

User's Manual

144MHz Band
330W Power Amplifier

Model HL-350VDX



TOKYO HY-POWER LABS., INC.

Introduction

The HL-350VDX is a 144MHz Band Linear Power Amplifier with the maximum output power of 300W (nominal, 330W max.), designed with Tokyo Hy-Power's accumulated VHF technologies. This is a completely solid-state amplifier capable of handling all transmission modes. There are built in such new functions as an automatic VSWR meter, a new type DC-operated line-flow fan and a GaAs FET RX Pre-amp with a selectable RX gain.

Main Features

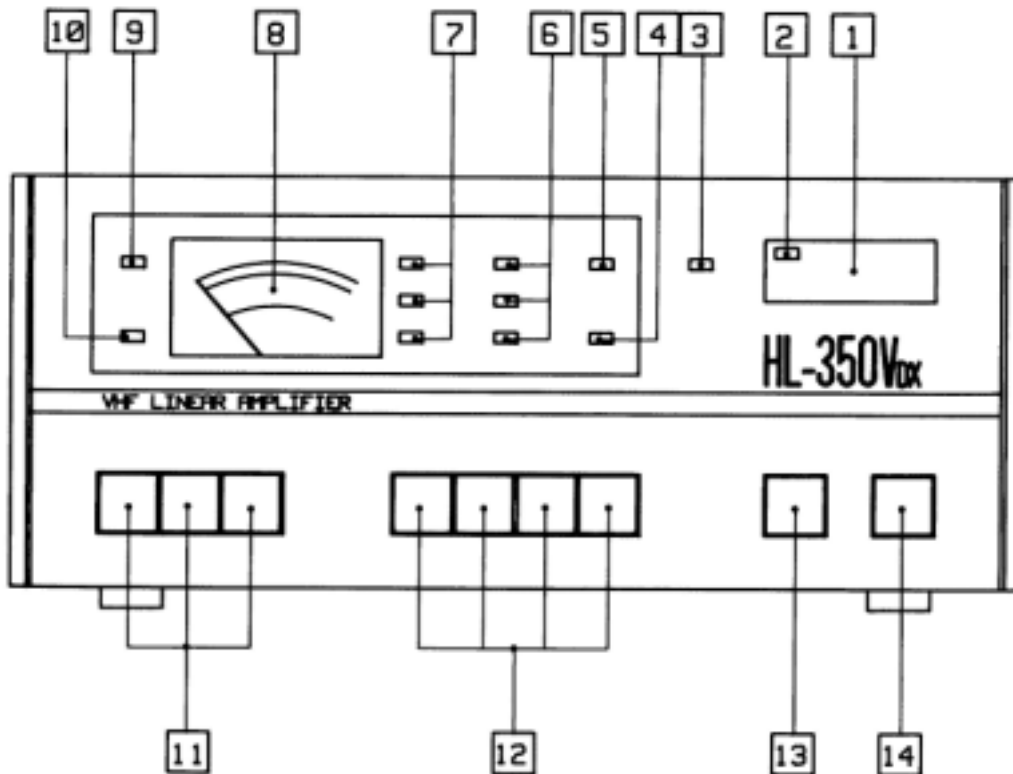
1. Easy to Operate/ Functional Design:
By combining a small heat-sink with a powerful DC-operated line-flow fan, the HL-350VDX is made light in weight.
It has a fashionable design by putting the heat-sink inside the cabinet.
2. Adoption of Multi-Protections:
It incorporates five kinds of protection circuits developed by our own advanced technologies. This sophisticated protection gives you a warning(shut-down) before getting into any trouble.
3. Multi-Metering Method:
The switch selected analog multi-meter on the front panel reads RF OUT (TX output power), AUTO SWR (standing wave ratio, automatically measured), or VCC (power supply line voltage), enabling the operation to be comfortably done at all times.
The high-performance power meter is of a directional coupler type, giving quite accurate readings.
4. Low-Noise RX Pre-Amp:
It incorporates a low-noise RX pre-amp utilizing a performance-proven GaAs FET.
The gain of the pre-amp can be selected depending on the receiving condition. More cozy VHF communication can be enjoyed with the HL-350VDX.
5. Auxiliary Remote Controlling Function:
A jack for the connection with a remote controller (optional HRC-60) is provided on the rear panel.
Remote controlling of the power supply, the RX pre-amp and so forth can be controlled in the remote location.

Specifications

Frequency Band :	144MHz Band (available for 144-148 MHz)
Mode:	FM, SSB and CW
RF Output Power:	300W nominal (330W max.)
RF Input Power:	10/25/50 W (manually selectable)
DC Power Supply:	13.8 VDC
Power Consumption:	42A max. (at 250W output)
Input/Output Impedance:	50Ω
Input/Output Connectors:	N-type
Spurious Signal Level:	-60dB or less
RX Pre-Amp Gain:	-20dB, +6dB, +15dB (selectable)
Accessories:	RF Output Meter/ Automatic VSWR Meter Low-Noise GaAs FET RX Pre-Amp Warning Protection Circuit (protections for overvoltage, overdrive and mis-match) Two-Speed Line Flow Cooling Fan Reverse DC Power Polarity Protection
Fuses:	20A x2, 1A x1
Attachments:	Power Supply Cable 8sqmm, 2m long: red x1, black x1 ACC 8-Pin DIN Plug x1 Jumper Cable with N-M connectors: 69cm long x1 Spare Fuses: 20A x2, 1A x1
Dimensions & Weight	9.6(W) x 3.9(H) x 14(D) inches, Approx. 12.5 lbs. 245(W) x 100(H) x 355(D) mm, Approx. 5.5kg

Explanation of Features

<FRONT PANEL>



1 POWER (MAIN DC POWER SUPPLY SWITCH):

A power switch for the TX amp unit. With the first push, the switch will be locked, turning the power ON. With the second push, the knob will be released to turn the power OFF.

2 POWER (LED):

Lights when the POWER of TX RF amp unit is turned ON.

3 WARNING (LED):

Lights when the power supply to the TX Amp unit is shut down due to overdrive, overvoltage or mismatch of antenna VSWR etc. After the possible cause of shut down is corrected, **1** POWER SWITCH may be turned ON again to reset.

4 FAN (LED):

Turns ON when the temperature of the heat sink exceeds 50 °C. Then, the fan

starts to run at its full speed. When the heat sink temperature exceeds 70 °C due to a long continuous transmission or any other reasons, the built-in thermo-sensor will halt the transmission automatically. In that case, do not turn OFF [1] POWER SWITCH. This is because the fan has to be kept running in order to cool down the heat sink. Keep [1] POWER SWITCH ON. Transmission can be restarted once the heat sink temperature is cooled down to the normal range.

[5] LO POWER (LED):

Lights when the TX input attenuator is turned on. With the attenuator ON, the transmission power becomes approx. half of the full output power.

[6] RX AMP +15dB/ +6dB/-20dB (LED):

Three LED's show the approximate gain of the R pre-amp at each gain selection. The gain can be selected by [12] RX AMP SWITCH.

[7] RF OUT/SWR/VCC (LED):

Indicates the scale of the multi-meter being selected.

[8] W/SWR/VCC METER:

The multi-meter gives the readings of wattage (RF output power), SWR (standing wave ratio), and Vcc (DC power supply voltage) respectively. The output power shown is average power. In the SSB operation, the output power indicated in the meter can only be approx. 40% of the peak power output. SWR is automatically shown at any power above 50W as a result of the incorporation of advanced IC.

[9] TX (LED):

Lights when the amp is in transmission mode. The LED goes OFF when in the receive (RX) mode.

[10] RX (LED):

Lights when the RX pre-amp is turned ON.

[11] RF OUT/SWR/VCC (METER SELECTION SWITCH):

Depending on the function to monitor, push the desired switch for the proper

readings.

12 RX AMP OFF/-20dB/+6dB/+15dB (SELECTION SWITCH):

Selects the gain of the RX pre-amp. Select the proper gain so that the signal can be copied most clearly.

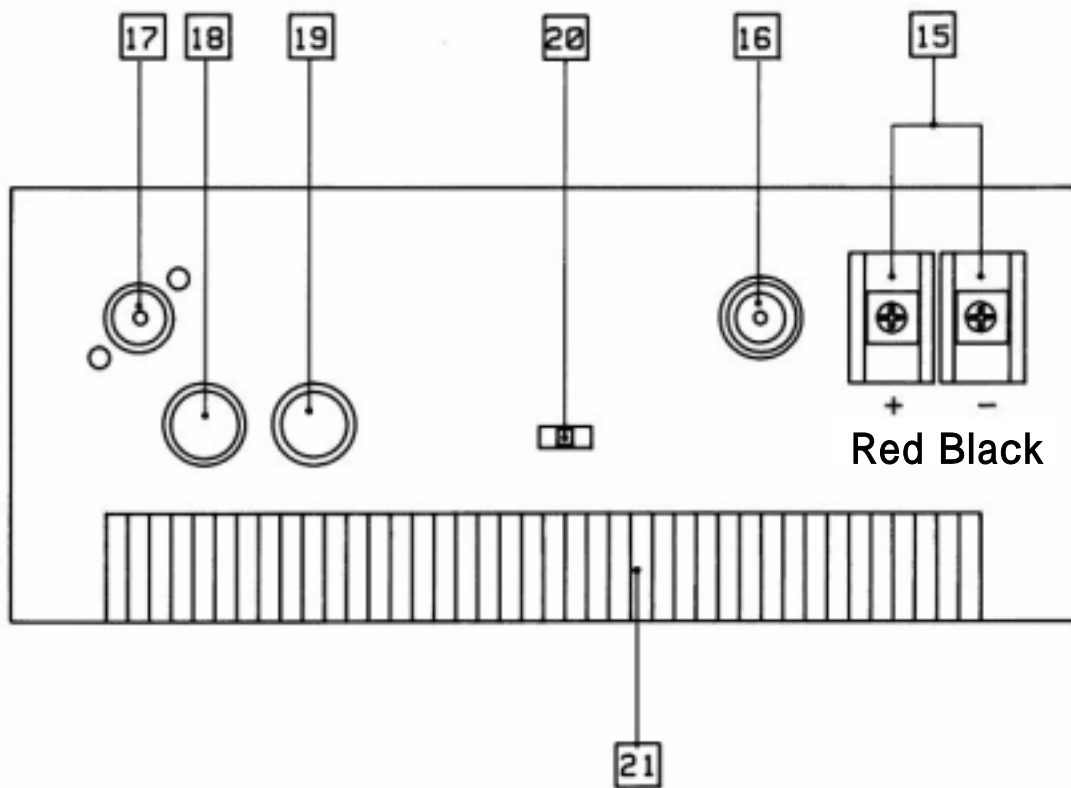
13 POWER LEVEL HI/LO (SELECTION SWITCH):

At 10W and 25W inputs, the power level can be switched to either HI or LO. At the LO mode, the output power becomes approx. half the HI power. (At 50W input, the power level cannot be switched to LO.)

14 MODE FM/SSB (SELECTION SWITCH):

Selects the changeover delay time for TX/RX transition when the operation is made with the RF key. It takes about 1 second for TX to change to RX state. When the switch is pressed for FM operation, TX state will instantly change to RX. For CW, keep this switch pressed ON (SSB position) and for the packet, keep it pressed OFF (FM position.)

<REAR PANEL>



15 13.8VDC (POWER SUPPLY TERMINAL):

Use the included power supply cable for the connection with a stabilized DC power supply.

Connect the red wire to + and black wire to - .

Make sure to use a power supply with a capacity of 50A minimum.

16 TX (INPUT CONNECTOR, TYPE N):

Connect the coaxial cable from the transceiver.

17 ANT (OUTPUT CONNECTOR, TYPE N):

Connect the coaxial cable from the antenna.

18 ACC (EXTERNAL TX/RX SWITCHING/PTT DIN SOCKET):

Connect DIN plug of hard key control cable from the radio.

Refer to Pages 9 to 11 for pin assignments of 8 pin DIN plug.

19 REMOTE (REMOTE CONTROLLER JACK):

With the use of the optional external remote head (Model No. HRC-60), the following functions can be remotely controlled:

- 1) Turning ON/OFF of POWER (DC power),
- 2) Turning ON/OFF of RX AMP (RX pre-amp),
- 3) Switching of HI/LO (TX output power level), and
- 4) Resetting of WARNING CIRCUIT shut down.

20 RF DRIVE 10W/25W/50W (INPUT LEVEL SELECT SWITCH):

Make sure to switch to the correct position depending on the output power of the transceiver to be used.

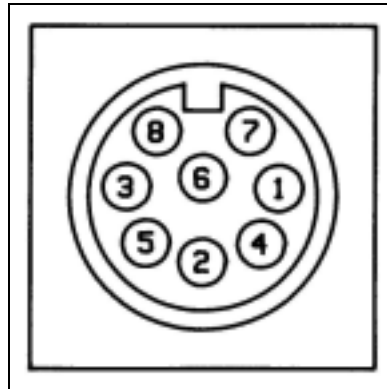
Note that an excessive driving power can kill the expensive RF power transistors. (At the time of shipment from our factory, the switch default is 50W.)

21 VENT:

For the forced air cooling system, do not block this vent, so that cooling air can flow smoothly.

*Wiring Details for REMOTE TERMINAL (remote controller connection jack) are as follows:

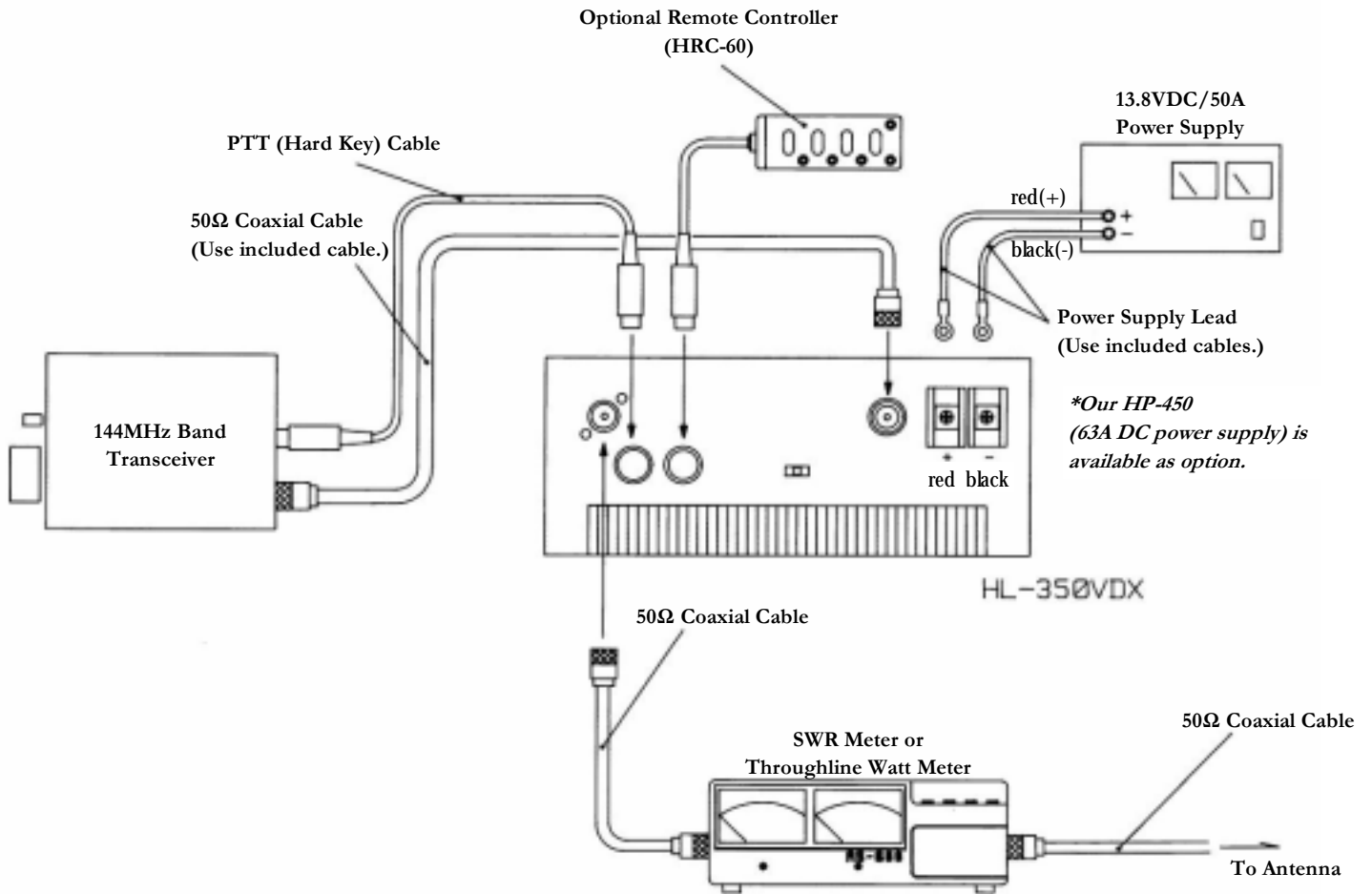
When viewed
from the outside
of the rear panel



*(Don't connect
ACC CONNECTOR here!)*

Terminal No.	Noun	Connection Details
	RX SW	This is connected to the switch of RX pre-amp. When 13.8VDC is applied, the RX pre-amp will be turned ON.
	VCC	This is connected to the + wire of the power supply cable. This pin always supplies 13VDC.
	HI/LO SW	When LO POWER position is selected, this pin will supply 13VDC.
	WARNING	When WARNING Lamp is turned ON, this pin will supply the voltage for lighting LED.
	TX	When the transmission is being made, this pin supplies 13VDC (50mA max.).
	GND	This is a grounding pin.
	POWER SW	This is connected to POWER SWITCH. When 13.8VDC is applied here, POWER will be turned ON.
	NC	This pin is not connected to anywhere.

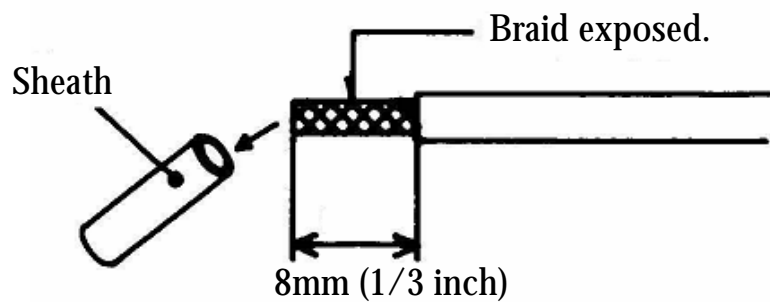
CONNECTION



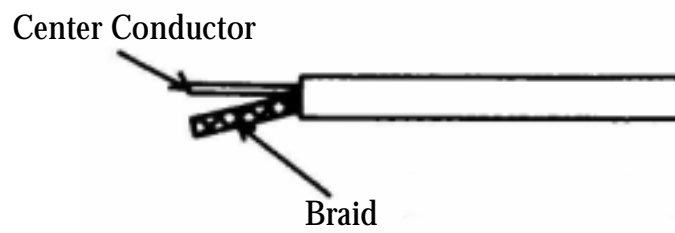
How to Make ACC Cable (for hard key from the transceiver):

Processing of Shield Wire Tips:

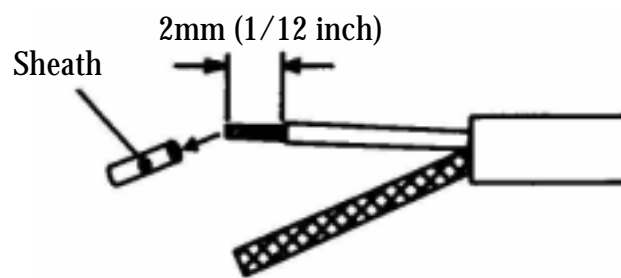
- a) Peel off the sheath.



b) Pull off the center wire.

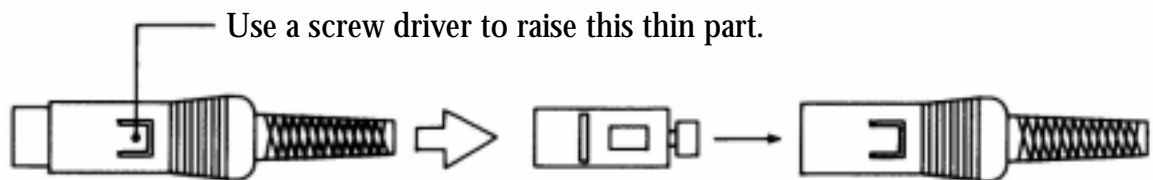


c) Peel off the sheath of the center wire tip.

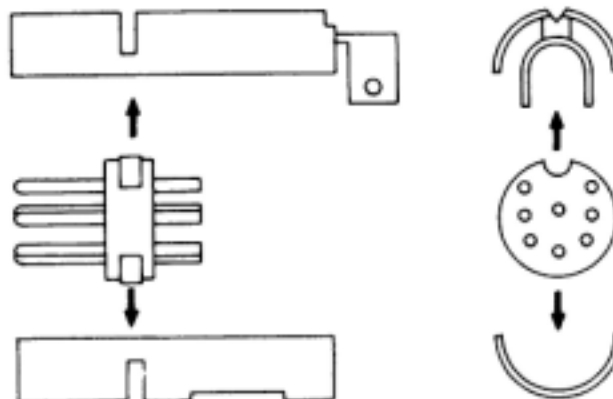


Disassemble DIN Plug:

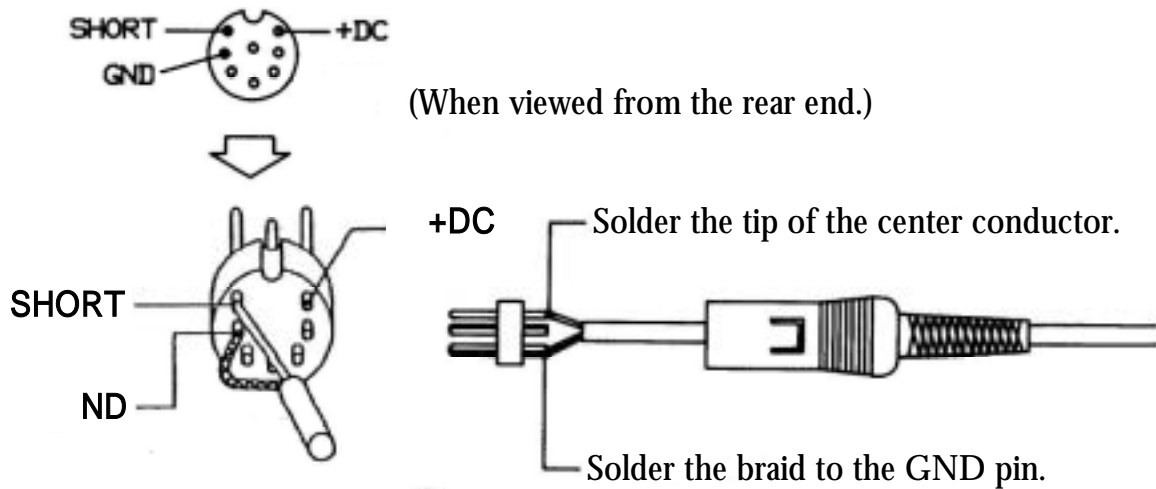
a) Remove the plastic case from the plug.



b) Remove cylindrical metallic parts.

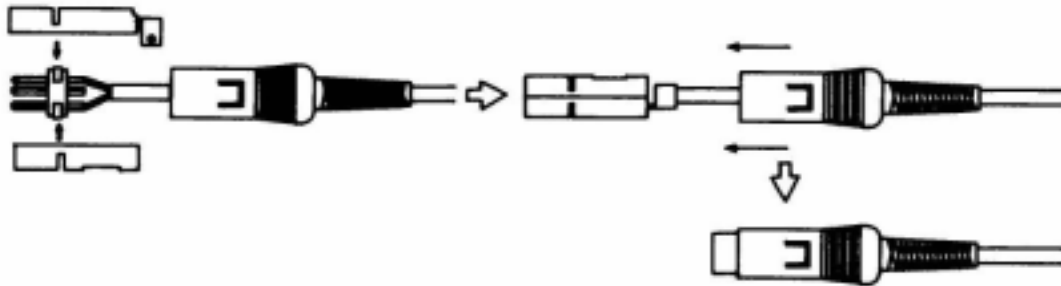


Solder to DIN Plug.



*Note: If the transceiver externally supplies no voltage (0V, =TX Gnd.) during the TX, solder the center conductor to Pin (SHORT), or if it supplies positive DC voltage of 2 to 15 V, then solder to Pin (+DC).

Re-assemble the plug.



Operation

Check antenna SWR:

- (1) Keep the POWER SWITCH of the HL-350VDX OFF.
- (2) Turn ON transceiver and tune in a vacant frequency channel.
Then, key to measure the antenna matching conditions with the SWR meter (Use FM or CW mode.).
- (3) If the measured SWR is much higher than 1.5, amp operation will become unstable.
Check your antenna for the correct resonance.

TX OPERATION

- (1) Before keying the radio, set the switches on the front and rear panel as follows:

POWER (Power Switch)	→ OFF
RX AMP (RX Pre-Amp Switch)	→ OFF
METER SELECT SWITCH	→ VCC
POWER LEVEL (Output Power Select Switch)	→ HI
MODE (Mode Select Switch)	→ either FM or SSB (set to the mode to be used)

- (2) Set RF DRIVE (Input Power Level Select Switch on rear panel) to the maximum power of the transceiver to be used.
Set to one of 10W/25W/50W ranges.

- (3) Turn ON POWER Switch of the HL-350VDX. Then, the lamp of the multi-meter will light.

- (4) Read the VCC meter scale.
Make sure that the meter deflection is on the thickened zone (around 13.8VDC).

- (5) Key the transceiver. TX Lamp on the front panel will light when the linear amplifier (TX) is working.

- (6) If needed, adjust the RF output power level knob of the transceiver in order not to overdrive the linear amp.

- (7) During the transmission, monitor RF OUT (TX Power) as well as SWR and VCC (Power Line Voltage) regularly by selecting the Multi-meter Switch, to see if HL-350VDX is working properly.

- (8) Press RX AMP Switch 12 accordingly when the received signal is too weak or too strong to be copied.

- (9) To work the transceiver alone on barefoot, the connection of all the coaxial cables to and from the amplifier may be left as they are.
Just turn OFF POWER SWITCH 1.

Then, the output power of the transceiver and the signal being received will by-pass the amplifier.

If the RX Pre-Amp alone is needed, turn ON RX AMP Switch 12 while POWER Switch 1 is kept turned OFF.

Cautions

1. Power Supply:

- (1) This amplifier is designed to work from 13.8VDC power supply.
Never connect to an AC line such as 115/120/220/240 VAC.
Such inadvertent connection will kill the amplifier.
- (2) Higher supply voltage above 14VDC will lead to damage of the amp.
Keep the power supply at the designed voltage of 13.8VDC.
- (3) High current will run with the amplifier at the time of transmission.
Use a stabilized DC power supply with a sufficient current capacity having a good regulation.
If the regulation of the power supply is poor, the designed maximum output power will not be achieved.
When extending the power supply cable, try to use cables thicker than 8 square millimeters in the shortest possible length.
The use of thinner cables will result in a voltage drop.

2. Antenna:

- (1) Use an antenna that can withstand a continuous 300W transmission.
The use of a lower-power designed antenna can be heated, deteriorating the SWR as the time passes.
In that case, the WARNING circuit will trip and/or the amplifier may be damaged.
- (2) This model is a high-gain/high-power linear amplifier.
If the antenna is located near the amplifier, RF intrusion will likely occur, causing troubles due to unexpected oscillation.
Try to locate the antenna far away (as much as possible) from the amplifier.

3. Installation:

- (1) Avoid setting the amplifier near the room heater or in the direct sun ray.
- (2) Do not block the air vent at the top cover.
Several inches of clearance are needed for the rear panel and wall.
The forced air-cooling fan intakes air from the top cover, and exhausts from the rear panel.
If the air intake port and/or exhaust port of the amplifier is/are blocked, the cooling effect inside will deteriorate, causing the inside temperature to be abnormally high.
Such abnormally high temperature can bring troubles to the amplifier.

4. Transceiver:

If this amplifier is driven with more than 50W, final power transistors may be killed due to over-drive.

Check if the output power of the driving transceiver is within the designed input power ranges of this amplifier.

5. Access To Internal Parts:

This amplifier is carefully assembled and adjusted with sophisticated RF measurement instruments.

Avoid making access to any of the parts inside.

Or it may cause the trouble of the amplifier.

Outline of Each Unit

1. TX Unit:

Part of the output power of the transceiver is detected at J101, so that the carrier controlled solid-state switching circuit turns ON/OFF IC201 (NJM2072D) and Q202 (2SC1959Y), activating the TX/RX change-over relay.

The RF signal inputted from J101 is amplified from 10W to 80W through DRIVER AMP Q1 (MRF247), and further amplified to the designed power of 250W to 330W through MAIN AMP Q1 ~ Q5 (MRF247 x4). RF input level can be selected to 10W, 25W or 50W by the POWER LEVEL SELECT SWITCH SW1.

At the 10W input, the RF signal is directly connected to DRIVER AMP so that the maximum gain can be attained.

At the 25W input, the RF signal goes through ATT1 (3dB) to be attenuated for a proper input level, and is then fed into DRIVER AMP. At the point of either 10W or 25W, the output power can be reduced approx. half by using the POWER LEVEL SELECT SWITCH.

At the 50W input, RL4 becomes activated to have DRIVER AMP by-passed so that the RF signal directly drives MAIN AMP to the power of 300W. The maximum current at the 300W output is approx. 36A where the heat dissipation is designed to be held as low as possible.

The base bias of each of Q2 through Q5 is controlled by Q7 (2SC1173Y). The combined power of 250W to 300W is fed through LPF and then sent out through J102.

A multimeter is incorporated into the HL-350VDX to exactly take hold of the working conditions. By switching the Meter Switch, W (RF OUT: Output Power), SWR (Standing Wave Ratio), or VCC (Power Line Voltage) can be monitored.

Wattage and SWR are detected by a directional coupler.

SWR can be directly read out with the meter at or above a certain output power (above 50W) as a result of the use of Divider IC203 (NJM4200D). The divider is stably fed with +5V from three-terminal Regulator IC205 (NJM78L05A), and -5V from DC-DC Converter IC202 (ICL7660CPA).

2. RX Unit:

The R Pre-Amp utilizes GaAs FET Q6 (MGF1302) and three-terminal Regulator IC1 (78L05A), so that a high gain amplification with low noise figure is achieved.

When to operate the RX pre-amp alone, with POWER SWITCH turned OFF, turn ON RX AMP SWITCH. Then, carrier controlling IC201 (NJM2072D) and switching transistor Q201 (2SA966) will supply voltage to Relay RL5 and the pre-amp at the RX state, so that a reception gain of approx. 15dB is obtained.

At the TX state, the voltage supplied to RL5 and the pre-amp becomes zero, where the output power of the transceiver inputted from J101 is outputted directly from J102 to the antenna.

3. WARNING Circuit:

The almost all part of WARNING circuit is incorporated into the control unit inside the front panel where tight RF shielding is provided.

Each detection unit utilizes a CM-type directional coupler, Excessive Input Detection Circuit being installed at the input side of DRIVER AMP, and SWR Detection circuit being installed at the output side of MAIN AMP.

Each detected voltage is amplified by OP Amp. IC204 (NJM2904D) and the relay controlling transistor Q203 (2SC3419Y) respectively, and turns OFF Power Supply Relays (RL6 and RL7) to halt the transmission in case a warning status is detected.

Two thermal sensors (SW101 and SW102) are installed.

SW102 increases the voltage of the line flow fan from 13VDC to 20VDC causing the line flow fan to effectively run at its full speed when the temperature of the heat sink exceeds 50 °C.

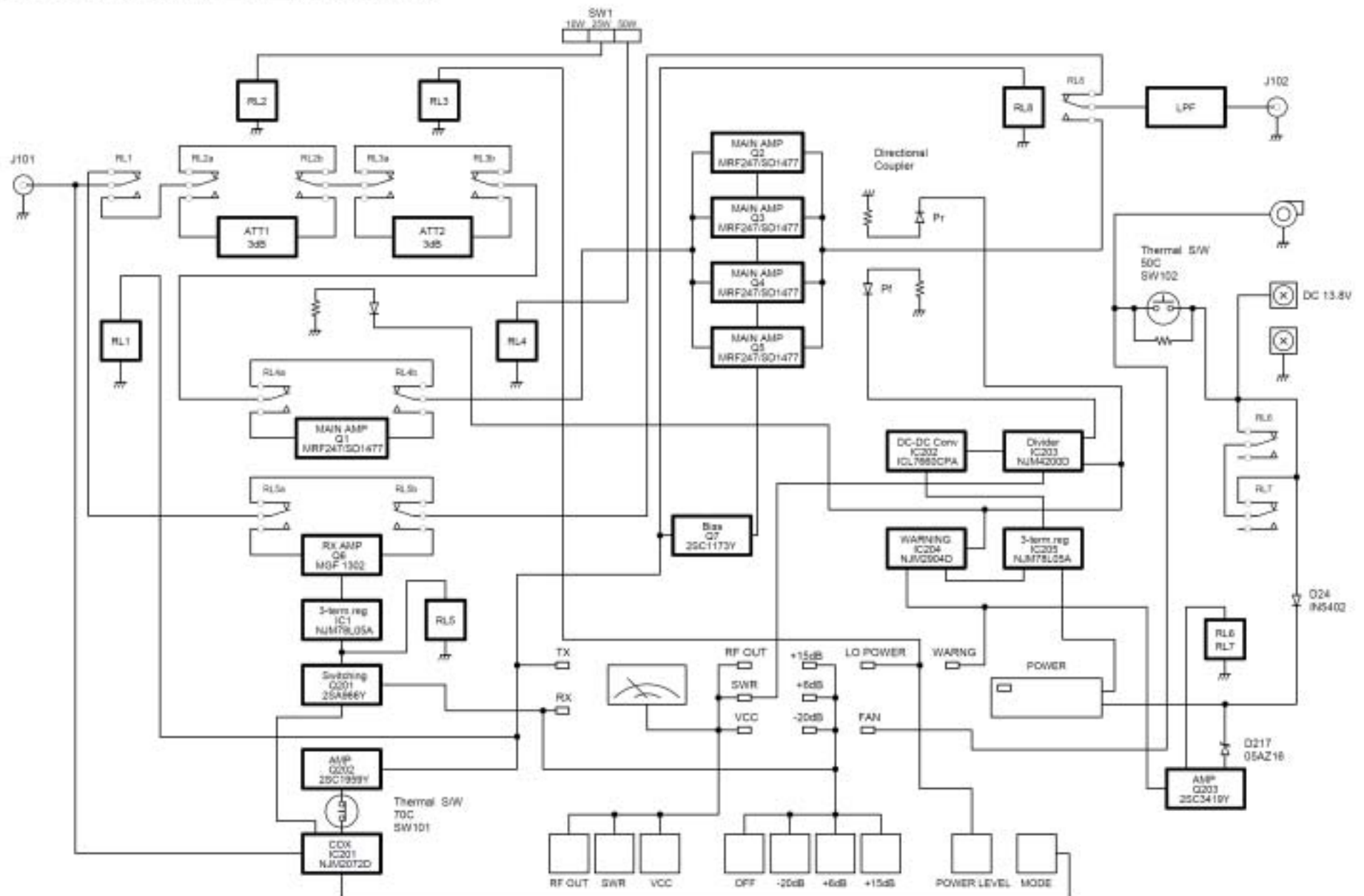
SW101 turns OFF the power of the carrier controlled switching circuit to halt the transmission preventing the power transistor from being damaged when the temperature of the heat sink exceeds 70 °C.

The HL-350V DX utilizes an indirect DC main power control circuit where the power is turned ON/OFF by the Power Relays (RL6 and RL7). Diode D24 (1N5402) being inserted in series to the wound coil of the relays, no current will be run in the wound coil even if POWER SWITCH is inadvertently turned ON with a wrong DC power polarity connection.

Thus, the relays will not be activated, so that a safe protection is secured.

If 24VDC is inadvertently connected, Zener Diode (05Z16A) will not turn ON Relay Controlling Transistor Q203 (2SC3419Y) preventing Power Relays (RL6 and RL7) from being activated.

BLOCK DIAGRAM OF HL-350VDX



Trouble Shooting

Following symptoms are not a sign of trouble.

Please refer to the treatment column for correction.

If you still cannot fix the situation, then please call our distributor or contact us for further technical advice.

Symptoms	Causes	Treatments
DC Power won't be turned on.	1) Power connector prematurely connected.	Properly connect it again.
	2) Power lead prematurely connected.	Check it for contact points.
	3) Wrong polarity connection.	Properly connect it again.
	4) Fuse blown.	Replace with new one.
No output power is obtained.	1) Microphone gain potentiometer or carrier level controller of XCVR turned down to the lowest level.	Turn the knob to half of the full level.
	2) The protection of HL-350VDX has tripped. (WARNING LED is lighting.)	Turn OFF the power. Once the trouble is corrected, turn ON the power to have the protection restored.
	3) Misconnection of input power.	Reconnect it properly.
	4) The power switch of XCVR is not turned on or XCVR is out of order.	Check XCVR.
Output power is less than designed specs.	1) The power supply voltage drops while in transmission.	Check the voltage in the transmitting stage.
	2) The output power of Transceiver is less than needed.	Check the output power of XCVR and increase the output power to the needed level.

MAJOR PARTS LIST

Marks	Q'ty	Part No. / Description
D2,D5,D7,D8,D18,D19, D25,D26,D27,D28, D201,D203,D204,D205, D206,D209 ~ 216,D219	24	1S2076A, silicon diode
D1	1	1K60, germanium diode
D9,D15,D16,D22,D23	5	1N4002, silicon diode
D24	1	1N4002, silicon diode
D6,D20,D21,D220	4	1SS97, shottky barrier diode
D217	1	05AZ16, zener diode
D218	1	CR02AM, thyristor
D14,D202	2	HZ5A1, zener diode
D10,D11,D12,D13	4	MI402, silicon diode
FAN101	1	HMK3404-01-070, line-flow fan
IC202	1	ICL7660CPA, IC
IC2	1	MC34063P, silicon monolithic IC
IC201	1	NJM2072D, IC
IC204	1	NJM2094D, op. amp IC
IC203	1	NJM 4200D, IC
IC1, IC205	2	NJM78L05A, 3-terminal regulator
LED201,LED211	2	SLP-455B-51, LED, yellow
LED202 ~ 210,LED212	10	SLP-255B-51, LED, green
F3	1	1A ϕ 6.4 x 30, fuse
F1,F2	2	20A ϕ 6.4 x 30, fuse
Q201	1	2SA966Y, transistor
Q7	1	2SC1173Y, transistor
Q202	1	2SC1959Y, transistor
Q203	1	2SC3419Y, transistor
Q1 ~ 5	5	MRF247/SD1477, power transistor
Q6	1	MGF1302, GaAS FET
RL1 ~ 5,RL201	6	AG2033, 2C-contact relay
RL6,RL7	2	G4PE-1117P 12VDC, 1a-contact relay
RL8	1	G2R-1 12VDC, 1c-contact relay
SW201	1	SPEA32L1118VH G701873M, 3-cir. 2-cont. push button S/W
SW203,SW204,SW205	3	SPEA12FX1080HF E16889990, 1-cir. 2-cont. push button S/W
SW202	1	SPEA42L1118VH G7018745M, 4-cir. 2-cont. push button S/W

SW1	1	SSSP12L1118VH G7018699M, 2-cir. 3-cont. slide S/W
VR1,VR2,VR202	3	1K ohms, semi-fixed variable resistors, horizontal
VR203,VR203,VR205	3	10K ohms, semi-fixed variable resistors, horizontal
VR201	1	100K ohms, semi-fixed variable resistors, horizontal
VR6	1	500 ohms, semi-fixed variable resistors, vertical
TC5	1	ECVIZW10X53T 10PF/250VDC, trimmer capacitor, ceramic
TC6	1	ECVIZW20X53T 20PF/250VDC, trimmer capacitor, ceramic
TC1	1	22222-808-11229 22PF/250VDC, film trimmer capacitor
TC4,TC8	2	50PF, trimmer capacitor
TC7	1	50PF/75VDC, trimmer capacitor, ceramic

OPTIONAL ACCESSORIES

- Remote Controller, HRC-60 (Sold separately):
8-Pin DIN Plug with a 1.5m long cable.
Dimension: 30(W) x 80(H) x 20(D) mm



- Extension Cable for HRC-60, HRC-6L (4m long, Sold separately):
8-Pin DIN Plug - 4m long cable - 8-Pin DIN Jack



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