. NO.:

TO

UNIT: 3120 Tx/Rx
PLUG CONSTRUCTION TYPE:
PLUG TYPE:
PLUG POS. NO.:
TERMINAL POS. NO.: P6

CONTACT/TERMINAL NO.	CORE COLOUR		FUNCTION	CONTACT/TERMINAL NO.
	MGCG 2x10	GR	+12V/24VDC	1
		BK	-12V/24VDC	2
		SCREEN	GROUND	GROUND
OR				
	2x Esuycy 1x16	TRANSPARENT	+12V/24VDC	1
		SCREEN	GROUND	GROUND
		TRANSPARENT	-12V/24VDC	2
		SCREEN	GROUND	GROUND

CABLE TYPE: MGCG 2x10	CABLE NO.: 2b	REMARKS: Cable length MGCG max. 5m, CABLE Diagram see DWG. No 5447-5E

FROM

UNIT: 9204
PLUG CONSTRUCTION TYPE:
PLUG TYPE:
PLUG POS. NO.:
TERMINAL POS NO.:

TO

UNIT: 3120 Tx/Rx
PLUG CONSTRUCTION TYPE:
PLUG TYPE:
PLUG POS. NO.:
TERMINAL POS. NO.: P6

CONTACT/TERMINAL NO.	CORE COLOUR	FUNCTION	CONTACT/TERMINAL NO
+ 24V DC	GR	+24V DC	1
- 24V DC	BK	-24V DC	2
GROUND	SCREEN	GROUND	GROUND

Ausgabe	Ander-Nr.	Datum	Name
2	13458	2.9.86	Ha

	Datum	Name
Gezeichnet	13.6.86	li
Geprüft		
Bearbeitet		Ha
Norm		

DEBEG

Ursprung

MHF/HF RADIOTELEPHONE 3120

CONNECTION TABLE
CABLE NO. 2a/2b

Maßstab: /

Zchngs.-Nr. 5447-6E

Blatt 2

Ersatz für 5447-4E

Ersetzt durch

9 Blätter

CABLE TYPE: 27A-20-9926 27 x 0,5	CABLE NO.: 3	REMARKS: Cable Length max 15 m Cable Diagram see DWG.No. 5447-5E

FROM	TO
UNIT: 3120 Tx/Rx	UNIT: 3120 CU
PLUG CONSTRUCTION TYPE:	PLUG CONSTRUCTION TYPE:
PLUG TYPE:	PLUG TYPE:
PLUG POS. NO.:	PLUG POS. NO.:
TERMINAL POS. NO.: TB1	TERMINAL POS. NO.: TB1

CONTACT/TERMINAL NO.	CORE COLOUR	FUNCTION	CONTACT/TERMINAL NO.
1	BK	SOD	1
2	BN	SID	2
3	RD	I/O-G	3
4	OR	CM	4
5	YE	R	5
6	GN	RIT	6
7	BL	KEY	7
8	VI	KEY-G	8
9	GR	S/RF	9
10	WH	S/RF-G	10
11	WH/BK	RFG H	11
12	WH/BN	RFG R	12
13	WH/RD	PR SEL H	13
14	WH/OR	PR SEL R	14
15	WH/YE	+5V DC	15
16	WH/GN	+5V DC	16
17	WH/BL	+24V DC	17
18	WH/VI	+24V DC	18
19	WH/GR	G	19
20	BN/BK	G	20
21	BN/RD	MIC-AF	21
22	BN/OR	MIC-G	22
23	BN/YE	RX-AF	23
24	BN/GN	RX-G	24
	BN/BL	SPARE	
	BN/VI	SPARE	
	BN/GR	SPARE	
GROUND	SCREEN	GROUND	GROUND

Ausgabe	Änder-Nr.	Datum	Name
2	13458	29.86	Ha

	Datum	Name
Gezeichnet	13 6 86	Ri
Geprüft		Ha
Bearbeitet		
Norm		

DEBEG

Ursprung

MHF/HF RADIOTELEPHONE 3120

CONNECTION TABLE
CABLE NO. 3

Maßstab /

Zchngs-Nr. 5447-6E

Blatt 3

Ersatz für: 5447-4E

Ersetzt durch:

9 Blätter

CABLE TYPE: NF 6001 7x0,5	CABLE NO.: 4	REMARKS: CONNECTION Diagram 3781 see DWG NO. 5168-2E Cable Diagram see DWG. No. 5447-5E

FROM	TO
UNIT: 3120 CU	UNIT: TELEX MODEM 3781
PLUG CONSTRUCTION TYPE:	PLUG CONSTRUCTION TYPE: LF-PLUG MALE
PLUG TYPE:	PLUG TYPE: DEM 9P
PLUG POS NO.:	PLUG POS. NO.: BU 101
TERMINAL POS. NO.: TB2	TERMINAL POS. NO.:

CONTACT/TERMINAL NO.	CORE COLOUR	FUNCTION	CONTACT/TERMINAL NO.
1	BN	SIG-IN	2
2	BL	SI-G	6
5	GN	KEY-H	3
6	GR	KEY-R	5
GROUND	SCREEN	GROUND	7, 8, 9
	P	SPARE	
	WH	SPARE	
	YE	SPARE	

	Datum	Name
Gezeichnet	13. 6. 86	Hi
Geprüft		
Bearbeitet		Ha
Norm		

DEBEG

MHF/HF RADIOTELEPHONE 3120

CONNECTION TABLE
CABLE NO. 4

Maßstab: /

Zchngs.-Nr. 5447-6E

Blatt 4

Ausgabe	Ander-Nr.	Datum	Name	Ursprung
2	13458	2.9.86	Ha	

Ersatz für 5447-4E | Ersetzt durch

9 Blätter

CABLE TYPE: NF 1001 2×0.5	CABLE NO.: 5	REMARKS: Connection Diagram 3781 see DWG No. 5168-2E. Cable Diagram see DWG. No 5447-5E

FROM	TO
UNIT: 3120 CU	UNIT: TELEX MODEM 3781
PLUG CONSTRUCTION TYPE:	PLUG CONSTRUCTION TYPE: LF-PLUG FEMALE
PLUG TYPE:	PLUG TYPE: DEM 9 S
PLUG POS. NO.:	PLUG POS. NO.: ST 101
TERMINAL POS. NO.: TB 2	TERMINAL POS. NO.:

CONTACT/TERMINAL NO.	CORE COLOUR	FUNCTION	CONTACT/TERMINAL NO
3	WH	SIG-OUT	1
4	BN	SO-G	5
GROUND	SCREEN	⊥ GROUND	6, 7, 8, 9

					Datum	Name
				Gezeichnet	13. 6. 86	[illegible]
				Geprüft		Ha
				Bearbeitet		
				Norm		
2	13458	2.9.86	Ha	DEBEG		
Ausgabe	Änder-Nr.	Datum	Name	Ursprung		

MHF/HF RADIOTELEPHONE 3120

CONNECTION TABLE
CABLE NO. 5

Maßstab: /

Zchngs-Nr. 5447-6E

Blatt 5

Ersatz für: 5447-4E

Ersetzt durch:

Blätter:

CABLE TYPE: NF 1001 2x0.5	CABLE NO.: 6	REMARKS: Cable Diagram see DWG. No 5447-5E

FROM	TO
UNIT: 3120 Cu	UNIT: Ext. Loudspeaker OR Socket FOR HEADPHONE
PLUG CONSTRUCTION TYPE:	PLUG CONSTRUCTION TYPE:
PLUG TYPE:	PLUG TYPE:
PLUG POS. NO.:	PLUG POS. NO.:
TERMINAL POS. NO.: TB 2	TERMINAL POS. NO.:

CONTACT/TERMINAL NO.	CORE COLOUR	FUNCTION	CONTACT/TERMINAL NO.
9	WH	NF	
10	BN	NF ⊥	
GROUND	SCREEN	GROUND	

	Datum	Name
Gezeichnet	13. 6. 86	Ubi
Geprüft		
Bearbeitet		Hla
Norm		

DEBEG

MHF/HF RADIOTELEPHONE 3120

CONNECTION TABLE
CABLE NO. 6

Maßstab: /

Zchngs.-Nr. 5447-6E

Blatt 6

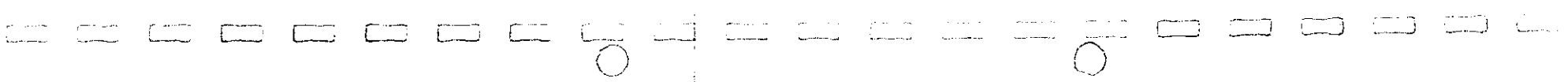
Ausgabe	Ander-Nr.	Datum	Name
2	13458	2.9.86	Hla

Ursprung

Ersatz für 5447-4E

Ersetzt durch

9 Blätter



CABLE TYPE: NF 7214 12x0,5	CABLE NO.: 7	REMARKS: Cable length max. 15m Cable Diagram see DWG. No. 5447-5E

FROM	TO
UNIT: 3120 Tx/Rx	UNIT: Coupler 3120 ATU
PLUG CONSTRUCTION TYPE:	PLUG CONSTRUCTION TYPE:
PLUG TYPE:	PLUG TYPE:
PLUG POS. NO.:	PLUG POS. NO.:
TERMINAL POS. NO.: TB 3	TERMINAL POS. NO.: TB 2

CONTACT/TERMINAL NO.	CORE COLOUR	FUNCTION	CONTACT/TERMINAL NO.
1	GN	G	1
2	RD	+24V	2
3	BL	RST	3
4	BK	G	4
5	BN	TUNE	5
6	VI	READY	6
7	OR	OL	7
8	PI	2182	8
9	GN	TX I TUNE	9
10	GR	KEY	10
11	YE	KEY G	11
12	WH	G	12
GROUND	SCREEN	GROUND	GROUND

Ausgabe	Ander-Nr.	Datum	Name
2	13458	2.9.86	Hfe

	Datum	Name
Gezeichnet	13. 6. 86	Ki
Geprüft		Hfe
Bearbeitet		
Norm		

DEBEG

Ursprung

MHF/HF RADIOTELEPHONE 3120

CONNECTION TABLE
CABLE NO. 7

Maßstab

Zchngs.-Nr. 5447-6E

Blatt 7

Ersatz für: 5447-4E

Ersetzt durch

9 Blätter

CABLE TYPE: RG 213/U	CABLE NO.: 8	REMARKS: Cable length max. 15m Cable Diagram see DWG. No. 5447-5E

FROM	TO
UNIT: 3120 TX/RX PLUG CONSTRUCTION TYPE: HF-PLUG-MALE PLUG TYPE: UHF PL 259 PLUG POS. NO.: J1 TERMINAL POS. NO.:	UNIT: COUPLER 3120 ATU PLUG CONSTRUCTION TYPE: HF-PLUG-MALE PLUG TYPE: UHF PL 259 PLUG POS. NO.: J1 TERMINAL POS. NO.:

CONTACT/TERMINAL NO.	CORE COLOUR	FUNCTION	CONTACT/TERMINAL NO.
	TRANSPARENT	TX-ANT.	
	SCREEN	GROUND	

Ausgabe	Änder-Nr.	Datum	Name		Datum	Name
2	13458	2.9.86	IHa	Gezeichnet	13.6.86	Ili
				Geprüft		IHa
				Bearbeitet		
				Norm		
				Ursprung		

DEBEG

MHF/HF RADIOTELEPHONE 3120

CONNECTION TABLE
CABLE NO. 8

Maßstab: ./.

Zchngs-Nr. 5447-6E

Blatt 8

Ersatz für: 5447-4E

Ersetzt durch:

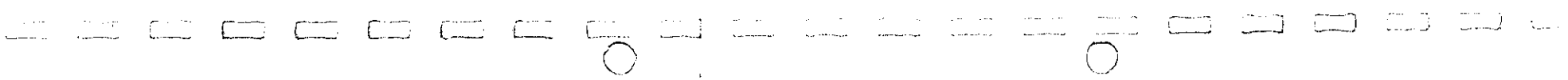
9 Blätter

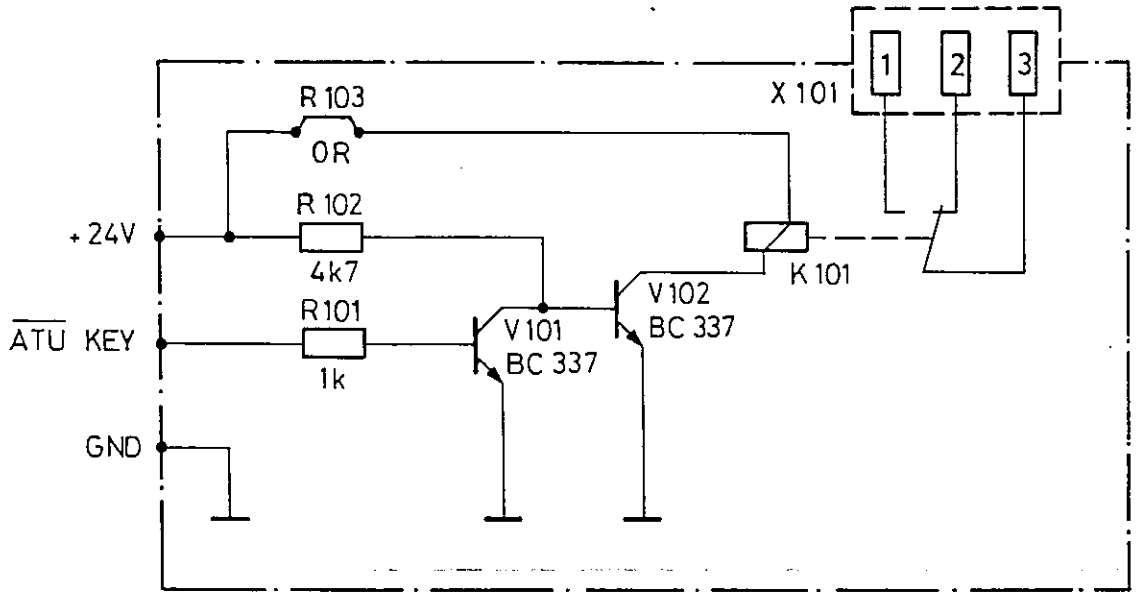
CABLE TYPE: RG 58/U	CABLE NO.: 9	REMARKS: Cable length max. 15m Cable Diagram see DWG. No. 5447-5E

FROM	TO
UNIT: 3120 TX/RX	UNIT: COUPLER 3120 ATU
PLUG CONSTRUCTION TYPE: HF-PLUG-MALE	PLUG CONSTRUCTION TYPE: HF-PLUG-MALE
PLUG TYPE: BNC UG-88 B/U	PLUG TYPE: BNC UG-88 B/U
PLUG POS. NO.: J2	PLUG POS. NO.: J2
TERMINAL POS. NO.:	TERMINAL POS. NO.:

CONTACT/TERMINAL NO.	CORE COLOUR	FUNCTION	CONTACT/TERMINAL NO.
	TRANSPARENT	RX-ANT.	
	SCREEN	GROUND	

					Datum	Name	MHF/HF RADIOTELEPHONE 3120	
				Gezeichnet	13. 6. 86	[illegible]	CONNECTION TABLE CABLE NO. 9	Maßstab /
				Geprüft		Ha		
				Bearbeitet				
				Norm				
				DEBEG			Zchngs-Nr. 5447-6E	Blatt 9
2	13458	2.9.86	Ha					
Ausgabe	Änder-Nr.	Datum	Name	Ursprung			Ersatz für: 5447-4E / Ersetzt durch	9 Blätter





TERMINAL TB3 CONTACT 2 +24V
CONTACT 10 ATU KEY

hierzu gehört: Stückliste Mat.-Nr. 031 6741

					Datum	Name
				Gezeichnet	1.10.87	Bo.
				Geprüft		
				Bearbeitet		
				Norm		

DEBEG

Ausgabe	Änder-Nr.	Datum	Name	Ursprung

RADIO TELEPHONE 3120 NL

Schaltbild CIRCUIT DIAGRAM

Relaisplatine RELAY PLATINE

Maßstab: -

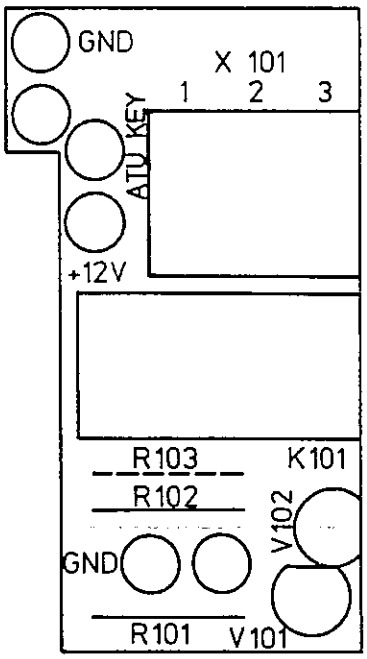
Zchngs.-Nr. 7455-1

Blatt

Ersatz für:

Ersetzt durch:

Blätter



Siebdruck, weiß RAL 90

hierzu gehört: Leiterbild : Zchngs.-Nr. 7455-2 Bl. 1 u. 2
Lötstopmaske :Zchngs.-Nr. 7455-2 Bl. 2
Bearbeitungszeichnung :Zchngs.-Nr. 7455-3

					Datum	Name
				Gezeichnet	28-09-87	
				Geprüft		
				Bearbeitet		
				Norm		
Ausgabe	Änder.-Nr.	Datum	Name	Ursprung		

DEBEG

RADIO TELEPHONE 3120NL

Bestückungsdruck
Relaisplatine

Maßstab 2:1

Zchngs.-Nr. 7455-3

Blatt

Ersatz für:

Ersetzt durch:

Blätter

STÜCKLISTE
PARTS LIST

A C H T U N G !

Bei Materialbestellungen bitten wir um folgende Angaben:

1. Ausgabedatum der Stückliste
2. Gerätetyp
3. Position lt. Stückliste
4. Materialnummer lt. Stückliste
5. Benennung lt. Stückliste

A T T E N T I O N !

If you want to order some spares, please let us know following details:

1. Edition of the Parts List
2. Type of Set
3. Position (according to the Parts List)
4. Partnumber " " " " "
5. Description " " " " "

AUSGABE: 07/91
EDITION:

Spare Part No.	Description
	CONTROL UNIT:
271.202264	PCB CONTROL SECTION CU
271.202265	PCB AF-SECTION CU
271.202266	PCB DISPLAY BOARD CU
271.202268	PCB CONTROL JUNCTION BOARD
	EXCITER UNIT:
271.202271	PCB T/R CONTROL
271.202272	PCB SYNTHESIZER (PLL)
271.202273	PCB RX-EXCITER
271.202278	PCB JUNCTION BOARD
271.202279	PCB PRESELECTOR BOARD
271.202311	PCB HANDSET FILTER BOARD
271.202308	LOW PASS FILTER MODULE
271.202276	PCB LOW PASS FILTER
271.202307	RF POWER AMPLIFIER MODULE
271.202274	PCB RF POWER AMPLIFIER 5PO2033
271.245246	PCB RF POWER AMPLIFIER 5PO3008
271.202277	POWER SUPPLY MODULE
271.202306	PCB A1 POWER SUPPLY
271.202329	PCB A2 POWER SUPPLY
271.202330	PCB A3 POWER SUPPLY
	ANTENNA TUNING UNIT:
271.202310	LC-NETWORK WITH UP-CONTROL MODULE
271.202269	PCB ATU UP-CONTROL
271.202270	PCB LC-NETWORK

PARTS LIST

1. System diagram
2. General diagram
3. Control unit
4. Control section
5. AF section
6. Display section
7. Handset filter
8. Remote control diagram
9. Junction board (for remote control)
10. T/R control
11. RX/Exciter
12. Frequency synthesizer
13. Pre-selector
14. Power amplifier
15. Low-pass filter
16. Power supply main circuit
17. Power supply A1 control
18. Power supply A2 DC/DC converter
19. Power supply A3 line interface
20. Junction board
21. ATU diagram
22. LC network
23. ATU control

PARTS LIST FOR SYSTEM DIAGRAM

A1	TRANSCEIVER UNIT
A2	ANTENNA TUNING UNIT

PARTS LIST FOR GENERAL DIAGRAM

A1	CONTROL UNIT	
A2	T/R CONTROL	
A3	RX/EXCITER	
A4	FREQUENCY SYNTHESIZER (PLL)	
A5	PRE SELECTOR	OPTION
A6	JUNCTION BOARD	
A7	POWER AMPLIFIER	
A8	LOW-PASS FILTER	
A9	POWER SUPPLY	
J1	M - R 2503 5/8 - 24UNEF - 2A	
J2	BNC - PJ 894 50 ohm	Included W2
P1	BNC - P - 3	Included W1
P2	TMP - P01X - B1	Included W2
P3	HNC2 - 2.5S - 3 3 poles	Included W3
P4	HIF3BA - 16D - 2.54R 16 poles	Included W4
P5	HIF3BA - 16D - 2.54R 16 poles	Included W4
P6	TMP - P01X - A1	Included W5
P7	TMP - P01X - A1	Included W5
P8	HIF3BA - 60D - 2.54R 60 poles	Included W6
P9	HIF3BA - 60D - 2.54R 60 poles	Included W6
P10	HIF3BA - 34D - 2.54R 34 poles	Included W7
P11	HIF3A - 34D - 2.54R 34 poles	Included W7
S1	ET103A32	

PARTS LIST FOR GENERAL DIAGRAM

W1	4645P00714C
W2	4645P00715C
W3	4645P00716C
W4	4645P00717C
W5	4645P00712C
W6	4645P00719C
W7	4645P00720C

PARTS LIST FOR CONTROL UNIT

A1	CONTROL SECTION		
A2	AF SECTION		
A3	DISPLAY BOARD		
A4	KEY BOARD		
A5	HANDSET FILTER BOARD		
J1	5051 - 10	10 poles	included W1
J2	5051 - 12	12 poles	included W2
J3	HIF3C - 20D - 2.54C	20 poles	included W3
J4	5051 - 02	2 poles	included W4
J5	5051 - 04	4 poles	included W5
J7	3C - 30	2 poles	
SP1	77R01	2 W max	
S1	SRN1026N		
S2	SRN1025S		
RV1	K16110 - 10KB	10 Kohm	1/10 W
RV2, 4	V16L4S(C26)15F B10 Kohm	10 Kohm with switch	1/10 W
RV3	K162A0 - 10KB +1 K Ω		1/10 W
W1	4645P00702		
W2	4645P00703		
W3	4645P00704		
W4	4645P00705		
W5	4645P00706		

PARTS LIST FOR CONTROL SECTION

Printed Circuit Board
Control Section 5P01765A Version 2

BATT1	GF50 - 3SA		3.6 V	
C1, 15, 16, 52 - 54, 81 - 84, 105 - 107, 112 - 114, 118, 120 - 122, 124 - 127	0.1 μ F	+ 80 % − 20 %	50 V	CER
C2 - 14	1000 PF	± 10 %	50 V	CER
C17 - 22, 85, 86, 88 - 90	0.01 μ F	+ 80 % − 20 %	50 V	CER
C23 - 51 55 - 80, 94 - 102	330 PF	± 10 %	50 V	CER
C87, 93, 103	10 μ F	± 20 %	25 V	AL
C104, 111 , 115 , 116, 123	47 μ F	± 20 %	10 V	AL
C108	10 μ F	± 20 %	16 V	AL
C117, 119, 128	47 μ F	± 20 %	16 V	AL
C109, 110	22 PF	± 5 %	50 V	CER
D1 - 14 , 17 - 19	1S1588			
D15	1SS97			
D16	HZ2B - 1		1.9~ 2.6 V	

PARTS LIST FOR CONTROL SECTION

IC1 , 16, 17	TD62503P	
IC2	74LS14	
IC3, 14, 15	74HC138P	
IC4	74HC32P	
IC5	μPD7810G - 36	
IC6	74HCT373P	
IC7	MBM27128 - 20	with IC26 - 2806 - GS4
IC8, 9	MBM2764 - 20	with IC26 - 2806 - GS4
IC10	TC5564PL - 15	
IC11	74HC273P	
IC12	74HC374P	
IC13	74HC95P	

J1	HIF3H - 34DA - 2.54DSA	34 poles
J2	HIF3H - 16DA - 2.54DSA	16 poles

P1	HIF3H - 50PA - 2.54DSA	50 poles
P2	FH1 - 12S - 2.54DSA	12 poles
P3	5046 - 12A	12 poles
P4	5046 - 10A	10 poles

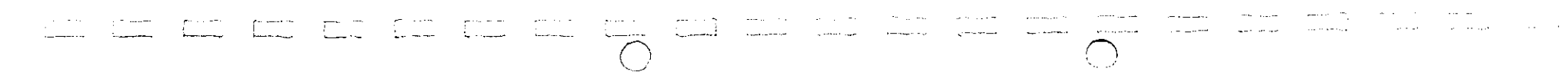
TR1	2SC1959 - Y
TR2 - 14	2SA1020 - O
TR15	2SA1015 - Y
TR16	2SC2786KF

TH1	D33A

R1	330 ohm× 7	±5 %	1/8 W	FRN
R2	10 ohm× 8	±5 %	1/8 W	FRN
R3, 4	1 Kohm× 7	±5 %	1/8 W	FRN
R5, 6	10 Kohm× 7	±5 %	1/8 W	FRN
R7	10 Kohm× 6	±5 %	1/8 W	FRN
R8	47 ohm× 7	±5 %	1/8 W	FRN
R9	10 Kohm× 8	±5 %	1/8 W	FRN
R10	47 ohm× 8	±5 %	1/8 W	FRN

PARTS LIST FOR CONTROL SECTION

R11, 12, 19, 21, 22	1 Kohm	±5 %	1/6 W	CAR
R13, 15	47 ohm	±5 %	1/6 W	CAR
R14	100 ohm	±5 %	1/6 W	CAR
R16	10 Kohm	±5 %	1/6 W	CAR
R17	15 Kohm	±5 %	1/6 W	CAR
R18, 20	4.7 Kohm	±5 %	1/6 W	CAR
R23	220 ohm	±5 %	1/6 W	CAR
R24	820 ohm	±5 %	1/6 W	CAR
X1	4515P00342	6.5536 MHz		
PCB1	8545P01765A			



PARTS LIST FOR AF SECTION

Printed Circuit Board
AF SECTION 5P01545B Version 2

C1, 5, 7, 8, 15, 25, 32, 35, 36, 38, 39, 46, 47, 56, 57, 87, 89, 96, 98, 102, 103, 104	10 μF	± 20 %	25 V	AL
C2	100 μF	± 20 %	25 V	AL
C3, 4, 6, 61, 70, 72, 73, 77	1000 PF	± 10 %	50 V	CER
C9, 54, 55, 60	1 μF	± 20 %	50 V	AL
C10, 11, 13	0.01 μF	± 10 %	50 V	FILM
C12, 17 - 20	0.022 μF	± 10 %	50 V	FILM
C14, 21	10 μF	± 20 %	25 V	TAN
C16, 22, 28 - 30, 45, 48 51 - 53, 58	4.7 μF	± 20 %	50 V	AL
C26	2.2 μF	± 20 %	16 V	TAN
C27	4700 PF	± 10 %	50 V	FILM
C31	100 PF	± 5 %	50 V	CER
C37, 49	68 PF	± 5 %	50 V	CER
C41 - 44, 59, 71, 74 - 76, 78, 79 - 86, 88, 90 - 95, 97, 99 - 101	0.01 μF	+ 80 % − 20 %	50 V	CER
C62, 65 - 68	470 μF	± 20 %	25 V	CER
C63, 69	0.1 μF	± 10 %	50 V	FILM
C64	470 μF	± 20 %	10 V	AL
D1, 12	HZ6C - 1		5.8 - 6.1 V	
D2, 3	HZ3C - 1		3.1 - 3.3 V	

PARTS LIST FOR AF SECTION

D4 - 7, 10, 11	1S1588			
D8, 9	HZ3A - 1		2.5 - 2.7 V	
D13 - 15	1SS97			
D16, 17, 20, 21	S5500B			
D18	HZ5C - 1		4.9 - 5.1 V	
D19	1S2471			
IC1	IR2433			
IC2	NJM2903D			
IC3	NJM082D			
IC4	SL6270C - DP			
IC5, 6	NJM4556D			
IC7	μPC2002H			
IC8 - 10	TC4066BP			
IC11	TC4001BP			
IC12	TC4011UBP			
IC13	NJM7815A		15 V	
IC14	TA78L075AP		0.75 V	
J1	HIF3H - 50DA - 2.54DSA		50 poles	
P1	HIF3F - 34PA - 2.54DSA		34 poles	
P2	5046 - 4A		4 poles	
P3	HIF3F - 20PA - 2.54DSA		20 poles	
P4	5046 - 2A		2 poles	
K1	MR62 - 12SR	12 V		
L1 - 5	220 μH	$\pm$ 10 %		
R1	10 Kohm $\times$ 8	$\pm$ 5 %	1/8 W	FRN
R2, 4, 68, 84, 110, 46	15 Kohm	$\pm$ 5 %	1/4 W	CAR
R3, 9, 12, 18, 19, 30, 38, 80, 94, 109	4.7 Kohm	$\pm$ 5 %	1/4 W	CAR

PARTS LIST FOR AF SECTION

R5, 6, 11, 13, 22, 23, 66, 67, 75, 81, 87, 90, 96, 104, 83	10 Kohm	± 5 %	1/4 W	CAR
R7, 60, 89, 91	47 Kohm	± 5 %	1/4 W	CAR
R8, 93	22 ohm	± 5 %	1/4 W	CAR
R10, 32, 40, 80	2.2 Kohm	± 5 %	1/4 W	CAR
R14, 15, 17, 21, 24, 28, 36, 55	1 Kohm	± 5 %	1/4 W	CAR
R16, 44	330 ohm	± 5 %	1/4 W	CAR
R20, 43, 45	27 Kohm	± 5 %	1/4 W	CAR
R25, 26, 33, 34	2.7 Kohm	± 5 %	1/4 W	CAR
R27, 35, 59, 82, 97	6.8 Kohm	± 5 %	1/4 W	CAR
R29, 37	1.2 Kohm	± 5 %	1/4 W	CAR
R31, 39	180 ohm	± 5 %	1/4 W	CAR
R41, 58, 70, 92	22 Kohm	± 5 %	1/4 W	CAR
R42, 74, 105	3.3 Kohm	± 5 %	1/4 W	CAR
R53	68 ohm	± 5 %	1/4 W	CAR
R54, 86	1 Mohm	± 5 %	1/4 W	CAR
R56, 57, 61, 72, 73, 76	100 Kohm	± 5 %	1/4 W	CAR
R62	39 Kohm	± 5 %	1/4 W	CAR
R64, 71, 107	680 ohm	± 5 %	1/4 W	CAR
R65, 69	1.5 Kohm	± 5 %	1/4 W	CAR
R78, 79, 85, 95	560 ohm	± 5 %	1/4 W	CAR
R98, 99	10 ohm	± 5 %	3 W	METAL
R100	220 ohm	± 5 %	1 W	METAL
R101	2.2 ohm	± 5 %	1/4 W	CAR
R102	220 ohm	± 5 %	1/4 W	CAR
R103	1 ohm	± 5 %	1 W	METAL
R106	18 Kohm	± 5 %	1/4 W	CAR
R108	470 ohm	± 5 %	1/4 W	CAR
R111	47 ohm	± 5 %	1/4 W	CAR

PARTS LIST FOR DISPLAY

Printed Circuit Board Display 5P01544A

D1,4	GL4PR5		red	
D2	GL4PG5		gre	
D3,19 - 43	GL4HY5		yel	
D5 - 17	TLY333T	7 segments	yel	
D18	GL112H9	12 segments	yel	
P1	HIF3H - 34PB - 2.54DSA		34 poles	
P2	HIF3H - 16PB - 2.54DSA		16 poles	
R1,2	1 Kohm	± 5 %	1/4 W	CAR
R3 - 7	680 ohm	± 5 %	1/4 W	CAR
PCB1	8545P01544A			

PARTS LIST FOR HANDSET FILTER BOARD

Printed Circuit Board
Handset Filter Board 5P02038 Version 2

C1 - 6	0.01 μF	+ 80 % − 20 %	50 V	CER
L1 - 3	220 μH	± 10 %		
J6	1506 - L	6 poles		
PCB1	8545P02038			

PARTS LIST FOR REMOTE CONTROL UNIT

A1	JUNCTION BOARD	
P1	HIF3BA - 34D - 2.54R	Included W1
P2	HIF3 A - 34D - 2.54R	Included W1
P3	5.5 - 250B	Included W2
P4	5.5 - 6	Included W2
P5	171511 - 1	Included W3
P6	171512 - 3	Included W3
W1	4645P00778A	
W2	4645P00815A	
W3	4645P00820	

PARTS LIST FOR JUNCTION BOARD
(Remote Control)

Printed Circuit Board
Junction Board 5P01555B Version 2

J1	HIF3BA - 34PA - 2.54DS	34 poles
TB1	S - 306 - 24P	24 poles
TB2	S - 306 - 10P	10 poles
TB3 - 5	P - 91	with LTO - 81T - 250N
PCB1	8545P01555B	

PARTS LIST FOR T/R CONTROL

Printed Circuit Board
T/R CONTROL 5P01738A Version 2

C1, 59, 116, 117, 122, 128, 137, 138, 142, 144, 159	10 μ F	± 20 %	25 V	AL
C59, 121	10 μ F	± 20 %	35 V	AL
C129	33 μ F	± 20 %	16 V	AL
C134, 135	33 μ F	± 20 %	35 V	AL
C2 - 8, 18 - 38, 40, 41 48 - 55, 57, 58, 61 - 73, 75 - 80, 84, 86 - 89, 92 - 115, 127, 139, 141, 143, 145, 160, 161	0.1 μ F	+ 80 % − 20 %	50 V	CER
C10 - 17	470 PF	± 10 %	50 V	CER
C42 - 47, 60, 81 - 83, 118 - 120	0.01 μ F	+ 80 % − 20 %	50 V	CER
C90, 91, 123, 124, 140	1000 PF	± 10 %	50 V	CER
C130, , 133, 136, 146 - 158	0.47 μ F	+ 80 % − 20 %	50 V	CER
C131, 132	22 PF	± 5 %	50 V	CER
C162	0.18 μ F	± 10 %	50 V	CER
C126	3.3 μ F	± 20 %	25 V	TAN
C163, 164, 167, 168	0.1 μ F	± 10 %	50 V	CER
C165, 166	1 μ F	± 10 %	50 V	CER

PARTS LIST FOR T/R CONTROL

D1, 10, 12, 14 - 17, 21, 26, 28 - 33	1S1588		
D2 - 9	HZ5B - 1	4.6 - 4.8 V	
D22	1SS97		
D23	HZ5C - 1		
D24	1S2471		
D25, 27	HZ6C - 1		
IC1, 4	74HC244P		
IC2, 5, 8, 13	74HC273P		
IC3, 7, 9, 10, 14, 15, 22, 27	TD62003P		
IC11	74LS14		
IC16	μPD7810G - 36		
IC17	74HCT373P		
IC18	MBM2764 - 20 with IC26 - 2806 - GS4	28 poles	
IC19	M5L8155P		
IC20	NJM082D		
IC21	NJM2901N		
IC23, 24, 26	4066		
IC25	NJM7812A	12 V	
IC28	HD14584B		
IC29	TC4001BP		
IC30	74HC157P		
L1 - 4, 6 - 8, 10 - 13	220 μH	± 10 %	
L5, 9	10 mH	± 10 %	
J1	HIF2B - 34D - 2.54RA	34 poles	included W1
J2	HIF2B - 10D - 2.54RA	10 poles	included W2
J3	HIF2B - 20D - 2.54RA	20 poles	included W3
J4	HIF3H - 50DA - 2.54DSA	50 poles	

PARTS LIST FOR T/R CONTROL

P1	HIF3BA- 60PA - 2.54DSA		60 poles	
P2	HIF3BA- 34D - 2.54R		34 poles	included W1
P3	HIF3BA- 10D - 2.54R		10 poles	included W2
P4	HIF3BA- 20D - 2.54R		20 poles	included W3
R1 - 8, 11 - 30, 40, 60, 62, 64, 66, 68, 117	470 ohm	±5 %	1/6 W	CAR
R9, 10, 72, 73 , 75 - 80, 96, 97, 100, 101, 103, 104, 106, 108, 112, 113, 118, 148, 150, 152, 154, 156, 158	1 Kohm	±5 %	1/6 W	CAR
R41 - 59, 61, 63, 65, 67, 69	47 ohm	±5 %	1/6 W	CAR
R70	3.3 ohm	±5 %	2 W	METAL
R71, 81, 82, 87, 95, 98, 99, 132, 134	10 Kohm	±5 %	1/6 W	CAR
R74, 85 , 90 - 91, 121, 149	22 Kohm	±5 %	1/6 W	CAR
R83, 93, 94, 109 - 111, 114, 166, 167	4.7 Kohm	±5 %	1/6 W	CAR
R84, 135, 136, 138	100 Kohm	±5 %	1/6 W	CAR
R86, 89, 141 - 146, 31 - 36, 38, 39	100 ohm	±5 %	1/6 W	CAR
R88, 119	3.3 Kohm	±5 %	1/6 W	CAR
R102, 105, 107, 124	1.5 Kohm	±5 %	1/6 W	CAR
R115, 120, 122, 131, 133	2.2 Kohm	±5 %	1/6 W	CAR

PARTS LIST FOR T/R CONTROL

R116, 137, 153, 92	47 Kohm	±5 %	1/6 W	CAR
R123	12 Kohm	±5 %	1/6 W	CAR
R125, 127	4.7 Kohm× 8	±5 %	1/8 W	FRN
R139, 140 , 155	27 Kohm	±5 %	1/6 W	CAR
R151	82 Kohm	±5 %	1/6 W	CAR
R161	33 Kohm	±5 %	1/6 W	CAR
R162 - 165	75 Kohm	±5 %	1/6 W	CAR
R147	68 Kohm	±5 %	1/6 W	CAR
RV1 - 3	50 Kohm	±20 %	0.3 W	VAR

TR1, 5, 9, 10	2SA1015 - Y	
TR2, 4, 8, 11	2SC1815	
TR3	2SC1959 - Y	
TR6	2SC3299	
TP1	TP - 8G	
X1	4515P00342	6.5536 MHz
PCB1	8545P01738A	
W1	4645P00707C	
W2	4645P00708C	OPTION
W3	4645P00709C	

PARTS LIST FOR RX/EXCITER

Printed Circuit Board
RX/EXCITER 5P02077 Version 2

C1, 3, 4, 8, 12, 13 , 191, 217, 234, 236, 238, 240 - 242, 244, 372, 373, 376, 377	10 μF	± 20 %	25 V	AL
C2, 30, 32 - 34, 36, 37, 39, 41 - 45, 153, 154, 156, 157 - 161, 163, 164, 165, 302, 305 - 313, 318, 330	4700 PF	+ 80 % − 20 %	50 V	CER
C5 - 7, 9 - 11, 14, 15, 17 - , 24 - 27, 35, 40, 81, 83, 169, 174, 175, 178 - 180, 182, 185, 201, 202 - 204, 206, 207 - 209, 213, 214, 215, 218, 220, 221, 228, 229, 231, 233, 246, 247, 250, 317, 319 - 322, 324, 327, 328, 331, 341 - 366, 21, 22	0.022 μF	+ 80 % − 20 %	50 V	CER
C16, 23, 28, 29, 31, 54 - 80, 82, 84 - 86, 108, 109, 114, 115, 121, 122, 127, 128, 133, 134, 136, 141, 142, 147, 148, 150 - 152, 170, 171, 173, 181, 186 - 190, 205, 20	0.1 μF	+ 80 % − 20 %	50 V	CER

PARTS LIST FOR RX/EXCITER

C212, 216, 219, 224, 232, 235, 239, 243, 245, 248, 251, 301, 315, 323, 325, 326, 332 - 334, 367, 370, 374, 375, 378 - 381	0.1 μF	+ 80 % − 20 %	50 V	CER
C38, 155, 162	15 PF	± 5 %	50 V	CER
C46	68 PF	± 5 %	50 V	CER
C47, 222	47 PF	± 5 %	50 V	CER
C48, 52	56 PF	± 5 %	50 V	CER
C49, 50	82 PF	± 5 %	50 V	CER
C51, 107, 110	180 PF	± 10 %	50 V	CER
C53, 117, 123, 143 - 146, 149, 167, 168, 210, 211	0.47 μF	+ 80 % − 20 %	50 V	CER
C104	150 PF	± 5 %	50 V	CER
C105	120 PF	± 5 %	50 V	CER
C106	220 PF	± 10 %	50 V	CER
C111	560 PF	± 10 %	50 V	CER
C112	330 PF	± 10 %	50 V	CER
C113, 116, 117, 118, 192, 225	1000 PF	± 10 %	50 V	CER
C119	1500 PF	± 10 %	50 V	CER
C120	1800 PF	± 10 %	50 V	CER
C124, 126	4700 PF	± 10 %	50 V	CER
C125	3300 PF	± 10 %	50 V	CER
C130, 132	5600 PF	± 10 %	50 V	CER
C131	0.015 μF	± 10 %	100 V	CER
C137, 139	0.039 μF	± 10 %	50 V	CER
C138	0.01 μF	± 10 %	50 V	CER
C166, 176, 177, 183, 184	390 PF	± 10 %	50 V	CER
C226, 227, 369	47 μF	± 20 %	25 V	AL

PARTS LIST FOR RX/EXCITER

C237	100 PF	± 5 %	50 V	CER
C303, 304	39 PF	± 5 %	50 V	CER
C314, 316	27 PF	± 5 %	50 V	CER
C368	47 μF	± 20 %	50 V	AL
C371, 172	0.1μF	± 10 %	50 V	CER

D1 - 13, 21 - 32, 36 - 38, 42 - 44, 58, 60	1S2588	
D14, 45, 46, 53, 54, 57, 76	1SS97	
D15, 16, 47, 49, 50, 52, 55, 56, 59, 62 - 75, 77	1S1588	
D17 - 20	MI402	
D33 - 35, 39 - 41	MI204	
D48	HZ2B - 1	1.9 - 2.6 V
D51	HZ9B - 2	8.5 - 8.9 V
D61	HZ6C - 2	6.0 - 6.3 V
FL1	4515P00345	70.455 MHz
FL2	MF - 455 - 12GZ	
FL3	MF - 33C	with muching transformer (T10, 11)
FL4	MF - 32C	with muching transformer (T12, 13)

PARTS LIST FOR RX/EXCITER

IC 3 - 6, 8	TC4066BP	
IC2	SN16913P	
IC7	NJM4556D	
IC9	L3K	
IC10	TA78L075AP	0.75 V
IC11	4155P00445	
IC12	NJM7815A	15 V
IC13	HD14584BP	

L1	10 mH	± 10 %
L2, 18, 23, 29, 52, 55	220 μH	± 10 %
L3, 4, 19, 56, 57	2.2 μH	± 20 %
L5, 8 - 10, 17	0.33 μH	± 20 %
L6, 7	0.1 μH	± 20 %
L11 - 13	47 μH	± 10 %
L14	0.47 μH	± 20 %
L15, 22	0.56 μH	± 20 %
L16	0.27 μH	± 20 %
L20	1.0 μH	± 20 %
L21	1.5 μH	± 20 %
L24	18 μH	± 10 %
L25, 50, 51	4.7 μH	± 10 %
L26	3.9 μH	± 10 %
L27, 28	2.7 μH	± 20 %
L30	100 μH	± 10 %
L31, 33	6.8 μH	± 10 %
L32, 37	10 μH	± 10 %
L34, 39	1 mH	± 10 %
L35, 49	470 μH	± 10 %
L36, 38	27 μH	± 10 %
L40, 44, 45, 47, 48	2.2 mH	± 10 %
L41, 43	22 μH	± 10 %
L42	82 μH	± 10 %

PARTS LIST FOR RX/EXCITER

L53	0.18 μH	± 20 %		
L54	0.12 μH	± 20 %		
R14, 126	180 ohm	± 5 %	1/6 W	CAR
R1, 3	750 ohm	± 5 %	1/6 W	CAR
R2, 19, 362	2.7 Kohm	± 5 %	1/6 W	CAR
R4, 10, 16, 127	680 ohm	± 5 %	1/6 W	CAR
R5, 17, 31, 36, 40, 74, 76, 120, 122, 140, 142, 150, 210, 220, 226, 240, 257, 266, 281	100 ohm	± 5 %	1/6 W	CAR
R6, 7, 18, 41, 85, 113, 116, 119, 133, 136, 139, 145, 251, 280	1 Kohm	± 5 %	1/6 W	CAR
R8, 23, 24, 37, 38, 57, 67, 69, 70, 77, 80, 92, 125, 148, 158, 159, 327, 241, 261, 306, 307, 315, 325	2.2 Kohm	± 5 %	1/6 W	CAR
R128	15 ohm	± 5 %	1/6 W	CAR
R9, 28, 35, 39, 42, 53, 62, 78, 164, 165, 227 - 229, 255, 262, 263, 279, 329, 337	4.75 Kohm	± 5 %	1/6 W	CAR
R48, 102 - 104, 106, 108, 110, 209, 219	220 ohm	± 5 %	1/6 W	CAR
R12, 13, 43, 44, 63, 123, 203, 213, 249, 259, 268, 273, 276, 324, 331, 332, 335, 352	10 Kohm	± 5 %	1/6 W	CAR

PARTS LIST FOR RX/EXCITER

R156	150 Kohm	± 5 %	1/6 W	CAR
R15	62 ohm	± 5 %	1/6 W	CAR
R20,21,26,27,151 - 154,157,160,163,166, 205,271,272,274,282	100 Kohm	± 5 %	1/6 W	CAR
R22,25,155,161,162, 167, 168,258,349	3.3 Kohm	± 5 %	1/6 W	CAR
R29,30,46,91,94 - 96, 98,99,202,207,212, 217,221,222,235,238, 239,248,345 - 348, 356 - 358	22 Kohm	± 5 %	1/6 W	CAR
R83,121,141	120 ohm	± 5 %	1/6 W	CAR
R32,224,267,316	1.5 Kohm	± 5 %	1/6 W	CAR
R33	10 ohm	± 5 %	1/6 W	CAR
R34,129	39 ohm	± 5 %	1/6 W	CAR
R45,206,216	120 Kohm	± 5 %	1/6 W	CAR
R47,72,84,90,131,146, 149	22 ohm	± 5 %	1/6 W	CAR
R49,66,114,115,132, 134,135,147,204,208, 214,218,237,242,243, 250,305	47 ohm	± 5 %	1/6 W	CAR
R50,52,58,60,71,73,79	270 ohm	± 5 %	1/6 W	CAR
R51,59	18 ohm	± 5 %	1/6 W	CAR
R55	51 ohm	± 5 %	1/6 W	CAR
R61,65,310,318	390 ohm	± 5 %	1/6 W	CAR
R64,81,82	3.3 ohm	± 5 %	1/6 W	CAR
R75	68 ohm	± 5 %	1/6 W	CAR

PARTS LIST FOR RX/EXCITER

R86, 230, 232, 235	330 ohm	± 5 %	1/6 W	CAR
R87, 278, 328	560 ohm	± 5 %	1/6 W	CAR
R88, 309, 317	6.8 ohm	± 5 %	1/6 W	CAR
R93, 302, 312, 323	1 Mohm	± 5 %	1/6 W	CAR
R97, 144, 201, 211, 215, 340, 341	15 Kohm	± 5 %	1/6 W	CAR
R117, 137, 247	220 Kohm	± 5 %	1/6 W	CAR
R118, 124, 138, 143, 264	6.8 Kohm	± 5 %	1/6 W	CAR
R350, 359 - 361	12 Kohm	± 5 %	1/6 W	CAR
R11, 68, 256, 265, 301, 313, 322, 333, 334	470 ohm	± 5 %	1/6 W	CAR
R236, 254, 269, 270	47 Kohm	± 5 %	1/6 W	CAR
R233	390 ohm	± 5 %	1/6 W	CAR
R246, 253, 336, 363	33 Kohm	± 5 %	1/6 W	CAR
R252	470 Kohm	± 5 %	1/6 W	CAR
R260, 275	5.6 Kohm	± 5 %	1/6 W	CAR
R308, 319, 321	56 ohm	± 5 %	1/6 W	CAR
R330	620 ohm	± 5 %	1/6 W	CAR
R342, 277	39 Kohm	± 5 %	1/6 W	CAR
R343	3.3 Kohm	± 5 %	1/6 W	CAR
R351	1.8 Kohm	± 5 %	1/6 W	CAR
R89	56 ohm	± 5 %	1/4 W	CAR
R111	820 ohm	± 5 %	1/4 W	CAR
R112	560 ohm	± 5 %	1/4 W	CAR
R56	750 ohm	± 5 %	1/4 W	CAR
R353	10 Kohm× 8	± 2 %	1/8 W	FRN
R354	10 Kohm× 6	± 5 %	1/8 W	FRN
R355	10 Kohm× 5	± 5 %	1/8 W	FRN
RV1	1 Kohm	± 20 %	0.3 W	VAR
RV2, 4, 8	500 ohm	± 20 %	0.3 W	VAR

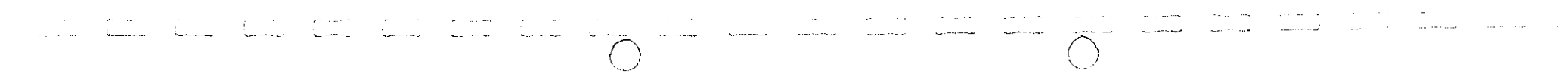
PARTS LIST FOR RX/EXCITER

RV3	5 Kohm	± 20 %	0.3 W	VAR
RV6	50 Kohm	± 20 %	0.3 W	VAR
RV7, 9, 10	10 Kohm	± 20 %	0.3 W	VAR

T1, 7, 8	4455P00215	
T2	4455P00220	
T3	4455P00359	
T4	4455P00222	
T5	4455P00223	
T6	4455P00224	
T9	4455P00218	
T10, 11	R0E45134X	
T12, 13	R0E45133X	
T14 - 16	4495P00063	
T17	E14P - 101	600 : 600 ohm
T18	4495P00487	
TH1, 2	D - 61A	
TR1, 2, 8, 11, 12, 16, 17, 24 - 26, 28, 29, 32, 35 - 37, 40, 42, 44 - 46, 49	2SC2786KF	
TR3, 22, 23	3SK73GR	
TR4	2SC1906	
TR5	2SC2053	
TR6, 13, 41, 43	2SC1426	
TR7, 30, 31, 47, 50	2SC1959 - Y	
TR9, 10, 34, 48, 51 - 57	2SA1015 - Y	
TR14, 15, 18 - 21	2SK125	
TR33, 38, 39	2SK30ATM - Y	

PARTS LIST FOR RX/EXCITER

TP1 - 12	WT - 8 - 3	
TP13 - 20	TP - 8G	
J1 - 5	TMP - J01X - V2	
J6	HIF3F - 34PA - 2.54DSA	34 poles
J7	HIF3F - 20PA - 2.54DSA	20 poles
M1,2	M8 - 8P	
SH1,2	MC203B840	
PCB1	8545P02077	



PARTS LIST FOR FREQUENCY SYNTHESIZER (PLL SECTION)

Printed Circuit Board
PLL SECTION 5P02078 Version 2

C1, 9 - 11, 14, 15, 18, 22, 24, 38, 40, 45, 46, 49, 52, 68, 88, 90 - 92, 94, 100, 107, 151, 160 - 162, 164, 189, 201, 223, 237 - 239, 241, 254, 255	0.1 μF	+ 80 % − 20 %	50 V	CER
C2	6800 PF	± 10 %	50 V	CER
C3	6200 PF	± 5 %	50 V	CER
C4, 8, 185, 203	10 μF	± 20 %	25 V	AL
C5	9100 PF	± 5 %	50 V	CER
C6	3900 PF	± 10 %	50 V	CER
C7, 17, 21, 23, 53, 89, 184, 190, 196, 202, 208, 215, 216, 221, 225, 242, 250	0.47 μF	+ 80 % − 20 %	50 V	CER
C12	390 PF	± 10 %	50 V	CER
C13	680 PF	± 10 %	50 V	CER
C16, 243	270 PF	± 10 %	50 V	CER
C19, 20	330 PF	± 10 %	50 V	CER

PARTS LIST FOR FREQUENCY SYNTHESIZER (PLL SECTION)

C25 - 28, 34, 37, 43, 44, 47, 50, 57, 58, 60, 61, 63, 65 - 67, 70, 74, 75, 78, 82, 83, 95, 97, 101, 102, 103, 108, 109, 110, 113, 114, 117, 118, 121 - 124, 128, 129, 130, 134, 135 - 137, 139, 140, 143, 144, 147, 148, 152, 153, 154, 187, 193, 199, 205, 209, 211, 213, 218, 219, 226, 227 - 229, 231, 232 - 235, 240, 244, 249, 251, 252, 253	0.01 μF	+ 80 % − 20 %	50 V	CER
C29 - 32	27 PF	± 5 %	50 V	CER
C33, 35, 73, 76	220 PF	± 10 %	50 V	CER
C36, 157	27 PF	± 5 %	50 V	CER
C39, 41, 42, 51, 54, 55, 56, 59, 71, 79, 80, 81, 86, 87, 93, 96, 98, 99, 112, 155, 163, 169, 175, 188, 195, 200, 207, 212, 214, 236, 245, 246 - 248	1000 PF	± 10 %	50 V	CER
C62, 126	0.5 PF	± 0.25 PF	500 V	CER
C64, 69, 116, 120, 125, 132, 138, 142, 149, 150, 182	47 PF	± 5 %	50 V	CER
C72	47 PF	± 5 %	50 V	CER
C77, 191, 197, 217, 224	47 μF	± 20 %	25 V	AL
C84, 85, 170, 177	18 PF	± 5 %	50 V	CER
C104, 106, 111, 133, 186, 192, 198, 204, 210	100 PF	± 10 %	50 V	CER

PARTS LIST FOR FREQUENCY SYNTHESIZER (PLL SECTION)

C105	2 PF	± 0.25 PF	50 V	CER
C115, 119, 141, 145	1 PF	± 0.25 PF	50 V	CER
C127, 171, 176	33 PF	± 5 %	50 V	CER
C131	10 PF	± 0.5 PF	50 V	CER
C146, 158	5 PF	± 0.25 PF	50 V	CER
C156, 159	12 PF	± 5 %	50 V	CER
C165	2.2μF	± 20 %	25 V	TAN
C166	0.1μF	± 10 %	50 V	CER
C167, 174	0.01 μF	± 10 %	50 V	CER
C168	8 PF	± 0.5 PF	50 V	CER
C172, 178, 230	1 μF	+ 80 % − 20 %	50 V	CER
C173	3 PF	± 0.25 PF	50 V	CER
C181, 183	22 PF	± 5 %	50 V	CER
C220	33μF	± 20 %	16 V	AL
C222	47μF	± 20 %	50 V	AL
CV1 - 4	20 PF	± 20 %		VAL

D1	HZ3A - 1		2.5 - 2.7 V
D2 - 7, 13, 16	1S2588		
D8 - 10, 12, 15	1SS97		
D11, 14	1SV54GC		
D17	HZ6B - 2		5.6 - 5.9 V
D18	1S1588		
FL1	4515P00344		16.9 MHz
IC1, 3	4155P00451		
IC2, 4	4155P00452		
IC5	4155P00453	OPTION	
IC6, 8, 10 - 13	μPB552C		
IC7, 9	μPB551C		
IC14, 16 - 20	SN16913P		

PARTS LIST FOR FREQUENCY SYNTHESIZER (PLL SECTION)

IC15	4155P00454			
IC21	NJM78L12A		12 V	
IC22	NJM082D			
IC23	TD62503P			
IC24	TC4072BP			
IC25	NJM7815A		15 V	
IC26	NJM78L05A		5 V	
L1 - 3, 7, 20	470 μH	± 10 %		
L4, 12, 15	22 μH	± 10 %		
L5	220 μH	± 10 %		
L6	12 μH	± 10 %		
L11, 19	4455P00236			
L13, 16	1.8 μH	± 20 %		
L17, 18	0.12 μH	± 20 %		
L8, 9	1.2 μH	± 20 %		
OSC1	4515P00346	10 MHz	1ppm	
R1, 4, 5, 7, 27, 46, 69, 72, 80, 86, 124, 132, 141, 146, 178, 179, 188, 189, 202, 207	4.7 Kohm	± 5 %	1/6 W	CAR
R2, 15, 17, 22, 23, 42, 47, 48, 94, 130, 137 , 151, 152, 165, 194, 195	10 Kohm	± 5 %	1/6 W	CAR
R3, 6, 33, 34, 43, 59, 75, 82, 87, 89, 95, 109, 120, 126, 134, 143	22 Kohm	± 5 %	1/6 W	CAR

PARTS LIST FOR FREQUENCY SYNTHESIZER (PLL SECTION)

R31	680 ohm	± 5 %	1/6 W	CAR
R9, 10, 12, 13, 55	470 Kohm	± 5 %	1/6 W	CAR
R55, 70, 104	1 Mohm	± 5 %	1/6 W	CAR
R11, 20, 29, 35, 64, 65, 79, 90, 99, 121, 148, 155, 170, 171, 173, 180, 181, 183, 190, 191	100 ohm	± 5 %	1/6 W	CAR
R14, 18, 19, 30, 32, 45, 52, 53, 73, 100, 103, 106, 114, 136, 145, 150, 153, 157, 175 - 177, 186, 187, 203, 204, 101, 185 211, 212	1 Kohm	± 5 %	1/6 W	CAR
R16	6.8 Kohm	± 5 %	1/6 W	CAR
R21, 24, 49, 78, 85, 98, 107, 110, 116, 117, 123, 129, 50, 131, 135, 138, 139, 147, 154, 159, 161, 163	220 ohm	± 5 %	1/6 W	CAR
R25, 37, 162	22 ohm	± 5 %	1/6 W	CAR
R26, 77, 84, 149	680 ohm	± 5 %	1/6 W	CAR
R8, 158, 172, 182, 196, 199	3.3 Kohm	± 5 %	1/6 W	CAR
R28, 38, 39, 40, 41, 54, 60, 63, 93, 156, 200	2.2 Kohm	± 5 %	1/6 W	CAR
R36, 57, 61, 67, 68, 102, 113, 115	560 ohm	± 5 %	1/6 W	CAR
R44, 66, 88, 92, 97, 164	47 ohm	± 5 %	1/6 W	CAR

PARTS LIST FOR FREQUENCY SYNTHESIZER (PLL SECTION)

R56, 58, 71, 74, 81, 108, 119, 125, 133, 142, 166, 168	47 Kohm	± 5 %	1/6 W	CAR
R112, 127	82 ohm	± 5 %	1/6 W	CAR
R62, 96, 122, 128	1.5 Kohm	± 5 %	1/6 W	CAR
R76, 83, 174, 184	10 ohm	± 5 %	1/6 W	CAR
R91, 167, 169	470 ohm	± 5 %	1/6 W	CAR
R111	1.2 Kohm	± 5 %	1/6 W	CAR
R144	33 ohm	± 5 %	1/6 W	CAR
R160	15 ohm	± 5 %	1/6 W	CAR
R192	330 ohm	± 5 %	1/6 W	CAR
R105, 197	12 Kohm	± 5 %	1/6 W	CAR
R198	1.8 Kohm	± 5 %	1/6 W	CAR
R51, 118	1 Kohm	± 5 %	1/4 W	CAR
R205, 206	100 ohm	± 5 %	1/4 W	CAR
R201	4.7 Kohm × 8	± 5 %	1/8 W	FRN
RV1	5 Kohm	± 20 %	0.3 W	VAR
RV2	20 Kohm	± 20 %	0.3 W	VAR
P1	HIF3H - 50PA - 2.54DSA		50 poles	
P2	THP - P01X - B1			Included W1
P3	THP - P01X - B1			Included W2
P4	THP - P01X - B1			Included W3
T1 - 4, 19	4455P00227			
T5, 6	4455P00230			
T7 - 10	4455P00235			
T11, 12, 13	4455P00229			

PARTS LIST FOR FREQUENCY SYNTHESIZER (PLL SECTION)

T16 - 18	4455P00228	
T14, 15	4455P00231	
TR1, 2, 5, 7, 10 - 14, 17 - 19, 21 - 30	2SC2786KF	
TR3, 33 - 35	2SA1015 - Y	
TR4	2SC1959 - Y	
TR6	3SK73GR	
TR8, 9, 15, 16, 20	2SC1906	
TR31, 32	2SK125	
TR36	2SC3299	
X1	4515P00339	10.4565 MHz
X2	4515P00338	10.4535 MHz
X3	4515P00337	10.455 MHz
X4	4515P00340	10.4567 MHz
X5	70N20A	70 MHz
X6	4515P00341	16.7 MHz
TP1 - 17	TP - 8G	
W1	4645P00722C	
W2	4645P00723C	
W3	4645P00721C	
W4	DFS020	
PCB1	8545P02078	

PARTS LIST FOR PRE-SELECTOR

C58, 65	220 PF	± 10 %	50 V	CER
C25, 31	270 PF	± 10 %	50 V	CER
C91, 95	470 PF	± 10 %	50 V	CER
C142	10 μF	± 20 %	16 V	AL
C138, 141	47 μF	± 20 %	50 V	AL

D1 - 4	MI402	
D5, 6, 9, 12, 15, 16, 19, 22, 25, 26, 29, 32, 35, 36, 43, 46, 53, 54, 61, 64, 71, 72, 87, 88, 99, 100, 101, 104, 105, 106, 117	1S2588	
D7, 8, 10, 11, 13, 14, 17, 18, 20, 21, 23, 24, 27, 28, 30, 31, 33, 34, 37 - 42, 44, 45, 47 - 52, 55 - 60, 62, 63, 65 - 70, 73 - 86, 89 - 98, 102, 103, 107 - 116	SVC333B	
D118	HZ5C - 1	4.9 - 5.1 V
IC1, 2	TC4028BP	
IC3, 4	TD62503P	
J1	THP - J01X - A2	
J2	HIF3BD - 10PA - 2.54DSA	10 poles
P1	THP - P01X - B1	Included W1
TP1 - 12	WT - 8 - 3	
TP13 - 16	TP - 8G	

PARTS LIST FOR PRE-SELECTOR

Printed Circuit Board
PRE-SELECTOR 5P02039 Version 2

C1, 3, 9, 15, 103, 112	0.47 μF	+ 80 % − 20 %	50 V	CER
C74, 78, 82 - 90, 96 - 102, 105, 108 - 110, 113 - 135, 137, 139, 140, 143 - 146	0.1 μF	+ 80 % − 20 %	50 V	CER
C2, 4, 7, 10, 11, 14, 16 - 23, 26, 28 - 30, 33 - 41, 43, 45 - 47, 49 - 57, 59, 62 - 64, 66 - 73, 76, 79, 80, 94	0.022μF	+ 80 % − 20 %	50 V	CER
C136	0.01 μF	+ 80 % − 20 %	50 V	CER
C8	8 PF	± 0.5 PF	50 V	CER
C5, 13	10 PF	± 0.5 PF	50 V	CER
C61	12 PF	± 5 %	50 V	CER
C27	18 PF	± 5 %	50 V	CER
C24, 32, 107	33 PF	± 5 %	50 V	CER
C92	36 PF	± 5 %	50 V	CER
C44	39 PF	± 5 %	50 V	CER
C93	47 PF	± 5 %	50 V	CER
C75, 81	56 PF	± 5 %	50 V	CER
C77	91 PF	± 5 %	50 V	CER
C60	100 PF	± 5 %	50 V	CER
C42, 48	120 PF	± 10 %	50 V	CER
C6, 12	150 PF	± 10 %	50 V	CER
C104, 106, 111	180 PF	± 10 %	50 V	CER

PARTS LIST FOR PRE-SELECTOR

L1, 4	1.8 μH	± 20 %		
L5, 8	3.3 μH	± 10 %		
L9, 12	5.6 μH	± 10 %		
L14, 17	12 μH	± 10 %		
L13	18 μH	± 10 %		
L18	100 μH	± 10 %		
L19, 22	120 μH	± 10 %		
L2, 3	220 μH	± 10 %		
L6, 7, 23, 33	470 μH	± 10 %		
L27, 32	680 μH	± 10 %		
L10, 11	1 mH	± 10 %		
L26, 31	1.5 mH	± 10 %		
L15, 16, 24	2.2 mH	± 10 %		
L25, 30	3.3 mH	± 10 %		
L20, 21	10 mH	± 10 %		
L28, 29	33 mH	± 10 %		
L34 - 36	22 mH	± 10 %		
R1, 2	1 Kohm	± 5 %	1/4 W	CAR
R3, 13, 14, 16, 26, 27, 35, 36, 44, 45, 53, 54, 60, 69	1.2 Kohm	± 5 %	1/4 W	CAR
R85	3.9 Kohm	± 5 %	1/4 W	CAR
R61	4.7 Kohm	± 5 %	1/4 W	CAR
R84	330 ohm	± 5 %	1/6 W	CAR
R70 - 75	470 ohm	± 5 %	1/6 W	CAR
R6, 10, 19, 23, 29, 33, 38, 42, 47, 51, 63, 67, 76 - 81	4.7 Kohm	± 5 %	1/6 W	CAR
R83	10 Kohm	± 5 %	1/6 W	CAR
R89 - 97	22 Kohm	± 5 %	1/6 W	CAR
R15, 86, 87	47 Kohm	± 5 %	1/6 W	CAR

PARTS LIST FOR PRE-SELECTOR

R4,5,7 - 9,11,12, 17,18,20,21,22,24, 25,28,30 - 32,34,37, 39 - 41,43,46,48 - 50,52,55 - 59,62, 64 - 66,68,82	100 Kohm	± 5 %	1/6 W	CAR
R88	10 Kohm × 6	± 5 %	1/8 W	CAR

T2,3	4455P00331
T4,5	4455P00334
T6,7	4455P00337
T12,13	4455P00343
T8	4455P00347
T11	4455P00348
T14	4455P00349
T17	4455P00350
T9,10	4455P00384
T15,16	4455P00385
T18,19	4455P00386
T1	4495P00487
TR1	2SC2786KF
W1	4645P00697
PCB1	8545P02039

PARTS LIST FOR POWER AMPLIFIER

Printed Circuit Board
PA 5P02033 Version 2

C21 - 24, 31 - 35, 42, 70, 75, 79, 83, 87, 94	1 μF	± 5 %	63 V	FILM
C1, 2, 8, 9, 11, 13, 16, 17, 71, 76, 80, 84, 88, 93, 95, 96	0.1 μF	± 5 %	100 V	FILM
C25, 27	0.1 μF	± 5 %	250 V	FILM
C72, 77, 81, 85, 89, 92	0.01 μF	± 5 %	250 V	FILM
C14, 15	2200 PF	± 10 %	400 V	FILM
C19, 73, 78, 82, 86, 90, 91	1000 PF	± 10 %	400 V	FILM
C10, 12	820 PF	± 10 %	50 V	CER
C3, 5, 7, 43, 48, 55, 58, 59, 63 - 68	0.01 μF	+ 80 % − 20 %	50 V	CER
C45 - 47, 49 - 52, 54, 60 - 62	0.1 μF	+ 80 % − 20 %	50 V	CER
C26	560 PF	± 5 %	300 V	MICA
C36, 37	220 PF	± 5 %	1 KV	MICA
C28, 29	3300 PF	± 5 %	300 V	MICA
C38 - 41	30000 PF	± 5 %	300 V	MICA
C4, 6, 44, 53, 56, 57	10 μF	± 20 %	50 V	AL
C30, 33	33 μF	± 20 %	50 V	AL
C74	100 μF	± 20 %	50 V	AL
C18, 20	47 μF	± 20 %	35 V	AL
C69	100 μF	± 20 %	63 V	AL

PARTS LIST FOR POWER AMPLIFIER

L3, 4, 7, 8	4495P00330			
L9, 10	4495P00331A			
L1	4495P00358			
L2	4495P00359			
L13, 14	4495P00360			
L5, 6	4495P00453			
L11, 12	4495P00483			
L15, 16	100 μH	± 10 %		
R34, 43	22 ohm	± 5 %	1/6 W	CAR
R47	47 ohm	± 5 %	1/6 W	CAR
R30, 44	100 ohm	± 5 %	1/6 W	CAR
R60, 61	270 ohm	± 5 %	1/6 W	CAR
R56	390 ohm	± 5 %	1/6 W	CAR
R45	820 ohm	± 5 %	1/6 W	CAR
R49	2.2 Kohm	± 5 %	1/6 W	CAR
R55	3.3 Kohm	± 5 %	1/6 W	CAR
R48, 50, 52	4.7 Kohm	± 5 %	1/6 W	CAR
R4, 29, 33, 36, 39, 40, 46	10 Kohm	± 5 %	1/6 W	CAR
R37	22 Kohm	± 5 %	1/6 W	CAR
R57	27 Kohm	± 5 %	1/6 W	CAR
R51	51 Kohm	± 5 %	1/6 W	CAR
R35	100 Kohm	± 5 %	1/6 W	CAR
R2	6.8 ohm	± 5 %	1/4 W	CAR
R5, 7, 31, 41	100 ohm	± 5 %	1/4 W	CAR
R8	270 ohm	± 5 %	1/4 W	CAR
R1, 3, 17, 18	820 ohm	± 5 %	1/4 W	CAR
R12 - 14	3.9 ohm	± 5 %	1/2 W	CAR
R10, 11	4.7 ohm	± 5 %	1/2 W	CAR
R15, 16	22 ohm	± 5 %	1/2 W	CAR
R25 - 28	100 ohm	± 5 %	1/2 W	CAR
R6	820 ohm	± 5 %	1/2 W	CAR

PARTS LIST FOR POWER AMPLIFIER

R54	3.3 Kohm	± 5 %	1/2 W	CAR
R9	2.7 ohm	± 5 %	2 W	METAL
R19 - 22	6.8 ohm	± 5 %	2 W	METAL
R23,24	22 ohm	± 5 %	2 W	METAL
R58,59	820 ohm	± 5 %	2 W	METAL
R32	1 Kohm	± 5 %	2 W	METAL
R38,53	1.8 Kohm	± 5 %	2 W	METAL
R42	2.2 Kohm	± 5 %	2 W	METAL

TR11	2SA429(G)O - TM
TR1,8	2SA1015 - Y
TR2 - 4	2SC2098
TR5,6	2SC2652
TR10,14	2SC2786KF
TR9,12	2SC3299
TR7,13	2SD1590

T4	4495P00323A
T6	4495P00324A
T1	4495P00325
T3	4495P00328
T7	4495P00361
T2	4495P00408A
T5	4495P00418
T8	4495P00419
T9	4495P00484A
T10	4495P00485A

RV1,2	200 ohm	± 20 %	0.5 W	VAL

IC1	TLP504A	
IC2	NJM78L08A	8 V
IC3	NJM2903D	

PARTS LIST FOR POWER AMPLIFIER

D1	1SS101		
D2,4	1S1588		
D3	HZ20 - 3	20.2 - 21.1 V	
S2	OHD3 - 100M		
S1	OHD3 - 110M		
TP1 - 4	TP - 8G		
J1	JHP - J01X - A2		
P1	HIF2B - 10D - 2.54RA	10 poles	Included W3
P3	1 - 480319 - 0		Included W1
P4	1 - 480319 - 0		Included W2
P6	BNC - LP - 3	50 ohm	Included W4
P7	HIF3BA- 10D - 2.54R	10 poles	Included W3
W1	4645P00710C		
W2	4645P00711C		
W4	4645P00713C		
W3	4645P00718C		
PCB1	8545P02033		

PARTS LIST FOR
POWER AMPLIFIER

Printed Circuit Board (Version 2) 5P03008A

C2,8,9,13,11,16,17 25,27,28,29,31,32 53,71,76,80,84,88 93	0.1 μF	± 5 %	100V	FILM
C3,5,7,43,48,55,58 59,63-68,97-105	0.01 μF	+ 80 % - 20 %	50V	CER
C4,6,44,56,57	10 μF	±20 %	50V	AL
C10,12	820 pF	±10 %	50V	CER
C14,15	2200 pF	±10 %	400V	FILM
C18,20,	47 μF	±20 %	35V	AL
C19,73,78,82,86,90 91	1000 pF	±10 %	400V	FILM
C21,22,34,35,42,70 75,79,83,87,94	1 μF	±10 %	63V	FILM
C23,24	2700 pF	±10 %	50V	CER
C36,37	220 pF	±5 %	1kV	MICA
C38-41	0.03 μF	±5 %	300V	MICA

PARTS LIST FOR
POWER AMPLIFIER

C45-47,49-52,54,60 61,62	0.1 μF	+80 % -20 %	50V	CER
C69	100 μF	±20 %	63V	AL
C72,77,81,85,89,92	0.01 μF	±10 %	400V	FILM
C74	100 μF	±20 %	50V	AL

D1,10	1SS101			NEC
D2,4,11,12	1S1588			TOSHIBA
D3	HZ20-3	22-24V	ZENER	HITACHI
D5-9	1S1887			TOSHIBA

IC1	TLP504A	OP/C ×4		TOSHIBA
IC2,4	78L08	AVR + 8V		
IC3,5	NJM2903D	COMPLATOR		new JRC
IC6	TC4013BP	D/FF		TOSHIBA

J1	TMP-J01X-A2	50 Ω	COAX.	

PARTS LIST FOR POWER AMPLIFIER

L1	4495P00358A			
L2	4495P00359A			
L3,4	4495P00330A			
L5,6	4495P00453			
L7	3.3 μH	±20 %		
L11,12	4495P00483A			
L13,14	4495P00360A			
R1,3,17,18	820 Ω	±5 %	¼ W	CAR
R2	6.8 Ω	±5 %	¼ W	CAR
R4,29,33,36,39,40,46 66,67	10k Ω	±5 %	1/6 W	CAR
R5,7,31,41	100 Ω	±5 %	¼ W	CAR
R6	820 Ω	±5 %	½ W	CAR
R8	270 Ω	±5 %	¼ W	CAR
R9	270 Ω	±5 %	2 W	METAL

PARTS LIST FOR POWER AMPLIFIER

R10,11	4.7 Ω	±5 %	½ W	CAR
R12,13,14	3.9 Ω	±5 %	½ W	CAR
R15,16	22 Ω	±5 %	½ W	CAR
R19,21	1k Ω	±5 %	¼ W	CAR
R20,22	15 Ω	±5 %	2 W	METAL
R23,24	1.2 Ω	±5 %	2 W	METAL
R25-28	100 Ω	±5 %	½ W	CAR
R30	100 Ω	±5 %	1/6 W	CAR
R32	1k Ω	±5 %	2 W	METAL
R34	22 Ω	±5 %	1/6 W	CAR
R35	100k Ω	±5 %	1/6 W	CAR
R37,64,65,70	22k Ω	±5 %	1/6 W	CAR
R38,53	1.8k Ω	±5 %	2 W	METAL
R42	2.2k Ω	±5 %	2 W	CAR
R43	820 Ω	±5 %	2 W	CAR

PARTS LIST FOR POWER AMPLIFIER

R44	1.5k Ω	±5 %	¼ W	CAR
R45	820 Ω	±5 %	1/6 W	CAR
R47,68	47 Ω	±5 %	1/6 W	CAR
R48,50,52,63	4.7k Ω	±5 %	1/6 W	CAR
R49	2.2k Ω	±5 %	1/6 W	CAR
R51	51k Ω	±5 %	1/6 W	CAR
R54	3.3k Ω	±5 %	½ W	CAR
R55	3.3k Ω	±5 %	1/6 W	CAR
R56	390 Ω	±5 %	1/6 W	CAR
R57	27k Ω	±5 %	1/6 W	CAR
R58,59	15k Ω	±5 %	¼ W	CAR
R60	270 Ω	±5 %	1/6 W	CAR
R62	120 Ω	±5 %	2 W	CAR
R69	1.5k Ω	±5 %	1/6 W	CAR
R71	270k Ω	±5 %	1/6 W	CAR

PARTS LIST FOR POWER AMPLIFIER

RV1	200 Ω	
RV2	5k Ω	
RV3	10k Ω	
S1,2	110℃	SWITCH
T1	4495P00325	
T2	4495P00408A	
T3	4495P00328	
T4	4495P00326A	
T5	4495P00327B	
T6	4495P00324A	
T7	4495P00361	
T8	4495P00419A	
T9	4495P00484B	
T10	4495P00485B	

PARTS LIST FOR
POWER AMPLIFIER

TR1,8	2SA1015-Y	TOSHIBA
TR2,3,4	2SC2098	TOSHIBA
TR5,6	MRF150MP	MOTOROLA
TR7	2SD1590	NEC
TR9,12	2SC3299	TOSHIBA
TR10,14	2SC2786KF	NEC
TR11	2SA429(G)O-TM	TOSHIBA
TR15	2SC1590	TOSHIBA

W1	4645P00710C
W2	4645P00711C
W3	4645P00718C
W4	4645P00713H

PARTS LIST FOR LOW PASS FILTER

Printed Circuit Board
L. P. F. 5P02034 Version 2

C22	27 PF	± 5 %	1 KV	MICA
C35,36	33 PF	± 5 %	1 KV	MICA
C54	39 PF	± 5 %	1 KV	MICA
C6	43 PF	± 5 %	1 KV	MICA
C1,3,15	220 PF	± 5 %	1 KV	MICA
C26	51 PF	± 5 %	1 KV	MICA
C20	56 PF	± 5 %	1 KV	MICA
C24,7	68 PF	± 5 %	1 KV	MICA
C40	75 PF	± 5 %	1 KV	MICA
C33	82 PF	± 5 %	1 KV	MICA
C2	91 PF	± 5 %	1 KV	MICA
C27	100 PF	± 5 %	1 KV	MICA
C23,25,38	110 PF	± 5 %	1 KV	MICA
C43	120 PF	± 5 %	1 KV	MICA
C4,41	130 PF	± 5 %	1 KV	MICA
C39,50	150 PF	± 5 %	1 KV	MICA
C9,37	160 PF	± 5 %	1 KV	MICA
C49,55	180 PF	± 5 %	1 KV	MICA
C16,52	200 PF	± 5 %	1 KV	MICA
C5	240 PF	± 5 %	1 KV	MICA
C18	270 PF	± 5 %	1 KV	MICA
C29	300 PF	± 5 %	1 KV	MICA
C21,28	330 PF	± 5 %	1 KV	MICA
C47,51	390 PF	± 5 %	1 KV	MICA
C31,53	430 PF	± 5 %	1 KV	MICA
C34,48	510 PF	± 5 %	1 KV	MICA
C13,17,45	560 PF	± 5 %	1 KV	MICA
C19	620 PF	± 5 %	1 KV	MICA
C11,14,42	750 PF	± 5 %	1 KV	MICA
C30	820 PF	± 5 %	1 KV	MICA

PARTS LIST FOR LOW PASS FILTER

Printed Circuit Board
L. P. F. 5P02034 Version 2

C32	910 PF	± 5 %	1 KV	MICA
C8,46	1200 PF	± 5 %	1 KV	MICA
C44	1300 PF	± 5 %	1 KV	MICA
C12	1600 PF	± 5 %	1 KV	MICA
C10	1800 PF	± 5 %	1 KV	MICA
C56	1 μF	± 5 %	100 V	FILM
C57,60	0.1 μF	± 5 %	100 V	FILM
C58,59	0.01 μF	± 5 %	250 V	FILM
C61 - 86	0.01 μF	+ 80 % − 20 %	50 V	CER
C87 - 97	0.1 μF	+ 80 % − 20 %	50 V	CER
D1 - 8	S5500B			
D9,10	1SS101			
J1,2	BNC - LR	50 ohm		
P1	HIF3F - 16PA - 2.54DS		16 poles	
T1,2	4495P00419			
K1 - 16	MR301 - 24HS		24 V	
R1 - 4	100 ohm	± 5 %	1/2 W	CAR
R5,6	10 Kohm	± 5 %	1/6 W	CAR
PCB1	8545P02034			

PARTS LIST FOR LOW PASS FILTER

L25,26	4495P00337B
L27	4495P00338A
L8,9	4495P00339A
L10,15,16	4495P00341A
L24	4495P00344B
L7	4495P00345A
L5	4495P00346A
L1,4	4495P00410
L17	4495P00412
L22	4495P00413
L6	4495P00415
L23	4495P00416
L2,3	4495P00420
L11-13	4495P00422
L14	4495P00424
L19,20,21	4495P00425
L18	4495P00426

PARTS LIST FOR POWER SUPPLY UNIT

Power Supply Main Circuit NJD-1966B

C1 - 3	330 μ F	± 20 %	50 V	AL
C4,5	1 μ F	± 5 %	50 V	FILM
C8A,B	4700 μ F	+ 50 %	35 V	AL
		− 10 %		
C9	0.001μ F	± 10 %	630 V	FILM
D1A,B	30BL11			
D2,3	W03C			
F1	QAD25 - 100			
K1	MB3D12			
K2	G5D - 1011H			
L1	T - 24B - 125			
L2	4476P03860A			
R1 x3	330 ohm	± 5 %	3 W	METAL
R2	10 ohm	± 5 %	2 W	METAL
ST1	5003F	110℃M - 1		
P1	HIF3C - 20D - 2.54C		20 poles	
P2	171822 - 6		6 poles	
P3	1 - 171822 - 0		10 poles	
P4	171822 - 5		5 poles	
P5	171822 - 4		4 poles	
P6	1 - 171822 - 0		10 poles	
P7	171822 - 3		13 poles	
P8,9	170148 - 2			

PARTS LIST FOR POWER SUPPLY-A1 CIRCUIT

Printed Circuit Board Power Supply-A1 P06192B

C1A ~T	0.0022 μF	± 10 %	50 V	FILM
C2	0.022 μF	± 10 %	400 V	FILM
C3A ~J, 20A ~B, 21A~B, 26	100 μF	± 20 %	63 V	AL
C4	2200 μF	+ 50 % − 10 %	63 V	AL
C5	100 μF	± 20 %	63 V	AL
C6	100 μF	± 20 %	35 V	AL
C7, 14	100 μF	± 20 %	25 V	AL
C8	47 μF	± 20 %	25 V	AL
C9, 18	0.047 μF	± 5 %	50 V	FILM
C10, 11, 13, 17	0.01 μF	± 10 %	50 V	FILM
C12, 30 - 35	0.0047 μF	± 10 %	50 V	FILM
C15	10 μF	± 20 %	100 V	AL
C16	1 μF	± 20 %	50 V	AL
C19	220 μF	± 20 %	16 V	AL
C22, 27~29	0.047 μF	± 10 %	50 V	FILM
C23, 24, 36	0.1 μF	± 5 %	50 V	FILM
C25	10 μF	± 20 %	50 V	AL

CR1, 2	03P2M	
D1	W03C	
D2	HZ12B - 2	12.6~13.1 V
D3, 8	HZ3A - 1	2.5~ 2.7 V
D4, 7, 9, 14, 15, 16, 19, 21, 22	1S953	
D5, 10, 11	HZ6C - 2	6.0~ 6.3V
D6, 12	HZ9C - 3	9.3~ 9.7 V
D17, 18, 20	CTG - 22	
F1	T - MF61NR15A	
F2	T - MF60NR0.5A	
FS1, 2	TS - 04 - P - SN	

PARTS LIST FOR POWER SUPPLY—A1 CIRCUIT

IC1	MB3759	
J2	171825 - 6	6 poles
J3	1 - 171825 - 0	10 poles
J4	171825 - 5	5 poles
J5	171825 - 4	2 poles
L1 A~T	4476P03861	
L2	H7A - T14.5 - 20 - 7.5	

R1A ~T	3.3	Kohm	± 5 %	1/4 W	CAR
R2, 8, 11, 13, 14, 24, 25, 28	1	Kohm	± 5 %	1/4 W	CAR
R3	10	ohm	± 5 %	2 W	METAL
R4A ~B	10	mohm			
R5	1.5	Kohm	± 5 %	2 W	METAL
R6, 16, 27, 30, 38, 40, 46	10	Kohm	± 5 %	1/4 W	CAR
R7	330	Kohm	± 5 %	1/4 W	CAR
R9, 10, 33, 34, 41	2.2	Kohm	± 5 %	1/4 W	CAR
R12	39	Kohm	± 5 %	1/4 W	CAR
R15, 50	33	Kohm	± 5 %	1/4 W	CAR
R17, 31, 37, 39, 42, 43, 45, 49	4.7	Kohm	± 5 %	1/4 W	CAR
R18, 47	12	Kohm	± 5 %	1/4 W	CAR
R19	220	Kohm	± 5 %	1/4 W	CAR
R20, 29, 32, 44	100	ohm	± 5 %	1/4 W	CAR
R21	51	Kohm	± 5 %	1/4 W	CAR
R22	5.6	Kohm	± 5 %	1/4 W	CAR
R23, 48	3.9	Kohm	± 5 %	1/4 W	CAR
R26	470	ohm	± 5 %	1/4 W	CAR
R35, 56	6.8	Kohm	± 5 %	1/4 W	CAR
R36	1.8	Kohm	± 5 %	1/4 W	CAR
R51	39	ohm	± 5 %	1/4 W	CAR
R52	220	ohm	± 5 %	1/4 W	CAR
R53	560	ohm	± 5 %	1/4 W	CAR
R54A~B	820	ohm	± 5 %	2 W	METAL
R55	56	Kohm	± 5 %	2 W	METAL

PARTS LIST FOR POWER SUPPLY-A1 CIRCUIT

TR1A~T	2SK532			
TR2	2SD717			
TR3	2SA1015 - Y			
TR4, 7, 9, 10, 11, 13	2SC1815			
TR5	2SC1173			
TR6	2SA1012			
TR8	2SD1164			
TR12	2SK30A			
VR1	1 Kohm	±20 %	0.25 W	VAR
VR2	500 ohm	±20 %	0.25 W	VAR
PCB1	3546P06192B			

PARTS LIST FOR POWER SUPPLY-A2 CIRCUIT

Printed Circuit Board Power Supply-A2 P06193

C1	2200 μ F	+ 50 % − 10 %	63 V	AL
C2	0.1 μ F	± 5 %	50 V	FILM
C3,4,13	0.0047 μ F	± 10 %	50 V	FILM
C5,6,7	1000 PF	± 10 %	630 V	FILM
C8	220 μ F	± 20 %	35 V	AL
C9 A～ B	470 μ F	± 20 %	25 V	AL
C10 A～ B	1000 μ F	± 20 %	10 V	AL
C11,16,24	10 μ F	± 20 %	50 V	AL
C12	0.047 μ F	± 5 %	50 V	FILM
C14,18	0.001 μ F	± 5 %	50 V	FILM
C15,22	100 μ F	± 20 %	25 V	AL
C17	0.0022 μ F	± 10 %	630 V	FILM
C19,20,21	0.01 μ F	± 10 %	50 V	FILM
C21	100 μ F	± 20 %	10 V	AL
C23	0.1 μ F	± 5 %	50 V	FILM

DS1,2	10DL2C41
DS3	ESAC82 - 004
F1	T - MF60NR3A
FS1	TS - 04 - P - SN
IC1	μPC1042C
L1	CY13× 8× 4.5P
L2,3	CY13× 8× 4.5A

PARTS LIST FOR POWER SUPPLY-A2 CIRCUIT

R1	82 Kohm	±5 %	1/4 W	CAR
R2 A~B	0.22 ohm	±5 %	1 W	METAL
R3,4,12,15,18, 22 - 25,27 - 30,35	1 Kohm	±5 %	1/4 W	CAR
R5	100 ohm	±5 %	2 W	METAL
R6	3.3 ohm	±5 %	2 W	METAL
R7	33 ohm	±5 %	2 W	METAL
R8 ,36,38 - 40	10 Kohm	±5 %	1/4 W	CAR
R9	100 ohm	±5 %	1 W	METAL
R10,11,16	2.2 Kohm	±5 %	1/4 W	CAR
R13	12 Kohm	±5 %	1/4 W	CAR
R14	100 Kohm	±5 %	1/4 W	CAR
R17	100 ohm	±5 %	1/4 W	CAR
R20	8.2 Kohm	±5 %	1/4 W	CAR
R21,26,34	4.7 Kohm	±5 %	1/4 W	CAR
R31	22 ohm	±5 %	1 W	METAL
R32,33,37	39 ohm	±5 %	1/4 W	CAR
TR1,2	2SK525			
TR3 ,10	2SA1015 - Y			
TR4, 7,11	2SC1815			
TR5,8	2SC2655			
TR6,9	2SA1020			
T1	4416P05730A			
VR1	1 Kohm	±20%	0.25 W	VAR
PCB1	3546P06193			

PARTS LIST FOR POWER SUPPLY-A3 CIRCUIT

Printed Circuit Board Power Supply-A3 P06318

C1 - 6	0.1 μF	± 5 %	50 V	FILM
C7	470 μF	±20 %	16 V	AL
D1	HZ9C - 1 - L - TA			
D2, 3	1S953			
J6	1 - 171825 - 0	10 poles		
J7	171825 - 3	3 poles		
PC1, 3	TLP521 - 2			
R1A ~B, 2A ~B, 4, 8	4.7 Kohm	±5 %	1/4 W	CAR
R3, 7	1 Kohm	±5 %	1/4 W	CAR
R9	220 ohm	±5 %	1/4 W	CAR
R10	120 ohm	±5 %	1/4 W	CAR
R11	10 Kohm	±5 %	1/4 W	CAR
R12	12 Kohm	±5 %	1/4 W	CAR
TR1, 2	2SC1815			
PCB1	4546P06318			

PARTS LIST FOR JUNCTION

Printed Circuit Board
Junction 5PO1764A Version 2

C1	0.1 μF	+ 80 % − 20 %	50 V	CER
C2,4	1 μF	+ 80 % − 20 %	50 V	CER
C3	0.01 μF	+ 80 % − 20 %	50 V	CER
F1	T - MF60NR	2A		
FS1	F - 711			
P1	HIF3BA - 60PA - 2.54DSA		60 poles	
P2	HIF3BA - 34PA - 2.54DSA		34 poles	
P3	HIF3BA - 20PA - 2.54DSA		20 poles	
P4	HIF3BA - 16PA - 2.54DSA		16 poles	
P5	HIF3BD - 10PA - 2.54DSA		10 poles	
P6	HNC2 - 2.5P - 3DS		3 poles	
R1	12 Kohm	± 5 %	1/6 W	CAR
R2	1 Kohm	± 5 %	1/6 W	CAR
TB1	TW - 8145 - 24P		24 poles	
TB2,3	TW - 8145 - 12P		12 poles	
TB4 - 6	P - 90 with LTO - 81T - 250N		1 pole	
PCB1	8545PO1764A			

PARTS LIST FOR LC NETWORK

Printed Circuit Board
LC NETWORK 5P01553B Version 2

C1	30 PF	± 5 %	1KV	MICA
C2	60 PF	± 5 %	1KV	MICA
C3	120 PF	± 5 %	1KV	MICA
C4, 13	240 PF	± 5 %	1KV	MICA
C5, 14	480 PF	± 5 %	1KV	MICA
C6, 15	960 PF	± 5 %	1KV	MICA
C7	1900 PF	± 5 %	1KV	MICA
C8	3800 PF	± 5 %	1KV	MICA
C9 , 118	30 PF	± 5 %	2.5 KV	MICA
C10, 11, 119	60 PF	± 5 %	2.5 KV	MICA
C12 , 117	120 PF	± 5 %	2.5 KV	MICA
C16 - 23, 32 - 34, 37 - 74, 77 - 87, 89 - 93, 95, 97, 100 - 105, 25-30 107, 108, 110 - 114, 121	0.1 μ F	+ 80 % − 20 %	50 V	CER
C122 - 124	0.022 μF	+ 80 % − 20 %	50 V	CER
C88	1000 PF	± 10 %	50 V	CER
C94, 96, 99, 116	47 μ F	± 20 %	50 V	AL
C115	2 PF	± 0.25 PF	500 V	CER
C120	10 PF	± 0.5 PF	500 V	CER
C98	short			
K1, 35	MR72C - 24S	+24 VDC		
K2 - 9, 11 - 16, 18 - 20, 26 - 32	MR71C - 24S	+24 VDC		
K23 - 25, 33	R09 - 1020			
K34	R09 - 1107			
D14 , 15, 17	HLMP - 6208	red 8 elements		
D16	HLMP - 6205	red 5 elements		
D18 - 36, 39 - 45, 53, 55	1S2471			
D47	1SS101			

PARTS LIST FOR LC NETWORK

D48	GL112H9	yel	12 segments
D49	GL3PG7	green	
D50	GL3PR7	red	
IC1	NJM7812A	+12 V	
IC2	NJM7805A	+ 5 V	
T1-2	4455P00298		
T3	4455P00293		
P1,3	HIF3H - 20D - 2.54DSA		20 poles
P2	HIF3H - 60D - 2.54DSA		60 poles
TB1,3 - 6	P - 90 with LTO - 81T - 250N		
TB2	S - 306 - 12 P		12 poles
J1	M - R 2503 5/8 - 24UNEF - 2A		
J2	BNC- PJ - 1.5		Included W2
L1	4455P00281		
L2	4455P00282		
L3	4455P00283		
L4	4455P00284		
L5	4455P00285		
L6	4143T00089		
L7	4143T00090		
L8	4143T00091		
L9	4143T00092		
L10	4143T00093		
L11	4143T00094		
L12	47 μH		

PARTS LIST FOR LC NETWORK

S1,2	MTA206N - P	
S3	BP1F - 2M4	with button 8Z0082
S4,5	BT1D - 2M4	
S6,7,9	DSS708	
S8	DSS705	

R1,50	300 ohm	± 2 %	10 W	WW
R2,51	75 ohm	± 2 %	10 W	WW
R3	150 ohm	± 2 %	10 W	WW
R6	47 ohm	± 50 %	1 W	METAL
R7	10 Mohm	± 10 %	5 W	CAR
R9,18 - 26,	10 ohm	± 5 %	1/4 W	CAR
R10 - 17,29 - 35	10 ohm	± 5 %	1/6 W	CAR
R37	390 ohm	± 5 %	1 W	METAL
R40,41,43	4.7 Kohm× 8	± 5 %	1/8 W	FRN
R42	4.7 Kohm× 5	± 5 %	1/8 W	FRN
R44	100 ohm	± 5 %	1/4 W	CAR
R45	2.7 Kohm	± 5 %	1/4 W	CAR
R46	270 ohm	± 5 %	1/4 W	CAR
R47,48	47 ohm	± 5 %	3 W	METAL
R52	220 ohm	± 5 %	1/4 W	CAR
R53	10 Kohm	± 5 %	1/4 W	CAR
R55,57	33 Kohm	± 5 %	1/4 W	CAR
R56,58	4.7 Kohm	± 5 %	1/4 W	CAR
R59	47 ohm	± 5 %	1/4 W	CAR

TR1,2	2SC1959 - Y
W1	HC2L - 2
W2	4645P00812A
PCB1	8545P01553B

PARTS LIST FOR ATU CONTROL

Printed Circuit Board
ATU Control 5P01749A Version 2

C1, 2, 19, 21	470 PF	± 10 %	50 V	CER
C3, 4, 29, 32	1000 PF	± 10 %	50 V	CER
C5, 6, 35, 39, 40, 68	0.01 μ F	+ 80 % − 20 %	50 V	CER
C7, 11, 14, 16 - 18, 20, 22, 23, 26 - 28, 30, 31, 34, 37, 38, 41 45 - 48, 50 - 58, 60 - 62, 64 - 67, 69 - 74	0.1 μ F	+ 80 % − 20 %	50 V	CER
C8, 9	22 PF	± 5 %	50 V	CER
C10, 49	10 μ F	± 20 %	35 V	AL
R12, 13, 24, 25, 33, 42 - 44	10 μ F	± 20 %	25 V	AL
C15	1 μ F	± 20 %	50 V	AL
C63	47 μ F	± 20 %	25 V	AL

D1, 5, 12 - 15	1S2471		
D2	HZ6C - 2		6.0 - 6.3 V
D3, 7, 8, 11	1SS101		
D4	HZ9C - 3		9.3 - 9.7 V
D6	HZ2B - 1		1.9 - 2.6 V
D9, 10	HZ5B - 1		4.6 - 4.8 V
D16	1SS97		
D17	1S1588		
L1, 2	100 μ H	± 10 %	

IC1	μPD7810G - 36	
IC2	74HCT373P	
IC3	MBM2764 - 20	with IC26 - 2806 - GS4
IC4	74HC273P	
IC5	74HC00P	
IC 6 - 9	TD62003P	
IC10	IR - 2433	

PARTS LIST FOR ATU CONTROL

IC11, 12	NJM2904D			
IC13, 14	NJM2903D			
IC15	NJM78L06A		6 V	
TR1 - 3, 6, 7, 9, 10	2SC1959 - Y			
TR5	2SC2298			
TR8	2SA1015 - Y			
J1, 3	HIF3H - 20PA - 2.54DSA		20 poles	
J2	HIF3H - 60PA - 2.54DSA		60 poles	
M1, 2	M8 - 8P			
R1 - 29, 94, 95	10 ohm	± 5 %	1/6 W	CAR
R30, 32 , 35, 42, 66, 69, 98	10 Kohm	± 5 %	1/6 W	CAR
R31 , 41	47 Kohm	± 5 %	1/6 W	CAR
R33	470 ohm	± 5 %	1/6 W	CAR
R34	18 Kohm	± 5 %	1/6 W	CAR
R36, 44 - 47, 49, 65, 68, 83, 85, 87, 89, 106, 107	1 Kohm	± 5 %	1/6 W	CAR
R43, 109	2.7 Kohm	± 5 %	1/6 W	CAR
R48, 50, 103	22 Kohm	± 5 %	1/6 W	CAR
R51, 91 - 93, 96, 99, 100, 105, 112	4.7 Kohm	± 5 %	1/6 W	CAR
R52	27 ohm	± 5 %	1/6 W	CAR

PARTS LIST FOR ATU CONTROL

R53, 54	18 ohm	± 5 %	1/6 W	CAR
R55, 57, 58, 60, 70, 108	100 ohm	± 5 %	1/6 W	CAR
R56, 59	68 ohm	± 5 %	1/6 W	CAR
R61, 111	120 ohm	± 5 %	1/4 W	CAR
R62	240 ohm	± 5 %	1/6 W	CAR
R63	62 ohm	± 5 %	1/6 W	CAR
R64, 67	56 ohm	± 5 %	1/6 W	CAR
R71, 72, 101 , 102	5.6 Kohm	± 5 %	1/6 W	CAR
R75 , 77	680 ohm	± 5 %	1/6 W	CAR
R79 , 81	820 ohm	± 5 %	1/6 W	CAR
R97	33 Kohm	± 5 %	1/6 W	CAR
R104	47 ohm	± 5 %	1/6 W	CAR
R110	33 ohm	± 5 %	1/6 W	CAR
R113	1 Kohm	± 5 %	1/4 W	CAR
X1	4515P00342	6.5536 MHz		
PCB1	8545P01749A			