

AUTOMATIC ANTENNA TUNER

AT-50

INSTRUCTION MANUAL

KENWOOD CORPORATION

KENWOOD

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1. FEATURES

The AT-50 antenna tuner was designed for use with either a mobile or fixed station transceiver. Principal features of the tuner include the following :

- Coverage of all Amateur bands from 1.8 through 29 MHz provides total operating flexibility.
- The AT-50 Automatic mode allows quick, "hands-off" tuning of your antenna system when you use the tuner in conjunction with your matching TS-50S transceiver.
- The Semi-automatic mode, when used with transceivers other than the TS-50S, functions with minimum operator intervention by automatically sensing the presence of your transmitter's low level RF signal. Or, select the Local Automatic mode from the AT-50 front panel for maximum personal control while still taking advantage of the automatic tuning circuitry.
- Storage of all preset tuning positions in EEPROM improves reliability by eliminating the need for any backup battery.

2. SPECIFICATIONS AND ACCESSORIES

2-1. Specifications

Frequency range	Amateur bands from 1.8 to 29.7 MHz
Voltage required	13.8 V DC \pm 15%
Ground system	Negative ground
Current consumed	2 A or less
Power limit (maximum throughput)	100 W continuous wave (after tuning)
Operating temperature range	-20 °C ~ +60 °C
Input impedance	50 ohms unbalanced
Maximum VSWR (after tuning)	1.3 or less
Tuning power	6~20 W
Antenna impedance range	20 to 150 ohms (SWR : approx. 2.5 or less)
Tuning time	Initial tuning time : 30 seconds or less After first preset : 3 seconds or less
Dimensions [W x H x D] (Including projections)	180 x 60 (68.5) x 233 (247) mm
Weight	2.1 kg

Note:

Ratings are subject to change due to technological improvement.

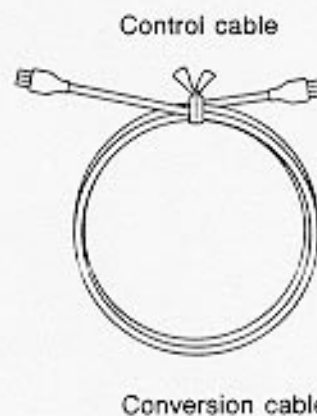
2-2. Accessories

Unpack your AT-50 carefully and confirm that it is supplied with the following accessories.

Control cable (E30-3145-05)	1 ea.
Conversion cable (E30-3155-05)	1 ea.
Fuse (4A) (F06-4029-05)	1 ea.
Warranty Card (U.S.A., Canada and Europe versions only) .	1 ea.
Instruction Manual (B62-0320-00)	1 copy.

After unpacking

Save the box and packing in the event your tuner needs to be transported for maintenance or service.



3. INSTALLATION

Note the following when installing the AT-50 :

1. Install the AT-50 as close to the antenna as possible. The tuner will be more efficient.
2. Install the tuner where it can be grounded effectively.
3. Do not install the tuner in damp or humid areas. These conditions increase the risk of electrical shock.
4. Remove all packing material, such as plastic bags, to prevent overheating and fire.
5. Install the tuner on a stable surface to prevent injury or damage by dropping.
6. Take the following precautions to reduce heat build-up :
 - (1) Do not place the tuner where it will be exposed to direct sunlight or will be close to heating appliances.
 - (2) Install the tuner in a well ventilated place.
 - (3) Allow approximately 10 cm (4 inches) of space around the tuner.
 - (4) Do not put anything (such as a tablecloth) on top of the case.
 - (5) Do not install the tuner in areas of excessive dust.
7. For mobile installation, install the tuner in the safest and easiest-to-use location in a vehicle. For example, install it on one side of the console box, under the dashboard, or beneath the front passenger seat. The main mode of operation you choose to use (Automatic, Semi-automatic, Local Automatic) should be considered before installation.
8. Install the tuner securely for mobile use to prevent injury or damage in the event of an accident.

3-1. Fixed Station

3-1-1. Antenna

A good antenna is required to transmit and receive signals efficiently. Install the antenna high and as far from TV antennas, houses, and electrical cables as possible.

Caution:

1. Antennas can have large voltages while transmitting (several kV). Therefore, install your antenna where it cannot be accidentally touched.
2. Interference to televisions or audio equipment can often be resolved by increasing the distance between the source of interference and the device receiving the interference.

3-1-2. Ground

Connect the GND terminal to a good earth ground. The quality of the ground significantly affects the performance of your station. Good grounding is required if the AT-50 is to provide the correct match for an antenna. The wire connected to the ground must be as short as possible.

When the AT-50 cannot be grounded effectively, such as in a tall building, use a counterpoise as an alternative. The correct length is as follows :

$$\text{Counterpoise Length} = (1/4 \times F) \times (0.95) \times (\text{O.N.})$$

Where F : Operating frequency wavelength

0.95 : Wavelength reduction rate

O.N. : Any odd number (e.g. 1, 3, 5,...)

Caution:

1. Never connect the GND terminal to a gas pipe or to electrical conduit in a building. A plastic water pipe is also not a suitable ground.
2. Do not share a ground with other equipment, such as air conditioners and water pumps. Equipment on a common ground may interfere with each other.

3-2. Mobile

3-2-1. Antenna

A short whip antenna is used as an HF band mobile antenna. Since HF band mobile antennas are larger and heavier than VHF antennas, a strong, rigid mount must be used. Grounding is particularly important when using a whip antenna. Follow established installation practices, and refer to the instructions supplied with the mobile antenna.

3-2-2. Power supply connection

If the power is supplied to the AT-50 from the transceiver, refer to the TS-50S Instruction Manual. If the AT-50 is connected to the vehicle battery, take the following precautions.

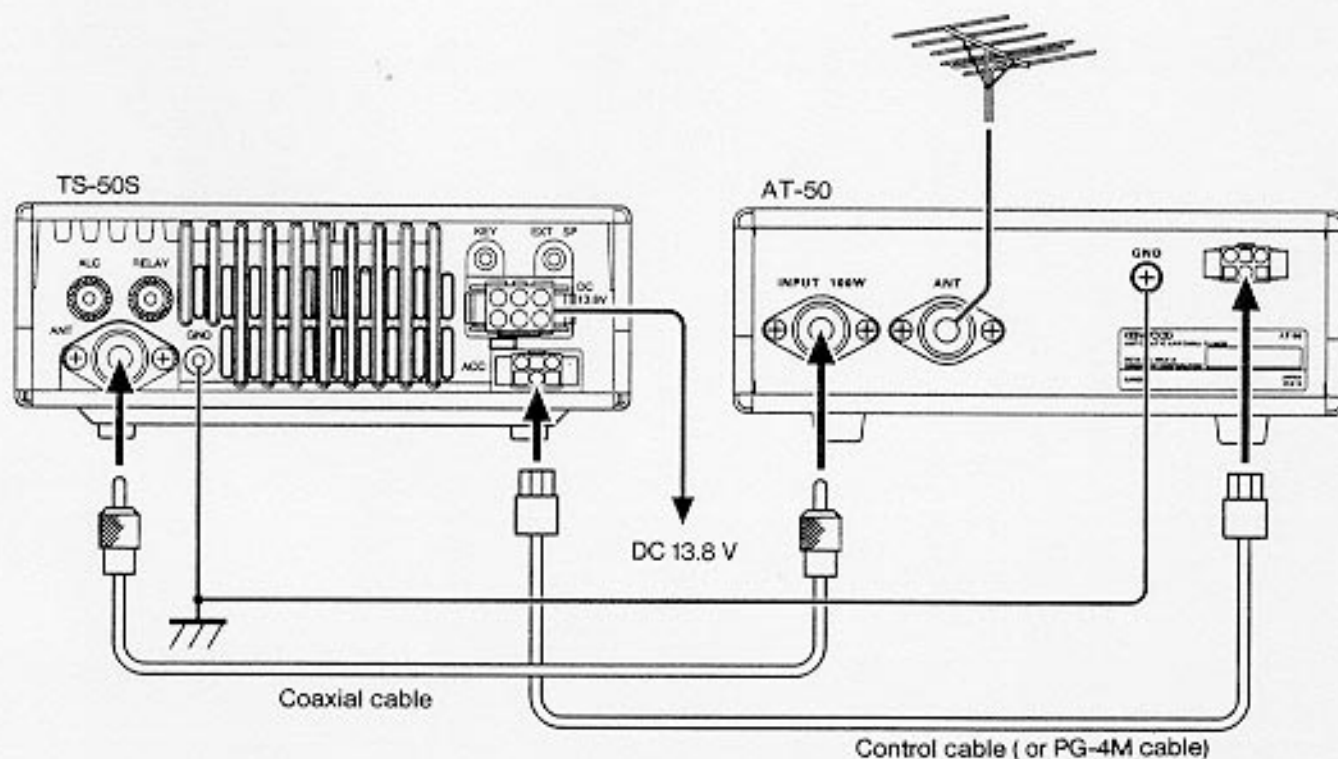
Note:

1. The AT-50 does not have a power switch. A key-switched power source is recommended.
2. The tuner operates on DC 13.8 V. Do not connect it directly to a 24 V battery sometimes used in larger vehicles or trucks.
3. The tuner contains a fuse. The fuse opens if the supply voltage exceeds 20 V or if an internal circuit fails.

4. CONNECTION WITH TS-50S

4-1. Connection Details

1. Turn the TS-50S power switch off.
2. Connect either end of the supplied Control cable or the optional PG-4M cable (6 m) to the TS-50S ACC connector. Connect the other end of the cable to the matching AT-50 connector.
3. Connect the coaxial cable (PL-259(M) connector) to the TS-50S ANT connector and the AT-50 INPUT 100W connector.
4. Connect the appropriate antenna to the AT-50 ANT connector.
5. Connect a ground wire between the TS-50S and AT-50 ground terminals, then ground one of the terminals.



4-2. Operation in Automatic Mode

This mode can be used only with the TS-50S transceiver. Use the Semi-automatic or Local Automatic mode when using other transceivers (see pages 12 to 15).

Connecting the TS-50S to the AT-50 with the Control or PG-4M cable makes it possible for the transceiver to control the actions of the AT-50 tuner. When the TS-50S [AT TUNE] key is pressed, the transceiver communicates with the AT-50, and enters the CW mode with a transmit power of approximately 10 W. The AT-50 LEDs light, its front panel keys are locked, and tuning begins automatically.

■ Automatic Mode Tuning

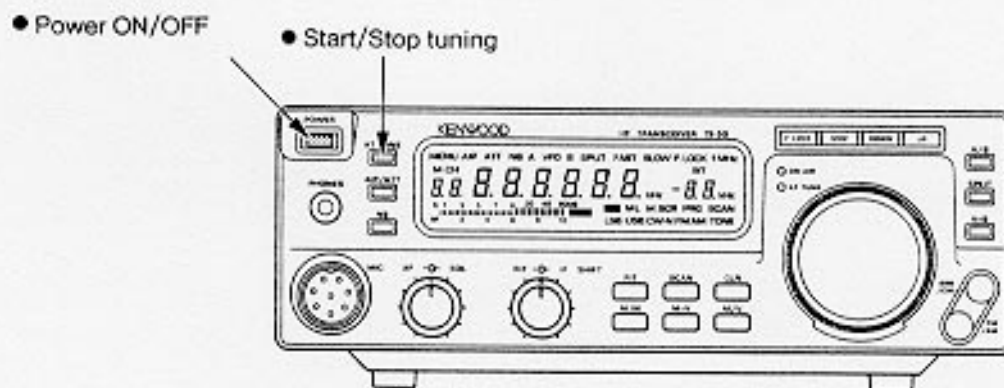
- 1 Select the desired transmit frequency. Choose a clear frequency to avoid interfering with others.
- 2 Press the [AT TUNE] switch on the TS-50S.

The TS-50S enters the CW mode, "AT" appears, and the AT TUNE and ON AIR indicators light. When tuning is complete, the AT TUNE and ON AIR indicators go off, and the original mode returns automatically. "AT" remains visible on the display.

Note:

1. The tuner only functions on frequencies on which the TS-50S can transmit.
2. Tuning can be stopped at any time by pressing the TS-50S [AT TUNE] key.

TS-50S Front panel



Operating Tip:

The AT-50 is capable of tuning antenna systems with substantial SWR; however, it is always best to use a correctly tuned antenna. Always tune the antenna to achieve the lowest SWR before using the AT-50.

■ Maximum Tuning Time

If tuning does not finish within 30 to 45 seconds including the preset time, the TS-50S emits a series of warning beeps, and the AT-50 ALARM lights.

When using the AT-50 the first time or with a new antenna, tuning may be incomplete after the maximum tuning time. In this case, do the following :

- ① Press the [AT TUNE] key again to complete the tuning operation.
- ② If the ALARM indicator remains on, check the antenna.

■ THRU setting

When THRU is selected, the output from the TS-50S is sent directly to the antenna without passing through the AT-50 tuning circuit.

- ① Hold down the [AT TUNE] key on the TS-50S for approximately 2 seconds.

The TS-50S emits a beep and the "AT" indicator goes off.

The AT-50 is in the THRU mode.

Note:

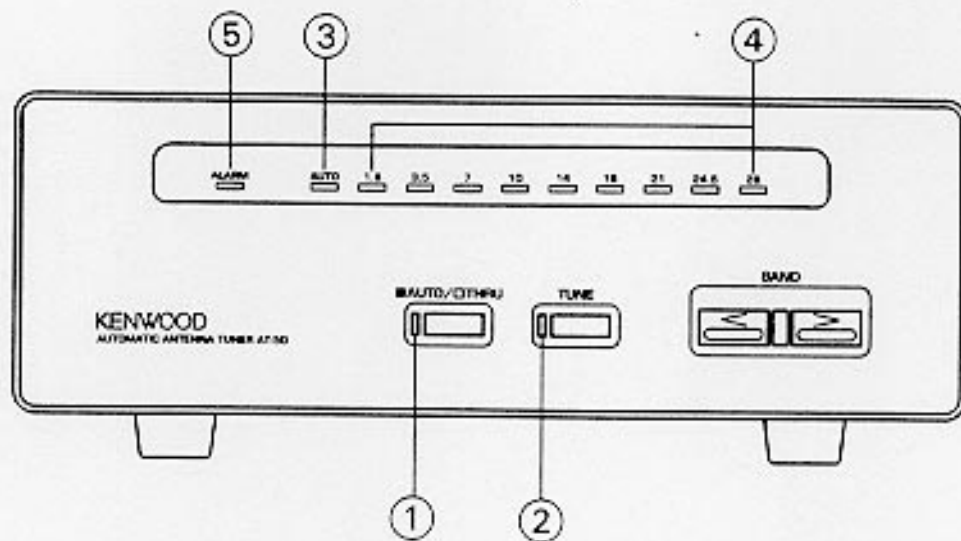
For Split Frequency operation where the transmit and receive frequencies are different, receive sensitivity is lost if the tuner is left in AUTO after tuning. The sensitivity loss will only be significant if the frequencies are widely separated (e.g. when operating split on the 40 meter DX and U.S. Phone bands). Use the THRU setting after tuning completes to resolve this.

■ SWR check

If your transmit output decreases after tuning, possibly due to changing frequency on the same band, retune to restore maximum output.

Note:

The TS-50S and AT-50 must be powered at the same time. When the TS-50S is turned on, it checks whether the AT-50 is connected. The transceiver then issues a connection confirmation command to the AT-50 that sets the tuner to the Automatic mode. Therefore, always connect the Control cable, then turn the TS-50S on. If the AT-50 is turned on after the TS-50S, the presence of the AT-50 is not checked, therefore the Semi-automatic or Local Automatic mode will be selected.



AT-50 LED indicators

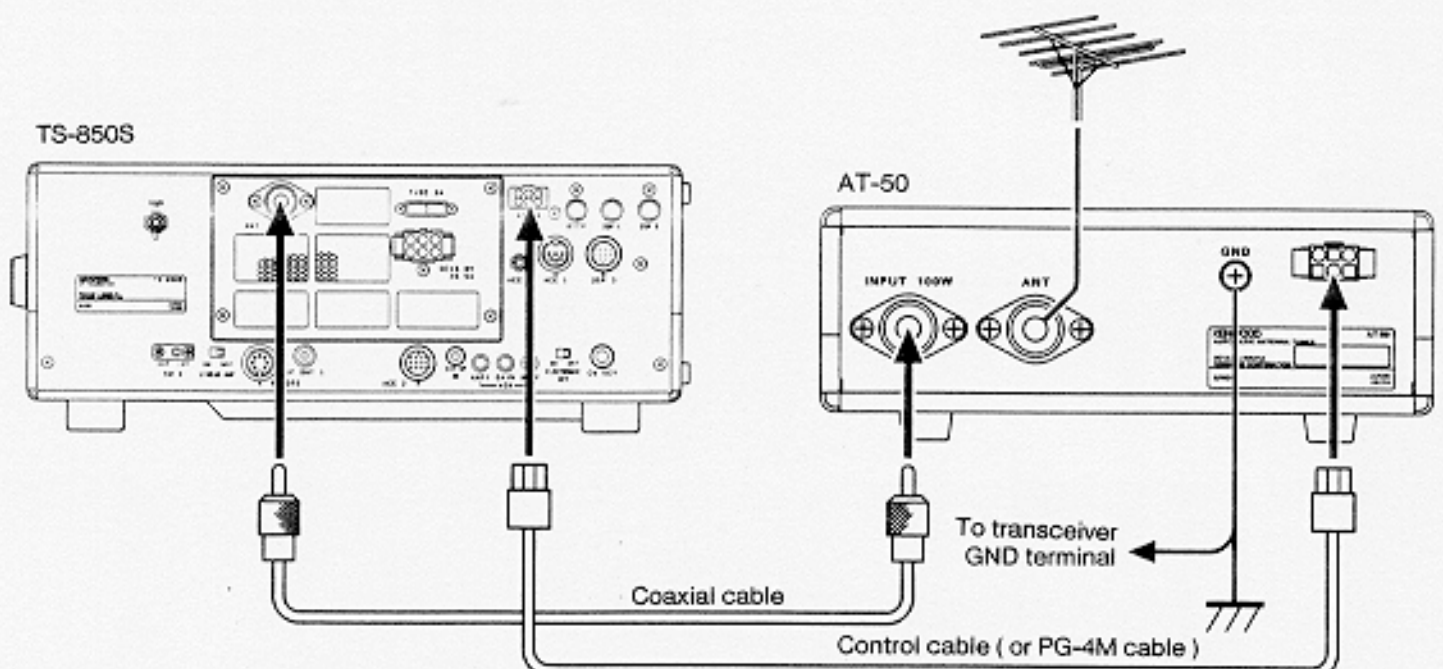
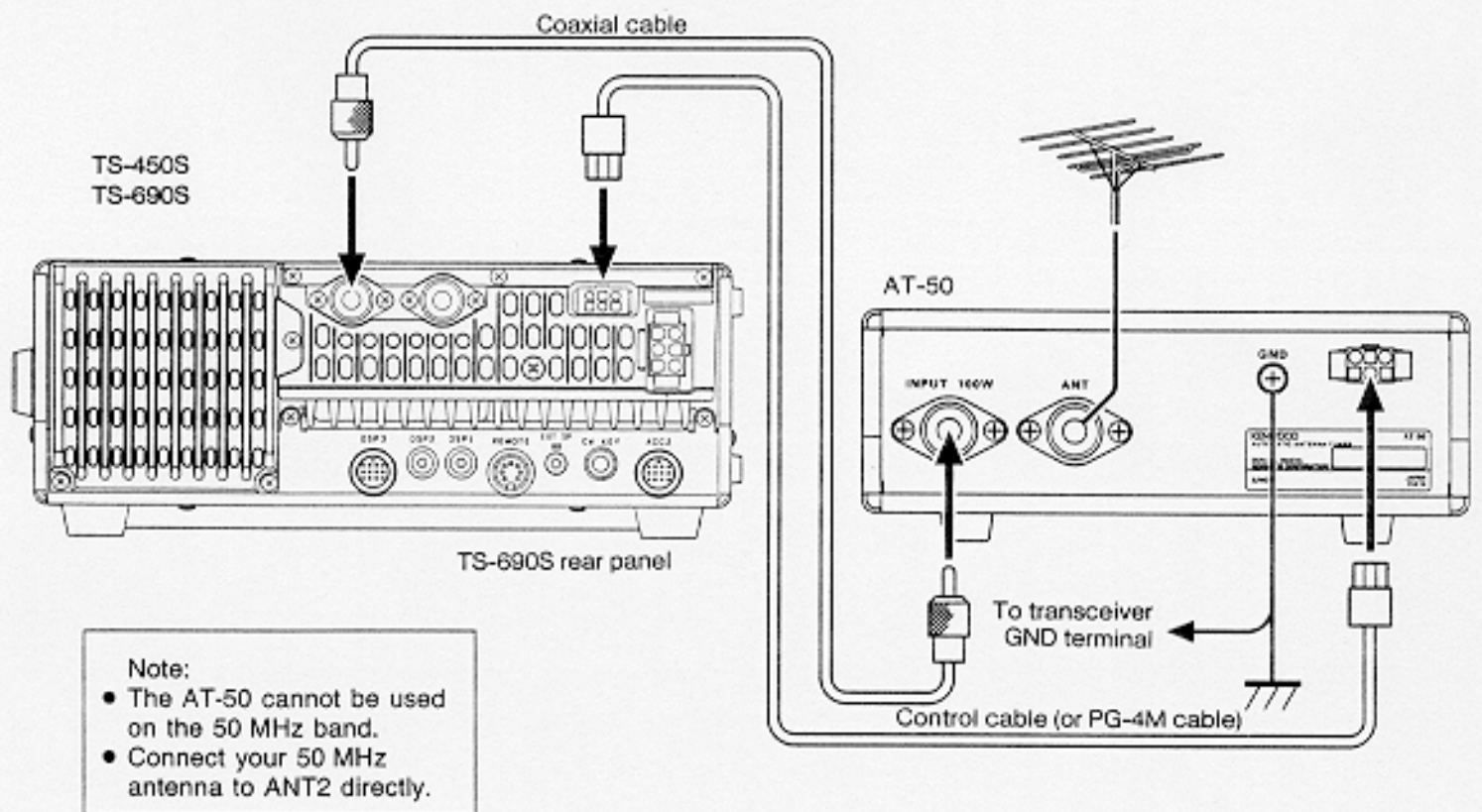
LED	Function
① AUTO/THRU	Lights in AUTO mode. Off in THRU mode.
② TUNE	Lights when tuning or presetting is in progress. Goes off when tuning ends.
③ AUTO	Lights in the Automatic mode.
④ BAND	Lights to indicate the current operating band. (Same band as for the TS-50S)
⑤ ALARM	Lights when tuning does not finish within the maximum tuning time. Goes off when the AT TUNE key is pressed.

5. CONNECTION WITH TRANSCEIVERS OTHER THAN TS-50S

The AT-50 can be used with transceivers other than the TS-50S; however, the Automatic mode cannot be used. Use the Semi-automatic or Local Automatic mode (see pages 12 to 15).

5-1. Connection with TS-850S, TS-690S, or TS-450S

1. Turn the TS-50S power switch off.
2. Connect either end of the supplied Control cable or the PG-4M cable (6 m) to the transceiver ACC connector. Connect the other end of the cable to the matching AT-50 connector.
3. Connect the coaxial cable (PL-259(M) connector) to the transceiver ANT connector and the AT-50 INPUT 100W connector.
4. Connect the appropriate antenna to the AT-50 ANT connector.
5. Connect a ground wire between the transceiver and AT-50 ground terminals, then ground one of the terminals.



5-2. Connection with Transceivers other than TS-850S, TS-690S, and TS-450S

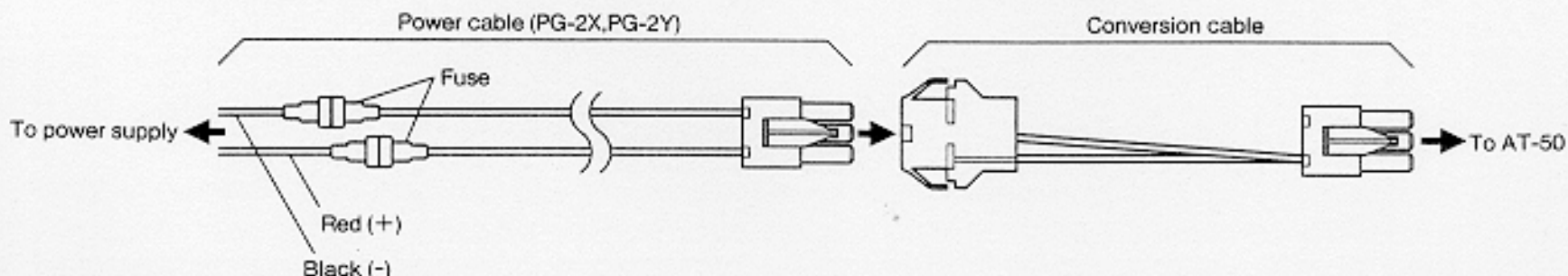
The supplied Control cable can be used only with the TS-50S, TS-850S, TS-690S, and TS-450S. For transceivers other than these, connect an optional PG-2X, or PG-2Y power cable to the supplied Conversion cable. The free end of the connectorized Conversion cable connects to the AT-50, and the two leads on the power cable are connected to an external power supply.

Note:

Use a DC 13.8 V regulated power supply (2 A or more).

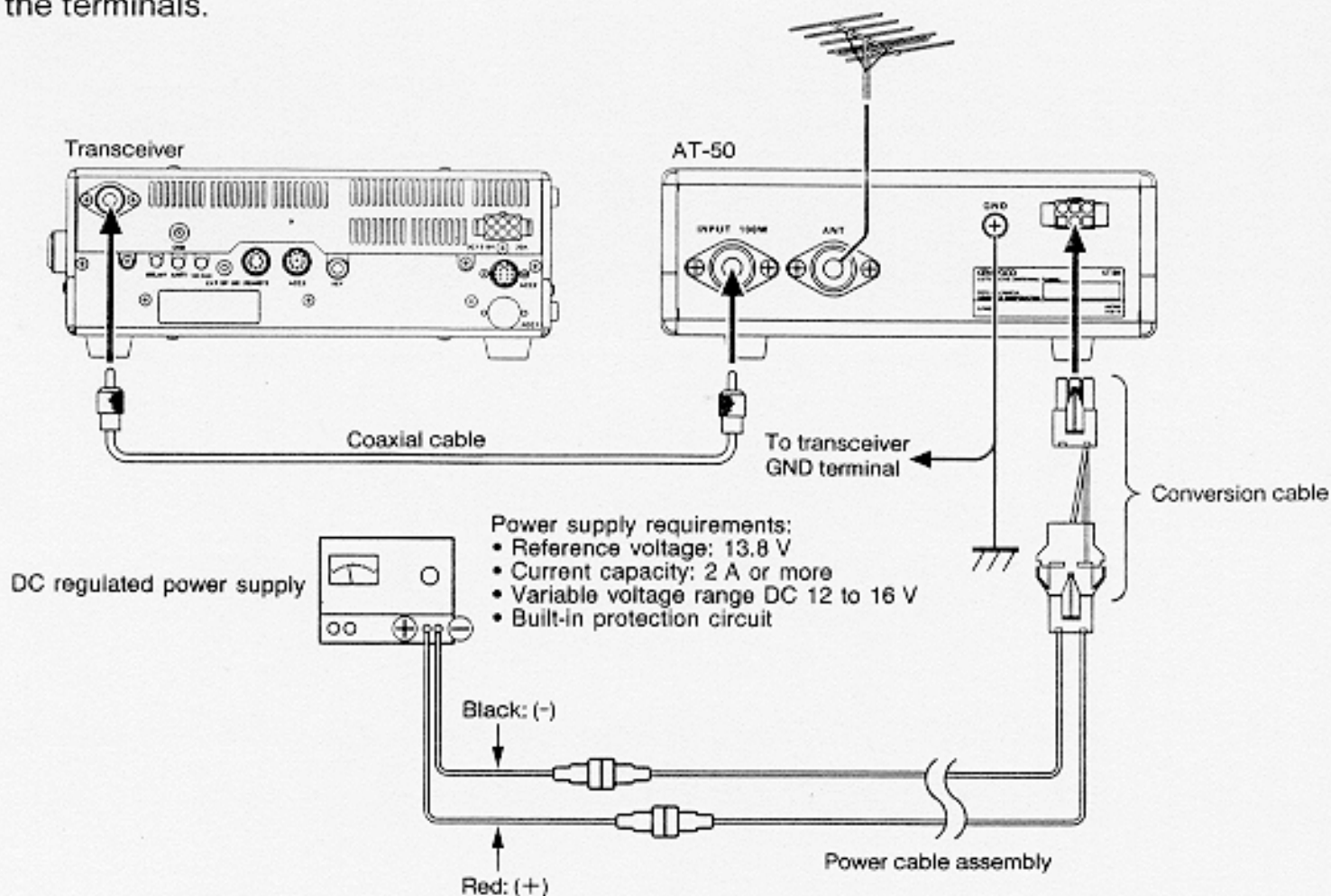
■ Power Cable Assembly

Connect an optional power cable and the supplied Conversion cable as shown below.



■ Connection Details

1. Turn the power switches of the transceiver and the external power supply off.
2. Connect the power cable assembly connector to the matching AT-50 connector, and the two leads to the power supply. Double check the power lead polarity (red: (+), black: (-)).
3. Connect the coaxial cable (PL-259(M) connector) to the transceiver ANT connector and the AT-50 INPUT 100W connector.
4. Connect the appropriate antenna to the AT-50 ANT connector.
5. Connect a ground wire between the transceiver and AT-50 ground terminals, then ground one of the terminals.



5-3. Operation in Semi-Automatic Mode

Use the Semi-automatic mode when the AT-50 is connected to a transceiver other than the TS-50S. Automatic tuning is possible with minimum operator intervention. AUTO or THRU mode must be selected at the AT-50.

■ Semi-automatic Mode Tuning

- ① Press the AT-50 [AUTO/THRU] key to select AUTO (the AUTO/THRU LED lights).
- ② Use the [BAND] keys to select AUTO. The AUTO LED lights.
- ③ Select the desired transceiver transmit frequency. Choose a clear frequency to avoid interfering with others.
- ④ Select a continuous carrier mode such as CW on the transceiver. Reduce output power to approximately 10 W, and start transmitting a steady carrier.

If the AT-50 ALARM LED lights, the power is too high. Adjust the transmit power, repeat step ②, and transmit a carrier again. When the AT-50 recognizes the same transmit level for more than two seconds, it checks the SWR, lights the TUNE LED, and starts tuning.

Note:

1. The Semi-automatic mode cannot be used unless the transmitter can be reduced to approximately 10 W output.
 2. After tuning completes, transmitting with approximately 10 W causes the AT-50 to enter the Semi-automatic mode briefly.
- ⑤ When tuning completes, the TUNE LED goes off. Return the transceiver to the receive mode immediately.

In the Semi-automatic mode, the SWR is checked at the preset position of the current band. If the SWR is equal to or greater than 2:1 or 3:1, the AT-50 switches bands, and checks the SWR again at the preset position of the new band. If the SWR is equal to or less than 2:1, tuning starts on this band. The maximum tuning time is 30 seconds.

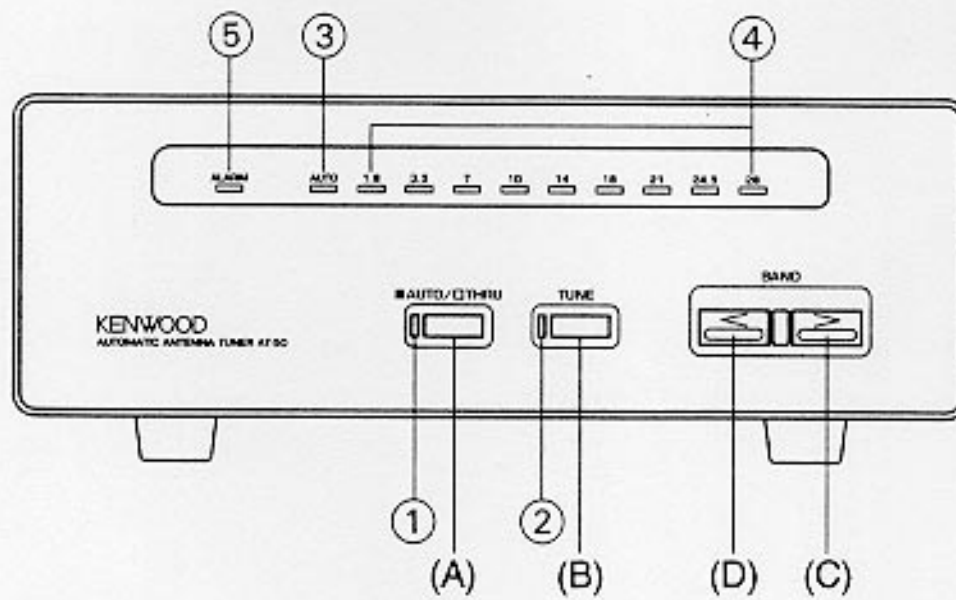
■ Maximum Tuning Time

If tuning does not finish within 30 to 45 seconds including the preset time, the AT-50 ALARM lights. When using the AT-50 the first time or with a new antenna, tuning may be incomplete after the maximum tuning time. In this case, do the following :

- ① Stop transmitting.
The AT-50 TUNE LED goes off and the tuning stops.
- ② Check the antenna.

Note:

- 1 In this mode, the tuner only changes bands automatically when Step ④ is performed. If you change your transmit band for any reason (e.g. while using memory scan), it is necessary to retune.
- 2 The automatic band identification feature, where the AT-50 searches automatically for the correct band, may cause the LED indicators to show a different band from the transceiver before tuning completes. After tuning, the LED indicators always show the correct band.
- 3 Tuning time can be reduced by tuning each band in Local Automatic mode first before using Semi-automatic mode.
- 4 Since the receive signal from the antenna passes through the AT-50 in this mode, receive sensitivity may be reduced if different transmit and receive frequencies are used.



AT-50 LED Indicators

LED	Function
① AUTO/THRU	Lights in AUTO mode. Off in THRU mode.
② TUNE	Lights when tuning or presetting is in progress. Goes off when tuning ends.
③ AUTO	Lights in the Semi-automatic mode.
④ BAND	Lights for the band currently selected by the automatic band identification feature.
⑤ ALARM	Lights when the power is too high during tuning. The THRU mode is selected and the AUTO/THRU LED goes off. Lights when tuning does not finish within the maximum tuning time. Goes off when transmit carrier stops.

Key Functions

Key	Function
(A) AUTO/THRU	Selects AUTO or THRU mode.
(B) TUNE	Not functional in the Semi-automatic mode.
(C) BAND UP	Selects the next higher amateur band.
(D) BAND DOWN	Selects the next lower amateur band.

■ [BAND] keys

Pressing the [BAND UP] key while in the 28 MHz band or the [BAND DOWN] key while in the 1.8 MHz band selects the Semi-automatic mode and the AUTO LED lights. If the [BAND UP or DOWN] key is pressed in the Semi-automatic mode, the AUTO LED goes off, and Local Automatic mode is selected.

5-4. Operation in Local Automatic Mode

Use the Local Automatic mode when the AT-50 is connected to transceivers other than the TS-50S. This mode is selected by pressing either [BAND] key while in Semi-automatic mode. The AUTO indicator goes out.

■ Local Automatic Mode Tuning

- ① Select the desired transceiver transmit frequency.
- ② Press the AT-50 [AUTO/THRU] key to select AUTO. The AUTO/THRU LED lights.
- ③ Use the [BAND UP/DOWN] keys to select the same transmit band as the transceiver. When the AUTO LED is off, Local Automatic mode is selected.
- ④ Select a continuous carrier mode such as CW on the transceiver. Reduce output power to approximately 10 W, and start transmitting a steady carrier.
- ⑤ Press the AT-50 [TUNE] key.
If the AT-50 ALARM LED lights, the power is too high. Adjust the transmit power, repeat step ②, and transmit a carrier again.
- ⑥ When tuning completes, the TUNE LED goes off.
Return the transceiver to the receive mode immediately.

■ Maximum Tuning Time

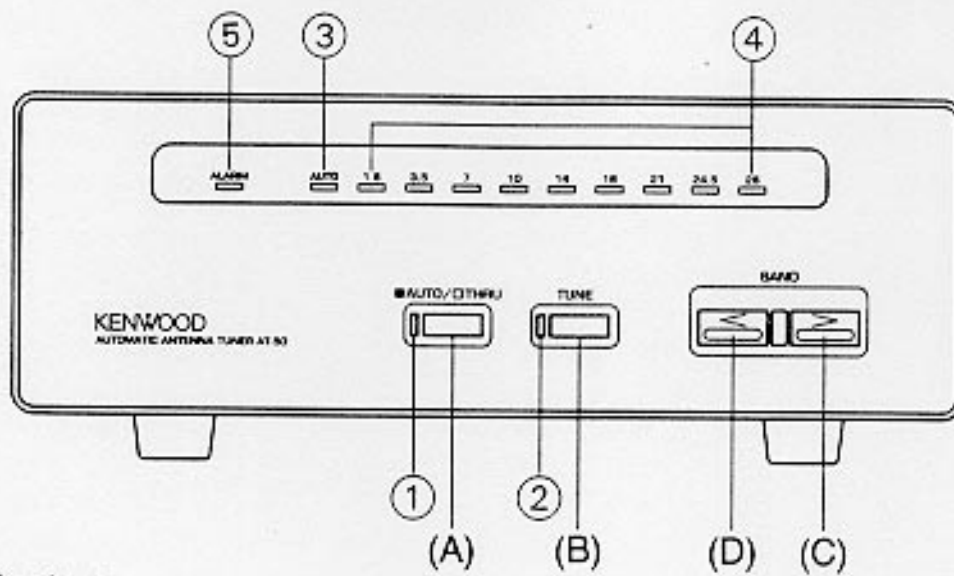
If tuning does not finish within 30 to 45 seconds including the preset time, the AT-50 ALARM lights.

When using the AT-50 the first time or with a new antenna, tuning may be incomplete after the maximum tuning time. In this case, do the following :

- ① Stop transmitting.
The AT-50 TUNE LED goes off and tuning stops.
- ② Check the antenna.

Note:

Since the receive signal from the antenna passes through the AT-50 in this mode, receive sensitivity may be reduced if different transmit and receive frequencies are used.



AT-50 LED Indicators

LED	Function
① AUTO/THRU	Lights in AUTO mode. Off in THRU mode.
② TUNE	Lights when tuning or presetting is in progress. Goes off when tuning ends.
③ AUTO	Off in the local automatic mode.
④ BAND	Lights to indicate the band selected with the BAND keys.
⑤ ALARM	Lights when the power is too high during tuning. THRU mode is selected and the AUTO/THRU LED goes off. Lights when tuning does not finish within the maximum tuning time. Goes off when transmit carrier stops.

Key Functions

Key	Function
(A) AUTO/THRU	Selects AUTO or THRU mode.
(B) TUNE	Starts or stops tuning in AUTO mode.
(C) BAND UP	Selects the next higher amateur band.
(D) BAND DOWN	Selects the next lower amateur band.

■ [BAND] keys

If the [BAND UP or DOWN] key is pressed in the Semi-automatic mode, the AUTO LED goes off, and tuning is possible within a single band. Select the desired band with either [BAND] key. Pressing the [BAND UP] key while in the 28 MHz band or the [BAND DOWN] key while in the 1.8 MHz band selects the Semi-automatic mode and the AUTO LED lights.

6. PRESET MEMORY FUNCTION

The AT-50 has a preset memory function for storing tuning settings for each amateur band once tuning is accomplished. Searching for the best tuning point begins from the tuning data (preset data) that is stored for each band.

The initial tuning time is 30 seconds or less. When preset data is available, tuning time is three seconds or less. Changing the AT-50 band stores the data. The data for that band is updated only with data resulting from a successful tuning operation. The frequency ranges of preset data are listed below. The best tuning data for a 50 Ω load is set initially for each band.

Note:

1. Transmit is disabled during presetting.
2. If the SWR is higher and the RF output remains the same or lower after tuning than before, this may indicate the AT-50 needs to switch bands. Retune following instructions for the mode being used.

Automatic Mode		Semi-automatic / Local Automatic Mode	
Band LED	Preset Frequency Range	Band LED	Preset Frequency Range
1.8MHz	$30\text{kHz} \leq f < 2.0\text{MHz}$	1.8MHz	$30\text{kHz} \leq f < 2.0\text{MHz}$
3.5MHz	$2.0\text{MHz} \leq f < 3.7\text{MHz}$	3.5MHz	$2.0\text{MHz} \leq f < 4.5\text{MHz}$
3.5MHz	$3.7\text{MHz} \leq f < 4.5\text{MHz}$		
7MHz	$4.5\text{MHz} \leq f < 7.5\text{MHz}$	7MHz	$4.5\text{MHz} \leq f < 7.5\text{MHz}$
10MHz	$7.5\text{MHz} \leq f < 10.5\text{MHz}$	10MHz	$7.5\text{MHz} \leq f < 10.5\text{MHz}$
14MHz	$10.5\text{MHz} \leq f < 14.5\text{MHz}$	14MHz	$10.5\text{MHz} \leq f < 14.5\text{MHz}$
18MHz	$14.5\text{MHz} \leq f < 18.5\text{MHz}$	18MHz	$14.5\text{MHz} \leq f < 18.5\text{MHz}$
21MHz	$18.5\text{MHz} \leq f < 21.5\text{MHz}$	21MHz	$18.5\text{MHz} \leq f < 21.5\text{MHz}$
24.5MHz	$21.5\text{MHz} \leq f < 25\text{MHz}$	24.5MHz	$21.5\text{MHz} \leq f < 25\text{MHz}$
28MHz	$25\text{MHz} \leq f < 28.3\text{MHz}$	28MHz	$25\text{MHz} \leq f < 30\text{MHz}$
28MHz	$28.3\text{MHz} \leq f < 29\text{MHz}$		
28MHz	$29\text{MHz} \leq f < 30\text{MHz}$		

7. SWR INDICATION

The CPU calculates the SWR to determine whether the AT-50 tuning is complete. Tuning is completed when the following conditions are met :

- The SWR is equal to or less than 1.2 :1.
- The power is equal to or larger than 8 W, and 80% or more of the input power when the AT-50 is in THRU mode.

The AT-50 uses this function in each mode to indicate the SWR with the band LED during tuning. The band LED indications correspond to the SWR values as follows :

ALARM	AUTO	1.8	3.5	7	10	14	18	21	24.5	28
SWR	1.0	1.1	1.2	1.5	2.0	3	5	10	20	30 ∞

Note:

The SWR indication should be used as a guide only.

8. HETERODYNE FREQUENCIES

Low level "beat" or heterodyne tones may be heard at some frequencies when using the AT-50. They are caused by the relationship of frequencies within the tuner. They are not due to a defect in the equipment. Beat tones may be heard at multiples of one-quarter of 11.06 MHz.

(Frequency examples)

2.765MHz

5.53MHz

11.06MHz

16.59MHz

22.12MHz

27.65MHz

9. MAINTENANCE

9-1. GENERAL INFORMATION

Your automatic antenna tuner has been factory aligned and tested to specification before shipment. Under normal circumstances the automatic antenna tuner will operate in accordance with these operating instructions. All adjustable trimmers and coils in your automatic antenna tuner were preset at the factory and should only be readjusted by a qualified technician with proper test equipment. Attempting service or alignment without factory authorization can void the automatic antenna tuner's warranty.

When operated properly, the automatic antenna tuner can give years of service without requiring realignment. The information in this section gives some general service procedures which can be accomplished without sophisticated test equipment.

9-2. SERVICE

Should it ever become necessary to return the equipment to your dealer or service center for repair, pack it in its original box and packing, and include a full description of the problems involved. Also include your telephone number. You need not return accessory items unless directly related to the service problem.

SERVICE NOTE

Dear OM/YL, If you desire to correspond on a technical or operational problem, please make your note short, complete, and to the point. And PLEASE make it readable.

Please list : Model and serial number
 Problems experienced

Give sufficient detail to diagnose. Include information such as other equipment in the station, meter readings and anything else you feel might be useful in attempting diagnosis.

Caution:

Do not pack the equipment in crushed newspapers for shipment. Extensive damage may result during shipping.

Note:

1. Record the date of purchase, serial number and dealer from whom purchased.
2. For your own information, retain a written record of any maintenance performed on the unit.
3. When claiming warranty service, please include a photocopy of the bill of sale, or other proof of purchase showing the date of sale.

9-3. CLEANING

The knobs, front panel and cabinet of the automatic antenna tuner are likely to become soiled after extended use. The knobs should be removed from the automatic antenna tuner and cleaned with a neutral detergent and warm water. Use a neutral detergent (not harsh chemicals) and damp cloth to clean the cabinet and front panel.

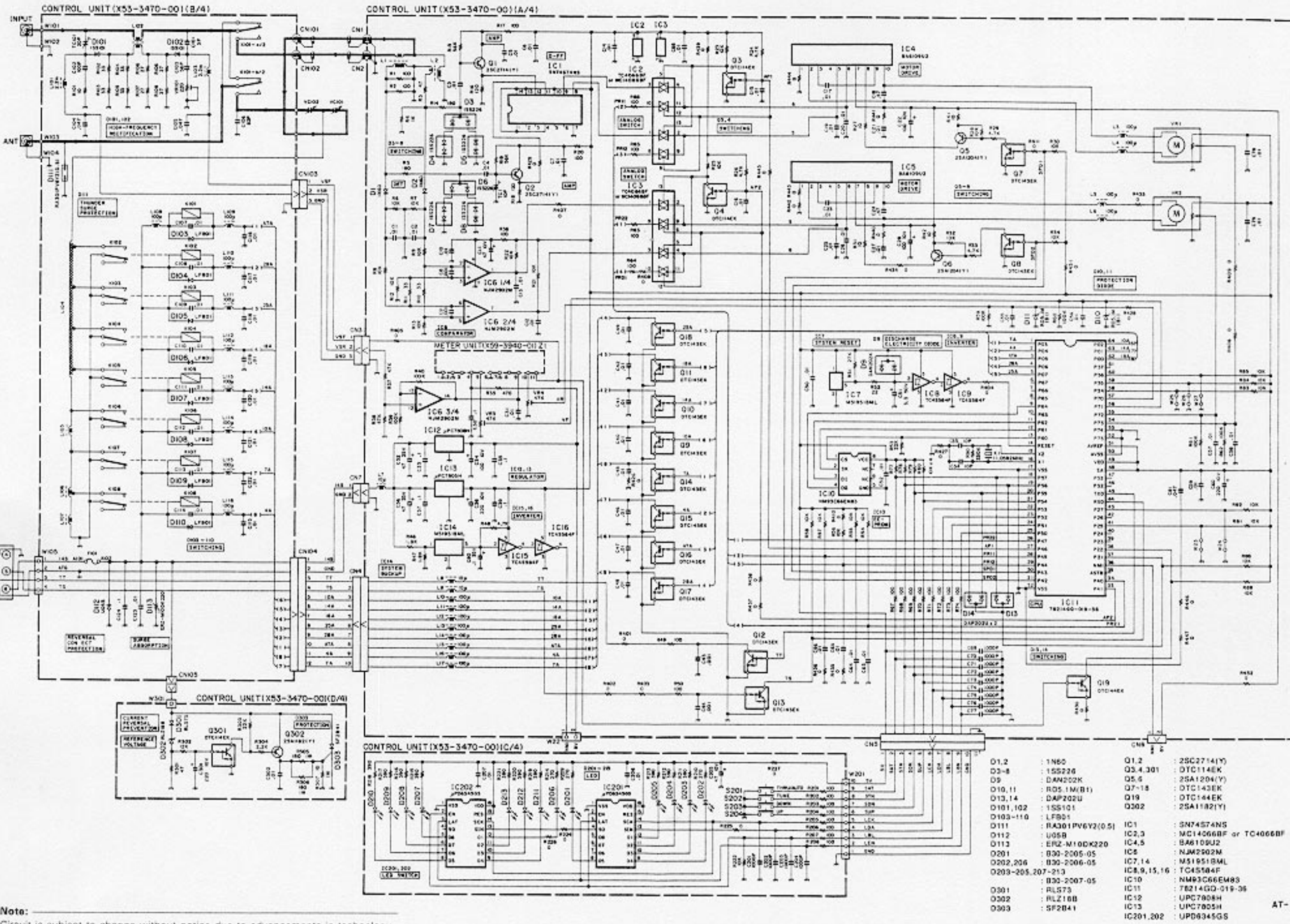
9-4. IN CASE OF DIFFICULTY

The problems described in this table are failures caused in general by improper operation or connection of the automatic antenna tuner, not by defective components. Examine and check according to the following table. If the problem persists, contact an authorized agent or service station.

Symptom	Possible cause	Corrective Action
No LEDs light after the power is turned on.	<ul style="list-style-type: none">a. The power to the transceiver (or the external power supply) is not turned on.b. The Control cable is not connected.c. The fuse is open.	<ul style="list-style-type: none">a. Turn the power switch of the transceiver (or the external power supply) on.b. Connect the supplied Control cable to the TS-50S ACC connector and the matching AT-50 connector.c. Resolve the problem and replace the fuse.
The Automatic mode cannot be used.	<ul style="list-style-type: none">a. The transceiver is not a TS-50S.b. The power supply is being turned on at the same time as the TS-50S.	<ul style="list-style-type: none">a. The Automatic mode can be used only with the TS-50S. Use Semi-automatic or Local Automatic mode with other transceivers.b. Connect the supplied Control cable to the TS-50S connector and the AT-50 connector, then turn the TS-50S power switch on.
The Semi-automatic mode cannot be used.	<ul style="list-style-type: none">a. The AUTO/THRU key is not set to AUTO.b. The transceiver is not in a continuous carrier mode.c. The input power is not within the correct range.d. The band was set to AUTO while the TUNE LED was on.	<ul style="list-style-type: none">a. Select AUTO with the AUTO/THRU key (LED lights).b. Select a continuous carrier mode (CW, FM, FSK).c. Adjust the output power of the transceiver to 10 W (6 to 20 W).d. Use a BAND key to select AUTO after the TUNE LED goes out.

Symptom	Possible cause	Corrective Action
Tuning does not finish within 30 seconds.	<ul style="list-style-type: none"> a. The AT-50 is being used for the first time. b. The SWR of the antenna is too high. 	<ul style="list-style-type: none"> a. If the AT-50 is being used for the first time, tuning may take longer than the maximum time. Retune. b. The antenna is not tuned for the transmit frequency. Fix the antenna.
Panel keys on the AT-50 do not function.	<ul style="list-style-type: none"> a. Automatic mode. b. Semi-automatic mode. 	<ul style="list-style-type: none"> a. If the tuner is connected to the TS-50S, all the panel keys do not function. b. The TUNE key does not function in the Semi-automatic mode.

AT-50 SCHEMATIC DIAGRAM



D1,2	: 1N60	Q1,2	: 2SC2714(Y)
D3-8	: 1SS226	Q3,4,301	: DTC114EK
D9	: DAN202K	Q5,6	: 2SA1204(Y)
D10,11	: R05-1M(B1)	Q7-18	: DTC143EK
D13,14	: DAP202U	Q19	: DTC144EK
D101,102	: 1SS101	Q302	: 2SA1182(Y)
D103-110	: LFB01		
D111	: RA301PV6V2(0.5)	IC1	: SN74574NS
D112	: U05B	IC2,3	: MC14066BF or TC4066BF
D113	: ER2-M100K220	IC4,5	: BA6109U2
Q201	: B30-2005-05	IC8	: NJM2502M
Q202,206	: B30-2006-05	IC7,14	: M51951BML
Q203-205,207-213	: B30-2007-05	IC8,9,15,16	: TC45584F
Q301	: RL573	IC10	: NMP3C66EM83
Q302	: RL218B	IC11	: 78214GD-019-36
Q303	: SF2841	IC12	: UPC7908H
		IC13	: UPC7805H
		IC201,202	: UPD6345GS

Note:
Circuit is subject to change without notice due to advancements in technology.