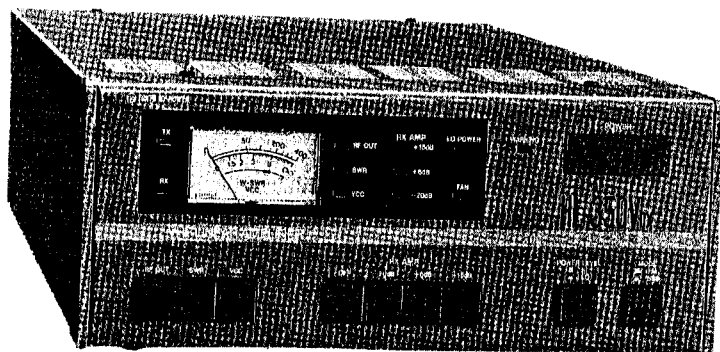


INSTRUCTION MANUAL FOR
144MHz BAND POWER AMP
MODEL HL-350VDX



TOKYO HY-POWER LABS., INC.

Introduction

The HL-350V DX is a 144MHz Band Power Amplifier with the maximum output power of 300W (nominal), designed based on Tokyo Hy-Power's accumulated VHF technologies. This is a completely solid-state amplifier capable of handling all transmission modes. It is a quite attractive amplifier incorporating 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-350V DX is made light in weight. A good-looking configuration is achieved by incorporating the heat-sink inside the main body.
2. **Adoption of Multi-Protections:**
It incorporates a 5-purpose protection circuit developed by our own advanced technologies. This highly dependable design can give you a caution before any trouble happens.
3. **Multi-Metering Method:**
Through the switch on the front panel, the meter indicates 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-350V DX.
5. **Auxiliary Remote Controlling Function:**
A jack for the connection with a remote controller (HRC-60 sold separately) is provided on the rear panel. Remote controlling of the power supply, the RX pre-amp and so forth can be made possible.

Specifications

Frequency : 144MHz Band (available for 144-148MHz)

Operatable Modes : FM, SSB and CW

RF Output Power : 300W Nominal (250W minimum)

RF Input Power : 10/25/50W (manually selectable)

DC Power Supply : 13.8VDC

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 GAs 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

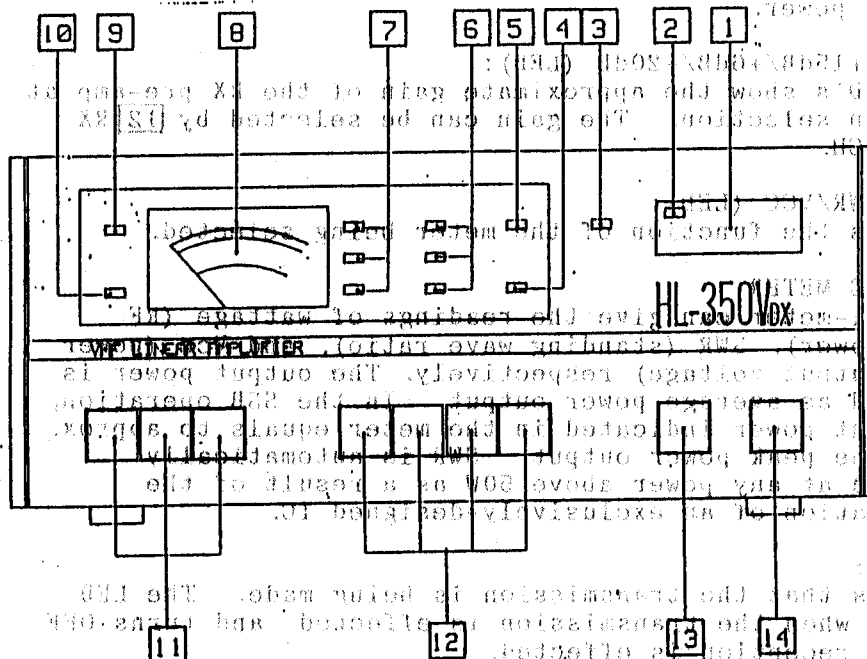
Fuses : 20A x 2, 1A x 1

Attachments :
 • Power Supply Cable 8sqmm, 2m long: red x 1, black x 1
 • ACC 8-Pin DIN Plug x 1
 • Jumper Cable with N-M connectors: 69cm long x 1
 • Spare Fuses, 20A x 2, 1A x 1

Dimensions/Weight : 245(W) x 100(H) x 355(D) mm, approx 5.5kg

Explanation of Features

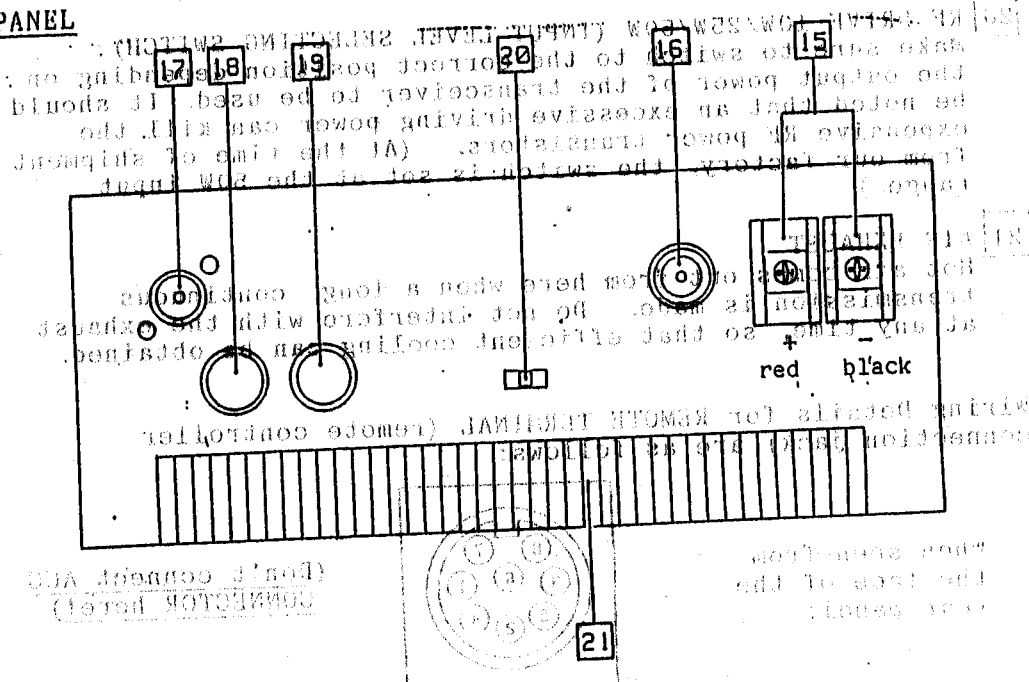
FRONT PANEL



- 1 **POWER (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 pushed back, unlocking the switch to turn the power OFF.
- 2 **POWER (LED):**
Indicates that the TX amp unit is turned ON.
- 3 **WARNING (LED):**
Indicates that the power supply to the TX RF Amp unit is being turned OFF when overdrive, overvoltage or mismatch in antenna VSWR is detected. After the defective location is corrected, 1 POWER SWITCH can be turned ON again.
- 4 **FAN (LED):**
Turns ON when the temperature of the heat sink exceeds 50°C. Then, the fan starts to operate to its full capacity. 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 operating in order to cool down the heat sink. Keep 1 POWER SWITCH being turned ON. Transmission can be restarted once the temperature is restored to the normal operating range.

- 5 LO POWER (LED):
Indicates that the attenuator is being inserted. With the attenuator ON, the transmission power is approx. half the full power.
- 6 RX AMP +15dB/+6dB/-20dB (LED):
Three LED's show the approximate gain of the RX pre-amp at each gain selection. The gain can be selected by 12 RX AMP SWITCH.
- 7 RF OUT/SWR/VCC (LED):
Indicates the function of the meter being selected.
- 8 W/SWR/VCC METER:
The multi-meter can give the readings of wattage (RF output power), SWR (standing wave ratio), and VCC (power supply output voltage) respectively. The output power is indicated as average power output. In the SSB operation, the output power indicated in the meter equals to approx. 40% of the peak power output. SWR is automatically indicated at any power above 50W as a result of the incorporation of an exclusively-designed IC.
- 9 TX (LED):
Indicates that the transmission is being made. The LED turns ON when the transmission is effected, and turns OFF when the reception is effected.
- 10 RX (LED):
Indicates that the RX pre-amp is being turned ON.
- 11 RF OUT/SWR/VCC (METER SELECTION SWITCH):
Depending on which function to be monitored, push ON the desired switch to obtain the readings.
- 12 RX AMP OFF/-20dB/+6dB/+15dB (SELECTION SWITCH):
Selects the gain of the RX pre-amp. Select the gain so that the signal being received can be most readable.
- 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.)
- 14 MODE FM/SSB (SELECTION SWITCH):
Selects the changeover delay time for TX/RX transition when the operation is done with the carrier controlled switching circuit. When it is kept pressed for SSB operation, it takes about 1 second for TX status to change into RX status. When the switch is pushed back for FM operation, TX status will instantly change into RX status. When to operate CW, keep this switch pressed ON (SSB position) and when to operate packet, keep it pressed OFF (FM position).

REAR PANEL



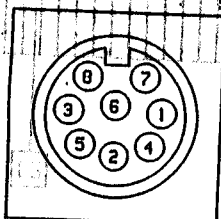
- 15** 13.8VDC (POWER SUPPLY TERMINAL):
Use the attached power supply cable for the connection with a stabilized DC power supply. Connect the red wire to +V and the black wire to -V. Make sure to use a power supply with a rated amperage of 50A or higher.
- 16** TX (INPUT CONNECTOR):
To be connected to the coaxial cable from the transceiver.
- 17** ANT (OUTPUT CONNECTOR):
To be connected to the coaxial cable from the antenna.
- 18** ACC (EXTERNAL TX/RX SWITCHING JACK):
Use this when the TX/RX changeover is forcedly controlled by the transceiver without the carrier controlled switching circuit utilized. Refer to Pages 8 and 9 for how to process the connection cable.
- 19** REMOTE (REMOTE CONTROLLER CONNECTION JACK):
With the use of the external remote controller (Model No. HRC-60; not attached to HL-350VDM shipment, an optional item), the following functions can be remotely controlled:
 - 1) Turning ON/OFF of POWER (power supply) indicated on the front panel,
 - 2) Turning ON/OFF of RX AMP (RX pre-amp),
 - 3) Switching of HI/LO (HI/LO transmission powers), and
 - 4) Resetting of WARNING CIRCUIT once it is activated.

20 RF DRIVE 10W/25W/50W (INPUT LEVEL SELECTING SWITCH):
Make sure to switch to the correct position depending on the output power of the transceiver to be used. It should be noted that an excessive driving power can kill the expensive RF power transistors. (At the time of shipment from our factory, the switch is set at the 50W input range.)

21 AIR EXHAUST
Hot air comes out from here when a long, continuous transmission is made. Do not interfere with the exhaust at any time, so that efficient cooling can be obtained.

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

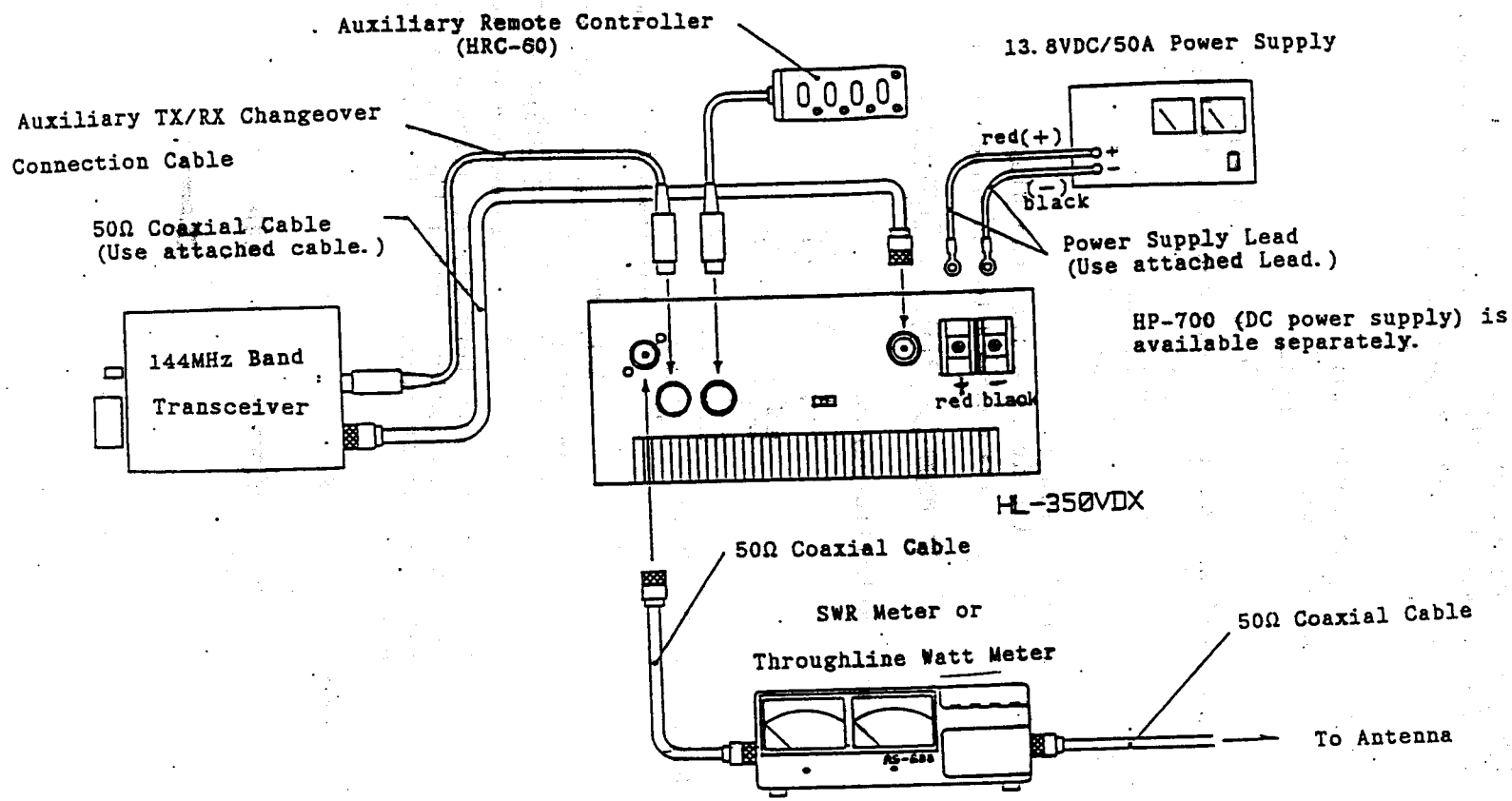
When seen from the face of the rear panel:



(Don't connect ACC CONNECTOR here!)

Terminal No.	Term	Connection Details
①	RX SW	This is connected to the switch of RX pre-amp. When the voltage of 13.8VDC is applied, the RX pre-amp will be turned ON.
②	VCC	This is connected to the + wire of the power supply cable. This terminal always supplies 13VDC.
③	HI/LO SW	When LO POWER position is selected, this terminal will supply 13VDC.
④	WARNING	When WARNING Lamp is turned ON, this terminal will supply the voltage for LED excitation.
⑤	TX	When the transmission is being made, this terminal supplies 13VDC (50mA max.).
⑥	GND	This is a grounding terminal.
⑦	POWER SW	This is connected to POWER SWITCH. When 13.8VDC is applied, POWER will be turned ON.
⑧	NC	This terminal is not wired.

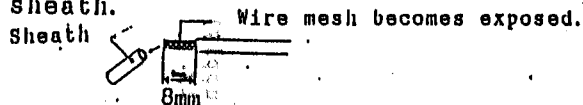
CONNECTION



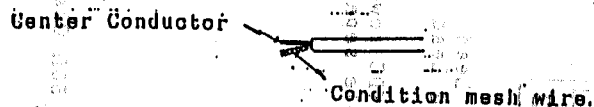
How to Process ACC Cable (for XCVR controlled forced TX/RX changeover):

① Processing of Tip of Shield Wire (right and left tips should be symmetrical.):

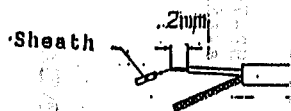
a) Peel off the sheath.



b) Pull off the center wire.



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



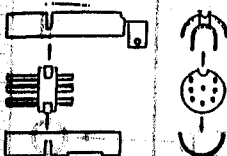
② Disassemble DIN Plug:

a) Remove the plastic case from the plug.

Use a screw driver to raise this thin part.

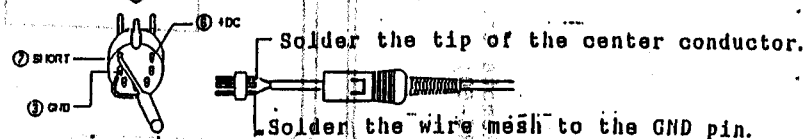


b) Remove metallic parts.



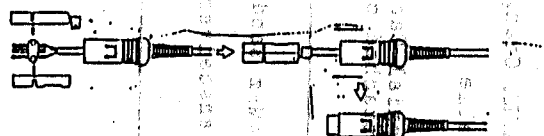
③ Solder to DIN Plug.

(when seen from the rear end.)



Note: If the transceiver externally supplies no voltage (0V) during the transmission, solder the center conductor to Pin ④, or if it supplies 2 to 15 volts, then solder to Pin ⑤.

④ Re-assemble the plug.



Operation

How to measure antenna SWR:

- (1) Keep the POWER SWITCH of the HL-350V DX OFF.
- (2) Turn ON the transceiver and tune in a frequency where NO QSO's are being made. Then, transmit and measure the antenna matching conditions with the SWR meter.
- (3) If the SWR is measured exceeding 1.5, not only the effective power transmitted from the antenna will be decreased, but also the operation of the HL-350V DX may become unstable. Thus, the SWR of the antenna must be lowered by adjusting the length or matching unit of the antenna.

TX OPERATION

- (1) Before transmission is going to be made, 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-350V DX. Then, the lamp of the SWR meter will turn ON.
- (4) Read out the readings of the VCC meter. Make sure that the indication of the meter is on the thickened line (around 13.8VDC).
- (5) Transmit with the transceiver. TX Indication Lamp on the front panel will turn ON indicating that the linear amplifier is being activated.
- (6) Adjust the output power adjustment level of the transceiver so that the amplifier will not be overdriven (as much as possible) from the amplifier.
- (7) During the transmission, monitor RF OUT (Transmission Power) as well as SWR and VCC (Power Line Voltage) from time to time by selecting the functions with the Multimeter Select Switch so that you can make sure that HL-350V DX is properly working.
- (8) Use RX AMP Switch [12] for a better reception when a weak, low-readable signal is burried with noises or a too-strong signal is being received.

- (9) When to operate with the output power of the transceiver alone, the connection of the coaxial cables to and from the amplifier can remain as is. Just turn OFF POWER Switch [1]. Then, the output power of the transceiver and the signal being received will go through the by-pass line of the amplifier. If the RX Pre-Amp alone is desired to be turned ON with the Power Amp OFF, turn ON RX AMP Switch [12] while POWER Switch [1] is kept turned OFF.

Cautions To Be Taken

1. Power Supply:
 - (1) This amplifier is designed for the use with a 13.8VDC power supply. Do not connect to an AC line such as 115/120/220/240VAC at any time. Such inadvertent connection will surely damage the amplifier.
 - (2) At any excessive voltage above 14VDC, the amplifier will tend to become defective or broken. Adjust the power supply to obtain the rated voltage of 13.8VDC.
 - (3) A considerable amount of current will be consumed by the amplifier at the time of transmission. Use a stabilized DC power supply with a sufficient current capacity having a good regulation. If a poorly-regulated power supply is used, the output power will decrease as a result of the drop in the line voltage. When to extend 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 rated antenna can cause the antenna itself to be heated, deteriorating the SWR as the time elapses. In that case, the WARNING circuit will be activated or the amplifier can possibly go defective.
 - (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 the unexpected oscillation. Try to locate the antenna far away (as much as possible) from the amplifier. Also, make sure that the HL-350VDX be well grounded.
3. Installation:
 - (1) Avoid using the amplifier near an air conditioning heater or under the direct sun light during the summer where the atmospheric temperature is excessively high.

- (2) Do not place anything that can possibly interfere with the air flow at the back of the amplifier. The forced-cooling fan intakes air from the upper case, 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 a power more than 50W, a trouble such as breakage of power transistors can possibly take place due to overdriving. Before the use, confirm that the output power of the transceiver you are going to use is within the input power ranges of this amplifier.

5. Access To Inside Parts:

This amplifier is assembled with sophisticated manufacturing technologies, and is shipped subject to minute adjustments and sound and fast inspections, try to minimize your access to any of the inside parts as the accessing to or modification of the inside parts can possibly cause malfunction.

At the 50W input, R14 becomes activated to have DRIVE 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 (250V15Y). The combined power of 250W to 300W is fed through L1P and then sent out through J102.

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

Waveguide 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 (NJM4300D). The divider is stably fed with 15V from three-terminal Regulator IC205 (NJM78L05A), and -5V from DC-DC Converter IC202 (ICL7660CPA).

The RX Pre-Amp utilizes GAs FET Q6 (MGE1302) and three-terminal Regulator IC1 (78L05A), so that a high gain amplification with low noise characteristics is achieved.

When to operate the RX pre-amp alone, with POWER SWITCH turned OFF, turn ON RX AMP SWITCH. Then, carrier controlling IC201 (NJM2003D) and switching transistor Q201 (2SA860) will supply voltage to relay R12 and the pre-amp at the RX status, so that a reception gain of approx. 15dB is obtained.

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 rated powers of 250W to 300W through MAIN AMP Q1 & Q5 (MRF247 x 2). RF input level can be selected to 10W, 25W or 50W by the POWER LEVEL SELECT SWITCH.

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 input 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 DRIVE 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-350V DX 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 RX Pre-Amp utilizes GaAs FET Q6 (MGF1302) and three-terminal Regulator IC1 (78L05A), so that a high gain amplification with low noise characteristics 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 status, so that a reception gain of approx. 15dB is obtained.

At the TX status, 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 (NIM2904D) 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-350VDC utilizes an indirect power supply 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.

MAIN PARTS LIST

Each of the following symptoms is not a sign of a circuit problem. If you please refer to the treatment column for correction. If you still cannot fix the situation, then please call our distributor for further technical advice.

Symptoms	Causes	Treatments
Power won't be turned on.	1) Power connector prematurely connected. 2) Power connector prematurely connected. 3) Wrong polarity connection. 4) Fuse blown.	Properly connect it again. Check it for contact points. Properly connect it again. 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. 2) The protection circuit is being activated (WARNING LED is lighting.) 3) Misconnection of input connector. 4) The power switch of XCVR is not turned on or XCVR is out of order.	Turn the knob to half of the full level. Turn off the power. Once the trouble is corrected, turn on the power to have the protection restored. Reconnect it properly. Check XCVR.
Output power is less than rated.	1) The power supply voltage reduces while in transmission. 2) The output power of the transmitter is less than rated.	Check the voltage in the transmitting state. Check the output power of XCVR and increase the output power to the rated level.

MAIN PARTS LIST

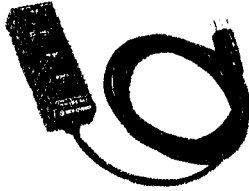
Marks	Qty	Part No./Description
D2, 5, 7, 8, 18, D19, 25, 26, 27, D28, 201, 203, D204, 205, 206, D209 - D216, D219	124	1S2076A, silicon diode
D1	1	1K60, germanium diode
D9, 15, 16, 22, D23	5	1N4002, silicon diode
D24	1	1N5402G, silicon diode
D6, 20, 21, 220 D217	4	1SS97, shotky barrier diode
D218	1	05A216, zener diode
D14, 202	2	CR02AM, thyristor
D10, 11, 12, 13 FAN101	4	1N75A1, zener diode
IC202	1	1N4002, silicon diode
IC2	1	1N4002, silicon diode
IC201	1	1N4002, silicon diode
IC204	1	1N4002, silicon diode
IC203	1	1N4002, silicon diode
IC1, 205	2	1N4002, silicon diode
LED201, 211	2	1N4002, silicon diode
LED202	2	1N4002, silicon diode
LED212	10	1N4002, silicon diode
F3	1	1N4002, silicon diode
F1, 2	2	1N4002, silicon diode
Q201	1	1N4002, silicon diode
Q7	1	1N4002, silicon diode
Q202	1	1N4002, silicon diode
Q203	1	1N4002, silicon diode
Q1 - Q5	5	1N4002, silicon diode
Q6	1	1N4002, silicon diode
RL1-5, RL201	6	1N4002, silicon diode
RL6, 7	2	1N4002, silicon diode
RL8	1	1N4002, silicon diode
SW201	1	1N4002, silicon diode
SW202, 204, 205	3	1N4002, silicon diode
SW203	1	1N4002, silicon diode
SW1	1	1N4002, silicon diode
VR1, 2, 202	3	1N4002, silicon diode
VR203 - VR205	3	1N4002, silicon diode
VR201	1	1N4002, silicon diode
VR6	1	1N4002, silicon diode
TC5	1	1N4002, silicon diode
TC6	1	1N4002, silicon diode
TC1	1	1N4002, silicon diode
TC4, 8	2	1N4002, silicon diode
TC7	1	1N4002, silicon diode

OPTIONAL ACCESSORIES

Remote Controller, HRC-60 (Sold separately):

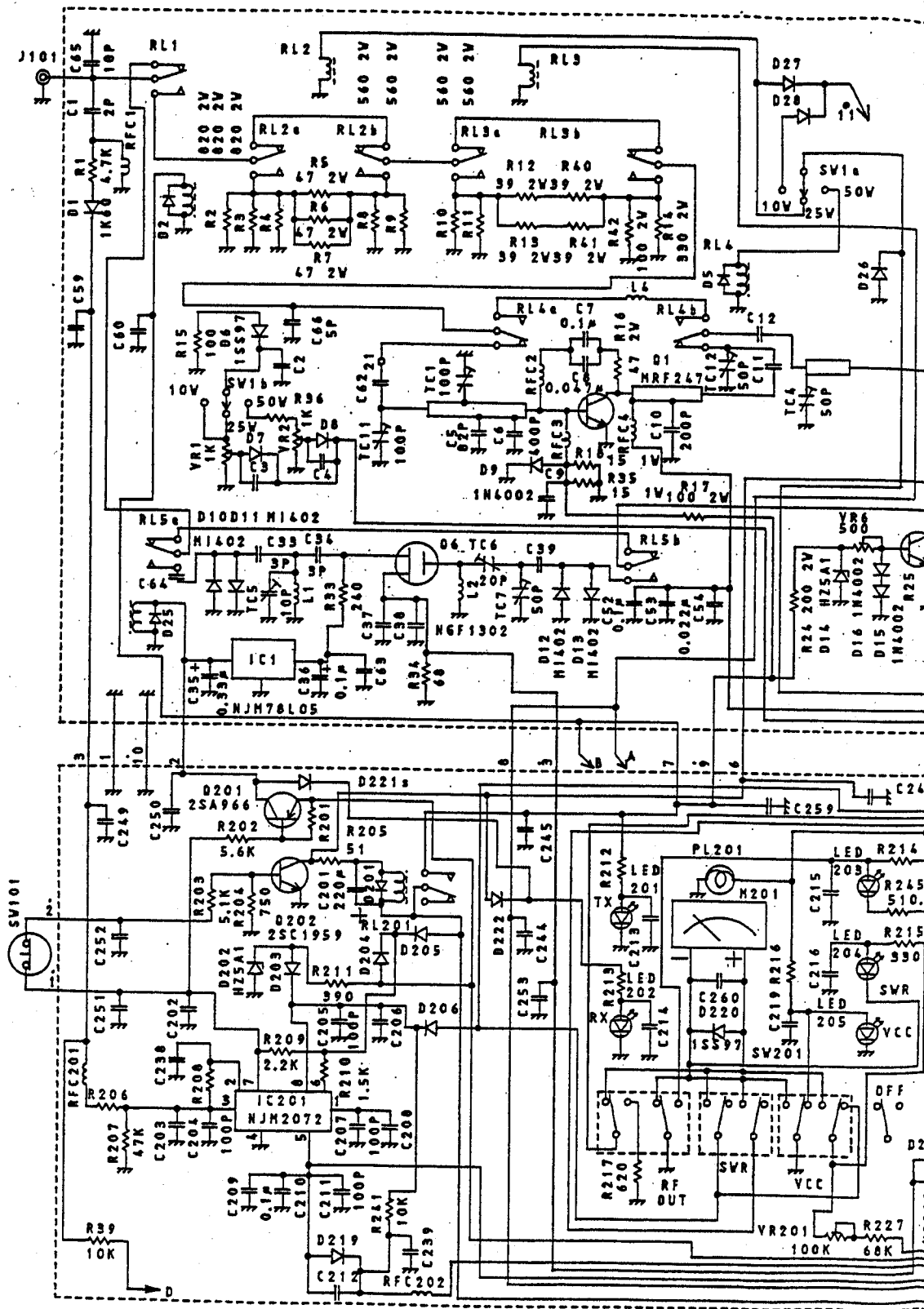
8-Pin DIN Plug with a 1.5m long cable.

Dimension: 30(W) x 80(H) x 20(D) mm



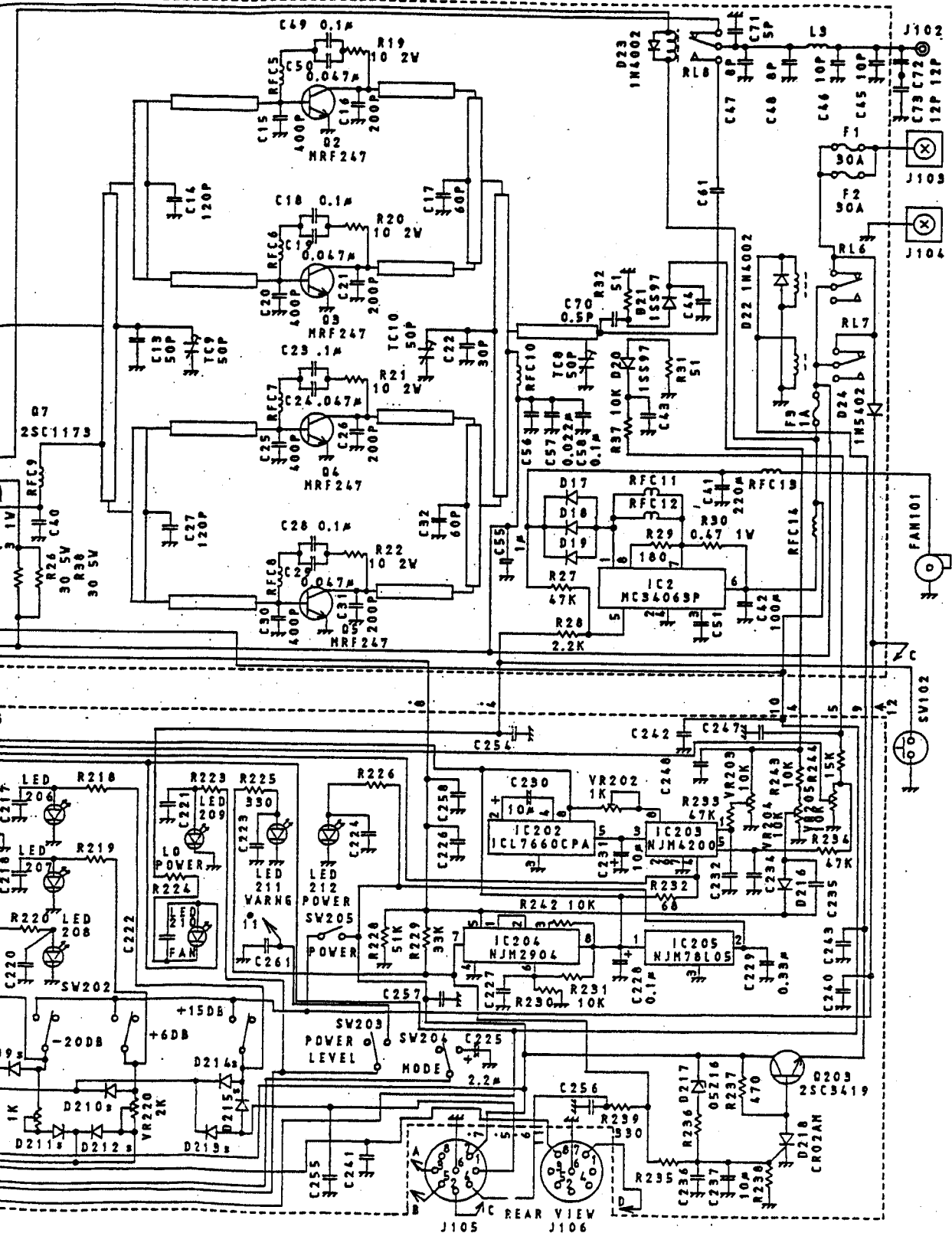
Extension Cable for HRC-60, HRC-6L (4m long, Sold separately):

8-Pin Din Plug – 4m long cable – 8-Pin DIN Jack



- All resistors unless otherwise specified are 1K ohms.
- All capacitors without capacitance designation are 1000PF.
- All diodes without designation are 1S2076A.

This circuit diagram is subject to change without prior notice.



HL-350VDX CIRCUIT DIAGRAM