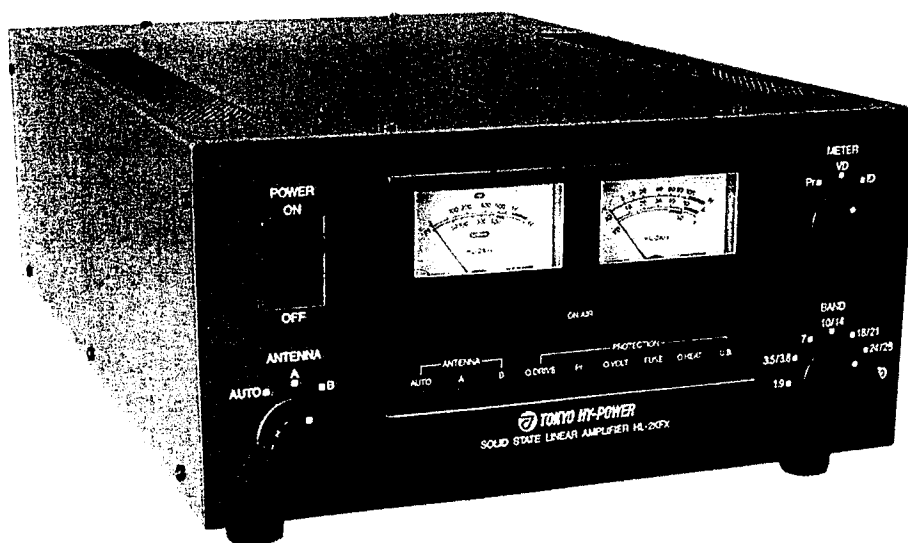


User Manual

Solid-State HF/50MHz Band
1kW Linear Power Amplifier

Model HL-2KFX



* Thank you for purchasing the Tokyo Hy-Power HF linear amp, HL-2KFX.*
Please read this manual thoroughly before you start to operate.

CAUTION : High Voltage Inside !

There are **high AC and DC voltages** running inside the cabinet. Also **high RF voltage** is being generated while the amp is keyed on. Do not make an unnecessary access to the internal components carelessly. Or it may be lethal to the operator's life. .

(1) HL-2KFX/FEATURES

- HL-2KFX is a compact and light weight desktop HF linear amplifier with the maximum input power of * 2kW. It is one of the most compact 1kW out HF linear in the industry . Driving power required is 70-100W. It covers all the amateur HF bands including new WARC bands as well as 6m band. Due to its solid-state broad band design, most of HF frequency bands can also be covered as well as amateur bands. (1.5kW on 6m band.)
- Eight units of M/A COM, Motorola MOS-FET MRF150 are used in the parallel push-pull form. MRF150 is a reliable and high gain RF transistor that is best suited for a low distortion, SSB amplification service. Unlike the tube type amplifier, no tuning procedure is required ,even if the frequency band is changed. All you need is just to change the band switch.
- Duct structure is used for the cooling air flow in the power transistor heat sink that consists of thick aluminum and copper sheets for fast and flat heat diffusion. This heat sink system together with the forced air cooling makes the amplifier very compact and reliable.
- With two large analog panel meters, forward RF output power, Pf can be monitored all the time. Also, drain voltage (Vd), reflected output power (Pr) and drain current (Id) can be monitored with the multi-function meter, so that the each operating state can be always checked properly.
- HL-2KFX works with AC power of 100V to 230V by changing the AC input circuitry on the terminal board. AC 200-230V operation is recommended for the better stability.
- The interlocked safety system has been built in the cabinet. When the upper cover is lifted, AC power will be cut off for the safety of the operator.

(2) HL-2KFX / SPECIFICATIONS

Frequency Band	: 1.9 - 28MHz all HF amateur bands & 50MHz band.
Operation Mode	: SSB, CW, RTTY, SSTV, AM
Exciting Power (RF Drive)	: 100W max.
Output Power (RF Out)	: 1kW max. SSB/CW for HF bands and 650W for 50MHz band (RTTY / SSTV/FM to be 1/2 of SSB/CW and AM to be 1/3)
Drain Voltage	: DC 53V (with no RF excitation)
Drain Current	: 50A max.
Input / Output Impedances	: 50 ohms (unbalanced)
Input / Output Connectors	: SO-239 (M-J)
RF Power Transistors	: MRF150 x 8
Class of Operation	: Class AB , Push-Pull circuit
AC Power	: AC 100/110/115/ 200/220/230V (50/60Hz, single phase), Switch selectable. Consumption : 2,200VA max. at peak
Built-in Meters	: RF Output (Pf) : 1kW F.S. Multi-meter : Reflected RF (Pr) : 50W : Drain Voltage : Vd 55V : Drain Current : Id 50A
Cooling Method	: Force air cooling
Dimensions	: 302 x 142 x 433 (W x H x D mm) or 11.9 x 5.6 x 17 (W x H x D inches)
Weight	: 24.9kgs. or approx. 55lbs.
Enclosed parts	: RCA plug x 2 pcs. Spare fuses 10A x 2 20A x 2

*** Specifications are subject to change without notice as a result of the further engineering development. ***

(3) Installation and Operation

① Installation

Please do not set the amp at those places where the direct sun light comes in and the environmental temperature will get too high. Do not put any thing on the ventilating window at the top of the cover case, otherwise the smooth air cooling will be disturbed and expensive RF power transistors will be damaged or eventually killed. Similarly do not block the air intake area of the two fans located at the rear by setting the amp too close to the wall.

② Checking The Inside

In order to avoid the possible electric shock with the high voltage used in this amplifier, please pull off the AC power plug and be sure to check if the DC high voltage is discharged (see if VD of the multi-meter in the front has become 0V). Do not the turn the pot (potentiometers) in the RF power detector, protection circuit, and FET gate bias supply circuits, as they have been precisely factory adjusted.

③ AC Power

HL-2KFX is set for AC 230V (234V) at the time of shipment from the factory. The amp may work with AC 115V (117V) . Check the AC voltage select switch located at the bottom to see if it is properly set before applying AC power.

④ Load Impedance

When operating this amp, be sure to connect the well matched antenna or the 50 ohm dummy load. If the impedance of the antenna system to be connected has high SWR value, please adjust the antenna for a good SWR value such as 1.5 (1.8 max) or connect antenna tuner between the amp and the antenna. Operation with no load or into an unstable antenna may lead to the severe damage of RF power transistors, although the protection circuits are provided with HL-2KFX.

⑤ RF Driving Power

This amp requires approx. 100W of drive to achieve the maximum rated output power of 1kW. When the transceiver with output over 100W is connected, be careful not to exceed 100W at any time. In case ID meter deflection is extraordinary high, the amp is being over driven and or antenna SWR is too high.

⑥ Cleaning

Depending on how long you have worked this amp, clean the dust inside, especially around the cooling fan and the heat sink fin area. With too much dust, cooling efficiency may be degraded.

⑦ Continuous Transmission

For the extremely long continuous transmission and or the contest operation, it is recommended that output power is reduced by 20 to 40%, decreasing the driving from radio. Similarly for the high duty cycle operation such as FM, RTTY etc., reduce the output by one half and for AM by one third of maximum rating.

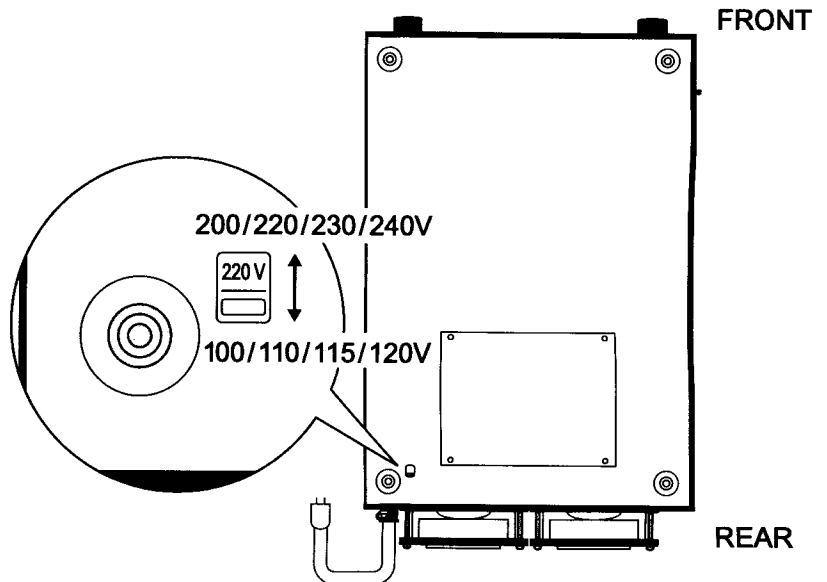
(4) About AC Line

*Although HL-2KFX is designed to work with both AC 230V and 115V lines, we recommend to operate with 230V line for better stability.

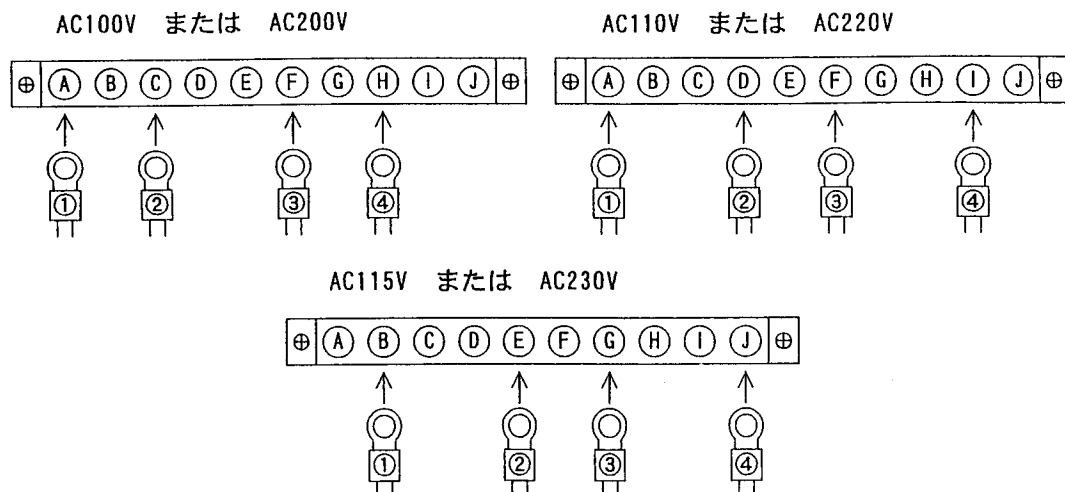
*The shape of AC power plug differs from country to country. Please prepare the one for your particular location.

*Initial Setting is AC 230V

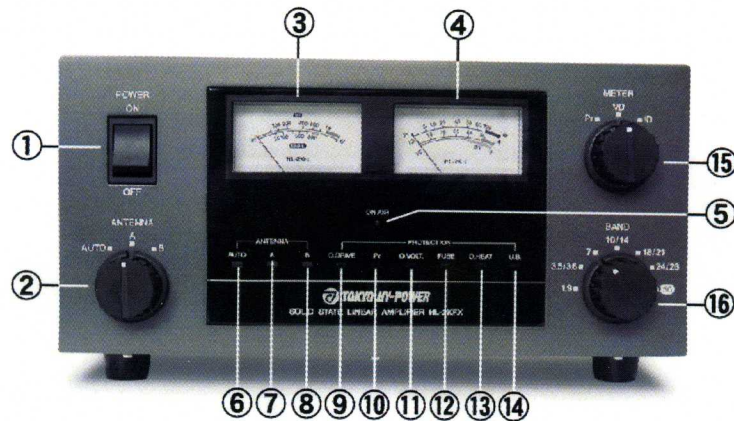
There is an AC voltage select switch at the bottom of the case as illustrated at the right. Carefully check this switch if it is properly set.



*By changing the primary wiring of the power transformer, HL-2KFX will work with other AC line voltages than 230V/115V. When changing this wiring, make it sure that AC power plug is pulled off and follow the instructions as illustrated below.



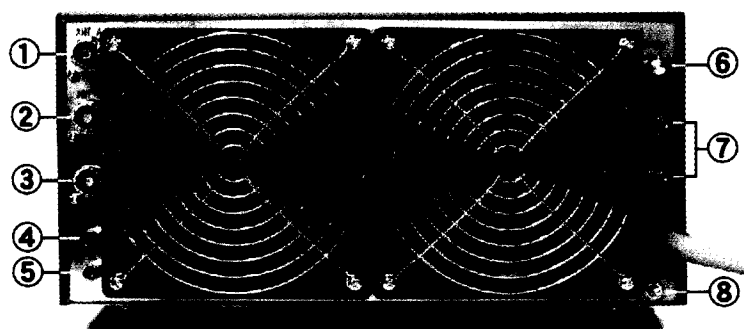
(5) Explanations for Front and Rear Panels



FRONT PANEL

- ① **POWER** : ON/OFF switch for AC power. When this switch is off, the linear amp becomes the “through” state. In other words, output power from the xceiver will bypass the amp. and will be fed to the antenna directly.
- ② **ANTENNA** : A switch to select ANT A, ANT B, or AUTO mode.
 - ANT A : Power output is always connected to ANT A.
 - ANT B : Power output is always connected to ANT B. (Selection of A., or B is possible even when POWER switch is off.)
 - ANT AUTO : Power output will be connected to ANT A on HF, and to ANT B on 50MHz. (This Function will not work when POWER switch is off.)
- ③ **Pf METER** : Will indicate the forward power output . (50MHz power is shown with lower scale.)
- ④ **DP r, VD, ID MULTI METER** : Will indicate reflected power, drain voltage, drain current of RF power FET's at final. ⑮ for “METER” is a multi-meter select switch.
- ⑤ **ON AIR** : LED lights when the amp is keyed to TX ON state.
- ⑥ **AUTO (LED)** : Lights when auto ANTENNA select mode is selected.
- ⑦ **A (LED)** : Lights when ANTENNA A is selected. ⑧ **B (LED)** : Lights when ANTENNA B is selected.
- ⑨ **O.DRIVE** : LED lights when over driven and the protection circuit works. To reset, turn off POWER once and turn it on again..
- ⑩ **Pr (LED)** : Lights when reflected power from antenna exceeds 100W and protection circuit works.
- ⑪ **O.VOLT (LED)** : Lights when drain voltage of MOS FET becomes much higher than rated one and protection circuit works.
- ⑫ **FUSE (LED)** : Lights when a fuse on the power amp unit is blown. Replace it with a new one.
- ⑬ **O.HEAT (LED)** : Lights when the temperature of power amp unit exceeds 70 degrees C, and protection circuit works. Wait for several minutes at least until the amp unit gets cooled off. Reset the POWER switch.
- ⑭ **U.B. (LED)** : Lights when unbalance occurs with two combined power amp units. May need to repair.
- ⑮ **METER** : Changes the reading of multi meter ④ .
- ⑯ **BAND** : Selects the operating freq. band. (Output low pass filter is changed by relays.)

REAR PANEL

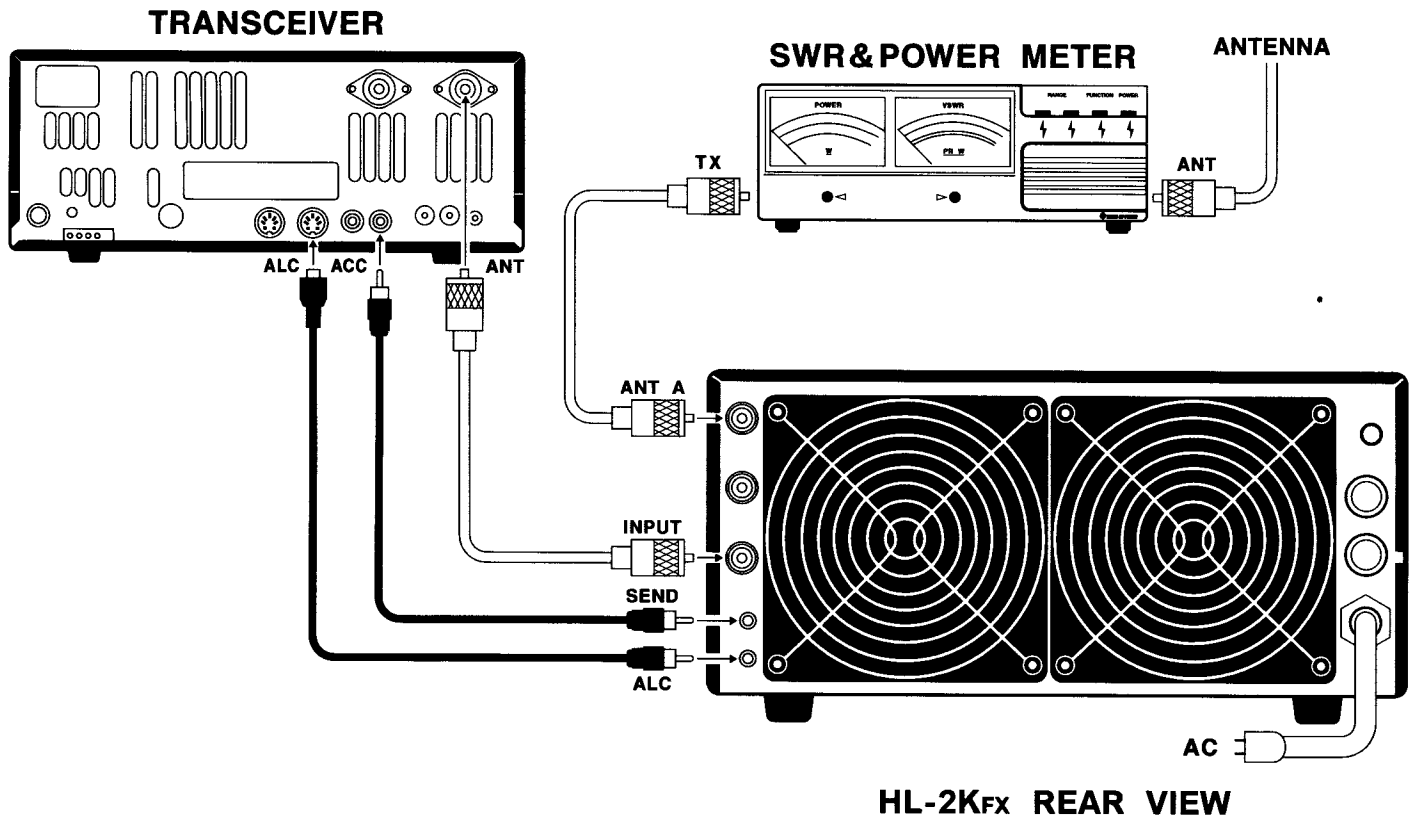


- ① **ANT A** : Output terminal for your ANTENNA A or for dummy load.
- ② **ANT B** : Output terminal for your ANTENNA B or for dummy load.
- ③ **INPUT** : Connect a coax cable from “ANT” (or OUT) of the transceiver.
- ④ **SEND** : Connect a remote cable from SEND terminal (or TX GND, REMOTE) of the transceiver to key HL-2KFX in combination with the transceiver. Grounded by the relay contact of the transceiver to key the amp.
- ⑤ **ALC** : Connect to ALC terminal of the transceiver to prevent the amp from getting distorted due to over driving or to keep the power output at certain level, especially when high power transceiver is combined.
- ⑥ **ALC ADJ** : Potentio-meter for adjusting the ALC voltage level , that is fed back to the transceiver .
Adjust the potentio-meter properly so that the output power from HL-2KFX is limited to certain level at voice peak (or cw). The ALC voltage is adjusted for approx -4V (good for IC-756PRO series) at time of factory shipment. (FT-1000MP may need approx. -11V, and TS-950 -12V or more. See the radio manuals for more details.) DC -12V max. will be obtained when this pot is fully turned clockwise, and 0V obtained when fully turned counter clockwise.
- ⑦ **FUSE** : 10A fuses for AC 230V line are used. Change to 20A when operated with AC 115V.
- ⑧ **GND** : Grounding terminal.

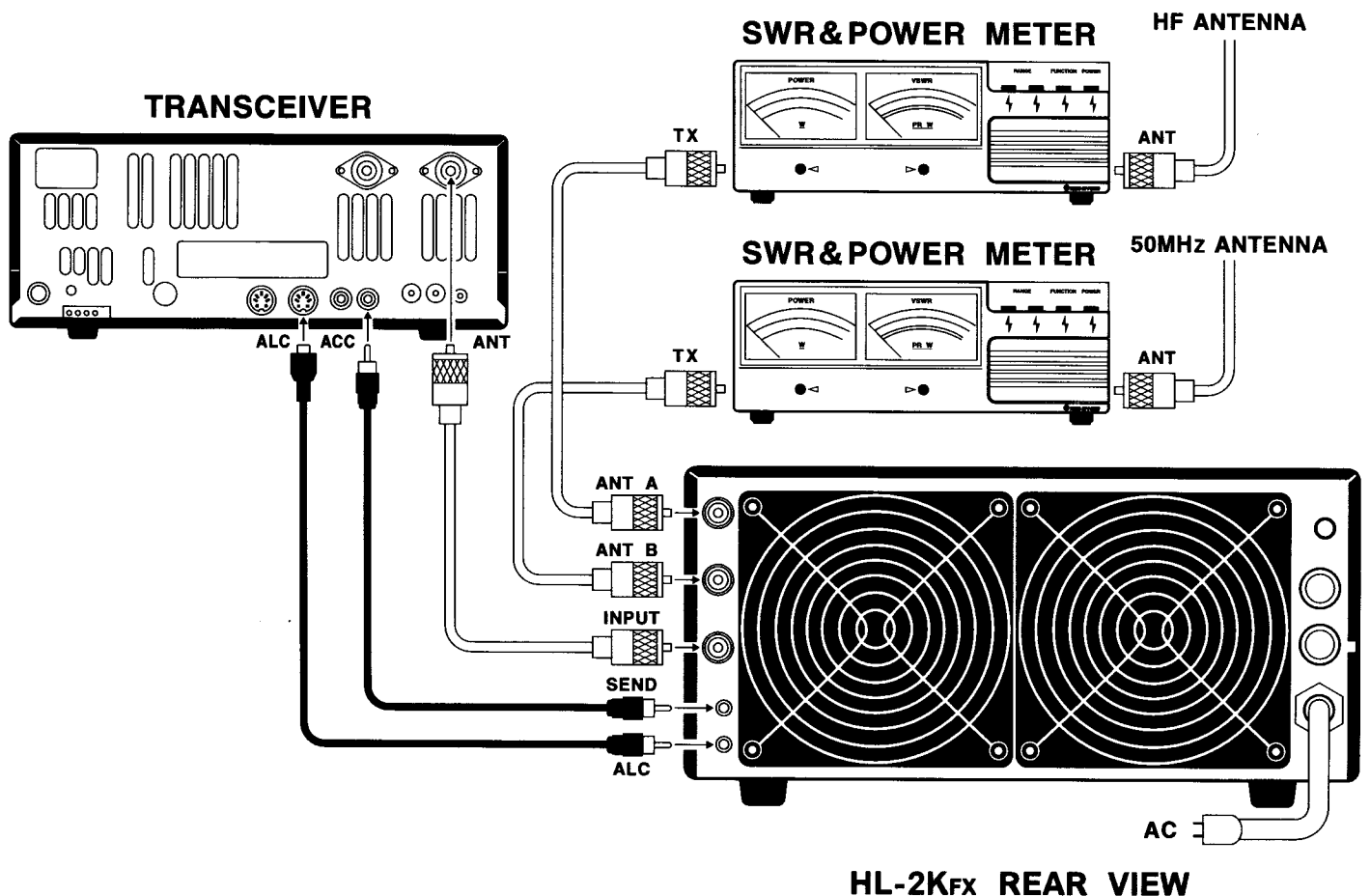
BOTTOM

- 115/220** : Select switch for AC power voltages. Usually it is set at “220V” position. When the amp is operated with AC100/110/115V, set the switch at “115V” position.

One antenna system example:



Two antenna system example:



1. Connect AC power cord and coaxial cables as shown in the illustration at left page. **SEND** socket should be connected to the pin of the transceiver remote socket, that is grounded at TX state. If this connection is missing, this amplifier will not work.
2. Keep the ① **POWER** switch OFF. Turning on your transceiver, and incoming signal will be heard , that is received by the antenna and comes into transceiver by by-passing the amp.
3. Next please check your antenna SWR with the transeiver , while the amp **power switch** is being kept **off**. Keying the transceiver on to “TX” state, check the SWR of the antenna. If the SWR is as high as 2 or more, try to lower it down to 1.5 or less by adjusting antenna element and or using antenna tuner etc.
4. Then turn on the ①**POWER** switch and set the ⑩**BAND** switch at the desired frequency band of operation. To check the amp performance, set the transceiver either RTTY, or CW mode. At this time, “ RF POWER “ knob of the radio (or knob for adjusting carrier output level) should be turned off to zero output.
5. When you key the transceiver on now, the amp will also be keyed on. Increase the driving power gradually, amplified strong signal will be transmitted from the HL-2Kfx. (Check if approximately 500W is achieved with 40W drive and ID runs around 25A. Increase further the drive power to 80-90W till 1kW out is achieved.) Check the antenna SWR once again to see if SWR value is still around 1.5 or hopefully less. There is a case that SWR will fluctuate as the amp is on. Check if the trap coil withstands 1kW power.
6. For SSB and CW operation, driving power of 70 to 100W is needed to get full 1kW output. Please try not to over-drive by monitoring the output power. Excessive output power operation may lead to the damaging of expensive RF power FET’s eventually.
7. For high duty operations such as FM, and RTTY etc., please keep the maximum output power a half of 1kW or 500W so that it may not damage the amplifier. (350W for AM.)
8. When the bare foot operation is desired, or amp operation is not necessary , just turn off the **POWER switch** of linear amp., while all the cable connections are left as they are.

(7) ABOUT THE MAJOR CIRCUITRY

HL-2KFX consists of input power splitter, a pair of 500W RF power amp unit, output power combiner, output LPF, output power detector, control circuit unit, and DC power supply.

1. **Input Power Splitter**

RF driving power is lead to the power splitter where the power is divided into two. Then each power is fed to a pair of 500W power amp unit.

2. **RF Power Amp Unit**

Each amp unit consists of 4 pcs. of MRF150's that are arranged in the parallel push-pull configuration. Drain voltage is 53V with idling drain current of 0.6A when there is no drive. Gate bias circuit is independent from each other, so that the whole amplifier units will achieve stable performance. Amplified signal will go from the drain of MOS FET to the wide band transformer. After the impedance transformation to 50 ohms, each output is lead to the power combiner where 1kW of power is obtained.

3. **Output Low Pass Filter (L.P.F.)**

Then signal will reach the L.P.F. unit where the harmonics and spurious signals will be removed. Further more, signals will go through the feed-thru power detector and T-R relay contacts and then reach the output terminal.

3. **Feed-thru Type Power Meter**

A part of the passing RF signal is detected through the toroidal core type current transformer. Detected signal will be rectified by the shottky diode and then the detected DC signal is going to be used for RF power meter circuit and protection circuit as well.

4. **ALC Circuit**

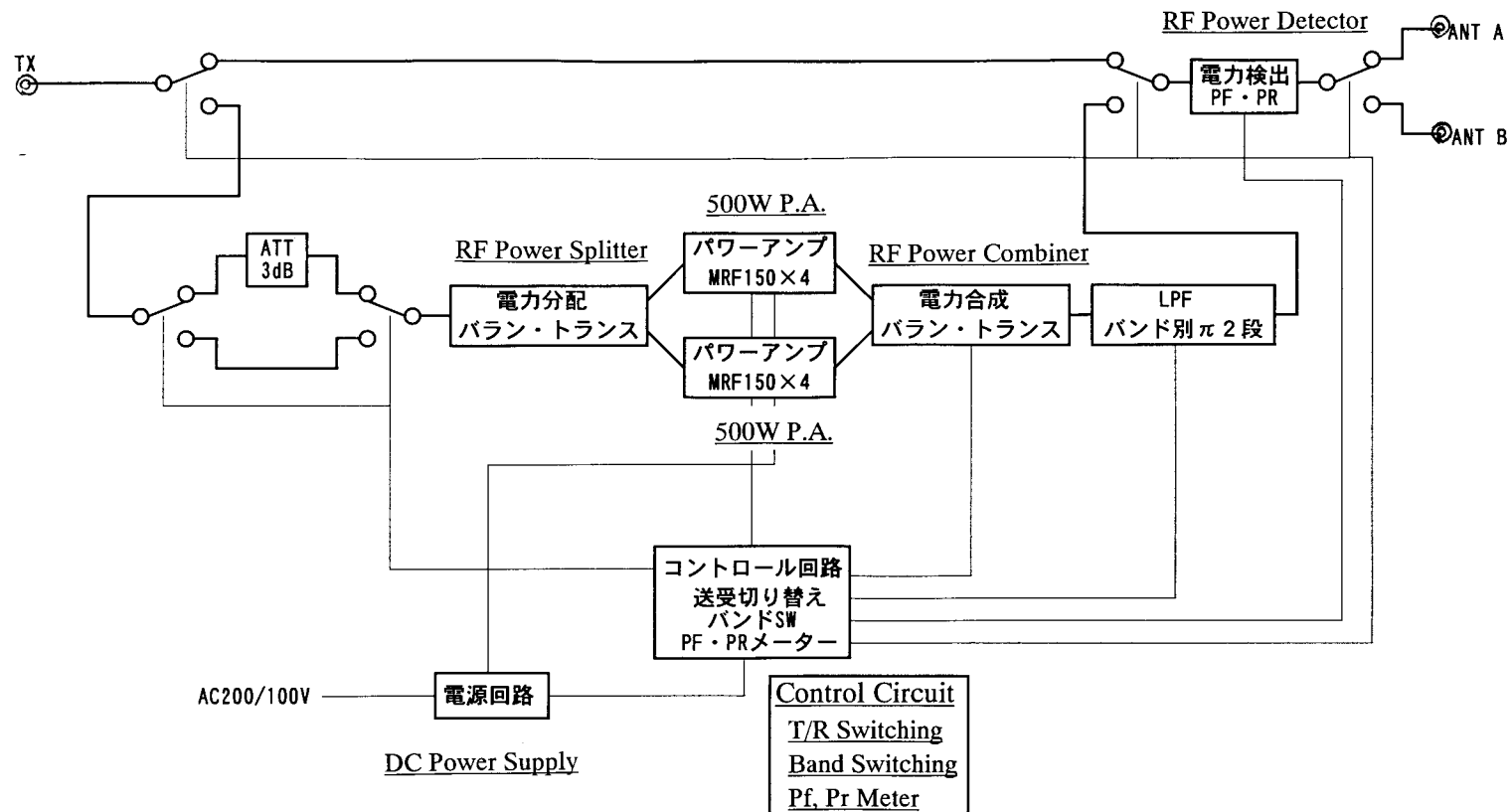
RF driving signal detected by the diode in the detector unit will be amplified by the Ope-amp and fed to the ALC terminal. This ALC voltage is negative. When this ALC voltage is properly fed back to the ALC input terminal of the transceiver, it will help amp. prevent the occurrence of distortion due to the over driving. Also, by adjusting the ALC level properly, output power can be set at free level.

5. **Control Circuit Unit**

The control unit board is placed at the rear of the front panel. All of the control functions needed for this amplifier is integrated in this board, such as monitoring of voltages, currents, and powers at final amp stage, band change of L.P.F., various protections, LED indicating and so forth.

6. **DC Power Supply Section**

Secondary output voltage from the power transformer is fed to the full-wave rectifier circuit of the bridge diode. Rectified DC voltage will then be filtered by the electrolytic capacitor block. The DC voltage will , then, be fed to the drain of MOS FET through the RF choke transformer , which also works as a part of RF NFB loop.



Model HL-2KFX Block Diagram

Date :	November 10th, 2003
Model HL-2KFX HF/50 kW Power Amp.	
By Shige Suzuki	
Tokyo Hy-Power Labs., Inc.	

