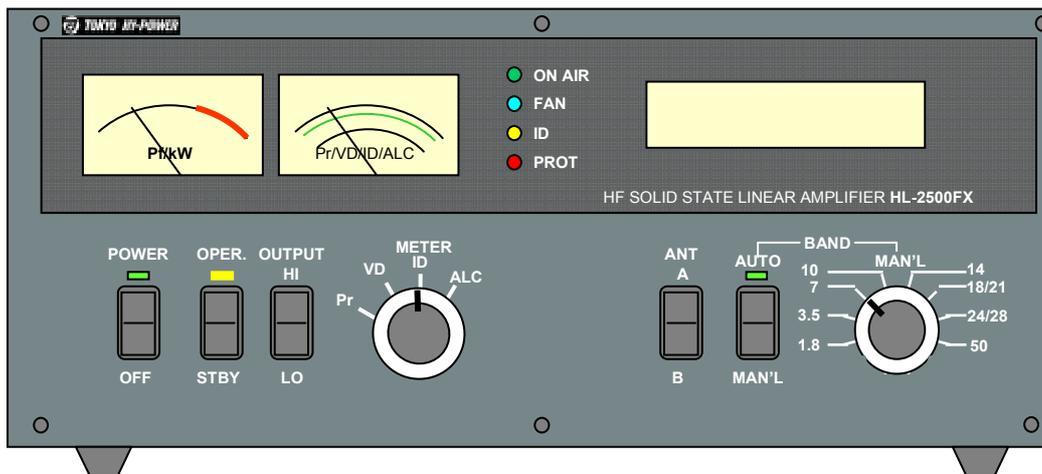


INSTRUCTION MANUAL

HF ·50MHz LINEAR POWER AMPLIFIER

HL-2500FX



1.Introduction

Thank you for purchasing the HL-2500FX. This compact and lightweight desktop HF linear power amplifier has a maximum input power of 2.9 kW. Our solid-state broadband power amp technology makes it the smallest and lightest in the industry.

Typical output power is 1.5 kW PEP/SSB on HF (1kW on 50MHz) with the drive power of 85-90 W. The built-in band decoder will let you forget about the band setting when the amplifier is connected to your modern radio through such band data cables as ICOM CI-V, DC voltage (Yaesu and Elecraft K3), and RS-232C (Kenwood). These data cables are optional parts. The one that matches your radio should be purchased separately.

2. Cautions

2-1 Unpack the amplifier, check the fan guard at the rear panel fan to see if there is any damage caused by the physical shock during the transportation. Fan blades must be free to rotate when powered. The amplifier is cooled by forced airflow. Several inches of clearance on the top and the rear wall are necessary to allow for smooth air intake into the fan. Do not block the air vents on the top cover.

2-2 Keep the amplifier out of direct sunlight, in a cool dry environment.

2-3 Internal high voltages, (AC, DC and RF), are present at all times, ON AIR or OFF. Internal access should be limited to avoid injury.

2-4 Turn off the AC main power immediately upon any unusual sounds, sights or odors. Check the multimeter readings of Vd and Id, the fuses and all cable connections around the amplifier. Please notify the dealer or the factory of any problems.

2-5 For your safety, do not operate the amplifier without adequate grounding. A proper ground connection will result in peak performance and stability, in addition to reduced RF strays or noises.

2-6 To eliminate the RF interference to such home appliances as TV, FM radio, telephone sets, etc.,

it is recommended that clamp-on ferrite cores be inserted at both ends of the remote control cable, ALC cable, coaxial jumper cable, and antenna cables, as needed. Also, a common mode AC line filter (near the AC outlet), and in-line low pass filters on the antenna coaxial cable, (as necessary), are recommended.

2-7 The amplifier has fast acting sophisticated protection circuits controlled by the latest microprocessor technology. Please note, however, any such actions that cause the same fault to occur repeatedly, will lead to failure of the valuable final power FET transistors. Also note that the full power CW (or carrier) drive under the erroneous MANUAL BAND SET leads to the failure of the final power FET's (See page 14, Section 10. *Trial*). In this sense, it is highly recommended that the amplifier is connected to the radio with Band Data Cable.

2-8 Before checking inside the amplifier, be sure to wait a few minutes for the high DC voltage to discharge (monitor Vd meter reading). The internal potentiometers for RF power detector, protection circuits, FET bias voltage circuit, etc., are precisely adjusted at the factory, and should not be altered. Doing so, would require readjustment with precision measuring instruments.

2-9 DC power supply selection is designed with wide AC line voltage technology and works with any voltage of 200V to 250V as well as 100V to 125V. 200V to 250V line, however, is recommended for the best stability and performance. Note that maximum output power is 1kW only, when 100V to 125V is connected. Prepare appropriate AC power cord plug that fits the outlet at your location.

2-10 Before powering on the amplifier, be sure to connect a dummy load (50 ohms, 1.5 kW min.) or a well-adjusted antenna to the output terminal. Operating without any load will cause extreme stress to the RF power FET's, although protection circuits should work under critical conditions.

2-11 Required drive power is slightly less than 100 W to obtain the full 1.5 kW output. Do not attempt to operate with excessive drive from a high power transceiver. Transmitting high drive RF (over 100 W) into the amplifier will void the warranty.

2-12 Keep the aluminum heat sink and air openings free from dust and blockages. Periodic cleaning will prevent degraded cooling efficiency.

2-13 For long continuous operation in RTTY/FM modes, it is recommended you reduce the RF drive levels by 20% to 30% lower output than CW/SSB modes.

2-14 To prevent damage to the precision electronic components, avoid extreme physical shock to the amplifier. If factory service is required, the amplifier **MUST** be shipped using the original box and packaging materials.

3. Features

3-1 Our solid-state broadband design engineers worked to make the HL-2500KFX, the lightest and most compact 1.5 kW amplifier in the industry. This world-class compact 1.5 kW amplifier is the easiest to handle and operate.

3-2 The amplifier is equipped with a newly developed band decoder. The amplifier's decoder changes bands automatically as the data signal is received from the associated HF transceiver's frequency bands.

3-3 The amplifier's main PA section includes 6 high power MOS FET THP2933's by Microsemi, resulting in 1.5 kW PEP (SSB max.). The amplifier's broadband characteristics require no further tuning once the operating band is selected.

3-4 The amplifier allows operation in full break-in CW mode due to the use of the amplifier's high-speed antenna relays (made by Panasonic).

3-5 With the unique duct structure design and the powerful blower fan, the aluminum heat sink block for RF PA module (and other components), are effectively cooled. The fan's quiet operation allows for even the weakest DX signals to be heard.

3-6 The amp utilizes an advanced 16 bit MPU (microprocessor) to run the various high speed protection circuits such as overdrive, high antenna SWR, DC overvoltage, band mis-set etc.

3-7 This amplifier is compatible with AC 200 V and 250 V as well as AC 100V to 125V.

3-8 For the safety of the operator, an Interlock system is employed. The AC power is shut down if the top cover is removed, and the automated safety interlock is activated.

3-9 An analog multimeter allows the operator to monitor Pr (Reflected power), Vd (Drain voltage of power FET), Id (Drain current) and ALC voltage.

3-10 For future expansion, the amplifier rear panel is equipped with a control cable connection socket TUNER, this is for the upcoming model HC-1500AT, auto antenna tuner by Tokyo Hy-Power Labs. in 2013.

5. AC Line Voltage

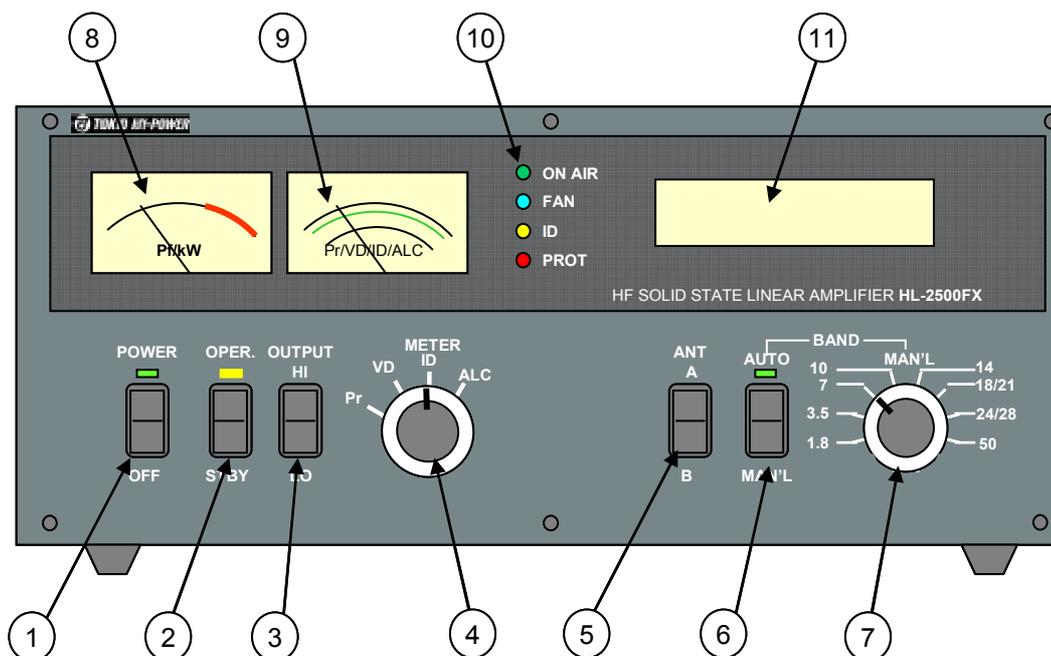
5-1 The amplifier is designed to work with any AC voltage world wide, (200- 250 V and 100-125V).

When connected to 100-125V line, maximum available output power is 1kW on HF and 500W on 6m band.

5-2 The correct AC plug (not included in the package), must be obtained locally due to the AC plug variations worldwide.

5-3 For the best performance and stability, it is strongly recommended that you will connect to AC 230V line (200V~250V).

6. Front Panel Description



① **POWER** Main power switch. At OPERATE, the amplifier is ready to go into ON AIR (TX) mode and at STBY, it is on STAND-BY mode.

③ **OUTPUT** To select High or Low Output levels. At LO, output is approximately 60% of HI.

④ **METER** To change the multimeter scales. Meter reads Pr, Vd, Id and ALC.

⑤ **ANT-A/B** To Select antenna "A" or "B". When main power switch is turned off, it is switched to A.

⑥ BAND-AUTO/MANUAL

To select band switching methods AUTO or MANUAL. When using AUTO, the manufacturer for the transceiver in use should be selected. When the band data cable is not used, MANUAL should be selected. (See page 19, 10 Operation / Setting)

⑦ BAND-MANUAL

Rotary switch for band change in the manual mode. While the transceiver is on Receive (RX) mode, turn to select the desired frequency band operate. The switches will not work when the transceiver and the amplifier are in Transmit (TX) mode.

⑧ METER (PF) Meter to read forward output power, PF. Full scale is 2.5 kW, and it reads average power.

⑨ MULTIMETER

Pr (Reflected power from antenna), VD (FET drain voltage), ID (FET drain current) and ALC voltage are shown on the scale as selected by ④ MANUAL select switch. Full scales are; PR: 250W, VD: 60V, Id: 80A, ALC: -10V.

⑩ ONAIR, FAN, ID, PROT (LED)

ON AIR : Lights when the amplifier is in transmit (TX) mode.

FAN : Lights when cooling fan is running at high speed.

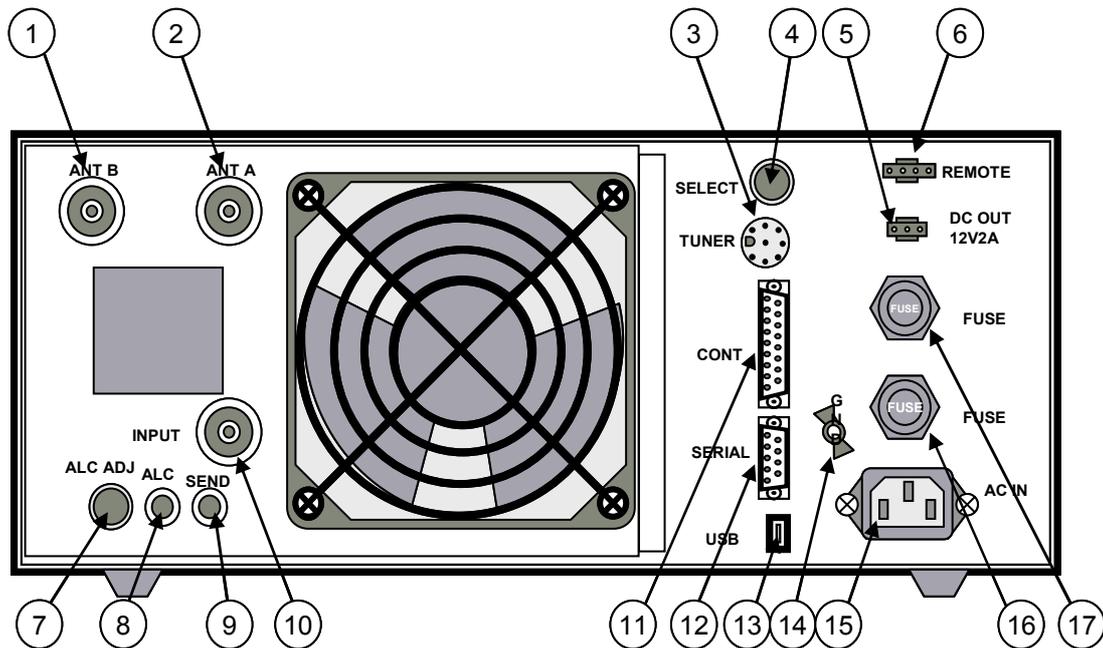
When the heat sink temperature reaches 35°C, cooling fan speed will continuously increase to enhance cooling capacity.

ID : Excessive ID Indicator (55A). Depending on the band and antenna situation, high drain current may flow into FET's. If 55A is exceeded, this LED lights to indicate that high ID is being drawn (This light does not necessarily mean a failure of the amplifier. However, if it lights too often, or too long, it is possible the drive power should be reduced and the antenna should be checked for SWR, to avoid stress to the FET's)

PROT : Lights when protection circuit shuts down the amplifier. Various protection circuits are built in such as Over-drive, Band mis-set, high Ant-SWR, Over-temperature etc. Detailed explanations will follow.

⑪ LCD PANEL Displays modes of operation and protection circuit. Detailed explanation will follow.

7 Rear Panel Description



① **ANT-B** RF Output Connector. Connect coax cable to the antenna B.

② **ANT-A** RF Output Connector. Connect coax cable to the antenna A.

③ **TUNER** DIN Socket. Connect the control cable from External Auto Antenna Tuner, HC-1500AT and or HC-1.5KAT.

④ **SELECT** Switch to select the transceiver (i.e. “CI-V” for ICOM CI-V, “I” for ICOM DC Voltage, “Y” for Yaesu, “K” for Kenwood, “Aux1-3” for three auxiliary positions of N.C./no connection.).

⑤ **DC OUT** 12V 2A, Auxiliary DC power supply terminal.

⑥ **REMOTE** Connector to switch the amp ON and OFF in the remote location.

⑦ **ALC ADJ.** Potentiometer to adjust ALC voltage level. Minus 10 V is available at maximum, when turned fully clockwise. Factory setting is 0 volts, with the pot turned fully counter-clockwise.

⑧**ALC** RCA Jack for ALC Voltage Output. Negative DC voltage appears at the center pin, which is fed back to the ALC terminal of the transceiver. ALC is used to keep the amplifier output power at certain limits. Also it is useful when the transceiver output power is higher than 100W (Seen page 18, Section 9-C. 7 ALC Adjustment). Also consult with your HF transceiver's user manual.

⑨**SEND** RCA Jack. Connect the control cable from the ACC terminal (or SEND, TX GND etc.) of the transceiver. Electrical conditions are 12V DC of open voltage at receive mode (RX), and short current of 35mA at transmit mode (TX).

⑩**INPUT** RF input connector. Connect the coax jumper cable from the transceiver.

⑪**CONT** D-Sub (15pin) Socket. Connect the band data cable to the transceiver/

⑫**SERIAL** Serial connector for control. (D-Sub 9pin) To access to CPU controller board through serial data bus.

⑬**USB** USB Connector. To access to CPU board. This socket is connected to serial connector ⑫.

⑭**GND** Ground terminal.

⑮**AC IN** 230V AC Main Socket. Socket for the AC power cord. (Socket is EMI filtered.)

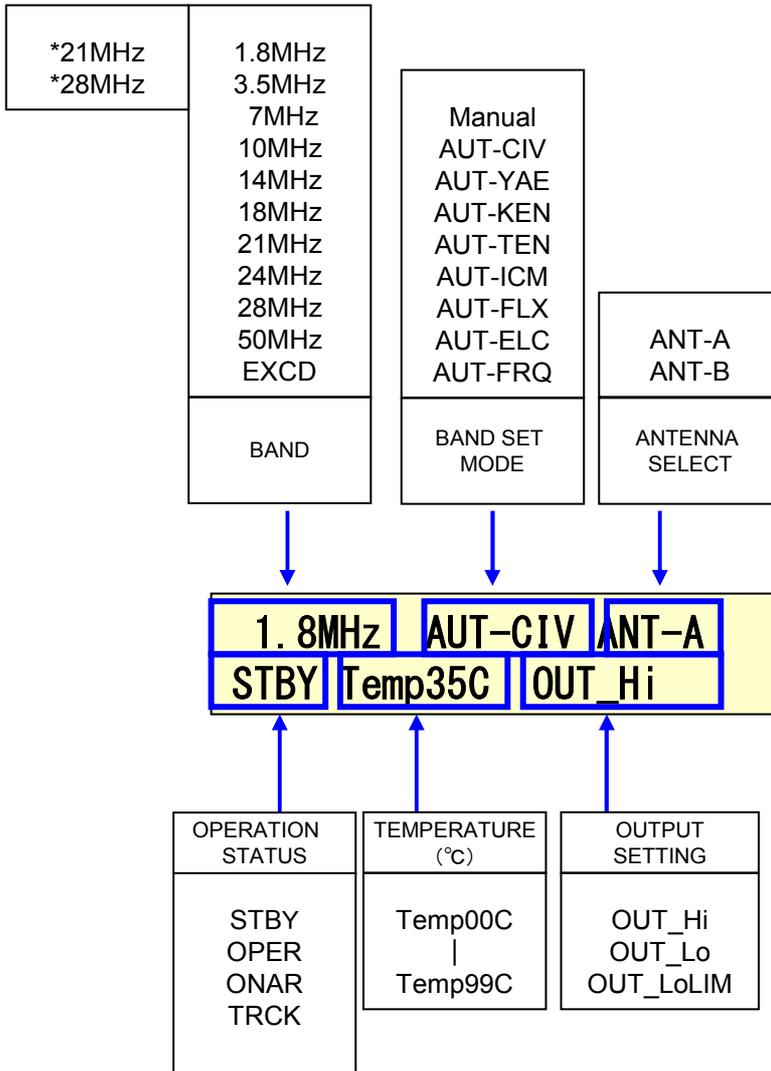
⑯⑰**Fuse** A pair of fuses for AC Mains. 250V/20A glass fuse.

7 LCD Panel Description

LCD displays the status of the amp in various situations. Capacity is 24 characters in two rows.

Basic Signs

Following s are the common signs to appear while amp is in operation.



Other Signs

Initial Messages

TOKYO HY-POWER
HL-2500FX V1.00

PLEASE WAIT
CHECKING CONDITIONS

ACV is 198V
Complete Initial Set-Up

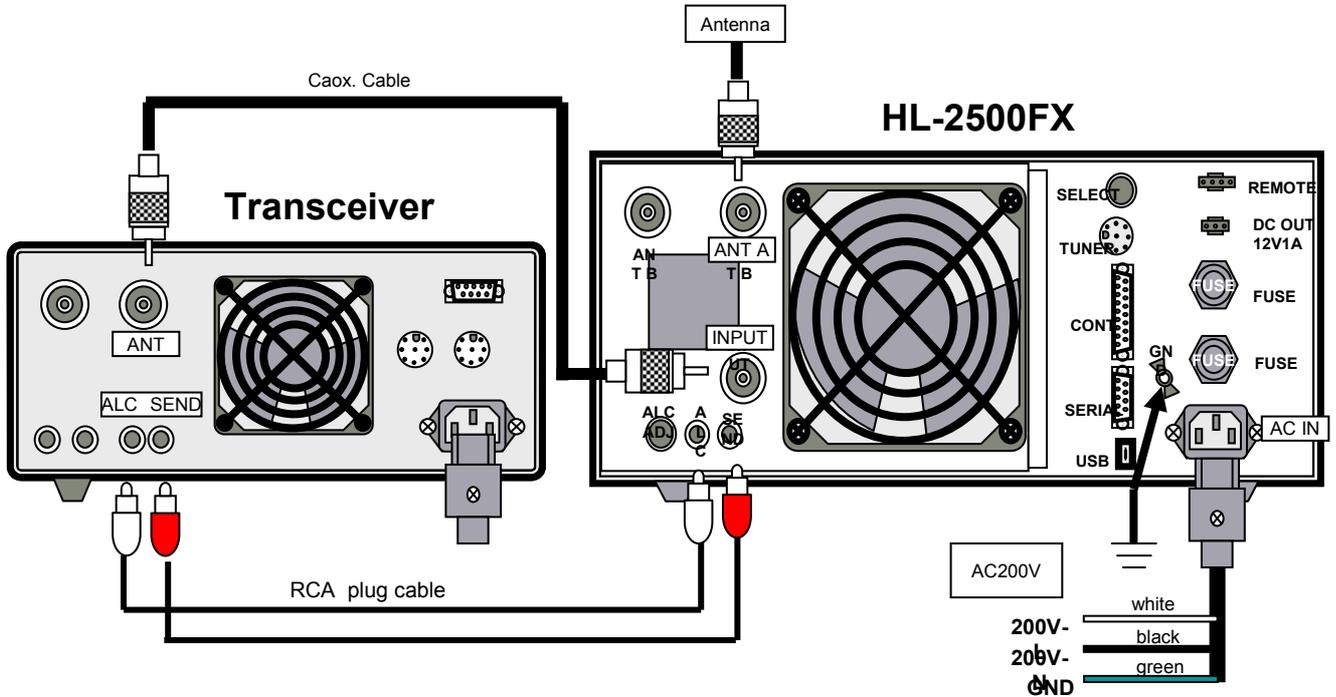
Protection Shutdown Message

24 MHz AUT-CIV ANT-A
PROT BAND MISSET

Detailed explanation will follow.

8-A Basic Connection

Following is a basic example of connection with the transceiver without using Band Data Cable.



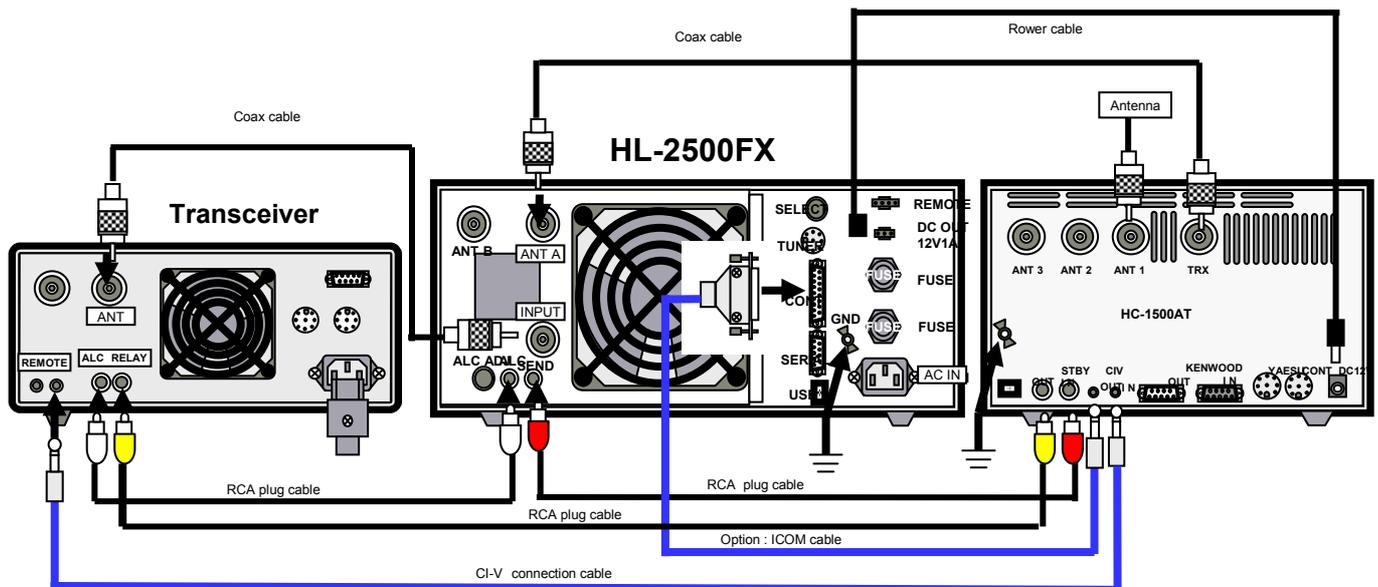
Note

■ SEND
SEND socket is named "RELAY", "TX GND", "SEND" etc depending on radio models. (Refer to user manual of the transceiver.)

■ ALC
ALC cable must be connected especially when driving the amp with high power transceiver. Otherwise shut-down will frequently occur.

8-B Connection with Auto Tuner HC-1500AT

Following illustration shows a connection example with ICOM radio(CI-V) and Tokyo Hy-Power HC-1500AT, auto antenna tuner. HC-1500AT is equipped with such an advanced function as receiving various data (ex. Band data, SEND command etc.) from the radio and then passing them to the linear amp. Example below utilizes this feature. (Refer to the HC-1500AT manual for the details.)



Note

HL-2500FX can be combined with our HC-1.5AT, auto tuner as well. Connect TUNER socket of HL-2500FX to CONT'L socket of HC-1.5KAT. Interface technology of our original design enables the joint frequency band setting.

DC power for HC-1.5KAT can also be fed from auxiliary DC supply (DC OUT 12V/2A) terminal of HL-2500FX.

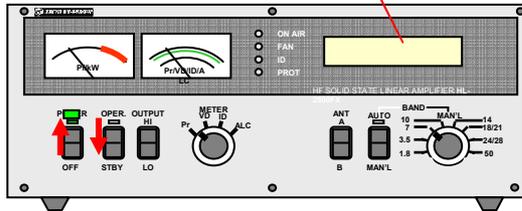
However, tuner will get "THRU (By-pass) mode when 50MHz is band set, as HC-1.5KAT has no 50MHz position.

9 Operation

9-A Quick Learning / About Status Modes

1) STBY (Stand-by) Mode

1.8MHz AUT-CIV ANT-A
STBY Temp35C OUT_Hi

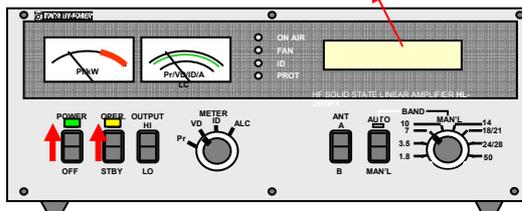


There are four operation status modes of STBY, OPER, ON-AIR, and PROT.

This is a status when POWER switch is only turned on. RF path is in THRU (or by-pass), and DC supply to FET drain is shut down. You may change BAND and other settings at this state.

2) OPER (Operate) Mode

1.8MHz AUT-CIV ANT-A
OPER Temp35C OUT_Hi



This is a status when POWER switch is turned on, and OPER/STBY switch is tuned to OPER. RF path is in THRU, and amp is turned into ON-AIR, as the radio's PTT is switched on. You may change BAND setting at this state.

CAUTION

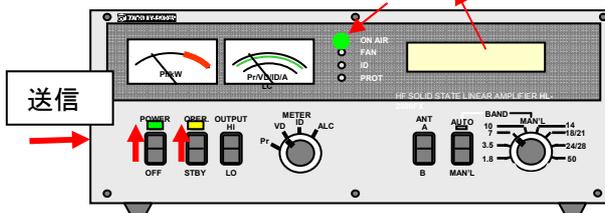
For your safety, the amp can not start up, if POWER switch is at OPER. Display below will appear.

PSE STBY OPERSW!

Turn to STBY once and turn to OPER again for reset.

3) ON-AIR(On-Air) Mode

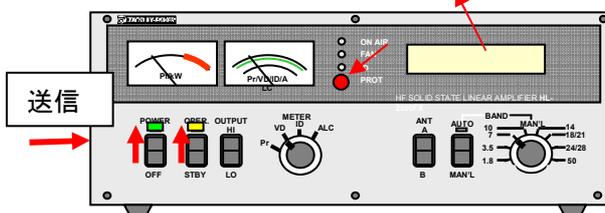
1.8MHz AUT-CIV ANT-A
ONAR Temp35C OUT_Hi



This is a status when transceiver's PTT is switched on, while POWER is turned on and OPER/STBY switch is turned to OPER. The amp is ready to amplify the driving signal from the transceiver. You may not change BAND and other setting at this state.

4) PROT (Protection) Mode

1.8MHz AUT-CIV ANT-A
PROT Over Heat



This is a status when PROTECTION circuit has tripped to shut off the amplifier. RF path becomes THRU, and internal circuitry may be shut down according to kinds of protections. Detailed explanation will follow.

9-B Quick Learning / About Basic Signs On LCD and LED Lamps

1) CB Band Inhibit

With ICOM, KENWOOD

EXCDMHz AUT-CIV ANT-A
STBY Temp35C OUT_Hi

The amp will shut down the transmission when driving signal of 26,000 through 27,999 (CB band) is detected due to FCC rule. When combining with ICOM and Kenwood radios, frequency data of operation is passed to CPU, even at RX state, to prohibit the transmission. **EXCDMHz** Is signed on LCD. (Freq. exceeded)

With YAESU, Manual Band Set, Frequency Count Band Set

28 MHz AUT-YAE ANT-A
PROT INHIBIT FREQ

When with Yaesu Radio, and with manual band set and freq. count band set methods, the amp transmission will be shut down when at TX

PROT INHIBIT FREQ will appear on LCD.

2) OPER. MODE Switch

LCD message

PSE STBY OPERSW!

The amp will be shut down, if POWER switch is turned on, while OPER/STBY is set at OPER. **PSE STBY OPERSW!** To reset, switch OPER. off and on. This is to avoid unintended sudden transmission, for your safety

3) TRACK Sign

3.5 MHz AUT-CIV ANT-A
TRCK Temp35C OUT_Hi

TRACK (Tracking) sign will appear, when the BAND changes , for a short period of 0.2 sec. This indicates that band frequency data is being sent over to combined auto tuner.

4) ID Lamp

- ON AIR
- FAN
- ID
- PROT

ID lamp lights when FET drain currents exceeds 55A, and is a kind of peak current indicator. It is not a problem, if it lights only at a voice peak (SSB).

5) FAN Lamp

- ON AIR
- FAN
- ID
- PROT

The cooling speed changes in proportion to the variation of internal temperature. As the ONAIR time gets longer , It is normal if fan noise sounds louder and FAN lamp to light brighter.

9-C Quick Learning / About TX Trial

We recommend for you to run a trial operation, at first, under the Manual Band Set mode (without band data cable connected to radio). With this trial, you can check if antenna, cables, and AC power line are in a proper condition. In case you encounter any trouble under Auto Band Set connection, later, you could return to this trial mode to see where the cause of trouble is.

1) Setting Before Power ON

Front Panel

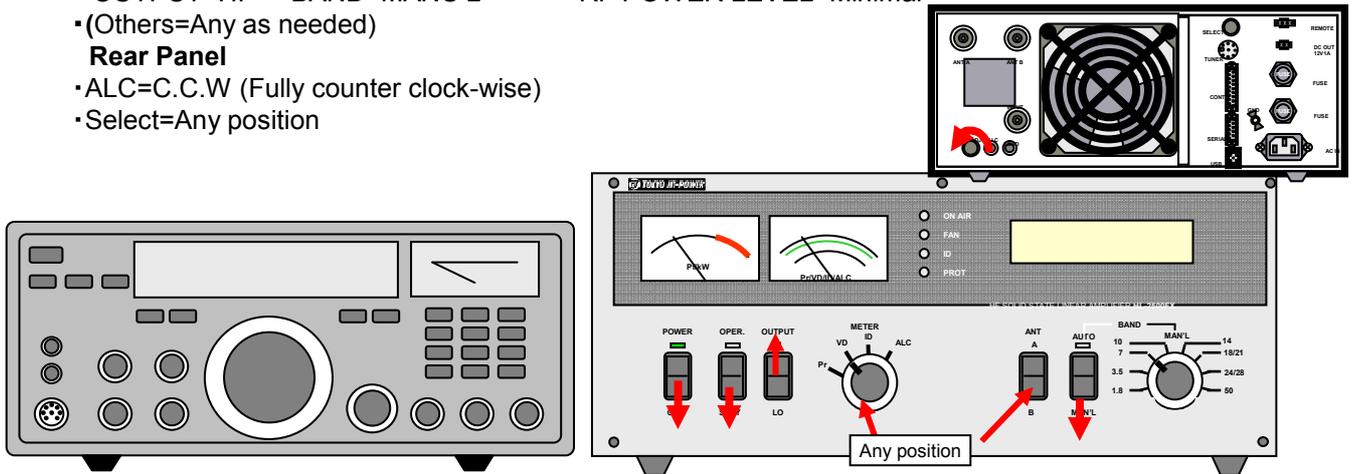
- POWER=OFF • OPER=OFF (STBY)
- OUTPUT=HI • BAND=MANU'L
- (Others=Any as needed)

Rear Panel

- ALC=C.C.W (Fully counter clock-wise)
- Select=Any position

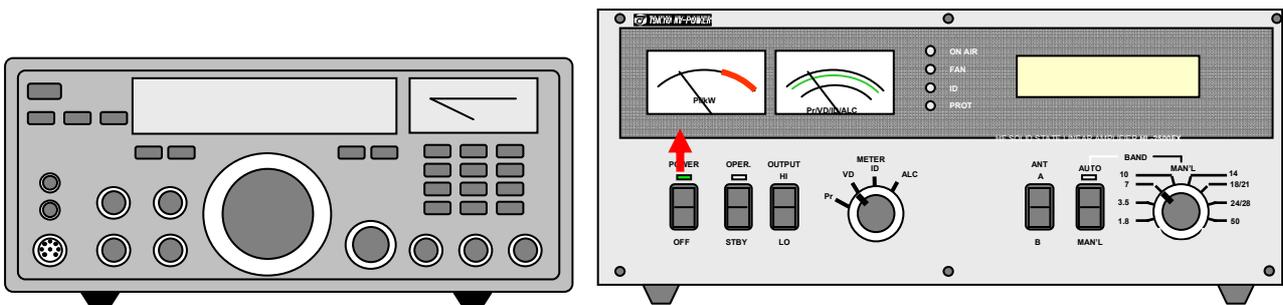
Transceiver

- Mode=CW (or RTTY)
- RF POWER LEVEL=Minimal

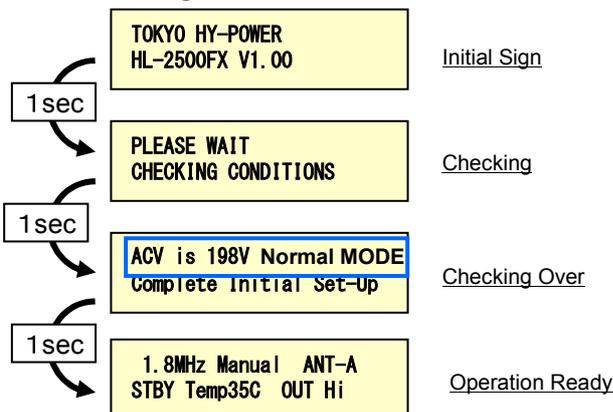


2) Powering ON

Turn the POWER on and the amp will start to execute initial self-check, Following messages will appear on LCD until status reaches normal operation mode.



Signs



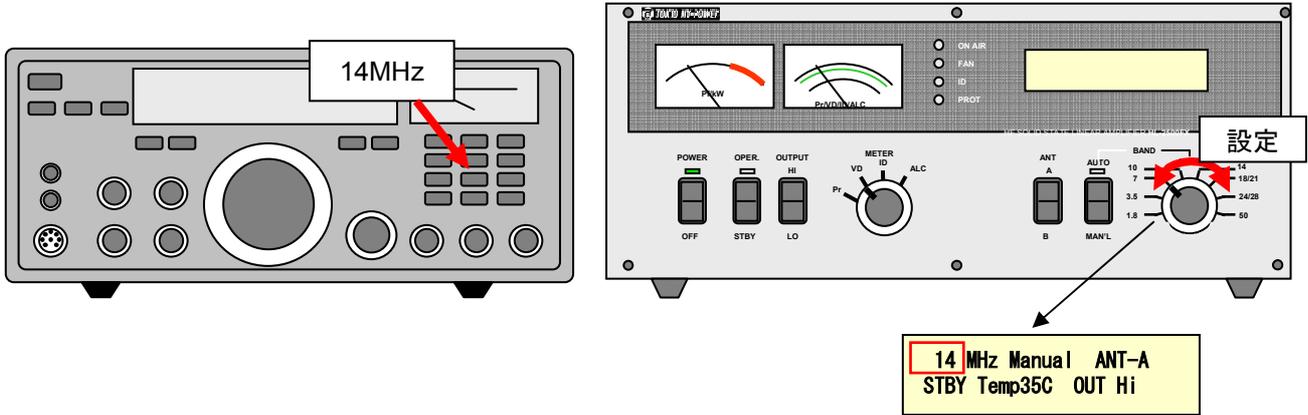
NOTE

After turning POWER switch on, MPU chip will check to see if AC line voltage is usable for the amplifier.

9—C Quick Learning / About TX Trial

3) Band Setting

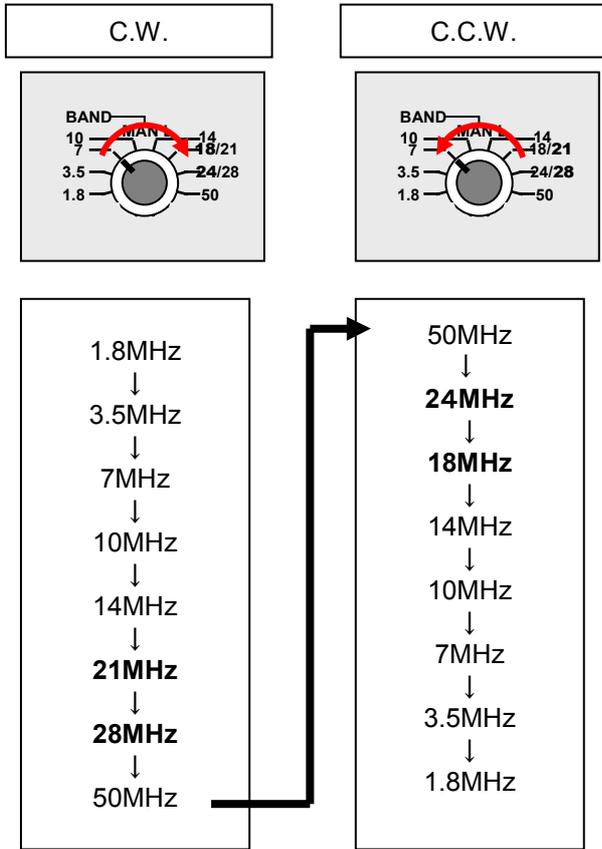
Set the freq. BAND as desired for both transceiver and HL-2500FX.
(Ex.: 14MHz)



NOTICE

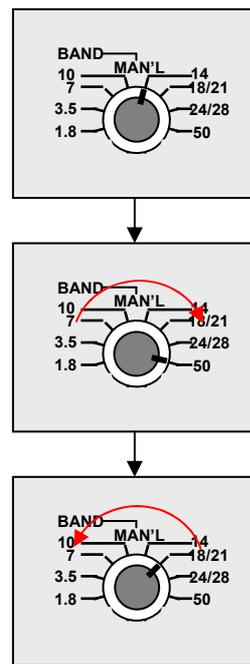
When the BAND switch is turned under Man'l Set mode, selected BAND will shift as follows:

- If turned clock-wise, BAND will shift in the order of 14⇒21⇒28⇒50MHz.
- And if BAND is turned back, counter clock-wise, BAND will shift in the order of 50⇒24⇒18⇒14MHz.



Example

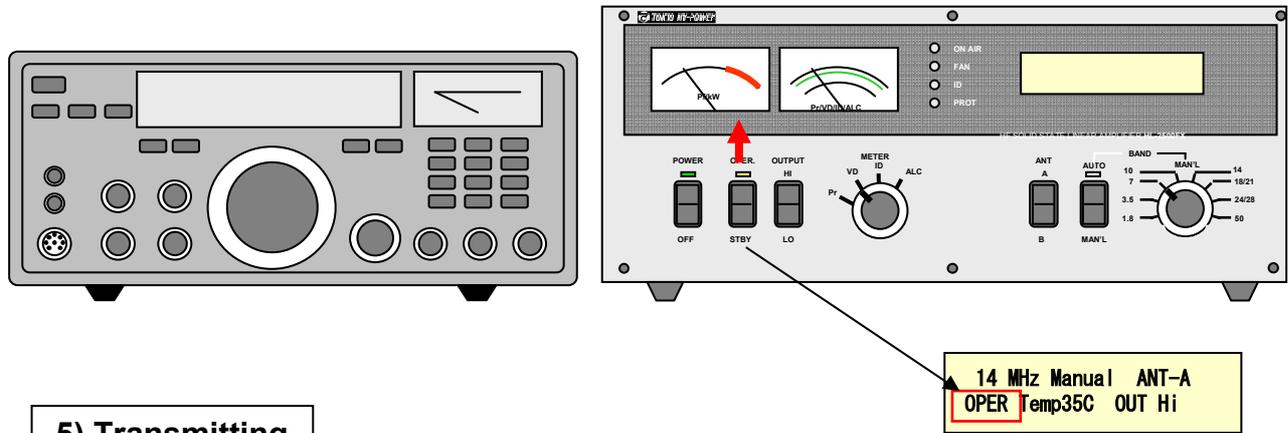
If you are shifting up from 14 to 18, you have to turn to 24/28 once, and then turn back to 18/21.



9-C Quick Learning / About TX Trial

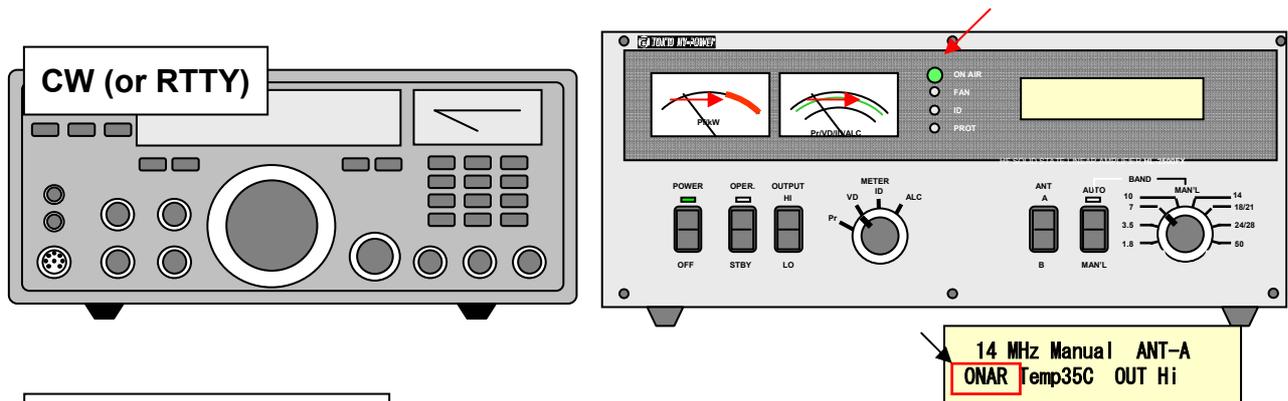
4) Switching to OPER

At OPER. (Operate Mode) status, the amp is ready to run together with combined transceiver.



5) Transmitting

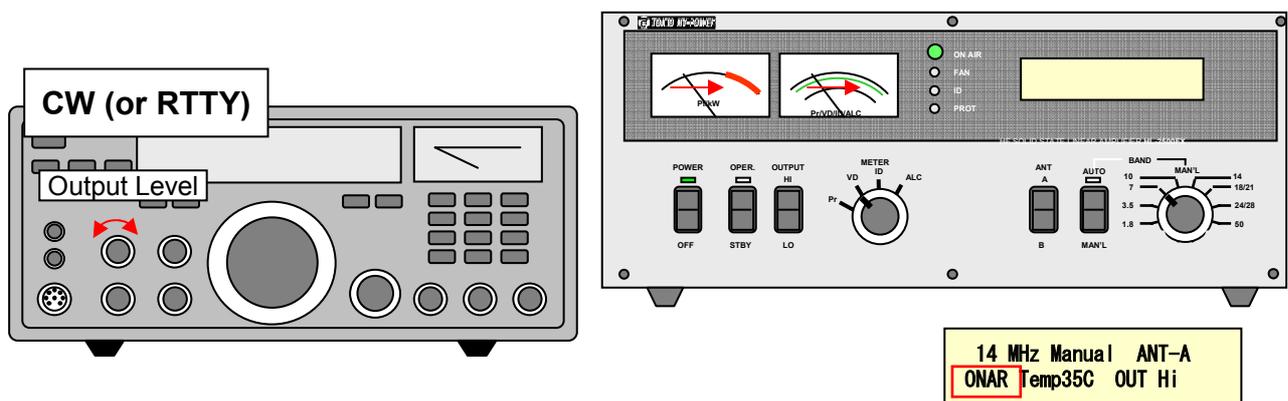
Key (RTT) the transceiver with CW (or RTTY) carrier. The amp is driven to transmit.



6) Increasing Output

Adjusting the knob of transceiver 's RF LEVEL, increase output level to desired value. (1,500W is maximum limit on HF, and 1,000W on 50MHz).

Observe reflection from antenna and RFI (interference) to nearby home appliance. Insert multiple number of clamp-on ferrite cores respectively to every coax cable s as well as various control and grounding cables around the amp and the transceiver.



9-C Quick Learning / About ALC Adjustment

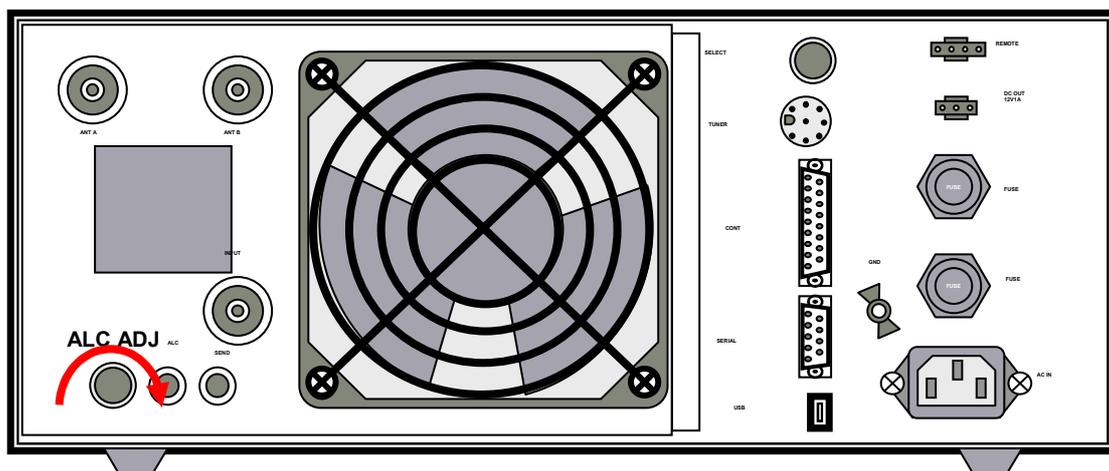
7) ALC Adjustment

ALC helps the amp keep its output power at desired level. ALC is effective to avoid overdriving of the amp, especially when high power transceiver is combined.

When adjusting ALC, use a dummy load of 2kW capacity, and /or a good antenna with SWR of 1:1 or less.

- ① "ALC ADJ" pot should be, at first, turned fully counter clock-wise.
- ② Select desired freq. band and CW (or RTTY) mode.
- ③ Increase the driving power from the radio so that required output power is achieved from the amp.
- ④ Carefully increase further the drive until five to ten percent increase is obtained for output.
- ⑤ Turn "ALC ADJ" pot clock-wise carefully so that output gradually decreases, to reach desired level.

(For more details, see "Hints and Tips of ALC, www.tokyohypower.com)



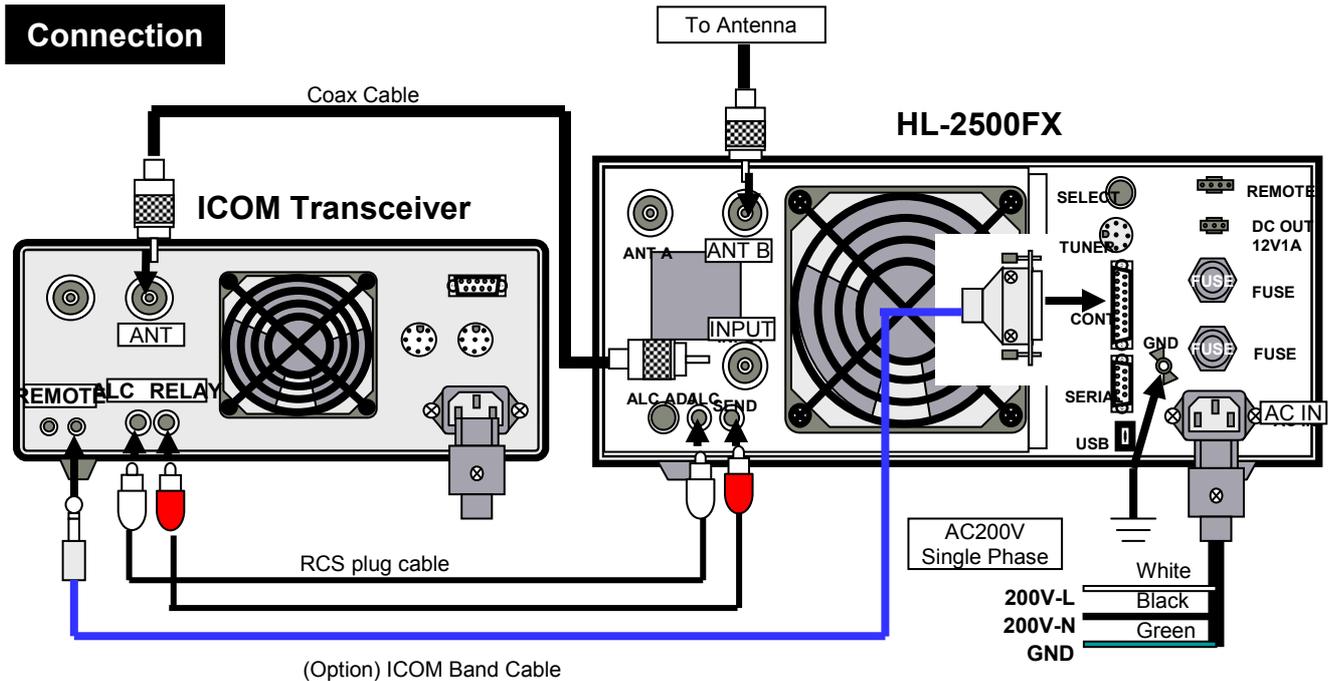
10 Operation / Setting

10-A With ICOM (CI-V)

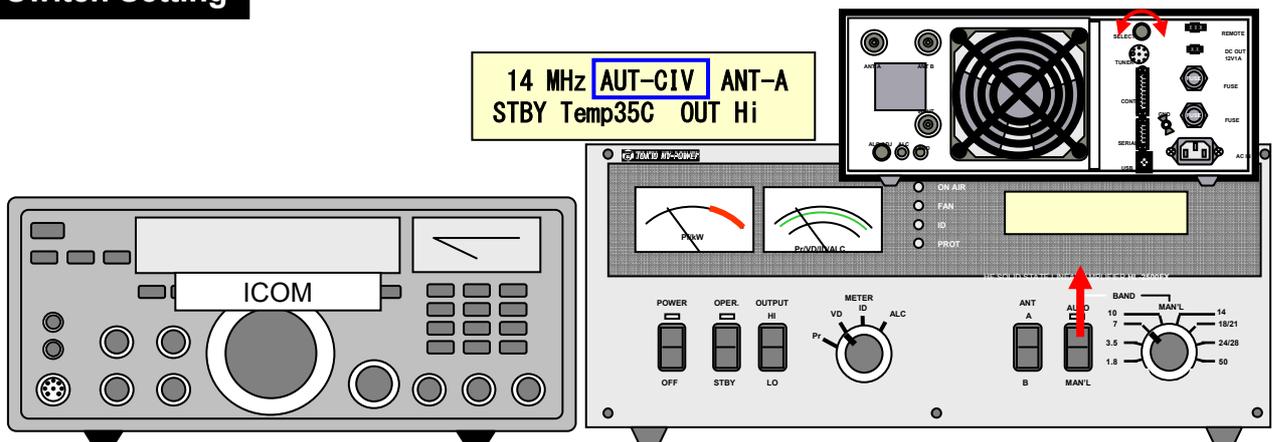
Connect twin RCA plug cable (included in the package), and optional ICOM band data cable as shown in the figure below.

Set AUTO/MAN'L switch to AUTO position and select ICOM with SELECT switch located on the rear panel. AUTO-CIV will be displayed on LCD panel.

Set the CI-V menu of ICOM radio as shown below, and HL-2500FX will follow the band of ICOM radio.



Switch Setting



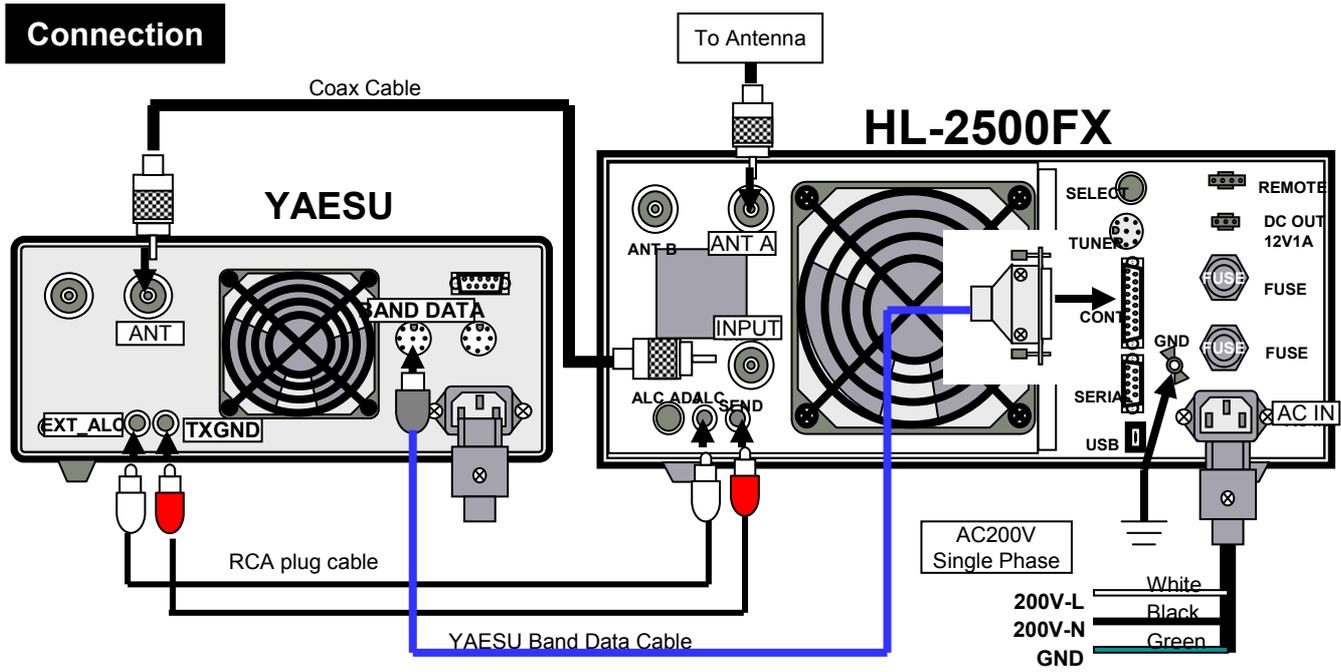
Setting of ICOM CI-V Menu

- CI-V BAUD RATE: 9600 [bps]
- CI-V ADDRESS: 5Ch
- CI-V Transceiver: ON
- CI-V with IC-731: OFF
- ※Refer to ICOM's instruction manual for CI-V details.

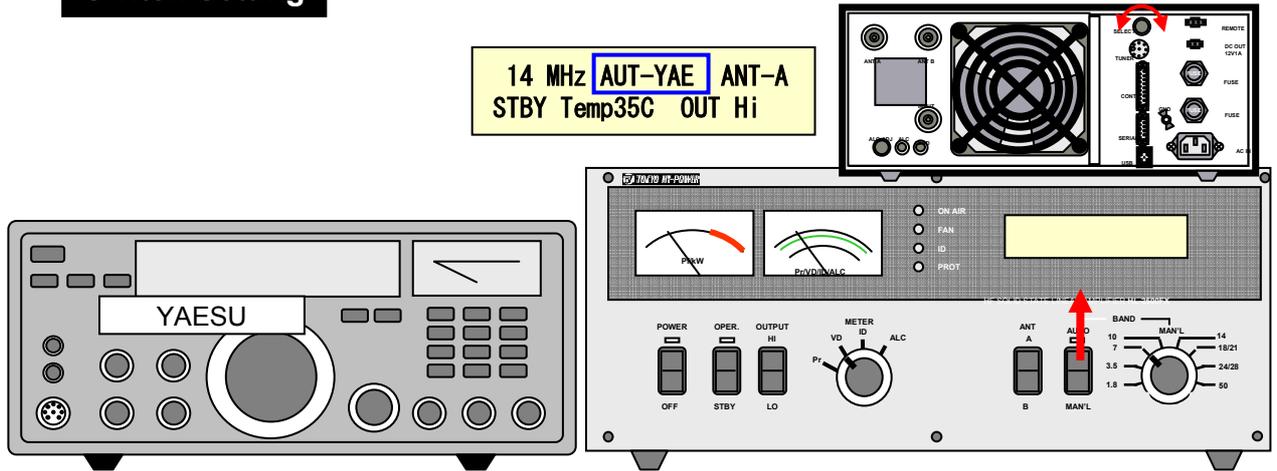
10 Operation / Setting

10-B With YAESU

Connect twin RCA plug cable (included in the package) and optional YAESU band data cable as shown in the figure below.
 Set AUTO/MAN'L switch to AUTO position and select YAESU with SELECT switch located on the rear panel. AUT-YAE will be displayed on LCD panel, and HL-2500FX will follow the band of Yaesu radio.



Switch Setting



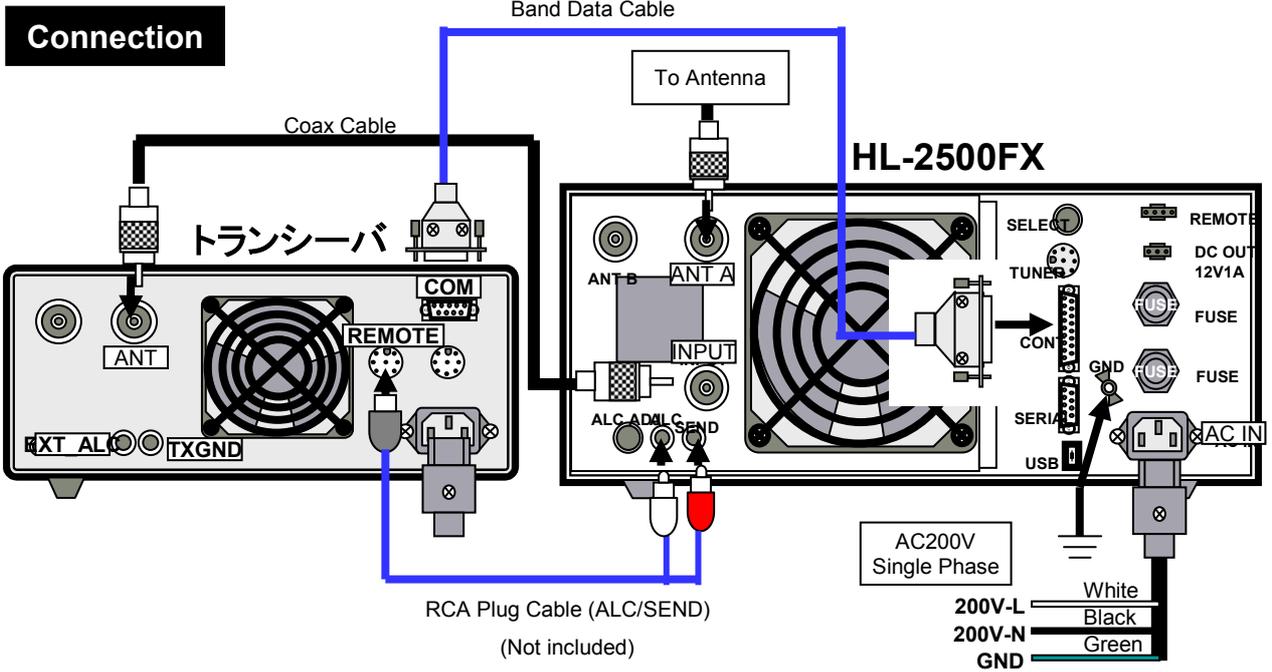
Setting of Transceiver

Some Yaesu models require initial settings for maximum output and T/R relay (TX GND) output.
 Refer to the user manual for details.

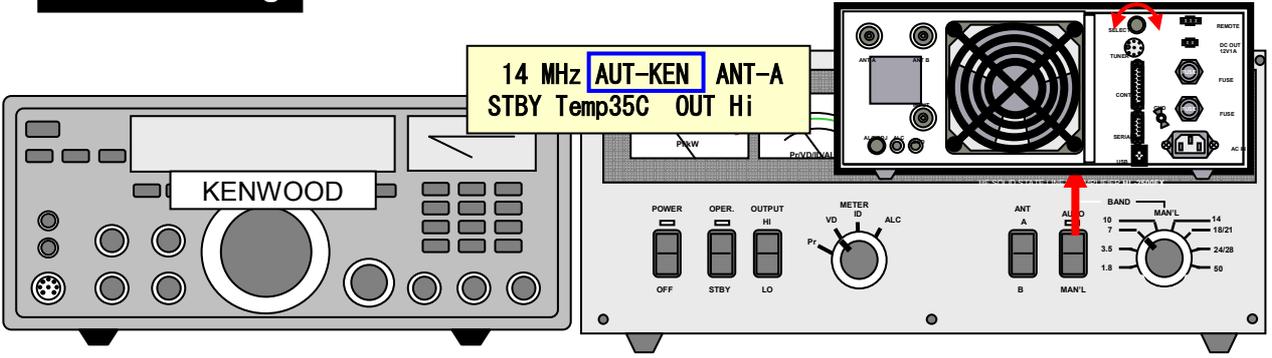
10 Operation / Setting

10-C With KENWOOD

Prepare a control cable for PTT(SEND) and ALC. One end should be DIN plug for REMOTE of Kenwood radio. The other end should be two RCA jacks of the amp. (Refer to Kenwood manual for REMOTE socket pin assignment.)
 Set AUTO/MAN'L switch to AUTO position and select KENWOOD with SELECT switch located on the rear panel. AUT-KEN will be displayed on the LCD panel, and HL-2500FX will follow the band of Kenwood radio.



Switch Setting



Setting of Transceiver

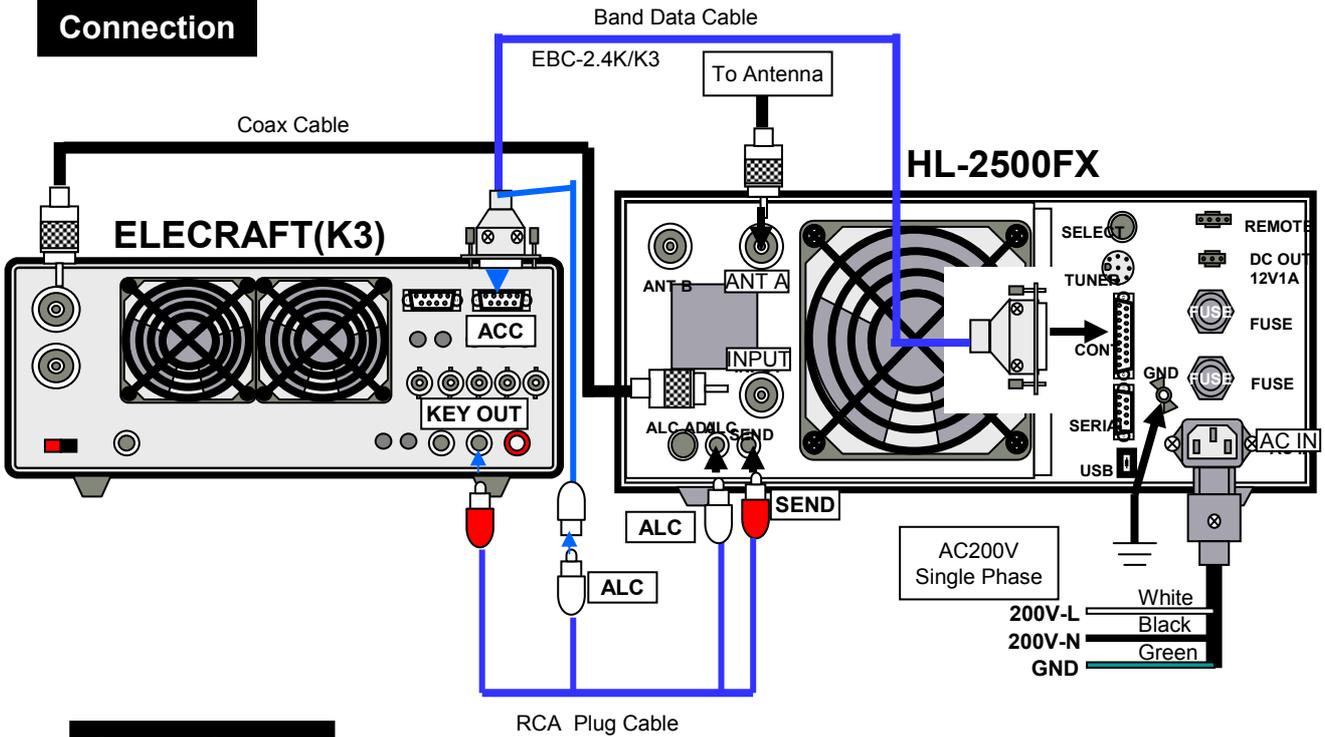
Baud Rate : 9600[bps]
 Stop Bit : 1 bit
 ※Refer to Kenwood manual for details.

10 Operation / Setting

10-D With ELECRAFT(K3)

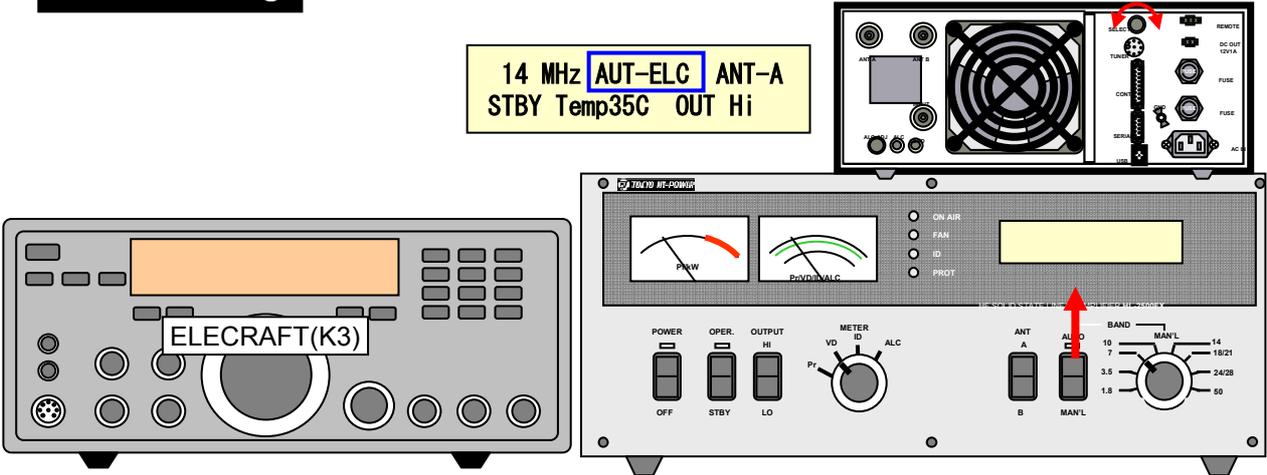
Connect included twin RCA plug cable and optional Elecraft band data cable as shown in the figure below.
 Set AUTO/MAN'L switch to AUTO position and select ELECRAFT with SELECT switch located on the rear panel.
 AUT-ELC will be displayed on LCD panel and HL-2500FX will follow the band of K3 radio.

Connection



Switch Setting

14 MHz **AUT-ELC** ANT-A
 STBY Temp35C OUT Hi



Setting of Transceiver
 Setting of "DONFIG menu" is required for K3transceiver.
 (Refer to K3 manual for details).

10 Operation / Setting

10-E Frequency Count Method

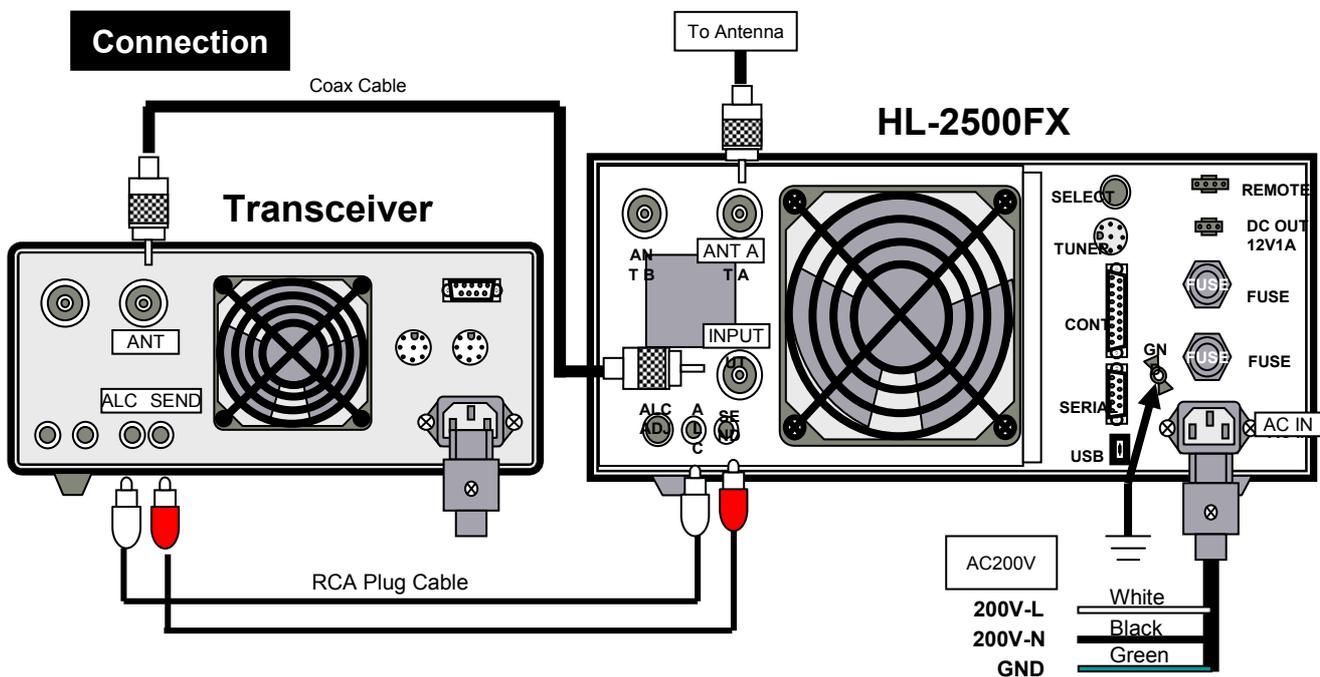
When there is no way of auto band-set connection between the transceiver and the amplifier and or when it is desired to make mutual band connection simple, auto band-set-operation is feasible utilizing the frequency counting feature built in this amplifier.

Set AUTO/MAN'L switch to AUT-FRQ with SELECT switch located on the rear panel. AUT-FRQ will be displayed on LCD panel and the amp will set the band automatically reading the frequency of driving signal. If the transceiver is keyed, the amplifier will set the operating band automatically by reading the frequency of driving signal.

CAUTION

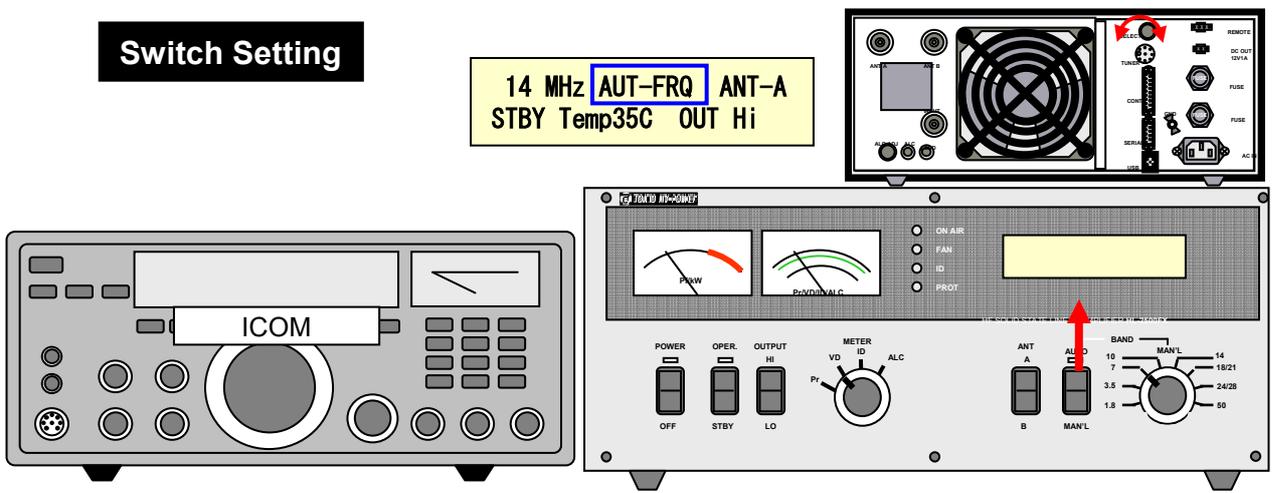
There is a time delay of 20 milli-sec from RX to TX state change under this method. Full break-in CW is not available with this method, for this reason.

Connection



Switch Setting

14 MHz **AUT-FRQ** ANT-A
STBY Temp35C OUT Hi



Setting of Transceiver

There is nothing required in particular.

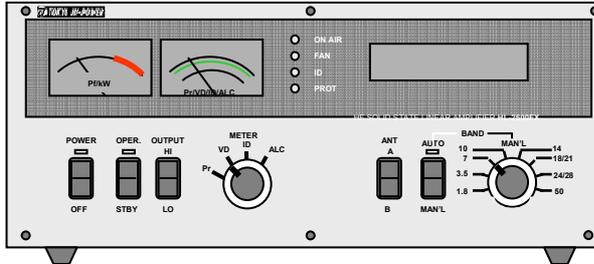
11 Protection Circuit

11-A Interlock Protection

★ “Interlock” is built in for the safety of operator, avoiding the unexpected accidents from electric and thermal shocks.

Sign

All power shut down.
No sign.



Status

Main DC P. Supply (Vdd)	Shut down
AC Magnet Relay	Shut down
RF path	Shut down
Fan Control	Shut down

Reset

- ① Fix top cover securely
- ② Cool off the amplifier sufficiently

1) Cover Interlock

When the top cover is removed, cover switch is activated to shut down AC power line. (POWER Lamp, LCD panel, cooling fan are all turned off.)

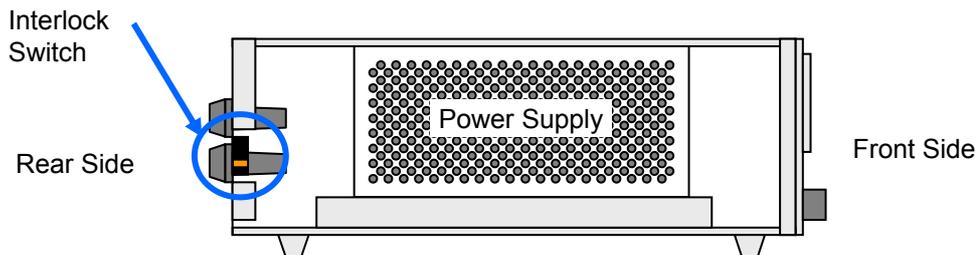
2) Temperature Interlock

When the internal temperature of the amp reaches 90°C, AC power line is shut down. (POWER Lamp, LCD panel, cooling fan are all turned off.)

In case all the lamps go off suddenly while transmitting, stop the transmission, unplug AC cord, and wait for five minutes. Check if AC main fuses are blown, or if the temp. inter-lock has been activated.

REMARKS

Location of Interlock Switch



The amp temperature is normally checked by thermal sensor and microprocessor. “FAULT” temp protection is usually switched on in prior to Temp. Interlock to turn on, the amp may have been heated by other heat source and or microprocessor is in failure.

11-B Fault Protection

FAULT PROTECTION

Fault Protection is built in to avoid the damage to the amp due to the severe cause of fault within the amplifier or on the AC power line.

Sign

PROT lamp glows.
Message is displayed

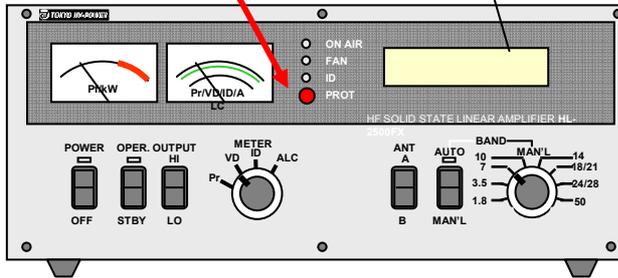
Status

Main DC P. Supply
AC Magnet Relay
RF Path
Fan Control

Shut Down
Shut Down
Thru
ON



Protection Sign



Reset

Set OPER/STBY switch to STAND-BY position, and turn POWER switch off and on.

List of Fault Protection

Prot.	LCD Sign	Description	Remedy
Over Heat	FAULT OVER TEMP	Heat sink temp reached 95°C	Cool off to reset
Fan Faulty	FAULT FAN FAIL	FAN faulty or speed too low	Repair at factory
AC Line High	FAULT OVER LINE VOLT	AC line exceeded 250V	Check AC line
AC Line Low	FAULT UNDER LINE VOLT	AC line fell to 85V or lower	Check AC line
Fuse Blown	FAULT FUSE BLOW	Internal fuse blown	Refer to Pxxx
Main P.S. Faulty	FAULT DC SUPPLY OUT	Output of main DC P.S. (Vdd) faulty	Repair at factory
Main P.S. Faulty	FAULT DC SUPPLY	Primary side of main DC P.S. faulty	Repair at factory

11 Protection Circuit

11-C Protection / Slight Fault

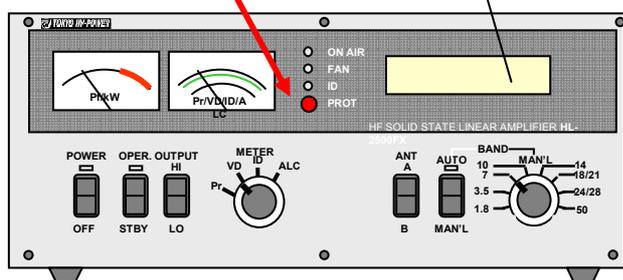
Another group of protection circuits are provided to shut down the transmission when the other faults occur within the amp.

Sign

PROT lamp glows.
Message is displayed

Status

Main DC P. Supply (Vdd)	On
AC Magnet Relay	ON
RF Path	Thru
FAN Control Circuit	ON



Reset

Switch "OPERATE/STBY" off and on.

List of PROT

Prot.	LCD Sign	Description	Re-adjust ALC
Over Output Power	PROT OVER POWER	RF output power exceeded 1,500W	Re-adjust ALC
Inhibit Freq.	PROT INHIBIT FREQ	CB band freq.(26,000~27,999MHz) detected	Check x-ceiver
Reflected Power	PROT OVER Pr	Power reflection from antenna exceeded 150W	Check antenna
Over Current	PROT OVER CURRENT	FET drain current (Id) exceeded 70A	Check antenna Re-adjust ALC
Over Dissipation	PROT OVER Ploss	FET drain dissipation (Pd) exceeded 2,000W	
Tj Over	PROT OVER Tj	FET junction temperature exceeded 190°C	
Over Drive	PROT OVER DRIVE	RF drive power exceeded 150W	Readjust ALC, decrease RF drive from X-ceiverf
Unbalance	PROT COMB HEAT	PA combiner temperature exceeded 70°C	Check antenna SWR Contact factory
* Crowbar	PROT CROWBAR	Crowbar prot. Circuit switched on	See below
Band Mis-set	PROT BAND MIS-SET	Band set incorrect., PA failed	Check band setting Contact factory

11 Protection Circuit

11-C Protection / Slight Fault

Crowbar

When the FET drain current and reflected power from antenna significantly exceed the limit, crowbar circuit trips instantly to protect valuable FET finals, without waiting for the response from the microprocessor. It blanks the RF drive for 100ms. During this time period, microprocessor detects the abnormal states to issue shut down command under "PROT CROWBER".

11 Protection Circuit

11-D Protection / Reduced Power

Operation

If slight failure occur such as “over current”, for example, while working under OUT=Hi mode (High output mode), the amp is not necessarily shut down, but enters into reduced power operation mode

Sign

Following message displayed

Status

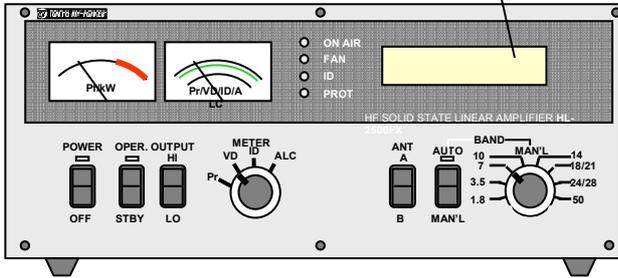


Main DC P. Supply (Vdd)
AC Magnet Relay
RF path
Output Setting)
FAN, control circuit

Low Voltage Applied
ON
ON (Amplifying)
Lo (Low Vd)
ON

Reset

Release PTT (to RX) once, and key (to TX) again.



List of Protection

Protection	LCD Sign	Description	Remarks
Sight Over Current	OUT: LoLim	Drain current (Id) exceeded 55A for 60sec	When exceeding 70A, PROT shuts down immediately
Slight Over Heat		Heat sink temp. exceeded 75°C	When exceeding 95°C,FAULT PROT shuts down
Over Dissipation		Total FET drain dissipation exceeded 2,000W	If 2,000W exceeded, even reduced power mode, PROT shuts down
Over Tj		FET junction temp (Tj) exceeded 190°C	If Tj keeps 90°C, even with reduced power mode, PROT shuts down

12 Technical Information about Various Connectors

12-A CONT Connector (Control)

Various control signals are concentrated in this connector. (D-SUB 15pin Connector, Female)

Pin Assignment

Pin #	Signal	Description	Remarks
1	+12V	Auxiliary DC P. Supply +12V0.1A	Never short
9	+5V	Auxiliary DC P. Supply +5V0.1A	Never short
2	RXD	Serial Comm. Port (RX)	For EIA232_TRX
10	TXD	Serial Comm. Port (TX)	For EIA232_TRX
3	BDY0	YAESU Band Data Input 0bit	With pull-up resistor
11	BDY1	YAESU Band Data Input 1bit	With pull-up resistor
4	BDY2	YAESU Band Data Input 2bit	With pull-up resistor
12	BDY3	YAESU Band Data Input 3 bit	With pull-up resistor
5	GND	Signal Ground	
13	AN-IC	ICOM Analog Freq. Info. IN	
6	AN-IC-G	ICOM Analog Freq. Info. Gnd	
14	T/R	T/R(SEND) IN	Connector in parallel with "SEND"
7	GND	Signal Ground	
15	CIV-T	ICOMCI-V TX Port	
8	CIV-R	ICOMCI-V RX Port	

12-B TUNER Connector

For connector to THP HC-1.5KAT, and HC-1500AT tuners. (DIN 7pin Connector, Female, Hoshiden TCS4470-0140577)

Pin #	Signal	Description	Remarks
2	GND	Signal Ground	
4	EVENT	Event IN (FREQ request signal)	
7	FREQ	Freq. Information OUT	FREQOUT=MHz/1000
1·3·5·6		No Connection	

12 Technical Information About Various Connectors

12-C CONT Connect (Control)

Serial connector for utility use (D-SUB 9pin Connector, Female)

Pin Assignment

Pin #	Signal	Description	Remarks
2	RD	RX Signal	For straight cable
3	TD	TX Signal	For straight cable
5	GND	Signal Ground	
Others		No Connection	

Note

This connector is for utility use, and can not be connected to the transceiver. It is a different one from TD/RD of CONT connector.

12-D DC12V Connector

Auxiliary DC power supply of DC12V2A capacity. Suitable for feeding auto tuner.
(Type SMPo3V by Nichiatsu)

Pin Assignment

Pin #	Signal	Description	Remarks
1	DC12V	Auxiliary DC P.S.12V2A	
2		No connection	
3	GND	Return	

12 Technical Information About Various Connectors

12-E REMOTE Connector

For controlling the amplifier from the remote location. (Type SMP04V by Nichiatsu)

Pin Assignment

Pin #	Signal	Description	Remarks
1	WAKE-UP+	Start up voltage IN+	Start up when DC12V applied. (DC12V100mA)
2	WAKE-UP-	Start up voltage IN-	
3	OPER_EXT	External OPER Input	To enter "Operate" when pin 3 grounded (15mA). 5V, when Open
4	GND	Signal GND	

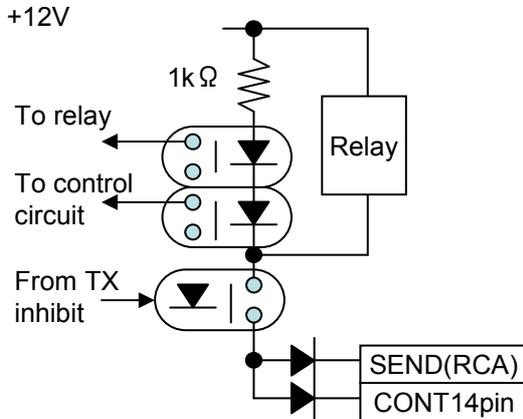
Note

Note : Please refer to "Remote Controlled Operation" Section.

12 Technical Information about Various Connectors

12-F About SEND Interface

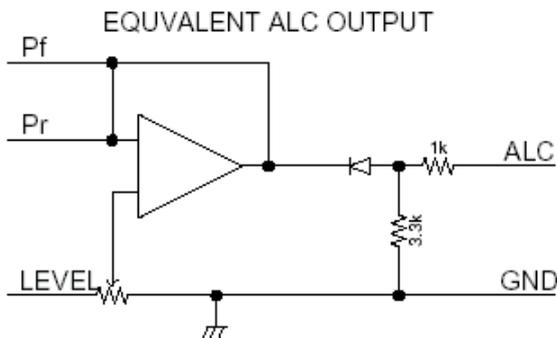
Circuit



TX/RX switch terminal (SEND socket) is controlled through photo-MOS relay rather than thru direct relay switching. Open voltage is +12V, and draws 10ma when grounded. When PROTECTION trips, photo-MOA relay for TX Inhibit becomes open and TX is shut down

12-G ALC Interface

Circuit



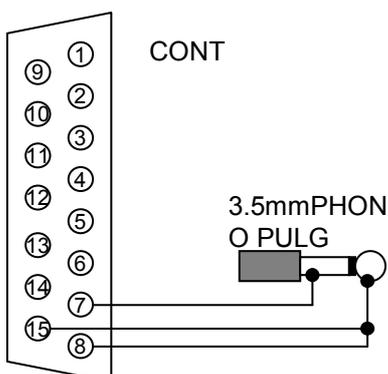
When the sum of forward output power (voltage) and reflected output power (voltage) exceeds the programmed ALC level, negative voltage is produced at ALC terminal.

ALC circuit consists of an Op-amp, and it is preferable that input port of the transceiver for the external ALC voltage has an input impedance of 10K Ω minimum.

Maximum ALC output of -10V is usually produced. Some of old fashioned radio may require higher voltage. Built-in gain switch needs switched in that case.

12-H About ICOM CI-V Interface

Circuit

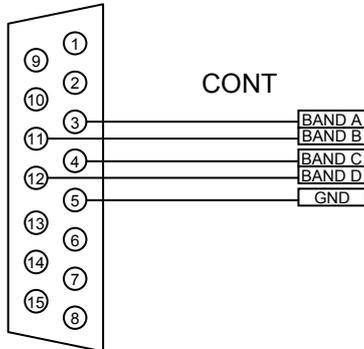


CI-V signal lines are connected to pins 7, 8 and 15 of CONT Connector.

12 Technical Information about Various Connectors

12-I About YAESU and K3 Interface

Circuit

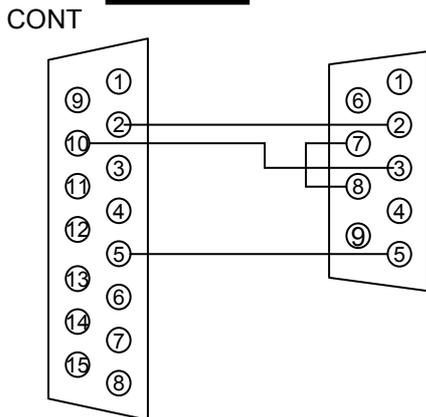


Four bits of band data (A to D) are connected to CONT connector as illustrated.

This interface is used for Elecraft K3 as well.

12-J About KENWOOD Interface

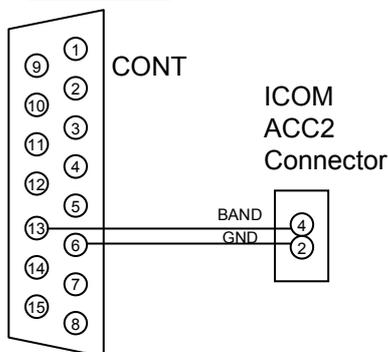
Circuit



Kenwood uses TD/RD pins of CONT connector for EIA232C based serial communication. Loop back wiring for pin 7 and 8 is required at Kenwood connector side.

12-H ICOM(BAND VOLTAGE) Interface

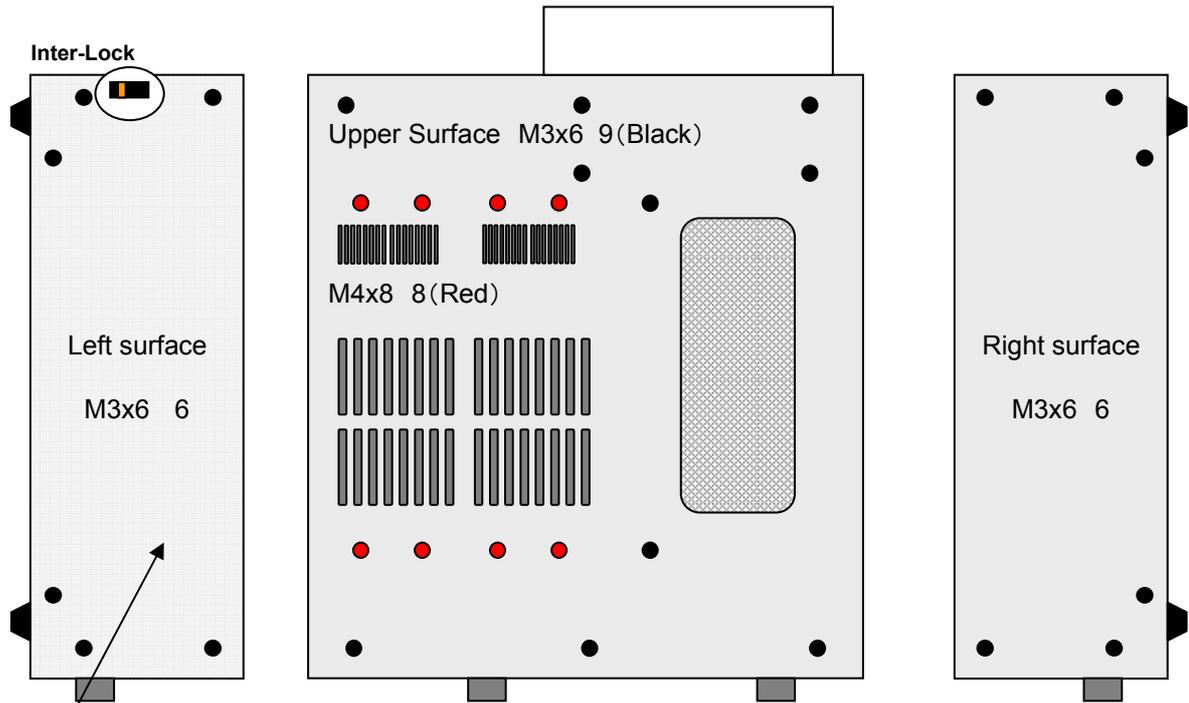
Circuit



13 Maintenance

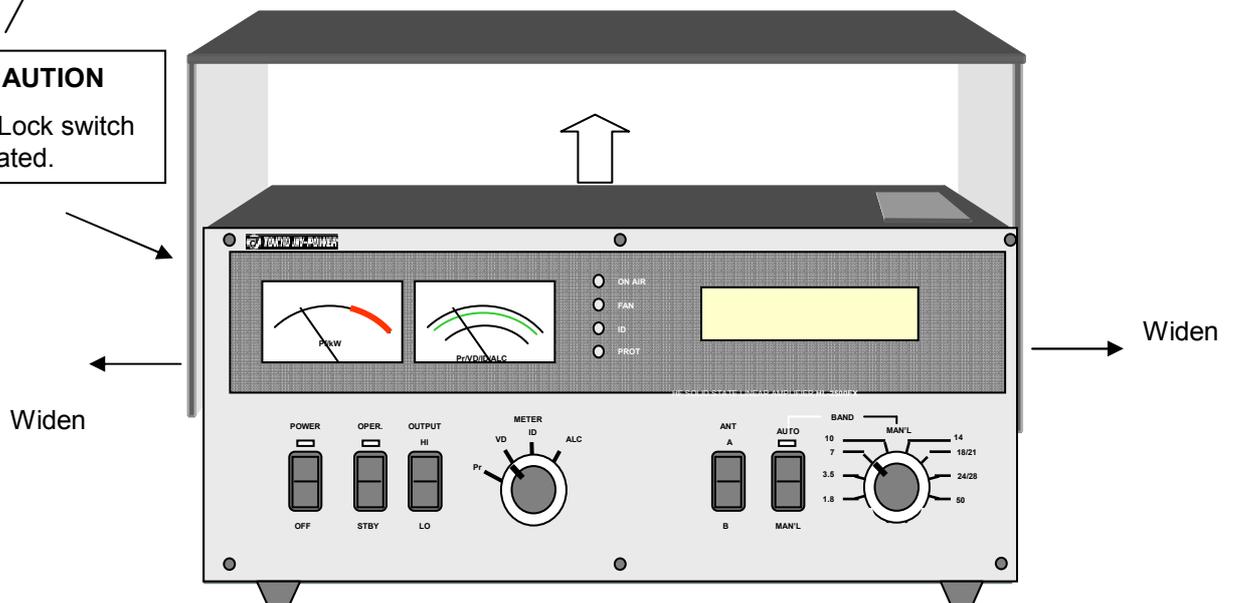
13-A How to remove the top cover

To remove the top cover, unscrew nine M3 bolts and eight M4 bolts on the upper surface, as well as six each M3 bolts at right and left surfaces of the cover.



Lift the cover carefully.

CAUTION
Inter-Lock switch is located.

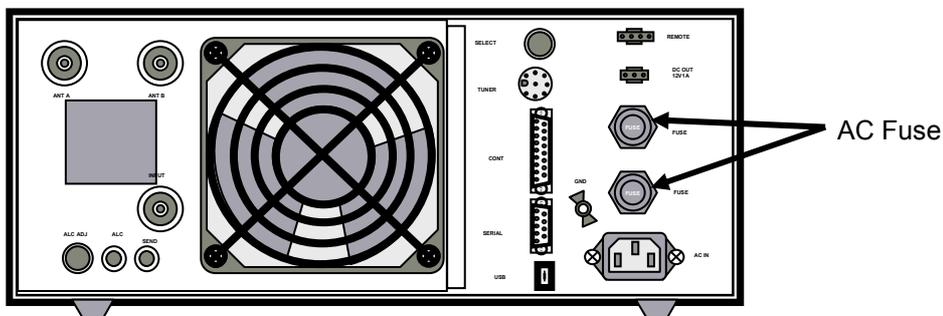


13 Maintenance

13-B How to replace Fuses

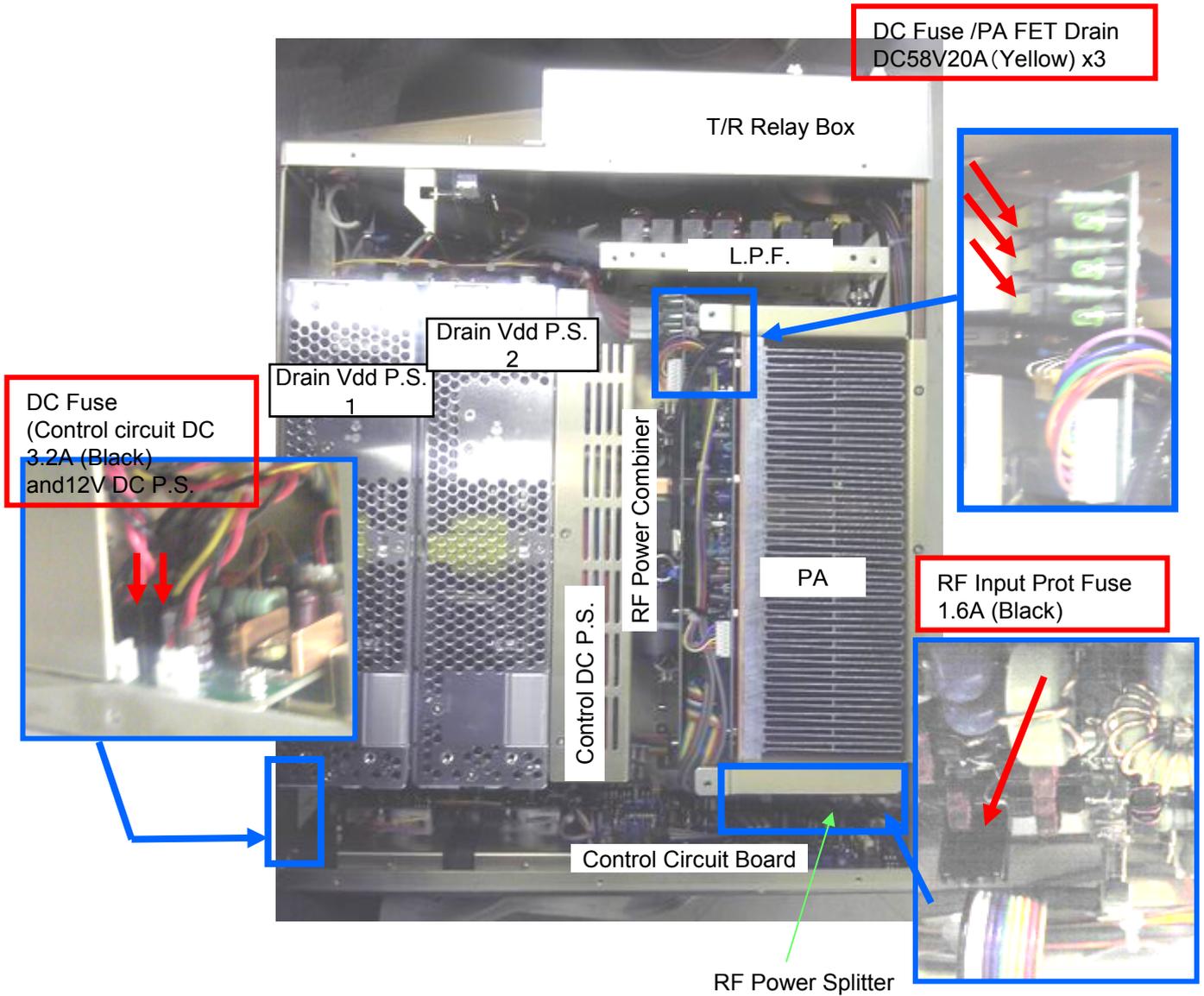
Variety of fuses are built in the amplifier. Fuses are consumption item, and may melt to blow, as time passes by even if there is no failure in the circuit.

Fuse Name and Location	Q'ty	Specs/Rating	Problem when blown	Possible Cause
AC Fuse AC Primary Line	2	250CF6.3x32 250V20A (Fast attack)	Do not power on	Over output Power supply failure
PA DC Fuse PA drain	3	#1197(Low Profile) Fuse, 58V20A	"FAULT FUSE BLOW"	Over current PA Failure
DC Fuse Control circuit	1	LM3.2 30V3.2A by Daito Micro Fuse	Do not power on	CONT terminal short Control circuit failure
DC Fuse Auxiliary DC P.S.	1	LM3.2 30V3.2A Daito Micro Fuse	No12V output (External tuner not work)	DC output terminal short
RF Input Prot. Fuse RF Input	1	LM1.6 30V1.6A by Daito Micro Fuse	No RF output from amp	Over drive

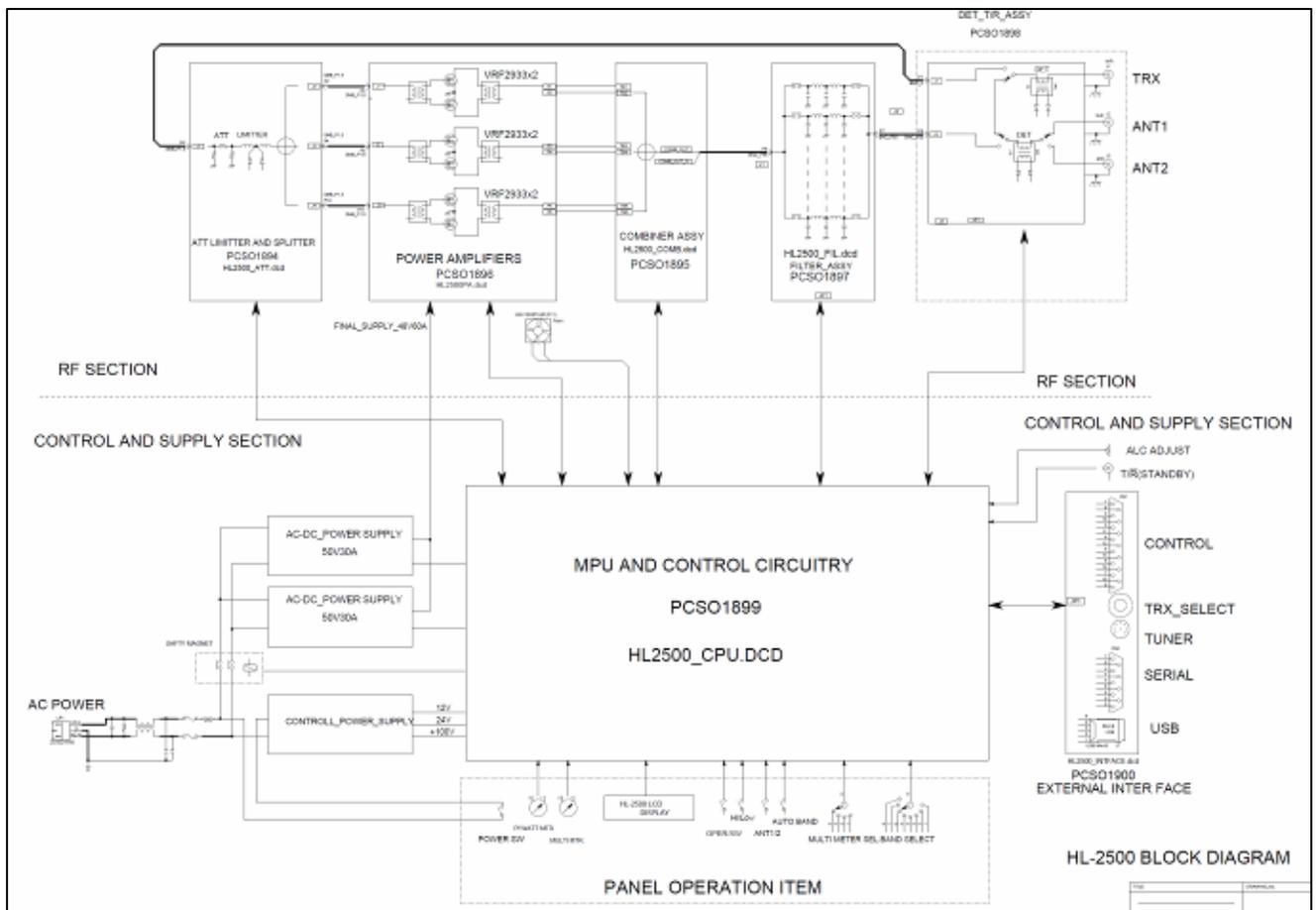


13 Maintenance

13-C Fuse Location



14 Block Diagram and Explanation of Major Circuitry



14-A RF Amp

Driving RF signal transmitted from the transceiver is lead to the ATT/ Limiter board via T/R-Assy unit, where there is 3dB attenuator as well as RF limiter. These circuitry properly levels the magnitude of RF signal and also instantly shuts down the input to protect the amplifier.

There is a three port splitter located in this board that sprits a driving signal equally into three components, which are then fed to final PA module.

PA module consists of three sets of wide band class AB1 linear amp. using THP2933 FET's in the push-pull form. 500W is achieved per one basic amp. board. Then the three outputs from the PA module is sent to the combiner unit, where three 500W components are combined to become 1,500W.

Operating status of three PA's are strictly monitored in the combiner stage with regard to heat balancing of respective amps.

Finally 1,500W of RF output is lead to LPF (low pass filter) unit, where harmonics and spurious signals are reduced to FCC rules. Filtered output signal is sent to T/R ASSY unit again and is lead to antenna terminal by way of antenna relay.

14 Block Diagram and Explanation of Major Circuitry

14-B DC Power Supply

AC power is received at the IEC socket intake and passes the line filter. There are safety fuses on both lines. There are control power supply and FET drain power supply . Start up is usually made by turning on and off of control power supply. DC 12V, 24V and 100V are available when control power supply is turned on, and are always outputted once the POWER is turned on.

There are a magnet relay at primary side and DC ON/OFF function at secondary side. Depending on the operating condition, this power supply is turned on and off through the control circuit, and is provided in this power supply to meet IEC61000-3-2 harmonics regulation.

14-C Control Circuit

Control circuit performs various control using micro-processor PIC18F8722 chip. Also, basic interface meet the necessary rules and conditions using the specialized semiconductor devices.