* I N S T R U C T I O N M A N U A L *

50MHz BAND

KW TUBE TYPE LINEAR AMPLIFIER

MODEL HL-1K/6

TOKYO HY-POWER LABS., INC.

C O N T E N T S

1.PREFACE

°Before setting and operating the device, read this instruction manual carefully to keep your HL-1K/6 in the best condition for a long time.

°The high voltage of over 2000V is applied in the internal part of the device.

Don't touch the internal part carelessly, or you may get an electric shock and it can be lethal for you.

°The internal electrodes of vacuum tube 4C x 250B may be damaged when they get a strong physical shock.

In case of transporting over the long distance, please pull off the vacuum tubes from the device and pack them carefully to be free from a strong shock.

2.FEATURES

°HL-1K/6 is a compact and light weight 50MHz band tube type linear amplifier with maximum input of 1KW.

°Two vacuum tubes . 4CX250B . made by EIMAC are used in parallel to get a stable operation. It boasts of maximum continuous output of 500W in SSB and SW modes.

°A large sirocco fan is used for cooling the vacuum tubes. Enhancing the reliability, tube performance can be fully achieved.

°To protect the vacuum tube, warm-up time is set for 60 seconds with time delay circuit using transistors.

°This amp is interlock-switched for the safety of the equipment and its operators not to supply the power to the device automatically when the upper cover is taken off.

°Plate current can be monitored all the time with plate current meter(IP), and plate voltage(EP), control grid current(IG) and output power(PO) can be monitored with multi-meter, and every operating condition can be checked easily.

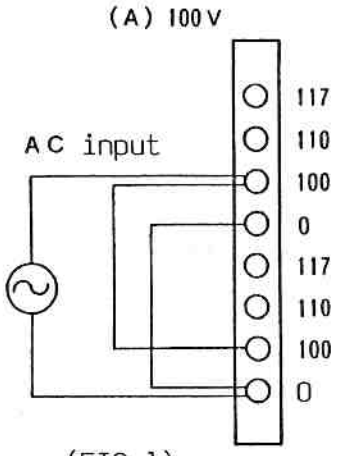
°The high-gain design which enables the maximum input operation, when driven with 10W class(10-15W) transceiver.

3.SPECIFICATIONS

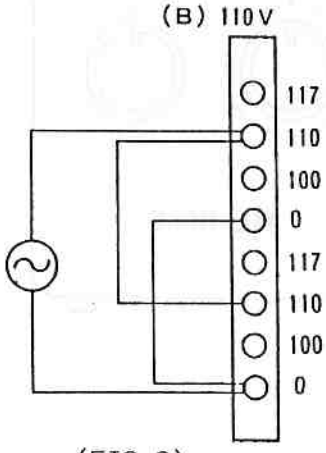
Frequency band	: 50MHz band(50-54MHz)
Mode	: SSB, CW, (RTTY/SSTV/AM/FM)
Output power	: 500W max. (RTTY/SSTV/AM : about a half of SSB and CW) and 60-70% of SSB for FM)
Driving power	: 15W max.(10w nominal)
Plate voltage	: DC 2KV(DC2.4KV with no RF excitation)
Plate current	: 500mA max.
Input impedance	: 50Ω (unballanced)
Output impedance	: 50Ω (unballanced)
Vacuum tubes	: EIMAC 4C x 250B x 2
Semiconductors	: Unijunction transistor x 1, Thyristor x 1, Diode x 31, LED x 3
Class of operation	: Class AB 1, Grounded Cathode (with grid tuned circuit)
AC supply voltage	: AC 100/110/117/120/200/220/230/240V 15/8A max. (50/60Hz)
Built-in meters	: Plate current meter: IP 600mA(full scale)
	Multi-meter : IG 3mA (") PO 1KW (") EP 3KV (")
Input/output connector	: M type (SO-239)
Dimensions	: 284(W) x 153(H) x 375(D) mm
Weight	: approx. 18 Kg
Accessories	: Control plug, Fuses(8A/200V, 15A/100V) M-M jumper cable
Cooling method	: Forced air cooling by a large sirocco fan
Power consumption	: 150VA at stand-by 1600VA at max. input

4.AC POWER SOURCE

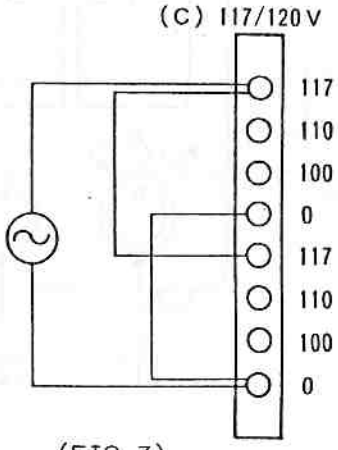
Terminal plate is furnished at AC primary side of the power transformer to select the voltage tap. The taps have been set for 220V and/or 234/240V at the time of shipment.
In case of different AC voltage, please change the connection of harmonica-terminal according to illustrations of A - F(FIG.1-6).



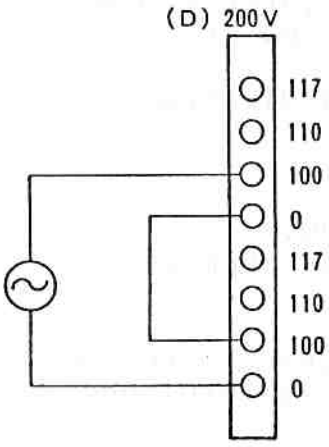
(FIG.1)



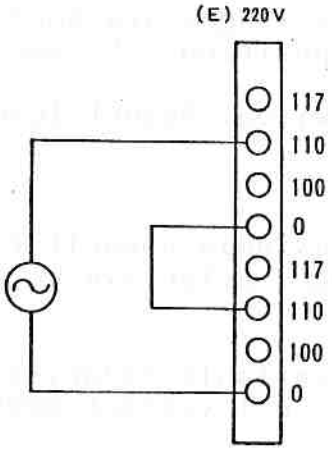
(FIG.2)



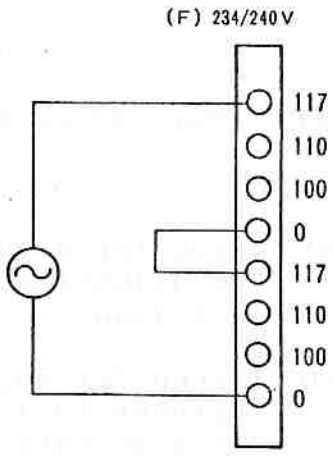
(FIG.3)



(FIG.4)



(FIG.5)

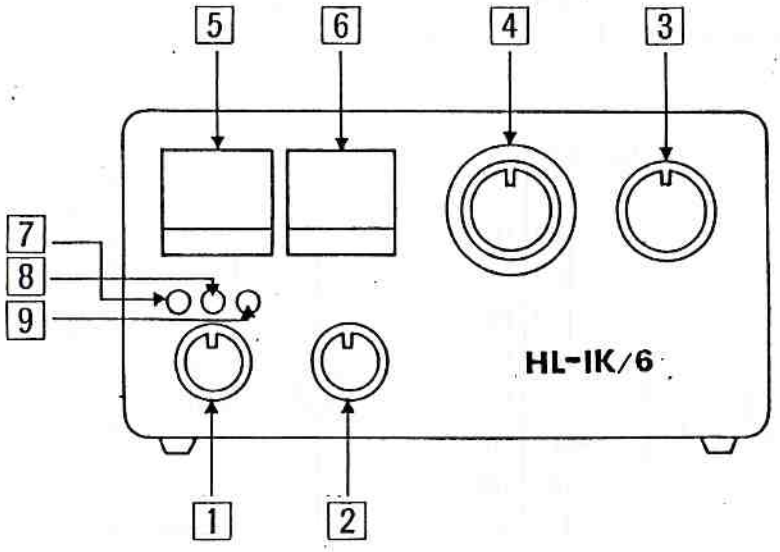


(FIG.6)

*Please check if AC Pin/Plug supplied is suitable for your country. If not, please change to the conventional AC Pin/Plug in your country.

5.EXPLANATION OF FEATURES

*FRONT PANEL



(FIG.7)

1)PWR·OFF/STBY/OPER : Power on·off/Stand-by/Operate select switch. At PWR·OFF and STBY positions, the amp is made "THRU" state, and output power of transceiver or transmitter will bypass the internal part of the device and reach antenna. (At STBY, various voltages are applied to internal parts.) At OPER position, the amp can be ON AIR.

2)METER : Multimeter select switch. Select IG/PO/EP indication.

3)LOAD : Knob for adjusting variable capacitor of LOAD. By adjusting this knob, effective RF power is supplied to the load.

4)PLATE : Knob for adjusting variable capacitor of PLATE to the most proper tuning point. 6:1 vernier mechanism is furnished for an easy tuning.

5)IP : Plate current meter. Indicates plate current of the vacuum tubes. Full scale is 600mA.

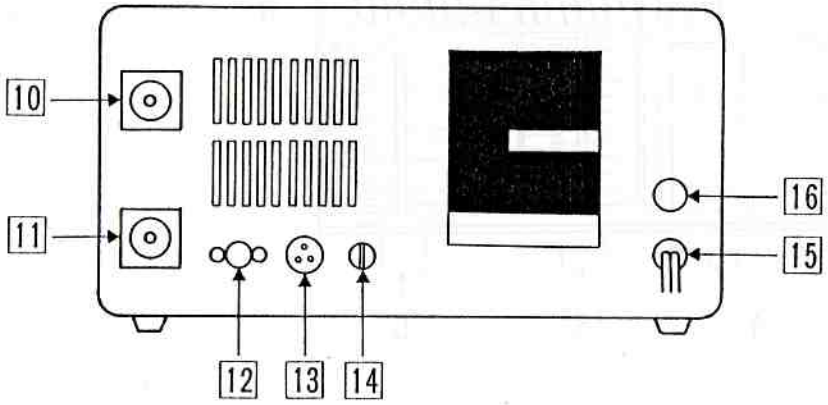
6)IG, PO, EP : Multi-meter. By selecting METER switch, you can read IG(Control Grid Current), PO(RF Output·Power) and EP(Plate Voltage) respectively.

7)POWER(LED:Green) pilot lamp : This lamp lights at STBY and OPER positions of switch ①, and indicates POWER is ON.

8)WARM UP(LED:Yellow) pilot lamp : Turning Power Switch ① to STBY position, this lamp lights when warming up of heater is completed. (It takes approx. 60 seconds.)

9)ON AIR(LED:Red) pilot lamp : This lamp lights when the amp is ON AIR.

*REAR PANEL



(FIG.8)

10)OUTPUT(ANT) : Output terminal of linear amp. Connect load(antenna or dummy load).

11)INPUT(TX) : Input terminal of linear amp. Connect cable from antenna terminal of transceiver or transmitter.

12)GND : Ground terminal.

13)CONTROL : Terminal for remote control of RX to TX and ALC output. By connecting cables between control terminals of transceiver or transmitter and the amp, changeover from RX to TX can be made automatically. Three cables(vinyl coated wire etc.) for STBY/ALC/EARTH are required to connect with transceiver.

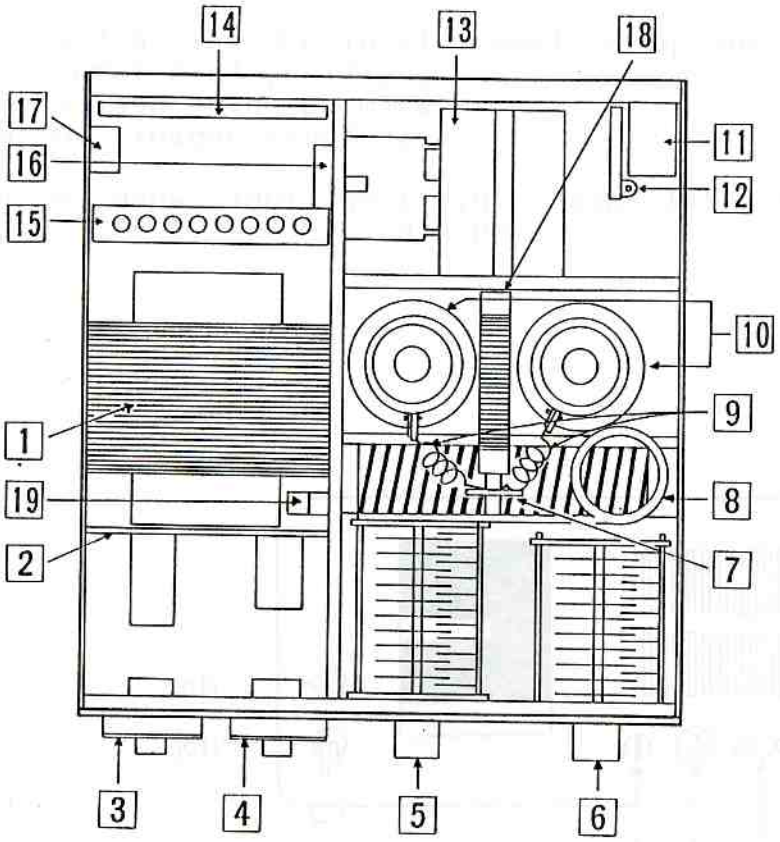
14)ALC : Adjusting knob for ALC output of control terminal ⑬. Adjust it according to the exciting power level of transceiver or transmitter.

15)AC POWER : AC power cord.

16)FUSE : 15A(at AC 100V). For AC 200V use, replace with 8A fuse.

*INTERNAL VIEWS

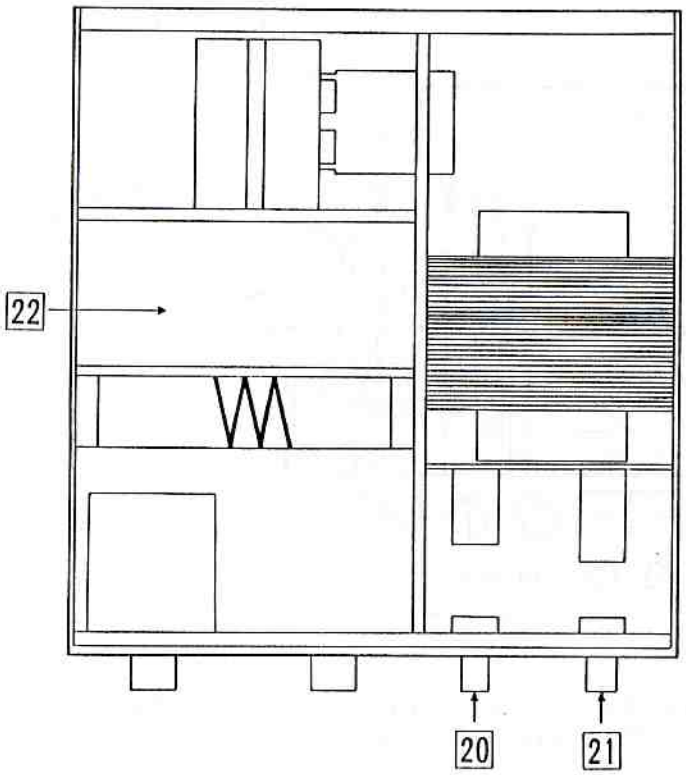
°Upside of the chassis



(FIG.9)

1)POWER TRANSFORMER
2)HIGH VOLTAGE RECTIFIER UNIT
3)PLATE CURRENT METER
4)MULTI-METER
5)TUNING VARIABLE CAPACITOR
6)LOADING VARIABLE CAPACITOR
7)COUPLING CAPACITOR(DC BLOCKING)
8)TANK COIL
9)PARASITIC OSCILLATION SUPPRESSOR
10)VACUUM TUBE(EIMAC 4X150A x 2)
11)ANTENNA RELAY
12)RF POWER DETECTOR UNIT
13)COOLING BLOWER
14)12V CG.SG POWER SUPPLY UNIT/
WARM-UP TIMER UNIT(setting time:60sec.)
15)AC SOURCE TERMINAL PLATE
16)CONTROL CRID BIAS
VARIABLE RESISTOR
17)INTERLOCK SWITCH
(AC SOURCE SIDE)
18)PLATE RF CHOKE COIL
19)INTERLOCK SWITCH
(HIGH VOLTAGE SIDE)

°Bottom of the chassis



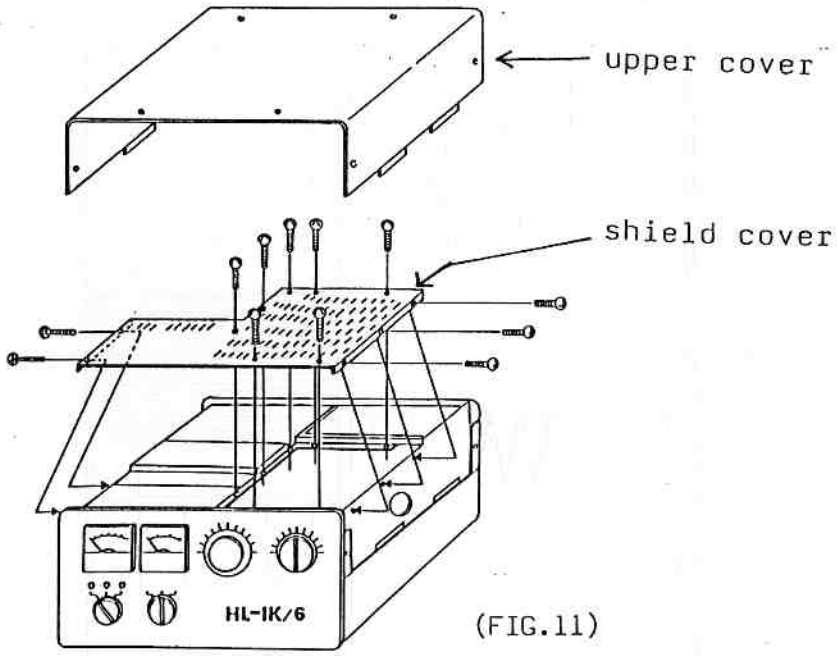
(FIG.10)

20)MULTI-METER SELECT SWITCH
21)PWR/STBY/OPER SELECT SWITCH
22)AIRDUCT AND RF INPUT CIRCUIT

6.HOW TO SET THE VACUUM TUBES AND CHIMNEYS

To protect the vacuum tubes, ~~4X150A~~ and chimneys have been packed separately from the device at the time of shipment.

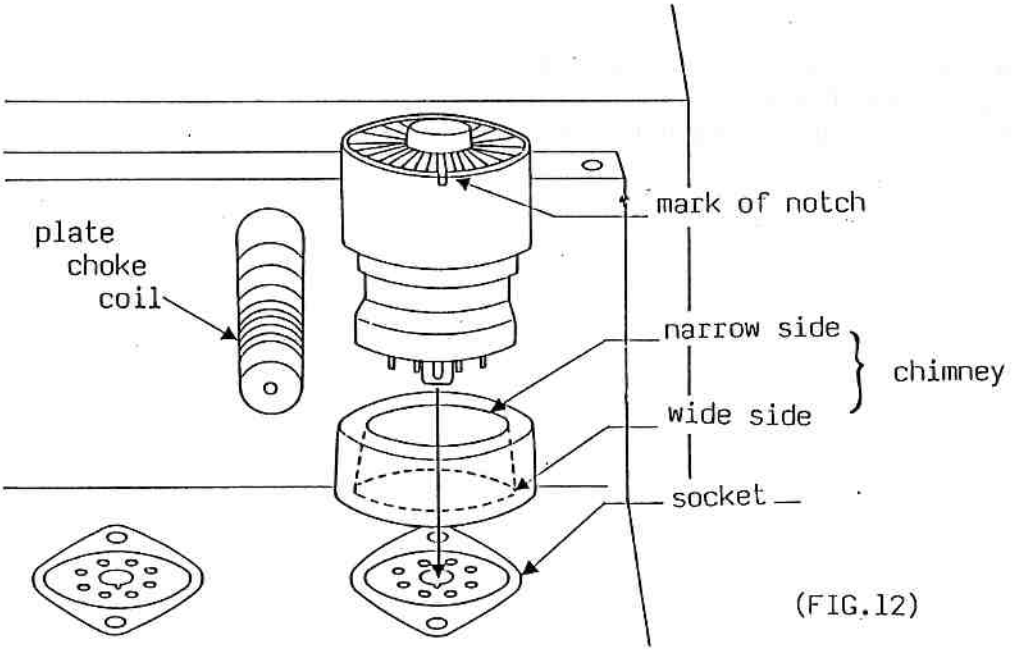
1)Remove upper cover and upper shield cover.(FIG.11)



(FIG.11)

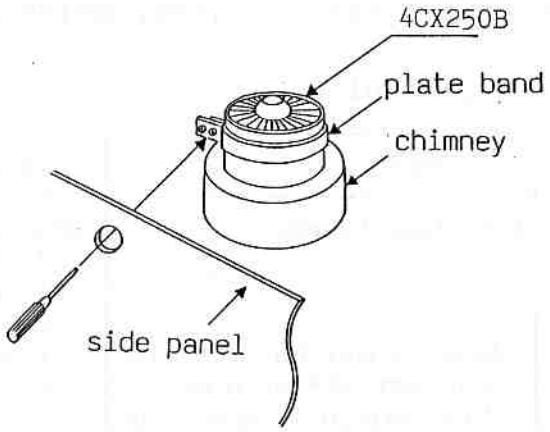
2)First, set the chimney and vacuum tube into the socket of inner side according to FIG.12.

(Place the tube so that the mark of notch faces the front, and raise the plate band for an easy tube installation.)



(FIG.12)

3)Then, set the plate band and tighten the screws with screwdriver approaching through side panel according to FIG.13.



(FIG.13)

4)As the same way, set the vacuum tube of the outer side.

5)Set the shield cover and upper cover.
(The shield cover must be always used.)

*Compact pins of socket for vacuum tubes are set tightly for higher reliability.

It may not be easy to insert the tube.
Please be sure to check if the tubes are set completely.

*Caution ; a)Be sure to check if plate band or parasitic suppressor don't touch chassis or tank coil etc.

b)Be careful not to supply the force though parasitic suppressor is set tightly, or plate choke coil may break.

c)Don't set and reset the vacuum tubes often, if not necessary.

7. TROUBLESHOOTING

The following symptoms are minor troubles, which can be solved rather easily.

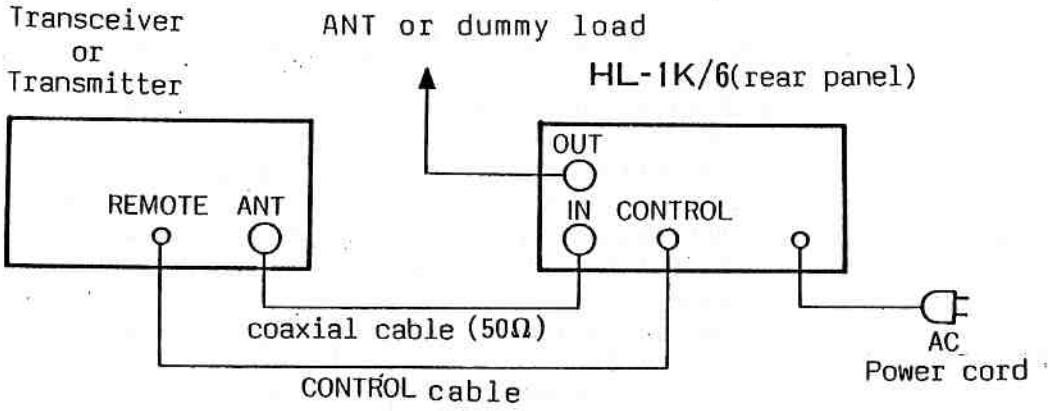
Please check each cause carefully.

Symptoms	Cause	Treatment
Can not turn on AC power.	1.AC fuse blown.	1.Replace fuse(15A at 100V, 8A at 200V). If fuse blows again, it should be a trouble.
	2.Upper cover has not closed completely(Interlock switch is open state).	2.Close upper cover completely.
	3.AC power cord isn't connected.	3.Plug it firmly(surely).
	4.Mis-wiring of voltage taps at AC power terminal.	4.Connect correctly according to Instruction manual.
Fuse blown soon.	1.Capacity of fuse is not proper.	1.Install correct fuse. (15A at 100V, 8A at 200V)
	2.Plate band or parasitic suppressor touchs other parts(chassis, tank coil for example).	2.Keep space from other parts.
	3.Upper shield cover has not closed completely. (High voltage interlock is short-circuit state)	3.Close upper shield cover completely not to be short circuit high voltage interlock.
	4.Mis-wiring of voltage taps at AC power terminal.	4.Connect correctly according to Instruction manual.
	5.As tubes were not set, plate band touched chassis and high-voltage circuitry became short-circuit state.	5.Set the tubes correctly.
Fan doesn't turn round. (or turns round slowly.)	1.Mis-wiring of voltage taps at AC power terminal.	1.Connect correctly according to Instruction manual.
	2.Some foreign substance are in the fan.	2.Remove the substance.
EP(Plate voltage) is only a half compared with the normal level.	Mis-wiring of voltage taps at AC power terminal.	Connect correctly according to Instruction manual.
IP(Plate current) at transmission is extremely low or zero.	1.Tubes are not set correctly.	1.Set the tubes into the sockets firmly.
	2.Mis-wiring of voltage taps at AC power terminal.	2.Connect correctly according to Instruction manual.

Symptoms	Cause	Treatment
	3.Deterioration of vacuum tubes. 4.It's not a transmitting state. 5.Control Grid bias variable resistor is turned off erroneously.	3.Replace tubes. 4.Be sure to check remote control cable. 5.Turn CG bias variable resistor to set IP at 130mA.
PO(output power) is low or zero.	1.ALC adjusting knob has been turned fully clockwise. 2.Deterioration of the vacuum tubes. 3.Antenna terminal is open or short stage. 4.Mis-tuning. 5.Driving power from transceiver or transmitter is less than the rated level. 6.Connectors of coaxial cable between transceiver or transmitter and HL-1K/6 are short or open. 7.Vacuum tubes haven't been set. 8.Input and output connectors are connected in a wrong way.	1.turn this knob counter-clockwise. 2.Replace the tubes. 3.Repair the open or short stage. 4.Tune correctly according to Instruction manual. 5.Adjust output level of transceiver or transmitter to reach HL-1K/6'rated level, so that enough RF output power can be achieved. 6.Replace coaxial cable or repair bad place. 7.Set the tubes correctly. 8.Set the connectors at the right position again.
"ON AIR" state cannot be made.	1.Cable for remote control is bad or not connected. 2.Warm-up time(approx.60 sec.) has not passed. 3.PWR·OFF/STBY/OPER select switch is not at OPER position.	1.Connect remote cable correctly. 2.Wait until warm-up has been completed and "WARM-UP" pilot lamp(yellow) lights. 3.Set this switch to OPER position.
Receiving signal cannot be received when power switch is at "OPER" position.	Short-circuit at remote cable.	Repair short-circuit.

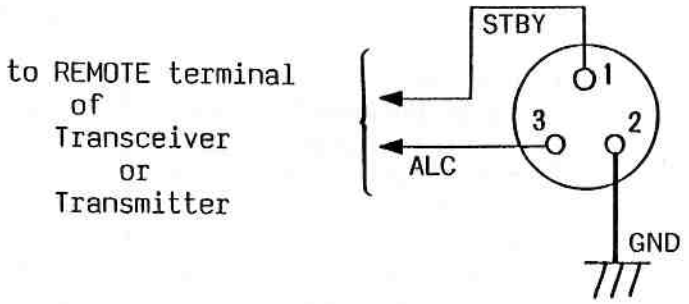
8.OPERATION

1)Connect RF jumper cables and power cord according to FIG.14.



(FIG.14)

*Connection of control terminal
(Control socket viewed from outside of the chassis)



(FIG.15)

°Set the cable from STBY terminal to the remote control terminal of transceiver or transmitter which gets grounded at transmitting.

°"Power amplification state" cannot be made without connecting STBY terminal.

A simple transmitting test without wiring Send/Receive remote control can be made by grounding STBY terminal.

2) Set the knobs of variable capacitors for Plate and Load to each corresponding position beforehand (at 50-ohm load) in referring to the attached test report.

3)Turn the POWER switch on(STBY position) and wait for approx.60 seconds until WARM-UP pilot lamp lights. Then, switch to OPER position and make your transceiver or transmitter on air.
ON AIR pilot lamp lights and idling plate current(IP) should run approx. 150mA.
Adjust carrier level of transmitter to get IP of approx. 300mA.

4)Always adjust Plate variable capacitor to make output power meter (PO) indication to increase and IP to dip.

5)Adjust Load variable capacitor to maximize PO meter indication.

6)Now increase carrier output power level of transceiver or transmitter to get IP of 500mA.
At this time, adjust each Load knob and Plate knob alternately to maximize the output power.
To achieve a clean output wave form, turn Load knob clockwise slightly to decrease PO(Output power) by 5-10% from the maximum point, and set the Plate knob always to get IP(Plate current) dipped.

*Try to finish this adjustment within a minute.
If it takes longer, please let the device idle for a minute.

7)Operate the device with adjusting ALC knob on rear panel to proper operating voltage according to the output of the transmitter. Set the ALC knob at the point where IG meter rarely deflects and Power meter or IP indication is about to decrease slightly from the peak.
Be sure to check the output power is not exceeding 500W after the adjustment.
To transmit a clear and not distorted signal wave, it is recommended that the ALC voltage is fed back to the external ALC input terminal of your transceiver used.
If there is no external ALC input terminal, do not try to overdrive HL-1K/6 so that grid-current starts running(or the IG meter starts deflecting).

9.AN OUTLINE OF MAJOR CIRCUITS

1)RF Input Circuit

RF power sent from transmitter or transceiver to input terminal goes through relay contact and is resonated with pi-type input network circuit. Power signal is impedance-transformed and then reaches control grid of the vacuum tube 4CX250B.

2)Power Amplification Unit(P.A.Unit)

P.A.Unit is a grounded cathode linear amplifier consisting of two vacuum tubes of 4CX250B connected in parallel.
-55V voltage is applied to the control grid to run approx. 150mA of IP as idling current for two tubes when no driving.
Approx. +350V voltage is applied to the screen grid.
At receiving state, control grid voltage becomes -140V to cut off the tube operation.

3)Output Circuit

The output power of vacuum tubes goes through parasitic suppressor R1/R2 and also coupling capacitor C1, and then, goes into pi(π) type output tuning circuit.
Power from output tuning circuit goes through relay RL2b and directional power meter unit, then reaches output terminal J2.

4)Directional Power Meter Unit

RF power detected by troidal core type current transformer is rectified by high efficiency schottky diode D29 and then, drives the power meter.

5)ALC Circuit

A part of driving input signal is rectified by diode and supplied to ALC terminal as a negative ALC voltage.
By connecting the ALC terminal and ALC input terminal of transceiver or transmitter to make a feedback, it will effectively prevent from increasing distortion caused by over-drive.

6)Heater Warming-up Unit

Time constant by capacitors and resistors of this circuit is set approx. 60 seconds to enough warm up vacuum tubes 4X150A beforehand.
Relay(RL1) is driven by 1 pc. each of uni-junction transistor and thyristor.

7)Power Supply Circuit

High voltage of AC 850V at secondary of power transformer is rectified by voltage doubler circuit of eight rectifying diodes to get the DC voltage of 2400V, which is then supplied to plate of the vacuum tubes.
Two heaters are connected in series to accept 12V line of power transformer and this AC voltage of 12V is shared with heater warm-up circuit(used after being rectified).
Besides, DC power supplies for screen grid of 390V and for control grid bias of -55V to -140V stabilized by zener diode are built in the unit.

10. CAUTION

1) Impedance

When you operate the device, please always connect, as a load, a well-adjusted antenna or a dummy load of 50Ω. In case that the antenna impedance is extremely off from 50Ω, please use the impedance matching circuit such as an antenna coupler etc. If you transmit under the no load or mis-matching condition, the expensive vacuum tubes may be deteriorated in a short time, and also output tuning circuit may get a damage.

2) Place of Installation

Install the device at well-ventilated and dry places where is not exposed to the direct rays of the sun, as the device radiates plenty of heat and uses a high voltage.

3) AC Power source

The device is designed to operate from AC 100-120V or AC 200-240V by selecting the connection of the internal part.
Be sure to check the connection of AC power terminal board near the power transformer.

4) When you open the cover,

a) To check the internal part of the device, please pull the AC power plug off and check if high voltage has been discharged to prevent from getting electric shock. (Be sure to check the EP 0(zero)V on the multi-meter.)

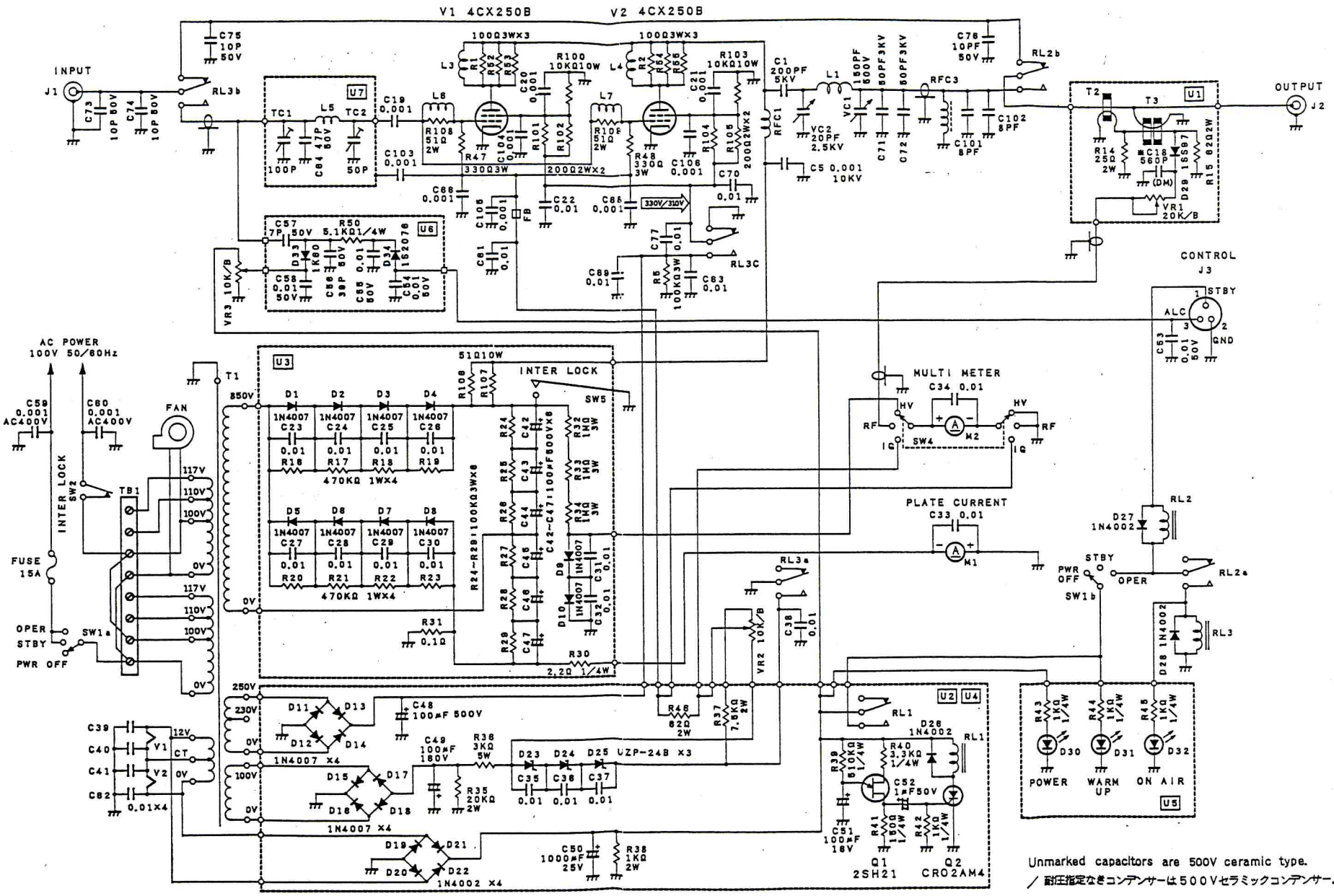
b) Don't touch or trim the directional power meter and control grid bias adjustable resistor VR2 as they have been already adjusted.

5) Driving Power

HL-1K/6 can get maximum output power with the driving power of 10W. If you use the transceiver or transmitter of over 15W output, please be careful not to exceed 15W output.
In case that IG meter is driven extremely, it may be overdriving or mis-matching.

6) Please clear dust in the internal part of the device at least once a year, or cooling fan will not work effectively, and it may be the cause of leak.

7) For AM/FM/RTTY/SSTV modes, please reduce the driving level to approx. a half of the maximum rated level.



Unmarked capacitors are 500V ceramic type.
／耐圧指定なきコンデンサーは500Vセラミックコンデンサー。

This diagram is subject to change without notice. ／本図は改良のため予告なく変更することがあります。

TOKYO HY-POWER HL-1K/6
CIRCUIT DIAGRAM

D7/00000018